PAPER:

ADVANCED ENGINEERING SURVEY

NAME:

MALIK AIMAL KHAN

ID:

7968

SECTION:

B

SIGN:

No of Pages:

18

SUBMITTED TO:

SIR: ENGR: ABDUL FARHAN.

## Q NO 1 PART (A):

To Tangents meet at a chainage of (I.D) ft with the deflection angle of 14°13'.23" . Degree of curve is 5° .

1. Chainage at the begining and end of the curve.
2. Length of long cord.
3. MID Ordinate and External distance.

### Ans of QNO 1:

### SOLUTION:

ID = 7968

### GIVEN:

Degree of curve = 5°

Deflection of angle = 14° 13' 23"

### TO FIND:

Length of long cord = ?

Mid ordinate and external distance = ?

chainage at the begining and end of the curve = ?

## SOLUTION:

Degree of curve = 5°

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

$$R = 1145.916 \text{ ft}$$

$$R = 1145.916 \text{ ft}$$

Now finding tangent length.

$$BT_1 = BT_2$$

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

$$BT_1 = BT_2 = 1145.916 \times \tan\left(\frac{14^\circ 13' 23''}{2}\right)$$

$$BT_1 = BT_2 = 142.965 \text{ ft}$$

## CURVE LENGTH:

$$L = \frac{\pi R \Delta}{180^\circ}$$

$$L = \frac{(3.14)(1145.916)(14^\circ 13' 23'')}{180^\circ}$$

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

## CHAINAGE AT INTERSECTION POINT:

$T_1 = 7968 - 142.965$ ft

$T_1 = 7825.035$ ft

$T_2 = 7825.035 + 284.31$

$T_2 = 8109.345$ ft.

## LENGTH OF CORD:

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

$$l = 2(1145.916) \sin\left(\frac{14^\circ 13' 23''}{2}\right)$$

$$l = 283.73 \text{ ft}$$

## MID ORDINATES:

$$EF = R\left(1 - \cos\left[\frac{\Delta}{2}\right]\right)$$

$$EF = (1145.916)\left[1 - \cos\left[\frac{14^\circ 13' 23''}{2}\right]\right]$$

$$EF = 8.81547 \text{ ft}$$

# EXTERNAL DISTANCE:

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

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

$$BF = 8.83 \text{ ft}$$

# Q No 1 (PART B)

Find the area from the data obtaind from the chain survey as shown in the table below using "simpson one third rule, The first offset is your ID÷1000.

## SOLUTION:

ID = 7968

| Chainage (m) | 0 | 30 | 60 | 90 | 120 | 150 |
|---|---|---|---|---|---|---|
| OFFSET (m) | $\frac{7968}{1000}$ = 7.968 | 7.968+3 = 10.968 | 7.968+4 = 11.968 | 7.968-2 = 5.968 | 7.968-4 = 3.968 | 7.968-3 = 4.968 |

$$b = 30 \text{ m}$$

Now finding area.

$$\text{Area} = \frac{b}{3}\left(7.968 + 3.968 + 2(11.968) + 4(10.968) + 4(5.968)\right) + \frac{(3.968 + 4.968)}{2} \times (30)$$

$$Area = \frac{30}{3}(103.616 + 134.04)$$

$$Area = 10\,(237.656)$$

$$Area = 2376.56\ m^2$$

## METHOD II :

$$Area\ (h_1 - h_5) = \frac{30}{3}(112.552)$$

$$= 1125.52\ m^2$$

$$Area\ (h_5 - h_6) = \frac{30}{2}(3.968 + 4.968)$$

$$Area = 134.04.$$

$$Area = 1125.52 + 134.04$$

$$Area = 1259.56\ m^2$$

## Q No 2:

A circular curve of radius (ID-200)m deflecting right through 20°40'0" is to be set out b/w two straights having chainage of the point of intersection as (ID-400)m.

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

ID = 7968

## SOLUTION:

Assuming radius as:

7968 − 7060

R = 908 m

Deflection angle = 20° 40' 0"

Now for point of intersection.

we assume.

7968 − 4060

Chainage at intersection Point = 3908m

## PEG INTERVAL = 20m

## TANGENT LENGTH:

$$BT_1 = BT_2$$

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

$$BT_1 = BT_2 = 908 \tan\left(\frac{20^\circ 40' 0''}{2}\right)$$

$$BT_1 = BT_2 = 165.557\,m$$

## LENGTH OF CURVE:

$$L = \frac{\pi R \Phi}{180^\circ}$$

$$L = \frac{(3.14) \times 908 \times 20^\circ 40' 0''}{180^\circ}$$

$$L = 327.350\,m$$

Now chain age $T_1$:

$T_1 = 3908 - 165.557$

$T_1 = 3742.443$

chain age at $T_2$:

$T_2 = 3742.443 + 327.350$

$T_2 = 4069.793$

Now finding length of 1st sub chord:

Chord 1 = 3770 - 3742.443

$C_1 = 27.557$

Last sub chord:

$C_{15} = 4069.793 - 4040$

$C_{15} = 29.793$

As we know that:

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

$= C_{10} = C_{11} = C_{12} = C_{13} = C_4 = 20m$

## Finding No of chords:

As we know:

$$\text{no of chords} = \frac{\text{Length of curve} - C_1}{\text{Interval}}$$

$$\text{no of chords} = \frac{327.350 - 27.557}{20}$$

no of chords = 14.9896 = 15 chords.

## DEFLECTION ANGLE:

$$\int = \frac{1718.9\, C_1}{60\, R}$$

$$\int = \frac{(1718.9)(27.557)}{60(908)}$$

$$\int_1 = 0.88945$$

$$\int_1 = 0^\circ 52' 10.03''$$

$$\delta_2 = \frac{1718.9 \times \text{Interval}}{60 \times R}$$

$$\delta_2 = \frac{1718.9 \times 20}{60 \times 908}$$

$$\delta_2 = 0.63102$$

$$\delta_2 = 0^\circ 37' 51.67''$$

$$\delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = \delta_{12} = \delta_{13} = \delta_{14}$$
$$= 0^\circ 37' 51.67''$$

$$\delta_{15} = \frac{1718.9 \times C_{15}}{60 R}$$

$$\delta_{15} = \frac{1718.9 \times 27.793}{60 (908)}$$

$$\delta_{15} = 0.8768$$

$$\delta_{15} = 0^\circ 52' 36.83''$$

Now Total deflection angles for chords are :

$\Delta_1 = \delta_1 = 0^\circ\ 52'\ 10.03''$

$\Delta_2 = \delta_1 + \delta_2 = 1^\circ\ 30'\ 1.7''$

$\Delta_3 = \Delta_2 + \delta_3 = 2^\circ\ 7'\ 53.37''$

$\Delta_4 = \Delta_3 + \delta_4 = 2^\circ\ 45'\ 45.04''$

$\Delta_5 = \Delta_4 + \delta_5 = 3^\circ\ 23'\ 36.71''$

$\Delta_6 = \Delta_5 + \delta_6 = 4^\circ\ 1'\ 28.38''$

$\Delta_7 = \Delta_6 + \delta_7 = 4^\circ\ 39'\ 20.05''$

$\Delta_8 = \Delta_7 + \delta_8 = 5^\circ\ 17'\ 11.72''$

$\Delta_9 = \Delta_8 + \delta_9 = 5^\circ\ 55'\ 3.39''$

$\Delta_{10} = \Delta_9 + \delta_{10} = 6^\circ\ 32'\ 55.06''$

$\Delta_{11} = \Delta_{10} + \delta_{11} = 7^\circ\ 10'\ 46.73''$

$\Delta_{12} = \Delta_{11} + \delta_{12} = 7^\circ\ 48'\ 38.4''$

$\Delta_{13} = \Delta_{12} + \delta_{13} = 8^\circ 26' 30.07''$

$\Delta_{14} = \Delta_{13} + \delta_{14} = 9^\circ 4' 21.74''$

$\Delta_{15} = \Delta_{15} + \delta_{15} = 9^\circ 56' 58.57''$

**CHECK:**

$$\text{Check} = \frac{\emptyset}{2}$$

$$\text{check} = \frac{20^\circ 40' 0''}{2}$$

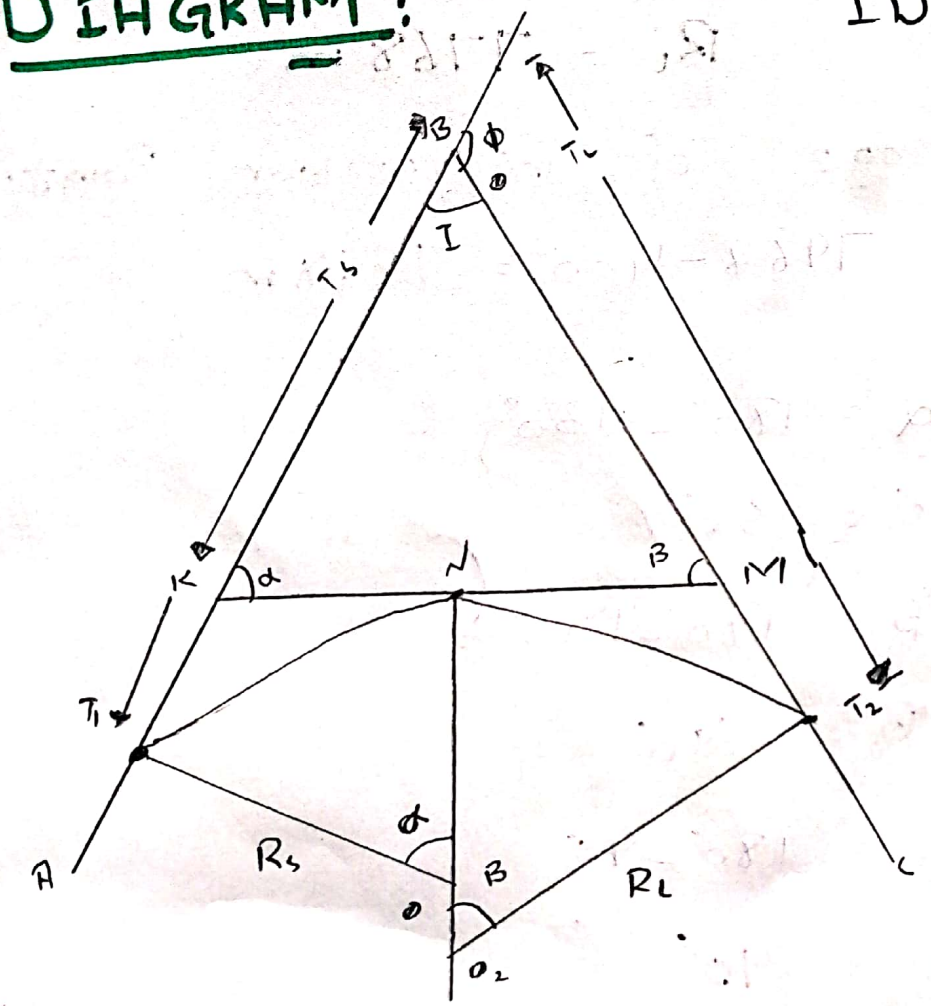
$$\text{check} = 10^\circ 20' 0''$$

## Q No 3:

To Tangents AB and BC are intersected by a line KM. The angle AKM and KMC are 130° and 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 Point of compound curve given that the chainage of intersection Point is (ID-400) m.

ID = 7968

## DIAGRAM:



## GIVEN:

$\angle AKM = 130^\circ$

$\angle KML = 140^\circ$

## TO FIND:

chainage of tangent points = ?

## SOLUTION:

$R_s = 7968 - 300$

$R_s = 7668\ m$

$R_L = 7968 - 200$

$R_L = 7768\ m$

chainage of intersection Point.

$7968 - 400 = 7568\ m$

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

$\alpha = 50^\circ$

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

$\beta = 40^\circ$

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

$I = 90^\circ$

$KT_1 = KN$

$KT_1 = KN = R_s \tan\left[\frac{\alpha}{2}\right]$

$KT_1 = KN = 7668 \tan\left(\frac{50}{2}\right]$

$KT_1 = KN = 3575.65\ m$

$MN = MT_2$

$MN = MT_2 = R_L \tan\left(\frac{\beta}{2}\right)$

$MN = MT_2 = 7768 \tan\left(\frac{40}{2}\right)$

$MN = MT_2 = 2827.32\ m$

$KM = KN + MN$

$KM = 3575.65 + 2827.32$

$KM = 6402.97 = 6403.$

FROM $\Delta BKM$

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

$$BK = \frac{(6403)(\sin 40^\circ)}{(\sin(90^\circ))}$$

$BK = 4115.77\ m.$

we have:

$$BM = \frac{KM \sin\alpha}{\sin I}$$

$$BM = \frac{(6403)(\sin 50^\circ)}{(\sin 90^\circ)}$$

$$BM = 4905\ m$$

$$T_L = 4115.77 + 3575.65$$

$$T_L = 7961.42\ m$$

$$T_S = 4905 + 2827.32\ m$$

$$T_S = 7732.32\ m$$

FOR $L_S$

$$L_S = \frac{\pi \times R_S \times \alpha}{180^\circ}$$

$$L_S = \frac{3.14 \times 7868 \times 50}{180^\circ}$$

$$L_S = 6688.2\ m$$

Now For $L_L$

$$L_L = \frac{\Pi \times R_L \times \beta}{180^\circ}$$

$$L_L = \frac{(3.14)(7768)(40)}{180^\circ}$$

$$L_L = 5420.33 \text{ m}$$

Now chainage : ($T_1$)

$$T_1 = 7568 - 7732.32$$

$$T_1 = -164.32$$

Plus $L_s$

$$= -164.32 + 6688.2$$

$$T_1 = 6523.88$$

Now chainage $T_2$ :

$$T_2 = 6523.88 + 5420.33\text{m}$$

$$T_2 = 11944.21$$