Important Foundation Stability Analysis Formulas PDF

Formulas
Examples
with Units

List of 11
Important Foundation Stability Analysis Formulas

1) Correction Factor for Circle and Square Formula

Evaluate Formula

Formula

$$N_q = 1 + \tan(\varphi)$$

Example with Units

$$2.0355 = 1 + \tan(46°)$$

2) Correction Factor for Rectangle Formula

Evaluate Formula

Formula

$$N_q = 1 + \left(\frac{B}{L}\right) \cdot (\tan(\varphi))$$

Example with Units

$$1.5178 = 1 + \left(\frac{2\,m}{4\,m}\right) \cdot (\tan(46°))$$

3) Correction Factor Nc for Circle and Square Formula

Evaluate Formula

Formula

$$N_c = 1 + \left(\frac{N_q}{N_c}\right)$$

Example

$$1.6387 = 1 + \left(\frac{1.98}{3.1}\right)$$

4) Correction Factor Nc for Rectangle Formula

Evaluate Formula

Formula

$$N_c = 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_q}{N_c}\right)$$

Example with Units

$$1.3194 = 1 + \left(\frac{2\,m}{4\,m}\right) \cdot \left(\frac{1.98}{3.1}\right)$$

5) Correction Factor Ny for Rectangle Formula

Evaluate Formula

Formula

$$N_\gamma = 1 - 0.4 \cdot \left(\frac{B}{L}\right)$$

Example with Units

$$0.8 = 1 - 0.4 \cdot \left(\frac{2\,m}{4\,m}\right)$$

6) Maximum Bearing Pressure Formula

Evaluate Formula

Formula

$$q_m = \left(\frac{P}{A}\right) \cdot \left(1 + \left(e_1 \cdot \frac{c_1}{r_1^2}\right) + \left(e_2 \cdot \frac{c_2}{r_2^2}\right)\right)$$

Example with Units

$$1.3728\,\text{kN/m}^2 = \left(\frac{631.99\,\text{kN}}{470\,\text{m}^2}\right) \cdot \left(1 + \left(0.478\,\text{m} \cdot \frac{2.05\,\text{m}}{12.3\,\text{m}^2}\right) + \left(0.75\,\text{m} \cdot \frac{3\,\text{m}}{12.49\,\text{m}^2}\right)\right)$$

7) Maximum Bearing Pressure for Eccentric Loading Conventional Case Formula

Evaluate Formula

Formula

$$q_m = \left(\frac{C_g}{b \cdot L}\right) \cdot \left(1 + \left(\frac{6 \cdot e_{load}}{b}\right)\right)$$

Example with Units

$$1.3344\,\text{kN/m}^2 = \left(\frac{1000\,\text{m}}{0.2\,\text{m} \cdot 4\,\text{m}}\right) \cdot \left(1 + \left(\frac{6 \cdot 2.25\,\text{mm}}{0.2\,\text{m}}\right)\right)$$

8) Maximum Soil Pressure Formula

Evaluate Formula

Formula

$$q_m = \frac{2 \cdot P}{3 \cdot L \cdot \left(\left(\frac{B}{2}\right) - e_{load}\right)}$$

Example with Units

$$105.5692\,\text{kN/m}^2 = \frac{2 \cdot 631.99\,\text{kN}}{3 \cdot 4\,\text{m} \cdot \left(\left(\frac{2\,\text{m}}{2}\right) - 2.25\,\text{mm}\right)}$$

9) Minimum Bearing Pressure for Eccentric Loading Conventional Case Formula

Evaluate Formula

Formula

$$q_{min} = \left(\frac{P}{b \cdot L}\right) \cdot \left(1 - \left(\frac{6 \cdot e_{load}}{b}\right)\right)$$

Example with Units

$$736.6633\,\text{kN/m}^2 = \left(\frac{631.99\,\text{kN}}{0.2\,\text{m} \cdot 4\,\text{m}}\right) \cdot \left(1 - \left(\frac{6 \cdot 2.25\,\text{mm}}{0.2\,\text{m}}\right)\right)$$

10) Net Bearing Capacity for Undrained Loading of Cohesive Soils Formula

Evaluate Formula

Formula

$$q_u = \alpha_f \cdot N_q \cdot C_u$$

Example with Units

$$43.758\,\text{kPa} = 1.3 \cdot 1.98 \cdot 17\,\text{kPa}$$

11) Net Bearing Capacity of Long Footing in Foundation Stability Analysis Formula

Evaluate Formula

Formula

$$q_u = \left(\alpha_f \cdot C_u \cdot N_c\right) + \left(\sigma_{vo} \cdot N_q\right) + \left(\beta_f \cdot \gamma \cdot B \cdot N_\gamma\right)$$

Example with Units

$$113.512\,\text{kPa} = \left(1.3 \cdot 17\,\text{kPa} \cdot 3.1\right) + \left(0.001\,\text{kPa} \cdot 1.98\right) + \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot 2\,\text{m} \cdot 2.5\right)$$

Variables used in list of Foundation Stability Analysis Formulas above

- **A** Area of Footing *(Square Meter)*
- **b** Breadth of Dam *(Meter)*
- **B** Width of Footing *(Meter)*
- c_1 Principal Axis 1 *(Meter)*
- c_2 Principal Axis 2 *(Meter)*
- C_g Circumference of Group in Foundation *(Meter)*
- C_u Undrained Shear Strength of Soil *(Kilopascal)*
- e_1 Loading Eccentricity 1 *(Meter)*
- e_2 Loading Eccentricity 2 *(Meter)*
- e_{load} Eccentricity of the Load on Soil *(Millimeter)*
- **L** Length of Footing *(Meter)*
- N_c Correction Factor Nc
- N_q Correction Factor Nq
- N_γ Correction Factor Ny
- N_c Bearing Capacity Factor
- N_q Bearing Capacity Factor Nq
- N_γ Value of Nγ
- **P** Axial Load on Soil *(Kilonewton)*
- q_m Maximum Soil Pressure *(Kilonewton per Square Meter)*
- q_m Maximum Bearing Pressure *(Kilonewton per Square Meter)*
- q_{min} Bearing Pressure Minimum *(Kilonewton per Square Meter)*
- q_u Net Bearing Capacity *(Kilopascal)*
- r_1 Radius of Gyration 1 *(Meter)*
- r_2 Radius of Gyration 2 *(Meter)*
- α_f Alpha Footing Factor
- β_f Beta Footing Factor
- γ Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- σ_{vo} Effective Vertical Shear Stress in Soil *(Kilopascal)*

Constants, Functions, Measurements used in list of Foundation Stability Analysis Formulas above

- Functions: **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), Millimeter (mm)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Kilonewton per Square Meter (kN/m²), Kilopascal (kPa)
  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

- φ Angle of Internal Friction *(Degree)*

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