

# Setting out of Curve

## Part-2

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## Question No-1

Two straights T1I and T2I intersect at chainage of  $(375+12)$ , the angle of deflection being  $110^\circ$ . Calculate the chainage of the tangent points of a right handed simple circular curve of 400m radius.

Solution

Chainage of  $l = (375 + 12) = 375$  (chains) + 12 (links)

Deflection angle,  $\Delta = 110^\circ$

Tangent length =  $R \tan 110^\circ/2 = 400 \tan 55^\circ = 571.26$  m

Length of curve =  $\pi R \Delta/180^\circ = \pi \times 400 \times 110^\circ/180^\circ = 767.94$  m

Let us assume that length of chain = 20 m

Chainage of P.I. = 375 (chains) + 12 (links) = 7502.40 m

Deduct tangent length - 571.26 m

Chainage of P.C. 6931.14 m

Add length of curve + 767.94 m

Chainage of P.T. 7699.08 m

Chainage of P.C. = (346 + 55.7)

Chainage of P.T. = (384 + 95.4)

## Question-2

Two straights AB and BC intersect at a chainage of 4242.0m. The angle of intersection is  $140^\circ$ . It is required to set out a  $5^\circ$  simple circular curve to connect the straights. Calculate all the necessary to set out the curve by method of offsets from chord produced with an interval of 30m.

Solution The chain used is of 30 m.

$$\text{Radius of curve, } R = \frac{1720}{D} = \frac{1720}{5} = 344 \text{ m}$$

$$\text{Deflection angle, } \Delta = 180^\circ - 140^\circ = 40^\circ$$

$$\text{Tangent length, } BT_1 = R \tan (\Delta/2) = 344 \tan 20^\circ = 125.2 \text{ m}$$

$$\text{Chainage of intersection point } B = 4242.0 \text{ m}$$

$$\text{Chainage of } T_1 = (4242.0 - 125.2) = 4116.8 \text{ m}$$

$$\begin{aligned} \text{Length of curve} &= R \times \Delta \times \pi/180^\circ \\ &= 344 \times 40^\circ \times \pi/180^\circ = 240.16 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Chainage of } T_2 &= \text{chainage of } T_1 + \text{length of the curve} \\ &= 4116.8 + 240.16 = 4356.96 \text{ m} \end{aligned}$$

*Length of the chords*

There will be nine chords altogether.

$$\text{First sub-chord, } C_1 = 4140 - 4116.8 = 23.2 \text{ m}$$

$$\text{The last sub-chord, } C_9 = 4356.96 - 4350.0 = 6.96 \text{ m}$$

There are seven unit-chords of 30 m length.

The offsets are

$$O_1 = \frac{C_1^2}{2R} = \frac{23.2^2}{2 \times 344} = 0.78 \text{ m}$$

$$O_2 = \frac{C_2 (C_1 + C_2)}{2R} = \frac{30 (23.2 + 30)}{2 \times 344} = 2.32 \text{ m}$$

$$O_3 = O_4 = O_5 = \dots = O_8 = \frac{C^2}{R} = \frac{30^2}{344} = 2.62 \text{ m}$$

$$O_9 = \frac{C_9 (C_8 + C_9)}{2R} = \frac{6.96 (30 + 6.96)}{2 \times 344} = 0.37 \text{ m}$$

## Question no-3

Two straights AI and BI meet at a chainage of 3450m. A right handed simple circular curve of 250m radius joins to them. The deflection angle between two straight is  $50^\circ$ . Tabulate the necessary data lay out curve by Rankine's method of deflection angles. take the chord interval is 20m.



*Solution* Tangent length =  $R \tan \frac{\Delta}{2} = 250 \times \tan 25^\circ = 116.58 \text{ m}$

$$\begin{aligned} \text{Length of the curve} &= R \times \Delta \times \frac{\pi}{180^\circ} = 250 \times 50^\circ \times \frac{\pi}{180^\circ} \\ &= 218.166 \approx 218.17 \text{ m} \end{aligned}$$

Chainage of starting point,  $T_1 = 3450 - 116.58 = 3333.42 \text{ m}$

Chainage of the end point,  $T_2 = 3333.42 + 218.17 = 3551.59 \text{ m}$

*Length of the chords*

There will be 12 chords altogether.

First sub-chord,  $C_1 = 3340 - 3333.42 = 6.58 \text{ m}$

Last sub-chord,  $C_{12} = \text{Chainage of } T_2 - 3540 = 3551.9 - 3540 = 11.59 \text{ m}$

$C_2 \text{ to } C_{11} = 20 \times 10 = 200 \text{ m}$

$$\delta_1 = 1719 \times C_1/R = 1719 \times 6.58/250 = 45'15'' = \Delta_1$$

$$\delta_2 = 1719 \times C_2/R = 1719 \times 20/250 = 2^\circ 17'31''$$

Hence,

$$\Delta_2 = \delta_2 + \Delta_1 = 2^\circ 17'31'' + 45'15'' = 3^\circ 2'46''$$

$$\Delta_3 = \delta_3 + \Delta_2 = 2^\circ 17'31'' + 3^\circ 2'46'' = 5^\circ 20'17''$$

$$\Delta_4 = \delta_4 + \Delta_3 = 2^\circ 17'31'' + 5^\circ 20'17'' = 7^\circ 37'48''$$

$$\Delta_5 = \delta_5 + \Delta_4 = 2^\circ 17'31'' + 7^\circ 37'48'' = 9^\circ 55'19''$$

$$\Delta_6 = \delta_6 + \Delta_5 = 2^\circ 17'31'' + 9^\circ 55'19'' = 12^\circ 12'50''$$

$$\Delta_7 = \delta_7 + \Delta_6 = 2^\circ 17'31'' + 12^\circ 12'50'' = 14^\circ 30'21''$$

$$\Delta_8 = \delta_8 + \Delta_7 = 2^\circ 17'31'' + 14^\circ 30'21'' = 16^\circ 47'52''$$

$$\Delta_9 = \delta_9 + \Delta_8 = 2^\circ 17'31'' + 16^\circ 47'52'' = 19^\circ 5'23''$$

$$\Delta_{10} = \delta_{10} + \Delta_9 = 2^\circ 17'31'' + 19^\circ 5'23'' = 21^\circ 22'54''$$

$$\Delta_{11} = \delta_{11} + \Delta_{10} = 2^\circ 17'31'' + 21^\circ 22'54'' = 23^\circ 40'25''$$

$$\delta_{12} = 1719 \times 11.59/250 = 1^\circ 19'42''$$

$$\begin{aligned} \Delta_{12} &= \delta_{12} + \Delta_{11} = 1^\circ 19'42'' + 23^\circ 40'25'' = 25^\circ 07'' \\ &= 25^\circ \end{aligned}$$

also,

$$\Delta_{12} = \frac{\Delta}{2} = \frac{50^\circ}{2} = 25^\circ$$

(approx.)

which is as should be.



## Question 4

It is required to set out a curve of radius 100m with pegs at approximately 10m from Centre. The deflection angle is  $60^\circ$ . Draw up the data necessary for pegging out the curve by each of the following method.

- (i) Offsets from long chord
- (ii) chord bisection
- (iii) Offsets from tangent

Offsets from long chord  
refer to Fig. 11.21

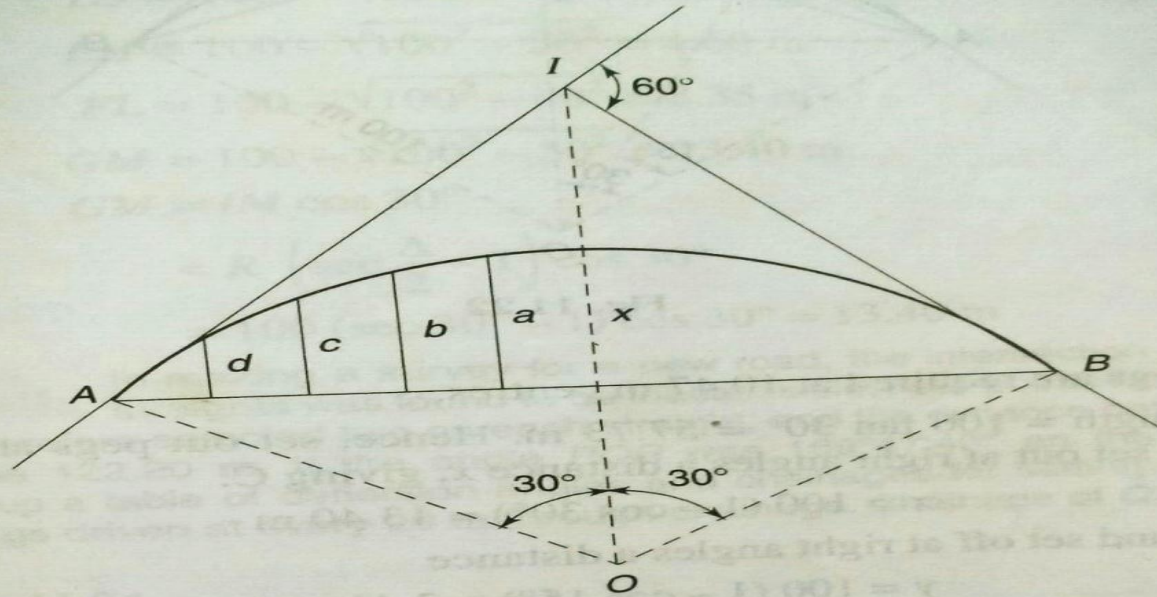


Fig. 11.21

Since, mid-ordinate  $O_0 = 100 (1 - \cos 60^\circ/2) = 13.40$  m

Thus,  $a = 13.40 - \frac{l^2}{2R}$

Let peg interval  $x = 10$  m, so that

$$a = 13.40 - \frac{10^2}{200} = 12.9 \text{ m}$$

$$b = 13.40 - \frac{20^2}{200} = 11.40 \text{ m}$$

$$c = 13.40 - \frac{30^2}{200} = 8.90 \text{ m}$$

$$d = 13.40 - \frac{40^2}{200} = 5.40 \text{ m}$$

and

(ii) *By chord bisection*

Refer to Fig. 11.22.

$$\text{Length of curve} = 100 \times 60^\circ \times \frac{\pi}{180^\circ} = 104.72 \text{ m}$$

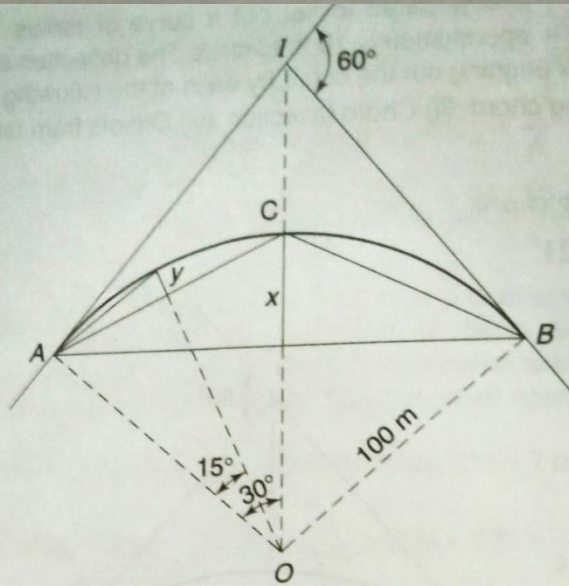


Fig. 11.22

Thus 11 pegs are required at 10.47 m centres.

Tangent length =  $100 \tan 30^\circ = 57.73 \text{ m}$ . Hence, set out pegs at *A* and *B*. Next bisect *AB* and set out at right angles a distance *x*, giving *C*.

$$x = 100 (1 - \cos 30^\circ) = 13.40 \text{ m}$$

Bisect *AC* and set off at right angles a distance

$$y = 100 (1 - \cos 15^\circ) = 3.41 \text{ m}$$

Similarly,

$$z = 100 (1 - \cos 7^\circ 30') = 0.86 \text{ m}$$



(iii) By offsets from tangent

Refer to Fig. 11.23.

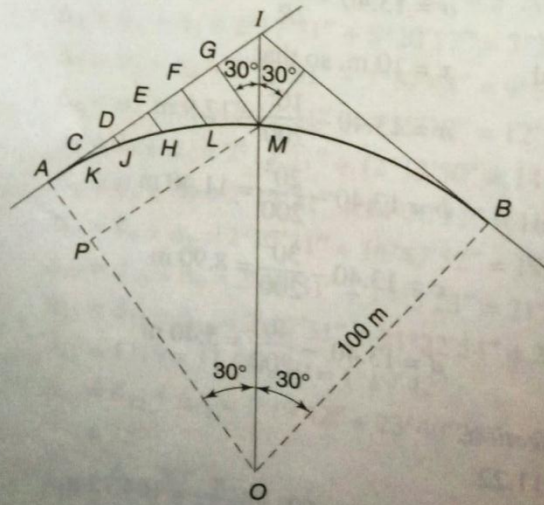


Fig. 11.23

Set out  
where

Set pegs at 10 m interval.

$$\text{Offset from tangent} = R - \sqrt{R^2 - x^2}$$

$$CK = 100 - \sqrt{100^2 - 10^2} = 0.5 \text{ m}$$

$$DJ = 100 - \sqrt{100^2 - 20^2} = 2.02 \text{ m}$$

$$EH = 100 - \sqrt{100^2 - 30^2} = 4.60 \text{ m}$$

$$FL = 100 - \sqrt{100^2 - 40^2} = 8.35 \text{ m}$$

$$GM = 100 - \sqrt{100^2 - 50^2} = 13.40 \text{ m}$$

Then,

$$GM = IM \cos 30^\circ$$

$$= R \left( \sec \frac{\Delta}{2} - 1 \right) \cos 30^\circ$$

$$= 100 (\sec 30^\circ - 1) \cos 30^\circ = 13.40 \text{ m}$$