LAB 29 - Forcing Toes Inside of the Right Of Way

There are numerous reasons why it may not be possible to acquire additional right of way on a project. In these situations, the end conditions must adjust to the location of the right of way where it is restrictive and follow the proper design criteria where it is not.

In this lab, an end condition section is constructed that determines the proper sideslope based on the criteria from the 2005 Roadway Design Guide and the location of the right of way. This end condition section is then attached to a template and used in a corridor to demonstrate its functionality.

Chapter Objectives:

- Modify an existing end condition section to account for the right of way.
- Add the modified section to a "backbone" template.
- Create a corridor that uses the modified template.
- Add point controls so that the template can locate the right if way line.

The following files are used with this lab:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Projects\12345\Design\InRoads\12345DES_Geometry-Toes.alg
- C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm
- C:\Projects\12345\Design\InRoads\12345DES_Templates_Toes-Lab.itl

Lab 29.1 - Modifying the End Condition Section and Adding it to a Template

In this exercise, a standard end condition section is copied and modified to account for the right of way. This end condition is then added to a template.

Section Objectives:

- Copy the end condition section.
- Add NULL points to control the maximum length of sideslopes and locate the right of way.
- Modify point constraints to place the toes in the proper location.
- Add the modified end condition section to a template.

Three NULL points are used to modify the end condition. Two are used to locate the maximum length of the 6 to 1 and 4 to 1 slopes. The third locates the right of way. The constraints are changed on the toe of slope points to extend to the NULL point closest to the centerline.

1. Open MicroStation and InRoads using the **C:\Projects\12345\Design\Drawings\ Reference_Files\12345DES_Model.dgn** file.

2. Load the following files into InRoads:

- **C:\Projects\12345\Design\InRoads\12345DES_Geometry-Toes.alg**

♦ **C:\Projects\12345\ROW_Survey\InRoads\DTM\12345 existing ground.dtm**

♦ **C:\Projects\12345\Design\InRoads\12345DES_Templates_Toes-Lab.itl**

3. Verify that the **C:\Workspace\Workspace-CDOT_XM\Standards-Global\ InRoads\ Preferences\CDOT_Civil.xin** file is loaded.

4. From the InRoads menu bar, select **Modeler > Create Template**.

5. Expand the template library to show the **3 - Sections - End Conditions > Z-Slope End Condition - High Speed End Conditions**.

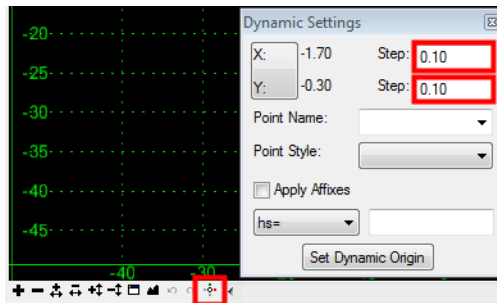6. **<R>** on the **Z8_6_to_1** and select **Copy** from the right click menu.
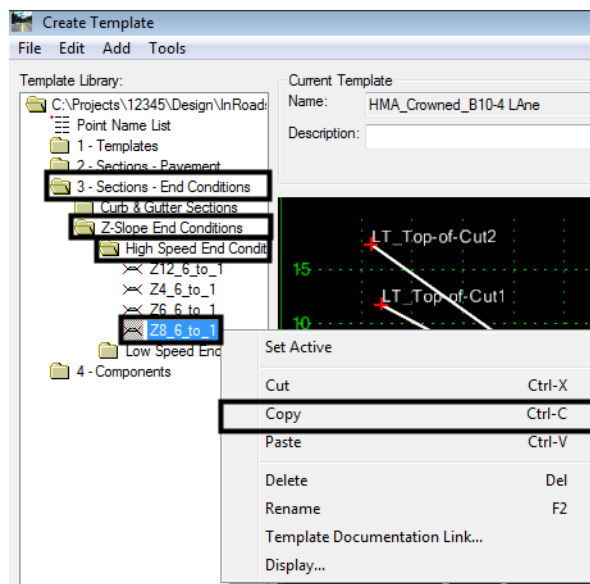
7. Paste the copy into the same folder.
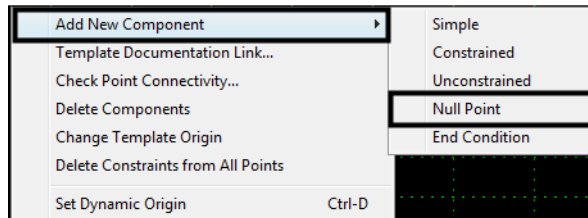
8. Rename the copy **Z8_6_to_1-Inside_ROW.**
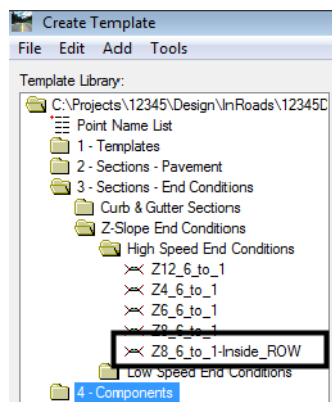
9. **<D> <D>** on the **Z8_6_to_1-Inside_ROW** to open it for editing.

10. Open the **Dynamic Settings** dialog box.

11. Key in *0.10* for the *X* and *Y Step*.

12. Verify that **Apply Affixes** is toggled off.

13. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.


14. In the *Dynamic Settings* dialog box, key in *Max_6_to_1* in the *Point Name* field.

15. Set the *Point Style* to *Default*.

16. Set the precision key in type to **xy=**.

17. In the precision key in field, key in *24,35* and press the *Enter* key. The 24 equals the maximum horizontal distance that a 6 to 1 toe can be from the pavement edge. The 35 represents the height above the pavement edge. The height for this point is irrelevant and can be set to any value. 35 is used here to place the point out of the way of other data while having the fit view at a reasonable scale.
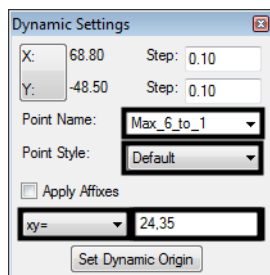

The *Max_6_to_1* point is placed in the correct location, but it is not constrained. It should be constrained to the pavement edge sot that the proper distance is maintained if the pavement width is changed.

18. **<R>** on the *Max_6_to_1* point and select **Add Constraint > Full Constraint** from the right click menu.
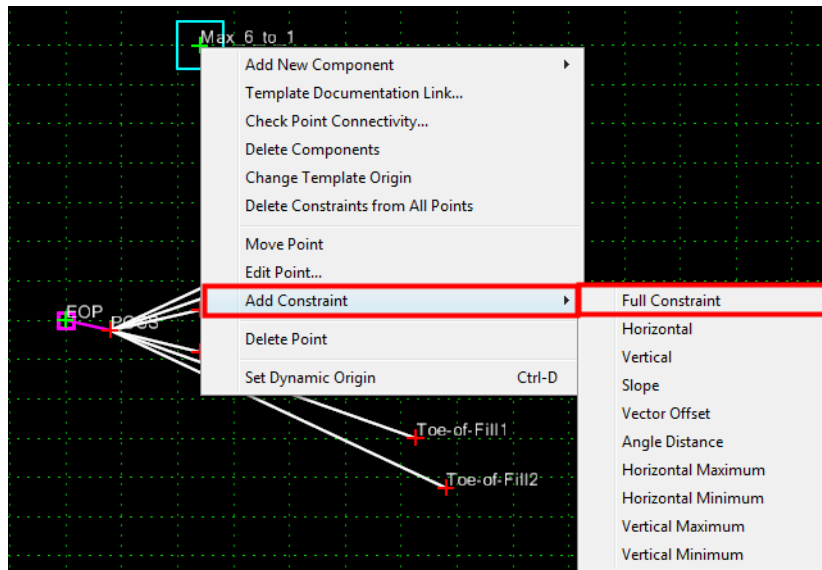

19. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.

The data in the dialog box is correct because the precision key in was used to place the point.

20. **<D> OK** to accept the constraints and dismiss the dialog box.
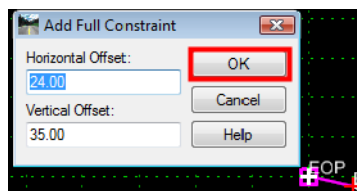
21. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.

22. In the *Dynamic Settings* dialog box, key in *Max_4_to_1* in the *Point Name* field.

23. In the precision key in field, key in *62.67,35* and press the *Enter* key.

24. **<R>** on the *Max_4_to_1* point and select **Add Constraint > Full Constraint** from the right click menu.

25. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.

26. **<D> OK** to accept the constraints and dismiss the dialog box.

Next, a point to follow the right of way is added.

27. **<R>** in the template view and select **Add New Component > Null Point** from the right click menu.

28. In the *Dynamic Settings* dialog box, key in *ROW_Marker* in the *Point Name* field.

29. In the precision key in field, key in **100,30** and press the **Enter** key.

30. **<R>** on the **ROW_Marker** point and select **Add Constraint > Full Constraint** from the right click menu.

31. **<D>** on the **EOP** point. This displays the *Add Full Constraint* dialog box.

32. **<D> OK** to accept the constraints and dismiss the dialog box.

33. Select **File > Save** from the *Create Template* menu bar.

The illustration below shows the template completed to this point.
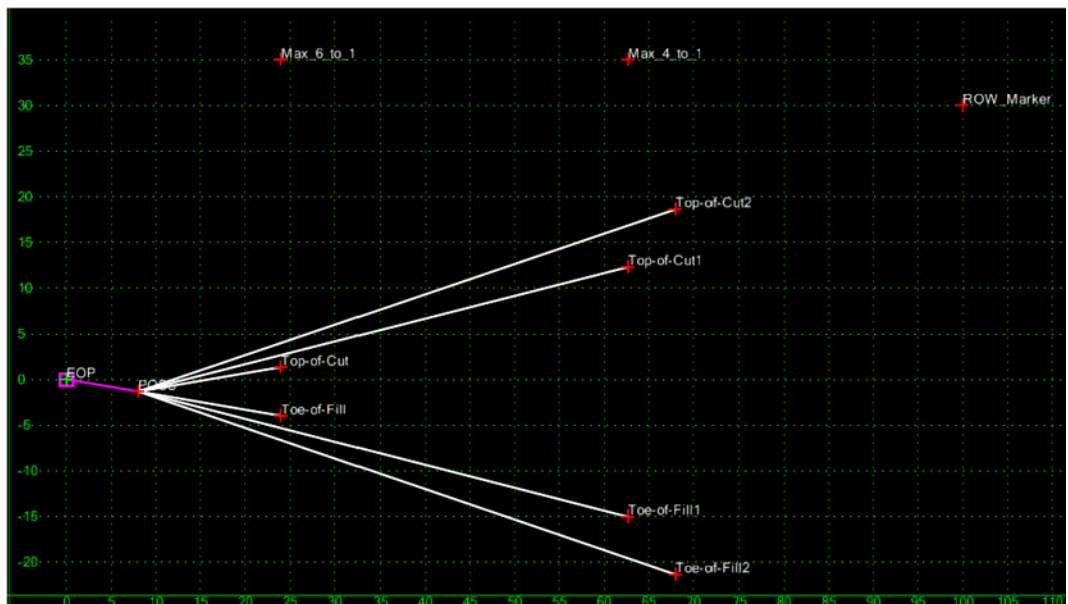
Next, the constraints on the toe points are changed to use the three Null points just added.

34. **<D> <D>** on the **Toe-of-Fill** point. This displays the *Point Properties* dialog box.

35. In the *Point Properties* dialog box, set the *Constraint 1 Type* to **Horizontal Minimum**.

36. Set the *Parent 1* to **Max_6_to_1**.

37. Set the *Parent 2* to **ROW_Marker**.

38. Verify that the *Value* is set to **0.00**.

39. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.
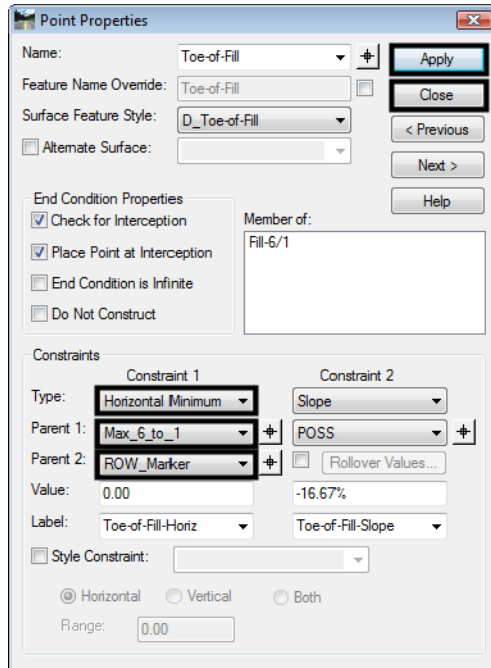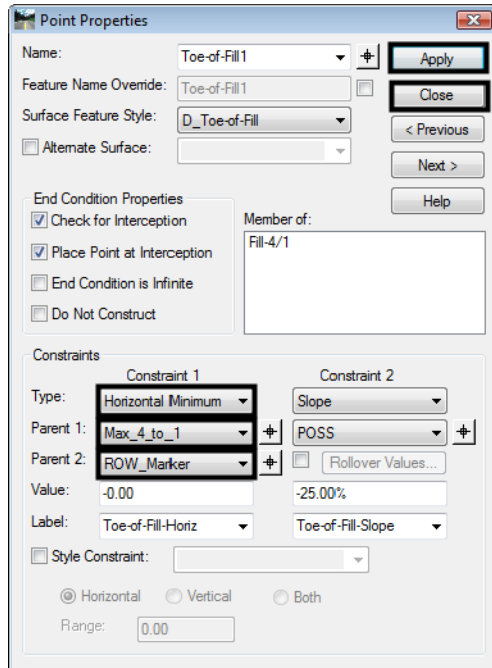

40. Repeat steps 34 through 39 for the **Top-of-Cut** point.

The Horizontal Minimum constraint uses the left most of the two Parent points as a Horizontal constraint. When the right of way is to the right of the two Max null points, the Max null point distance is used for the sideslope. When the right of way is to the left of a Max null point, the ROW_Marker sets the length of the sideslope.

41. **<D> <D>** on the **Toe-of-Fill1** point.

42. Set the *Constraint 1 Type* to **Horizontal Minimum**.

43. Set the *Parent 1* to **Max_4_to_1**.

44. Set the *Parent 2* to **ROW_Marker**.

45. Verify that the *Value* is set to *0.00*.

46. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.


47. Repeat steps 41 through 46 for the **Top-of-Cut1** point.

48. **<D> <D>** on the **Toe-of-Fill2** point.

49. Toggle off **End Condition is Infinite**.

50. Set the *Parent 1* for the *Horizontal* constraint to **ROW_Marker**.

51. Key in *0.00* for the Value of the *Horizontal* constraint.

52. **<D> Apply** to accept the changes. **<D> Close** to dismiss the dialog box.
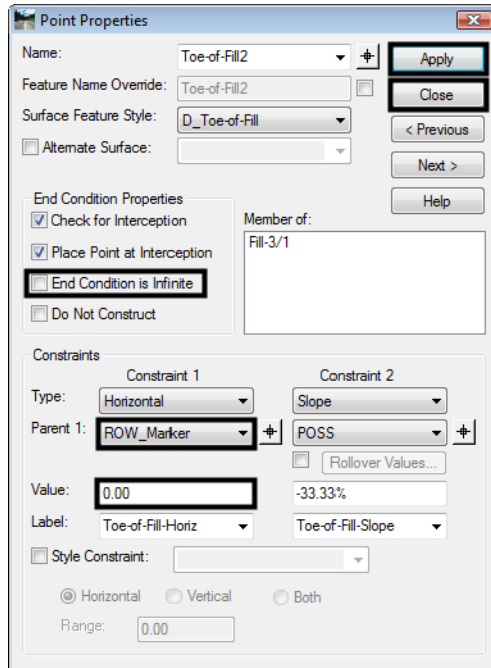
53. Repeat steps 48 through 52 for the **Top-of-Cut2** point.

54. Select **File > Save** from the *Create Template* menu bar.

This completes the section. It is now ready to be added to the template backbone.

55. Expand the **1 - Templates** folder in the Template Library area.

56. **<D> <D>** on the **HMA_B10-4 Lane** template to make it active.

57. In the *Dynamic Settings* dialog box, toggle on **Apply Affixes**.

58. **<D>** on the **Z8_6_to_1-Inside_ROW** section to display it in the *Preview* window.

59. **<D> an hold** on the section's origin and drag it into the template view.

60. **<R>** and select **Mirror** from the right click menu.

61. **Drop** the section on the *HMA_Lift1_EOP-Top* point. Below is an illustration of the finished template.
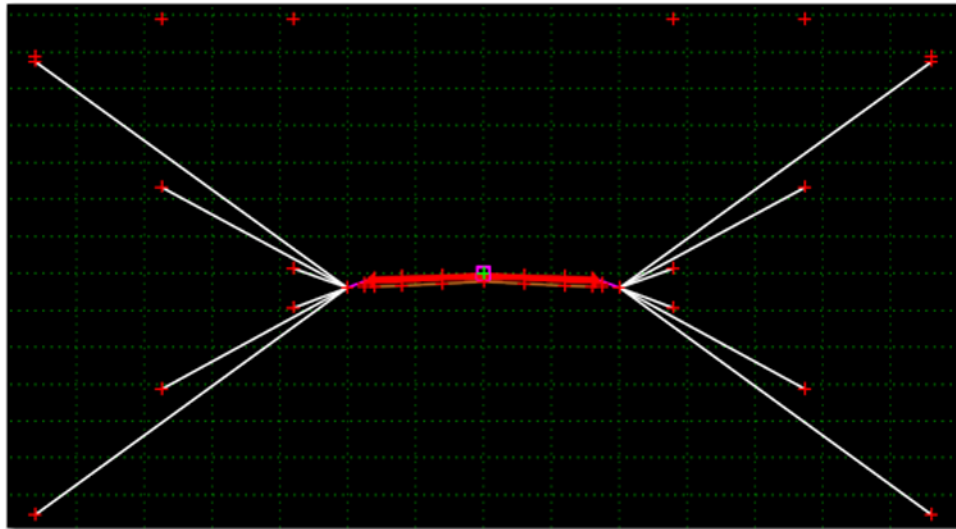
62. **<D> <D>** on the **LT_Toe-of-Fill**. Notice that the *Constraint 1* has changed from *Horizontal Minimum* to *Horizontal Maximum*. Horizontal Maximum uses the right most point of the two parents as a horizontal constraint.
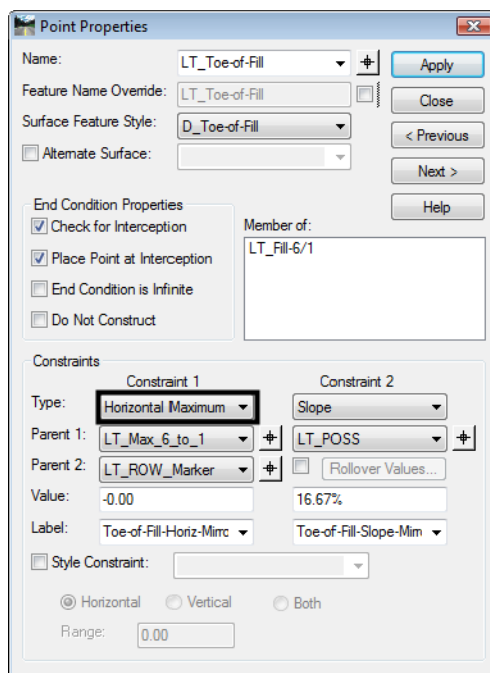
63. Select **File > Save** from the *Create Template* menu bar.

64. Close the *Create Template* dialog box.

This completes the work done in the template library. Next, the template is used in a corridor.

Section Summary:

- ♦ The end condition sections in the standard template library can be easily modified to stop at the right of way.
- ♦ Null points are used to determine the maximum length of the sideslope.
- ♦ Horizontal Minimum constraints change to Horizontal Maximum constraints when the template is reflected (or on the reflected side when mirrored).

Lab 29.2 - Corridor Set up and Run

As designed, the template requires two point controls to follow the right of way lines. For this exercise, the right of way lines have already been chained together and imported as horizontal alignments.

Section Objectives:

- ♦ Create a corridor and template drop.
- ♦ Create point controls for the right of way.
- ♦ Add the right of way alignments as reference displays in the Roadway Designer views.

1. Select **Modeler > Roadway Designer** from the InRoads menu bar.

2. From the Roadway Designer menu bar, select **File > New**.

3. Verify the directory is *C:\\12345\Design\InRoads*.

4. Key in *12345DES_Toes-Lab.ird* for the file name.

5. **<D> Save** to create the Roadway Designer file and dismiss the *Save Roadway Design As* dialog box.

6. Select **Corridor > Corridor Management** from the Roadway Designer menu bar.

7. Key in *SH 86* for the corridor *Name*.

8. Verify that **SH 86** and **SH 86 V** are set as the *Horizontal Alignment* and *Vertical Alignment*.

9.   **<D> Add** to create the corridor then **<D> Close** to dismiss the *Manage Corridors* dialog box.
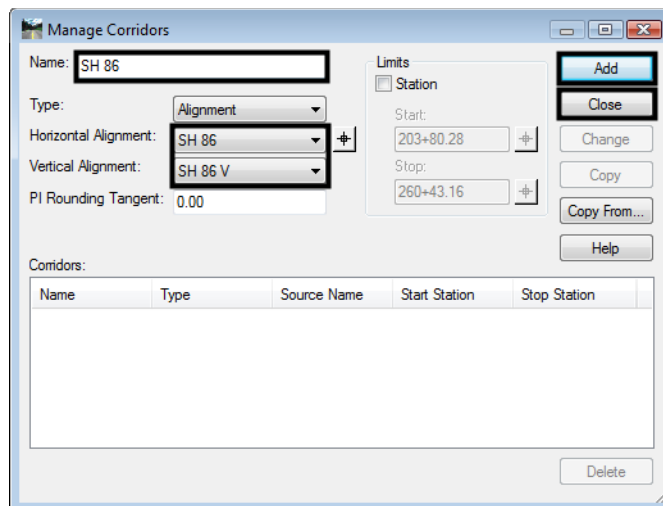

10.   Select **Corridor > Template Drops** from the Roadway Designer menu bar.

11.   Key in **25** for the *Interval*.

12.   In the *Library Templates* area, expand the **C:\Projects\12345\Design\InRoads\12345DES_Templates_Toes-Lab.itl > 1 - Templates** folder.

13.   Highlight the **HMA_Crowned_B10-4 Lane** template.

14.   **<D> Add** then **<D> Close** to dismiss the *Template Drops* dialog box.
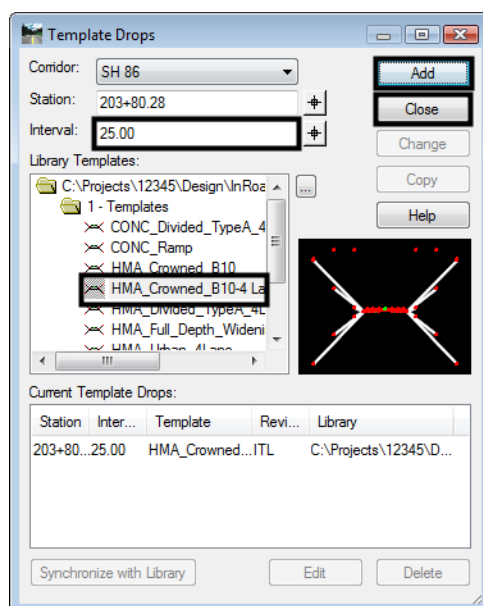
15.   Select **Corridor > Point Controls** from the Roadway Designer menu bar.

16.   In the *Point Controls* dialog box, set the *Point* to **RT_ROW_Marker**.

17. Toggle on **Horizontal** for the *Mode*.

18. Verify that the *Control Type* is set to **Alignment**.

19. Select **RT_ROW** for the *Horizontal Alignment*.

20. **<D> Add** to create the point control.
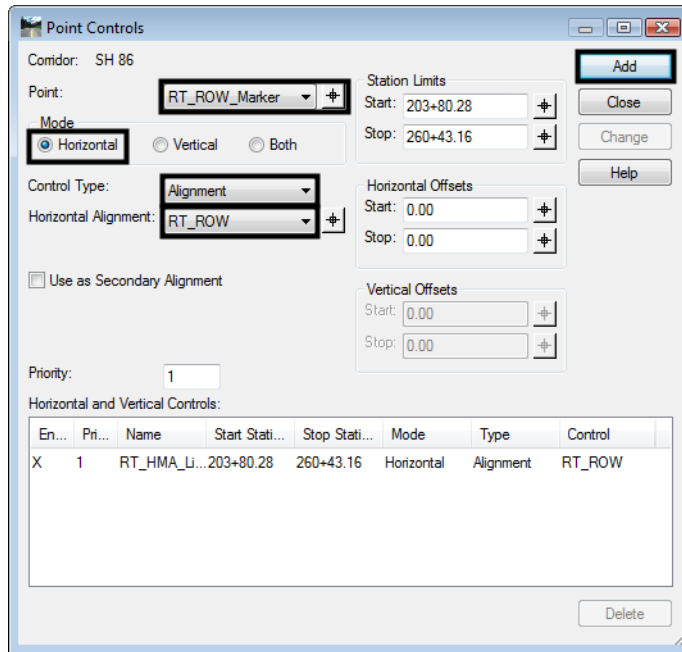
21. Set the *Point* to **LT_ROW_Marker**.

22. Select **LT_ROW** for the *Horizontal Alignment*.

23. **<D> Add** to create the point control. **<D> Close** to dismiss the *Point Controls* dialog box.

The toes will now remain inside the right of way. However, it is not apparent. To show the relationship between the toes and the right of way, The right of way alignments are displayed in the Roadway Designer window as references.

24. Select **Corridor > Display References** from the Roadway Designer menu bar.

25. Verify that **Alignment** is toggled on.

26. Select **RT_ROW** for the *Alignment*.

27. Toggle on **Displays as Right of Way**.

28. **<D> Add**. Notice the line displayed on the right side of the template view. That line represents the offset distance to the right of way from the corridor alignment.
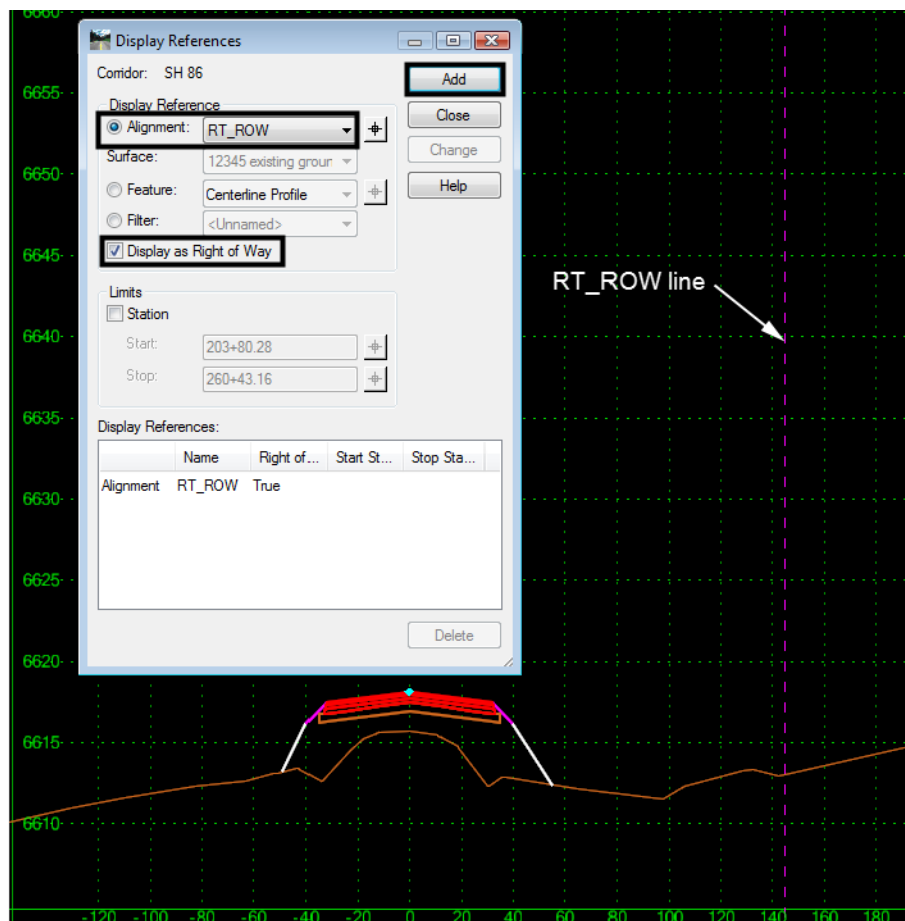
29. Repeat steps 26 through 28 using **LT_ROW** for the alignment.

30. **<D> Close** to dismiss the *Display References* dialog box.

31. Scroll through the stations. Notice two things, 1) the toes never go outside the right of way, and 2) If the toe can not tie before the right of way, it is omitted.

> *Note:* This end condition will not solve every template drop. Those template drops that do not solve will have to be examined to determine the best solution for those areas. The solutions for those areas are not a part of this lab.

Section Summary:

♦ The ROW_Marker points are attached to the right of way horizontal alignments using point controls.

♦ Using Display References helps to show that the template is working properly.

♦ Design decisions have to be made in areas where the toes can not tie inside the right of way.

Chapter Summary:

• The right of way controls can be easily added to an existing template.

- This example uses a point control, however the same results can be achieved by making the ROW markers into end conditions.

- Developing these kinds of templates is an iterative process. Parts will be developed that show areas which need further consideration.