LAB 8 - Building Sections

This lab demonstrates how to create the sub-assemblies known as sections and illustrates the use of parent components and display rules.

Chapter Objectives:

- Build a section with existing components using the drag and drop method
- Build an end condition section and reset the priorities so that it functions properly
- Build a section from new and existing components
- Set up the parent/child relationship between components and demonstrate how it works
- Create display rules, apply them to components, and demonstrate their functionality

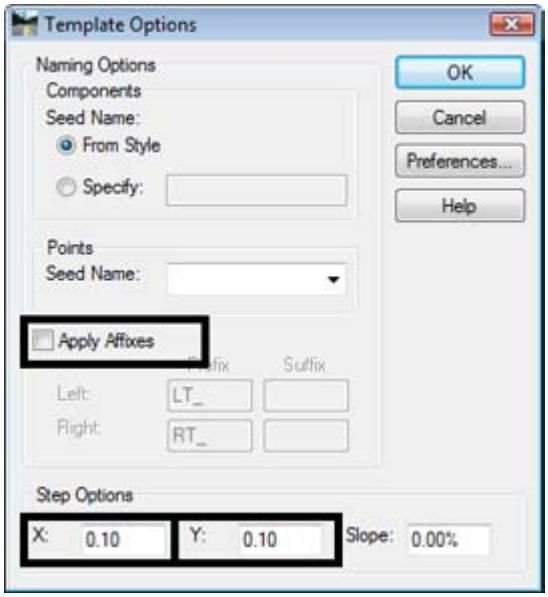
Before beginning this lab, verify that the following files are loaded:

- C:\Projects\12345\Design\Drawings\Reference_Files\12345DES_Model.dgn
- C:\Workspace\Workspace-CDOT_V8i\Standards-Global\InRoads\Preferences\CDOT_Civil.xin
- C:\Projects\12345\12345\Design\InRoads\DES12345_Templates.itl (This file was modified in Lab 1)

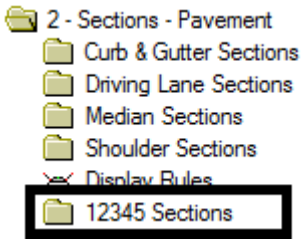
Lab 8.1 - Build a Lane Section

This example demonstrates how to assemble basic components into sections using the drag and drop method. This lab builds on the concepts and used data from ***Lab 1 - Building Components***. Open the ***Create Template*** dialog box.

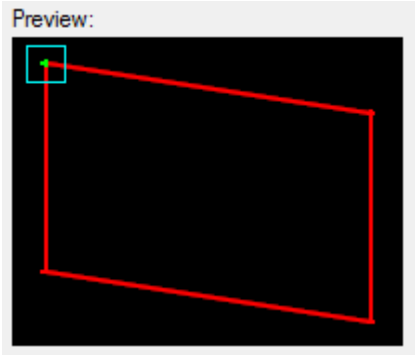
1. Select **Tools > Options** from the ***Create Template*** menu bar.
2. Make sure that ***Apply Affixes*** is toggled off and the ***X*** and ***Y Step Options*** are set to ***0.10***.



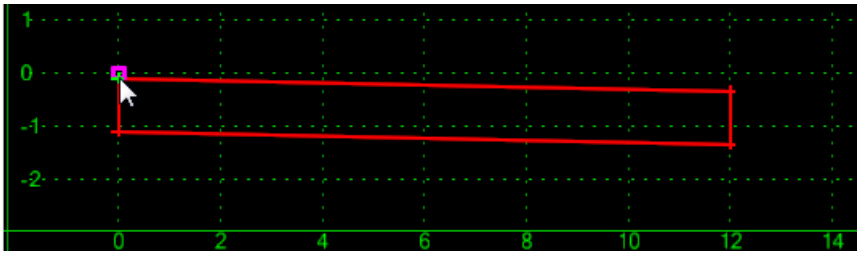
3. **<D> <D>** on the root folder in the Template Library pane to expand the folder structure.
4. Expand the ***2 – Sections – Pavement*** folder.
5. Create a new folder under ***2 – Sections – Pavement*** called ***12345 Sections***.



6. Create a new template in the ***12345 Sections*** folder. Name it ***Conc_Driving_Lane***.
7. Expand the ***4 – Components*** folder. Also expand the ***12345 Components*** folder created in Lab 1.
8. **<D>** on the ***Conc_Lane_12"x12'*** component. The component is displayed in the Preview window.
9. **<D> and hold** on the component's origin (the green dot).

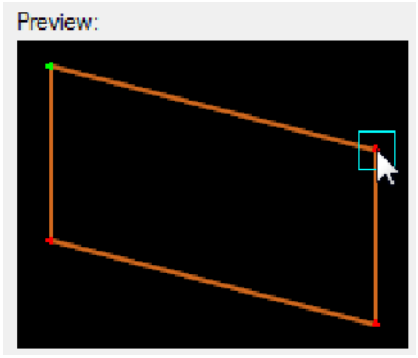


10. **Drag** the component into the template view and **drop** (release the data button) it on the new section's origin.

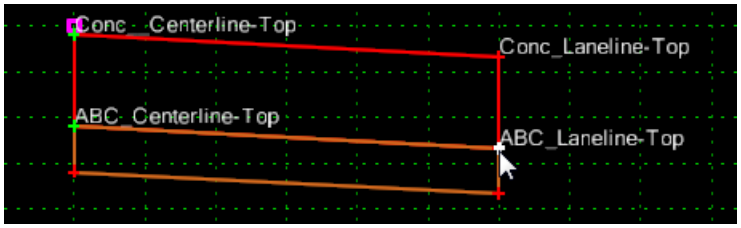


11. Expand the ***4 – Components >Aggregate Bases > Driving Lanes*** folder.
12. **<D>** on the ***ABC_Lane*** component.

13. **<D> and hold** on the upper right point of the component in the preview window.



14. **Drag** the component into the Template View and move the pointer on to the lower right corner of the concrete component and **Drop**. The "+" on the concrete component turns white when to pointer is on it.



Note: Steps 14 and 15 were done to show that components do not have to be placed by the origin.

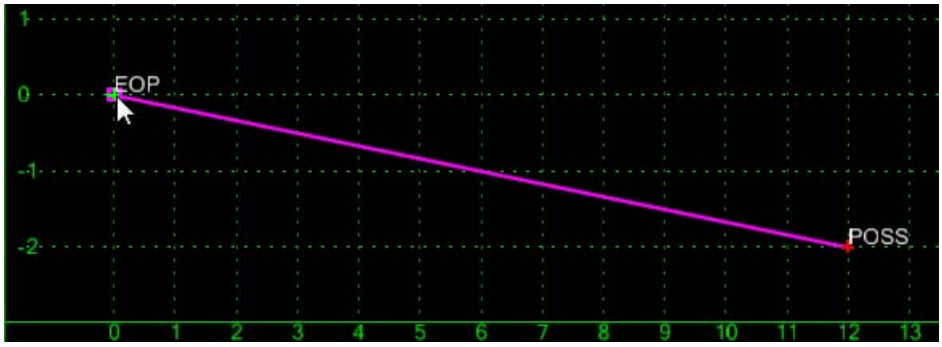
This completes the Conc_Driving_Lane section. This section is now ready to use to create a complete template. This lab illustrates how to build a "backbone" section from existing components. It also shows that components do not have to be placed by their origin, they can be placed using any point on the component.

Lab 8.2 - Build an End Condition Section

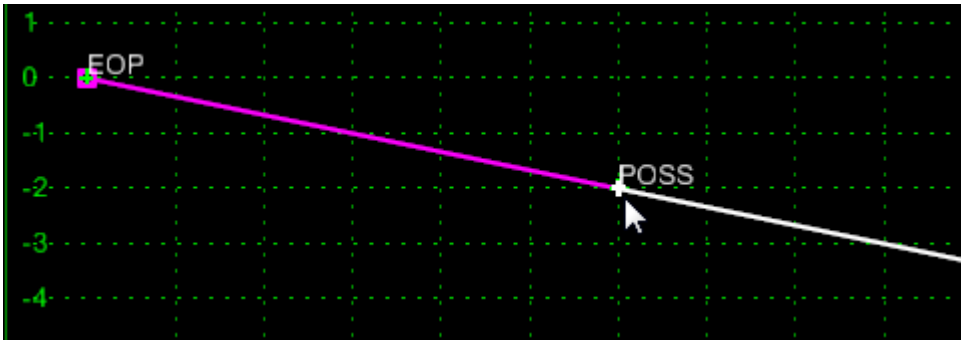
This example demonstrates the construction of an end condition. End conditions are more complicated than a simple component and require additional editing to make complete. The drag and drop method will be used to create a new end condition section and the end condition priorities will be modified so that the section operates properly.

1. Create a new template in the ***12345 Sections*** folder named ***12345_End-Condition***.
2. Expand the ***4 – Components >End Condition > Z-Slope > High Speed*** folder.
3. **<D>** on the ***Z-Slope_12_6_to_1*** component.
4. **<D> and hold** the component's origin in the preview window.

5. **Drag and Drop** the component on the origin in the Template View.



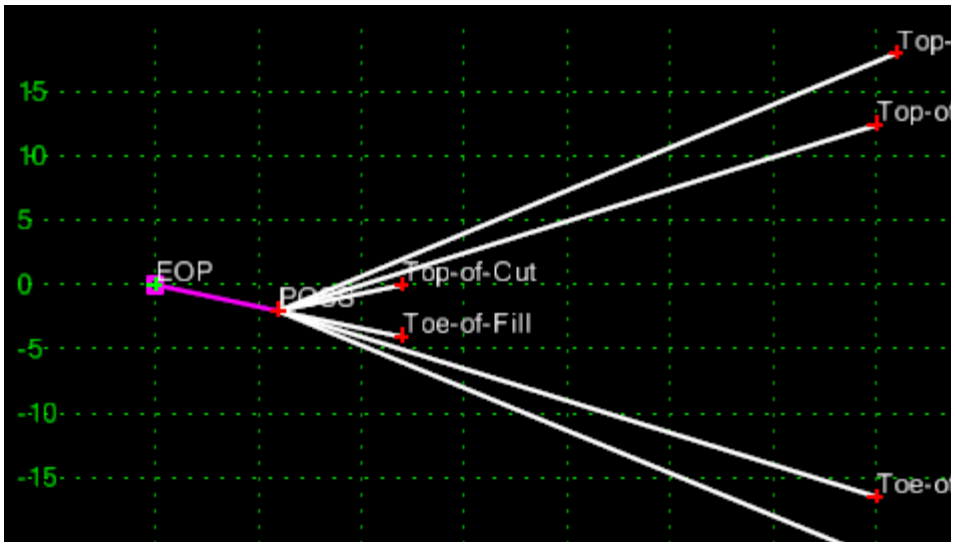
6. Expand the ***4 – Components >End Condition > Fill Slope Components*** folder.
7. **<D>** on the ***Fill_6_to_1*** component.
8. **Drag and Drop** the component on to the ***POSS*** point.



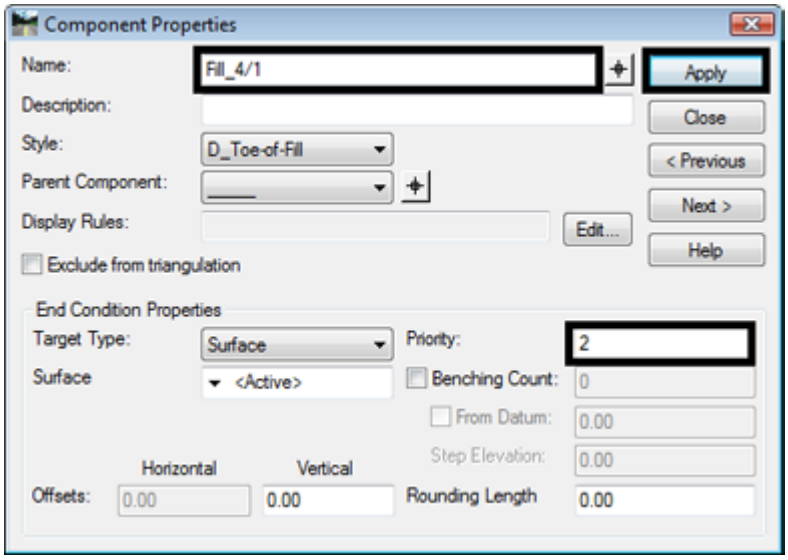
9. Repeat steps 8 and 9 using ***Fill_4_to_1*** and ***Fill_3_to_1.***

10. Expand the ***4 – Components >End Condition > Cut Slope Components*** folder.

11. **Drag and Drop** the ***Cut_6_to_1, Cut_4_to_1*** and ***Cut_3_to_1*** components on to the ***POSS*** point.



12. **<D> <D>** on the ***Fill 6/1*** component.
13. Verify that the ***Priority*** is set to ***1.***
14. **<D> Next.** This shows the properties for the **Fill_4/1** component.
15. Set the ***Priority*** is set to ***2.*** **<D> Apply.**



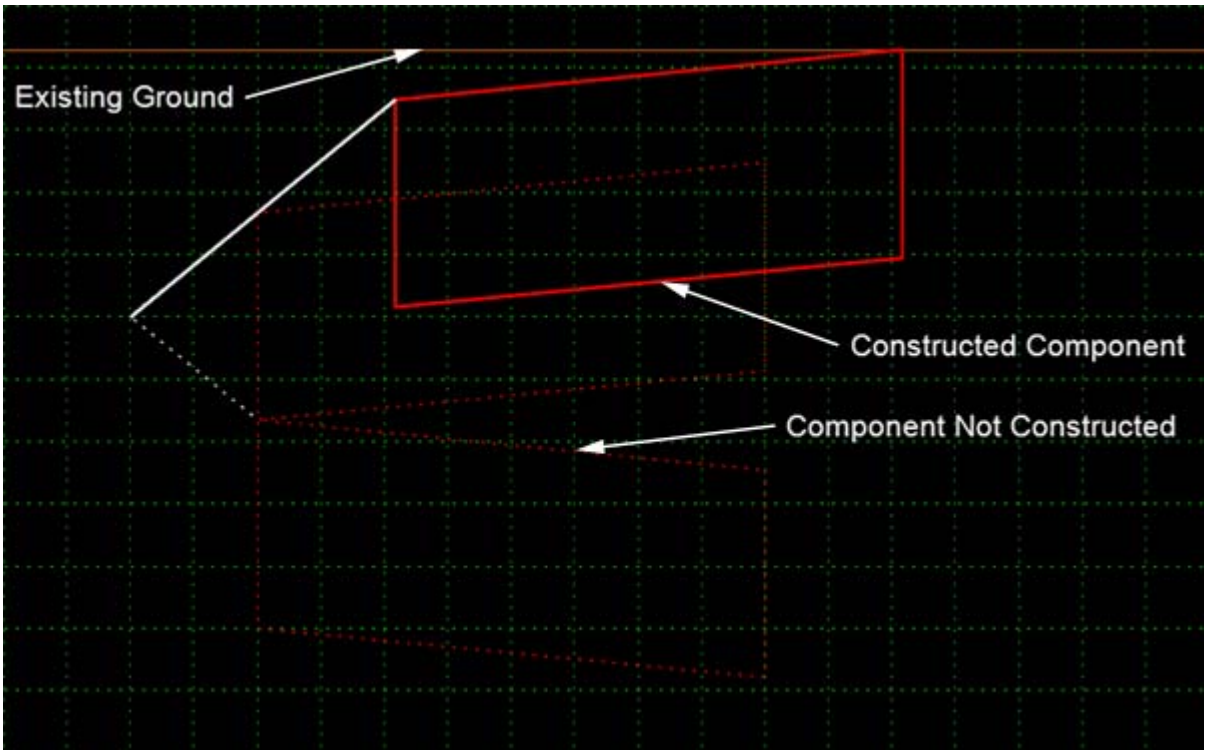
16. Set the remaining priorities as follows

- **Fill_3/1** = ***3***
- **Cut_6/1** = ***4***
- **Cut_4/1** = ***5***
- **Cut_3/1** = ***6***

17. Close the Component Properties dialog box
18. **<D>** the **Test** button.
19. In the ***Test End Conditions*** dialog box, **<D> Draw** and notice how the end condition behaves.
20. **<D> Close**.

Lab 8.3 - Using Parent Components

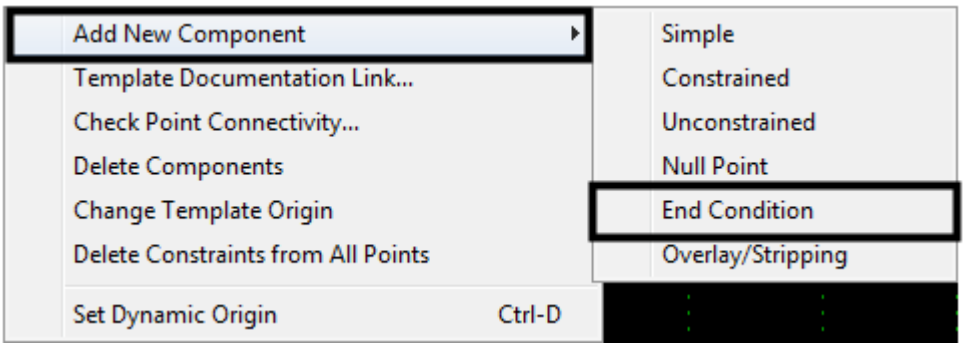
This example places a sidewalk at the end of a cut or fill slope. It illustrates how the parent/child relationship between components can be used. The sidewalk position end conditions are parents to the sidewalk components. This "turns off" the sidewalk when its parent end condition does not intercept the target surface.



1. Create a new template in the ***12345 Sections*** folder named ***Parent Component Example***.

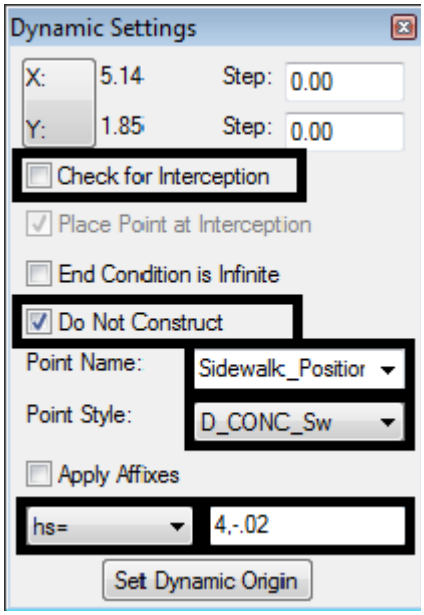
The end condition component is used to locate the position of the sidewalk. It contains two segments. The first segment matches the sidewalk's width and slope. The second segment intercepts the target surface where the actual sidewalk goes. The Do Not Construct point property is used so that the points will be located but the end condition component will not be added to the finished template.

2. **<R>** in the Template View and select **Add New Component > End Condition**.

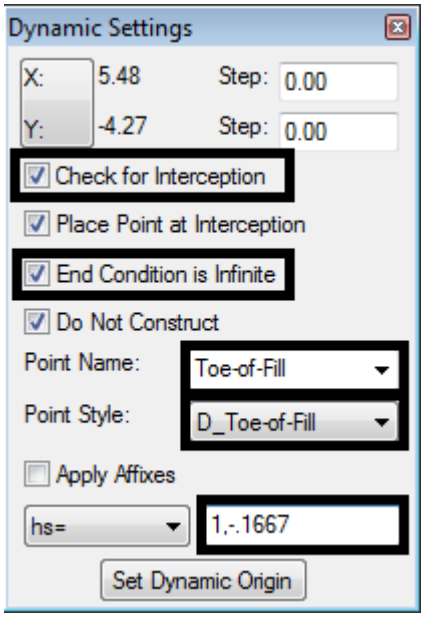


3. Key in ***Fill*** for the component ***Name***.
4. Select ***D_Toe-of-Fill*** for the ***Style***.
5. Key in ***1*** for the ***Priority***.
6. In the ***Dynamic Settings*** dialog box, set the ***Point Name*** to **POSS**.
7. Place the point on the template origin.
8. In the ***Dynamic Settings*** dialog box, toggle off ***Check for Interception***.
9. Verify ***End Condition is Infinite*** is toggled off.
10. Toggle on ***Do Not Construct***.
11. Key in ***Sidewalk_Position*** for the ***Point Name***.
12. Select **D_CONC_Sw** for the ***Point Style***.
13. Set the key in mode to **hs=**.
14. Key in ***4,-.02*** and press ***Enter***.

Note: Because the ***Do Not Construct*** was toggled on, a line from POSS to Sidewalk Position is not created.



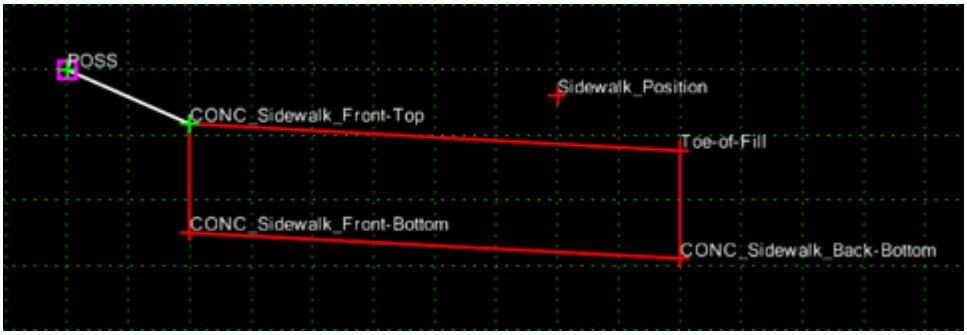
15. In the ***Dynamic Settings*** dialog box, toggle on ***Check for Interception***.
16. Toggle on ***End Condition is Infinite***.
17. Set the ***Point Name*** to **Toe-of-Fill**.
18. Key in ***1,-.1667*** and press ***Enter***.



19. **<R>** in the template view and select **Finish**.

The Sidewalk and fill slope components that will be used as part of the template are built from the toe located by the end condition back to the POSS.

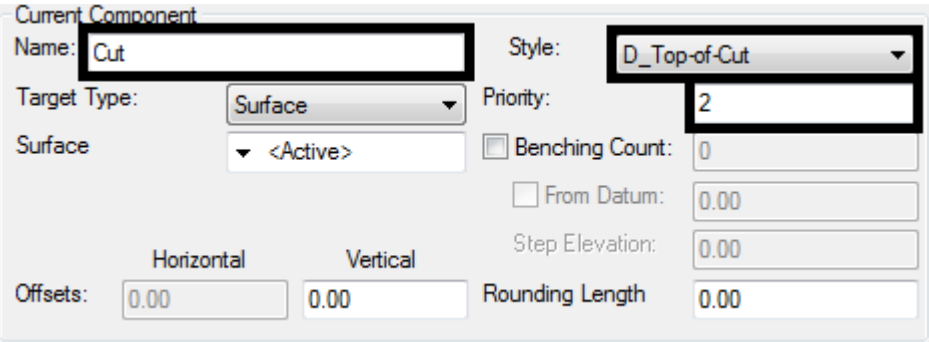
20. Expand the ***4 – Components >Sidewalks & Bike Paths > Sidewalks*** folder.
21. **<D>** on the ***4"_CONC_Sidewalk*** component.
22. **<D> and hold** on the upper right point in the Preview.
23. **Drag and Drop** the component on the ***Toe-of-Fill*** point.
24. **<D> <D>** on the ***CONC_Sidewalk_Front-Top*** point.
25. Set Constraint 1 ***Type***: to **Horizontal,** the ***Parent 1***: field to **Toe-of-Fill,** and key in ***-4.00*** for the ***Value***.
26. Set Constraint 2 ***Type***: to **Slope** constraint, the ***Parent 1:*** field to **Toe-of-Fill,** and key in ***-2.00 %*** for the ***Value.***
27. **<D> Apply** and **Close**.
28. **<R>** in the template view and select **Add New Component > Unconstrained.**
29. Key in ***Fill_6_to_1*** for the component ***Name.***
30. Select **D_Toe-of-Fill** for the ***Style***.
31. Place the first point on the ***POSS*** (also the template origin).
32. Place the second point on the ***CONC_Sidewalk_Front-Top*** point.
33. **<R>** and select **Finish**. The illustration below shows the template completed to this point.



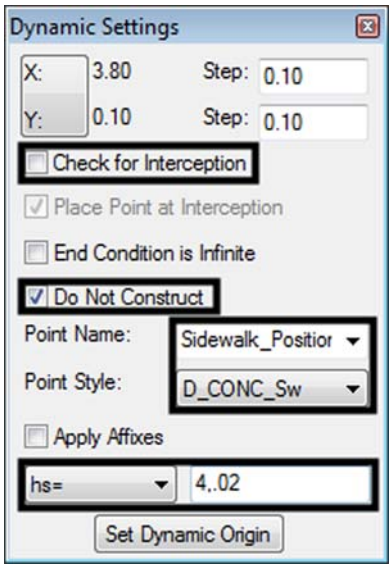
The cut components work the same as the fill components built above.

34. **<R>** in the template view and select **Add New Component > End Condition.**
35. Key in ***Cut*** for the component ***Name***.
36. Set the ***Style*** to **D_Top-of-Cut**.

37. Key in ***2*** for the ***Priority***.

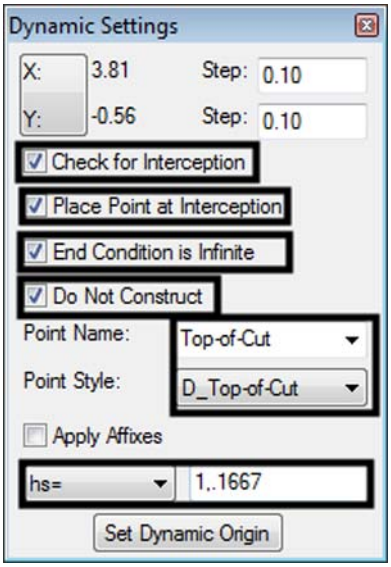


38. In the ***Dynamic Settings*** dialog box, set the ***Point Name*** to **POSS**.
39. Place the point on the ***POSS***.
40. In the ***Dynamic Settings*** dialog box, toggle off ***Check for Interception***.
41. Toggle on ***Do Not Construct***.
42. Key in ***Sidewalk_Position1*** for the ***Point Name***.
43. Select **D_CONC_Sw** for the ***Point Style***.
44. Key in ***4,.02*** and press ***Enter***.



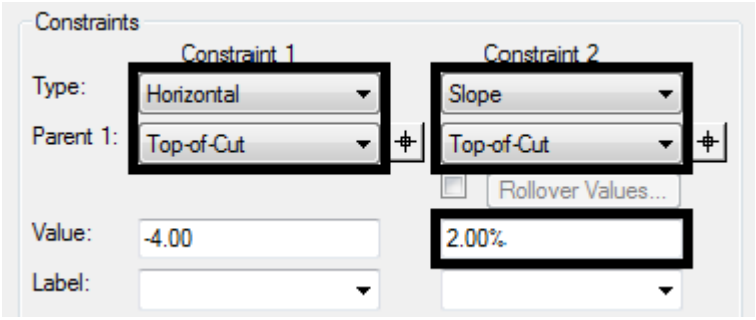
45. In the ***Dynamic Settings*** dialog box, toggle on ***Check for Interception***.
46. Toggle on ***End Condition is Infinite***.
47. Set the ***Point Name*** to **Top-of-Cut**.

48. Key in ***1,.1667*** and press ***Enter***.

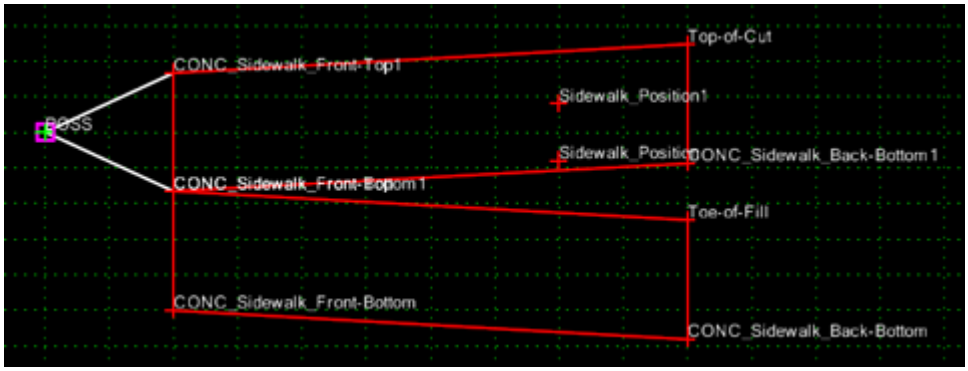


49. **<R>** and select **Finish**.
50. **<D>** on the ***4"_CONC_Sidewalk*** component.
51. **<D> and hold** on the upper right point in the Preview.
52. **Drag and Drop** the component on the ***Top-of-Cut*** point**.**
53. **<R>** and select **Finish**.
54. **<D> <D>** on the **CONC_Sidewalk_Front-Top1** point.
55. Set ***Constraint 1*** to **Horizontal** and make the ***Parent 1*** **Top-of-Cut**.
56. Set ***Constraint 2*** to **Slope** and make the ***Parent 1*** **Top-of-Cut**.
57. Key in ***2.00%*** for the slope ***Value***.
58. **<D> Apply**.
59. **<D> Close**.
60. **<R>** in the template view and select **Add New Component > Constrained.**
61. Key in ***Cut_6_to_1*** for the component ***Name.***
62. Select **D_Top-of-Cut** for the ***Style***.
63. Place the first point on the ***POSS*** (also the template origin).

64. Place the second point on the ***CONC_Sidewalk_Front-Top1*** point.



65. **<R>** and select **Finish**. The completed template is shown below.



66. **<D>** the **Test** button.

In the ***Test End Conditions*** dialog box, **<D> Draw** and notice how the template behaves. Notice that both sidewalks remain visible and a third is added as the ground line is moved. This is because there is no relationship between the hidden end conditions and the sidewalk components.

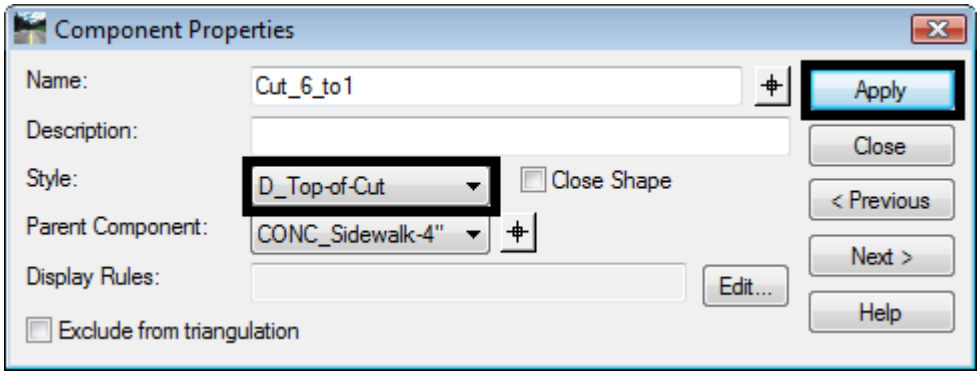
67. **<D> Close**.

The steps below set up the parent/child relationships that will turn off the components for the end condition that is not used.

68. **<D> <D>** on the **Cut_6_to_1** Component.

69. Set the ***Parent Component*** to **CONC_Sidewalk-4".**

70. **<D> Apply**.



71. **<D>** the **Next** button until ***Fill_6_to_1*** is listed.
72. Set the ***Parent Component*** to **CONC_Sidewalk-4".**
73. **<D> Apply**.
74. **<D>** the **Next** button until **CONC_Sidewalk-4"** is listed.
75. Set the ***Parent Component*** to **Fill.**
76. **<D> Apply.**
77. **<D>** the **Next** button until **CONC_Sidewalk-4"1** is listed.
78. Set the ***Parent Component*** to **Cut.**
79. **<D> Apply**.
80. **<D>** the **Test** button.
81. In the ***Test End Conditions*** dialog box, **<D> Draw** and notice how the end condition behaves; only the components that are children of the end condition solution are displayed.

Lab 8.4 - Using Display Rules

Display rules turn on or off the display of components based on user defined criteria. In this example, display rules are used to exchange the normal end condition for a guardrail end condition.

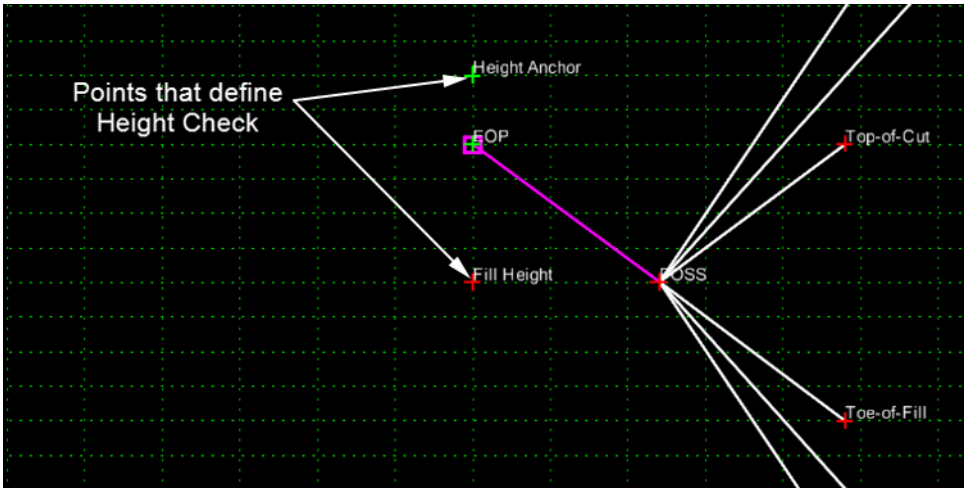
The typical section created in this lab contains two separate end conditions, the standard Z12_6_to_1 section and an end condition used with guardrail. Both end conditions could apply at any given template drop. To determine which end condition will be used, the ***Height Check*** component is added to the template. This component determines the fill height from the edge of pavement to the existing ground. If the fill height exceeds the maximum value the guardrail end condition is used.

The standard end condition section is added to the template.

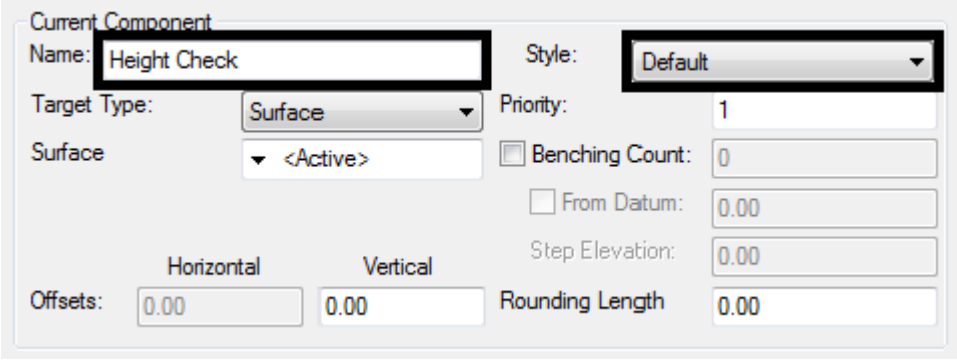
1. Create a new template in the ***12345 Sections*** folder. named ***Display Rules Example***.
2. Expand the ***3 – Sections - End Sections > Z-Slope End Conditions > High Speed End Conditions*** folder.

3. **<D>** on the ***Z12_6_to_1*** Section.
4. **<D> and Hold** the section's origin in the ***Preview*** window.
5. **Drag and Drop** the section on the new template's origin.

Height Check is an end condition component. It runs vertically through the template origin (which will also contain the EOP point) to intercept the existing ground. The distance between the Fill Height point and the EOP is used to determine if the guardrail is used.

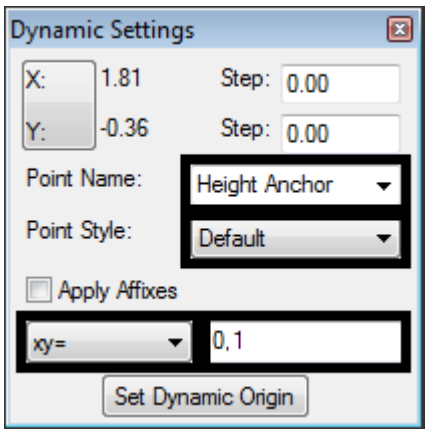


6. **<R>** in the Template View and select **Add New Component > End Condition**.
7. Key in ***Height Check*** for the ***Name***.
8. Select **Default** for the ***Style***.



9. In the ***Dynamic Settings*** dialog box, key in ***Height Anchor*** for the ***Point Name***.
10. Select **Default** for the ***Point Style***.
11. Set the key in mode to **XY=**.

12. Key in ***0,1*** and press ***Enter***.

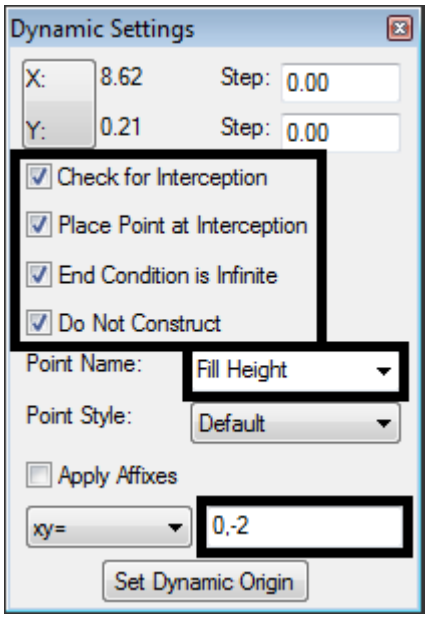


This point sets the Height Check end condition over the EOP so that the fill height can be checked vertically at this point.

13. Key in ***Fill Height*** for the ***Point Name***.

14. Toggle on **Check for Interception**, **Place Point at Interception**, **End Condition is Infinite**, and **Do Not Construct**.

15. Key in ***0,-2*** and press ***Enter***.



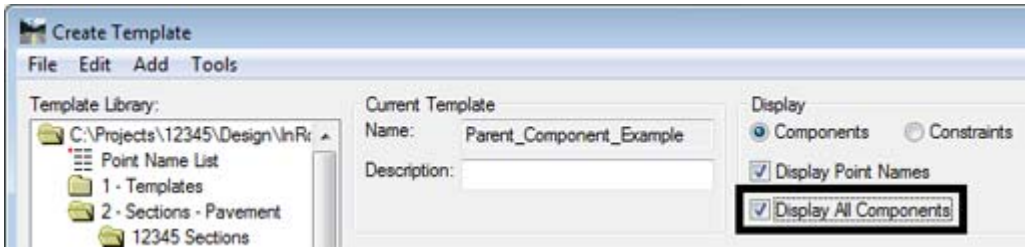
This sets the starting location for the Fill Height point. This point intercepts the existing ground directly under the EOP to determine the fill height. The 2 foot distance below the template origin is an arbitrary value, so long as the Fill Height point is placed below the Height Anchor point the template will work properly.

16. **<R>** and select **Finish**.

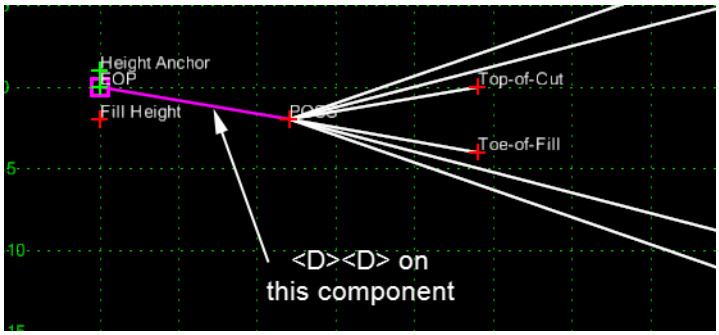
17. Select **File > Save**. (This is an intermediate save to prevent loss of information.)

The Z-Slope_12_6_to_1 component will be set to a child of the Height Check so that its display can be turned on and off based on the fill height.

18. Toggle on ***Display All Components***.



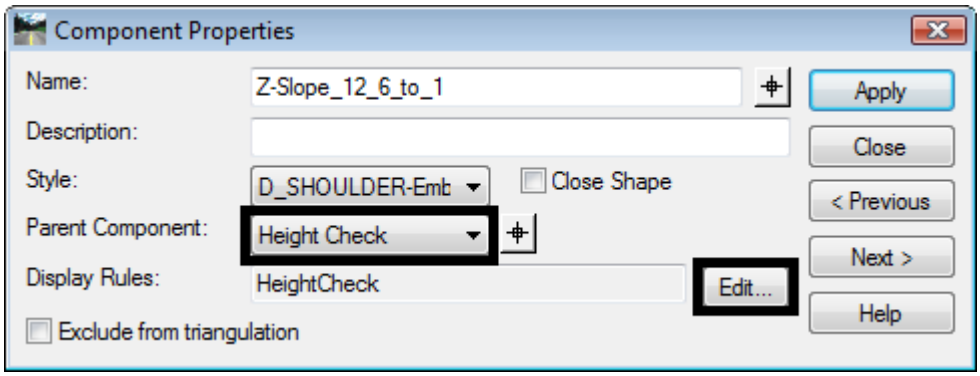
19. **<D> <D>** on the **Z-Slope_12_6_to_1** component.



20. In the ***Component Properties*** dialog box, set the ***Parent Component*** to **Height Check.**

The Display Rule sets the criteria for the component to be displayed.

21. **<D> Edit** to display the ***Component Display Conditional Expression*** dialog box.

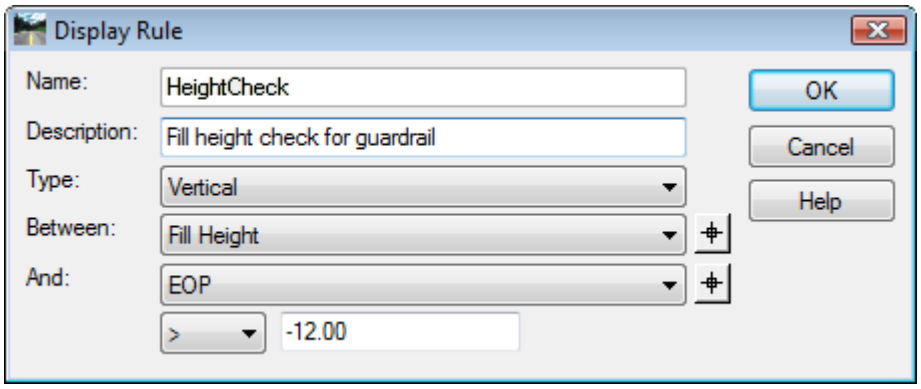


22. In the ***Component Display Conditional Expression*** dialog box, **<D> Add**. The ***Display Rule*** dialog box is displayed.

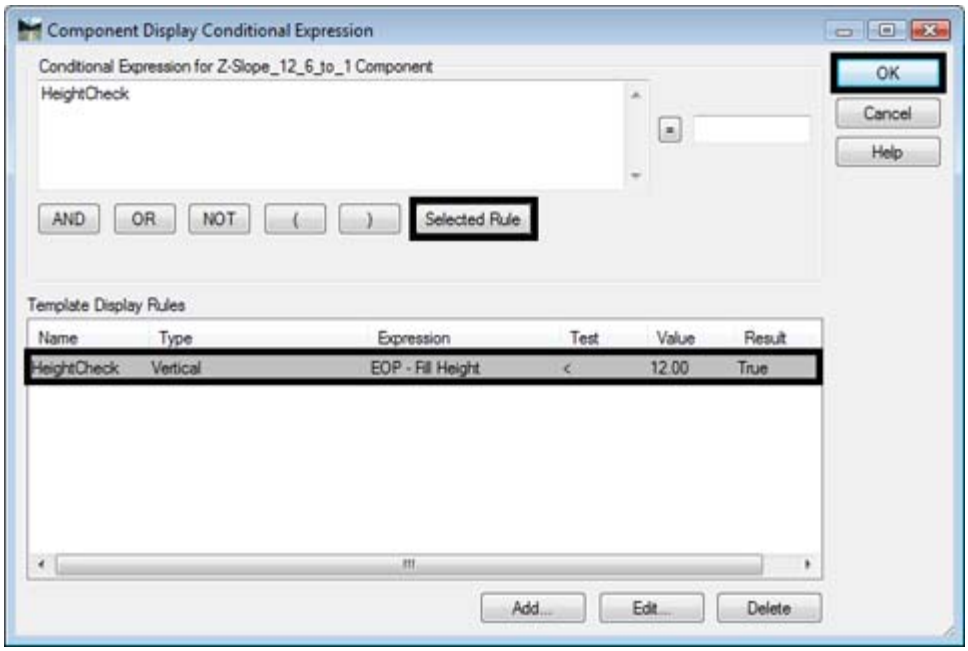
The Display Rule determines when the Z-Slope_12_6_to_1 component is displayed. It is set so that when the fill height at the edge of pavement is more than 12 feet, the normal end condition is turned off.

23. In the ***Display Rule*** dialog box, key in ***Height Check*** for the ***Name***.

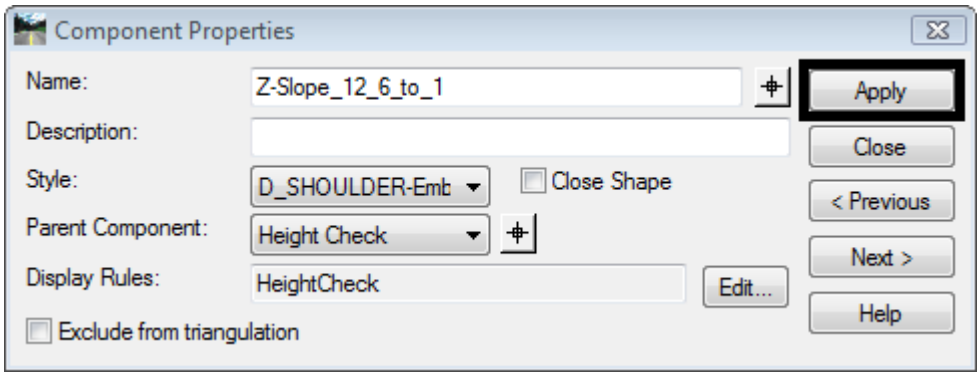
24. Key in ***Fill height check for guardrail*** in the ***Description*** field.
25. Set the ***Type*** to **Vertical**.
26. Set ***Between*** to **Fill Height**.
27. Set ***And*** to **EOP**.
28. Set the expression to **>.**
29. Key in **-12** in the value field.
30. **<D> OK**.



31. Back in the ***Component Display Conditional Expression*** dialog box, highlight the **Height Check** entry in the ***Template Display Rules*** area.
32. **<D>** the **Selected Rule** button.
33. **<D> OK**.



34. In the ***Component Properties*** dialog box, **<D> Apply**.



35. **<D> Close**.

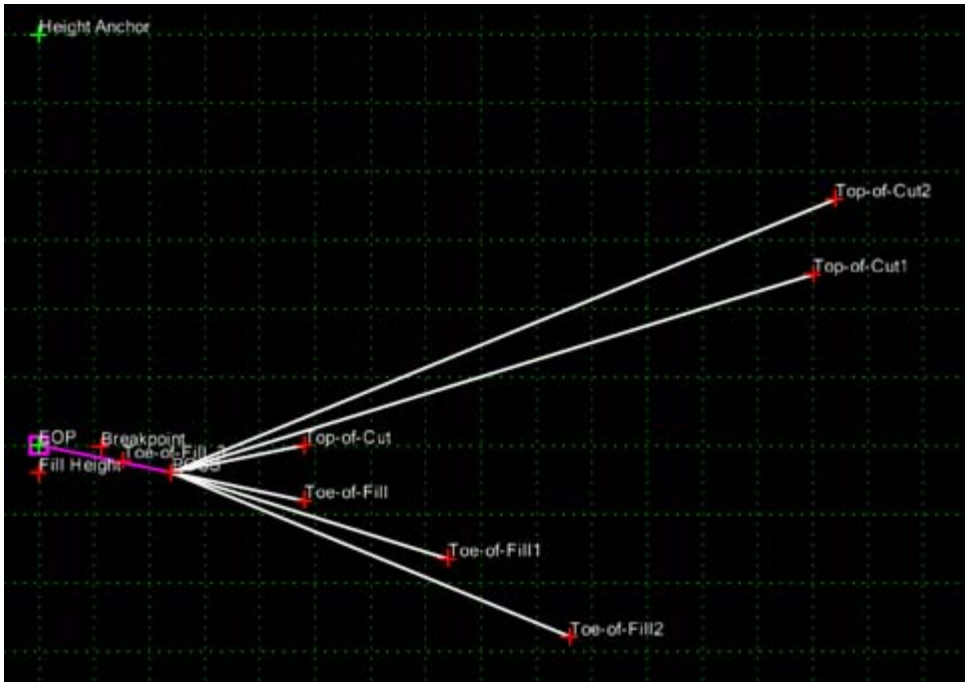
As defined in the Z12_6_to_1 Section, the 3 to 1 fill slope will never be used. This is because the guardrail component is activated before the 4 to 1 option reaches its maximum distance. By changing the value on the horizontal constraint to 32 on the 4 to 1 slope, it will reach its maximum length before the guardrail end condition is used.

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

37. Change the ***Value*** of the ***Horizontal Constraint*** to **32.**

38. **<D> Apply**.

39. **<D> Close**. The template looks like the illustration below.



40. **<D> Test**.

41. **<D> Draw**. Notice that once the ground line drops 12 feet below the EOP, the **Z-Slope_12_6_to_1** component disappears.

42. **<D> Close** to return to the ***Create Template*** dialog box.

Now we will add the Normal_Paved_Installation-6ft-Shoulder component to the template. This component uses the Height Check display rule along with the NOT operator to display the guardrail components only when the standard end condition is not used.

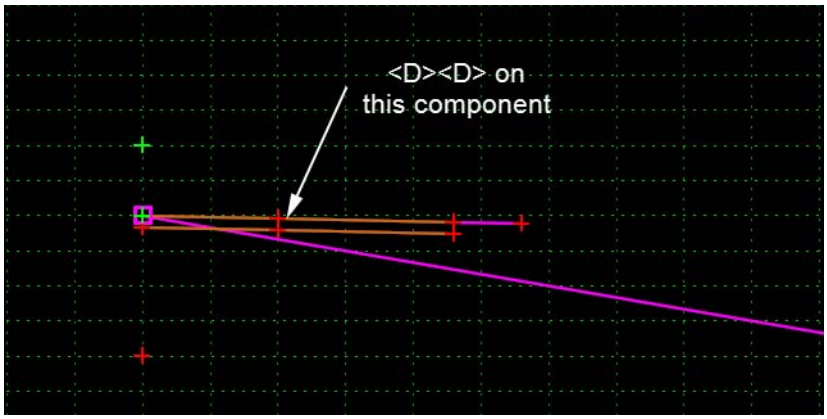
43. Expand the ***4 – Components > Barriers & Misc Components > Guardrail Widening*** folder.

44. **<D>** on **Normal_Paved_Installation-6ft-Shoulder** in the library tree view.

45. **<D> and Hold** on the component's origin (the upper left point) in the ***Preview*** window.

46. **Drag and Drop** the section on the ***EOP*** point in the template view.

47. **<D> <D>** on the **HMA_GRAIL-Widening_Normal_6ft-Shoulder** component.



48. **<D>** the **Edit** button for the ***Display Rules***.

49. In the ***Component Display Conditional Expression*** dialog box, **<D>** the **NOT** button.

50. Highlight **Height Check** in the ***Template Display Rules*** area, then **<D>** the **Selected Rule** button.

51. **<D> OK**.

52. In the ***Component Properties*** dialog box, **<D> Apply** and **Close**.

    Because the display rules don't work well with end conditions, this component is used to locate the toe of the fill slope from the end of the guardrail section.

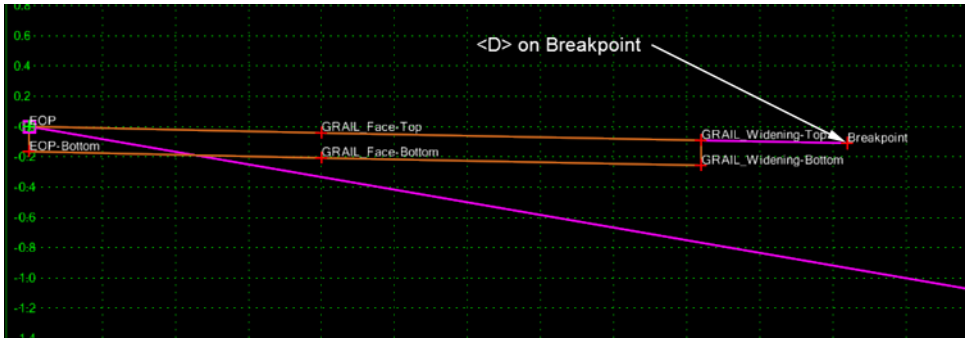
53. Zoom in around the guardrail widening component placed above.

54. **<R>** in the Template View and select **Add New Component > End Condition**.

55. Key in ***Fill_2_to_1*** for the ***Name***.

56. Select **Default** for the ***Style***.

57. **<D>** on the **Breakpoint** point.

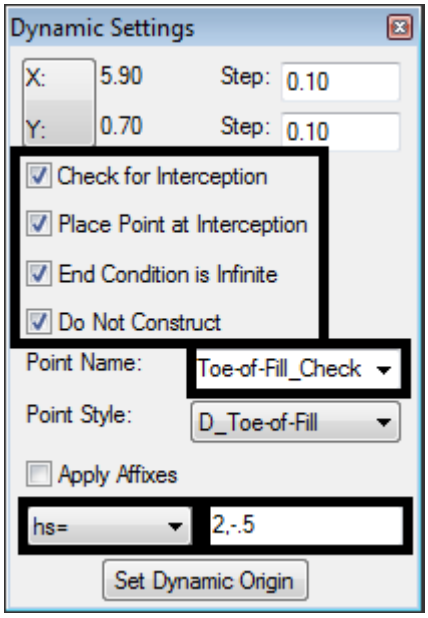


58. In the ***Dynamic Settings*** dialog box, Key in ***Toe-of-Fill_3*** for the ***Point Name***.

59. Toggle on **Check for Interception**, **Place Point at Interception**, **End Condition is Infinite**, and **Do Not Construct**.

60. Set the key in mode to **hs=**

61. Key in ***2,-.5*** and press ***Enter***.



62. **<R>** and select **Finish**.

The final component actually constructs the fill slope in the template. It will be made a child of the guardrail widening component so that it displays only when the guardrail widening component is displayed.

63. **<R>** in the Template View and select **Add New Component > Constrained**

64. Key in ***Fill_2_to_1*** for the ***Name.***

65. Set the ***Style*** to **D_Toe-of-Fill.**

66. **<D>** on the **Breakpoint** point.
67. **<D>** on the ***Toe-of-Fill_3*** point.
68. **<R>** and select **Finish.**
69. **<D> <D>** on the **Fill_2_to_1** component.
70. Set the ***Parent Component*** to **HMA_GRAIL-Widening_Normal_6ft-Shoulder.**
71. **<D> Apply**.
72. **<D> Close.**
73. **<D> Test**.
74. **<D> Draw**. Notice that when the **Z-Slope_12_6_to_1** component disappears the guardrail component and its children are shown.

Chapter Summary:

- All four exercises used the drag and drop method to add components to a section.
- In *Lab 8.2 -Build an End Condition Section*, the special properties of end condition components were illustrated. Setting the end condition priority determines the processing order of end condition components.
- *Lab 8.3 -Using Parent Components* and *Lab 8.4 -Using Display Rules* built sections from new and existing components. A variety of methods can be used to put data into a template.
- *Lab 8.3 -Using Parent Components* and *Lab 8.4 -Using Display Rules* used the parent/ child relationship between components to display the proper solution. This groups components so that if the parent is displayed then the children are also displayed.
- In *Lab 8.4 -Using Display Rules* display rules were created to turn on and off components that are not part of the solution. Display Rules set criteria used to determine if a component will be displayed.