Important Bearing Capacity of Cohesive Soil Formulas PDF

Formulas
Examples
with Units

List of 28
Important Bearing Capacity of Cohesive Soil Formulas

1) Bearing Capacity Factor Dependent on Cohesion for Circular Footing Formula

Evaluate Formula

Formula

$$N_c = \frac{q_f - \sigma_s}{1.3 \cdot C}$$

Example with Units

$$8.5403 = \frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{1.3 \cdot 1.27\,\text{kPa}}$$

2) Bearing Capacity Factor Dependent on Cohesion for Square Footing Formula

Evaluate Formula

Formula

$$N_c = \frac{q_f - \sigma_s}{\left(C\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$9.6542 = \frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{\left(1.27\,\text{kPa}\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

3) Bearing Capacity for Circular Footing given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$q_f = \left(7.4 \cdot C\right) + \sigma_s$$

Example with Units

$$55.298\,\text{kPa} = \left(7.4 \cdot 1.27\,\text{kPa}\right) + 45.9\,\text{kN/m}^2$$

4) Bearing Capacity of Cohesive Soil for Circular Footing Formula

Evaluate Formula

Formula

$$q_f = \left(1.3 \cdot C \cdot N_c\right) + \sigma_s$$

Example with Units

$$60.759\,\text{kPa} = \left(1.3 \cdot 1.27\,\text{kPa} \cdot 9\right) + 45.9\,\text{kN/m}^2$$

5) Bearing Capacity of Cohesive Soil for Square Footing Formula

Evaluate Formula

Formula

$$q_f = \left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \sigma_s$$

Example with Units

$$59.0445\,\text{kPa} = \left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + 45.9\,\text{kN/m}^2$$

6) Cohesion of Soil for Circular Footing given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$C = \frac{q_f - \sigma_s}{7.4}$$

Example with Units

$$1.9054\,\text{kPa} = \frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{7.4}$$

7) Cohesion of Soil given Bearing Capacity for Circular Footing Formula

Evaluate Formula

Formula

$$C = \frac{q_f - \sigma_s}{1.3 \cdot N_c}$$

Example with Units

$$1.2051\,\text{kPa} = \frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{1.3 \cdot 9}$$

8) Cohesion of Soil given Bearing Capacity for Square Footing Formula

Evaluate Formula

Formula

$$C = \frac{q_f - \sigma_s}{\left(N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$1.3623\,\text{kPa} = \frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{\left(9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

9) Effective Surcharge for Circular Footing given Value of Bearing Capacity Factor Formula

Evaluate Formula

Formula

$$\sigma_s = q_f - \left(7.4 \cdot C\right)$$

Example with Units

$$50.602\,\text{kN/m}^2 = 60\,\text{kPa} - \left(7.4 \cdot 1.27\,\text{kPa}\right)$$

10) Effective Surcharge given Bearing Capacity for Circular Footing Formula

Evaluate Formula

Formula

$$\sigma_s = \left(q_f - \left(1.3 \cdot C \cdot N_c\right)\right)$$

Example with Units

$$45.141\,\text{kN/m}^2 = \left(60\,\text{kPa} - \left(1.3 \cdot 1.27\,\text{kPa} \cdot 9\right)\right)$$

11) Effective Surcharge given Bearing Capacity for Square Footing Formula

Evaluate Formula

Formula

$$\sigma_s = q_f - \left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right)$$

Example with Units

$$46.8555\,\text{kN/m}^2 = 60\,\text{kPa} - \left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right)$$

12) Length of Footing given Bearing Capacity for Square Footing Formula

Evaluate Formula

Formula

$$L = \frac{0.3 \cdot B}{\left(\frac{q_f - \sigma_s}{C \cdot N_c}\right) - 1}$$

Example with Units

$$2.5685\,\text{m} = \frac{0.3 \cdot 2\,\text{m}}{\left(\frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{1.27\,\text{kPa} \cdot 9}\right) - 1}$$

13) Width of Footing given Bearing Capacity for Square Footing Formula

Evaluate Formula

Formula

$$B = \left(\left(\frac{q_f - \sigma_s}{C \cdot N_c}\right) - 1\right) \cdot \left(\frac{L}{0.3}\right)$$

Example with Units

$$3.1146\,\text{m} = \left(\left(\frac{60\,\text{kPa} - 45.9\,\text{kN/m}^2}{1.27\,\text{kPa} \cdot 9}\right) - 1\right) \cdot \left(\frac{4\,\text{m}}{0.3}\right)$$

14) Frictional Cohesive Soil Formulas

14.1) Bearing Capacity Factor Dependent on Cohesion for Rectangular Footing Formula

Evaluate Formula

Formula

$$N_c = \frac{q_{fc} - \left(\left(\sigma_s \cdot N_q\right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma\right)\right)}{\left(C\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$8.5594 = \frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)\right)}{\left(1.27\,\text{kPa}\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

14.2) Bearing Capacity Factor Dependent on Cohesion for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$N_c = \frac{q_{fc} - \left(\left(\sigma_s \cdot N_q \right) + \left(\left(0.5 \cdot \gamma \cdot B \cdot N_\gamma \right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L} \right) \right) \right) \right)}{\left(C \right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L} \right) \right)}$$

Example with Units

$$6.5875 = \frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2 \cdot 2.01 \right) + \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right) \right) \right)}{\left(1.27\,\text{kPa} \right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right)}$$

14.3) Bearing Capacity Factor Dependent on Surcharge for Rectangular Footing Formula

Evaluate Formula

Formula

$$N_q = \frac{q_{fc} - \left(\left(\left(C \cdot N_c \right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L} \right) \right) \right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma \right) \right)}{\sigma_s}$$

Example with Units

$$1.996 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9 \right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right) \right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \right)}{45.9\,\text{kN/m}^2}$$

14.4) Bearing Capacity Factor Dependent on Surcharge for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$N_q = \frac{q_{fc} - \left(\left(\left(C \cdot N_c \right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L} \right) \right) \right) + \left(\left(0.5 \cdot \gamma \cdot B \cdot N_\gamma \right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L} \right) \right) \right) \right)}{\sigma_s}$$

Example with Units

$$1.9332 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9 \right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right) \right) + \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6 \right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right) \right) \right)}{45.9\,\text{kN/m}^2}$$

14.5) Bearing Capacity Factor Dependent on Unit Weight for Rectangular Footing Formula

Evaluate Formula

Formula

$$N_\gamma = \frac{q_{fc} - \left(\left(\left(C \cdot N_c \right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L} \right) \right) \right) + \left(\sigma_s \cdot N_q \right) \right)}{0.4 \cdot B \cdot \gamma}$$

Example with Units

$$1.5553 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9 \right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}} \right) \right) \right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01 \right) \right)}{0.4 \cdot 2\,\text{m} \cdot 18\,\text{kN/m}^3}$$

14.6) Bearing Capacity Factor Dependent on Weight for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$N_\gamma = \frac{q_{fc} - \left(\left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\sigma_s \cdot N_q\right)\right)}{\left(0.5 \cdot B \cdot \gamma\right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$1.3825 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right)\right)}{\left(0.5 \cdot 2\,\text{m} \cdot 18\,\text{kN/m}^3\right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

14.7) Cohesion of Soil for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$C = \frac{q_{fc} - \left(\left(\sigma_s \cdot N_q\right) + \left(\left(0.5 \cdot \gamma \cdot B \cdot N_\gamma\right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L}\right)\right)\right)\right)}{\left(N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$0.9296\,\text{kPa} = \frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right)\right)}{\left(9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

14.8) Cohesion of Soil given Ultimate Bearing Capacity for Rectangular Footing Formula

Evaluate Formula

Formula

$$C = \frac{q_{fc} - \left(\left(\sigma_s \cdot N_q\right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma\right)\right)}{\left(N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$1.2078\,\text{kPa} = \frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)\right)}{\left(9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

14.9) Effective Surcharge for Rectangular Footing Formula

Evaluate Formula

Formula

$$\sigma_s = \frac{q_{fc} - \left(\left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma\right)\right)}{N_q}$$

Example with Units

$$45.5799\,\text{kN/m}^2 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)\right)}{2.01}$$

14.10) Effective Surcharge for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$\sigma_s = \frac{q_{fc} - \left(\left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\left(0.5 \cdot \gamma \cdot B \cdot N_\gamma\right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L}\right)\right)\right)\right)}{N_q}$$

Example with Units

$$44.147\,\text{kN/m}^2 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right)\right)}{2.01}$$

14.11) Length of Rectangular Footing given Ultimate Bearing Capacity Formula

Evaluate Formula

Formula

$$L = \frac{0.3 \cdot B}{\left(\frac{q_{fc} - \left(\left(\sigma_s \cdot N_q\right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma\right)\right)}{C \cdot N_c}\right) - 1}$$

Example with Units

$$6.4034\,\text{m} = \frac{0.3 \cdot 2\,\text{m}}{\left(\frac{127.8\,\text{kPa} - \left(\left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)\right)}{1.27\,\text{kPa} \cdot 9}\right) - 1}$$

14.12) Ultimate Bearing Capacity for Rectangular Footing Formula

Evaluate Formula

Formula

$$q_{fc} = \left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\sigma_s \cdot N_q\right) + \left(0.4 \cdot \gamma \cdot B \cdot N_\gamma\right)$$

Example with Units

$$128.4435\,\text{kPa} = \left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(0.4 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right)$$

14.13) Ultimate Bearing Capacity for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$q_{fc} = \left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\sigma_s \cdot N_q\right) + \left(\left(0.5 \cdot \gamma \cdot B \cdot N_\gamma\right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L}\right)\right)\right)$$

Example with Units

$$131.3235\,\text{kPa} = \left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right) + \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 1.6\right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right)$$

14.14) Unit Weight of Soil for Rectangular Footing given Shape Factor Formula

Evaluate Formula

Formula

$$\gamma = \frac{q_{fc} - \left(\left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\sigma_s \cdot N_q\right)\right)}{\left(0.5 \cdot B \cdot N_\gamma\right) \cdot \left(1 - 0.2 \cdot \left(\frac{B}{L}\right)\right)}$$

Example with Units

$$15.5531\,\text{kN/m}^3 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right)\right)}{\left(0.5 \cdot 2\,\text{m} \cdot 1.6\right) \cdot \left(1 - 0.2 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)}$$

14.15) Unit Weight of Soil given Ultimate Bearing Capacity for Rectangular Footing Formula

Evaluate Formula

Formula

$$\gamma = \frac{q_{fc} - \left(\left(\left(C \cdot N_c\right) \cdot \left(1 + 0.3 \cdot \left(\frac{B}{L}\right)\right)\right) + \left(\sigma_s \cdot N_q\right)\right)}{0.4 \cdot B \cdot N_\gamma}$$

Example with Units

$$17.4973\,\text{kN/m}^3 = \frac{127.8\,\text{kPa} - \left(\left(\left(1.27\,\text{kPa} \cdot 9\right) \cdot \left(1 + 0.3 \cdot \left(\frac{2\,\text{m}}{4\,\text{m}}\right)\right)\right) + \left(45.9\,\text{kN/m}^2 \cdot 2.01\right)\right)}{0.4 \cdot 2\,\text{m} \cdot 1.6}$$

Variables used in list of Bearing Capacity of Cohesive Soil Formulas above

- **B** Width of Footing *(Meter)*
- **C** Cohesion in Soil as Kilopascal *(Kilopascal)*
- **L** Length of Footing *(Meter)*
- 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)*

Constants, Functions, Measurements used in list of Bearing Capacity of Cohesive Soil Formulas above

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

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