

Chapter 4

Vertical curves

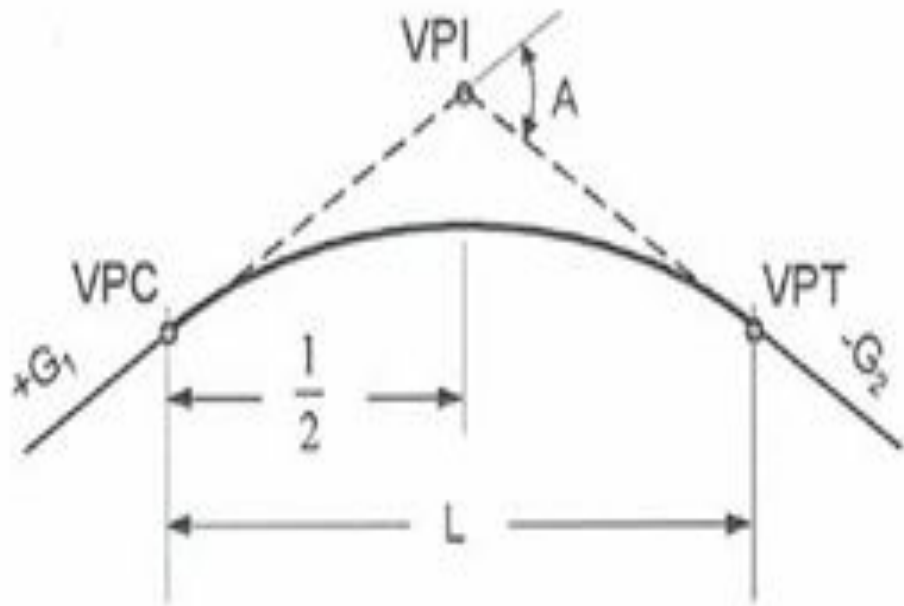


□ Shape: Parabolic not circle

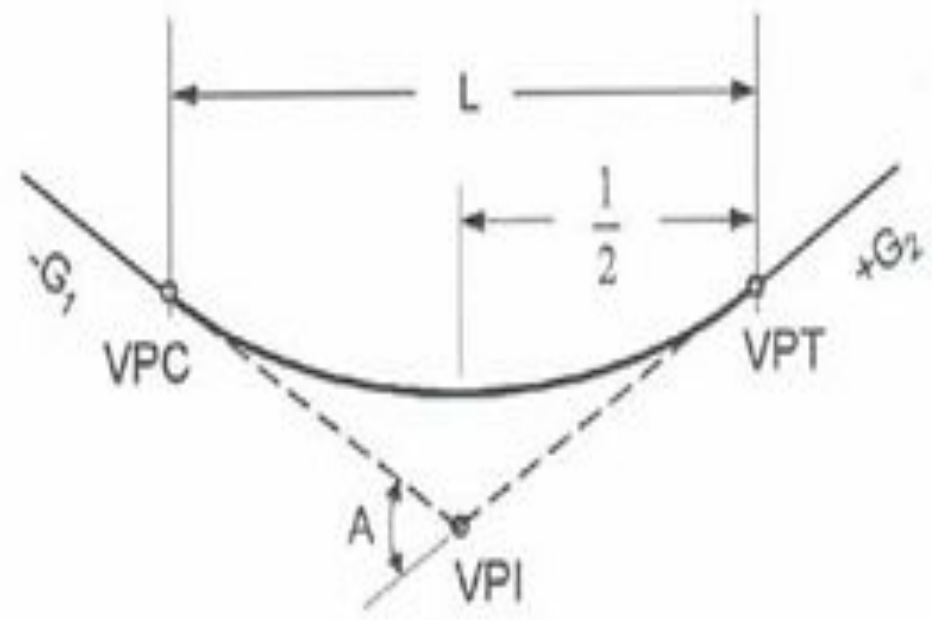
□ Types:-

1. Crest
2. Sag





Crest



Sag

G_1 and G_2 = Tangent grades in percent

A = Algebraic difference

L = Length of vertical curve

VPI = Vertical point of intersection

VPC = Vertical point of curvature

VPT = Vertical point of tangency



- Design: Curve length (L).
- Crest -(L): depends on sight distance.
- Sag- (L): depends on :
 1. head light distance
 2. Drainage
 3. Driver comfort



Crest

S.S.D: (S)

When S is less than L ,

$$L = \frac{AS^2}{658}$$

When S is greater than L ,

$$L = 2S - \frac{658}{A}$$



Crest

□ P.S.D (S):

When $S < L$,

$$L = \frac{AS^2}{864}$$

When $S > L$,

$$L = 2S - \frac{864}{A}$$



Sag

When S is less than L ,

$$L = \frac{AS^2}{200[0.6 + S(\tan 1^\circ)]} = \frac{AS^2}{120 + 3.5S}$$

When S is greater than L ,

$$L = 2S - \frac{200[0.6 + S(\tan 1^\circ)]}{A} = 2S - \left(\frac{120 + 3.5S}{A} \right)$$



Example

A vertical curve of $G1=+3\%$, $G2=+1\%$, on a two-lane two way road. Find the curve length?

Assume S.S.D=220ft, P.S.D=730ft,
H.L.D=500ft.

b) If the road is widened and divided by island,
Find the curve length?



Solution

a) As the road is two lane two way road, then P.S.D is control.

$$\begin{aligned} A &= |G_2 - G_1| \\ &= |+1 - +3| = 2 \end{aligned}$$

Assume $P.S.D < L$

$$L = 2(730^2) / 864 = 1233.6 \text{ft} \quad \text{ok.}$$



b) As road now is widened with two lanes per direction then P.S.D has no meaning and S.S.D is control.

Assume $S.S.D < L$

$$L = 2(220^2) / 658 = 147.1 \quad \text{not ok.}$$

Assume $S.S.D > L$

$$L = 2(220) - (658/2) = 111 \text{ ft} \quad \text{ok.}$$

