Bearing Capacity of Soil by Terzaghi's Analysis Formulas

List of 31 Bearing Capacity of Soil by Terzaghi's Analysis Formulas

Bearing Capacity of Soil by Terzaghi's Analysis

1) Angle of Shearing Resistance given Weight of Wedge

Open Calculator

fx $$\varphi = a\tan\left(\frac{W_{we} \cdot 4}{\gamma \cdot (B)^2}\right)$$

ex $$82.57338° = a\tan\left(\frac{138.09\text{kN} \cdot 4}{18\text{kN/m}^3 \cdot (2\text{m})^2}\right)$$

2) Cohesion of Soil given Loading Intensity by Terzaghi's Analysis

Open Calculator

fx $$C = \frac{q - \left(\left(\frac{2 \cdot P_p}{B}\right) - \left(\frac{\gamma \cdot B \cdot \tan\left(\frac{\varphi \cdot \pi}{180}\right)}{4}\right)\right)}{\tan\left(\frac{\varphi \cdot \pi}{180}\right)}$$

ex $$4.230063\text{kPa} = \frac{26.8\text{kPa} - \left(\left(\frac{2 \cdot 26.92\text{kPa}}{2\text{m}}\right) - \left(\frac{18\text{kN/m}^3 \cdot 2\text{m} \cdot \tan\left(\frac{82.57° \cdot \pi}{180}\right)}{4}\right)\right)}{\tan\left(\frac{82.57° \cdot \pi}{180}\right)}$$

3) Downward Force on Wedge

Open Calculator

fx $$R_v = q \cdot B + \left(\frac{\gamma \cdot B^2 \cdot \tan(\varphi) \cdot \left(\frac{\pi}{180}\right)}{4}\right)$$

ex $$56.00902\text{kN} = 26.8\text{kPa} \cdot 2\text{m} + \left(\frac{18\text{kN/m}^3 \cdot (2\text{m})^2 \cdot \tan(82.57°) \cdot \left(\frac{\pi}{180}\right)}{4}\right)$$

4) Loading Intensity using Bearing Capacity Factors

Open Calculator

$$q_b = (C \cdot N_c) + (\sigma_s \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)$$

$$129.2229\text{kPa} = (4.23\text{kPa} \cdot 1.93) + (45.9\text{kN/m}^2 \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)$$

5) Unit Weight of Soil given Weight of Wedge and Width of Footing

Open Calculator

$$\gamma = \frac{W_{we} \cdot 4}{\tan((\varphi)) \cdot (B)^2}$$

$$18.00829\text{kN/m}^3 = \frac{138.09\text{kN} \cdot 4}{\tan((82.57^\circ)) \cdot (2\text{m})^2}$$

6) Weight of Wedge given Width of Footing

Open Calculator

$$W_{we} = \frac{\tan(\varphi) \cdot \gamma \cdot (B)^2}{4}$$

$$138.0264\text{kN} = \frac{\tan(82.57^\circ) \cdot 18\text{kN/m}^3 \cdot (2\text{m})^2}{4}$$

7) Width of Footing given Load Intensity

Open Calculator

$$B = \frac{-q + \sqrt{(q)^2 + R_v \cdot \gamma \cdot \tan(\varphi)}}{\frac{\gamma \cdot \tan(\varphi)}{2}}$$

$$0.944649\text{m} = \frac{-26.8\text{kPa} + \sqrt{(26.8\text{kPa})^2 + 56.109\text{kN} \cdot 18\text{kN/m}^3 \cdot \tan(82.57^\circ)}}{\frac{18\text{kN/m}^3 \cdot \tan(82.57^\circ)}{2}}$$

8) Width of Footing given Weight of Wedge

Open Calculator

$$B = \sqrt{\frac{W \cdot 4}{\tan\left(\frac{\varphi \cdot \pi}{180}\right) \cdot \gamma}}$$

$$0.297356\text{m} = \sqrt{\frac{10.01\text{kg} \cdot 4}{\tan\left(\frac{82.57^\circ \cdot \pi}{180}\right) \cdot 18\text{kN/m}^3}}$$

Specialization of Terzaghi's Equations

9) Bearing Capacity depending on Shape Factors

Open Calculator

$$q_s = (s_c \cdot C \cdot N_c) + (\sigma_s \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot s_\gamma)$$

$$152.2176\text{kPa} = (1.7 \cdot 4.23\text{kPa} \cdot 1.93) + (45.9\text{kN/m}^2 \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1.60)$$

10) Bearing Capacity Factor Dependent on Cohesion

Open Calculator

$$N_c = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot s_\gamma))}{s_c \cdot C}$$

$$1.932958 = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1.60))}{1.7 \cdot 4.23\text{kPa}}$$

11) Bearing Capacity Factor Dependent on Unit Weight

Open Calculator

$$N_\gamma = \frac{q_f - ((s_c \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot B \cdot \gamma \cdot s_\gamma}$$

$$1.600739 = \frac{60\text{kPa} - ((1.7 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 2\text{m} \cdot 18\text{kN/m}^3 \cdot 1.60}$$

12) Bearing Capacity for Round Footing

Open Calculator

$$q_{round} = (1.3 \cdot C \cdot N_c) + (\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.6)$$

$$27.91317\text{kPa} = (1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.6)$$

13) Bearing Capacity for Square Footing

Open Calculator

fx $$q_{square} = (1.3 \cdot C \cdot N_c) + (\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.8)$$

ex $$33.67317\text{kPa} = (1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.8)$$

14) Bearing Capacity for Strip Footing

Open Calculator

fx $$q_{strip} = (C \cdot N_c) + (\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma)$$

ex $$36.984\text{kPa} = (4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6)$$

15) Cohesion of Soil depending on Shape Factors

Open Calculator

fx $$C = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot s_\gamma))}{s_c \cdot N_c}$$

ex $$4.236483\text{kPa} = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1.60))}{1.7 \cdot 1.93}$$

16) Cohesion of Soil given Round Footing and Bearing Capacity

Open Calculator

fx $$C_r = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.6))}{1.3 \cdot N_c}$$

ex $$17.01869\text{kPa} = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.6))}{1.3 \cdot 1.93}$$

17) Cohesion of Soil given Square Footing and Bearing Capacity

Open Calculator

fx $$C_{sq} = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.8))}{1.3 \cdot N_c}$$

ex $$14.72296\text{kPa} = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.8))}{1.3 \cdot 1.93}$$

18) Cohesion of Soil given Strip Footing and Bearing Capacity

Open Calculator

fx $$C_{st} = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 1))}{1 \cdot N_c}$$

ex $$16.15539\text{kPa} = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1))}{1 \cdot 1.93}$$

19) Effective Surcharge given Round Footing and Bearing Capacity

Open Calculator

fx $$\sigma_{round} = \frac{q_f - ((1.3 \cdot C \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.6))}{N_q}$$

ex $$15.9736\text{kN/m}^2 = \frac{60\text{kPa} - ((1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.6))}{2.01}$$

20) Effective Surcharge given Square Footing and Bearing Capacity

Open Calculator

fx $$\sigma_{square} = \frac{q_f - ((1.3 \cdot C \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 0.8))}{N_q}$$

ex $$13.10793\text{kN/m}^2 = \frac{60\text{kPa} - ((1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 0.8))}{2.01}$$

21) Effective Surcharge given Strip Footing and Bearing Capacity

Open Calculator

fx $$\sigma_{strip} = \frac{q_f - ((1 \cdot C \cdot N_c) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot 1))}{N_q}$$

ex $$11.46075\text{kN/m}^2 = \frac{60\text{kPa} - ((1 \cdot 4.23\text{kPa} \cdot 1.93) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1))}{2.01}$$

22) Shape Factor Dependent on Cohesion

Open Calculator

fx $$s_c = \frac{q_f - ((\sigma' \cdot N_q) + (0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot s_\gamma))}{N_c \cdot C}$$

ex $$1.702605 = \frac{60\text{kPa} - ((10.0\text{Pa} \cdot 2.01) + (0.5 \cdot 18\text{kN/m}^3 \cdot 2\text{m} \cdot 1.6 \cdot 1.60))}{1.93 \cdot 4.23\text{kPa}}$$

23) Shape Factor Dependent on Unit Weight

Open Calculator

$$s_\gamma = \frac{q_f - ((s_c \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot B \cdot \gamma \cdot N_\gamma}$$

$$1.600739 = \frac{60\text{kPa} - ((1.7 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 2\text{m} \cdot 18\text{kN/m}^3 \cdot 1.6}$$

24) Unit Weight of Soil given Round Footing and Bearing Capacity

Open Calculator

$$\gamma = \frac{q_s - ((1.3 \cdot C_r \cdot N_c) + (\sigma_{round} \cdot N_q))}{0.5 \cdot N_\gamma \cdot B_{round} \cdot 0.6}$$

$$13.17296\text{kN/m}^3 = \frac{110.819\text{kPa} - ((1.3 \cdot 17.01\text{kPa} \cdot 1.93) + (15.97\text{kN/m}^2 \cdot 2.01))}{0.5 \cdot 1.6 \cdot 5.7\text{m} \cdot 0.6}$$

25) Unit Weight of Soil given Shape Factor

Open Calculator

$$\gamma = \frac{q_f - ((s_c \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot N_\gamma \cdot B \cdot s_\gamma}$$

$$18.00831\text{kN/m}^3 = \frac{60\text{kPa} - ((1.7 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 1.6 \cdot 2\text{m} \cdot 1.60}$$

26) Unit Weight of Soil given Square Footing and Bearing Capacity

Open Calculator

$$\gamma = \frac{q_s - \left((1.3 \cdot C_{sq} \cdot N_c) + \left(\sigma_{square} \cdot N_q\right)\right)}{0.5 \cdot N_\gamma \cdot B_{square} \cdot 0.8}$$

$$17.3611\text{kN/m}^3 = \frac{110.819\text{kPa} - ((1.3 \cdot 14.72\text{kPa} \cdot 1.93) + (13.10\text{kN/m}^2 \cdot 2.01))}{0.5 \cdot 1.6 \cdot 4.28\text{m} \cdot 0.8}$$

27) Unit Weight of Soil given Strip Footing and Bearing Capacity

Open Calculator

$$\gamma = \frac{q_s - \left((1 \cdot C_{st} \cdot N_c) + \left(\sigma_{strip} \cdot N_q\right)\right)}{0.5 \cdot N_\gamma \cdot B_{strip} \cdot 1}$$

$$19.71271\text{kN/m}^3 = \frac{110.819\text{kPa} - ((1 \cdot 16.15\text{kPa} \cdot 1.93) + (11.46\text{kN/m}^2 \cdot 2.01))}{0.5 \cdot 1.6 \cdot 3.59\text{m} \cdot 1}$$

28) Width of Footing given Round Footing and Bearing Capacity

Open Calculator

fx $$B_{round} = \frac{q_f - ((1.3 \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot N_\gamma \cdot \gamma \cdot 0.6}$$

ex $$5.713753\text{m} = \frac{60\text{kPa} - ((1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 1.6 \cdot 18\text{kN/m}^3 \cdot 0.6}$$

29) Width of Footing given Shape Factor

Open Calculator

fx $$B = \frac{q_f - ((s_c \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot N_\gamma \cdot \gamma \cdot s_\gamma}$$

ex $$2.000923\text{m} = \frac{60\text{kPa} - ((1.7 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 1.6 \cdot 18\text{kN/m}^3 \cdot 1.60}$$

30) Width of Footing given Square Footing and Bearing Capacity

Open Calculator

fx $$B_{square} = \frac{q_f - ((1.3 \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot N_\gamma \cdot \gamma \cdot 0.8}$$

ex $$4.285315\text{m} = \frac{60\text{kPa} - ((1.3 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 1.6 \cdot 18\text{kN/m}^3 \cdot 0.8}$$

31) Width of Footing given Strip Footing and Bearing Capacity

Open Calculator

fx $$B_{strip} = \frac{q_f - ((1 \cdot C \cdot N_c) + (\sigma' \cdot N_q))}{0.5 \cdot N_\gamma \cdot \gamma \cdot 1}$$

ex $$3.598333\text{m} = \frac{60\text{kPa} - ((1 \cdot 4.23\text{kPa} \cdot 1.93) + (10.0\text{Pa} \cdot 2.01))}{0.5 \cdot 1.6 \cdot 18\text{kN/m}^3 \cdot 1}$$

Variables Used

- **B** Width of Footing *(Meter)*
- **B_{round}** Width of Footing for Round Footing *(Meter)*
- **B_{square}** Width of Footing for Square Footing *(Meter)*
- **B_{strip}** Width of Footing for Strip Footing *(Meter)*
- **C** Cohesion *(Kilopascal)*
- **C_r** Cohesion of Soil given Round Footing *(Kilopascal)*
- **C_{sq}** Cohesion of Soil given Square Footing *(Kilopascal)*
- **C_{st}** Cohesion of Soil given Strip Footing *(Kilopascal)*
- **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
- **P_p** Passive Earth Pressure *(Kilopascal)*
- **q** Load Intensity *(Kilopascal)*
- **q_b** Loading Intensity with Bearing Capacity Factors *(Kilopascal)*
- **q_f** Ultimate Bearing Capacity *(Kilopascal)*
- **q_{round}** Bearing Capacity for Round Footing *(Kilopascal)*
- **q_s** Bearing Capacity *(Kilopascal)*
- **q_{square}** Bearing Capacity for Square Footing *(Kilopascal)*
- **q_{strip}** Bearing Capacity for Strip Footing *(Kilopascal)*
- **R_v** Total Downward Force in Soil *(Kilonewton)*
- **s_c** Shape Factor dependent on Cohesion
- **$s_γ$** Shape Factor Dependent on Unit Weight
- **W** Weight of Wedge *(Kilogram)*
- **W_{we}** Weight of Wedge in Kilonewton *(Kilonewton)*
- **γ** Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- **σ'** Effective Surcharge *(Pascal)*
- **$σ_{round}$** Effective Surcharge given Round Footing *(Kilonewton per Square Meter)*
- **$σ_s$** Effective Surcharge (KN/m2) *(Kilonewton per Square Meter)*

- σ_{square} Effective Surcharge given Square Footing *(Kilonewton per Square Meter)*
- σ_{strip} Effective Surcharge given Strip Footing *(Kilonewton per Square Meter)*
- φ Angle of Shearing Resistance *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Function: **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: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Pressure** in Kilopascal (kPa), Kilonewton per Square Meter (kN/m²), Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
  Specific Weight Unit Conversion

Check other formula lists

- Bearing Capacity for Strip Footing for C-Φ Soils Formulas
- Bearing Capacity of Cohesive Soil Formulas
- Bearing Capacity of Non-cohesive Soil Formulas
- Bearing Capacity of Soils Formulas
- Bearing Capacity of Soils: Meyerhof's Analysis Formulas
- Foundation Stability Analysis Formulas
- Atterberg Limits Formulas
- Bearing Capacity of Soil by Terzaghi's Analysis Formulas
- Compaction of Soil Formulas
- Earth Moving Formulas
- Lateral Pressure for Cohesive and Non Cohesive Soil Formulas
- Minimum Depth of Foundation by Rankine's Analysis Formulas
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- Porosity of Soil Sample Formulas
- Scraper Production Formulas
- Seepage Analysis Formulas
- Slope Stability Analysis using Bishops Method Formulas
- Slope Stability Analysis using Culman's Method Formulas
- Soil Origin and Its Properties Formulas
- Specific Gravity of Soil Formulas
- Stability Analysis of Infinite Slopes Formulas
- Stability Analysis of Infinite Slopes in Prism Formulas
- Vibration Control in Blasting Formulas
- Void Ratio of Soil Sample Formulas
- Water Content of Soil and Related Formulas

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