

Important General Relation for Suspension Cables Formulas PDF



Formulas Examples with Units

List of 17 Important General Relation for Suspension Cables Formulas

1) Catenary Formulas

1.1) Catenary Length given Tension at any Point of Simple Cable with UDL Formula

[Evaluate Formula](#)**Formula**

$$L_{\text{span}} = \sqrt{\frac{(T_s^2) - (T_m^2)}{q^2}}$$

Example with Units

$$20.9962 \text{ m} = \sqrt{\frac{(210 \text{ kN}^2) - (4 \text{ kN}^2)}{10.0 \text{ kN/m}^2}}$$

1.2) Horizontal Component given Tension at any Point of Simple Cable with UDL Formula

[Evaluate Formula](#)**Formula**

$$H = \sqrt{(T^2) - ((W' \cdot s)^2)}$$

Example with Units

$$520.3062 \text{ kN} = \sqrt{(600 \text{ kN}^2) - ((6.0 \text{ kN/m} \cdot 49.8 \text{ m})^2)}$$

1.3) Tension at any Point given Catenary Length of Simple Cable with UDL Formula

[Evaluate Formula](#)**Formula**

$$T_s = \sqrt{(T_m^2) + (q \cdot L_{\text{span}})^2}$$

Example with Units

$$150.0533 \text{ kN} = \sqrt{(4 \text{ kN}^2) + (10.0 \text{ kN/m} \cdot 15 \text{ m})^2}$$

1.4) UDL given Tension at any Point of Simple Cable with UDL Formula

[Evaluate Formula](#)**Formula**

$$q = \sqrt{\frac{(T_s^2) - (T_m^2)}{L_{\text{span}}^2}}$$

Example with Units

$$13.9975 \text{ kN/m} = \sqrt{\frac{(210 \text{ kN}^2) - (4 \text{ kN}^2)}{15 \text{ m}^2}}$$

2) Parabola Formulas

2.1) Tension at Midspan given Parabolic Equation for Cable Slope Formula

[Evaluate Formula](#)**Formula**

$$T_{\text{mid}} = \frac{q \cdot x^2}{2 \cdot y}$$

Example with Units

$$196 \text{ kN} = \frac{10.0 \text{ kN/m} \cdot 7 \text{ m}^2}{2 \cdot 1.25}$$



2.2) UDL given Parabolic Equation for Cable Slope Formula

Formula

$$q = \frac{y \cdot 2 \cdot T_{\text{mid}}}{(x)^2}$$

Example with Units

$$10 \text{ kN/m} = \frac{1.25 \cdot 2 \cdot 196 \text{ kN}}{(7 \text{ m})^2}$$

Evaluate Formula 

2.3) UDL given Tension at Midspan for UDL on Parabolic Cable Formula

Formula

$$q = 8 \cdot T_{\text{mid}} \cdot \frac{d}{L_{\text{span}}^2}$$

Example with Units

$$10.0352 \text{ kN/m} = 8 \cdot 196 \text{ kN} \cdot \frac{1.44 \text{ m}}{15 \text{ m}^2}$$

Evaluate Formula 

3) Supports at Same Level Formulas

3.1) Horizontal Component of Cable Tension for UDL Formula

Formula

$$T_{\text{cable udl}} = q \cdot \frac{L_{\text{span}}^2}{8 \cdot f}$$

Example with Units

$$56.25 \text{ kN} = 10.0 \text{ kN/m} \cdot \frac{15 \text{ m}^2}{8 \cdot 5 \text{ m}}$$

Evaluate Formula 

3.2) Maximum Reactions at Supports Formula

Formula

$$T_{\text{max}} = \left(q \cdot \frac{L_{\text{span}}}{2} \right) \cdot \sqrt{1 + \left(\frac{L_{\text{span}}^2}{16 \cdot f^2} \right)}$$

Evaluate Formula 

Example with Units

$$93.75 \text{ kN} = \left(10.0 \text{ kN/m} \cdot \frac{15 \text{ m}}{2} \right) \cdot \sqrt{1 + \left(\frac{15 \text{ m}^2}{16 \cdot 5 \text{ m}^2} \right)}$$

3.3) Sag of Cable at Midway between supports given Horizontal Component of Cable Tension for UDL Formula

Formula

$$f = q \cdot \frac{L_{\text{span}}^2}{8 \cdot T_{\text{cable udl}}}$$

Example with Units

$$5 \text{ m} = 10.0 \text{ kN/m} \cdot \frac{15 \text{ m}^2}{8 \cdot 56.25 \text{ kN}}$$

Evaluate Formula 



3.4) Sag of Cable at Midway between supports given Maximum Reactions at Supports Formula



Formula

$$f = \sqrt{\frac{\frac{L_{\text{span}}^2}{16}}{\left(\frac{2 \cdot T_{\text{max}}}{q \cdot L_{\text{span}}}\right)^2 - 1}}$$

Example with Units

$$5 \text{ m} = \sqrt{\frac{\frac{15 \text{ m}^2}{16}}{\left(\frac{2 \cdot 93.75 \text{ kN}}{10.0 \text{ kN/m} \cdot 15 \text{ m}}\right)^2 - 1}}$$

Evaluate Formula

3.5) Span Length given Horizontal Component of Cable Tension for UDL Formula

Formula

$$L_{\text{span}} = \sqrt{\frac{8 \cdot f \cdot T_{\text{cable udl}}}{q}}$$

Example with Units

$$15 \text{ m} = \sqrt{\frac{8 \cdot 5 \text{ m} \cdot 56.25 \text{ kN}}{10.0 \text{ kN/m}}}$$

Evaluate Formula

3.6) Span Length given Vertical Reaction at Supports Formula

Formula

$$L_{\text{span}} = V_R \cdot \frac{2}{q}$$

Example with Units

$$15 \text{ m} = 75 \text{ kN} \cdot \frac{2}{10.0 \text{ kN/m}}$$

Evaluate Formula

3.7) UDL given Maximum Reactions at Supports Formula

Formula

$$q = \frac{T_{\text{max}}}{\left(\frac{L_{\text{span}}}{2}\right) \cdot \sqrt{1 + \left(\frac{L_{\text{span}}^2}{16 \cdot f^2}\right)}}$$

Example with Units

$$10 \text{ kN/m} = \frac{93.75 \text{ kN}}{\left(\frac{15 \text{ m}}{2}\right) \cdot \sqrt{1 + \left(\frac{15 \text{ m}^2}{16 \cdot 5 \text{ m}^2}\right)}}$$

Evaluate Formula

3.8) UDL given Vertical Reaction at Supports Formula

Formula

$$q = 2 \cdot \frac{V_R}{L_{\text{span}}}$$

Example with Units

$$10 \text{ kN/m} = 2 \cdot \frac{75 \text{ kN}}{15 \text{ m}}$$

Evaluate Formula

3.9) Uniformly distributed Load given Horizontal Component of Cable Tension for UDL Formula

Formula

$$q = \frac{T_{\text{cable udl}} \cdot 8 \cdot f}{(L_{\text{span}})^2}$$

Example with Units

$$10 \text{ kN/m} = \frac{56.25 \text{ kN} \cdot 8 \cdot 5 \text{ m}}{(15 \text{ m})^2}$$

Evaluate Formula



3.10) Vertical Reaction at Supports Formula

Formula

$$V_R = q \cdot \frac{L_{\text{span}}}{2}$$

Example with Units

$$75 \text{ kN} = 10.0 \text{ kN/m} \cdot \frac{15 \text{ m}}{2}$$

Evaluate Formula 



Variables used in list of General Relation for Suspension Cables Formulas above

- **d** Maximum Sag (Meter)
- **f** Sag of Cable at Midway between Supports (Meter)
- **H** Horizontal Tension (Kilonewton)
- **L_{span}** Cable Span (Meter)
- **q** Uniformly Distributed Load (Kilonewton per Meter)
- **s** Catenary Length (Meter)
- **T** Cable Tension (Kilonewton)
- **T_{cable udl}** Cable Tension for UDL (Kilonewton)
- **T_m** Midspan Tension (Kilonewton)
- **T_{max}** Maximum Value of Tension (Kilonewton)
- **T_{mid}** Tension at Midspan (Kilonewton)
- **T_s** Tension at Supports (Kilonewton)
- **V_R** Vertical Reaction at Supports (Kilonewton)
- **W'** Total Load per Unit Length (Kilonewton per Meter)
- **x** Distance from Midpoint of Cable (Meter)
- **y** Parabolic Equation of Cable Slope

Constants, Functions, Measurements used in list of General Relation for Suspension Cables Formulas above

- **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.
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement:** **Surface Tension** in Kilonewton per Meter (kN/m)
Surface Tension Unit Conversion 



Download other Important Suspension Cables PDFs

- [Important Cable System, Sag and Drainage on Bridges Formulas](#) 
- [Important General Relation for Suspension Cables Formulas](#) 
- [Important Parabolic Cable Tension and Length Formulas](#) 

Try our Unique Visual Calculators

-  [Percentage of number](#) 
-  [LCM calculator](#) 
-  [Simple fraction](#) 

Please SHARE this PDF with someone who needs it!

This PDF can be downloaded in these languages

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

9/18/2024 | 11:42:11 AM UTC

