# Sheet No ( 2 ) Vertical Alignment

**1-** A 2.2% grade meets a -3.8% grade, what will be the total length of vertical curve to satisfy the stopping sight distance if the design speed is 80 km/hr.

Determine also the elevation on the curve every station if the elevation of the VPI point is (51.62 m) and its station is (220+67.5).

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**2-** An underpass is to be constructed underneath a major highway, the underpass has the following data:

- $g_1$=-4% and $g_2$ = 5%
- Design speed=90 kph
- Stopping sight distance should be achieved and S< l
- Level of VPT = 42.5 m.

Design the sag vertical curve, give elevation every station and location, **Find** the elevation of the lowest point of the curve

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**3-** A crest curve of 500 ft. length is used to connect between 1.7% and -1.5% grades. if the station and the elevation of the highest point are (66+22.1) and 120.65 ft. respectively, **calculate** the elevation on the curve every 100 ft.

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**4-** A parabolic vertical curve is constructed to connect between 2.00% and -3.00% grades. If the maximum offset between the curve and the tangent is 3.5 m.

**Calculate** the minimum required length of vertical curve the maximum safe speed, which can be accommodated on the curve.

**Give** the elevation every 50 ft. intervals on the curve if the level of VPT is (612.31 ft.)

**5-** *If the passing sight distance on vertical must be maintained,* ***calculate*** *the length of the vertical curve and* ***give*** *the grade elevation every station, if the g1=-4.1% & g2=-1.2%,* ***design*** *speed = 40 mph, and the level of VPI = (64.22).*

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**6-** *In determining the passing sight distance for a 2-lane highway, the following data were obtained:*

- *Average passing speed = 64 mph.*
- *Preliminary delay = 4.2 sec.*
- *Average acceleration rate =1.45 mph/sec.*
- *Left lane occupancy time = 10 sec.*
- *Clearance length = 195 ft.*

*Based on the above data,* ***design*** *the vertical required to connect two slopes of +4% and -2.5% respectively. If the elevation of VPI is (150.45).* ***Determine*** *the elevation of a point on the curve at 0.3L from the PVC.*

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**7-** *A crest vertical curve is required to connect two grades +g1% and -g2%. If The design length = 800 ft. And SSD=500 ft.* ***Determine*** *the two grades and the safe operating speed on the curve knowing that:*

*Elevation of the highest point = (42.00).*

*Elevation of VPC = (38.00).*

*Note that :[* $IF\ S \le L \rightarrow L = \frac{AS^2}{1260}$ *&* $IF\ S \ge L \rightarrow L = \frac{2S - 1260}{A}$ *]*

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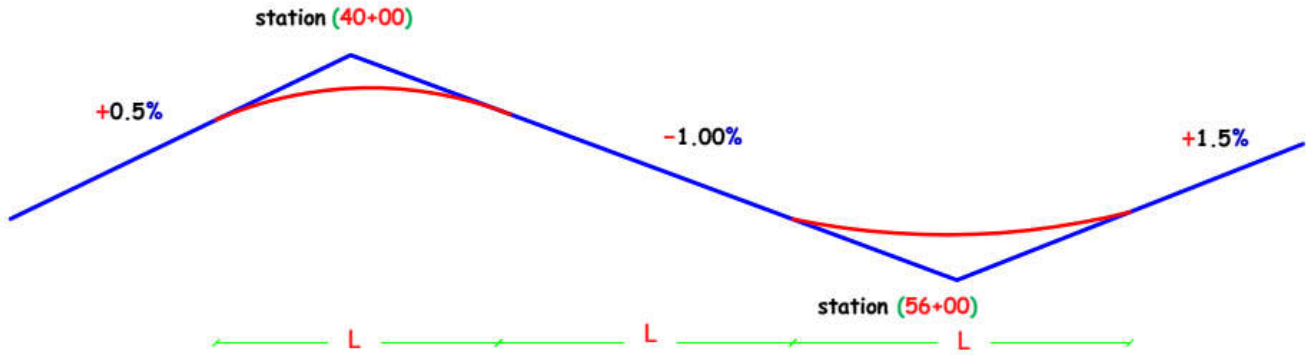
**8-***Find the safe operating speed should maintained along the following ramp, then determine the location and elevation of the highest point.*



**9-** *The following sketch is a profile of a portion of highway having a design speed 70 kph.*

***It is required to design the successive vertical curves knowing that:***

- *f =0.32*
- *Station of PVT1= 303+15*
- *Station of PVT2= 309+78*