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Section :- B

Subject :- Advance Engineering Survey

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Semester :- 4th

Depth :- CED

# QNo:-1@

**Given data :-** Degree of curve = 5°

Deflection angle = Δ = 14°13'23"

Chainage intersection = 7939 (ID)

**Required data :-**

① chainage at begining and end of curve

② length of long chord

③ Mid ordinate and external distance

**Solution :-**

$$\text{Radius} = \frac{5789.28}{D}$$

$$R = \frac{5789.28}{5^\circ}$$

$$\boxed{R = 1145.85 \text{ ft}}$$

## Length of long chord :-

Length of long chord $= 2R \sin \Theta/2$

$\Rightarrow 2(1145.85)\sin\left(\frac{14°13''23''}{2}\right)$

$\Rightarrow L = 2291.7 \sin(7°6'41.5'')$

$\Rightarrow$ **$L = 283.7150$ ft**

## Mid ordinate :-

Mid ordinate $= R(1-\cos\Theta/2)$

$\Rightarrow$ Mid ordinate $= 1145.85\left(1-\cos\frac{14°13'23''}{2}\right)$

$\Rightarrow 1145.85(1-\cos 7°6'41.5'')$

$\Rightarrow 1145.85(1-0.9923)$

$\Rightarrow 1145.85(7.7\times10^{-3})$

Mid ordinate **$= 8.823$ ft**

## External Distance :-

$R\left(\frac{1}{\cos\Theta/2}-1\right)$

$$\Rightarrow 1145.85 \left( \frac{1}{\cos\left(\frac{14°13'23''}{2}\right)} - 1 \right)$$

$$\Rightarrow 1145.85 \left( \frac{1}{\cos 7°6'41.5''} - 1 \right)$$

$$\Rightarrow 1145.85 \left( \frac{1}{0.9923} - 1 \right)$$

$$\Rightarrow 1145.85 \left( 7.759 \times 10^{-3} \right)$$

External distance = 8.891 ft

## Tangent length :-

Tangent length = $R \tan \frac{\Delta}{2}$

Tangent length = $1145.85 \tan \left( \frac{14°13'23''}{2} \right)$

$= 1145.85 (0.124)$

$= 142.08$ ft

## Now length of curve :-

$$= \frac{\pi R \Delta}{180°}$$

$$= \frac{3.14 \times 1145.85 \cdot 14°13'23''}{180°}$$

**length of curve = 284.30 ft**

**Finally :-**

chainage = 7939 ft

minus tangent length = -142.08 ft

$T_1$ = 7811.92 ft

add curve length = 284.30 ft

$T_2$ = 8096.22 ft

**Q1 B :-**

| chainage (m) | 0 | 30 | 60 | 90 | 120 | 150 |
|---|---|---|---|---|---|---|
| offset (m) | 7.939 | 7.939+3 | 7.939+4 | 7.939-2 | 7.939-4 | 7.939-3 |

# Simson's one Third rule

$$\text{Area} = \frac{b}{3}\left(h_1 + h_7 + 4(h_2 + h_4 + h_5) + 2(h_3 + h_5)\right)$$

→ In general cas

$$\text{Area} = \frac{b}{3}(X + 2O + 4E)$$

X = Sum of first and last offset

O = Sum of remaining odd offset

E = Sum of even offset.

Solve :-

| | | |
|---|---|---|
| 1) | 7.939 | 7.939 |
| 2) | 10.426 | 41.704 |
| 3) | 11.426 | 22.285 |
| 4) | 5.426 | 21.704 |
| 5) | 3.426 | 6.852 |
| 6) | 4.426 | 4.426 |

$\Sigma = 104.91$

$$\text{Area} = (h_1 - h_6)$$

$$= b/3 \times 104.91$$

$$= \frac{30}{3} \times 104.91$$

$$= 1049.1\ m^2$$

Q:2:-

**Solve:-** First we will assume the radius, then it will be equals to ID -7050

Given data

ID = 7939

R= 7939-7050 = 889m

deflection angle = 20° 40°

Peg interval = 20m

chainage at intersection point, which also be assumed

= 7939-4050 = 3889 m

**Calculation** Now to find tangent line

$BT_1 = BT_2 = R\tan(\Theta/2)$

$BT_1 = BT_2 = 889 \tan\left(\frac{20^\circ 40^\circ}{2}\right)$

$BT_1 = BT_2 = 163.4\ m$

Length of curve

$$L = \frac{\pi R \theta}{180^\circ}$$

$$L = \frac{3.14 \times 889 \times 20^\circ\ 40^\circ}{180^\circ}$$

$$L = 316.628\ m$$

Chainage

$$T_1 = 3889 - 163.4$$

$$= 3725.6\ m$$

$$T_2 = 3725 + 316.628$$

$$T_2 = 4042.228$$

Now length of first sub chord

$= 3775 - 3725$

$= 50\ m$

length of last sub chord

$4042.228 - 4040$

$= 2.29m$

As we know that

$C_1 = C_2 = C_3 = C_4 \cdots\cdots C_{15} = 20m$

Now No of chord $= \dfrac{\text{length of curve}}{\text{Peg interval}} - C_1$

$= \dfrac{316.628 - 19.20}{20}$

$= 14.87$ is somehow 14

So No of cords $= 14$

Deflection angle =

$$\delta_1 = \frac{1718.9\, c_1}{60\, R} = \frac{1718.9 \times 34.20}{60(889)}$$

$$= 0^\circ 4' 60''$$

$$\delta_2 = \frac{1718.9 \times 20}{60(889)}$$

$$\Rightarrow 1^\circ 37' 14''$$

Then $\delta_2 = \delta_3 = 4 \cdots \delta_{14} = 1^\circ 37' 14''$

$\delta_{14} = 0^\circ, 48', 57''$

total deflection angle for the chords are

$\Delta_1 = \delta_1 = 0^\circ 4' 60''$

$\Delta_2 = \delta_1 + \delta_2 = 1^\circ 38' 48.5''$

$\Delta_3 = \delta_2 + \delta_3 = 2^\circ 18' 43.42''$

$\Delta_4 = \delta_3 + \delta_4 = 2^\circ 52' 41.9''$

$\Delta_5 = \delta_4 + \delta_5 = 3^\circ 48' 38.67''$

$\Delta 6 = \delta 5 + \delta 6 = 4^\circ 18' 32.14''$

$\Delta 7 = \Delta 6 + \delta 7 = 4^\circ 52' 32.14''$

$\Delta 8 = \Delta 7 + \delta 8 = 5^\circ 30' 28.83''$

$\Delta 9 = \Delta 8 + \delta 9 = 6^\circ 8' 25.52''$

$\Delta 10 = \Delta 9 + \delta 10 = 6^\circ 46' 28.9''$

$\Delta 11 = \Delta 10 + \delta 11 = 7^\circ 24' 18.9''$

$\Delta 12 = \Delta 11 + \delta 12 = 8^\circ 2' 15.59''$

$\Delta 13 = \Delta 12 + \delta 13 = 8^\circ 40' 12.28''$

$\Delta 14 = \Delta 13 \ \delta 14 = 9^\circ 18' 8.97''$

$\Delta 15 = \Delta 14 + \delta 15 = 10^\circ 15' 11.45''$

$$\text{Check} = \frac{\Delta}{2} = \frac{20^\circ 40''}{2} = 10^\circ 11' .10''$$

# Q:- 3:-

## Given data:-

$\angle AKM = \alpha = -130^\circ + 180^\circ = 50^\circ$

$\angle KMC = \beta = -140^\circ + 180^\circ = 40^\circ$

$R_1$ = Radius = ID - 300

= 7939 - 300

= 7639m

$R_2$ = Radius = ID - 400

= 7939 - 400

= 7539 m

Chainage of intersection point

= ID - 400

**= 7539 m**

P=12

## Required Data :-

Tangent points = ?

compound curvature = ?

## Solution :-

$\Theta = \alpha + \beta = 40^\circ + 50^\circ = 90^\circ$

$I = 180^\circ - 90^\circ = 90^\circ$

Now $KI_2 = KN = R_1 \tan(\alpha/2)$

$= 7639 \tan(50^\circ/2)$

$= 3562.12 \text{ m}$

Now $MN = MT_2 = R_2 \tan(\frac{\beta}{2})$

$= 7739 \tan(40^\circ/2)$

$= 2816.76 \text{ m}$

So $MN = MT_2 = 2816.76 \text{ m}$

$KM = MT_2 + KT_1 = 3562.12 + 2816.76$

$= 6378.88$

Now find $\angle BKM$ by Sin Rule

$$BK = \frac{MK - \sin B}{\sin I}$$

$$= \frac{6378.88 \sin(40)}{\sin 90^\circ}$$

$$\boxed{BK = 4128.31 m}$$

$$BM = \frac{MK - \sin d}{\sin I}$$

$$BM = \frac{6378.88 \sin 58}{\sin 90^\circ}$$

$$\boxed{BM = 4886.06 m}$$

$$T_1 = KT_1 + BK$$

$$= 3562.12 + 4128.31$$

$$\boxed{= 7690.43}$$

$$T_2 = MT_2 + BM$$

$$= 2816.76 + 4886.06$$

$$\boxed{= 7703.36}$$

$$L_1 = \frac{3.14 \times 7639 \times 50^\circ}{180^\circ}$$

$$\boxed{L_1 = 6688.16\ m}$$

$$L_S = \frac{\pi R_2 B}{180^\circ}$$

$$L_S = \frac{3.14 \times 7739 \times 40^\circ}{180^\circ}$$

$$\boxed{L_S = 5418.70\ m}$$

Chainage of intersection point,

$$= 7539\ m$$

Chainage of intersection - T1

$$= 7539 - 7677.37$$

$$\boxed{= -138.37}$$

PI OS $L_1 = -138.37 + 6688.16$

$$\boxed{= 6549.79\ m}$$

So chainage of compound curvature

$= 5418.70 + 6549.79$

$= 11968.49\text{m}$