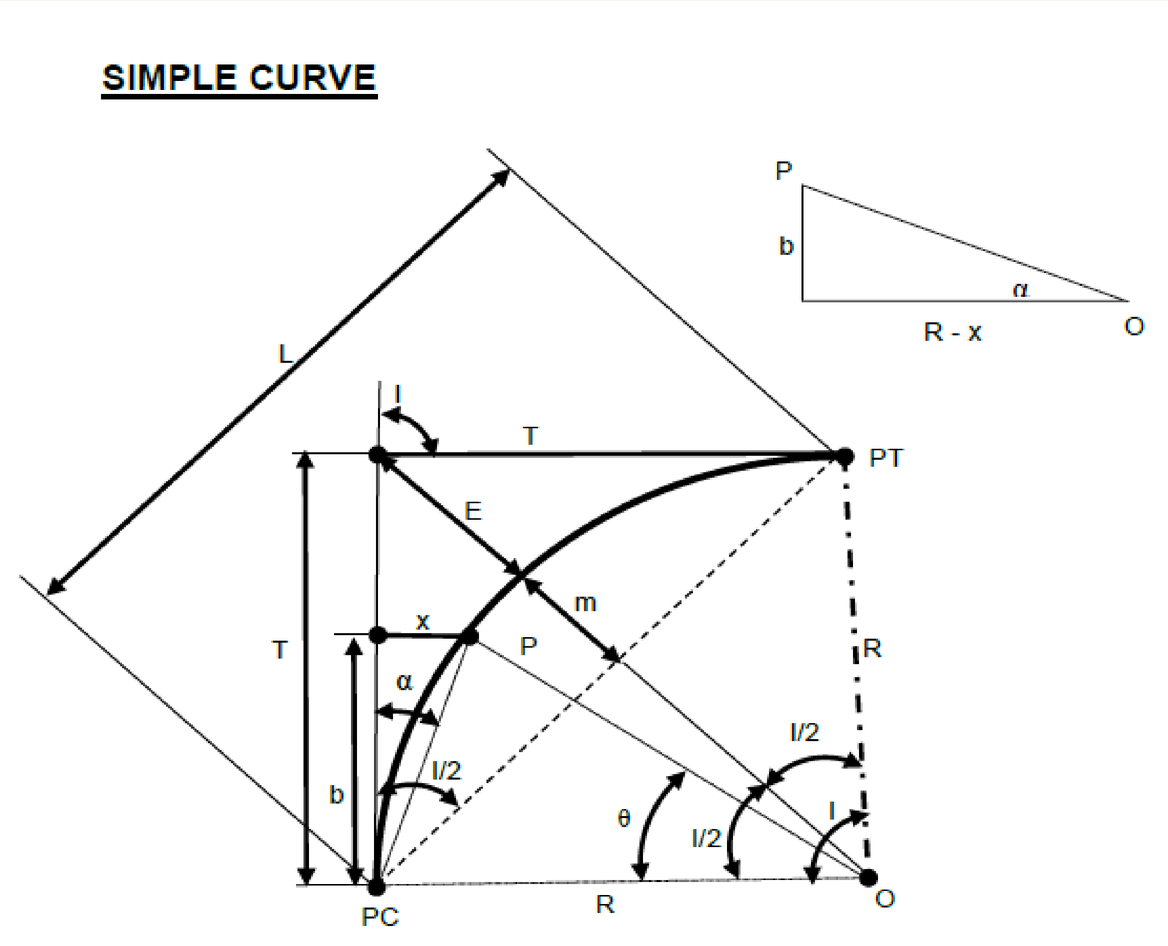
HORIZONTAL CURVES

Simple Curves:



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x = perpendicular offset from the tangent to the curve

α= deflection angle from PC to any point P on the curve

$$\alpha = \frac{\theta}{2}$$

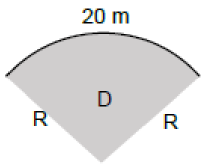
$$\tan\alpha = \frac{x}{b}$$

I = angle on intersection of the tangents or central angle of simple curve
D = degree of curve
PI = point of intersection (of tangents)
PC = point of curvature
PT = point of tangency

Radius of Curve

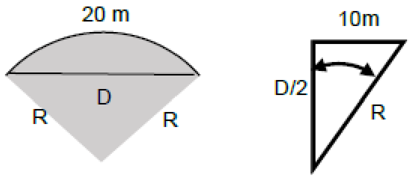
Arc Basis

$$20 = \frac{\pi RD}{180^\circ}$$



Chord Basis

$$10 = R\sin\frac{D}{2}$$



LENGTH OF CURVE

$$L_c = \frac{\pi RI}{180^\circ}$$

$$L_c = \frac{20I}{D} \quad \text{(using arc basis)}$$

TANGENT DISTANCE

$$T = R\tan\frac{I}{2}$$

LENGTH OF LONG CHORD

$$L = 2R\sin\frac{I}{2}$$

EXTERNAL DISTANCE

$$E = R\left(\sec\frac{I}{2} - 1\right)$$

MIDDLE ORDINATE

$$m = R - R\cos\frac{I}{2} = R\left(1 - \cos\frac{I}{2}\right)$$

MINIMUM RADIUS OF CURVATURE

The minimum radius of curve so that a car can round the curve at velocity v without skidding is:

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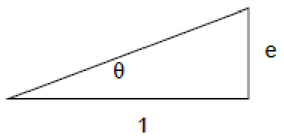

$$R_{min} = \frac{v^2}{127\,(e + f)} \quad \text{in meter}$$

v = design speed in kph
e = superelevation
f = coefficient of friction
Φ= angle of friction

IMPACT FACTOR

$$I_f = \tan(\theta + \phi) = \frac{v^2}{gR}$$

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Problem 1:

- Two tangents of a simple curve have azimuths of 120° and 156°30’ respectively. If the external distance is 12.02 m., compute the radius, middle ordinate and tangent distance.

- Ans: R = 226.94 m

  M = 11.42 m

  T = 74.83 m

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Problem 2:

- The central angle of a simple curve is 38°, if the mid-point of the curve is 13 m. nearer the vertex, what is the degree of curve? Use arc basis.

- Ans: 5.08°

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Problem 3:

- The angle of intersection of a circular curve is 45 degrees 30 minutes and its radius is 198.17m. PC is at station 0+700.

  a. Compute the right angle offset from Sta. 0+736.58 on the curve to tangent through PC. **Ans: 3.37 m**

  b. Compute the deflection angle of Sta. 0+736.58 from PC. **Ans: 5.29°**

  c. Degree of curve. Use chord basis. Assume 20 m length of chain. **Ans: 5.78°**

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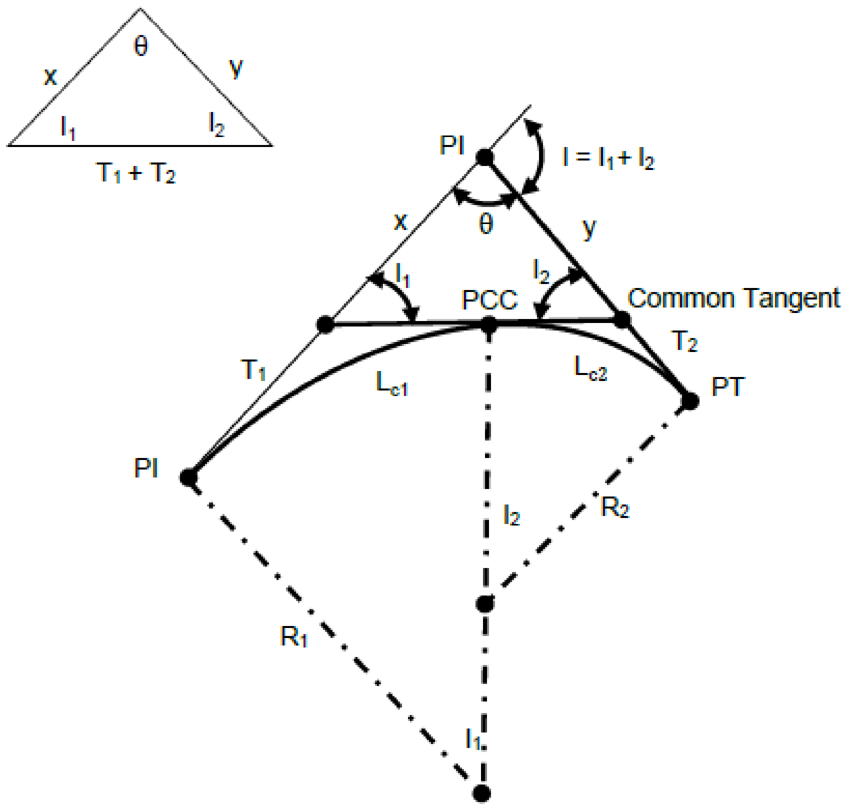
COMPOUND CURVE



PCC = point of compound curve

With known stationing of PC:

$$\text{Sta. PT} = \text{Sta. PC} + L_{c1} + L_{c2}$$

With known stationing of PI:

$$\text{Sta. PT} = \text{Sta. PI} - x - T_1 + L_{c1} + L_{c2}$$

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Problem 1:

- The tangents of a compound curve intersect at an angle of 104°. The first curve has a radius of 420 m. and a central angle of 38°. If the common tangent is 200 m. long, what is the radius of the second curve?

- Ans: 85.28 m

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Problem 2:

- A long chord from the P.C. to P.T. of a compound curve is 150 m. long and the angle it makes with the longer and shorter Chord are 6° and 10° respectively. Find the larger radius of the compound curve so that the common tangent will be parallel to the long chord.

- **Ans: R = 452.02 m**

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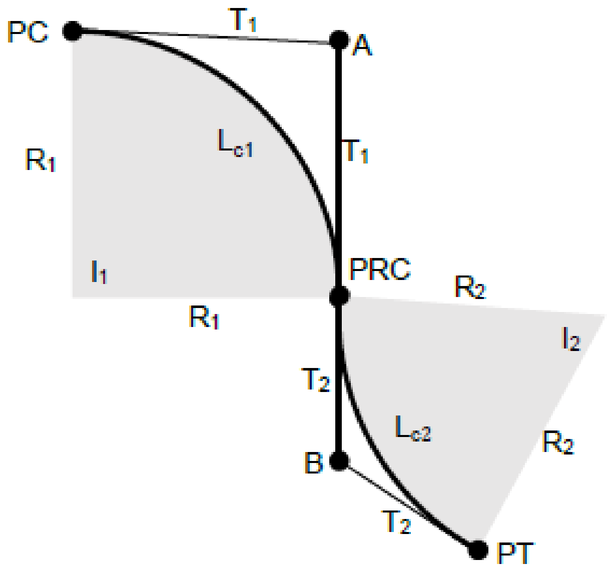
REVERSED CURVE



PRC = point of reversed curvature

With known stationing of A:

$$\boxed{\text{Sta. PT} = \text{Sta. A} - T_1 + L_{c1} + L_{c2}}$$

With known stationing of PC:

$$\boxed{\text{Sta. B} = \text{Sta. PC} + L_{c1} + L_{c2}}$$

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Problem 3:

- Given the lines and direction as follows: AB = 57.6 m. due East, BC = 91.5 m., N.68°E, CD = 102.6 m., azimuth of 312°. A reverse curve is to connect these three lines thus forming the center line of a new road. Compute the length of the common radius of the reverse curve.

- **Ans: 111.69m**

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Problem 4:

- A reversed curve is to connect two tangents which is parallel to each other and are 200 m apart with directions of due east. There is an intermediate tangent of 200 m in between the reversed curve and the horizontal distance of the P.C and P.T. measured parallel to the tangents is 800 m long. The P.C of the reversed curve is on the upper tangent while the P.T of the reversed curve is at the lower tangent. Compute the common radius of the reversed curve.

- Ans: 800 m

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