Important Parabolic and Transition Curves Formulas PDF

Formulas
Examples
with Units

List of 11
Important Parabolic and Transition Curves Formulas

1) Parabolic Curves Formulas

1.1) Distance from Point of Vertical Curve to Lowest Point on Sag Curve Formula

Evaluate Formula

Formula

$$X_s = -\left(\frac{G_I}{R_g}\right)$$

Example with Units

$$-0.198\,\text{m} = -\left(\frac{10}{50.5\,\text{m}^{-1}}\right)$$

1.2) Elevation of Lowest Point on Sag Curve Formula

Evaluate Formula

Formula

$$E_s = E_0 - \left(\frac{G_I^{\,2}}{2 \cdot R_g}\right)$$

Example with Units

$$49.0099\,\text{m} = 50\,\text{m} - \left(\frac{10^{\,2}}{2 \cdot 50.5\,\text{m}^{-1}}\right)$$

1.3) Elevation of Point of Vertical Curvature Formula

Evaluate Formula

Formula

$$E_0 = V - \left(\left(\frac{1}{2}\right) \cdot \left(L_c \cdot G_I\right)\right)$$

Example with Units

$$50\,\text{m} = 750\,\text{m} - \left(\left(\frac{1}{2}\right) \cdot \left(140\,\text{m} \cdot 10\right)\right)$$

1.4) Elevation of Point of Vertical Intersection Formula

Evaluate Formula

Formula

$$V = E_0 + \left(\frac{1}{2}\right) \cdot \left(L_c \cdot G_I\right)$$

Example with Units

$$750\,\text{m} = 50\,\text{m} + \left(\frac{1}{2}\right) \cdot \left(140\,\text{m} \cdot 10\right)$$

1.5) Elevation of PVC given Elevation of Lowest Point on Sag Curve Formula

Evaluate Formula

Formula

$$E_0 = E_s + \left(\frac{G_I^{\,2}}{2 \cdot R_g}\right)$$

Example with Units

$$49.9901\,\text{m} = 49\,\text{m} + \left(\frac{10^{\,2}}{2 \cdot 50.5\,\text{m}^{-1}}\right)$$

1.6) Length of Curve using Rate of change of Grade in Parabolic Curves Formula

Evaluate Formula

Formula

$$L_{Pc} = \frac{G_2 - \left(- G_I \right)}{R_g}$$

Example with Units

$$0.3564\,\text{m} = \frac{8 - \left(- 10 \right)}{50.5\,\text{m}^{-1}}$$

1.7) Rate of Change of Grade given Distance from PVC to Lowest Point on Sag Curve Formula

Evaluate Formula

Formula

$$R_g = - \left(\frac{G_I}{X_s} \right)$$

Example with Units

$$50\,\text{m}^{-1} = - \left(\frac{10}{-0.2\,\text{m}} \right)$$

2) Transition (Spiral) Curves Formulas

2.1) Minimum Length of Spiral Formula

Evaluate Formula

Formula

$$L = \frac{3.15 \cdot \left(V_v^{\,3} \right)}{R_t \cdot a_c}$$

Example with Units

$$361.8352\,\text{m} = \frac{3.15 \cdot \left(41\,\text{km/h}^{\,3} \right)}{300\,\text{m} \cdot 2}$$

2.2) Radius of Circular Curve Minimum Length Formula

Evaluate Formula

Formula

$$R_t = \frac{3.15 \cdot \left(V_v^{\,3} \right)}{L \cdot a_c}$$

Example with Units

$$300.0044\,\text{m} = \frac{3.15 \cdot \left(41\,\text{km/h}^{\,3} \right)}{361.83\,\text{m} \cdot 2}$$

2.3) Rate of Increase of Radial Acceleration Formula

Evaluate Formula

Formula

$$a_c = \frac{3.15 \cdot \left(V_v \right)^3}{L \cdot R_t}$$

Example with Units

$$2 = \frac{3.15 \cdot \left(41\,\text{km/h} \right)^3}{361.83\,\text{m} \cdot 300\,\text{m}}$$

2.4) Vehicle Velocity given Minimum Length of Spiral Formula

Evaluate Formula

Formula

$$V_v = \left(\frac{L \cdot R_t \cdot a_c}{3.15} \right)^{\frac{1}{3}}$$

Example with Units

$$40.9998\,\text{km/h} = \left(\frac{361.83\,\text{m} \cdot 300\,\text{m} \cdot 2}{3.15} \right)^{\frac{1}{3}}$$

Variables used in list of Parabolic and Transition Curves Formulas above

- a_c Rate of Increase of Radial Acceleration
- E_0 Elevation of Point of Vertical Curve *(Meter)*
- E_s Elevation of Lowest Point on a Sag Curve *(Meter)*
- G_2 Grade at End of Curve
- G_1 Grade at Beginning of Curve
- L Minimum Length of Spiral *(Meter)*
- L_c Length of Curve *(Meter)*
- L_{Pc} Length of Parabolic Curves *(Meter)*
- R_g Rate of Change of Grade *(Per Meter)*
- R_t Radius of Curve *(Meter)*
- V Elevation of Point of Vertical Intersection *(Meter)*
- V_v Vehicle Velocity *(Kilometer per Hour)*
- X_s Distance from PVC to Lowest Point on a Sag Curve *(Meter)*

Constants, Functions, Measurements used in list of Parabolic and Transition Curves Formulas above

- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Kilometer per Hour (km/h)
  Speed Unit Conversion
- Measurement: **Linear Atomic Density** in Per Meter (m^{-1})
  Linear Atomic Density Unit Conversion

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