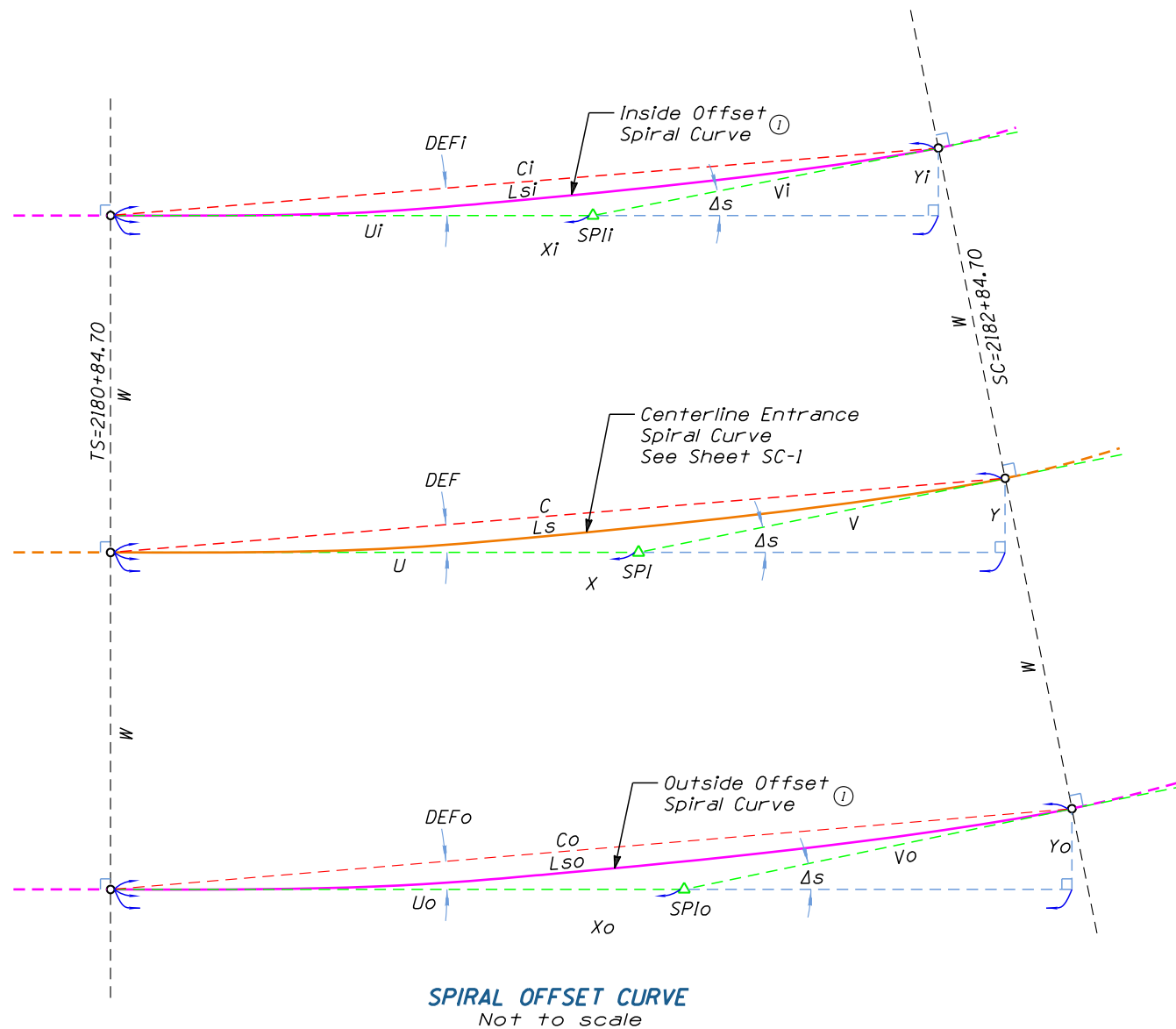


SPIRAL OFFSET CURVE



DEFINITIONS

- W = Offset distance
- X_i / X_o = Distance along X axis
- Y_i / Y_o = Distance along Y axis
- C_i / C_o = Offset Spiral Chord
- V_i / V_o = Distance to SC(Sta)
- U_i / U_o = Distance to Offset Spiral PI
- DEF_i / DEF_o = Offset Spiral Deflection angle
- L_{si} / L_{so} = Offset Spiral Length
- SPI_i / SPI_o = Offset Spiral PI

See SC-1 for additional definitions

① Offset Spiral Curve characteristics vary slightly from the centerline spiral. The formula's on this sheet are dependent upon the centerline spiral as described on sheet SC-1.

FORMULAS

INSIDE OFFSET SPIRAL

$$\begin{aligned}
 X_i &= X - (\sin(\Delta s) * W) \\
 Y_i &= Y - W + (\cos(\Delta s) * W) \\
 C_i &= \sqrt{X_i^2 + Y_i^2} \\
 V_i &= Y_i / \sin(\Delta s) \\
 U_i &= X_i - (Y_i / \tan(\Delta s)) \\
 L_{si} &= C_i * L_s / C \\
 DEF_i &= \arctan(Y_i / X_i) \\
 R_i &= R - W \\
 D_i &= 5729.57795 / R_i \\
 a_i &= D_i * 100 / L_{si}
 \end{aligned}$$

OUTSIDE OFFSET SPIRAL

$$\begin{aligned}
 X_o &= X + (\sin(\Delta s) * W) \\
 Y_o &= Y + W - (\cos(\Delta s) * W) \\
 C_o &= \sqrt{X_o^2 + Y_o^2} \\
 V_o &= Y_o / \sin(\Delta s) \\
 U_o &= X_o - (Y_o / \tan(\Delta s)) \\
 L_{so} &= C_o * L_s / C \\
 DEF_o &= \arctan(Y_o / X_o) \\
 R_o &= R + W \\
 D_o &= 5729.57795 / R_o \\
 a_o &= D_o * 100 / L_{so}
 \end{aligned}$$

Alternate formula's for Spiral Lengths as published in "Route Location and Design" by Thomas Felix Hickerson (1967)
 $L_{si} = L_s - (0.017453 * W * \Delta s)$ and $L_{so} = L_s + (0.017453 * W * \Delta s)$

EXAMPLE

Given: $\Delta s = 2^\circ 00' 00''$; $L_s = 200$; $C = 199.98912'$; $R = 2864.78898$ (From SC-1)
 $X = 199.97558$; $Y = 2.32693$; $W = 100'$

INSIDE OFFSET SPIRAL

$$\begin{aligned}
 X_i &= 199.97558 - (\sin(2.0000^\circ) * 100) = 196.48563 \\
 Y_i &= 2.32693 - 100 + (\cos(2.0000^\circ) * 100) = 2.26601 \\
 C_i &= \sqrt{196.48563^2 + 2.26601^2} = 196.49870 \\
 V_i &= 2.26601 / \sin(2.0000^\circ) = 64.92959 \\
 U_i &= 196.48563 - (2.26601 / \tan(2.0000^\circ)) = 131.59559 \\
 L_{si} &= 196.49870 * 200 / 199.98912 = 196.50939 \\
 DEF_i &= \arctan(2.26601 / 196.48563) = 0.66075^\circ \text{ or } 00^\circ 39' 39'' \\
 R_i &= 2864.78898 - 100 = 2764.78898 \\
 D_i &= 5729.57795 / 2764.78898 = 2.07234^\circ \text{ or } 2^\circ 04' 20'' \\
 a_i &= 2.07234 * 100 / 196.50939 = 1.05458
 \end{aligned}$$

OUTSIDE OFFSET SPIRAL

$$\begin{aligned}
 X_o &= 199.97558 + (\sin(2.0000^\circ) * 100) = 203.46553 \\
 Y_o &= 2.32693 + 100 - (\cos(2.0000^\circ) * 100) = 2.38785 \\
 C_o &= \sqrt{203.46553^2 + 2.38785^2} = 203.47954 \\
 V_o &= 2.38785 / \sin(2.0000^\circ) = 68.42076 \\
 U_o &= 203.46553 - (2.38785 / \tan(2.0000^\circ)) = 135.08645 \\
 L_{so} &= 203.47954 * 200 / 199.98912 = 203.49061 \\
 DEF_o &= \arctan(2.38785 / 203.46553) = 0.67239^\circ \text{ or } 00^\circ 40' 21'' \\
 R_o &= 2864.78898 + 100 = 2964.78898 \\
 D_o &= 5729.57795 / 2964.78898 = 1.93254^\circ \text{ or } 1^\circ 55' 57'' \\
 a_o &= 1.93254 * 100 / 203.49061 = 0.94969
 \end{aligned}$$

| SPIRAL OFFSET CURVE TABLE | | | | | | | | | | | | |
|---------------------------|-----|---------|----------|----------|---------|----------|-----------|---------|---------|-------|---------|--------|
| | W | a | D | R | Length | Delta | DEF | Chord | X | Y | U | V |
| INSIDE | 100 | 1.05463 | 2°04'20" | 2764.789 | 196.509 | 2°00'00" | 00°39'39" | 196.499 | 196.486 | 2.266 | 131.596 | 64.930 |
| | 50 | 1.02678 | 2°02'08" | 2914.789 | 198.255 | 2°00'00" | 00°39'49" | 198.244 | 198.231 | 2.296 | 132.468 | 65.802 |
| CENTERLINE | 0 | 1.00000 | 2°00'00" | 2864.789 | 200.00 | 2°00'00" | 00°40'00" | 199.989 | 199.976 | 2.326 | 133.341 | 66.675 |
| OUTSIDE | 50 | 0.97440 | 1°57'57" | 2914.789 | 201.745 | 2°00'00" | 00°40'10" | 201.734 | 201.721 | 2.357 | 134.214 | 67.548 |
| | 100 | 0.94975 | 1°55'57" | 2964.789 | 203.491 | 2°00'00" | 00°40'21" | 203.480 | 203.466 | 2.388 | 135.087 | 68.421 |