

# LAB 6 - Profiles and Vertical Alignments

Once the horizontal alignment is defined, then the profile and vertical alignment can be created. Profiles are a graphic representation of a surface along a specified path (alignment, graphic element, etc.). Profiles are also used to create and display vertical alignments.

## **Chapter Objectives:**

- Review an existing vertical alignment.
- Create a profile.
- Update the profile with a variety of features.
- Display profile annotation data.
- Use vertical alignment tracking.
- Create a new vertical alignment.

The following files are used in this lab:

- C:\Projects\12345\Design\Drawings\Reference\_Files\12345DES\_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES\_Design.alg
- C:\Projects\12345\Design\InRoads\12345 existing ground.dtm

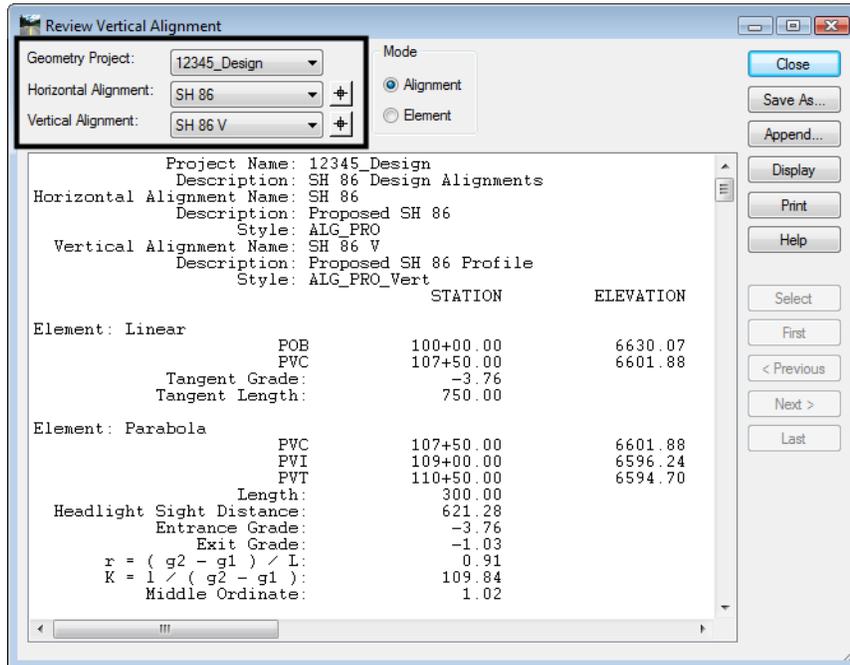
## Lab 6.1 - Reviewing Vertical Alignments

### **Section Objectives:**

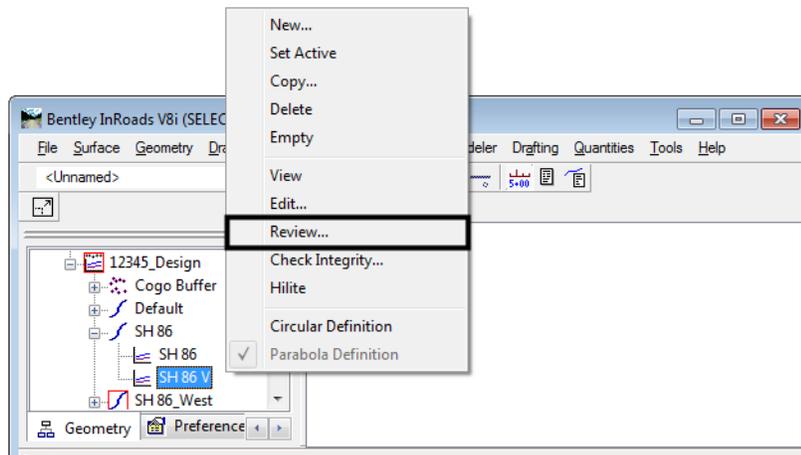
- ◆ Examine the Review Vertical Geometry window and explore the functionality of the dialog box.

Reviewing vertical alignments is similar to reviewing horizontal alignments. The **Review Vertical Alignment** dialog box allows you to easily change between multiple Geometry Projects, Horizontal, and Vertical alignments.

1. Select **Geometry > Review Vertical** from the InRoads main menu.



The review dialog box can also be opened with the right-click menu.



**Section Summary:**

- ◆ Reviewing vertical alignments works the same as reviewing horizontal alignments.

**Lab 6.2 - Creating Profiles**

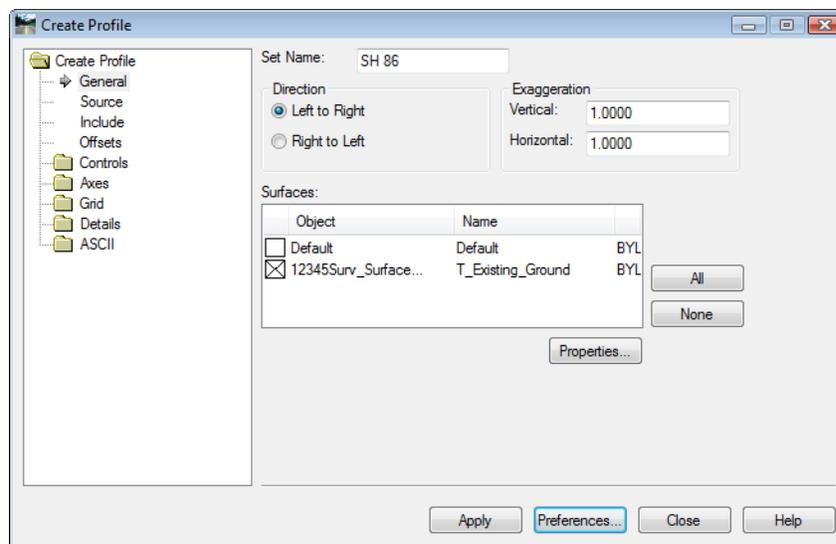
Before a vertical alignment can be displayed graphically, a profile must be created. These are referred to as profile sets in InRoads. A profile set can be created from a horizontal alignment, a MicroStation element, or a series of data points. A profile can contain DTM surfaces, vertical alignments and DTM features. Once a profile set has been created, items displayed can be turned on or off and elements can be updated based on current data.

### Section Objectives:

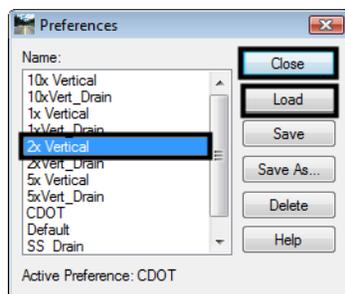
- ◆ Examine the profile dialog box.
- ◆ Select profile Preferences.
- ◆ Display vertical alignment annotation.

The DTM 12345Surv\_Surface\_Existing surface will be used to display an existing ground-line

1. In the InRoads explorer, select the **Geometry** tab, verify that **12345\_Design** is the *active* geometry project and that the horizontal alignment **SH86** is the *active* alignment.
2. Select **Evaluation > Profile > Create Profile** from the InRoads main menu. The *Create Profile* dialog will appear.



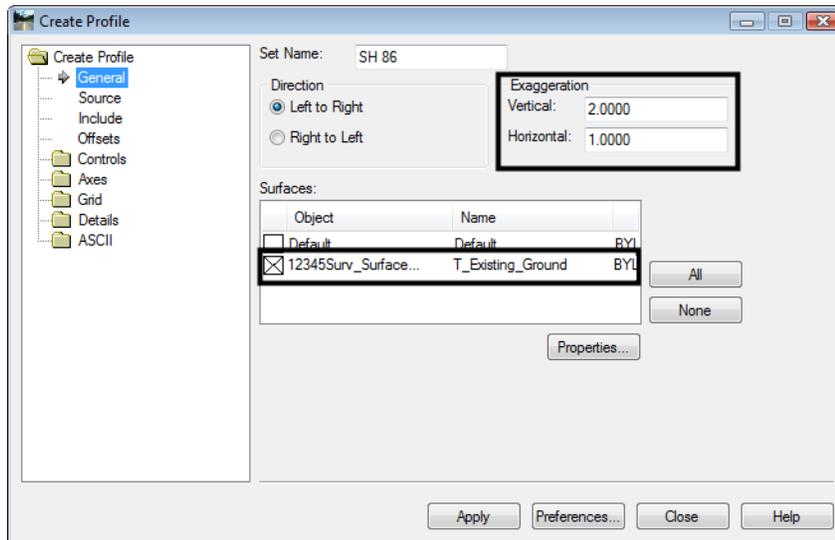
3. <D> the **Preferences** button. The *Preferences* dialog box is displayed.
4. Highlight the **2x vertical** preference.



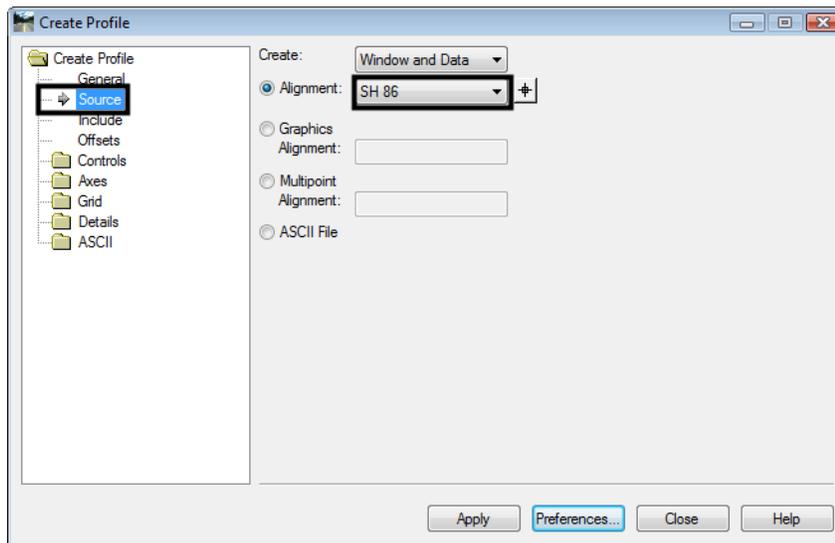
5. <D> the **Load** then **Close** buttons. Notice that the *Exaggeration* has changed to **2.00**.

**Note:** Load preferences before making any other menu settings. Loading Preferences resets all menu settings to those predefined in the preference.

- In the **Surfaces** area of the dialog box, Verify that the **12345SURV\_Surface\_Existing** surface is toggled on.

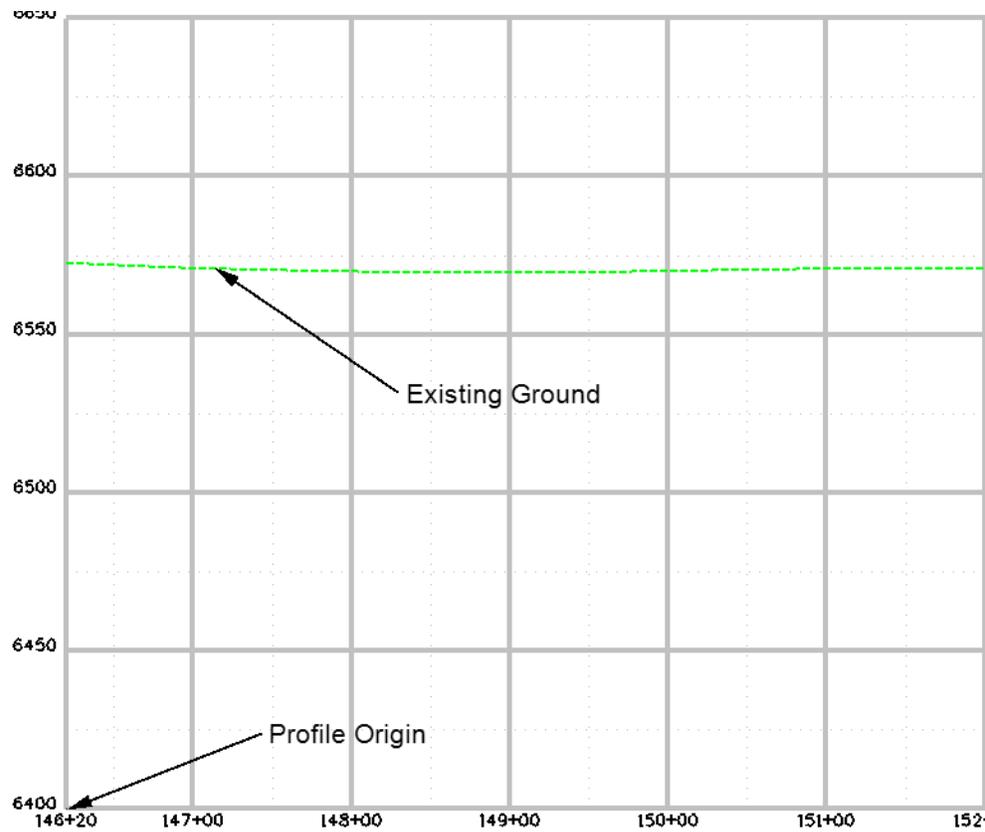


- <D> the **Source** leaf. Verify that the **SH 86** alignment is selected.



- <D> the **Apply** button. The **Create Profile** dialog box is temporarily minimized.

9. You are prompted by MicroStation to 'Identify location'. <D> in the MicroStation view. The Profile window is placed and the *Create Profiles* dialog box is restored.



**Note:** For convenience, we are displaying the profile in the current drawing. Normally, Profiles and cross sections are created in their own dgn files. Consult the directory structure and file naming convention for your specific discipline to determine standards relating to profile display.

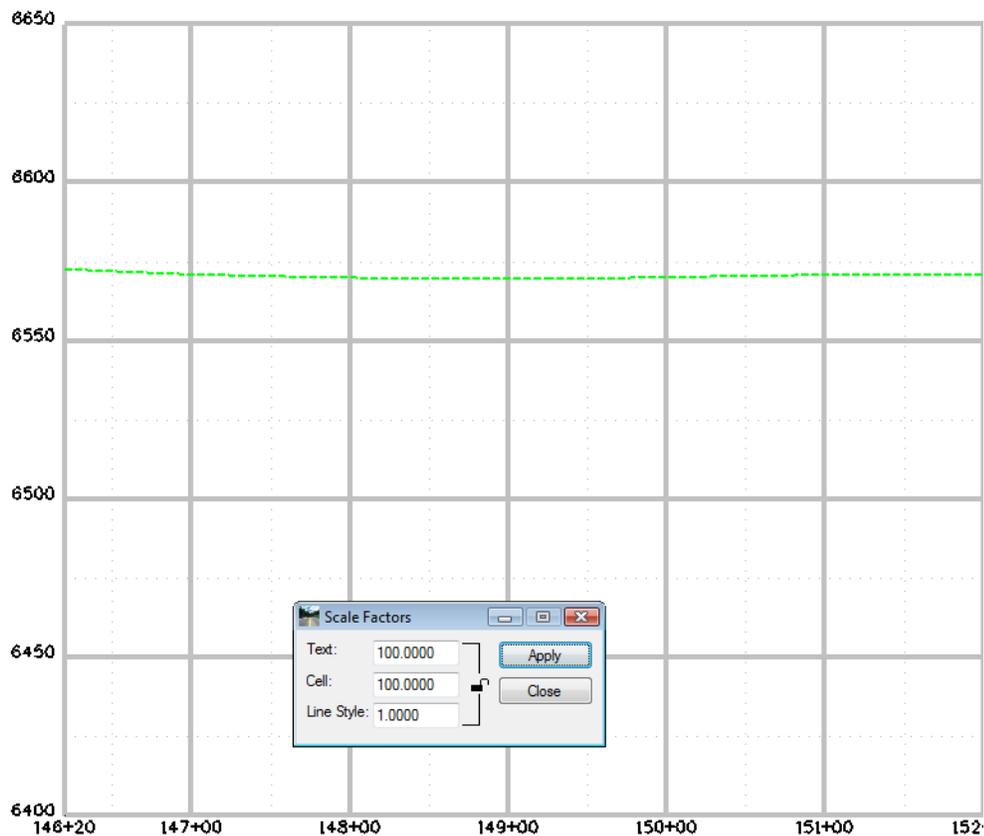
## Lab 6.3 - Viewing Vertical Alignments and Annotation

Once a profile is created from a horizontal alignment, vertical alignments associated with that horizontal alignment can be displayed.

### **Section Objectives:**

- Display the vertical alignment line in a profile
  - Display vertical alignment annotation
1. Select **Geometry > View Geometry > Active Vertical** to display a graphic of the active vertical alignment.

- ◆ Alternately in the **Workspace Bar** under the **Geometry** tab you can <R> on the Vertical Alignment and select **View** just as you did with Horizontal Alignments.

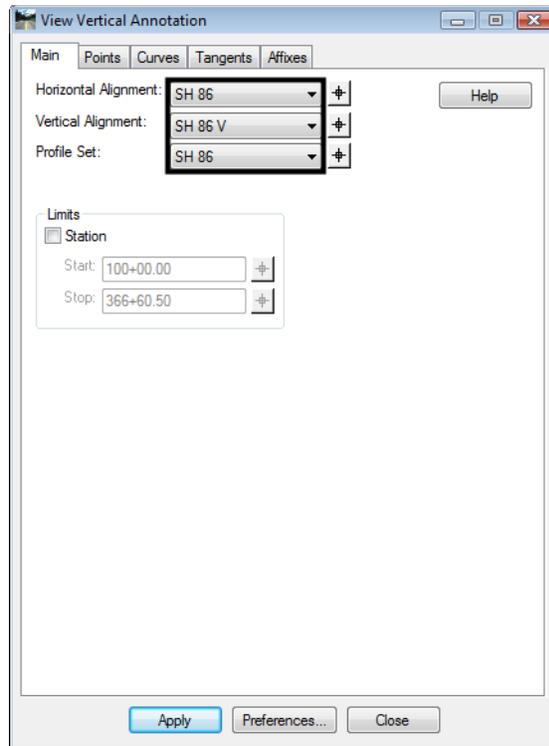


**Note:** Annotation size for the index elevations and stationing calculated using the global scale factor. The profile text size can not be changes once the profile is displayed. To change the text size, the original profile is deleted and a new one is created using the desired global scale factor.

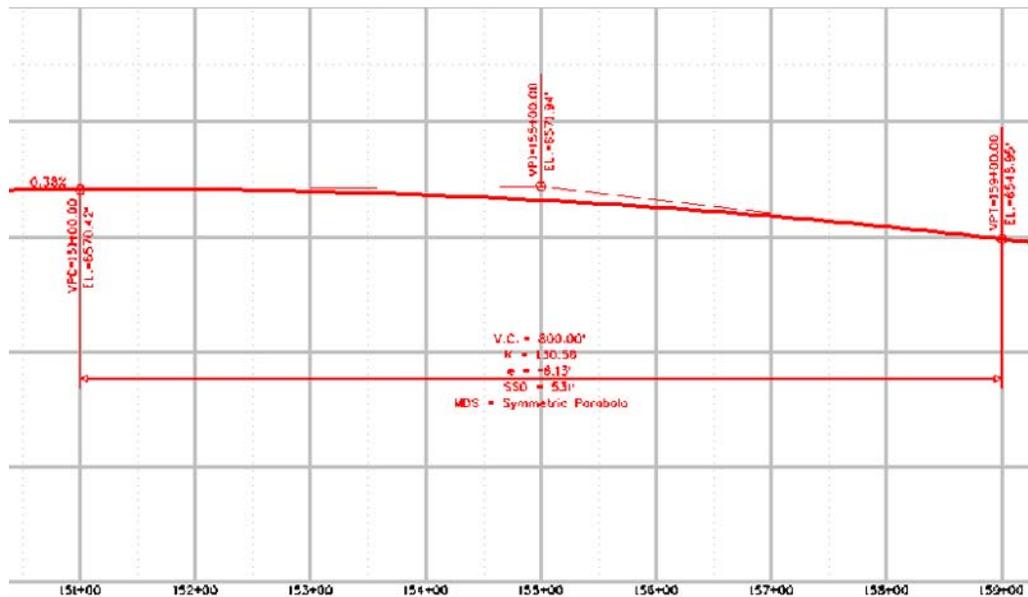
Vertical alignment annotation is used to display the vertical alignment line and other data in a profile set.

2. Select **Geometry > View Geometry > Vertical Annotation** from the InRoads main menu. This displays the **View Vertical Annotation** dialog box.

- Verify the appropriate *Horizontal*, *Vertical Alignments*, and *Profile Set* are correctly identified.

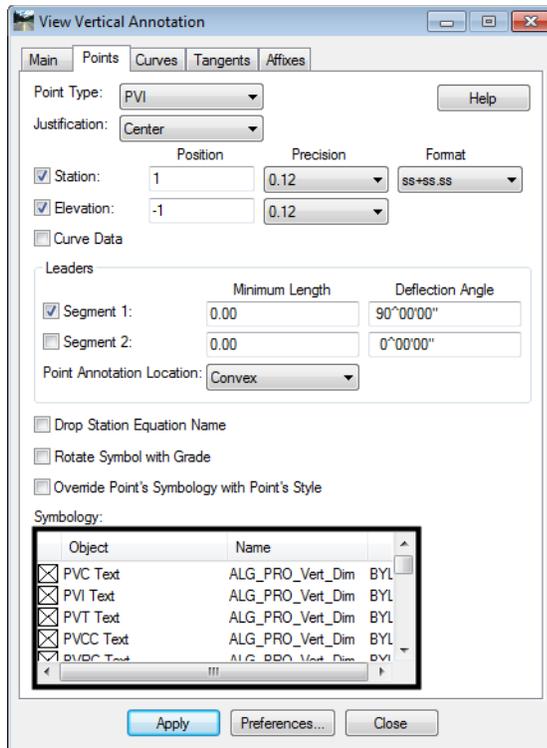


- <D> the **Apply** button.

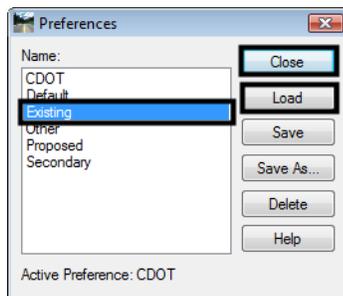


Take some time and investigate the remaining tabs along the top of the *View Vertical Annotation* dialog box and the individual settings for each.

5. <D> the **Points** tab. Note the settings in the *Symbology* portion of the dialog box. By default, the *Proposed* preferences are used.

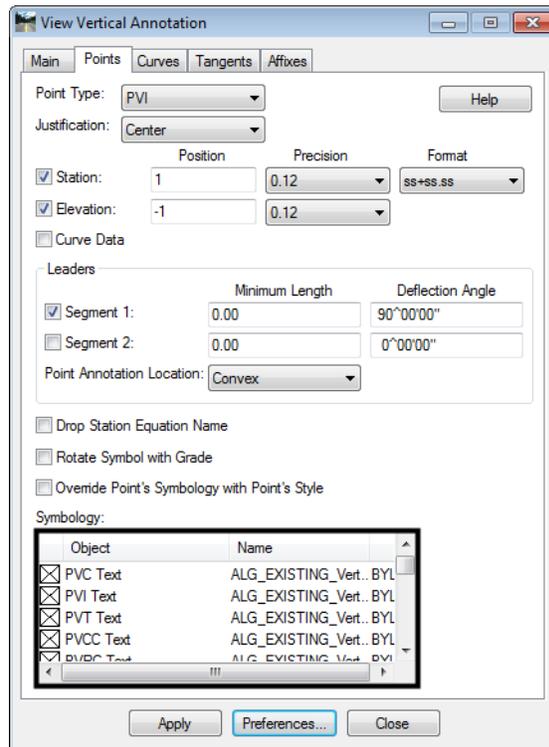


6. <D> the **Preferences** button.



7. <D> the **Existing** preference.
8. <D> the **Load** then **Close** buttons.

9. Note the change in the defined **Symbology**.



10. <D> the **Apply** button. Review the results in the MicroStation drawing. Notice that the data remains the same, however the symbology (level, color, etc.) is changed.
11. For practice, continue to **Load** and **Display** additional preferences. Investigate what levels the elements are being placed on. The various preferences determine the location of graphics.

### Section Summary:

- ◆ Use the Preferences to make the major settings in the Create Profile and Vertical Alignment Annotation dialog boxes.
- ◆ View Active Vertical only displays the geometry elements that make up the vertical alignment.
- ◆ Vertical Alignment Annotation displays the geometry elements and text data that describe the alignment.

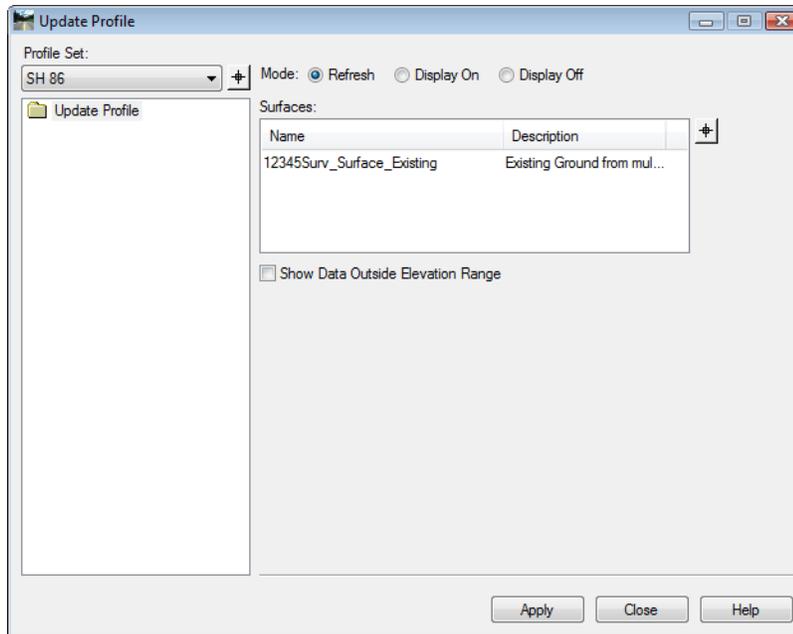
## Lab 6.4 - Updating Profiles

When a profile is created the user has the option to display items such as: multiple surfaces, profile lines offset from the horizontal alignment, and features such as underground utilities and pipes. However, the Create Profile command does not allow the user to specify which features are displayed.

The Update Profile command should be used to add, remove, or update data within an existing profile set. This command allows the user to specify which features will be affected by the command and can also be used to update and surface data that has changed since the profile was created.

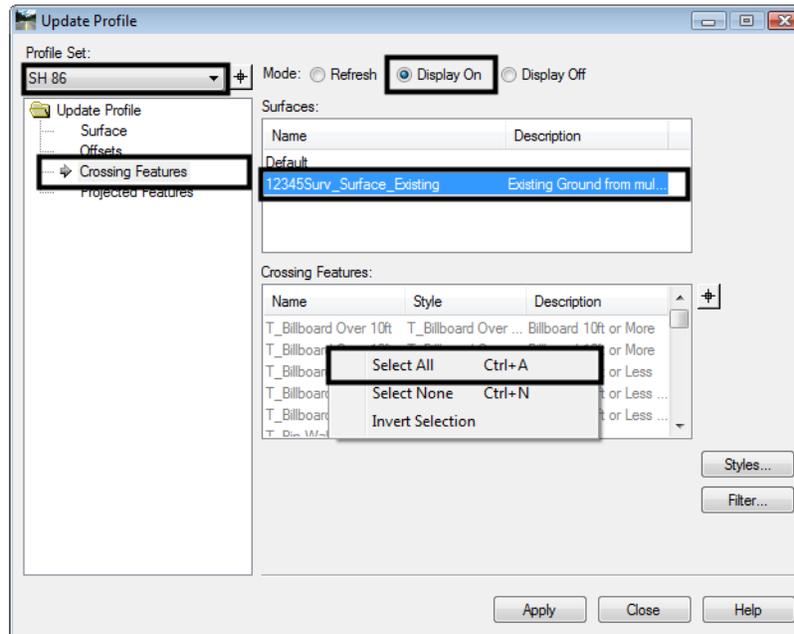
### Section Objectives:

- ◆ Use the Update Profile command to add features to the display.
  - ◆ Illustrate how Global Scale Factors affect cell size.
  - ◆ Examine how Feature Filters affect dialog box lists.
1. From the InRoads main menu, select **Evaluation > Profile > Update Profile**. The **Update Profile** dialog box is displayed.

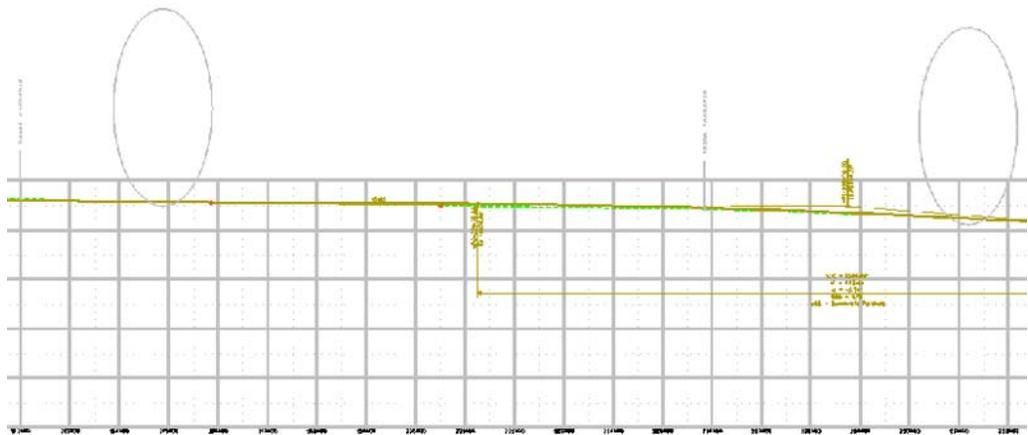


2. Verify **SH 86** is the active **Profile Set**.
3. In the **Mode** section toggle on **Display On**.
4. <D> the **Crossing Features** leaf.
5. In the **Surfaces** section highlight **12345SUR\_Surface**.

6. <R> in the **Crossing Features** list and <D> **Select All** from the right click menu.



7. <D> the **Apply** button. Using MicroStation viewing tools locate a crossing culvert.



Profile and cross section displays are drawn at true horizontal scale. A vertical exaggeration is applied to cells displayed in profiles or cross sections based on the vertical scale applied to the grid.

**Note:** Two classes of elements can be displayed on profiles; 1) True scale items such as culverts and 2) items represented by text such as utility crossings, flow-lines, ROW, etc.

For True Scale items:

The global scale factor for cells should be set to 1.

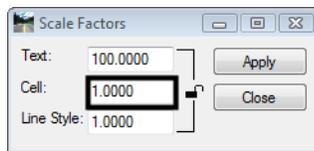
For Informational items:

The global scale factor should be set equal to the plot scale.

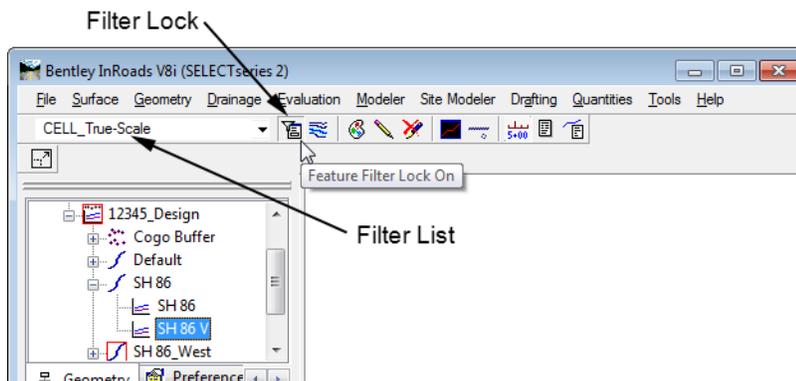
## Lab 6.5 - Refreshing a Profile Display

First, true-scale items such as the culverts.

1. Select **Tools > Global Scale Factors**.
2. <D> on the **Scale Factor Lock** icon so that it is in the open position. This allows modification to the cell scale only. This allows annotation and other commands to remain unaffected by the scale factor that is used specific for cells.

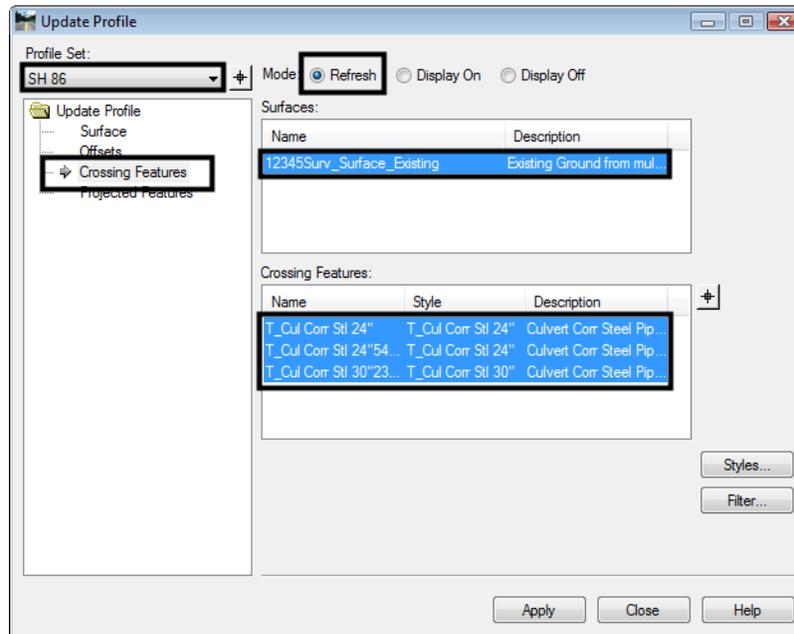


3. In the **Cell** field, key in **1**.
4. <D> the **Apply** then **Close** buttons in the **Global Scale Factor** dialog box.
5. From the **Locks** toolbar, select **CELL\_True-Scale** from the **Feature Filter** list.
6. Toggle on the **Feature Filter** lock.



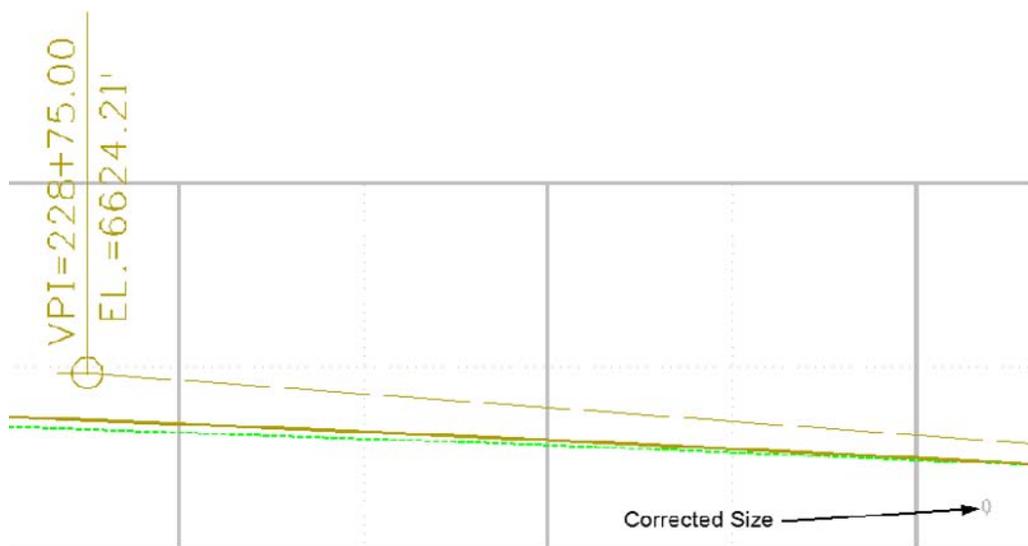
7. Close and reopen the **Update Profile** dialog box.
8. Verify **SH 86** is still the active **Profile Set**.
9. In the **Mode** section toggle on **Refresh**.
10. <D> the **Crossing Features** leaf.
11. Highlight the **12345SURV\_Surface** in the **Surfaces** area.

12. Select all of the **Crossing Features** listed.



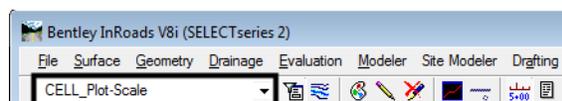
13. <D> the **Apply** button.

14. Use MicroStation viewing tools to locate a crossing culvert and review the results.



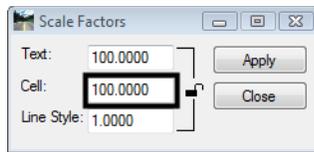
15. Use MicroStation Measuring tools to verify pipe size(s).

16. From the **Locks** toolbar select **CELL\_Plot-Scale** from the Feature Filter list.



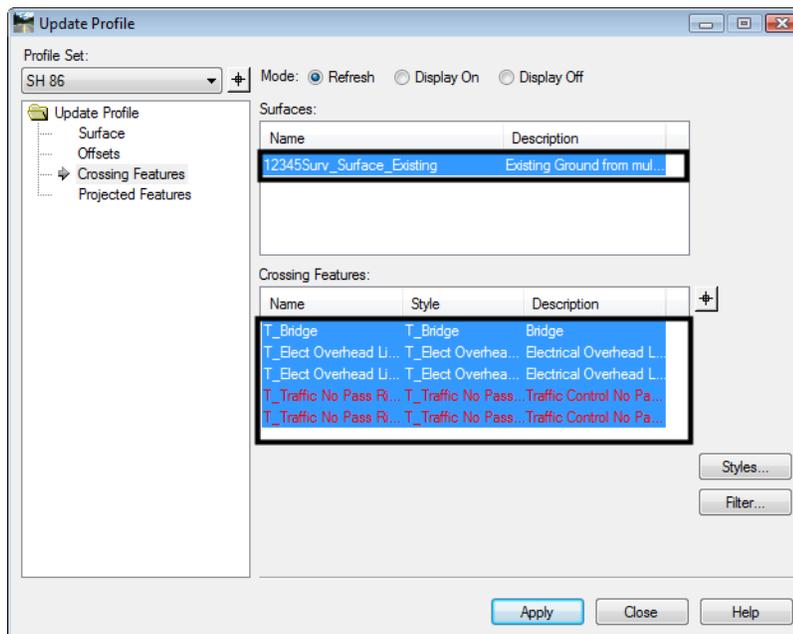
**Note:** Verify that the feature filter is toggled on.

17. Change the InRoads Scale Factor to **100** for cells.

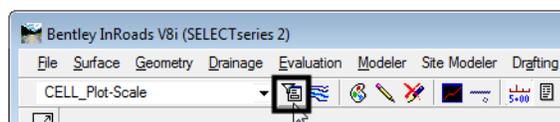


**Note:** This is the desired plot scale change accordingly.

18. Close and reopen the **Update Profile** dialog box.



19. Verify **SH 86** is still the active Profile Set. Use the target button next to the Profile Set to graphically change the active profile set.
20. In the Mode section toggle the radio **Refresh** button.
21. <D> the **Crossing Features** leaf.
22. <D> the surface name **12345SURV\_Surface**.
23. Select all of the **Crossing Features** listed.
24. <D> the **Apply** button.
25. Turn **Off** the **Feature Filter** lock.



### Section Summary:

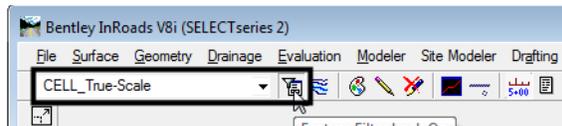
- ◆ Update Profile is the better tool to use when adding features to a profile. With Update Profile the user can choose which features to display. With Create Profile, all features that can be displayed (based on feature style settings) are displayed.
- ◆ There are two types of feature cells used in profiles; true scale cells that use a global scale factor of 1 and plot scale cell that use a global scale factor the same as the plot scale.

## Lab 6.6 - Annotating a Feature in a Profile

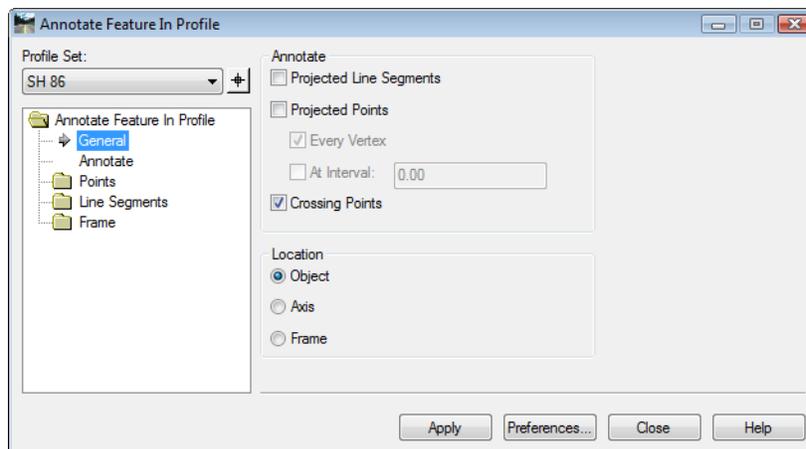
Features that have been displayed in profiles (or cross sections) can be annotated with information extracted from the surface model.

### Section Objectives:

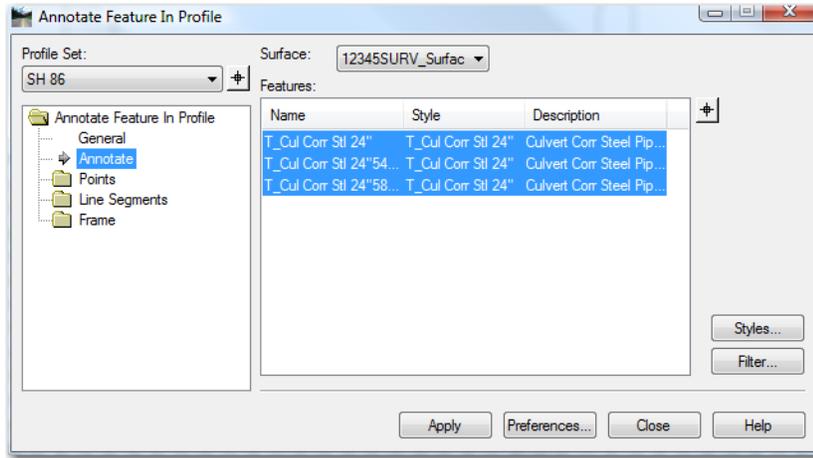
- ◆ Annotate the true scale features in the profile.
1. Using MicroStation commands, window into any culvert displayed in the profile created in the previous lab.
  2. From the **Locks** toolbar select **CELL\_PLOT-Scale** filter and verify the feature filter is toggled **On**.



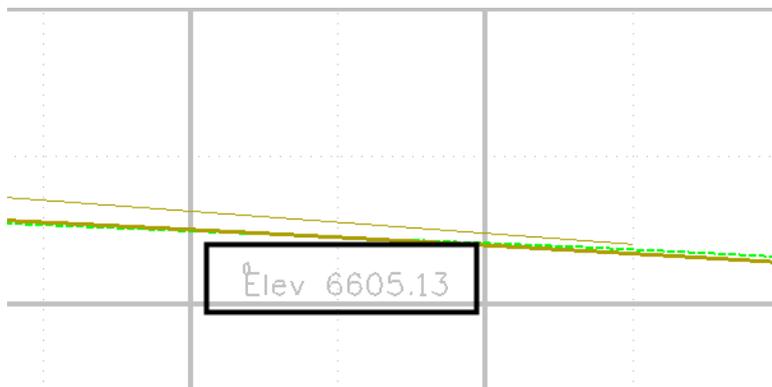
3. Select **Evaluation > Profile > Annotate Feature** from the InRoads main menu. The **Annotate Feature In Profile** dialog box is displayed.



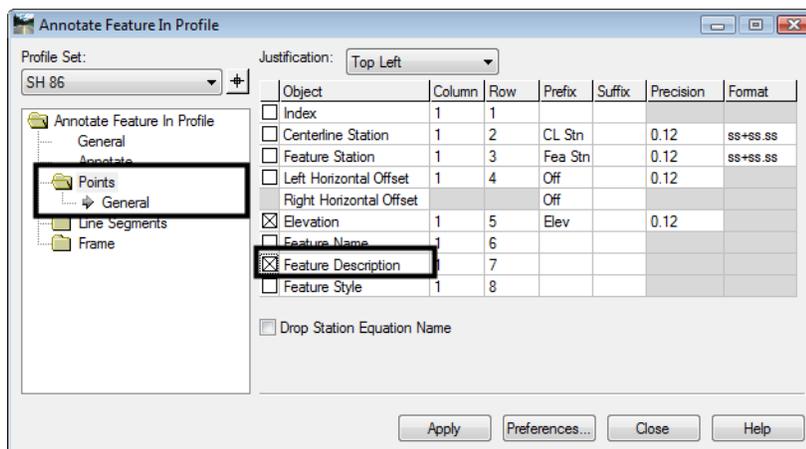
4. Select the **Annotate** leaf. Notice that the features are already highlighted. Also, there is a drop down menu that is used for selecting the surface that contains the features to be annotated.



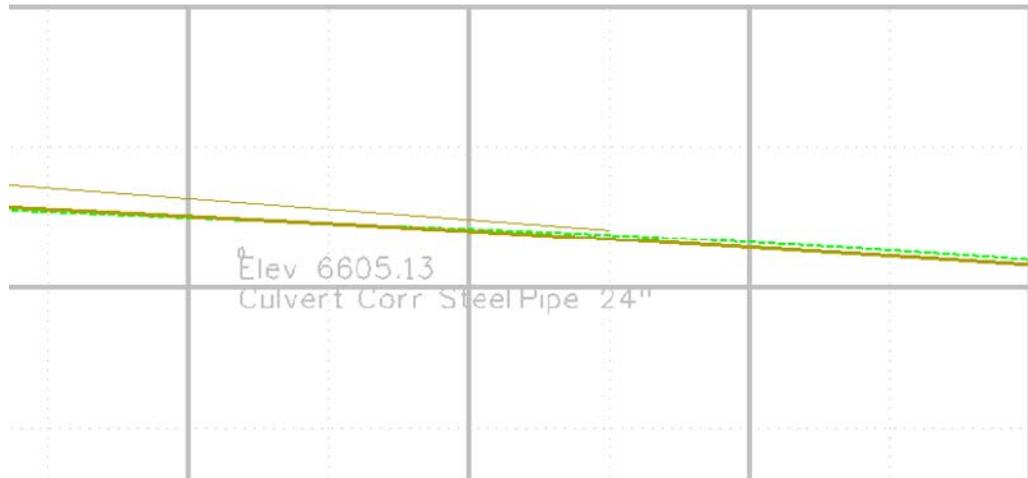
5. <D> the **Apply** button and review the results.



6. <D> the **Points** branch.
7. Toggle on the **Feature Description**.



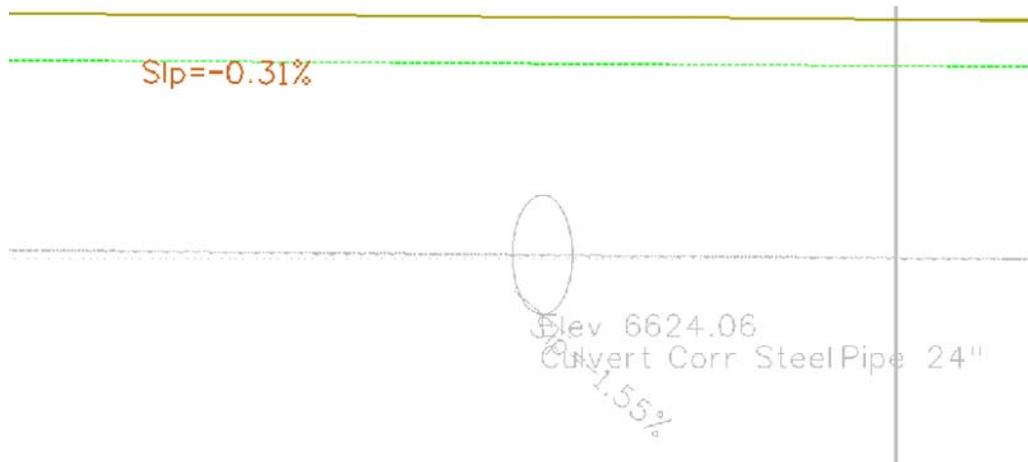
8. <D> the **Apply** button and review the results in your profile.



9. Experiment with enabling other options in the **Point** branch and redisplaying the annotation.

Challenge Exercise:

Update your profile to show **projected features**. Annotate the projected features.



### Section Summary:

- ◆ Only features displayed in the profile can be annotated.
- ◆ Set the global scale factor for text to the plot scale before executing the command.

## Lab 6.7 - Annotating a Profile

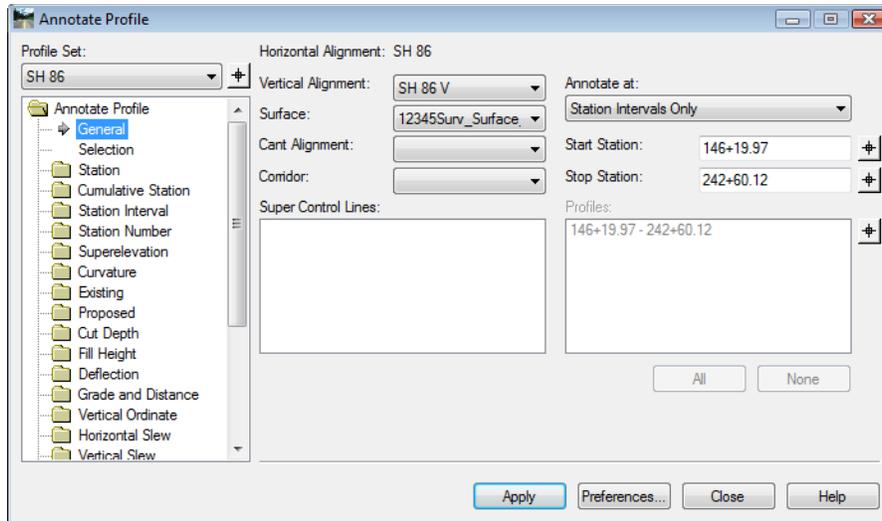
In addition to annotating vertical alignments, profiles can be annotated with both existing and design information.

### Section Objectives:

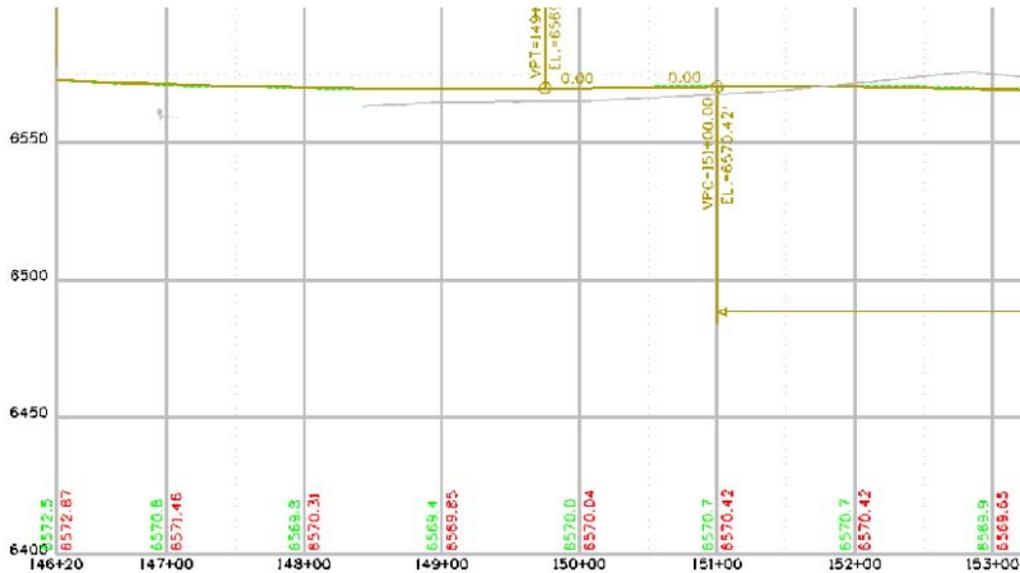
- ◆ Add Existing and proposed elevation information to the profile.

- ◆ Add Cut Depth and fill height information to the profile.

1. Select **Evaluation > Profile > Annotate Profile** from the InRoads main menu.

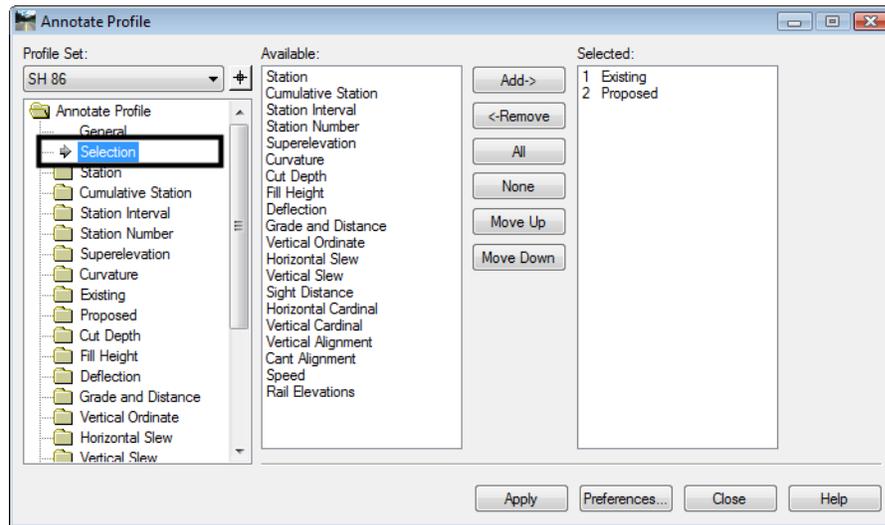


2. **<D> Apply**. The existing and proposed grades annotate the profile.



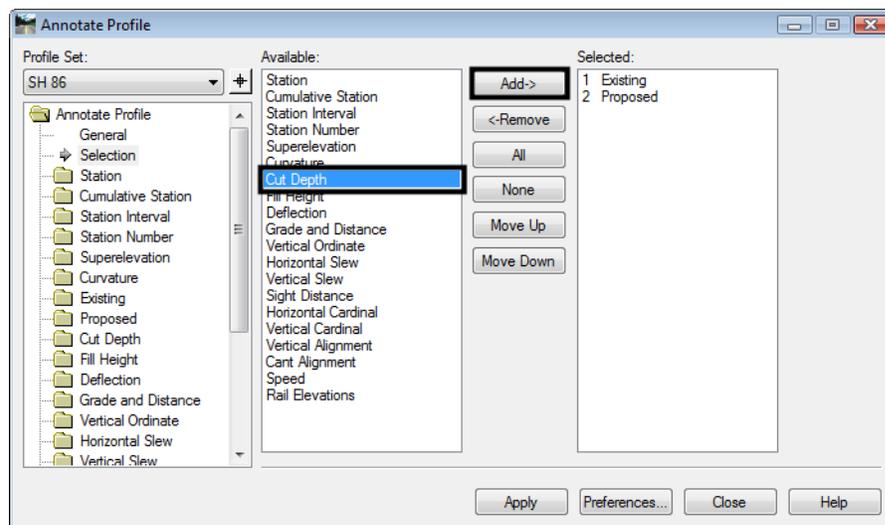
3. Take some time and review the leaves of the **Annotate Profile** dialog box. Investigate the individual settings for each.

4. Now go back and <D> the **Selection** leaf.



**Note:** The dialog box shows two categories; *Available* and *Selected*. *Available* lists the items that can be annotated in a profile, *Selected* identifies the items chosen for annotation.

5. <D> the item **Cut Depth** from the Available list.
6. <D> the **Add** button. Cut Depth will be added to the *Selected* list.

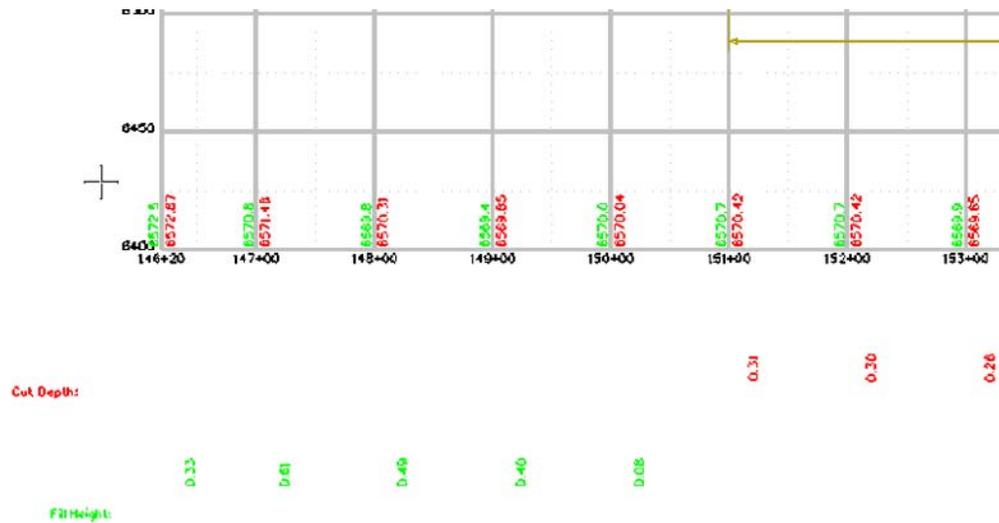


7. <D> the item **Fill Height** from the Available list.
8. <D> the **Add** button. Fill Height will be added to the Selected list.

**Note:** Make sure that *Existing* and *Proposed* remain in the 1 and 2 slots. To move a selected item, highlight the item and <D> the **Move Up** or **Move Down** buttons

9. <D> the **Apply** button and review the profile display.

**Note:** You may have to zoom out to view the additional annotation.



### Section Summary:

- ◆ Annotate Profile is used to place existing surface elevations and vertical alignment elevations on the profile set.
- ◆ Other data related to profiles can also be displayed.
- ◆ When displaying additional data, make sure Existing and Proposed stay at the top of the list.
- ◆ Change the settings on the Frame leaf to move additional data closer to the profile window.

## Lab 6.8 - Vertical Alignment Tracking

Vertical alignments can be interactively queried similar to horizontal alignments.

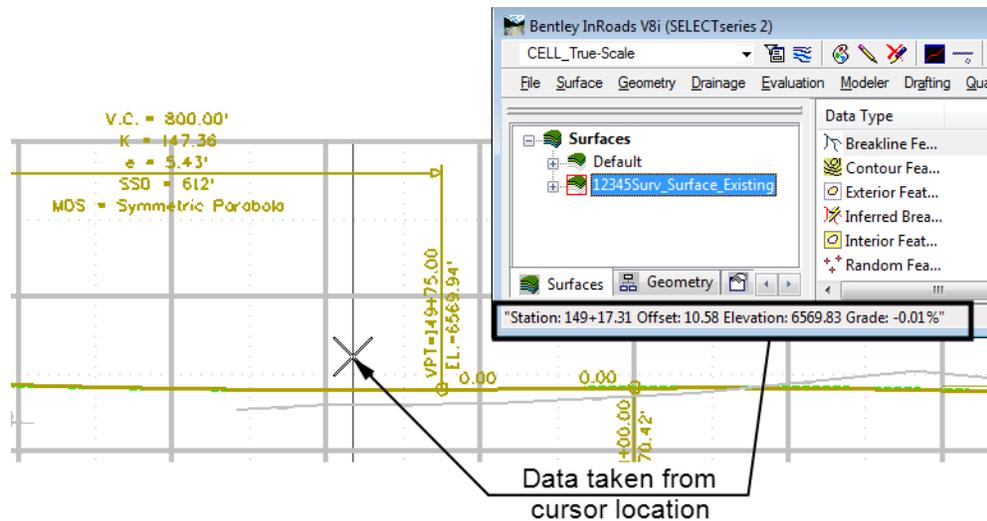
### Section Objectives:

- ◆ Examine Vertical Alignment tracking in the profile.
- ◆ Examine the vertical alignment data in Horizontal Alignment tracking.

The next series of steps illustrates Vertical Alignment tracking.

1. Select **Tools > Tracking > Vertical Alignments** from the InRoads main menu.

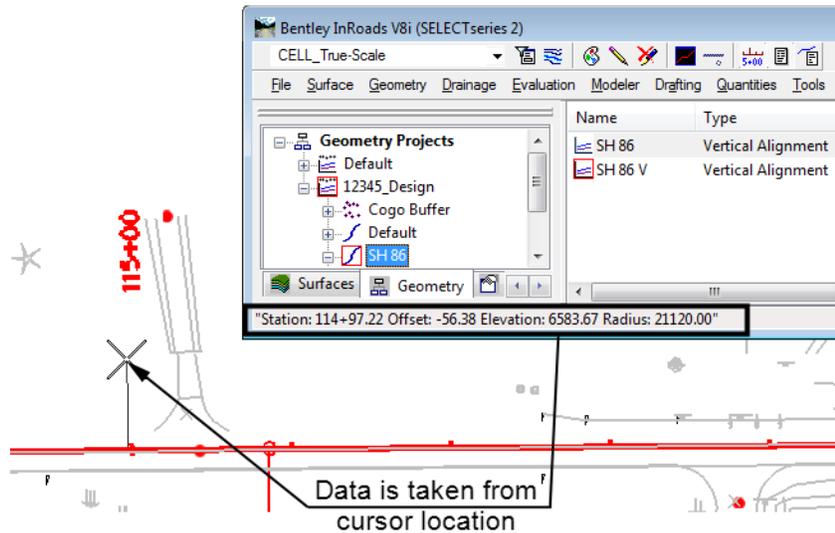
2. Move the cursor inside the Profile Set window and review the output in the InRoads Status bar.



**Note:** As you move your cursor in the profile set window InRoads displays vertical alignment information in the status field. There is *not* an option to write this information to the MicroStation file.

This series of steps illustrates tracking vertical data in the plan view

3. Select **Tools > Tracking > Horizontal Alignment**.
4. Move the cursor along the active horizontal alignment and review the readout in the InRoads Status bar.



Results displayed are the station and offset relative to the active horizontal alignment. The elevation is relative to the active vertical alignment.

### Section Summary:

- ◆ Tracking is used to gain information that is related to the horizontal and vertical alignments.

## Lab 6.9 - Create a Vertical Alignment

Vertical alignments define an elevation path for the proposed design to follow. It is stored under the parent horizontal alignment.

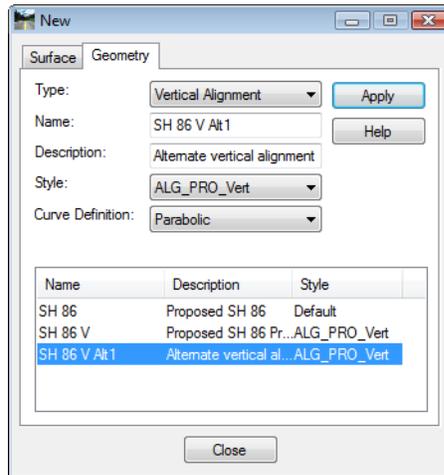
### Section Summary:

- ◆ Create a new vertical alignment slot.
- ◆ Add PIs to the vertical alignment.
- ◆ Define the vertical curves.

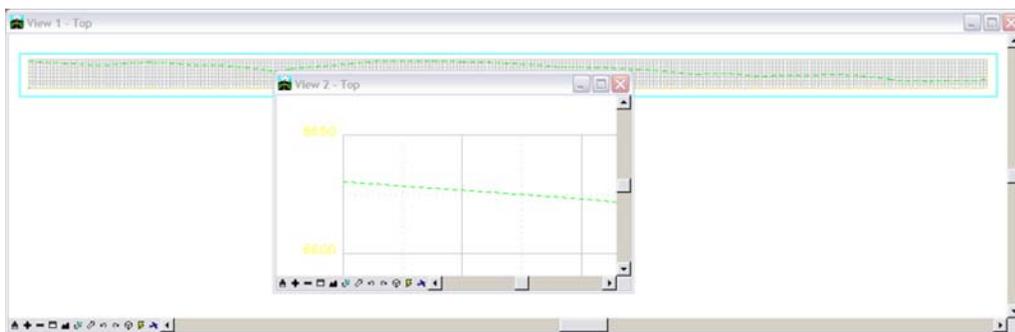
Create a slot in the active geometry project for your vertical alignment.

1. Select **File > New**.
2. <D> the **Geometry** tab.
3. Set the *Type* to **Vertical Alignment**.
4. Key in **SH 86 V Alt1** for the *Name*.

5. Key in **Alternate vertical alignment** for the **Description**.
6. Set the **Style** to **ALG\_PRO\_Vert**.
7. Verify that the **Curve Definition** is set to **Parabolic**.
8. Select **Apply** then **Close**

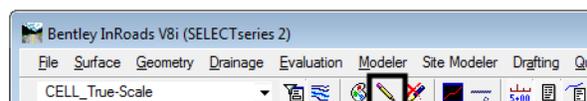


9. Set up your MicroStation windows so the entire profile is visible in one window, then open another MicroStation window and Zoom in to the beginning of the profile as shown.

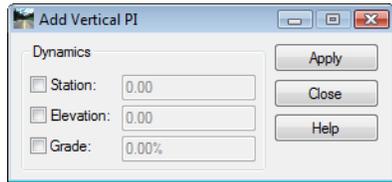


Next, add PVI's to the Vertical Alignment.

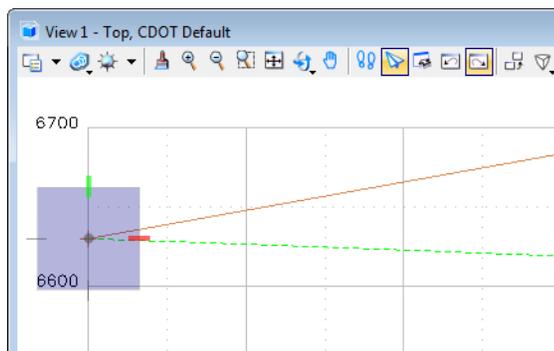
10. Verify that the **Write Mode** is set **Pencil**.



11. Select **Geometry > Vertical Curve Set > Add PI** from the InRoads main menu.

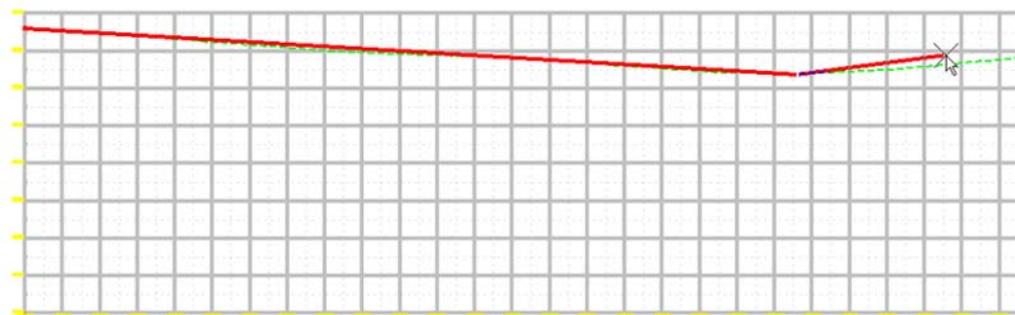


12. Select **Apply**.
13. For the first PVI, snap to the beginning of the ground line in the window where you are zoomed in.



14. In the MicroStation key in field, enter the following commands: (Be certain to use the % sign in the key-in.)

◆ ***dg=900,-3.76%***



◆ ***dg=400,1.03%***

◆ ***dg=425,-4.29%***

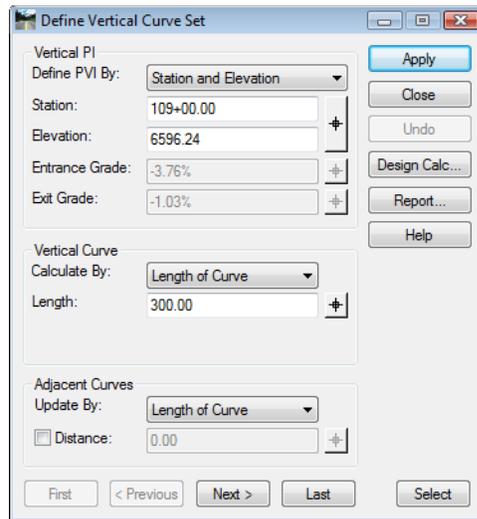
◆ ***se=11725,6574.78***

The ***dg=*** key-ins place a PI at the specified distance and grade from the previous point. The ***se=*** key-in places a PI at the specified station and elevation.

15. <R> twice to exit, then **Close** the **Add Vertical PI** dialog box.
16. Update the view.

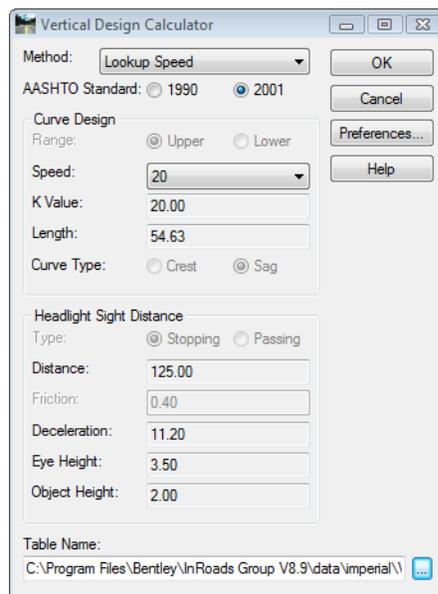
The vertical alignment is displayed permanently in the design file. Because Pencil mode is active, the tangents will automatically update when the curves are added.

17. Select **Geometry > Vertical Curve Set > Define Curve** from the InRoads main menu.

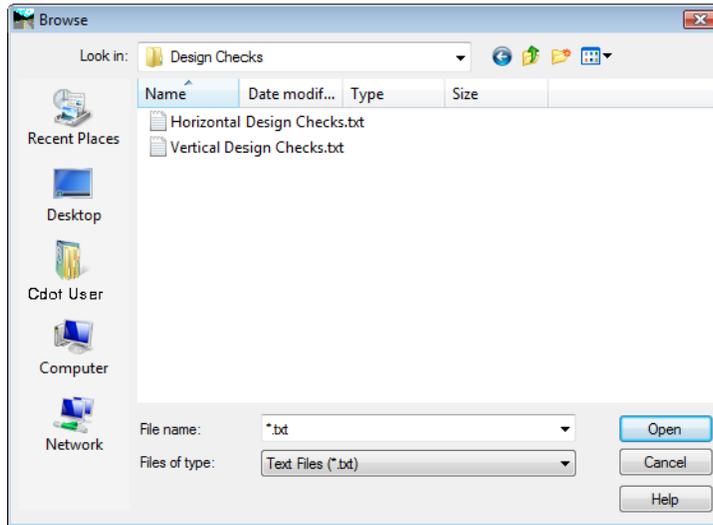


The Define Vertical Curve dialog box is automatically displayed ready to accept input for the first curve on the vertical alignment. To step to other curve sets, you can use *Previous* and *Next*, or *First* and *Last*.

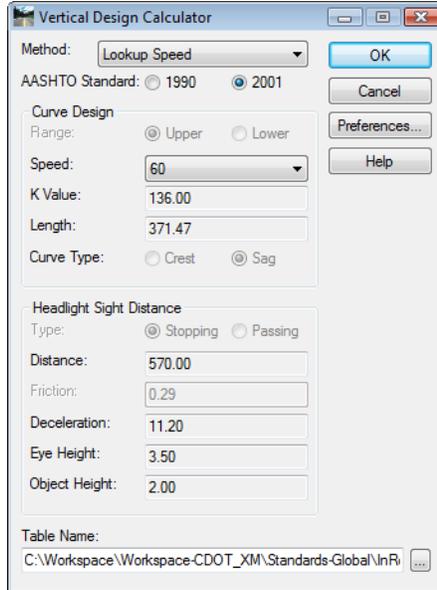
18. Under the *Vertical Curve* area, set *Calculate By* to *Length of Curve*.
19. Key in **300** for the *Length*.
20. Select **Design Calc.**



21. Click in the **Table Name** field and Browse to the C:\Workspace\Workspace-CDOT\_V8i\Standards-Global\InRoads\Design Checks folder and select the file **Vertical Design Checks.txt**.



22. Verify that the length of curve meets your design criteria.



23. **<D> Cancel** when done. Do not accept the minimum curve, just verify that yours meets the criteria.

24. Select **Apply**

25. Select **Next** to move to the second intersection of tangents.

26. Verify that **Calculate By:** is set to **Length of Curve**.

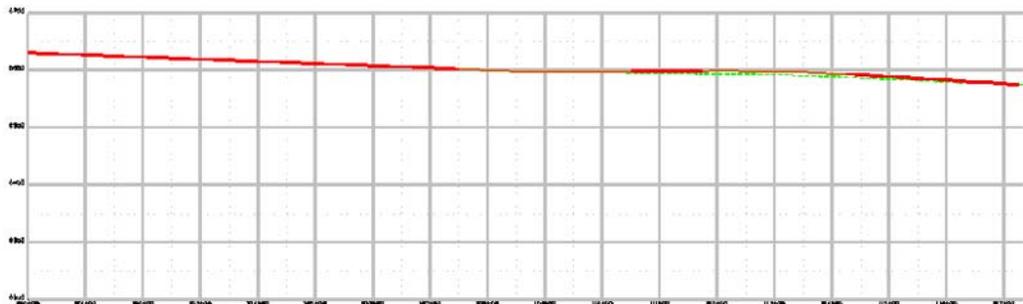
27. Key in **250** for the **Length**.

28. Select **Design Calc.**

29. Verify that the length of curve meets your design criteria.

30. Select **Apply**.

31. Close the **Define Vertical Curve Set** dialog box.



32. Save the geometry project.

33. Close InRoads and MicroStation.Labs for InRoads V8i SS2

### **Section Summary:**

- ◆ Vertical alignments are defined in the profile window.
- ◆ Vertical PIs can be added by data point or key in.
- ◆ The Define Curve dialog box can also be used to adjust PI stations and elevations.

**Chapter Summary:**

- Use the review vertical alignment command to examine vertical alignment data when a profile is not required.
- Profiles are required to view vertical alignments graphically.
- Use Update Profile to add, remove, or revise data in a profile set.
- Annotate Feature in Profile only affects features displayed in the profile.
- Annotate Profile is used to display existing surface and vertical alignment elevations in the profile.
- Vertical Alignment Tracking displays Station, Offset, Elevation, and Grade information in the InRoads main dialog box.
- Typically, vertical alignments are defined by locating all of the VPIs then placing the curves.