

Important Length of Valley Curve Formulas PDF



**Formulas
Examples
with Units**

List of 20 Important Length of Valley Curve Formulas

1) Design of Valley Curve Formulas

1.1) Design Speed given Length of Valley Curve Formula

Formula

$$v = \left(L_s \cdot R \cdot C_a \right)^{\frac{1}{3}}$$

Example with Units

$$4.0975 \text{ m/s} = \left(7 \text{ m} \cdot 2.34 \text{ m} \cdot 4.2 \text{ m/s} \right)^{\frac{1}{3}}$$

Evaluate Formula 

1.2) Design Speed given Length of Valley Curve and Time Formula

Formula

$$v = \frac{L_s}{t}$$

Example with Units

$$1.75 \text{ m/s} = \frac{7 \text{ m}}{4 \text{ s}}$$

Evaluate Formula 

1.3) Design Speed given Total Length of Valley Curve Formula

Formula

$$v = \left(\left(\frac{L_s}{2} \right)^2 \cdot \frac{C_a}{N} \right)^{\frac{1}{3}}$$

Example with Units

$$3.8812 \text{ m/s} = \left(\left(\frac{7 \text{ m}}{2} \right)^2 \cdot \frac{4.2 \text{ m/s}}{0.88 \text{ rad}} \right)^{\frac{1}{3}}$$

Evaluate Formula 

1.4) Deviation Angle given Total Length of Valley Curve Formula

Formula

$$N = \left(\frac{L_s}{2} \right)^2 \cdot \frac{C_a}{v^3}$$

Example with Units

$$0.4116 \text{ rad} = \left(\frac{7 \text{ m}}{2} \right)^2 \cdot \frac{4.2 \text{ m/s}}{5 \text{ m/s}^3}$$

Evaluate Formula 

1.5) Length of Valley Curve Formula

Formula

$$L_s = \frac{v^3}{R \cdot C_a}$$

Example with Units

$$12.7188 \text{ m} = \frac{5 \text{ m/s}^3}{2.34 \text{ m} \cdot 4.2 \text{ m/s}}$$

Evaluate Formula 



1.6) Length of Valley Curve given Time and Design Speed Formula

Formula

$$L_s = v \cdot t$$

Example with Units

$$20\text{ m} = 5\text{ m/s} \cdot 4\text{ s}$$

Evaluate Formula 

1.7) Radius of Curve given Length of Valley Curve Formula

Formula

$$R = \frac{v^3}{L_s \cdot C_a}$$

Example with Units

$$4.2517\text{ m} = \frac{5\text{ m/s}^3}{7\text{ m} \cdot 4.2\text{ m/s}}$$

Evaluate Formula 

1.8) Rate of Change of Acceleration Formula

Formula

$$C_a = \frac{v^3}{L_s \cdot R}$$

Example with Units

$$7.6313\text{ m/s} = \frac{5\text{ m/s}^3}{7\text{ m} \cdot 2.34\text{ m}}$$

Evaluate Formula 

1.9) Rate of Change of Acceleration given Total Length of Valley Curve Formula

Formula

$$C_a = \left(\frac{L_s}{2} \right)^2 \cdot N \cdot v^3$$

Example with Units

$$1347.5\text{ m/s} = \left(\frac{7\text{ m}}{2} \right)^2 \cdot 0.88\text{ rad} \cdot 5\text{ m/s}^3$$

Evaluate Formula 

1.10) Time given Length of Valley Curve and Design Speed Formula

Formula

$$t = \frac{L_s}{v}$$

Example with Units

$$1.4\text{ s} = \frac{7\text{ m}}{5\text{ m/s}}$$

Evaluate Formula 

1.11) Time given Rate of Change of Acceleration Formula

Formula

$$t = \frac{v^2}{R \cdot C_a}$$

Example with Units

$$2.5438\text{ s} = \frac{5\text{ m/s}^2}{2.34\text{ m} \cdot 4.2\text{ m/s}}$$

Evaluate Formula 

1.12) Total Length of Valley Curve Formula

Formula

$$L_s = 2 \cdot \sqrt{\frac{N \cdot v^3}{C_a}}$$

Example with Units

$$10.2353\text{ m} = 2 \cdot \sqrt{\frac{0.88\text{ rad} \cdot 5\text{ m/s}^3}{4.2\text{ m/s}}}$$

Evaluate Formula 



2) Length of Valley Curve greater than Stopping Sight Distance Formulas

2.1) Deviation Angle given Length of Valley Curve Greater than Stopping Sight Distance Formula

Formula

Evaluate Formula 

$$N = \frac{L_s \cdot (2 \cdot h_1 + 2 \cdot S \cdot \tan(\alpha_{\text{angle}}))}{S^2}$$

Example with Units

$$0.9658_{\text{rad}} = \frac{7_{\text{m}} \cdot (2 \cdot 0.75_{\text{m}} + 2 \cdot 3.56_{\text{m}} \cdot \tan(2^\circ))}{3.56_{\text{m}}^2}$$

2.2) Driver Eye Height given Length of Valley Curve Greater than Stopping Sight Distance Formula

Formula

Evaluate Formula 

$$h_1 = \frac{N \cdot S^2 - 2 \cdot L_s \cdot S \cdot \tan(\alpha_{\text{angle}})}{2 \cdot L_s}$$

Example with Units

$$0.6723_{\text{m}} = \frac{0.88_{\text{rad}} \cdot 3.56_{\text{m}}^2 - 2 \cdot 7_{\text{m}} \cdot 3.56_{\text{m}} \cdot \tan(2^\circ)}{2 \cdot 7_{\text{m}}}$$

2.3) Inclination Angle given Length of Valley Curve Greater than Stopping Sight Distance Formula

Formula

Example with Units

Evaluate Formula 

$$\alpha_{\text{angle}} = \text{atan}\left(\frac{N \cdot S^2 - 2 \cdot h_1}{2 \cdot S \cdot L_s}\right)$$

$$10.9611^\circ = \text{atan}\left(\frac{0.88_{\text{rad}} \cdot 3.56_{\text{m}}^2 - 2 \cdot 0.75_{\text{m}}}{2 \cdot 3.56_{\text{m}} \cdot 7_{\text{m}}}\right)$$

2.4) Length of Valley Curve Greater than Stopping Sight Distance Formula

Formula

Example with Units

Evaluate Formula 

$$L_s = \frac{N \cdot S^2}{2 \cdot h_1 + 2 \cdot S \cdot \tan(\alpha_{\text{angle}})}$$

$$6.378_{\text{m}} = \frac{0.88_{\text{rad}} \cdot 3.56_{\text{m}}^2}{2 \cdot 0.75_{\text{m}} + 2 \cdot 3.56_{\text{m}} \cdot \tan(2^\circ)}$$



3) Length of Valley Curve Less than Stopping Sight Distance Formulas

3.1) Deviation Angle Given Length of Valley Curve Less than Stopping Sight Distance Formula



Formula

Evaluate Formula 

$$N = (2 \cdot S) - \frac{2 \cdot h_1 + (2 \cdot S \cdot \tan(\alpha_{\text{angle}}))}{L_s}$$

Example with Units

$$6.8702_{\text{rad}} = (2 \cdot 3.56_{\text{m}}) - \frac{2 \cdot 0.75_{\text{m}} + (2 \cdot 3.56_{\text{m}} \cdot \tan(2^\circ))}{7_{\text{m}}}$$

3.2) Driver Sight Height given Length of Valley Curve Less than Stopping Sight Distance Formula

Formula

Evaluate Formula 

$$h_1 = \frac{(L_s - 2 \cdot S) \cdot N + 2 \cdot S \cdot \tan(\alpha_{\text{angle}})}{2}$$

Example with Units

$$0.0715_{\text{m}} = \frac{(7_{\text{m}} - 2 \cdot 3.56_{\text{m}}) \cdot 0.88_{\text{rad}} + 2 \cdot 3.56_{\text{m}} \cdot \tan(2^\circ)}{2}$$

3.3) Inclination Angle given Length of Valley Curve Less than Stopping Sight Distance Formula



Formula

Evaluate Formula 

$$\alpha_{\text{angle}} = \text{atan}\left(\frac{(L_s - 2 \cdot S) \cdot N + 2 \cdot h_1}{2 \cdot S}\right)$$

Example with Units

$$11.0807^\circ = \text{atan}\left(\frac{(7_{\text{m}} - 2 \cdot 3.56_{\text{m}}) \cdot 0.88_{\text{rad}} + 2 \cdot 0.75_{\text{m}}}{2 \cdot 3.56_{\text{m}}}\right)$$

3.4) Length of Valley Curve Less than Stopping Sight Distance Formula

Formula

Evaluate Formula 

$$L_s = 2 \cdot S - \frac{2 \cdot h_1 + (2 \cdot S \cdot \tan(\alpha_{\text{angle}}))}{N}$$

Example with Units





$$5.1329_{\text{m}} = 2 \cdot 3.56_{\text{m}} - \frac{2 \cdot 0.75_{\text{m}} + (2 \cdot 3.56_{\text{m}} \cdot \tan(2^\circ))}{0.88_{\text{rad}}}$$



Variables used in list of Length of Valley Curve Formulas above

- **C_a** Rate of Change of Acceleration (Meter per Second)
- **h₁** Driver Sight Height (Meter)
- **L_s** Length of Curve (Meter)
- **N** Deviation Angle (Radian)
- **R** Radius of Curve (Meter)
- **S** Sight Distance (Meter)
- **t** Time (Second)
- **v** Design Speed (Meter per Second)
- **α_{angle}** Inclination (Degree)

Constants, Functions, Measurements used in list of Length of Valley Curve Formulas above

- **Functions:** **atan**, atan(Number)
Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right 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:** **Time** in Second (s)
Time Unit Conversion 
- **Measurement:** **Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement:** **Angle** in Radian (rad), Degree (°)
Angle Unit Conversion 



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