LAB 7 - Feature Based Modeling

This section covers how to use Surface Modeling tools for excavation and backfills. You will also use these tools to create pier features.

Chapter Objectives:

- Learn how to create excavation and backfill surfaces for footers (piers, walls, etc.).
- Learn how to use the ***Generate Sloped Surface*** command to create proposed surfaces by intercepting existing or design surfaces.
- Learn how to profile excavation and backfill surfaces.
- Learn how to set the elevation of elements or features.
- Learn how to import MicroStation graphics into a surface.
- Learn how to create pier features and a pier surface for volume computations.

The following files are used in this lab:

- C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Preferences\ CDOT_Civil.xin
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange
- C:\Projects\12345\Design\InRoads\12345 SH119
- C:\Projects\12345\Design\InRoads\12345 SH119 SH52 Interchange.alg
- C:\Projects\12345\Bridge\Drawings\Reference_Files\12345BRDG_Model_D-16-DU.dgn
- C:\Workspace\Workspace-CDOT_XM\Standards-Global\InRoads\Templates\ CDOT_Template-Library.itl

Lab 7.1 - Open Project Data

1. Open MicroStation and InRoads using the ***C:\Projects\12345\Bridge\Working \CU12345BRDG_Model.dgn*** file.
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 SH119*** and ***12345 SH119 SH52 Interchange.alg.***
6. Open ***C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground for interchange***.

Lab 7.2 - Create an Excavation Surface for a Pier Footer

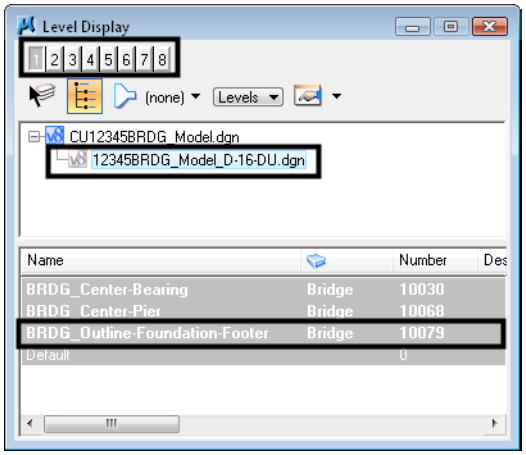
In this section, surfaces are created for the excavation and backfill for a pier footer for bridge D-16-DU. The primary commands used are ***Generate Sloped Surface*** and ***Generate Longitudinal Feature***. For more information on either of these commands, please see the ***Surface Editing*** chapter of ***A Practical Guide for Using InRoads XM.***

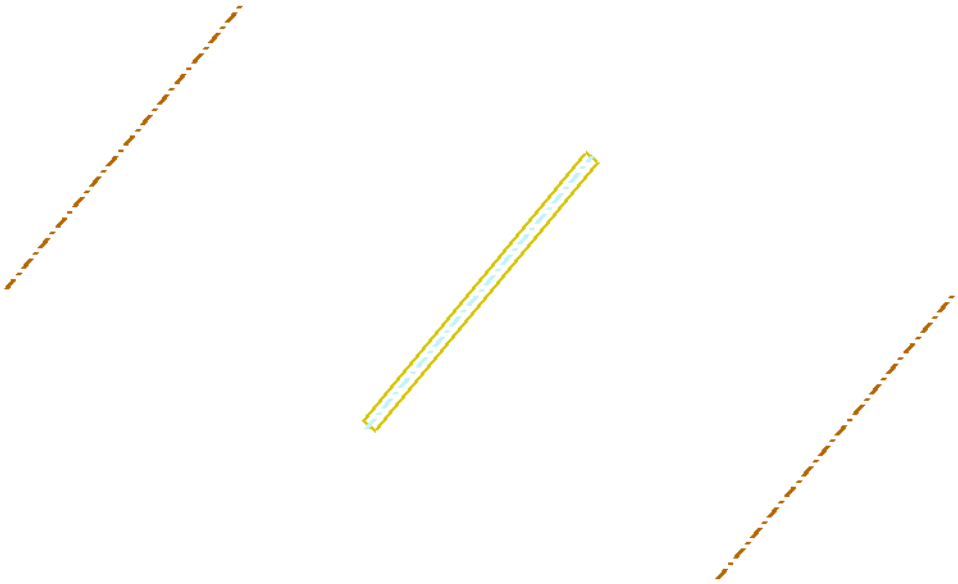
In a later lab, these surfaces will be used to calculate volumes.

1. In MicroStation, select **Settings > Level > Display**.
2. Toggle ***View Index 1*** on and all others off.
3. Toggle ***Show Level Name or Filters*** to ***Levels***.
4. Highlight the ***12345BRDG_Model_D-16-DU.dgn*** file.

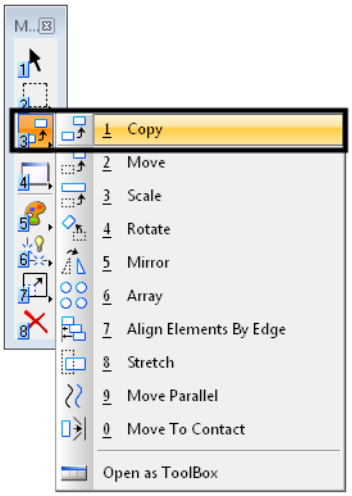
   Note: This is the reference file that was attached in Lab 2. If it is not listed in this dialog, re-attach the reference file now.

5. Turn on the ***BRDG_Outline-Foundation-Footer*** level.

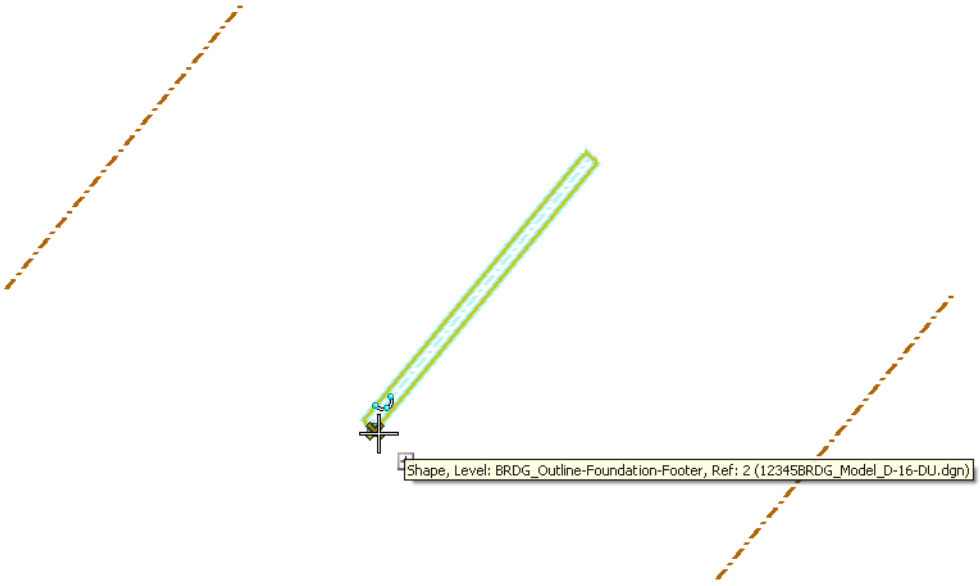




6. Select MicroStation's **Copy** tool.

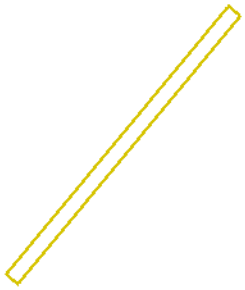


7. Snap to a corner of the outline to choose it to copy.



8. Snap to the same corner to place it at the same location in the current working file.
9. In MicroStation, select **File > Reference**.
10. Highlight the ***12345BRDG_Model_D-16-DU.dgn*** file and toggle the ***Display*** off.

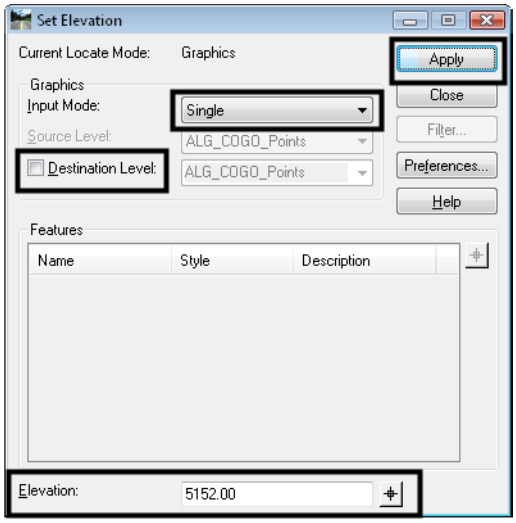
The new copy of the outline should still be showing in the current file.



Note: The outline is currently at elevation 0. Next, the outline must be moved to the appropriate elevation.

11. Select **Surface > Design Surface > Set Elevation**.
12. Make certain the current ***Locate Mode*** is ***Graphics***. If not, toggle it on your ***Locks*** toolbar.

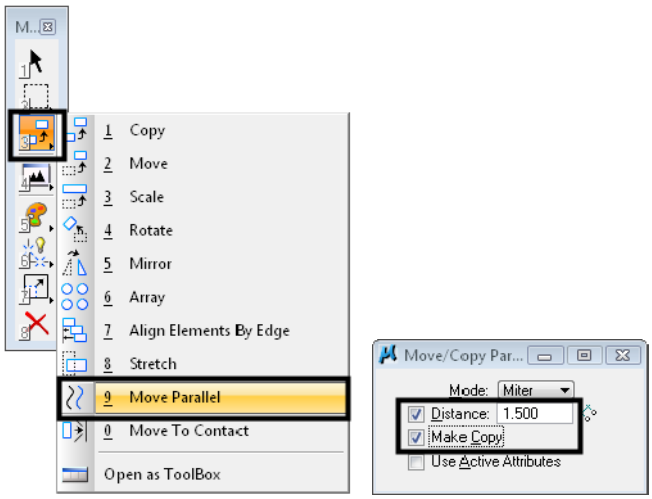
13. In the ***Set Elevation*** dialog box, set the ***Input Mode*** to ***Single***.
14. Toggle off the ***Destination Level***.
15. Key in ***5152*** for the ***Elevation***.



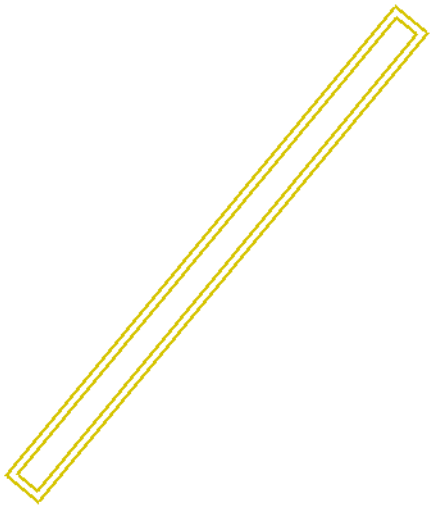
16. **<D> Apply**.
17. **<D>** the outline.
18. **<D>** to Accept.

    Note: The outline may disappear because elevation 5152 is not within your display depth. If it does, Fit your view with MicroStation.

19. Select MicroStation's **Move Parallel** tool.

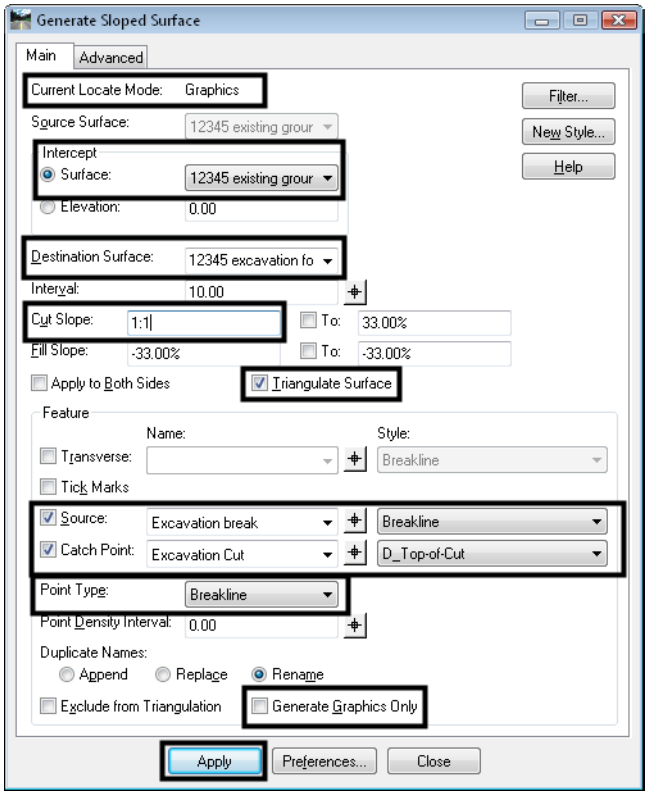


20. Toggle on ***Distance*** and key in ***1.5***.
21. Toggle on ***Make Copy***.
22. **<D>** on the outline.
23. **<D>** to Accept on the outside of the footer outline.



24. **<R>** to stop copying.
25. Select **Surface > Design Surface > Generate Sloped Surface**.
26. Verify that the current ***Locate Mode*** is ***Graphics***. If not, toggle ***Locate Feature / Locate Graphics*** to ***Locate Graphics*** on the ***Locks*** toolbar.
27. Verify that ***Generate Graphics Only*** is toggled off.
28. Set the ***Intercept Surface*** to ***12345 existing ground for interchange***.
29. Key in ***12345 excavation for pier footer*** as the ***Destination Surface***.
30. Set the ***Cut Slope*** to ***1:1***.

    Note: The ratio is automatically converted into a percentage.
31. Toggle on ***Triangulate Surface***.
32. Toggle on ***Source*** and key in ***Excavation break***.
33. Set the ***Style*** to ***Breakline***.
34. Toggle on ***Catch Point*** and key in ***Excavation Cut***.
35. Set the ***Style*** to ***D_Top-of-Cut***.
36. Set the ***Point Type*** to ***Breakline***.

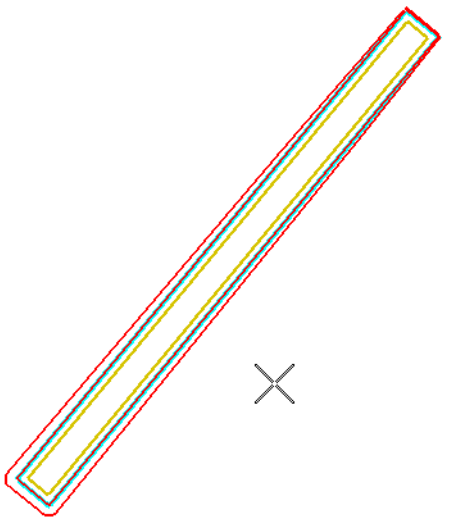


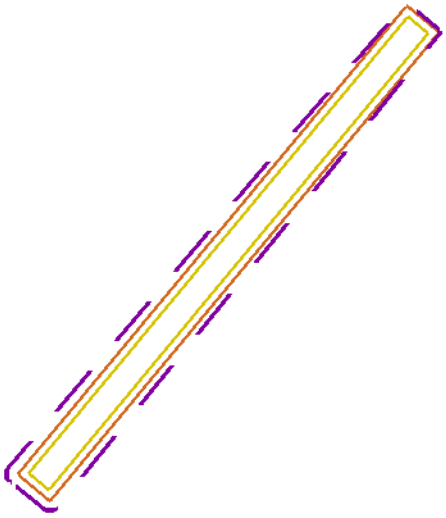
37. **<D> Apply**.

38. **<D>** on the outer pier outline.
39. **<D>** to Accept.
40. **<R>** for Entire (the entire element).

    Important! If you **<D>** again instead of **<R>**, that location is the starting point for the slope and the excavation will not be completed around the pier.

41. Move your cursor to the ***outside*** until the temporary graphic looks like shown here, then **<D>** to Accept the location.





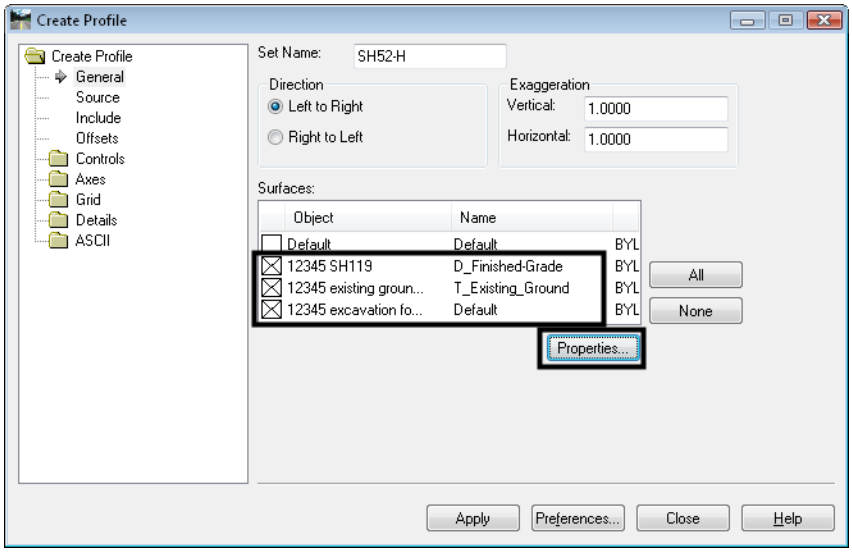
<R> out of the command.

Note: The ***Generate Sloped Surface*** command is very useful for creating sloped surfaces from features or graphical elements that intercept other surfaces. The intercepts can be existing ground surfaces, design surfaces or even surfaces previously created with this command.

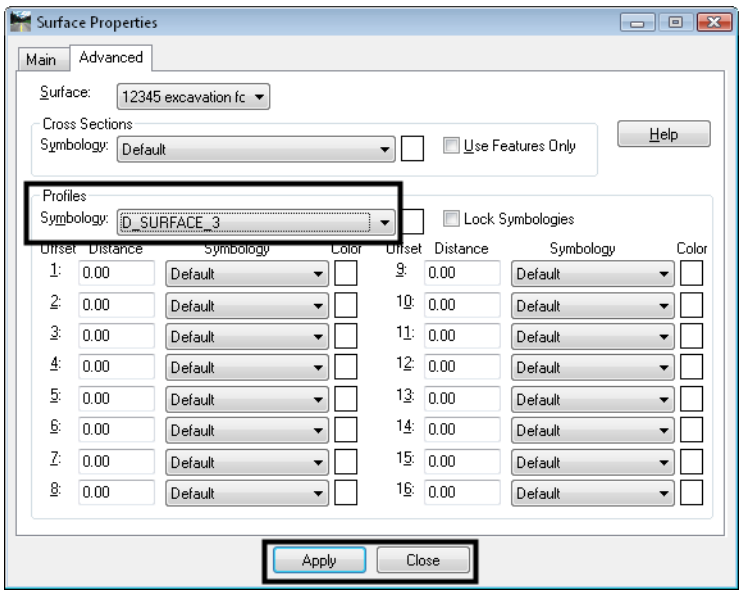
42. Select **Evaluation > Profile > Create Profile**.

43. Toggle on ***12345 existing ground for interchange***, ***12345 SH119*** and ***12345 excavation for pier footer***.

44. Highlight ***12345 excavation for pier footer*** and choose ***Properties***.



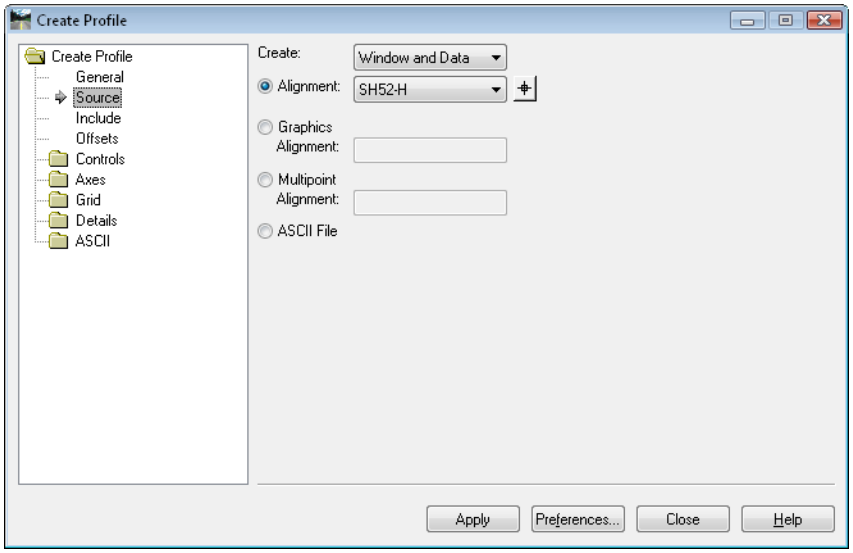
45. Set the ***Profile Symbology*** to ***D_SURFACE_3***.



46. **<D> Apply**, then **Close**.

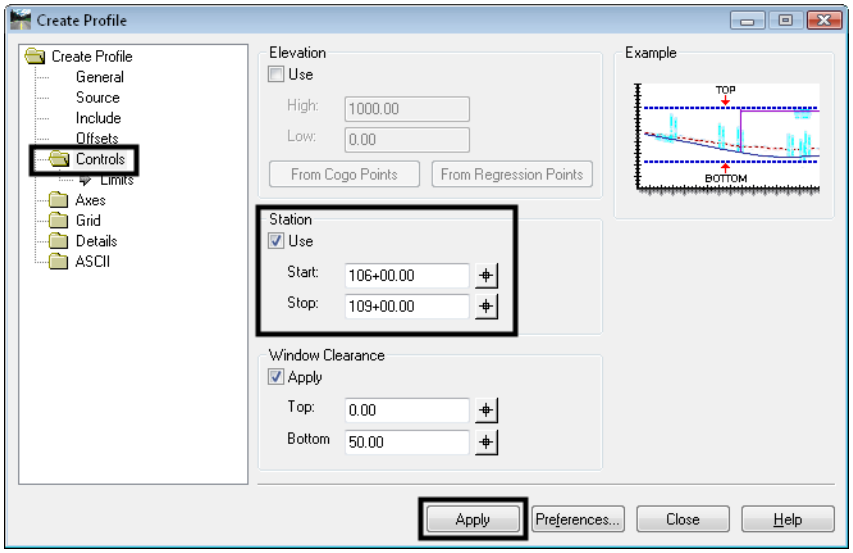
47. Back on the ***Create Profile*** dialog box, select the ***Source*** branch

48. Set ***Alignment*** to ***SH52-H***



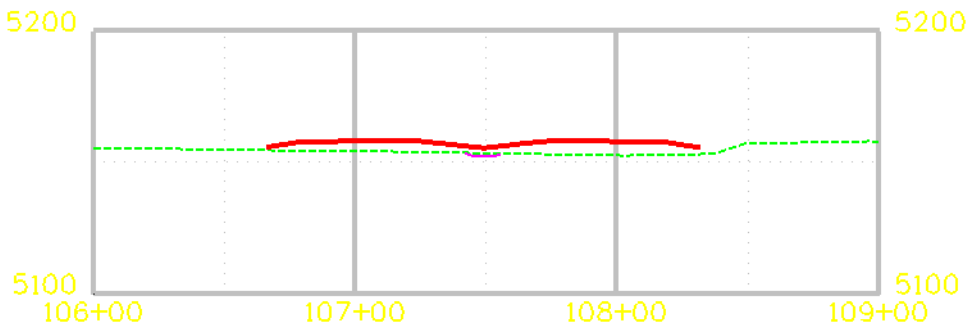
49. Select the ***Controls*** branch.

50. Set the ***Station Limits*** to ***106+00*** to ***109+00***.

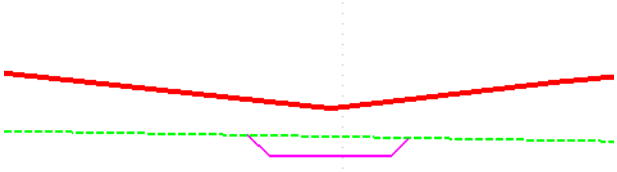


51. **<D> Apply**.

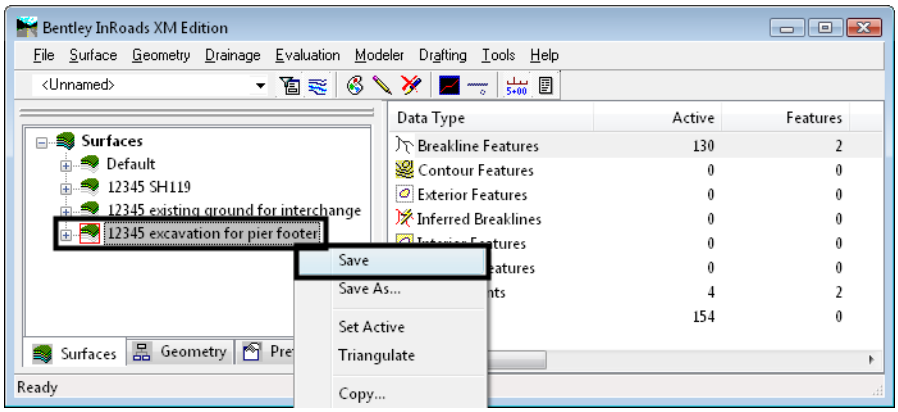
52. **<D>** a clear area in the design file for the location of the profile.



53. Window in to see the excavation surface.

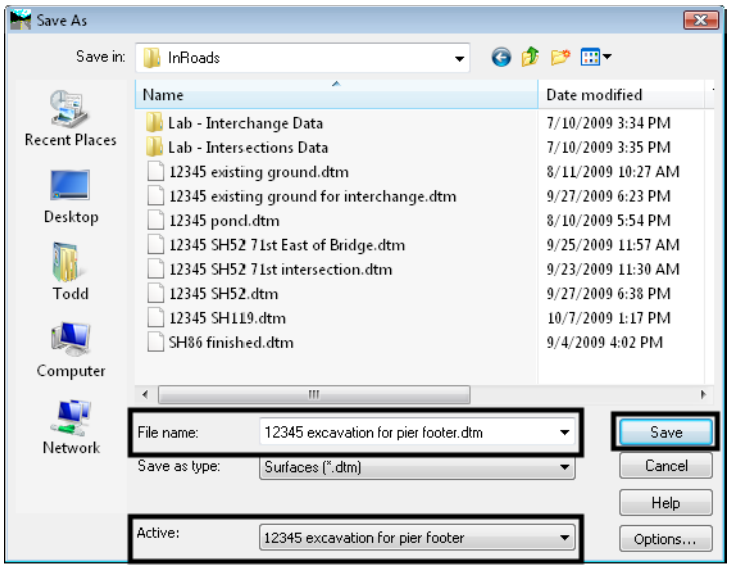


54. Right-click on the ***12345 excavation for pier footer*** surface in the ***Explorer*** part of the menu and choose ***Save***.



Note: Verify the ***Active Surface*** is ***12345 excavation for pier footer***

55. If the ***File name*** is blank, use the ***Active*** drop-down to again choose ***12345excavation for pier footer*** and the name appears in the ***File name*** field as well.



56. Verify the ***Save In*** path is ***C:\Projects\12345\Bridge\InRoads***.

57. **<D> Save** then **Cancel**.

Lab 7.3 - Create a Backfill surface for a Pier

Next, the surface for the backfill is created, using the same procedure.

1. Select **Surface > Design Surface > Generate Sloped Surface** if you previously closed it.

2. Verify that the current ***Locate Mode*** is ***Graphics***. If not, toggle ***Locate Feature / Locate Graphics*** to ***Locate Graphics*** on the ***Locks*** toolbar.

3. Verify that ***Generate Graphics Only*** is toggled off.

4. Set the ***Intercept Surface*** to ***12345 SH119***.

5. Key in ***12345 backfill for pier footer*** as the ***Destination Surface***.

6. Set the ***Cut Slope*** to ***1:1***.

   Note: The ratio is automatically converted into a percentage.

7. Toggle on ***Triangulate Surface***.

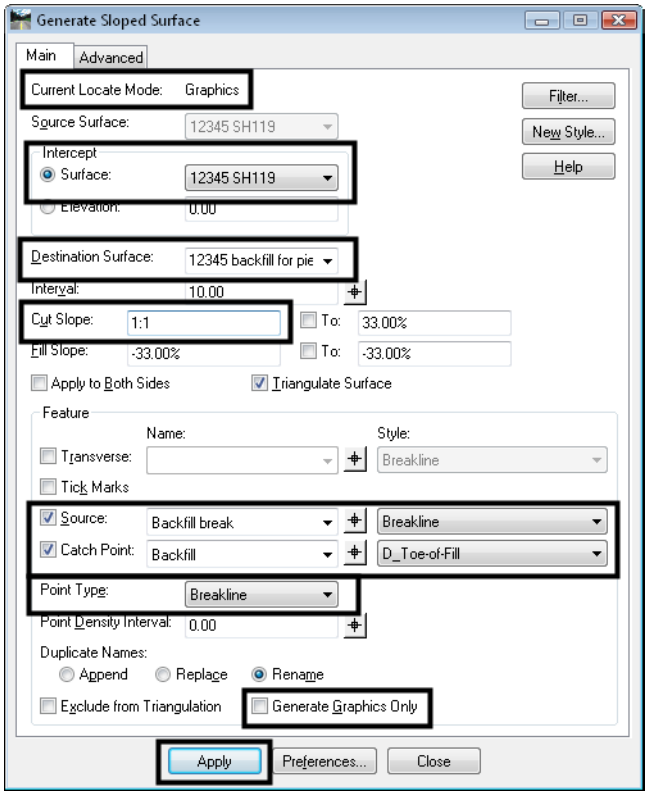
8. Toggle on ***Source*** and key in ***Backfill break***.

9. Set the ***Style*** to ***Breakline***.

10. Toggle on ***Catch Point*** and key in ***Backfill***.

11. Set the ***Style*** to ***D_Top-of-Fill***.

12. Set the ***Point Type*** to ***Breakline***.



13. **<D> Apply**.

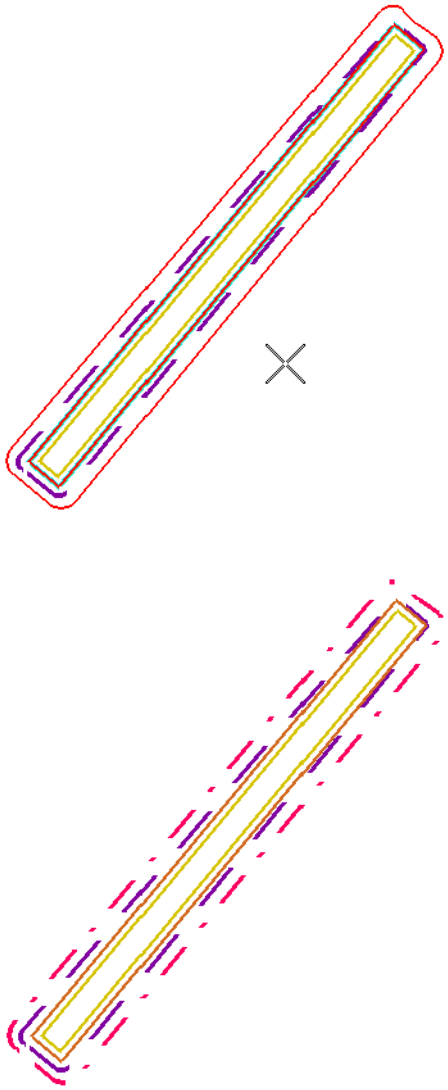
14. **<D>** on the outer pier outline.

15. **<D>** to Accept.

16. **<R>** for Entire (the entire element).

Important! If you **<D>** again instead of **<R>**, that location is the starting point for the slope and the backfill will not be completed around the pier.

17. Move your cursor to the ***outside*** until the temporary graphic looks like shown here, then **<D>** to Accept the location.



18. **<R>**.

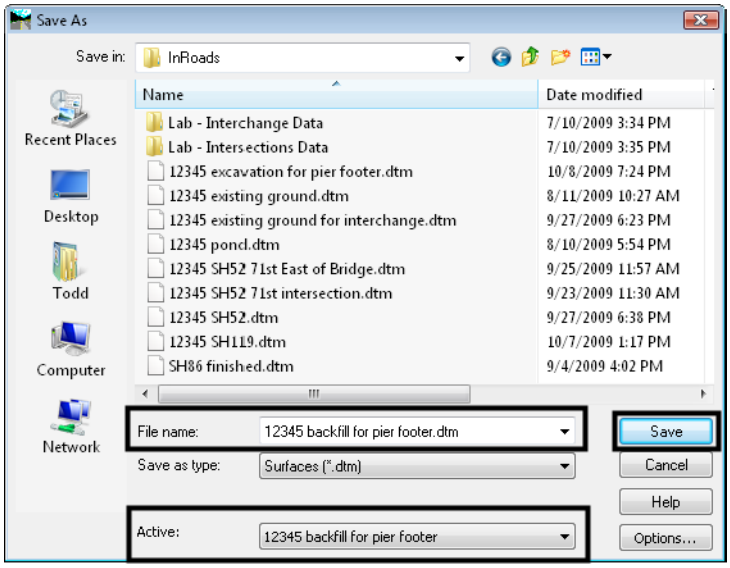
19. **<D> Close** on the ***Generate Sloped Surface*** dialog.

20. Right-click on the ***12345 backfill for pier footer*** surface in the ***Explorer*** part of the menu and choose ***Save***.

    Note: Verify the ***Active Surface*** is ***12345 backfill for pier footer***

21. If the ***File name*** is blank, use the ***Active*** drop-down to again choose ***12345 backfill for pier footer*** and the name appears in the ***File name*** field as well.

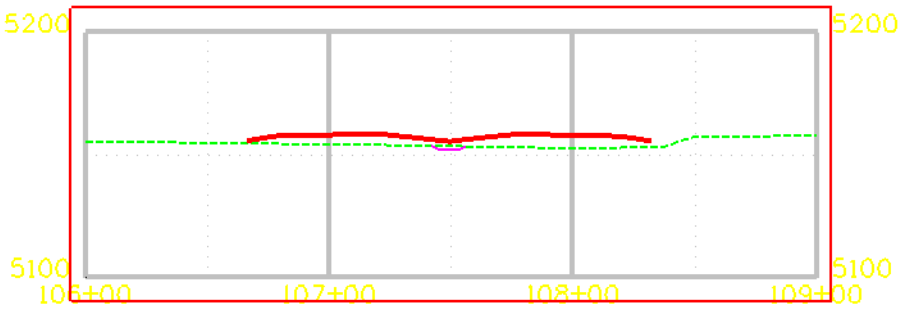
22. Verify the ***Save In*** path is ***C:\Projects\12345\Design\InRoads***.



23. **<D> Save** then **Cancel**.

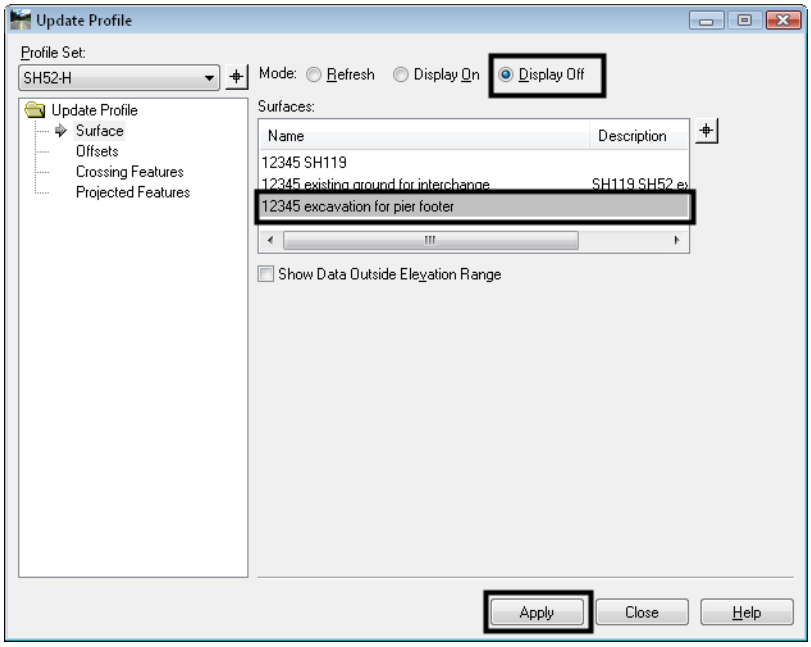
24. Select **Evaluation > Profile > Update Profile**.

25. Verify the ***Profile Set*** is the one used in the previous section if you have more than one in your file. A box is drawn around the Profile Set listed.

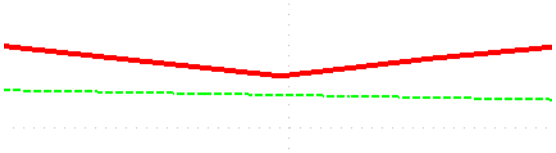


26. Toggle ***Mode*** to ***Display Off***.

27. Highlight the ***12345 excavation for pier footer***.



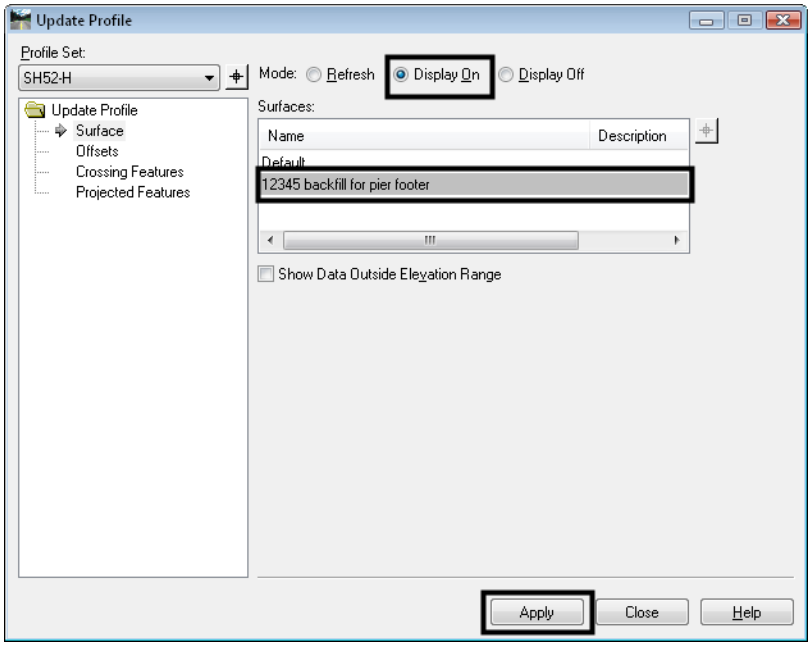
28. **<D> Apply**.



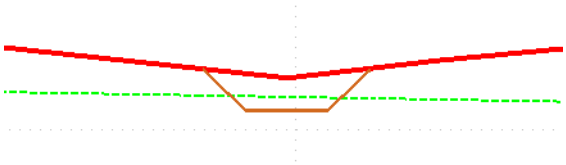
Note: The excavation surface is no longer shown on the profile.

29. Toggle ***Mode*** to ***Display On***.

30. Highlight the ***12345 backfill for pier footer***.



31. **<D> Apply**.



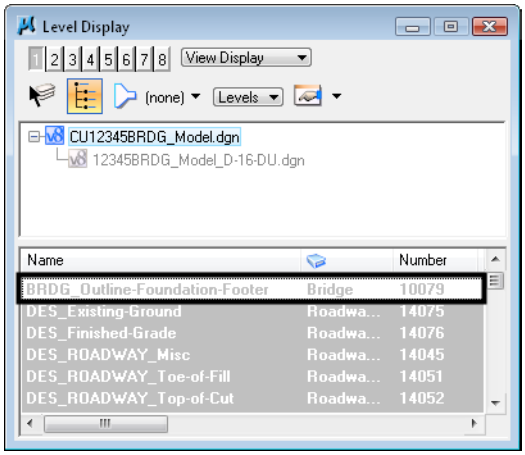
Note: The backfill surface is now shown on the profile.

32. **<D> Close** on the ***Update Profile*** dialog.

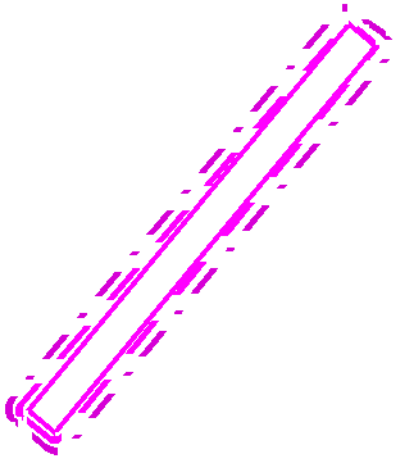
Lab 7.4 - Create Pier Features

The footer and pier must be excluded from the backfill quantities. This can be accomplished by manually calculating the quantity and deducting it from what will be calculated from the surface as it exists now. Or, features may be added to the surface that take the footer and pier into account when InRoads computes the quantity. In the next series of steps, the second option is shown, creating four breaklines: ***bottom of footer***, ***top of footer***, ***bottom of pier***, and ***top of pier***. Since DTMs do not support overhangs or true verticals, the footer and pier are represented as 'near' verticals.

1. Turn off the ***BRDG_Outline-Foundation-Footer level***.

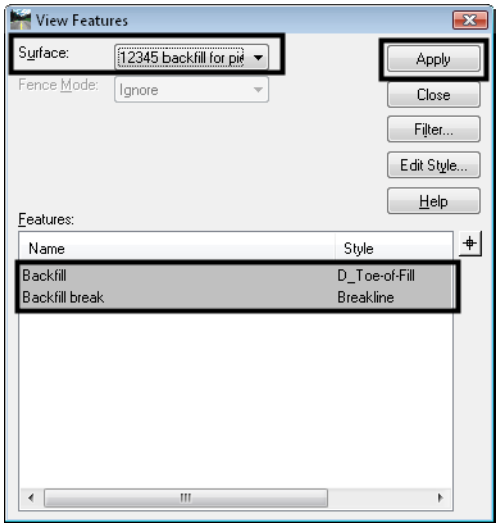


2. **Delete** all of the remaining plan graphics to make it easier to see the features as they are developed (do not delete the profile graphics).

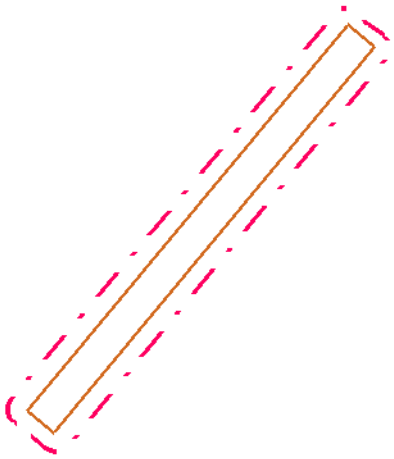


3. Select **Surface > View Surface > Features**.
4. Set the ***Surface*** to ***12345 backfill for pier footer***.

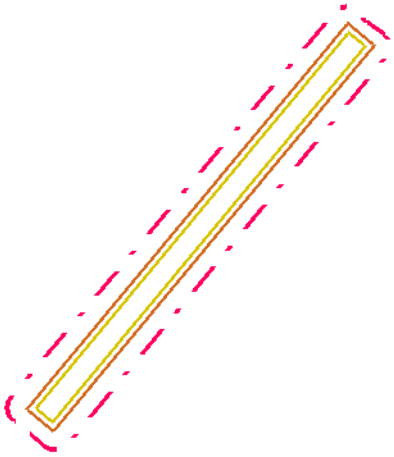
5. Highlight both features.



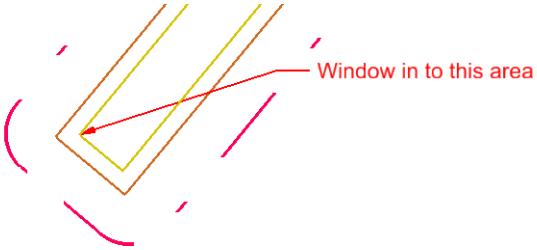
6. **<D> Apply**, then **Close**.

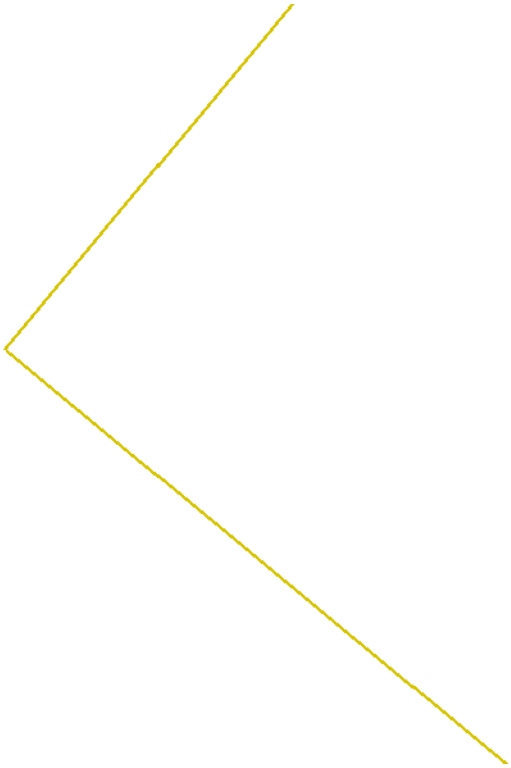


7. Turn on the ***BRDG_Outline-Foundation-Footer level***.

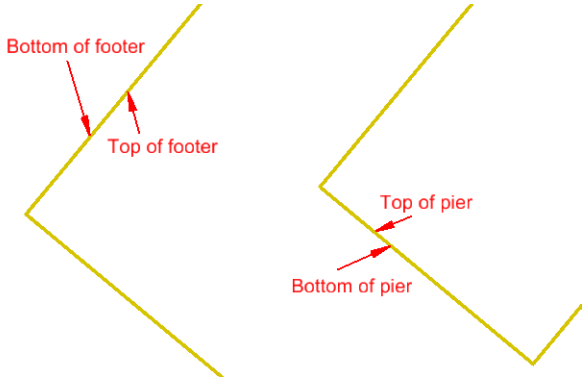


8. Window in to the corner of the footer.

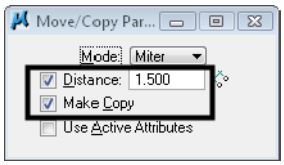




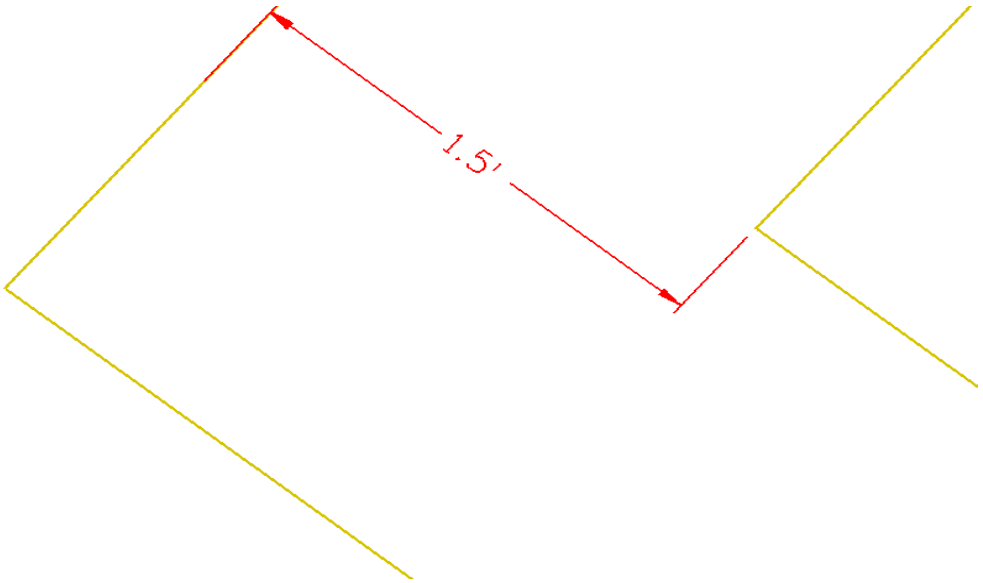
Note: This element represents the bottom of the footer. In the next series of steps, MicroStation is used to create 3 parallel copies of this element.



9. Select MicroStation's **Move Parallel** tool.
10. Toggle on ***Distance*** and key in ***1.50***.
11. Toggle on ***Make Copy***.

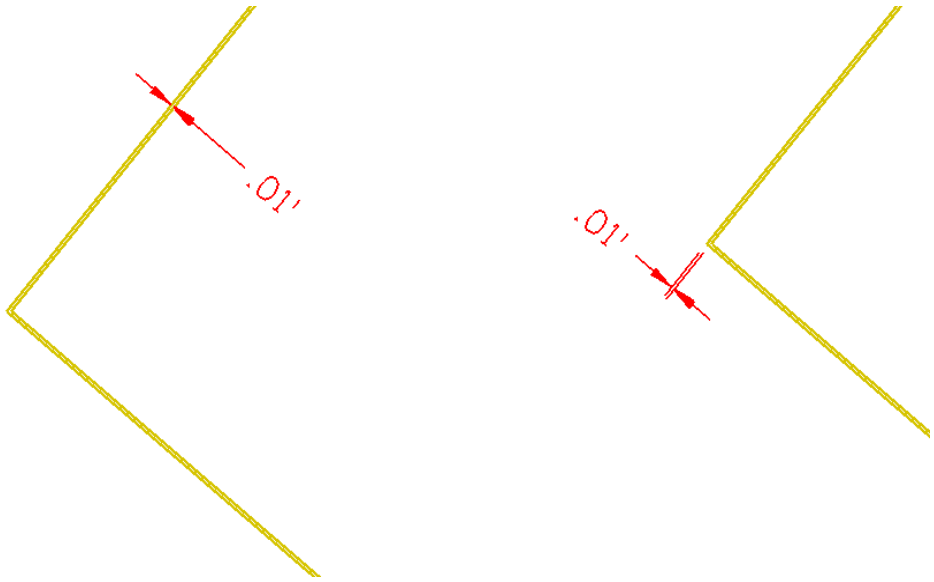


12. **<D>** on the footer outline.
13. **<D>** to Accept ***inside*** the footer outline.
14. **<R>** to end the copy.



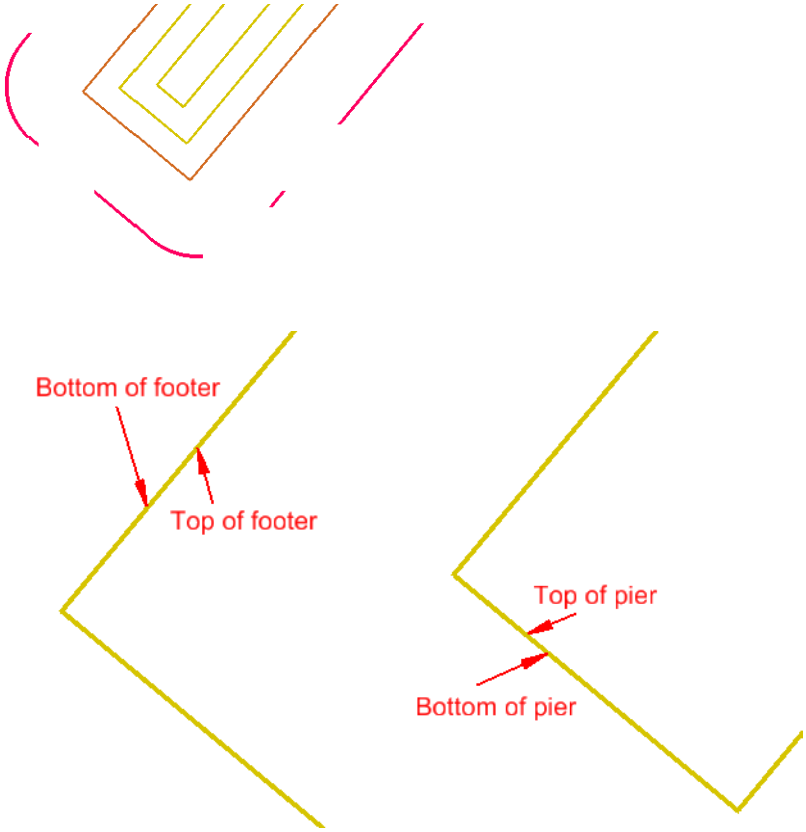
Note: This is the bottom of the pier.

15. In the **Move Parallel** command, change the ***Distance*** to ***0.01***.
16. Make a copy of each line, to the inside.



Note: These lines represent the top of the footer and the top of pier.

Note: There are now four concentric rectangles representing the footer and pier. In this case, one monolithic pier is being used; for multiple piers this procedure would be repeated for each.



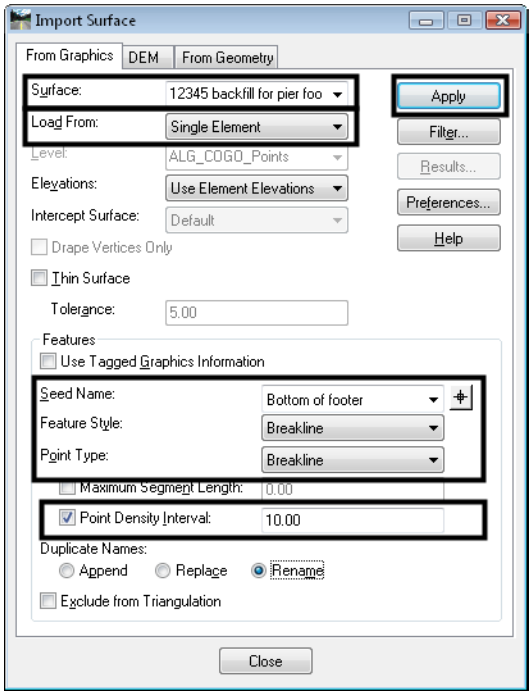
Each of these MicroStation shapes must now be made into a feature, then moved to the correct elevation.

17. Select **File > Import > Surface**.
18. Select the ***From Graphics*** tab.
19. Set the ***Surface*** to ***12345 backfill for pier footer***.
20. Set ***Load From*** to ***Single Element***.
21. Set ***Elevations*** to ***Use Element Elevations***.

    Note: All of these shapes are at the same elevations. After importing them, the proper elevations will be set.

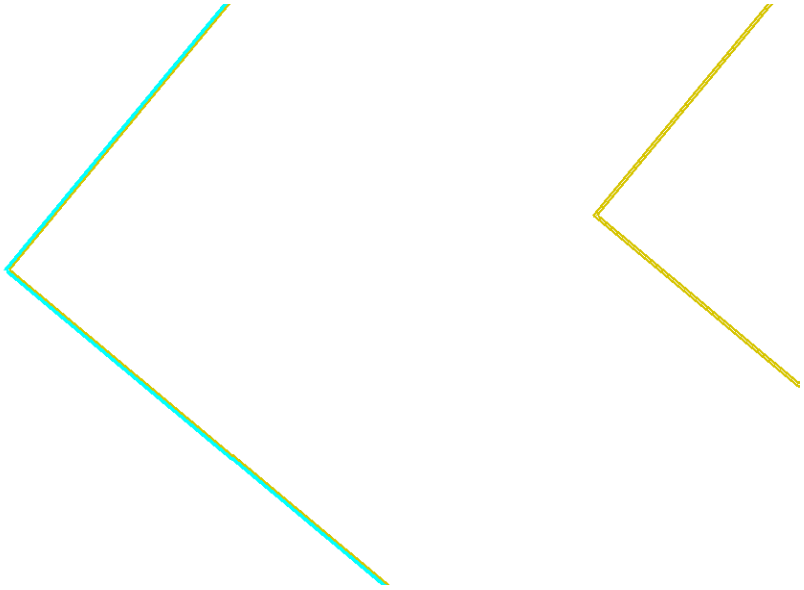
22. Key in ***Bottom of footer*** for the ***Seed Name***.
23. Set the ***Feature Style*** to ***Breakline***.
24. Set the ***Point Type*** to ***Breakline***.

25. Toggle on ***Point Density Interval*** and key in ***10.00*** for the value.



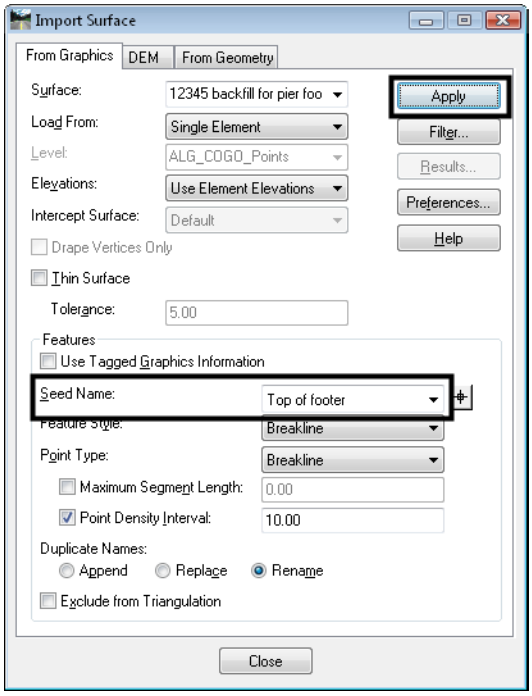
26. **<D> Apply**.

27. **<D>** on the bottom of footer line.



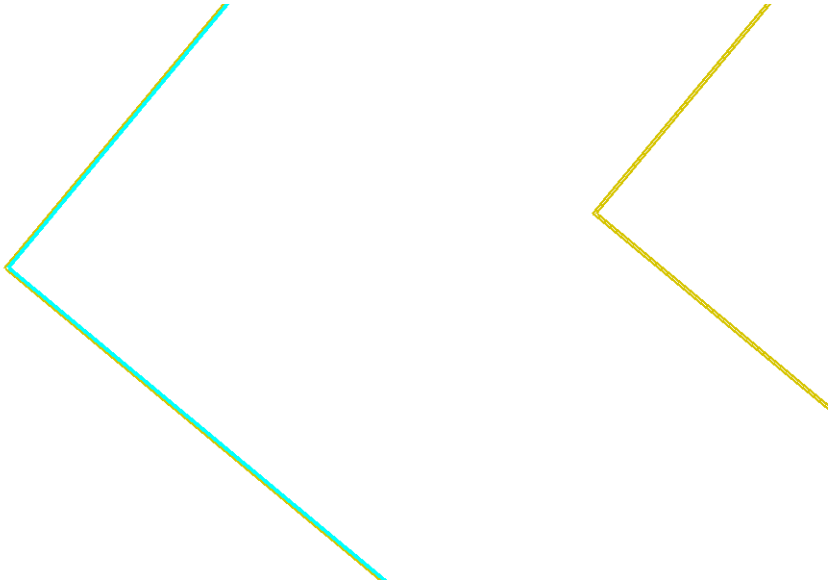
28. **<D>** to Accept.

29. Key in ***Top of footer*** for the ***Seed Name***



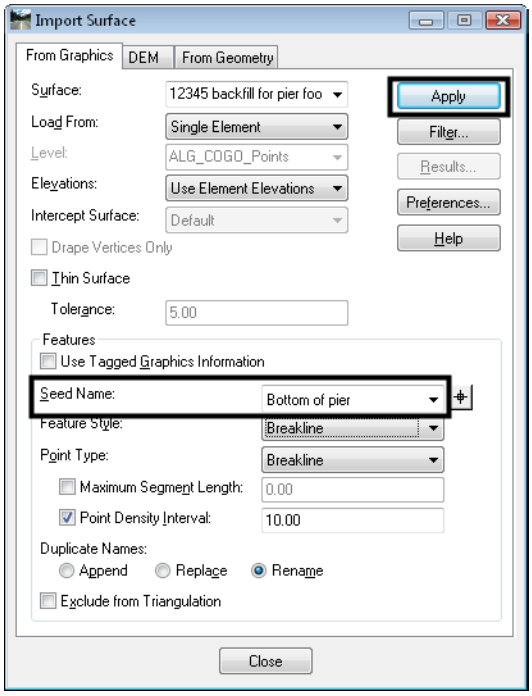
30. **<D> Apply**.

31. **<D>** on the top of footer line.



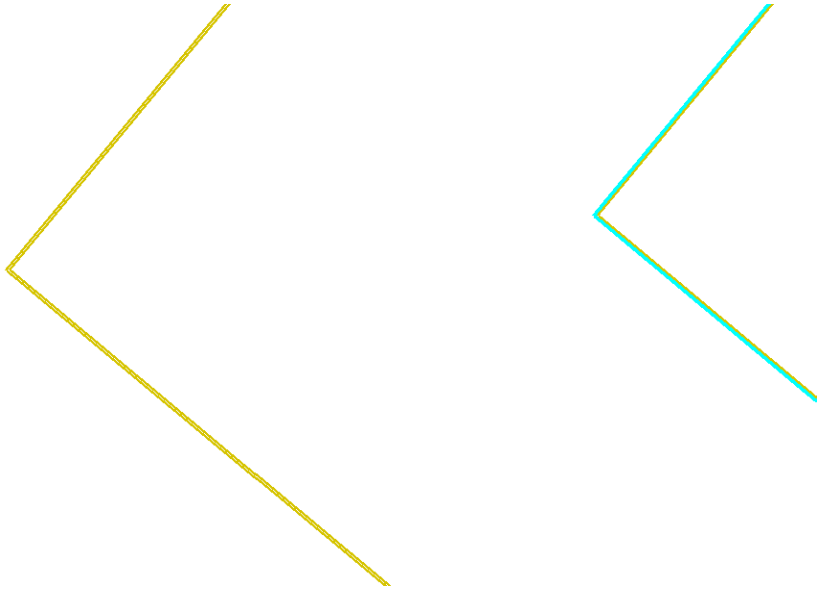
32. **<D>** to Accept.

33. Key in ***Bottom of pier*** for the ***Seed Name***.



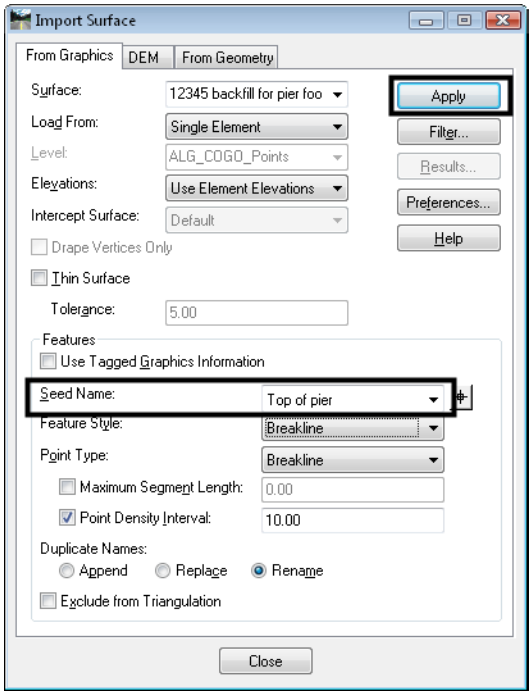
34. **<D> Apply**.

35. **<D>** on the bottom of pier line.



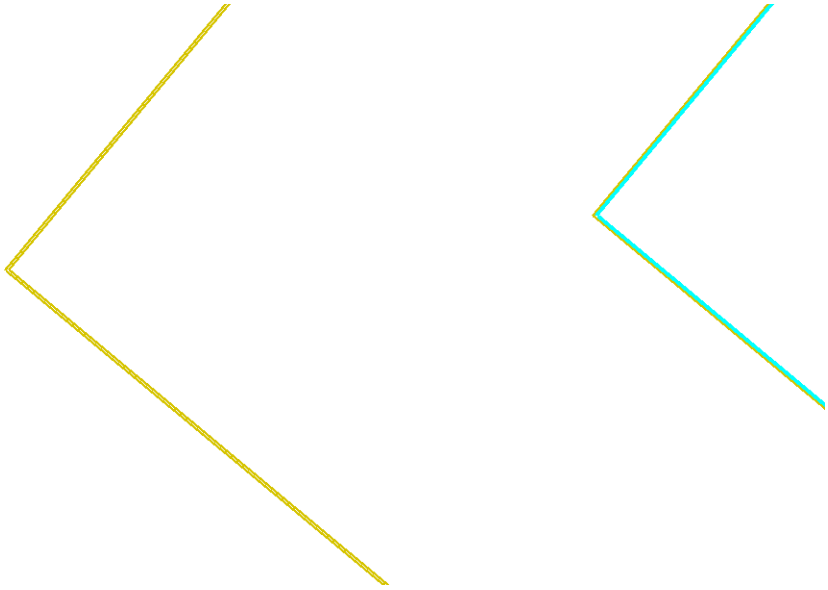
36. **<D>** to Accept.

37. Key in ***Top of pier*** for the ***Seed Name***.



38. **<D> Apply**.

39. **<D>** on the top of pier line.



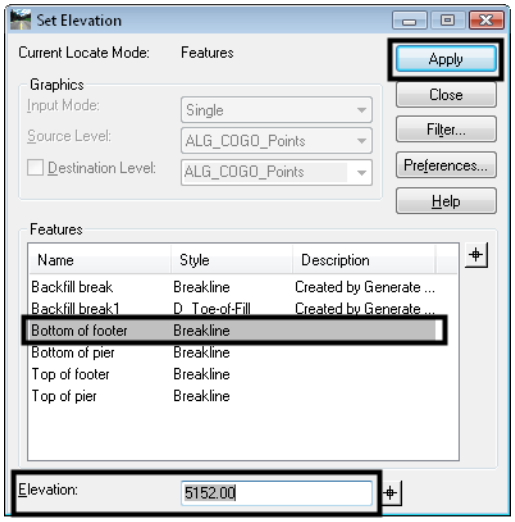
40. **<D>** to Accept.

41. Select **Surface > Design Surface > Set Elevation**.

42. If the current ***Locate Mode*** is not set to ***Features***, toggle ***Locate Graphics/Locate Features*** on the locks toolbar to ***Locate Features***.

Note: This command can set the elevation of either graphical elements or features. Since the shapes have already been loaded into the surface, they are already features.

43. Highlight the ***Bottom of footer*** feature.
44. Key in an ***Elevation*** of ***5152***.

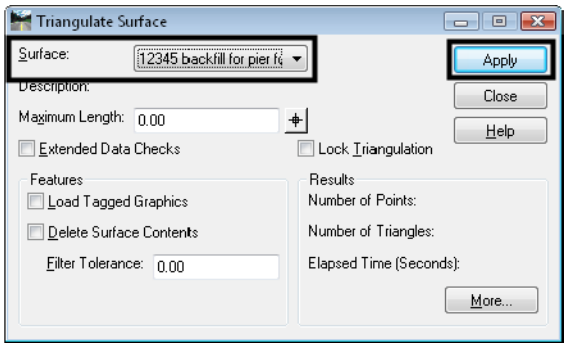


45. **<D> Apply**.
46. Highlight the ***Top of footer*** feature.
47. Key in an ***Elevation*** of ***5153.5***.
48. **<D> Apply**.
49. Highlight the ***Bottom of pier*** feature.
50. Leave the ***Elevation*** set to ***5153.5***.
51. **<D> Apply**.
52. Highlight the ***Top of pier*** feature.
53. Key in an ***Elevation*** of ***5180***.
54. **<D> Apply** then **Close**.

Note: Alternately, you can set the MicroStation graphics to the correct elevation using the ***Set Elevation*** command prior to importing the graphics as features into InRoads.The ***Set Elevation*** command works on either graphics or features based on the ***Locate mode***.

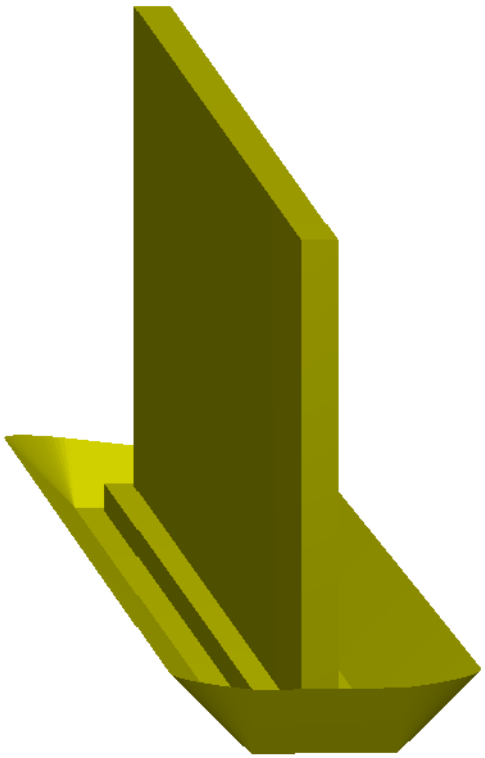
55. Select **Surface > Triangulate Surface**.

56. Verify the ***Surface*** is ***12345 backfill for pier***.



57. **<D> Apply** then **Close**.

Note: This has basically created a footer and pier sitting in a trough. The triangles and/or contours may be displayed to review the surface if desired. This image shows a rotated view of the triangles that has been shaded using MicroStation's **Utilities > Render > Smooth**.



58. ***Save*** the ***12345 backfill for pier footer*** surface to the directory C:\Projects\12345\Bridge\InRoads.

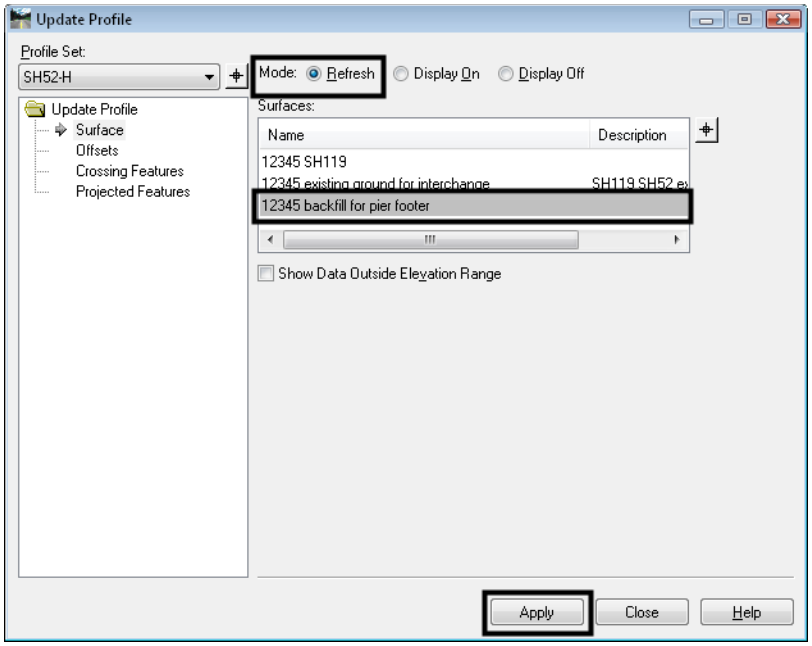
59. Window in to the previously displayed profile.

60. Select **Evaluation > Profile > Update Profile**.

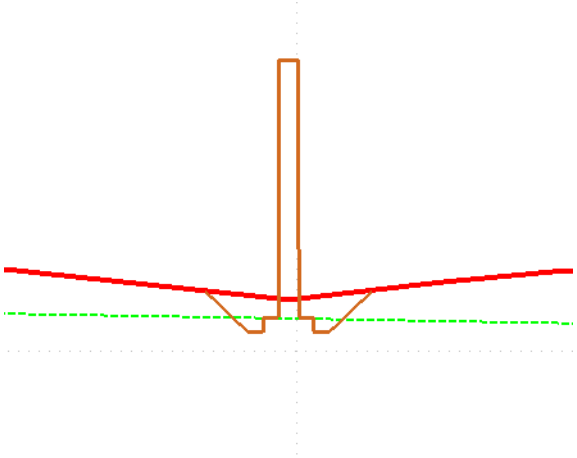
    Note: If there is more than one profile in the design file, make certain the correct ***Profile Set*** is listed.

61. Set the ***Mode*** to ***Refresh***.

62. Highlight the ***12345 backfill for pier surface***.



63. **<D> Apply**, then **Close**



Note: This surface, along with the excavation surface will be used in a later lab to calculate volumes.

Chapter Summary:

- The ***Generate Sloped Surface*** command is very useful for creating sloped surfaces from features or graphical elements that intercept other surfaces.
- The intercepts can be existing ground surfaces, design surfaces or even surfaces previously created with this command.
- Features can be added to a proposed surface representing footers, piers, walls, etc.), which can be used for volume computations.
- MicroStation elements or surface features can be placed at the correct elevation using the ***Set Elevation*** command in InRoads.
- MicroStation elements can be imported as surface features using the ***Import Surface*** command in InRoads; if they are not at the correct elevation, the elevation can be set using the InRoads ***Set Elevation*** command.