

Paper :- Advanced Engineering Survey.

Name :- Mottamya Ikram Date: Pg ①

To D 72 78

Q1) Two Tangents ----- External distance
----- area

Sol: -

$$\theta = 5 \quad \text{change} = 7 + 27.8$$
$$R = 5729.58 / \theta = 1145.91 \text{ ft}$$

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

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

$$BT_1 = BT_2 = 142.96 \text{ ft}$$

$$\text{length of curve} = L = \frac{\pi R \theta}{180^\circ}$$

$$L = \frac{3.14 \times 1145.91 \times 14^\circ 13' 23''}{180^\circ}$$

$$L = 284.31 \text{ ft}$$

Chainage Intersection point B = ~~7+27.8~~ 7+27.8

Minus tangents length BT = - (1 + 42.96)

$$\text{Chainage of } T_1 = 5 + 88.4$$

$$\text{Plus } L = 2 + 84.3$$

$$\text{Chainage } T_2 = 8 + 72.7$$

Sol ②: -

$$\text{length of chord} = L = 2R \sin \left(\frac{\theta}{2} \right)$$

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

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$$L = 283.78 \text{ ft}$$

Sol ③

Mid ordinate & External distance
Mid ordinate - $Ef = R \left(1 - \cos \frac{\theta}{2} \right)$

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

$$Ef = 1145.91 (1 - 0.99)$$

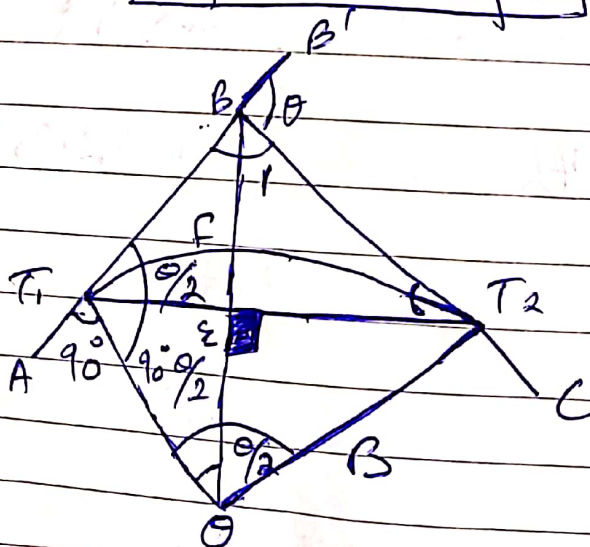
$$Ef = 1145.91 (0.007)$$

$$Ef = 8.021 \text{ ft}$$

External Distance $Bf = R \left(\sec \left(\frac{\theta}{2} \right) - 1 \right)$

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

$$Bf = 8.88 \text{ ft}$$



Q1 (B) find area from the -----
----- and so on.

| | | | | | | |
|------------|-------|----------------|----------------|----------------|----------------|----------------|
| Chainage m | 0 | 30 | 60 | 90 | 120 | 150 |
| off set m | 7.278 | 7.278+3 | 7.278+4 | 7.278-2 | 7.278-4 | 7.278-3 |
| | 7.278 | 10.278 | 11.278 | 5.278 | 3.278 | 4.278 |
| | a | a ₁ | a ₂ | a ₃ | a ₄ | a ₅ |

Given DATA :-

$b = 30$ $ID = 7.278$

Sol :-

$$Area = \frac{b}{3} (a_0 + a_4 + 2a_2 + 4a_1 + 4a_3 + \left(\frac{a_4 + a_5}{2}\right) \times b$$

$$Area = \frac{30}{3} (7.278 + 3.278 + 2(11.278) + 4(10.278) + 4(5.278) + \left(\frac{3.278 + 4.278}{2}\right) \times 30$$

$$Area = \frac{30}{3} (10.556 + 22.556 + 41.112 + 21.112) + \left(\frac{7.556}{2}\right) \times 30$$

$$Area = \frac{30}{3} (95.336) + (3.778) \times 30$$

$$Area = 10 (95.336) + 113.34$$

$$Area = 953.36 + 113.34$$

$$Area = 1066.7$$

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Q 2: A circular curve of radius -----
----- 20m.

GIVEN DATA: -

$$\text{Radius} = \text{ID} - 200$$

$$= 7078$$

$$\theta = 20^\circ 40' \quad \text{and} \quad \text{and}$$

$$\therefore \text{Chainage of B} = \text{ID} - 400$$

$$= 7278 - 400$$

$$= 6878$$

$$\text{Peg Interval} = 20\text{m}$$

~~Solve~~

Req: -

Deflection Angle = ?

Sol: -

$$\text{Tangent length} = BT_1 = BT_2 = R \tan \frac{\theta}{2}$$

$$= \text{and} \quad 7078 \tan \frac{20^\circ 40'}{2}$$

$$= 1290.54\text{m}$$

$$\text{length of curve} = L = \pi R \times \frac{\theta}{180^\circ}$$

$$= 3.14 \times 7078 \times \frac{20^\circ 40'}{180^\circ}$$

$$= 2551.75\text{m}$$

$$\text{Chainage of } T_1 = \text{chainage of B} - BT_1$$

$$= 6878 - 1290.54 = 5587.46\text{m}$$

$$\text{chainage of } T_2 = \text{chainage of } T_1 + L$$

$$= 5587.46 + 2551.75 = 8139.21\text{m}$$

chainage of T₁

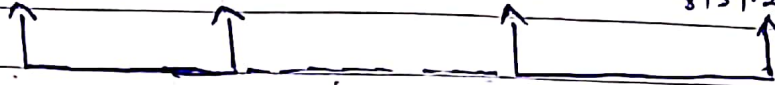
5587.46

5600

8127

chainage of T₂

8139.21



chord length

$$G_1 = \frac{1718.91 \times C_1}{60 \times R} = \frac{1718.91 \times 12.54}{60 \times 7078} = 0^\circ 3' 2.72''$$

$$G_2 - G_{12} = \frac{1718.91 \times C_2}{60 \times R} = \frac{1718.91 \times 20}{60 \times 7078} = 0^\circ 4' 51.42''$$

$$G_3 = \frac{1718.91 \times C_3}{60 \times R} = \frac{1718 \times 12.21}{60 \times 7078} = 0^\circ 2' 57.91''$$

Deflection Angle: —

$$\Delta_1 = G_1 = 0^\circ 3' 2.72''$$

$$\Delta_2 = \Delta_1 + G_2 = 0^\circ 7' 54.14''$$

$$\Delta_3 = \Delta_2 + G_3 = 0^\circ 12' 45.56''$$

$$\Delta_4 = \Delta_3 + G_4 = 0^\circ 17' 36.98''$$

$$\Delta_5 = \Delta_4 + G_5 = 0^\circ 22' 28.4''$$

$$\Delta_6 = \Delta_5 + G_6 = 0^\circ 27' 19.82''$$

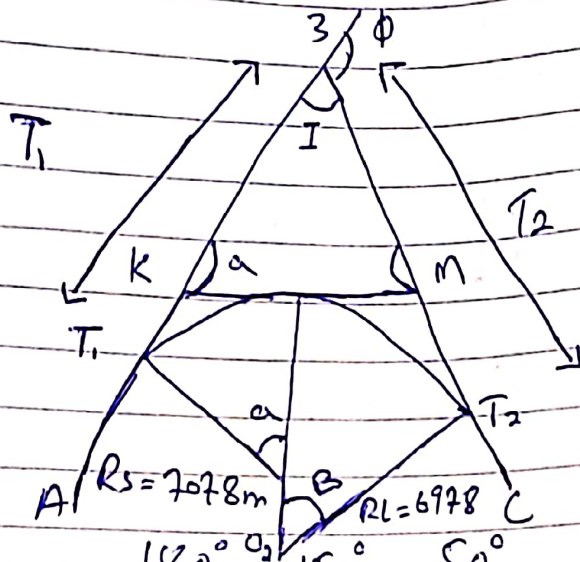
$$\Delta_7 = \Delta_6 + G_7 = 0^\circ 32' 11.24''$$

$$\Delta_8 = \Delta_7 + G_8 = 0^\circ 37' 2.66''$$

$$\Delta_9 = \Delta_8 + G_9 = 0^\circ 41' 54.08''$$

$$\Delta_{10} = \Delta_9 + G_{10} = 0^\circ 46' 45.5''$$

Q3 - Two tangents AB & BC (ID - 400m)



Sol: $R_s = 7078m$ $R_l = 6978m$

$$a = 180^\circ - 150^\circ = 50^\circ$$

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

$$\phi = a + B = 90^\circ$$

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

$$kT_1 = kN = R_l \tan\left(\frac{B}{2}\right) = 6978 \tan\left(\frac{40}{2}\right)$$

$$kT_1 = kN = 2539.78m$$

$$mN = mT_2 = R_s \tan\left(\frac{a}{2}\right) = 7078 \tan\left(\frac{50}{2}\right)$$

$$mN = mT_2 = 3300.52m$$

$$km = mT_2 + mN = 2539.78 + 3300.52$$

$$= 5840.3m$$

find ΔBkm , by sin rule

$$\frac{BK}{\sin B} = \frac{m}{\sin(I)}$$

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$$BK = \frac{mk \sin \beta}{\sin(I)} = \frac{5840.3 \times \sin 40^\circ}{\sin(90^\circ)}$$
$$= 3754.07 \text{ m}$$

$$BM = \frac{Mk \sin \alpha}{\sin(I)} = \frac{5840.3 \times \sin 50^\circ}{\sin(90^\circ)}$$
$$= 4473.92 \text{ m}$$

$$T_L = kI_1 + BK = 2539.78 + 3754.07 = 6293.85 \text{ m}$$

$$T_S = mI_2 + BM = 3300.52 + 4473.92 = 7774.44 \text{ m}$$

$$L_L = \frac{\pi R \beta}{180^\circ} = \frac{3.14 \times 6978 \times 40^\circ}{180^\circ} = 4869.09 \text{ m}$$

$$L_S = \frac{\pi R \alpha}{180^\circ} = \frac{3.14 \times 7078 \times 50^\circ}{180^\circ} = 6173.58 \text{ m}$$

$$\Rightarrow \text{change of Intersection Point minus} = I_2 = 7278 - 400 = 6878 \text{ m}$$

$$\Rightarrow \text{change of } T_2 = 6878 - 6293.85 = 584.15 \text{ m}$$

$$\Rightarrow \text{Plus } L_L = 584.15 + 4869.09 = 5453.24 \text{ m}$$

$$\Rightarrow \text{change of compound curvature } \text{N Plus } L_S = 5453.24 + 6173.58 = 11626.82 \text{ m}$$

$$\Rightarrow \text{change of } T_1 = \cancel{11626} 11626.82 \text{ m}$$