

Advanced Engineering Survey

Q1:-

Sol:-

Given Data:-

Degree of Curve = 5°

$\alpha = 14^\circ 13' 23''$

chainage of Intersection = 7974 ft

$$R = 5729.5 / \Delta = \frac{5729.5}{5}$$

$$= 1145.91 \text{ ft}$$

$$\text{Tangent length} = R \tan \frac{\phi}{2}$$

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

$$= 149.96 \text{ ft}$$

$$\text{length of curve} = \frac{\pi R \phi}{180}$$

$$= \frac{\pi \times 1145.91 \times 1493' 23''}{180}$$

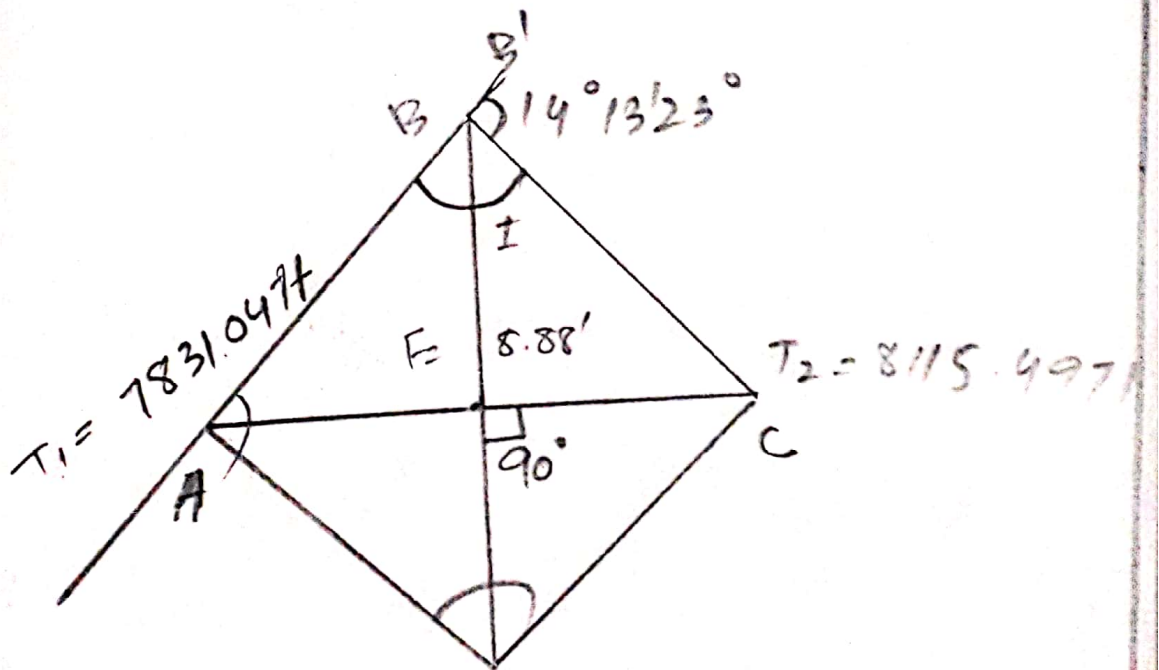
$$= 284.45 \text{ ft}$$

Chainage of Intersection = 7974
minus tangent length = -142.96 ft

chainage T_1 = 7831.04 ft

add curve length = 284.45 ft

chainage T_2 = 8115.49 ft



=> length of long cord

$$2R \sin Q/2$$

$$2 (1145.91) \sin (14^{\circ}13'23''/2)$$

length of long chord = 283.72 ft

=> mid ordinate

$$= R (1 - \cos Q/2)$$

$$= 1145.91 (1 - \cos (14^{\circ}13'23''/2))$$

$$= 8.81 \text{ ft}$$

=> External coordinate:

$$R (\sec Q/2 - 1)$$

$$= 8.88 \text{ ft}$$

(b)

Change(m)	0	30	60	90	120	150
offsets(m)	7.974	10.974	11.974	5.974	3.974	1.974

$$\text{offsets} = 6$$

$$\text{Interpt} = 5$$

$$\text{Interval} = 30$$

offset Not	offsets	Simpso Multiplier	Product
1	7.974	1	7.974
2	10.974	4	43.896
3	11.974	2	23.948
4	5.974	4	23.896
5	3.974	1	<u>3.974</u>

$$\sum = 103.688$$

$$\text{Area } (h_1 - h_5) = \frac{30}{3} \times 103.688 = 1036.88 \text{ m}^2$$

$$\text{Area} = (h_5 - h_6) = \frac{30}{2} (3.974 + 4.974) = 134.22 \text{ m}^2$$

$$\begin{aligned}\text{Total area} &= 1036.88\text{m}^2 + 134.22\text{m}^2 \\ &= 1171.1\text{m}^2\end{aligned}$$

QUESTION # 02

Sol:

Given Data :-

$$\text{Deflection angle} = \Delta = 20^\circ 40'$$

$$\text{Radius} = 7974 - 7674 = 300\text{m}$$

\therefore (7674 assume value)

chainage of Intersection

$$7974 - 5004 = 2970\text{m}$$

\therefore (5004 assum value)

$$\rightarrow R = 300 \times 2 = 600\text{m}$$

$$\text{Tangent length} = R \tan(\Delta/2)$$

$$600 \tan \frac{20^\circ 40'}{2}$$

$$= 109.39\text{m}$$

$$\text{Curve length} = \frac{\pi R \Delta}{180}$$

$$= \frac{\pi \times 600 \times 20^\circ 40'}{180}$$

$$= 216.42 \text{ m}$$

So,

$$\text{Chainage of Intersection} = 2970 \text{ m}$$

$$\text{minus Tangent length} = -109.39$$

$$\text{Chainage of } T_1 = 2860.61 \text{ m}$$

$$\text{Add curve length} = 216.42 \text{ m}$$

$$\text{chainage of } T_2 = 3077.03 \text{ m}$$

Length of 1st chord

$$C_1 = 2880 - 2860.61 = 19.39$$

$$\text{no of chord} = \frac{\text{length of curve} - C_1}{\text{Interval}}$$

$$= \frac{216.42 - 19.39}{20} = 9.87$$

length of last chord

$$3077.03 - 3060 = 17.03$$

$$C_2 = C_3 = C_4 = C_5 = \dots = C_{10} = 20 \text{ m}$$

By Deflection angle

$$\delta_1 = \frac{1718.9 \times C_1 (\text{degree})}{60 \times R}$$

$$\delta_1 = \frac{1718.9 \times 19.39}{60 \times 600}$$

$$\delta_1 = 0^\circ 55' 32.95''$$

$$\delta_2 = \frac{1718.9 \times 20}{60 \times 600}$$

$$\delta_2 = 0^\circ 57' 17.8''$$

$$\delta_{11} = \frac{1718.9 \times 17.03}{60 \times 600}$$

$$\delta_{11} = 0^\circ 48' 47.29''$$

⇒ Total deflection angle for chord arc.

$$\Delta_1 = \delta_1 = 0^\circ 55' 32.95''$$

$$\Delta_2 = \Delta_1 + \delta_2 = 1^\circ 52' 50.75''$$

$$\Delta_3 = \Delta_2 + \delta_3 = 2^\circ 50' 8.55''$$

$$\Delta_4 = \Delta_3 + S_4 = 3^{\circ} 47' 26.35''$$

$$\Delta_5 = \Delta_4 + S_5 = 4^{\circ} 44' 44.15''$$

$$\Delta_6 = \Delta_5 + S_6 = 5^{\circ} 42' 1.95''$$

$$\Delta_7 = \Delta_6 + S_7 = 6^{\circ} 39' 19.75''$$

$$\Delta_8 = \Delta_7 + S_8 = 7^{\circ} 36' 37.55''$$

$$\Delta_9 = \Delta_8 + S_9 = 8^{\circ} 33' 55.35''$$

$$\Delta_{10} = \Delta_9 + S_{10} = 9^{\circ} 31' 13.15''$$

$$\Delta_{11} = \Delta_{10} + S_{11} = 10^{\circ} 20' 0.44''$$

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

$$\text{error} = 0.56''$$

QUESTION # 3

Given Data :-

$$\angle AKM = 130^\circ$$

$$\angle KMC = 140^\circ$$

chainage of Intersection

$$7974 - 400 = 7574 \text{ m}$$

$$\text{1st radius} = 7974 - 300 = 7674 \text{ m}$$

$$\text{2nd radius} = 7974 - 200 = 7774 \text{ m}$$

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

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

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

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

$$I = 90^\circ$$

$$KI_1 = NI_2 = R \tan \frac{\alpha}{2}$$

$$= 7674 \tan \frac{50^\circ}{2} = 3578.44 \text{ m}$$

$$MI_2 = NI_1 = R \tan \frac{\beta}{2}$$

$$= 7774 \tan 40/2$$

$$= 2829.50 \text{ m}$$

$$MK = NK + NM = 3578.44 + 2829.50 = 6407.94 \text{ m}$$

Now,

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

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

$$BK = \frac{6407.94 \sin 40}{\sin 90} = 4118.94 \text{ m}$$

$$\frac{BM}{MK \sin \alpha} = \frac{1}{\sin I} \Rightarrow BM = \frac{MK \sin \alpha}{\sin I}$$

$$= \frac{6407.94 \sin 50}{\sin 90}$$

$$= 4908.76 \text{ m}$$

$$T_3 = K T_2 + BK = 3578.44 + 4118.94 = 7697.38 \text{ m}$$

$$T_2 = M T_2 + BM = 2829.50 + 4908.76 = 7738.26 \text{ m}$$

$$L_3 = \frac{\pi R_3 \alpha}{1000} = \frac{\pi \times 7674 \times 50}{180} = 6696.82 \text{ m}$$

$$L_c = \frac{\pi R_c \beta}{180^\circ} = \frac{\pi \times 7774 \times 40}{180^\circ}$$

$$L_c = 5427.27$$

Chainage of Intersection = 7574m

$$\text{minus } T_s = -7697.38 \text{ m}$$

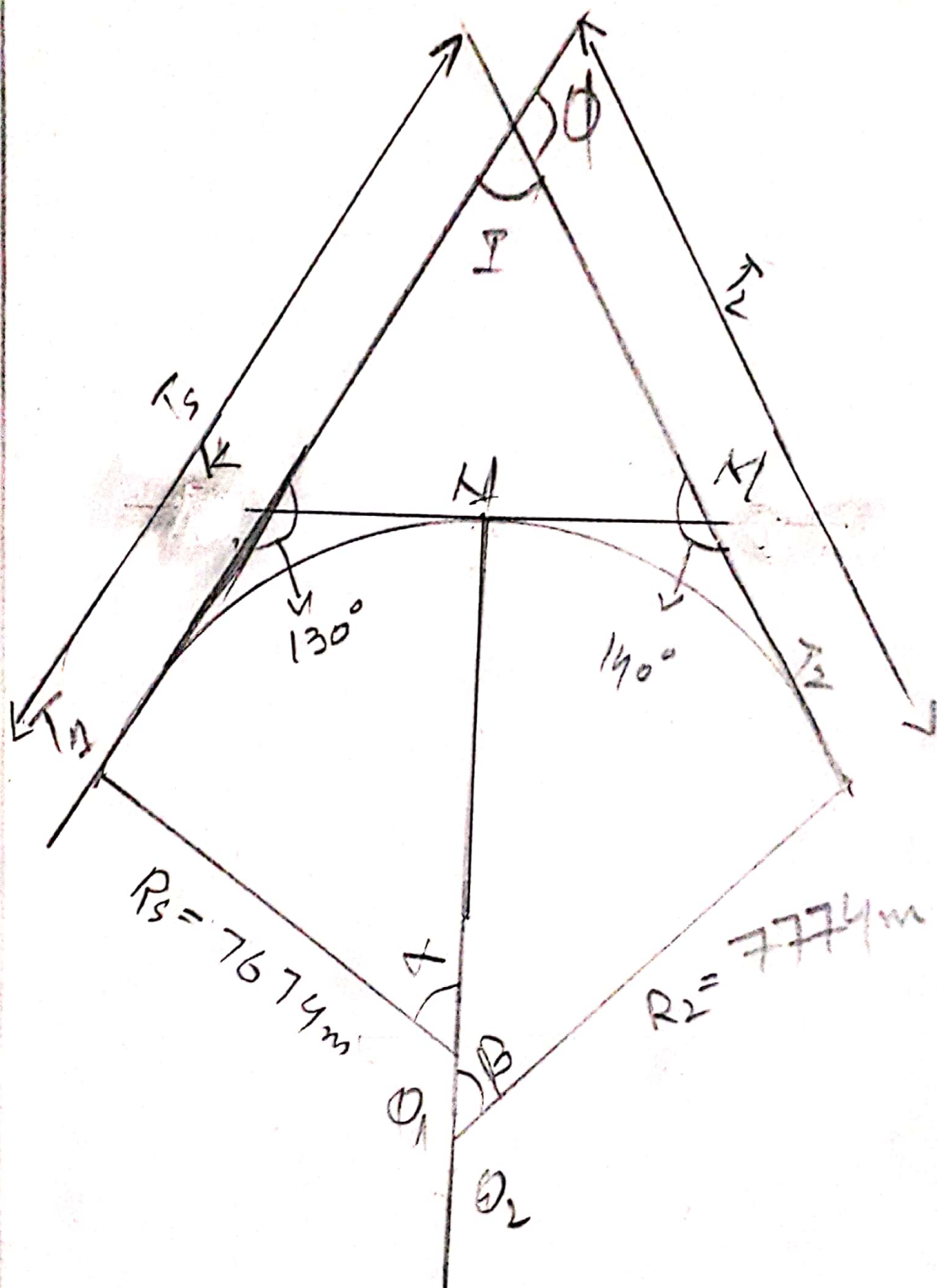
$$\text{Add } L_s = -6696.82$$

$$\text{Chainage of } T_1 = -123.38 \text{ m}$$

$$\begin{aligned} \text{Chainage of Compound curve} \\ = 6573.44 \end{aligned}$$

$$\text{add } L_c = +5427.27 \text{ m}$$

$$\text{Chainage of } T_2 = 12000.71 \text{ m}$$



$$R_1 = 7674\text{m}$$

$$R_2 = 7774\text{m}$$