"PAPER"

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PNO# 01:-

Part (A)

Tangent meet at a Chainage

= 7671

Deflection Angle = $\phi = 14°13'23''$

Degree of Curve = $5°$

Sol:→

$$R = \frac{5729.58}{D} = \frac{5729.58}{5°} = 1145.91 ft$$

Tangent length = $BT_1 - BT_2 = R \tan\left(\frac{\phi}{2}\right)$

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

$$BT_1 = BT_2 = 142.96 ft$$

Length of Curve = $L = \frac{\pi R \phi}{180}$

$$L = \frac{\pi \times 1145.91 \times 14°13'23''}{180}$$

$$L = 284.45 ft$$

Chainage of interseetion point = 7671 ft

minus tangent length = $BT_1 = -142.96 ft$

P.T.O

Chainage of T_1 = 7528.04 ft

Chainage of intersection point = 7671 ft

plus 1 (length of Chord) = 234.45 ft.

Chainage of T_2 = 7955.45 ft

Now length of Chord = $l = R \sin\left(\frac{\Phi}{2}\right)$

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

$= 283.72$ ft.

Mid ordinate $= R\left(1 - \cos\left(\frac{\Phi}{2}\right)\right)$

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

$= 8.81$ ft.

External distance :-

$R(\sec\left(\frac{\Phi}{2}\right) - 1$

$1145.91\left(\sec\frac{14°13'23''}{2} - 1\right.$

$= 8.8$ ft

Q NO# 01 :-

Part (B) :-

offset NO	offset	Simpson Multiplier	product
1	7.671	1	7.671
2	10.671	4	42.684
3	11.671	2	23.342
4	5.671	4	22.684
5	3.671	2	7.342
6	4.671	1	4.671
			Σ 104.394

$$\text{Area}\ (h_1 - h_0) = \frac{b}{3} \times 108.394$$

$$= \frac{30}{3} \times 108.394$$

$$\text{Area} = 1083.94\ m^2$$

Q NO # 03:-

Given Data:-

$\Delta AKM = 130^\circ$

$\Delta KML = 140^\circ$

1st arc radius $= (7671 - 300) = 7371\ m.$

2nd arc radius $= (7671 - 200) = 7471\ m.$

Chainage of intersection point $= (7671 - 400)$

$= 7271\ m.$

Required ⇒

Tangent point = ?

Compound Curvature = ?

Solution:→

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

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

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

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

$KT_1 = KN = R_2 \tan\left(\frac{K}{2}\right)$

$= 7371 \tan\left(\frac{50^\circ}{2}\right)$

$= 3437.15\ m$

P.T.O

$$KM = MT_2 = R_s \tan\left(\frac{\beta}{2}\right) = 7471 \tan\left(\frac{40^\circ}{2}\right)$$

$$Mn = MT_2 = 2719.22\,m.$$

$$KM = MT_2 + KT_1 = 3437.15 + 2719.22\,m$$

$$KM = 6156.37\,m$$

Now,

$$\frac{BK}{MK \sin\beta} = \frac{1}{\sin I} = \frac{6156.37 \times \sin 40^\circ}{\sin 90}$$

$$= 3957.23\,m$$

$$BK = \frac{MK \sin\alpha}{\sin I} = \frac{6156.41 \times \sin 50^\circ}{\sin 90^\circ} = 4716.08\,m$$

$$T_L = KT_1 + BM = 3437.15 + 3957.23$$

$$= 7394.38\,m$$

$$T_s = MT_L + BM = 2719.22 + 4716.08$$

$$= 7435.3\,m$$

$$L_L = \frac{\pi R_L \alpha}{180} = \frac{\pi \times 7371.38 \times 50}{180}$$

$$L_L = 6429.48\,m$$

P.T.O

$$L_s = \frac{\pi R_s \beta}{180} = \frac{\pi \times 7471 \times 40}{180} = 5213.09\ m$$

Chainage of intersection point.

$= 7271\ m$

Chainage of intersection point.

$-T_L = 7394.38\ m$

Chainage of $T_1 = -123.38\ m$

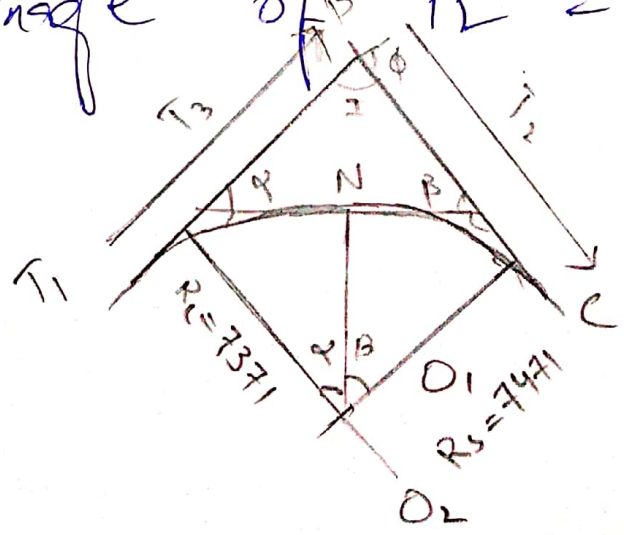
plus $L = +\ 6429.48$.

$= 6306.1\ m$

Chainage of Compound Curvature.

(N) plus $L_s = 5213.09\ m$

Chainage of $T_2 = 11519.19\ m$



QNO# 02 :-

Given Data :-

Circular radius = 7671 - 7387.

= 284 m.

Deflection angles = 20° 40' 0"

point of intersection = 7671 - 5124

= 2547 m

Interval = 20 m.

Solution :-

$R = 2 \times 284 = 568$ m.

$BT_1 = BT_2 = R \tan \frac{\Phi}{2}$

$= 568 \tan \frac{20° 40'}{2}$

$BT_1 = BT_2 = 103.56$ m

length of Curve $L = \frac{\pi R \Phi}{180}$

$L = \frac{\pi \times 568 \times 20° 40'}{180}$

$L = 204.87$ m

P.T.O

Chainage of point of intersection = 2547 m

minus Tangents = -103.56m

Chainage of T_1 = 2443.44m.

plus L = 204.87m

Chainage of T_2 = 2648.31m

length of first Chord = C_1

$2460 - 2443.44$

$= 16.56$m

$C_2 = C_3 = C_4 \ldots\ldots C_{10}$

$C_{11} = 2642.31 - 2630$

$C_{11} = 18.40$m.

By Deflection Methods:

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

$$\delta_2 = \frac{1718.9 \times 16.56}{60(563)} = \frac{1718.9 \times 20}{60(563)}$$

$\delta_2 = 1^\circ\ 0'\ 31.48''$

$\delta_2 = \delta_3 \ldots\ldots \delta_{10}$

$$\delta_{11} = \frac{1718.9 \times 18.40}{60 \times (568)}$$

P.T.O

$\delta_{11} = 0°55'40.98''$.

Total deflection (Tangential) angle for the Chord is.

$\Delta_1 = \delta_1 = 0°50'6.86''$.

$\Delta_2 = \delta_1 + \delta_2 = 0°50'6.86'' + 1°0'31.48''$.

$\Delta_2 = 1°50'98.34''$.

$\Delta_3 = 2°51'9.82''$.

$\Delta_4 = 3°51'41.3''$.

$\Delta_5 = 4°52'12.98''$.

$\Delta_6 = 5°52'44.26''$.

$\Delta_7 = 6°52'44.26''$.

$\Delta_8 = 7°53'47.22''$.

$\Delta_9 = 8°54'18.7''$.

$\Delta_{10} = 9°50'31.34''$.

Check $\frac{\Phi}{2} = \frac{20°40'}{2}$

$10°20'0''$