# LAB 3 - Working With Alignments

Alignments are reference points that are used to relate the design world to the real world. The coordinates that make up the alignment are located at the construction site and measurements for design elements are taken from these coordinates.

In this lab, a horizontal and vertical alignment is created that represents the new flowline for a drainage channel. The new flowline must match the existing flowline horizontally and vertically at the beginning and end of the alignment as well as at an inlet structure in the middle.

### *Chapter Objectives:*

- Import a horizontal alignment from a graphic element.
- Add a horizontal curve to the alignment.
- Create a profile.
- Define a vertical alignment.

The following files are used in this lab:

- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Bridge\Drawings\Reference Files\12345BRDG_Model-Drain.dgn
- C:\Projects\12345\Bridge\Drawings\Reference Files\12345BRDG_Prof.dgn
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Drain

## Lab 3.1 - Draw Graphic Elements for the Horizontal Alignment

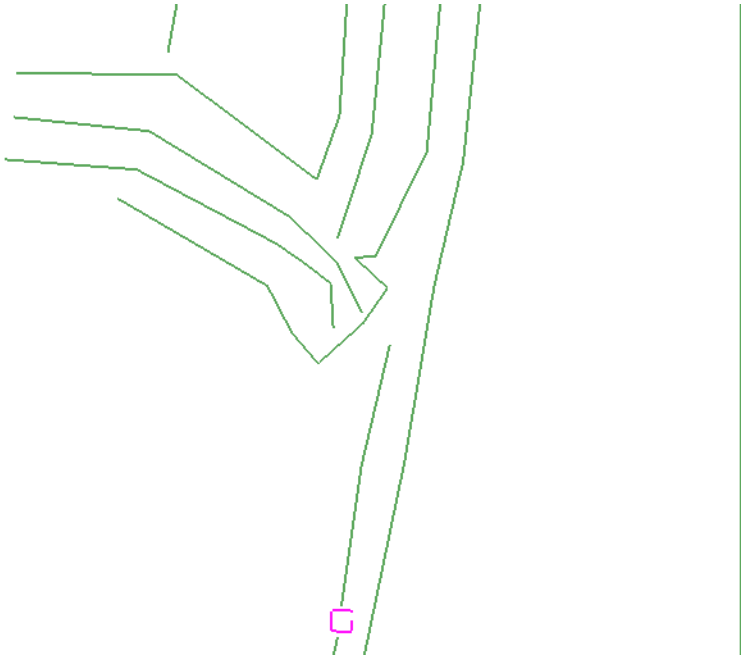
There are numerous methods for entering horizontal alignment data into InRoads. Most of these methods are designed for survey and roadway geometry. Because this lab is not concerned with roadway geometric design criteria, the alignment can be laid out graphically then imported into inRoads.

### *Section Objectives:*

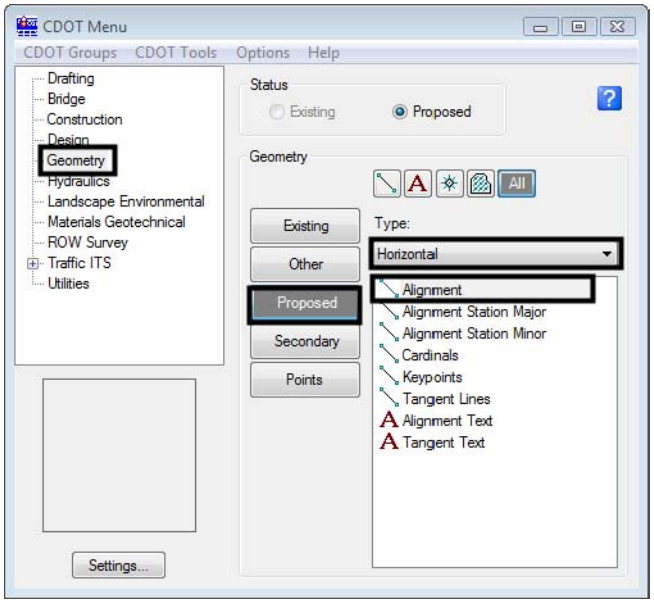
- Create MicroStation graphic elements that represent the alignment.
- Create a complex chain from those elements.
- Import the graphic as a horizontal alignment.
- Change the direction of the alignment, if needed.

1. Start MicroStation and InRoads using the **12345BRDG_Model-Drain.dgn** file.
2. In the main InRoads dialog box, verify that the ***CDOT_Civil.xin*** is loaded.
3. From the InRoads menu bar, select **File > Open**.
4. Navigate to the **C:\Projects\12345\ROW_Survey\InRoads\DTM** directory and open the **12345_Drain** file

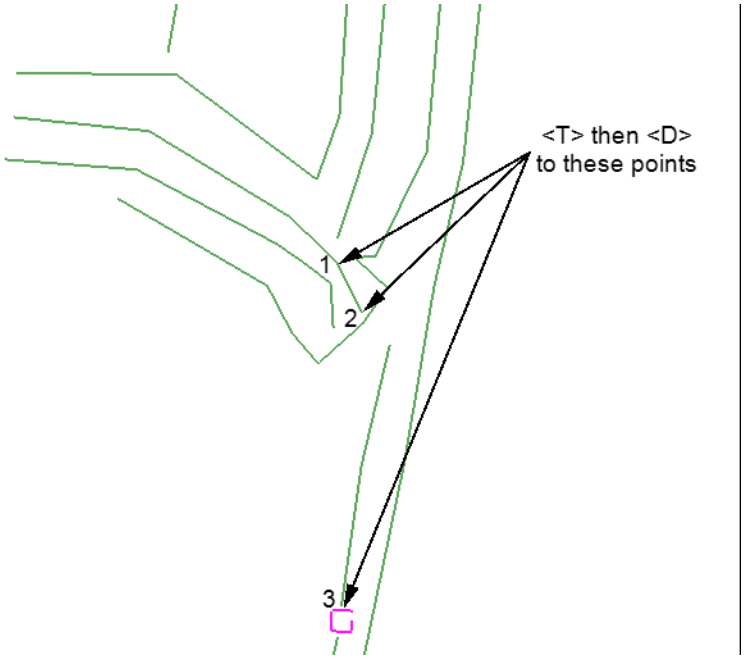
5. Using the MicroStation view controls, zoom into the area shown in the illustration below.



6. From the ***CDOT Menu***, select the **Geometry** group.
7. **<D>** the **Proposed** button.
8. Verify that the ***Type*** is set to **Horizontal**.
9. Highlight **Alignment** from the item list. This activates the Place SmartLine command.

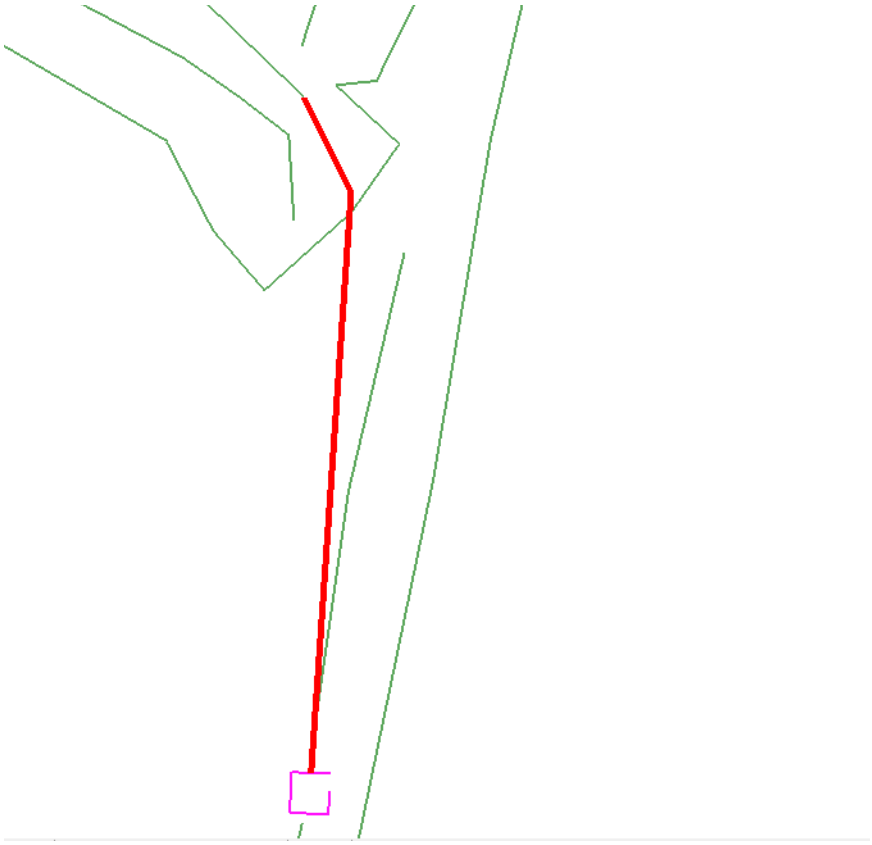


10. **<T>** then **<D>** on the points shown in the illustration below.



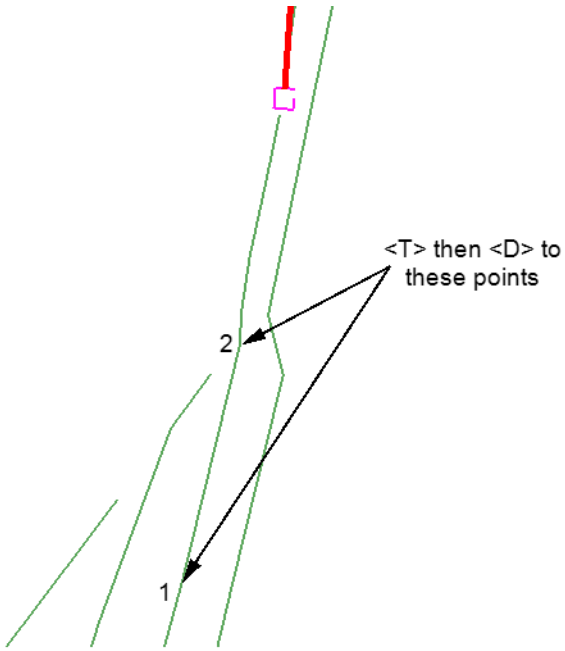

Points 1 and 2 are on the flowline of the existing channel. Point 3 is in the center of the top side of the inlet structure.

11. **<R>** to exit the **Place SmartLine** command. The result is a linestring placed as shown below.



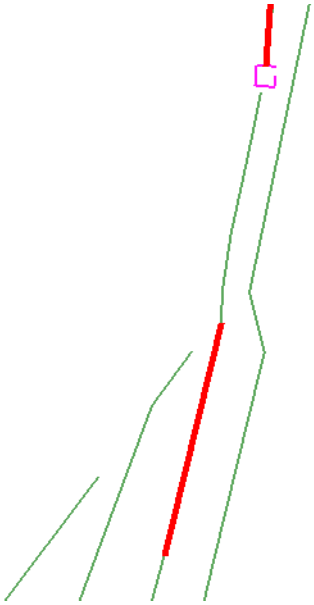
12. Zoom out to see the channel below the inlet.

13. **<T>** then **<D>** on the points shown in the illustration below.



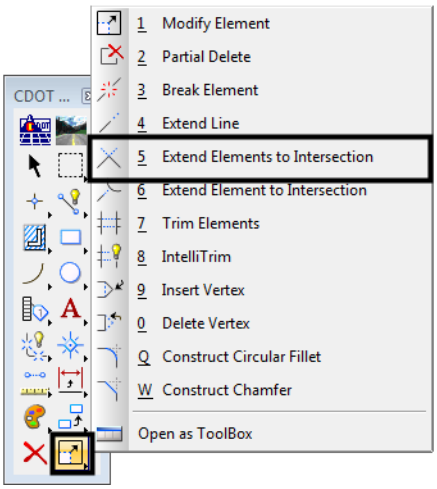

This line will match the new channel to the existing channel below the inlet.

14. **<R>** to exit the **Place SmartLine** command. The result is a linestring placed as shown below.



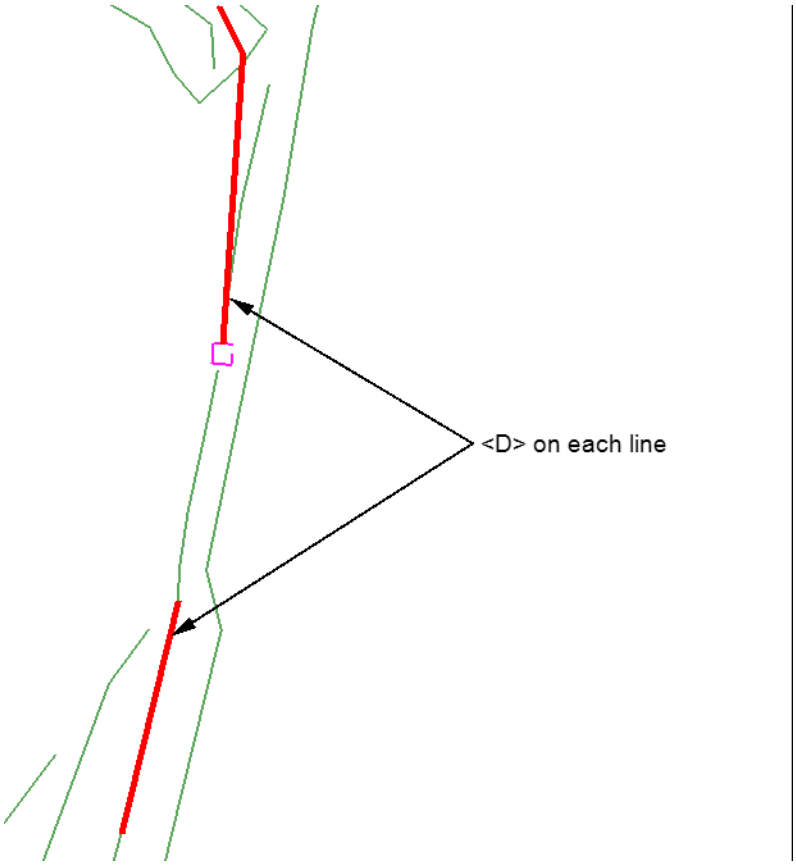
In order to create an alignment from these elements must match up end to end. The MicroStation Extend Elements to Intersection is used to accomplish this.

15. From the MicroStation Main toolbar select the **Extend Elements to Intersection** command.




16. **<D>** on the first linestring near the inlet.

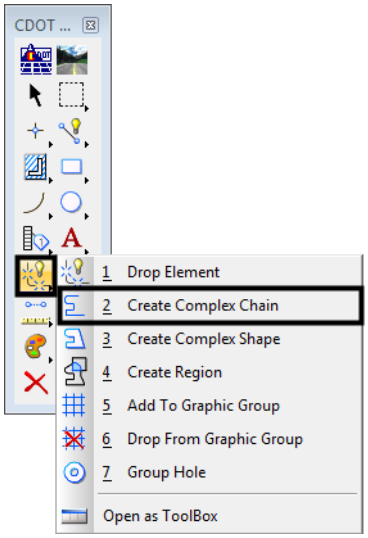
17. **<D>** the second linestring near the end closest to the inlet.




***Note:*** If you are having trouble selecting the correct lines, the green terrain lines can be deleted to get them out of the way.

The MicroStation Create Complex Chain command is used to join the two linestrings into a single element which can be imported into InRoads as a horizontal alignment.

18. From the MicroStation Main toolbar select the **Create Complex Chain** command.




19. **<D>** on each line, then **<D>** in a blank area to accept the elements.

20. **<R>** to exit the **Create Complex Chain** command.

This completes the linestring that will be used for the alignment. Next, the linestring is imported into InRoads.

### *Section Summary:*

- MicroStation graphic elements can be used to create InRoads alignments.
- Multiple elements can be joined to create a single element which is easier to import into a single alignment.

## Lab 3.2 - Create a Geometry Project and Import a Horizontal Alignment

### *Section Objectives:*

- Create a new InRoads geometry project.
- Import the chain into InRoads.

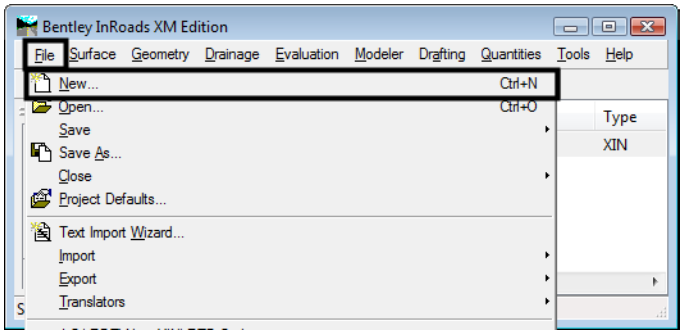
The first step is to create a Geometry Project. This is the file that holds the horizontal and vertical alignment data.

1. Start MicroStation and InRoads (if they are not already started) and open the ***12345BRDG_Model-Drain.dgn*** file.

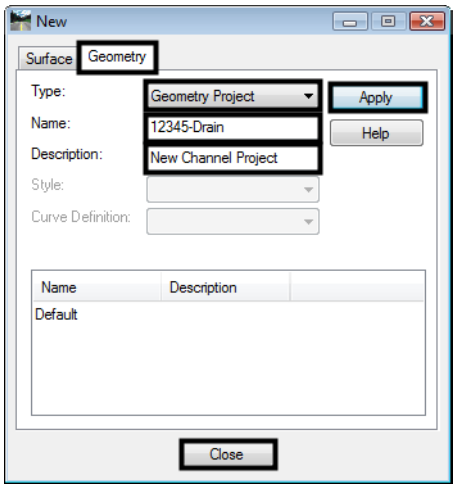
2. If InRoads was already opened, save and close any InRoads data files that are open.

3. From the inRoads menu, open the ***C:\Projects\12345\ROW_Survey\InRoads\DTM\12345_Drain*** file.

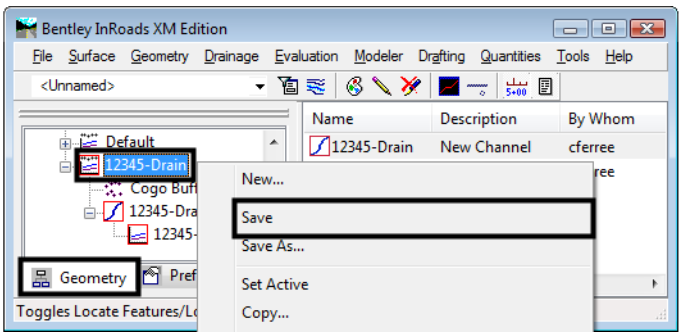
4. From the InRoads main menu, select **File > New**.




5. In the ***New*** dialog box, **<D>** the **Geometry** tab.
6. Set the ***Type*** to **Geometry Project**.
7. Key in ***12345-Drain*** for the ***Name***.
8. Key in ***New channel project*** for the ***Description***.
9. **<D> Apply** then **<D> Close** to dismiss the dialog box.



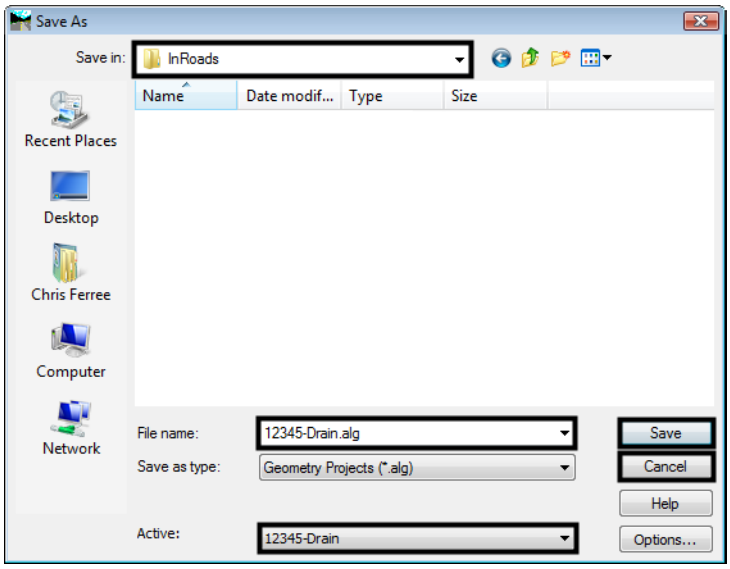

10. On the InRoads Explorer, **<D>** the **Geometry** tab.
11. **<R>** on the **12345-Drain** geometry project and select **Save** from the right click menu.



12. In the ***Save As*** dialog box, navigate to the **C:\Projects\12345\Bridge\InRoads** folder.

13. At the bottom of the dialog box, use the ***Active*** drop down menu to reselect the **12345-Drain** geometry project. This will automatically fill in the name field so that the name on the hard drive matches what is shown in InRoads.

14. **<D> Save** then **<D> Cancel** to dismiss the dialog box.




Next, the horizontal alignment is created from the graphic element drawn above.

15. From the InRoads menu bar, select **File > Import > Geometry**.

16. In the ***Import Geometry*** dialog box, verify that the **From Graphics** tab is selected.

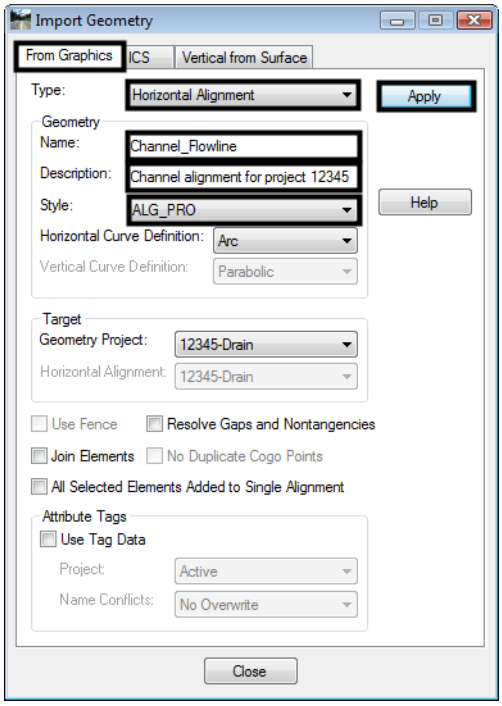
17. Set the ***Type*** to **Horizontal Alignment**.

18. Key in ***Channel_Flowline*** for the ***Name***.

19. Key in ***Channel alignment for project 12345*** for the ***Description***.

20. Set the ***Style*** to **ALG_PRO**.

21. **<D> Apply**. The ***Import Geometry*** dialog box minimizes.




22. **<D>** on the linestring then **<D>** in a blank area to accept the element.

23. **<R>** to end the command. The ***Import Geometry*** dialog box is redisplayed.

24. **<D>** the **Close** button to dismiss the dialog box.

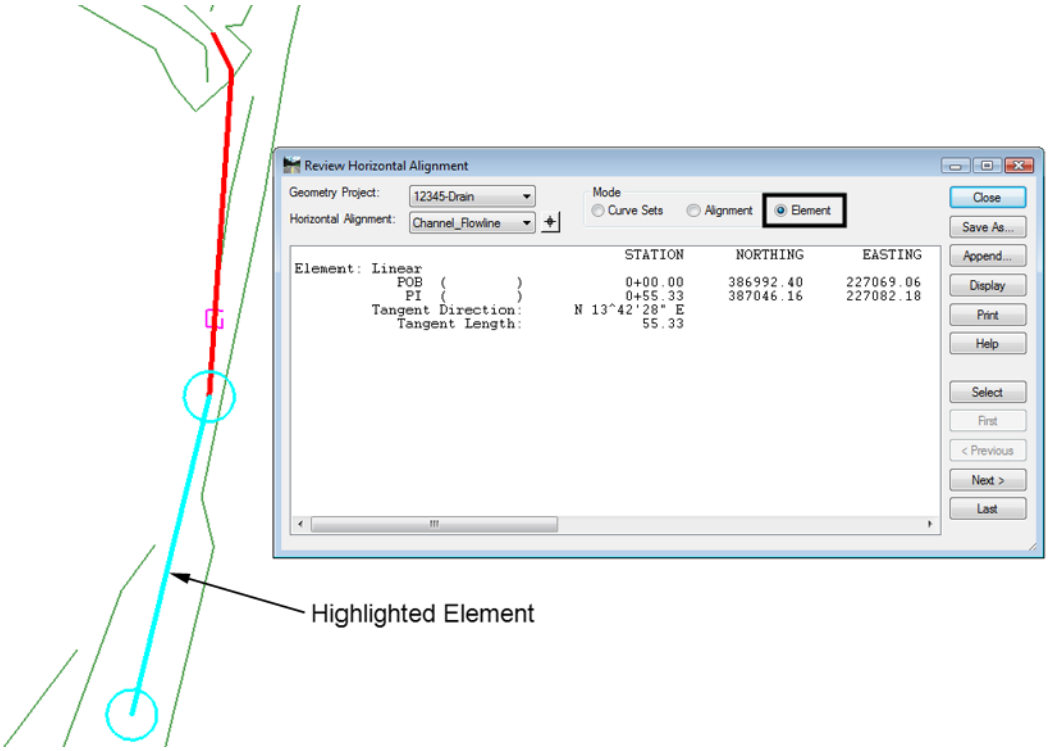
The linestring has now been added to the 12345-Drain geometry project. Next, the direction of the alignment must be determined. The alignment should run from north to south. The direction of the alignment is determined by the direction of the linestring (or complex chain). To check the direction of the alignment use the review command.

25. In the InRoads explorer, expand the **12345-Drain** geometry project to show the **Channel_Flowline** alignment.

26. **<R>** on the **Channel_Flowline** alignment and select **Review** from the right click menu.

27. Move the **Review Horizontal Alignment** dialog box so that the **Channel_Flowline** alignment is visible.

28. In the ***Review Horizontal Alignment*** dialog box, toggle the mode to Element. This causes the first element of the alignment to highlight.



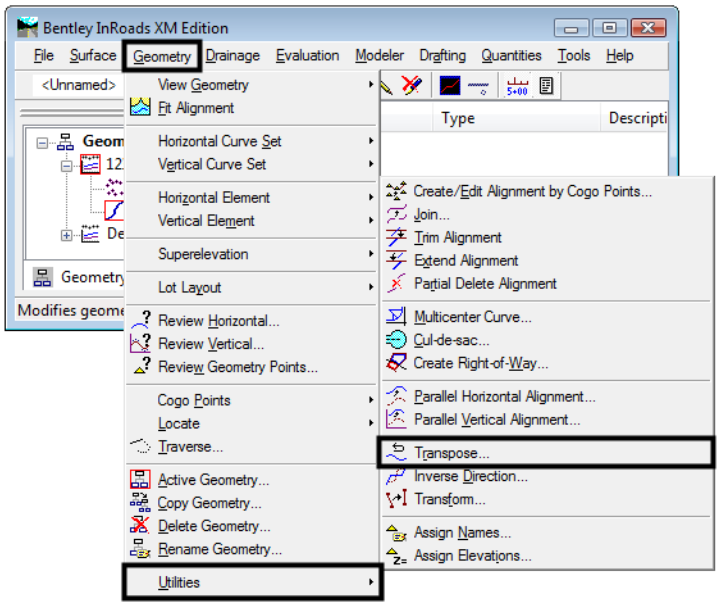

29. **<D> Close** to dismiss the Review Horizontal Alignment dialog box.

If the element highlights as shown in the image above, the alignment is running the wrong way.

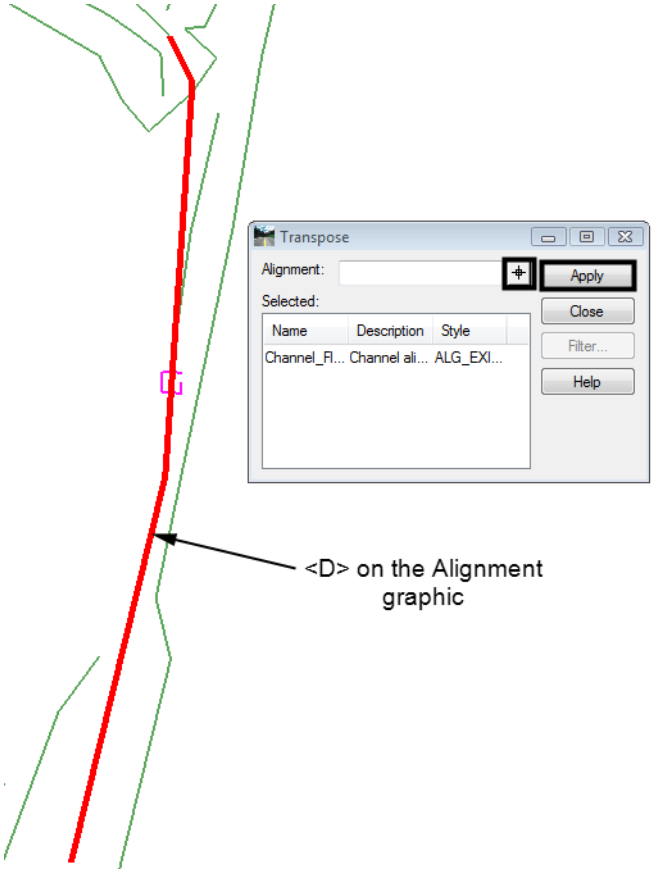
To change the direction of the alignment:

***Important!*** Complete steps 30 through 33 only if your alignment starts at the south end, as illustrated above.

30. From the InRoads main menu bar, select **Geometry > Utilities > Transpose**.

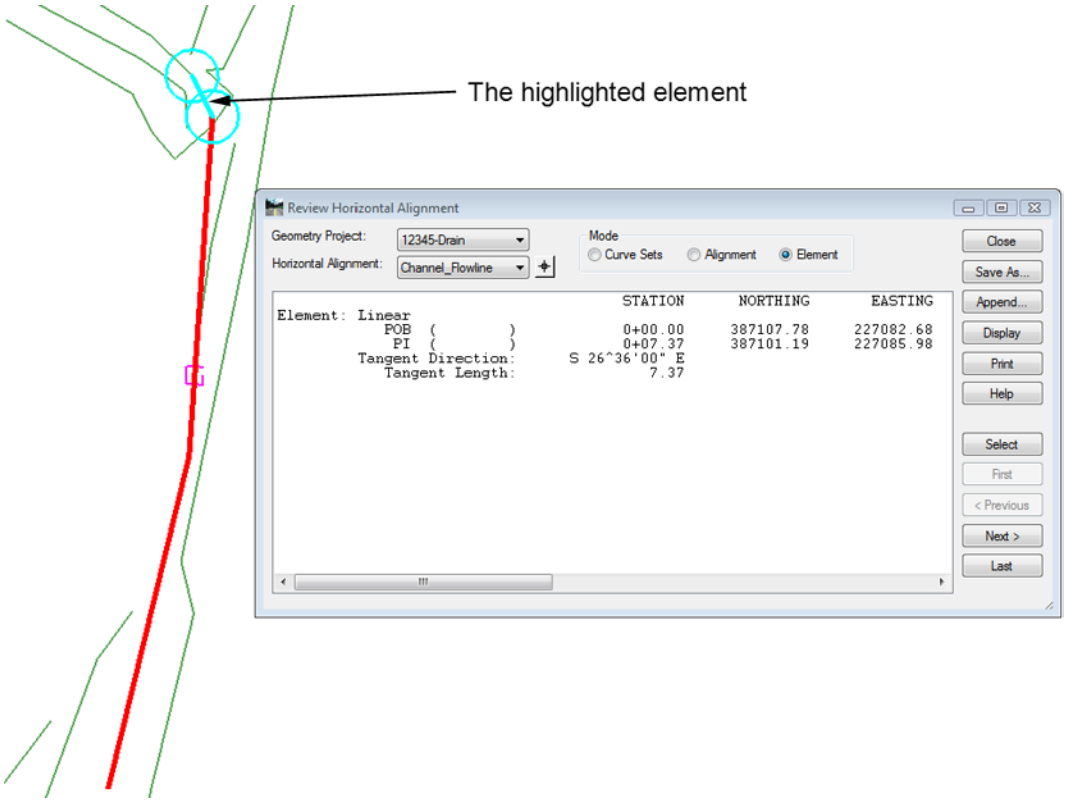



31. In the Transpose dialog box, **<D>** the "target" button then **<D>** on the alignment. **<D>** in a blank area to accept.



32. The alignment name appears in the Selected list. **<D>** the **Apply** button. **<D> Close** to dismiss the ***Transpose*** dialog box.

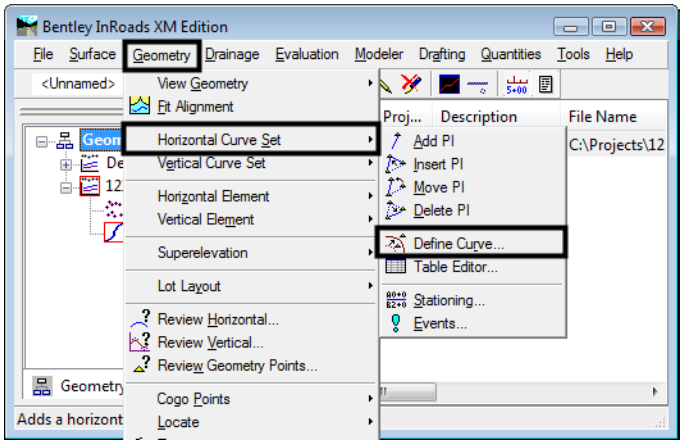
33. Review the alignment again. The north most element highlights indicating the alignment now runs in the desired direction.



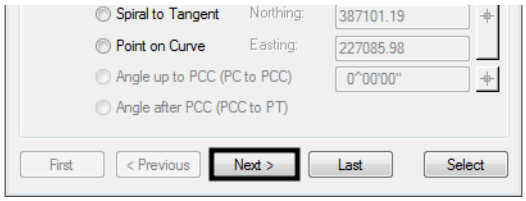

34. **<D> Close** to dismiss the Review Horizontal Alignment dialog box.

To smooth the intersection between the last two segments of the alignment, a horizontal curve is added to the alignment.

35. From the InRoads menu bar, select **Geometry > Horizontal Curve Set > Define Curve**.

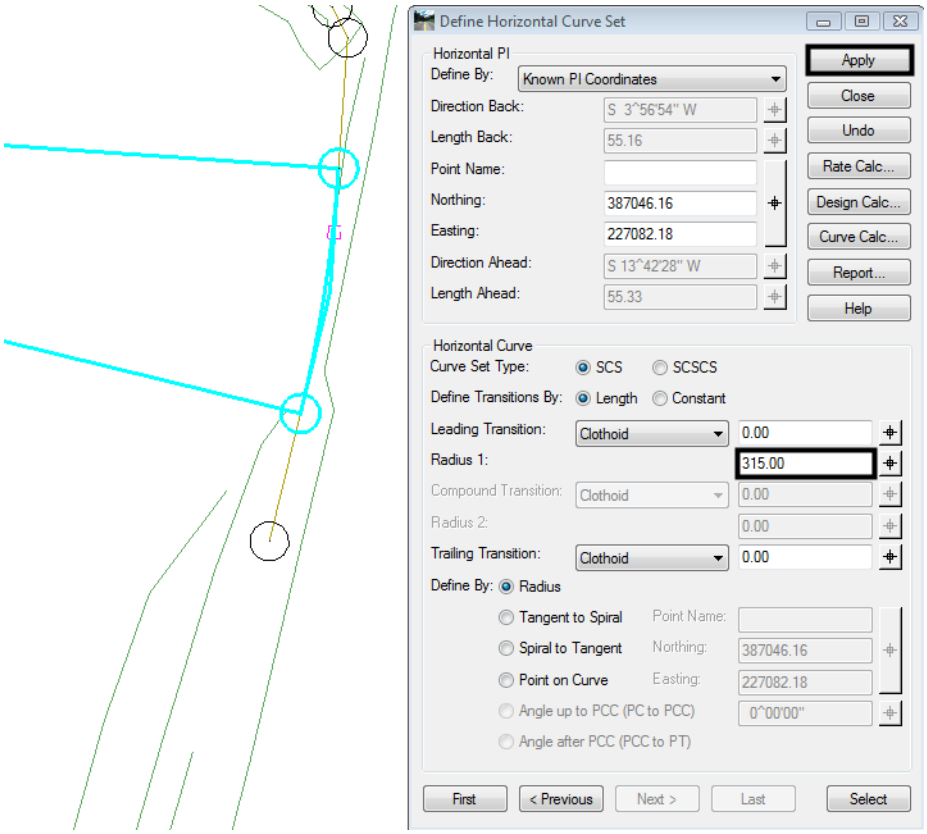


36. The first PI highlighted does not need a curve because that segment of the alignment is there to match the existing flowline. **<D>** the **Next** button to move to the next PI.




37. In the ***Radius 1*** field, key in ***315***. This radius is a design decision made by the engineer.

38. **<D> Apply**. The MicroStation graphics are updated to show the radius.




39. **<D> Close** to dismiss the ***Define Horizontal Curve Set*** dialog box.

40. **In the InRoads explorer, <R>** on the **12345-Drain** geometry project and select **Save** from the right click menu.

## *Section Summary:*

- The Geometry project holds horizontal and vertical alignment data.
- Use the same name for the geometry project when saving it as used when it was created.
- When importing a horizontal alignment from graphics, the direction of the element determines the direction of the alignment.

# Lab 3.3 - Creating a Vertical Alignment

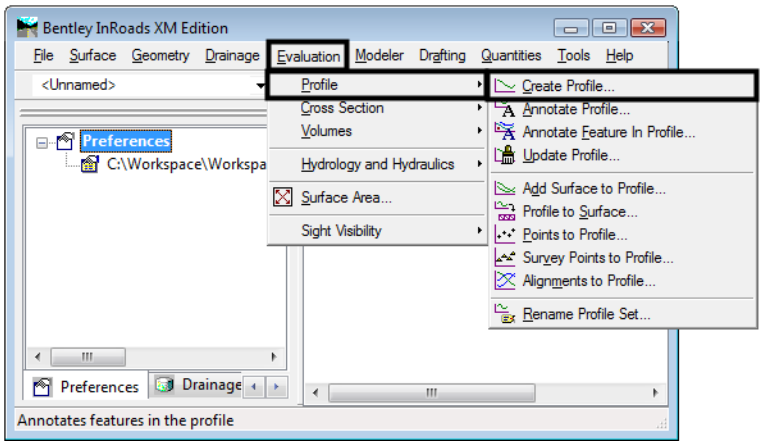
A vertical alignment controls the elevation of the template as it is placed along the corridor. Vertical alignments are typically built in a profile window.

## *Section Objectives:*

- Create a profile along the new horizontal alignment.
- Create a vertical alignment placeholder.
- Add data to the vertical alignment

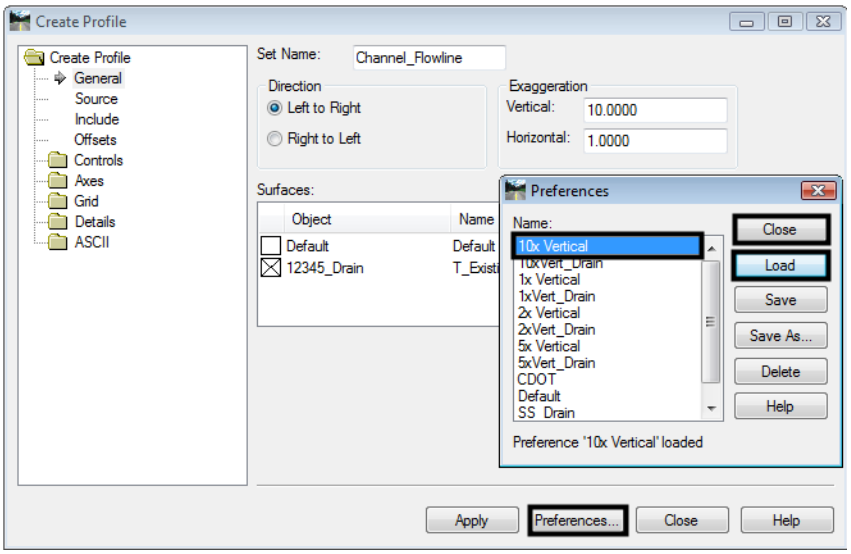
In order to add data to a vertical alignment, a profile window is required.

1. From the MicroStation menu bar, select **File > Open.**
2. Navigate to the **C:\Projects\12345\Bridge\Drawings\Reference Files** folder and select the **12345BRDG_Prof.dgn** file.
3. From the InRoads menu bar, select **Evaluation > Profile > Create Profile**.




4. In the ***Create Profile*** dialog box, **<D>** the **Preferences** button.
5. In the ***Preferences*** dialog box, select **10x Vertical**.

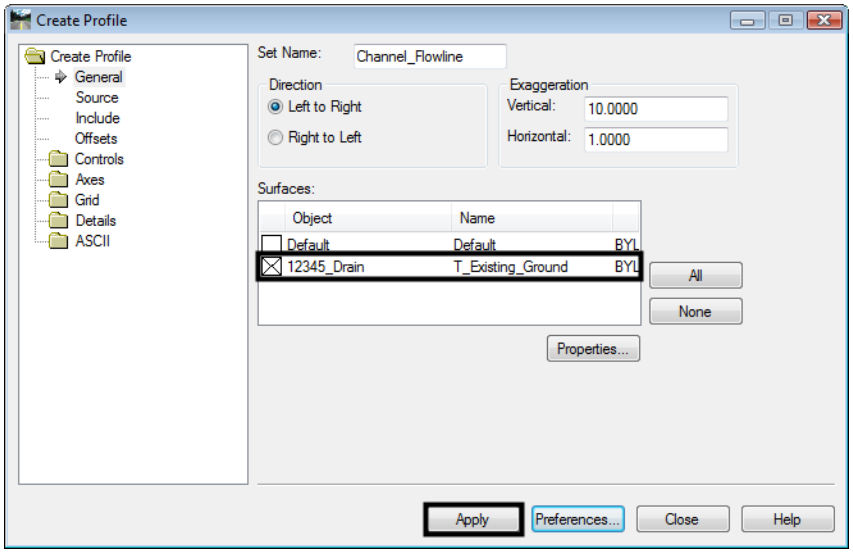
6. **<D> Load** then **<D> Close** to dismiss the ***Preferences*** dialog box.




Using the 10x vertical exaggeration makes it easier to see elevation changes in relatively flat terrain.

7. Verify that the **12345_Drain** surface is the only selected surface.

8. **<D> Apply** then **<D>** in the MicroStation view window. The profile is drawn in the dgn.

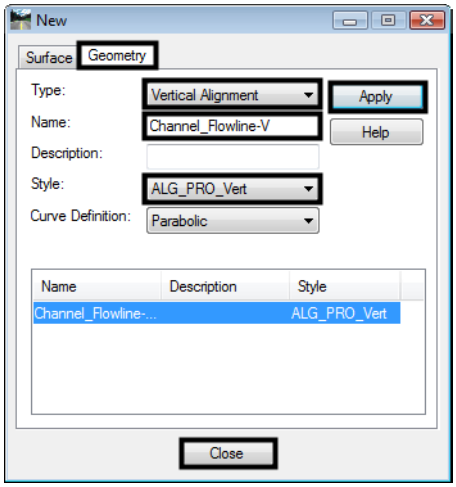



9. **<D> Close** to dismiss the ***Create Profile*** dialog box.

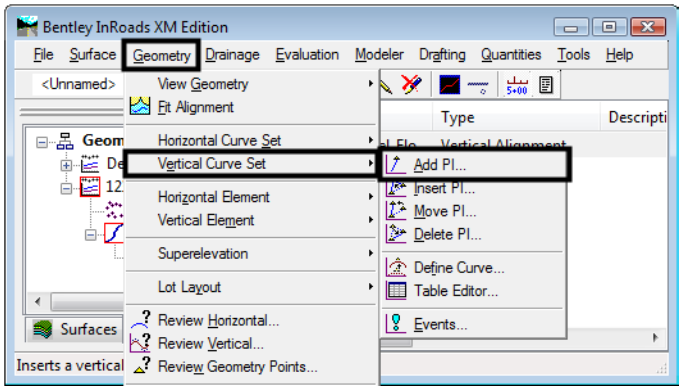
10. In MicroStation, zoom in on the profile so that the elevations between ***4680*** and ***4700*** are visible.

With the profile window created, the vertical alignment data can be entered. The first step in this process is to create a vertical alignment placeholder for the Channel_Flowline horizontal alignment.

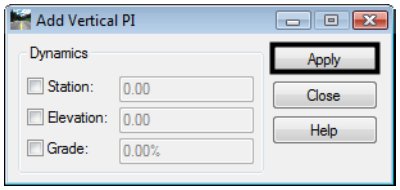
11. On the InRoads menu bar, select **File > New**.
12. In the ***New*** dialog box, **<D>** the **Geometry** tab.
13. Set the ***Type*** to **Vertical Alignment**.
14. Key in ***Channel_Flowline-V*** for the ***Name***.
15. Set the ***Style*** to **ALG_PRO_Vert**.
16. **<D> Apply** then **<D> Close** to dismiss the ***New*** dialog box.



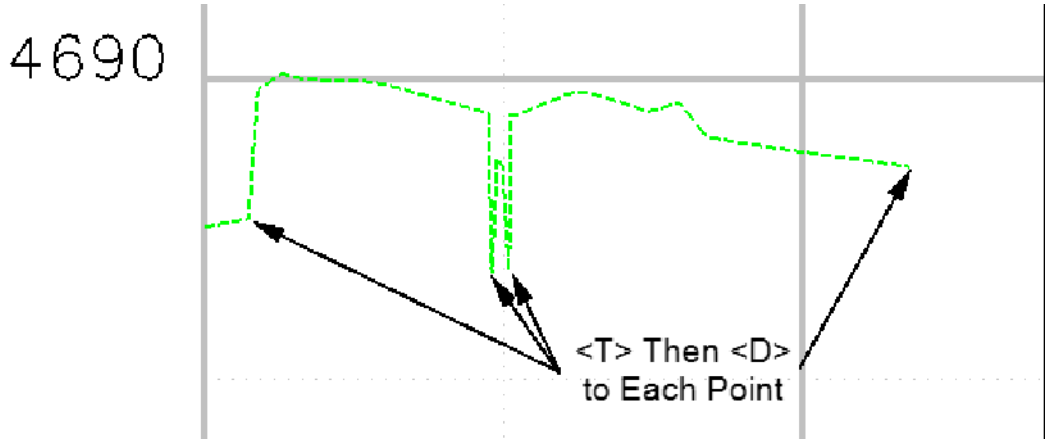

17. On the InRoads menu bar, select **Geometry > Vertical Curve Set > Add PI**.




18. In the ***Add Vertical PI*** dialog box, **<D>** the **Add** button.

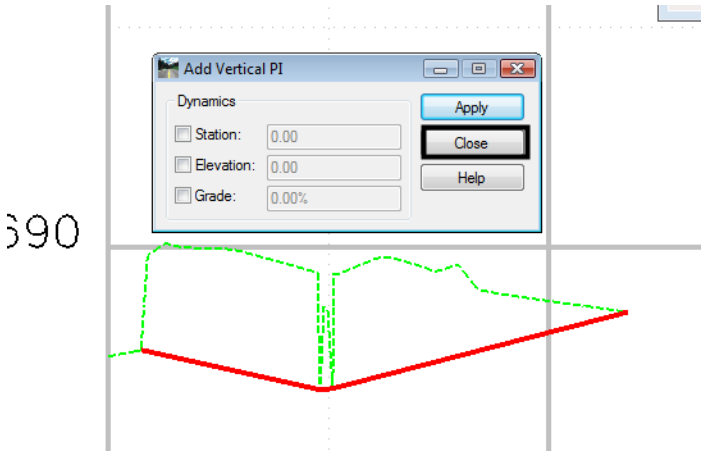


19. **<T>** then **<D>** on each of the points indicated in the illustration below.




20. **<R> <R>** to exit the **Add Vertical PI** command. **<D>** the **Close** button to dismiss the ***Add Vertical PI*** dialog box.

The illustration below shows the completed vertical alignment.




21. **In the InRoads explorer, <R>** on the **12345-Drain** geometry project and select **Save** from the right click menu.

## *Section Summary:*

- A vertical alignments is a child of a horizontal alignment.
- Vertical alignment data is entered within a profile window.
- A profile window can be exaggerated vertically to emphasize elevation changes.
- Vertical PIs can be placed by tentative snapping to elements within the profile window. The SE=*station,elevation* key in can also be used to place vertical PIs.

## *Chapter Summary:*

- Horizontal and vertical alignments are used to define the location or path of construction.
- Horizontal PIs can be placed by tentative snapping to elements within the drawing window. The xy=*easting coordinate,northing coordinate,elevation(optional)* key in can also be used to place horizontal PIs.

- A profile window displays the elevations of the existing ground under the horizontal alignment.
- Profiled are the entry point for vertical alignment data.
- Save the geometry project after data is entered. This file does not save automatically.