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Subject: Advance Engineering survey

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Q1:-

(a) Two tangent meet at a chainage of 7544 ft with a deflection angle of 14°13'23" degree of Curve is 5. Calculate

* Chainage at beginning and at End
* Length of longchord
* Mid-ordinate and External distance.

⊙ **Given Data:-**

Tangent intersection chainage = 7544 ft

Deflection angle = 14°13'23"

Degree of Curve = 5°

⊙ **Solution:-**

$$D = 5^\circ$$

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

$$R = \frac{5729.58}{5^\circ}$$

$$\boxed{R = 1145.91 \text{ ft}}$$

Tangent length;

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

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

$$= 142.96 \text{ ft}$$

Length of Curve:

$$l = \frac{\pi R \phi}{180}$$

$$l = \frac{\pi * 1145.91 * 14^\circ 13' 23''}{180}$$

$$\boxed{l = 284.45 \text{ ft}}$$

Chainage of intersection point = 7544 ft

minus tangent Length = −142.967 ft

Chainage of T_1 = 7401.04 ft

plus l = 284.45 ft

Chainage of T_2 = 7685.49 ft

Length of Chord "l_c"

$$= 2R \sin\left(\frac{\phi}{2}\right)$$

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

$$\boxed{\text{Length of chord} = 283.72 \text{ ft}}$$

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

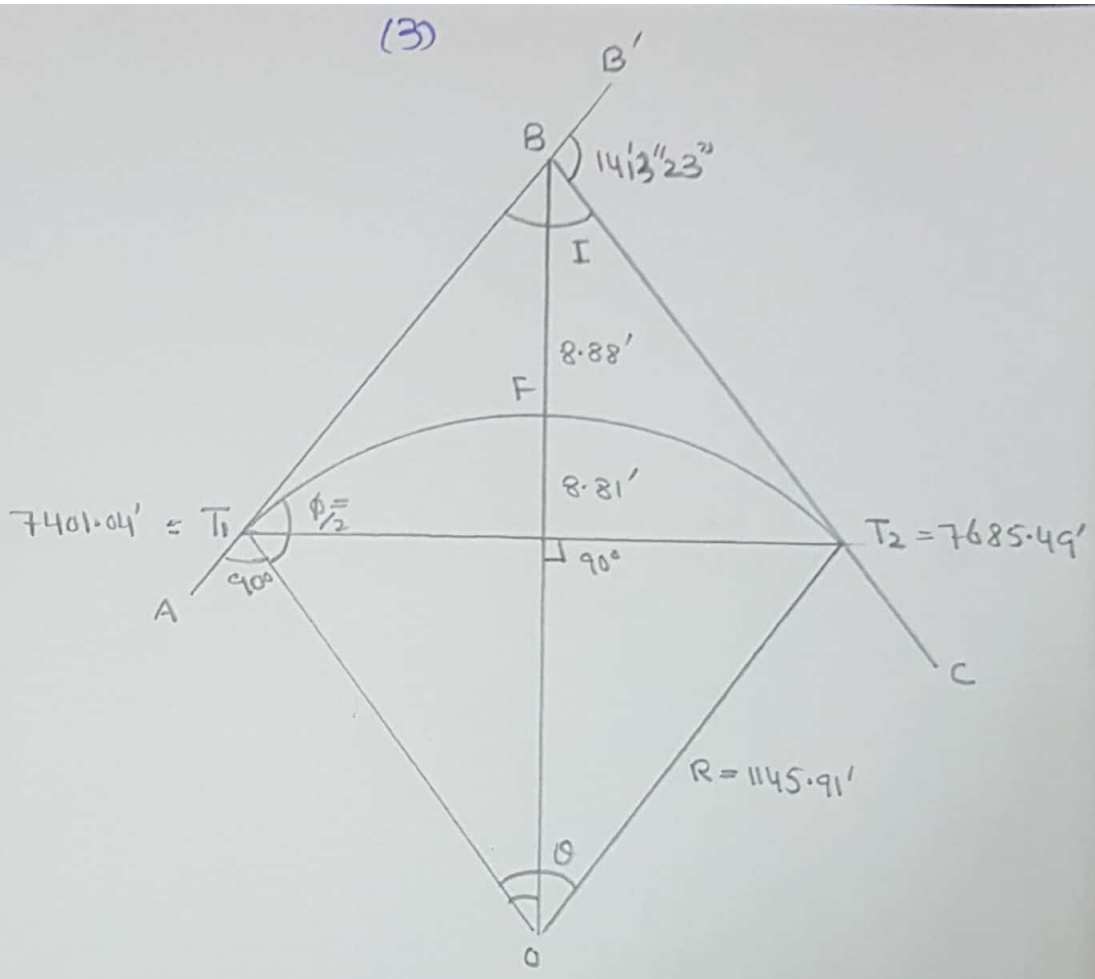
$$= 1145.91\left(1 - \cos\left(\frac{14^\circ 13' 23''}{2}\right)\right)$$

$$= 8.81 \text{ ft}$$

$$\text{External distance} = R\left(\sec\left(\frac{14^\circ 13' 23''}{2}\right) - 1\right)$$

$$= 8.88 \text{ ft}$$

(3)



Q1 (b) (4) Find the area from the data obtained from Chain survey as shown in the table below using Simpson $\frac{1}{3}$ rule. first offseet is (7544 ~~5~~ 1000) for example if someone has I.D 7544 then first term is 7544 and so on.

Chainage(m)	0	30	60	90	120	150	
offset(m)	7.544	10.544	11.544	5.544	3.544	4.544	
	O_1	O_2	O_3	O_4	O_5	O_6	

Solution:-

Common difference between interval is 30m

$n=5$ interval so area is obtain through A_1 & A_2

$A_1 \rightarrow [h_1 \rightarrow h5]$

$[O_1 \rightarrow O5]$

$A_2 \rightarrow [O5 \rightarrow O6]$

$$A_1 = \frac{B}{3}[(O_1+O5)+4(O2+O4)+2(O3)]$$

$$= \frac{30}{3}[(7.544+3.544)+4(10.544+5.544)+2(11.544)]$$

$$A_1 = 10 * 98.52$$

$$\boxed{A_1 = 985.28\ m^2}$$

A_2 → by Traphizoid formula (5)

$$A_2 = (05 + 06) * \frac{B}{2}$$

$$= (3.544 + 4.544) * \frac{30}{2}$$

$$= 121.32 \text{ m}^2$$

$$A = A_1 + A_2$$

$$A = 985.28 + 121.32$$

$$\boxed{A = 1106.6 \text{ m}^2}$$

Q2 A circular curve of Radius (6) (7544-200) = 7344m deflecting right through 20°4′ is to be set out between two straight having of the point of intersection as (7544-400) = 7144m.

Calculate all the data nessasry for setting out the curve using deflection angle method with peg interval 20m.

⊙ **Given Data:-**

Circular radius

7544-7274 = 270m

(Assume value is 7274)

Deflection angle = 20′41′

Point of intersection

7544-4997 = 2547m

interval = 20m

Solution:-

$R = 270 * 2 = 540m$

$BT_1 = BT_2 = R \tan(\frac{\phi}{2})$

$= 540 \tan(\frac{20°40'}{2})$

$= 98.45m$

Length of Curve,

$$l = \frac{\pi R \phi}{180}$$

$$l = \frac{\pi * 540 * 20°40'}{180}$$

$l = 194.77\ m$

Point of intersection = 2547m

minus tangent = −98.45m

Chainage of T_1 = 2448.55mm

plus l = 194.77m

Chainage of T_2 = 2643.32m

$C_1 = 2465 - 2448.55$

$C_1 = 16.5m$

$C_2 = C_3 = C_4 = C_5 = C_6 = C_7 = C_8 = C_9 = 20m$

$C_{10} = 2643.32 - 2625$

$C_{10} = 18.32m$

By deflection method

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

$$\delta_1 = \frac{1718.9 * 16.45}{60(540)} = 0°58'18.92''$$

$$\delta_2 = \frac{1718.9 \times 26}{60(540)} = 1^\circ 3' 39.78''$$

$$\delta_{10} = \frac{1718.9 * 18.32}{60(540)} = 0^\circ 58' 18.92''$$

* Total deflection (tangential) angle for the Chord is;

$\Delta_1 = \delta_1 = 0^\circ 52' 21.7''$

$\Delta_2 = \Delta_1 + \delta_2 = 1^\circ 56' 1.55''$

$\Delta_3 = \Delta_2 + \delta_3 = 2^\circ 59' 41.3''$

$\Delta_4 = \Delta_3 + \delta_4 = 4^\circ 3' 21.11''$

$\Delta_5 = \Delta_4 + \delta_5 = 5^\circ 7' 0.89''$

$\Delta_6 = \Delta_5 + \delta_6 = 6^\circ 10' 40.67''$

$\Delta_7 = \Delta_6 + \delta_7 = 7^\circ 14' 20.45''$

$\Delta_8 = \Delta_7 + \delta_8 = 8^\circ 18' 0.23''$

$\Delta_9 = \Delta_8 + \delta_9 = 9^\circ 21' 40.01''$

$\Delta_{10} = \Delta_9 + \delta_{10} = 10^\circ 19' 58.9''$

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

Q3 Two tangent AB and BC are intersected by a line KM. The angle AKM and ∠KMC are 130° and 140° respectively. The radius of 1st Arc (7544-300) 7244m and 2nd arc (7544-200) = 7344m find Chainage of tangent point and point of Compound Curve given that the chainage of intersection point is (7544-400) = 7144 m

⊙ **Given:-**

$\Delta AKM = 130°$

$\Delta KMC = 140°$

1st arc radius = (7544-300)
= 7244m

2nd arc radius = (7544-200)
= 7344m

Chainage of intersection point = (7544-400)
= 7144m

Solution:-

$\alpha = 180° - 130° = 50°$

$\beta = 180° - 140° = 40°$

$\phi = \alpha + \beta = 90°$

$I = 180° - \phi = 90°$

$KT_1 = KN = R_L \tan(\alpha/2)$

$= 7244 \tan(50/2)$

$= 3377.93\ m$

$KT_2 = MT_2 = R_S \tan(\beta/2)$

$= 7344 \tan(40/2)$

$= 2672.99m$

$KM = MT_2 + KT_1 = 3377.93 + 2672.9$

$= 6050.92\,m$

Now,

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

$$= \frac{6050.92 \sin 40^\circ}{\sin 90} = 3889.45m$$

$$BM = \frac{6050.92 * \sin 50^\circ}{\sin 90} = 4635.27m$$

$T_L = KT_1 + BK = 3377.93 + 3889.45 = 7267.38m$

$T_S = MT_2 + BM = 2672.99 + 4635.27 = 7308.26m$

$$L_L = \frac{\pi R_L \alpha}{180} = \frac{\pi * 7244 * 50}{180} = 6321.58m$$

$$L_S = \frac{\pi R_S \beta}{180} = \frac{\pi * 7344 * 40}{180} = 5127.07m$$

Chainage of intersection pt = 7144m

minus tangent = $-7267.38\,m$

Chainage of $T_1 = -123.38m$

Plus $L = +6321.58m$

Chainage of Compound Curvature plus L_S = 5127.07m

Chainage of T_2 = 11335.27 m