Example:

A horizontal curve on a single-lane highway has its PC at station 124 + 10 and its PI at station 131 + 40. The curve has a superelevation of 0.06 ft/ft and is designed for 70 mph. What is the station of the PT?

\[ e = 0.06 \quad v = 70 \text{ mph} \]

PC @ Sta 124 + 10
PI @ Sta 131 + 40

\[ \frac{e}{100} + \frac{s}{5} = \frac{v^2}{15R_v} \]

\[ R = R_v \quad \text{for single lane} \quad f_s = 0.10 \quad \text{(Table 3.5)} \]

\[ \frac{e}{100} + 0.10 = \frac{(70)^2}{15(R_v)} \]

\[ 2.25R_v = 4900 \]

\[ R_v = R = 2041.7 \text{ ft} \]

We need \( L \). (Requires \( \Delta \))

So, \( T = R \tan \frac{\Delta}{2} \)

\( T = \text{distance between PC and PI} \)

\[ T = 13140 - 12410 = 730' \]

\[ 730 = 2041.7 + \tan \frac{\Delta}{2} \]

\[ \Delta = 39.3^\circ \]

Now, solve for \( L \):

\[ L = \frac{\pi}{180} R \Delta = \frac{\pi}{180} (2041.7)(39.3) = 1402 \text{ ft} \]

\[ \text{Sta PT} = 12410 + 1402 = 13812 \text{ ft} \]

(Sta PC)
Example:

A freeway exit ramp has a single lane and consists entirely of a horizontal curve with a central angle of 90 degrees and a length of 628 ft. If the distance cleared from the centerline for sight distance is 19.4 ft, what design speed was used?

\[ L = 628' \]
\[ M = 19.4 \text{ ft} \]
\[ V = ? \] (Determine \( S \) to find \( V \)).

\[ M = RV \left[1 - \cos \left(\frac{28.65s}{R_V}\right)\right] \]

we need \( R_V \). Since single lane ramp, \( R_V = R \).

\[ L = \frac{\pi}{180} RA \]
\[ 628 = \frac{\pi}{180} R (90) \]

\[ R = 400 \text{ ft} \]

\[ 19.4 = 400 \left[1 - \cos \left(\frac{28.65s}{400}\right)\right] \]

\[ .9515 = \cos \left(\frac{28.65s}{400}\right) \]

\[ 17.92 = \frac{28.65s}{400} \]

\[ S = 250 \text{ ft} \]

\[ \text{From Table 3.1, } S = 250 \text{ ft } \Rightarrow V = 35 \text{ mph} \]
Example:

A section of highway has vertical and horizontal curves with the same design speed. A vertical curve on this highway connects a +1% and a +3% grade and is 420 ft long. If a horizontal curve on this highway is on a two-lane section with 12-ft lanes, has a central angle of 37 degrees, and has a super-elevation of 6%, what is the length of the horizontal curve?

\[ A = | G_2 - G_1 | = | 3 - 1 | = 2 \]
\[ K_{sag} = \frac{L_s}{A} = \frac{420}{2} = 210 \]

From Table 3.3, for \( K = 210 \)

design speed = 75 mph.

\[ \frac{e}{100} + f_s = \frac{V^2}{15R_v} \]
\[ \frac{6}{100} + 0.09 = \frac{(75)^2}{15R_v} \]

\[ R_v = 2500 \text{ ft} \]

Using Table 3.5, \( R_v = 2510 \)

\[ R = \frac{L}{2} = R_v \]

\[ R = 2500 + 6 = 2506 \text{ ft} \]

\[ L = \frac{\pi R A}{180} = \frac{\pi}{180} (2506)(37) = 1618 \text{ ft} \]

(OK 1624 using table)