Important Lateral Pressure for Cohesive and Non Cohesive Soil Formulas PDF

Formulas
Examples
with Units

List of 25
Important Lateral Pressure for Cohesive and Non Cohesive Soil Formulas

1) Coefficient of Active Pressure given Angle of Internal Friction of Soil Formula

Evaluate Formula

Formula

$$K_A = \left(\tan\left(\left(45 \cdot \frac{\pi}{180}\right) - \left(\frac{\varphi}{2}\right)\right)\right)^2$$

Example with Units

$$0.1632 = \left(\tan\left(\left(45 \cdot \frac{3.1416}{180}\right) - \left(\frac{46°}{2}\right)\right)\right)^2$$

2) Coefficient of Active Pressure given Total Thrust from Soil for Level Surface Formula

Evaluate Formula

Formula

$$K_A = \frac{2 \cdot P}{\gamma \cdot \left(h_w\right)^2}$$

Example with Units

$$0.1156 = \frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2}$$

3) Coefficient of Passive Pressure given Angle of Internal Friction of Soil Formula

Evaluate Formula

Formula

$$K_P = \left(\tan\left(\left(45 \cdot \frac{\pi}{180}\right) - \left(\frac{\varphi}{2}\right)\right)\right)^2$$

Example with Units

$$0.1632 = \left(\tan\left(\left(45 \cdot \frac{3.1416}{180}\right) - \left(\frac{46°}{2}\right)\right)\right)^2$$

4) Coefficient of Passive Pressure given Thrust of Soil are Free to Move only Small Amount Formula

Evaluate Formula

Formula

$$K_P = \frac{2 \cdot P}{\gamma \cdot \left(h_w\right)^2}$$

Example with Units

$$0.1156 = \frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2}$$

5) Coefficient of Passive Pressure given Thrust of Soil that are Completely Restrained Formula

Evaluate Formula

Formula

$$K_P = \frac{2 \cdot P}{\gamma \cdot \left(h_w\right)^2}$$

Example with Units

$$0.1156 = \frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2}$$

6) Cohesion of soil given Total Thrust from Soil that are Free to Move Formula

Evaluate Formula

Formula

$$C = \left(0.25 \cdot \gamma \cdot h_w \cdot \sqrt{K_A}\right) - \left(0.5 \cdot \frac{P}{h_w} \cdot \sqrt{K_A}\right)$$

Example with Units

$$4.7781\,\text{kPa} = \left(0.25 \cdot 18\,\text{kN/m}^3 \cdot 3.1\,\text{m} \cdot \sqrt{0.15}\right) - \left(0.5 \cdot \frac{10\,\text{kN/m}}{3.1\,\text{m}} \cdot \sqrt{0.15}\right)$$

7) Cohesion of soil given Total Thrust from Soil with Small Angles of Internal Friction Formula

Evaluate Formula

Formula

$$C = \left(\left(0.25 \cdot \gamma \cdot h_w\right) - \left(0.5 \cdot \frac{P}{h_w}\right)\right)$$

Example with Units

$$12.3371\,\text{kPa} = \left(\left(0.25 \cdot 18\,\text{kN/m}^3 \cdot 3.1\,\text{m}\right) - \left(0.5 \cdot \frac{10\,\text{kN/m}}{3.1\,\text{m}}\right)\right)$$

8) Height of Wall given Thrust of Soil that are Completely Restrained and Surface is Level Formula

Evaluate Formula

Formula

$$h_w = \sqrt{\frac{2 \cdot P}{\gamma \cdot K_P}}$$

Example with Units

$$2.6352\,\text{m} = \sqrt{\frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot 0.16}}$$

9) Height of Wall given Total Thrust of Soil that are Free to Move only Small Amount Formula

Evaluate Formula

Formula

$$h_w = \sqrt{\frac{2 \cdot P}{\gamma \cdot K_P}}$$

Example with Units

$$2.6352\,\text{m} = \sqrt{\frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot 0.16}}$$

10) Total Height of Wall given Total Thrust from Soil for Level Surface behind Wall Formula

Evaluate Formula

Formula

$$h_w = \sqrt{\frac{2 \cdot P}{\gamma \cdot K_A}}$$

Example with Units

$$2.7217\,\text{m} = \sqrt{\frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot 0.15}}$$

11) Total Height of Wall given Total Thrust from Soil that are Completely Restrained Formula

Evaluate Formula

Formula

$$h_w = \sqrt{\frac{2 \cdot P}{\gamma \cdot \cos(i) \cdot \left(\frac{\cos(i) + \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}{\cos(i) - \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}\right)}}$$

Example with Units

$$0.5689\,\text{m} = \sqrt{\frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot \cos(30°) \cdot \left(\frac{\cos(30°) + \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}{\cos(30°) - \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}\right)}}$$

12) Total Height of Wall given Total Thrust from Soil that are Free to move Formula

Evaluate Formula

Formula

$$h_w = \sqrt{\frac{2 \cdot P}{\gamma \cdot \cos(i) \cdot \left(\frac{\cos(i) - \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}{\cos(i) + \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}\right)}}$$

Example with Units

$$2.2554\,\text{m} = \sqrt{\frac{2 \cdot 10\,\text{kN/m}}{18\,\text{kN/m}^3 \cdot \cos(30°) \cdot \left(\frac{\cos(30°) - \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}{\cos(30°) + \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}\right)}}$$

13) Total Thrust from Soil that are Completely Restrained Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot (h_w)^2 \cdot \cos(i)\right) \cdot \left(\frac{\cos(i) + \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}{\cos(i) - \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}\right)$$

Example with Units

$$296.9695\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot (3.1\,\text{m})^2 \cdot \cos(30°)\right) \cdot \left(\frac{\cos(30°) + \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}{\cos(30°) - \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}\right)$$

14) Total Thrust from Soil that are Completely Restrained and Surface is Level Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot \left(h_w\right)^2 \cdot K_P\right)$$

Example with Units

$$13.8384\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2 \cdot 0.16\right)$$

15) Total Thrust from Soil that are Free to Move Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot \left(h_w\right)^2 \cdot \cos\left(i\right)\right) \cdot \left(\frac{\cos\left(i\right) - \sqrt{\left(\cos\left(i\right)\right)^2 - \left(\cos\left(\varphi\right)\right)^2}}{\cos\left(i\right) + \sqrt{\left(\cos\left(i\right)\right)^2 - \left(\cos\left(\varphi\right)\right)^2}}\right)$$

Example with Units

$$18.8921\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2 \cdot \cos\left(30°\right)\right) \cdot \left(\frac{\cos\left(30°\right) - \sqrt{\left(\cos\left(30°\right)\right)^2 - \left(\cos\left(46°\right)\right)^2}}{\cos\left(30°\right) + \sqrt{\left(\cos\left(30°\right)\right)^2 - \left(\cos\left(46°\right)\right)^2}}\right)$$

16) Total Thrust from Soil that are Free to Move only Small Amount Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot \left(h_w\right)^2 \cdot K_P\right)$$

Example with Units

$$13.8384\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2 \cdot 0.16\right)$$

17) Total Thrust from Soil that are Free to Move to Considerable Amount Formula

Evaluate Formula

Formula

$$P = \left(\left(0.5 \cdot \gamma \cdot \left(h_w\right)^2 \cdot K_A\right) - \left(2 \cdot C \cdot h_w \cdot \sqrt{K_A}\right)\right)$$

Example with Units

$$9.9239\,\text{kN/m} = \left(\left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2 \cdot 0.15\right) - \left(2 \cdot 1.27\,\text{kPa} \cdot 3.1\,\text{m} \cdot \sqrt{0.15}\right)\right)$$

18) Total Thrust from Soil when Surface behind Wall is Level Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot \left(h_w\right)^2 \cdot K_A\right)$$

Example with Units

$$12.9735\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2 \cdot 0.15\right)$$

19) Total Thrust from Soil with Small Angles of Internal Friction Formula

Evaluate Formula

Formula

$$P = \left(0.5 \cdot \gamma \cdot \left(h_w\right)^2\right) - \left(2 \cdot C \cdot h_w\right)$$

Example with Units

$$78.616\,\text{kN/m} = \left(0.5 \cdot 18\,\text{kN/m}^3 \cdot \left(3.1\,\text{m}\right)^2\right) - \left(2 \cdot 1.27\,\text{kPa} \cdot 3.1\,\text{m}\right)$$

20) Unit Weight of Soil given Thrust of Soil that are Completely Restrained and Surface is Level Formula

Evaluate Formula

Formula

$$\gamma = \frac{2 \cdot P}{\left(h_w\right)^2 \cdot K_P}$$

Example with Units

$$13.0073\,\text{kN/m}^3 = \frac{2 \cdot 10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2 \cdot 0.16}$$

21) Unit Weight of Soil given Total Thrust from Soil for Level Surface behind Wall Formula

Evaluate Formula

Formula

$$\gamma = \frac{2 \cdot P}{\left(h_w\right)^2 \cdot K_A}$$

Example with Units

$$13.8744\,\text{kN/m}^3 = \frac{2 \cdot 10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2 \cdot 0.15}$$

22) Unit Weight of Soil given Total Thrust from Soil that are Completely Restrained Formula

Evaluate Formula

Formula

$$\gamma = \frac{2 \cdot P}{\left(h_w\right)^2 \cdot \cos\left(i\right)} \cdot \left(\frac{\cos\left(i\right) + \sqrt{\left(\cos\left(i\right)\right)^2 - \left(\cos\left(\varphi\right)\right)^2}}{\cos\left(i\right) - \sqrt{\left(\cos\left(i\right)\right)^2 - \left(\cos\left(\varphi\right)\right)^2}}\right)$$

Example with Units

$$9.5278\,\text{kN/m}^3 = \frac{2 \cdot 10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2 \cdot \cos\left(30°\right)} \cdot \left(\frac{\cos\left(30°\right) + \sqrt{\left(\cos\left(30°\right)\right)^2 - \left(\cos\left(46°\right)\right)^2}}{\cos\left(30°\right) - \sqrt{\left(\cos\left(30°\right)\right)^2 - \left(\cos\left(46°\right)\right)^2}}\right)$$

23) Unit Weight of Soil given Total Thrust from Soil that are Free to Move Formula

Evaluate Formula

Formula

$$\gamma = \frac{2 \cdot P}{\left(h_w\right)^2 \cdot \cos(i)} \cdot \left(\frac{\cos(i) - \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}}{\cos(i) + \sqrt{(\cos(i))^2 - (\cos(\varphi))^2}} \right)$$

Example with Units

$$0.6061\,\text{kN/m}^3 = \frac{2 \cdot 10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2 \cdot \cos(30°)} \cdot \left(\frac{\cos(30°) - \sqrt{(\cos(30°))^2 - (\cos(46°))^2}}{\cos(30°) + \sqrt{(\cos(30°))^2 - (\cos(46°))^2}} \right)$$

24) Unit Weight of Soil given Total Thrust from Soil with Small Angles of Internal Friction Formula

Evaluate Formula

Formula

$$\gamma = \left(\left(2 \cdot \frac{P}{\left(h_w\right)^2} \right) + \left(4 \cdot \frac{C}{h_w} \right) \right)$$

Example with Units

$$3.7199\,\text{kN/m}^3 = \left(\left(2 \cdot \frac{10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2} \right) + \left(4 \cdot \frac{1.27\,\text{kPa}}{3.1\,\text{m}} \right) \right)$$

25) Unit Weight of Soil given Total Thrust of Soil that are Free to Move only Small Amount Formula

Evaluate Formula

Formula

$$\gamma = \frac{2 \cdot P}{\left(h_w\right)^2 \cdot K_P}$$

Example with Units

$$13.0073\,\text{kN/m}^3 = \frac{2 \cdot 10\,\text{kN/m}}{\left(3.1\,\text{m}\right)^2 \cdot 0.16}$$

Variables used in list of Lateral Pressure for Cohesive and Non Cohesive Soil Formulas above

- **C** Cohesion in Soil as Kilopascal *(Kilopascal)*
- h_w Total Height of Wall *(Meter)*
- **i** Angle of Inclination *(Degree)*
- K_A Coefficient of Active Pressure
- K_P Coefficient of Passive Pressure
- **P** Total Thrust of Soil *(Kilonewton per Meter)*
- **γ** Unit Weight of Soil *(Kilonewton per Cubic Meter)*
- **φ** Angle of Internal Friction *(Degree)*

Constants, Functions, Measurements used in list of Lateral Pressure for Cohesive and Non Cohesive Soil Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **cos**, cos(Angle) *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **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.*
- 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) *Length Unit Conversion*
- Measurement: **Pressure** in Kilopascal (kPa) *Pressure Unit Conversion*
- Measurement: **Angle** in Degree (°) *Angle Unit Conversion*
- Measurement: **Surface Tension** in Kilonewton per Meter (kN/m) *Surface Tension Unit Conversion*
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³) *Specific Weight Unit Conversion*

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