Problem

- A+3.9% grade intersect a -1.9% grade at station 20+50.00 and elevation of 1005+00 ft.
- Determine the minimum length of crest vertical curve for a design speed of 50 mph.
- Calculate the location of PVC and the elevation of middle point of the curve.
- Assumption
- Height of eye, H_1 = 3.5 ft and height of object, H_2 = 2.0 ft and SSD = 425 ft.

Slide #16 Problem

$G_1 = +3.9\%$

$G_2 = -1.9\%$

$A = |G_1 - G_2|$

Station = 20 + 50.00

Elevation = 1005 + 00 ft

1 mile = 1.609 km

Min length of curve vertical curve = ?

V = 50 mph = 80.47 km/h = 22.35 m/s = 73.34 ft/s

$a = 11.2\ ft/s^2$ or $3.4\ m/s^2$

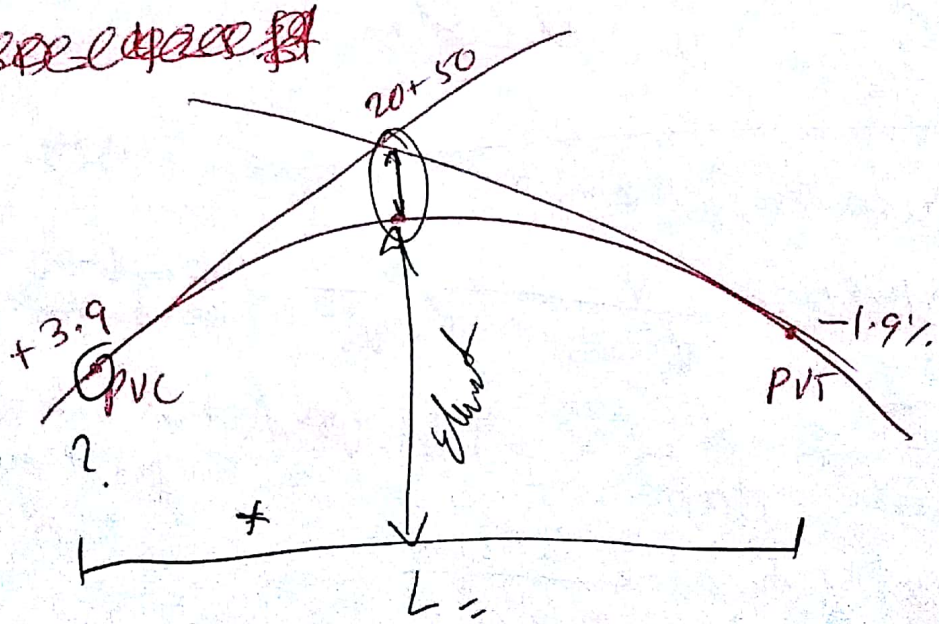
Location of PVC = ?

Elevation of middle part of curve = ?

$H_1 = 3.5$ ft

$H_2 = 2$ ft

Design



$$SSD = \frac{V^2}{2a} + Vt_2$$

$$= \frac{73.34^2}{2 \times 11.2} + 73.34 \times 2.5$$

$$SSD = 423.5 \text{ ft}$$

$$SSD \approx 425 \text{ ft}$$

$G_1 - G_2$

$A = 3.9 - (-1.9)$

$= 5.8$

Check: i) $S < L$ or $S > L$

i) $S < L$

$$L = \frac{AS^2}{100\left(\sqrt{2H_1} + \sqrt{2H_2}\right)^2} = \frac{5.8 \times 425^2}{100\left(\sqrt{2(3.5)} + \sqrt{2 \times 2}\right)^2}$$

$$= 485.4 \text{ ft}$$

As $S < L$ this Length will be provided.

Middle point of curve:

$$X = \frac{L}{2} = \frac{485.4}{2} = 242.7 \text{ ft}$$

Location of PVC $= 2050.00 - \frac{L}{2} = 2050 - 242.7 = 1807.3$

$= 18 + 07.31$ (station)

Mid curve offset $= \frac{AL}{800} = \frac{5.8 \times 485.4}{800} = 3.52 \text{ ft}$

Elevation of middle $= 1005 - 3.52 = 1001.45 \text{ ft}$