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I.D # 7902

Section : A

Paper :- Survey II

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Q#1:-

Tangent Meet at Chainage = 7902

Deflection angle = $14^\circ 13' 23''$

Degree of Curve = 5°

Sol:-

$D = 5^\circ$

$$R = \frac{5729.58}{D}$$

$$R = \frac{5729.58}{5^\circ} = \boxed{1145.91 ft}$$

Tangent length = $BT_1 = BT_2 = R\tan(\phi/2)$

$$BT_1 = BT_2 = 1145.91 \times \tan\left(\frac{14^\circ 13' 23''}{2}\right)$$

$$= \boxed{142.96 ft}$$

Length of Curve $L = \dfrac{\pi R \phi}{180^\circ} = \dfrac{(3.14)(1145.91)(14^\circ 13' 23'')}{180^\circ}$

$$\boxed{L = 284.45 ft}$$

Chainage of Intersection Point = 7902

Chainage of T_1 = 7902 − Tangent Length

$= 7902 - 142.96\,ft$

$\boxed{T_1 = 7759.04\,ft}$

Chainage of $T_2 = T_1 +$ Length of Curve

$= 7759.04 + 284.45$

$\boxed{T_2 = 8043.49}$

Length of Chord $= 2R\sin(\phi/2)$

$= 2(1145.91)\sin\left(\frac{14°13'23''}{2}\right)$

$= \boxed{283.72\,ft}$

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

$= 1145.91\left(1-\cos\left(\frac{14°13'23''}{2}\right)\right)$

$= \boxed{8.81\,ft}$

External Distance $= R(\sec(\phi/2)-1)$

$= 1145.91\left(\sec\left(\frac{14°13'23''}{2}\right)\right)$

$= \boxed{8.88\,ft}$

Q#1 (b)

ID= 7902 ÷ 1000 = $\boxed{7.902}$

Chainage (m)	Offset	Simpson Multiplier	Product
0	7.902	1	7.902
30	7.902+3=10.902	4	43.608
60	7.902+4=11.902	2	23.804
90	7.902−2=5.902	4	23.608
120	7.902−4= 3.902	2	7.804
150	7.902−3 = 4.902	1	4.902
		Σ =	111.628

Area = $(h_1 - h_6)$

$$= \frac{b}{3} \times (111.628) \qquad \because b = 30$$

$$= \frac{30}{3} \times (111.628)$$

$$\boxed{\text{Area} = 1116.28\ m^2}$$

Q# 02:-

Given data:-

Circular Radius = 7902 − 7000

7000 Assumed value

$$\boxed{R = 902\ m}$$

Deflection Angle = 20° 40′ 0″

Sol:-

Chainage at Point of Intersection which we also assume = ID − 4000

= 7902 − 4000

$$\boxed{\text{Chainage} = 3902\ m}$$

Peg Interval = 20 m

So, we can find tangent Length

$$BT_1 = BT_2 = 902 \tan\left(\frac{20^\circ 40'}{2}\right)$$

$$= \boxed{164.463\ m}$$

Now

Length of Curve

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

$$= \frac{(3.14)(902)(20^\circ 40')}{180^\circ}$$

$$\boxed{L = 325.187}$$

$T_1 = 3902 - 164.463$

$$\boxed{T_1 = 3737.537}$$

Chainage at $T_2 = \underbrace{3737.537 + 325.187}_{T_1 + L}$

$$\boxed{T_2 = 4062.724}$$

Value Assumed = 3770

Now Length of 1st Sub Chord = $3770 - 3737.537$

$C_1 = \boxed{32.463}$

Again length of Last Sub Chord = Assumed value = 4030

$\Rightarrow 4062.724 - 4030$

$C_{15} = \boxed{32.724}$

$C_2 = C_3 = C_4 = \dots C_{14} = 20\,m$

Now we can find No. of Chords

$$\text{No. of Chords} = \frac{\text{Length of Curve} - C_1}{\text{Interval}}$$

$$= \frac{325.127 - 32.463}{20}$$

$$= 14.87 \cong 15$$

$$= 15 \text{ chords}$$

Now find deflection Angle:

$$\delta_1 = \frac{1718.9 \times C_1}{60\ R}$$

$$= \frac{1718.9 \times 32.463}{60 \times 902}$$

$$= \frac{55{,}800.6507}{54120}$$

$$\delta_1 = 1^\circ\ 1'\ 51.79''$$

$$\delta_2 = \frac{1718.9 \times 20}{60 \times 902}$$

$$\delta_2 = 0^\circ 38' 6.78''$$

$$\delta_2 = \delta_3 = \delta_4 = \cdots \delta_{14} = \boxed{0^\circ 38' 6.78''}$$

$$\delta_{15} = \frac{1718.9 \times 32.724}{60 \times 902}$$

$$= \boxed{1^\circ 2' 21.64''}$$

Now total deflection (tangentional) angle for the chords are

$$D_1 = \delta_1 = 1^\circ 1' 51.79''$$

$$D_2 = D_1 + \delta_2 = 1^\circ 39' 58.57''$$

$$D_3 = D_2 + \delta_3 = 2^\circ 18' 5.35''$$

$$D_4 = D_3 + \delta_4 = 2^\circ 56' 12.13''$$

$$D_5 = D_4 + \delta_5 = 3^\circ 34' 18.91''$$

$$D_6 = D_5 + \delta_6 = 4^\circ 12' 25.69''$$

$$D_7 = D_6 + \delta_7 = 4^\circ 50' 32.47''$$

$$D_8 = D_7 + \delta_8 = 5^\circ 28' 39.25''$$

$$D_9 = D_8 + \delta_9 = 6^\circ 6' 46.03''$$

$$D_{10} = D_9 + \delta_{10} = 6^\circ 44' 52.81''$$

$$D_{11} = D_{10} + \delta_{11} = 7^\circ 22' 59.59''$$

$$D_{12} = D_{11} + \delta_{12} = 8^\circ 1' 6.37''$$

$$D_{13} = D_{12} + \delta_{13} = 8^\circ 39' 13.15''$$

$$D_{14} = D_{13} + \delta_{14} = 9^\circ 17' 19.93''$$

$$D_{15} = D_{14} + \delta_{15} = 10^\circ 19' 41.57''$$

Question No 3

Given Data :-

$\Delta AKM = 130^\circ$

$\Delta KMC = 140^\circ$

1st arc radius $= 7902 - 300 = \boxed{7602}$

2nd arc radius $= 7902 - 200 = \boxed{7702}$

Chainage of intersection point $= 7902 - 400$

$= \boxed{7502}$

Required:-

Tangent points = ?

compound curvature = ?

Solution :-

$\alpha = 180^\circ - 130^\circ = 50^\circ$

$\beta = 180^\circ - 140^\circ = 40^\circ$

$\phi = \alpha + \beta = 90^\circ$

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

$KT_1 = KN = R_1 \tan\left(\frac{\alpha}{2}\right)$

$= 7602 \tan\left(\frac{50}{2}\right)$

KT_1 ~~KN~~ $= \boxed{3544.870}$

Scanned with CamScanner

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

$$= 7702 \tan\left(\frac{40^\circ}{2}\right)$$

$$MN = \boxed{2803.298}$$

$$KM = MT_1 + MT_2 = 3544.870 + 2803.298$$

$$KM = \boxed{6348.168}$$

Now

$$\frac{BK}{MK \sin\beta} = \frac{1}{\sin I}$$

$$BK = \frac{MK \sin\beta}{\sin I} = \frac{6348.168 \times \sin(40^\circ)}{\sin 90^\circ}$$

$$BK = \boxed{4080.523}$$

$$BM = \frac{MK \sin\alpha}{\sin I} = \frac{6348.168 \times \sin(50^\circ)}{\sin 90^\circ}$$

$$BM = \boxed{4862.978}$$

$$T_L = KT_1 + BK = 3544.870 + 4080.523$$

$$T_L = \boxed{7625.393}$$

$$T_S = MT_2 + BM = 2803.298 + 4862.978$$

$$L_L = \frac{\pi R_L \alpha}{180} = \frac{3.14\,(7602)\,50^\circ}{180}$$

$$L_L = \boxed{6630.633}$$

$$L_S = \frac{\pi R_L \beta}{180} = \frac{3.14\,(7702)\,40^\circ}{180}$$

$$L_S = \boxed{5374.284}$$

chainage of intersection point = 7502

chainage of intersection point $- T_L$ = 7502 - 7625.393

$= \boxed{-123.393}$

Plus L_L = -123.393 + 6630.633

$= \boxed{6507.24}$

chainage compound curvature (N)

Plus L_S = 6507.24 + 5374.284

chainage of T_2 = $\boxed{11881.524}$