Important Design of Superelevation Formulas PDF

Formulas
Examples
with Units

List of 12
Important Design of Superelevation Formulas

1) Allowable Speed of Vehicle in Horizontal Curve Formula

Evaluate Formula

Formula

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

Example with Units

$$27.0839\,\text{m/s} = \sqrt{0.22 \cdot 9.8066\,\text{m/s}^2 \cdot 340\,\text{m}}$$

2) Distance between Front and Rear Wheel Formula

Evaluate Formula

Formula

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

Example with Units

$$23.5431\,\text{m} = 2 \cdot 32\,\text{m} \cdot 0.37\,\text{m} - 0.37\,\text{m}^2$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.2382\,\text{m} = \frac{2 \cdot 9\,\text{m}^2}{2 \cdot 340\,\text{m}}$$

4) Number of Lanes in Horizontal Curve Formula

Evaluate Formula

Formula

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

Example with Units

$$3.1062 = \frac{2 \cdot 0.37\,\text{m} \cdot 340\,\text{m}}{9\,\text{m}^2}$$

5) Psychological Widening at Horizontal Curves Formula

Evaluate Formula

Formula

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

Example with Units

$$0.5799\,\text{m} = \frac{28.23\,\text{m/s}}{2.64 \cdot \sqrt{340\,\text{m}}}$$

6) Radius of Outer Track Line of Front Wheel Formula

Evaluate Formula

Formula

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

Example with Units

$$35.171\,\text{m} = \sqrt{34\,\text{m}^2 + 9\,\text{m}^2}$$

7) Radius of Outer Track Line of Rear Wheel Formula

Evaluate Formula

Formula

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

Example with Units

$$30.7083\,\text{m} = \sqrt{32\,\text{m}^2 - 9\,\text{m}^2}$$

8) Rate of Super Elevation Formula

Evaluate Formula

Formula

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

Example with Units

$$0.1793 = \frac{0.75 \cdot 28.23\,\text{m/s}^2}{9.8066\,\text{m/s}^2 \cdot 340\,\text{m}}$$

9) Ruling Minimum Radius Formula

Evaluate Formula

Formula

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

Example with Units

$$369.3843\,\text{m} = \frac{28.23\,\text{m/s}^2}{9.8066\,\text{m/s}^2 \cdot \left(0.07 + 0.15\right)}$$

10) Total Widening needed at Horizontal Curve Formula

Evaluate Formula

Formula

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

Example with Units

$$0.8182\,\text{m} = \frac{2 \cdot 9\,\text{m}^2}{2 \cdot 340\,\text{m}} + \frac{28.23\,\text{m/s}}{2.64 \cdot \sqrt{340\,\text{m}}}$$

11) Velocity of Vehicle for Psychological Widening Formula

Evaluate Formula

Formula

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

Example with Units

$$27.5037\,\text{m/s} = 2.64 \cdot 0.565\,\text{m} \cdot \sqrt{340\,\text{m}}$$

12) Velocity of Vehicle for Ruling Minimum Radius Formula

Evaluate Formula

Formula

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

Example with Units

$$24.1353\,\text{m/s} = \sqrt{270\,\text{m} \cdot 9.8066\,\text{m/s}^2 \cdot \left(0.07 + 0.15\right)}$$

Variables used in list of Design of Superelevation Formulas above

- **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 in list of Design of Superelevation Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- 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 Meter per Second (m/s)
  Speed Unit Conversion

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