CONNECTICUT DEPARTMENT OF TRANSPORTATION

DIGITAL DESIGN ENVIRONMENT GUIDE

CONNECT EDITION

Volume 3.1 – OpenRoads Designer Alignments

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Course Overview

In these exercises you will learn how to create horizontal and vertical alignments. This guide will not document each tool that is available on the OpenRoads interface. See the online help for commands not detailed in this document.

OpenRoads Designer CONNECT Edition Help

Skills Taught

- CTDOT Alignment and Linear Feature Definitions uses
- Horizontal Centerline Layout
- Horizontal Alignment Annotation
- Vertical Profile Creation
- Driveways
- Placement of Non-Centerline Geometry
- Reporting

These workflows detail the Centerline **"Alignment"** layout information that should be contained in an alignment base model design file. The alignment base model file will reside within the project folder structure the ***...\Highways\Base_Models*** folder. Depending on the complexity of the project one or more alignment files can be created. Horizontal alignments and vertical alignments (profiles) are stored in the alignment DGN file(s). References files such as survey and terrain files are attached without nesting.

We will also cover other Geometry Feature Definitions **"Linear"** that are available with the workspace and their uses.

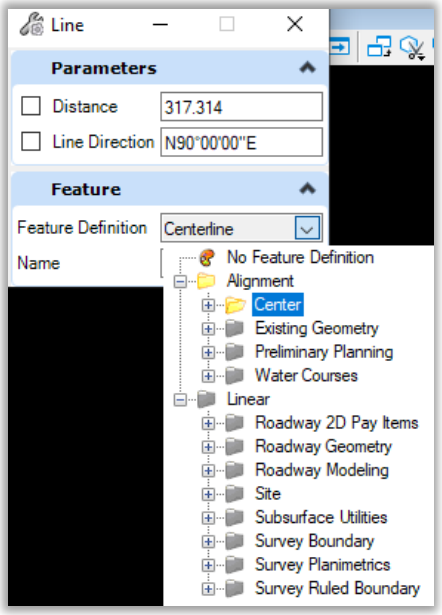


Figure 1 – Geometry Feature Definition Folders

Exercise 1 – Getting Started

1.1 Opening the Application

Before starting this exercise:

- The CTDOT CONNECT DDE synced through SharePoint
- The COMPASS **Training** Project Synced (i.e. 9999-0001 – Design)

Notes for working on actual projects:

1. CTDOT users should have the CTDOT CONNECT DDE synced through SharePoint with the COMPASS Project Synced along with the CAD Configuration.
2. Consultants should have CTDOT DDE properly installed or be syncing to the CTDOT DDE SharePoint/COMPASS system.
3. Make note of the **Coordinate System** you will be working in. If you have existing survey data, you will need to find out what system is being used **(NAD 83/NAVD 88 or NAD 27/NAVD 29).**
4. Log on to the CONNECTION Client. *Bentley Connect licensing requires users to log into their Bentley account to secure a software license. CTDOT users should log in using your CTDOT email address and Bentley password. If you do not see the dialog box, select the ∧ icon on the bottom Windows Screen. Click on the Connection Client Icon and select* ***Open*****.**

1. Launch the Application. On your desktop double click on the **Accounting Icon**.

Figure 2 - CTDOT CAD Accounting Icon

2. On the CTDOT Accounting Menu there will be several applications to pick. In the ***Run Program*** field select the needed program:
   - **Compass OpenRoads CE**
   - for the Available Account select ***OVERHEAD*** for training proposes.
   - Click on the **Start** button to load the program.

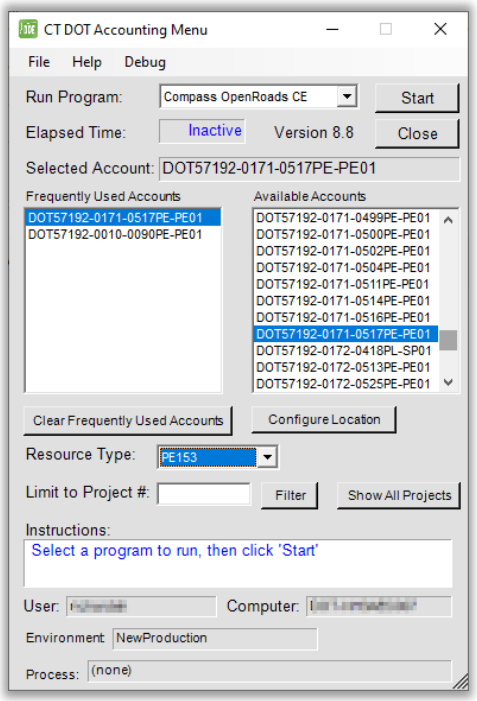


Figure 3 - CTDOT CAD Account Dialog Box

3. After launching the program, a Welcome Screen for ***OpenRoads Designer*** will appear.
4. Ensure you are using the **Custom Configuration** and **CT_WorkSpace**, then select the relevant **WorkSet** (Training WorkSets start with 9999_0001, select the # that you were assigned) and **Role**.
5. Select the **Browse** icon, browse to:

   Highway/Base_Models/HW_CB_0047_0122_ Exercise_1_Alignments.dgn

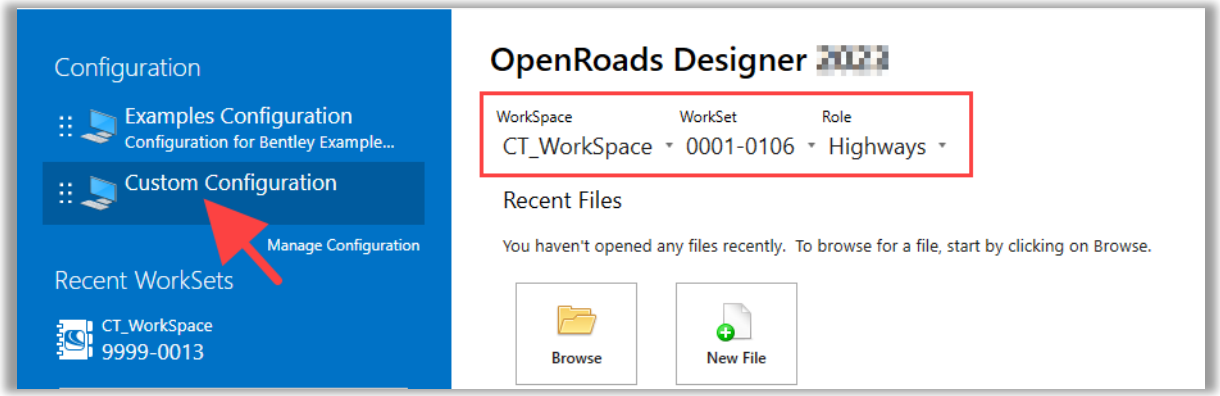


Figure 4 – OpenRoads Start up Screen

6. In the upper left select the **OpenRoads Modeling** Workflow, and click on the **Geometry** tab.

   The Geometry Ribbon contains tools that the designer will use to create Horizontal and Vertical Geometry and plan elements that are based on Civil Geometry. The OpenRoads Geometry commands are selected from the **Geometry** tab of the **OpenRoads Modeling** workflow. The commands are separated into four main categories:

   - General Tools
   - Horizontal
   - Vertical
   - Common Tools

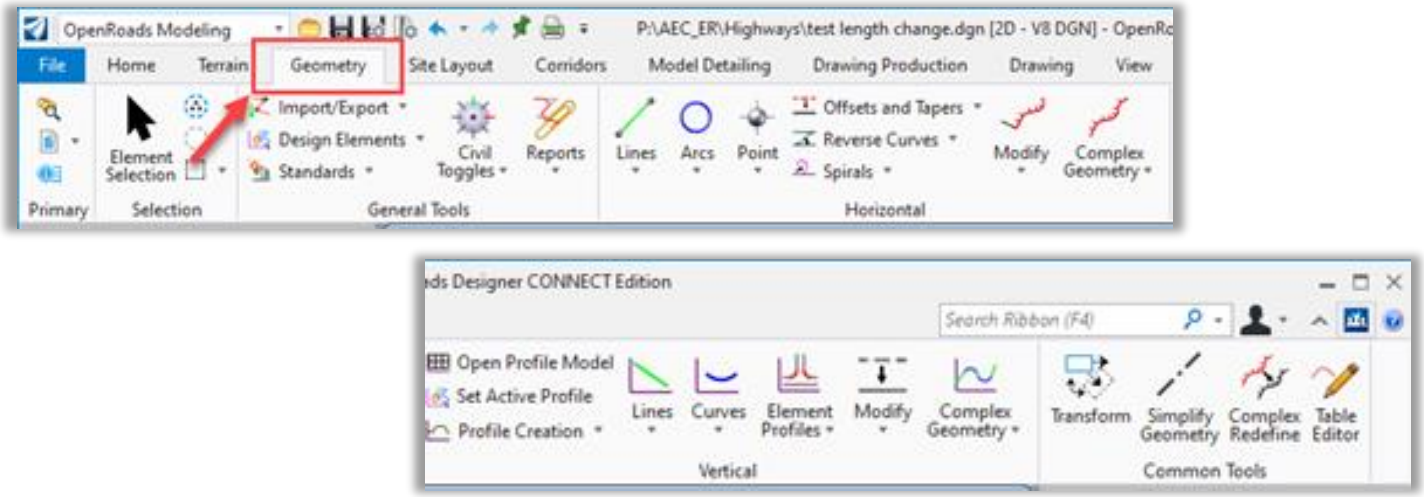


Figure 5 – Geometry Tools

1.2 Geometry Feature Definitions

1. Click on ***Lines > Lines Between Points***

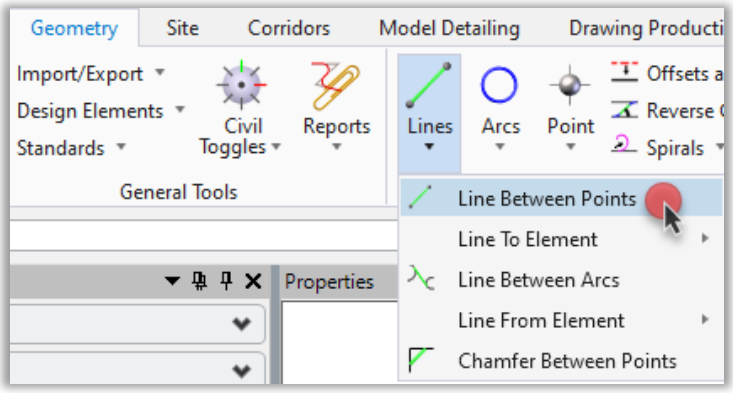


Figure 6 – Geometry Tool Line Between Points

2. Notice the two folders:

   Alignment – *Used for Centerlines and can be annotated with Stationing, PI, PC, PT, Bearing, and Curve Data.*

   Linear – Typically used for offset Control Lines, XSC Cross Points, Template Breaklines, and Pay Items.

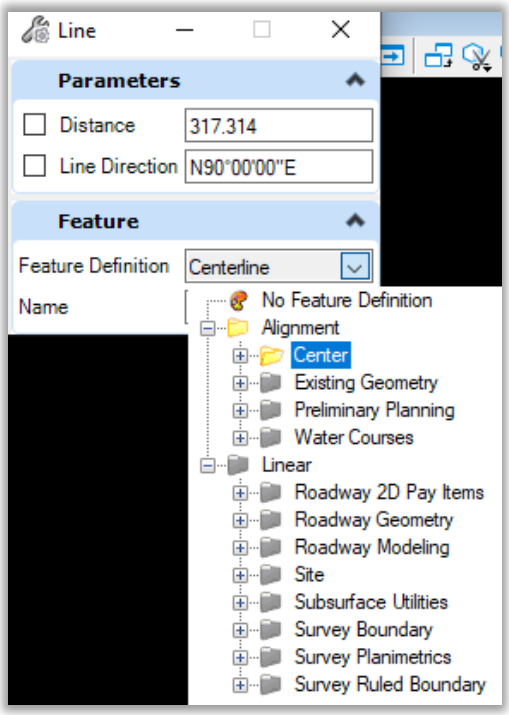


Figure 7 - Geometry Feature Definition Folders

1.2.1 Alignment Feature Definitions

1.2.1.1 Center Alignment

Below are the **Feature Definitions** that will be used to lay out Centerlines:

Used in an Alignment type design file: ***HW_CB_1234_1234_Alignments.dgn***

Feature Definition	Annotation Group	Description
Alignment\Center	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Green	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Pink	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Small Blue	Small CL_Centerline	stationing will be every 10 ft.
Alignment\Driveway	Driveway Stationing	stationing will be every 10 ft.
Alignment\Existing Baseline	BL_Stationing	Stationing will be every 50ft.
Alignment\Segment – Curve	N\A	None
Alignment\ Segment - Line	N\A	None

Note: *When annotating alignments the option to override the assigned Annotation Group can be selected. This will be discussed in Exercise 6, there is an annotation group Named CL_Centerline Flip that can be used to annotate Right to Left allignments*

1.2.1.2 Other Alignments

These Centerline Feature Definitions are used by other units:

- Survey - Alignment\Existing Survey\e_GEOM__BL
- Hydraulics and Drainage - Alignment\Water Courses\….

The Preliminary Planning Feature Definitions may be used during scoping, these definitions come with a two lane roadway template already attached:

- Alignment\Preliminary Planning\2 Lane
- Alignment\Preliminary Planning\2 Lane BCPC

1.2.2 Linear Feature Definitions - Roadway Geometry

Below are listings of other Feature Definitions available when using the Geometry Tools.

1.2.2.1 Control Lines

These **Feature Definitions** are used as Point Controls for Corridors, Linear and Surface Templates. e.g., The Edge of Roadway feature definitions is used to increase or decrease the shoulder width.

Used in a Corridor type design file: ***HW_CB_1234_1234_Corridor_Route123.dgn***

Feature Definition	**Additional Information**
Roadway Geometry\Channel Line	
Roadway Geometry\Curb Cut	
Roadway Geometry\Driveway Match Line	
Roadway Geometry\Driveway Ramp Back Line	
Roadway Geometry\Edge of Pavement Line	
Roadway Geometry\Edge of Road Line	
Roadway Geometry\Edge of Truck Apron Line	
Roadway Geometry\Island Curb Line	
Roadway Geometry\Misc Line	
Roadway Geometry\Misc Point Control Line – blue	
Roadway Geometry\Misc Point Control Line – green	
Roadway Geometry\Misc Point Control Line – pink	
Roadway Geometry\Processed Aggregate Perimeter	
Roadway Geometry\Riprap Perimeter	
Roadway Geometry\Seam Line	
Roadway Geometry\Shoulder Line	
Roadway Geometry\Sidewalk Line	
Roadway Geometry\Slope Limit Cut	
Roadway Geometry\Slope Limit Fill	
Roadway Geometry\Slope Limit Line	
Roadway Geometry\Travelway Line	
Roadway Geometry\Yellow Line	

1.2.2.2 Structure Outlines

These **Feature Definitions** are used to Trace over Proposed Structures you may need to tie into.

Used in a Corridor type design file: ***HW_CB_1234_1234_Corridor_Route123.dgn***

Feature Definition	Additional Information
Structure Outlines\Bridge	
Structure Outlines\Building	
Structure Outlines\Wall	

1.2.2.3 Imported Existing

These **Feature Definitions** are used to trace over existing feature you would like to see annotated on Cross Section Sheets

Used in the design file: ***HW_CB_1234_1234_CrossingFeatures_Existing.dgn***

Feature Definition	XSC Crossing Point Annotation
Imported Existing\Existing BCLC	EX. BCLC
Imported Existing\Existing BCPC	EX. BCPC
Imported Existing\Existing Building	EX. BUILDING
Imported Existing\Existing Concrete Curb	EX CONC. CURB
Imported Existing\Existing Edge of Road	EX. EOR
Imported Existing\Existing Fence	EX FENCE
Imported Existing\Existing Granite Curb	EX. GRANITE CURB
Imported Existing\Existing Granite Sloped Curb	EX GRANITE SLOPED CURB
Imported Existing\Existing Noise Wall	EX. NOISE WALL
Imported Existing\Existing Road CL	EX. CL
Imported Existing\Existing Stone Wall	EX. STONE WLL REMAINS
Imported Existing\Existing Walk	EX. WALK
Imported Existing\Existing Water Edge	EX. WATER EDGE
Imported Existing\Existing Wetland Limit	WETLAND LIMIT

1.2.2.4 Existing Right of Way

These **Feature Definitions** are used to trace over existing ROW lines you would like to tie in to and/or see annotated on Cross Section Sheets.

Used in the design file: ***HW_CB_1234_1234_CrossingFeatures_Existing.dgn***

Feature Definition	**XSC Crossing Point Annotation**
Right of Way\Existing\Directional	N/A
Right of Way\Existing\Easement Line	EX. EASEMENT
Right of Way\Existing\Interior Non-Access Highway Line	EX. HIGHWAY LINE
Right of Way\Existing\Lease Line	N/A
Right of Way\Existing\Location Survey Highway Line	EX. HIGHWAY LINE
Right of Way\Existing\Lot Line	N/A
Right of Way\Existing\Non-Access Highway Line	EX. HIGHWAY LINE
Right of Way\Existing\Property Line	N/A
Right of Way\Existing\Railroad	N/A
Right of Way\Existing\Release Line	N/A
Right of Way\Existing\State Line	N/A
Right of Way\Existing\Street Line	EX. STREET LINE
Right of Way\Existing\Town Line	N/A
Right of Way\Existing\Unlimited Access Highway Line	EX. HIGHWAY LINE

1.2.2.5 Proposed Right of Way

These **Feature Definitions** are used to place ROW lines you would like to tie in to and/or see annotated on Cross Section Sheets.

Used in the design file: ***HW_CB_1234_1234_ROW_Proposed.dgn***

Feature Definition	**XSC Crossing Point Annotation**
Right of Way\Proposed\Acquisition Line	ACQUISITION LINE
Right of Way\Proposed\Defined Easement Line	EASEMENT LINE
Right of Way\Proposed\DROW Line	N/A
Right of Way\Proposed\Lease Line	N/A
Right of Way\Proposed \Minimum ROW Line	N/A
Right of Way\Proposed\Release Line	N/A
Right of Way\Proposed\Slope Easement	N/A
Right of Way\Proposed\Temporary Work Area Line	N/A

1.2.2.6 Watercourses

These **Feature Definitions** are used to place water lines you would like to see annotated on Cross Section Sheets.

Used in the design file: ***HW_CB_1234_1234_CrossingFeatures_Existing.dgn***

Feature Definition	**XSC Crossing Point Annotation**
Watercourses\100 Yr Flood	100 YR FLOOD PLAIN
Watercourses\500 Yr Flood	500 YR FLOOD PLAIN
Watercourses\High Tide Line	HTL
Watercourses\High Water Line	MHW
Watercourses\Low Water Line	MLW
Watercourses\Ordinary High Water Line	OHW
Watercourses\SCEL	S.C.E.L.
Watercourses\Wetland (Approx)	WETLAND LIMIT

1.2.1 Linear Feature Definitions - Roadway 2D Pay Items

These **Feature Definitions** are used to Place Pay Items in the 2D Master DGN file to assist in quantity calculations and call outs.

Used in the design file: ***HW_CB_1234_1234_Master_2D_Design.dgn***

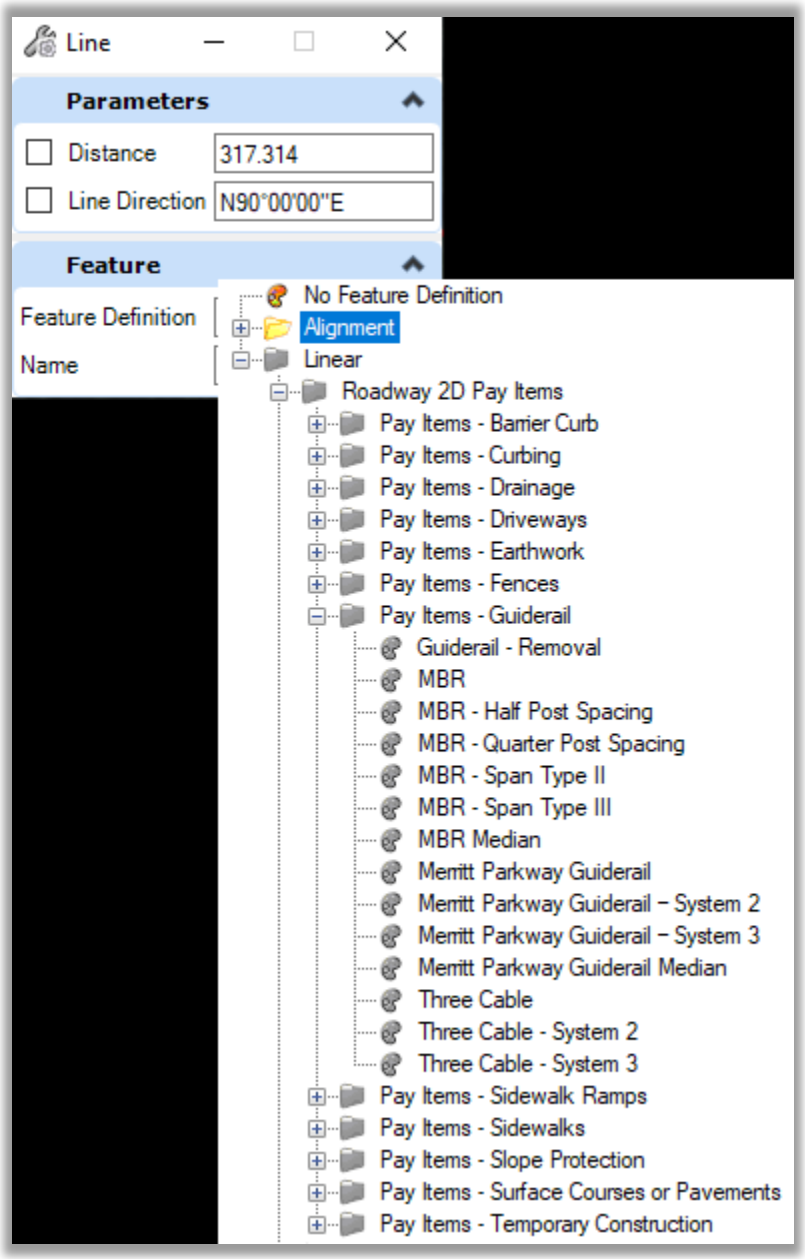


Figure 8 – Guiderail Pay Items

1.2.2 Other Linear Feature Definitions

These **Feature Definitions** in the remaining folders are for use in other tools available in the application of by other units:

- Roadway Modeling – used to build Roadway, Liners and Surface Template breakline features.
- Survey Boundary
- Survey Planimetrics
- Survey Rules Boundary
- Subsurface Utilities
- Site Design

1.3 Reference Files

1. Open the Reference dialog box, notice the following files are attached using no nesting:
   - SV_D1_047_0122_ORD.dgn
   - 4710503.grn
   - 4710504.grn
   - 4710505.grn
2. Review the files.

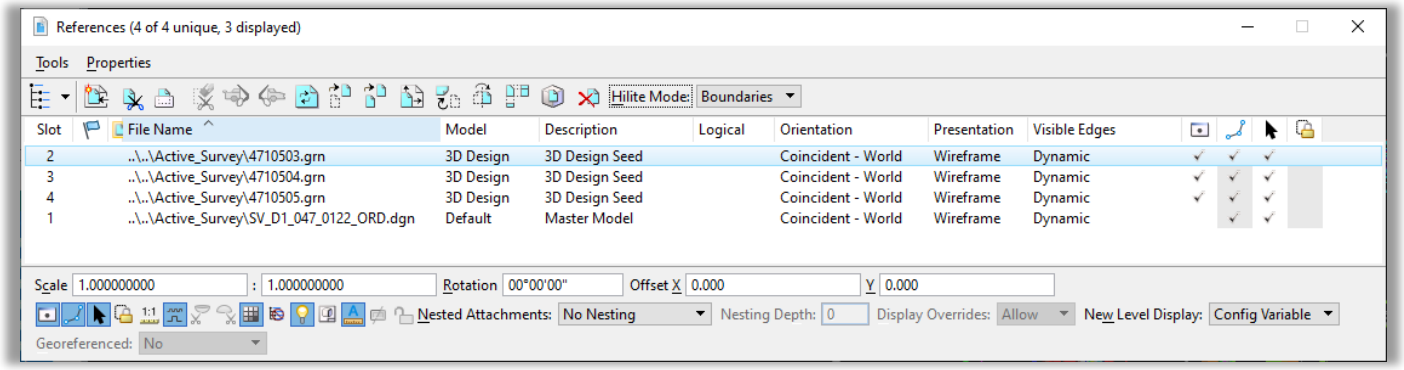


Figure 9 - References

Exercise 2 – Horizontal Alignment Segments

This workflow covers the process of creating featured horizontal alignment segments using OpenRoads Designer. The alignment segments will be created using the draft lines provided in the dataset. In this exercise we will construct featurized tangents and arcs to be used to create a Complex Centerline in Exercise 3.

2.1 MicroStation Construction Lines

This DGN file contains MicroStation draft lines of the PI Points, Tangents and Curves for the alignment. These elements were created using Construction type Element Templates. This ensures that construction lines will not be plotted if the design is printed. Below are the steps one can take to draw draft lines for project needs, for proposes of this class these elements have already been created.

1. Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_2_Alignments.dgn***
2. Go to the **CTDOT** workflow, in the **Attributes group**, right click and enable **Element Class** to be displayed on the menu.

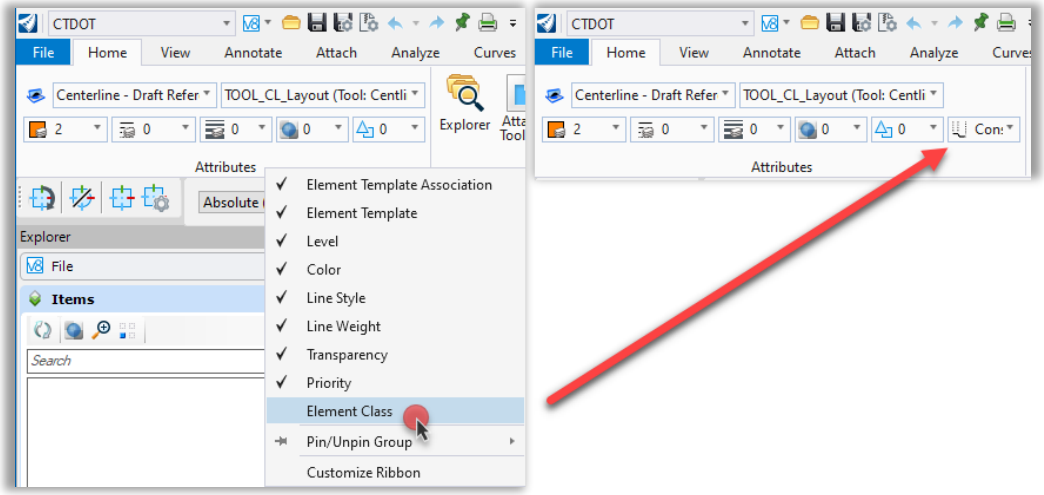


Figure 10 – Show Element Class

3. Navigate to the element Template **Roadway Alignments > Center > Centerline – Draft Reference Lines.** This will trigger the active level and Element Class to update.

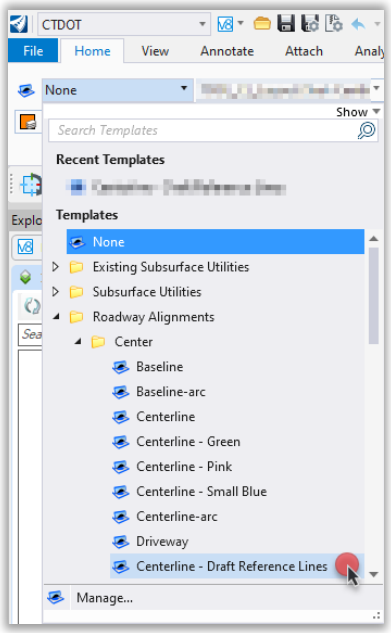


Figure 11 – Set Element Template

Notice the change of the class from Primary to **Construction** and the Level is set to **Tool_CL_Layout**.

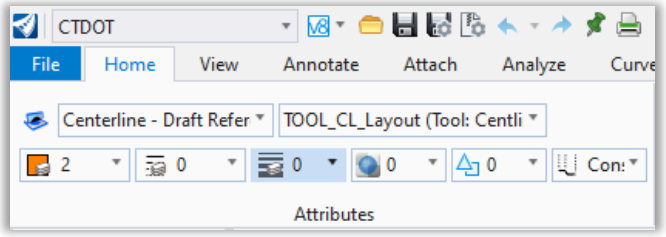


Figure 12 – Set to Construction Class

4. The circles were created using the **Place Circle** tool (CTDOT > Home > Placement > Place Circle pull down) with the following parameters:
   Method: ***Center***
   Area: ***Solid***
   Fill Type: ***None***
   Toggle on: **Diameter** and set to ***5***
   Follow the Prompts to place the circles.

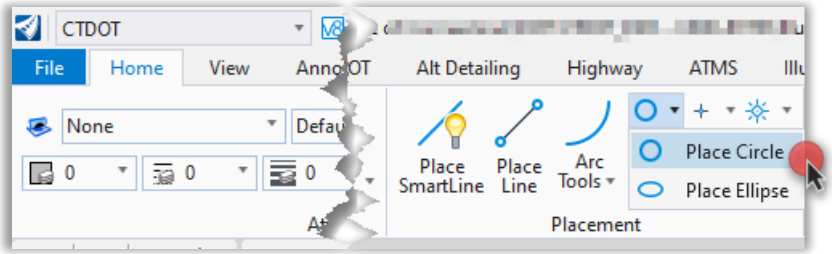


Figure 13 – Place Circle Tool

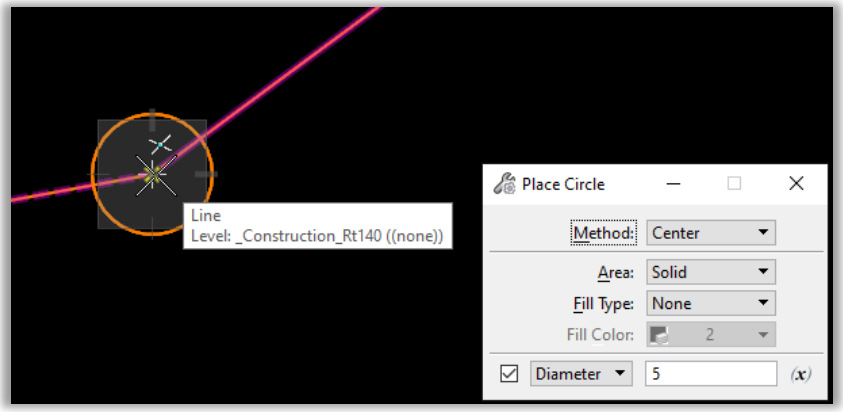


Figure 14 – Place Circle dialog box

3. Place MicroStation Arcs Between MicroStation Tangents. Begin laying arcs between the tangents using the **Place Arc** tool (CTDOT > Home > Placement > Place Arc Tools pull down) with the ***Start, End, and Mid*** method.
    - Activate the **Tangent Snap** by double-clicking it.
    - Click on the tangent behind the arc and then the tangent ahead of the arc.
    - Select **CW (clockwise)** or **CCW (counterclockwise)** based on the curve's direction.
    - Aim for whole-number radii for consistency. In this case, use the predefined radii.

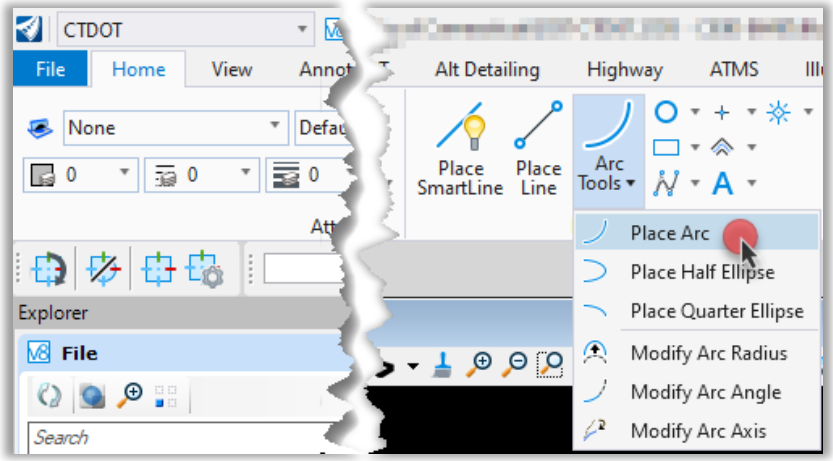


Figure 15 – Place Arc tool

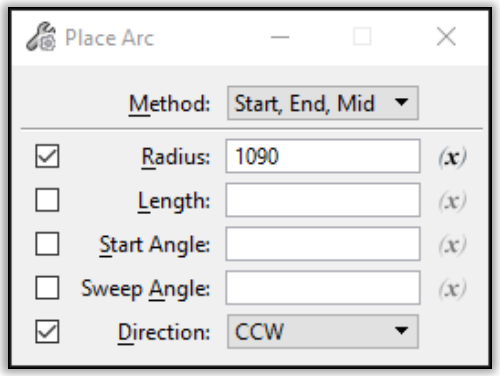


Figure 16 – Place Arc dialog box

Curve Number	Radius (ft)	Length (ft)
Curve 1	1090	-
Curve 2	750	-
Curve 3 (PCC-1)	1151	342.500
Curve 3 (PCC-2)	1055	516.493
Curve 4	510	-
Curve 5	510	-
Curve 6	1000	-
Curve 7	2500	-

2.2 Existing Terrain Setup and Activation

1. Select the Existing Ground and ensure it is set as **Active**.
2. The terrain can be set active or cleared by hovering over the boundary and from the pop-up menu selecting the **Set Terrain Active** or **Clear Active**. If the Terrain is not active, please set it active at this time.

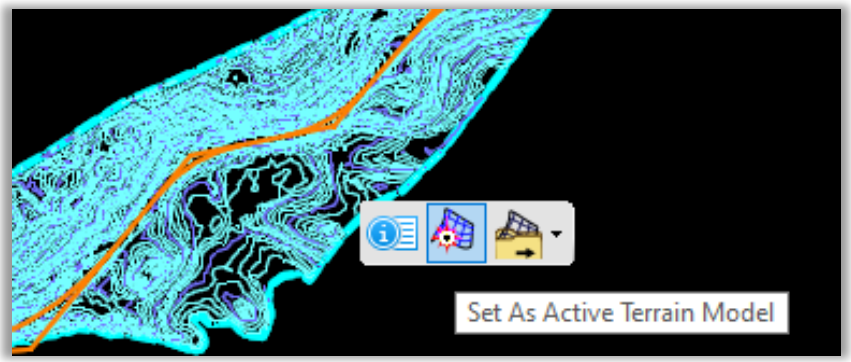


Figure 17 – Set As Active Terrain Model

3. Click on the terrain boundary and select the **"I" Information** tool. In the popup dialog set the **override symbology** to ***Yes***. Then to help with the horizontal alignment creation, you can turn on or off the ***Contours*** or ***Triangles*** as needed.

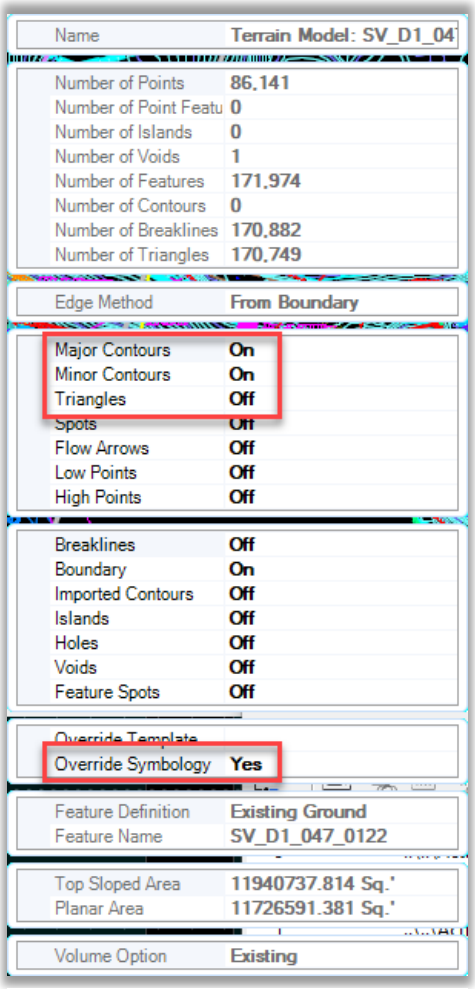


Figure 18 - Override Symbology

2.3 Feature Definitions Toolbar

Feature Definitions are included in the CTDOT workspace. They are used to control symbology, and various other properties that are applied to the geometric elements.

The feature definitions are used to:

- Define what the geometric elements actually are. What is being modeled such as curb, centerline, edge of pavement, etcetera.
- Control symbology in various views, including capability to define differing symbology in plan, profile, and 3D spaces
- Define terrain modeling attributes (spot, break line, void, etcetera)
- Define surface display characteristics annotation

The Feature Definition Toolbar is a way to easily activate and deactivate the Feature Definition settings. Using the Feature Definition Toolbar is not a requirement, but most users will find it helpful. It is important to choose the correct Feature Definition when placing elements in the design because that Feature Definition will control the properties not only of that element during that step but also how it looks and interacts with other design elements in later steps during the design process.

For this section it is only important that the user has gained some basic familiarity with the toolbar, the names of the icons and a general sense of how each tool will work. Through use and practice the user will quickly understand the best practice for using each of the tools.

1. If your Feature Definition toolbar is not opened, select the **OpenRoads Modeling** workflow, on the **Geometry** tab in the **General tools** section open the ***Feature Definition Tool Bar***. After it opens dock the toolbar just below the ribbon.

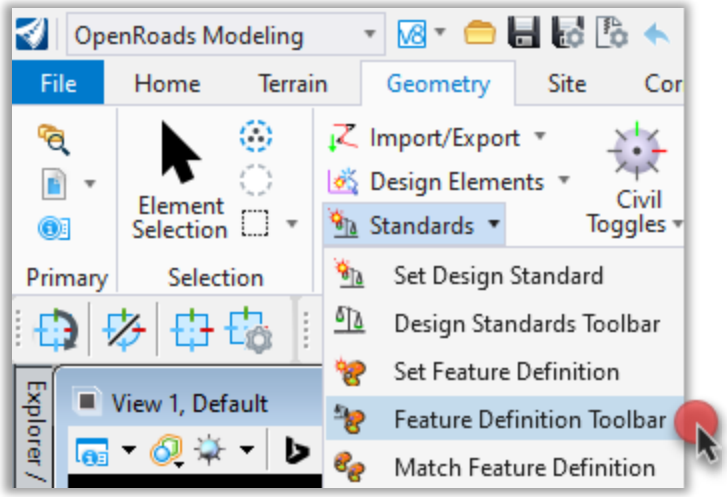


Figure 19 – Open Feature Definition Tool Bar

2. From the **Feature Definition** Toolbar:
    - select the active **Feature Definition**, ***Alignment > Center > Segment – Line***
    - Toggle on the first icon to automatically assign the selected feature as the active feature as you use various OpenRoads Geometry commands: **Use Active Feature Definition**
    - Deactivate the **Chain Command**, (If Chain is Activated when placing geometry lines then the curser snaps to the last data point but the end and beginning of the line will not be ruled to each other. It is better practice to manually snap as needed.

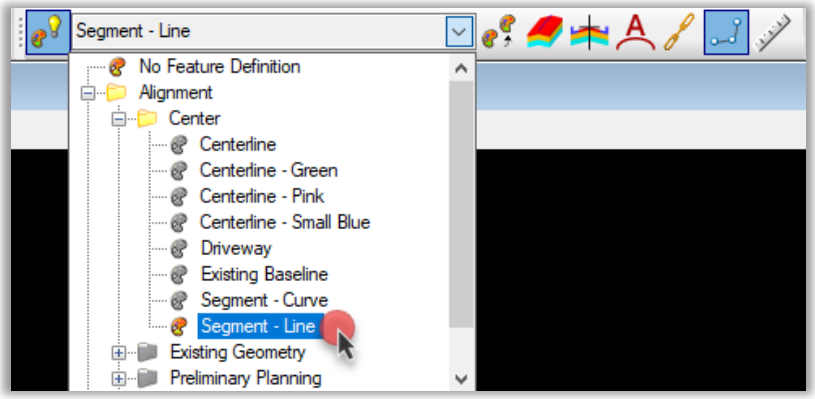


Figure 20 – Set Feature Definition

What does **Use Active Feature Definition** do? 

Selecting the Override Feature Definition icon will force the active tool to use the Feature Definition shown in the Feature Definition Toggle Bar. The user will not have to select the feature definition when placing the element

In this example, the **Line Between Points** command is selected. The **Feature Definition** is defined by the active feature (ON) selected in the **Feature Definition Toggle Bar**. Notice the Feature Definitions selection is locked out

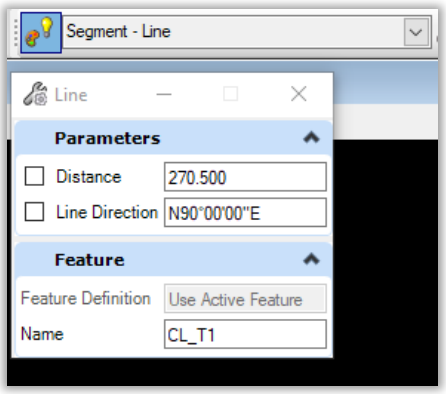


Figure 21 – Enter Feature Name

In this example, the **Line Between Points** command is selected. The **Feature Definition** is not defined by the active feature (OFF) selected in the **Feature Definition Toggle Bar**. Notice the Feature Definition must be manually selected.

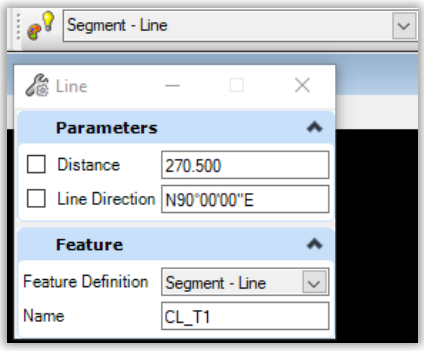


Figure 22 - Enter Feature Name

What do the tools on the right of the Feature Definition selection do?

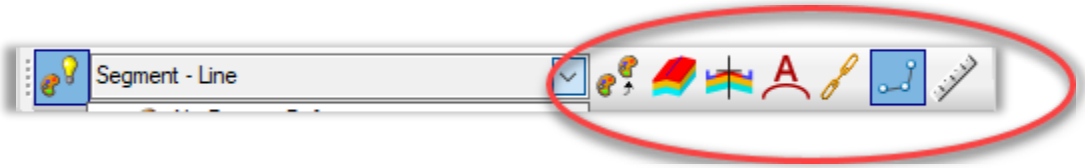


Figure 23 – other Active Feature Definition tools

Match Feature

- Use the Match Feature Definition tool to populate the combo box with the feature definition assigned to the selected element.
- This tool will allow the user to match the Feature Definition of an element in the dgn file and if the Override Feature Definition tool is selected then the Feature Definition will be applied to the current element being placed.

Create 3D Automatically

- The Create 3D Automatically tool will generate 3D model elements for the created elements. This tool will be covered in more detail in the Modeling sections and is not used for creating Horizontal Alignments.

Feature Definition Template

- The Feature Definition Template tool will apply a roadway template to the created element automatically. This tool will be covered in more detail in the Modeling sections and is not used for creating Horizontal Alignments.

Chain Tools

- If Tool Chaining is toggled on, then many tools can automatically determine base elements to use during calculations. For example, Arc Between Elements will choose the two most recent elements and set them for base elements to construct its fillet
- If you use chain and move a point it will only move one line and not both.

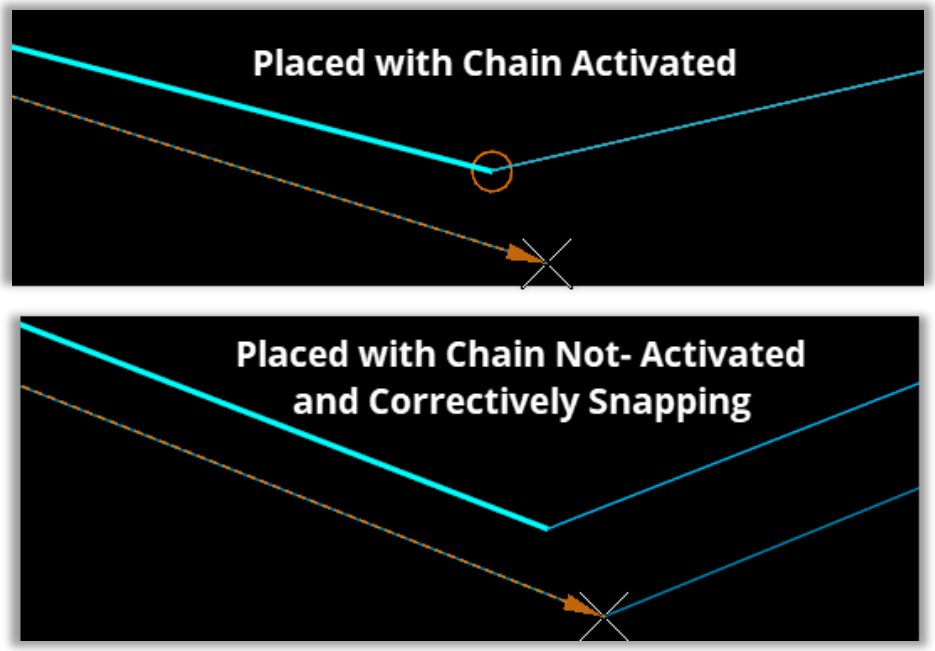


Figure 24 – Snapping Options

Persist Snap

- If Persist Snap toggled on, persists the snap into the geometry (default is snap on).
- A persisted snap is a geometric rule that can be stored with the elements. For example when placing a line between two points if the user snaps to the mid point of an arc as the starting point a rule is created. If the length of the arc changes, and the midpoint shifts, then the beginning of the line will shift to remain at the mid point of the arc. This is because the Midpoint Snap has be Persisted.

Rule Deactivation

- If Rule Deactivation is toggled on, then tools create elements with rules disabled. Snaps are not the only type of rules that are created when placing civil elements. Civil rules include any geometric constraint that could define the position of the element. Offset from another element, taper rate based on another element, length, bearing, radius, skew angle, etc

2.4 Horizonal Alignment Segments

In the following exercises you will learn how to use the various line tools to create ruled elements. The purpose of the exercise to become familiar with the tool and how to use it. ORD offers the user a significant amount of flexibility when placing ruled geometry.

1. Go to the **OpenRoads Modeling** workflow, in the **Attributes Group**, right click and enable **Element Class** to be displayed on the menu. Change the Element Class to **Primary**.
2. We will now place line segments. Ensure the correct Feature Definition is active. Drop down on the **Feature Definition Toolbar** select ***Alignment > Center > Segment-Line*****.** Set the feature definition **ACTIVE**.

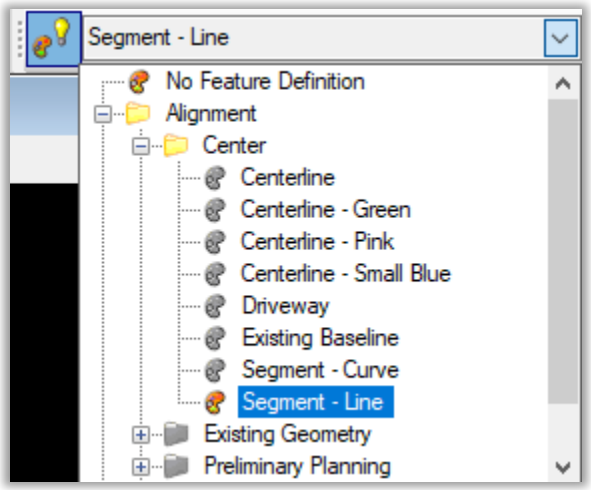


Figure 25 - Set Feature Definition

3. Let's now explore the Horizontal section and become familiar with the available tools.

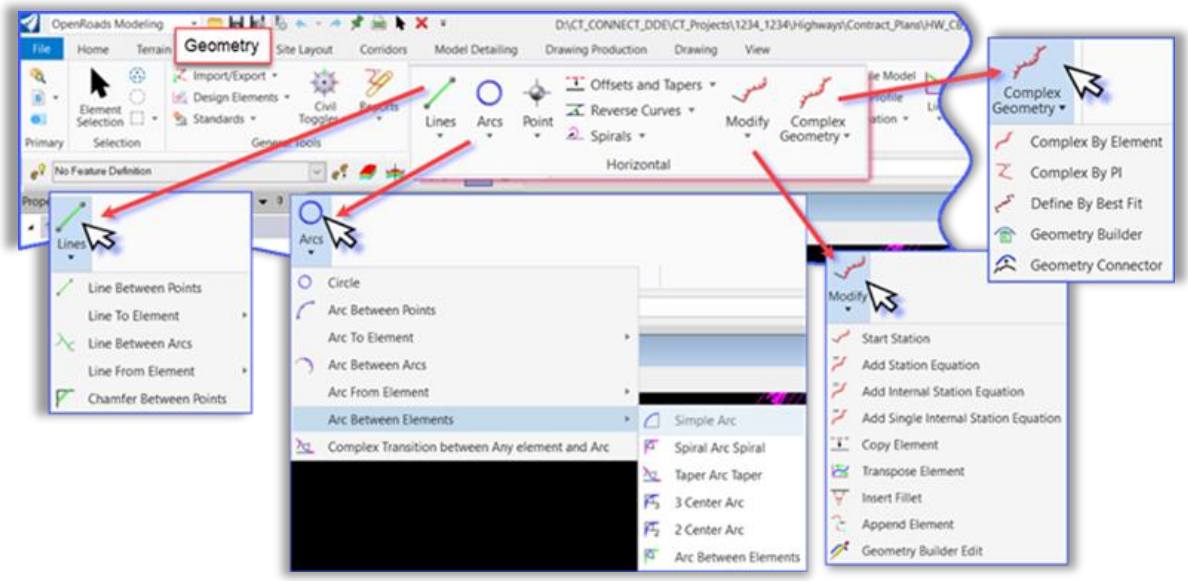


Figure 26 – Geometry Tools

Lines 	Various line placement tool (By Points, To Elements, From Elements, Between Arcs, and Chamfers).
Arcs 	Various arc placement tools (By Points, To Elements, From Elements, Between Arc, 2 Center and 3 Center and Complex Transitions).
Modify 	Stationing, Station Equations, working with Civil rules and copying civil elements.
Complex Geometry 	Creating and redefining Complex alignments, Best Fit, Offset tool (copy parallel) reverse curves, and Create Geometry by Template.

4. There are also tools in the Common Tools group that are helpful.

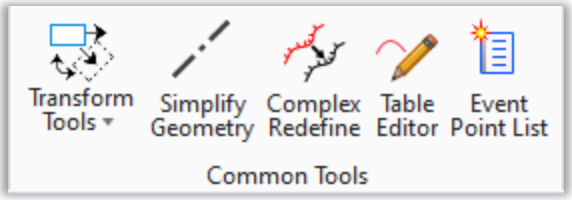


Figure 27 – Other Common Geometry tools

Transform Tools	Allows you to translate, rotate and scale an element.
Simplify Geometry	Allows you removal of intervals and external referencing rules for horizontal and vertical geometries.
Complex Redefine	Allows you to redefine an existing complex alignment partially replaced by new geometry.
Table Editor	Allows you to edit table.
Event List	Allows you to create event point list.

2.4.1 Placing Lines

1. We will now move on to creating geometry. Go to **Geometry**, drop down on **Lines > Line Between Points**.

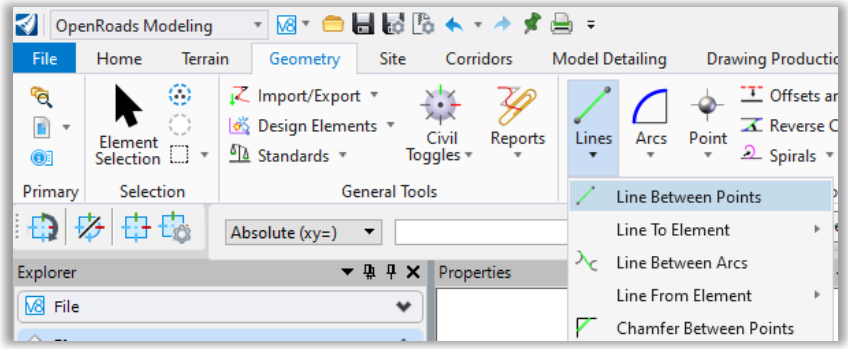


Figure 28 – Line Between Points

2. Use this tool to layout the tangents. Place tangents sequentially, selecting the as follows:

   Line 1:

   Name - ***CL_Route140_T1***

   Note: *To streamline naming, copy the name of the first tangent and paste it for subsequent tangents, updating only the number at the end. There are a total of 8 tangents in this alignment.*

   Point 1 – **Snap to center of first circle**

   Point 2 - **Snap to center of second circle**

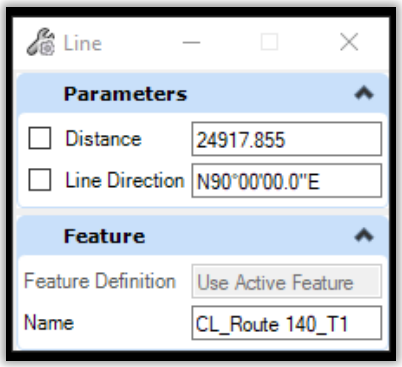


Figure 29 – Enter Feature Name

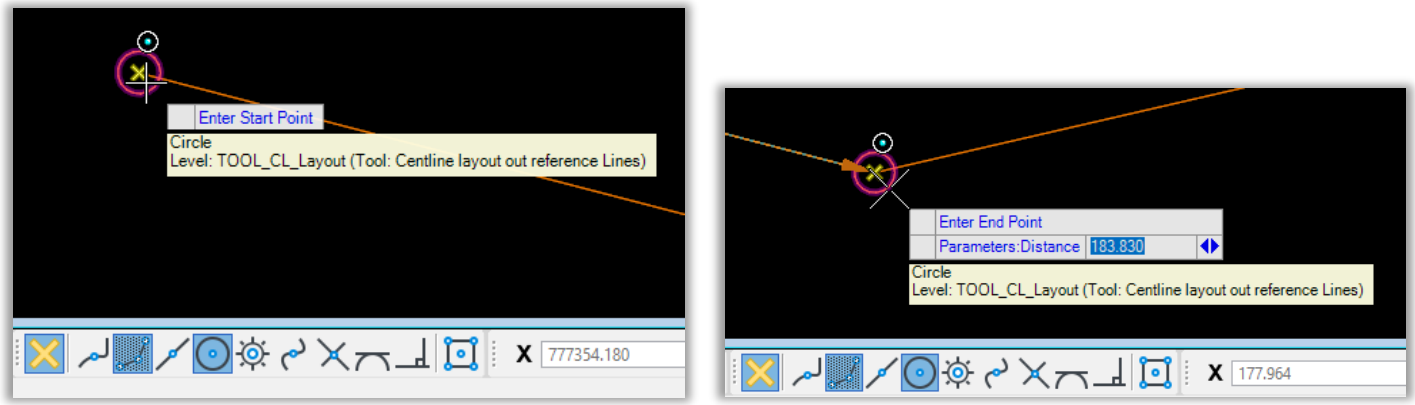


Figure 30 - Place Linear Features

Line 2:

Name - ***CL_Route140_T2***

Point 1 – **Snap end point of the first ORD Line**

Point 2 - **Snap to center of third circle**

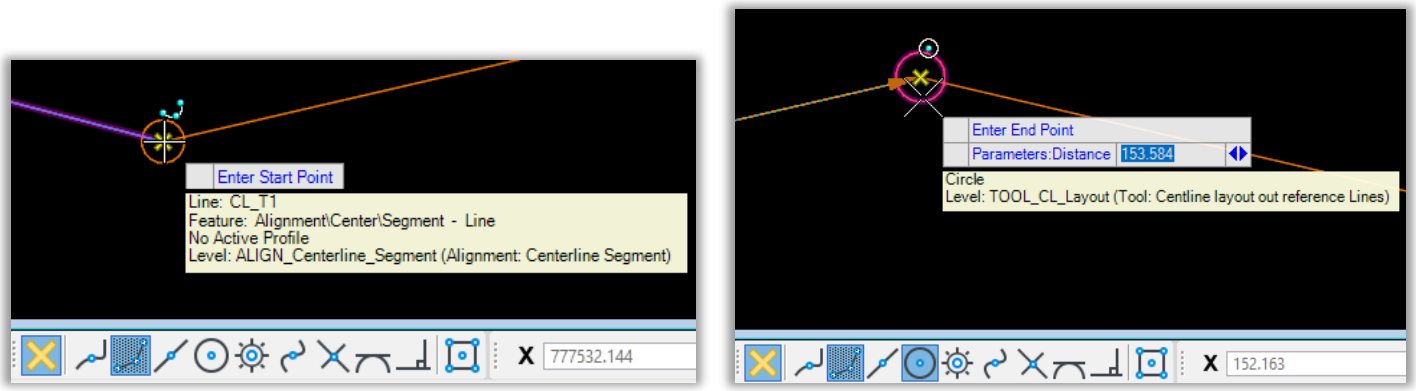


Figure 31 - Place Linear Features

Continue creating lines until the end and snap to the last Circle.

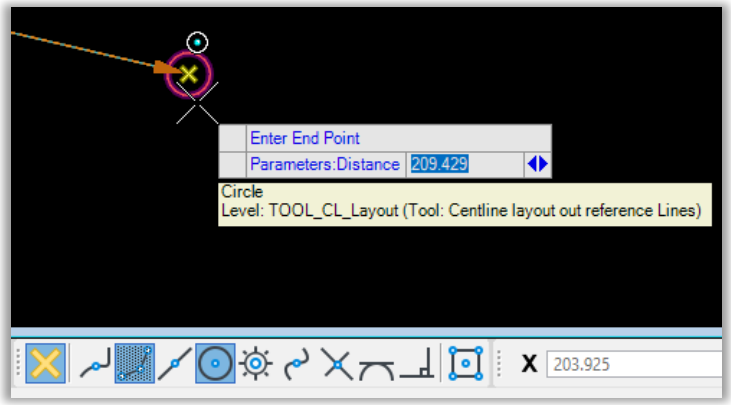


Figure 32 - Place Linear Features

2.4.2 Placing Curves

1. Now place the curves, in the drop down on the **Feature Definition Toolbar** select ***Alignment > Center > Segment-Curve***. Set the feature definition **ACTIVE**.

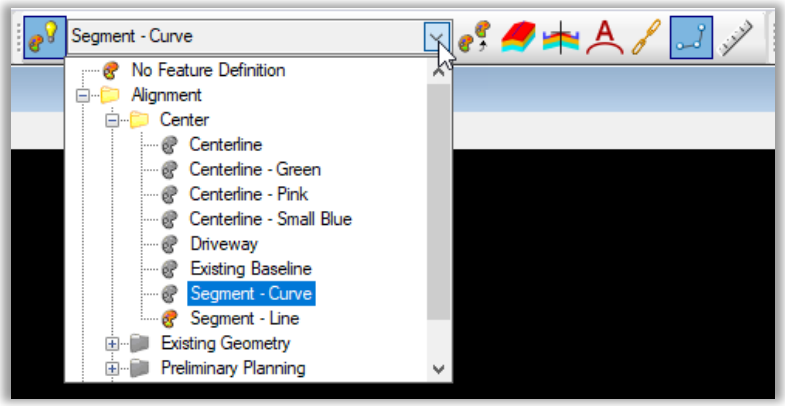


Figure 33 - Set Feature Definition

2. Go to the **Geometry Tab > Horizontal Group**, drop down on **Arcs > Arcs Between Elements > Simple Arc**. Use this tool to layout the curves.

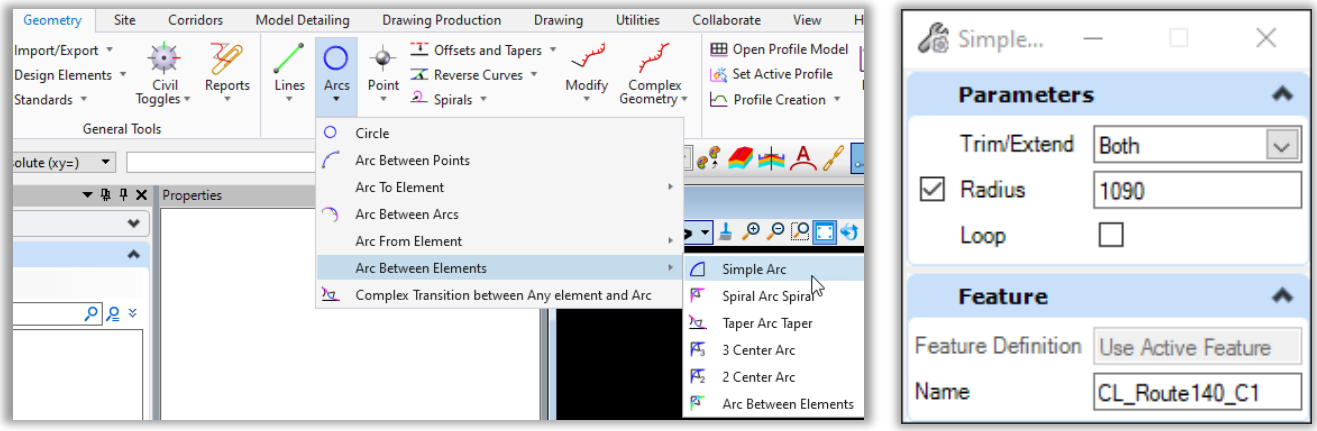


Figure 34 - Simple Arc

Curve Number	Feature Name	Radius (ft)	Length (ft)
Curve 1	CL_Route140_C1	1090	-
Curve 2	CL_Route140_C2	750	-
Curve 3 (PCC-1)	CL_Route140_C3	1151	342.500
Curve 3 (PCC-2)	CL_Route140_C3	1055	516.493
Curve 4	CL_Route140_C4	510	-
Curve 5	CL_Route140_C5	510	-
Curve 6	CL_Route140_C6	1000	-
Curve 7	CL_Route140_C7	2500	-

3. When you get to the Compound Curve. Use the **2 Center Arc** tool. Set the parameters as shown in the image below to have it lay over the orange draft lines. Name this curve CL_Route140_C3.

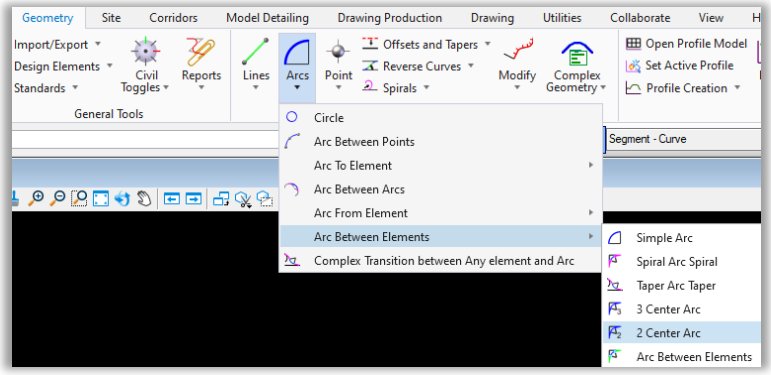


Figure 35 – 3 Center Arc

Enter the top Section:
Trim Extend: **Both** PCC-2: Radius: ***1055***

Enter the Bottom Section:
Type: ***Curve*** Method: ***Length***
Length: ***342.500*** PCC-1: Radius: ***1151***

Name: ***CL_Route140_C3***

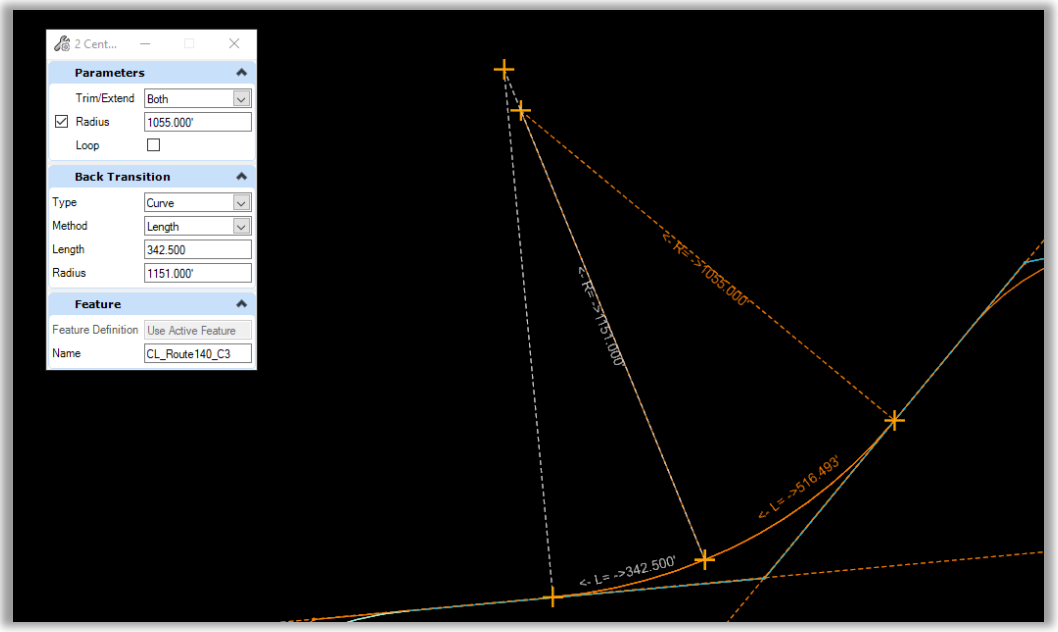


Figure 36 – Compound Curve

4. Review the element names by using the **Select Element** tool and floating the cursor over the element as shown below (you do not need to select the element).

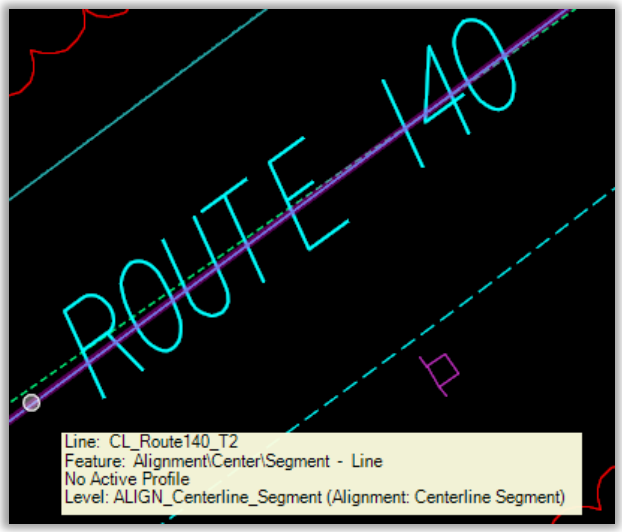
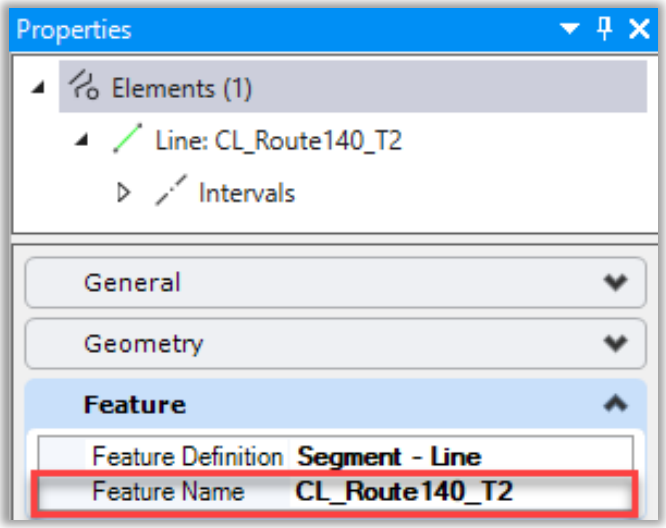


Figure 37 – Hover over element

The **Feature Definition** and **Feature Name** for a selected element can be edited in the Properties dialog as shown below.



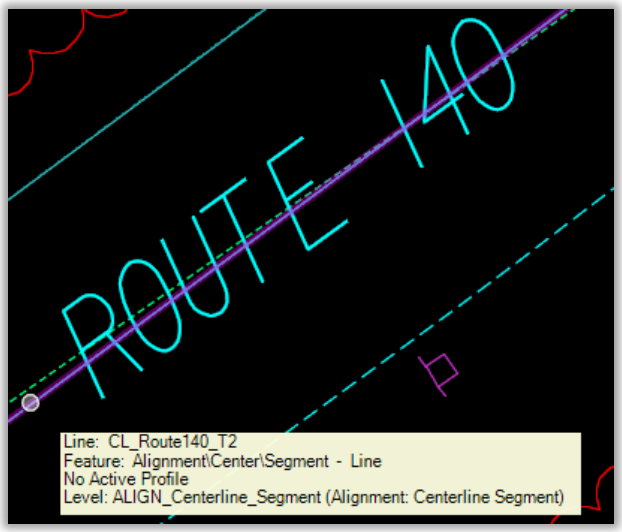


Figure 38 – Edit feature in Properties dialog

Exercise 3 – Horizontal Alignment Centerlines

This workflow covers the process of creating a featured horizontal centerline alignment using OpenRoads Designer. This will be complexed alignment segment created using the featurized tangents and arcs created in Exercise 1.

3.1 Create a Horizontal Alignment from Geometry Segments

1. Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_3_Alignments.dgn***
2. Go to level manager and turn off all levels except **TOOL_CL_Layout (Tool: Centerline layout out reference Lines)**, turn display off for all references, and delete the draft lines **if you want.**
3. Now turn all the Levels and Reference Displays back on.
4. On the **Feature Definitions Toolbar** set the Feature Definition to **Alignment > *Center* > *Centerline***.
5. Individual civil geometry elements are connected together as a single entity using the Complex By Element command. Select **Geometry Tab > Horizontal Group > Complex Geometry dropdown > Complex By Element** to access the command.
6. Use the **Complex by Element Tool** to connect all tangents and arcs into a single alignment. Name the final alignment **CL_Route140**. This tool is very similar to the create complex chain dialog form MicroStation. There is a manual and an automatic option with a maximum gap.
7. Manually click the tangents and arcs from **left to right**, hover over the line, once arrow placement is towards the desired direction (forward arrow), click on the element and so on.

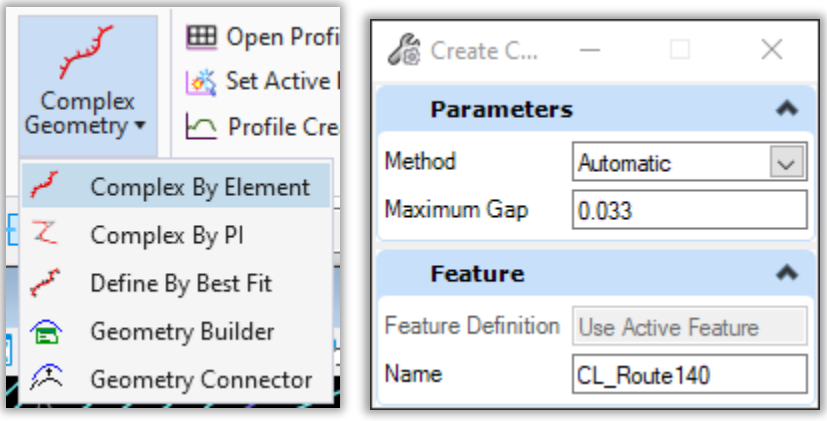


Figure 39 – Complex by Element tool

In the example above, the **Feature Definition** is set to **Use Active Feature** as defined in the ***Feature Definition Toggle Bar***.

When the **Method** is set to **Automatic**, the software will automatically select elements to make up the complex geometry by searching for elements with endpoints that connect within the **Maximum Gap** value. If a fork is found, where two elements are found within the **Maximum Gap** tolerance, the user is prompted to identify which path to accept to compete the operation.

Be sure to enter a **Name** for the geometry.

When locating the starting element an arrow is displayed defining the direction to store the element. Complex elements can be stored in the opposite direction than they were originally defined by selecting the other end of the graphics.

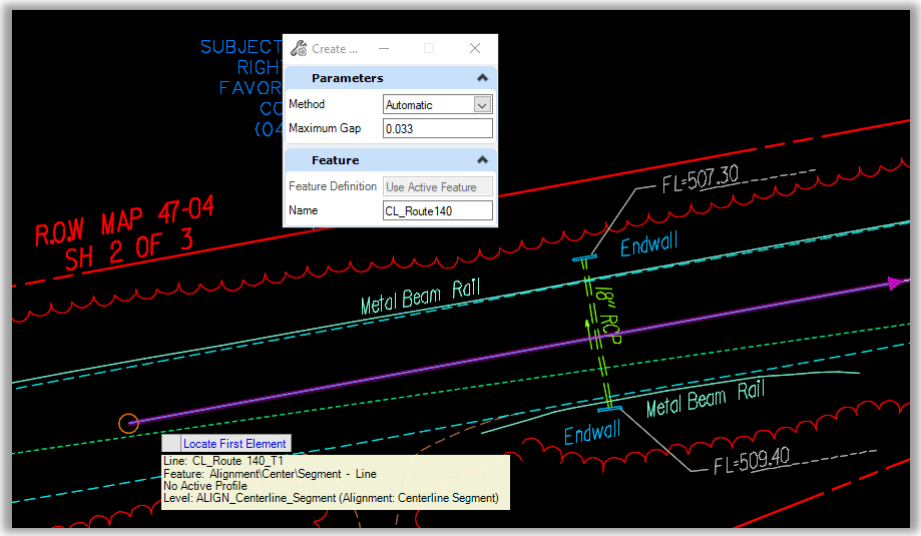


Figure 40 – Alignment direction arrow

Note: *There are other Centerline feature definitions available for complex designs needing to be differentiated by color.*

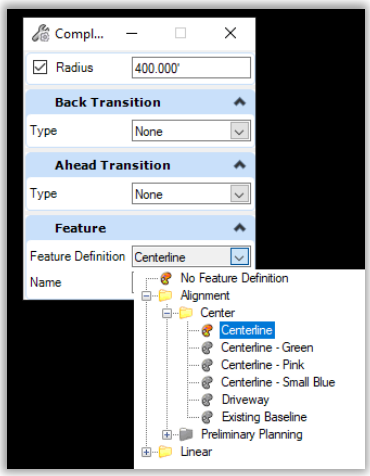


Figure 41 – Center Line Features

3.2 Define Start Station for Horizontal Alignment

When an OpenRoads alignment is stored, the software assumes a beginning station value of 0+00. The station can be redefined by use of the Start Station command. The **Start Station** assigns stationing to an element. A station value and a position along the element for that station value are assigned. If no station value is assigned, then the beginning station is assumed to be zero (0+00.00).

The command has two parameters:

- **Start Distance** The distance along the alignment to assign the Start Station. The beginning station is computed based on the Start Distance and the Start Station value.
- **Start Station** The station value to be assigned at the Start Distance location.

1. In the **Horizontal toolbar** click on the **Modify** tools – select the **Start Station** tool.
2. Follow the prompts: ***Locate Element,*** select the beginning of the alignment. ***Start Station Position***, enter 0.00 as Start Distance. ***Enter Starting Station***, enter Start Station 100+00.00 and click within the view.
3. Click on the alignment, it will now display the start station and the offset. **Make sure the entire alignment is highlighted, not just a segment of the alignment.**

   NOTE: *Any changes to the alignment will also update the Stationing.*

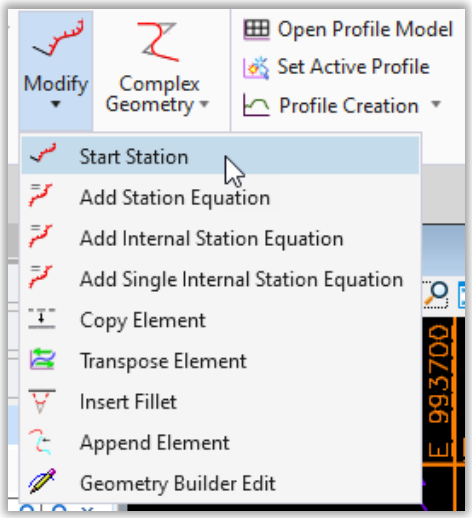


Figure 42 – Start Station tool

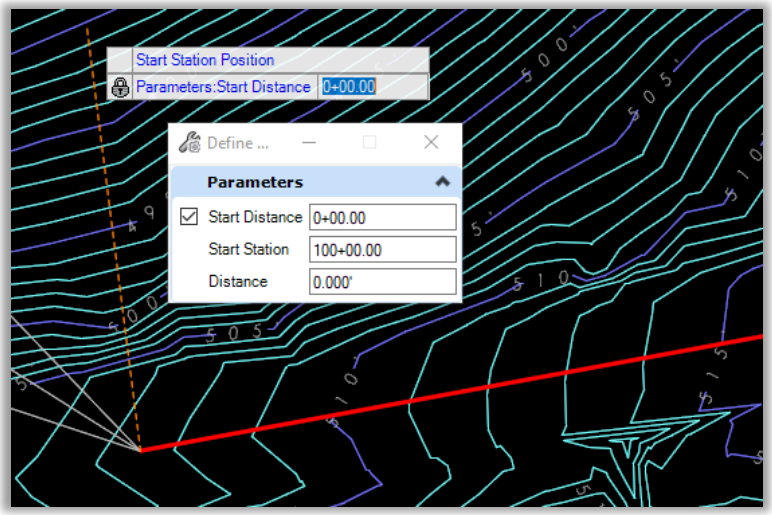


Figure 43 – Start station applied

3.3 Station Equations

The station parameters can be edited by selecting the rule in the design file, or from the Properties dialog. **Add Station Equation –** The Add Station Equation command, located below the Start Station command, adds parameters for the Ahead Station and Back Station. When the command is selected, the user is prompted to select the alignment to assign the station equation.

After the alignment has been selected, the location of the equation can be identified graphically, or by keying in the **Back Station** value.

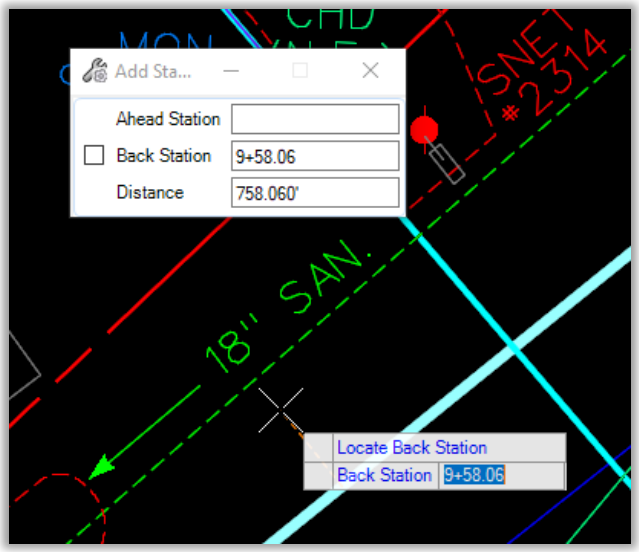


Figure 44 – Start Equation tool

The ahead station is stored as a "region" much like the legacy GEOPAK format. When the **Ahead Station** value is entered, it is not necessary to define the region number.

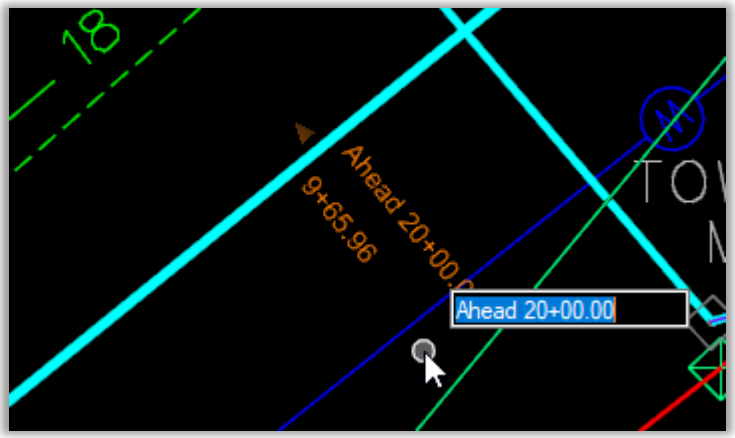


Figure 45 – Start Station applied to alignment

The station equation value can be reviewed and edited by selecting the element as shown below. The parameters can also be edited in the **Properties** dialog.

Exercise 4 – Horizontal Alignment Annotation

When geometric alignments are placed in the file, the annotation is not automatically generated by the software. The user must identify the alignments that are to be annotated either individually, by selecting the specific alignments, or by annotating all of the alignments contained in the active model, or all models in the active file.

Annotation commands are selected from the **OpenRoads Modeling** WorkFlow in the **Drawing Production** tab, as shown below.

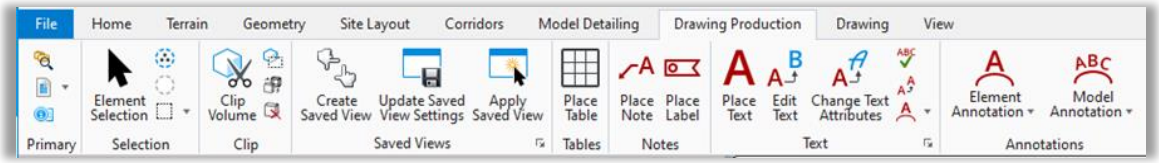


Figure 46 – Drawing Production tab

The **Annotate Element** command is used to annotate one of more selected elements. The command prompts to select the OpenRoads element to be annotated. Multiple elements can be selected. Reset (right-click) to complete the selection process and initiate the annotation placement. An example of annotation at the beginning of an alignment is shown below.

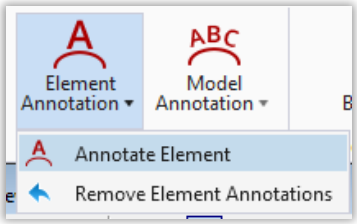


Figure 47 – Tool Dialog

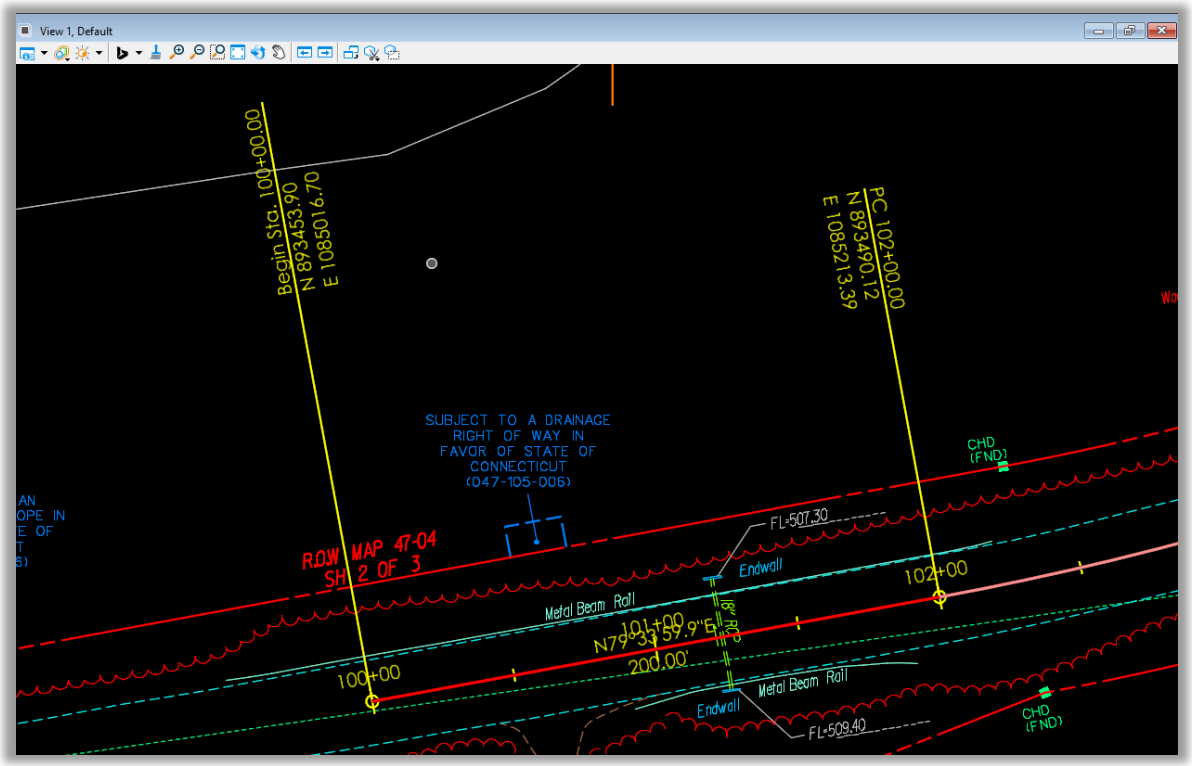


Figure 48 – Alignment with station annotation

The **Remove Element Annotations** command is used to remove the annotation from selected elements. When prompted, select the elements to remove the annotation. Reset (right-click) to end the selection process and initiate the removal process.

The **Model Annotation** command us used to annotate all of the elements in the active model, or all models, by selecting a specific Annotation Group. Two options are available as shown below.

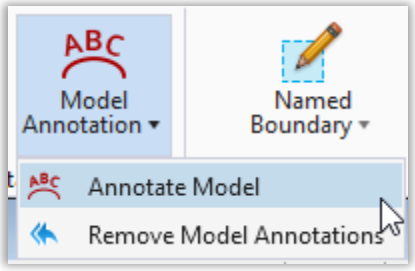


Figure 49 – Annotate Model and Remove Model Annotations options

ANNOTATE MODEL – Select this command to annotate all the elements in a model, or in all models, by selecting a specific Annotation Group. When the command is selected, the user is prompted as shown below. Issue a data point (left mouse-click) to initiate the process.

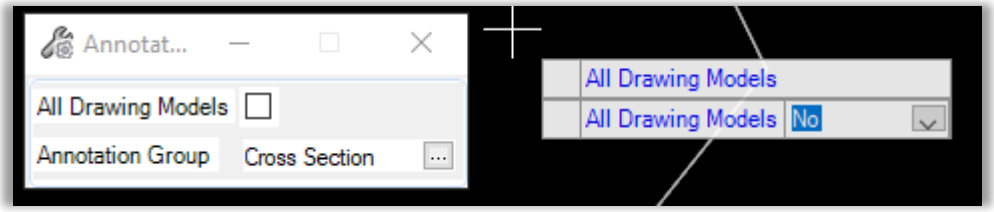


Figure 50 – Annotate Model prompt

REMOVE MODEL ANNOTATIONS – Select this command to remove all annotations from the active model or all models in the active file.

4.1 Annotation Groups

The following Centerlines have annotation set up to display:

Feature Definition	Annotation Group	Description
Alignment\Center	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Green	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Pink	CL_Centerline	Stationing will be every 50ft.
Alignment\Centerline – Small Blue	Small CL_Centerline	stationing will be every 10 ft.
Alignment\Driveway	Driveway Stationing	stationing will be every 10 ft.
Alignment\Existing Baseline	BL_Stationing	Stationing will be every 50ft.
Alignment\Segment – Curve	N\A	None
Alignment\ Segment - Line	N\A	None

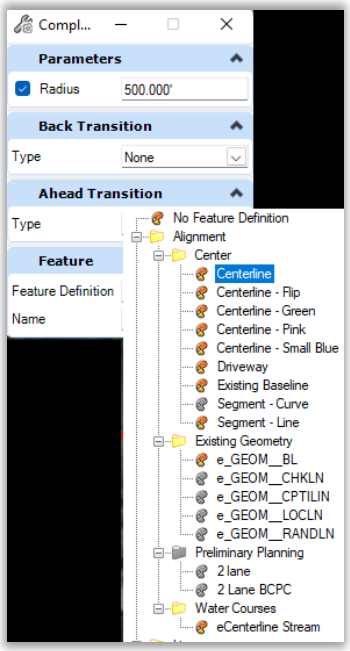


Figure 51 – Centerline Feature Definition

These folders are for use by other Units:

- Alignment\Existing Survey – for the Survey Unit
- Alignment\Water Courses – for Hydraulics and Drainage

The Preliminary Planning Folder has two feature definitions, these are set to Annotate as well as automatically place a Roadway Template down the Center.

Note:

- *Segment – Curve and Segment - Line do not have an annotation Group set up and are not to be annotated.*
- *When annotating alignments the option to override the assigned Annotation Group can be selected. This is useful when an alignment runs opposite on right to left. In this case the* ***CL Stationing Flip*** *Annotation group should be used.*

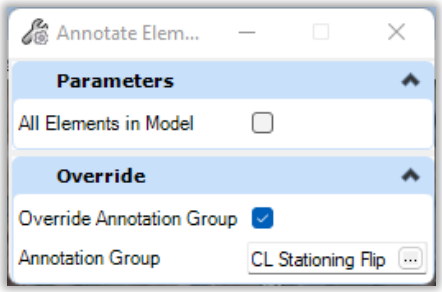


Figure 52 Override Annotation Group

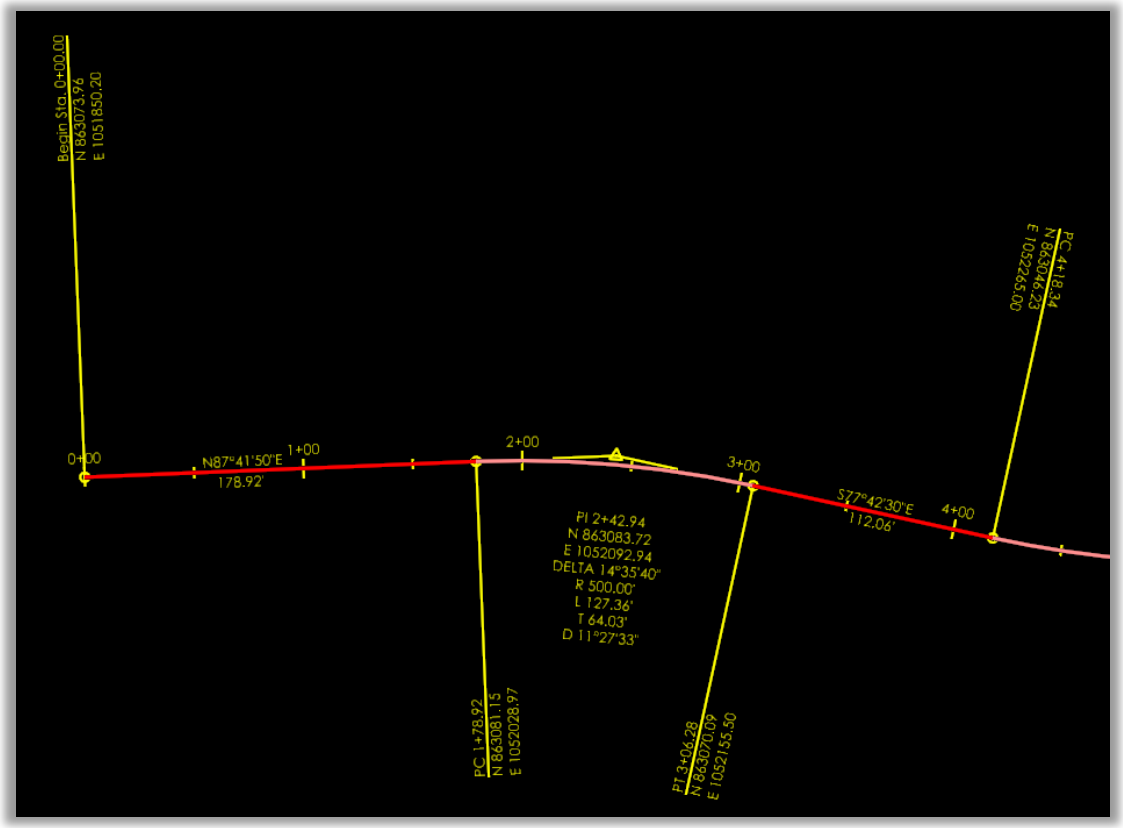


Figure 53 – Centerline Annotation (Left to Right)

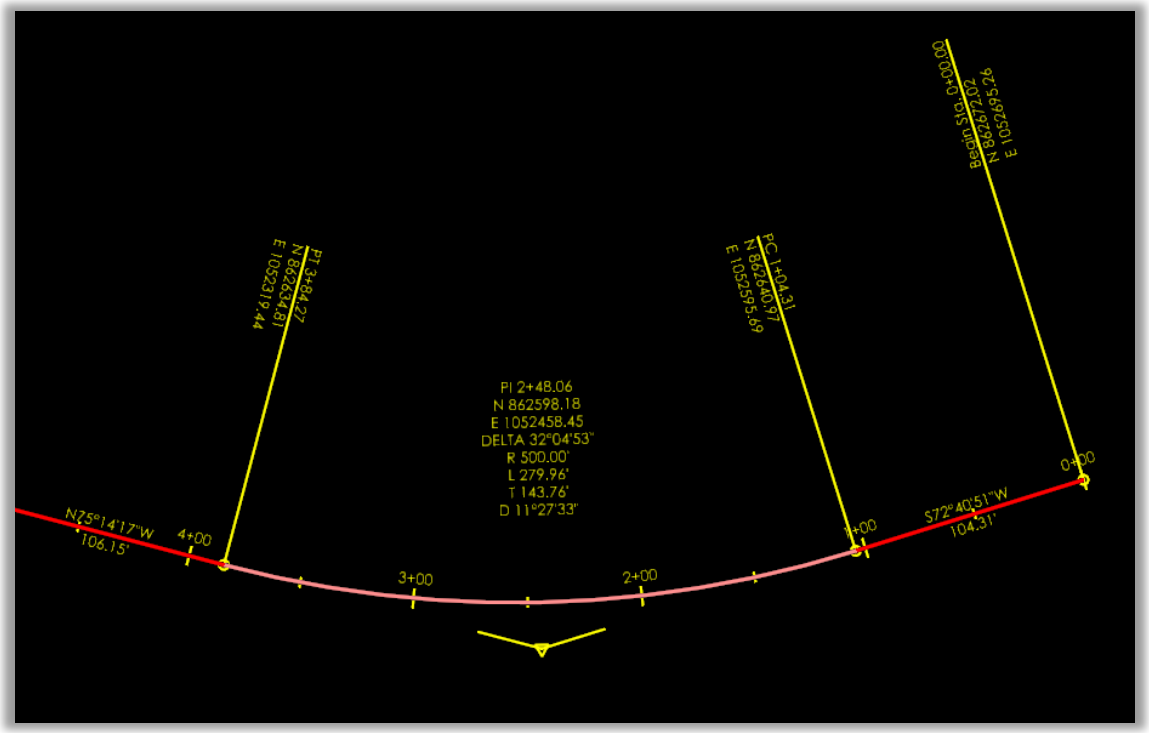


Figure 54 – Centerline – Using the Flip Annotation Group (Right to Left)

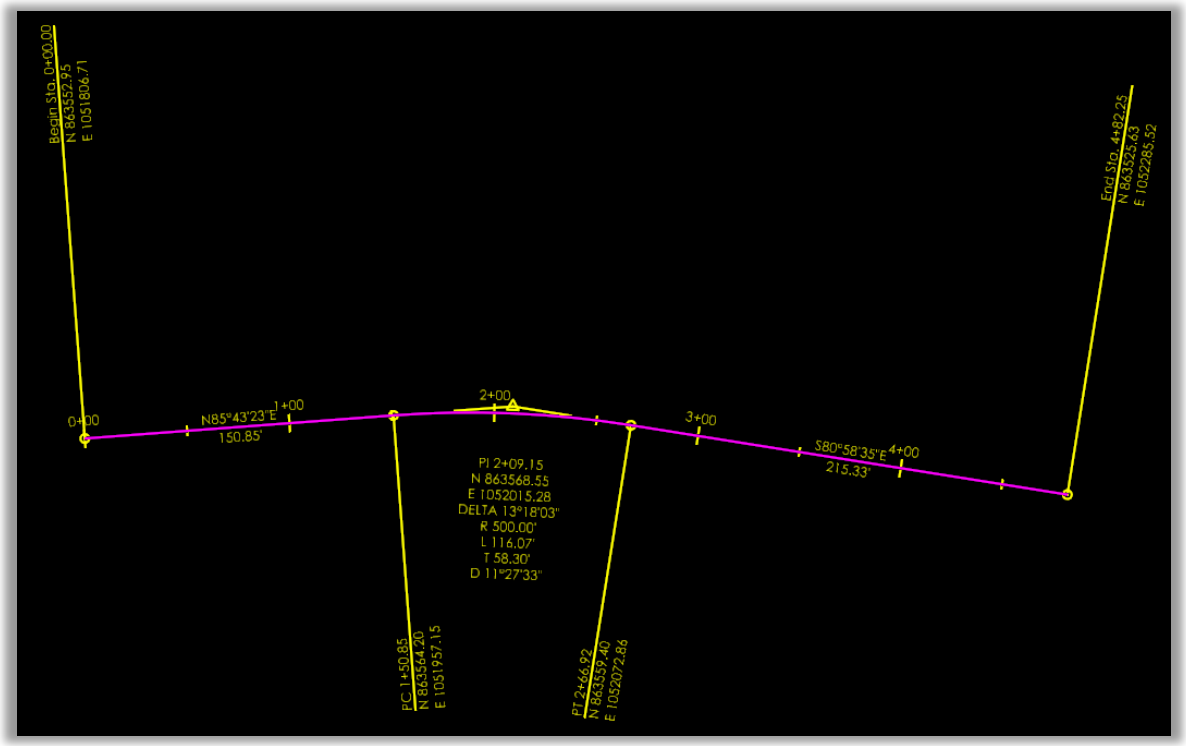


Figure 55 – Centerline – Pink Annotation

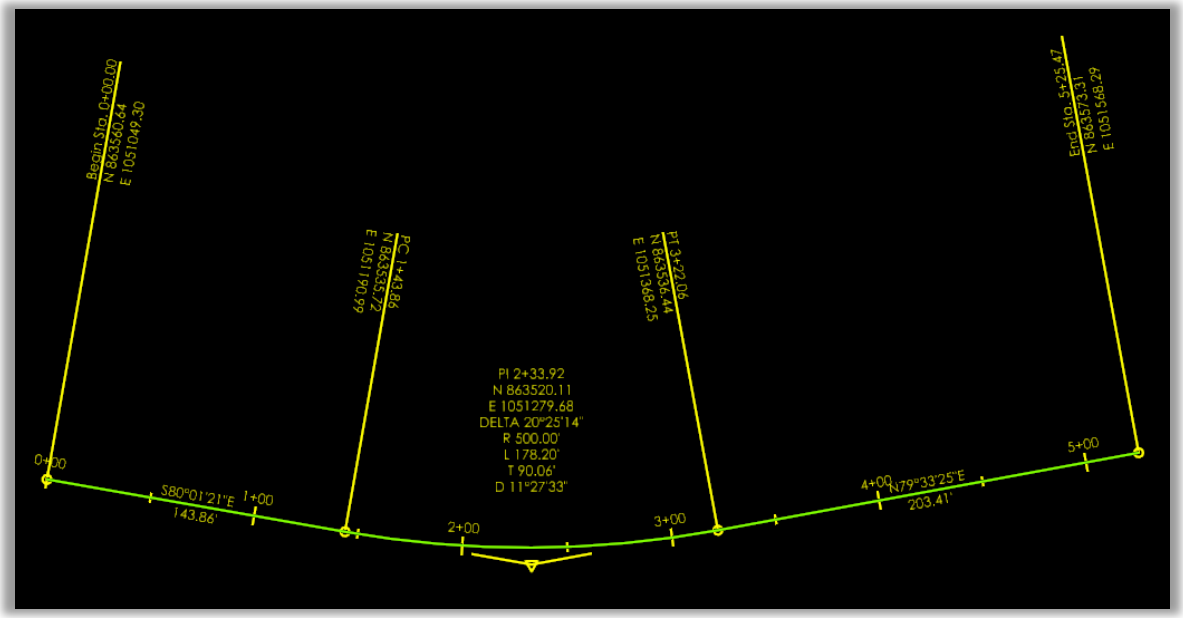


Figure 56 – Centerline – Green Annotation

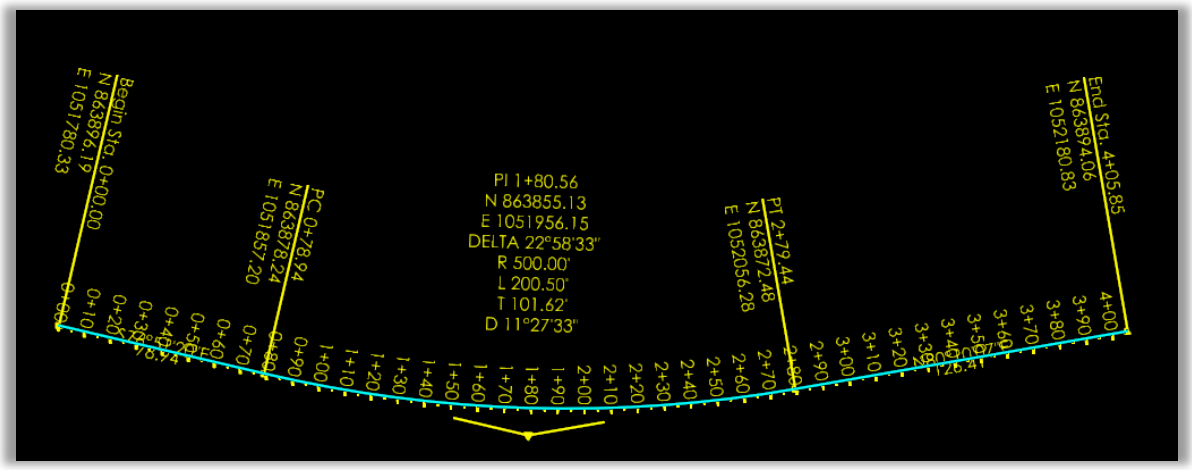


Figure 57 – Centerline – Small Blue

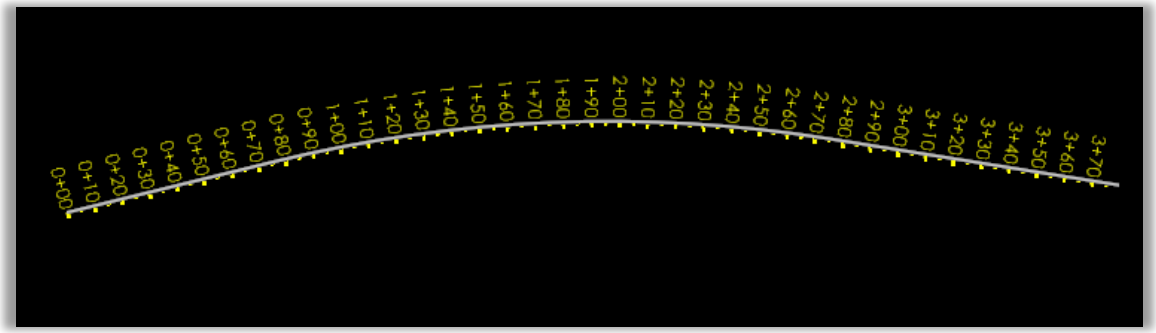


Figure 58 – Driveway Annotation

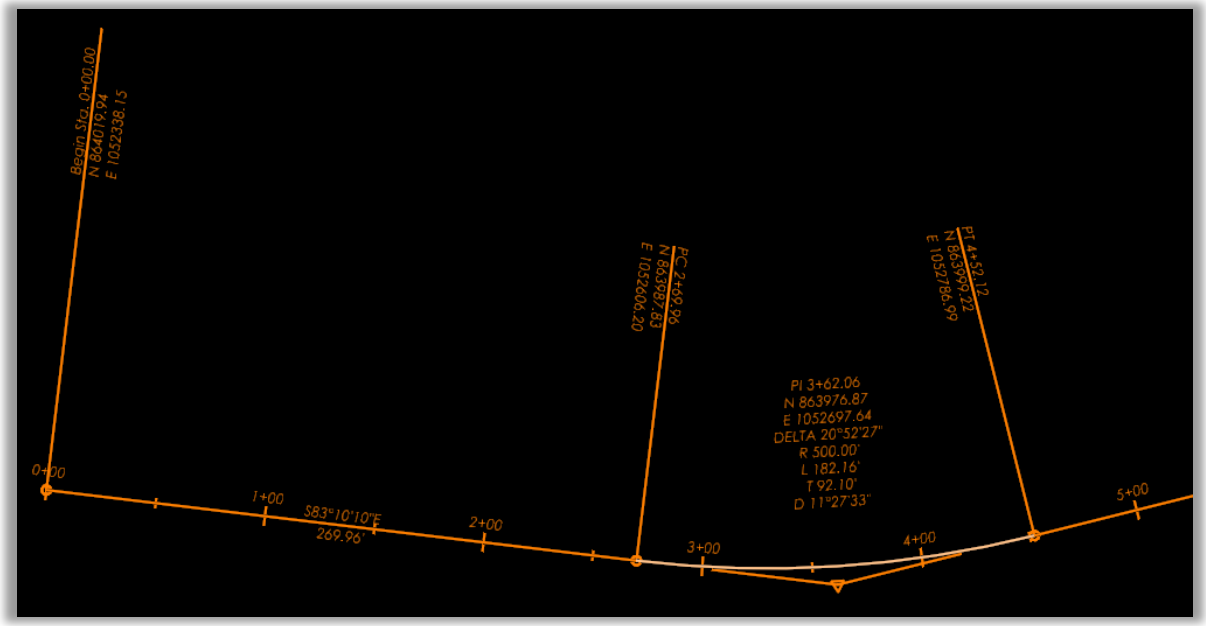


Figure 59 - Existing Baseline Annotation

4.2 Annotate an Alignment

A Horizontal Alignment needs the following annotation:

- Stationing
- PC – Station, Northing, and Easting
- PI – Station, Northing, and Easting
- PT – Station, Northing, and Easting
- Curve Data
  - PI - Station, Northing, and Easting
  - Delta Angle with Direction
  - Radius Length
  - Curve Length
  - Tangent Length
  - Degree of Curve
- Tangent Bearings
- Tangent Lengths

This has been automated; the is information will be displayed in the Alignment Design file by using OpenRoads tools. Some adjustments to location of alignment annotation can be made, if they overlap each other or other element.

1. Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_4_Alignments.dgn***.
2. Select the **OpenRoads Modeling** workflow or the **OpenRoads Drawing Production** workflow.
3. Click the **Annotate Element** tool.

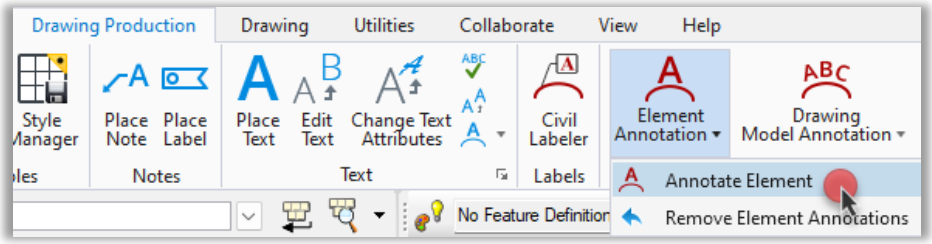


Figure 60 - Annotate Element tool

4. Select the alignment **CL_Route140**, follow the prompts to display the Annotation, right-click to Reset.

5. Notice each alignment is now annotated/labeled.

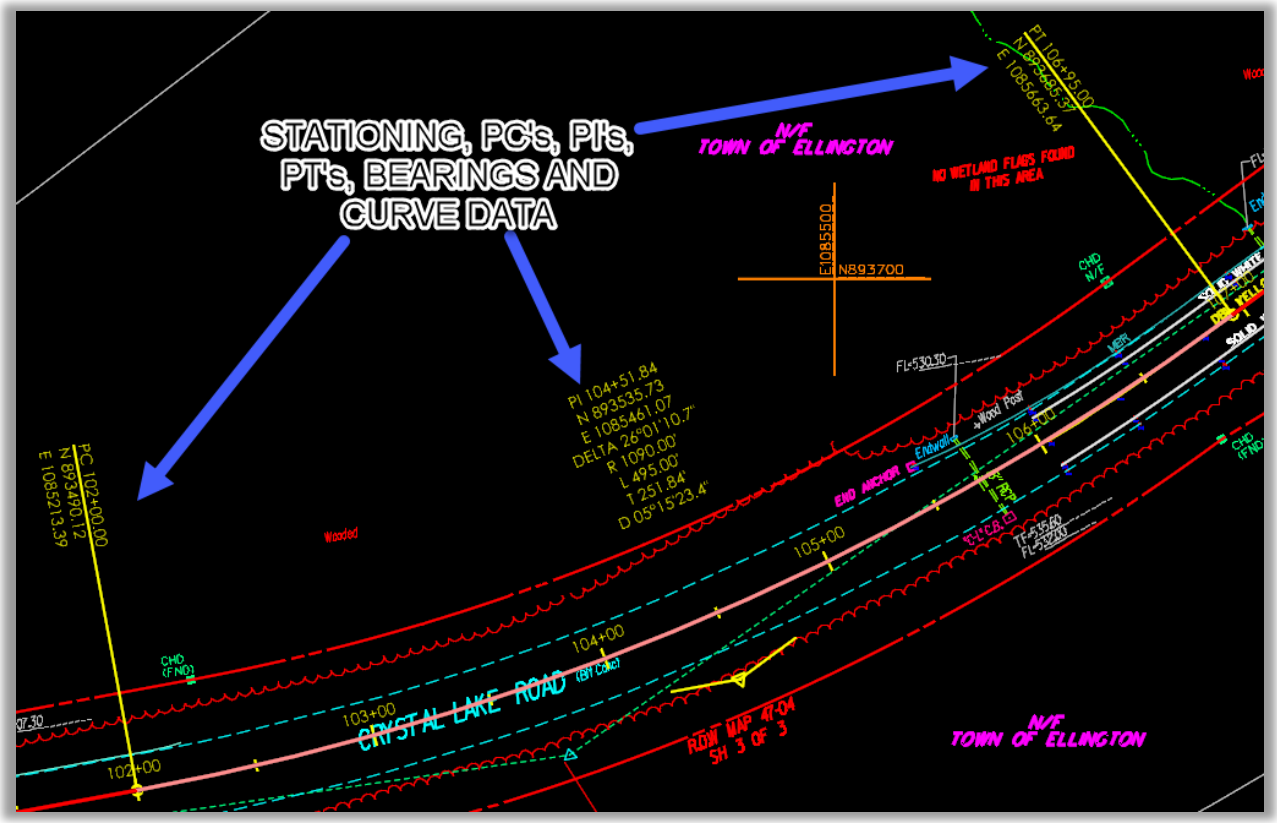


Figure 61 – Annotated Alignment

Exercise 5 – Mainline Profile

Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_5_Alignments.dgn***

In this module the creation of a vertical alignment (proposed profile) with the PI method will be described. There are several methods to create vertical alignments for more on other methods or other alignment tools please see the Bentley's OpenRoads Help – Vertical Geometry.

OpenRoads Designer stores vertical alignments as a component of the horizontal alignment in the same design file as the horizontal geometry. This is true for both existing vertical alignments, which are extracted from an OpenRoads Terrain Model, and proposed vertical alignments.

Although the vertical geometry is stored in the design file, the graphical display of the vertical alignment information is not plotted in the design file. Vertical alignments are displayed in a profile window for review and editing.

Vertical geometry tools are accessed from the **Geometry** tab of the **OpenRoads Modeling** workflow, as shown below.

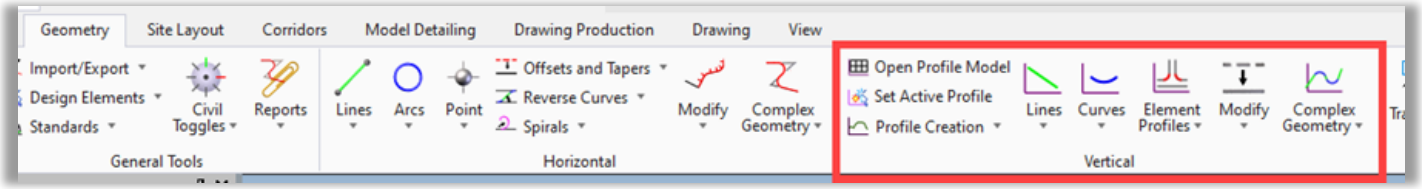


Figure 62 – Ribbon Access to Vertical geometry tools

Commonly used Vertical Alignment Tools

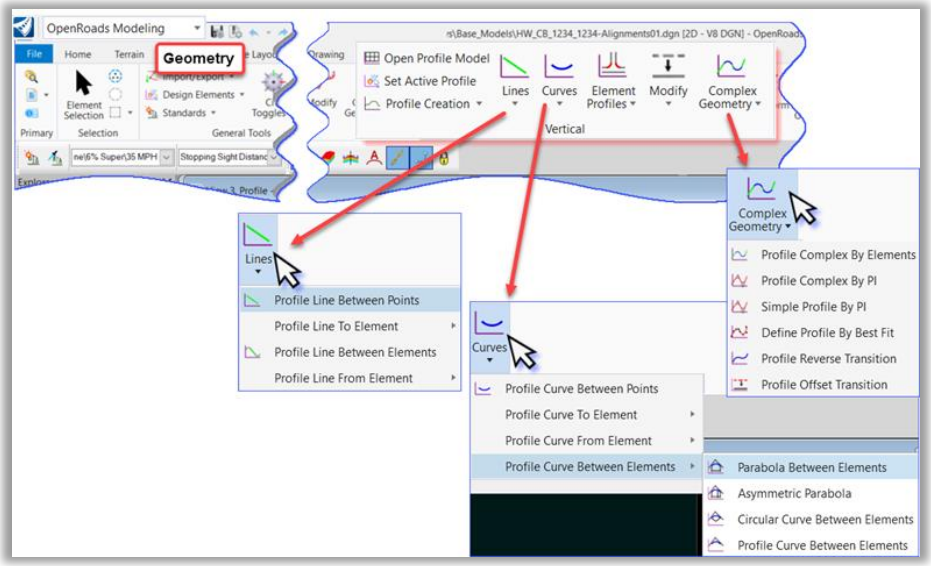


Figure 63 - Vertical Alignment Tools

When Complete Set the Vertical Alignment Active.

5.1 Getting Familiar with Profiles

5.1.1 Profile Settings

The Design File settings contain parameters for formats as you work with vertical alignments. ***Select File > Settings > File > Design File Settings*** and then click the **Civil Formatting** item from the list on the left of the dialog. The **Profile Settings** are set to the values shown below in the CTDOT seed files.

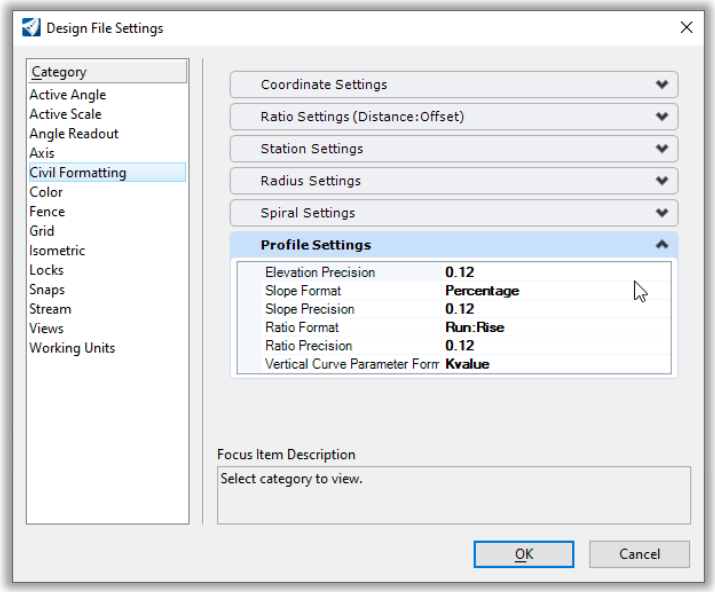


Figure 64 – Profile settings in Design File

5.1.2 Existing Ground Profiles

Existing ground profiles are extracted along the selected civil geometry element from the active terrain model. The active terrain model is set by selecting the terrain element and choosing the **Set As Active Terrain Model** icon as shown below.

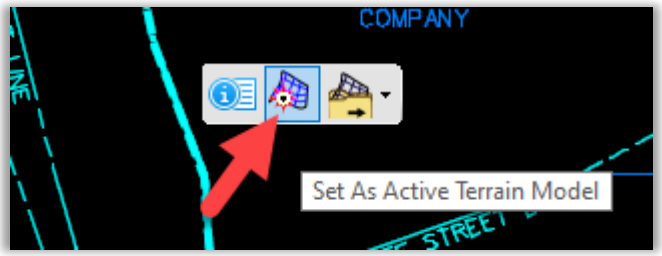


Figure 65 – Set active terrain model

To extract the existing profile, select the alignment graphics and let the cursor rest on the graphic element until the pop-up menu appears. Choose the **Open Profile Model** icon as shown below.

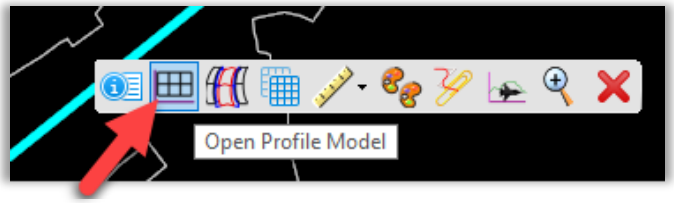


Figure 66 – Open Profile Model

You are prompted to select or open a view window to use for the profile display. Open a **new view window** and then **left click** in the view window to display the profile. An example is shown below.

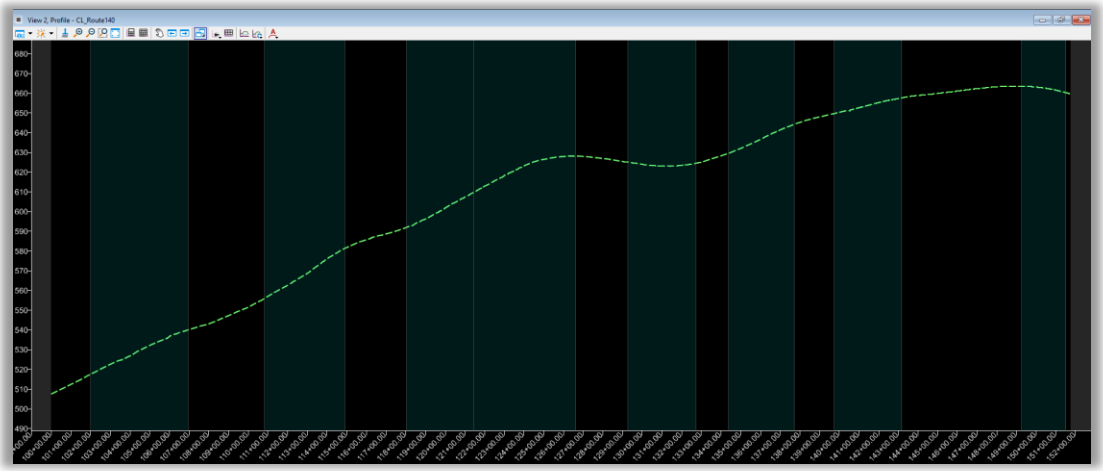


Figure 67 – Profile view with existing ground

Note: *The profile is displayed in the profile view for review and editing; however, the profile is not written to the design file. The selected view window is used as a temporary display of all the profiles associated with the selected alignment. The selected view window is not specifically associated with an alignment/profile and can be used to display the profiles from different geometric alignments as needed.*

5.1.3 Profile Feature Definitions

The symbology of vertical geometry is defined by Feature Definitions; however, the feature definition for profiles is not assigned by the user. Feature definitions for vertical alignments are defined as follows:

- Existing vertical alignments inherit their display parameters from the feature definition that has been assigned to the terrain model that was used to extract the profile.
- Proposed vertical alignments inherit their display parameters from the feature definition that has been assigned to the horizontal geometry that the vertical geometry is associated with.

To help differentiate between the tangent lines and vertical curves, proposed profiles are defined to display the vertical curves with color 20, and tangent lines with color 1.

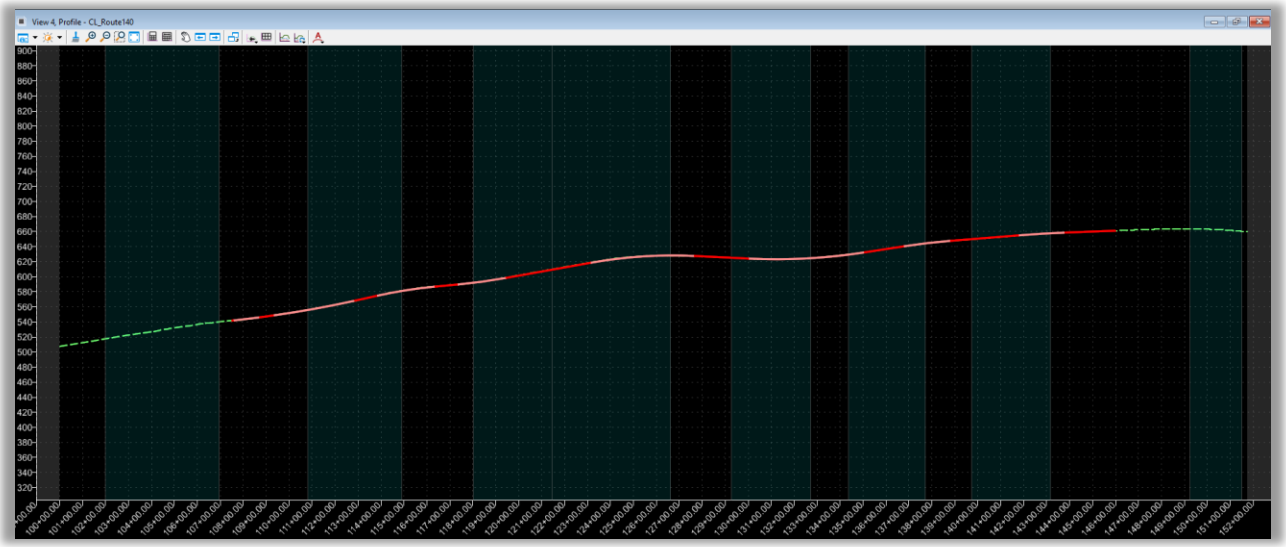


Figure 68 - Proposed vertical profile with color coding

5.2 Creating Vertical Alignments

5.2.1 Setup

1. Assure the Existing Terrain is Active.
2. Now, we will set up the Views. Right click in **View 1, Default** and select ***View Control > 3 Views Plan/Profile/3D***.
3. Follow the prompts to view the mainline Profile. In the horizontal view (View 1, Default) select the Centerline (the horizontal alignment previously created) in Exercise 3

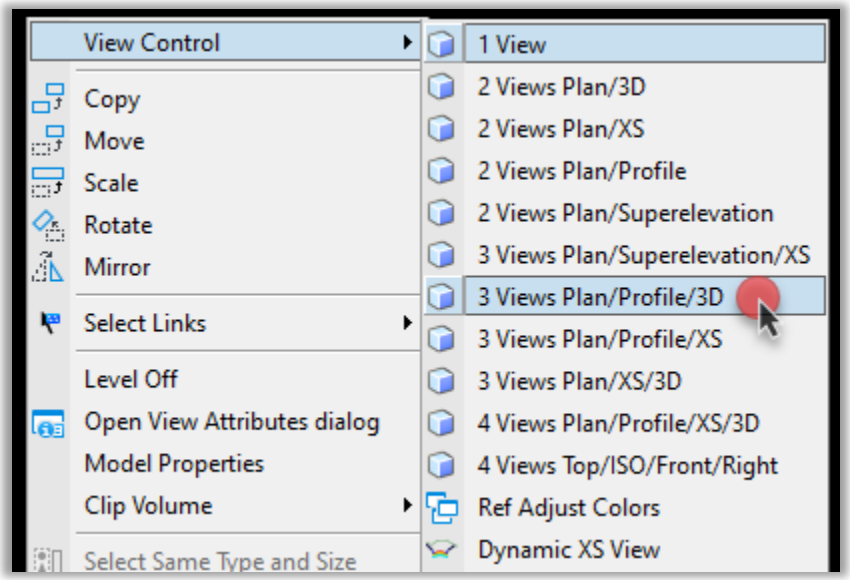


Figure 69 – 3-view Plan/Profile/3D Layout

4. If not already docked, from the **Geometry** ribbon select the **General Tools** tool and select and dock the ***Design Standards Toolbar*** and the ***Feature Definition Toolbar***.
5. From the **Feature Definition Toolbar**: select the active feature definition for ***Alignment > Center > Segment – Line*** and **Lock** the feature definition.

5.2.2 Place Tangent Segments

1. From the **Vertical tool group** select the ***Lines – Profile Line Between Points*** tool.

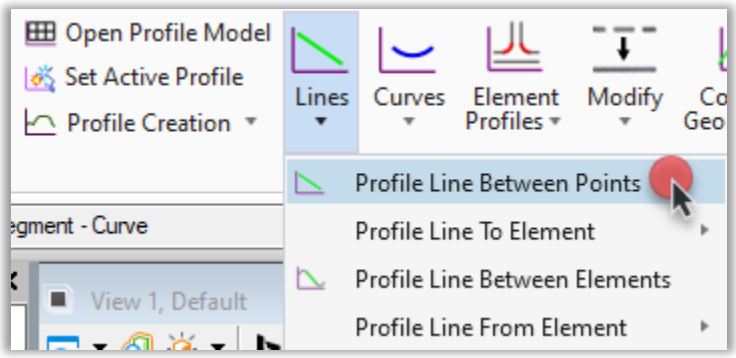


Figure 70 – Profile Line Between Points tool

2. In the **Line** toolbox, the **Feature Definition** should be set to: ***Use Active Feature***, this should be greyed out, and it will set the feature tangent line to the active feature definition picked in the previous step.

   Name: ***CL_Route140_T1***

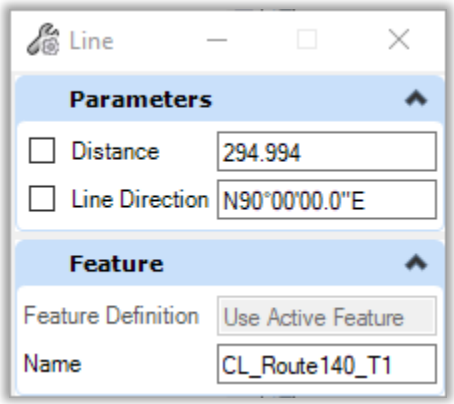


Figure 71 – Name first profile line segment

Good Practice Tips : *Name the lines and curves similar to horizontal alignments, PVI stations should be multiples of 5, Parabolic Curves have even length like 100, 500, etc, Check town standards and Highway Design Manual for slope min and max.*

3. In "**View 3, Profile – CL_Route140**" ***select the first PI location***. Use the **Near Point Snap** on the green dashed existing ground line to where you would the begin of the existing profile (around station 107+50, near the first orange line)

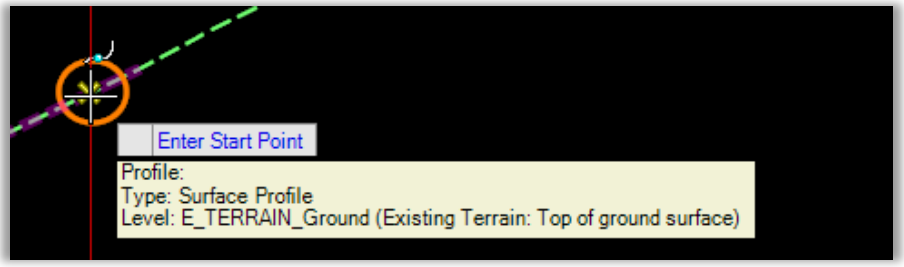


Figure 72 – Start Vertical

4. Move the courser to pick the next PI points and pick the next orange Dot. Follow the prompts to accept.

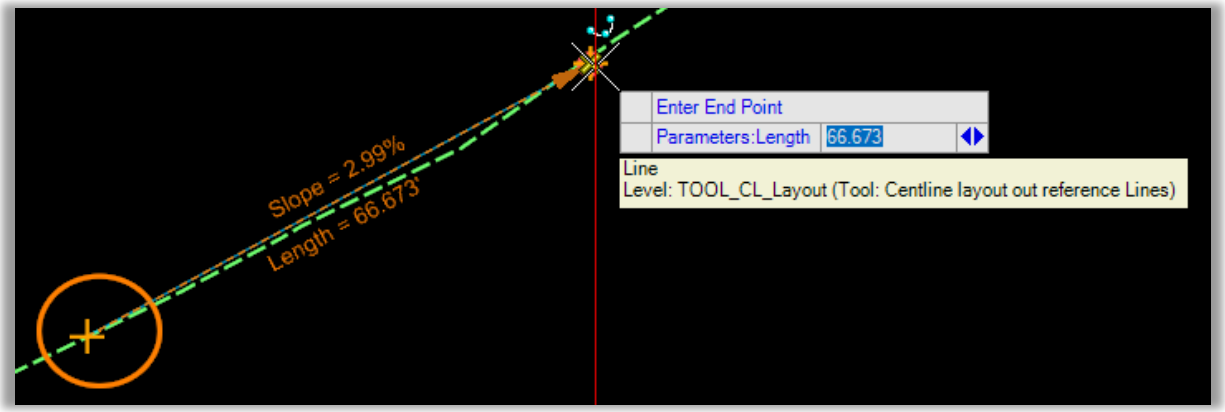


Figure 73 – Second Point

5. Delete the first orange Dot.
6. Use the ***Lines – Profile Line Between Points*** tool again and place the second tangent by snaping on the first line and then the next orange Dot.
7. Repeat steps 5 and 6 until the end, the end of the last line should be snapped back to the existing ground (use **Near Point Snap**).

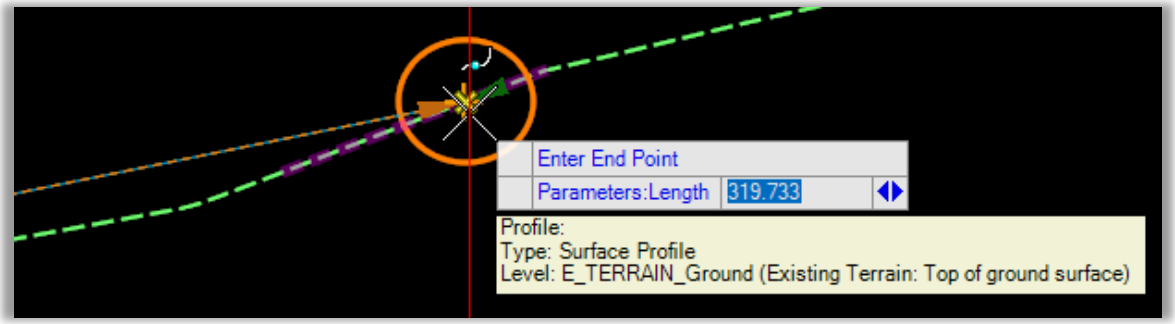


Figure 74 – End Profile

5.2.3 Place Vertical Curve Segments

1. Next the vertical curves will be placed. From the **Feature Definition Toolbar**: select the active feature definition for ***Alignment > Center > Segment - Curve*** and **Lock** the feature definition.
2. Select the **Curves – Profile Curve Between Elements – Parabola Between Elements** tool. Follow the prompts.
   - **Locate First Profile Element** – click on the first tangent
   - **Locate Second Profile Element** – click on the second tangent
   - *Define the curve by entering the length,* ***L =100 (feet)***
   - **Accept** (left-click)
   - *Trim/Extend* use the arrow keys to go to ***Both***, *Tab* key
   - **Accept** (left-click).

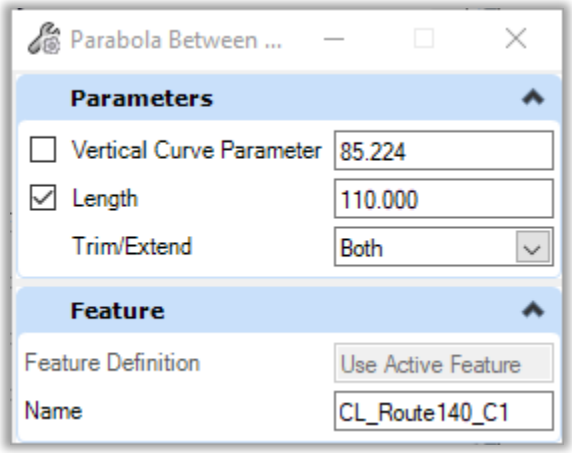


Figure 75 – Profile Curve Between Elements Tool

3. Repeat these steps for the next curve, using these inputs:

Length	Name
110	CL_Route140_C1
350	CL_Route140_C2
250	CL_Route140_C3
210	CL_Route140_C4
450	CL_Route140_C5
500	CL_Route140_C6
200	CL_Route140_C7
200	CL_Route140_C8

4. Review the vertical alignment (proposed profile). Make adjustments if needed. Using the Element Selection tool click on the first tangent, depending on the rules (relationships) with which the tangent was placed Length, Slope, Station and Elevation can be changed. The Length of Curve can be adjusted.

5.2.4 Create a Complex Vertical Alignment

1. Complex the vertical alignment, select **Complex Geometry – Profile Complex By Elements**. From the **Feature Definition Toolbar**: select the active feature definition for ***Alignment › Center › Centerline*** and **Lock** the feature definition.
2. Set the following: ***Method to Automatic***, ***Maximum Gap to 0.033***. Feature Definition: Use Active Feature (greyed out – Feature Definition locked previously), ***Name: enter the alignment name*** – example: CL_Rt140. Follow the prompts. ***Locate First Element***. Select the beginning of the vertical alignment, the entire alignment will highlight. ***Accept*** (left-click).
3. Set the profile active. Using the ***Element Selection*** tool, select the profile, from the pop-up menu select: ***Set As Active Profile***. This will associate this profile with the horizontal alignment, and you can now see the alignment also in the 3D view (View 2, Default-3D). ***Save Settings***.

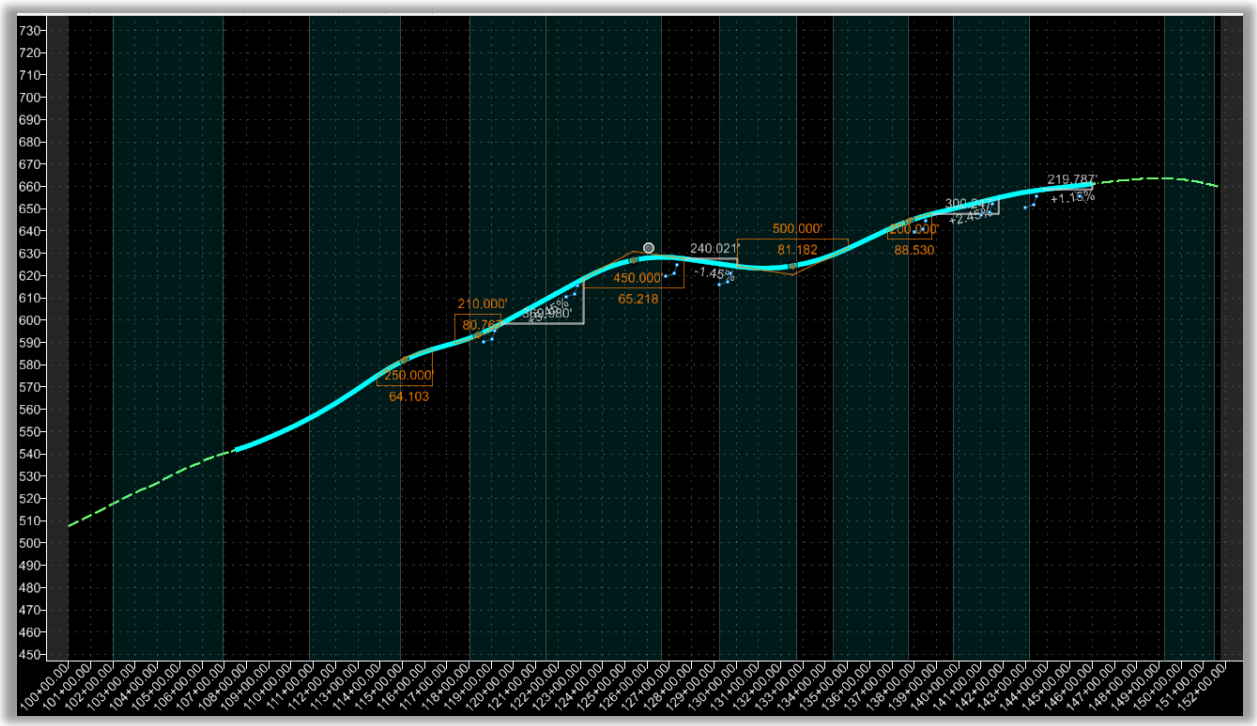


Figure 76 – Create complex vertical alignment

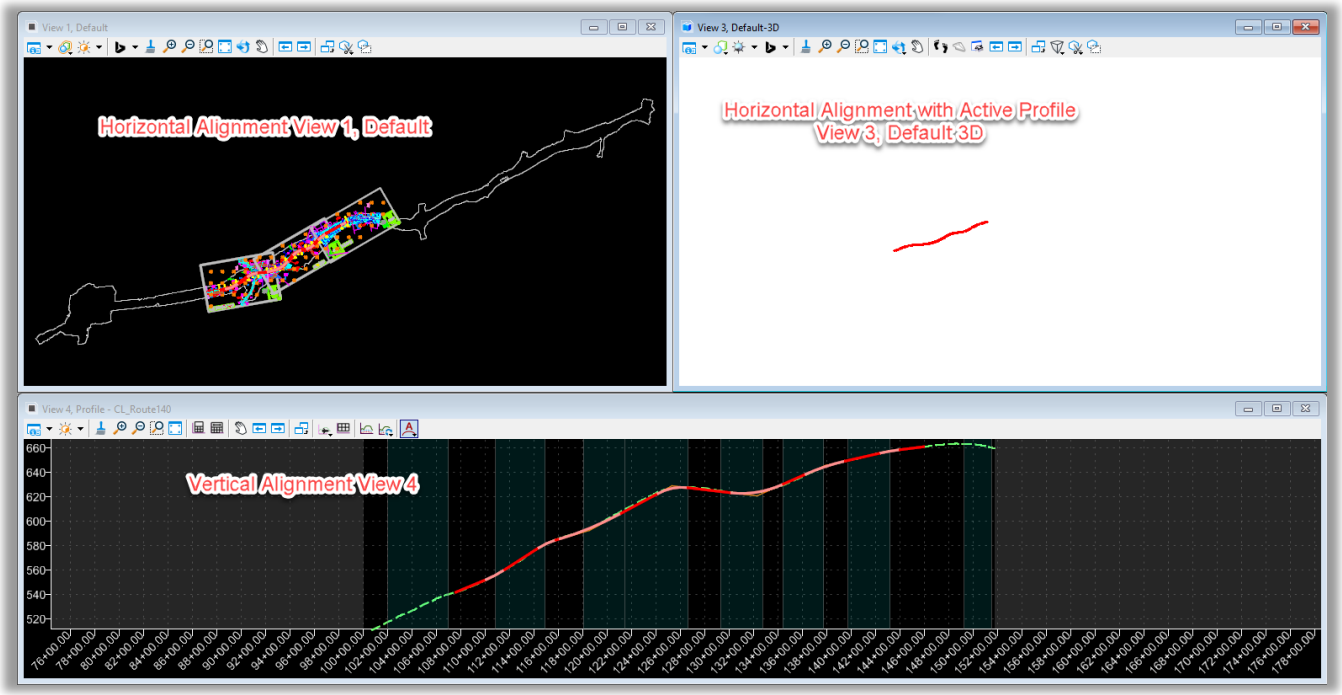


Figure 77 – Set profile active to see in the 3d view

6. The profile in the alignment dgn file is not annotated, for annotation of profiles see Volume 13.

Exercise 6 – Intersecting Alignments

In this exercise the creation of a horizontal and vertical alignments with the PI method will be described. There are several methods to create alignments for more on other methods or other alignment tools please see Bentley's OpenRoads Help – Horizontal Geometry.

6.1 Horizontal Alignment of Side Roads

6.1.1 Complex By PI

1. Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_6a_Alignments.dgn***
2. In the View Window zoom in near **the side road draft lines and circles at station 127+00.**
3. Change the **Feature Definition** to: ***Alignment > Center > Centerline***.
4. Select the tool **Complex By PI**.

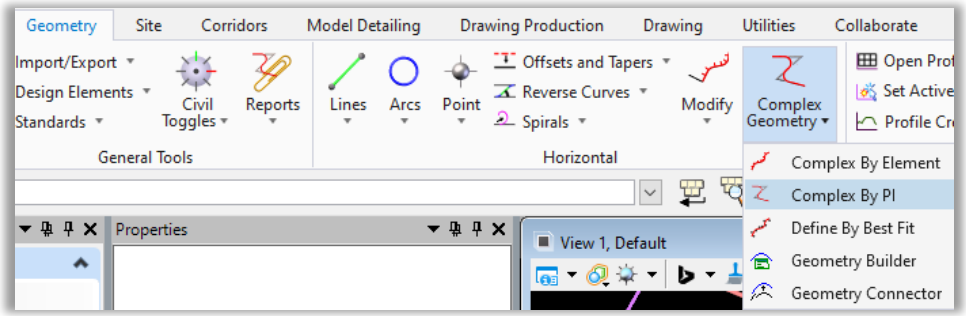


Figure 78 – Complex by PI tool

4. Click on the **Near Point Snap**

Figure 79 – Activate Near Point Snap

5. Select the **Mainline Route 140 Centerline at the Draft Circle**
   Radius at ***200'*** we will adjust after
   None for back and ahead
   Name: ***Hopkins_Road_CL***

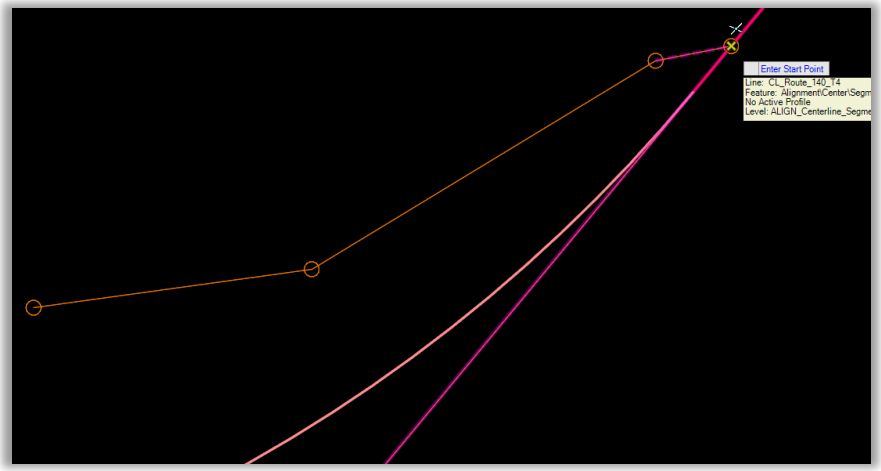


Figure 80 – First PI point placed

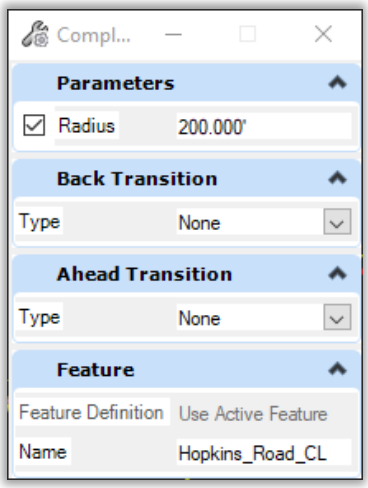


Figure 81 – Place additional PI points

5. Set Snaps to **Center**.

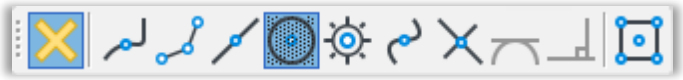


Figure 82 – Sets Snaps to Center

6. Place the **second PI point** in the **center of the Draft Circle** to the top left, continue up the line to the circle near **SNET Pole 2405** and follow the prompts to accept the alignment and stop the command.

7. Set the Begin Station to 600+00.

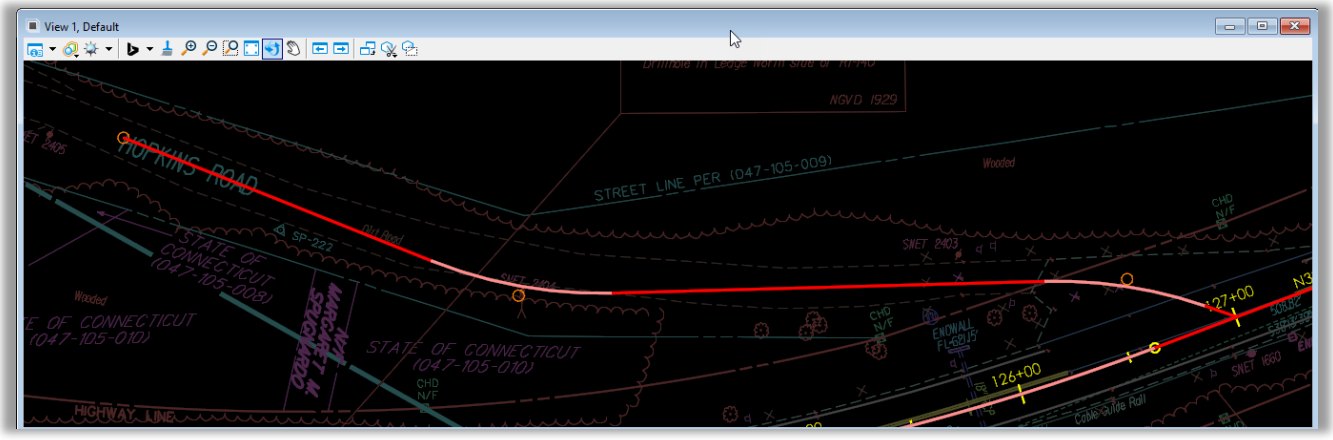


Figure 83 – Assign begin station

6.1.2 Adjustments to the Horizontal Alignment

Depending on the **Design Intent**, the placement and relationship between the elements will control how individual elements of the horizontal alignment can be modified.

For more information on placements and relationship of elements see Bentley's OpenRoads Help.

In the example the PI method was used, this will allow for modifications to the PI locations and the radii of curves.

In the flowing steps you will be making adjustments to the sideroad alignment to see how it reacts to the changes.

1. Using the **Element Selection tool** click select the **PI of the second curve** and move it to a new location; see the horizontal alignment move. Follow the prompts to move the PI to a new location.
2. Move the Point back to the draft circle.
3. Now adjust the radius. **Click on alignment**, this will activate the radius components that can be adjusted. Click on the **second radius** (orange text) a box with the radius will appear, here change the radius to **590**. Press ***Enter***.

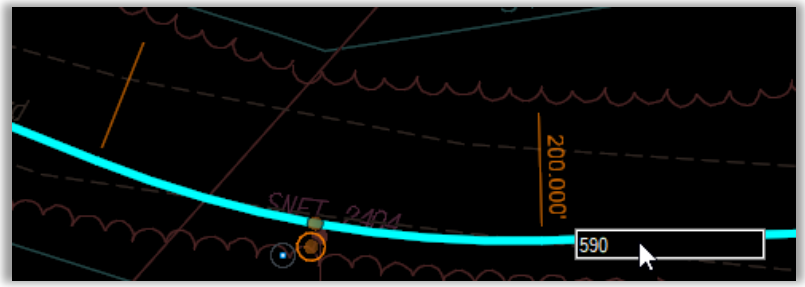


Figure 84 – Edit curve radius

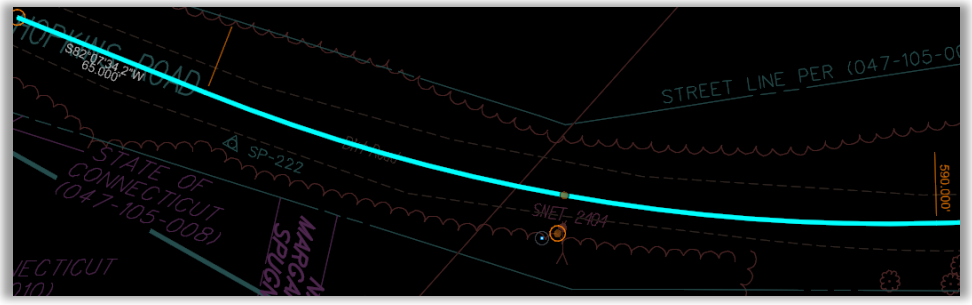


Figure 85 – New location of alignment

4. **Click on the first curve**, enter a new radius of 270 feet. Press ***Enter***.

   These are just a few of the options to control and edit horizontal alignments, see Bentley's OpenRoads Help for more detailed edit options.

6.2 Override Annotation Group for Right to Left Alignments

1. Select the alignment Hopkins_Road_CL, follow the prompts from **Exercise 4.2** to display the Annotation, right-click to Reset.
2. Zoom in on **Hopkins_Road_CL,** notice the annotation is upside down, this is because the alignment runs right to left. This can be fixed by changing the Annotation Group.
3. On the **Drawing Production** tab, select **Element Annotation > Remove Element Annotation** tool. Click on the **Hopkins_Road_CL** alignment, follow the prompts to remove the annotation, right-click to Reset.

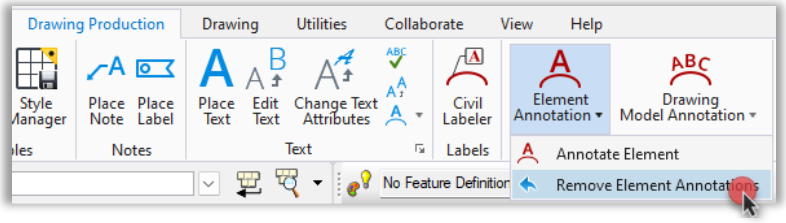


Figure 86 – Remove Element Annotations

4. Select the **Annotate Element** tool.

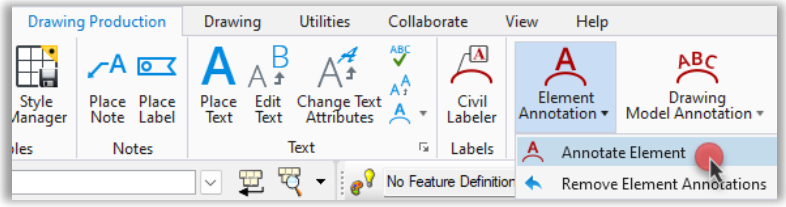


Figure 87 – Annotate Element

4. On the Annotation Element dialog box, toggle on ***Override Annotation Group***, in the popup menu select ***Plan > Linear > CL Stationing Flip***. Follow the prompts and select the **Hopkins_Road_CL.** Notice the stationing is no long upside down.

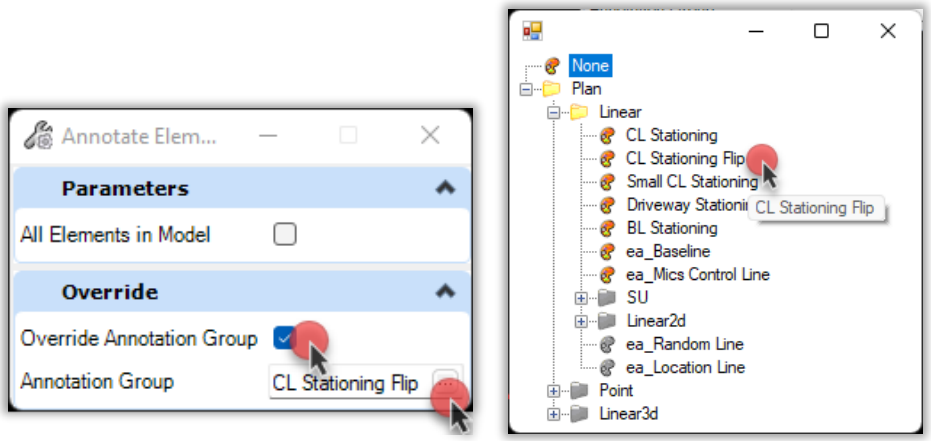


Figure 88 – Override Annotation Group

6.3 Vertical Alignment of Side Roads

6.3.1 View Profile

1. Select **Hopkins Horizontal Alignment** and in the pop-up select **Open Profile Model**.

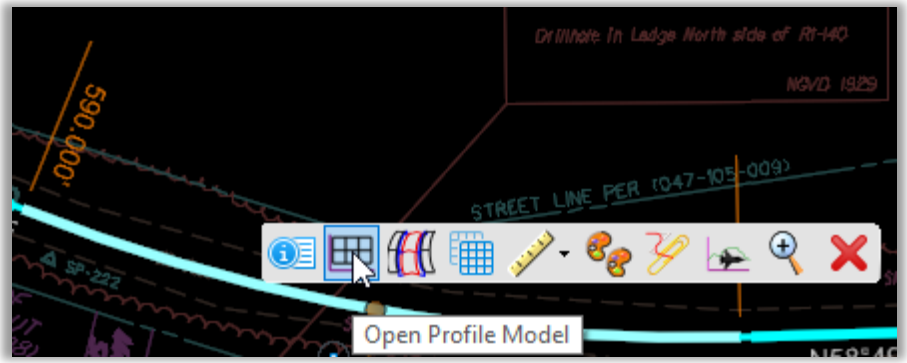


Figure 89 – Open Hopkins profile model

2. Select a View 4,

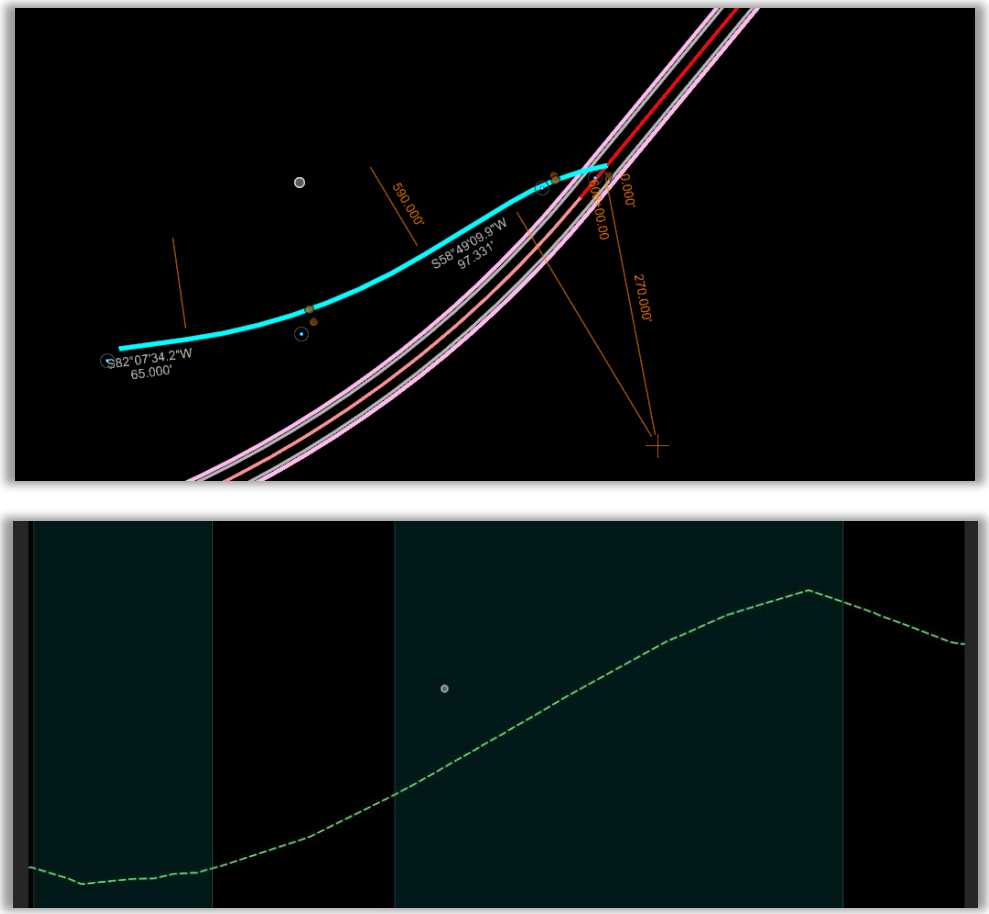


Figure 90 – Set profile to View 4

6.3.2 Project Mainline Crossing Points on to Profile

1. In the Reference dialog box turn on the Route 140 Corridor File
2. Change Snaps to Key Point

Figure 91 – Enable key points snap

3. In View 1, Zoom in on the beginning of Hopkins Road
4. On the Geometry tab in the Vertical section select: **Profile Creation > Profile Intercept Point**

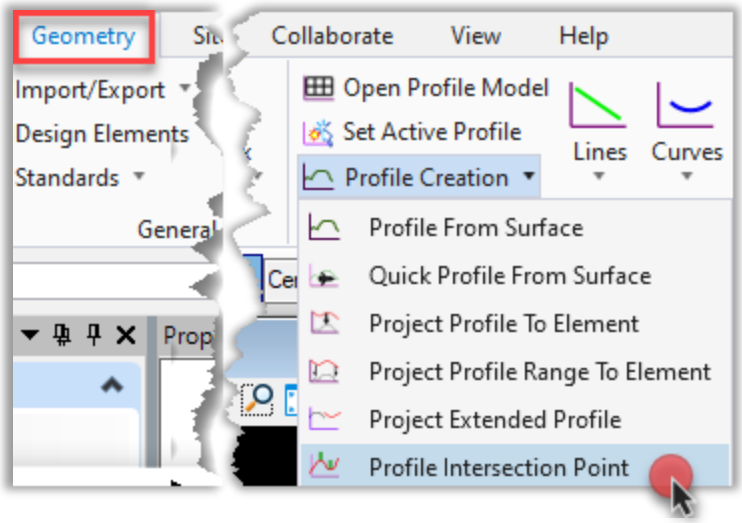


Figure 92 – Profile Intercept Point tool

5. Follow the prompts in View 1, select the **Hopkins Centerline**, then select the Shoulder, Edge of Road and the Route 140 Centerline.
6. Right click, **Reset to complete**.

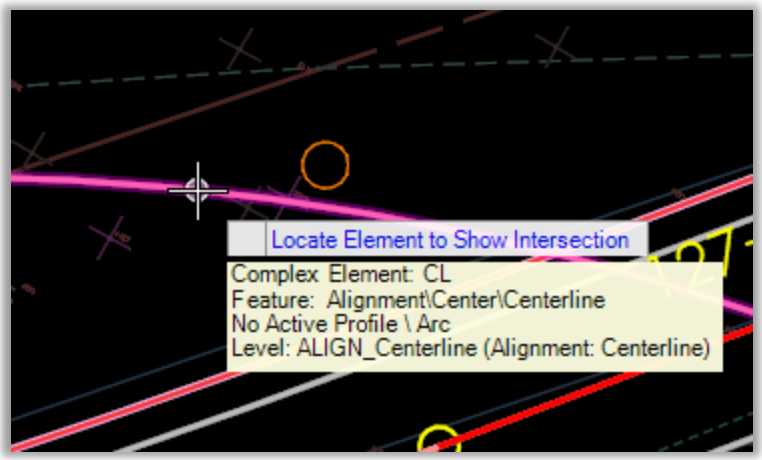


Figure 93 – Select elements to intercept

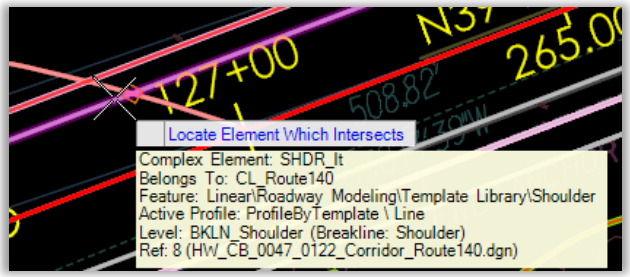


Figure 94 – Intercepted points in profile view

Figure 95 – Projected alignment elements shows

The three points will now be placed in the profile window.

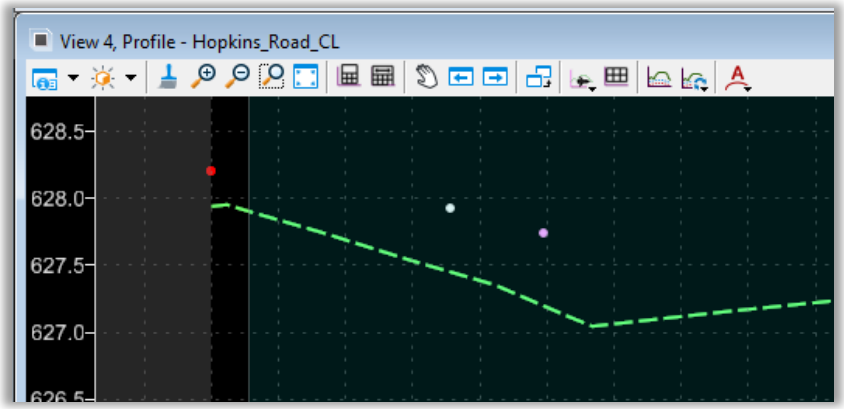


Figure 96 – Projected points on Hopkins profile

6.3.3 Create Vertical Alignment

1. Change the **Feature Definition** to: ***Alignment > Center > Centerline***
2. Using the Draft line Element Template, draw a line between the Centerline and Shoulder points on the profile. Extend the line out to around 601+20

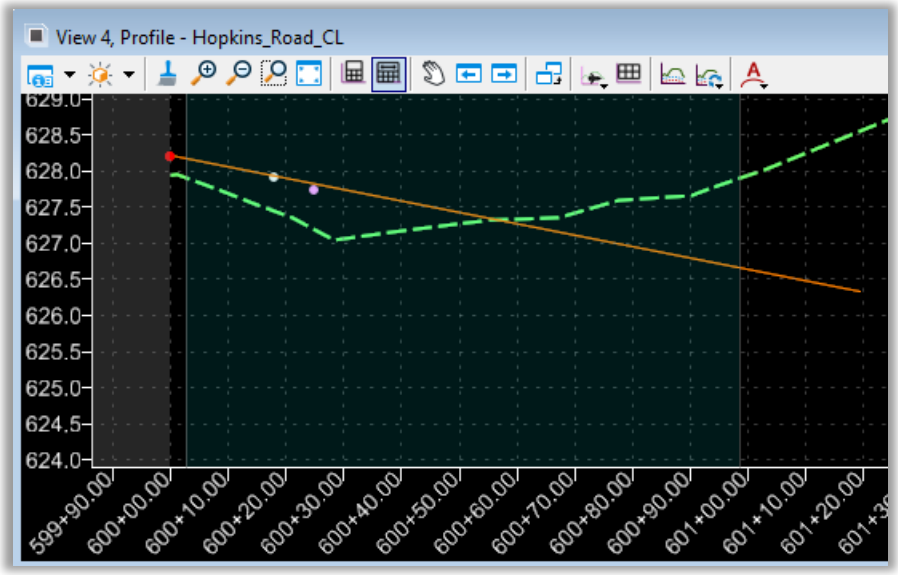


Figure 97 – Place draft line to being profile

3. Use the Profile Complex By PI Tool to layout the vertical alignment.

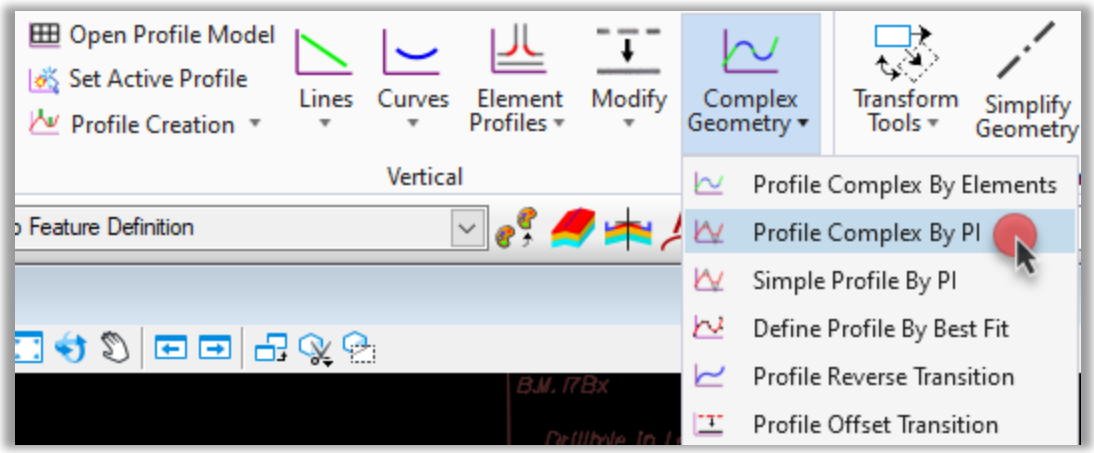


Figure 98 – Profile Complex by PI tool

4. In the dialog box enter
   Curve Length ***40.00***, we will adjust after
   Vertical Curve Type***: Parabola***
   Name: ***Hopkins_Road_CL***

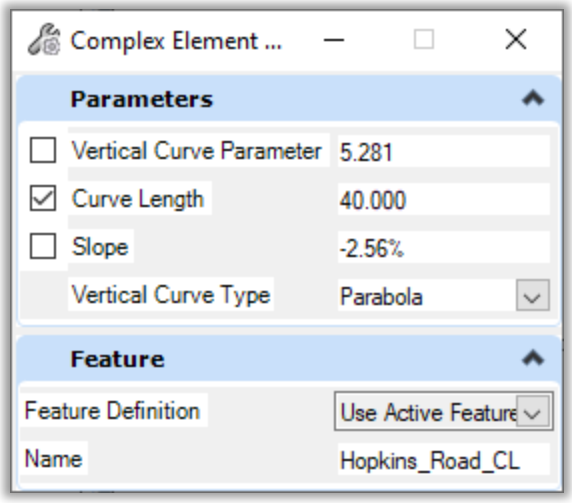


Figure 99 – Vertical profile name and curve setup

5. Select the **Red Point**
6. Change snaps to **Near Point**, click near the **Orange Line**, select toward the right end of the line.

Figure 100 – Snap to draft profile

Figure 101 – Place complex element on draft line

7. Next place a Data Point near the top of the Profile and select the **Existing Ground**. Right Click to **Reset to Complete**.

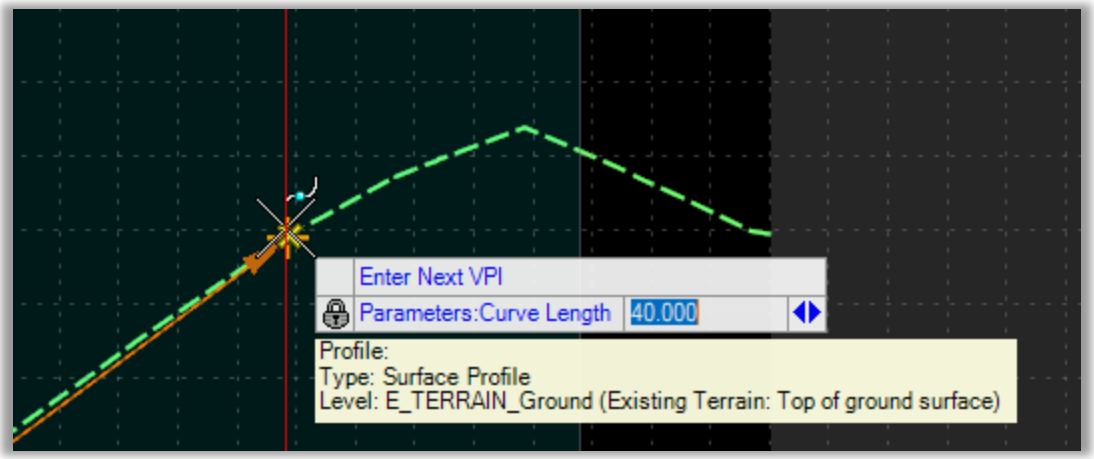


Figure 102 – Snap to existing ground

8. Modify the Vertical Curve to **170**.

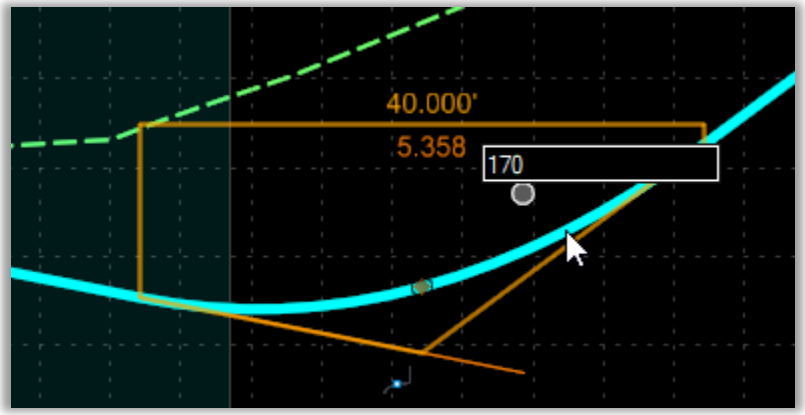


Figure 103 – Adjust curve length

9. Try out the **Modify > Profile insert Curve** tool. Add a curve between the first curve and the end of the alignment with a Length of **100**.

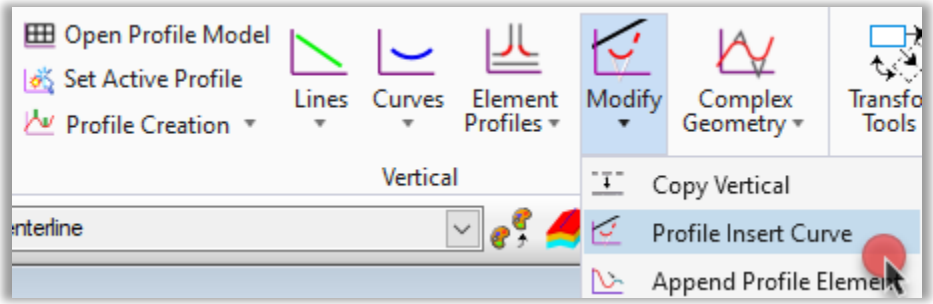


Figure 104 – Insert new profile curve

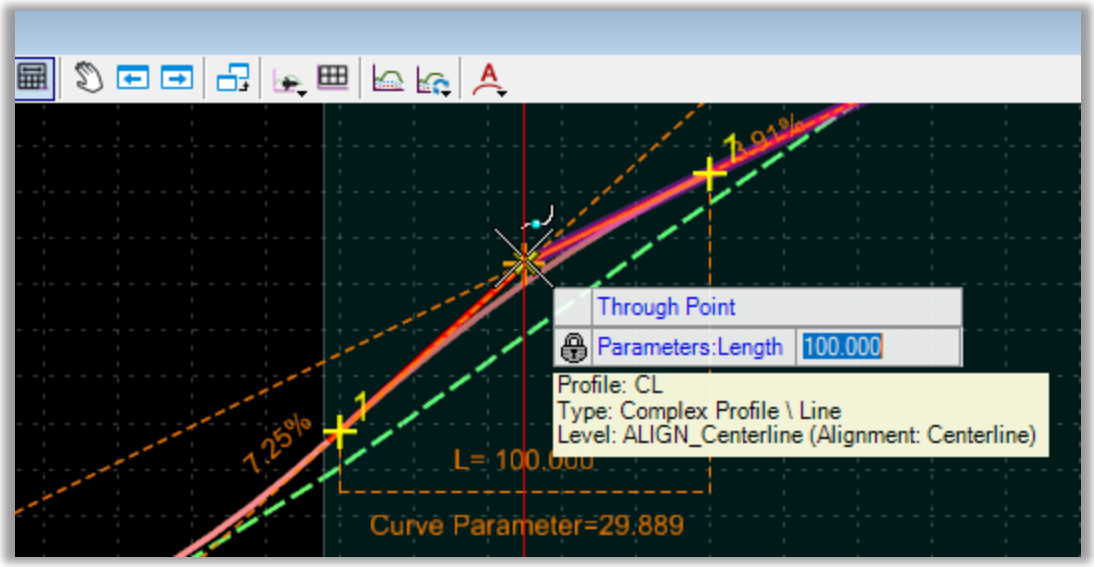


Figure 105 – New curve segment inserted

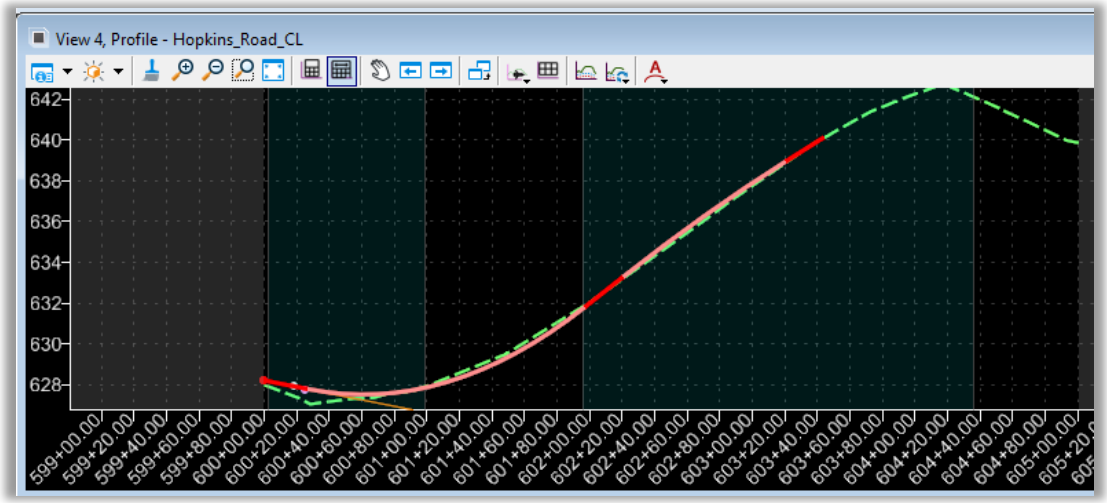


Figure 106 – Completed driveway vertical profile

Exercise 7 - Geometry Reports

Several preconfigured reports are provided with the OpenRoads software that can be used to review alignment information.

7.1 Horizontal Reports

1. Select the **Browse** icon, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_7_Alignments.dgn***
2. Form the **OpenRoads** workflow, select the **Home** tab, in the **Model Analysis and Reporting Section** select: **Reports > Horizontal Geometry Report**.

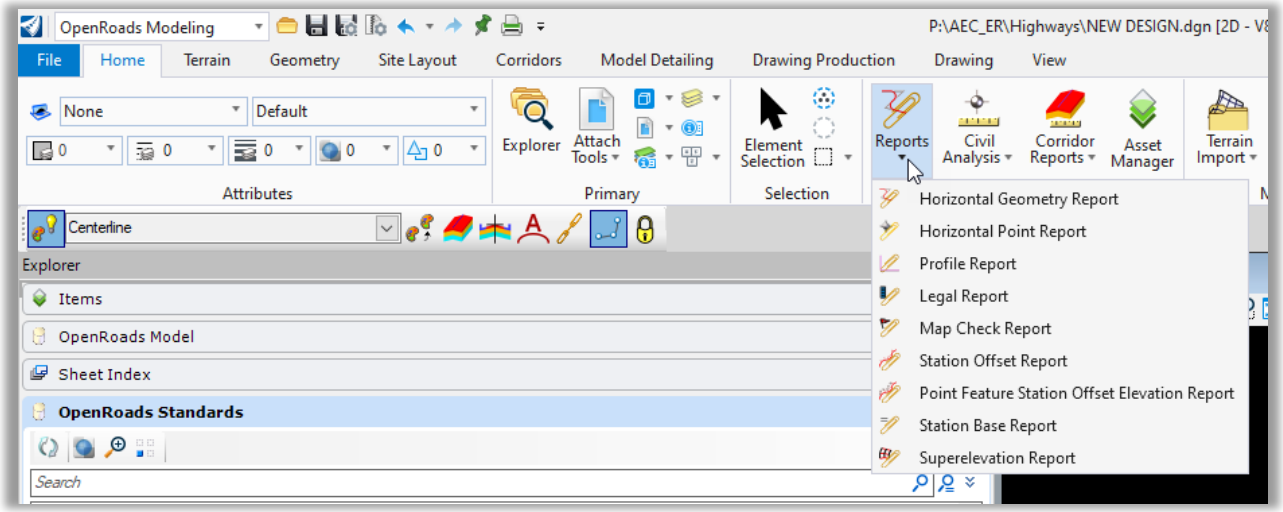


Figure 107 - Horizontal Geometry Report tool on ribbon

Additionally, reports can be generated by selecting a civil geometry element and choosing the Reports icon from the pop-up menu.

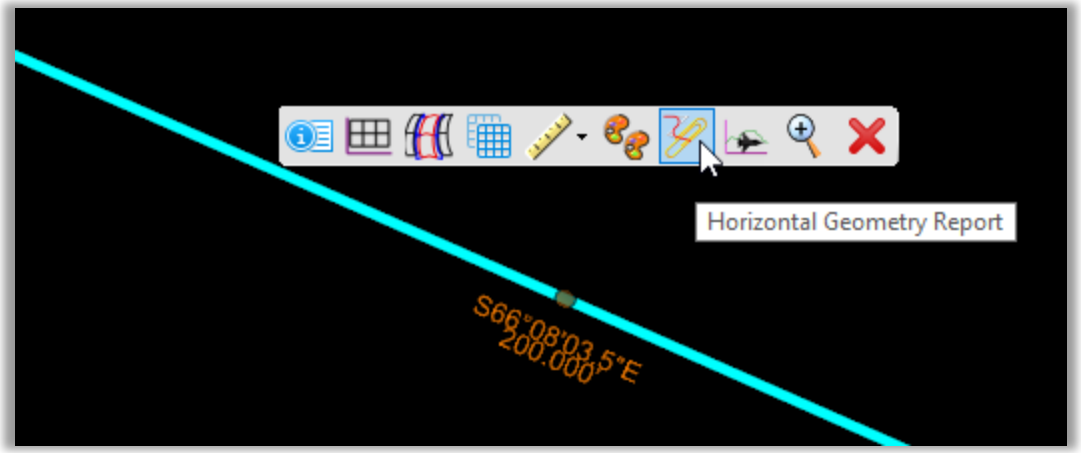


Figure 108 - Horizontal Geometry Report tool on popup menu

3. In the pop-up dialog box select:
   Lock to Start
   Lock to End
   No Interval
   No Profile
   Follow the prompts and select a **Horizontal Alignment**, **Right Click** to reset and complete and **Click** through the heads-up prompts.

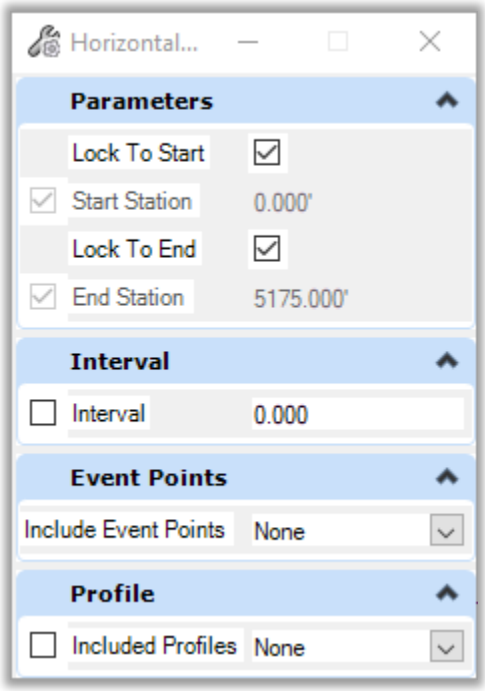


Figure 109 - Horizontal Geometry Report dialog box

4. When a report is generated, the default report for the element type is displayed. This example shows the default report for an alignment.

   Several reports are available and can be selected from the list at left. Depending on the element type that the selected report has been configured to accept, it may not show any information.

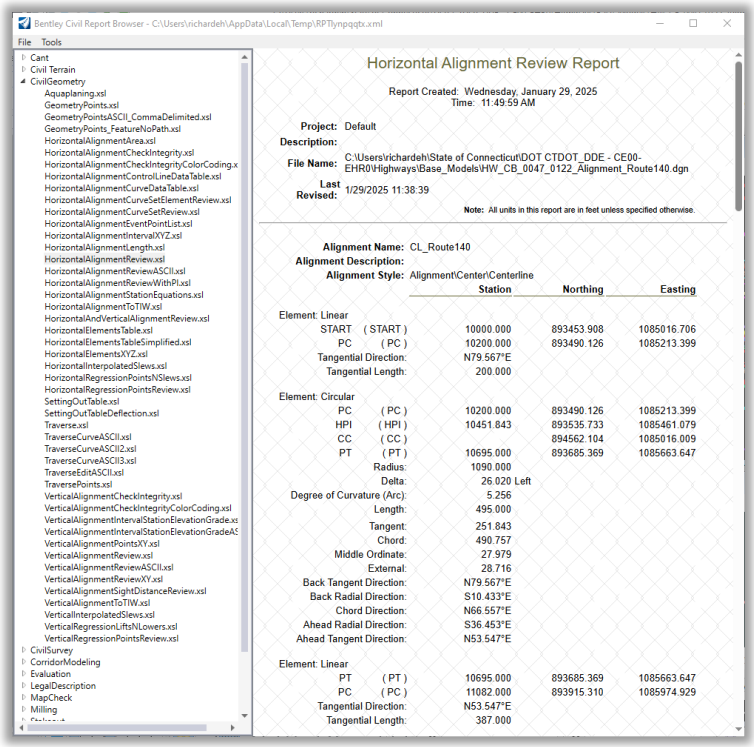


Figure 110 - Horizontal Geometry Report Output

5. Select ***Tools > Format Options***

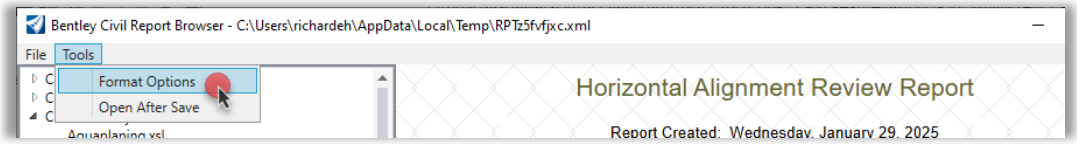


Figure 111 – Report Format Options tool drop drop

In this dialog box the format of the report can be modified as needed. The format options are stored as a user setting in the Windows Registry and must be manually set by each user on their computer. The settings shown above are recommended for CTDOT projects. Changes made to the Format Options dialog are dynamically applied to the current report when the dialog is closed.

6. Click the **Close** button

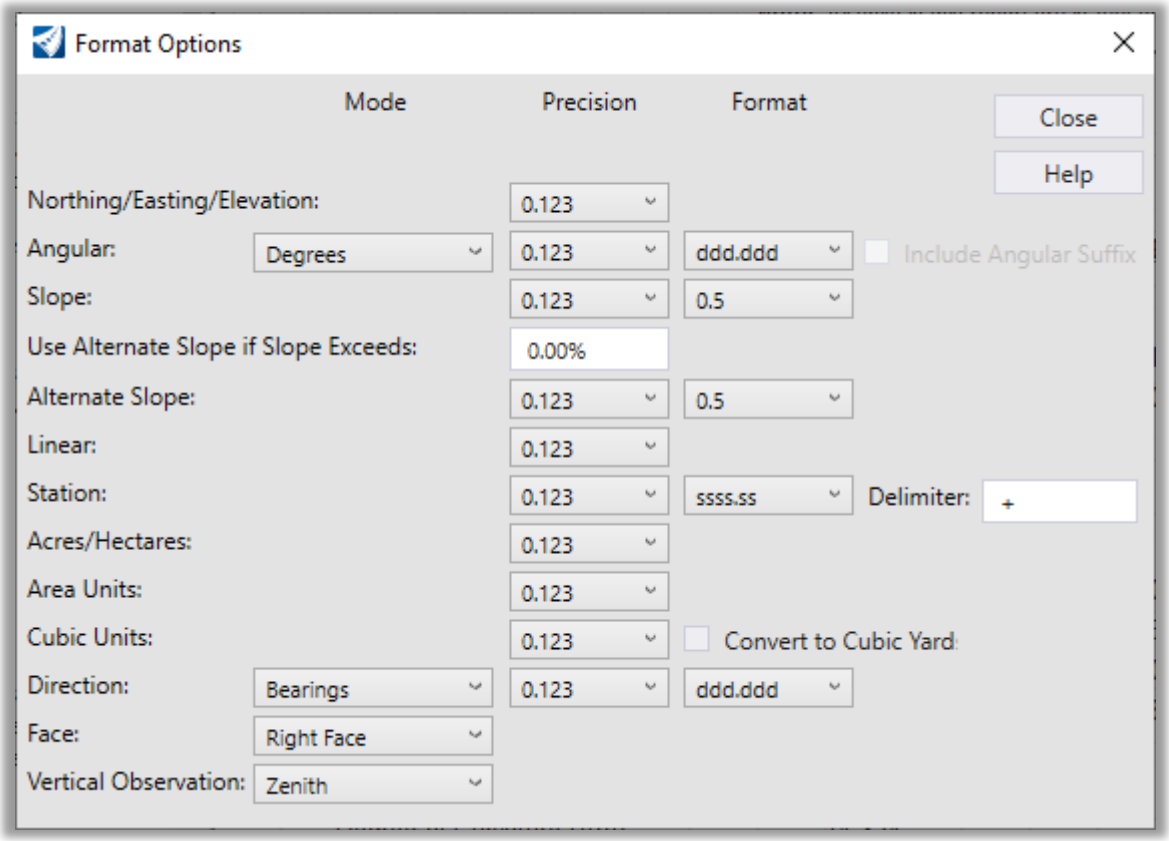


Figure 112 – Report Format Options

7. Select ***File > Save as*** and choose Microsoft Excel (*.xlsx)

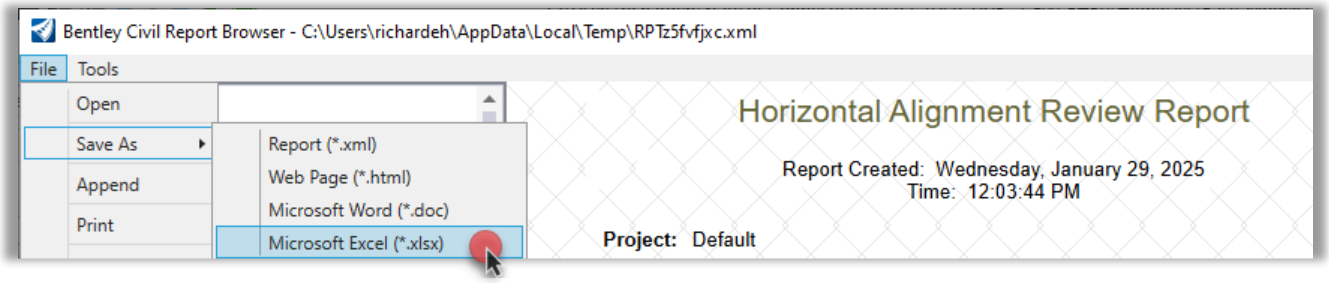


Figure 113 – report Save as

Browse to your computer ***Documents*** folder and name the file: ***Route_140_Horizontal_Alignment***. Click **Save**.

Warning – do not attempt to save this directly to you Compass Project as this causes issues.

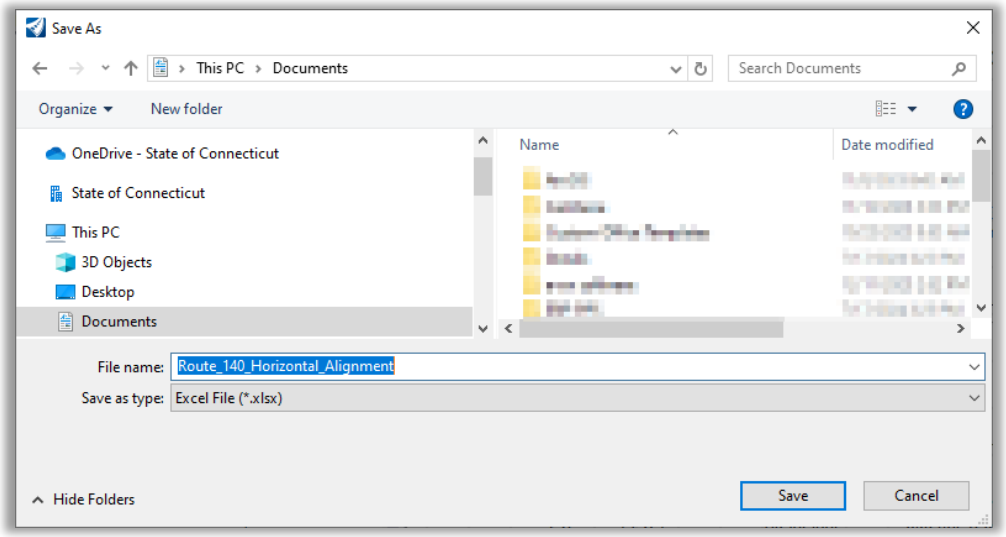


Figure 114 – Save as dialog box

8. Outside to OpenRoads from your desk top **Open** File Explorer. Browse to open the ***excel file*** that was just created and review. **Close** the excel file after your review is complete. This file can now be moved to the appropriate folder in your Compass project.

7.2 Vertical Reports

1. In the Profile view select the **Vertical Alignment**, when the pop-up tool bar appears select **Profile Report**.
   Note: This can also be accessed form the **OpenRoads** workflow, select the **Home** tab, in the **Model Analysis and Reporting Section**, select **Reports > Horizontal Geometry Report**.

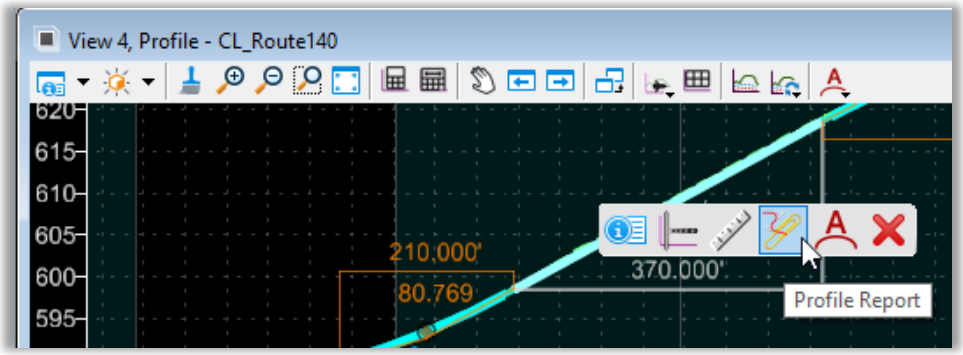


Figure 115 – Profile Report popup

2. Select ***Tools > Format Options*** or ***File > Save*** as described in the Horizontal Reporting section.

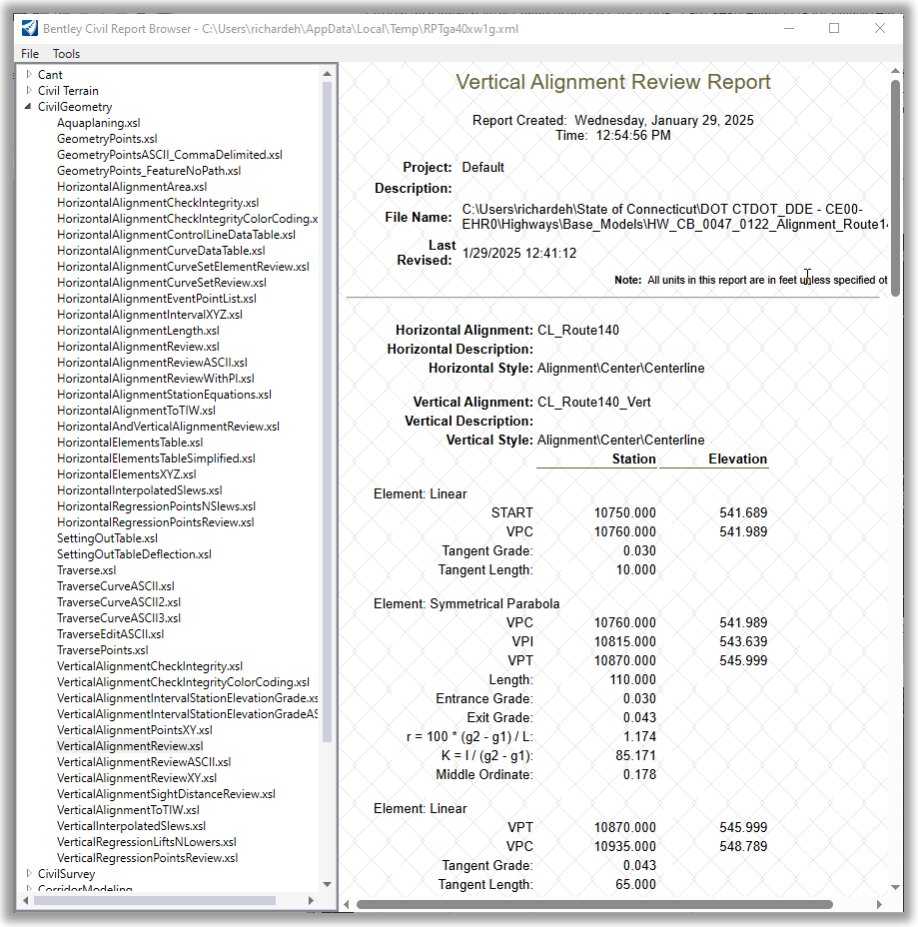


Figure 116 – Profile Report output

Exercise 8 - Driveways

There are various way to create a Driveway. For simple Driveway users can use CTDOT provided **Driveway Civil Cells**. For complex Driveway users need to design them.

In the following exercises you will learn one method to create them. Users will use various tools to create Driveway Alignment, Driveway Profile, Driveway Edge etc. Driveway Alignment and Profile are similar to Exercise 1, 2, 3 and 4 above. Users will learn that each driveway element is ruled main corridor (CL_Route140) so that when the main corridor is updated, Driveway also updates automatically.

8.1 Create the Horizontal Centerline

1. Select **File > Open**, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_8_Driveways.dgn.*** Please review the references.

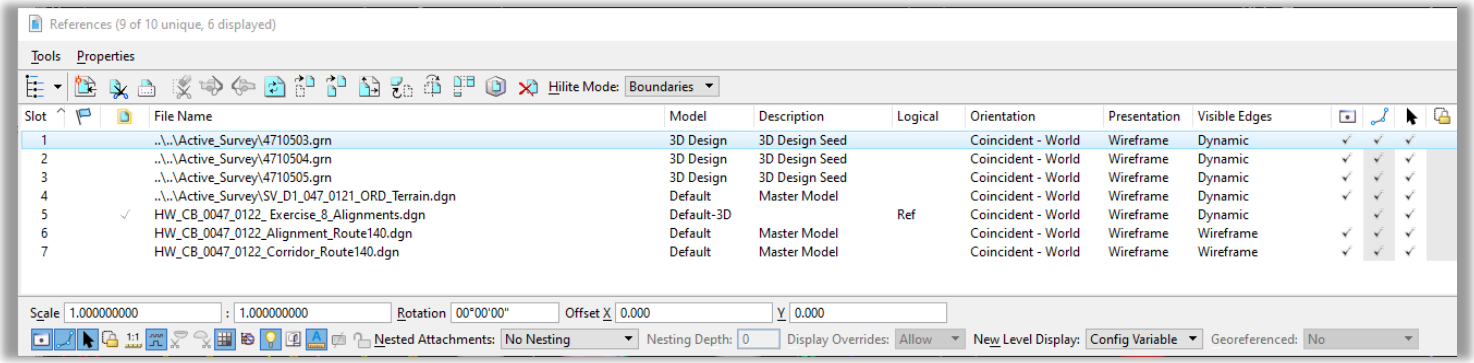


Figure 117- References

2. In the View window zoom in near station **119+00**.
3. Change the **Feature Definition** to: ***Alignment > Center > Driveway***.

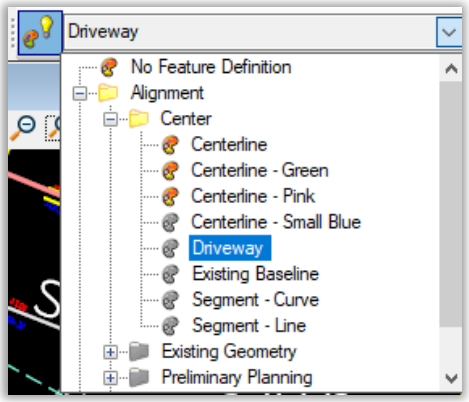


Figure 118 – Change the Feature Definition

4. Select the tool **Complex By PI**.

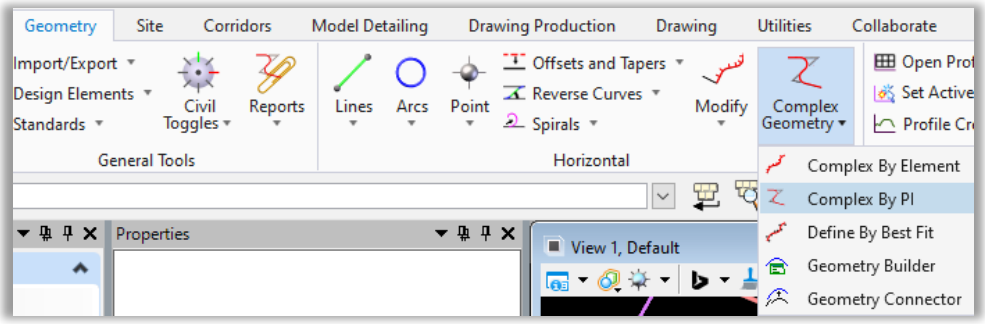


Figure 119 – Complex by PI tool

5. In the dialog box enter Radius = 10', with no back or forward transition.

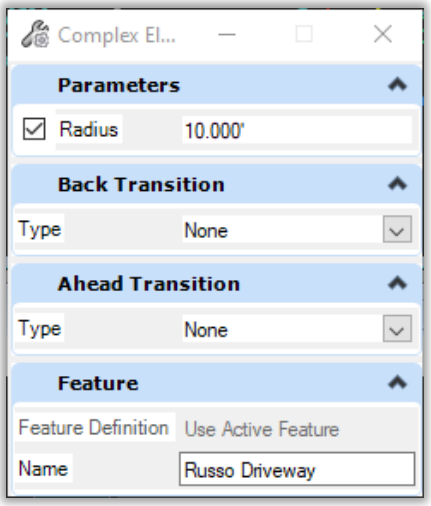


Figure 120 – Radius and Feature settings for Driveway centerline

6. Click on the **Near Point Snap**, and select the **Mainline Centerline**, continue placing points along the **center of the Driveway**. After placement edit as needed.

Figure 121 – Near Point Snap selected

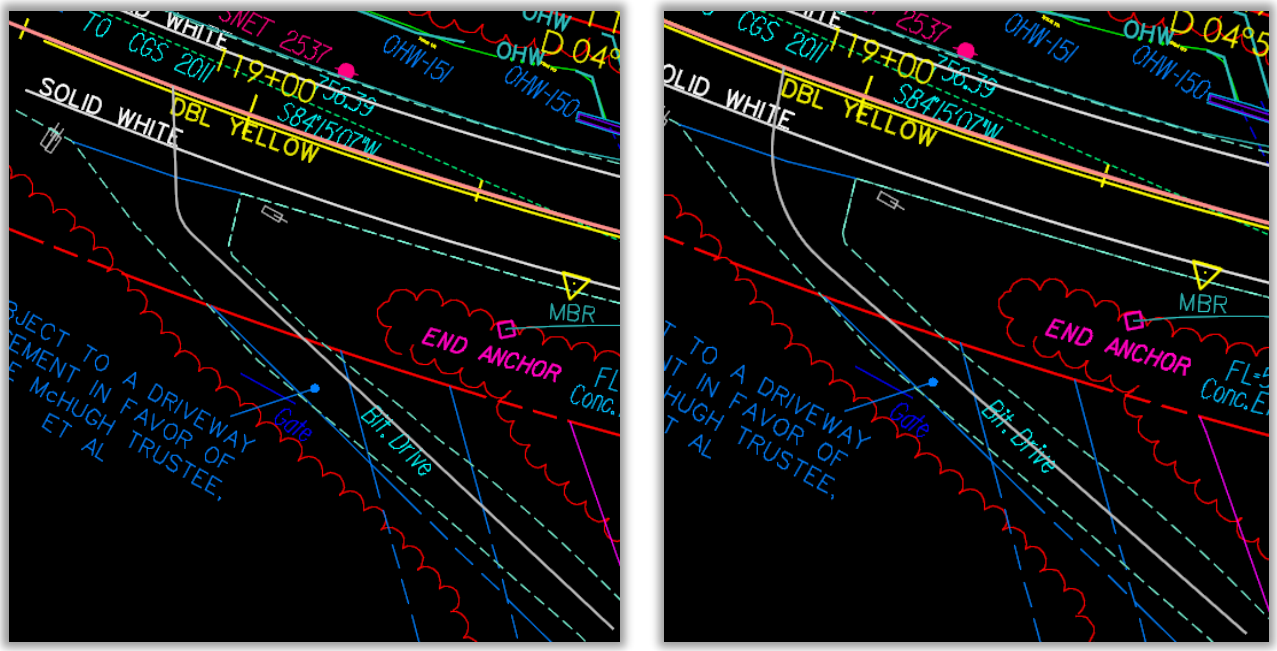


Figure 122 – Before and after driveway alignment modifications

Figure 123 Alignment modifications (Left – Move PI, Middle and Right modify Radius)

7. Edit the Mainline Radius and notice the Driveway stays ruled to the alignment changes. Undo the changes and watch the driveway revert back.

8.2 Create the Horizontal Driveway Edges

1. Set the **Feature Definition** to: ***Alignment > Linear > Roadway Geometry > Edge of Driveway Line***.

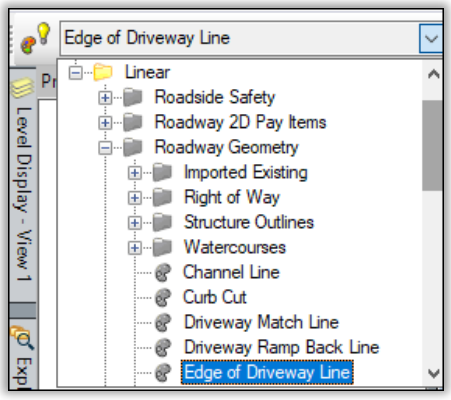


Figure 124 – Set the feature definition to Edge of Driveway Line

2. From **Geometry Tab > Horizontal group** select **Offsets and Tapers** dropdown **> Single Offset Entire Element**.

> ***Note:*** *If you are using offset* ***Geometry*** *as a method to adjust template lines in a* ***Corridor, Surface Template or Liner Template****, that geometry should be placed in the corridor DGN file it will be assign to and* ***not*** *in the* ***Alignment DGN file****.*

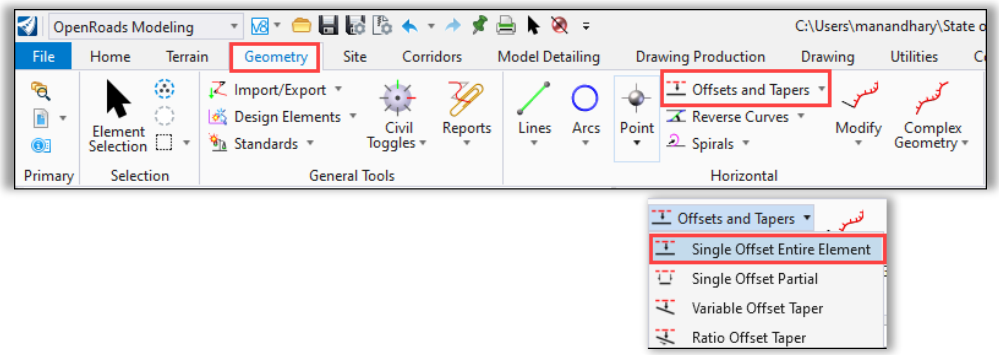


Figure 125 – Single Offset Entire Element tool

3. Follow the heads-up prompts:
   Locate Element: Driveway Centerline **Russo Dwy**
   Enter offs. et: ***5 ft***
   Mirror: ***Yes***
   Name: ***E_Dwy1***

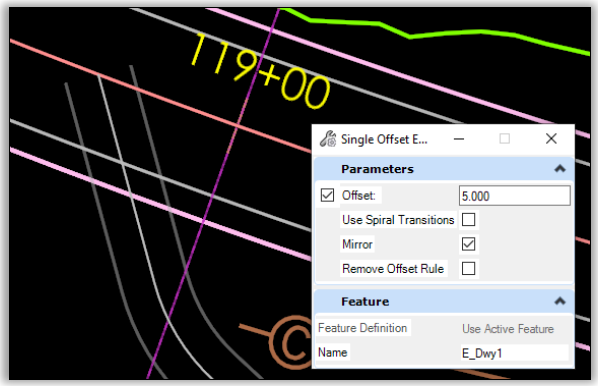


Figure 126 – Offset geometry with mirror option

4. Create Driveway Curb Returns. Go to the **Geometry Tab > Horizontal Group**, drop down on **Arcs > Arcs Between Elements > Simple Arc**.

   Locate First Element: main Corridor (CL_Route140) **EOR_rt**
   Locate Second Element: left edge of Driveway **E_Dwy1**
   Radius: ***50 ft***
   Trim/Extend: ***Ahead***

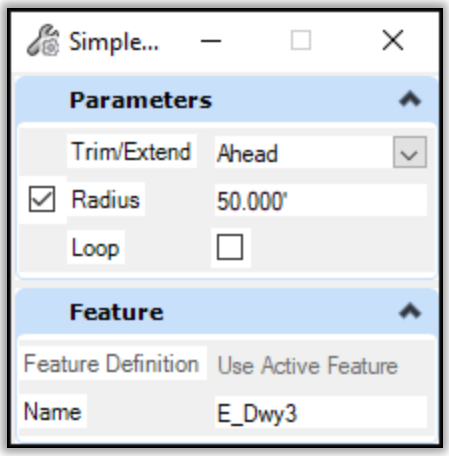


Figure 127 – Left driveway curb return using simple arc

5. Repeat Step 13 for Right edge of Driveway with following parameters.

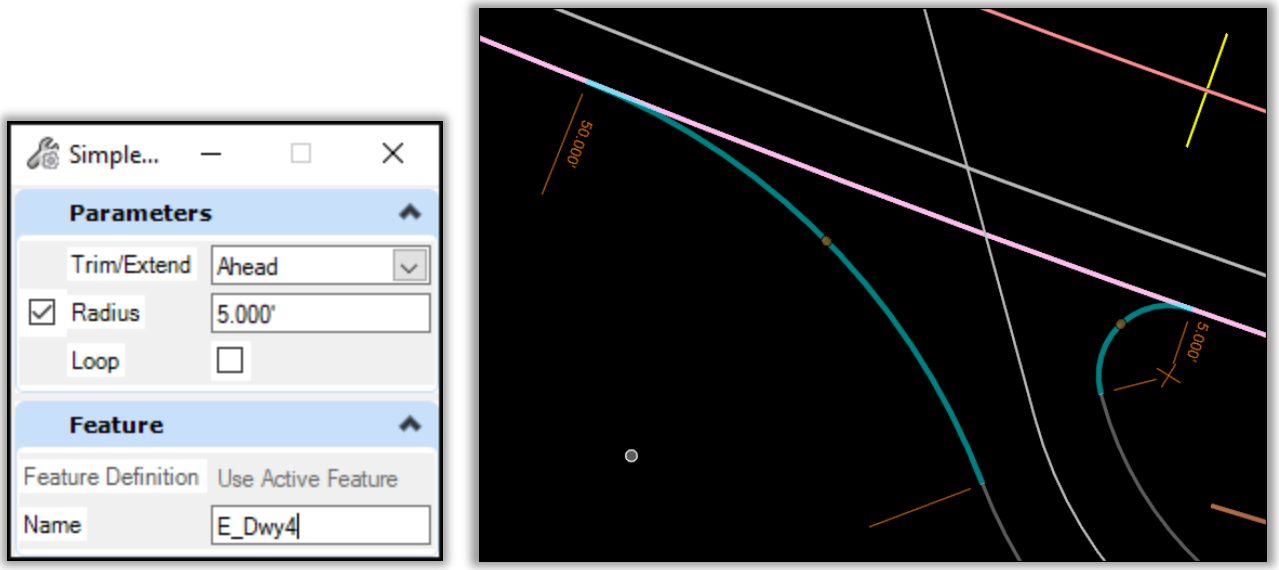


Figure 128 - Right driveway curb return using simple arc

8.3 Create the Lip Geometry

Once the Horizontal Driveway layout is complete, profiles need to be created. The profiles of the Driveway should tie to EOR and with a 1 ½" vertical lip.

1. Create horizontal geometry for the driveway lip. From **Geometry Tab > Horizontal group** select **Offsets and Tapers** dropdown **> Single Offset Partial**.

   Offset: ***- 1 ft*** (We will change this to -.001, once profile is assigned to this line.)
   Name: ***Dwy_Lip1***
   Locate Element: main Corridor (CL_Route140) **EOR_rt**
   Start Distance And Offset: Keypoint Snap to left edge of **Driveway E_Dwy3**
   End Distance And End Offset: Keypoint Snap to Right edge of **Driveway E_Dwy4**
   Mirror : ***NO***

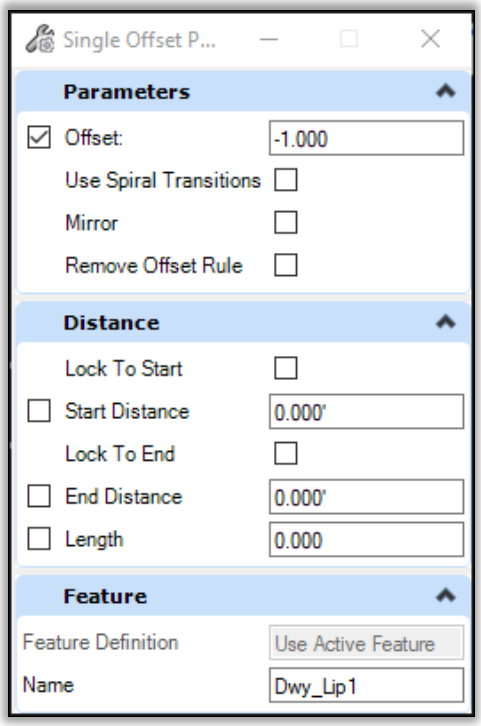


Figure 129 – Single Offset Partial for driveway lip

2. Create the profile driveway lip line. From **Geometry Tab > Vertical** group select, **Element Profiles** dropdown **> Profile By Vertical Offset From Element**.

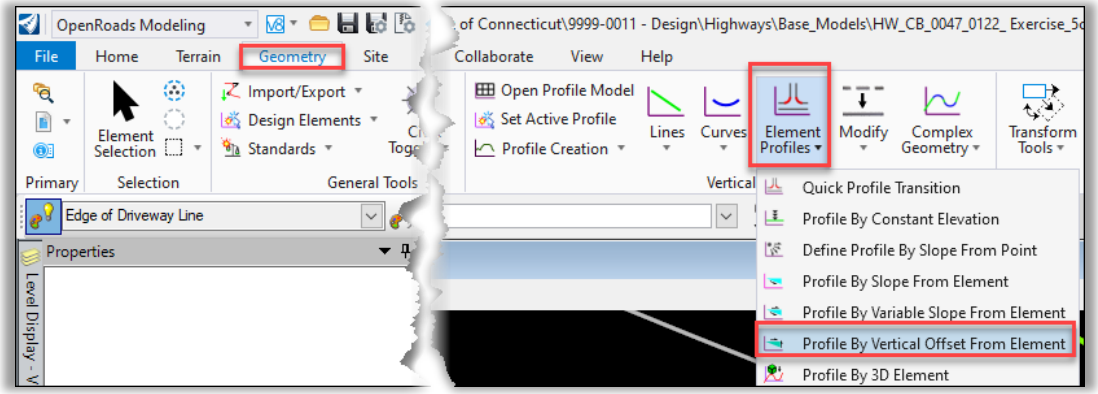


Figure 130 – Profile by Vertical Offset from Element

Slope Style: ***Constant***
Locate Plan Element to Profile: **Dwy_Lip1**
Locate Reference Element: Select main Corridor (CL_Route140) **EOR_rt**
Vertical Offset: ***0.125 ft (1 ½ in)***

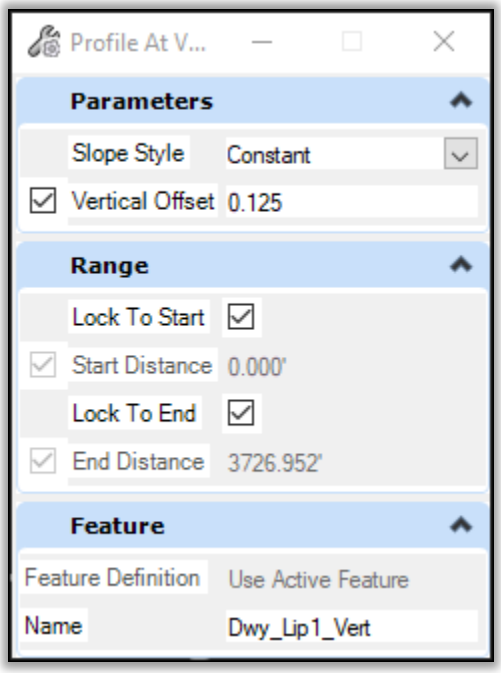


Figure 131 – Vertical offset set to 0.125

You can now verify the profile for ***Dwy_Lip1*** by using any **View** using **Open Profile Model** command.

8.4 Create the Driveway Profile

1. Display the Main Corridor EOR and Driveway Lip in Driveway CL Profile. Open Profile Model for Dwy CL (Russo Dwy). From **Geometry Tab > Vertical group > Profile Creation** dropdown **> Profile Intersection Point**.

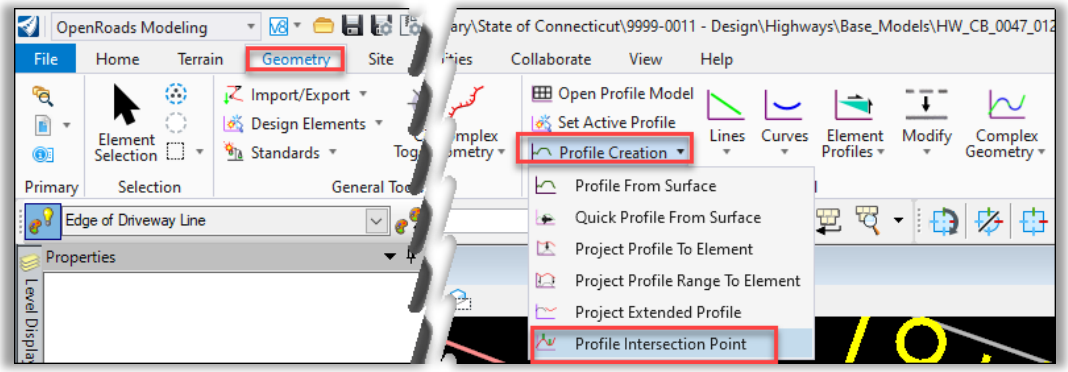


Figure 132 – Point Intersection Point tool

Locate Element to Show Intersection : **Russo Dwy**
Locate Element Which Intersects: **Dwy_Lip1**, **EOR_rt** (SHDR_rt and CL_Route140 if needed)
Reset

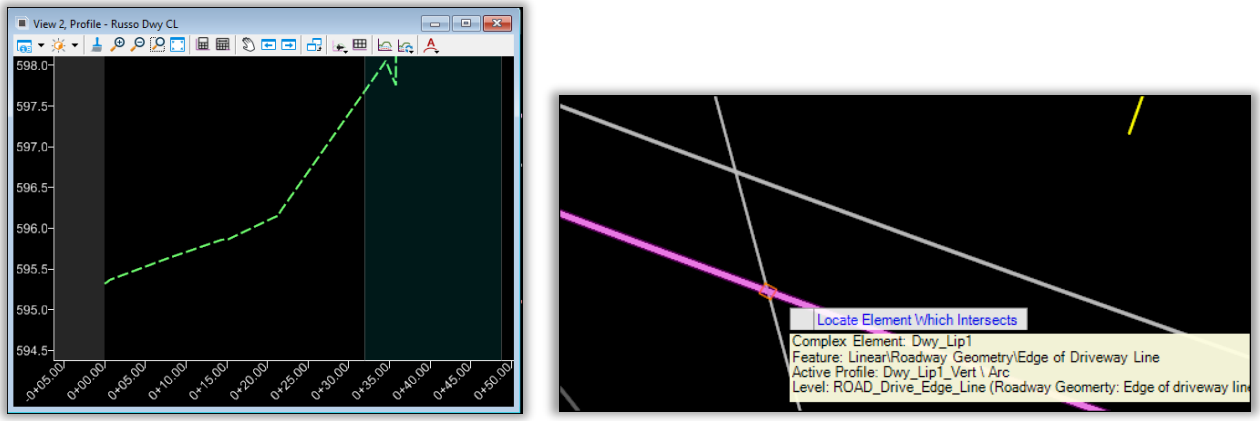


Figure 133 – Intersection points added to profile

2. Change offset of ***Dwy_Lip1*** to ***-0.001***. EOR and Dwy should match, but if the offset is 0, during triangulation there will be vertical face which we want to avoid.

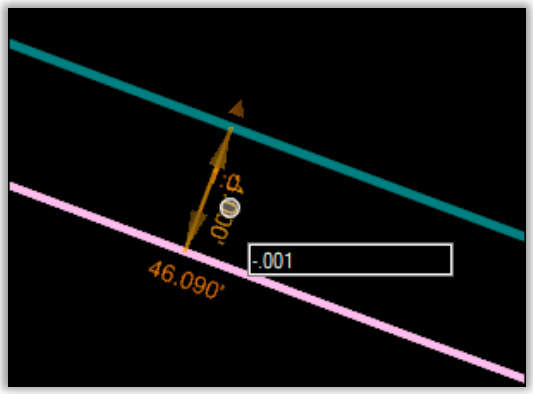


Figure 134 – Dwy_Lip1 offset adjusted to -0.001

3. Check the profile of **Russo Dwy**.
   Red Dot: CL_Route140
   Grey Dot: SHDR_rt
   Pink Dot: EOR_rt
   Magenta Dot: Dwy_Lip1

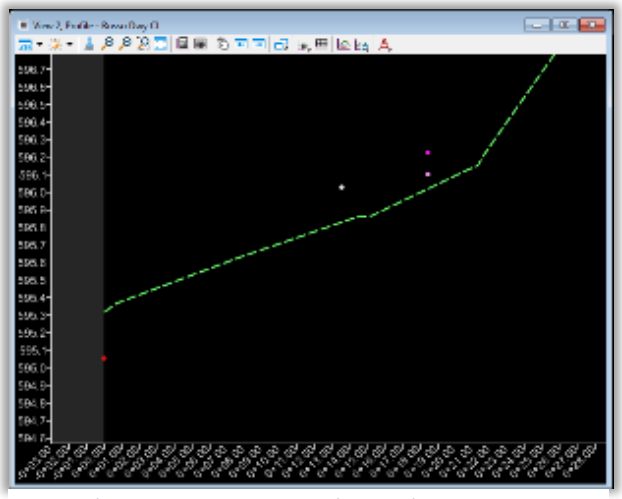


Figure 135 – Intersection points shown

1. From **Geometry Tab > Vertical group > Lines** dropdown **> Profile Line Between Points**.

   Enter Start Point: Snap to **Magenta Dot Dwy_Lip1**

   Enter End Point: Snap to **Existing ground**. (Slope and Limits of Driveway is left to the designer to practice)

2. Activate the Driveway Profile once completed.

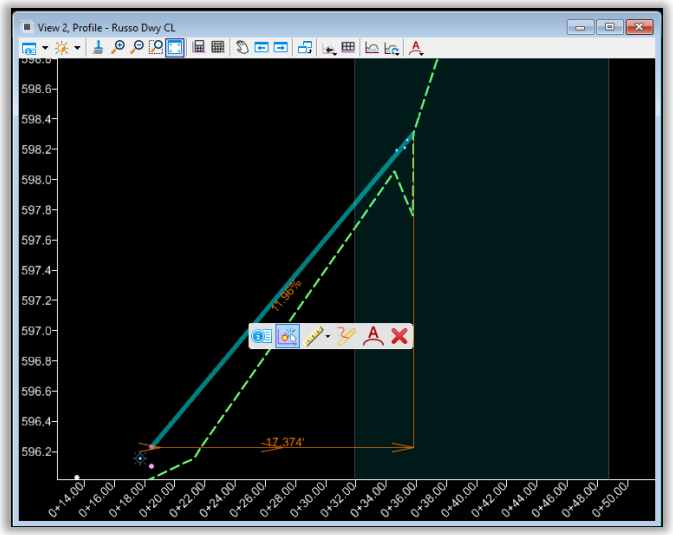


Figure 136 – Activate the profile

3. If ***CL_Route140*** corridor changes, Driveway profile will also automatically update.

Exercise 9 – Geometry for XSC Crossing Points

This exercise will cover the creation of Non-Centerline Geometry such as Flood Lines, Water Marks, Wetlands and ROW lines. There are two tables below listing the Feature Definitions and point labels that will appear in Cross Section Sheets for Crossing linear features:

- **Geometry Features** create using the Place Geometry Tools
- **Breakline Features** that are created from running a roadway template on a corridor, Linear Template, or Surface Template.

Note: *This exercise will cover the placement of* ***Geometry Features****, the creation of Roadway Breadlines will be covered in Volumes 3.2 and 3.3.*

Table 9-1 -Geometry Features for XSC Crossing Points

Feature Definition	XSC Crossing Point Annotation
Imported Existing\Existing BCLC	*EX. BCLC*
Imported Existing\Existing BCPC	*EX. BCPC*
Imported Existing\Existing Building	*EX. BUILDING*
Imported Existing\Existing Concrete Curb	*EX CONC. CURB*
Imported Existing\Existing Edge of Road	*EX. EOR*
Imported Existing\Existing Fence	*EX FENCE*
Imported Existing\Existing Granite Curb	*EX. GRANITE CURB*
Imported Existing\Existing Granite Sloped Curb	*EX GRANITE SLOPED CURB*
Imported Existing\Existing Noise Wall	*EX. NOISE WALL*
Imported Existing\Existing Road CL	*EX. CL*
Imported Existing\Ruins	*EX. RUINS*
Imported Existing\Existing Stone Wall	*EX. STONE WLL REMAINS*
Imported Existing\Existing Walk	*EX. WALK*
Right of Way\Existing\Easement Line	*EX. EASEMENT*
Right of Way\Existing\Interior Non-Access Highway Line	*EX. HIGHWAY LINE*
Right of Way\Existing\Location Survey Highway Line	*EX. HIGHWAY LINE*
Right of Way\Existing\Non-Access Highway Line	*EX. HIGHWAY LINE*
Right of Way\Existing\Street Line	*EX. STREET LINE*
Right of Way\Existing\Unlimited Access Highway Line	*EX. HIGHWAY LINE*
Watercourses\100 Yr Flood	*100 YR FLOOD PLAIN*
Watercourses\500 Yr Flood	*500 YR FLOOD PLAIN*
Watercourses\High Tide Line	*HTL*
Watercourses\High Water Line	*MHW*
Watercourses\Low Water Line	*MLW*
Watercourses\Ordinary High Water Line	*OHW*
Watercourses\SCEL	*S.C.E.L.*
Watercourses\Existing Water Edge	*EX. WATER EDGE*
Watercourses\State Wetland	*WETLAND LIMIT*

Watercourses\State Federal Wetland	*WETLAND LIMIT*
Right of Way\Proposed\Acquisition Line	ACQUISITION LINE
Right of Way\Proposed\Defined Easement Line	EASEMENT LINE
Right of Way\Proposed\DROW Line	EASEMENT LINE
Right of Way\Proposed\Slope Easement	EASEMENT LINE
Right of Way\Proposed\Temporary Work Area Line	EASEMENT LINE

Table 9-2 Breakline Features for XSC Crossing Points

Road CL	"Elevation"
Shoulder	SHDR
Travelway	TRWAY
Edge of Road	EOR
Walk Concrete	EOSW

9.1 Create Line Work

1. Select the **Browse** icon, browse to ***Highway/Base_Models,*** select ***HW_CB_0047_0122_Exercise_9_CrossingFeatures_Existing.dgn***
2. In the Plan View set the **Existing Ground Active**.
3. In the view window into **Stations 114+00 to 120+00**.

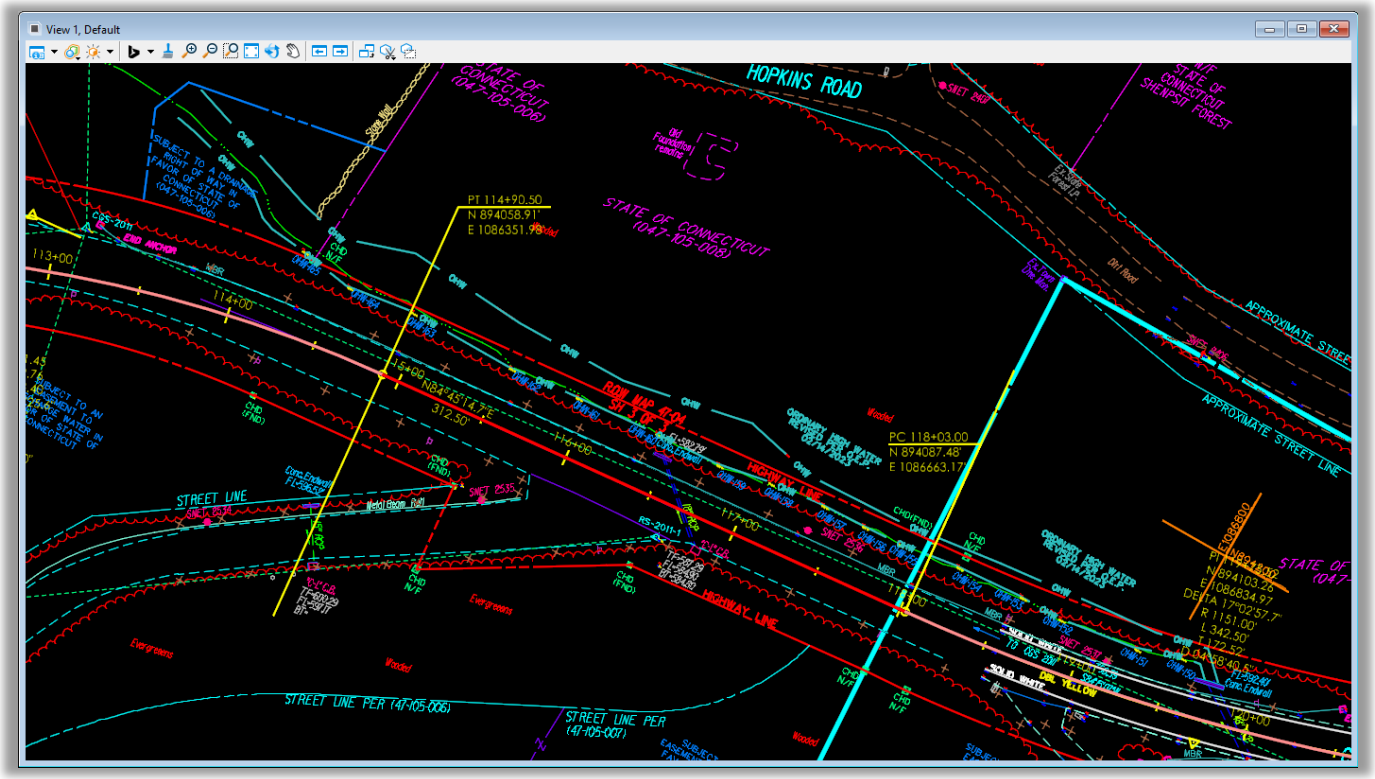


Figure 137 – View of Stations 114+00 to 120+00

4. Use the MicroStation **Copy** tool to copy in the two OHW lines from the Reference File.

   Note: *For graphics that are just plain lines the* **Copy** *command is the desired tool for this. For civil features in reference files, it would be better to trace over the line work using the* **Place Line String** *command.*

5. Select the two lines. In the **Properties** dialog, **extended** section adjust the Line Style Parameters to ***1.0***. ***Note:*** *This ground file was created a v8i so the scale needs to be adjusted.*

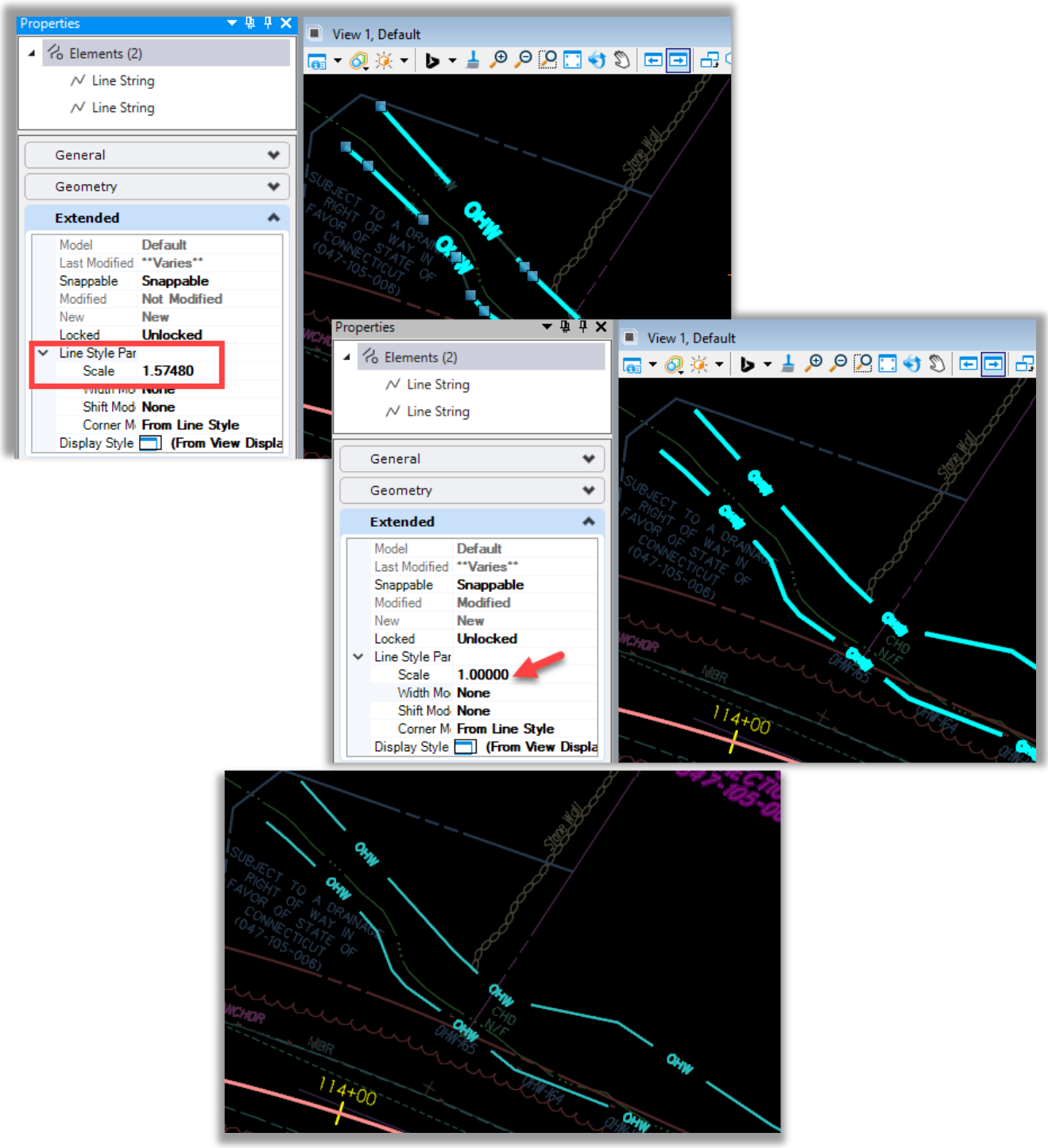


Figure 138 – Adjust Line Style Parameters

9.2 Create Feature

1. Set the **Feature Definition** to ***Linear > Roadway Geometry > Watercourses > Ordinary Highwater Line***.

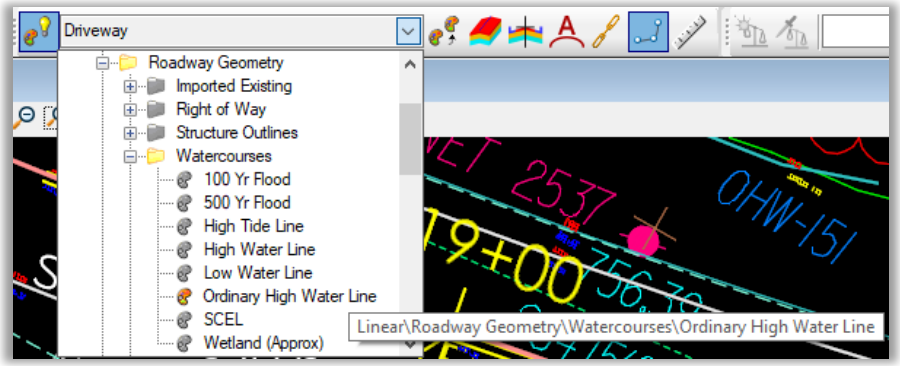


Figure 139 – Select Feature Definition

2. On the **Geometry** tab, **General Tools** section select **Set Feature Definition**.

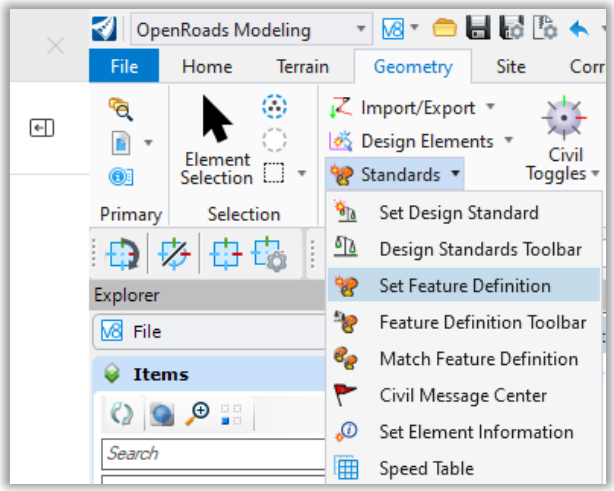


Figure 140 - Set Feature Definition Tool

8. Set the Feature Type to ***Linear***

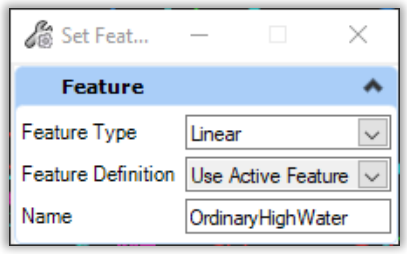


Figure 141- Set Feature Definition

9. In the view select the **Top Ordinary Highwater Line** and follow the prompts to add the Feature Definition, repeat to the **Bottom Ordinary Highwater Line**.

9.3 Create Profile

1. Hover over and select the new Geometry, a menu will pop up, select **Open Profile Model**, select a view.

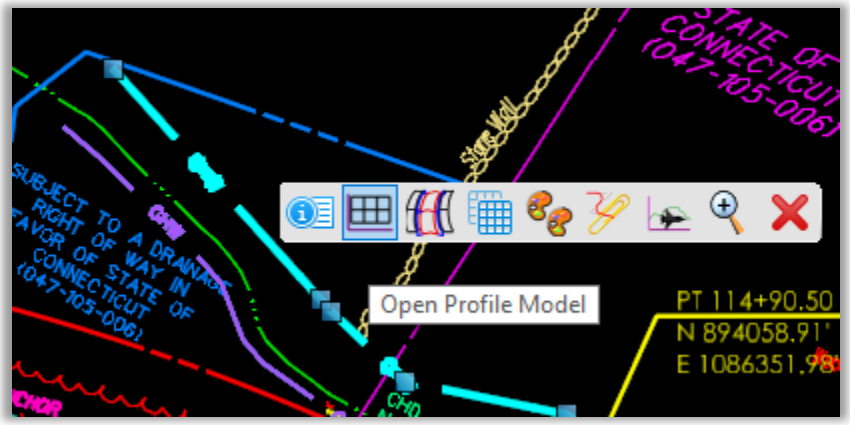


Figure 142 – Open Profile Model

2. In the Profile View, hover over the **Existing Ground** dashed line and select **Set As Active Profile**, this will make the existing ground the profile.

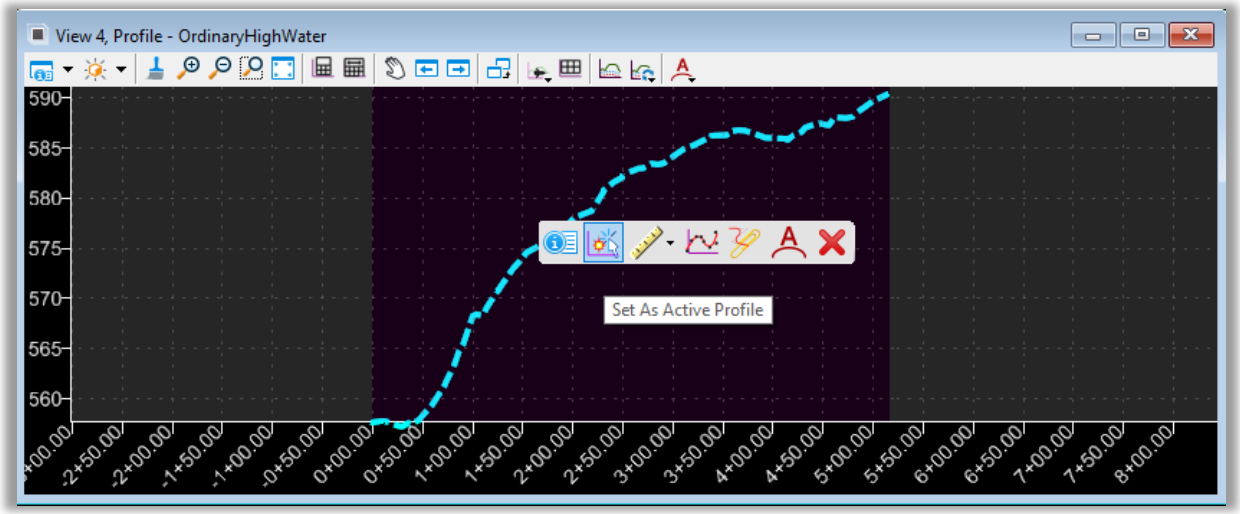


Figure 143 – Set As Active Profile

3. Repeat for the other line.

4. Open a file that has a corresponding Corridor Model ***Highway > Base_Models > HW_CB_0047_0122_Corridor_Route140.dgn*** and view the dynamic cross sections. Right click in View 1, Default and select, **View Control > Plan/ XS / 3D**.

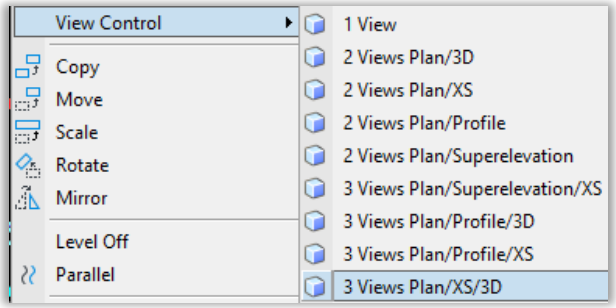


Figure 144 - Select View Control

5. Select **Ok** to create a Dynamic View.

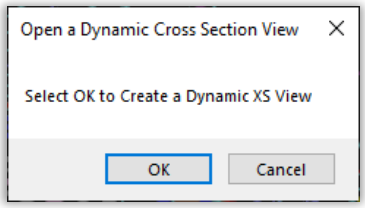


Figure 145 – Select Dynamic XC View

6. Locate the corridor (not an alignment, the alignment Method will not show the Crossing Points), then select the View.
7. Enter or click to the station 114+20 to view the crossing points.

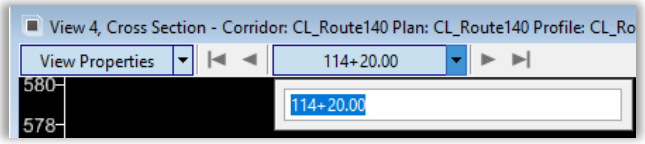


Figure 146 – Set Station

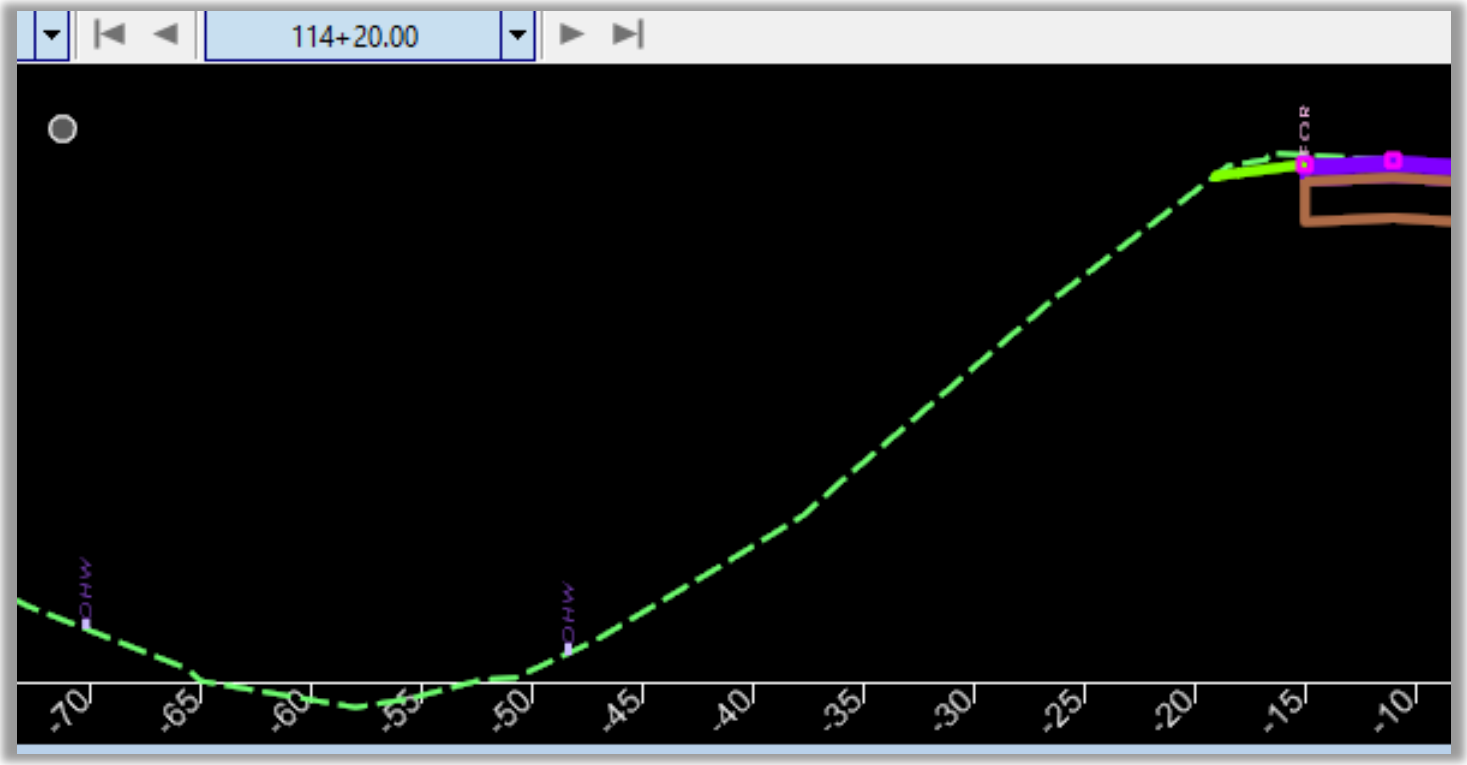


Figure 147 – Dynamic Cross Section showing Crossing Points

8. When you create a file for Cross Section Sheets, these Points will annotate.

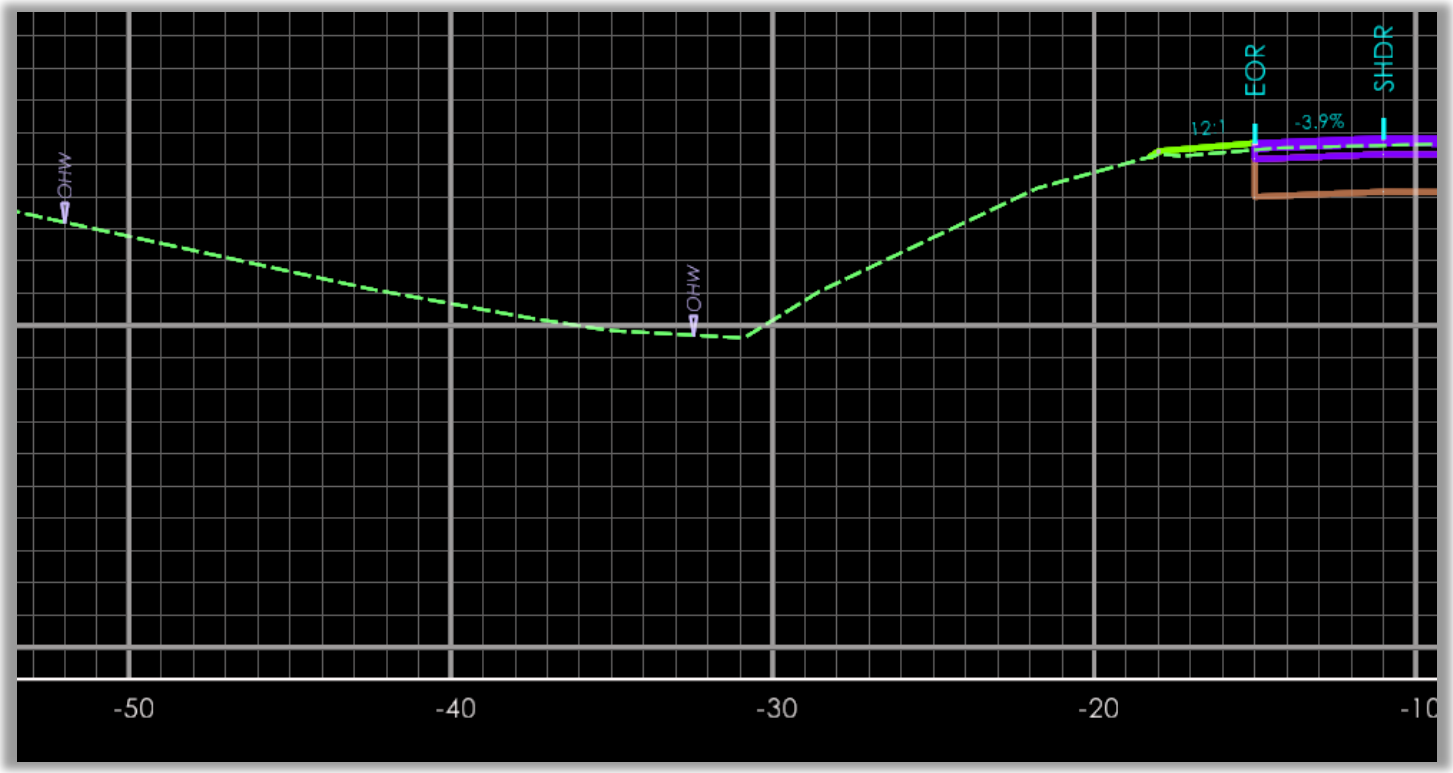


Figure 148 – Cross Section Sheet Annotation

Dataset Install for Self-Paced Training

The training data set is stored in SharePoint for those doing self-paced training.

1. In **Microsoft Edge** browse to: DOT CTDOT_DDE - Training Datasets - All Documents
2. Click on **Training Data Sets** and select **Volume 3_1**. Click on the three dots **...** and select **Download**.

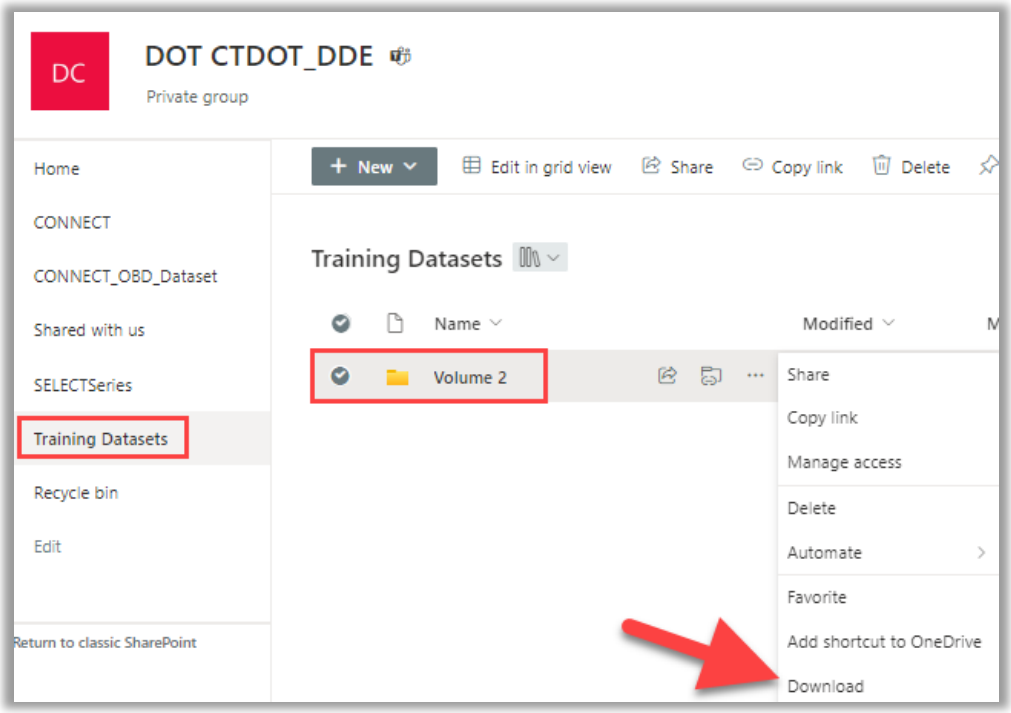


Figure 149 - DDE SharePoint Page - Download Training Dataset

3. **CTDOT employees –** In File Explorer under **This PC** browse to **Downloads** and copy the ***Active_Survey,*** and ***Highways*** folders to your Non-Project Work Area.

   C:\|Users\|yourname\|OneDrive - State of Connecticut\|CAD_NonProjects\|Design\|

   Consultants or those who would like to work outside of one drive can create a working folder on their computer.
4. When launching the application In CAD Accounting use the ***Non-Projects*** option for Run Program.

Appendix

Civil Accudraw

Placing elements in a 2D model is like manual drafting — all elements appear on the same plane, the sheet of paper.

- In 3D, you place elements in space — horizontally (for example, a floor), vertically (for example, a wall), or at any other angle or direction (for example, a sloping roof).
- By default, data points in a 3D model are placed at the view's Active Depth. Where you snap a tentative point or place a data point in a blank part of a view, it will be located at the active depth. You can, however, snap a tentative point to an existing element at any depth in a view. When you accept such tentative points, the data point is placed at the level of the snap point.

Civil AccuDraw and its drawing plane let you place elements away from the active depth. Often this improves productivity, since you need not constantly change the active depth.

Civil Accudraw is activated by selecting the Civil Accudraw icon from the geometry tab as shown below.

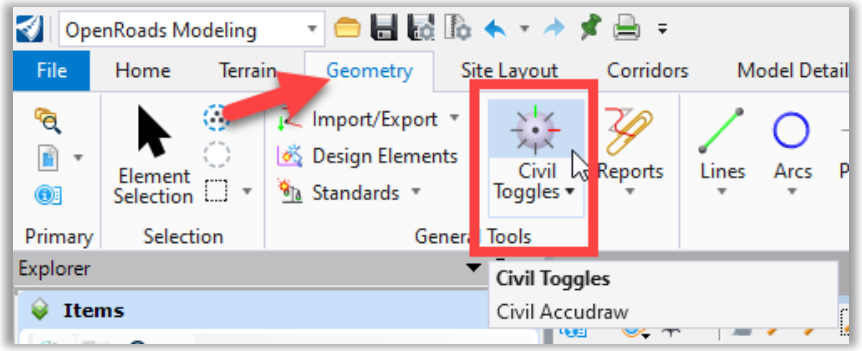


Figure 150 – Ribbon Location of Civil AccuDraw

The first icon is used to turn Civil AccuDraw on or off.

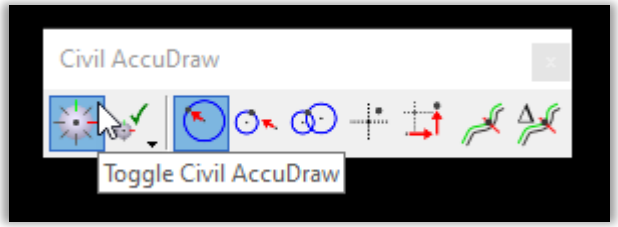


Figure 151 - Civil AccuDraw Toolbar

Civil AccuDraw performs many of the same functions as MicroStation AccuDraw but has greatly expanded capabilities for the civil designer.

Warning: *Simultaneous use of Civil AccuDraw and MicroStation AccuDraw will cause errors. Close MicroStation AccuDraw when using Civil AccuDraw.*

Civil AccuDraw Settings

Civil AccuDraw Settings are accessed by selecting second icon as shown below.

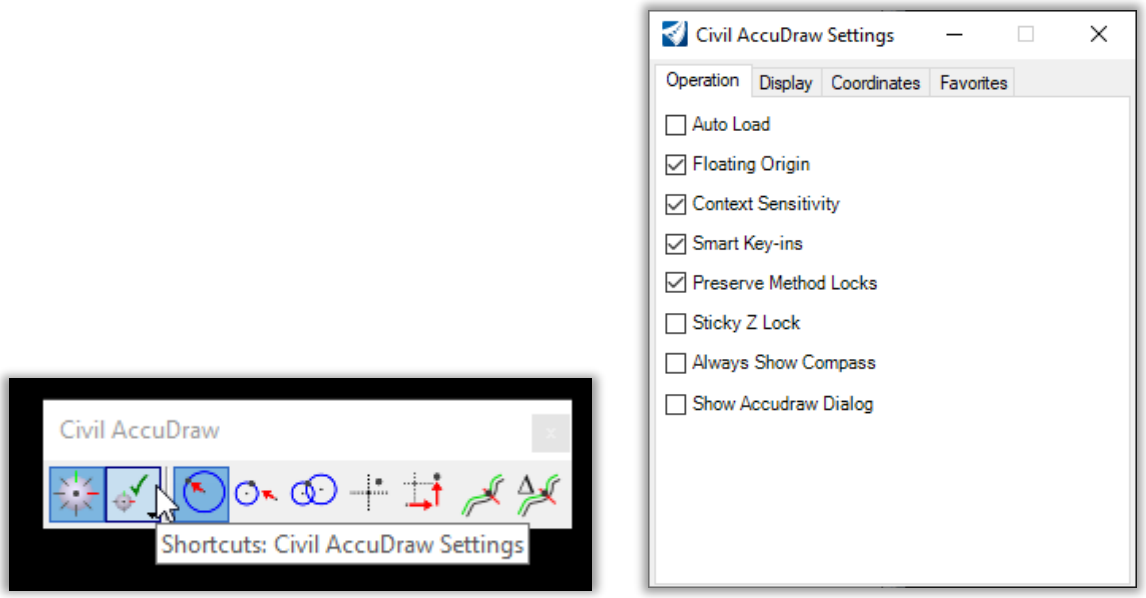


Figure 152 - Civil AccuDraw Settings

Auto Load – Toggle this option ON to automatically load Civil AccuDraw.

Floating Origin - *CTDOT recommends turning this option off.*

ON: the origin moves to the last point placed. OFF: the origin remains fixed.

Context Sensitivity - *CTDOT recommends turning this option off.*

ON: the compass rotates in response to the context of various tools.

Smart Key-Ins -

ON: Civil AccuDraw interprets a number as positive or negative, depending on the direction of the pointer from the compass.

XY ordinates only: Smart Key-ins cause Civil AccuDraw to move the focus to either the x or the y field depending on the pointer position.

Preserve Method Locks -

ON: the locked values remain locked after switching the ordinate methods. For example, using station-offset ordinates and a lock station of 1+00, switch to distance-direction ordinates. Station 1+00 will remain locked while inputting distance-direction. The resulting effect will be a distance-direction-stationlock.

Sticky Z Lock -

ON: inputs to Z ordinates remain locked (sticky) until they are changed. This is useful in a 3D DGN to control the Z ordinate. For example, input 100.00 for the Z ordinate and the value remains constant until changed.

OFF: The Z ordinate follows the cursor dynamics.

This also controls whether the origin for delta Z measurements follows the XY origin or is independent of XY.

ON: the origin for delta Z is completely independent of the XY origin. For example, the user can set the origin for dXdY measurements from point A and set dZ to be measured from a second point B. The Z origin does not change until reset by the user. The effect will be apparent when drawing a linestring. When drawing a linestring, the dynamic orientation of the compass will adjust to align with the most recent line segment. The Z origin will remain fixed wherever the user placed it at in the beginning.

Note: When Accudraw ordinates are set to X,Y the sticky Z toggle does not apply. This is because, by definition, XY mode is always assumed to be absolute.

Always Show Compass -

ON: the compass is always visible.

OFF: the compass is only visible when the appropriate input is required.

Civil AccuDraw Tools

Hold down the second icon to reveal the shortcut menu shown below.

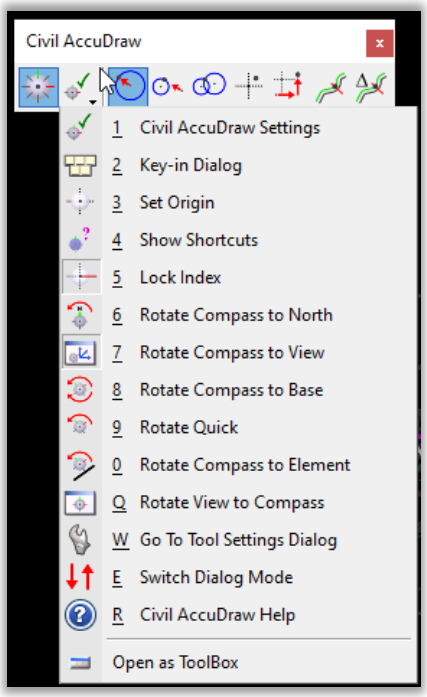


Figure 153 - Civil AccuDraw Tools

XY Tool

When the **XY** mode is selected and a civil command is active, the coordinates of the current cursor position are displayed in a floating dialog as shown below.

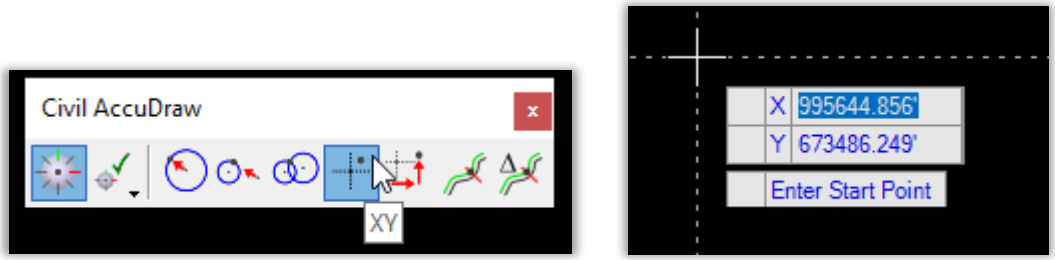


Figure 154 - Civil AccuDraw XY Tool

- The **Tab** key is used to move through the key-in fields in the dialog.
- Values entered in the floating dialog are locked when the Enter key is pushed.
- To unlock a value, tab to the field and push the End key.

Civil AccuDraw Compass and Curser Input

When the **Always Show Compass** setting is toggled on, a compass is displayed at AccuDraw's origin point when Civil AccuDraw is active.

The compass is always circular and is marked by a number of tics. The default is 4 compass points which can be changed in the settings.

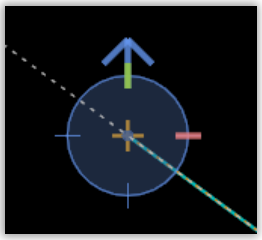


Figure 155 - Civil AccuDraw Compass

The north arrow on the compass will always point to north as defined by selecting **File > Settings > File > Design File Settings > Angle Readout**.

If the *Civil AccuDraw Settings* dialog (shown above) has the **Context Sensitive** option turned on (default), then the compass auto-rotates in a similar fashion to MicroStation AccuDraw:

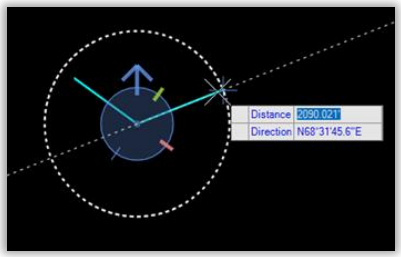


Figure 156 - Civil AccuDraw curser input

- The **Distance-Direction** ordinate is used to enter points in polar coordinates as shown above.
- The input for angle and direction fields follows the **File > Settings File > Design File Settings > Angle Readout** settings.
- Note that rather than direction being shown, the label and value are now an Angle. This is because the context is based on the direction of the preceding line segment rather than an absolute direction.
- The compass can be rotated with the **V, B, T, RQ, RE** shortcuts.
- **V** rotates the drawing plane to align with the view axes.
- **T** rotates the drawing plane to align with the axes in a standard Top view.
- **RQ** is used to quickly and temporarily rotate the drawing plane.
- **RE** rotates the drawing plane to match the orientation of a selected element.
- Use the **T** (Top) shortcut or the corresponding drop-down to return to a pure direction.

Station Off-set

The **Station-Offset** ordinate is used with a reference element to enter information as a station and offset relative to a selected element.

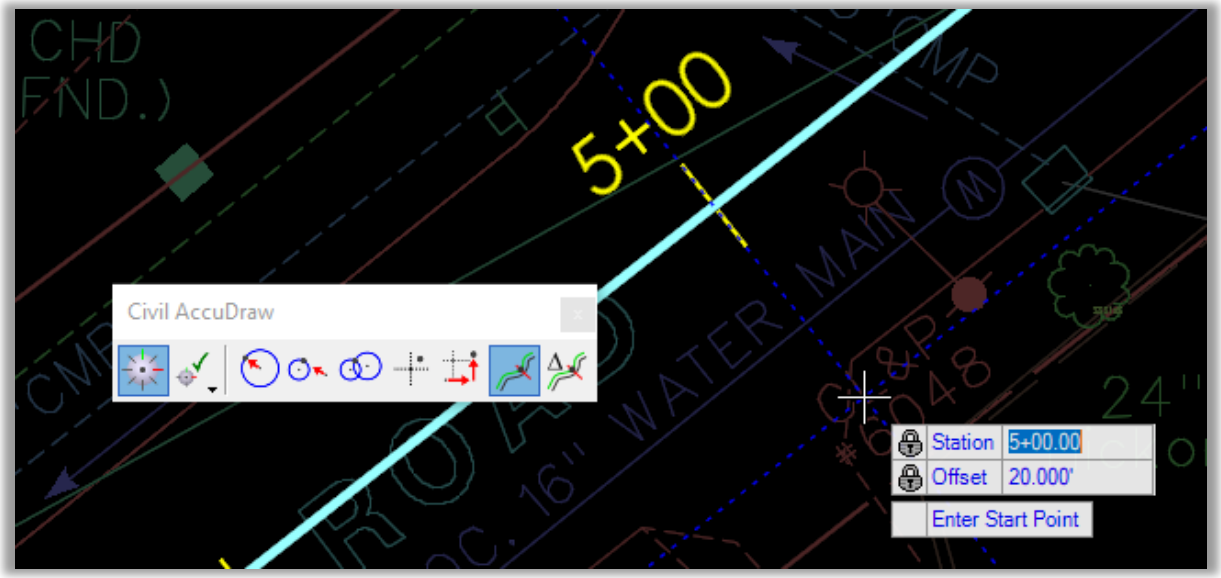


Figure 157 - Civil AccuDraw Station Off-Set

The reference element can be a MicroStation element or an ORD Geometry element. If a MicroStation element is selected, the beginning of the element is assumed to be station 0+00. If a civil element is selected with stationing defined, the station value of the selected element is used.

Take the following steps to select the reference element with the **Station-Offset** ordinate active:

- Tab to activate the **Offset** field that is floating on the cursor
- Enter the letter "**O**" shortcut to set the origin. You are prompted to select the reference element.

Once selected, data can be entered using station and offset values relative to the reference element as shown above.

Dynamic Tools

Geometry Rules

Civil Geometry elements drawn using the OpenRoads tools are "ruled" graphics that behave according to the geometric rules that define how the element was placed.

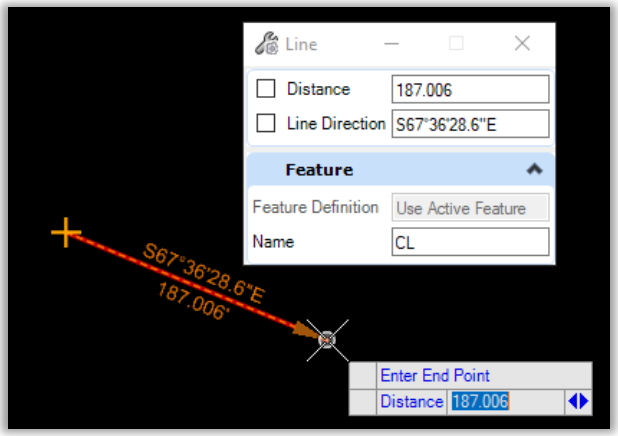


Figure 158 – Place Line Dialog

For example, a line drawn using the **Line Between Points** command has the following rules: **Distance** and **Line Direction** as shown below.

These parameters can be entered in the **Tool Settings** dialog, shown at right above, or by using the parameters floating on the cursor.

If you use the input field that floats on the cursor, the left and right arrow keys are used to switch between multiple parameters.

When a parameter value is entered, it is locked as shown below. The parameter can be unlocked by unchecking the item in the **Tool Settings** dialog, or by pressing the End key on the keyboard while the parameter value on the cursor has the keyboard focus.

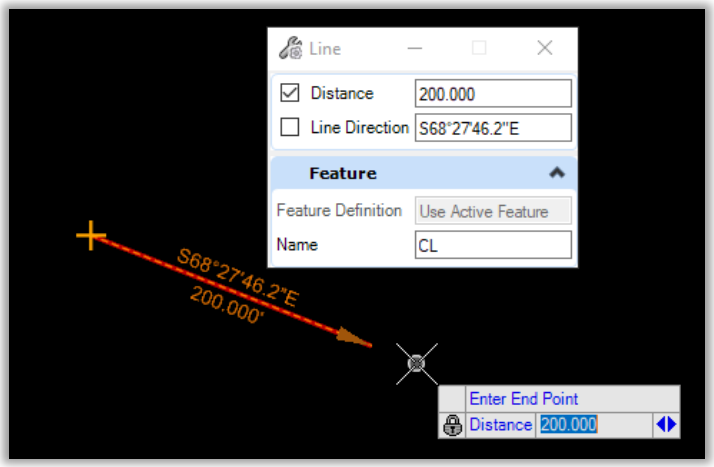


Figure 159 – Distance is locked

After a parameter value has been keyed in, use the left and right arrow keys, or the **Tool Settings** dialog to enter values for the remaining parameters.

Issue a data point (left-click) to place the element.

The rules can be reviewed and edited by using the MicroStation **Element Selection** tool to select the element. In the example below, the rules for the selected line are displayed.

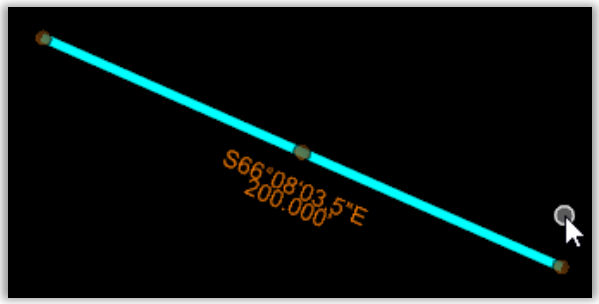


Figure 160 – Rules displayed

The rules can be edited by left-clicking on one of the parameters as shown below.

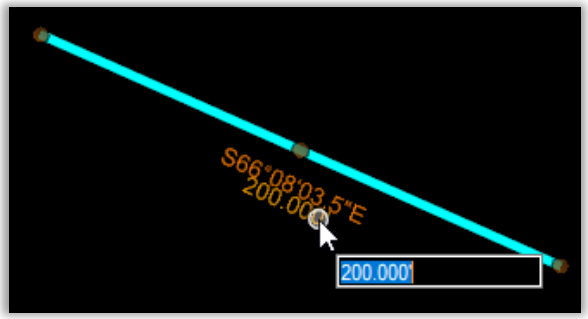


Figure 161 – Rules can be edited as shown

The rules for the selected element can also be reviewed and edited in the **Properties** dialog as shown below.

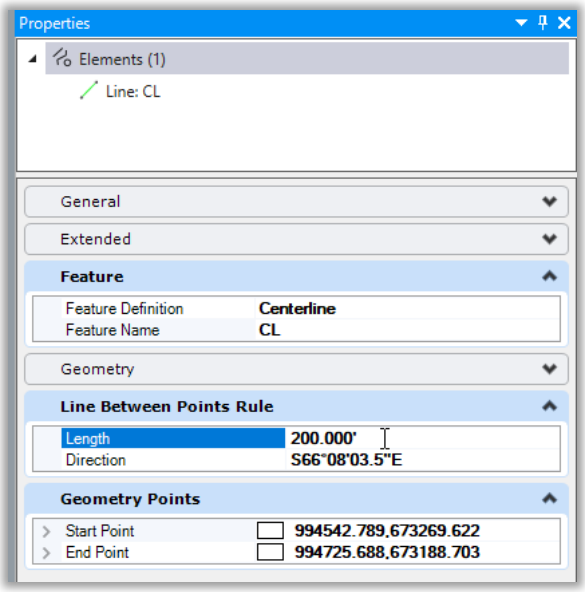


Figure 162 – Properties Dialog

MicroStation's **Manipulate** commands (Copy, Scale, Rotate, etc.) cannot be used on ruled geometry. The rule must be removed to use these commands.

To remove a rule, select the element and let the cursor rest on the selected element until the pop-up menu appears. Choose the **Rules** menu as shown below.

The following options are provided:

- Lock - Deactivate Rules
- Remove Rule
- Unlock - Activate Referencing Rules
- Lock - Deactivate Reference Rules
- Remove Rule

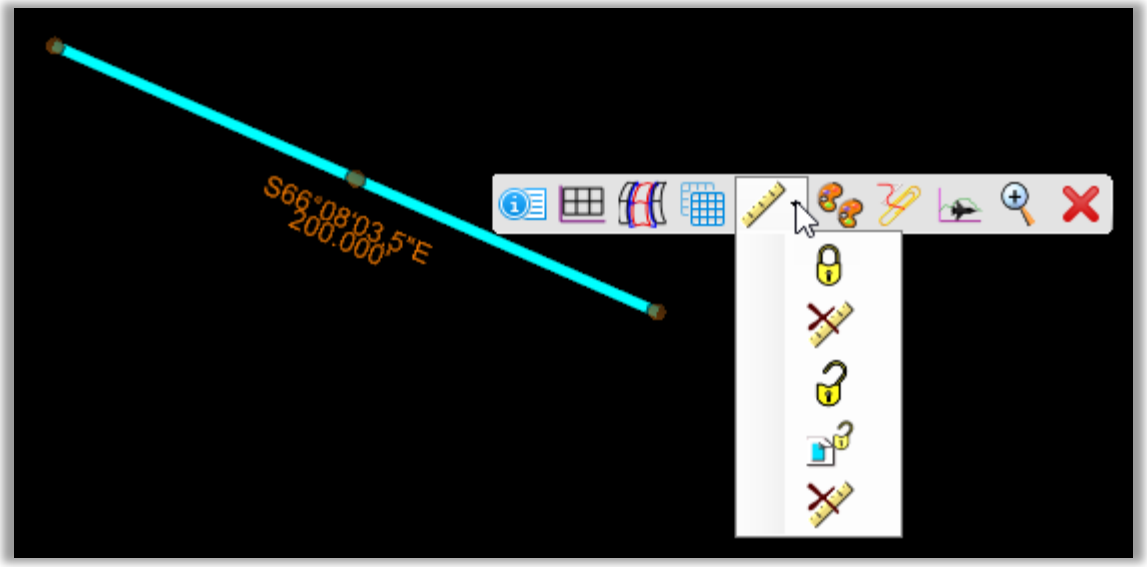


Figure 163 – Rules menu options

Element Manipulators

OpenRoads Geometry elements have **Manipulators** that are displayed in MicroStation when an element is selected. These manipulators can be used to edit the selected element graphically or by entering a value.

Clicking on one of the key-point manipulators will display direction arrows to edit the line, as shown on the example below.

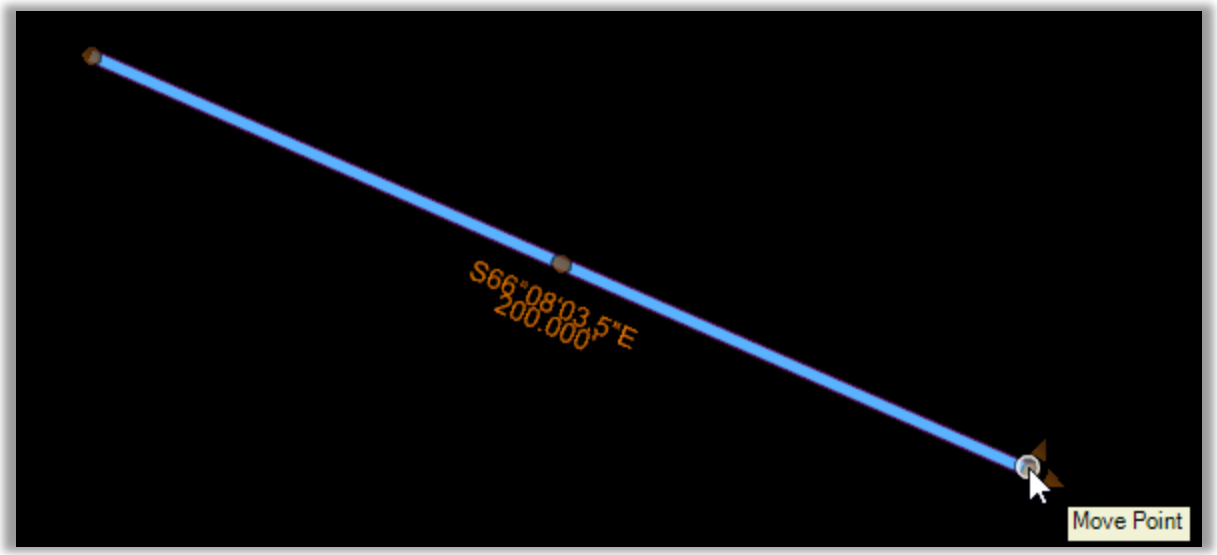


Figure 164 – Key-point manipulator at end of line

Tip: The size and color of the Manipulator Text can be adjusted in the **User Preferences**. From the MicroStation menu, select ***File > Settings > User > Preferences*** and then choose the **View Options – Civil** item on the left side of the dialog. The **Manipulator Size** or the **Manipulator Font Scale** parameters can be used to adjust the text size.

Snaps

As geometry elements are placed in the design, the elements are "ruled" to one another using snaps.

The most common snap is the Key Point snap. In the example below, the second line was placed using a Key Point snap. When the line is selected, the icon for the snap mode that was used is displayed.

If the first line is modified, the second line will maintain its relationship to the first line according to the Key Point snap rule.

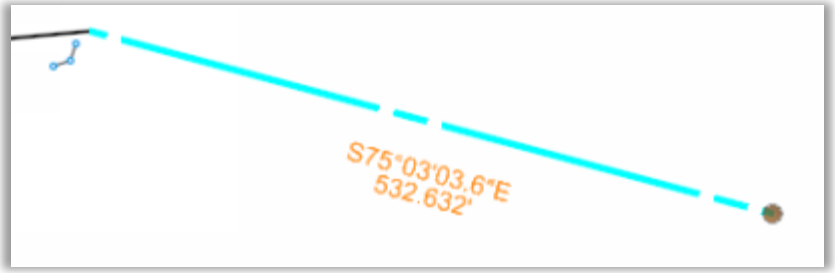


Figure 165 – Second line maintains its relationship if first is modified

Occasionally you may wish to create civil geometry elements that are not "ruled" to other elements. Turn off the **Persist Snaps icon** on the **Feature Definition Toggle Bar** to place civil geometry elements by snapping to other geometry without creating a rule.

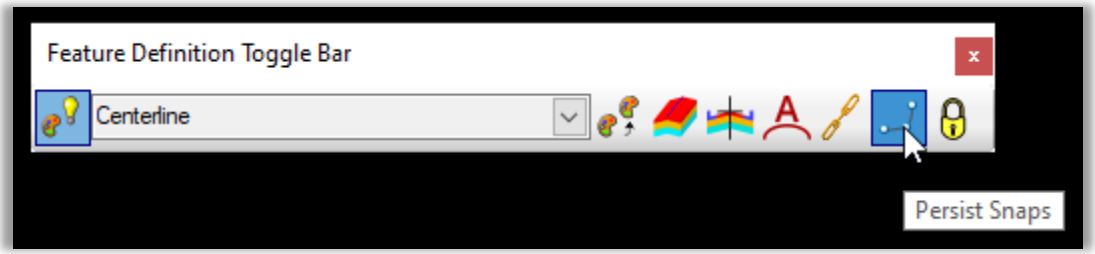


Figure 166 – Toggle Persist Snaps icon off

Design Intent

As geometric elements are drawn in MicroStation using the OpenRoads Horizontal Geometry tools, the software retains information about not only **what** element was drawn, but **how** it was drawn. This is referred to as the **Design Intent**.

In the example below, the horizontal line was drawn first. The second line was drawn using the **Perpendicular** snap to draw the line at a perpendicular form the horizontal line to a specific ending point.

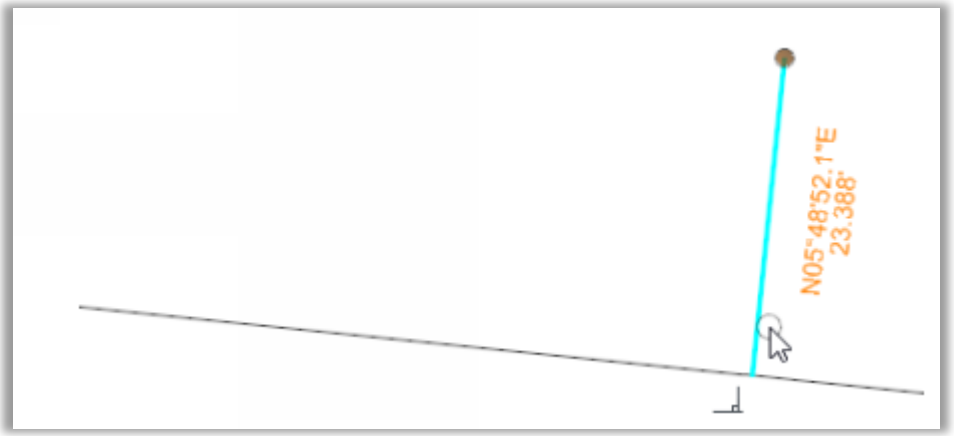


Figure 167 – Perpendicular line drawn

If the horizontal line is modified by changing the direction of the line, the design intent for the perpendicular line is preserved. The **Perpendicular rule**, and the ending location are preserved as shown below.

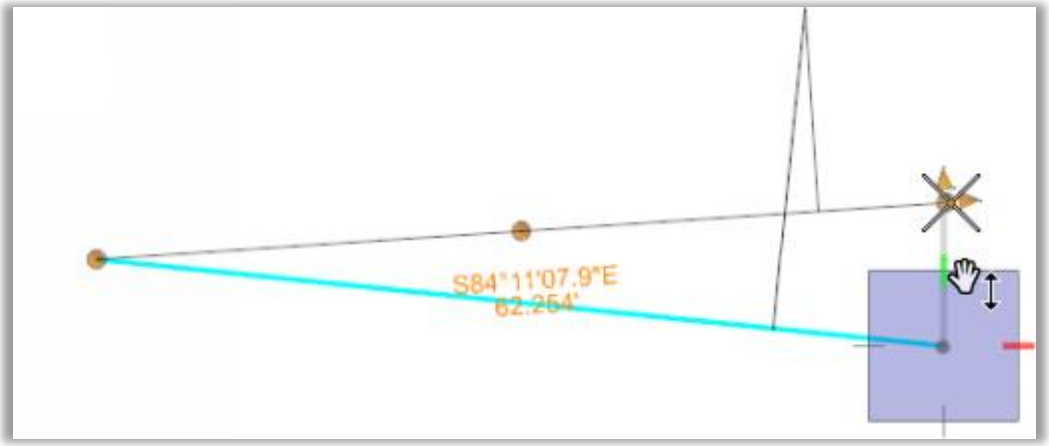


Figure 168 – Perpendicular rule intact even if original line modified

Editing Dynamic Text

When a civil geometry element is selected, and the various rules are displayed, some rules are shown in grey and cannot be edited by left-clicking on the text. To edit these rules, you must select the underlying geometry directly.

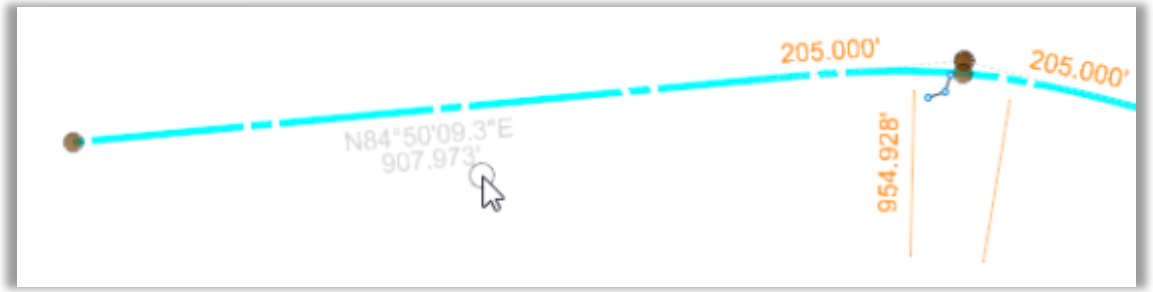


Figure 169 – Greyed out text cannot be edited

Take the following steps to select the underlying element.

Use the MicroStation Element Selection tool to select the geometry element • Right-click on the element that you wish to edit.

The underlying element is selected, and the associated rules can be edited as shown below.

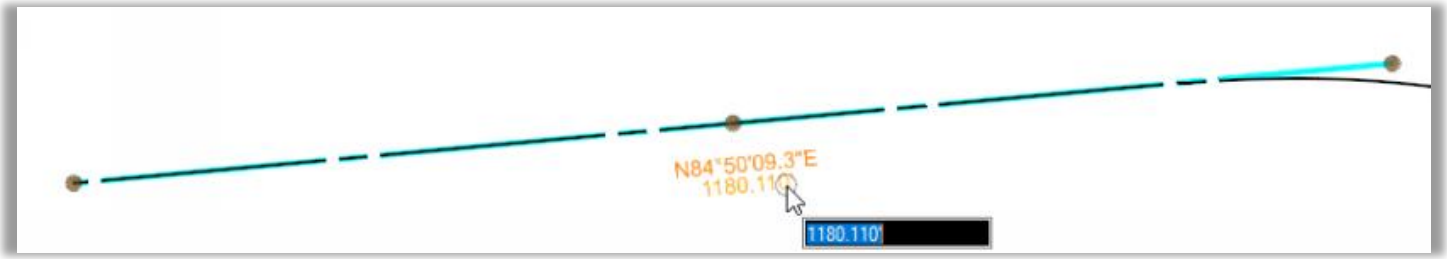


Figure 170 – Right clicking on the element allows you to edit it

Deactivating Rules

Geometry elements that have active rules can be selected, edited, and deleted at any time. Deactivating the rules will lock the element in place so that it cannot be edited or deleted unless the rules are reactivated. This is useful to lock an alignment in place once the design has been completed.

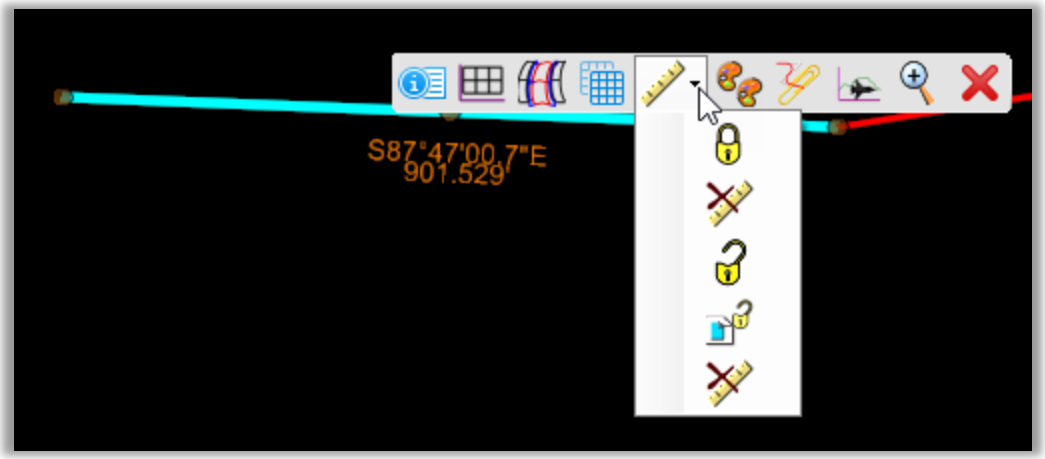


Figure 171 – Locking and Unlocking Options for geometry lines

To deactivate the rules on a given element, select the element and let the cursor rest on the element until the pop-up menu appears. Choose the **Lock – Deactivate Rule** option as shown below.

Design Standards

Design Standards are used to monitor various alignment parameters on OpenRoads geometry elements. The standards are stored in DGN Libraries in the following location:

...|CT_Configuration|Organization-Civil|_CT_Civil Standards - Imperial|Dgnlib|Design Standards

The design standards can be used for two purposes:

- Provide default values for element creation tools such as radius of a curve for a selected CTDOT standard.
- Check and report on the compliance of a geometric element with the design standard that has been assigned to the element.

When a design standard is violated, the user is notified in two ways:

- An icon is displayed on the graphics to indicate that there is a problem.
- The Civil Message Center reports any errors.

The **Design Standards Toolbar** allows you to select and apply a design standard. From the OpenRoads Modeling **Geometry** tab, select ***Standards > Design Standards Toolbar*** to access the dialog shown below. Design Standards can also be applied to an element after it has been created by using the Set Design Standard icon on the Design Standards Toolbar.

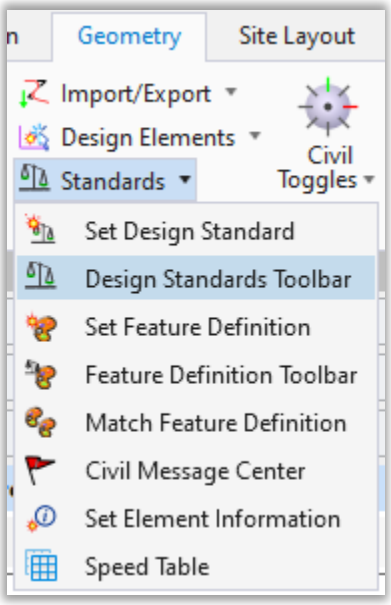


Figure 172 – Design Standards Toolbar

The toolbar contains a drop-down list to select the design standards and the design speed. The vertical design standard, displayed in the drop-down menu to the right, is automatically set when the horizontal design standards is selected.

There are two icons located to the left of the drop-down menus. The first, **Set Design Standard**, is used to apply the current design standard to selected geometric elements. The second, **Toggle Active Design Standard**, is used to set the selected design standards active for relevant commands.

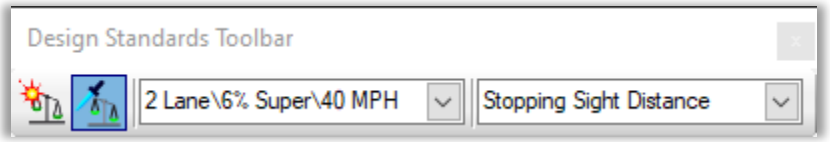


Figure 173 – Toggle Active Design Standard

Annotation Groups

Alignment elements are assigned a **Feature Definition**, which controls the symbology of the element (level, color, line style, and line weight) as well as the annotation properties of the element. The CTDOT Standards include feature definitions for alignments, which can be reviewed from the Project Explorer dialog, as shown below.

There are several levels of configuration that has been set to get the annotation to display to CTDOT standards.

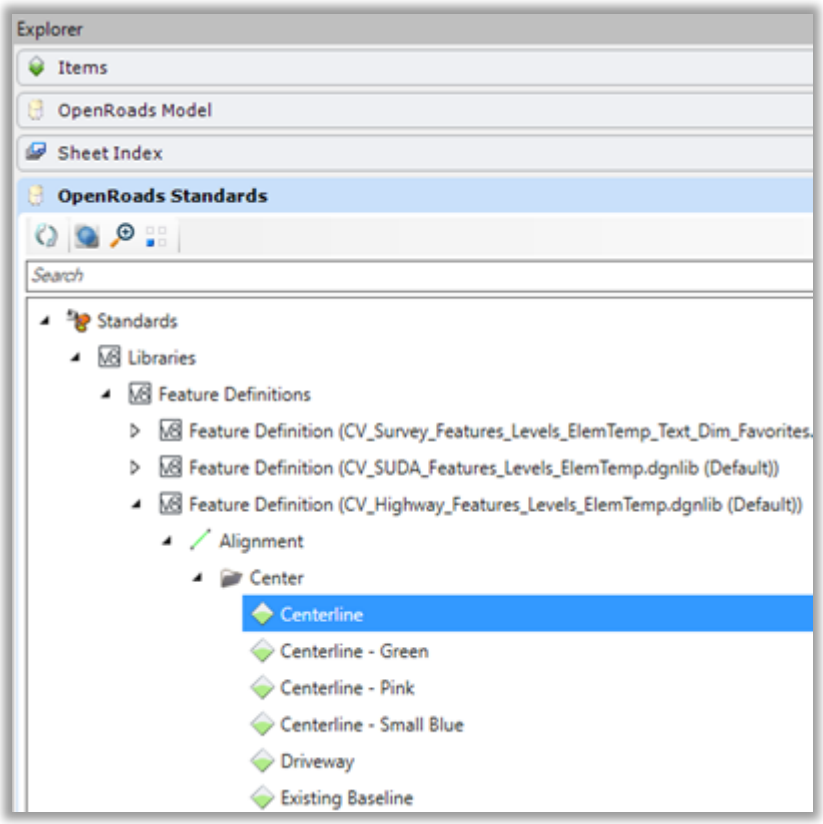


Figure 174 – CTDOT alignment feature definitions

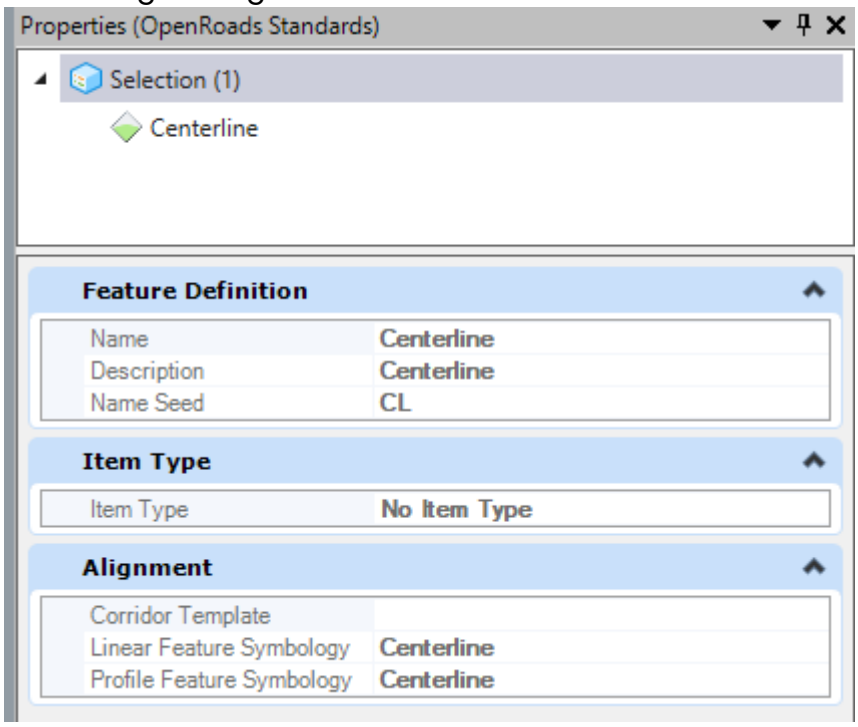


Figure 175 – Centerline feature definition properties

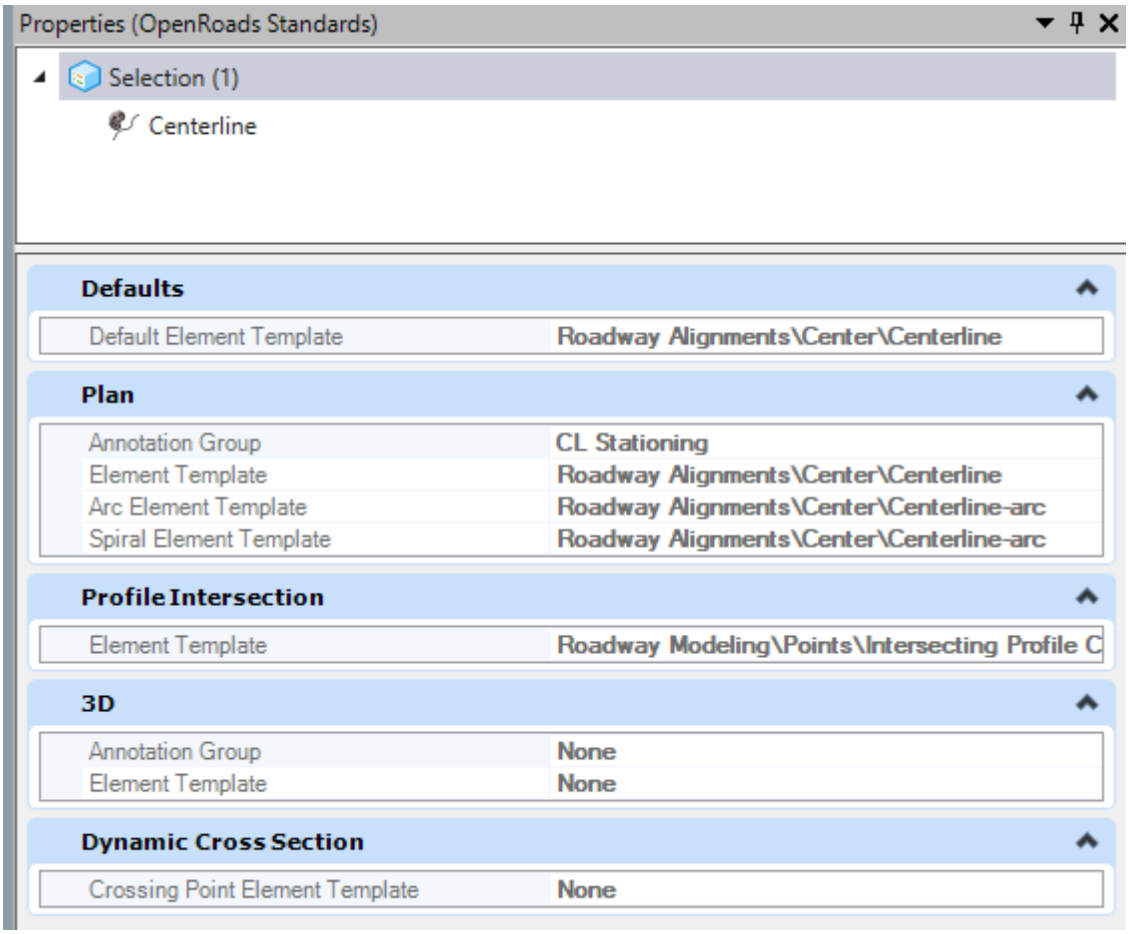


Figure 176 – Centerline feature defaults and templates

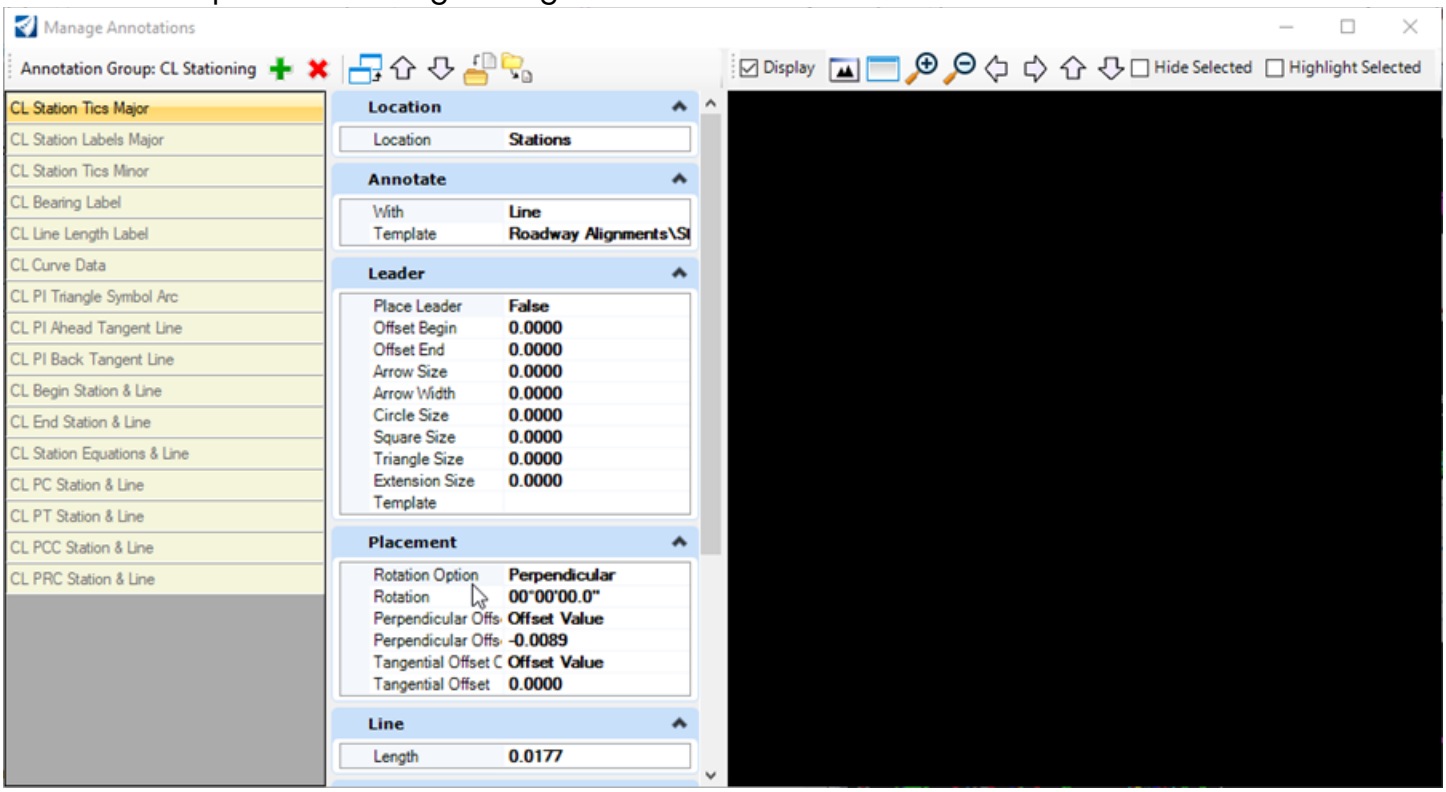


Figure 177 – Centerline Stationing Annotation Group settings

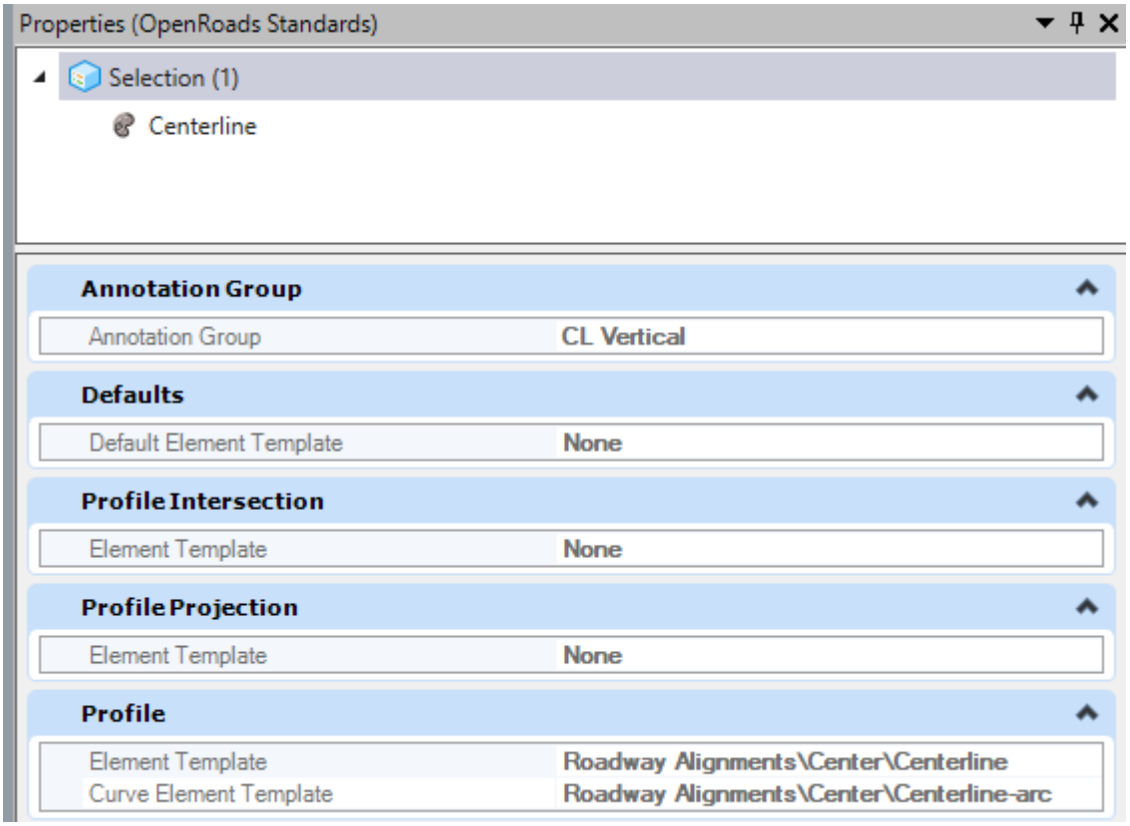


Figure 178 – Centerline Vertical Annotation and profile settings

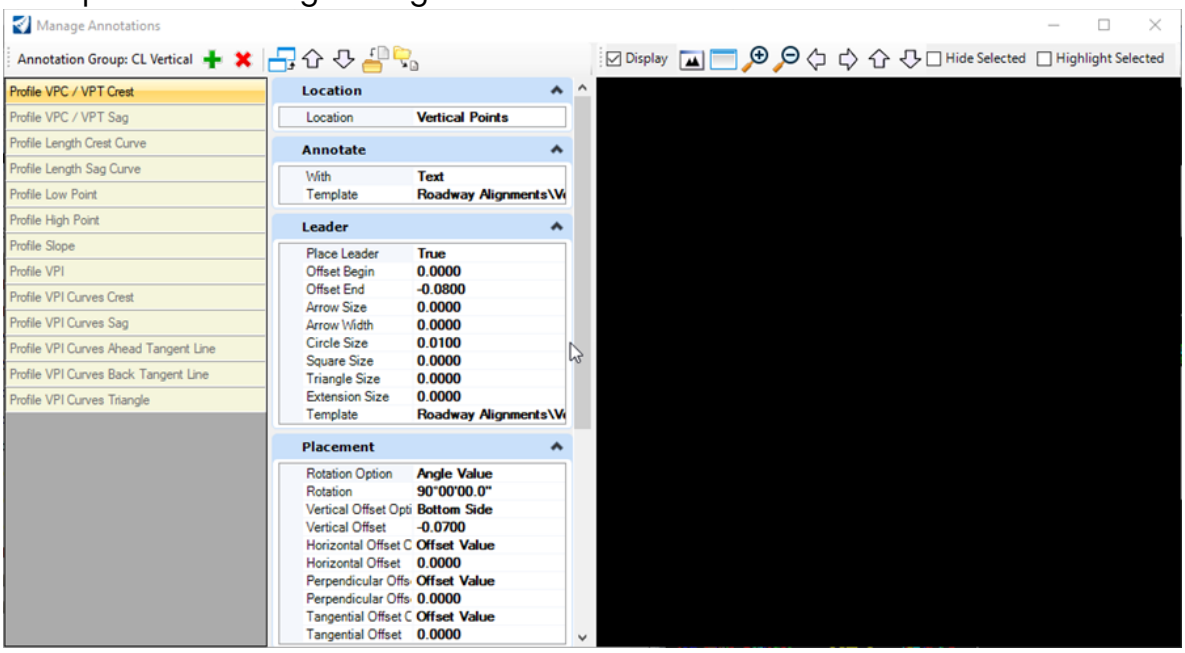


Figure 179 – Profile annotation settings for vertical elements

Note: *the alignment feature definition controls the symbology and annotation settings for both the horizontal geometry and the proposed vertical alignment.*