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Design of Superelevation Formulas

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List of 12 Design of Superelevation Formulas

Design of Superelevation 🔗

1) Allowable Speed of Vehicle in Horizontal Curve 🔗

Open Calculator 🔗

fx $v_a = \sqrt{0.22 \cdot [g] \cdot R_{mean}}$

ex $27.0839 \text{m/s} = \sqrt{0.22 \cdot [g] \cdot 340\text{m}}$

2) Distance between Front and Rear Wheel 🔗

Open Calculator 🔗

fx $l_{fr} = 2 \cdot R_2 \cdot W_m - W_m^2$

ex $23.5431\text{m} = 2 \cdot 32\text{m} \cdot 0.37\text{m} - (0.37\text{m})^2$

3) Mechanical Widening needed for Large Radius of Road Curve 🔗

Open Calculator 🔗

fx $W_m = \dfrac{n \cdot l_{fr}^2}{2 \cdot R_{mean}}$

ex $0.238235\text{m} = \dfrac{2 \cdot (9\text{m})^2}{2 \cdot 340\text{m}}$

4) Number of Lanes in Horizontal Curve ⮺

Open Calculator ⮺

$$fx \quad n = \frac{2 \cdot W_m \cdot R_{mean}}{l_{fr}^2}$$

$$ex \quad 3.106173 = \frac{2 \cdot 0.37m \cdot 340m}{(9m)^2}$$

5) Psychological Widening at Horizontal Curves ⮺

Open Calculator ⮺

$$fx \quad W_{ps} = \frac{v_{vehicle}}{2.64 \cdot \sqrt{R_{mean}}}$$

$$ex \quad 0.579919m = \frac{28.23m/s}{2.64 \cdot \sqrt{340m}}$$

6) Radius of Outer Track Line of Front Wheel ⮺

Open Calculator ⮺

$$fx \quad R_2 = \sqrt{R_1^2 + l_{fr}^2}$$

$$ex \quad 35.17101m = \sqrt{(34m)^2 + (9m)^2}$$

7) Radius of Outer Track Line of Rear Wheel ⮺

Open Calculator ⮺

$$fx \quad R_1 = \sqrt{R_2^2 - l_{fr}^2}$$

$$ex \quad 30.70831m = \sqrt{(32m)^2 - (9m)^2}$$

8) Rate of Super Elevation ⚲

$$fx \quad e = \frac{0.75 \cdot v_{\text{vehicle}}^2}{[g] \cdot R_{\text{mean}}}$$

$$ex \quad 0.17926 = \frac{0.75 \cdot (28.23\text{m/s})^2}{[g] \cdot 340\text{m}}$$

9) Ruling Minimum Radius ⚲

$$fx \quad R_{\text{ruling}} = \frac{v_{\text{vehicle}}^2}{[g] \cdot (e + f_{\text{lateral}})}$$

$$ex \quad 369.3843\text{m} = \frac{(28.23\text{m/s})^2}{[g] \cdot (0.07 + 0.15)}$$

10) Total Widening needed at Horizontal Curve ⚲

$$fx \quad W_e = \frac{n \cdot l_{\text{fr}}^2}{2 \cdot R_{\text{mean}}} + \frac{v_{\text{vehicle}}}{2.64 \cdot \sqrt{R_{\text{mean}}}}$$

$$ex \quad 0.818155\text{m} = \frac{2 \cdot (9\text{m})^2}{2 \cdot 340\text{m}} + \frac{28.23\text{m/s}}{2.64 \cdot \sqrt{340\text{m}}}$$

11) Velocity of Vehicle for Psychological Widening ⚲

$$fx \quad v_{\text{vehicle}} = 2.64 \cdot W_{\text{ps}} \cdot \sqrt{R_{\text{mean}}}$$

$$ex \quad 27.50375\text{m/s} = 2.64 \cdot 0.565\text{m} \cdot \sqrt{340\text{m}}$$

12) Velocity of Vehicle for Ruling Minimum Radius ⤴

Open Calculator ⤴

fx
$$v_{vehicle} = \sqrt{R_{ruling} \cdot [g] \cdot (e + f_{lateral})}$$

ex
$$24.13535m/s = \sqrt{270m \cdot [g] \cdot (0.07 + 0.15)}$$

Variables Used

- **e** Rate of Super Elevation
- **$f_{lateral}$** Coefficient of Lateral Friction
- **l_{fr}** Distance between Front and Rear Wheel *(Meter)*
- **n** Number of Lanes
- **R_1** Radius of Outer Track Line of Rear Wheel *(Meter)*
- **R_2** Radius of Outer Track Line of Front Wheel *(Meter)*
- **R_{mean}** Mean Radius of Curve *(Meter)*
- **R_{ruling}** Ruling Minimum Radius *(Meter)*
- **v_a** Allowable Speed *(Meter per Second)*
- **$v_{vehicle}$** Velocity *(Meter per Second)*
- **W_e** Total Widening Needed at Horizontal Curve *(Meter)*
- **W_m** Mechanical Widening on Horizontal Curves *(Meter)*
- **W_{ps}** Psychological Widening at Horizontal Curves *(Meter)*

Constants, Functions, Measurements used

- 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: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion ⬀

Check other formula lists

- **Design of Superelevation Formulas** 🖝

- **Pavement Materials Formulas** 🖝

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