Geometry for Surveyors

This course is for the **2023 Release 1** *version of:*

OpenSite Designer CONNECT Edition

OpenRoads Designer CONNECT Edition

OpenRail Designer CONNECT Edition

About this Practice Workbook...

- This workbook is designed for use in Live instructor-led training and for OnDemand self study. OnDemand videos for this course are available on the *LEARNserver*.
- This PDF file includes bookmarks providing an overview of the document. Click on a bookmark to quickly jump to any section in the file.
- Only Imperial files are included in the dataset.
- This course workbook uses the *Training and Examples* WorkSpace and the *Training-Imperial*.
- The terms “Left-click”, “Click”, “Select” and “Data” are used interchangeably to represent pressing the left mouse button. The terms “Right-click” and “Reset” are also used interchangeably to represent pressing the right mouse button. If your mouse buttons are assigned differently, such as for left-handed use, you will need to adjust accordingly.

Have a Question? Need Help?

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

Bentley Institute

Edition: **02-01**

Course Level: **Fundamental**

Description and Objectives

Course Description

In this module you will learn the basics of drawing geometry with the civil geometry tools. You will start by learning how to enter property information and create a subdivision parcel. You will then learn to create the centerline, edges of pavement and right of way geometry for the Subdivision Road. You will also learn how to place labels and annotate geometry.

Skills Taught

- Geometry Builder
- Map Check Report
- Place Labels with Civil Labeler
- Civil AccuDraw
- Place Point
- Place Line Between Points
- Place Simple Arc From Element
- Place Simple Line From Element
- Complex By Element
- Horizontal Alignment Report
- Single Offset Entire Element
- Annotate Element
- Trim to Element
- Geometry Points Filter

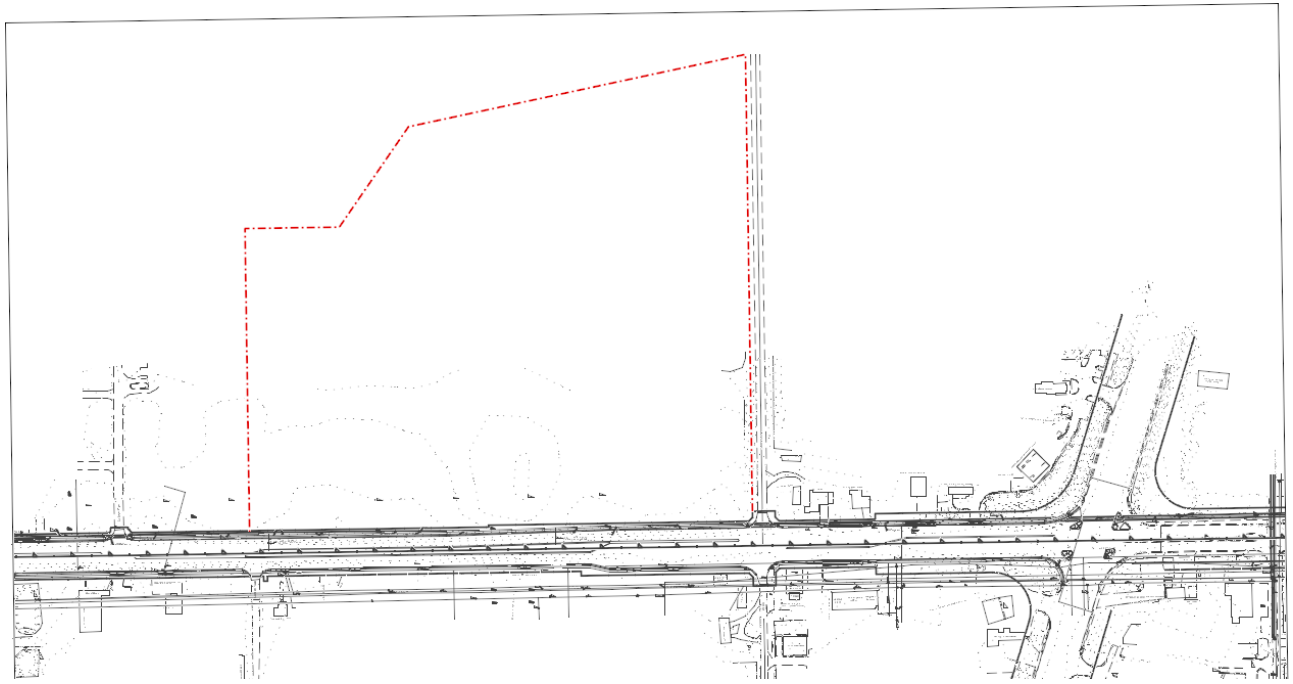
Creating the Subdivision Parcel

The OpenCivil products feature special civil geometry tools that are better suited for creating civil geometry elements. These civil geometry tools are a dynamic and intelligent set of rules based tools that are more powerful than the standard drawing tools. There are a number of ways to place horizontal geometry with the civil geometry tools. You can place individual lines and arcs in a wide variety of placement options, such as point to point, from elements, and between elements.

In this section, you will use the Geometry Builder for precision placement of the property lines which will make up the subdivision for your project. Geometry Builder lets you enter property information in a user friendly tabular format.

In this lesson you will use:

- Geometry Builder
- Place Labels with Civil Labeler



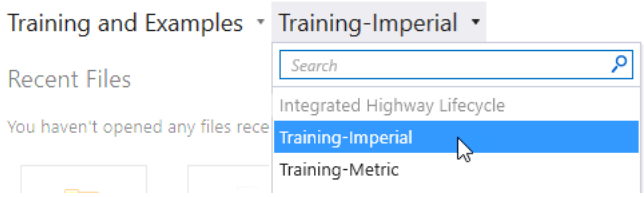
1. Start the software.
2. Set the WorkSpace and WorkSet.

   The WorkSpace and WorkSet define standards that are used by the software, and the ones used for this training are installed during the software installation.

   Typically, the WorkSpace contains organizational standards and the WorkSet contains project standards.

   a. Select **Training and Examples** from the *WorkSpace* drop-down menu.

   b. Select **Training-Imperial** from the *WorkSet* drop-down menu.



3. Open an existing file.

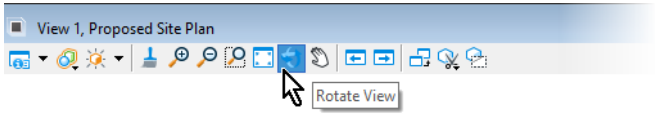
   a. Select **Browse**.

   b. Browse to *C:\Bentley Training\Geometry for Surveyors* or other folder where you unzipped the dataset files.

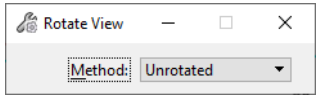
   c. Select the file **Proposed Site Plan.dgn** and click **Open**.

4. To begin the design of the Subdivision's Property Boundary Line, you will rotate the view to its default orientation to facilitate precision input.

   a. Along the *View Control* toolbar, select the **Rotate View** tool.

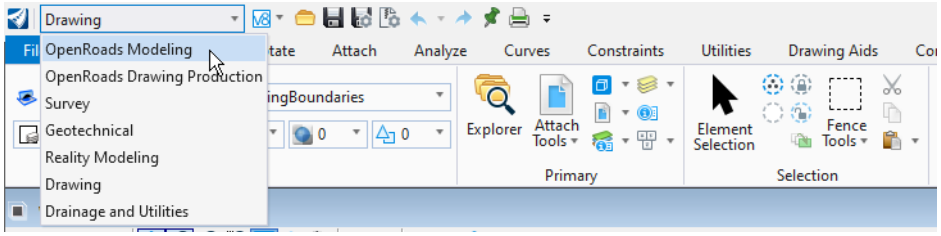


   b. In the *Tool Settings* window, select **Unrotated** from the drop-down menu.



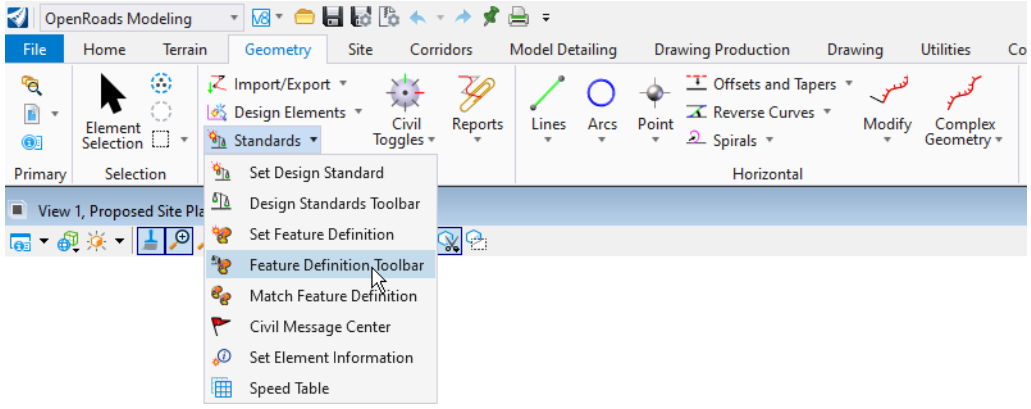
   This will unrotate the view relative to the global coordinate system.

5. Switch to the **OpenRoads Modeling**, **OpenRail Modeling**, or **OpenSite Modeling**



6. Activate the **Geometry** tab.

7. On the *General Tools* ribbon group, under **Standards**, select **Feature Definition Toolbar**.

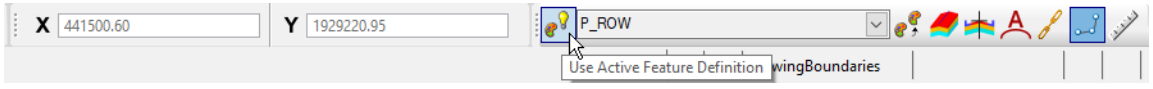


The Feature Definition toolbar opens.

8. **Dock** the *Feature Definition Toolbar* at the bottom or top of the application window.

9. In the *Feature Definition Toolbar*, set the active feature definition to *Linear* > *Right of Way* > **P_ROW**

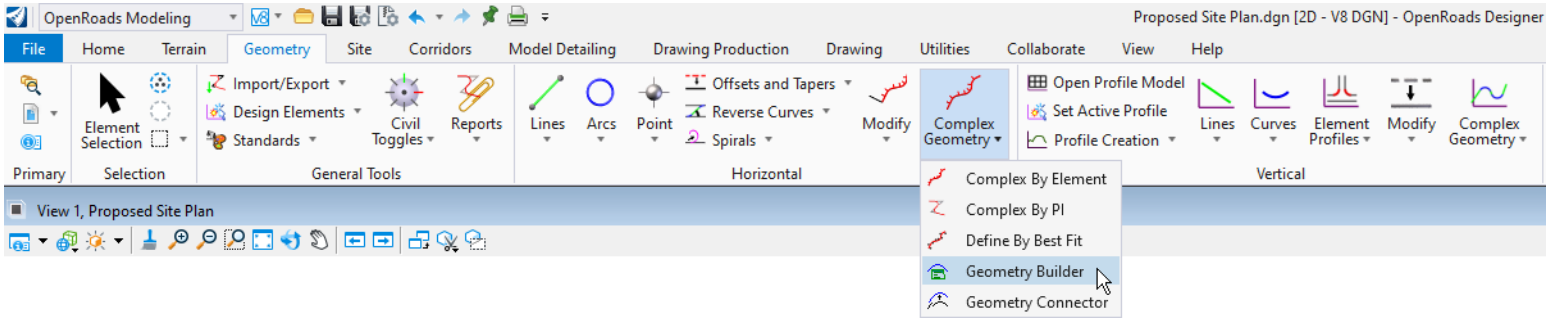
10. To the left of the active feature definition, toggle on **Use Active Feature Definition**.



NOTE: A Feature Definition defines what an element is and how it will be displayed. Always pick the appropriate feature definition when placing civil geometry elements.

11. Create the subdivision parcel:

    a. On the *Horizontal* ribbon group, under **Complex Geometry**, select **Geometry Builder**.



    b. In the *Geometry Builder* dialog, click the **Add new geometry** button.

    c. In the left-hand pane, click on *NewGeometry1* and rename it to **Proposed Subdivision**.

    d. Toggle **ON** *Create Civil Ruled Elements*

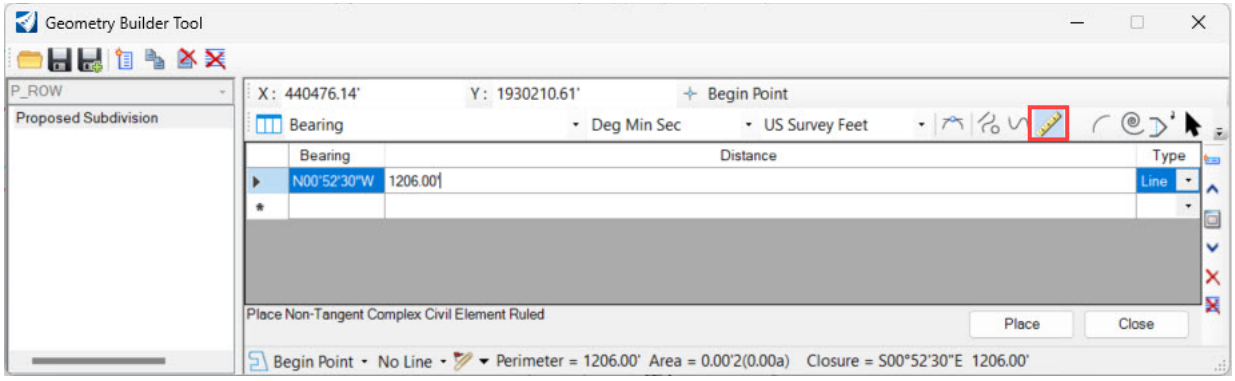
    e. In the *X* field, type **440476.14**.

    f. In the *Y* field type **1930210.61**.

    g. In the *Bearing* column, type **n 00 52 30 w**.

    h. In the *Distance* column type **1206**.

    i. Set the *Type* to **Line** and press the **<Tab>** key.



Continuing in the Geometry Builder tool.

j. For the second entry, type **s 77 54 26 w** for the *Bearing*, **911.24** for the *Distance*, and set the *Type* to **Line**.

k. For the third entry, type **s 34 37 02 w** for the *Bearing*, **321.75** for the *Distance*, and set the *Type* to **Line**.

l. For the fourth entry, type **s 89 07 30 w** for the *Bearing*, **249.64** for the *Distance*, and set the *Type* to **Line**.

m. For the fifth entry, type **s 00 52 30 e** for the *Bearing*, **797.75** for the *Distance*, and set the *Type* to **Line**.

n. For the sixth entry, type **n 89 07 30 e**, for the *Bearing*, **632.48** for the *Distance*, and set the *Type* to **Line**.

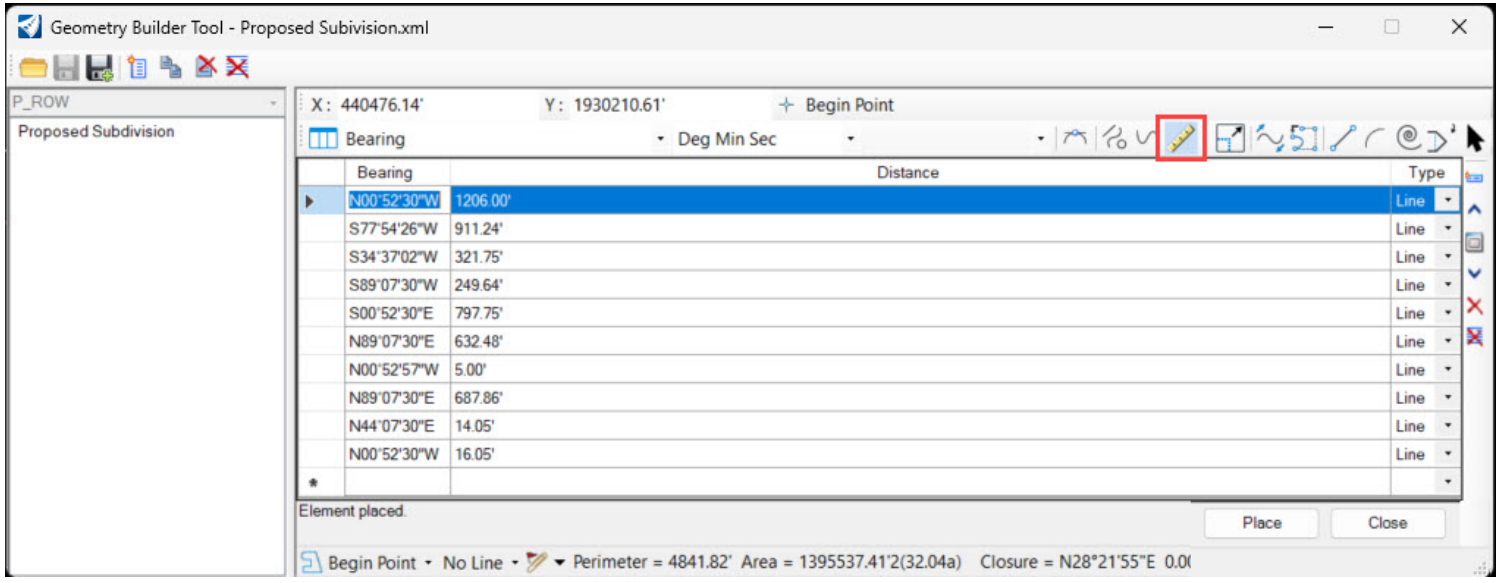
o. For the seventh entry, type **n 00 52 57 w**, for the *Bearing*, **5.00** for the *Distance*, and set the *Type* to **Line**.

p. For the eighth entry, type **n 89 07 30 e**, for the *Bearing*, **687.86** for the *Distance*, and set the *Type* to **Line**.

q. For the ninth entry, type **n 44 07 30 e** for the *Bearing*, **14.05** for the *Distance*, and set the *Type* to **Line**.

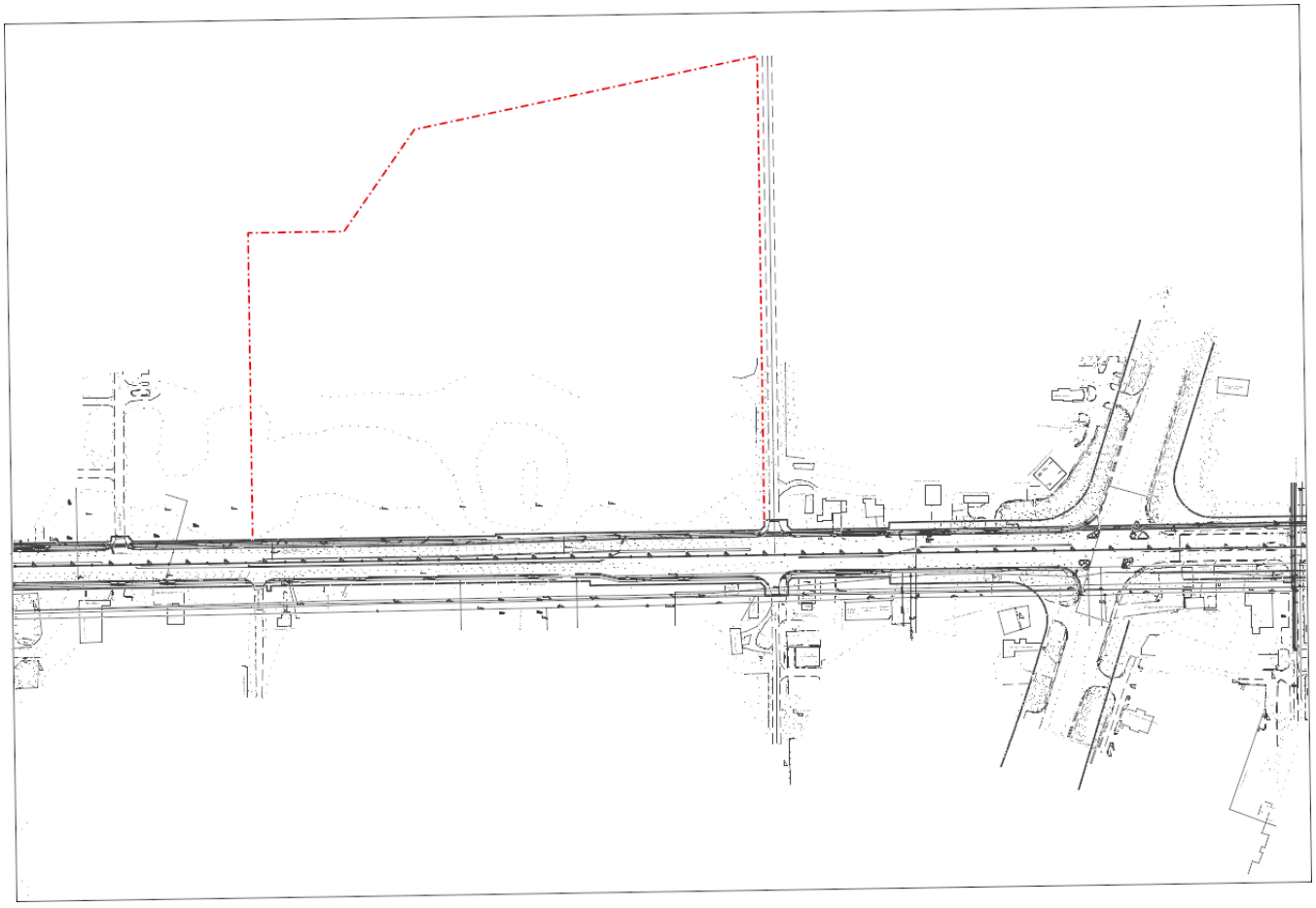
r. For the tenth entry, type **n 00 52 30 w** for the *Bearing*, **16.05** for the *Distance*, and set the *Type* to **Line**.

s. Click the **Place** button.



As you can see, the *Geometry Builder* tool is a great tool to use to enter existing parcel data. Note, the tool keeps track of the Perimeter, Area and Closure at the bottom of the dialog. You will learn more about this tool in the *Right of Fundamentals* course.

Completed property boundary is placed.



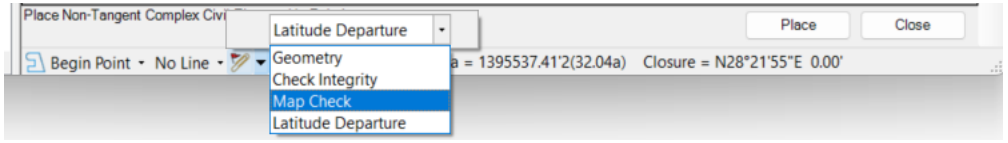
In addition to graphically creating the property, you have the ability to save the property information into an external .xml. This is useful if you need to recall the property information later when changes are required.

12. Save the property information to an .xml file.

    a. In the *Geometry Builder* dialog, click **Save** and save the file as **Proposed Subdivision.xml** to the *c:\Bentley Training\Geometry for Surveyors* folder.

13. Review the Map Check Report.

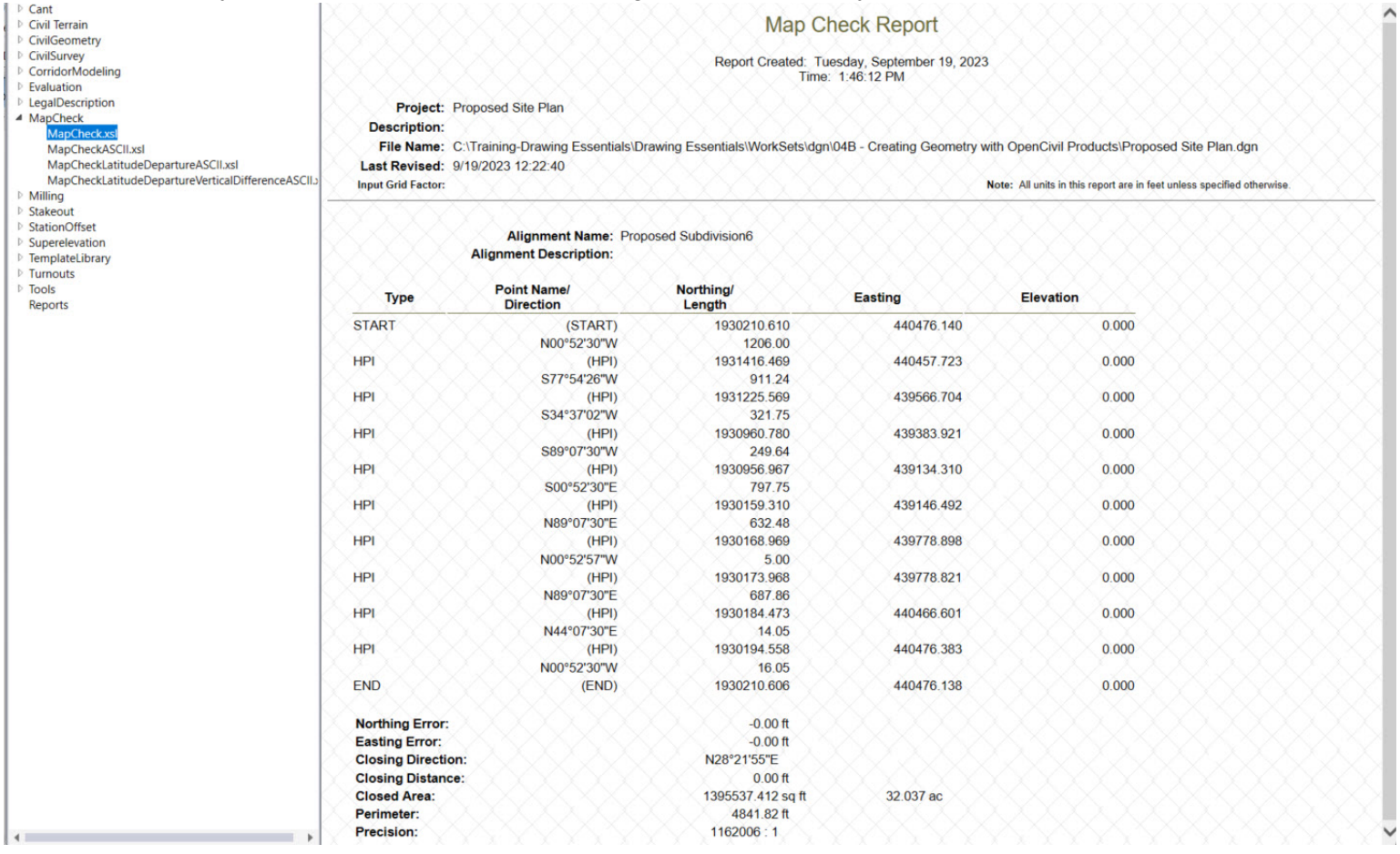
    a. At the bottom of the *Geometry Builder* dialog, set the report option to **Map Check**.



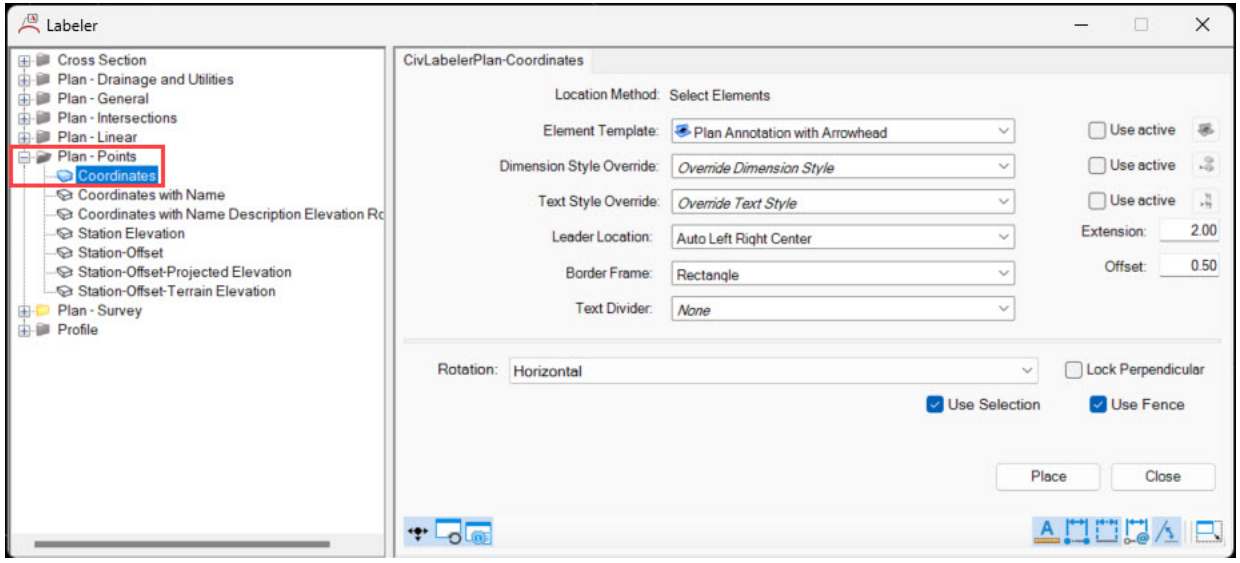
    b. Click on the Report icon 

    c. The **Map Check** report will display in the *Bentley Civil Report Browser* window.

    d. Review the property data and closure. The report is a great tool to check your parcels. Close the report when done reviewing.

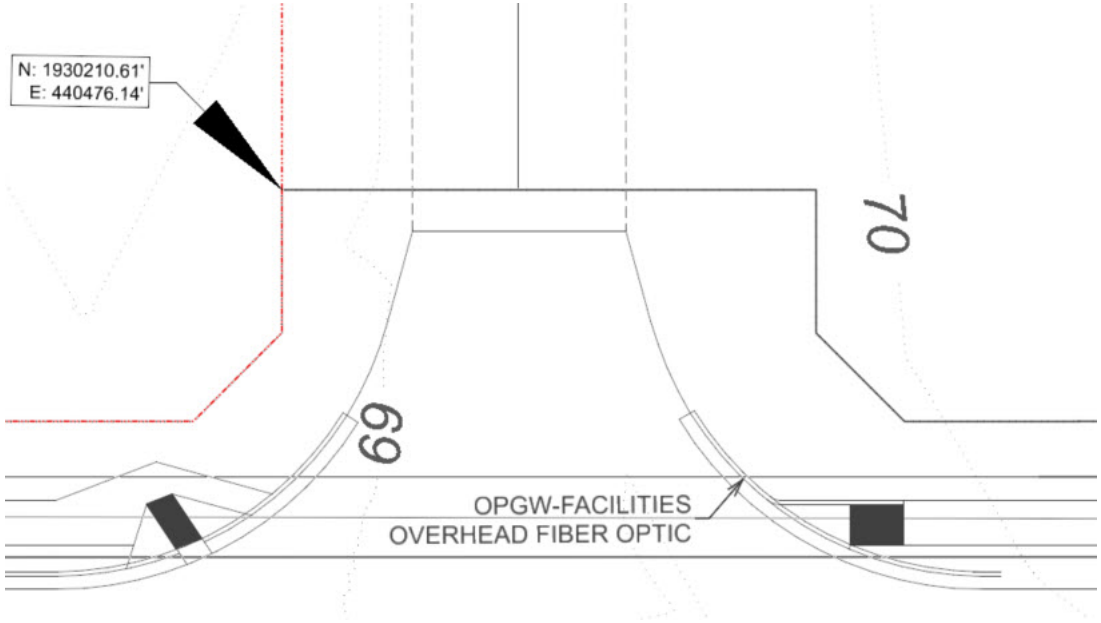


14. Use Civil Labeler to annotate the points of the proposed subdivision:
    a. Close the Geometry Builder tool.
    b. **Zoom** in on the southwest corner.
    c. Click on the **Drawing Production** tab.
    d. In the *Labels* ribbon group, select **Civil Labeler**
    e. Select and expand the *Plan - Points* folder.
    f. Select **Coordinates**, this is a label set up to annotate the Northing and Easting coordinates.



    g. Select **Place**
    h. Following the prompts in the lower left corner of the screen, *Identify point*:
        - Snap to beginning point of the property.
        - Move your cursor to the left of the point and data point to place the label.

i. Completed label.



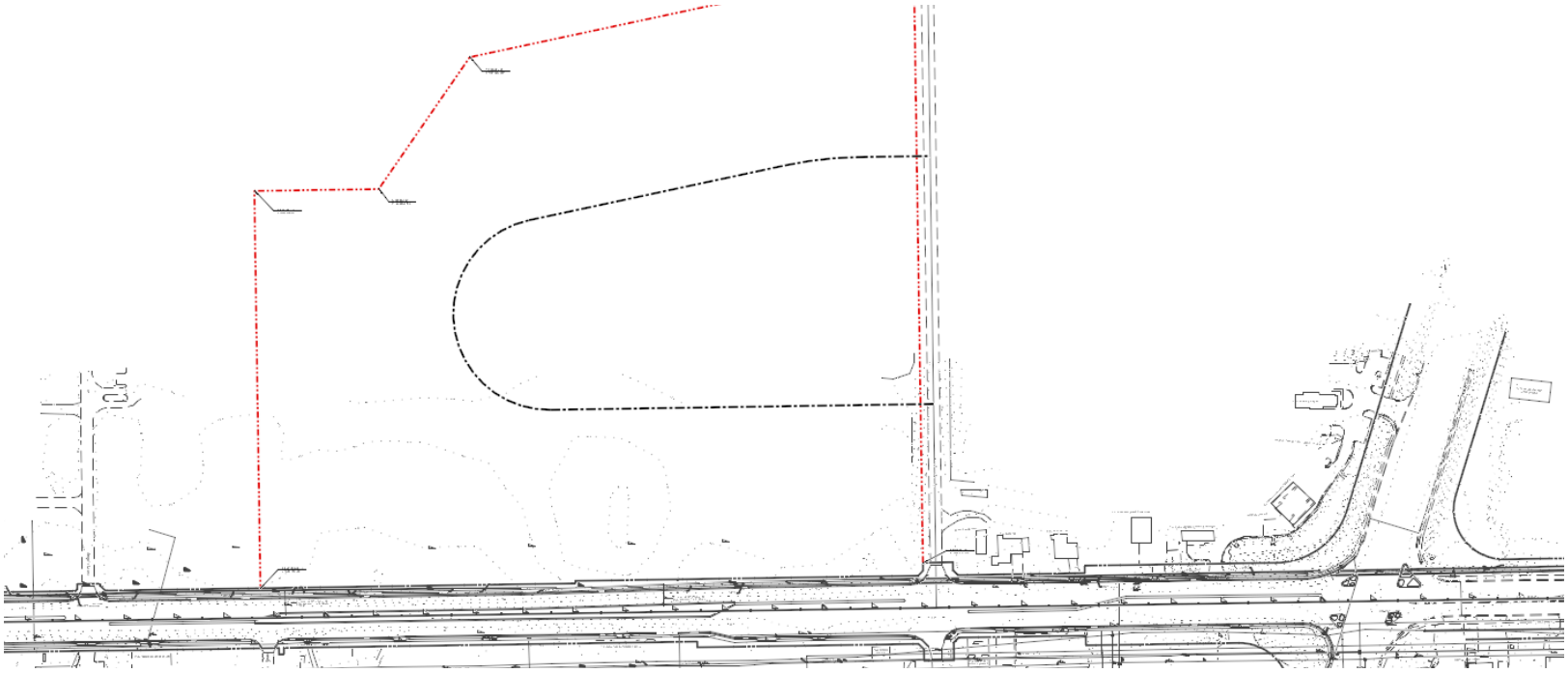
j. Continue labeling the other points of the proposed subdivision boundary.

Creating the Subdivision Road Centerline

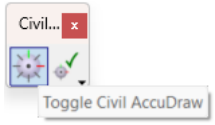
In this section, you will lay out the roadway centerline for the subdivision utilizing some of the horizontal civil geometry tools.

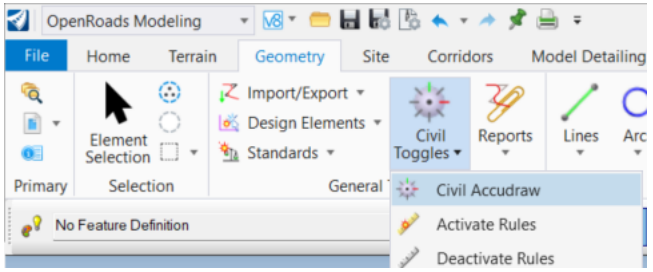
In this lesson you will:

- Place Points using Civil AccuDraw
- Place Line Between Points
- Place Simple Arc From Element
- Place Simple Line From Element



1. Place a monument point at existing coordinates.
   a. Activate *Civil AccuDraw,* select *Geometry* > *General Tools* > *Civil Toggles* > **Civil AccuDraw**
      - The Civil AccuDraw toggle bar will appear.





      - Civil AccuDraw is used for precision placement of geometry.

   b. Be sure to press the *Civil AccuDraw* compass icon to enable it. Once enabled, the toolbar will expand.

   c. Select the **XY** option from the *Civil AccuDraw* toolbar. This enables XY mode for placing precision coordinates.

   d. Select *Geometry* > *Horizontal* > **Point**
      - The *Point* dialog will appear and a small dialog will be attached to your cursor with input fields for X and Y coordinates.

   e. In the *Point* dialog, set the *Feature Definition* to *Points* > *Monument* > **MON_Control** and set the *Name* to **MON_01**

   f. Set the *Rotation Mode* to **Absolute Value** and key-in **90** or **0** for the rotation angle.

   g. In the *X* field attached to your cursor, type in: **440497.77** and press **<TAB>** to lock the value.

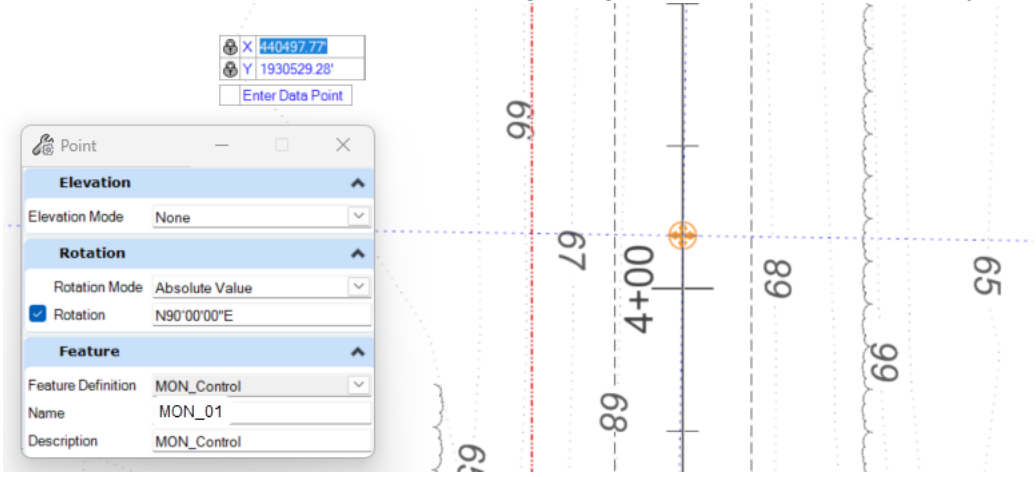
   h. In the *Y* field attached to your cursor, type in: **1930529.28** and press **<TAB>** to lock the value.

   i. Data Point to accept all values.

   j. Data Point or left click again to complete placement of the point.

k. Right click or press **<ESC>** to exit the command.

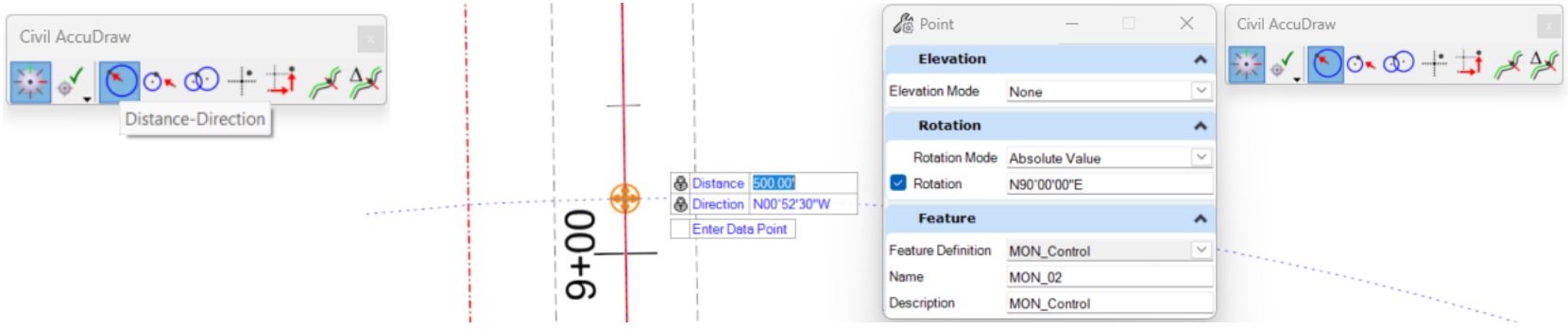
The monument has now been placed. This will be the point of beginning for the subdivision roadway centerline.



Now, we are going to place another monument but this time it will be placed using the distance and direction mode.

2. Place another monument 500 feet to the north along the side road centerline. This will be the end point of the subdivision centerline.

a. Select the **Distance-Direction** option from the *Civil AccuDraw* toolbar.



b. Select *Geometry* > *Horizontal* > **Point**

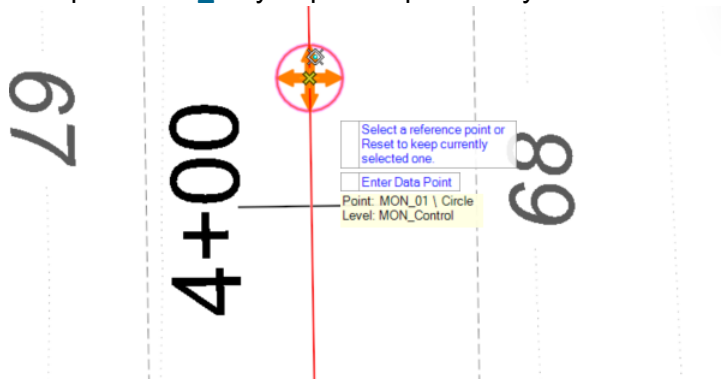
- The *Point* dialog will appear and a small dialog will be attached to your cursor with input fields for *Distance* and *Direction*.

c. In the *Point* dialog, set the *Feature Definition* to *Points* > *Monument* > **MON_Control** and set the *Name* to **MON_02**

d. Set the *Rotation Mode* to **Absolute Value** and key-in **90** or **0** for the rotation angle.

e. Select the letter **O** on your keyboard, the heads up prompt will change to *Select a reference point or Reset to keep currently selected one.*

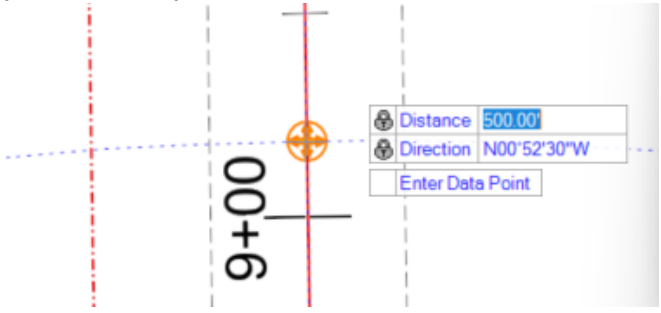
f. Origin Point Snap or Key Point Snap to **MON_01** you placed previously.



g. Data point to accept. The heads-up prompt will change back to *Distance* and *Direction*.

h. In the *Distance* field attached to your cursor, type in: **500.00** and press **<TAB>** to lock the value.

i. In the *Direction* field attached to your cursor, type in: **N00:52:30:W** and press **<TAB>** to lock the value.



j. Data Point to accept the rotation.

k. Data point again or left click to complete placement of the point.

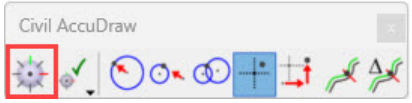
l. Right click or press **<ESC>** to exit the command.

In addition to the *XY* mode and Distance-Direction, *Civil AccuDraw* has many other modes such as: Distance-Distance, Delta X and Delta Y, Station-Offset and more. Points and Geometry elements can be placed using those modes. You are not going to cover all those in this course but just be aware there are many modes you can use to place geometry with *Civil AccuDraw*.

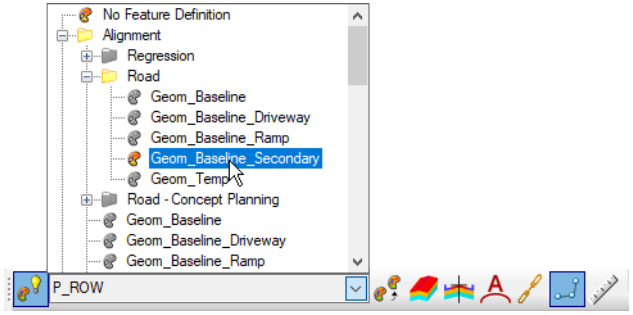
3. Check the distance and bearing between the two monuments.
    a. Select *Home > Model Analysis and Reporting > Civil Analysis >* **Inverse Points**
    b. Set the *Input Type* to **Linear**, data point to accept.
    c. Toggle ON *Send Output*. This will enable the report window to display the results.
    d. Key Point Snap or Origin Point Snap to **MON_01**
    e. Key Point Snap or Origin Point Snap to **MON_02**
    f. Right click. The inverse report window will appear.
    g. Review the results and verify the distance between the points is 500 and the bearing is N 00^’30’50” W
    h. Close the report window.

Now, let’s begin placing the geometry elements for the Subdivision Road centerline.

4. Begin placing the first tangent line for the roadway centerline.
    a. Toggle **Off** *Civil AccuDraw* by pressing the compass icon on the *Civil AccuDraw* toolbar.

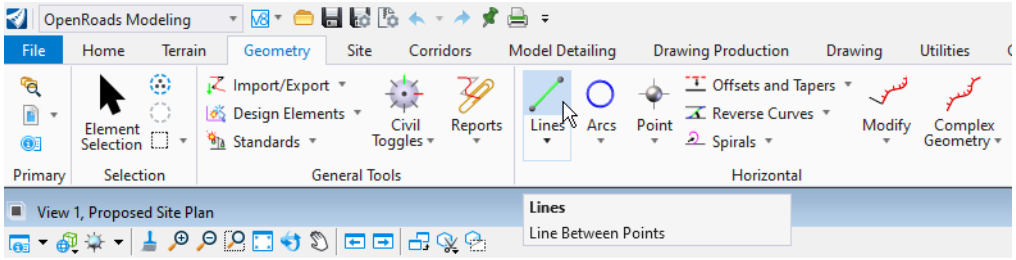


    b. Next, set the *active feature definition* to **Alignment** > **Road** > **Geom_Baseline_Secondary**.



- Recall, the *Feature Definition* controls what an element is and how it is graphically displayed in the design file.

5. On the **Geometry** tab, in the *Horizontal* ribbon group, select **Line Between Points**.



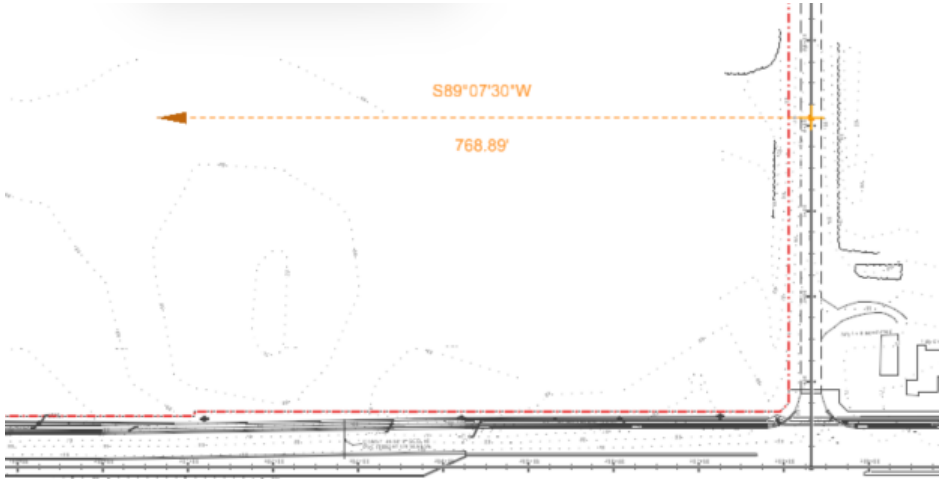
c. Follow the heads-up prompt at your cursor, *Enter Start Point*.

d. Using the *Origin Snap*, **snap** to the *Monument* point you place in the previous step to place the start point.

e. In the *Enter End Point* prompt near your cursor, enter **768.89** into the *Distance* field.

f. Press the right-arrow key and enter **S89:07:30:W** into the *Direction* field.

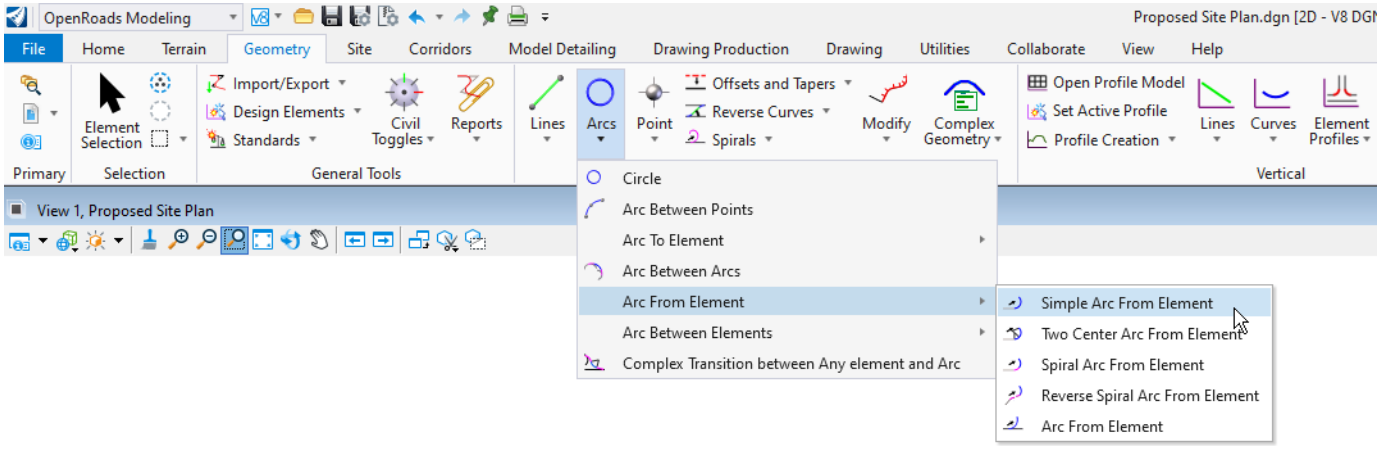
NOTE: For bearing input, a colon (**:**) can be used in place of keying in degrees, minutes and seconds characters.



g. Issue a **Data Point** to place the end point.

6. Draw a tangential arc segment for the roadway centerline:

   a. On the *Horizontal* ribbon group, select *Arcs* > *Arc From Element* > **Simple Arc From Element**.



   b. *Locate the previous element* you just placed with a **Data Point**.

   c. *Snap to the end of the centerline* and **Data Point**.

   d. *Sweep the arc* in a **clockwise direction**.

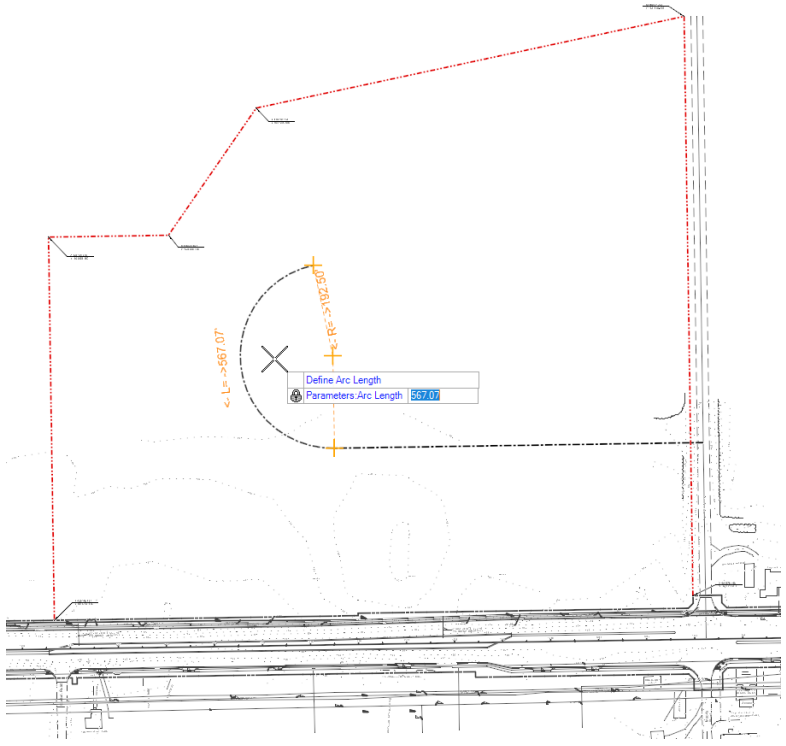
   e. In the *Radius* field, type **192.5** and press the <**Enter**> key.

   f. **Data Point** to accept and place the center of the arc.

   g. Type **567.07** into the *Arc Length* field and press the <**Enter**> key.

   h. Issue a **Data Point** to place the end of the arc.

   i. Set *Trim/Extend* to **Back** and issue a **Data Point**.



7. Draw the next tangent segment of the centerline:

   a. On the *Horizontal* ribbon group, select **Lines** > **Line From Element** > **Simple Line From Element**.

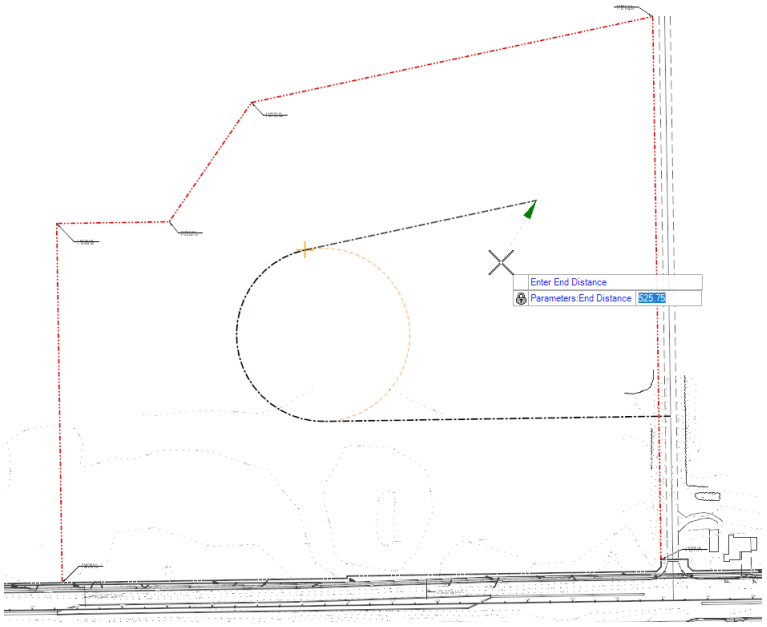
   b. *Identify* the arc you just placed with a **Data Point**.

   c. Snap to the end of the arc and issue a **Data Point**.

   d. Type **525.75** into the *End Distance* field and press the <**Enter**> key.

   e. **Data Point** to accept.

   f. *Trim/Extend* **Back** and issue a **Data Point**.

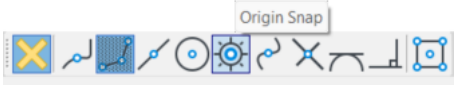


8. Draw a tangential line from *MON_02* extending towards the previous line.

   g. On the *Horizontal* ribbon group, select *Lines* > **Line Between Points**.

   h. Follow the heads-up prompt at your cursor, *Enter Start Point*.

   i. Using the *Origin Snap*, **snap MON_02**



   j. In the *Enter End Point* prompt near your cursor, enter **250.00** into the *Distance* field. Press **<TAB>** to lock the value.

   k. Press the right-arrow key and enter **S89:07:30:W** into the *Line Direction* field. Press **<TAB>** to lock the value.

   l. Data point to accept.

   Next, we will place an arc between this tangent line and the previous tangent line placed.

9. Draw an arc between the tangent lines.

   a. On the *Horizontal* ribbon group, select *Arcs > Arc Between Elements >* **Simple Arc**

   b. *Locate First Element:* Select the line tangent to the last curve

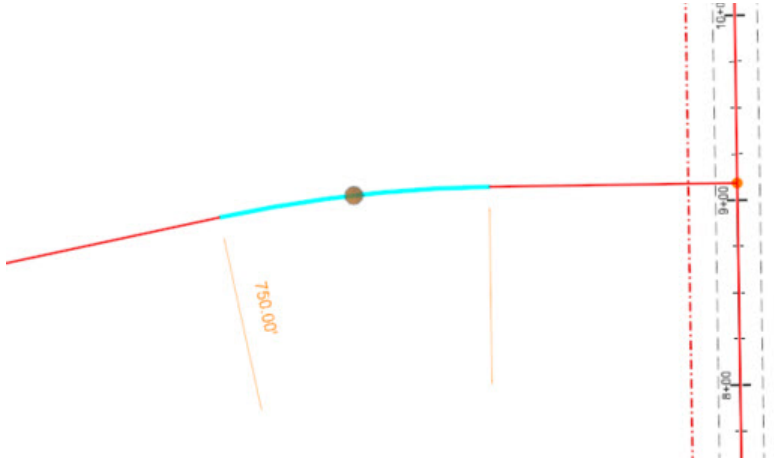
   c. *Locate Second Element:* Select the line ending at **MON_02**

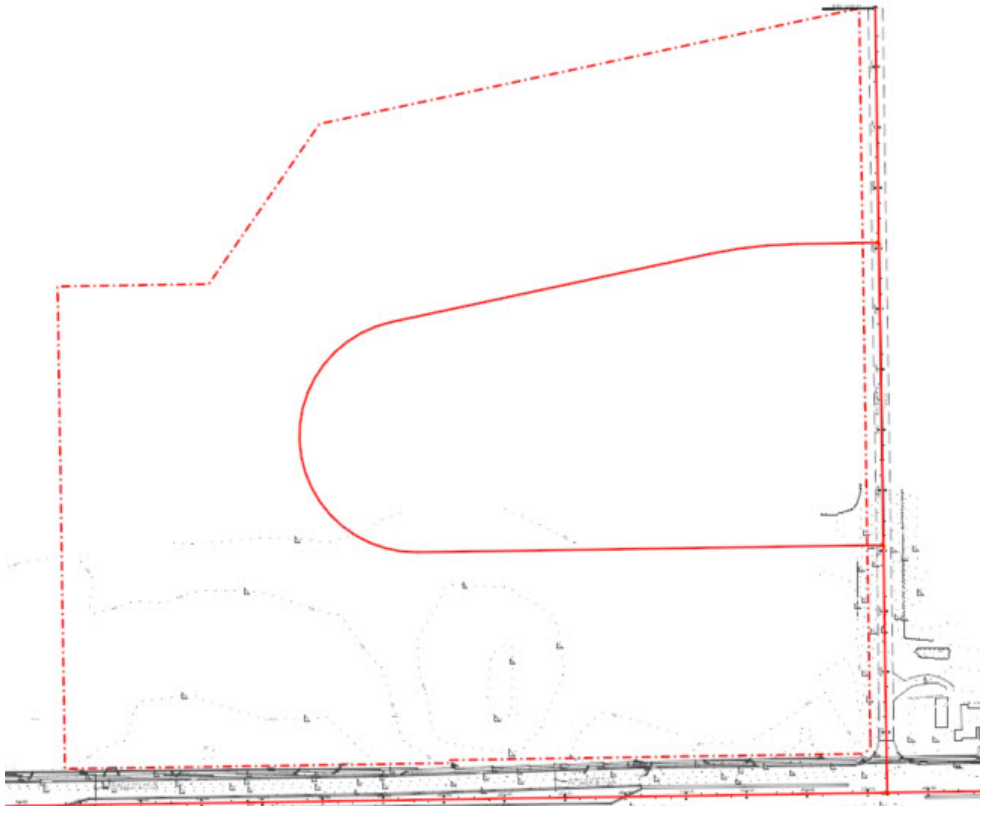
   d. In the *Radius* field, type **750** and press the <**Enter**> key.

   e. Issue a **Data Point** to accept.

   f. Set *Trim/Extend* to **Both** and issue a **Data Point**.

   The geometry elements are now complete.



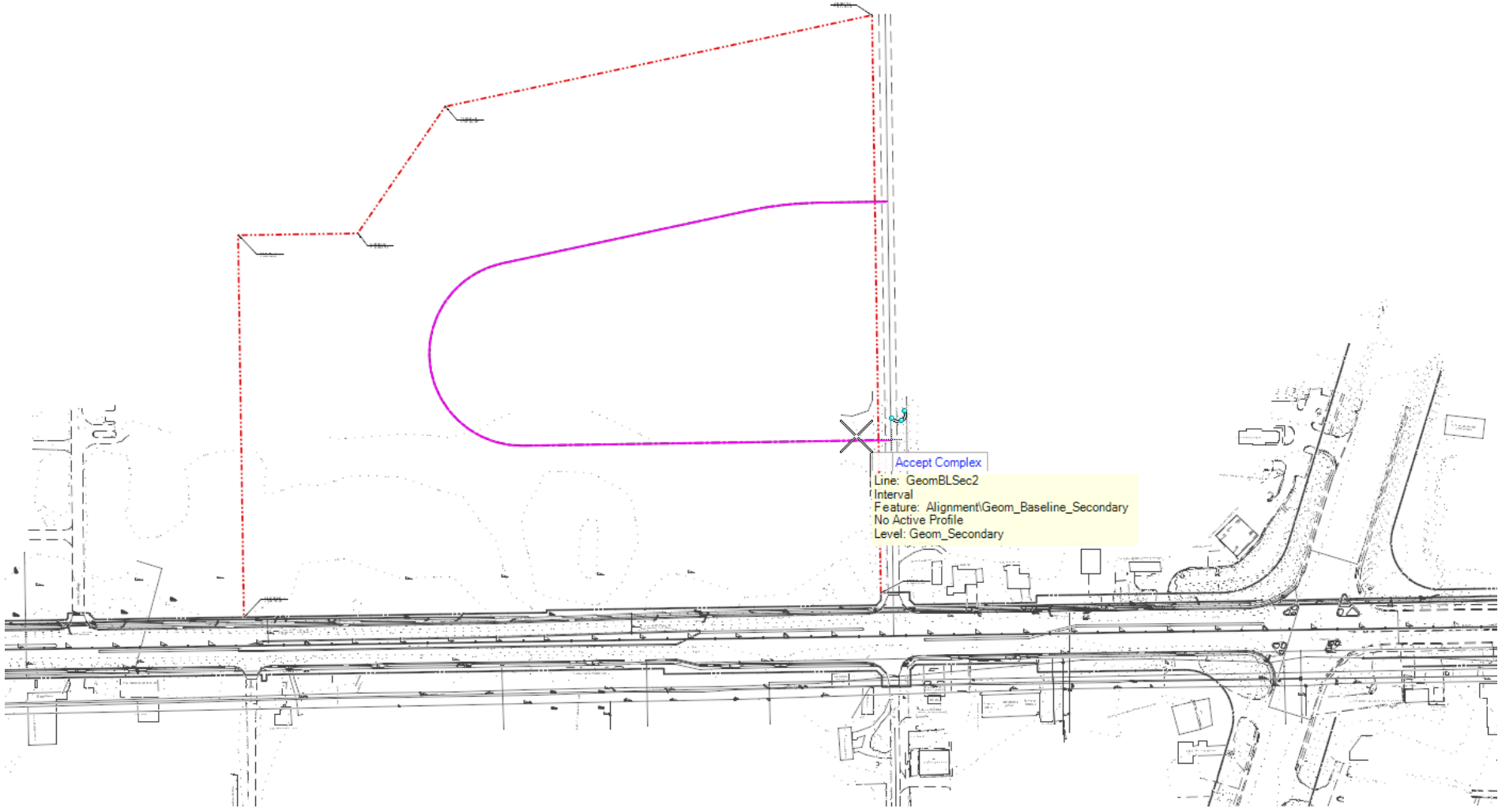


Complexing the Centerline Elements Together to Form a Horizontal Alignment

Now that you have constructed the individual centerline elements, you will join the elements together into a complex element, also known as a horizontal alignment.

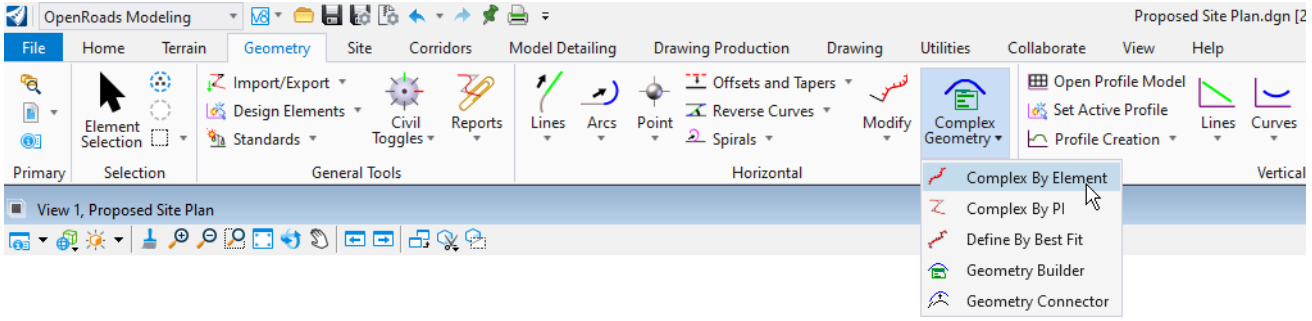
In this lesson you will:

- Utilize the Complex By Element tool

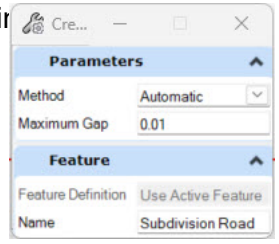


1. Create the Horizontal Alignment for the Subdivision Road.

   a. On the *Horizontal* ribbon group, select **Complex Geometry** > **Complex By Element**.



   b. In the Tool Settings window, set the followi



      - *Method:* **Automatic**
      - *Maximum Gap:* **0.01**
      - *Name:* **Subdivision Road**

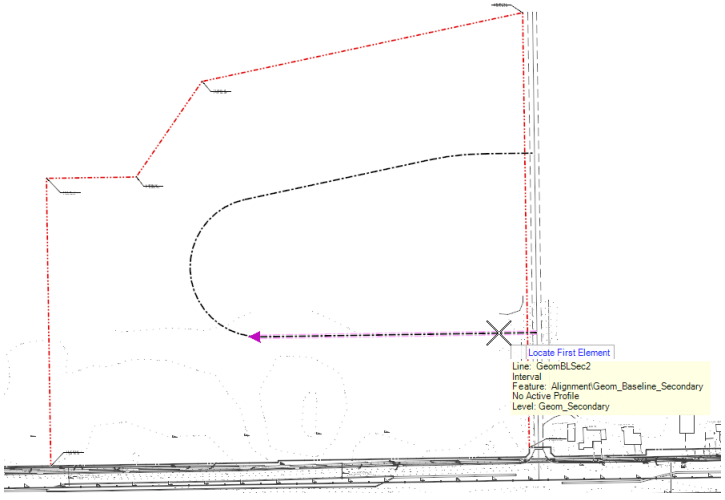
   c. Hover your cursor over the *right-hand side of the first centerline element you created* so that the arrowhead appears on the **opposite end, in the direction you want to create the horizontal alignment**.

   d. **Data Point**.

   e. The connecting elements highlight.

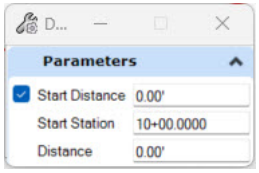
   f. **Data Point** to accept.

   g. The complex element/horizontal alignment is created.



The next step is to define the start station of the horizontal alignment. By default, alignments start at 0+00. Now you will learn how to define the start station.

2. Define the start station for the horizontal alignment.
   a. Select *Geometry > Horizontal > Modify >* **Start Station**
   b. Follow the heads-up prompts:
   c. *Locate Element:* Select the Subdivision Road alignment.
   d. *Start Distance:* **0**
   e. *Start Station:* **10+00.00**



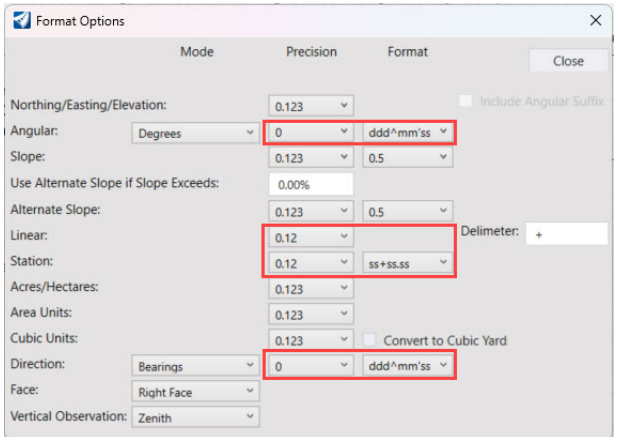
3. Review the horizontal alignment report.
   a. Select *Home > Model Analysis and Reporting > Reports >* **Horizontal Geometry Report**
   b. Follow the heads-up prompt:
      - *Locate First Element:* Select **Subdivision Road**
      - *Locate Next Element - Reset to Complete:* Right click
      - *Start Station:* Press **<ALT>** to lock to start
      - *End Station:* Press **<ALT>** to lock to end
      - *Interval:* **0**
      - *Include Event Points:* **None**
      - *Included Profiles:* **None**
   c. Data point to complete. The *Bentley Civil Report Browser* will appear displaying the *Horizontal Alignment Review Report*.
   d. Take a moment to review the alignment data in the report. Note that there are many other report types that you can select from the left side of the report window.
   e. Take a moment and explore some of the other horizontal alignment reports.
   f. Return to the *HorizontalAlignmentReview.xsl* report.

You may have noticed the station format, bearing format and precision are not what we typically like to see. Let's adjust the formatting to our liking.

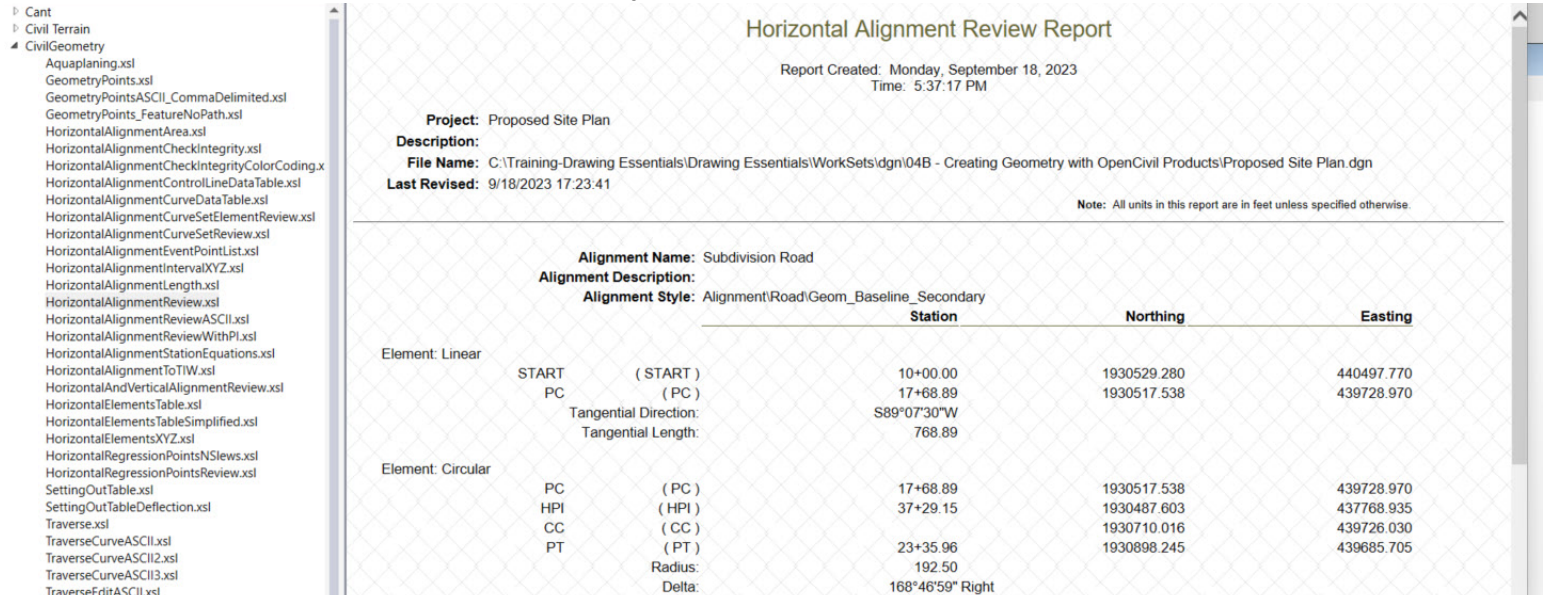
4. Adjust the report format

   a. In the report browser window, select *Tools* > **Format Options**

   b. In the *Format Options* dialog, adjust the **Precision** and **Format** options highlighted in red and then select **Close**.



   c. Review the report and notice the format is now adjusted. Close the report window.

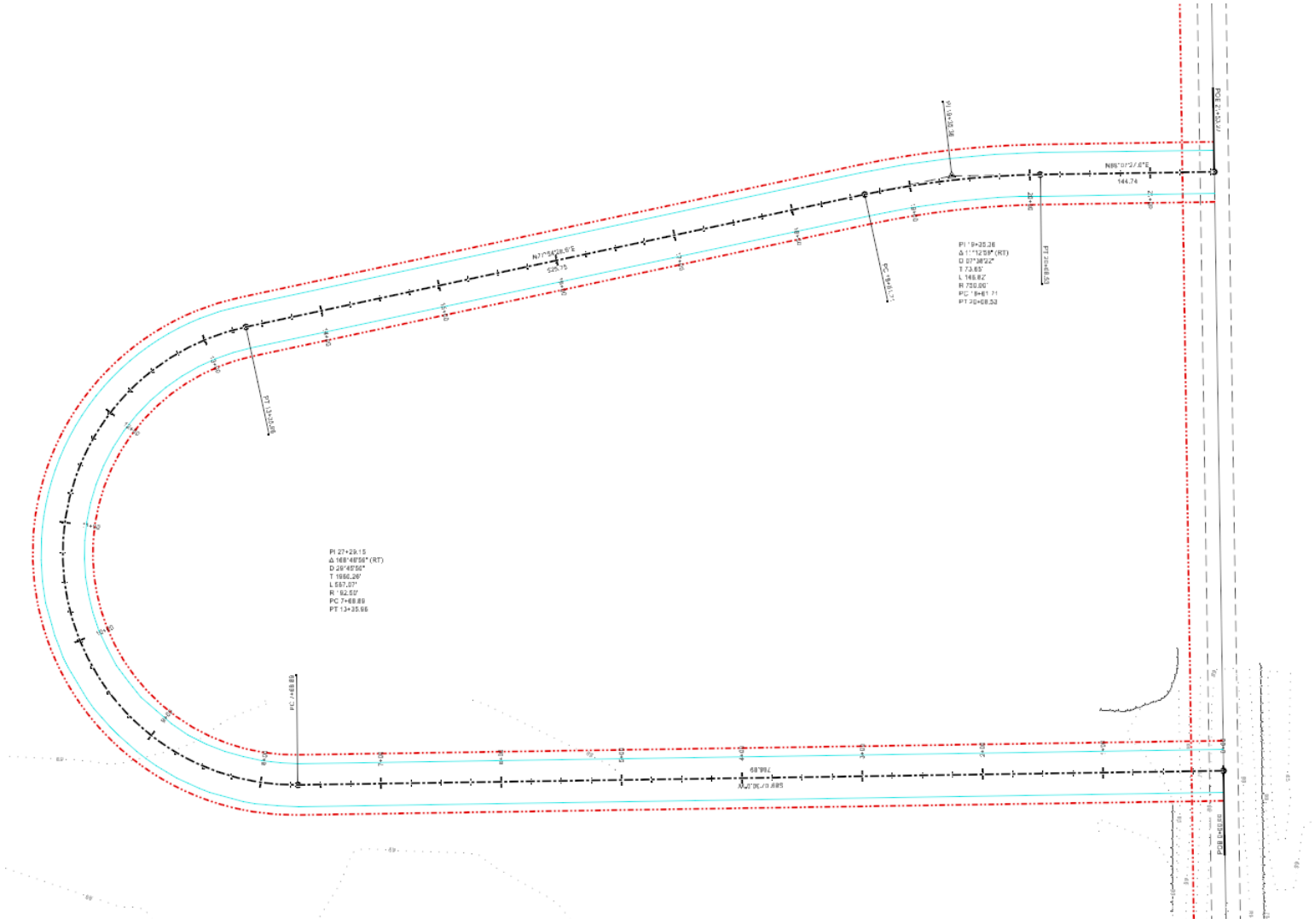


Annotating the Horizontal Alignment

Now that you've created a roadway centerline alignment, you'll annotate it with stationing and other annotations.

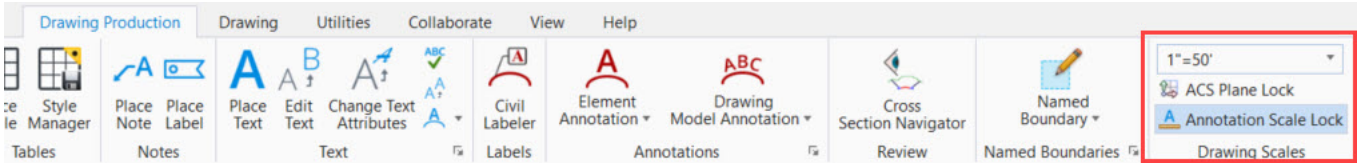
In this lesson you will:

- Use the Annotate Element tool



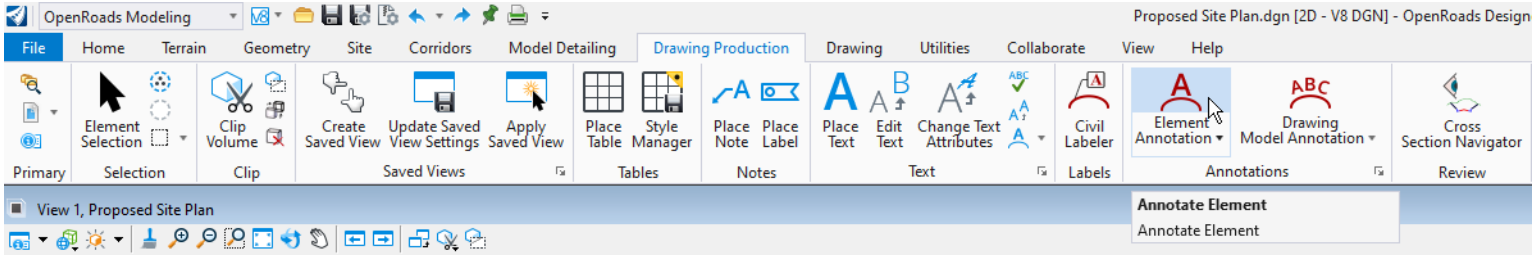
1. Annotate the horizontal alignment.

   a. On the *Drawing Production* tab, be sure the *Annotation Scale* is set to **1”=50’** and *Annotation Scale Lock* is toggled **ON**.



   For *OpenSite* location of *Annotation Scale Lock* > **Drawing > Utilities > Drawing Scale**

   b. On the *Drawing Production* tab, in the *Annotations* ribbon group, select **Annotate Element**.



   c. Select the *Subdivision* alignment with a **Data Point**.

   d. Click a **Reset** to complete.The alignment is annotated.

      Take a few moments to review the annotations. Along with the stationing, the PC’s, PT’s and curves are all annotated.

   e. Select the *Element Selection* tool.

   f. Select the *Subdivision* alignment.

      Notice the *orange text manipulators*. Locate the radius manipulator of the first arc: **192.50’**.

   g. **Click** on this *text manipulator*.

      Notice the editable heads-up field that appears.

   h. Change the *radius* to **225** and press <**Enter**>.

Notice that the radius of the arc changes, as do those for the road edge of pavement and the right of way lines. The stationing annotation also updates. This illustrates how the geometry is dynamic and how the annotation is associative.

Simply making changes to the base geometry elements will automatically update the annotation placed on the geometry.

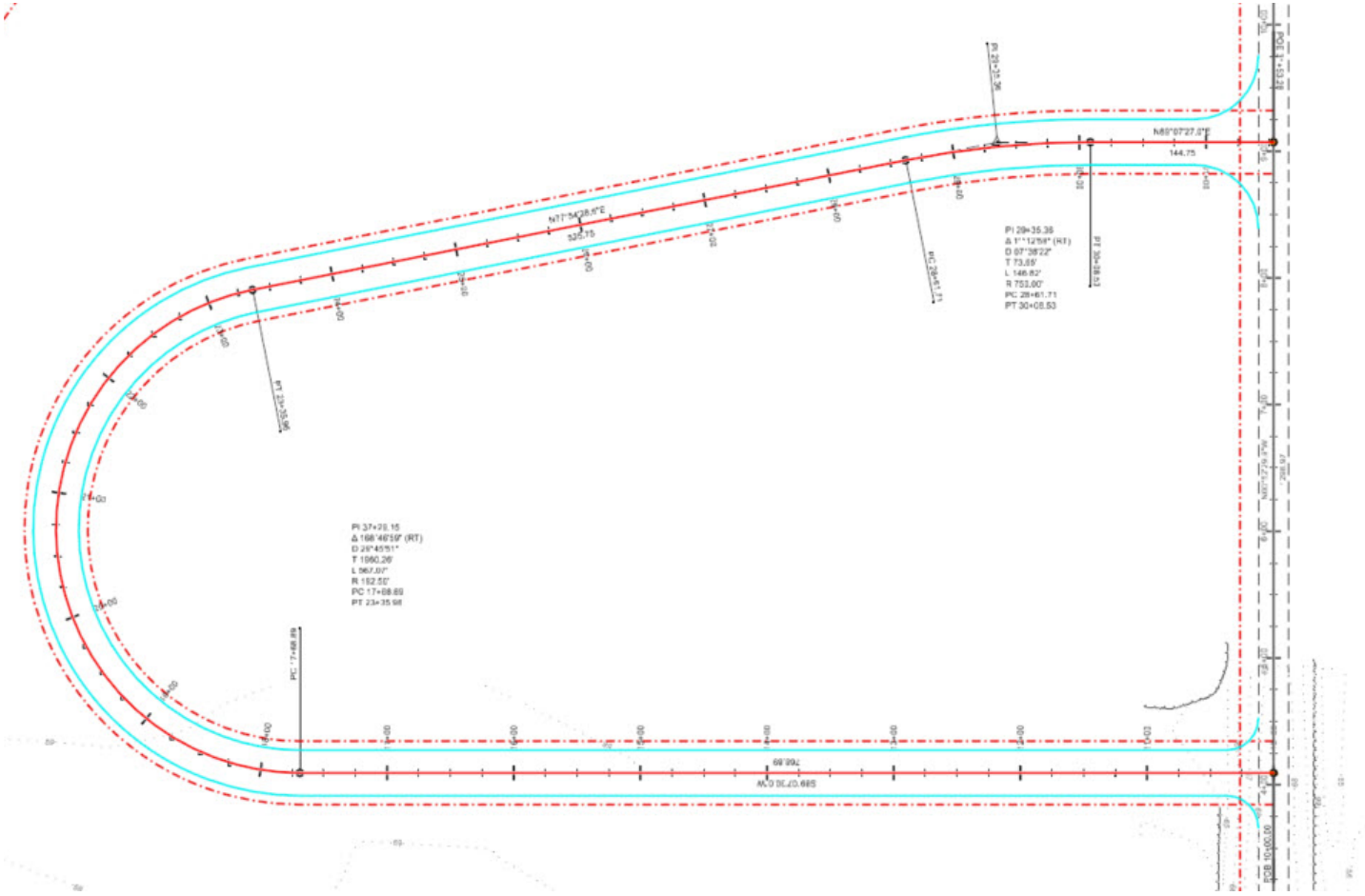
2. Undo the last change by pressing <**Ctrl**> + <**Z**> or by clicking the **Undo** button.

Offsetting the Centerline Alignment to Create Roadway Features

Now that you have constructed the roadway centerline for the subdivision, in this section you will offset this centerline to create roadway features for the proposed edge of pavement and right of way.

In this lesson you will:

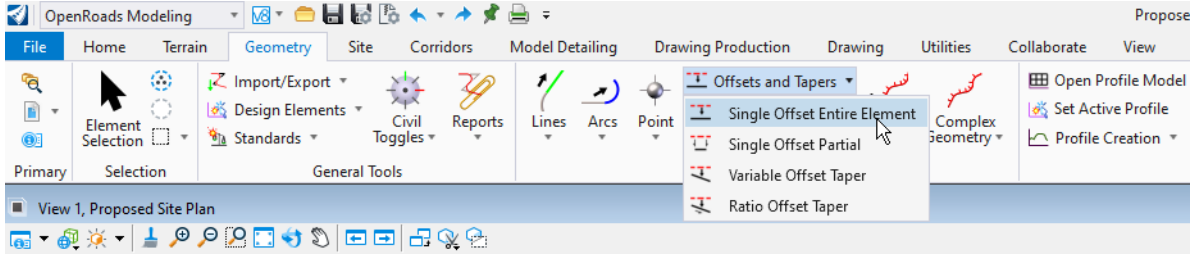
- Utilize the Single Offset Entire Element tool to create roadway features



1. Create the edge of pavement offset geometry.

   a. Continuing in **Proposed Site Plan.dgn**, set the active feature definition to *Linear* > *Pavement* > **Road Edge of Pavement**.

   b. In the *Horizontal* ribbon group, select *Offsets and Tapers* > **Single Offset Entire Element**.

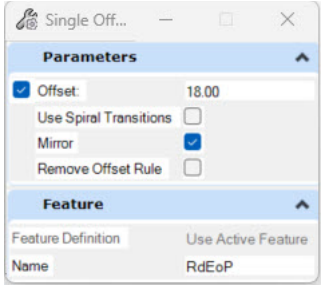


   c. In the *Tool Settings window*, make sure all the check boxes are **unchecked**.

   d. Select the **Subdivision Road** centerline with a **Data Point**.

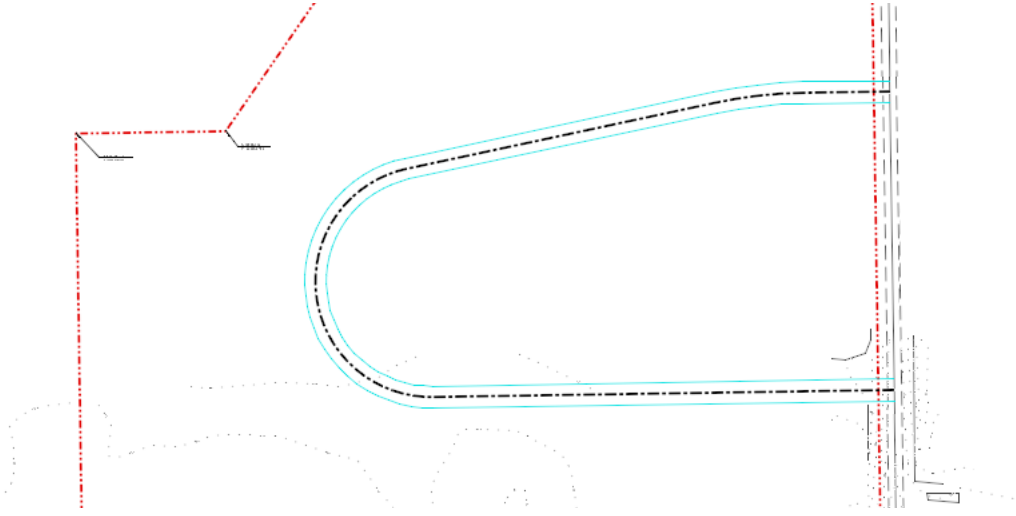
   e. *Move your cursor up* and enter **18** for the *Offset*.

   f. **Data Point** to accept.



   g. Toggle *Mirror* to **Yes** and enter a **Data Point**.

   h. **<Esc>** to Exit command



Both edge of pavement elements are now created. Notice we have two intersection areas. You will now learn how to create the radius returns at these intersections.

2. Create the Radius Returns at the north intersection where Subdivision Road ends.

   a. **Zoom** in to the northern intersection where Subdivision Road meets the side road N. Moody Rd. near station 9+00.

   b. Select *Geometry > Horizontal > Arcs > Arc Between Elements >* **Simple Arc**

   c. Follow the heads-up prompts:

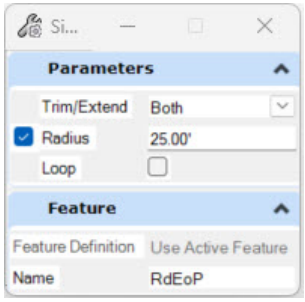
      - *Locate First Element:* Select the **left** edge of pavement for Subdivision Road.
      - *Locate Second Element:* Select the existing **left** edge of pavement element for the N. Moody Rd.
      - *Radius:* **25**
      - *Trim/Extend:* **Back**

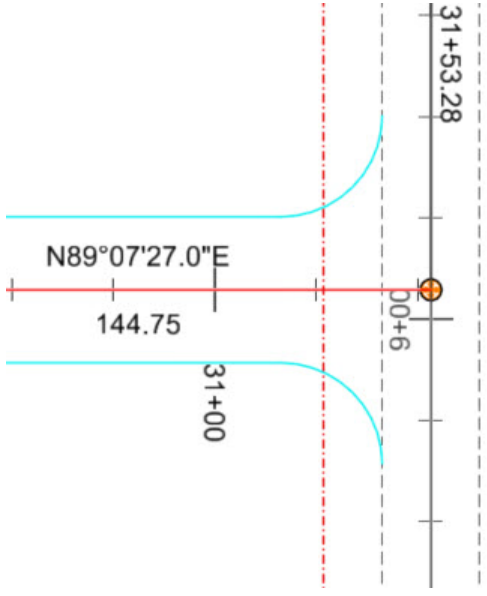
   d. Data point to complete.

   e. Repeat the same process for the right edge of pavement radius return.

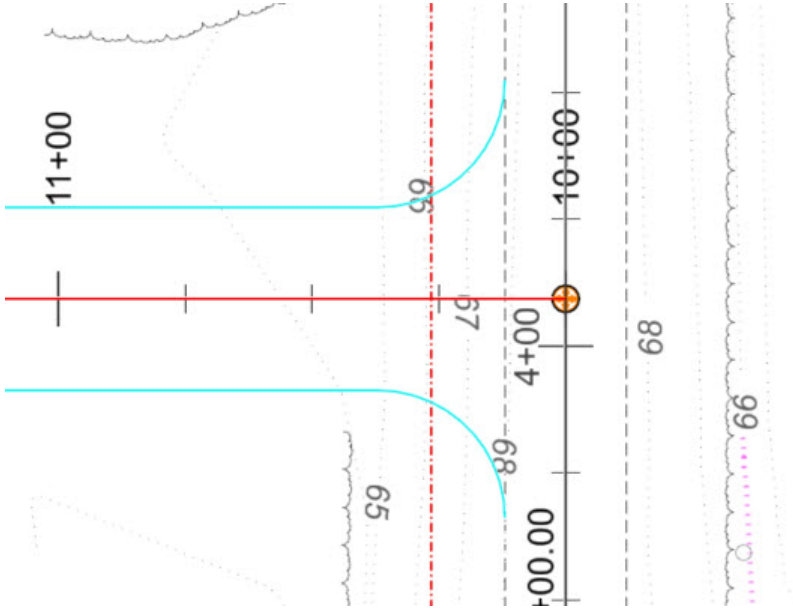
      - Continuing in the **Simple Arc** command. Follow the heads-up prompts:
      - *Locate First Element:* Select the **right** edge of pavement for Subdivision Road.
      - *Locate Second Element:* Select the existing **left** edge of pavement element for the N. Moody Rd.
      - *Radius:* **25**
      - *Trim/Extend:* **Back**

   f. Data point to complete.





3. Create the Radius Returns at the south intersection where Subdivision Road begins at 10+00.
   a. **Zoom** in to the beginning of Subdivision Road.
   b. Use the same process and settings to create radius returns for this intersection.



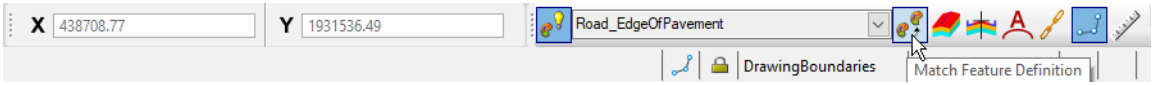
Remember, all the geometry is dynamic and associative. You can change the radius values at any time and the connected geometry will adjust. Let's take a look.

4. Change the radius returns for the northern intersection to be **50**.
   a. Select the north radius return, select the dynamic text value of *25* and key-in **50**, data point to complete.
   b. Select the south radius return, select the dynamic text value of *25* and key-in **50**.data point to complete.
   c. Press **UNDO** two times to change the Radii back to their original values of **25**.

Now that the edge of pavement geometry is complete let's create the proposed right of way lines for Subdivision Road.

5. Create the proposed right of way for Subdivision Road.

   d. In the *Feature Definition Toolbar*, select **Match Feature Definition**.



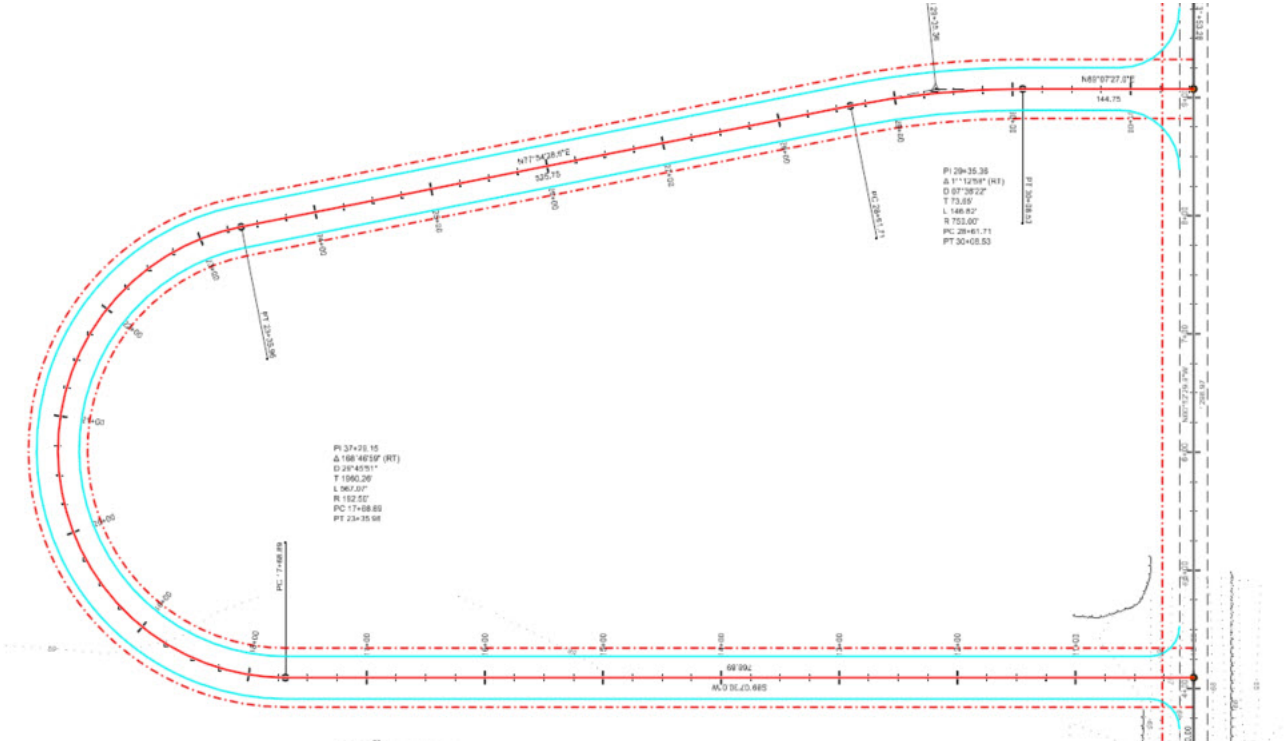
   e. *Select* one of the **proposed subdivision lines**. This will update the *Feature Definition* to **P_ROW**.

   f. In the *Horizontal* ribbon group, select *Offsets and Tapers* > **Single Offset Entire Element**.

   g. In the *Tool Settings window*, make sure all the check boxes are unchecked.

   h. Select the **Subdivision Road** centerline and use an offset of **25**.

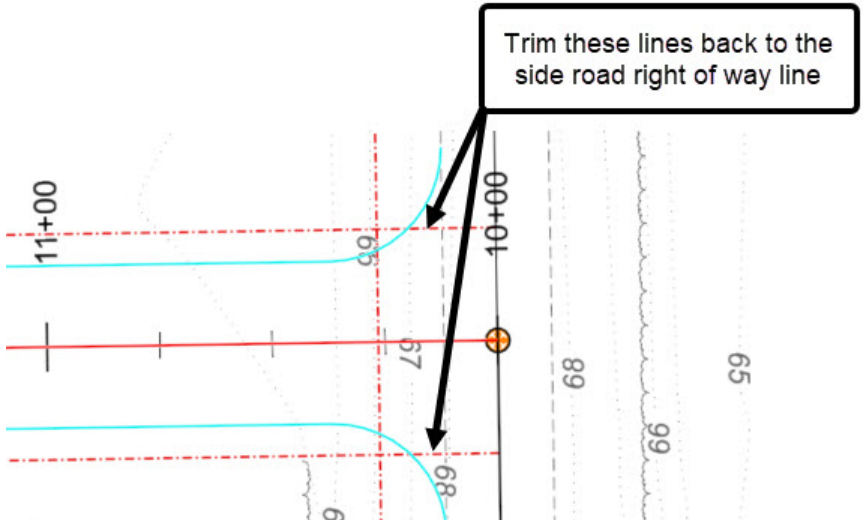
   i. Say **Yes** to *Mirror*.



(Completed roadway features)

Now that the offset geometry is complete, let's cleanup up the right of way lines that extend beyond the side road right of way line.

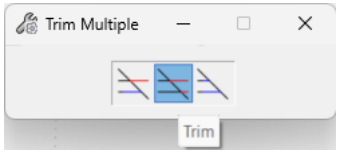
6. Trim the right of way features to end at the side road right of way line.



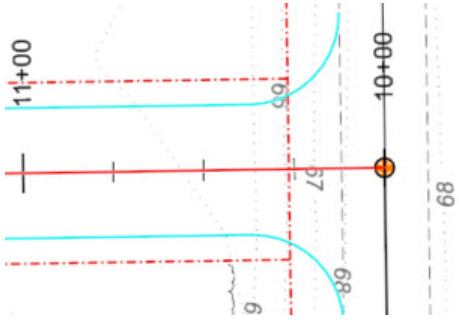
a. **Zoom** in to the southern intersection area where Subdivision Road begins.

b. Select *Drawing* > *Modify* > **Trim Multiple**

- Set the Trim options to **Trim**

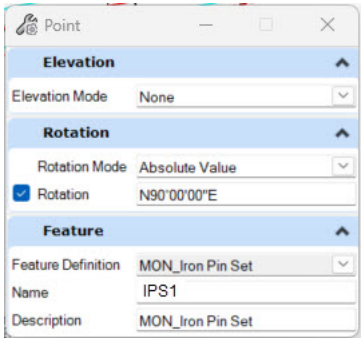


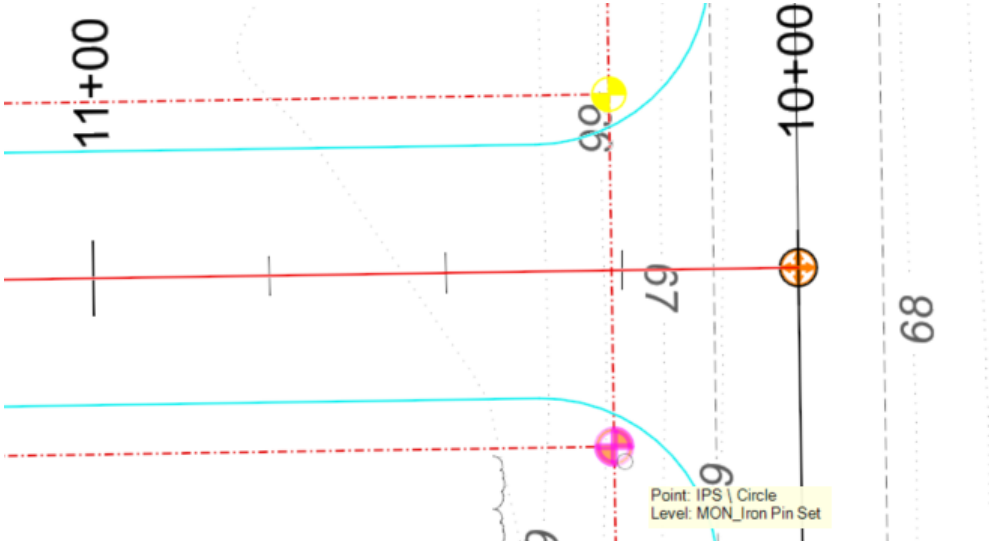
- *Identify cutting elements:* Select the side road right of way line as the cutting element
- *Identify elements to trim:* Select the Subdivision right side right of way element, be sure to select the part of the element that extends to the side road centerline. Data point to accept.
- *Identify elements to trim:* Select the Subdivision left right of way element, be sure to select the part of the element that extends to the side road centerline. Data point to accept.



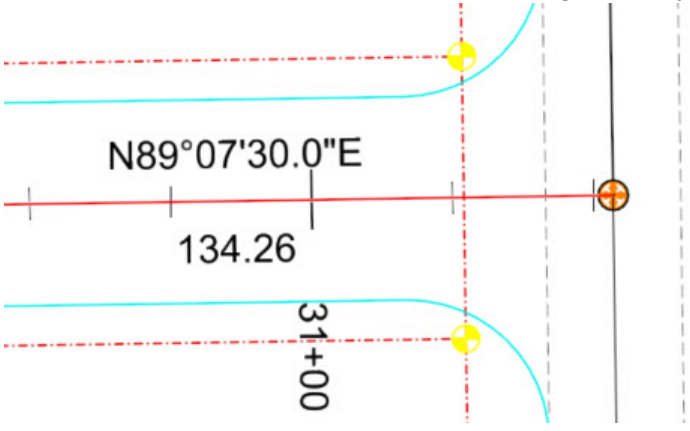
c. Repeat the process for the northern intersection area.

7. Place Iron Pins where the Subdivision Road right of way intersects the side road right of way.
   a. Select *Geometry* > *Horizontal* > **Point**
   b. Set the *Feature Definition* to *Point* > *Monuments* > **MON_Iron Pin Set**
   c. Set the dialog as shown below.





   d. Key-point snap to the first right of way intersection to place **IPS1**, data point to accept.
   e. Key-point snap to the second intersection right of way intersection to place **IPS2**, data point to accept.
   f. Repeat this process for the northern intersection where the Subdivision Road right of way intersects the side road right of way line.

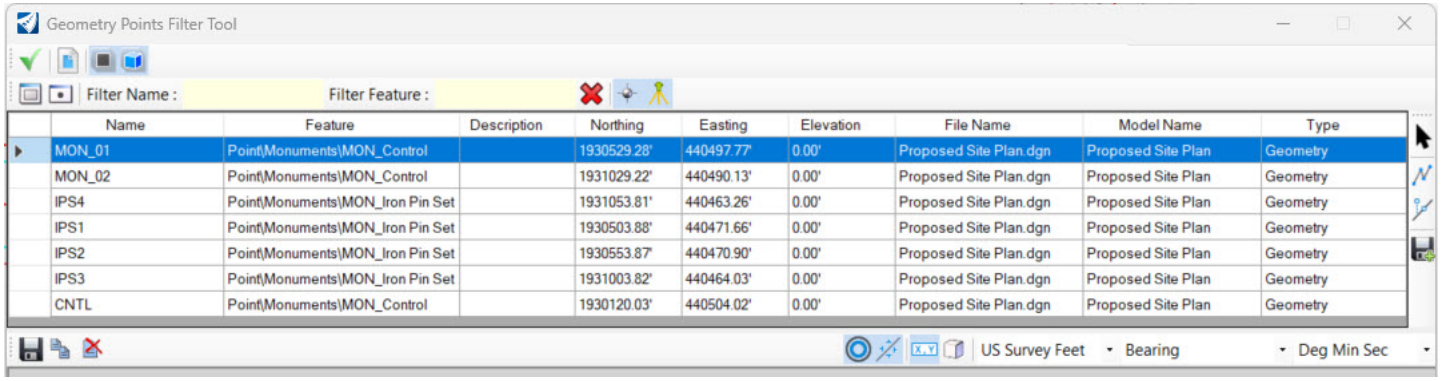


Now that we have placed some Iron Pins and Monuments let's review all the geometry points in this design file.

8. Reviewing Geometry Points with the Geometry Points Filter.

   a. Select the *Points Filter* tool, the dialog will appear displaying all the points in this file and any files attached as references.

      - This tool has many useful features for viewing and filtering points. There are also utilities to Inverse between points and report Station-Offset. Another useful feature is the ability to save the point list to a .csv file.



   b. Filter all the iron pins set.

   c. Type **IPS**, in the *Filter Name* field. The points will be filtered to only show the Iron Pins that we set.

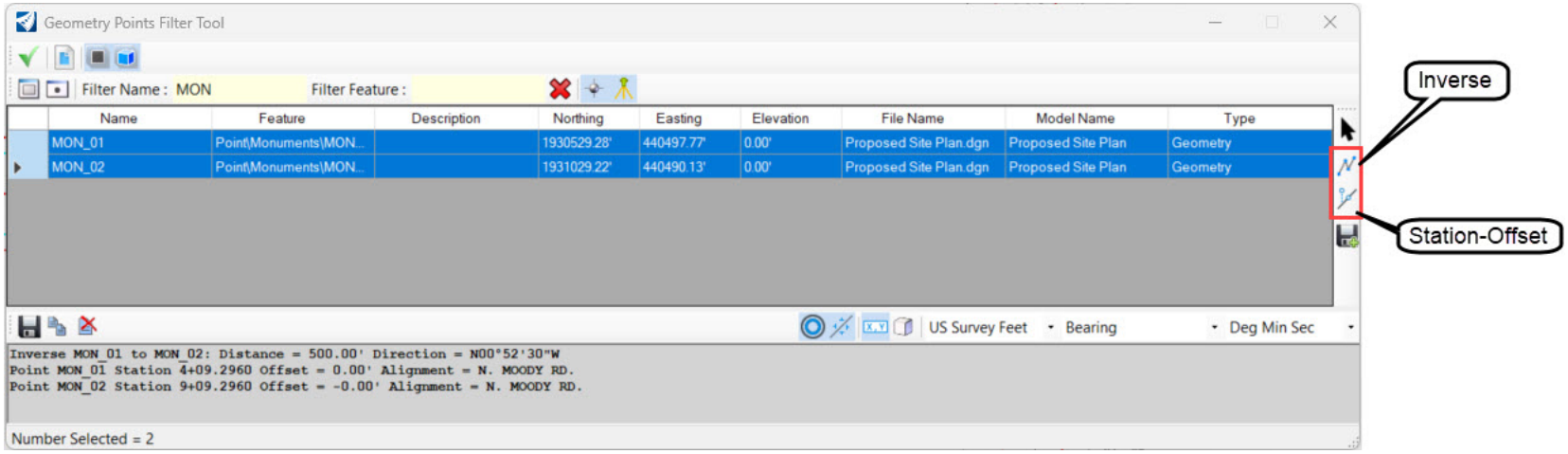
   d. Press the **Delete** button (red X) to clear the filter.

   e. Type **MON**, in the Filter Name field. Only the monuments will be display in the list.

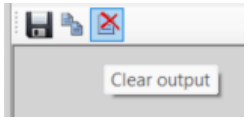
   f. Select the *Inverse* tool. Note, the inverse data is displayed in the bottom portion of the dialog.

   g. Select the *Station-Offset* tool.

h. Select the side road N. Moody Rd. as the reference alignment. Note, the station and offset information is displayed in the bottom portion of the dialog.



i. Clear the results report by pressing the *Clear Output* button. Note, you can also save the results to a .txt file or copy them to the clipboard.



j. Close the *Geometry Points Filter* dialog.

Skills Assessment

The questions below will test your retention of the skills covered in this course.

---

1. Which tool provides the user the ability to enter property information in a user friendly tabular format?
   a. Geometry Points Filter
   b. COGO Navigator
   c. Geometry Builder
   d. Parcel Editor
2. The Geometry Builder tool gives you the ability to check closure, true or false?
   a. True
   b. False
3. Which tool can be used to locate geometry points at specific locations in reference to other geometry points and elements?
   a. AccuDraw
   b. XY=
   c. Absolute XY
   d. Civil AccuDraw
4. Which tool is used to create the horizontal alignment?
   a. Create Alignment
   b. Create Complex By Element
   c. Join
   d. Connect By Element

Skills Assessment - Answers

The answers to the skills assessment questions are highlighted below.

---

1. Which tool provides the user the ability to enter property information in a user friendly tabular format?
   a. Geometry Points Filter
   b. COGO Navigator
   c. **Geometry Builder**
   d. Parcel Editor
2. The Geometry Builder tool gives you the ability to check closure, true or false?
   a. **True**
   b. False
3. Which tool can be used to locate geometry points at specific locations in reference to other geometry points and elements?
   a. AccuDraw
   b. XY=
   c. Absolute XY
   d. **Civil AccuDraw**
4. Which tool is used to create the horizontal alignment?
   a. Create Alignment
   b. **Create Complex By Element**
   c. Join
   d. Connect By Element

Summary

In this module you learned fundamental skills for drawing geometry with the civil geometry tools. You learned how to enter property information and how to create a subdivision parcel. You learned how to create the centerline, edges of pavement and right of way geometry for the Subdivision Road. You also learned how to place labels, annotate geometry and review geometry reports.

Skills Taught

- Geometry Builder
- Map Check Report
- Place Labels with Civil Labeler
- Civil AccuDraw
- Place Point
- Place Line Between Points
- Place Simple Arc From Element
- Place Simple Line From Element
- Complex By Element
- Horizontal Alignment Report
- Single Offset Entire Element
- Annotate Element
- Trim to Element
- Geometry Points Filter