

# CEE 4020 - Computer Applications in CEE

## Profiles

October 22, 2012

### Surface Profiles

Creating a raw surface profile requires the following information

- A fully developed surface
- An alignment
- Any design information associated with the alignment will automatically carry over and apply to the profile design. For example, if there is a design speed associated with an alignment it will also be reflected in allowable vertical curves.

Note that profile designs are not dynamically linked to the parent alignment. Hence, any change in alignment geometry does not automatically get reflected in profile geometry.

### Profiles Developed From Layout

Define a new profile for the alignment for Ramp 1, using the following station elevation information:

Station	Station Description	Design Parameter
5+00	BP	Elevation: 345', grade in = -2.50%
9+00	PVI	Elevation: 335', Curve length=250'
11+8	PVI	Elevation: 336', Curve length: 300'
14+00	PVI	Elevation: 340', Curve length: 100'
17+54	EP	Elevation: 347', grade in = 1.98%

- Create profile from layout
- Do not fill in any design information
- Go to 'Vertical Curve Settings': set curve type to be Parabolic, Crest curve length to 250' and Sag Curve length to 250'.
- Select Tan-Tan (with curves) option
- Use Transparent Command: 'Profile Station Elevation' to specify station and elevation in the given profile view

## Tabular Editing

- Right click on profile and select Edit Profile. Open grid view
- Check for curves.

## Relevant formula

Of interest is the minimum Length of Vertical Curve ( $L_{min}$ ).

- Crest vertical curve:  

$$L_{min} = 2S - \frac{2158}{A} \text{ when } S < L$$

$$L_{min} = \frac{AS^2}{2158} \text{ when } S > L$$
- Sag vertical curve:  

$$L_{min} = 2S - \frac{400+3.5S}{A} \text{ when } S < L$$

$$L_{min} = \frac{AS^2}{400+3.5S} \text{ when } S > L$$

Broadly speaking for cases when  $S < L$  the formula reduces to  $L = KA$ , where  $K = \frac{S^2}{2158}$  and  $K = \frac{S^2}{400+3.5S}$  respectively for crest and sag curves and  $A = [G_1 - G_2]$ ,  $G_1$  and  $G_2$  are the incoming and outgoing grades of tangents; and  $S$  is the sight distance. Note  $S$  is a function of design speed.