

## 1. STAKING PROBLEM

$$\begin{aligned} \text{GIVEN: } PC & \text{ AT } 43+46.04 \\ \Delta & = 8^\circ 15' \\ D & = 3^\circ 00' \end{aligned}$$

REQ'D STAKE 25' CHORDS TO P.T.

SOLUTION:

SOLVE FOR L R

$$\begin{aligned} L & = \Delta / D (100) \\ & = 8^\circ 15' / 3 (100) \\ & = 275' \end{aligned}$$

$$\begin{aligned} R & = 5729.58 / 3.0 \\ & = 1909.86' \end{aligned}$$

$$PT = 43+46.04 + 275' = 46+21.04$$

SUB ANGLE

$$d_a = 3.96' / 100 * 3^\circ = 0.1188^\circ$$

$$d = 25' / 100 * 3^\circ = 0.75^\circ$$

$$d_b = 21.04' / 100 * 3^\circ = 0.6312^\circ$$

DEFLECTION ANGLE

$$d_a = 0.1188 / 2 = 0.0594^\circ$$

$$d = 0.75 / 2 = 0.375^\circ$$

$$d_b = 0.6312 / 2 = 0.3156^\circ$$

CHORDS =  $2R \sin d/2$

$$C_a = 2(1909.86) \sin 0.0594 = 3.96'$$

$$C = 2(1909.86) \sin 0.375 = 25.00'$$

$$C_b = 2(1909.86) \sin 0.3156 = 21.04'$$

2) GIVEN:

$$T = 2461 \frac{35}{1}$$

DEFL  $\Delta$  BETWEEN 17+00 AND 20+00 =  $2^{\circ}15'$

REQ'D:

CENTRAL ANGLE

SOLUTION

$$T = R \tan \frac{\Delta}{2}$$

a. SOLVE FOR R

SINCE DEFL  $\Delta$  FOR 300' =  $2^{\circ}15'$

$$\text{ARC DEFINITION} = \frac{2^{\circ}15'}{3} \times 2 = 1^{\circ}30'$$

$$\begin{aligned} R &= 5729 \frac{58}{10} \\ &= 5729 \frac{58}{1.5} \\ &= 3819 \frac{72}{1} \end{aligned}$$

b. SOLVE FOR  $\Delta$ 

$$T = R \tan \frac{\Delta}{2}$$

$$2461 \frac{35}{1} = 3819 \frac{72}{1} \tan \frac{\Delta}{2}$$

$$\Delta = 2 \tan^{-1} \frac{2461 \frac{35}{1}}{3819 \frac{72}{1}}$$

$$= 2 \tan^{-1} 0.644$$

$$= 65.5938$$

$$= \underline{65^{\circ} 35' 38''}$$

## 3. CHORD LENGTH

GIVEN: 5 DEGREE HIGHWAY CURVE

REQ'D: CHORD LENGTH BETWEEN  $37+18^{45}$  AND  $22+05^{27}$ 

SOLUTION:

$$\text{CHORD LENGTH} = C = 2R \sin \Delta/2$$

a. SOLVE FOR R

$$= 5729^{58} / 5$$

$$= 1145^{92}$$

b. SOLVE FOR L

$$= 37+18^{45} - 22+05^{27}$$

$$= 1513^{18}$$

c. SOLVE FOR  $\Delta$ 

$$= \Delta/D (100)$$

$$\Delta = (L * D) / 100$$

$$= (1513^{18} * 5) / 100$$

$$= 75.659^{\circ}$$

$$= 75^{\circ} 39' 32''$$

d. SOLVE FOR C

$$= 2R \sin \Delta/2$$

$$= (2) 1145^{92} \sin 75.659/2$$

$$= \underline{1405^{62}}$$



## 4 DEFLECTION ANGLE

$$\begin{aligned} \text{GIVEN: CURVE RADIUS} &= 1250^{00} \text{'} \\ \Delta &= 30^{\circ} 50' 45'' \\ \text{PC} &= 45+18 \underline{38} \end{aligned}$$

REQ'D

DEFLECTION ANGLE TO STATION 48+00<sup>00</sup>

SOLUTION

$$\text{DEFLECTION ANGLE} = 1/2 \text{ SUBTENDED ANGLE}$$

$$L = 48+00^{00} - 45+18 \underline{38} = 281 \underline{62}$$

$$\begin{aligned} D &= 5729 \underline{58} / 1250^{00} = 4.5837 \\ &= 4^{\circ} 35' 01'' \end{aligned}$$

$$\begin{aligned} \text{SUBTENDED ANGLE} &= 2.81 \underline{62} (4.5837) \\ &= 12^{\circ} 54' 31'' \end{aligned}$$

$$\text{DEFLECTION} = 1/2 (12.9085)$$

$$= 6.454 = \underline{6^{\circ} 27' 16''}$$

5.

$$PI = 39+74.7$$

$$\Delta = \begin{matrix} 31.25 + 34.67 & = & 65.92^\circ & = & 32.9583 \\ 31^\circ 15' & 34^\circ 40' & = & 65^\circ 55' & 32^\circ 57' 30'' \end{matrix}$$

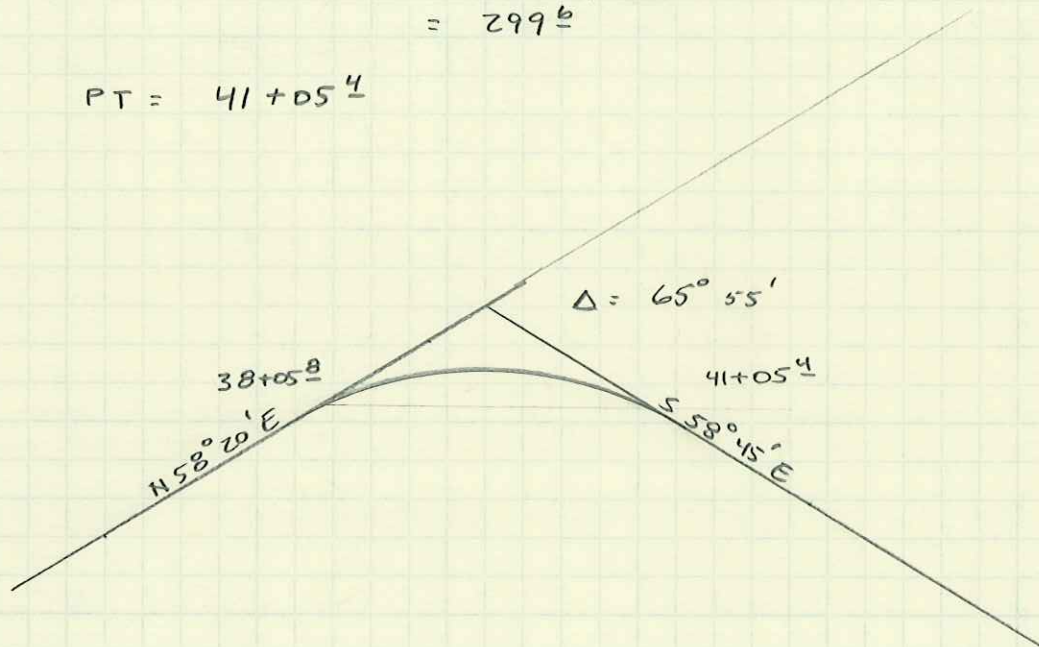
$$D = 22^\circ \quad R = 5729.58 / 22 = 260.44'$$

$$T = R \tan \Delta/2 = 260.44 \tan 32.9583 \\ = 168.86'$$

$$PC = 38+05.8$$

$$L = \Delta/D * 100 = 65.92/22 * 100 = \\ = 299.6$$

$$PT = 41+05.4$$

STAKING

$$d_a = L(D)/100 = 44.2(22^\circ)/100 = 9.724^\circ$$

$$1/2 d_a = 9.724^\circ / 2 = 4.862^\circ$$

$$C_a = 2R \sin d_a/2 = 2(260.44) \sin 4.862^\circ = 44.15'$$

$$d_b = 5.4(22^\circ)/100 = 1.188^\circ$$

$$1/2 d_b = 1.188^\circ / 2 = 0.594^\circ$$

$$C_b = 2R \sin d_b/2 = 5.40'$$

#5 CONTINUED

$$d = 50(22^\circ)/100 = 11^\circ$$

$$1/2 d = 5.5^\circ$$

$$C = 2(260^{44}) \sin 5.5^\circ = 49^{92}$$

Station	sub L	L	Sub angle	defl angle	Inc. Chords	Total Deflection	Total Chord	Azimuth
3805.8	44.2	44.2	9.724	4.862	44.15	4.862	44.15	55.33
3850	50	94.2	11	5.5	49.92	10.362	93.69	60.192
3900	50	144.2	11	5.5	49.92	15.862	142.37	65.692
3950	50	194.2	11	5.5	49.92	21.362	189.74	71.192
4000	50	244.2	11	5.5	49.92	26.862	235.36	76.692
4050	50	294.2	11	5.5	49.92	32.362	278.81	82.192
4100	5.4	299.6	1.188	0.594	5.40	32.956	283.36	87.692
4105.4								88.286
D =	22							
R =	260.44							

## 6. TOTAL CHORD METHOD

FOLLOWS THE SAME LOGIC AS PROBLEM 5 EXCEPT  
L AND d ARE INCREASING

EXAMPLE @ 39+50

$$L = 144^{\text{Z}}$$

$$d = 1.442 * 22^\circ = 31.724^\circ$$

$$1/2 d = 15.862^\circ$$

$$C_{39+50} = 2(R) \sin d/2 = 2(260^{44}) \sin 15.862 = 142^{37}$$



PROBLEM 6 CONTINUED

Station	sub L	L	Sub angle	defl angle	Inc. Chords	Total Deflection	Total Chord	Azimuth
3805.8	44.2	44.2	9.724	4.862	44.15	4.862	44.15	55.33
3850	50	94.2	11	5.5	49.92	10.362	93.69	60.192
3900	50	144.2	11	5.5	49.92	15.862	142.37	65.692
3950	50	194.2	11	5.5	49.92	21.362	189.74	71.192
4000	50	244.2	11	5.5	49.92	26.862	235.36	76.692
4050	50	294.2	11	5.5	49.92	32.362	278.81	82.192
4100	5.4	299.6	1.188	0.594	5.40	32.956	283.36	87.692
4105.4								88.286
D =	22							
R =	260.44							

7. WAGON WHEEL

Station	sub L	L	Sub angle	defl angle	Inc. Chords	Total Deflection	Total Chord	Azimuth
3805.8	44.2	44.2	9.724	4.862	44.15	4.862	44.15	55.33
3850	50	94.2	11	5.5	49.92	10.362	93.69	60.192
3900	50	144.2	11	5.5	49.92	15.862	142.37	65.692
3950	50	194.2	11	5.5	49.92	21.362	189.74	71.192
4000	50	244.2	11	5.5	49.92	26.862	235.36	76.692
4050	50	294.2	11	5.5	49.92	32.362	278.81	82.192
4100	5.4	299.6	1.188	0.594	5.40	32.956	283.36	87.692
4105.4								88.286
D =	22							
R =	260.44							

8. MIDPOINT IS  $L/2 = 149.8'$

$$= \text{STATION PC} + L/2 = 39+55.6$$

STAKE 38+50, 39+00, 39+50 FROM THE PC

STAKE 40+00, 40+50, 41+00 FROM THE PT

FROM PC

<u>STA</u>	<u>d</u>	<u>C</u>	<u>TO</u>	<u>TD</u>
3850	4.862	44.15	1.87'	44.11'
39+00	10.362	93.69	8.46'	93.31'
39+50	15.862	142.37	19.64'	141.01'

$$TO = C \sin \frac{1}{2} d$$

$$TD = C \cos \frac{1}{2} d$$

FROM PT

<u>STA</u>	<u>d</u>	<u>C</u>	<u>TO</u>	<u>TD</u>
41+00	0.594	5.40	0.03'	5.40'
40+50	6.094	55.30	2.94'	55.22'
40+00	11.594	104.68	10.57'	104.14'