LAB 2 - Reviewing Roadway Design Data

Chapter Objectives:

- Develop an understanding of the roadway design data.
- Learn InRoads' tools that are used to display and evaluate surfaces.
- Learn InRoads' tools that are used to display and evaluate alignments.

The following files are used in this lab:

- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\Bridge\Working\12345BRDG_Model-Drain.dgn
- C:\Projects\12345\Design\InRoads\12345 SH52
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 interchange.alg
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange

Lab 2.1 - Requesting InRoads Design Data

See Section 1.5 *Requesting InRoads Design Data* to determine which InRoads data files are needed to start your work. The labs assume that you have been provided the appropriate InRoads data files from the responsible groups noted in Section 1.5.

Lab 2.2 - Using InRoads Surface and Geometry Tools

This section covers how to use surface and geometry viewing, annotation, tracking, and reporting tools to review InRoads data that is provided to the Bridge group by the Roadway Design group. A "working" file will be used to view geometry, cross sections, and profiles.

1. Open MicroStation and InRoads using the *C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn* file.

    Note: The standard filename for working files includes the user's initials in front of the filename. In this case, "CU" stands for CDOT User.

2. Delete any MicroStation graphics currently in the design file.

3. Verify the correct **.xin* file is loaded.

4. Select **File > Open** from the InRoads menu.

5. Open *C:\Projects\12345\Design\InRoads\12345 SH52* and *12345 SH119 SH52 interchange*.*alg*.

6. Open *C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange*.
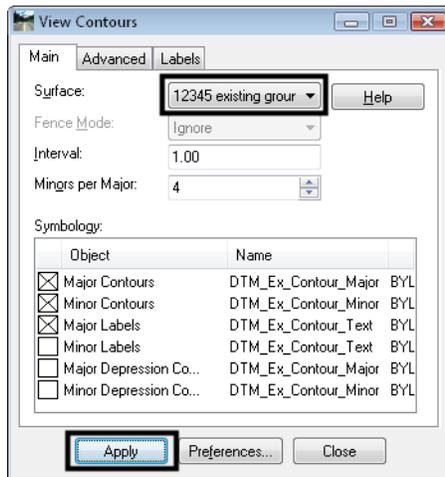
Review the surfaces

1. Select **Surface > View Surface > Contours**.
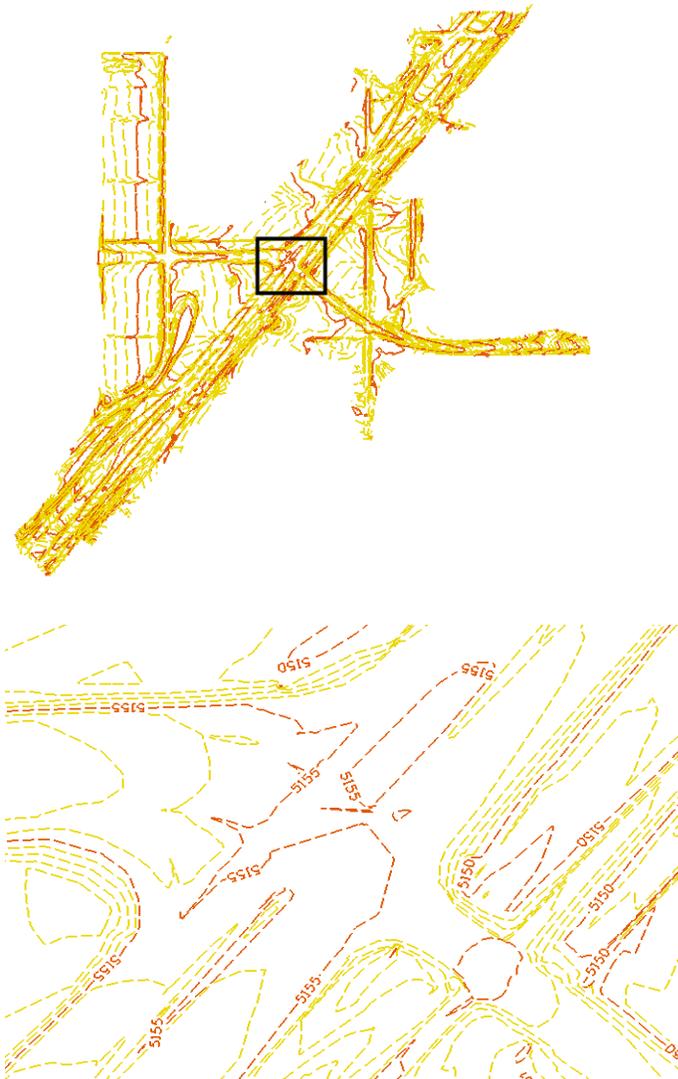
2. Select **Preferences**.
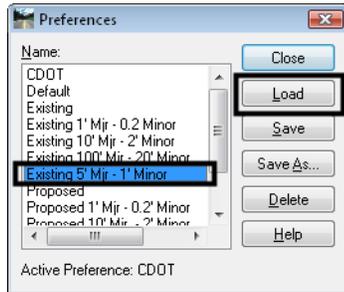
3. Highlight the *Existing 5' Mjr – 1' Minor* preference.

    Note: The *Preference* controls the interval of the contours, number of minors per major
             contour, labeling, levels the contours are displayed on, etc.

4. **<D> Load**, then **Close**.

5. Set the *Surface* to *12345 existing ground for interchange*.

6. **<D> Apply**.

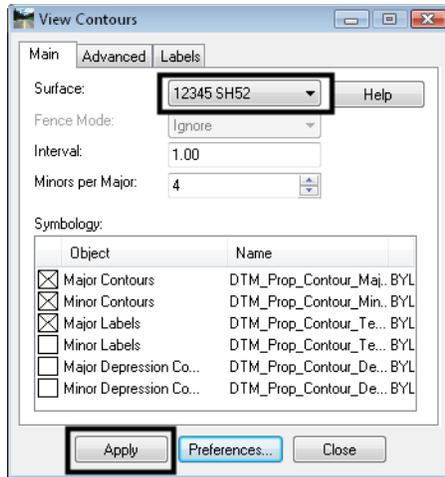7. Review the contours and zoom into the proposed bridge area.

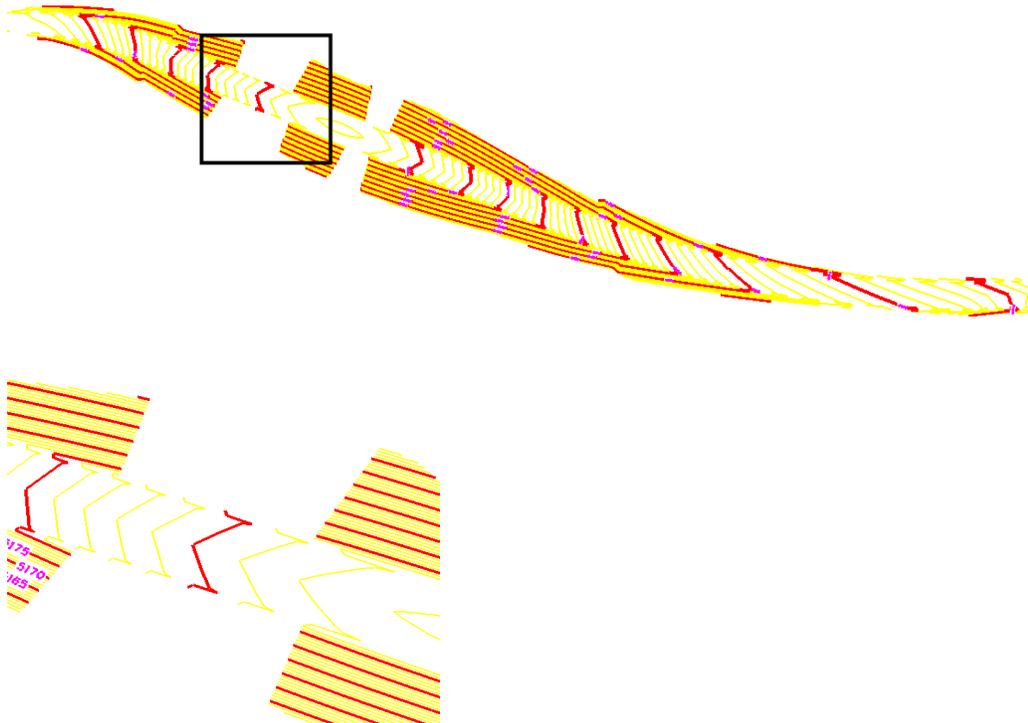8. Use MicroStation to **Delete** the contours when done reviewing.

    Note: The contours are a graphic group, so make certain graphic group lock is on.

9. Select **Preferences** from the **View > Contours** dialog.

10. Highlight the ***Proposed 5' Mjr – 1' Minor*** preference.
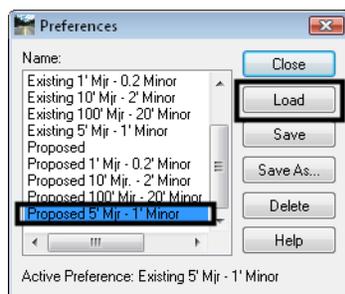
11. **<D>** Load.

12. Switch the surface to *12345 SH52*.

13. **<D>** Apply.

14. Close the *Preferences* dialog.

> *Note:* Loading the preference changes the contour settings so this display uses the proposed symbology.

15. Review the contours and window in as shown.

> ***Note:*** In this case, the design model does not have sideslopes in the area where the proposed bridge will be located.

16. **Close** the *View Contours* dialog.

17. Use MicroStation to **Delete** the contours when done reviewing.

18. Select **Surface > Update 3D/Plan Surface Display**.

> ***Note:*** This command is useful since it provides access to most surface viewing commands in one dialog, and it allows you do delete the displays without using the MicroStation Delete command.

19. Toggle *Display On* and highlight the *existing ground* surface.

20. Toggle on *Perimeter*.
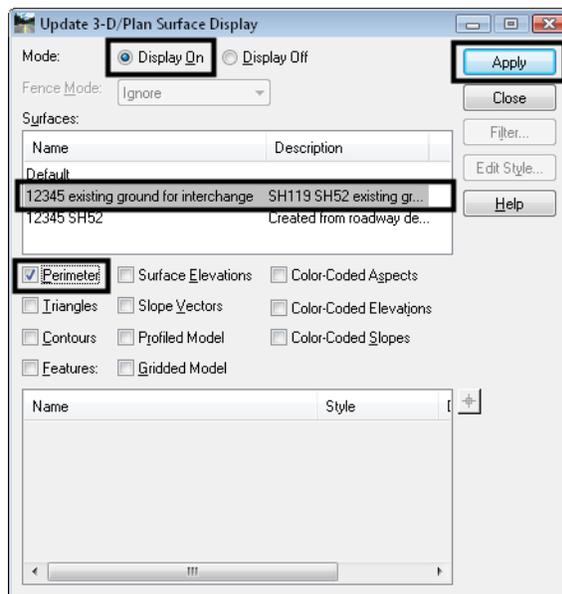
21. **<D> Apply**.

22. **Fit** the MicroStation view to see the perimeter of the surface.

Note: The perimeter of the existing ground is useful to review the limits of the survey.
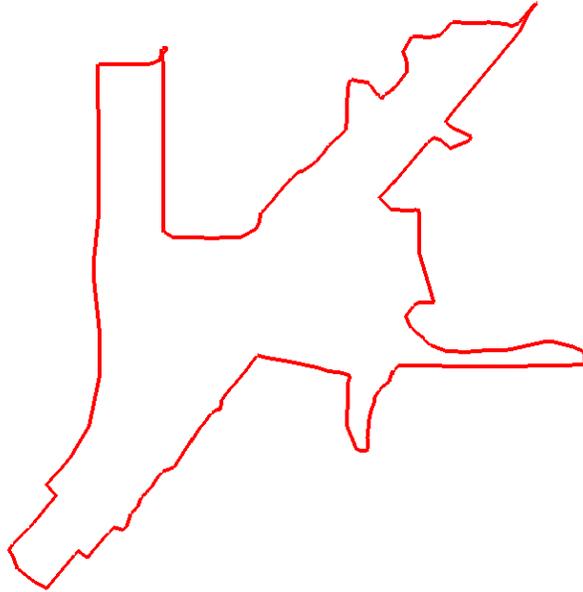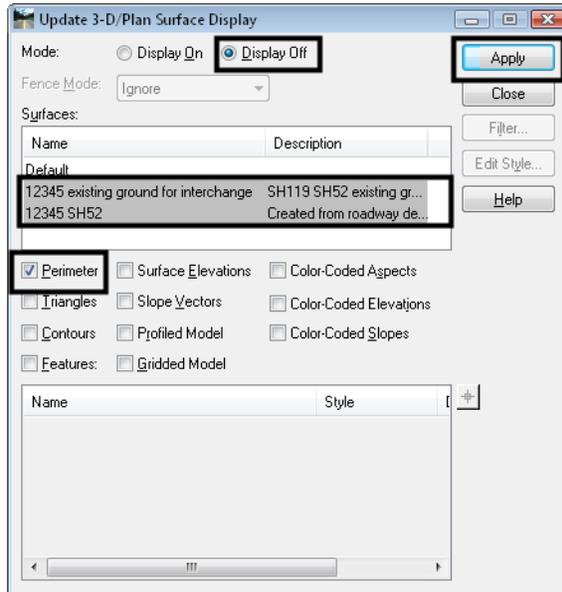

23. Repeat for the *SH52 surface*.

Note: You can highlight more than one surface at a time. These were done separately to more easily tell which surface is which.

24. Toggle *Display Off*.
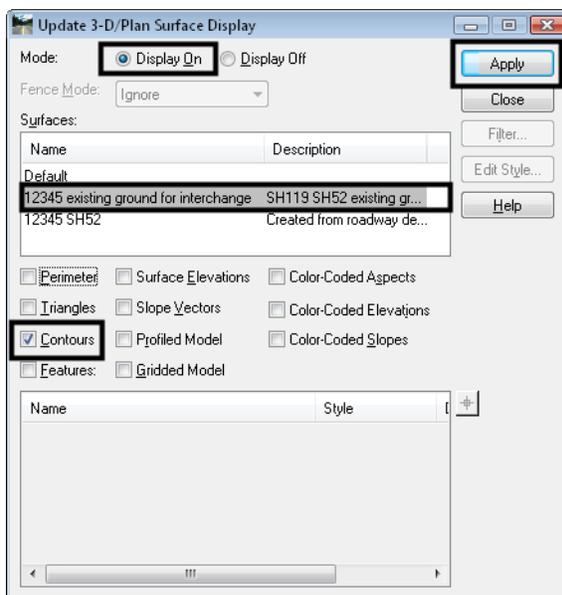
25. Highlight both surfaces.

26. **<D>** **Apply**.

27. Toggle *Display On*.

28. Toggle on *Contours*.

29. Toggle off *Perimeter*.

30. Highlight the *existing ground* surface.

31. **<D>** **Apply**.

32. Review the contour display.

33. Toggle Display Off.

34. **<D> Apply**.

> ***Note:*** You are not given a choice on the preference when using this command for displays, but you were able to delete the perimeter and contours without using the MicroStation delete command.

35. **<D> Close**.

Review alignments using Viewing, Tracking and Stationing

The following InRoads tools will be used in this lab to review alignments that are created by the Roadway Design group.

- ♦ **Geometry > View Geometry > All Horizontals** which displays all horizontal alignments in the active geometry project with no annotation.
- ♦ **Tools > Tracking > Tracking** which displays the Station and Offset for a specific point, along with surface data.
- ♦ **Tools > Tracking > Horizontal Alignments** which provides a readout of the Station, Offset and Curve radius (if applicable) for a specific point, along with elevation of the active vertical alignment.
- ♦ **Geometry > View Geometry > Active Horizontal** which displays only the active horizontal with no annotation.
- ♦ **Geometry > View Geometry > Horizontal Annotation** which displays the specified alignment or alignments along with annotation of the tangent and curve data.
- ♦ **Geometry > View Geometry > Stationing** which displays station for the specified horizontal alignment.

1. Select **Geometry > View Geometry > All Horizontals**.

2. Fit the MicroStation view.

Note: This geometry file contains horizontal and vertical alignments for ***SH119 NB*** and ***SB***, ***SH52***, ***Ramps A-D***, and several walls.
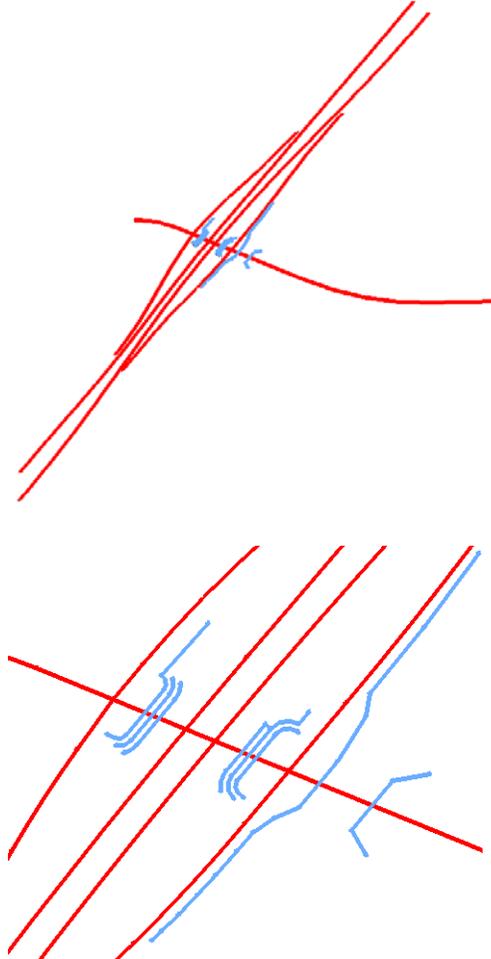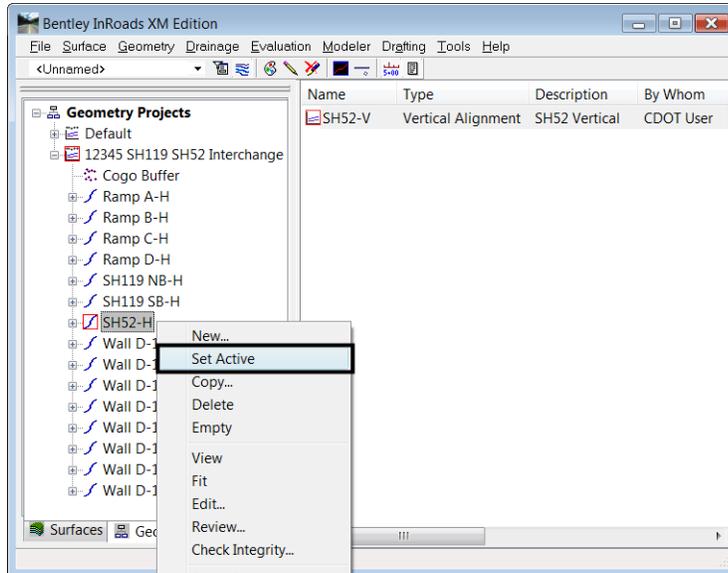

3. In the ***Explorer*** part of the InRoads menu, **<D>** on the ***Geometry*** tab and **<D>** on the '+' next to the geometry project to expand the list of alignments.

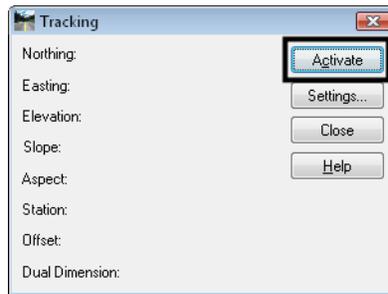**Note:**   You may need to use the arrows to scroll across to see the Geometry tab.
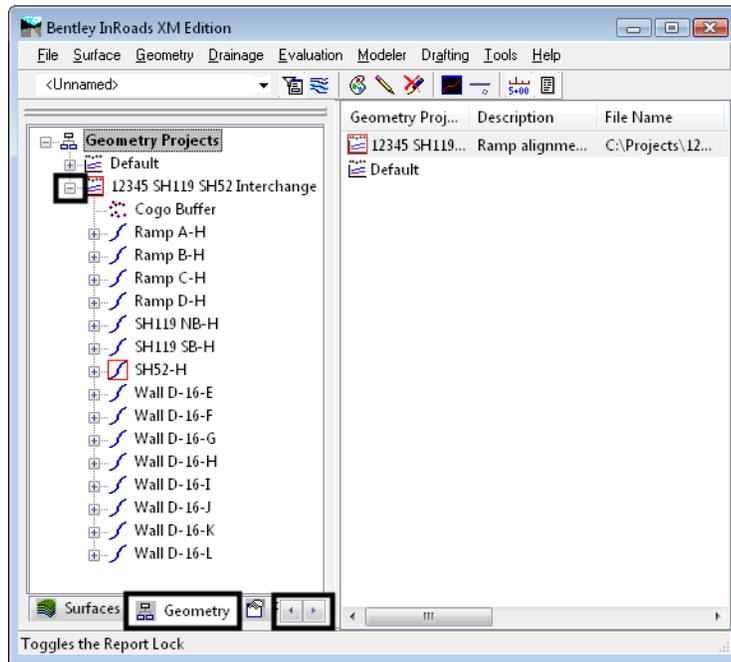
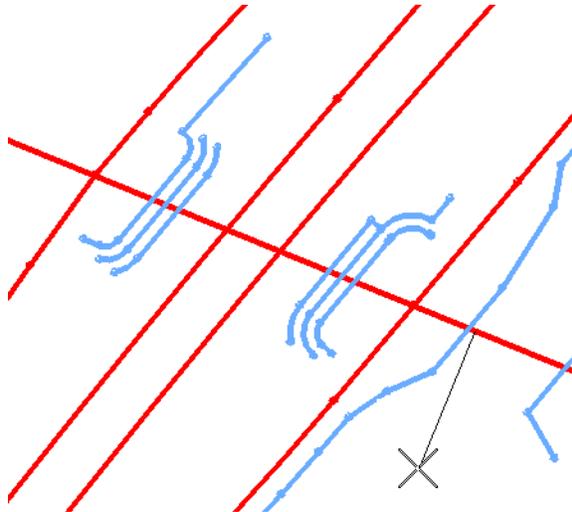4.   Right-click on **SH52-H** and select **Set Active** if it's not already.

Note: The active alignment has a red box around its icon.

5. Select **Tools > Tracking > Tracking**.

6. **<D> Activate**.

7. Move your cursor in the vicinity of the wall alignments as shown.

Note: The readout of ***Station***, ***Offset***, etc is shown in the dialog box. Using this command gives you a readout of the stationing on the alignment, the perpendicular offset to your cursor location the coordinates of your cursor location, and the ***Elevation*** (along with other data) of the ***active surface*** at your cursor location.

8. Snap to the end point of the wall alignment as shown.
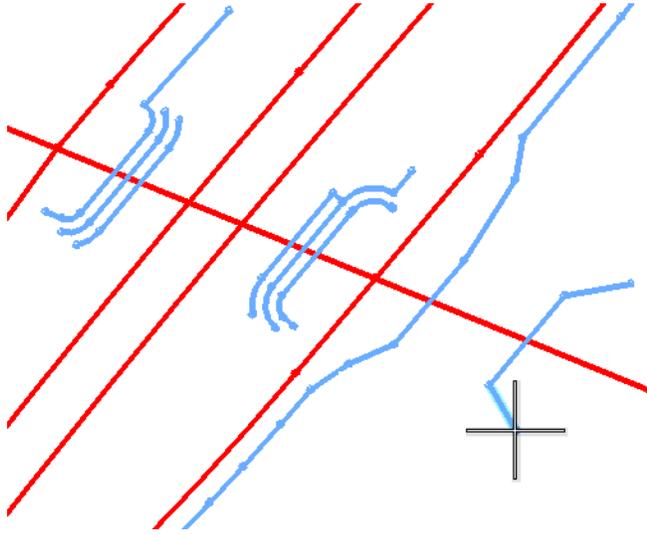
Note: You may snap using **<T> <D>** just as you would in MicroStation or if you want to use *AccuSnap*, hold down your **<Ctrl>** and **<Shift>** keys on your keyboard. This is true whenever you need to use *AccuSnap* within an InRoads command.
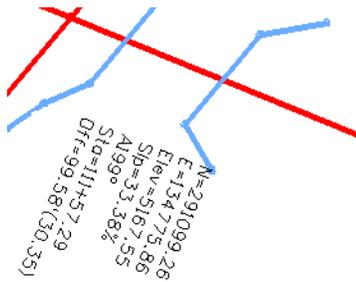

Note: The readouts are written to the design file. The text is written perpendicular to the alignment being tracked and is top-left justified on the point where you snapped.

In the next series of steps you'll attach a reference file containing the SH52 bridge pier and abutment graphics and then use these graphics to obtain additional tracking information.

9. Select **File > Reference** from the MicroStation menu.

10. Select **Tools > Attach**.

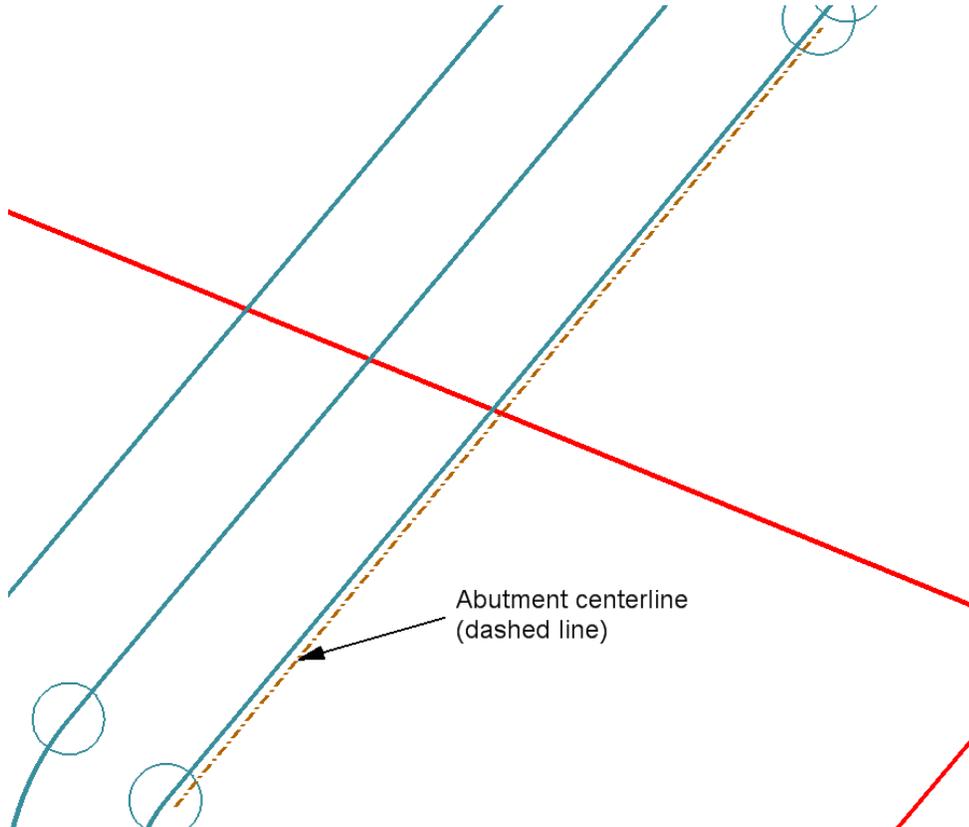11. Select *C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Model_D-16-DU.dgn*.
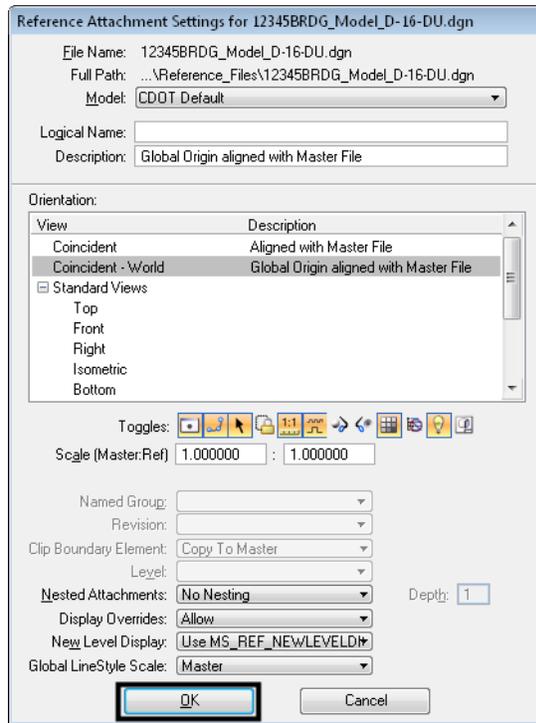
12. **<D> OK** to accept the default reference settings.
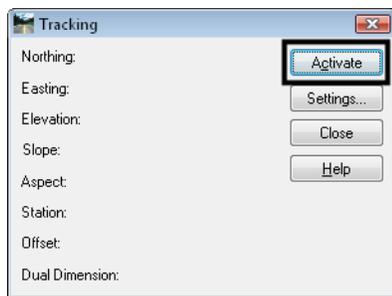
13. **Close** the *Reference* dialog box.

   Note: Abutment and Pier centerlines are shown in the file.
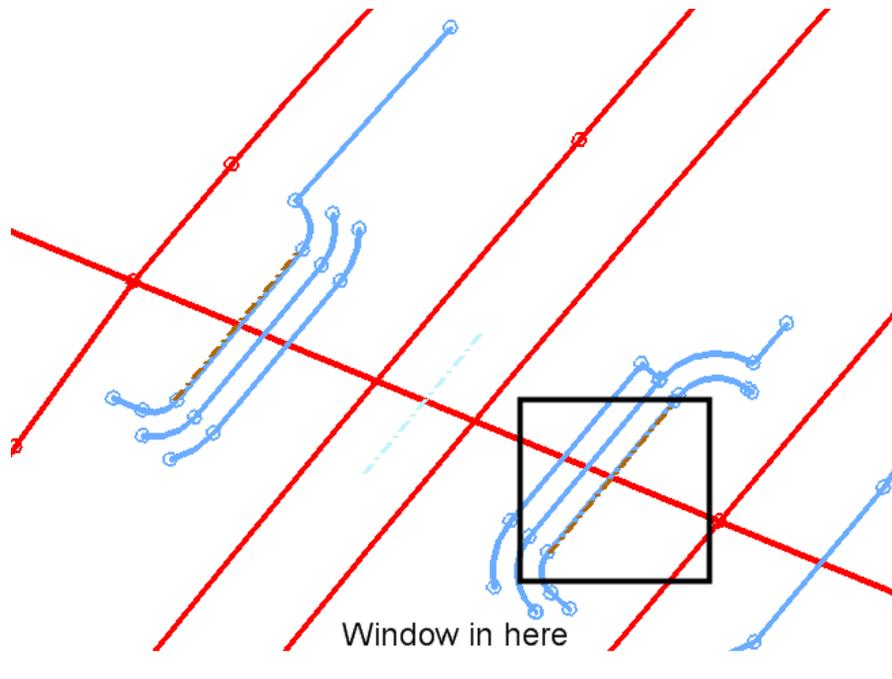
14. Window in on the area shown to see the abutment centerline.
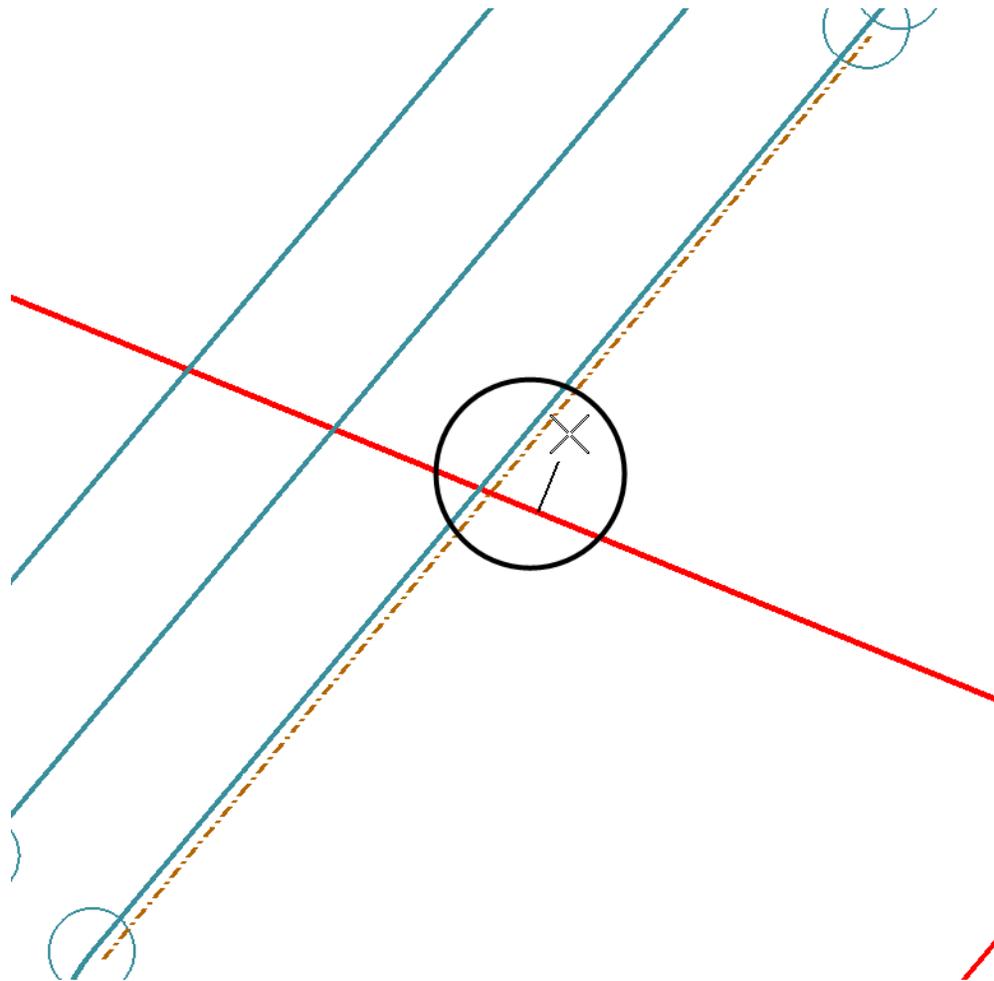

Abutment centerline
(dashed line)

15. Select **Tools > Tracking > Tracking**.

16. **<D> Activate**.

17. Move your cursor in the vicinity of the abutment graphic as shown.


18. Select MicroStation's Intersection snap mode.

19. Snap to the intersection of the abutment centerline and the SH52 centerline alignment.
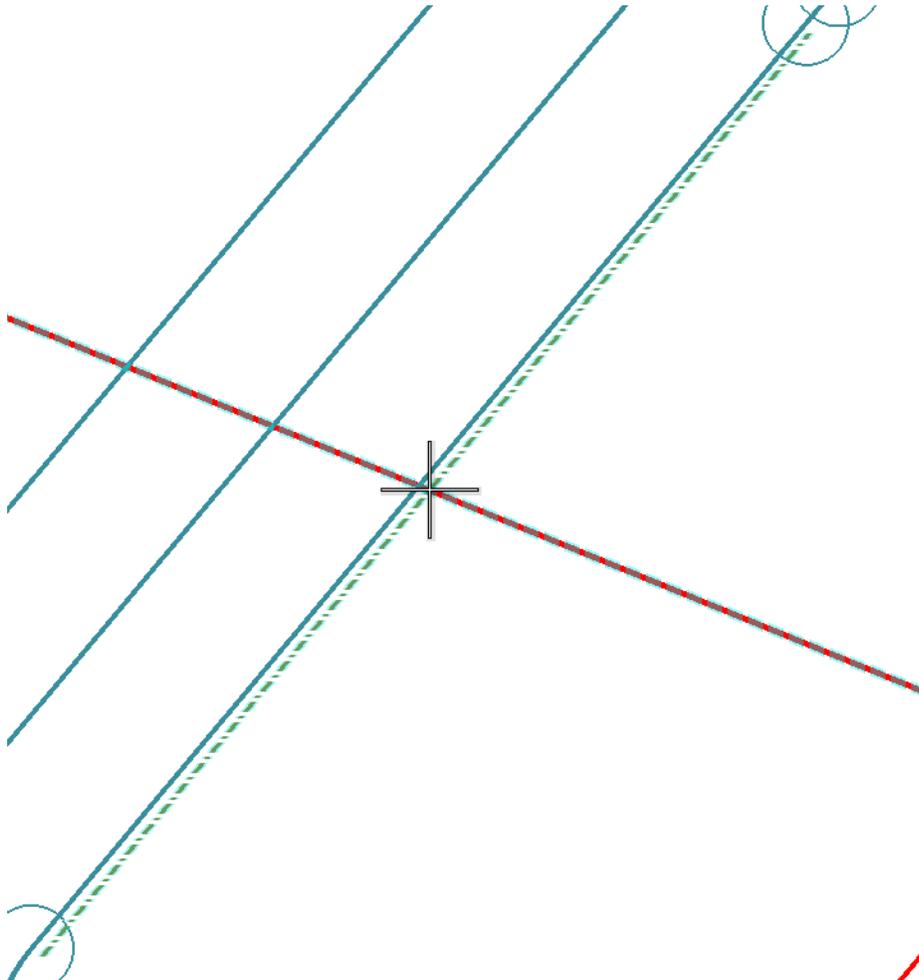
> ***Note:*** The readouts are written to the design file. Note that the abutment centerline is
> located at station 108+73.63 on the SH52 alignment. Tracking is a convenient tool
> for obtaining station locations of abutment centerlines or backfaces.
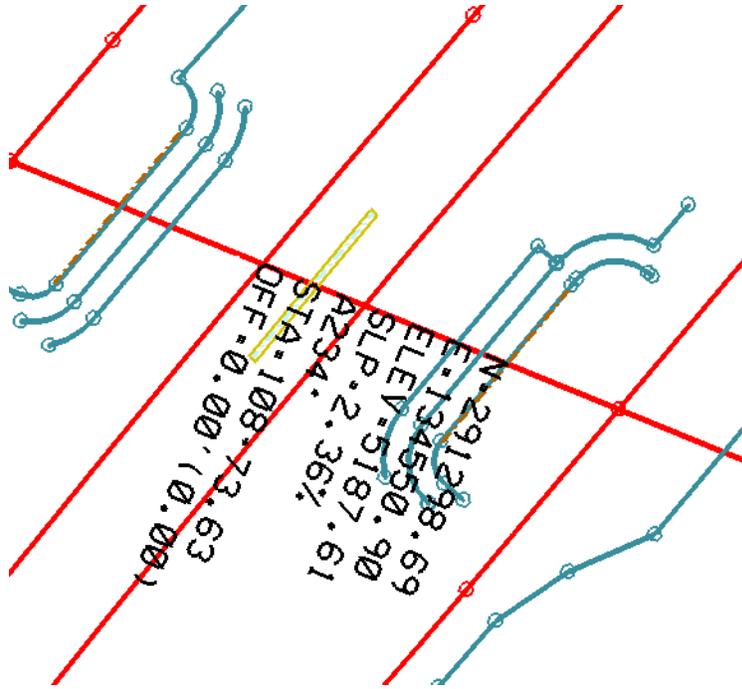
20. **<D> Close** to exit the ***Tracking*** command.

21. **Delete** the readout with MicroStation.

22. Turn off the display of the bridge reference file.
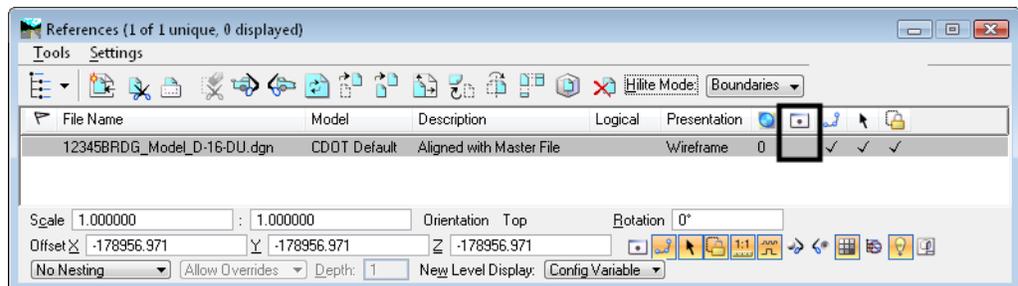
23. Select **Tools > Tracking > Horizontal Alignments**.
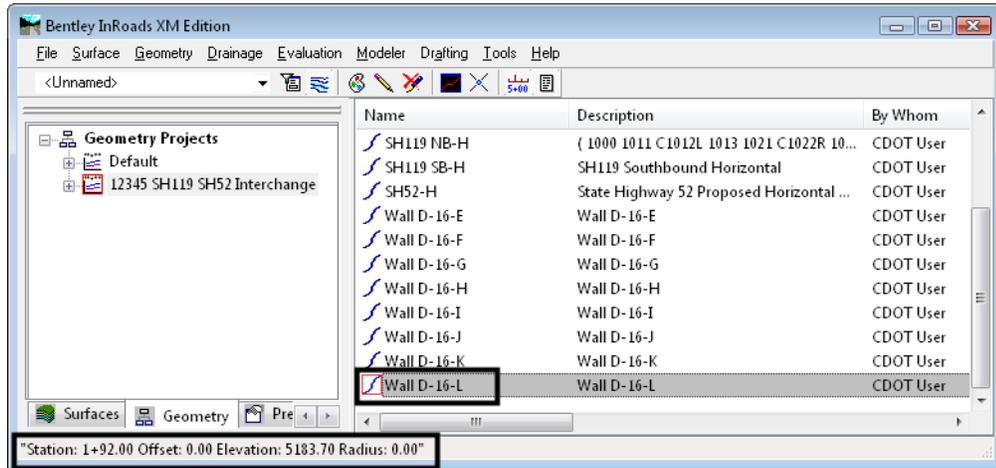
> *Note:*   The *Station*, *Offset*, *Elevation* and curve *Radius* is shown in both the InRoads and MicroStation message fields. Using this command gives you a readout of the stationing on the alignment, the perpendicular offset to your cursor location and the elevation of the *active vertical alignment* associated with the horizontal you're tracking (as opposed to the DTM elevation in the Tracking command).
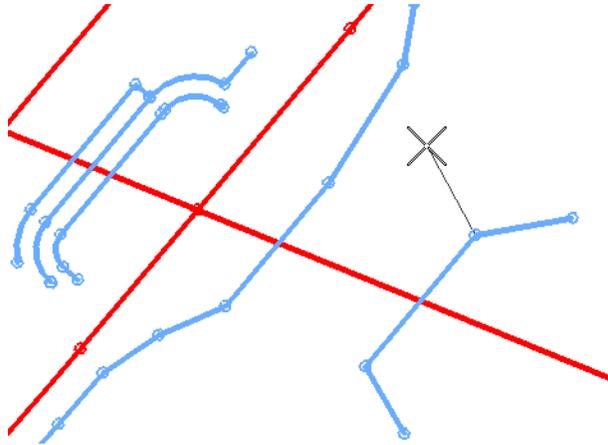
24. Make *Wall D-16-L* active.

25. Track the Alignment with *Horizontal Alignment Tracking*.

26. Toggle *Point Snap* on.

27. Track the alignment and note that the cursor only tracks from the beginning, ending and angle points or PIs of the alignment.

Note: This can be used to easily check the stationing of the angle points for the wall to see if the wall segments are of even lengths.

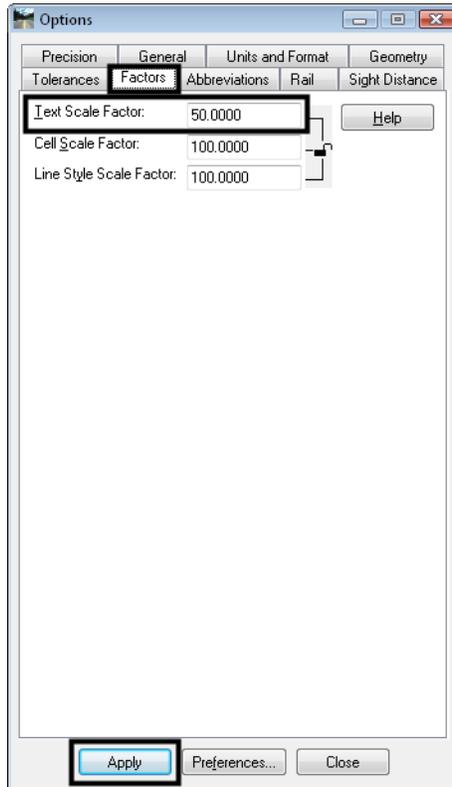28. Toggle ***Point Snap*** back to ***No Snap***.

Next, you will station an alignment. The ***Text Scale Factor*** is applied to all text, ticks and offsets created by InRoads and may be changed at any time.

29. Choose **Tools > Options > Factors**.

    Note the default settings.

30. **<D>** the lock icon to unlock the three settings so they can be set individually.

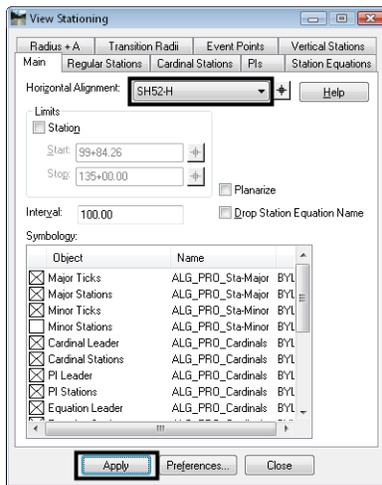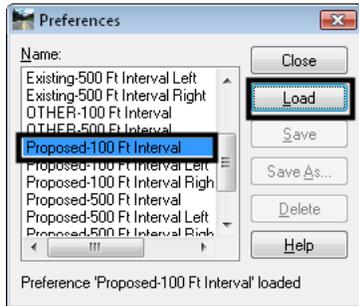31. Change the *Text Scale Factor* to **50**.

32. <D> Apply.

33. <D> Close.

   Note: If you **Apply** without saving a preference, the change only remains active until
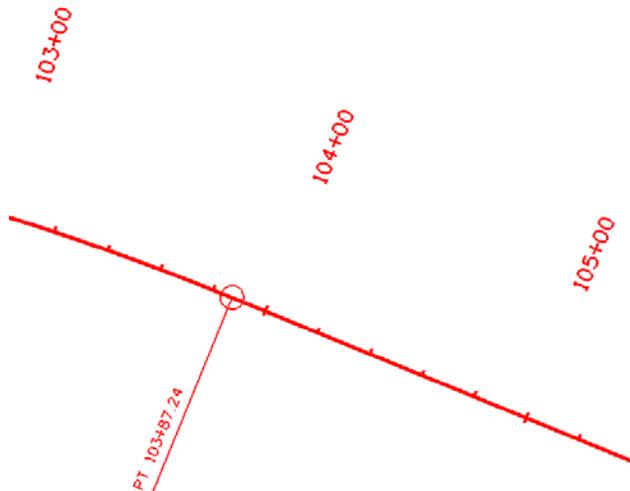   you exit InRoads.

34. Select **Geometry > View Geometry > Stationing**.

35. Toggle the *Horizontal Alignment* to *SH52-H*.

   Note: The Horizontal Alignment defaults to the active alignment. Changing it here also
   changes the active alignment.

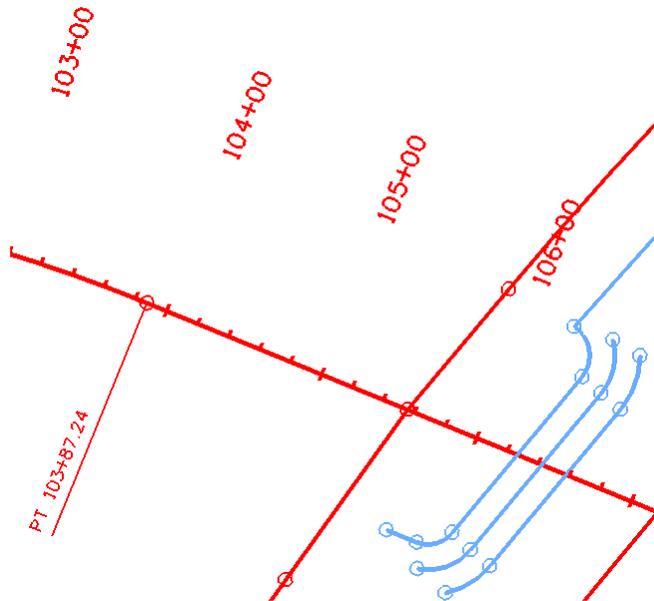36. Load the preference ***PROPOSED-100 Ft Interval***.

37. **<D> Apply**.

38. Select **Tools** > **Options** > **Factors** and set the **Text Scale Factor** to **100**. (Don't forget to **Apply**.)

39. **<D> Apply** on the *Stationing* dialog, then **Close**.

Note: Since you are in Pencil mode, the second set of stationing replaces the first set.

Note: The display of the stationing on the alignment honors the *Text Factor* as you can see. In general, you use a text factor equal to the scale you plan to plot. When reviewing data that you do not plan to plot, as you are here, you may choose a different text scale to make the text more legible in the file.
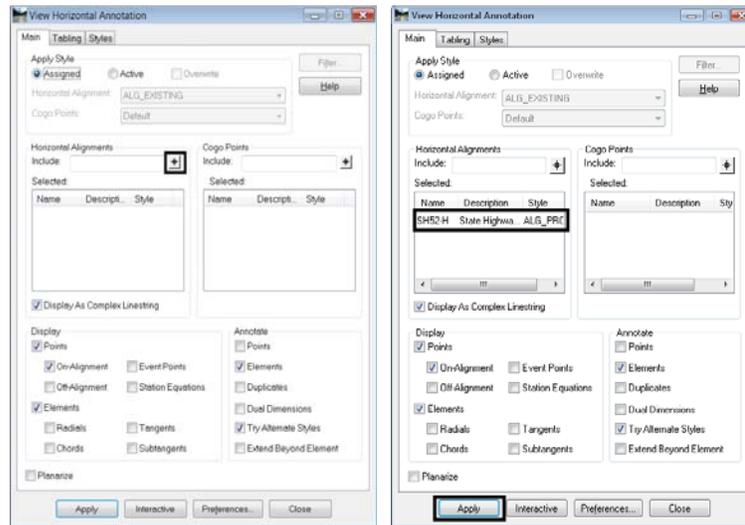
40. Use MicroStation to **Delete** the Stationing.

*Note:* The stationing is made up of graphic groups, making it easier to delete.

41. Choose **Geometry > View Geometry> Horizontal Annotation**.

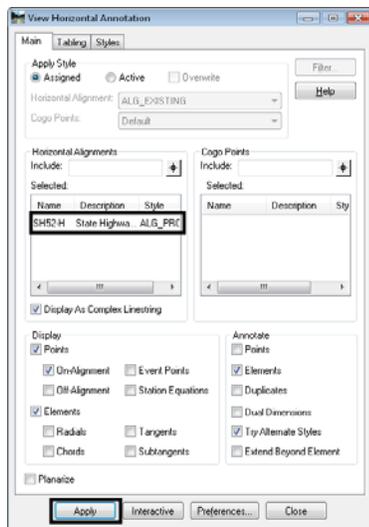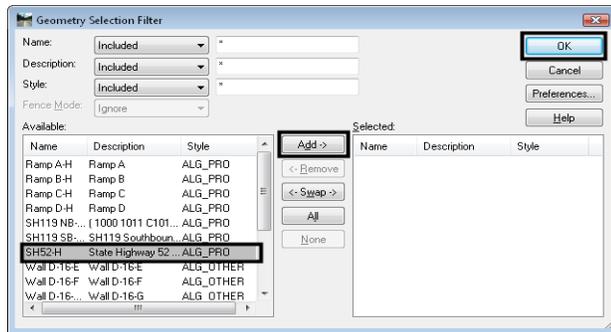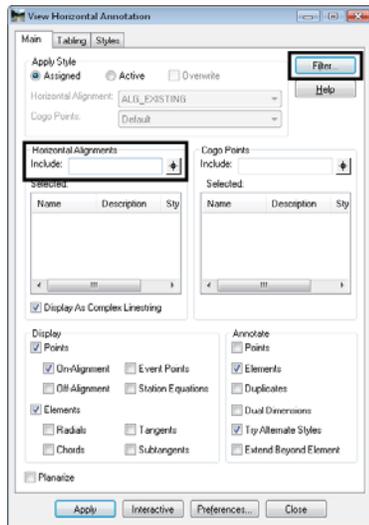42. In the *Horizontal Alignments Include* field, select the *SH52-H* alignment.

You may either:

♦   Use the target button next to the ***Include*** field and graphically pick the alignment,

♦   Type the alignment name in the ***Include*** field (wildcards are allowed), or
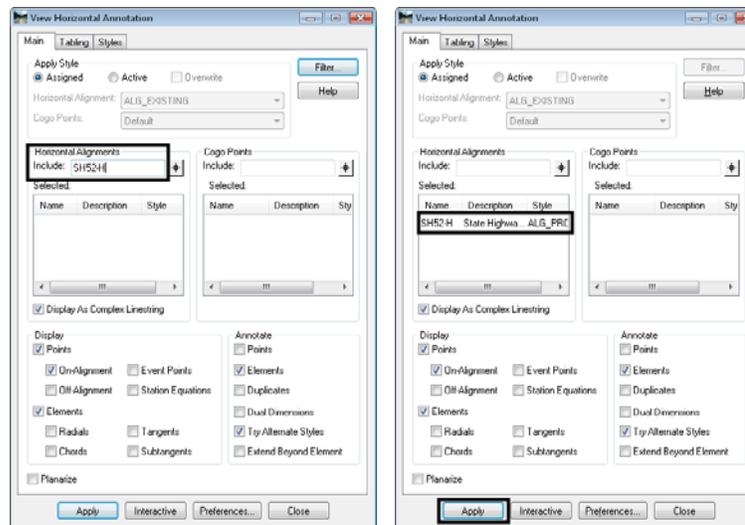
♦ **<D>** in the *Include* field and choose *Filter* to pick the alignment from a list and select **Add** and then **OK**.
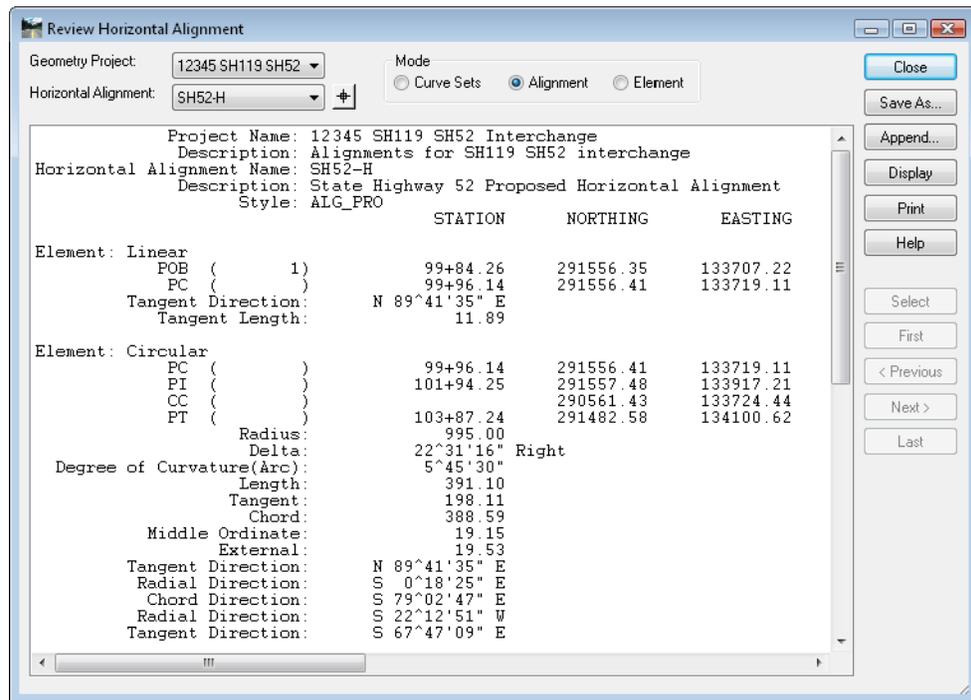

43. **<D> Apply** and the alignment is annotated.

44. Window in and review the annotation.

> ***Note:*** You may also **<D> Interactive** and then choose one piece of any alignment at a time to annotate (whether or not it is currently active or displayed).

45. Choose **Geometry > Review Horizontal**.

> ***Note:*** You can also right-click on the horizontal in the *Explorer* portion of the menu and choose **Review**.
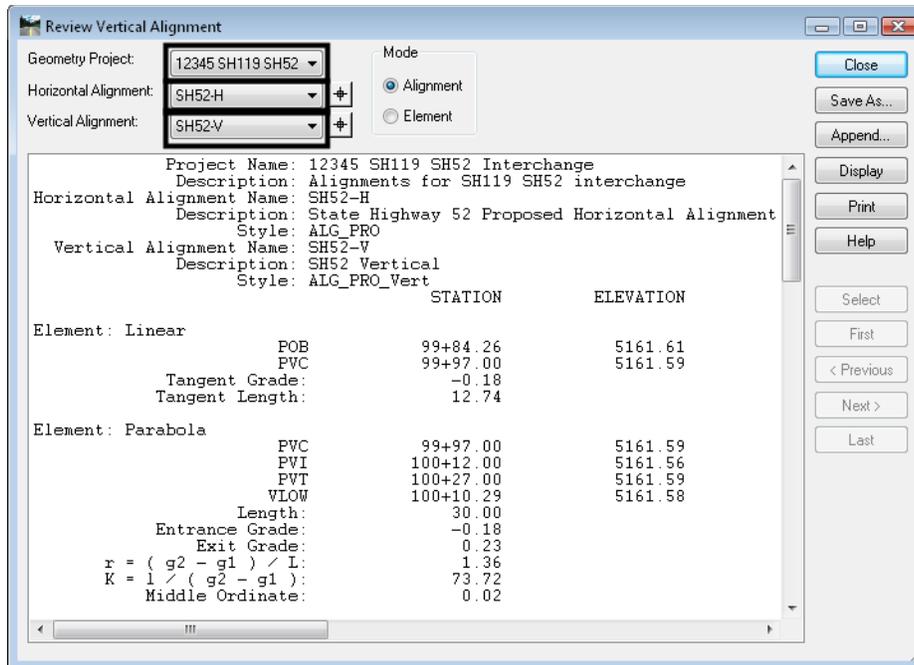

> ***Note:*** The *Review* lists all the information about the *active* horizontal alignment. This report can be saved as a text file, displayed in the design file or printed if necessary. You can also switch to a different alignment using the drop-down list at the top of the dialog.

> ***Important!*** The *Print* command allows the report to be printed to any printer that can be accessed on the current machine.

46. **<D> Close** when you are finished evaluating the alignment.

47. Choose **Geometry > Review Vertical**.

Note: You can change Geometry Projects, Horizontal Alignments, or Vertical Alignments using the drop-down list at the top of the ***Review*** dialog. You can also use the target buttons to graphically identify alignments.

Note: The ***Review*** lists all the information about the active vertical alignment. In this case, the vertical is the top of wall elevation.

48. **<D> Close** when you are finished evaluating the alignment.

49. Continue to review other alignments as desired.

50. Select **Tools > XML Reports > Geometry**.

51. Select the ***SH52-H*** alignment.

   As described earlier, you may either:

   ♦   Use the target button next to the ***Include*** field and graphically pick the alignment,

   ♦   Type the alignment name in the ***Include*** field (wildcards are allowed), or

   ♦   **<D>** in the ***Include*** field and choose ***Filter*** to pick the alignment from a list.

52. Toggle on ***Include Vertical Alignments***.

53. Toggle on ***Active***.

54. Toggle all other options off.
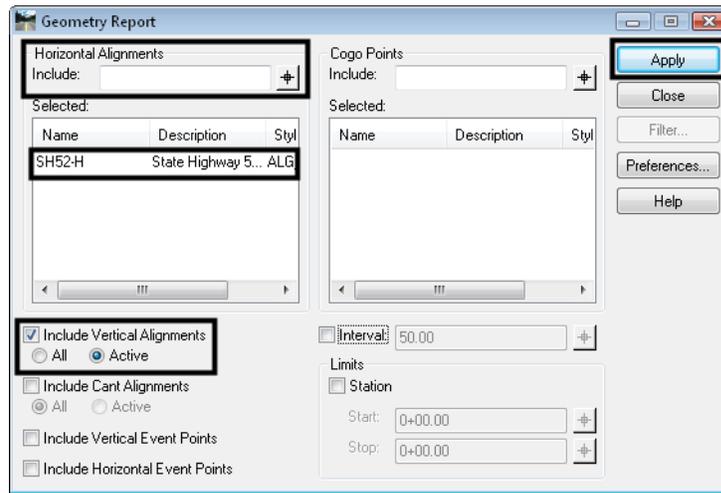
55. **<D>** **Apply**.

   Note: When you create a report using one of the **XML Report** commands, an ***.xml** data
   file with the results is created in the user's ***Local Settings\Temp*** folder. This XML
   file is formatted in the Report Browser using an XSL style sheet, or format. Most
   reports have a default format, but you can choose between other formats as desired.

56. In the ***Report Browser*** that appears, available formats are listed on the left side. Choose the
   format: ***Geometry > HorizontalAndVerticalAlignmentReview.xsl***.

   Note: All XML reports use this same browser, so the folder structure at left lists all
   different types of reports. Here, you are looking at an alignment, so you choose a
   report format from the ***Geometry*** folder. If you are reporting on Stations and
   Offset, you would use formats from the ***StationOffsets*** folder, and so on.

57. Review the report.
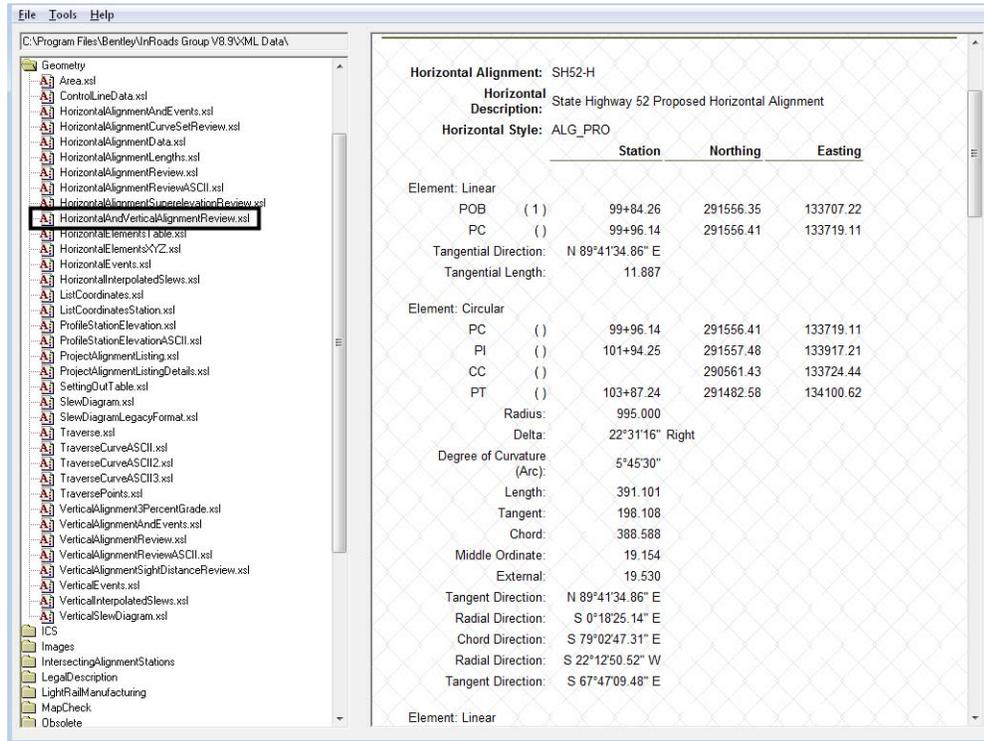
> **Note:** If you right-click a format and choose *Style Sheet Help*, a dialog will pop up
> describing the data required to complete that particular format.

> **Important!**   Just like in the *Review* command, reports may be printed directly from this
> dialog. Select **File > Print** to access this function.

58. Choose **Tools > Format Options**.
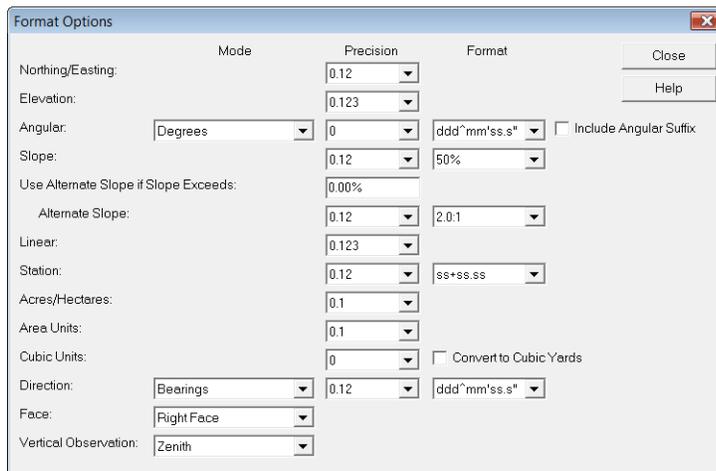
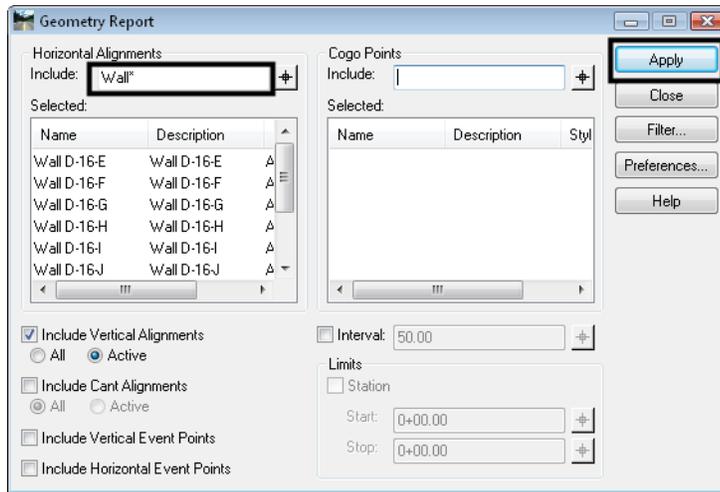> **Note:** Much of the formatting of the report can be modified on the fly by changing the
> settings in this dialog box.

59. Change the **Northing Easting Precision** to show four decimals.
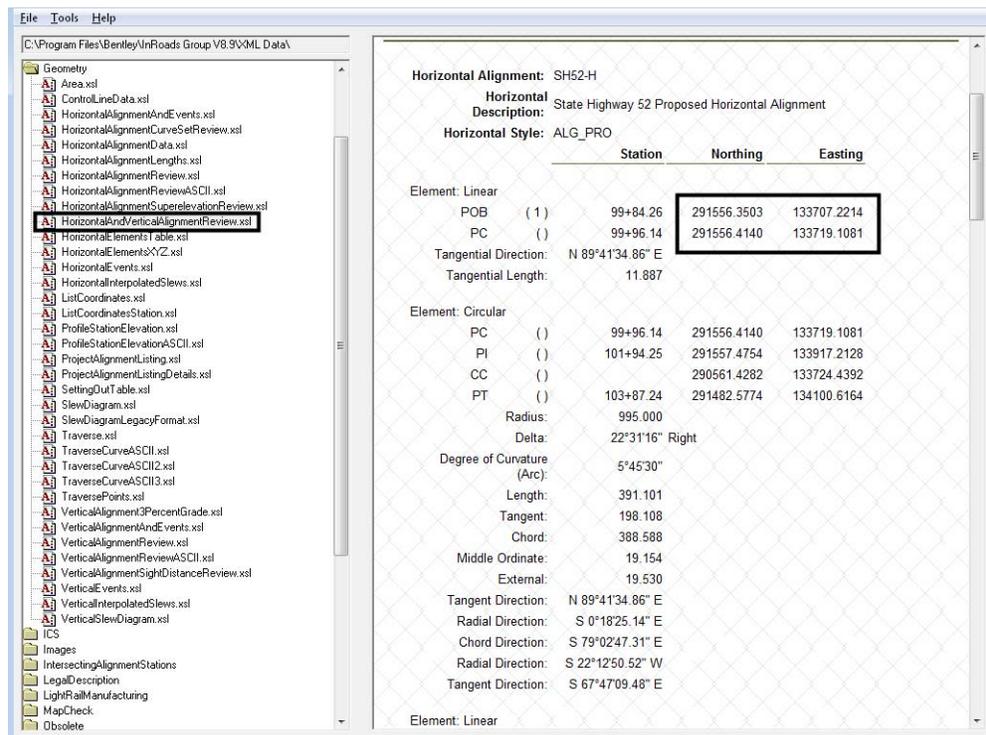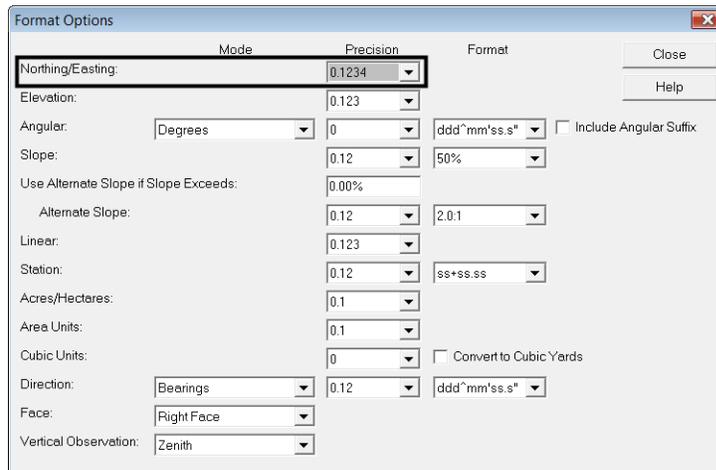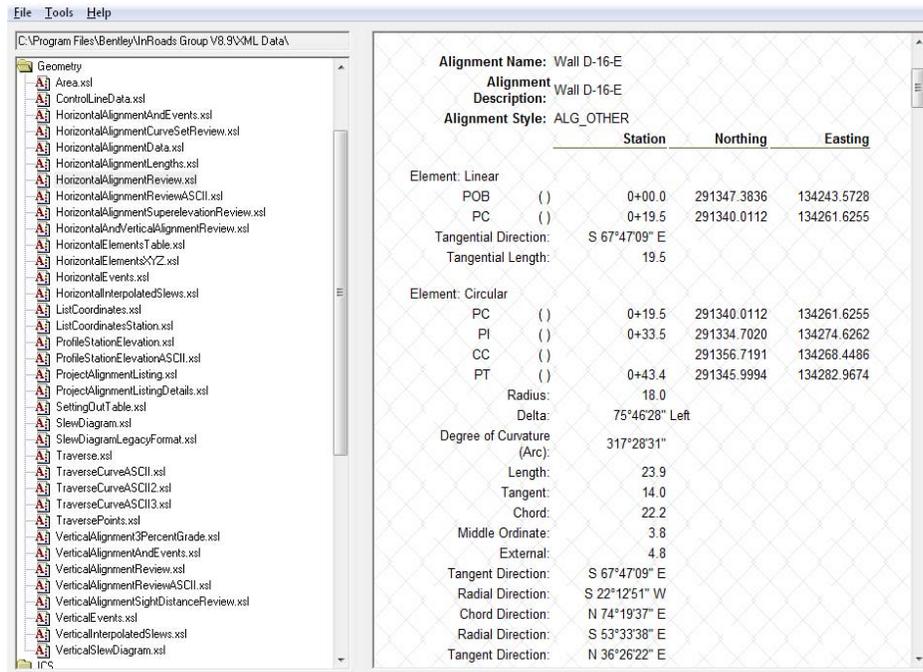

60. **<D> Close** on the **Format Options** dialog.

61. **Close** the Report.

62. Back in the *Geometry Report* dialog, **<D>** in the *Include* field and key in **Wall*** to select all the Wall alignments.

63. **<D> Apply**.

In the Report Browser, note the reports now shows each of the wall alignments.


64. **Close** the Report Browser when you're done reviewing the report.

Lab 2.3 - Using InRoads Evaluation Tools

Next, you will be creating profiles and cross sections to analyze geometry and surface data provided by Roadway Design. This includes annotating information on the profiles and cross sections. For this annotation the text scale factor is applied to all the text, ticks and offsets for the cross sections as well as profiles.

> ***Note:*** Each time you create profiles or cross sections, you create a new set and it is given a name, which by default is derived from the alignment name with a counter on the end. Later, you will use this set name when identifying the profile or section set to view, annotate, etc.

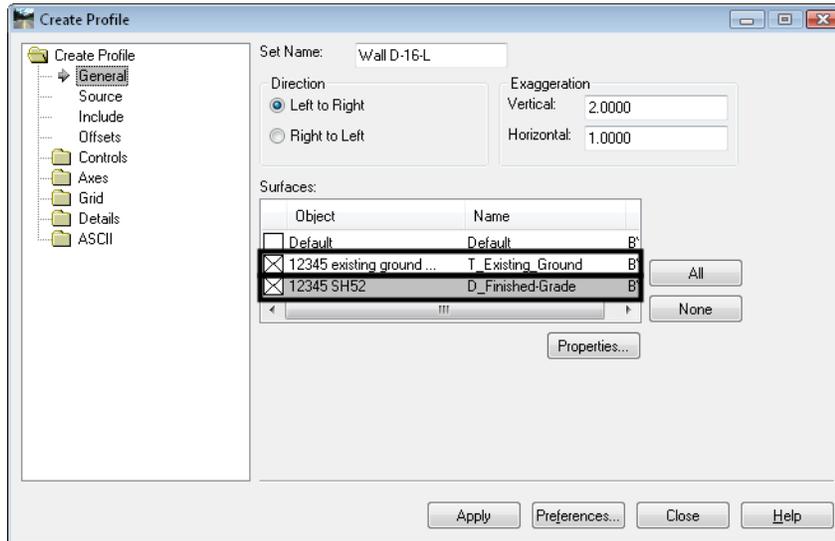1. For this example, set the ***Text Scale Factor*** to **40**.
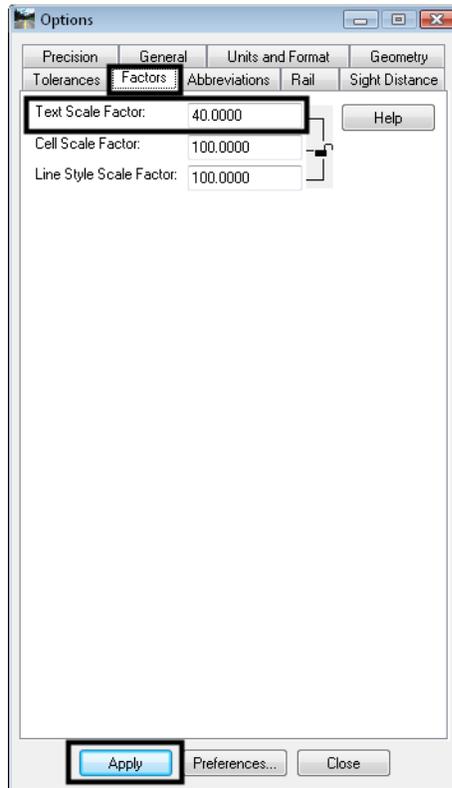
2. Choose **Evaluation > Profile > Create Profile**.

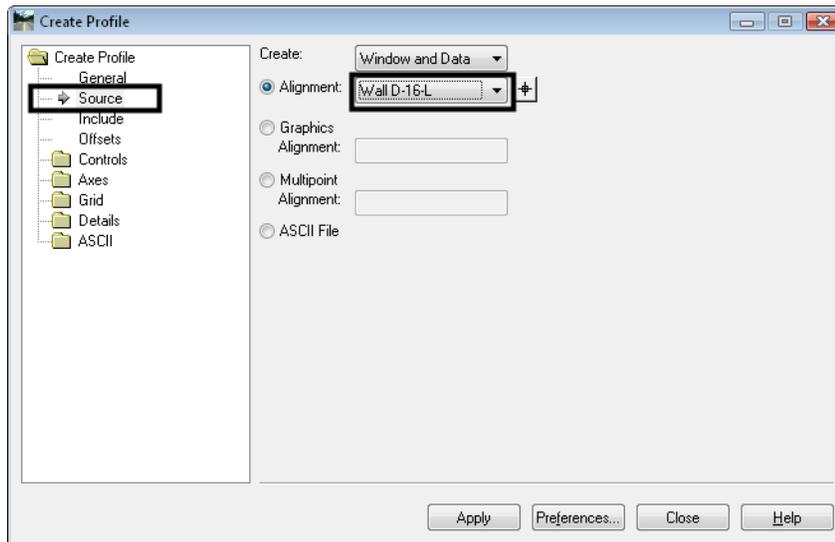3. **<D> Preferences** and **Load** the *2x Vertical* preference.
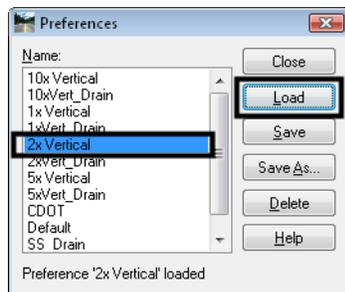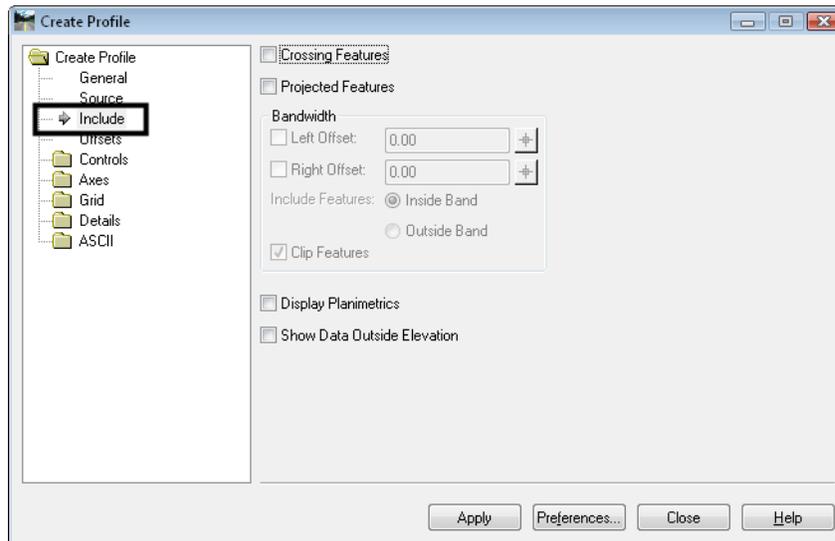

4. **<D> Close** on the *Preferences* dialog.

5. In the *Surfaces* area, toggle on both the *existing ground* and *SH52*.

6. **<D>** on the *Source* branch on the left of the dialog.

7. Make certain Alignment is toggled on and set to *Wall D-16-L*.

8. **<D>** on the *Include* branch.

Note: If you want to display crossing features on your profile like pipes or utilities, toggle on *Crossing Features.* These features must first exist in the surface(s) you're profiling. The feature's style controls if the feature can be shown on the profile.

Note: If you want to show features that fall outside the profile window, toggle on *Projected Features*. This will show the orthogonal projection of the features onto the profile. You also have the option of specifying a *Bandwidth* to either side of the profile to project the features.

9. For this exercise, leave these options toggled off.

10. **<D>** on the *Controls* branch and toggle off all Controls.
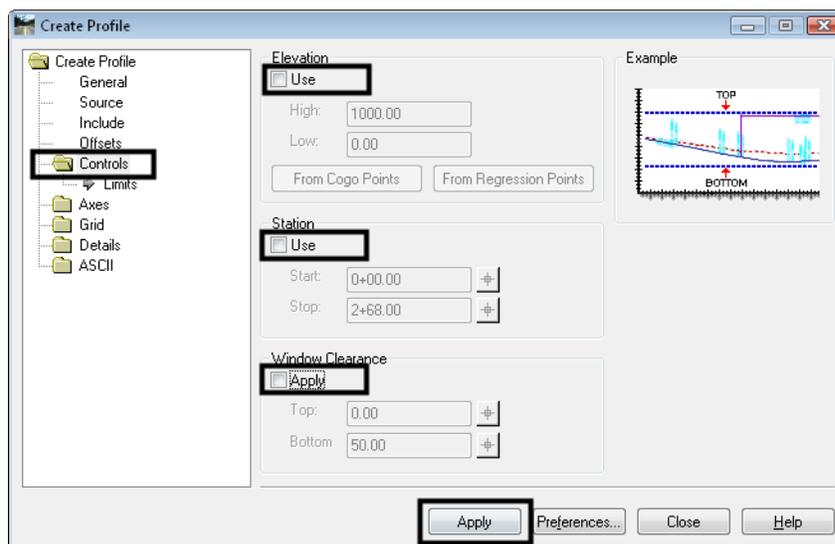
> ***Note:*** The *Elevation* option is used to set absolute values for the left axis. With it off, the left axis elevations are determined by the high and low elevations of the surfaces. The *Station* option allows you to create a partial profile. With it off, the entire alignment is profiled. The *Window Clearance* option is used when you want to add grid to the top or bottom of the profile for annotation, which we do not need here.

11. **<D> Apply** and **<D>** a clear area in your design file when prompted to ***Identify Location***.

> ***Note:*** This is the location of the lower left corner of the profile grid, so make certain there is room above and to the right of the point you select. You do not need to click near the horizontal alignment.
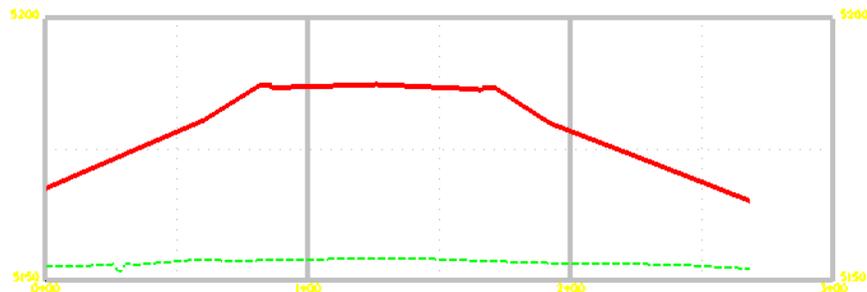
The profile is displayed with the two surfaces showing. Offsets can also be shown on the profile.
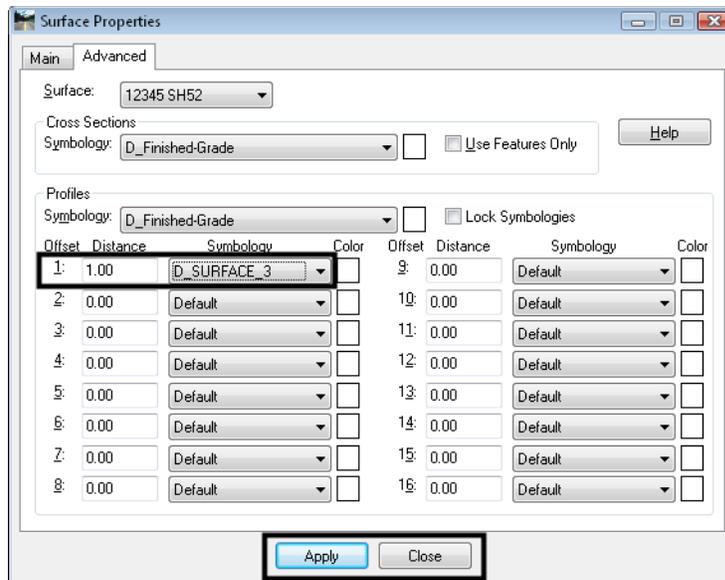
12. Use MicroStation to delete the profile.

13. Under ***General***, highlight the existing ground surface and choose **Properties**.
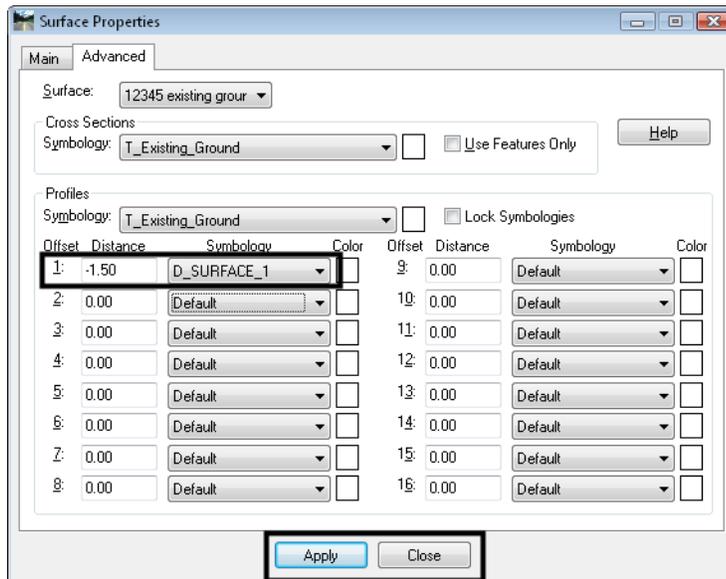
14. On the ***Advanced*** tab of ***Surface Properties***, set ***Offset 1*** to *-1.50* and the ***Symbology*** to ***D_Surface1***.

> ***Note:*** A negative offset is to the left of the alignment.

15. **<D> Apply**.

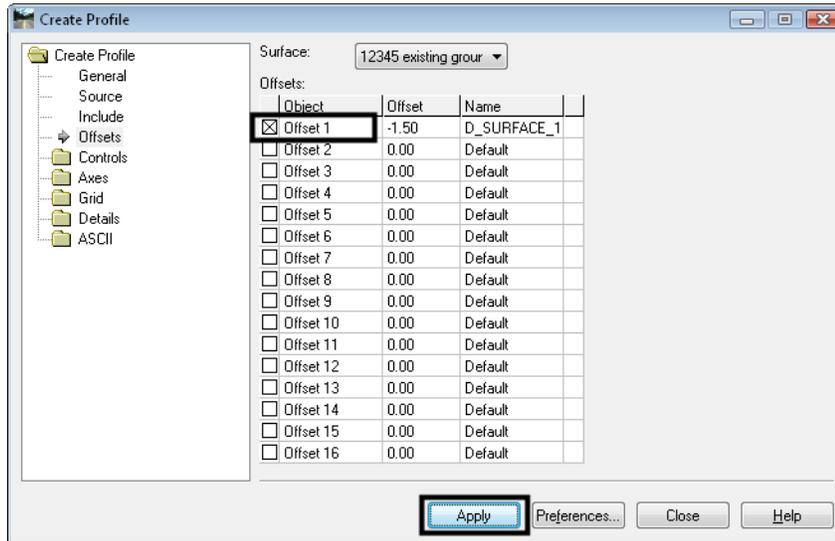16. Toggle the *Surface* to *12345 SH52* and select *Properties*.

17. On the *Advanced* tab, Set *Offset 1* to *1.00* and the *Symbology* to *D-Surface3*.

18. **<D> Apply** then **Close**.
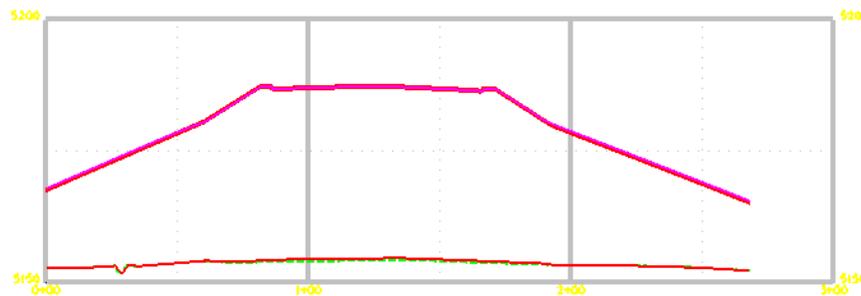
19. Choose *Offsets* on the *Profile* dialog.
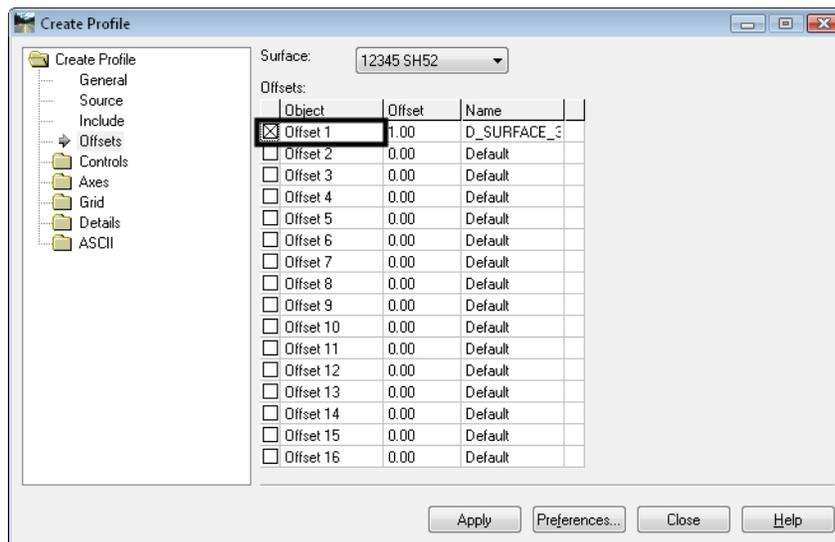
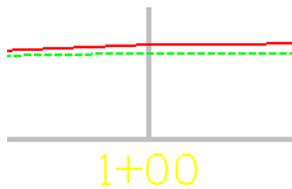20. Set the *Surface* to *12345 SH52* and toggle on *Offset 1*.

21. Set the *Surface* to *12345 existing ground for interchange* and toggle on *Offset 1*.

22. **<D>** Apply and **<D>** a clear area in your design file when prompted to *Identify Location*.


23. Window in close to the ground surface on the profile.

Note: The profile now shows two lines for the existing ground and two lines for the proposed. The existing ground is shown at the wall centerline and 1.5' in front of the wall. The proposed ground is shown at the wall centerline and 1.0' behind the wall. You can use profile offsets to set the bottom of wall elevations (e.g. if the toe of wall is 1.5 feet in front of the wall face, you can copy that offset line down by 1.5' (or whatever the vertical exaggeration requires) to get the top of the footing. Dropping it 3 feet will provide the minimum bottom of footing).
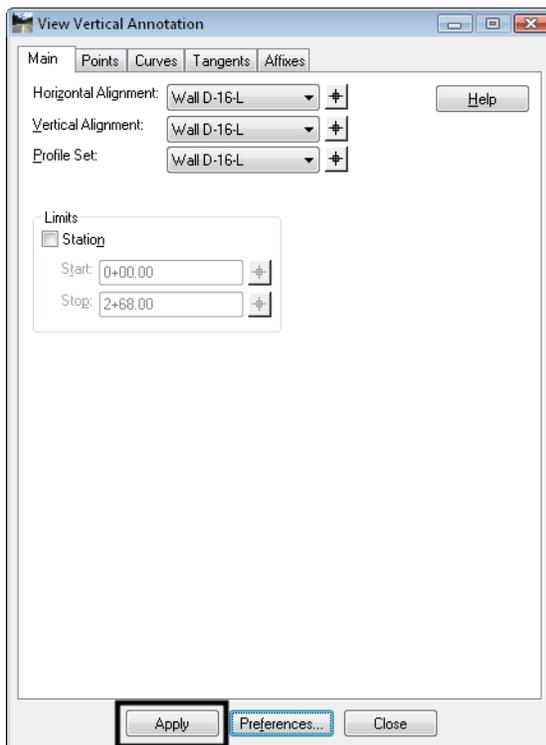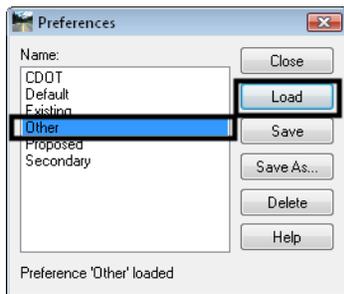
24. **<D>** Close on the *Profile* dialog.

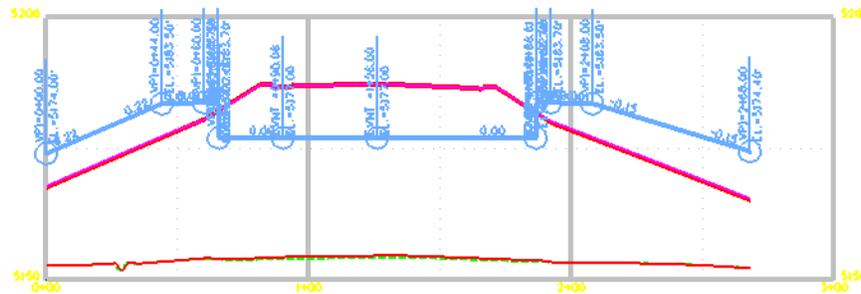25. Select **Geometry > View Geometry > Active Vertical**.
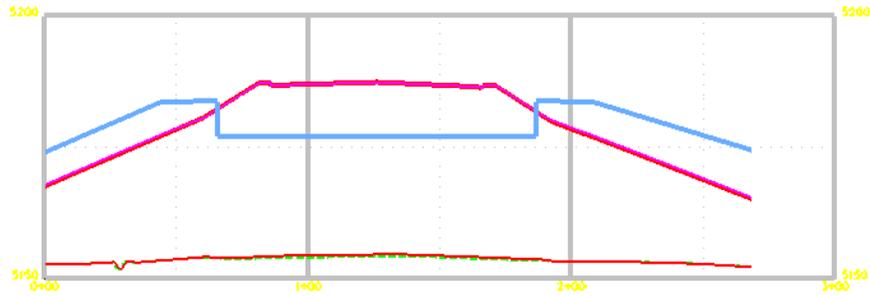
You may instead want to display and annotate the vertical alignment.

26. Select **Geometry > View Geometry > Vertical Annotation**.

27. **Load** the *Other* preference.

28. **<D> Apply**.

29. Review the annotation on the profile. You may need to change the ***Text Scale Factor*** using **Tools > Options > Factors**. If you **<D>** Apply again, the original annotation is deleted and the new annotation is placed.
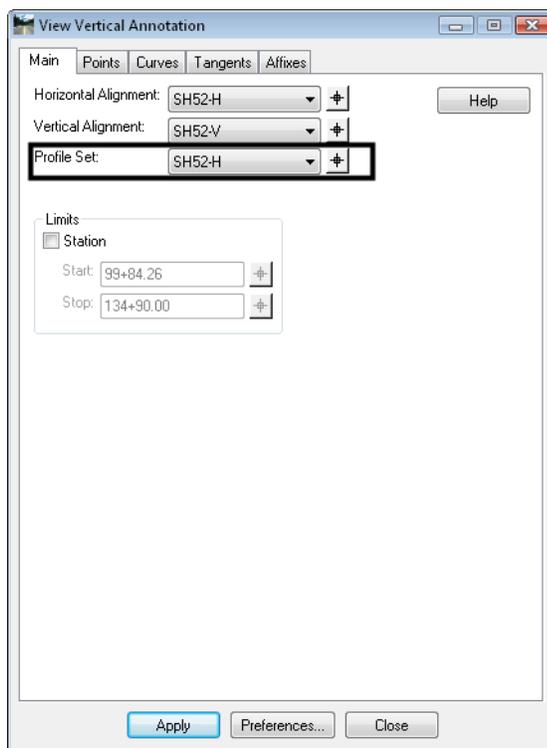
30. **<D> Close** when done.

31. Right-click on the ***SH52-H*** alignment in the ***Explorer*** part of the InRoads menu and choose ***Set Active***.

32. Create a profile for this alignment using the same steps as shown above, except only toggle on the ***existing ground*** surface.

33. View the vertical annotation, using the ***Proposed*** preference.

Note: When more than one profile exist in the MicroStation file, you can tell InRoads which one to use for annotation by selecting it from the drop-down list or by using the target button and selecting it graphically.
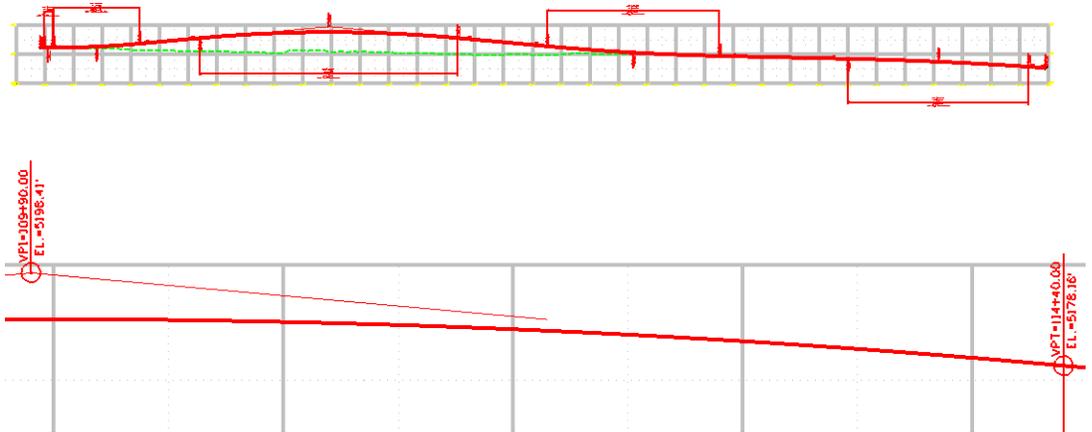
The vertical alignment for **SH52** does not currently show the location of the bridges. This can be accomplished using ***Event Points*** as shown below.

34. Verify **SH52-H** is still active.

35. Select **Geometry > Horizontal Curve Set > Events**.

36. Toggle on ***Add Vertical Event Points***.
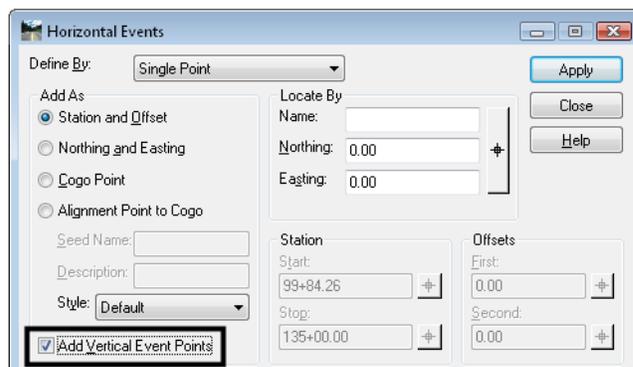
Important! Adding event points results in a modification to the *.alg file. In order to make this type of edit, you will need write access to the alignment file being used in the geometry project. This file is typically located in the Design group's InRoads folder and often has restricted access. If direct access is not granted, someone fron the Design group will need to add the event points for you. Either way, communication with the Design group is critical.

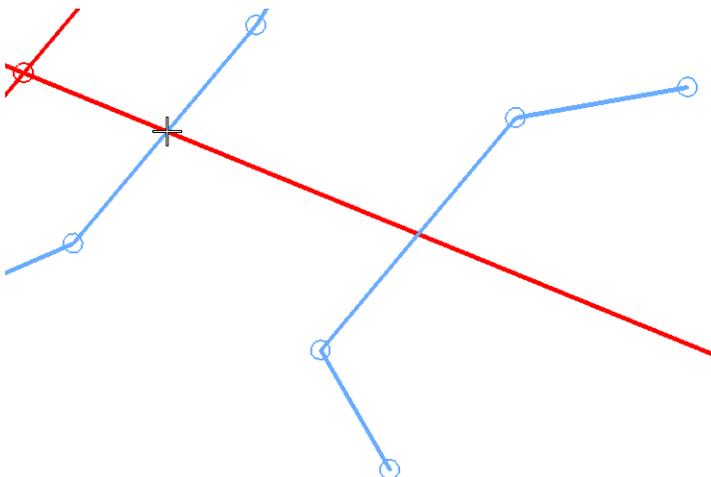37. **<D>** the Snap icon on the MicroStation Status bar and choose ***Intersection***.
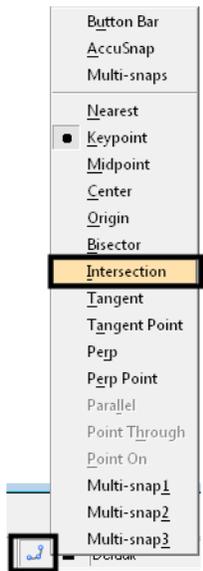
38. **<D>** the Target button in the ***Locate By*** field on the dialog.
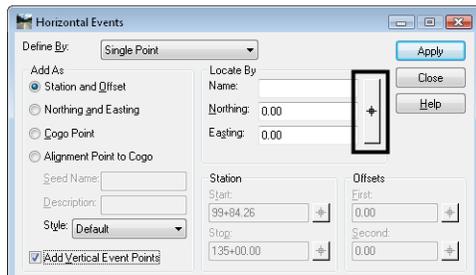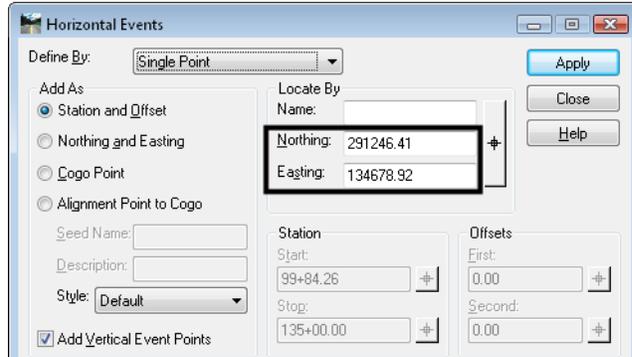

39. Hold down your **<Ctrl>** and **<Shift>** keys on your keyboard and move your cursor to the intersection of the ***SH52*** and ***Wall D-16-K*** alignment.

> **Note:** *<Ctrl>* and *<Shift>* can be held down any time you want to use ***AccuSnap*** within an InRoads command.
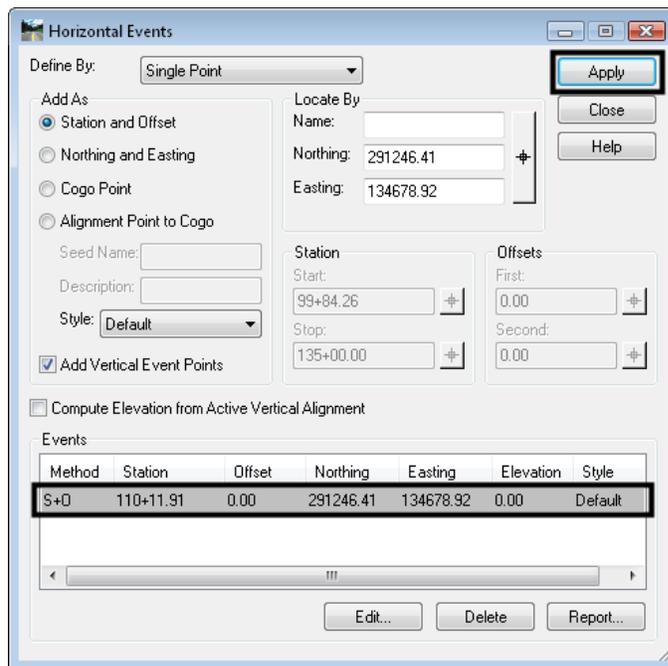
40. When the two alignments highlight with a yellow X at the intersection, **<D>** to select the location.
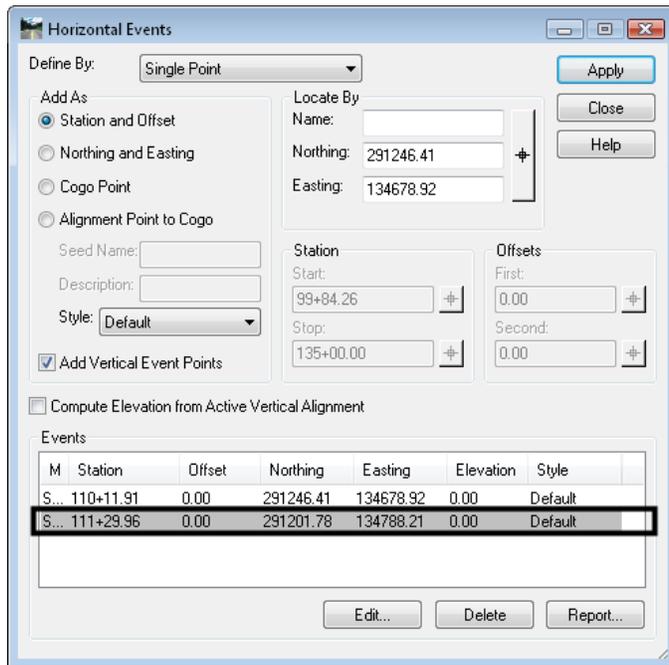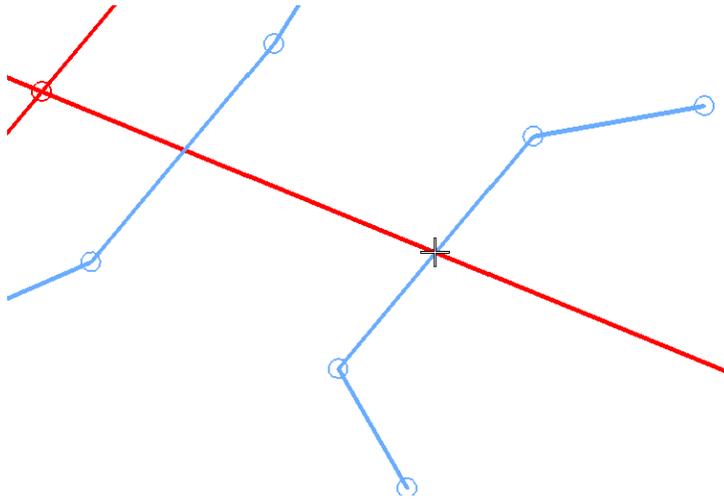
    The coordinates of the intersection are entered in the dialog.

41. **<D> Apply** to add the event point.

42. Repeat this process for the location of the intersection of *SH52* and *Wall D-16-L*.


43. **<D> Close** when you have both Event Points located.

44. View the vertical annotation for *SH52*, again using the *Proposed* preference.
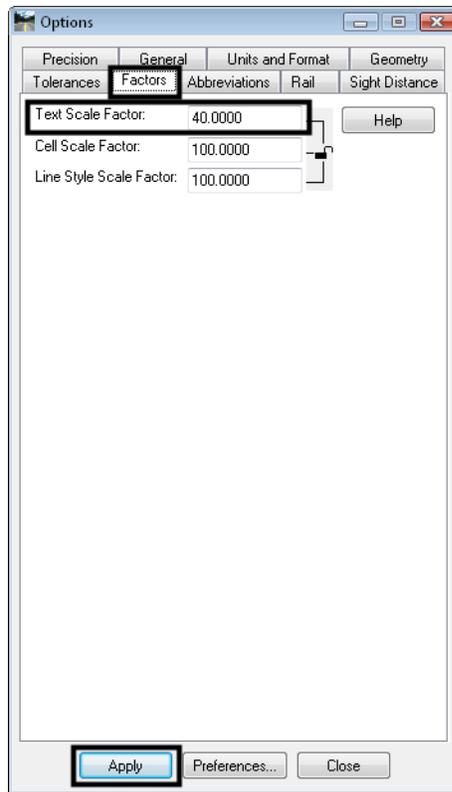
   Note: The last used preference remains active in a dialog until another one is selected or
             you close InRoads, so you should not need to load it this time.

The locations of the intersecting alignments are annotated on the profile as Event Points.
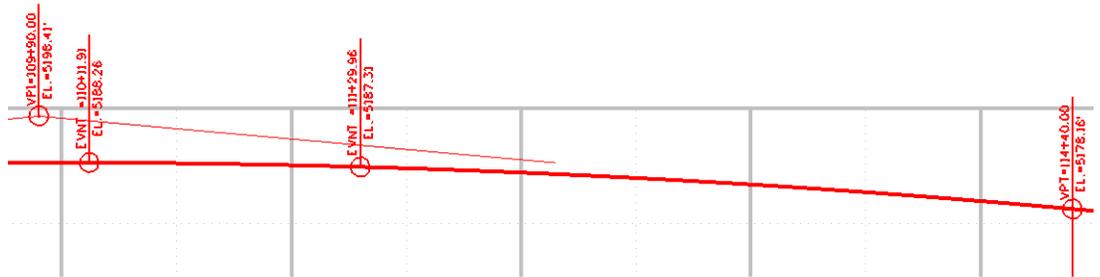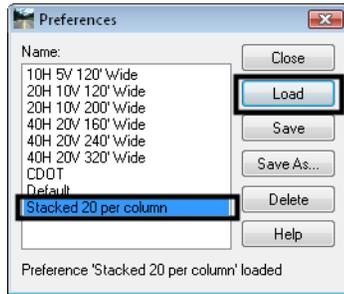

Next, you will create cross sections.

45. For this example, set the ***Text Scale Factor*** to **40**.
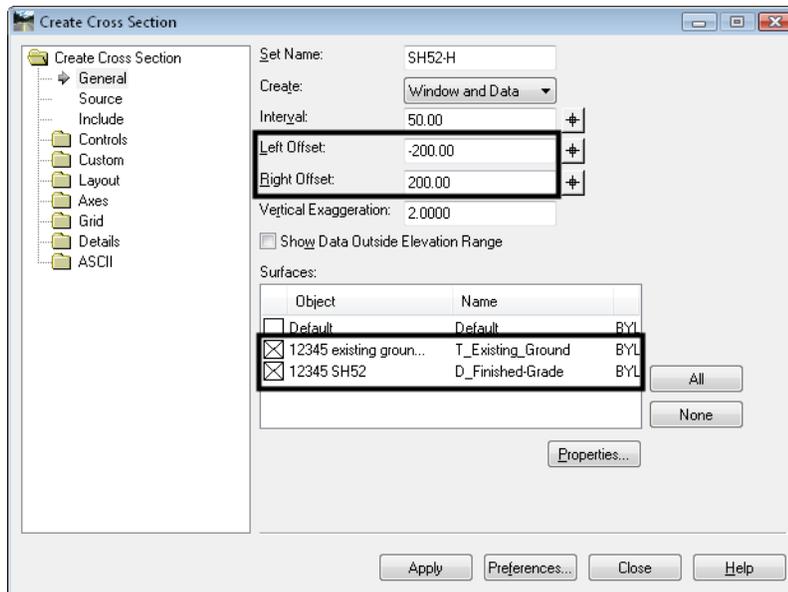

46. Choose **Evaluation > Cross Section > Create Cross Section**.
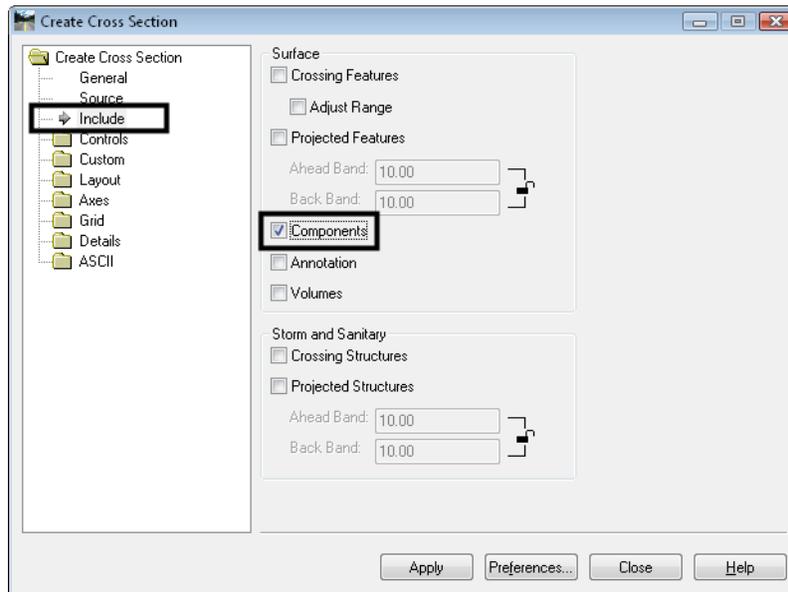
47. Load the *Stacked 20 per column* preference.

48. Set the *Offsets* to **-200 and 200**.

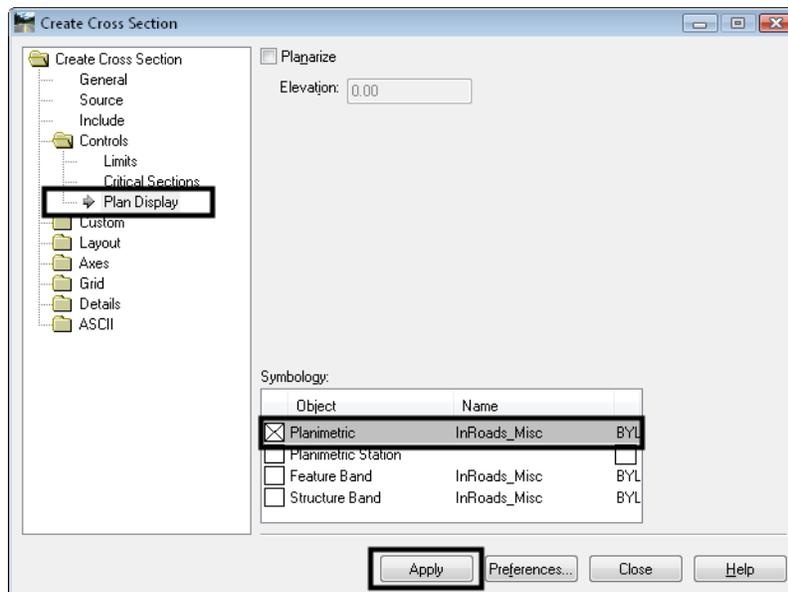49. Toggle on both surfaces.

50. **<D>** on the *Include* branch at left.

51. Toggle on *Components*.


52. **<D>** on *Controls > Plan Display*.

53. Toggle on the *Planimetric* option in the *Symbology* branch.

> ***Note:*** The planimetric option displays a MicroStation element showing where each cross section is cut.

54. **<D> Apply**.

55. **<D>** in a clear area in the design file. Like the profile, you are identifying the lower left corner for the display, so make certain you are in an area that is clear above and to the right of your <D>.
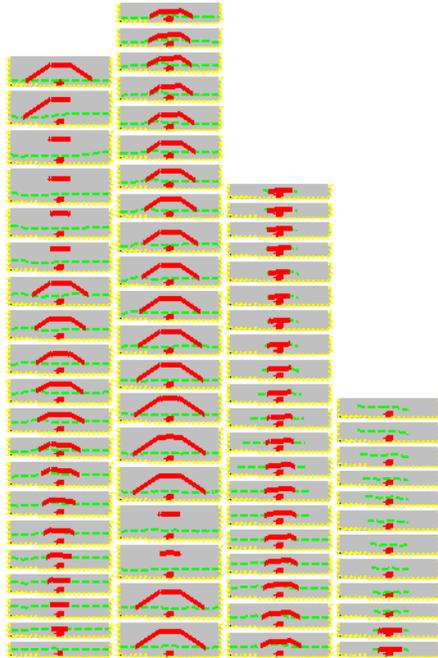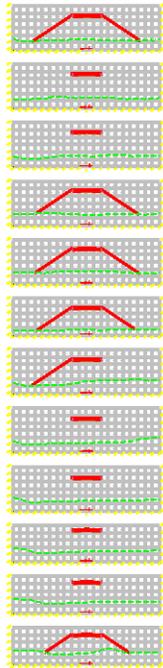

56. **Fit** your MicroStation view and notice the planimetric lines. You can see that by default, cross sections are cut perpendicular to the active alignment. In a later section, you will learn to cut the cross sections on a skew.
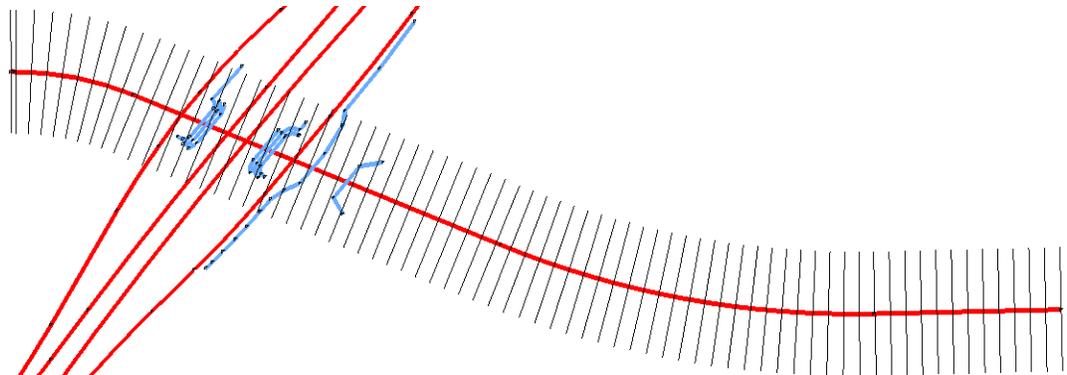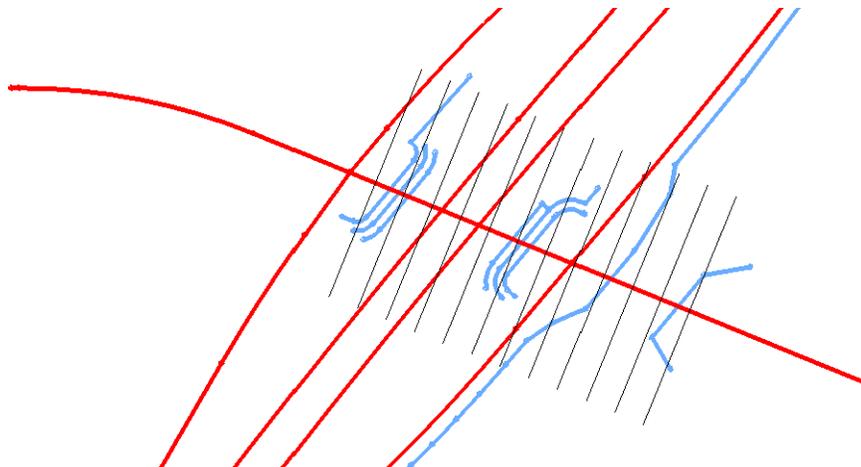

57. Use MicroStation to delete the cross sections and the planimetric lines in the plan view.

58. **<D>** on *Controls > Limits*.

59. Toggle on *Station*.

60. Set the *Start Station* to **116+00.00**.

61. Set the *End Station* to **111+50.00**.

62. <D> **Apply**.

63. **<D>** in a clear area in the design file.
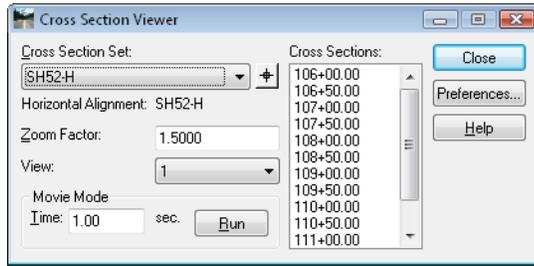

64. **Fit** your MicroStation view and notice the planimetric lines.

Note: Using the Station Limits allows you to cut sections for just a portion of the alignment.

You can zoom in and out of the cross sections to review them, or you can use a viewer that will automatically zoom into a selected cross section.

65. Choose **Evaluation > Cross Section > Cross Section Viewer**.

The viewer allows you to view cross sections by set. If you have more than one set of sections in the file, you can use the drop-down to choose the set you want to view, or you can use the target and **<D>** inside one of the sections. If you are zoomed out far enough, you will see a box drawn around the set of sections currently shown in the Viewer.

66. **<D>** on any one of the sections in the list.

67. With only one MicroStation view open, the Viewer automatically uses it to zoom into the section selected. If you have more than one MicroStation view open, you are prompted to select the view with a **<D>**.
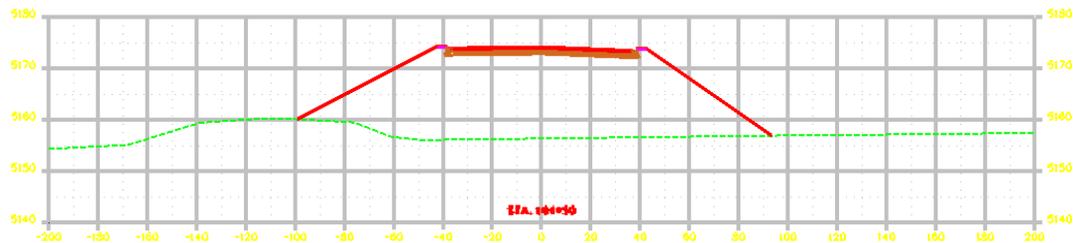

68. Change the *Zoom factor* to **1.0000** and choose another section.

69. **<D> Run**.

Just as before, with only one MicroStation view open, the Viewer automatically uses it to zoom into the sections, but this time it automatically scrolls through the entire set. If you have more than one MicroStation view open, you are prompted to select the view with a **<D>**.

Note: *<Esc>* on your keyboard stops the viewing process.

70. **<D> Close** on the **Cross Section Viewer**.

71. Window in to any one of the sections.
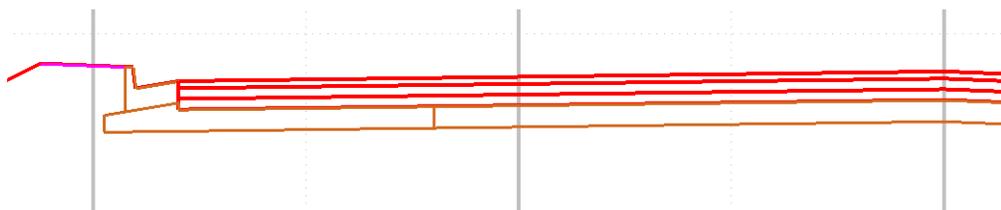
> **Note:** The lifts, curb and gutter, etc. are *components*, which were turned on before cutting sections. Design surfaces are made up of these components, as well as features and triangles.

72. Select **Evaluation > Cross Section > Update Cross Section**.

73. Set the *Cross Section Set* to *SH52-H*.

74. Set the *Mode* to *Display Off*.

75. Select the *Components* branch at left.

76. Highlight the *12345 SH52* surface.

77. Right-click in the component list and **<D>** *Select All*.

78. **<D> Apply**, then **Close**.
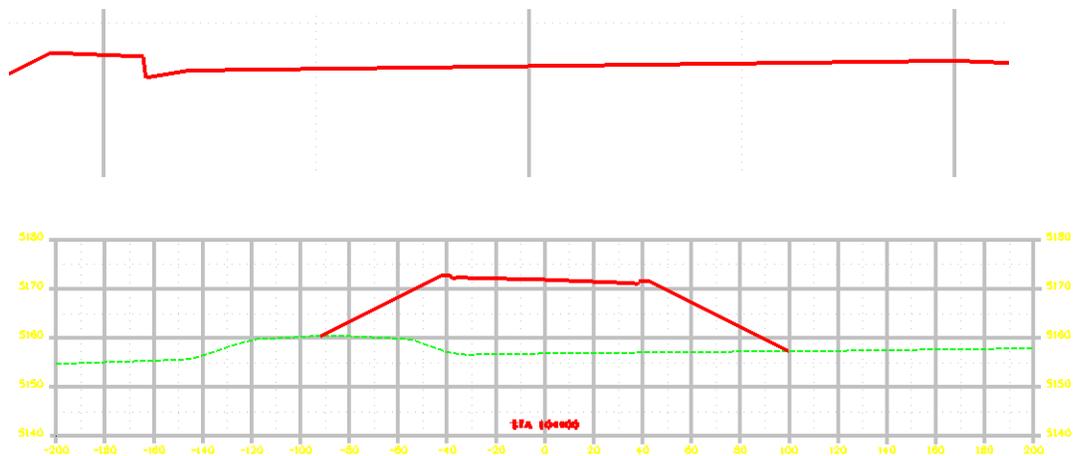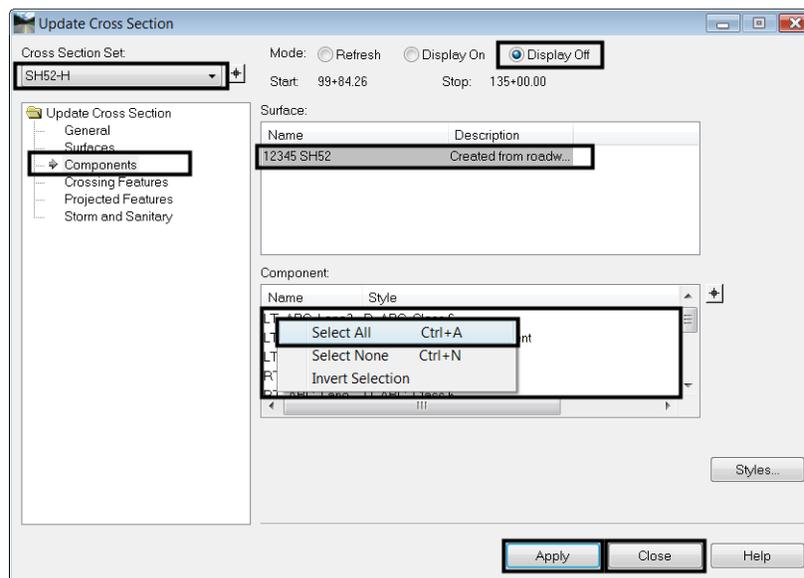
> **Note:** The cross sections now show only the triangulated surface for SH52. Components may be turned on and off as desired using this procedure.

79. Use MicroStation to **Delete** the cross section set and the planimetric lines.

> ***Note:***   Sections can be cut along any alignment, not just a highway alignment.

80. Using what you have learned, cut 25' sections along Wall-16-L that are 20' wide on either side.
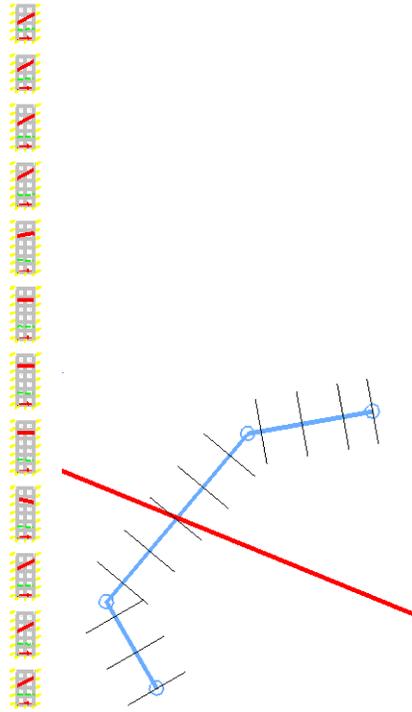
81. Review the sections.

82. Use MicroStation to **Delete** the cross section set and the planimetric lines.

Chapter Summary::

- Surfaces may be reviewed graphically by viewing the perimeter, triangles and/or contours among other surface displays.

- Horizontal alignments may be viewed graphically along with their stationing and annotation.

- Horizontal alignments may also be tracked as a review tool.

- Reports for horizontal alignment can be generated with the Review commands or with the XML Report command.

- With a horizontal alignment and surface, you can generate a profile and annotate a vertical alignment.

- With a horizontal alignment and surface, you can generate a set of cross sections to review the data.