Bentley OpenRoads Workshop

2017 FLUG Spring Training Event

431 - Approach and Driveway Modeling in OpenRoads

Practice Workbook

This workbook is designed for use in Live instructor-led training and for OnDemand self study. OnDemand videos for this course are available on the *Bentley LEARN Server*.

Approach and Driveway Modeling in OpenRoads

SELECTseries 4 (08.11.09.872)

About this Practice Workbook...

- This PDF file includes bookmarks providing an overview of the document. Click on the bookmark to quickly jump to any section in the file. You may have to turn on the bookmark function in your PDF viewer.

- Both Imperial and Metric files are included in the dataset. Throughout this practice workbook Imperial values are specified first and the metric values second with the metric values enclosed in square brackets. For example: *12' [3.4m]*

- This training uses the *Bentley-Civil* workspace delivered with the software. It is very important that you select the *Bentley-Civil* workspace when working the exercises in this course.

Have a Question? Need Help?

If you have questions while taking this course, click the button below to submit them to the Civil Design Forum on Bentley Communities where peers and Bentley subject matter experts are available to help.

Exercise 1: Model a Simple Intersection

Description

Within OpenRoads, the there are many tools for modeling in 3D.

In this exercise, you will learn how to model a simple at-grade intersection that transitions from a proposed roadway to meet and match the existing roadway. This is also an example for how to model driveways and other simple approaches and intersecting elements.

Skills Taught

- Create horizontal and vertical geometry for curb returns

- Create match lines

- Create a terrain model of the intersection pavement surface

- Model pavement layers within the intersection

- Model the curb and gutter, sidewalks, and side slopes around the intersection

Create the Horizontal Geometry of the Curb Returns

In this exercise, you will define the horizontal geometry for the intersection curb radii.

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1. Start the software.

2. Select the workspace...

InRoads, GEOPAK, and PowerCivil Users	MX ROAD Users

InRoads, GEOPAK, and PowerCivil Users

A. Select the User, Project, and Interface settings.

- User: *Examples*

- Project: *Bentley-Civil-Imperial* or *[Bentley-Civil-Metric]*

- Interface: *Bentley-Civil*

Continue with step 3

Help with the Workspace

If the *Bentley-Civil-Imperial* or *[Bentley-Civil-Metric]* projects are not listed, review the troubleshooting information in the Bentley Communities by clicking here or visiting communities.bentley.com and searching for "Civil Workspace".

MX ROAD Users

A. On the MX Project Start Up window, click **New Project**.

B. Click **Browse** and select the folder where the training dataset is located.

C. Key in **Training** in the *Project Name* field.

D. Set the Default MX Project Settings to *UK_imperial [UK_metric]*.

E. Select the User, Project, and Interface settings.

- User: *Examples*

- Project: *Bentley-Civil-Imperial* or *[Bentley-Civil-Metric]*

- Interface: *Bentley-Civil*

F. Click **OK**. The MX project files are created and the software opens into a blank file named draw.dgn.

G. Select **File > Open** from the CAD menu.

Continue with step 3

3. Browse to the folder where you unzipped the dataset files and select the file *Project File-Imperial.dgn [Project File-Metric.dgn]*.
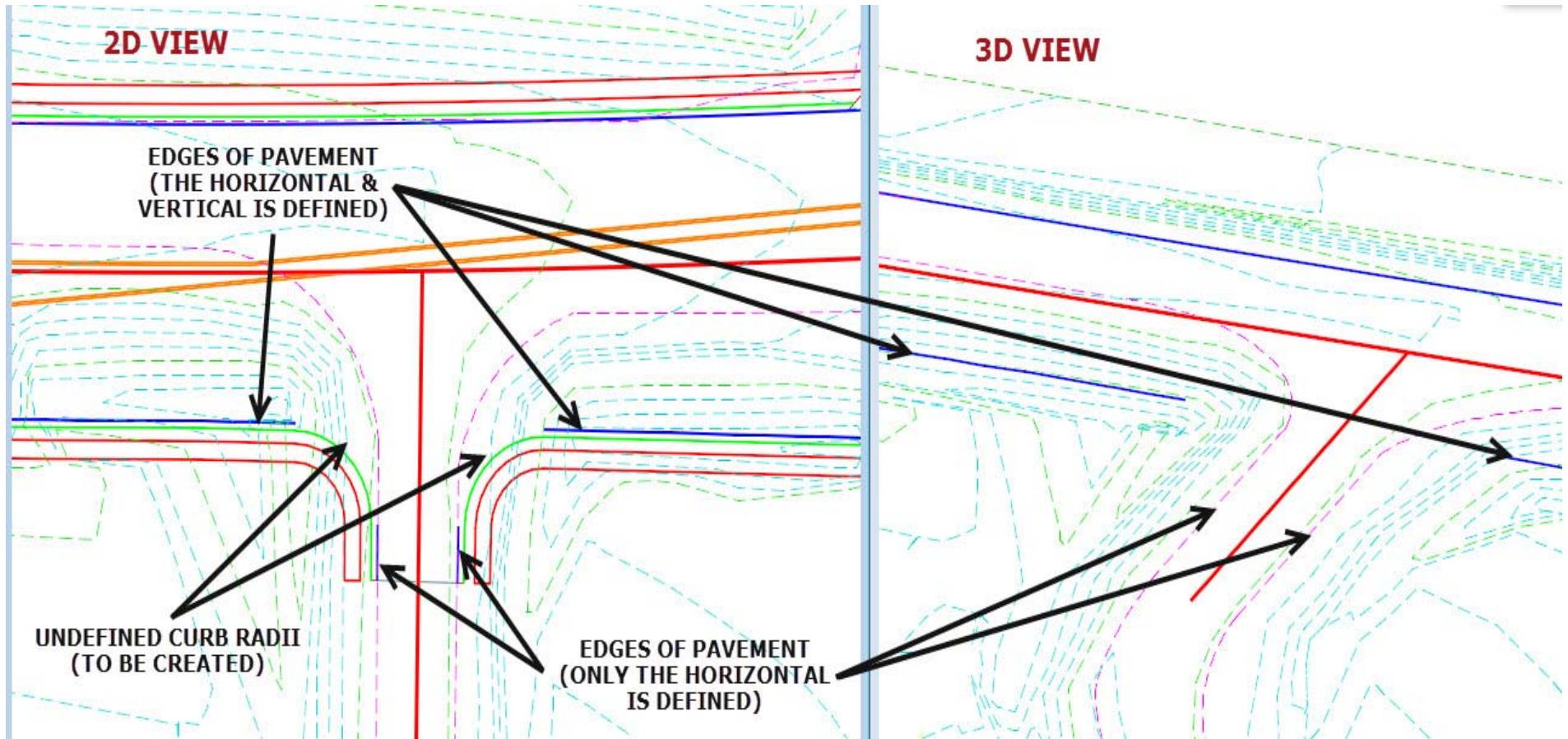
NOTE: Notice the differences in View 1 (2D view) and View 2 (3D view). When modeling, it's important to recognize that an element can have a horizontal definition without a vertical definition.
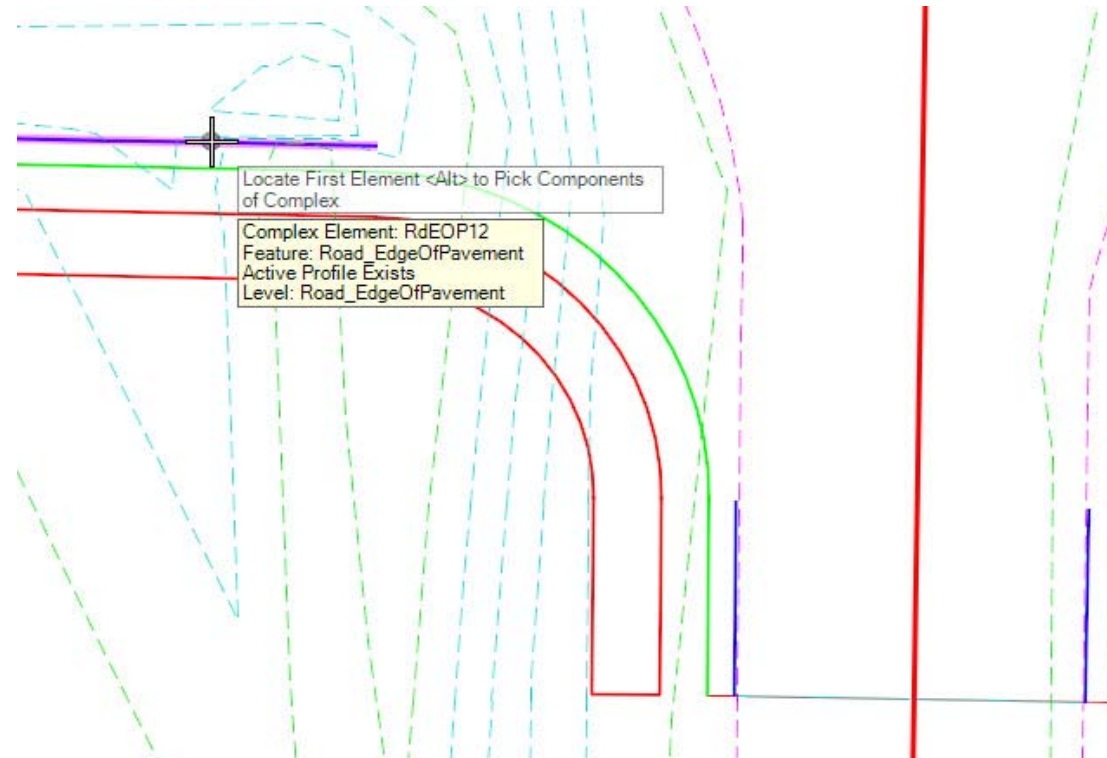
4. Make sure *View 1* is active.

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Create the Southwest Curb Return

1. On the task menu, open the **Horizontal Geometry** toolbox.
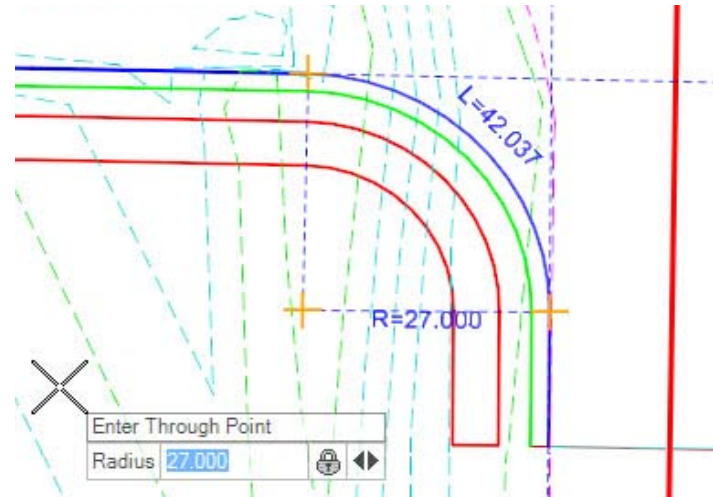
2. Select the **Arc Between Elements** tool.

   a. Then, following the prompts, **Locate the First Element** by selecting the proposed EOP of the main roadway west of the intersection.

Locate First Element <Alt> to Pick Components of Complex

Complex Element: RdEOP12
Feature: Road_EdgeOfPavement
Active Profile Exists
Level: Road_EdgeOfPavement

   b. **Enter Back Offset** and key in 0.

   c. **Tab** to lock the value.

   d. **Data Point** to move to next prompt.

   e. **Locate the Second Element** by selecting the western proposed EOP of the secondary roadway south of the intersection.

   f. **Enter Ahead Offset** and key in 0.

   g. **Tab** to lock the value.

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h. **Data point** to move to the next prompt.

i. E**nter Through Point** and key in *27[8.23]*

j. Move the cursor to the southwest quadrant of the intersection.

k. **Data point** to move to next prompt.

l. Set the **Trim\Extend Option** to *Both*.

m. **Data Point** to place the arc.

Create the Southeast Curb Return

1. On the task menu, open the **Horizontal Geometry** toolbox.

2. Select the **Arc Between Elements** tool.

   a. Following the prompts, repeat the previous process and create an arc with a radius of *27[8.23]* for the southeast curb return.

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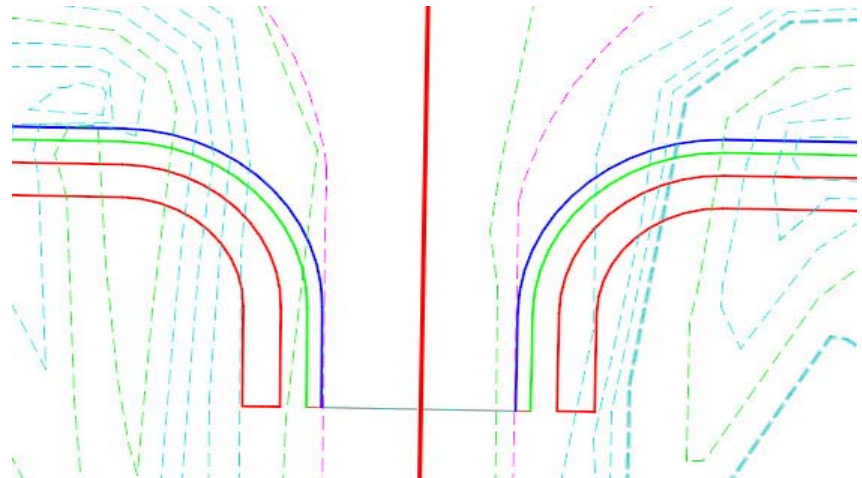
Create the Vertical Geometry of the Curb Returns and Secondary Road Edge of Pavement

In this exercise, you will define the vertical geometry for the intersection curb radii and the secondary road edges of pavement.

1. Evaluate the 2D view (View 1) and the 3D view (View 2).
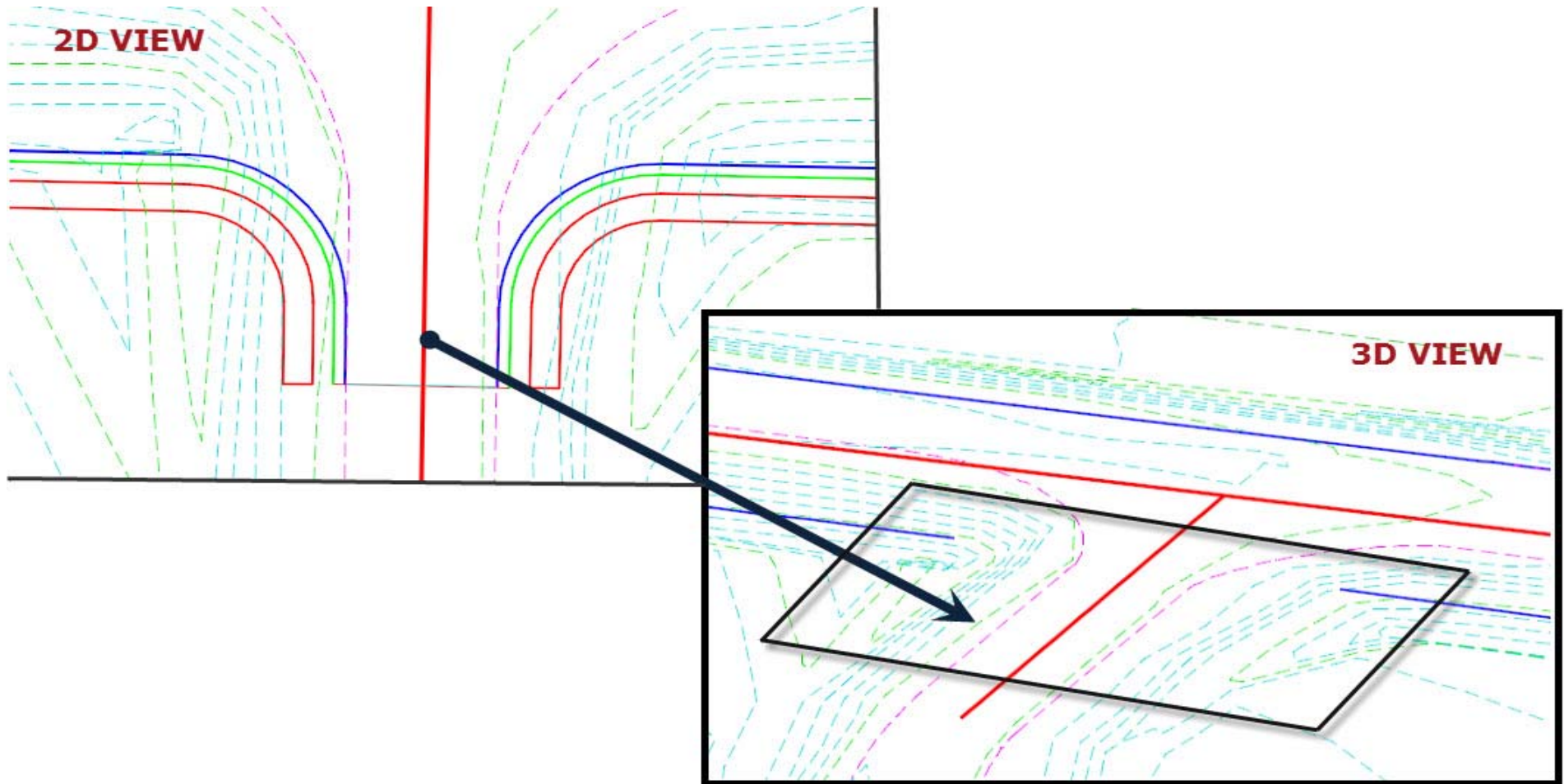
Assign Vertical Definition to the Proposed Edges of Pavement on the Secondary Road

In this step, we will define the elevations for the two edges of pavement along the secondary road. It's important to note that the model must create a smooth transition from the proposed roadway to the existing pavement of the secondary road.

1. Open the profile model for the western edge of pavement

   a. In View 1, select the western edge of pavement along the secondary roadway.

   b. Continue to hover the cursor at the selection point until the context sensitive menu appears.
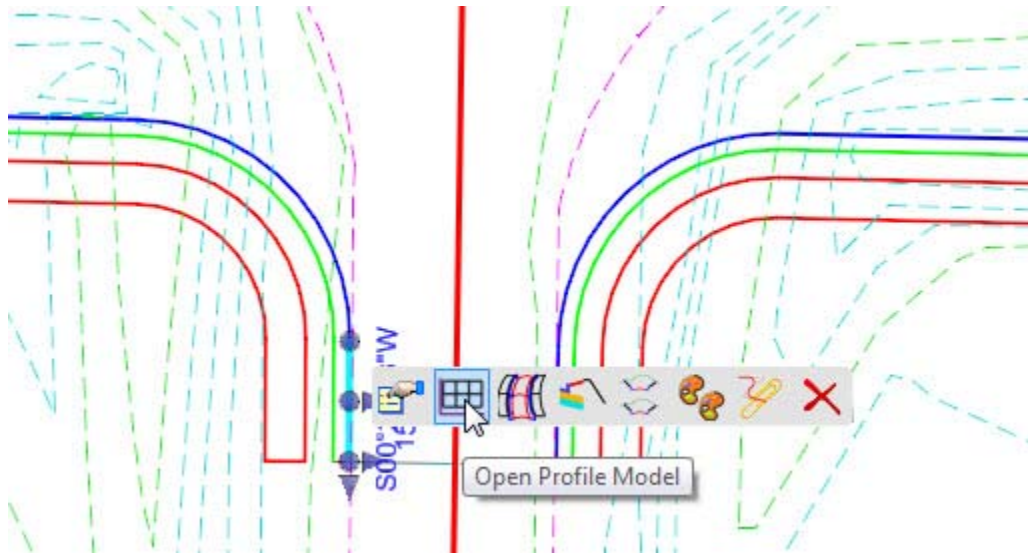
   c. Select the **Open Profile Model** tool.

   d. Open any view by selecting the respective button at the bottom of the screen. Profiles can be displayed in any view. You can place the profile in view 3 if you choose.

The profile model opens.
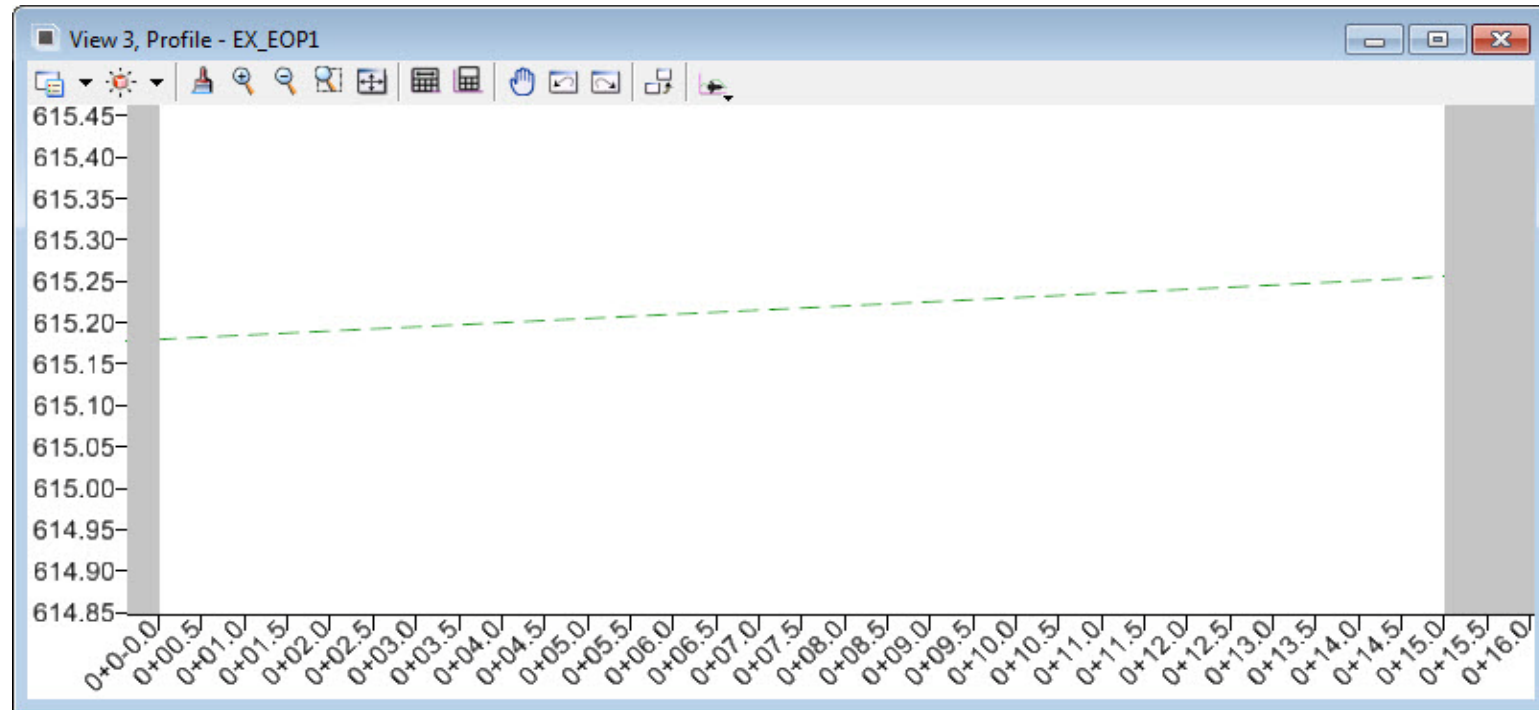
NOTE: We want the new intersection to transition from the new main roadway to the existing secondary road. OpenRoads allows a vertical definition to be defined as the terrain.

2. Set the terrain as the active profile along the *western* edge of pavement.

    a. Select the **Element Selection** tool.

    b. Select the terrain line and hover until the context menu appears.

    c. Select the **Set Active Profile** tool.

3. Open the profile model for the *eastern* edge of pavement.

4. Set the terrain as the active profile along the eastern edge of pavement.

You may close the view that contains the profile model if you wish.

The profiled edges of pavement appear in the 3D view.
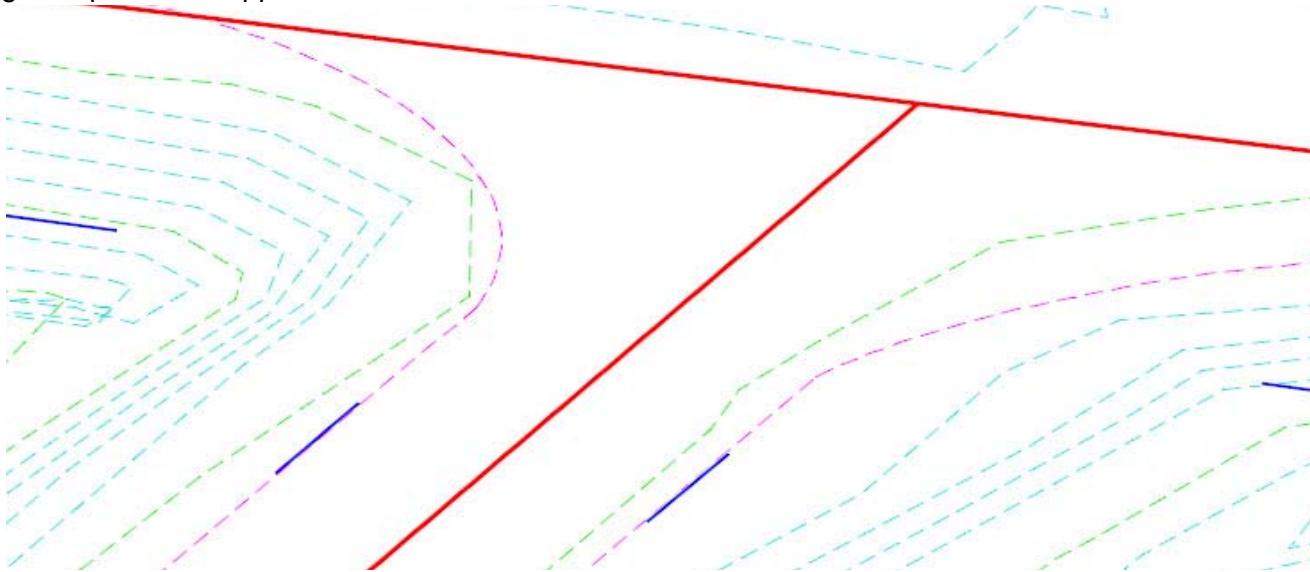
Assign Vertical Definition to the Curb Returns Between the Main Roadway and the Secondary Road

The edges of pavement have now been "profiled" or assigned a vertical definition. We will now profile the curb returns to create the vertical definition between the proposed main roadway and the existing secondary roadway.

1. Create the profile transition along the southwest curb return.

2. On the task menu, open the **Vertical Geometry** toolbox.

3. Select the **Quick Profile Transition** tool.

   a. Then, following the prompts, set the **Quick Transition Method** to *Parabolic*.

   b. Data point to move to the next prompt.

   c. **Locate What to Define** by selecting the arc for the southwest curb return.

The curb is profiled with a parabolic vertical definition and displayed in the 3D view.

NOTE: Use the Quick Profile Transition command to define a linear or parabolic profile to an element by matching the slope and elevation of adjoining elements. Depending on the configuration of adjacent elements, either a single crest/sag curve is created or a reverse transition.

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4. Create the profile transition along the southeast curb return.

5. Open the profile model for each curb return and review the profiles.
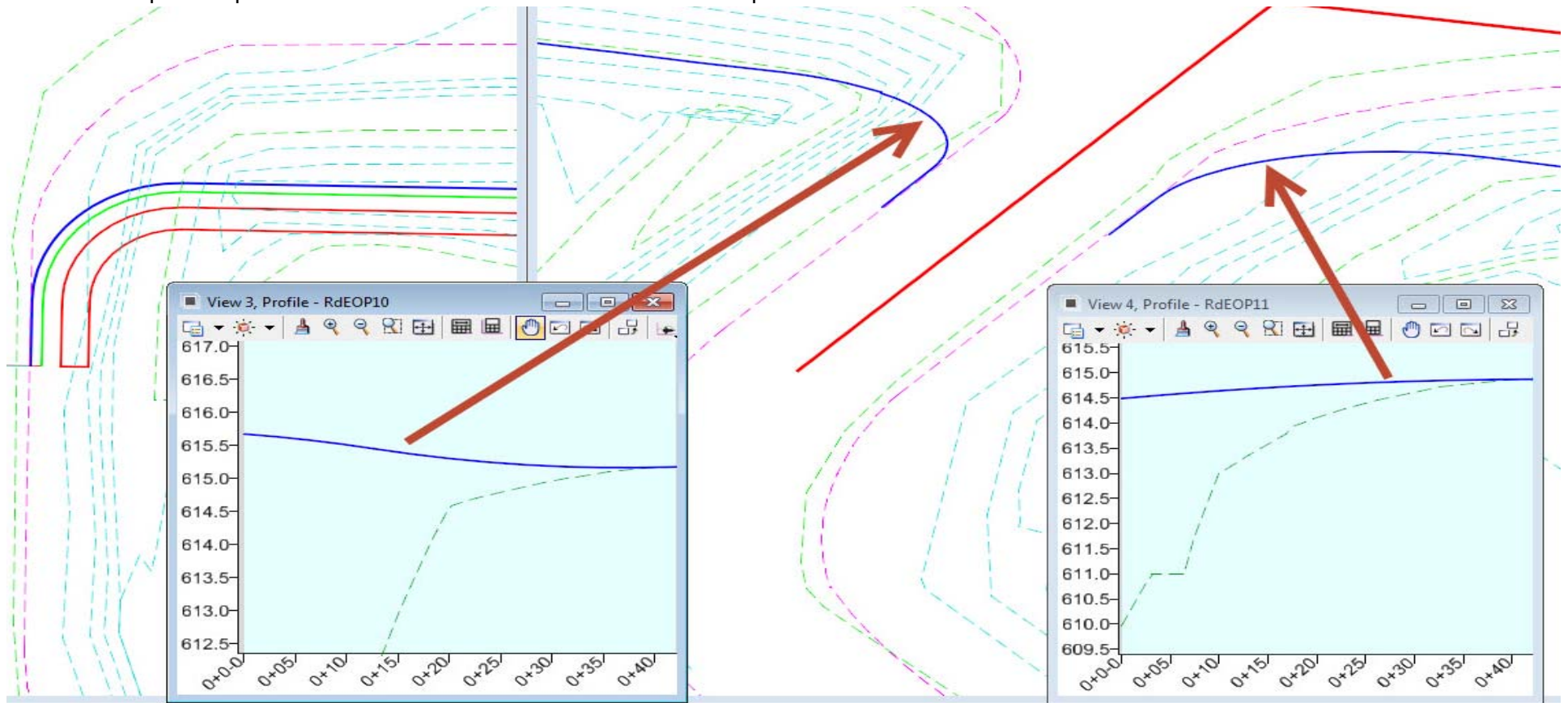
Create Match Lines for the Secondary Road

In this exercise, you will create a match line along the main roadway through the intersection as well as a match line across the secondary road where the proposed pavement meets the existing roadway.

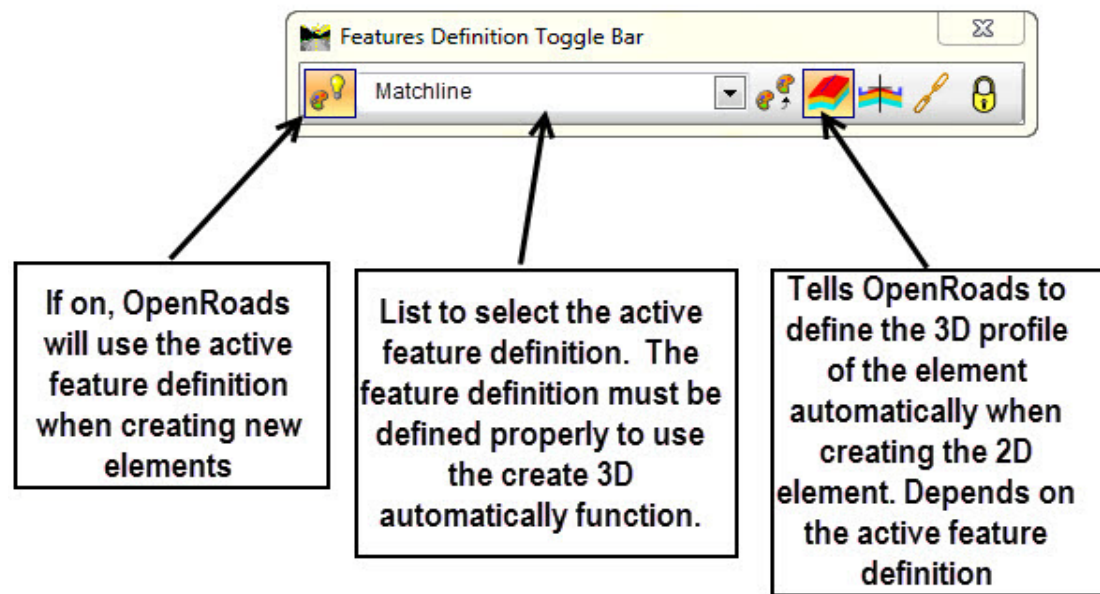1. Draw the match line through the intersection.
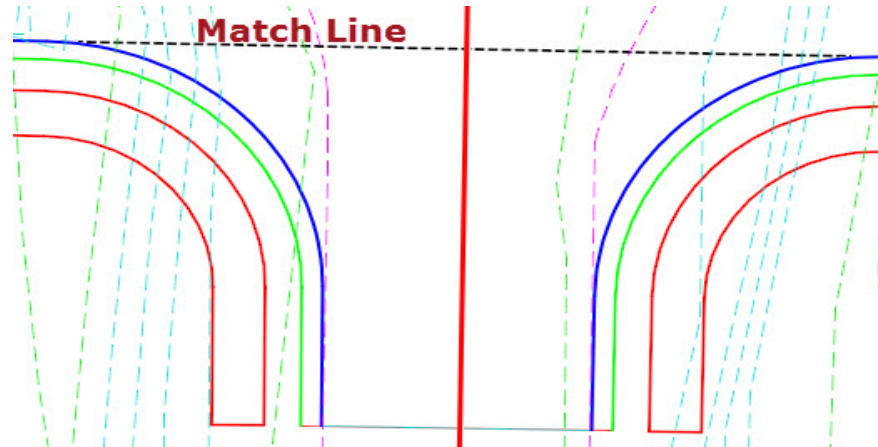
For the previous elements, you created the curb return profiles by utilizing the Quick Profile Transition tool. In this exercise, you will use OpenRoads to create the profile automatically when creating the match line between the proposed roadway and the small intersection.

2. Turn on the option to create 3D elements automatically.

   a. Set *View 1* active.

   b. On the task menu, open the **General Geometry** toolbox.

   c. Select the **Features Definition Toggle Bar** tool.

   d. Define the settings below on the feature definition tool bar:

      ▪ **Use Active Feature Definition** - *On*

      ▪ Active Feature Definition - browse to *Linear > Geometry* and select *Matchline*

      ▪ **Create 3D Automatically** - *On*

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Features Definition Toggle Bar — Matchline

If on, OpenRoads will use the active feature definition when creating new elements

List to select the active feature definition. The feature definition must be defined properly to use the create 3D automatically function.

Tells OpenRoads to define the 3D profile of the element automatically when creating the 2D element. Depends on the active feature definition

3. On the task menu, open the **Horizontal Geometry** toolbox.

4. Select the **Line Between Points** tool.

   a. Following the prompts, being sure to *snap* to the mainline edge of pavement at the beginning of the curb return and data point.

   b. Draw the line across the intersection, being sure to *snap* to the other mainline edge of pavement, and data point to place the line.

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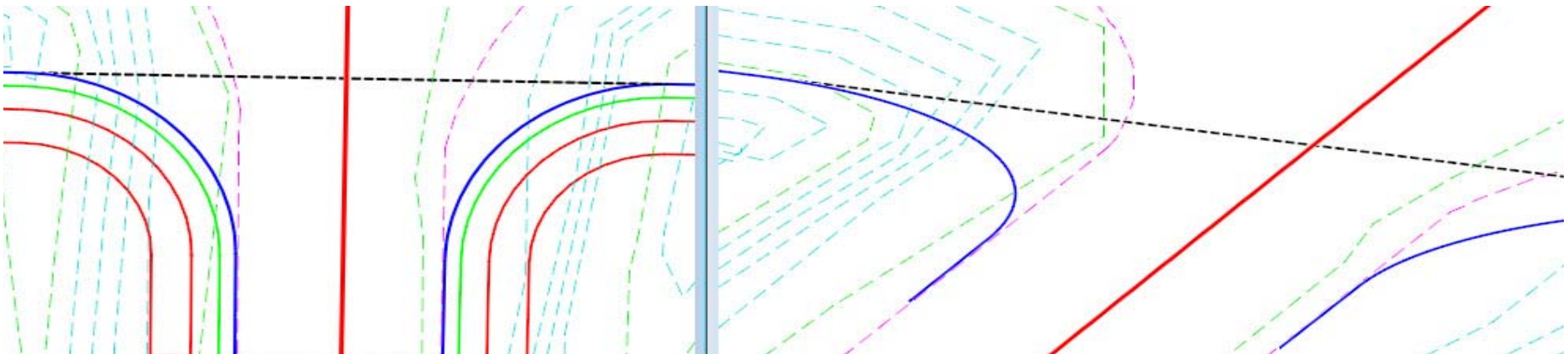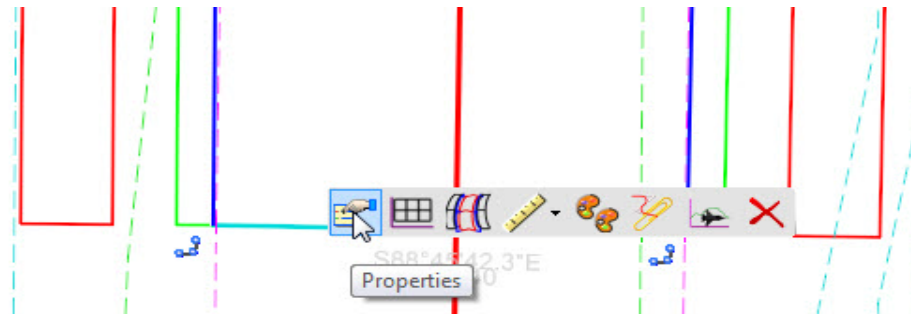
5. Define the match line on the secondary road.
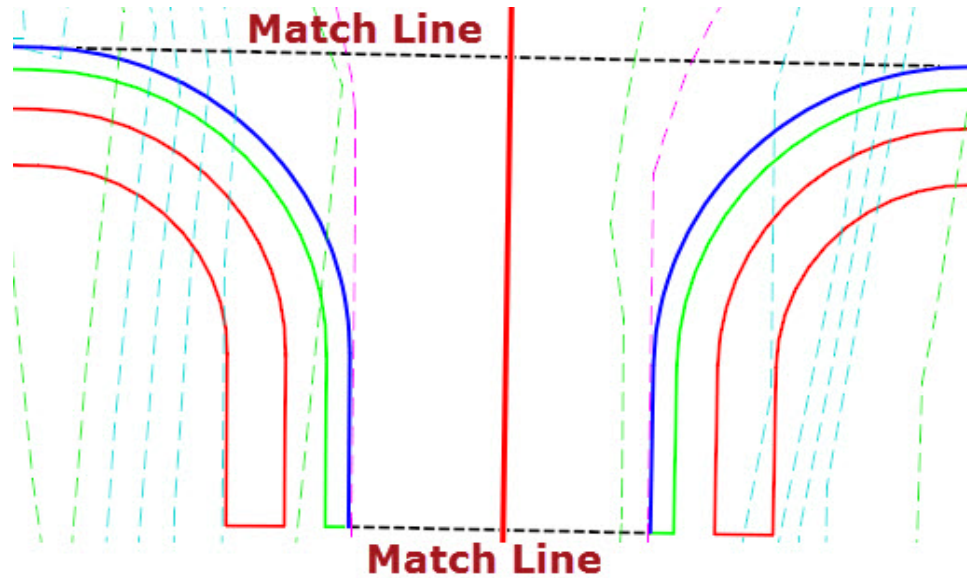
This line is already present in the file. You will assign the *Matchline* feature definition to this line.

a. Select the cyan line that represents the match line across the secondary road.

b. Open the **Properties menu**

c. Change the **Feature Definition** of the line to *Matchline*.

NOTE: browse to *Linear > Geometry* and select *Matchline* feature definition.

Assign a Vertical Definition to the Match Line on the Secondary Road

We have created the match line across the secondary road in 2D, and will now create the profiles and assign elevations to it.

The match line along the new roadway was created automatically in the previous step.
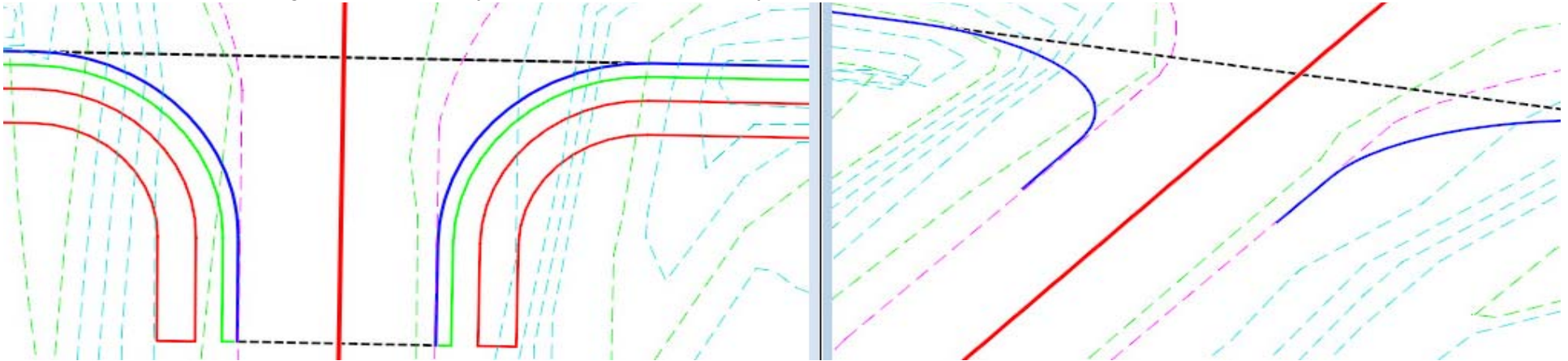
6. Create the profile for the secondary road match line.
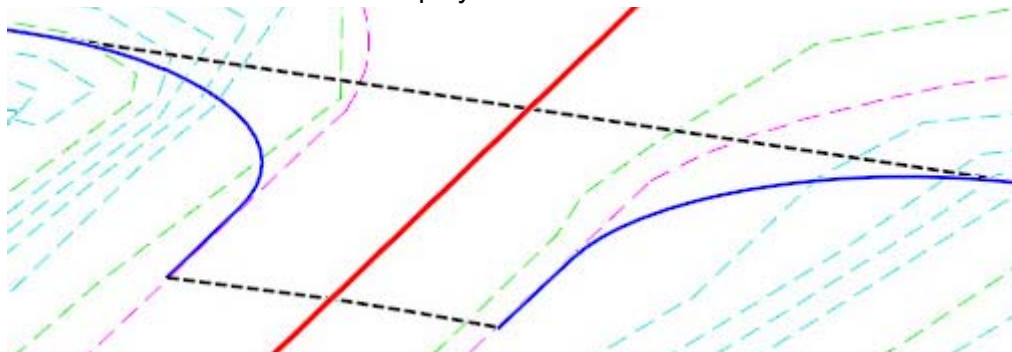
7. In View 1, select the match line.

   a. Pick **Open Profile Model** from the context menu.

8. Within the profile model, select the terrain line.

   a. Pick **Set as Active Profile** from the context menu.

The match line is profiled with the terrain elevations and displayed in the 3D view.

Create a Terrain Model of the Intersection

Now that you have defined the horizontal and vertical properties of the match lines and edge of pavement elements, we will create a terrain from them.

1. Create a terrain model of the intersection using the edges of pavement and match lines.

2. On the task menu, open the **Terrain Model** toolbox.

3. Select the **Create from Elements** tool.

    a. On the dialog box, for the **Feature Definition**, browse to the *Terrain Display* folder and select *Design_Triangles*.

    b. Then, following the prompts, select the edges of pavement and match lines.

    c. Set the **Feature Type** to *Boundary*.

    d. Set the **Edge Option** to *Max Triangle Length*.

    e. Set the **Max Side Length** to *2[0.61].*

    f. Data point to create the terrain.
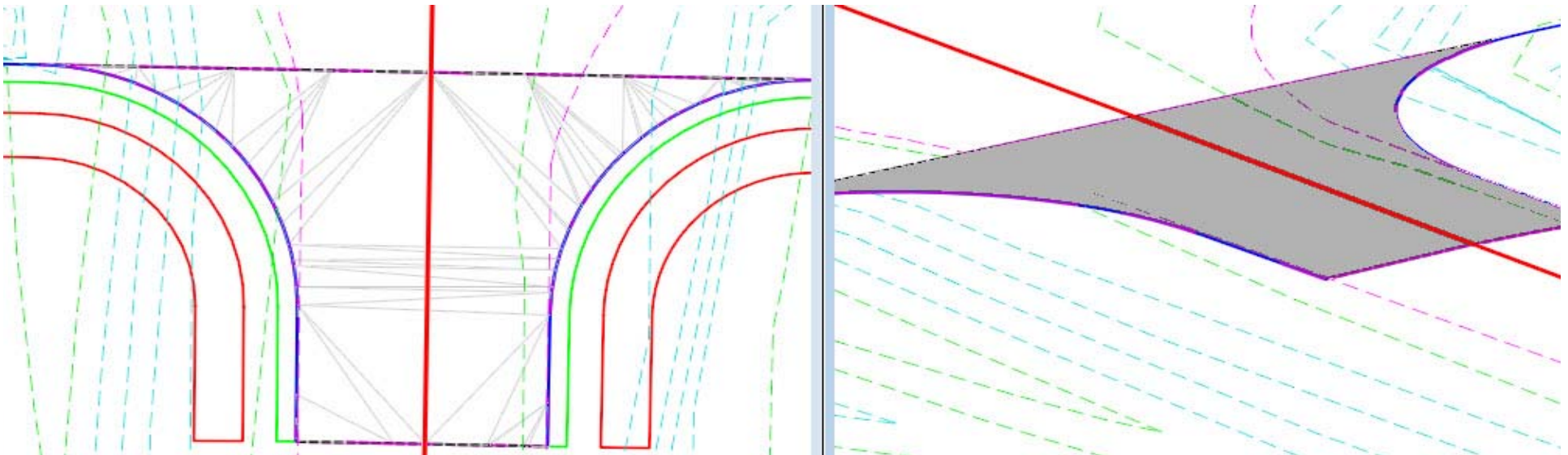
Apply a Surface Template to Model the Pavement

In this exercise, you will model the pavement layers within the intersection using a surface template.

Copy the Project Template into the Standard Library

A standard template library has already been loaded from the workspace. However, this exercise uses a customized project template contained in a different template library. We will copy the project template into the standard template library for use in our design. The **Template Library Organizer** provides a means to access and copy templates from other libraries or the active dgn into a standard template library.

1. On the task menu, open the **Corridor Modeling** toolbox.

2. Select the **Create Template** tool.

   a. On the Create Template, go to *Tools > Template Library Organizer*.
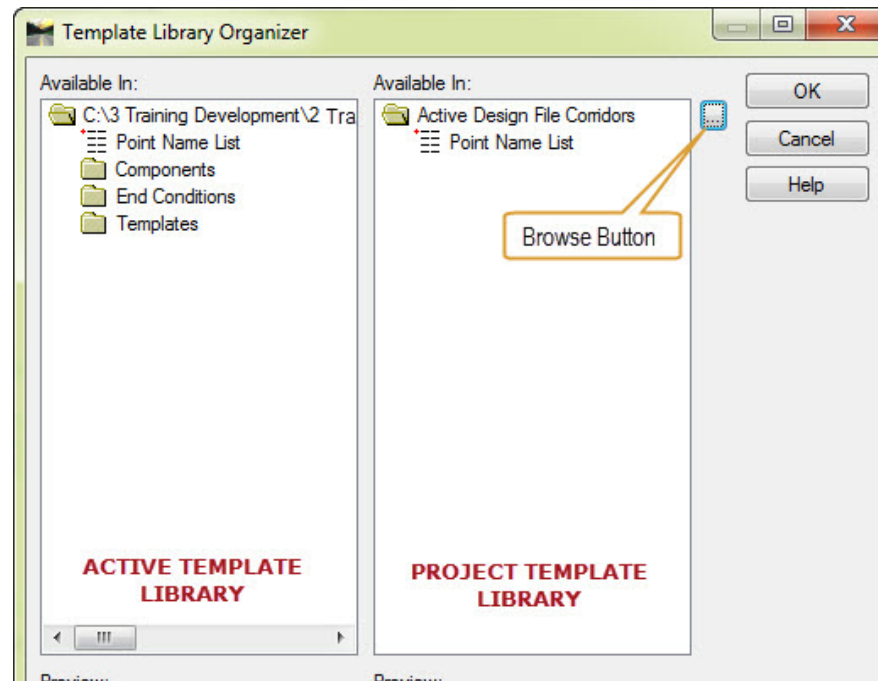
   b. Browse to the training data set and open the file *Approach and Drives.itl.[Approach and Drives_METRIC.itl]*

c. Double click the heading to expand the project template library.

d. Browse to *Templates > Intersection Modeling.*
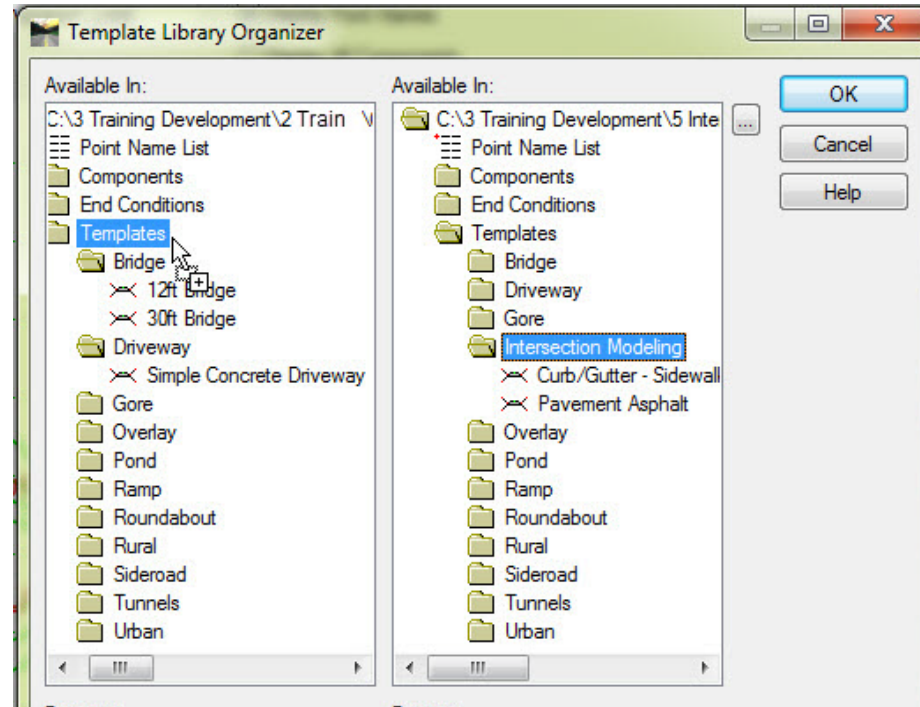
e. Drag the *Intersection Modeling* folder from the right column into the left column and drop it into the *Templates* folder.

f. Click **OK**.

g. Click **Yes** to save the new templates and write them into the active template library file (.itl).

h. The *Intersection Modeling* folder and associated templates are now in the active template library.
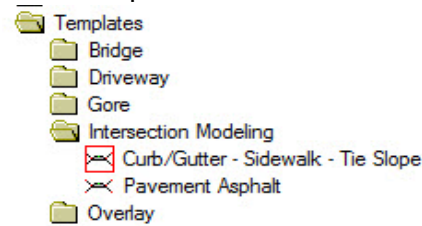
3. **Close** the Create Template dialog box.

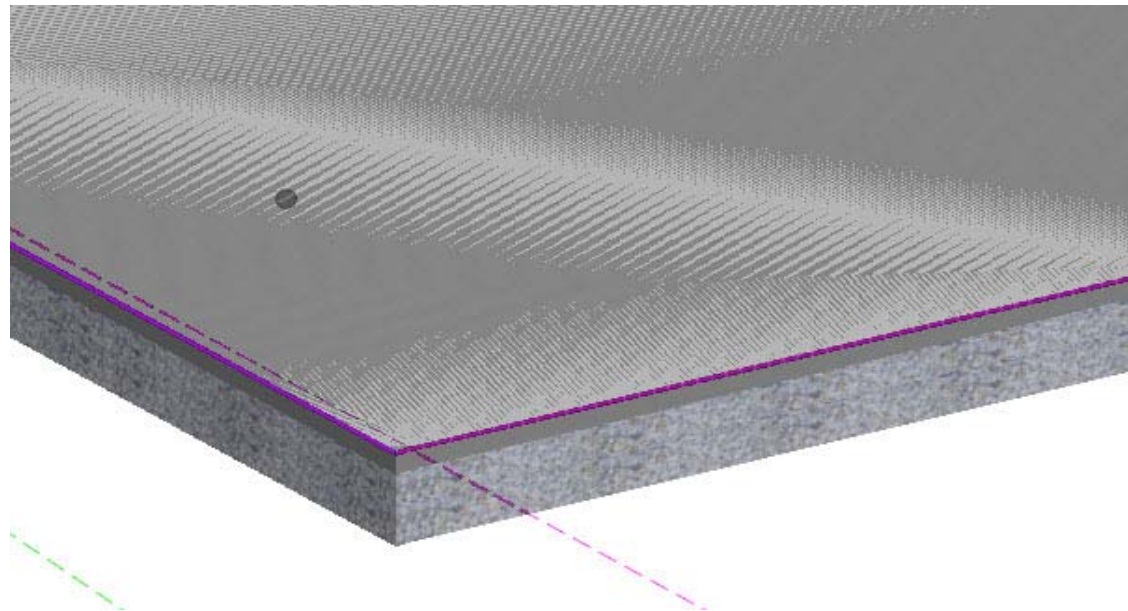## Create the Pavement Layers Within the Intersection Model

1. On the task menu, open the **3D Geometry** toolbox.

2. Select the **Apply Surface Template** tool.

   The *Apply Surface Template* tool allows you to create 3D component layers in the model by selecting a template from the active template library and applying it across a terrain.

   a. Following the prompts, in *View 1* select the terrain model.

   b. Set the **Apply External Clip Boundary** setting to *No*.

   c. Data point to move to the next prompt

   d. **Select Template** - Hold the *ALT* key while pressing the *down arrow* to open the template library.

   e. Browse to the *Templates* folder, open the *Intersection Modeling* heading and select the template **Pavement Asphalt**.

   f. Click **OK** and data point.

   g. Data point to **Accept the Selection**.

3. Review the 3D model.

Model the Curb and Gutter, Sidewalk, and End Conditions

In this exercise, you will model the curb and gutter, sidewalks, and side slopes for the intersection using a linear template.

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1. On the task menu, open the **3D Geometry** toolbox.
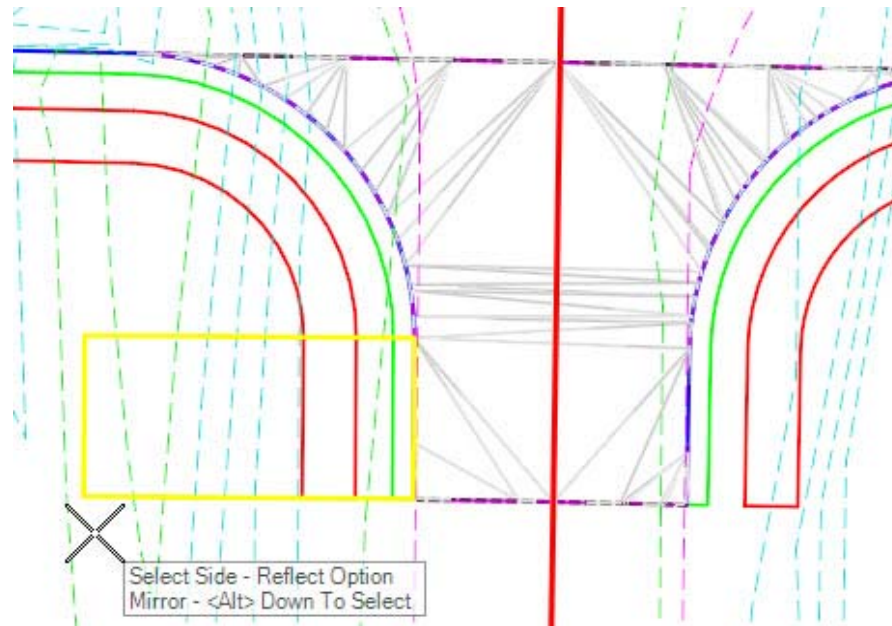
2. Select the **Apply Linear Template** tool.

   The *Apply Linear Template* tool allows you to create 3D components within in the model by selecting a template from the active template library and applying it along a 3D linear element. This tool is very useful in modeling design elements such as ditches, walls, levees, and channels.

   a. Following the prompts, in *View 1*, **Locate Element to Apply Template** and select the western edge of pavement feature along the secondary road.
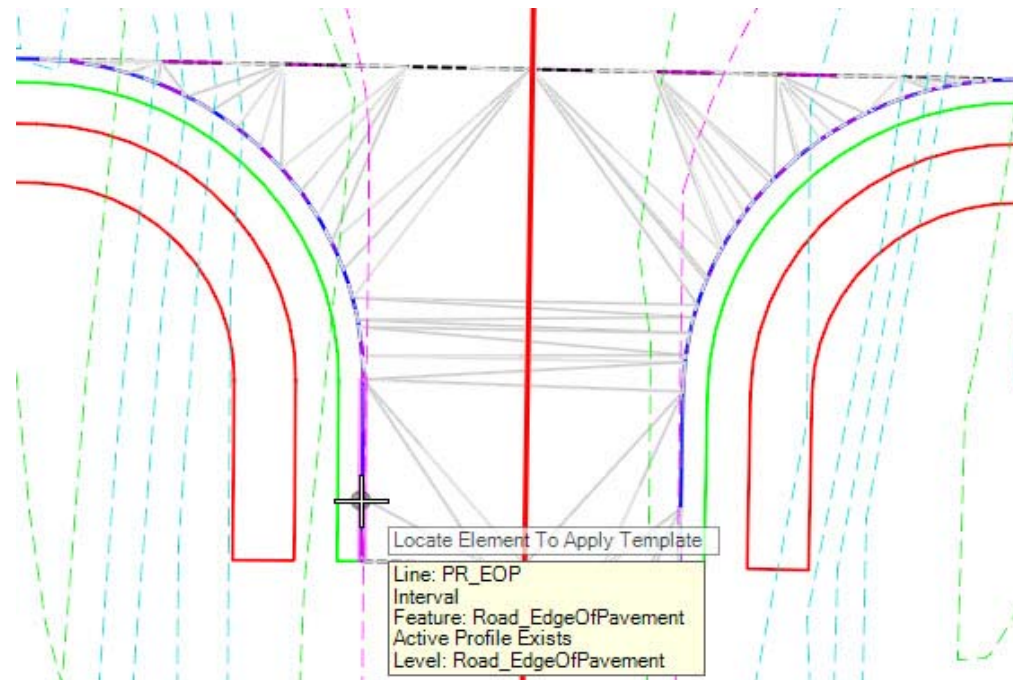
   b. **Select Template** - Hold the *ALT* key while pressing the *down arrow* to open the template library.

c. Browse to the *Templates* folder, open the *Intersection Modeling* heading and select the template **Curb/Gutter-Sidewalk-Tie Slope**.

d. Click **OK** and data point.

e. **Start Station** - Press the *ALT* key to lock the template's starting station to the beginning of the selected element.

f. Data point to move to the next prompt.

g. **Stop Station** - Press the *ALT* key to lock the template's stop station to the end of the selected element.

h. Data point to move to the next prompt.

i. **Select Side** - Move the cursor to the west of the secondary road. The yellow box will move to the outside of the roadway.

Select Side - Reflect Option
Mirror - <Alt> Down To Select

j. Data point to move to the next prompt.

k. **Exterior Corner Sweep Angle** - Do not change the setting.

l. Data point to move to the next prompt.

m. The linear template is placed and the components displayed in the 3D model (View 2).
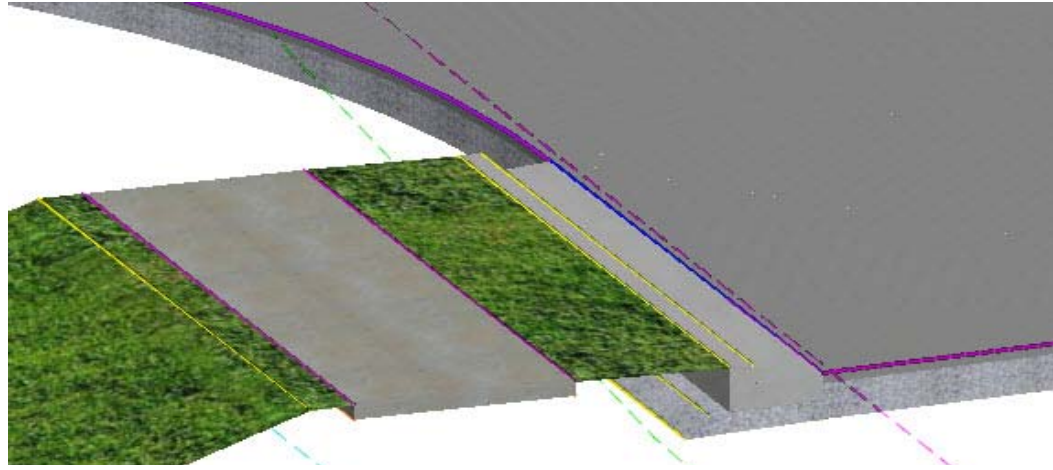
n. Continue in the **Apply Linear Template** tool

o. Place the **Curb/Gutter-Sidewalk-Tie Slope** template along the other edge of pavement features using the same settings as before.

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