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Cable System, Sag and Drainage on Bridges Formulas

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List of 17 Cable System, Sag and Drainage on Bridges Formulas

Cable System, Sag and Drainage on Bridges

Cable Systems

1) Cable Tension using Natural Frequency of Each Cable

Open Calculator

fx $$T = \left(\left(\omega_n \cdot \frac{L_{span}}{n} \cdot \pi\right)^2\right) \cdot \frac{q}{[g]}$$

ex $$600.9406\text{kN} = \left(\left(5.1\text{Hz} \cdot \frac{15\text{m}}{9.9} \cdot \pi\right)^2\right) \cdot \frac{10.0\text{kN/m}}{[g]}$$

2) Fundamental Vibration Mode given Natural Frequency of Each Cable

Open Calculator

fx $$n = \frac{\omega_n \cdot \pi \cdot L_{span}}{\sqrt{T}} \cdot \sqrt{\frac{q}{[g]}}$$

ex $$9.907757 = \frac{5.1\text{Hz} \cdot \pi \cdot 15\text{m}}{\sqrt{600\text{kN}}} \cdot \sqrt{\frac{10.0\text{kN/m}}{[g]}}$$

3) Natural Frequency of Each Cable

Open Calculator

fx $$\omega_n = \left(\frac{n}{\pi \cdot L_{span}}\right) \cdot \sqrt{T \cdot \frac{[g]}{q}}$$

ex $$5.096007\text{Hz} = \left(\frac{9.9}{\pi \cdot 15\text{m}}\right) \cdot \sqrt{600\text{kN} \cdot \frac{[g]}{10.0\text{kN/m}}}$$

4) Span of Cable given Natural Frequency of Each Cable

Open Calculator

fx $$L_{span} = \left(\frac{n}{\pi \cdot \omega_n}\right) \cdot \sqrt{T \cdot \left(\frac{[g]}{q}\right)}$$

ex $$14.98826\text{m} = \left(\frac{9.9}{\pi \cdot 5.1\text{Hz}}\right) \cdot \sqrt{600\text{kN} \cdot \left(\frac{[g]}{10.0\text{kN/m}}\right)}$$

Catenary Cable Sag and Distance between Supports

5) Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$c = \left(\frac{T_s}{q}\right) - d$$

ex $$19.56\text{m} = \left(\frac{210\text{kN}}{10.0\text{kN/m}}\right) - 1.44\text{m}$$

6) Maximum Sag given Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$d = (-c) + \left(\frac{T_s}{q}\right)$$

ex $$1.44\text{m} = (-19.56\text{m}) + \left(\frac{210\text{kN}}{10.0\text{kN/m}}\right)$$

7) Span of Cable given Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$L_{span} = 2 \cdot c$$

ex $$39.12\text{m} = 2 \cdot 19.56\text{m}$$

8) Tension at Supports given Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$T_s = (d + c) \cdot q$$

ex $$210\text{kN} = (1.44\text{m} + 19.56\text{m}) \cdot 10.0\text{kN/m}$$

9) Total Sag given Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$f_{cable} = d + c$$

ex $$21\text{m} = 1.44\text{m} + 19.56\text{m}$$

10) UDL given Catenary Parameter for UDL on Catenary Parabolic Cable

Open Calculator

fx $$q = \frac{T_s}{d + c}$$

ex $$10\text{kN/m} = \frac{210\text{kN}}{1.44\text{m} + 19.56\text{m}}$$

Rainwater Accumulation and Drainage on Bridges

11) Average Rainfall Intensity given Runoff Rate of Rainwater from Bridge during Rainstorm

Open Calculator

fx $$I = \frac{q_p}{1.00083 \cdot C_r \cdot A_{catchment}}$$

ex $$16.00032\text{mm/min} = \frac{1.256\text{m}^3\text{/s}}{1.00083 \cdot 0.5 \cdot 9412\text{m}^2}$$

12) Deck Width for Handling Rainwater Runoff to Drain Scuppers

Open Calculator

fx $$w = S + \frac{t}{3}$$

ex $$4.5\text{m} = 2.5\text{m} + \frac{6}{3}$$

13) Drainage Area given Runoff Rate of Rainwater from Bridge during Rainstorm

Open Calculator

$$A_{catchment} = \frac{q_p}{1.00083 \cdot C_r \cdot I}$$

$$9412.188m^2 = \frac{1.256m^3/s}{1.00083 \cdot 0.5 \cdot 16mm/min}$$

14) Runoff Coefficient given Runoff Rate of Rainwater from Bridge during Rainstorm

Open Calculator

$$C_r = \frac{q_p}{1.00083 \cdot I \cdot A_{catchment}}$$

$$0.50001 = \frac{1.256m^3/s}{1.00083 \cdot 16mm/min \cdot 9412m^2}$$

15) Runoff Rate of Rainwater from Bridge during Rainstorm

Open Calculator

$$q_p = 1.00083 \cdot C_r \cdot I \cdot A_{catchment}$$

$$1.255975m^3/s = 1.00083 \cdot 0.5 \cdot 16mm/min \cdot 9412m^2$$

16) Shoulder Width for Deck Width of Rainwater Runoff to Drain Scuppers

Open Calculator

$$S = w - \left(\frac{t}{3}\right)$$

$$2.5m = 4.5m - \left(\frac{6}{3}\right)$$

17) Traffic Lane given Deck Width for Handling Rainwater Runoff to Drain Scuppers

Open Calculator

fx $t = (w - S) \cdot 3$

ex $6 = (4.5m - 2.5m) \cdot 3$

Variables Used

- $A_{catchment}$ Catchment Area for Rainstorm *(Square Meter)*
- **c** Catenary Parameter *(Meter)*
- C_r Runoff Coefficient
- **d** Maximum Sag *(Meter)*
- f_{cable} Sag of Cable *(Meter)*
- **I** Intensity of Rainfall *(Millimeter per Minute)*
- L_{span} Cable Span *(Meter)*
- **n** Fundamental Vibration Mode
- **q** Uniformly Distributed Load *(Kilonewton per Meter)*
- q_p Peak Rate of Runoff *(Cubic Meter per Second)*
- **S** Shoulder Width *(Meter)*
- **t** Number of Traffic Lane
- **T** Cable Tension *(Kilonewton)*
- T_s Tension at Supports *(Kilonewton)*
- **w** Width of Deck *(Meter)*
- ω_n Natural Frequency *(Hertz)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665 Meter/Second²
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Millimeter per Minute (mm/min)
  Speed Unit Conversion
- Measurement: **Force** in Kilonewton (kN)
  Force Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Surface Tension** in Kilonewton per Meter (kN/m)
  Surface Tension Unit Conversion

Check other formula lists

- **Cable System, Sag and Drainage on Bridges Formulas**
- **General Relation for Suspension Cables Formulas**
- **Parabolic Cable Tension and Length Formulas**

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