PAPER

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- Subject ADVANCE ENGINEERING SURVEY
- Section A

4th semester

Paper Advance Engineering Survey

Q(1)

Q(a) Two tangents meet at a chainage of (1.D) ft with the deflection angle of 14°13'23". Degree of curve is 5°

1.) Chainage at the beginning end of the curve.
2) Length of long chord.
3) Mid ordinate and external distance.

Given Data:

Two tangent meet 7891 (1D)
deflection angle 14°13'23"
D = 5°

Solution:

1) Chainage of beginning and end of the curve.

$R = 5729.58/D$ ft

putting D

$R = 5729.58/5$ ft

$R = 1,145.916$ ft

$BT_1 = BT_2 = R \tan(\theta/2)$

$BT = 1.145.916 \tan\left(\frac{14°13'23"}{2}\right)$

$BT = 139.097$ ft.

length of curve $= L = \frac{\pi/2\theta}{180°}$

$L = \frac{\pi (1145.916) 14°13'23"}{180}$

$L = \frac{5117.060}{180}$

$L = 284.317$ ft

chainage of intersection point

$B = 7891$ ft

minus tangent length $BT_1 = -139.087$ ft

chainage of $T_1 = 7751.903$

Plus $L = +284.317$

Chainage of $T_1 = 8036.22$.

b) length of chord

$T_1E = R\sin(\Delta/2)$

$I = 2T_1E = 2R\sin(\Delta/2)$

putting values.

$I = 2(1145.916)\sin(14°13'23''/2)$

$I = 283.731$ ft.

c) External Distance.

$BF = R\left(\frac{1}{\cos(\Delta/2)} - 1\right)$

$BF = 1145.916\left(\frac{1}{\cos(14°13'23'')} - 2\right)$

$BF = 1145.916(0.316)$

$BF = 362.109$ ft

d) Mid ordinates.

$EF = R(1-\cos(\Delta/2))$

$= 1145.916(1-\cos(14°13'23''))$

EF **$= 8.815$ ft.**

Q(I)

P(b) Find the area from the data obtained from Chain Survey, as shown in the table below using Simpson the Third rule. The first offset is ID ÷ 1000.

My ID = 7891

offset(m)	0	30	60	90	120	150
chainage	7.891	10.891	11.891	5.891	3.891	4.891

Solutions: using elevation of simpsons one 3rd rule

$$\text{Area} = \frac{b}{3}\left(h_1 + h_n + 2(a_1 + a_3 \cdots) + 4(a_2 + a_4 \cdots)\right)$$

So putting the elevation values in formula.

$$\text{Area} = \frac{30}{3}\left(7.891 + 4.891 + 2(11.891 + 3.891) + 4(10.891 + 5.891)\right)$$

$$= 10(12.782 + 2(15.782) + 4(16.782))$$

$$= 10(111.474)$$

$$= 1114.74\,m^2$$

$$= 0.111474\,ha$$

Q(2) A circular curve of radius (T.D – 200m deflecting right through 20°40' is to be set between two straights having chainage of the point of intersection as (I.P – 400m) Calculate all the data necessary for setting out the curve using deflecting angles method with peg intervals being 20m.

Given Data

$R = I.P = 7891 - 7291$

$R = 600$

Deflection angle = 20°40'

point of intersection = 7891 – 5600

= 2,291m

Interval = 20m

Solution!

$BT_1 = BT_2 = R \tan(\theta/2)$

$= 600 \tan \frac{20°40'}{2}$

$= 109.399$

length of curve.

$\frac{1}{2}L = \left(\frac{\pi R \theta}{180}\right) = \left(\frac{\pi 600\, 20°48'}{180}\right)$

$\boxed{L = 216.42}$

chainage of point intersection = 2,291 page (5)

Minus tangent = − 109·399

chainage T_1 = 2181·601

Plus L = + 216·42

Chainage T_2 = 2398·21

length of 1st chord = C_1 = 2200 − 2181

= 18·399.

$C_2 = C_3 = C_4 = C_5 \cdots C_9 = 20m$

C_{10} = 2398.021 − 2380 = 18·021

1) By deflection angle

$$\delta_1 = \frac{1718·9\, C_1}{R}\,(mm) = \frac{1718·9\, C_1}{60R}\ degree$$

$$\delta_1 = \frac{1718·9\,(18·399)}{60\times600} = \frac{31626·041}{3600} = 0°52'2·60''$$

$$\delta_2 = \frac{1718·9\,(20)}{60\times600} = 0°57'17·80''$$

$\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9$

$$\delta_{10} = \frac{1718·9\,(18·021)}{60\times600} = 0°51'37·63''$$

Note n/o of chords = $\frac{\text{length of curve} - C_1}{\text{interval}}$

$$= \frac{216·42 - 18·399}{20}$$

$$= 9·90105$$

$$I = 9$$

13) Deflection angle.

total deflection (tangential) angle for the chordes are.

$\Delta_1 = \delta_1 = 0°52'42.60''$

$\Delta_2 = \delta_1 + \delta_2 = \Delta_1 + \delta_2 = 1°50'0.40''$

$\Delta_3 = 2°47'18.20''$

$\Delta_4 = 3°44'36.00''$

$\Delta_5 = 4°41'53.80''$

$\Delta_6 = 5°39'11.60''$

$\Delta_7 = 6°36'29.40''$

$\Delta_8 = 7°33'47.20''$

$\Delta_9 = 8°31'5.00''$

$\Delta_{10} = 9°22'42.63''$

Check, $\frac{20°40'}{2} = 10°20'$

(~~Given Data~~)

Q3) Two tangent AB & BC are intersected by a line ICM. The angles AKM and KMC are 130° & 140° respectively. The radius of 1st arc is (ID - 300) m and 2nd arc is (ID - 200) m. Find the chainage of tangent points and the points of compound curve given that the chainage of intersection point is (ID - 400) m.

Given Data

$\angle AKM = 130°$

$\angle KMC = 140°$

1st arc radius = (7891 - 300)
= 7591

2nd arc radius = (7891 - 200)
= 7691

chainage of intersection (7891 - 400)
= 7491.

Solutions

$\alpha = 180° - 130° = 50°$

$\beta = 180° - 140° = 40°$

$\phi = \alpha + \beta = 90°$

$IT_1 = ICM = R_1 \tan(\phi/2)$
$= 7591 \tan(50/2)$
$= 3539.741433$

$KT_2 = MT_2 = R_2 \tan(\Delta_2/2)$
$= 7691 \tan(40/2)$
$= 2749.295$

$KM = MT_1 + MT_2$
6339.0365

Now,

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

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

$BK = \frac{6339.0365 \times \sin 40°}{\sin 90°}$

$= \frac{4074.65411\,m}{1}$

$BM = \frac{6339.0365 \times \sin 50}{\sin 90°}$

$= 4855.98368\,m.$

$T_2 = KT_1 + BK = 3589.741 + 4074.6544$
$= 7614.3954m$

$T_1 = MT_2 + BM = 2749.295 + 4855.9836$
$= 7655.2786m.$

$L_1 = \frac{\pi (D_1) \alpha}{180} = \frac{\pi\, 7691(50)}{180}$
$= 6674.3972m.$

$L_2 = \frac{\pi R_2 \Delta}{180} = \frac{\pi\, 7691(40)}{180} = 5369.330910m$

Chainage of intersection from page(9)

Chainage of intersection point
= 7491

$-T_1$ = -7617.395

Chainage of T_1 = -123.395

Plus L_1 = +6624.3972m.
= 6501.0022

Chainage of compound curvature-

Plus L_S = +5369.3305m

Chainage of T_2 = 11870.3331.