Ferris State University

Surveying Engineering

Surveying Computation - SURE 215

PROBLEM NUMBER 230

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Circular Curve Layout Problem

Write your answers in the spaces provided

Given Data:

Radius (R) = 648.583

External Distance (E) = 39.867

PT Station = 13+98.30

Compute The Following Elements Of The Circular Curve:

Central Angle (Delta) = _____

Length Of Curve (L) = _____

Long Chord (LC) = _____

Degree Of Curve (D), Arc Definition = _____

Tangent Distance (T) = _____

Middle Ordinate (M) = _____

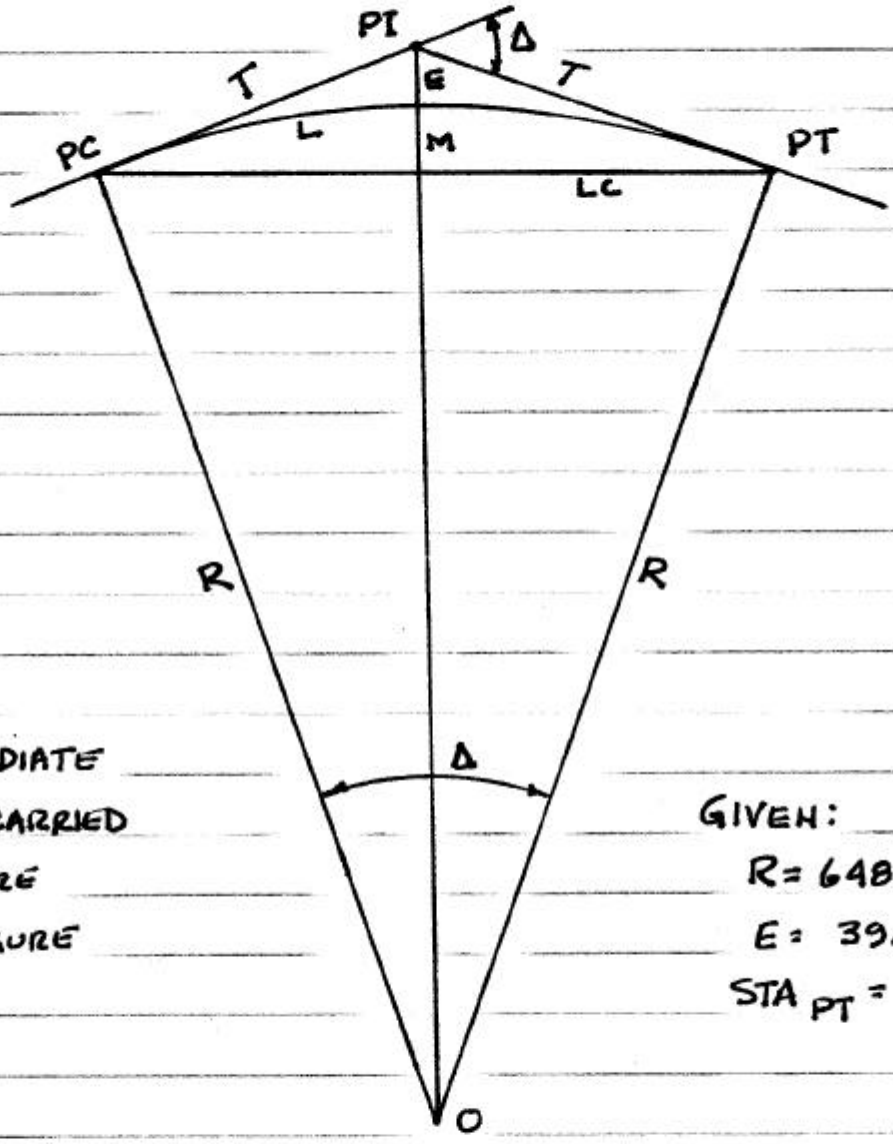
Compute The Field Layout Information For Evry Even 50-foot Station By:

a. Deflection Angle From The PC

b. Tangent Offset Method (The First Half From The PC & The Second Half From The PT)

c. Offsets From The Long Chord

Prepare A Table For Each Of The Above And Label Each One Appropriately



NOTE: INTERMEDIATE CALCULATIONS CARRIED OUT TO ONE MORE SIGNIFICANT FIGURE

GIVEN:
$R = 648.583'$
$E = 39.867'$
$STA_{PT} = 13+98.30$

1) COMPUTE THE MISSING ELEMENTS OF THE CURVE

$$D = \left(\frac{360^\circ}{2\pi R}\right) 100' = \frac{(360^\circ)(100')}{2\pi (648.583')} = \underline{8^\circ 50' 02.4''}$$

(ARC DEFINITION)

$$E = \left(\frac{R}{\cos \Delta/2}\right) - R \Rightarrow \cos \Delta/2 = \frac{R}{E+R}$$

$$\Delta = 2\cos^{-1}\left(\frac{R}{E+R}\right) = 2\cos^{-1}\left(\frac{648.583'}{39.867' + 648.583'}\right)$$

$$= \underline{39^\circ 11' 17.9''}$$

$$L = \frac{\Delta}{D} = \frac{39^\circ 11' 17.9''}{8^\circ 50' 02.4''} = 4+43.6077 \text{ STA}$$

$$= \underline{443.6077'}$$

$$LC = 2R\sin(\Delta/2) = 2(648.583')\sin\left(\frac{39^\circ 11' 17.9''}{2}\right)$$

$$= \underline{435.0117'}$$

$$T = R\tan(\Delta/2) = 648.583' \tan\left(\frac{39^\circ 11' 17.9''}{2}\right)$$

$$= \underline{230.8754'}$$

$$M = R(1 - \cos \Delta/2) = 648.583'\left[1 - \cos\left(\frac{39^\circ 11' 17.9''}{2}\right)\right]$$

$$= \underline{37.558'}$$

$$STA_{PC} = STA_{PT} - L$$

$$= (13+98.30) - (4+43.608)$$

$$= \underline{9+54.69}$$

2) FIELD LAYOUT FOR 50' STATION BY DEFLECTION Δ FROM PC

$\Delta_a = (10+00) - (9+54.69) = 45.3077'$

$d_a = \frac{\Delta_a D}{100'} = \frac{(45.3077')(8°50'02.4')}{100'} = 4°00'08.9"$

$\delta_a = \frac{d_a}{2} = \frac{4°00'08.9"}{2} = 2°00'04.4'$

$C_a = 2R \sin \delta_a = 2(648.583') \sin(2°00'05") = 45.299'$

$\delta_{50' STA} = \frac{D}{4} = \frac{8°50'02"}{4} = 2°12'30.6'$

$C_{50' STA} = 2R \sin \delta_{50' STA} = 2(648.583') \sin(2°12'30.6") = 49.988'$

$\Delta_b = (13+98.30) - (13+50) = 48.30'$

$\delta_b = \frac{\Delta_b D}{200'} = \frac{(48.30')(8°50'02")}{200'} = 2°08'00.3"$

$C_b = 2R \sin \delta_b = 2(648.583') \sin(2°08'00") = 48.289'$

$\Delta_{a,b}$ ⇒ NOMINAL SUBCHORDS ~~SUBCURVE~~ AT ENDS OF CURVE, BEING THE ARC LENGTHS

δ ⇒ DEFLECTION ANGLE

C ⇒ CHORD DISTANCES

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STATION	INCREMENTAL CHORD	DEFLECTION INCREMENT	DEFLECTION ANGLE
9+54.69 (PC)			
10+00	45.300'	2°00'04"	2°00'04"
+50	49.988'	2°12'30.6"	4°12'35"
11+00	49.988'	2°12'30.6"	6°25'06"
+50	49.988'	2°12'30.6"	8°37'36"
12+00	49.988'	2°12'30.6"	10°50'07"
+50	49.988'	2°12'30.6"	13°02'37"
13+00	49.988'	2°12'30.6"	15°15'08"
+50	49.988'	2°12'30.6"	17°27'39"
13+98.30 (PT)	48.289'	2°08'00.3"	19°35'39" ✓

3) TANGENT OFFSET METHOD

STATION	DEFLECTION ANGLE (δ)	CHORD (c) FROM PC/PT	TAN. DIST. = c cos δ	TANGENT OFFSET = c sin δ
9+54.69 (PC)				
10+00	2°00'04"	45.2956'	45.268'	1.582'
10+50	4°12'35"	95.2216'	94.965'	6.990'
11+00	6°25'06"	145.0062'	144.097'	16.210'
11+50	8°37'36"	194.5691'	192.368'	29.184'
13+98.30 (PT)				
13+50	2°08'00"	48.2871'	48.254'	1.798'
13+00	4°20'31"	98.2068'	97.925'	7.435'
12+50	6°33'02"	147.9805'	147.014'	16.882'
12+00	8°45'32"	197.5282'	195.225'	30.079'

4) OFFSETS FROM THE LONG CHORD

STA	CHORD (C)	DEFLECTION ∠ (δ)	$\theta = \frac{\Delta}{2} - \delta$	CHORD DIST	CHORD OFFSET
9+54.69 (PC)					
10+00	45.2956'	2°00'04"	17°35'35"	43.177'	13.691'
+50	95.2216'	4°12'35"	15°23'04"	91.810'	25.262'
11+00	145.0062'	6°25'06"	13°10'33"	141.189'	33.053'
+50	194.5691'	8°37'36"	10°58'03"	191.015'	37.017'
12+00	243.8492'	10°50'07"	8°45'32"	241.005'	37.132'
+50	292.7608'	13°02'37"	6°33'02"	290.850'	33.398'
13+00	341.2437'	15°15'08"	4°20'31"	340.244'	25.835'
+50	389.2196'	17°27'39"	2°08'00"	388.950'	14.485'
13+98.30 (PT)	435.012'	19°35'39"	0°00'00"	435.012'	0.000' ✓

CHORD DIST = $R \cos\theta$

CHORD OFFSET = $R \sin\theta$