Important Surveying Vertical Curves Formulas PDF

Formulas
Examples
with Units

List of 19
Important Surveying Vertical Curves Formulas

1) Allowable Centrifugal Acceleration given Length Formula

Evaluate Formula

Formula

$$f = \left(\left(g_1\right) - \left(g_2\right)\right) \cdot \frac{V^2}{100 \cdot L_c}$$

Example with Units

$$0.6006\,\text{m/s}^2 = \left(\left(2.2\right) - \left(-1.5\right)\right) \cdot \frac{100\,\text{km/h}^2}{100 \cdot 616\,\text{m}}$$

2) Change of Grade given Length Formula

Evaluate Formula

Formula

$$N = L \cdot P_N$$

Example with Units

$$1.4 = 20\,\text{m} \cdot 0.07$$

3) Downgrade given Length based on Centrifugal Ratio Formula

Evaluate Formula

Formula

$$g_2 = g_1 - \left(L_c \cdot 100 \cdot \frac{f}{V^2}\right)$$

Example with Units

$$-1.496 = 2.2 - \left(616\,\text{m} \cdot 100 \cdot \frac{0.6\,\text{m/s}^2}{100\,\text{km/h}^2}\right)$$

4) Length given S is Less than L and Change of Grade Formula

Evaluate Formula

Formula

$$L_c = N \cdot \frac{SD^2}{800 \cdot h}$$

Example with Units

$$635.5588\,\text{m} = 3.6 \cdot \frac{490\,\text{m}^2}{800 \cdot 1.7\,\text{m}}$$

5) Length of Curve Based on Centrifugal Ratio Formula

Evaluate Formula

Formula

$$L_c = \left(\left(g_1\right) - \left(g_2\right)\right) \cdot \frac{V^2}{100 \cdot f}$$

Example with Units

$$616.6667\,\text{m} = \left(\left(2.2\right) - \left(-1.5\right)\right) \cdot \frac{100\,\text{km/h}^2}{100 \cdot 0.6\,\text{m/s}^2}$$

6) Length of Curve given Change in Grade where S is more than L Formula

Evaluate Formula

Formula

$$L_c = 2 \cdot SD - \left(800 \cdot \frac{h}{N}\right)$$

Example with Units

$$602.2222\,\text{m} = 2 \cdot 490\,\text{m} - \left(800 \cdot \frac{1.7\,\text{m}}{3.6}\right)$$

7) Length of Curve when Height of Observer and Object are Same Formula

Evaluate Formula

Formula

$$L_c = 2 \cdot SD - \left(800 \cdot \frac{h}{\left(g_1 \right) - \left(g_2 \right)} \right)$$

Example with Units

$$612.4324\,\text{m} = 2 \cdot 490\,\text{m} - \left(800 \cdot \frac{1.7\,\text{m}}{\left(2.2 \right) - \left(-1.5 \right)} \right)$$

8) Length of Curve when S is Less than L Formula

Evaluate Formula

Formula

$$L_c = SD^2 \cdot \frac{\left(g_1 \right) - \left(g_2 \right)}{200 \cdot \left(\sqrt{H} + \sqrt{h_2} \right)^2}$$

Example with Units

$$705.2362\,\text{m} = 490\,\text{m}^2 \cdot \frac{\left(2.2 \right) - \left(-1.5 \right)}{200 \cdot \left(\sqrt{1.2\,\text{m}} + \sqrt{2\,\text{m}} \right)^2}$$

9) Length of Curve when S is Less than L and h1 and h2 are same Formula

Evaluate Formula

Formula

$$L_c = \left(\left(g_1 \right) - \left(g_2 \right) \right) \cdot \frac{SD^2}{800 \cdot h}$$

Example with Units

$$653.2132\,\text{m} = \left(\left(2.2 \right) - \left(-1.5 \right) \right) \cdot \frac{490\,\text{m}^2}{800 \cdot 1.7\,\text{m}}$$

10) Length of Curve when Sight Distance is More Formula

Evaluate Formula

Formula

$$L_c = 2 \cdot SD - \frac{200 \cdot \left(\sqrt{H} + \sqrt{h_2} \right)^2}{\left(g_1 \right) - \left(g_2 \right)}$$

Example with Units

$$639.5467\,\text{m} = 2 \cdot 490\,\text{m} - \frac{200 \cdot \left(\sqrt{1.2\,\text{m}} + \sqrt{2\,\text{m}} \right)^2}{\left(2.2 \right) - \left(-1.5 \right)}$$

11) Length of Vertical Curve Formula

Evaluate Formula

Formula

$$L = \frac{N}{P_N}$$

Example with Units

$$51.4286\,\text{m} = \frac{3.6}{0.07}$$

12) Permissible Grade given Length Formula

Evaluate Formula

Formula

$$P_N = \frac{N}{L}$$

Example with Units

$$0.18 = \frac{3.6}{20\,\text{m}}$$

13) Sight Distance when Length of Curve is Less Formula

Evaluate Formula

Formula

$$SD = 0.5 \cdot L_c + \frac{100 \cdot \left(\sqrt{H} + \sqrt{h_2}\right)^2}{\left(g_1\right) - \left(g_2\right)}$$

Example with Units

$$478.2267\,\text{m} = 0.5 \cdot 616\,\text{m} + \frac{100 \cdot \left(\sqrt{1.2\,\text{m}} + \sqrt{2\,\text{m}}\right)^2}{\left(2.2\right) - \left(-1.5\right)}$$

14) Sight Distance when Length of Curve is Less and Both Height of Observer and Object is Same Formula

Evaluate Formula

Formula

$$SD = \left(\frac{L_c}{2}\right) + \left(400 \cdot \frac{h}{\left(g_1\right) - \left(g_2\right)}\right)$$

Example with Units

$$491.7838\,\text{m} = \left(\frac{616\,\text{m}}{2}\right) + \left(400 \cdot \frac{1.7\,\text{m}}{\left(2.2\right) - \left(-1.5\right)}\right)$$

15) Sight Distance when S is Less than L Formula

Evaluate Formula

Formula

$$S = \left(\frac{1}{c}\right) \cdot \left(\sqrt{H} + \sqrt{h_2}\right)$$

Example with Units

$$5.0193\,\text{m} = \left(\frac{1}{0.5}\right) \cdot \left(\sqrt{1.2\,\text{m}} + \sqrt{2\,\text{m}}\right)$$

16) Sight Distance when S is Less than L and h1 and h2 are same Formula

Evaluate Formula

Formula

$$SD = \sqrt{\frac{800 \cdot h \cdot L_c}{\left(g_1\right) - \left(g_2\right)}}$$

Example with Units

$$475.8378\,\text{m} = \sqrt{\frac{800 \cdot 1.7\,\text{m} \cdot 616\,\text{m}}{\left(2.2\right) - \left(-1.5\right)}}$$

17) Tangential Correction Formula

Evaluate Formula

Formula

$$c = \frac{g_1 - g_2}{4} \cdot n$$

Example

$$0.4162 = \frac{2.2 - -1.5}{4} \cdot 0.45$$

18) Upgrade given Length based on Centrifugal Ratio Formula

Evaluate Formula

Formula

$$g_1 = \left(L_c \cdot 100 \cdot \frac{f}{V^2} \right) + \left(g_2 \right)$$

Example with Units

$$2.196 = \left(616\,\text{m} \cdot 100 \cdot \frac{0.6\,\text{m/s}^2}{100\,\text{km/h}^2} \right) + \left(-1.5 \right)$$

19) Velocity given Length Formula

Evaluate Formula

Formula

$$V = \sqrt{\frac{L_c \cdot 100 \cdot f}{g_1 - \left(g_2 \right)}}$$

Example with Units

$$99.9459\,\text{km/h} = \sqrt{\frac{616\,\text{m} \cdot 100 \cdot 0.6\,\text{m/s}^2}{2.2 - \left(-1.5 \right)}}$$

Variables used in list of Surveying Vertical Curves Formulas above

- **c** Tangential Correction
- **f** Allowable Centrifugal Acceleration *(Meter per Square Second)*
- g_1 Upgrade
- g_2 Downgrade
- **h** Height of Vertical Curves *(Meter)*
- **H** Height of Observer *(Meter)*
- h_2 Height of Object *(Meter)*
- **L** Length of Vertical Curve *(Meter)*
- L_c Length of Curve *(Meter)*
- **n** Number of Chords
- **N** Change in Grade
- P_N Permissible Rate
- **S** Sight Distance *(Meter)*
- **SD** Sight Distance SSD *(Meter)*
- **V** Vehicle Velocity *(Kilometer per Hour)*

Constants, Functions, Measurements used in list of Surveying Vertical Curves 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: **Speed** in Kilometer per Hour (km/h)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion

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