Bridge Design Details 2E October 2019

Horizontal Curve Equations

BC = Beginning of Curve

EC = End of Curve

d = Deflection Angle for point on curve

Δ = Delta or Central Angle

L = Length along Curve (BC to POC)

L = Length of Curve = $\frac{2\pi R}{360°}\Delta$

LC = Long Chord = $2R\,(1\text{-}\sin\frac{\Delta}{2})$

M = Middle Ordinate = $R\,(1\text{-}\cos\frac{\Delta}{2})$

PC = Point of Curvature

PI = Point of Intersection

POC = Point on Curve

PT = Point of Tangency

R = Radius

T = Tangent Distance = $R\tan\frac{\Delta}{2}$

Ex = External = $\left(\frac{R}{\cos\frac{\Delta}{2}} - R\right)$

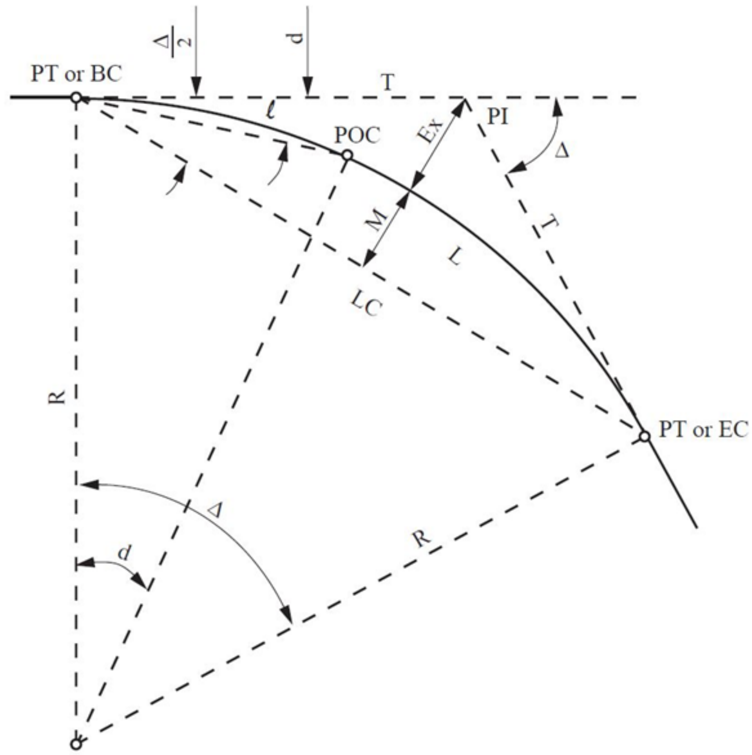

Figure 2A.E.1 Horizontal Curve Functions

All Curve Data may be obtained with two of the following curve parameters:

- Delta (Δ)
- Radius
- Tangent
- Length
- External

Example:

Given Length and Radius, solve for Delta Δ.

$$T = R\tan\frac{\Delta}{2} \qquad L = \frac{2\pi R}{360°}\Delta$$

$$\tan\frac{\Delta}{2} = \frac{T}{R} \Rightarrow 2\tan^{-1}(\frac{T}{R}), \Delta \text{ in degrees}$$

$$\Delta \text{ in degrees} = \frac{L \times 3{,}437.7467}{R}$$

Example:

Given Radius and Delta Δ, solve for L.

$$L = \frac{2\pi R\Delta}{360°} \; or \; L = R \; func\Delta \Rightarrow \frac{L}{2\pi R} = \frac{\Delta}{360°} \Rightarrow L = \frac{2\pi R}{360°}\Delta \quad \text{where } \Delta \text{ is in degrees}$$

$$d = \frac{\Delta d}{2} \; where \; \frac{\Delta d}{360°} = \frac{\ell}{2\pi R} \Rightarrow d = \frac{180\ell}{2\pi R} \text{ (in degrees)}$$

$$Ex = \frac{R}{\cos\frac{\Delta}{2}} - R \Rightarrow R\left(\frac{1}{\cos\frac{\Delta}{2}} - 1\right)$$

$$R - R\cos\frac{\Delta}{2} \Rightarrow R\left(1 - \cos\frac{\Delta}{2}\right)$$