calculatoratoz.com

unitsconverters.com

Highway Geometric Design Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 32 Highway Geometric Design Formulas

Highway Geometric Design

Gradients

1) Camber given Gradient

Open Calculator

fx $$H_c = \frac{h_{Elevation}}{2}$$

ex $$1.5\text{m} = \frac{3\text{m}}{2}$$

2) Distance from Center of Camber given Height for Parabolic Shape Camber

Open Calculator

fx $$X = \left(\frac{H_c \cdot (h_{Elevation} \cdot B)}{2}\right)^{0.5}$$

ex $$3.940178\text{m} = \left(\frac{1.5\text{m} \cdot (3\text{m} \cdot 6.9\text{m})}{2}\right)^{0.5}$$

3) Grade Compensation formula 1

Open Calculator

fx $$s = \frac{30 + R_c}{R_c}$$

ex $$1.230769 = \frac{30 + 130\text{m}}{130\text{m}}$$

4) Grade Compensation formula 2

Open Calculator

fx $$s = \frac{75}{R_c}$$

ex $$0.576923 = \frac{75}{130\text{m}}$$

5) Gradient given Camber

Open Calculator

fx $$h_{Elevation} = 2 \cdot H_c$$

ex $$3\text{m} = 2 \cdot 1.5\text{m}$$

6) Gradient given Height for Parabolic Shape Camber

Open Calculator

fx $$h_{Elevation} = \frac{2 \cdot \left(X^2\right)}{H_c \cdot B}$$

ex $$2.93913\text{m} = \frac{2 \cdot \left((3.9\text{m})^2\right)}{1.5\text{m} \cdot 6.9\text{m}}$$

7) Height for Parabolic Shape Camber

Open Calculator

$$H_c = \frac{2 \cdot \left(X^2\right)}{h_{Elevation} \cdot B}$$

$$1.469565\text{m} = \frac{2 \cdot \left((3.9\text{m})^2\right)}{3\text{m} \cdot 6.9\text{m}}$$

8) Height for Straight Line Camber

Open Calculator

$$H_c = \frac{B}{h_{Elevation} \cdot 2}$$

$$1.15\text{m} = \frac{6.9\text{m}}{3\text{m} \cdot 2}$$

9) Radius of Road given Grade Compensation formula 1

Open Calculator

$$R_c = \frac{30}{s - 1}$$

$$130.4348\text{m} = \frac{30}{1.23 - 1}$$

10) Radius of Road given Grade Compensation formula 2

Open Calculator

$$R_c = \frac{75}{s}$$

$$60.97561\text{m} = \frac{75}{1.23}$$

11) Width of Road given Height for Parabolic Shape Camber

Open Calculator

fx $$B = \frac{2 \cdot \left(X^2\right)}{H_c \cdot h_{Elevation}}$$

ex $$6.76\text{m} = \frac{2 \cdot \left((3.9\text{m})^2\right)}{1.5\text{m} \cdot 3\text{m}}$$

12) Width of Road given Height for Straight Line Camber

Open Calculator

fx $$B = H_c \cdot (h_{Elevation} \cdot 2)$$

ex $$9\text{m} = 1.5\text{m} \cdot (3\text{m} \cdot 2)$$

Horizontal Curves

Extra Widening on Horizontal Curves

13) Psychological Widening on Horizontal Curves

Open Calculator

fx $$W_{ps} = \frac{v}{9.5 \cdot (R_t)^{0.5}}$$

ex $$0.303869\text{m} = \frac{50\text{km/h}}{9.5 \cdot (300\text{m})^{0.5}}$$

14) Total Extra Widening required on Horizontal Curves

Open Calculator

fx $$W_e = \left(\frac{n \cdot \left(l^2\right)}{2 \cdot R_t}\right) + \left(\frac{v}{9.5 \cdot \left(R_t^{0.5}\right)}\right)$$

ex $$0.843869\text{m} = \left(\frac{9 \cdot \left((6\text{m})^2\right)}{2 \cdot 300\text{m}}\right) + \left(\frac{50\text{km/h}}{9.5 \cdot \left((300\text{m})^{0.5}\right)}\right)$$

15) Total Extra Widening required on Horizontal Curves wrt Wm and Wps

Open Calculator

fx $$W_e = (W_{ps} + W_m)$$

ex $$0.89\text{m} = (0.52\text{m} + 0.37\text{m})$$

Set Back Distance and curve Resistance

16) Set Back Distance by Approx Method (L is greater than S)

Open Calculator

fx $$m = \frac{SSD^2}{8 \cdot R_t}$$

ex $$10.66667\text{m} = \frac{(160\text{m})^2}{8 \cdot 300\text{m}}$$

17) Set Back Distance by Approx Method (L is less than S)

Open Calculator

$$m = \frac{L_c \cdot (2 \cdot SSD - L_c)}{8 \cdot R_t}$$

$$10.5\text{m} = \frac{140\text{m} \cdot (2 \cdot 160\text{m} - 140\text{m})}{8 \cdot 300\text{m}}$$

18) Set Back Distance by Rational Method (L is greater than S) Single Lane

Open Calculator

$$m = R_t - R_t \cdot \cos\left(\frac{SSD}{2 \cdot R_t}\right)$$

$$10.60361\text{m} = 300\text{m} - 300\text{m} \cdot \cos\left(\frac{160\text{m}}{2 \cdot 300\text{m}}\right)$$

Summit Curve

19) Length of Summit Curve for Stopping Sight Distance when Curve Length is less than SSD

Open Calculator

fx
$$L_{Sc} = 2 \cdot SSD - \left(\frac{\left((2 \cdot H)^{0.5} + (2 \cdot h)^{0.5} \right)^2}{N} \right)$$

ex
$$265.0368\text{m} = 2 \cdot 160\text{m} - \left(\frac{\left((2 \cdot 1.2\text{m})^{0.5} + (2 \cdot 0.15\text{m})^{0.5} \right)^2}{0.08} \right)$$

20) Length of Summit Curve for Stopping Sight Distance when Curve Length is more than SSD

Open Calculator

fx
$$L_{Sc} = \frac{N \cdot SSD^2}{\left((2 \cdot H)^{0.5} + (2 \cdot h)^{0.5} \right)^2}$$

ex
$$465.7662\text{m} = \frac{0.08 \cdot (160\text{m})^2}{\left((2 \cdot 1.2\text{m})^{0.5} + (2 \cdot 0.15\text{m})^{0.5} \right)^2}$$

21) Length of Summit Curve when Length of Curve is greater than OSD or ISD

Open Calculator

fx $$L_{Sc} = \frac{N \cdot \left(SSD^2\right)}{8 \cdot H}$$

ex $$213.3333\text{m} = \frac{0.08 \cdot \left((160\text{m})^2\right)}{8 \cdot 1.2\text{m}}$$

22) Length of Summit Curve when Length of Curve is less than OSD or ISD

Open Calculator

fx $$L_{Sc} = 2 \cdot SSD - \left(\frac{8 \cdot H}{N}\right)$$

ex $$200\text{m} = 2 \cdot 160\text{m} - \left(\frac{8 \cdot 1.2\text{m}}{0.08}\right)$$

Transition Curve

23) Length of Transition Curve according to Rate of change of Centrifugal Acceleration

Open Calculator

fx $$L_s = \frac{v_1^3}{C \cdot R_t}$$

ex $$36.39259\text{m} = \frac{(17\text{m/s})^3}{0.45\text{m/s}^3 \cdot 300\text{m}}$$

24) Length of Transition Curve according to Rate of Introduction of Superelevation

Open Calculator

fx $$L_e = \left(\frac{e \cdot N_{Rate}}{2}\right) \cdot (W + W_{ex})$$

ex $$562.1245\text{m} = \left(\frac{0.07 \cdot 150.1}{2}\right) \cdot (7\text{m} + 100\text{m})$$

25) Length of Transition Curve by Empirical Formula for Mountainous and Steep Terrains

Open Calculator

fx $$L_{Slope} = \frac{v_1^2}{R_t}$$

ex $$0.963333\text{m} = \frac{(17\text{m/s})^2}{300\text{m}}$$

26) Length of Transition Curve by Empirical Formula for Plain and Rrolling Terrain

Open Calculator

fx $$L_{Terrain} = \frac{2.7 \cdot (v_1)^2}{R_t}$$

ex $$2.601\text{m} = \frac{2.7 \cdot (17\text{m/s})^2}{300\text{m}}$$

27) Length of Transition Curve if Pavement is Rotated about Inner Edge

Open Calculator

$$L_t = e \cdot N_{Rate} \cdot (W + W_{ex})$$

$$1124.249\text{m} = 0.07 \cdot 150.1 \cdot (7\text{m} + 100\text{m})$$

28) Radius of Circular Curve given Length of Transition Curve

Open Calculator

$$R_t = \frac{v_1^3}{C \cdot L_s}$$

$$300.0214\text{m} = \frac{(17\text{m/s})^3}{0.45\text{m/s}^3 \cdot 36.39\text{m}}$$

Valley Curve

29) Length of Valley Curve for Head Light Sight Distance when Length is less than SSD

Open Calculator

$$L_{Vc} = 2 \cdot SSD - \left(\frac{2 \cdot h_1 + 2 \cdot SSD \cdot \tan(\alpha)}{N}\right)$$

$$154.5767\text{m} = 2 \cdot 160\text{m} - \left(\frac{2 \cdot 0.75\text{m} + 2 \cdot 160\text{m} \cdot \tan(2.1^\circ)}{0.08}\right)$$

30) Length of Valley Curve for Head Light Sight Distance when Length is more than SSD

Open Calculator

fx $$L_{Vc} = \frac{N \cdot SSD^2}{2 \cdot h_1 + 2 \cdot SSD \cdot \tan(\alpha)}$$

ex $$154.7545\text{m} = \frac{0.08 \cdot (160\text{m})^2}{2 \cdot 0.75\text{m} + 2 \cdot 160\text{m} \cdot \tan(2.1^\circ)}$$

31) Length of Valley Curve given Beam Angle and Height of Head Light

Open Calculator

fx $$L_{Vc} = 2 \cdot SSD - \left(\frac{1.5 + 0.035 \cdot SSD}{N}\right)$$

ex $$231.25\text{m} = 2 \cdot 160\text{m} - \left(\frac{1.5 + 0.035 \cdot 160\text{m}}{0.08}\right)$$

32) Length of Valley Curve given Height of Head Light and Beam Angle

Open Calculator

fx $$L_{Vc} = N \cdot \frac{SSD^2}{1.5 + 0.035 \cdot SSD}$$

ex $$288.4507\text{m} = 0.08 \cdot \frac{(160\text{m})^2}{1.5 + 0.035 \cdot 160\text{m}}$$

Variables Used

- **B** Pavement Width *(Meter)*
- **C** Rate of Change of Centrifugal Acceleration *(Meter per Cubic Second)*
- **e** Rate of Superelevation
- **h** Height of Subject above Pavement Surface *(Meter)*
- **H** Height of Eye Level of Driver above Roadway *(Meter)*
- h_1 Average Head Light Height *(Meter)*
- H_c Height of Camber *(Meter)*
- $h_{Elevation}$ Elevation Difference *(Meter)*
- **l** Length of Wheel Base as per IRC *(Meter)*
- L_c Length of Curve *(Meter)*
- L_e Transition Curve Length for Superelevation *(Meter)*
- L_s Length of Transition Curve *(Meter)*
- L_{Sc} Length of Parabolic Summit Curve *(Meter)*
- L_{Slope} Transition Curve Length for Slope *(Meter)*
- L_t Transition Curve Length *(Meter)*
- $L_{Terrain}$ Transition Curve Length for Terrain *(Meter)*
- L_{Vc} Length of Valley Curve *(Meter)*
- **m** Set Back Distance *(Meter)*
- **n** Number of Traffic Lanes
- **N** Deviation Angle
- N_{Rate} Allowable Rate of Change of Superelevation
- R_c Radius of Circular Curve *(Meter)*

- R_t Radius of Curve *(Meter)*
- **s** Percent Grade
- **SSD** Stopping Sight Distance *(Meter)*
- **v** Speed of Vehicle *(Kilometer per Hour)*
- v_1 Design Speed on Highways *(Meter per Second)*
- **W** Normal Pavement Width *(Meter)*
- W_e Total Extra Widening Required on Horizontal Curves *(Meter)*
- W_{ex} Extra Widening of Pavement *(Meter)*
- W_m Mechanical Widening on Horizontal Curves *(Meter)*
- W_{ps} Psychological Widening on Horizontal Curves *(Meter)*
- **X** Distance from Center of Camber *(Meter)*
- **α** Beam Angle *(Degree)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **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: **Speed** in Kilometer per Hour (km/h), Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Jerk** in Meter per Cubic Second (m/s³)
  Jerk Unit Conversion

Check other formula lists

- **Highway and Road Formulas**
- **Highway Geometric Design Formulas**
- **Sight Distances of Highway Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

6/28/2024 | 5:51:47 AM UTC *Please leave your feedback here...*