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Geometric Design of Railway Track Formulas

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List of 22 Geometric Design of Railway Track Formulas

Geometric Design of Railway Track

1) Cant Deficiency for given Maximum Theoretical Cant

Open Calculator

fx $$D_{Cant} = e_{Thmax} - e_{Eqmax}$$

ex $$5\text{cm} = 15\text{cm} - 10\text{cm}$$

2) Cant Deficiency for given Theoretical Cant

Open Calculator

fx $$D_{Cant} = e_{th} - e_{Cant}$$

ex $$5\text{cm} = 16.25\text{cm} - 11.25\text{cm}$$

3) Degree of Curve in Railways

Open Calculator

fx $$D_c = \left(\frac{1720}{R}\right) \cdot \left(\frac{\pi}{180}\right)$$

ex $$5^\circ = \left(\frac{1720}{344\text{m}}\right) \cdot \left(\frac{\pi}{180}\right)$$

4) Equilibrium Cant for BG

Open Calculator

$$e_{bg} = 1.676 \cdot \frac{V^2}{127 \cdot R}$$

$$0.251699\text{m} = 1.676 \cdot \frac{(81\text{km/h})^2}{127 \cdot 344\text{m}}$$

5) Equilibrium Cant for MG

Open Calculator

$$e_{mg} = 1.000 \cdot \frac{V^2}{127 \cdot R}$$

$$0.150179\text{m} = 1.000 \cdot \frac{(81\text{km/h})^2}{127 \cdot 344\text{m}}$$

6) Equilibrium Cant for NG

Open Calculator

$$e_{ng} = 0.762 \cdot \frac{V^2}{127 \cdot R}$$

$$0.114436\text{m} = 0.762 \cdot \frac{(81\text{km/h})^2}{127 \cdot 344\text{m}}$$

7) Equilibrium Cant in Railways

Open Calculator

$$e_{eq} = G \cdot \frac{V^2}{127 \cdot R}$$

$$0.240286\text{m} = 1.6\text{m} \cdot \frac{(81\text{km/h})^2}{127 \cdot 344\text{m}}$$

8) Maximum Theoretical Cant in Railways

Open Calculator

$$e_{Thmax} = e_{Eqmax} + D_{Cant}$$

ex $15\text{cm} = 10\text{cm} + 5\text{cm}$

9) Radius for given Degree of Curve in Railways

Open Calculator

$$R = \left(\frac{1720}{D_c}\right) \cdot \left(\frac{\pi}{180}\right)$$

ex $337.2549\text{m} = \left(\frac{1720}{5.1^\circ}\right) \cdot \left(\frac{\pi}{180}\right)$

10) Shift in Railways for Cubic Parabola

Open Calculator

$$S = \frac{L^2}{24 \cdot R}$$

ex $2.046996\text{m} = \frac{(130\text{m})^2}{24 \cdot 344\text{m}}$

11) Theoretical Cant in Railways

Open Calculator

$$e_{th} = e_{Cant} + D_{Cant}$$

ex $16.25\text{cm} = 11.25\text{cm} + 5\text{cm}$

12) Weighted Average of Different Trains at Different Speeds

Open Calculator

$$W_{Avg} = \frac{n_1 \cdot V_1 + n_2 \cdot V_2 + n_3 \cdot V_3 + n_4 \cdot V_4}{n_1 + n_2 + n_3 + n_4}$$

ex

$$58.88889\text{km/h} = \frac{16 \cdot 50\text{km/h} + 11 \cdot 60\text{km/h} + 6 \cdot 70\text{km/h} + 3 \cdot 80\text{km/h}}{16 + 11 + 6 + 3}$$

Transition Curve

13) Length of Transition Curve as per Railway Code

Open Calculator

$$L_{RC} = 4.4 \cdot R^{0.5}$$

ex $81.60784\text{m} = 4.4 \cdot (344\text{m})^{0.5}$

14) Length of Transition Curve based on Arbitrary Gradient

Open Calculator

$$L_{AG} = 7.20 \cdot e_{Vmax} \cdot 100$$

ex $86.4\text{m} = 7.20 \cdot 12\text{cm} \cdot 100$

15) Length of Transition Curve based on rate of change of Cant Deficiency

Open Calculator

$$L_{CD} = 0.073 \cdot D_{Cant} \cdot V_{Max} \cdot 100$$

ex $31.025\text{m} = 0.073 \cdot 5\text{cm} \cdot 85\text{km/h} \cdot 100$

16) Length of Transition Curve based on Rate of change of Super Elevation

Open Calculator

$$L_{SE} = 0.073 \cdot e_{Vmax} \cdot V_{Max} \cdot 100$$

$$74.46\text{m} = 0.073 \cdot 12\text{cm} \cdot 85\text{km/h} \cdot 100$$

17) Radius of Transition Curve for BG or MG

Open Calculator

$$R_t = \left(\frac{V_{bg/mg}}{4.4}\right)^2 + 70$$

$$152.6446\text{m} = \left(\frac{40\text{km/h}}{4.4}\right)^2 + 70$$

18) Radius of Transition Curve for NG

Open Calculator

$$R_t = \left(\frac{V_{ng}}{3.65}\right)^2 + 6$$

$$151.3181\text{m} = \left(\frac{44\text{km/h}}{3.65}\right)^2 + 6$$

19) Safe Speed on Transitioned Curves for BG or MG

Open Calculator

$$V_{bg/mg} = 4.4 \cdot 0.278 \cdot (R_t - 70)^{0.5}$$

$$39.87557\text{km/h} = 4.4 \cdot 0.278 \cdot (152\text{m} - 70)^{0.5}$$

20) Safe Speed on Transitioned Curves for NG

Open Calculator

fx $$V_{ng} = 3.65 \cdot 0.278 \cdot (R_t - 6)^{0.5}$$

ex $$44.1384\text{km/h} = 3.65 \cdot 0.278 \cdot (152\text{m} - 6)^{0.5}$$

21) Speeds from Length of Transition Curves for High Speeds

Open Calculator

fx $$V_{High} = 198 \cdot \frac{L}{e \cdot 1000}$$

ex $$321.75\text{km/h} = 198 \cdot \frac{130\text{m}}{0.08\text{m} \cdot 1000}$$

22) Speeds from Length of Transition Curves for Normal Speeds

Open Calculator

fx $$V_{Normal} = 134 \cdot \frac{L}{e \cdot 1000}$$

ex $$217.75\text{km/h} = 134 \cdot \frac{130\text{m}}{0.08\text{m} \cdot 1000}$$

Variables Used

- D_c Degree of Curve for Railways *(Degree)*
- D_{Cant} Cant Deficiency *(Centimeter)*
- **e** Super Elevation for Transition Curve *(Meter)*
- e_{bg} Equilibrium Cant for Broad Gauge *(Meter)*
- e_{Cant} Equilibrium Cant *(Centimeter)*
- e_{eq} Equilibrium Cant in Railways *(Meter)*
- e_{Eqmax} Maximum Equilibrium Cant *(Centimeter)*
- e_{mg} Equilibrium Cant for Meter Gauge *(Meter)*
- e_{ng} Equilibrium Cant for Narrow Gauge *(Meter)*
- e_{th} Theoretical Cant *(Centimeter)*
- e_{Thmax} Maximum Theoretical Cant *(Centimeter)*
- e_{Vmax} Equilibrium Cant for Max Speed *(Centimeter)*
- **G** Gauge of Track *(Meter)*
- **L** Length of Transition Curve in meters *(Meter)*
- L_{AG} Length of Curve based on Arbitrary Gradient *(Meter)*
- L_{CD} Length of Curve based on Cant Deficiency Rate *(Meter)*
- L_{RC} Length of Curve based on Railway Code *(Meter)*
- L_{SE} Length of Curve based on Change of superelevation *(Meter)*
- n_1 Number of Trains with Speed 1
- n_2 Number of Trains with Speed 2
- n_3 Number of Trains with Speed 3

- n_4 Number of Trains with Speed 4
- R Radius of Curve *(Meter)*
- R_t Radius of Transition Curve *(Meter)*
- S Shift in Railways in Cubic parabola *(Meter)*
- V Speed of Vehicle on Track *(Kilometer per Hour)*
- V_1 Speed of Trains Moving with Same Speed 1 *(Kilometer per Hour)*
- V_2 Speed of Trains Moving with Same Speed 2 *(Kilometer per Hour)*
- V_3 Speed of Trains Moving with Same Speed 3 *(Kilometer per Hour)*
- V_4 Speed of Trains Moving with Same Speed 4 *(Kilometer per Hour)*
- $V_{bg/mg}$ Safe Speed on Transitioned Curves for B.G/M.G *(Kilometer per Hour)*
- V_{High} Speeds from Length of Curve for High Speeds *(Kilometer per Hour)*
- V_{Max} Maximum Speed of Train on Curve *(Kilometer per Hour)*
- V_{ng} Safe Speed on Transitioned Curves for N.G *(Kilometer per Hour)*
- V_{Normal} Speeds from Length of Curve for Normal Speeds *(Kilometer per Hour)*
- W_{Avg} Weighted Average Speed *(Kilometer per Hour)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Measurement: **Length** in Centimeter (cm), Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Kilometer per Hour (km/h)
  Speed Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

Check other formula lists

- **Geometric Design of Railway Track Formulas**
- **Materials Required per km of Railway track Formulas**
- **Points and Crossings Formulas**
- **Rail Joints, Welding of Rails and Sleepers Formulas**
- **Track and Track Stresses Formulas**
- **Traction and Tractive Resistances Formulas**

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