



Design of Retaining Walls Formulas

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Examples!

Conversions!

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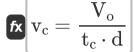


List of 16 Design of Retaining Walls Formulas

Design of Retaining Walls &

Cantilever and Counterfort Retaining Walls

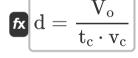
1) Counterfort Shear Unit Stress on Horizontal Section



Open Calculator

$$=$$
 $3.136001 \text{MPa} = \frac{8 \text{MPa}}{5.1 \text{mm} \cdot 500.2 \text{m}}$

2) Horizontal Distance from Face of Wall to Main Steel



Open Calculator 🗗

- 3) Normal Shear Unit Stress on Horizontal Section

$$\mathbf{f}\mathbf{x} \left[\mathbf{V}_{\mathrm{o}} = \left(\mathbf{v}_{\mathrm{c}} \cdot \mathbf{t}_{\mathrm{c}} \cdot \mathbf{d}
ight)
ight]$$

Open Calculator

$$= 8.163264 \mathrm{MPa} = (3.2 \mathrm{MPa} \cdot 5.1 \mathrm{mm} \cdot 500.2 \mathrm{m})$$



4) Shear Force on Section

fx

Open Calculator

$$oxed{ F_{
m shear} = V_1 + \left(\left(rac{M_{
m b}}{
m d}
ight) \cdot \left(an(heta) + an(\Phi)
ight)
ight) }$$

$$= 3.6 \text{E} \text{ 11N} = 500 \text{N} + \left(\left(\frac{53 \text{N*m}}{500.2 \text{m}} \right) \cdot \left(\tan(180^\circ) + \tan(90^\circ) \right) \right)$$

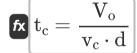
5) Shear Force on Section for Vertical Wall Face

 $\mathbf{F}_{\mathrm{shear}} = \mathrm{V}_1 + \left(rac{\mathrm{M}_\mathrm{b}}{\mathrm{d}}
ight) \cdot \mathrm{tan}(\mathbf{ heta})$

Open Calculator 🗗

$$ext{ex} 500 ext{N} = 500 ext{N} + \left(rac{53 ext{N*m}}{500.2 ext{m}}
ight) \cdot an(180 \degree)$$

6) Thickness of Counterfort Shear Unit Stress on Horizontal Section



Open Calculator 🛂

$$=$$
 $\frac{8 \text{MPa}}{3.2 \text{MPa} \cdot 500.2 \text{m}}$



Earth Pressure and Stability &

7) Height of Water above Bottom of Wall given Total Thrust from Water Retained behind Wall

$$\mathbf{f}_{\mathbf{x}} \left[\mathbf{H}_{\mathrm{w}} = \sqrt{2 \cdot rac{\mathbf{T}_{\mathrm{W}}}{\gamma_{\mathrm{w}}}}
ight]$$

Open Calculator 🚰

$$=$$
 1.806095m $=\sqrt{2\cdotrac{16 ext{kN/m}}{9.81 ext{kN/m}^3}}$

8) Total Thrust from Water Retained by Wall

$$ag{T_{
m W}} = \left(0.5 \cdot {
m \gamma_w} \cdot {
m (H_w)}^2
ight)$$

Open Calculator 🗗

$$ext{ex} \ 15.8922 ext{kN/m} = \left(0.5 \cdot 9.81 ext{kN/m}^3 \cdot (1.80 ext{m})^2
ight)$$

9) Unit Weight of Water given Total Thrust from Water Retained behind Wall

$$\gamma_{
m w} = \left(2 \cdot rac{{
m T_W}}{{
m (H_w)}^2}
ight)$$

Open Calculator

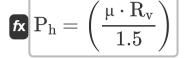
$$oxed{ egin{align*} egin{align*} \mathbf{ex} \ 9.876543 \mathrm{kN/m^3} = \left(2 \cdot rac{16 \mathrm{kN/m}}{\left(1.80 \mathrm{m}
ight)^2}
ight) \end{aligned} }$$





Gravity Retaining Wall

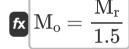
10) Earth Thrust Horizontal Component given Sum of Righting Moments



Open Calculator 🚰

ex
$$200.04 \mathrm{N} = \left(rac{0.6 \cdot 500.1 \mathrm{N}}{1.5}
ight)$$

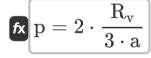
11) Overturning Moment



Open Calculator

$$= 10.06667 N^*m = \frac{15.1N^*m}{1.5}$$

12) Pressure when Resultant is Outside Middle Third

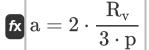


Open Calculator

ex
$$83.35 \text{Pa} = 2 \cdot \frac{500.1 \text{N}}{3 \cdot 4 \text{m}}$$



13) Resultant Outside Middle Third



Open Calculator

 $4.002401 \mathrm{m} = 2 \cdot rac{500.1 \mathrm{N}}{3 \cdot 83.3 \mathrm{Pa}}$

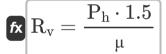
14) Retaining Wall Righting Moment

fx $M_{
m r}=1.5\cdot M_{
m o}$

Open Calculator

 $15.15N*m = 1.5 \cdot 10.1N*m$

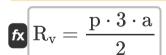
15) Total Downward Force on Soil for Horizontal Component



Open Calculator

 $ext{ex} 500 ext{N} = rac{200 ext{N} \cdot 1.5}{0.6}$

16) Total Downward Force on Soil when Resultant is Outside Middle Third



 $\boxed{499.8\mathrm{N} = \frac{83.3\mathrm{Pa} \cdot 3 \cdot 4\mathrm{m}}{2}}$



Variables Used

- a Middle Third Distance (Meter)
- **d** Horizontal Distance (Meter)
- F_{shear} Shear Force on Section (Newton)
- **H**_w Height of Water (Meter)
- M_b Bending Moment (Newton Meter)
- Mo Overturning Moment (Newton Meter)
- Mr Retaining Wall Righting Moment (Newton Meter)
- p Earth Pressure (Pascal)
- Ph Horizontal Component of Earth Thrust (Newton)
- R_v Total Downward Force on Soil (Newton)
- t_c Thickness of Counterfort (Millimeter)
- Tw Thrust from Water (Kilonewton per Meter)
- **V**₁ Shear on Section 1 (Newton)
- Vc Counterfort Shear Unit Stress (Megapascal)
- Vo Normal Shear Unit Stress (Megapascal)
- γ_w Unit Weight of Water (Kilonewton per Cubic Meter)
- • Angle between Earth and Wall (Degree)
- µ Coefficient of Sliding Friction
- Angle Wall Face makes with Vertical (Degree)





Constants, Functions, Measurements used

- Function: sqrt, sqrt(Number)
 Square root function
- Function: tan, tan(Angle)

 Trigonometric tangent function
- Measurement: Length in Millimeter (mm), Meter (m)

 Length Unit Conversion
- Measurement: Pressure in Megapascal (MPa), Pascal (Pa)
 Pressure Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Surface Tension in Kilonewton per Meter (kN/m)
 Surface Tension Unit Conversion
- Measurement: Moment of Force in Newton Meter (N*m)
 Moment of Force Unit Conversion
- Measurement: Specific Weight in Kilonewton per Cubic Meter (kN/m³)
 Specific Weight Unit Conversion





Check other formula lists

- Properties of Basic Material of Concrete Structures Formulas
- Design for Beams and Ultimate Strength for Rectangular Beams with Tension Reinforcement Formulas
- Design of Compression Members
 Formulas
- Design of Retaining Walls Formulas
 - Design of Two Way Slab System and Footing Formulas

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