

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 the path of the horizontal alignment. 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

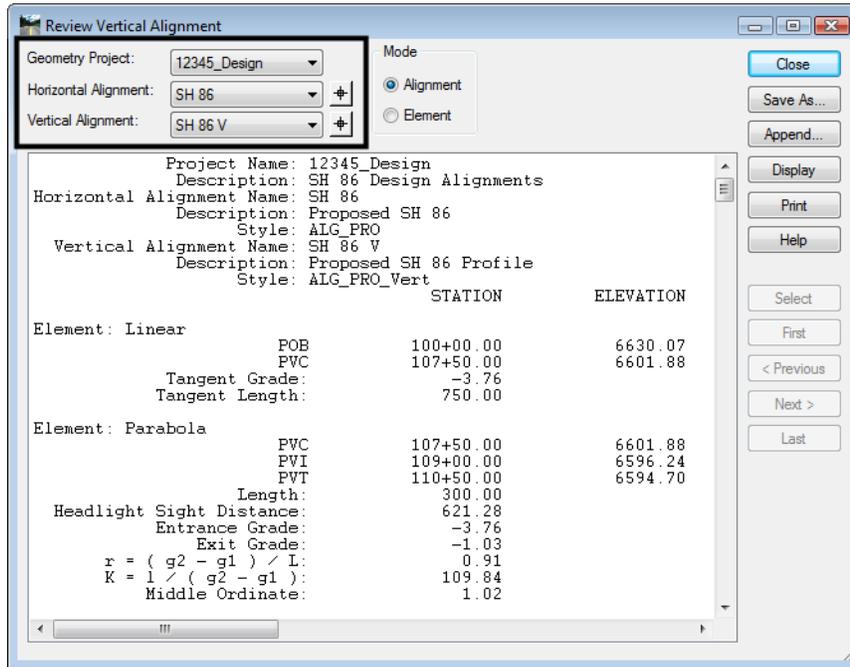
Lab 6.1 - Reviewing Vertical Alignments

Section Objectives:

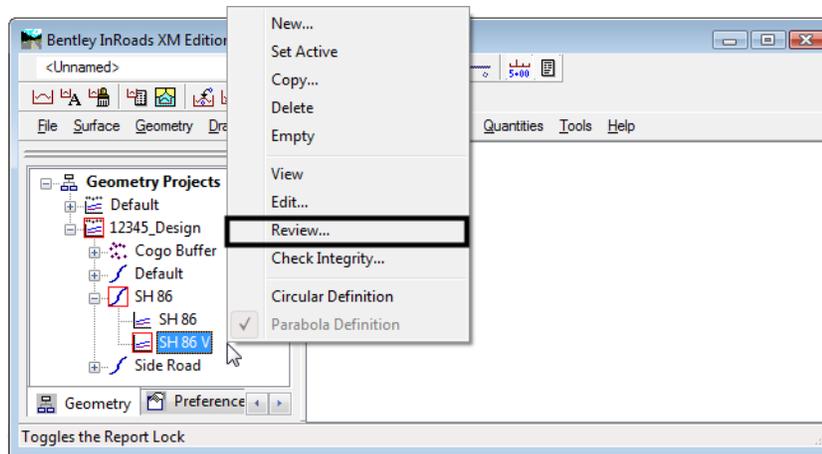
- ◆ Examine the Review Vertical Geometry window.
- ◆ Explore the functionality of the dialog box.

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

1. Select **Geometry > Review Vertical**.



2. The review dialog can also be opened with the right-click fly-out menus.



Section Summary:

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

Lab 6.2 - Creating Profiles

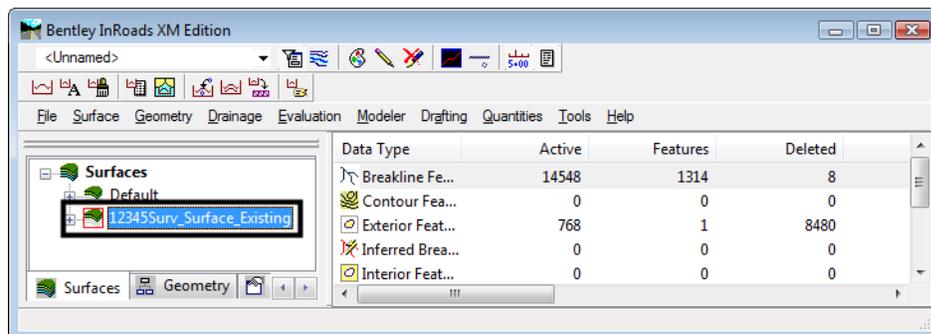
Prior to graphically displaying a vertical alignment a profile must be created. These are referred to as profile sets in InRoads. A profile set can be created using a horizontal alignment, a MicroStation element, or interactively to define the horizontal (plan) location the vertical information is extracted from. Upon creation, a profile can display DTM surfaces, vertical alignments and DTM features. Once created, a profile set can be refreshed to display additional data, turn the display or data off, or to redraw the graphics based on current DTM information.

Section Objectives:

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

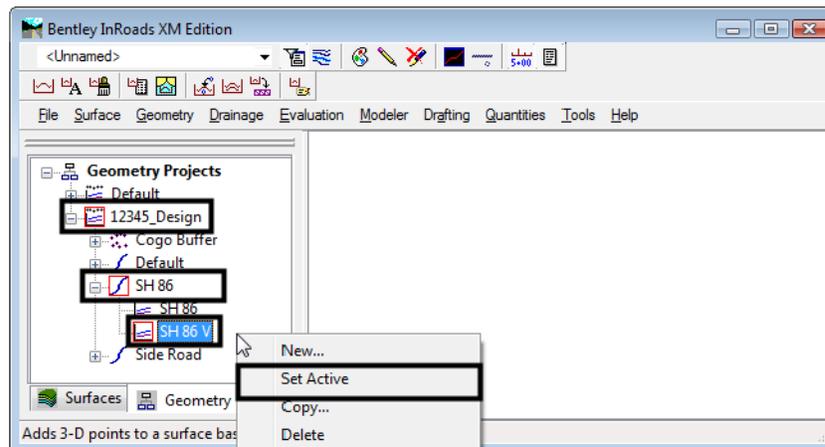
Prior to creating a profile set, load the DTM **12345Surv_Surface_Existing** if not already loaded. This surface will be used to display an existing ground-line.

1. Select **File > Open**.

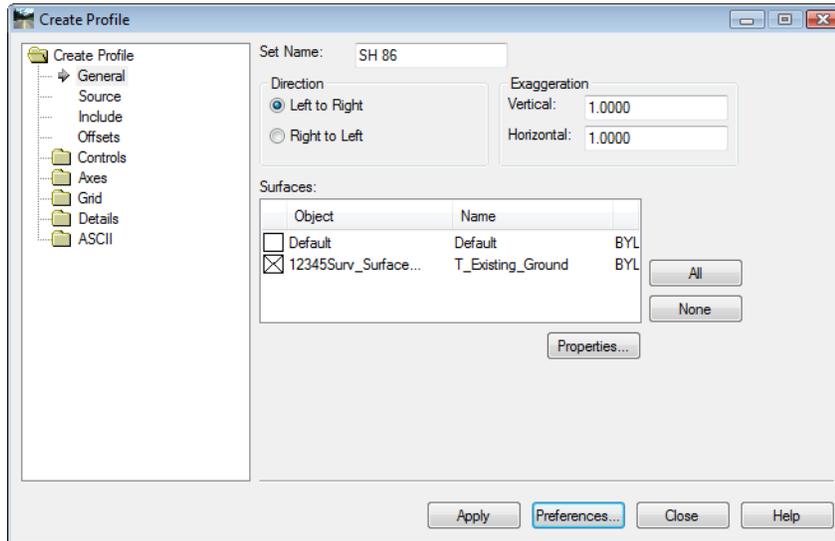


2. In the workspace bar under the **Geometry** tab, verify that **12345_Design** is the *active* geometry project and that the horizontal alignment **SH86** is the *active* alignment.

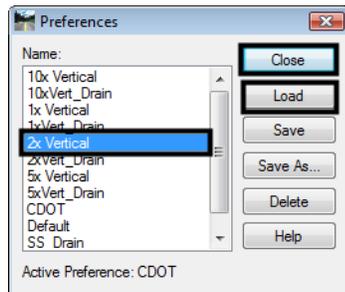
Note: To make something active, <R> on the name and select *Set Active* from the fly-out menu.



3. Select **Evaluation > Profile > Create Profile** the *Create Profile* dialog will appear.



4. <D> the **Preferences** button. The *Preferences* dialog will appear.
5. <D> the predefined settings for **2x vertical**.

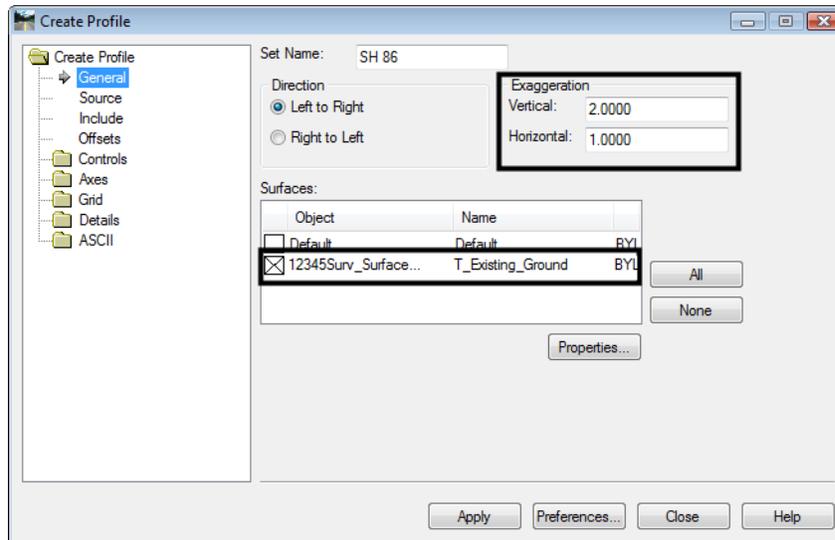


6. <D> the **Load** then **Close** buttons.

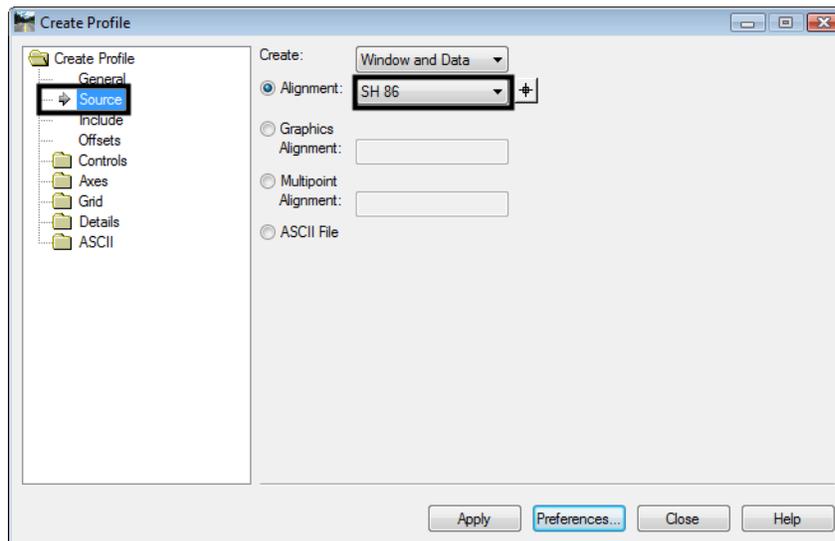
Note: Load preferences before making any other menu settings. Loading Preferences resets all menu settings to those predefined in the preference.

7. Note the *Exaggeration* specified.

8. Verify that in the *Surfaces* portion of the dialog, the *Display* box is checked for surface 12345SURV_Surface_Existing.

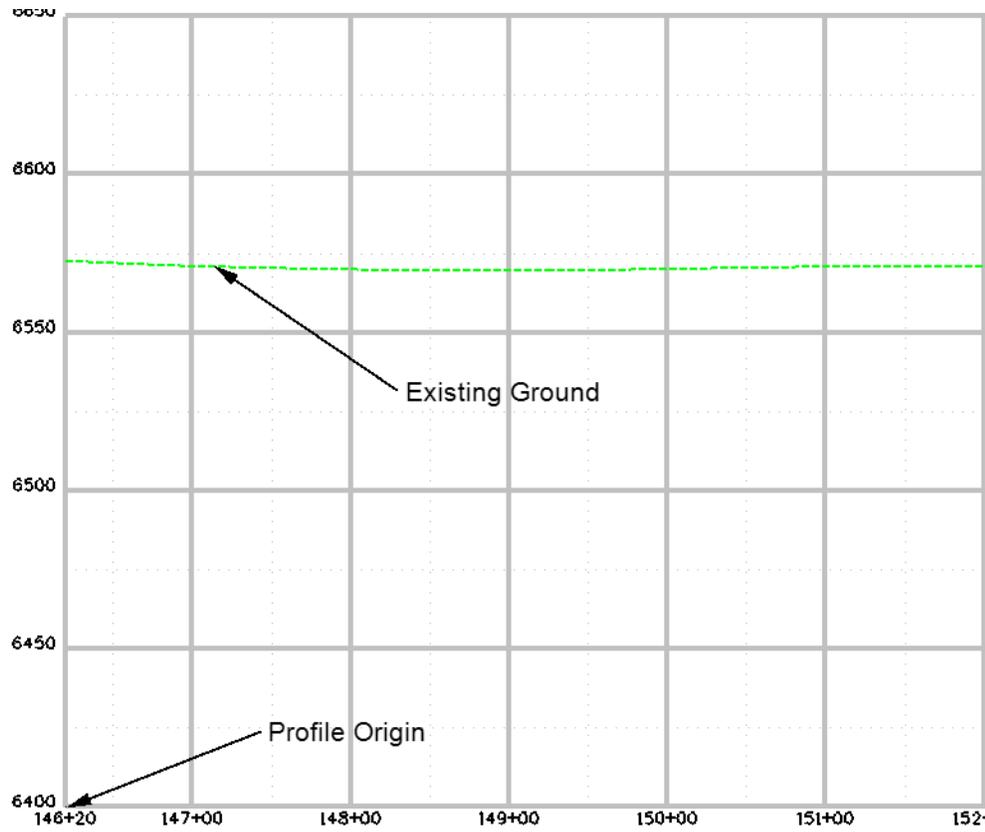


9. <D> the **Source** leaf. Verify that the **SH 86** alignment is selected.



10. <D> the **Apply** button. The *Create Profile* dialog will temporarily minimize.

11. You are prompted by MicroStation to 'Identify location'. <D> in the MicroStation view. The Profile window will be placed and the *Create Profiles* dialog will restore.

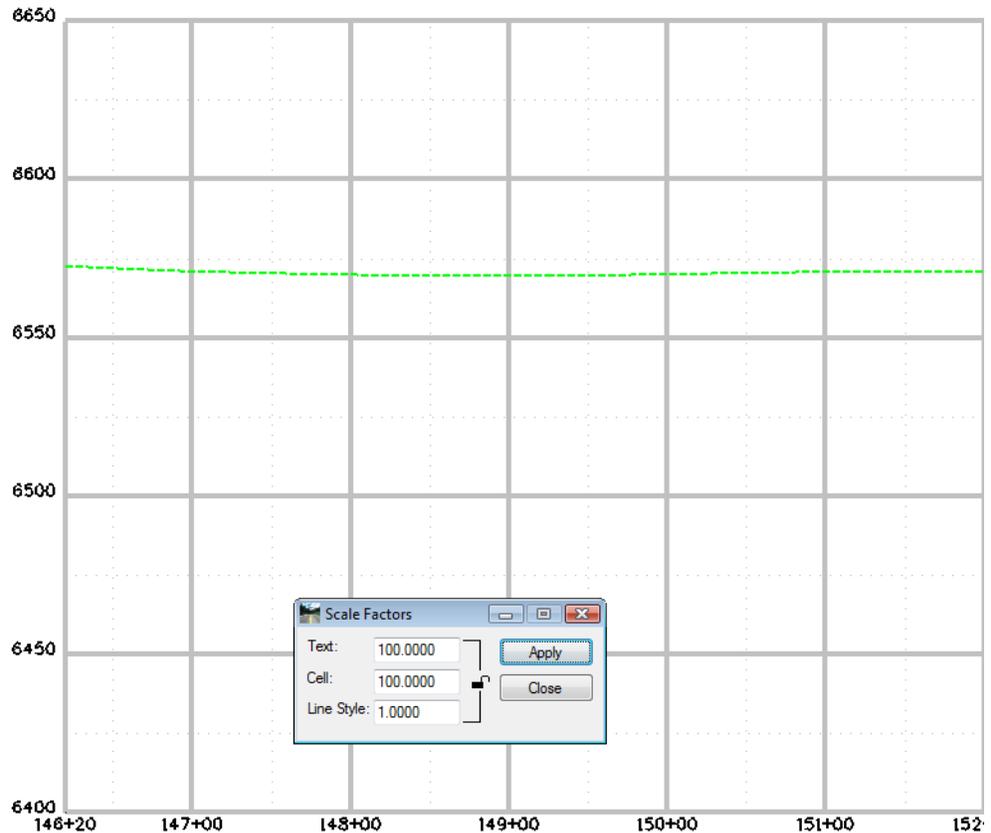


Note: For convenience, we are displaying the profile in our current drawing. Standard practice dictates that separate drawings should be created for profile and cross section display. Consult the directory structure and file naming convention for your specific discipline to determine standards relating to profile display.

Viewing Vertical Alignments

12. 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.

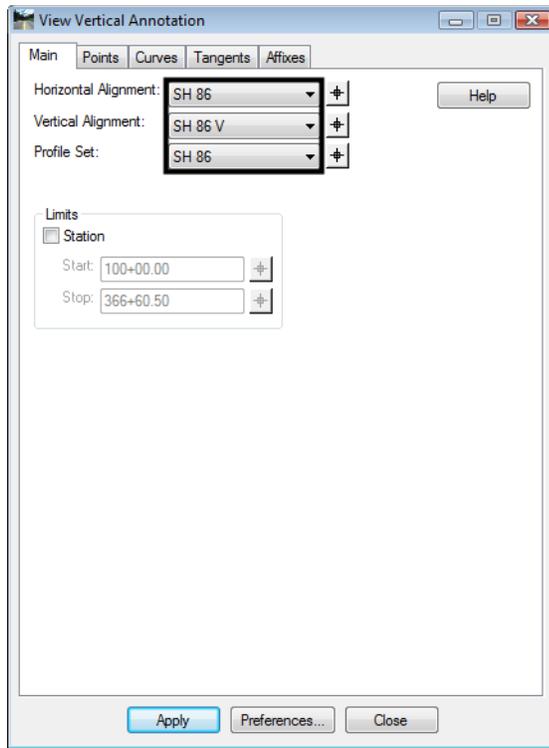


Note: Annotation size for the index elevations and stationing text is generated based on the global scale factor defined for text. The text size specified should be set based on the ultimate plotting scale. To change text size on a profile, delete the displayed profile, change the global scale factor, and regenerate the profile display.

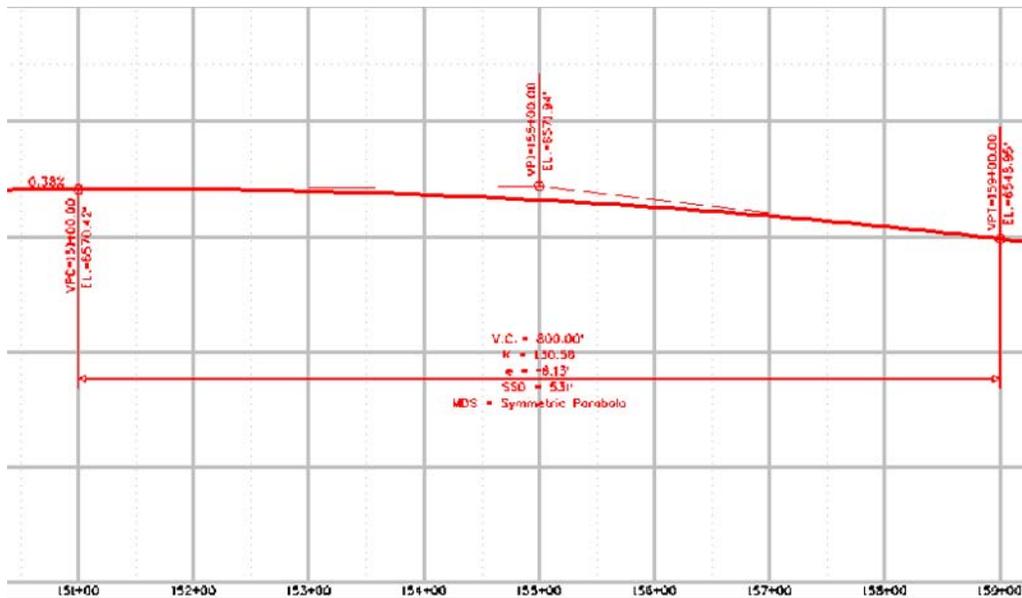
Annotating Vertical Alignments

Similar to horizontal stationing, annotation of vertical alignments is accomplished much the same way.

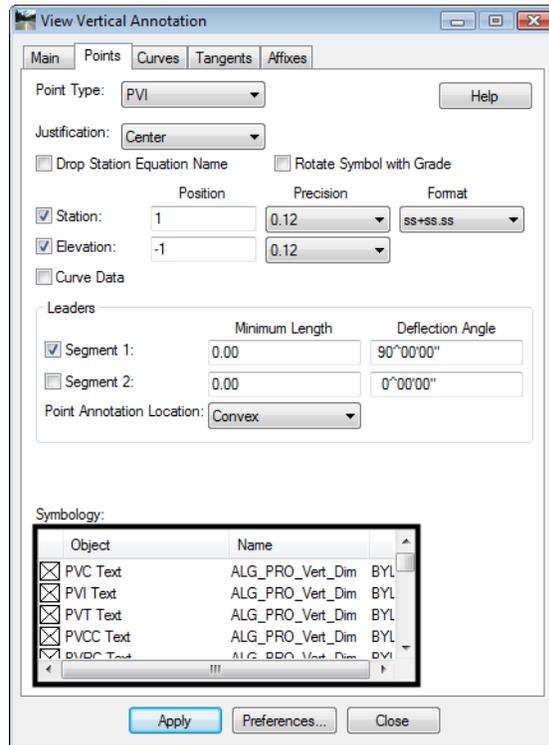
13. Select **Geometry > View Geometry > Vertical Annotation** to view vertical alignment annotation.



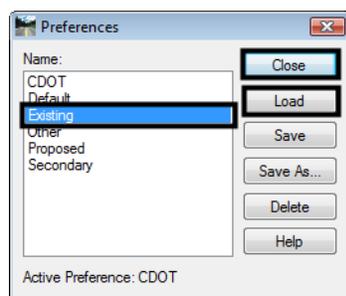
14. **Verify** the appropriate *Horizontal*, *Vertical Alignments*, and *Profile Set* are correctly identified.
15. Click **Apply**.



16. Take some time and investigate the remaining tabs along the top of the **View Vertical Annotation** dialog and the individual settings for each.
17. <D> the **Points** tab. Note the settings in the **Symbology** portion of the dialog. By default, **Symbology** for a **Proposed** alignment loads.

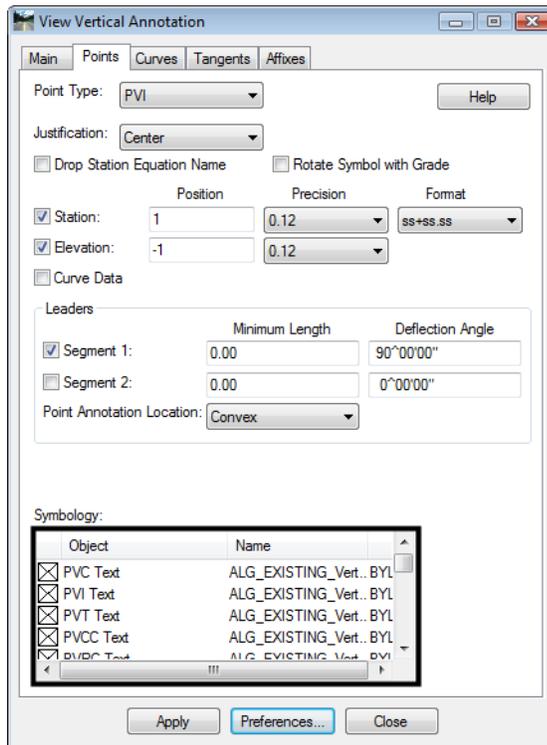


18. <D> the Preferences button.



19. <D> the name **Existing**.
20. <D> the **Load** then **Close** buttons.

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



22. <D> the **Apply** button from the *View Vertical Annotation* dialog. Review the results in the MicroStation drawing. The content of the graphics should remain the same, however, different levels, color, style, and weight are utilized.
23. For practice, continue to *Load* and *Display* additional preferences.
24. 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.

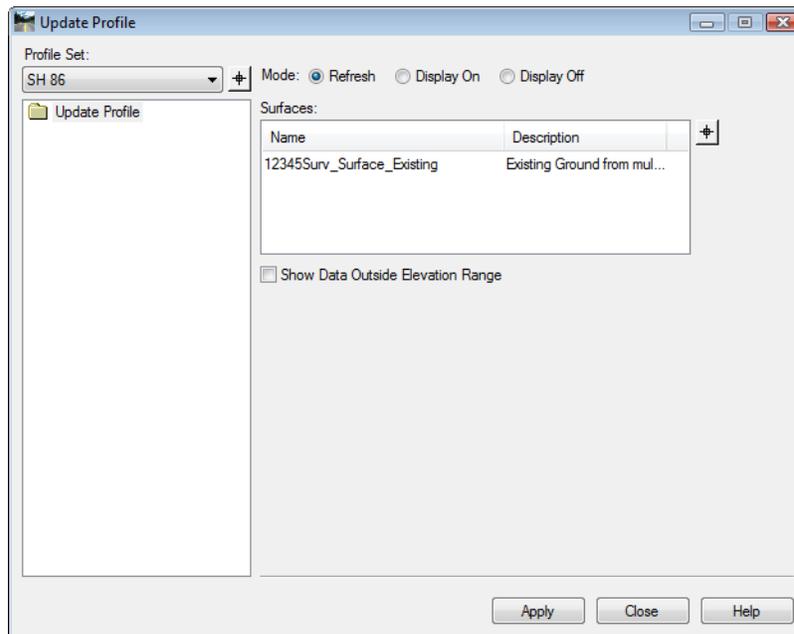
Lab 6.3 - Updating Profiles

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.

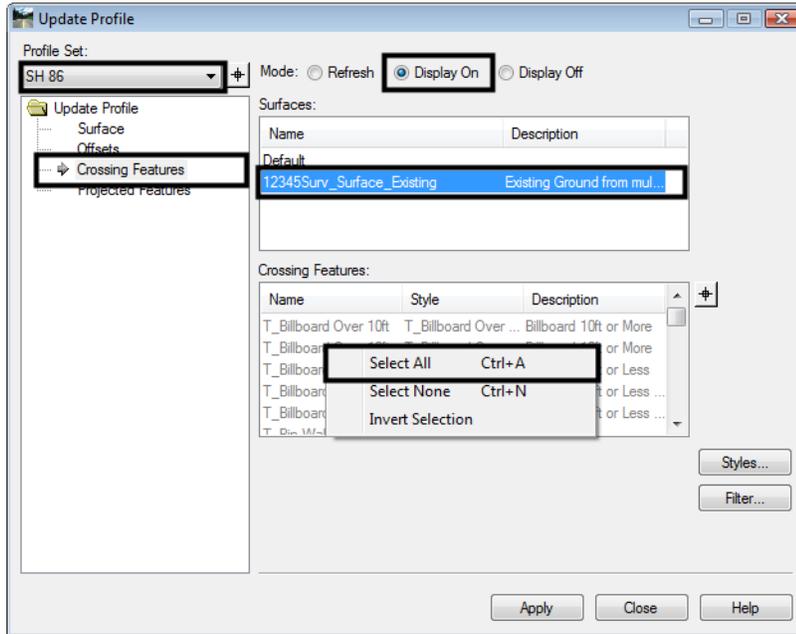
Section Objectives:

- ◆ 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 pull down menu **Evaluation > Profile > Update Profile**. The *Update Profile* dialog will appear.

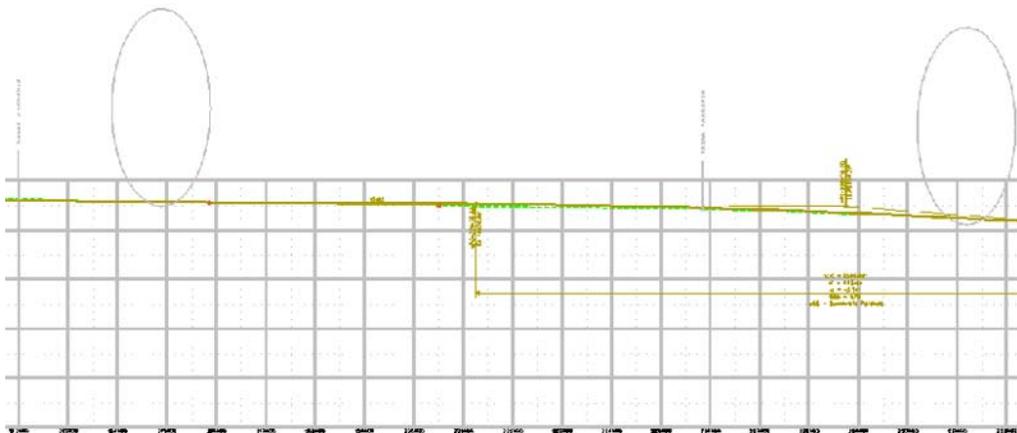


2. <D> the **Crossing Features** leaf.
3. Verify **SH 86** is the active *Profile Set*.
4. In the *Mode* section toggle the radio button **Display On**.
5. In the *Surfaces* section <D> **12345SUR_Surface**.

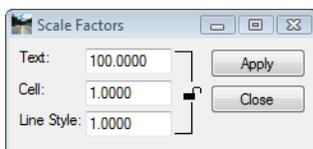
6. <R> in the *Crossing Features* list and select **All** from the menu.



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



Note: Profile and cross section displays are drawn at true horizontal scale. A vertical distortion will be applied to cells displayed in profiles or cross section views based on the vertical scale applied to the grid. Some DTM features displayed in these graphics are configured to display at their true horizontal (x-direction) sizes. Therefore, prior to displaying features in either profiles or cross sections the global scale factor for cells should be set to 1.



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 item 1:

The global scale factor for cells should be set to 1 and a subset of the dtm crossing features should be displayed (or refreshed in this case). This is accomplished with the use of feature filters.

For Item 2:

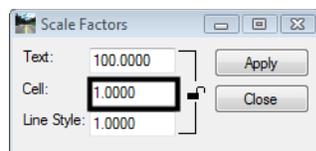
The global scale factor should be set equal to the plot scale.

Note: See the following page for information on updating a profile to refresh the graphics.

Refreshing a Profile Display

First, take care of refreshing the display of the true-scale items such as the culverts.

8. Select **Tools > Global Scale Factors**.

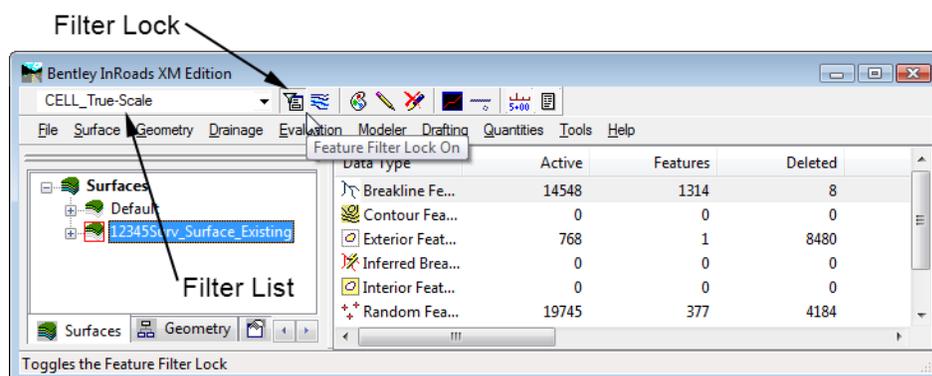


9. Key in the field **Cell: 1**.

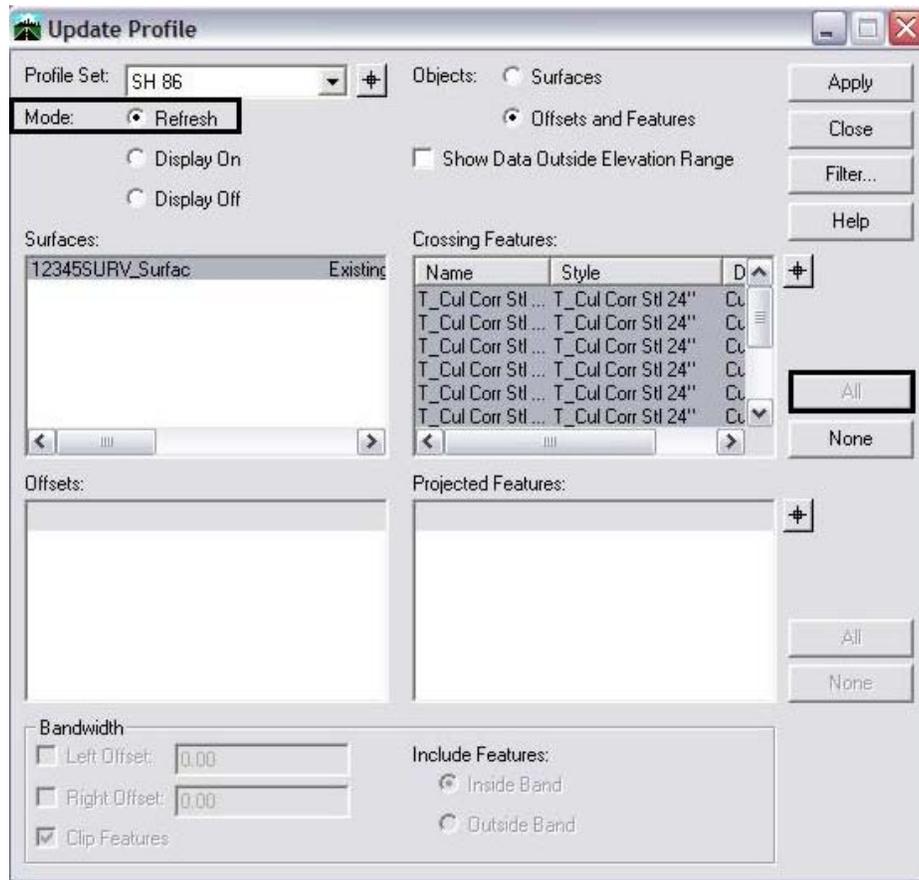
Note: You may need to **Unlock** the icon to allow modification to the cell scale only. By doing so, when you update the profile, the cells will draw at their true sizes. Leaving the Text field at 100 and Line Style field set to 1. This allows annotation and other commands to remain unaffected by the scale factor that was input specific for cells.

10. <D> the **Apply** then **Close** buttons in the **Scale Factor** dialog

11. In the main InRoads interface, select the filter **CELL_True-Scale** from the drop-down list. Also toggle **On** the **Feature Filter** lock.



12. Close and reopen the *Update Profile* dialog.



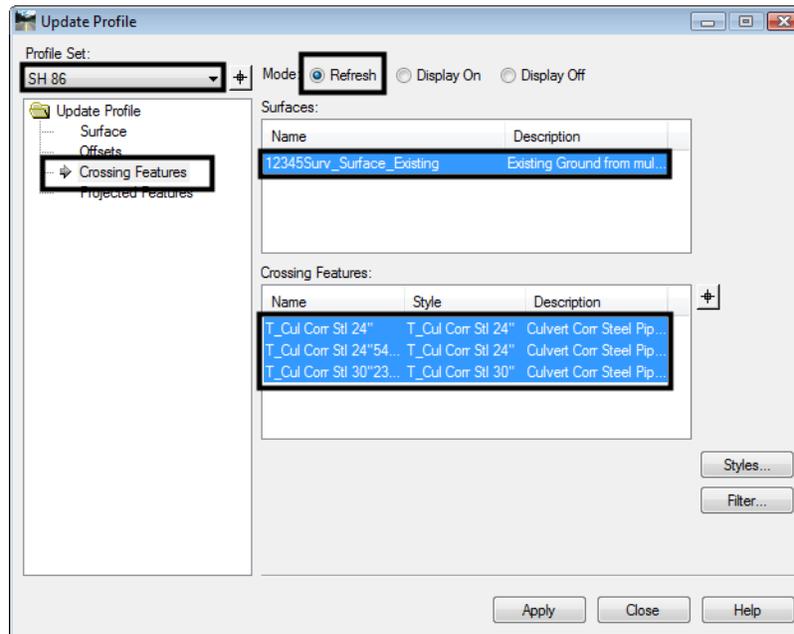
13. Verify **SH 86** is still the active *Profile Set*. Use the target button next to the Profile Set to graphically change the active profile set.

14. In the *Mode* section toggle the **Refresh** radio button.

15. <D> the **Crossing Features** leaf.

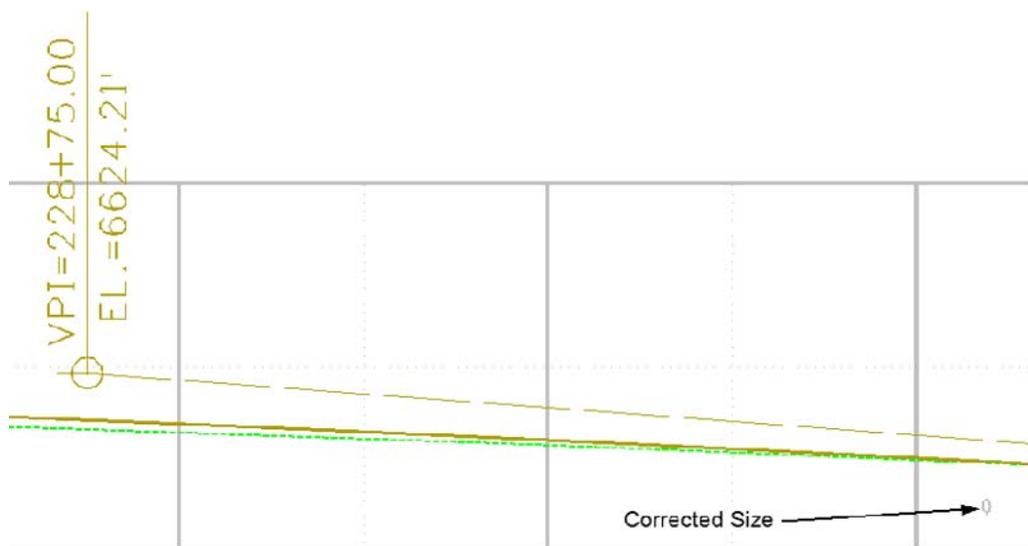
16. <D> the surface name **12345SURV_Surface**.

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



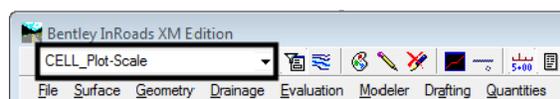
18. <D> the **Apply** button.

19. Using MicroStation viewing tools, locate a crossing culvert and review the results.



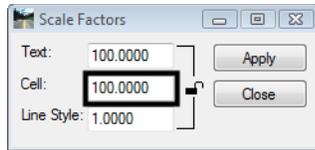
20. Use MicroStation Measuring tools to verify pipe size(s).

21. From the **Locks** toolbar select **CELL_Plot-Scale** filter from the pull down list.



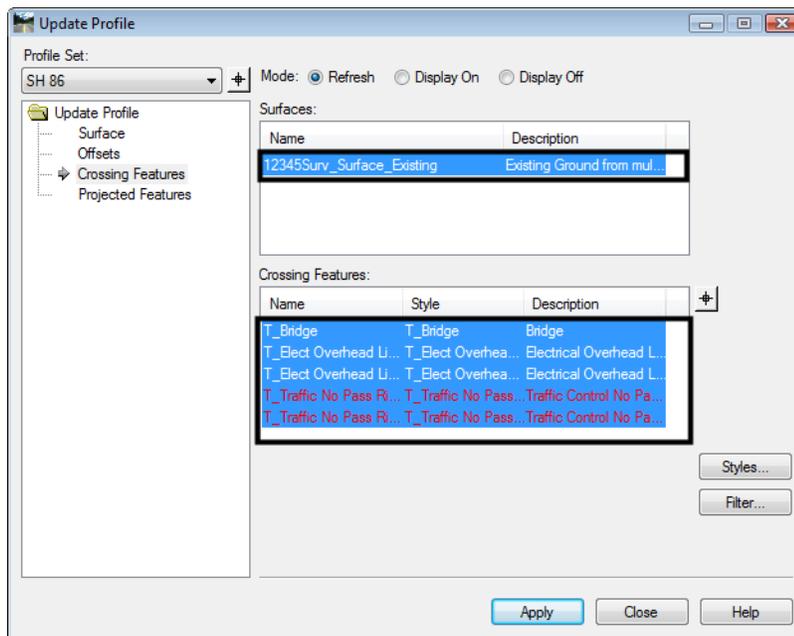
Note: Verify that the feature filter is toggled on.

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

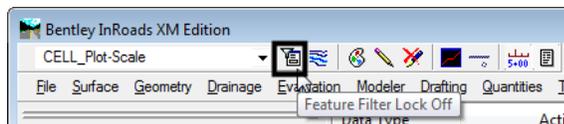


Note: This is the desired plot scale change accordingly.

- Close and reopen the **Update Profile** dialog.



- 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.
- In the Mode section toggle the radio **Refresh** button.
- <D> the **Crossing Features** leaf.
- <D> the surface name **12345SURV_Surface**.
- Select all of the **Crossing Features** listed.
- <D> the **Apply** button.
- 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 6.4 - Annotating a Feature in a Profile

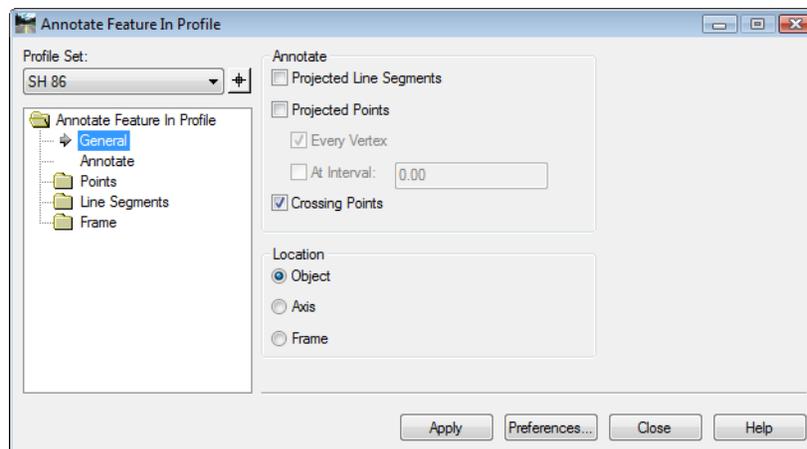
Features that have been displayed in profiles (or cross sections) can be annotated with information extracted from the surface model.

Section Objectives:

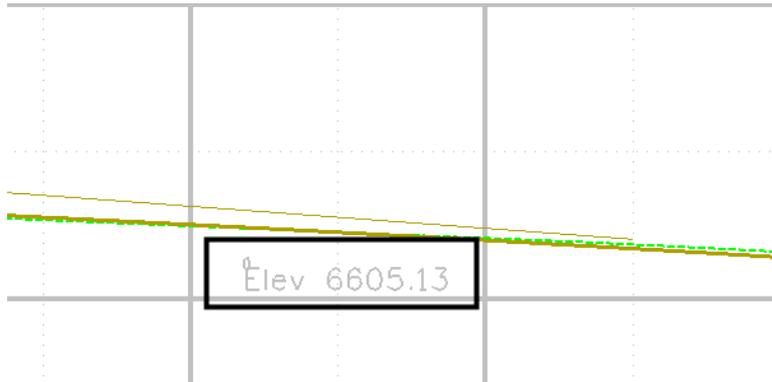
- ◆ Annotate the true scale features in the profile.
1. Using MicroStation commands, window into any culvert displayed in the profile created in the previous lab.
 2. From the **Locks** toolbar select **CELL_PLOT-Scale** filter and verify the feature filter is toggled **On**.



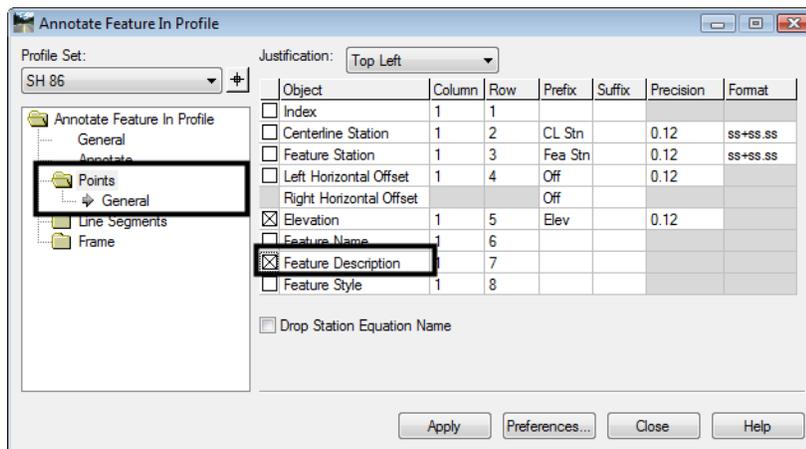
3. Select **Evaluation > Profile > Annotate Feature** in Profile. The **Annotate Feature In Profile** dialog will appear.



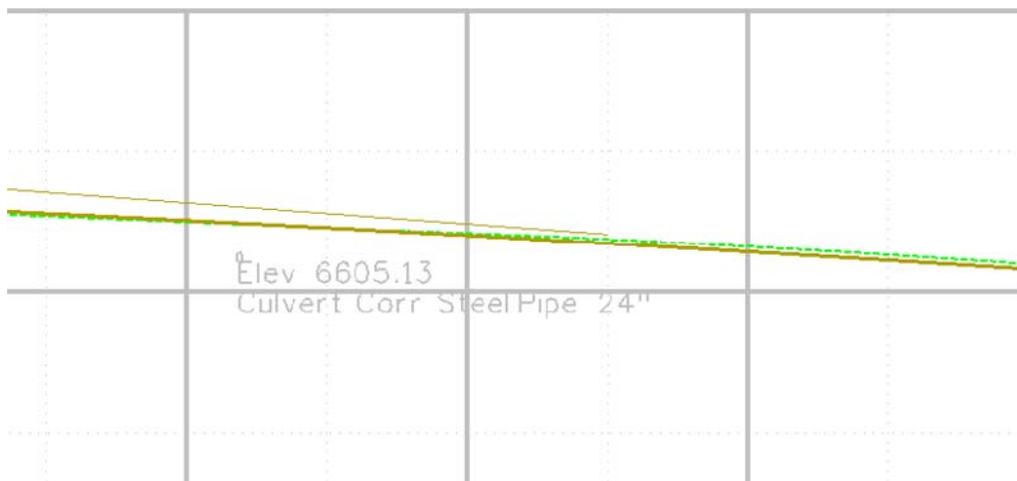
4. <D> the **Apply** button and review the results.



5. <D> the **Points** branch.
6. Check **On the Feature Description**.



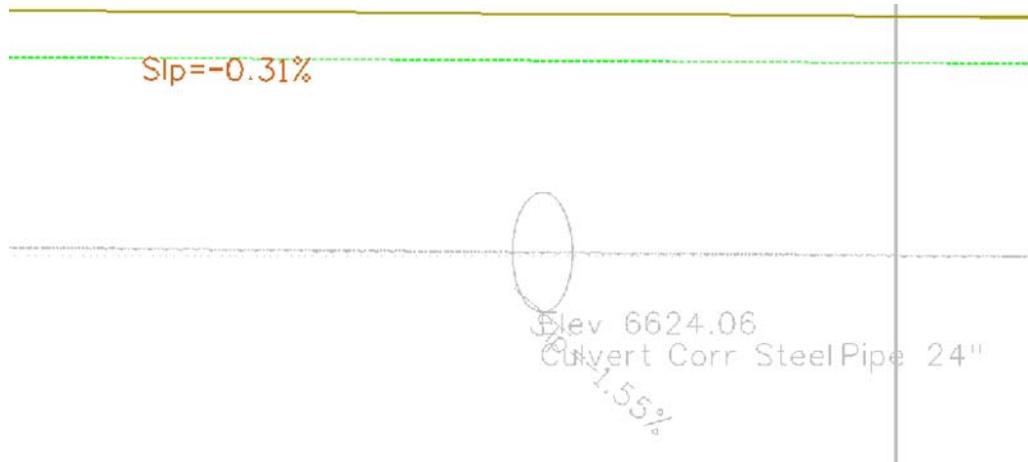
7. <D> the **Apply** button and review the results in your profile.



8. Experiment with enabling other options in the **Point** tab 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.

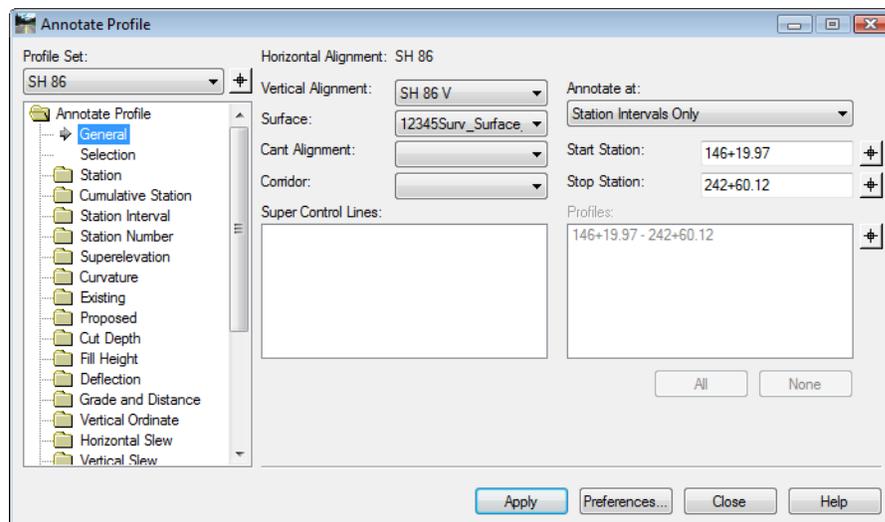
Lab 6.5 - Annotating a Profile

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

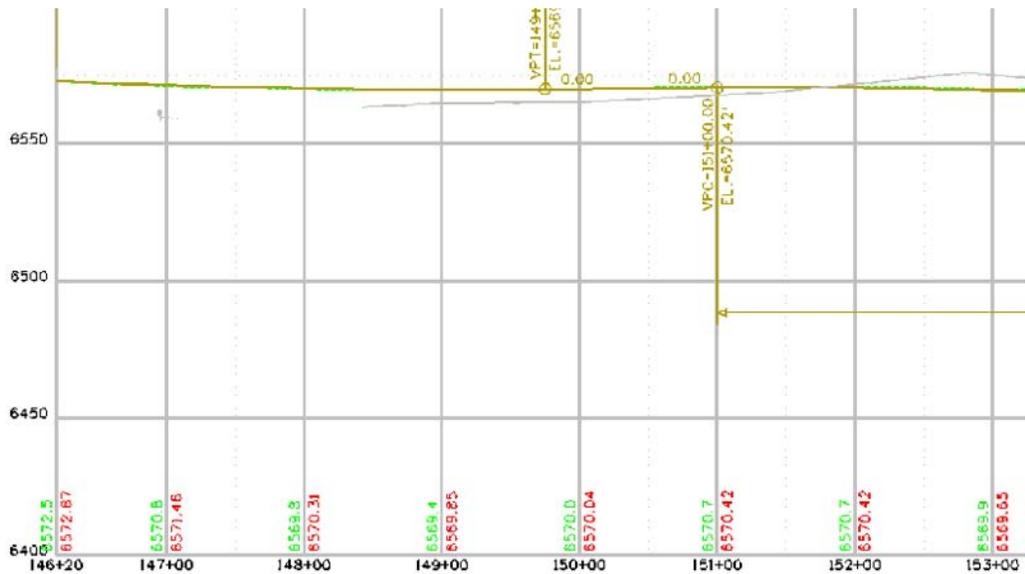
Section Objectives:

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

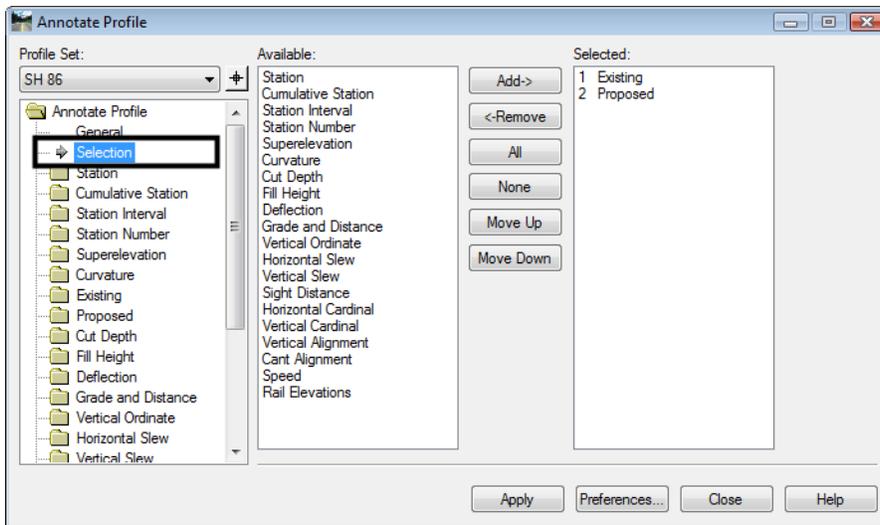
1. Select **Evaluation > Profile > Annotate Profile**.



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



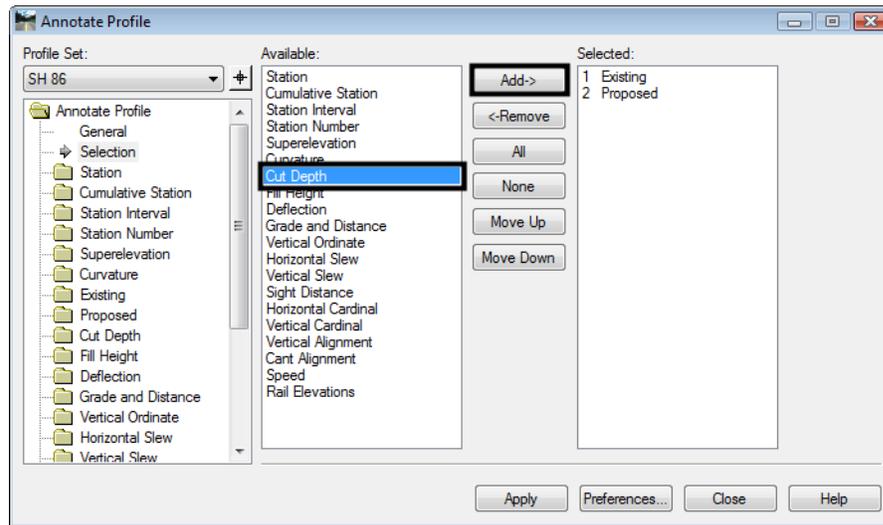
3. Take some time and review the leaves of the **Annotate Profile** dialog. Investigate the remaining tabs and the individual settings for each.
4. Now go back and <D> the **Selection** leaf.



Note: The dialog 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.

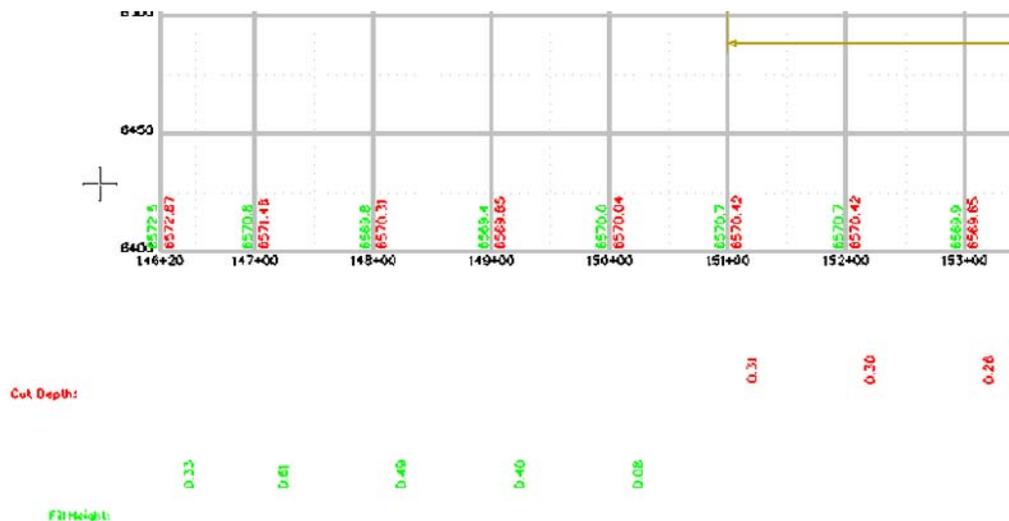


7. <D> the item **Fill Height** from the Available list.
 8. <D> the **Add** button. Fill Height will be added to the Selected list.

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 6.6 - Vertical Alignment Tracking

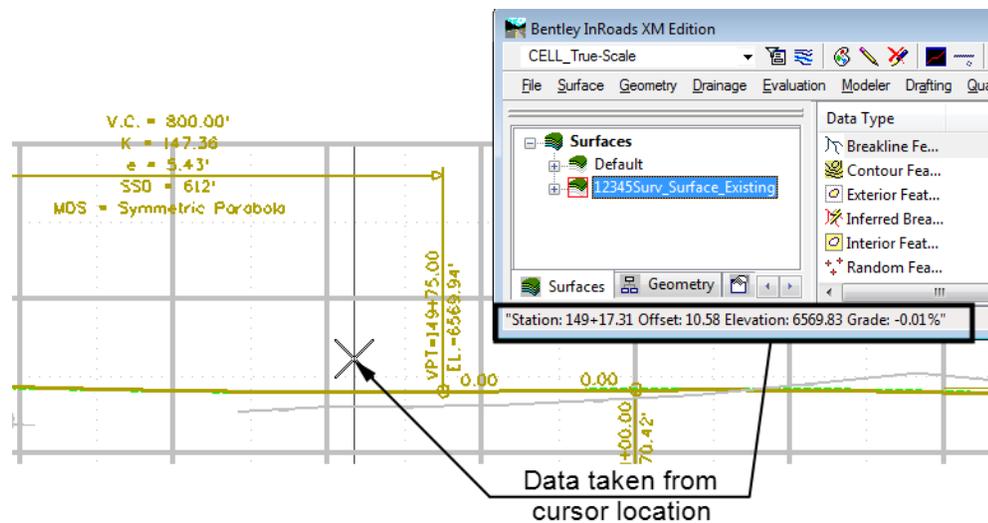
Vertical alignments can be interactively queried similar to horizontal alignments.

Section Objectives:

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

Tracking Vertical Alignments in Profile View

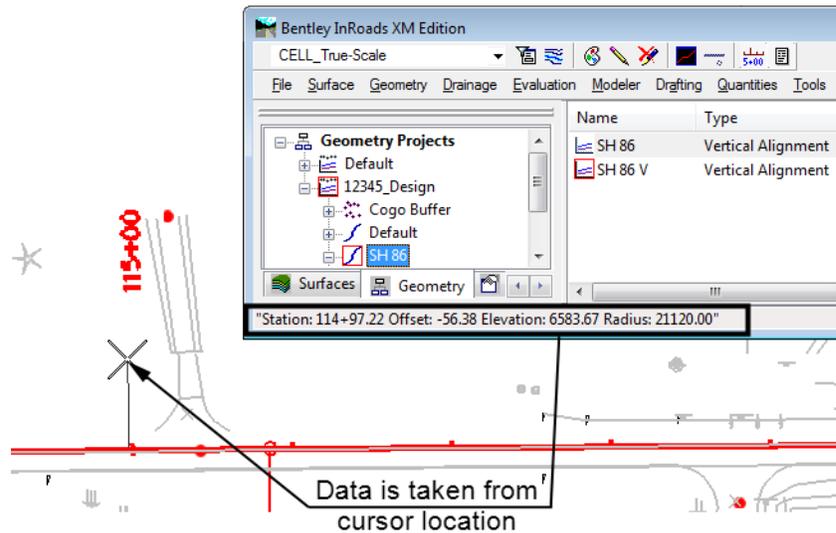
1. Select **Tools > Tracking > Vertical Alignments**.
2. Move the cursor inside the Profile Set window and review the output in the InRoads Status bar.



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

Tracking Vertical Grades in Plan View - Review

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 6.7 - Create a vertical alignment

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

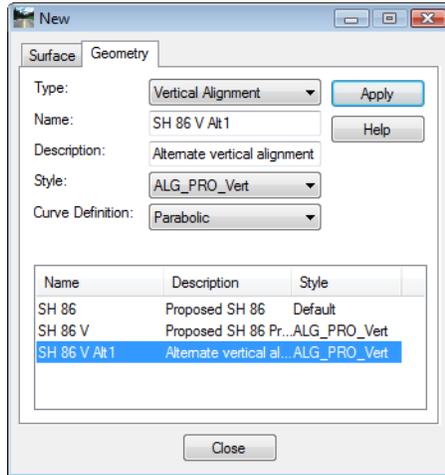
Section Summary:

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

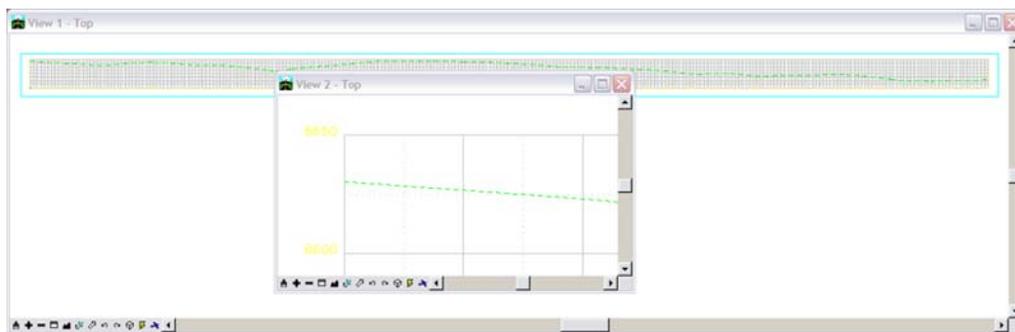
Create a slot in the active geometry project for your vertical alignment.

1. Select **File > New**.
2. Choose the **Geometry** tab.
3. Toggle the Type to Vertical Alignment and set the following:
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**

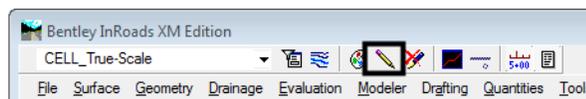


9. Set up your MicroStation windows so the entire profile is visible in one window, then open another MicroStation window and Zoom in to the beginning of the profile as shown.

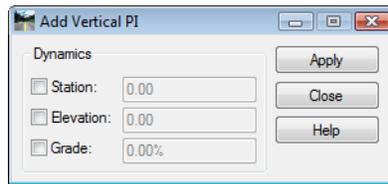


Next, add PVI's to the Vertical Alignment.

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



11. Select **Geometry > Vertical Curve Set > Add PI**.

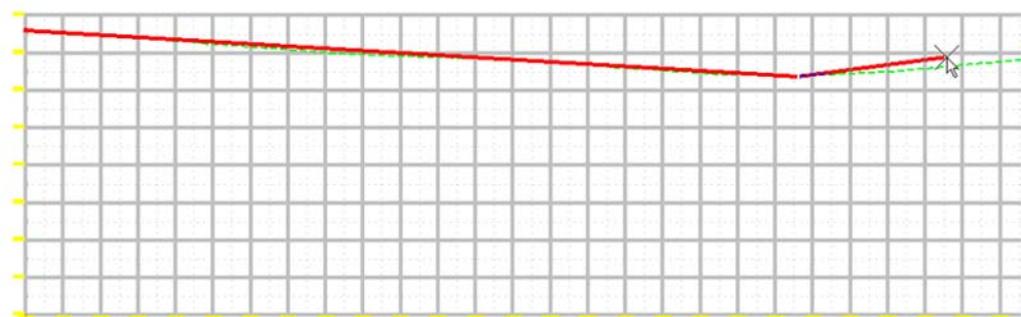


12. Select **Apply**.
13. For the first PVI, snap to the beginning of the ground line in the window where you are zoomed in.



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

◆ ***dg=900,-3.76%***



◆ ***dg=400,1.03%***

◆ ***dg=425,-4.29%***

◆ ***se=11725,6574.78***

The ***dg=*** key-ins place additional vertical PIs at the specified distance and grade. The last one again places a vertical PI at the station and elevation specified.

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.**

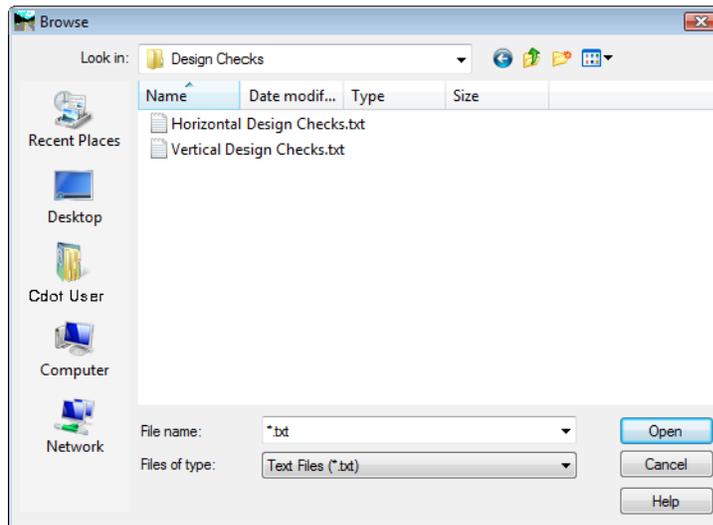
The Define Vertical Curve dialog box is automatically displayed ready to accept input for the first curve on the vertical alignment. To step to other curve sets, you can use *Previous* and *Next*, or *First* and *Last*.

18. Under the **Vertical Curve** category,

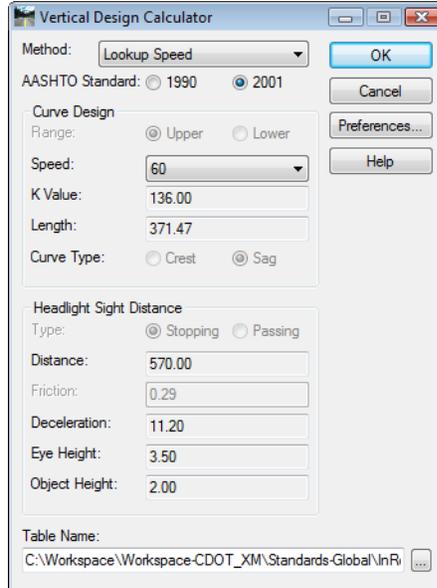
- ◆ Set **Calculate By** to **Length of Curve**.
- ◆ Key in **300** for the **Length**.

19. Select **Design Calc.**

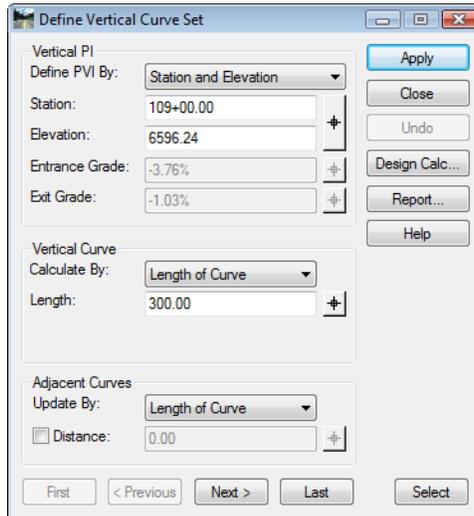
20. Click in the Table Name and Browse to the **C:\Program Files\Workspace-CDOT\Standards-Global \InRoads\Design Checks** folder and choose the file **Vertical Design Checks.txt**.



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



22. Choose **Cancel** when done. You do not want to accept the minimum curve, just verify that yours meets the criteria.

23. Select **Apply**24. Select **Next** to move to the second intersection of tangents.

- ◆ Set *Calculate By*: to **Length of Curve**.
- ◆ Key in **250** for the *Length*.

25. Select **Design Calc.**

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

27. Choose **Cancel** when done.28. Select **Apply**.29. Close the **Define Vertical Curve Set** dialog.**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.

