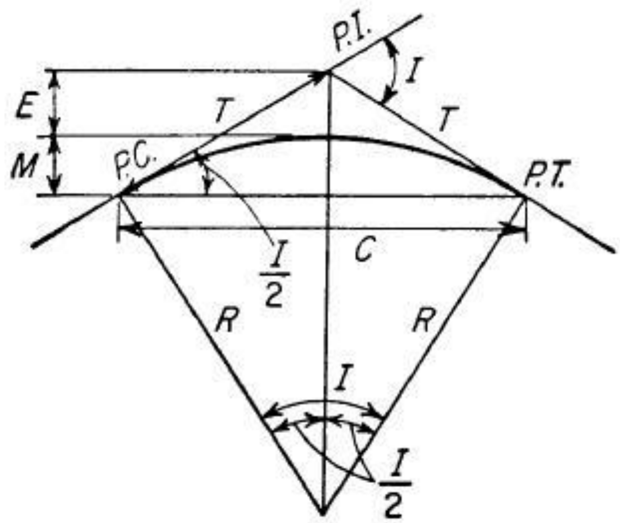
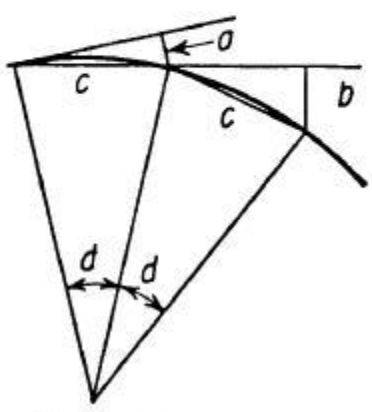
Circular Curves

The most common type of horizontal curve used to connect intersecting tangent (or straight) sections of highways or railroads are Circular curves. In most countries, two methods of defining circular curves are in use: the first, in general use in railroad work, defines the degree of curve as the central angle subtended by a chord of 100 ft (30.48 m) in length; the second, used in highway work, defines the degree of curve as the central angle subtended by an arc of 100 ft (30.48 m) in length.

The terms and symbols generally used in reference to circular curves are listed next below:



Circular curve.



Offsets to circular curve.

PC= point of curvature, beginning of curve

PI= point of intersection of tangents

PT =point of tangency, end of curve

R= radius of curve, ft (m)
D= degree of curve (see previous text)
I= deflection angle between tangents at PI, also central angle of curve
T= tangent distance, distance from PI to PC or PT, ft (m)
L= length of curve from PC to PT measured on 100-ft
(30.48-m) chord for chord definition, on arc for arc definition, ft (m)
C= length of long chord from PC to PT, ft (m)
E= external distance, distance from PI to midpoint of curve, ft (m)
M= midordinate, distance from midpoint of curve to midpoint of long chord, ft (m)
d= central angle for portion of curve (d
l length of curve (arc) determined by central angle
d, ft (m)
c= length of curve (chord) determined by central angle d, ft (m)
a= tangent offset for chord of length c, ft (m)
b= chord offset for chord of length c, ft (m)
Equations of Circular Curves

$$R = \frac{5{,}729.578}{D}$$ exact for arc definition, approximate for chord definition

$$= \frac{50}{\sin \frac{1}{2} D}$$ exact for chord definition

$$T = R \tan \tfrac{1}{2} I$$ exact

$$E = R \operatorname{exsec} \tfrac{1}{2} I = R (\sec \tfrac{1}{2} I - 1)$$ exact

$$M = R \operatorname{vers} \tfrac{1}{2} I = R (1 - \cos \tfrac{1}{2} I)$$ exact

$$C = 2R \sin \tfrac{1}{2} I$$ exact

$$L = \frac{100 I}{D}$$ exact

$$L - C = \frac{L^3}{24R^2} = \frac{C^3}{24R^2}$$ approximate

$$d = \frac{Dl}{100}$$ exact for arc definition

$$= \frac{Dc}{100} \qquad \text{approximate for chord definition}$$

$$\sin \frac{d}{z} = \frac{c}{2R} \qquad \text{exact for chord definition}$$

$$a = \frac{c^2}{2R} \qquad \text{approximate}$$

$$b = \frac{c^2}{R} \qquad \text{approximate}$$

Source: http://www.engineeringcivil.com/circular-curves.html