



# Parabolic and Transition Curves Formulas

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## List of 11 Parabolic and Transition Curves Formulas

## Parabolic and Transition Curves

## Parabolic Curves

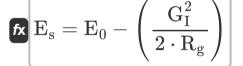
1) Distance from Point of Vertical Curve to Lowest Point on Sag Curve

$$\left| \mathbf{K} \right| \mathbf{X}_{\mathrm{s}} = - \left( rac{\mathbf{G}_{\mathrm{I}}}{\mathbf{R}_{\mathrm{g}}} 
ight) 
ight|$$

Open Calculator 🗗

$$oxed{ex} ext{-0.19802m} = -igg(rac{10}{50.5 ext{m}^{-1}}igg)$$

2) Elevation of Lowest Point on Sag Curve



Open Calculator

$$oxed{49.0099 ext{m} = 50 ext{m} - \left(rac{(10)^2}{2 \cdot 50.5 ext{m}^{-1}}
ight)}$$



#### 3) Elevation of Point of Vertical Curvature

 $\mathbf{E}_0 = \mathrm{V} - \left( \left( rac{1}{2} 
ight) \cdot \left( \mathrm{L_c} \cdot \mathrm{G_I} 
ight) 
ight)$ 

Open Calculator

$$\texttt{ex} \ 50 \mathrm{m} = 750 \mathrm{m} - \left( \left( \frac{1}{2} \right) \cdot \left( 140 \mathrm{m} \cdot 10 \right) \right)$$

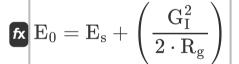
## 4) Elevation of Point of Vertical Intersection

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

Open Calculator 🗗

$$\boxed{\mathbf{ex}} 750\mathrm{m} = 50\mathrm{m} + \left(\frac{1}{2}\right) \cdot (140\mathrm{m} \cdot 10)$$

## 5) Elevation of PVC given Elevation of Lowest Point on Sag Curve



Open Calculator 🚰

$$oxed{49.9901 ext{m} = 49 ext{m} + \left(rac{(10)^2}{2 \cdot 50.5 ext{m}^{-1}}
ight)^2}$$



6) Length of Curve using Rate of change of Grade in Parabolic Curves 🗗

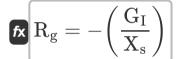


$$\mathbf{L}_{\mathrm{Pc}} = rac{\mathrm{G_2} - (-\mathrm{G_I})}{\mathrm{R_g}}$$

Open Calculator 🗗

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

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



Open Calculator

$$oxed{ex} 50 \mathrm{m}^{\scriptscriptstyle{-1}} = -igg(rac{10}{ ext{-}0.2 \mathrm{m}}igg)$$

## Transition (Spiral) Curves

8) Minimum Length of Spiral

$$extbf{L} = rac{3.15 \cdot \left( ext{V}_{ ext{v}}^3 
ight)}{ ext{R}_{ ext{t}} \cdot ext{a}_{ ext{c}}}$$

Open Calculator

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



#### 9) Radius of Circular Curve Minimum Length 🚰

 $\left| \mathbf{R}_{\mathrm{t}} 
ight| = rac{3.15 \cdot \left( \mathrm{V_{v}^{3}} 
ight)}{\mathrm{L} \cdot \mathrm{a_{c}}}$ 

Open Calculator

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

## 10) Rate of Increase of Radial Acceleration

 $\mathbf{x} \mathbf{a}_{\mathrm{c}} = rac{3.15 \cdot \left( V_{\mathrm{v}} 
ight)^3}{\mathrm{L} \cdot \mathrm{R}_{\mathrm{t}}}$ 

Open Calculator 🖸

 $\mathbf{ex} = 2.000029 = \frac{3.15 \cdot (41 \mathrm{km/h})^3}{361.83 \mathrm{m} \cdot 300 \mathrm{m}}$ 

## 11) Vehicle Velocity given Minimum Length of Spiral

 $V_{
m v} = \left(rac{{
m L}\cdot{
m R}_{
m t}\cdot{
m a}_{
m c}}{3.15}
ight)^{rac{1}{3}}$ 

Open Calculator 🖸

 $ext{ex} egin{aligned} 40.9998 ext{km/h} = \left(rac{361.83 ext{m} \cdot 300 ext{m} \cdot 2}{3.15}
ight)^{rac{1}{3}} \end{aligned}$ 



#### Variables Used

- ac Rate of Increase of Radial Acceleration
- En Elevation of Point of Vertical Curve (Meter)
- E<sub>S</sub> Elevation of Lowest Point on a Sag Curve (Meter)
- G<sub>2</sub> Grade at End of Curve
- G<sub>I</sub> Grade at Beginning of Curve
- L Minimum Length of Spiral (Meter)
- L<sub>c</sub> Length of Curve (Meter)
- Lpc Length of Parabolic Curves (Meter)
- Rq Rate of Change of Grade (Per Meter)
- Rt Radius of Curve (Meter)
- **V** Elevation of Point of Vertical Intersection (Meter)
- **V**<sub>v</sub> Vehicle Velocity (Kilometer per Hour)
- X<sub>S</sub> Distance from PVC to Lowest Point on a Sag Curve (Meter)





## Constants, Functions, Measurements used

- 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<sup>-1</sup>)

  Linear Atomic Density Unit Conversion





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