Important Terzaghi's Analysis in Water Table is Below the Base of Footing Formulas PDF

Formulas
Examples
with Units

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

1) Cohesion of Soil given Depth and Width of Footing Formula

Evaluate Formula

Formula

$$C = \frac{q_{fc} - \left(\left(\gamma \cdot D_{footing} \cdot N_q \right) + \left(0.5 \cdot \gamma \cdot B \cdot N_\gamma \right) \right)}{N_c}$$

Example with Units

$$0.7892\,\text{kPa} = \frac{127.8\,\text{kPa} - \left(\left(18\,\text{kN/m}^3 \cdot 2.54\,\text{m} \cdot 2.01 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{9}$$

2) Cohesion of Soil given Net Ultimate Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$8.3157\,\text{kPa} = \frac{150\,\text{kN/m}^2 - \left(\left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{9}$$

3) Cohesion of Soil given Safe Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$13.4237\,\text{kPa} = \frac{\left(\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(2.8 \cdot 10.0\,\text{Pa} \right) \right) - \left(\left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{9}$$

4) Depth of Footing given Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$D_{footing} = \frac{q_{fc} - \left(\left(C \cdot N_c \right) + \left(0.5 \cdot \gamma \cdot B \cdot N_\gamma \right) \right)}{\gamma \cdot N_q}$$

Example with Units

$$2.4204\,\text{m} = \frac{127.8\,\text{kPa} - \left(\left(1.27\,\text{kPa} \cdot 9 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{18\,\text{kN/m}^3 \cdot 2.01}$$

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

Evaluate Formula

Formula

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

Example with Units

$$4.1914\,\text{m} = \frac{150\,\text{kN/m}^2 - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{18\,\text{kN/m}^3 \cdot \left(2.01 - 1 \right)}$$

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

Evaluate Formula

Formula

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

Example with Units

$$3.3776\,\text{m} = \frac{\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{18\,\text{kN/m}^3 \cdot 2.01}$$

7) Effective Surcharge given Bearing Capacity Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$103.6808\,\text{kN/m}^2 = \frac{150\,\text{kN/m}^2 - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{2.01 - 1}$$

8) Effective Surcharge given Safe Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$32.0735\,\text{kN/m}^2 = \frac{\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{2.8 + 2.01 - 1}$$

9) Factor of Safety given Bearing Capacity Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$4.9859 = \frac{\left(5.0\,\text{kPa} \cdot 9 \right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right)}{70\,\text{kN/m}^2 - 45.9\,\text{kN/m}^2}$$

10) Factor of Safety given Depth and Width of Footing Formula

Evaluate Formula

Formula

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

Example with Units

$$1.7785 = \frac{\left(5.0\,\text{kPa} \cdot 9\right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot \left(2.01 - 1\right)\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)}{70\,\text{kN/m}^2 - \left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right)}$$

11) Net Ultimate Bearing Capacity given Bearing Capacity Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$120.159\,\text{kN/m}^2 = \left(5.0\,\text{kPa} \cdot 9\right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1\right)\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)$$

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

Evaluate Formula

Formula

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

Example with Units

$$92.1618\,\text{kN/m}^2 = \left(\left(5.0\,\text{kPa} \cdot 9\right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot \left(2.01 - 1\right)\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)\right)$$

13) Safe Bearing Capacity given Bearing Capacity Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$88.8139\,\text{kN/m}^2 = \left(\frac{\left(5.0\,\text{kPa} \cdot 9\right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1\right)\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)}{2.8}\right) + 45.9\,\text{kN/m}^2$$

14) Safe Bearing Capacity given Depth and Width of Footing Formula

Evaluate Formula

Formula

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

Example with Units

$$51.0949\,\text{kN/m}^2 = \left(\frac{\left(5.0\,\text{kPa} \cdot 9\right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right) \cdot \left(2.01 - 1\right)\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)}{2.8}\right) + \left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m}\right)$$

15) Ultimate Bearing Capacity given Bearing Capacity Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$110.3418\,\text{kPa} = \left(5.0\,\text{kPa} \cdot 9 \right) + \left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m} \cdot 2.01 \right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right)$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.0401\,\text{kN/m}^3 = \frac{150\,\text{kN/m}^2 - \left(5.0\,\text{kPa} \cdot 9 \right)}{\left(0.5 \cdot 2\,\text{m} \cdot 1.6 \right) + \left(1.01\,\text{m} \cdot \left(2.01 - 1 \right) \right)}$$

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

Evaluate Formula

Formula

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

Example with Units

$$4.1321\,\text{kN/m}^3 = \frac{60\,\text{kPa} - \left(5.0\,\text{kPa} \cdot 9 \right)}{\left(1.01\,\text{m} \cdot 2.01 \right) + \left(0.5 \cdot 2\,\text{m} \cdot 1.6 \right)}$$

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

Evaluate Formula

Formula

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

Example with Units

$$41.5967\,\text{kN/m}^3 = \frac{\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(\left(5.0\,\text{kPa} \cdot 9 \right) \right)}{\left(2.01 \cdot 1.01\,\text{m} \right) + \left(0.5 \cdot 2\,\text{m} \cdot 1.6 \right)}$$

19) Unit Weight of Soil given Net Ultimate Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$36.6506\,\text{kN/m}^3 = \frac{150\,\text{kN/m}^2 - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 2\,\text{m} \cdot 1.6}$$

20) Unit Weight of Soil given Safe Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$6.0569\,\text{kN/m}^3 = \frac{\left(\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(2.8 \cdot 45.9\,\text{kN/m}^2 \right) \right) - \left(\left(1.27\,\text{kPa} \cdot 9 \right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 2\,\text{m} \cdot 1.6}$$

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

Evaluate Formula

Formula

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

Example with Units

$$6.0165\,\text{m} = \frac{150\,\text{kN/m}^2 - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m} \right) \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 18\,\text{kN/m}^3 \cdot 1.6}$$

22) Width of Footing given Effective Surcharge Formula

Evaluate Formula

Formula

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

Example with Units

$$4.0723\,\text{m} = \frac{150\,\text{kN/m}^2 - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 18\,\text{kN/m}^3 \cdot 1.6}$$

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

Evaluate Formula

Formula

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

Example with Units

$$5.676\,\text{m} = \frac{\left(\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(2.8 \cdot \left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m} \right) \right) \right) - \left(\left(5.0\,\text{kPa} \cdot 9 \right) + \left(\left(18\,\text{kN/m}^3 \cdot 1.01\,\text{m} \right) \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 18\,\text{kN/m}^3 \cdot 1.6}$$

24) Width of Footing given Safe Bearing Capacity Formula

Evaluate Formula

Formula

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

Example with Units

$$0.673\,\text{m} = \frac{\left(\left(70\,\text{kN/m}^2 \cdot 2.8 \right) - \left(2.8 \cdot 45.9\,\text{kN/m}^2 \right) \right) - \left(\left(1.27\,\text{kPa} \cdot 9 \right) + \left(45.9\,\text{kN/m}^2 \cdot \left(2.01 - 1 \right) \right) \right)}{0.5 \cdot 18\,\text{kN/m}^3 \cdot 1.6}$$

25) Width of Footing given Ultimate Bearing Capacity Formula

Evaluate Formula

Formula

$$B = \frac{q_{fc} - \left(\left(C \cdot N_c \right) + \left(\gamma \cdot D_{footing} \cdot N_q \right) \right)}{0.5 \cdot \gamma \cdot N_\gamma}$$

Example with Units

$$1.6995\,\text{m} = \frac{127.8\,\text{kPa} - \left(\left(1.27\,\text{kPa} \cdot 9 \right) + \left(18\,\text{kN/m}^3 \cdot 2.54\,\text{m} \cdot 2.01 \right) \right)}{0.5 \cdot 18\,\text{kN/m}^3 \cdot 1.6}$$

Variables used in list of Terzaghi's Analysis in Water Table is Below the Base of Footing Formulas above

- **B** Width of Footing *(Meter)*
- **C** Cohesion in Soil as Kilopascal *(Kilopascal)*
- C_s Cohesion of Soil *(Kilopascal)*
- **D** Depth of Footing *(Meter)*
- $D_{footing}$ Depth of Footing in Soil *(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_{fc} Ultimate Bearing Capacity in Soil *(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' Effective Surcharge *(Pascal)*
- σ_s Effective Surcharge in KiloPascal *(Kilonewton per Square Meter)*

Constants, Functions, Measurements used in list of Terzaghi's Analysis in Water Table is Below the Base of Footing Formulas above

- 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

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