Laying out Culverts and Drainage Design in Connect
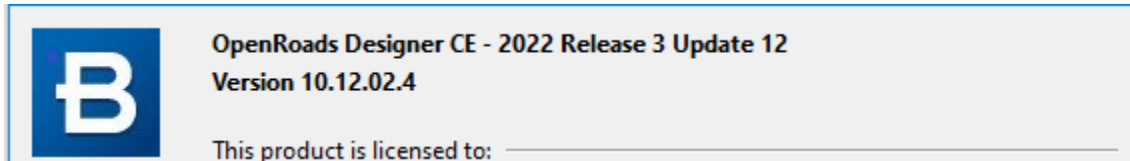
These instructions were created April 2024. These instructions were created with:

OpenRoads Designer CE - 2022 Release 3 Update 12
Version 10.12.02.4

This product is licensed to:

First, review the project information and determine where the best locations for the structures that are needed. Once a location is determined, calculate the correct size. Refer to the BDM Chapter 4 https://iowadot.gov/bridge/policy/04-01-00Prelim.pdf. When the correct type, size and location are determined, design the new structure.

Two methods can be used to analyze the corridor to design the new structures. If designing a structure that is perpendicular to the alignment, use the first method of Cutting a Dynamic Section.

First Method

Cutting a Dynamic Section - The tool needed to do this is in the OpenRoads Modeling workflow on the Corridors tab in the Review group or on the Drainage Utilities workflow on the Utilities View tab in the Drawing Views group. Keep in mind that these tools work well if the structure is placed 90 degrees from the alignment. If the desired design is not, then use the second method.

When using this tool, the recommendation is to turn the corridor reference display off in the 2D model View 1. This was done previously when setting up the CADD file. The reason for this, is this tool will ask to select a corridor or alignment. With the corridor turned off, selection of the alignment is easier. To do this, make sure the View 1 is set to be the active view and open the Reference dialog box and turn off the corridor.
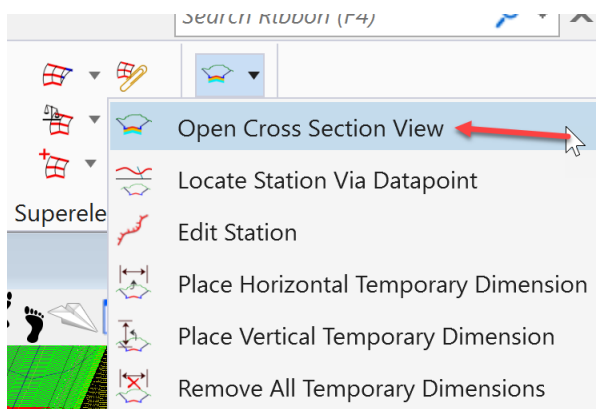
Next, open a view to display the section in. For this example, use View 7.

In the OpenRoads Modeling workflow; on the Corridors tab in the Review group, select the Dynamic Sections tools.
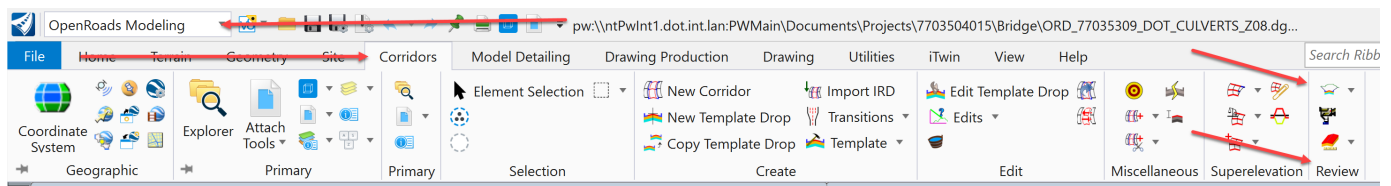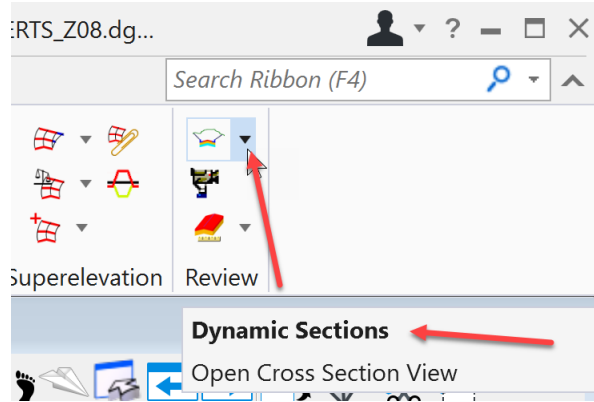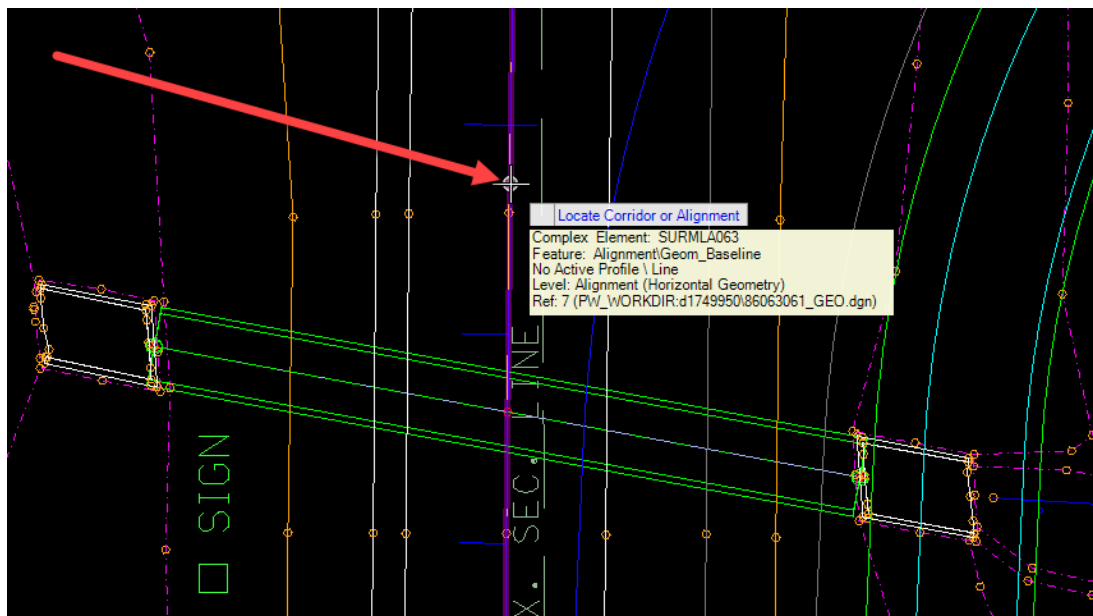
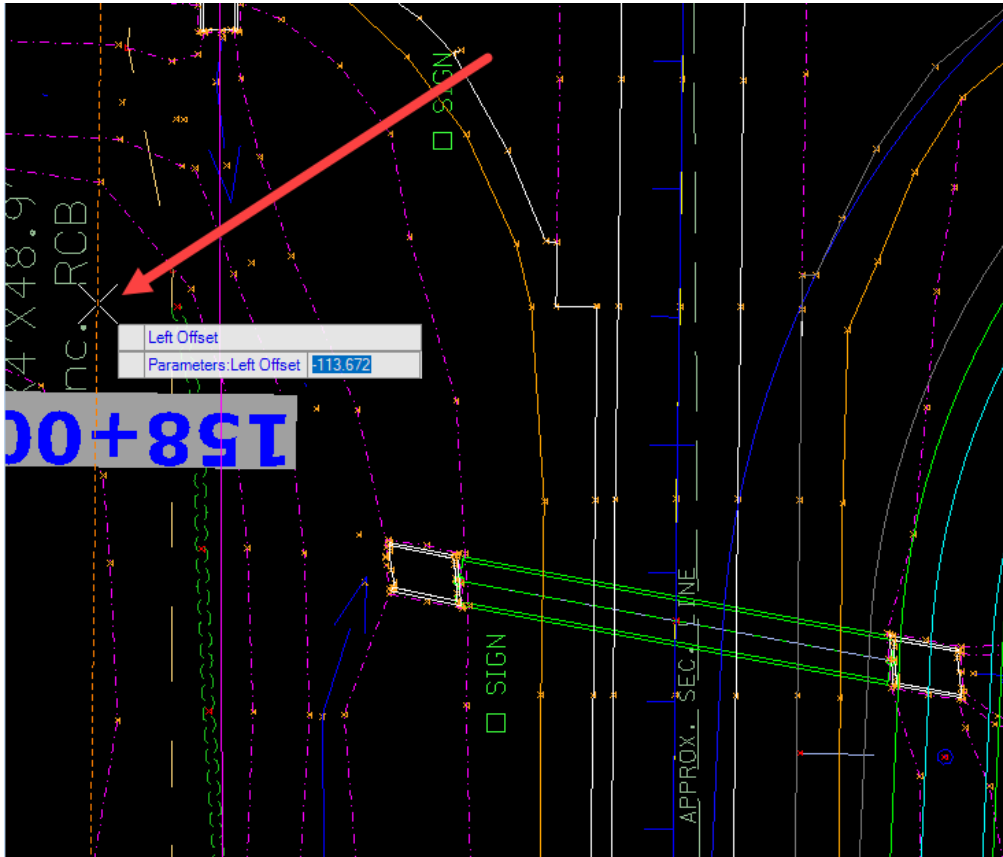Then select the Open Cross Section View tool.
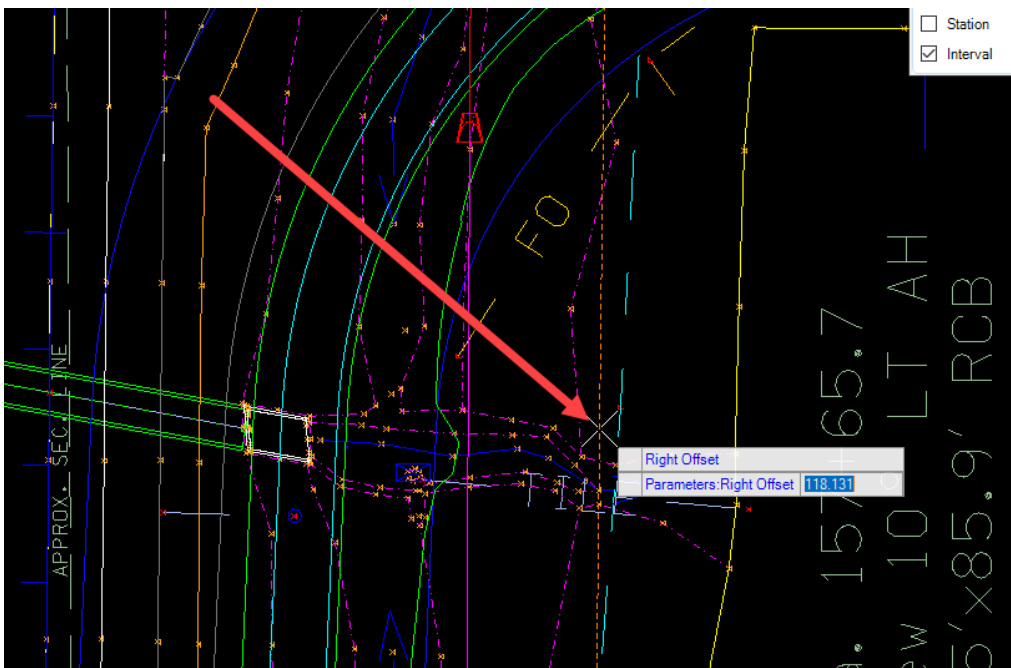

It prompts to locate the alignment.

Data point on the alignment in the 2D view. In this example View 1.

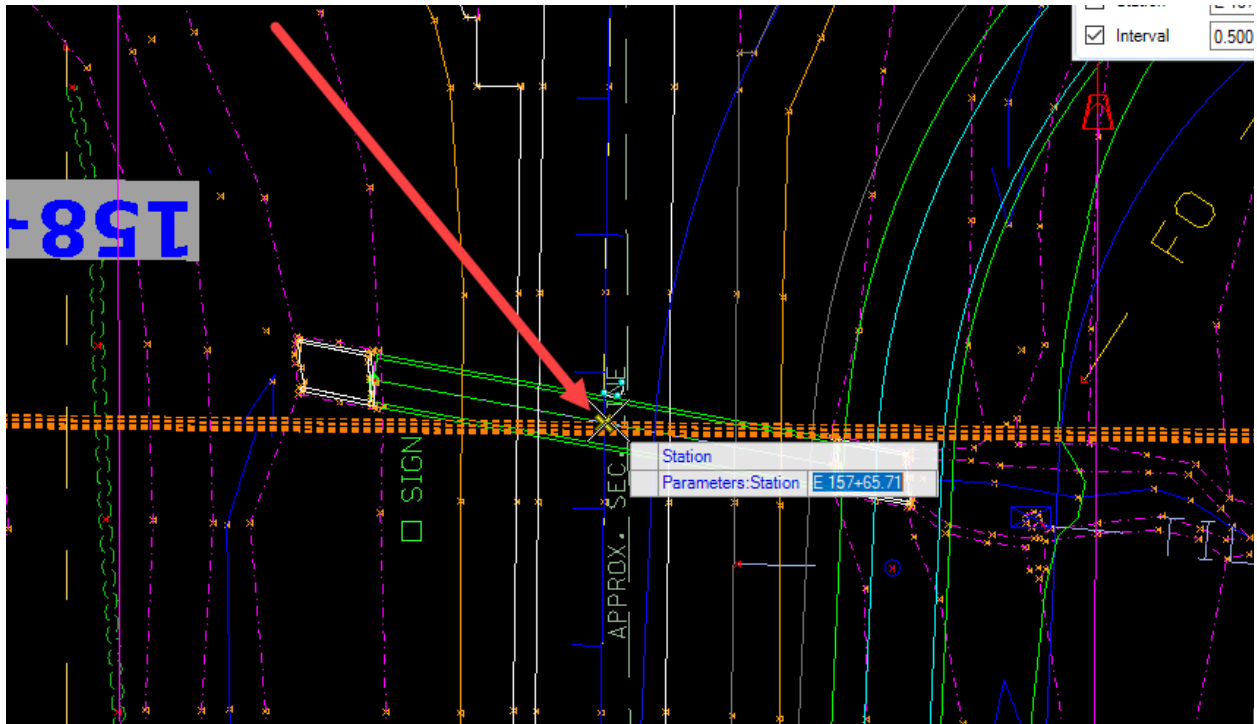Then select the Offset Left. This will determine how far left the section will cover.

Then select the Offset Right. This will determine how far right the section will cover.
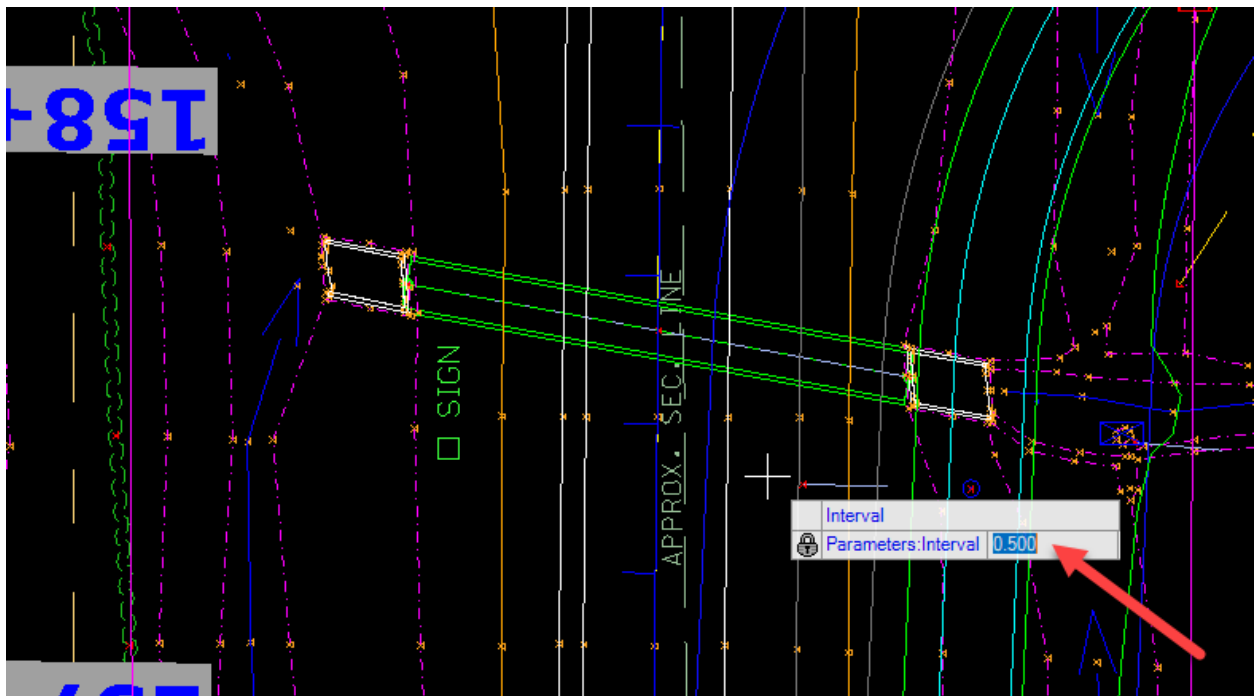
Then select the Station.

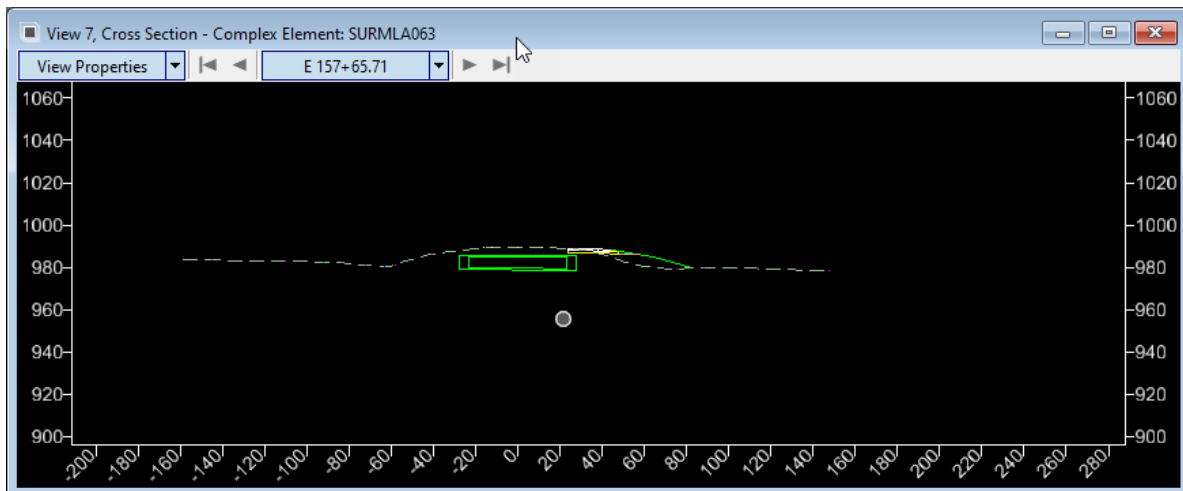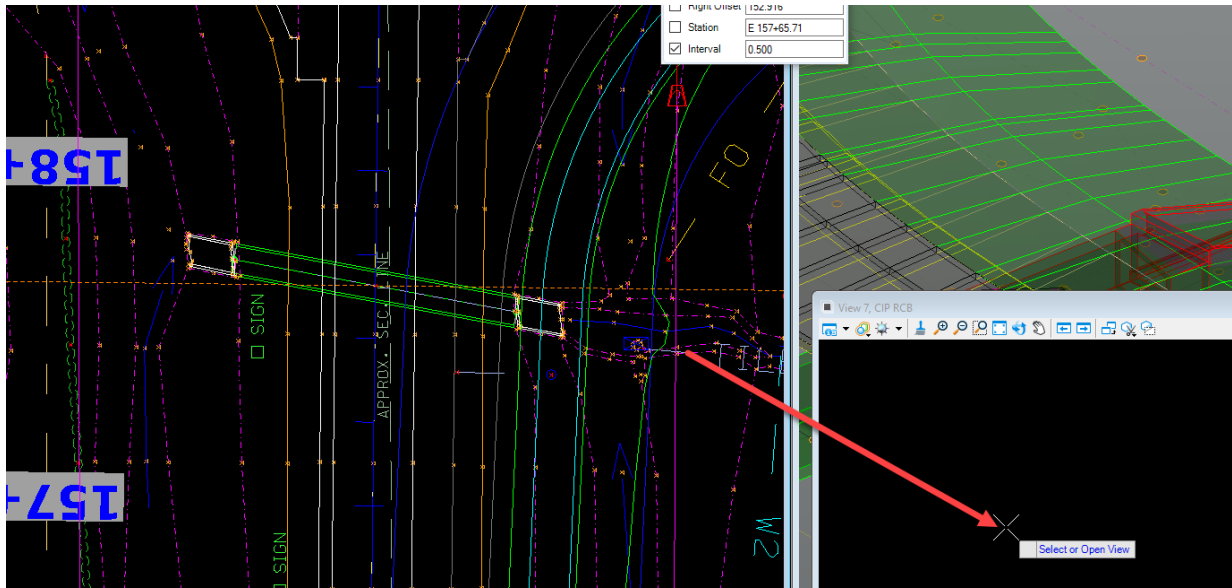**Note:** This does not need to be perfect when selecting it here, it can be adjusted later to a specific station.
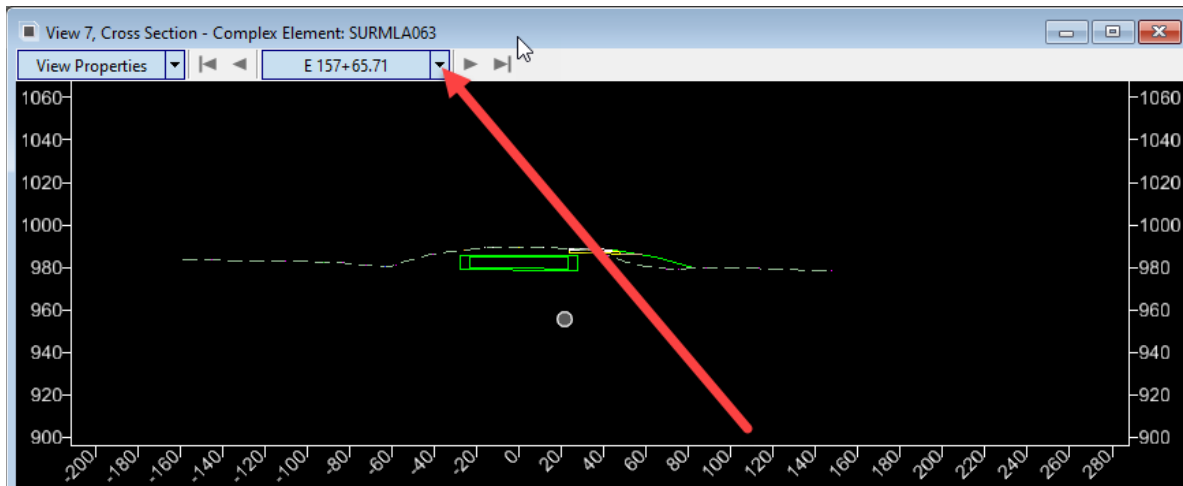

Select the Interval.

Note: Recommend an interval of 0.5 = 6" for culvert design.
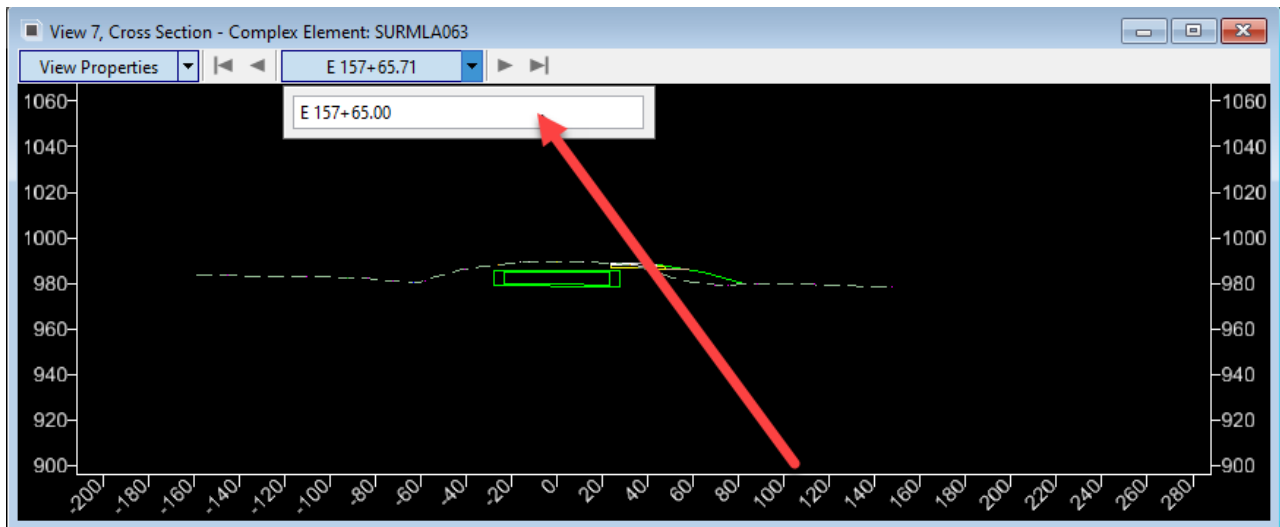
Select the View. Data point in View 7 and the section will appear.

Adjust the Station with the pull down at the top of view window.

Then type the Station value needed and hit enter.

Or use the arrow buttons on each side of the Station value field to change the station at the Interval that was selected when the section was created. The value 0.5 = 6" was used so it will advance or move back every 6" by clicking on the buttons.
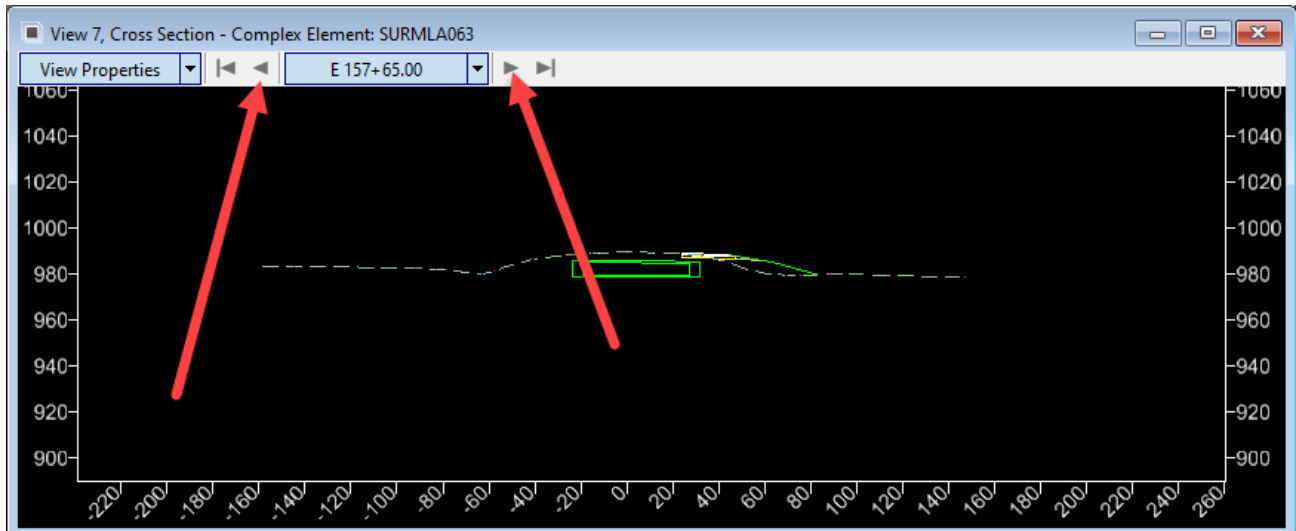
Now that there is a section cut in the area for placing the new structure, place the headwall cell that corresponds with the structure design.
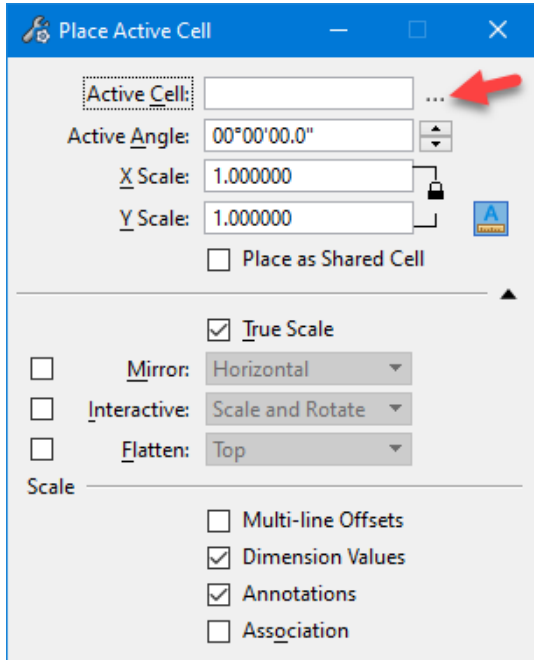
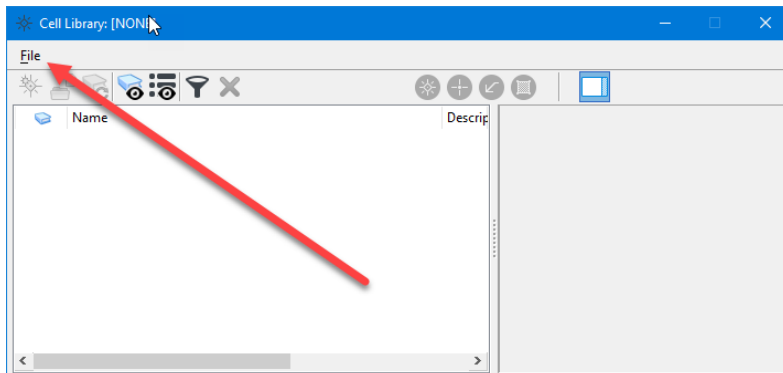To do this, make the View 1 = 2D model active and use the place cell tool.
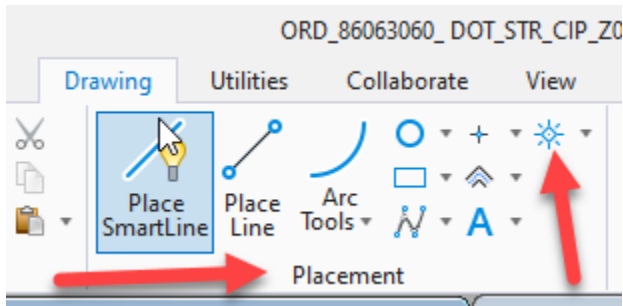
Select the correct cell library

pw:\\NTPwint1.dot.int.lan:PWMain\Documents\Resources\ClientWorkspaces\IowaDOT\IowaDOTProduction\Organization-Civil\IowaDOT_Standards\Cell\Headwalls_CIP.cel and Headwalls_Precast.cel
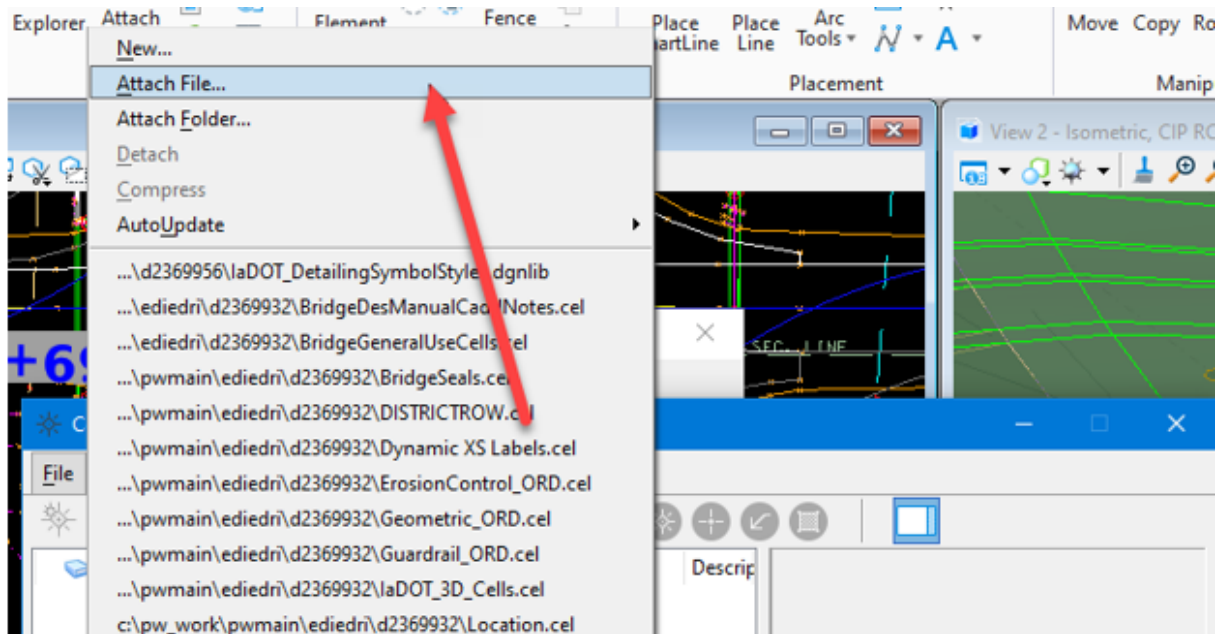
Click on the dots next to the Active Cell field.

This will open the following dialog box. Then click on the File menu.
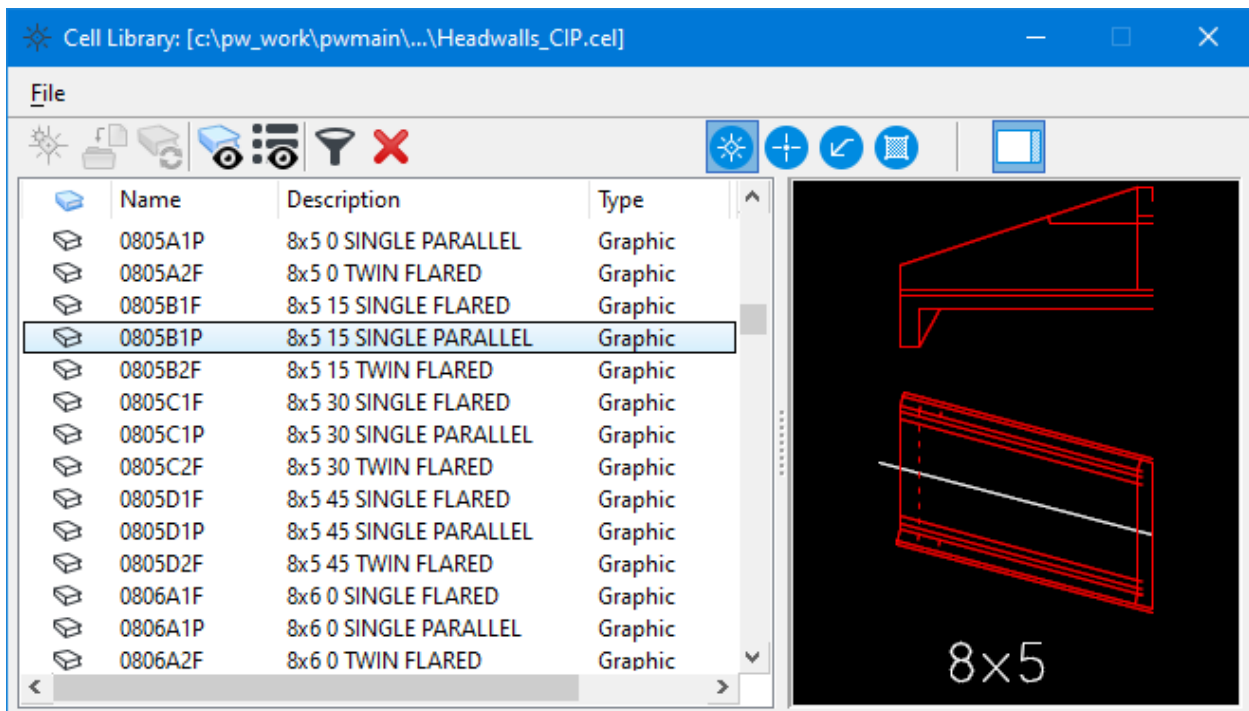
Then click on Attach File….

Browse to
pw:\\NTPwint1.dot.int.lan:PWMain\Documents\Resources\ClientWorkspaces\IowaDOT\IowaDOTProdu
ction\Organization-Civil\IowaDOT_Standards\Cell\

Once the correct cell library is attached, select the correct cell that corresponds with the structure that is being designed.

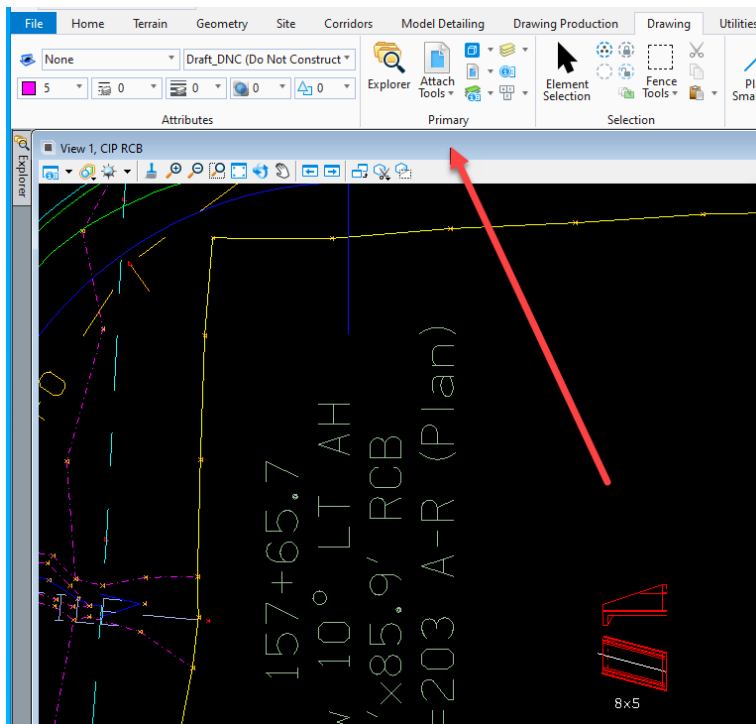For this example, use the single 8' x 5' 15-degree CIP RCB. The cell needed is 0805B1P

Then place this cell in the 2D View 1 next to the location of the structure being designed.
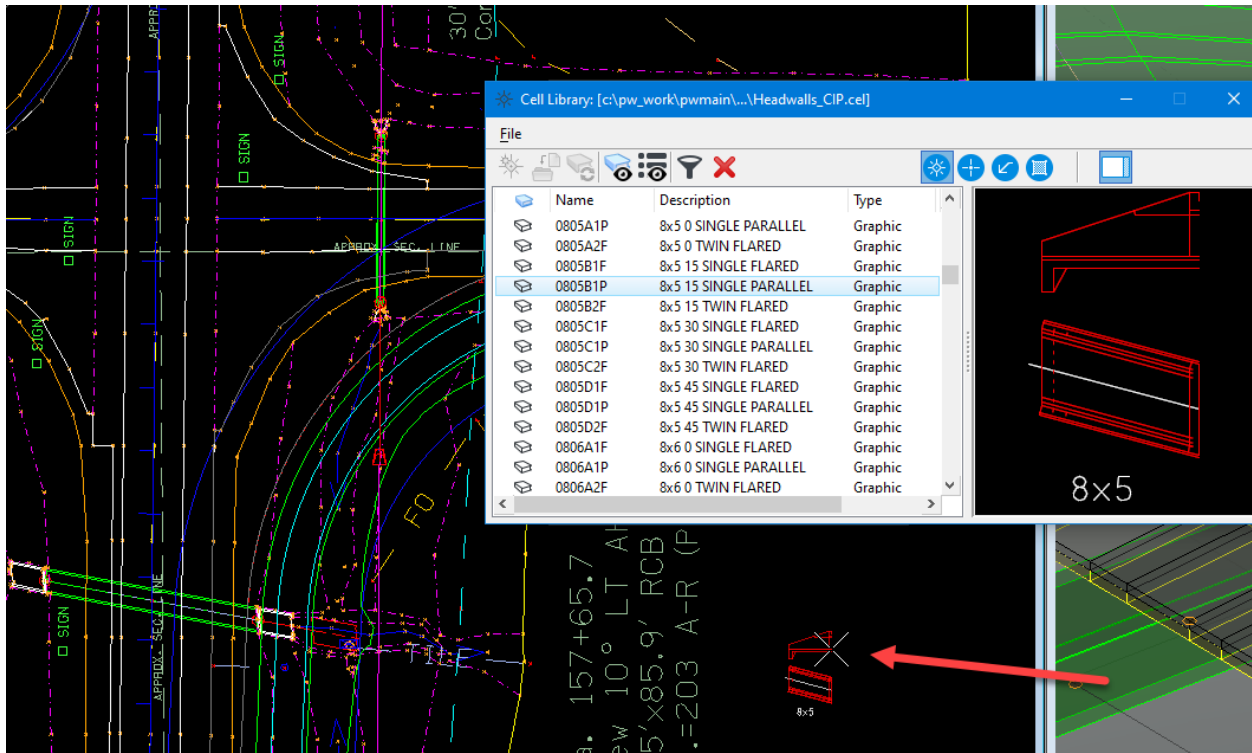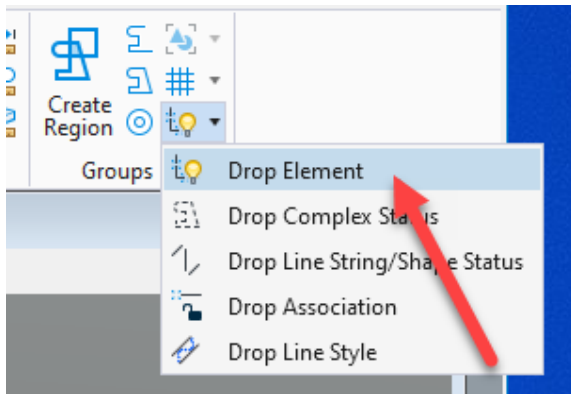

Copy the profile part of the headwall into the cross-section model in View 7.
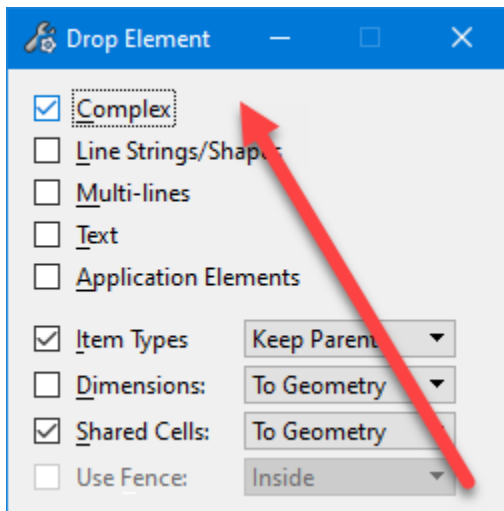
To do this, make the View 1 active by clicking on top of the view.
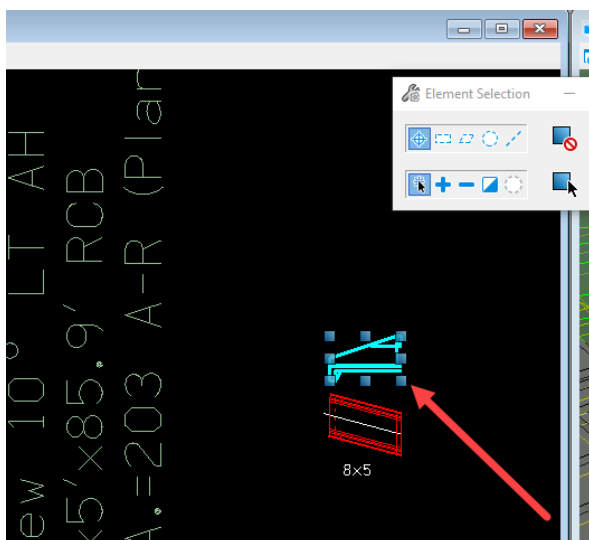
Then select the drop element tool.
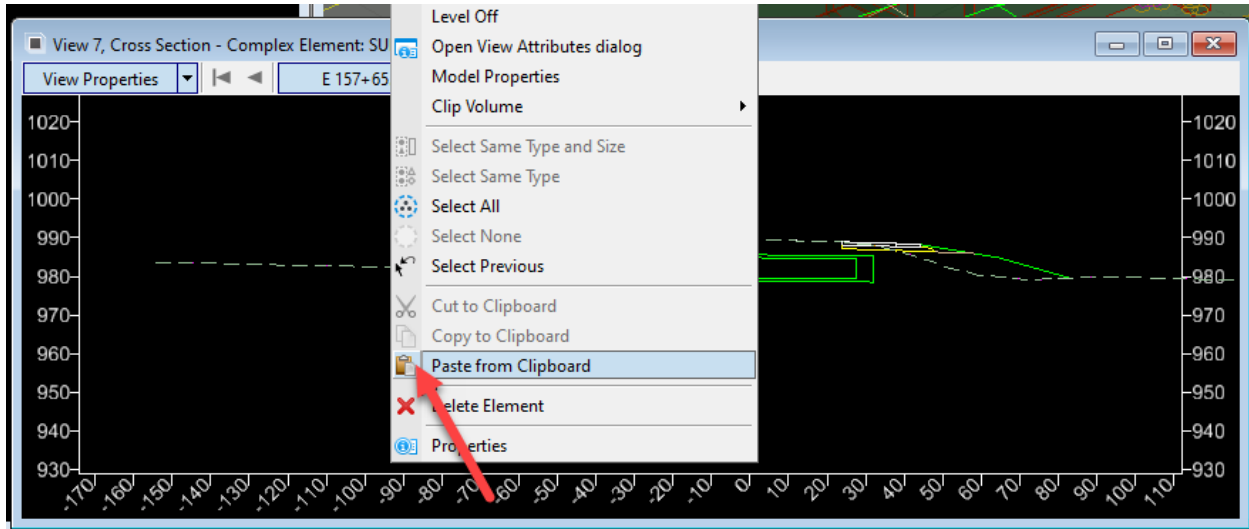

Select complex.

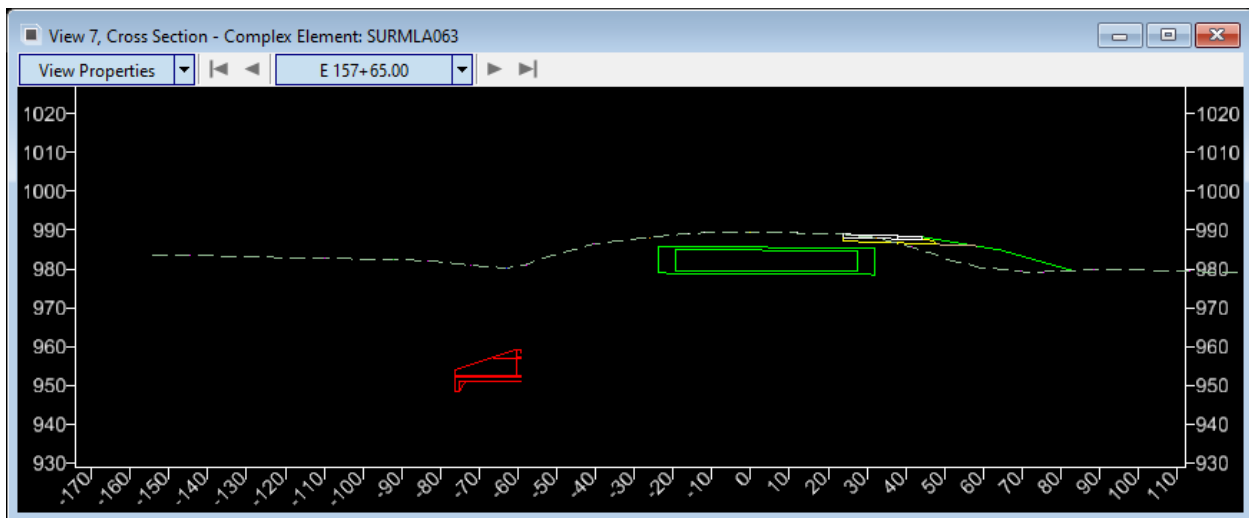Then click on the cell, which allows selection of just the profile part of the headwall cell.

Then use the element selection tool and select the profile part of the headwall cell that was just placed.

Press the Ctrl + C key on the keyboard to do a copy. Then make the View 7 active by clicking on top of the view. In View 7, right click and hold for a second to access the right click menu.


Select Paste from Clipboard. The profile part of the headwall cell should appear on the end of the cursor in that view. Datapoint to place the cell.


This was done to provide a copy of the profile part of the headwall cell in the Cross Section Dynamic view window that will be used to determine the invert locations of the structure. These are intended to be used as temporary graphics and will remain in this view no matter what section is cut until deleted. Once done using them it is good practice to delete them.

Next, select the profile part of the headwall cell that was just placed in the Dynamic Cross Section view with the element selection tool. Use the Mirror tool, set it to Vertical direction and toggle on Make Copy to make the cell for the other side of the structure. This is used to determine the invert locations at the other end of the structure.
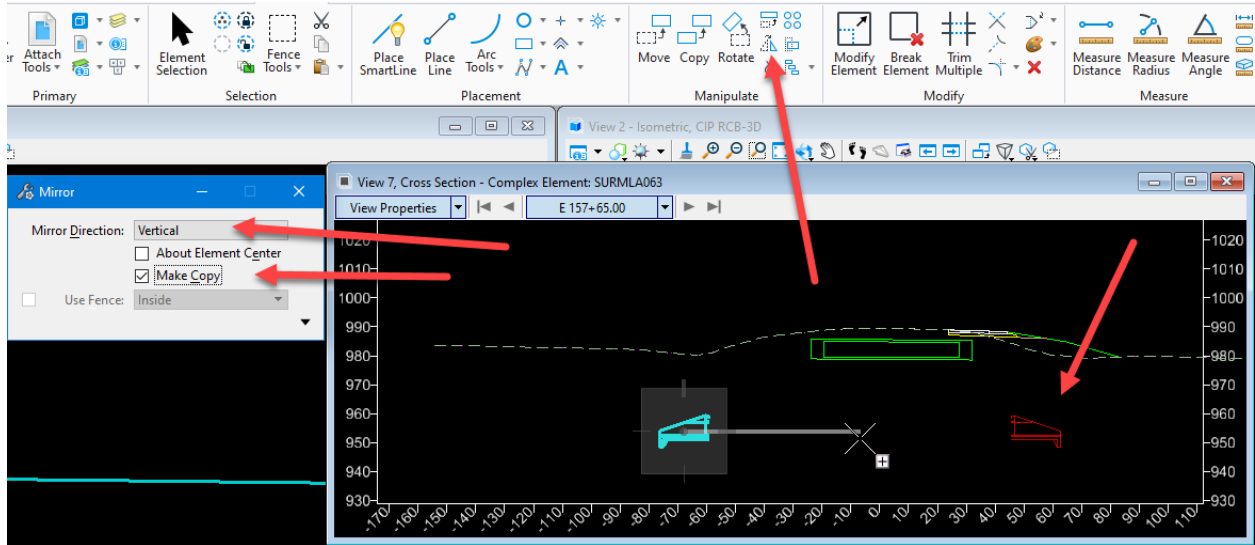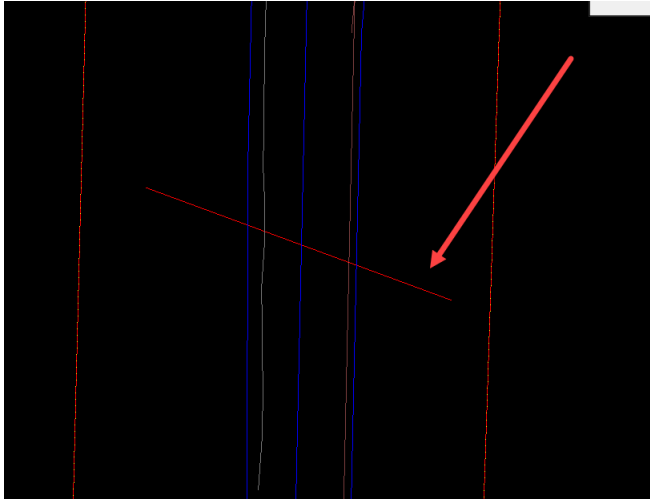
These graphics can be moved and placed anywhere they are needed to design the new structure.
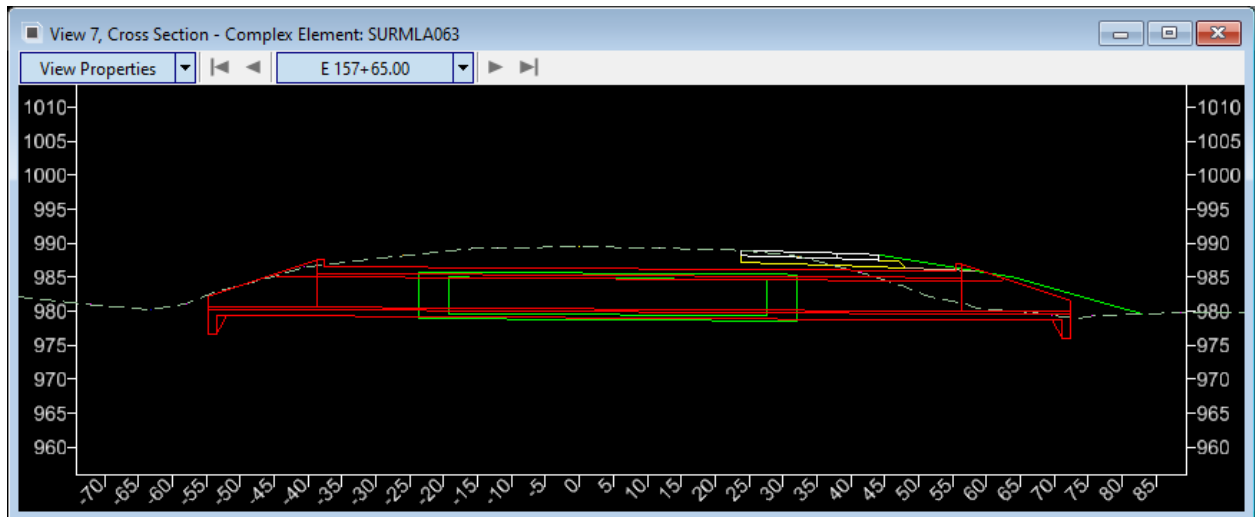
If designing a structure that is not perpendicular to the alignment, use the second method of Designing in the Profile Window.
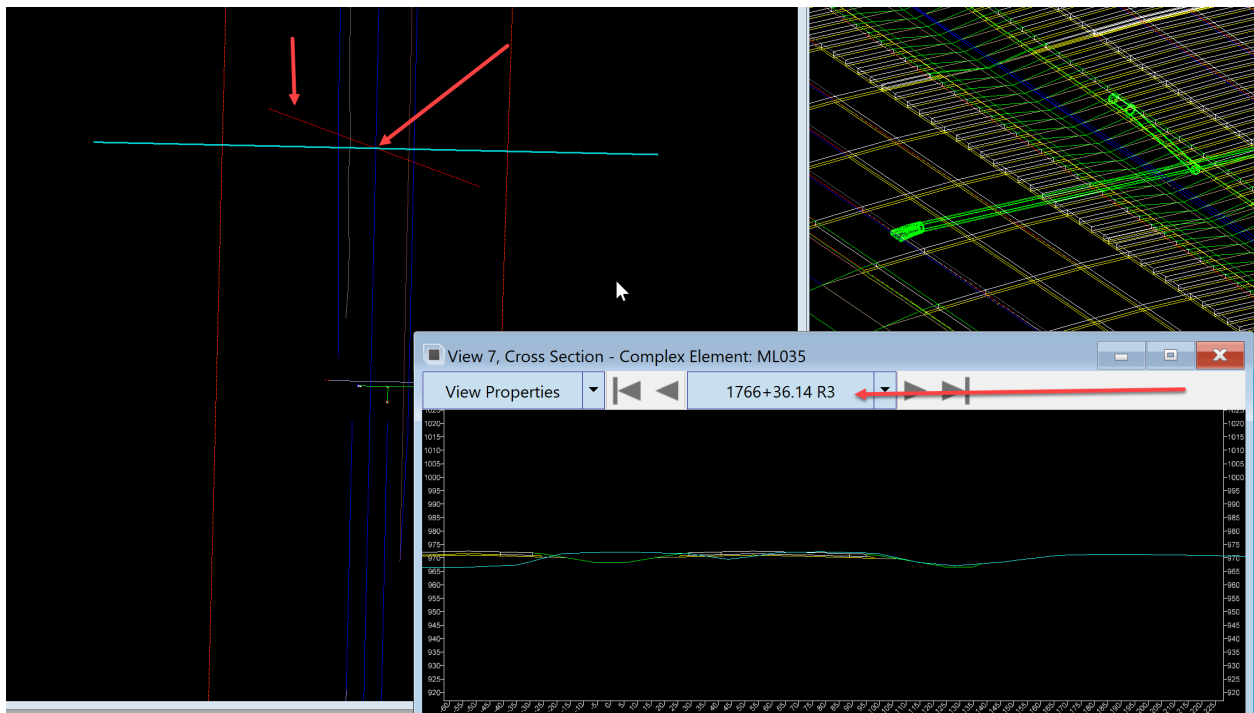
Second Method

Designing in the Profile Window - To start, place a line where the structure should be placed.


Then, cut a section on that line where it intersects the alignment. This will give us a station value for the new structure.
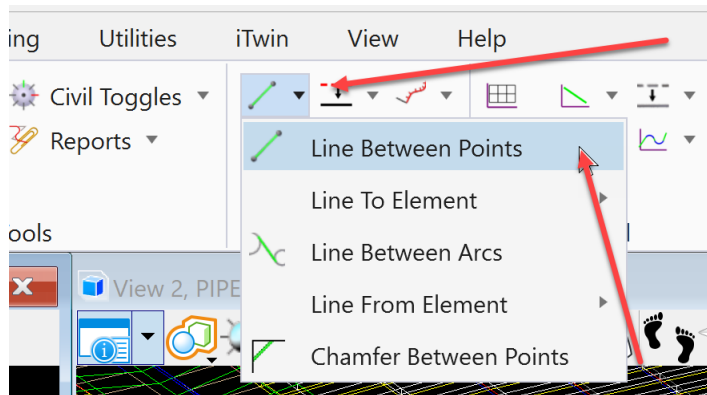
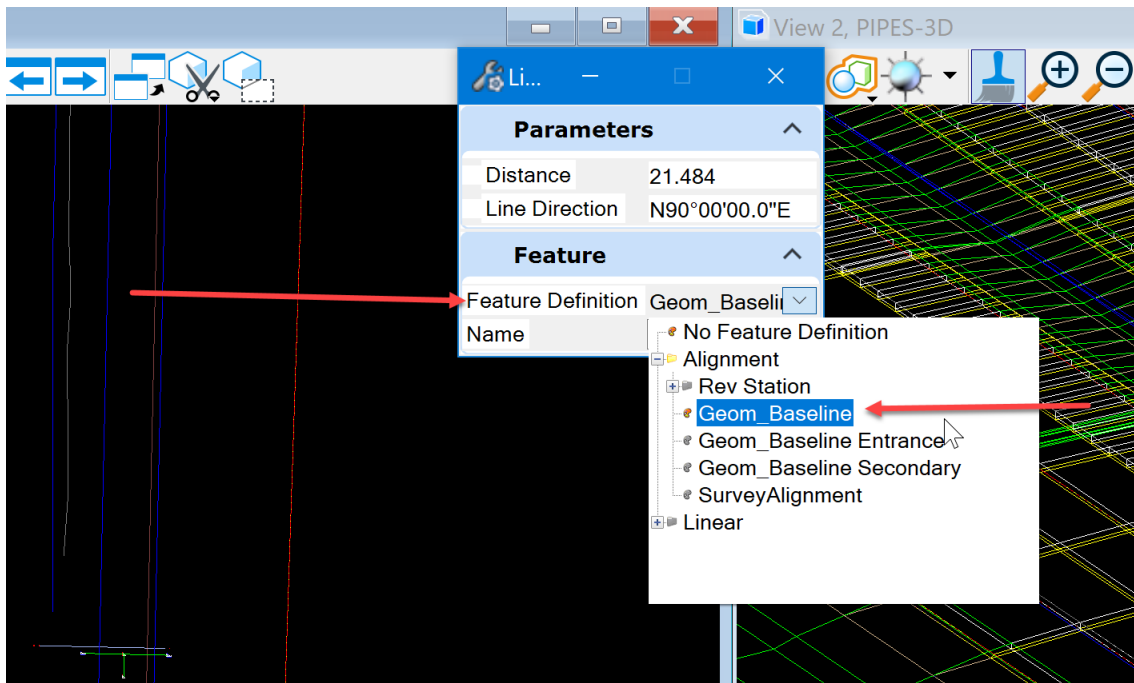For this example, it will be STA 1766+36.14

Next, place a geometry base line on the line placed as the structure alignment, the red line in the image above. Change the workflow to OpenRoads Modeling workflow. On the Geometry tab select the Line tools in the Horizontal group.
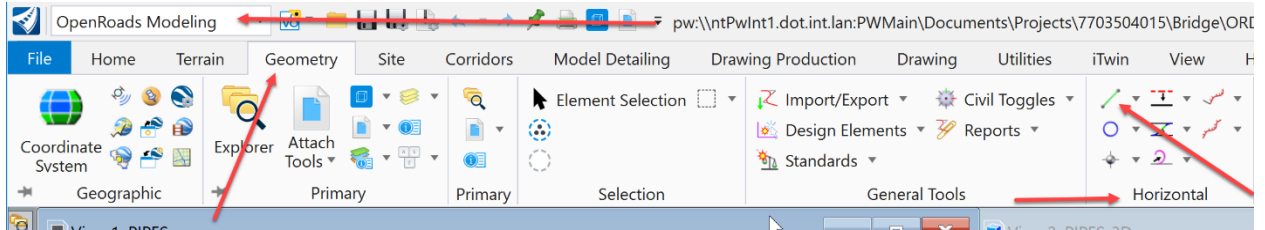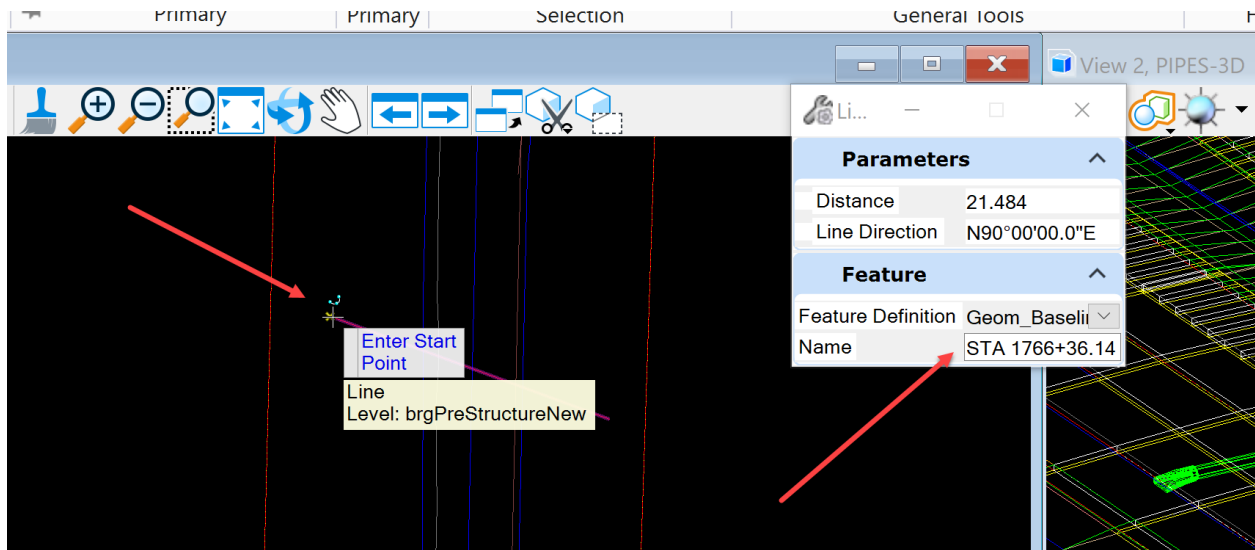
Select the Line Between Points tool.

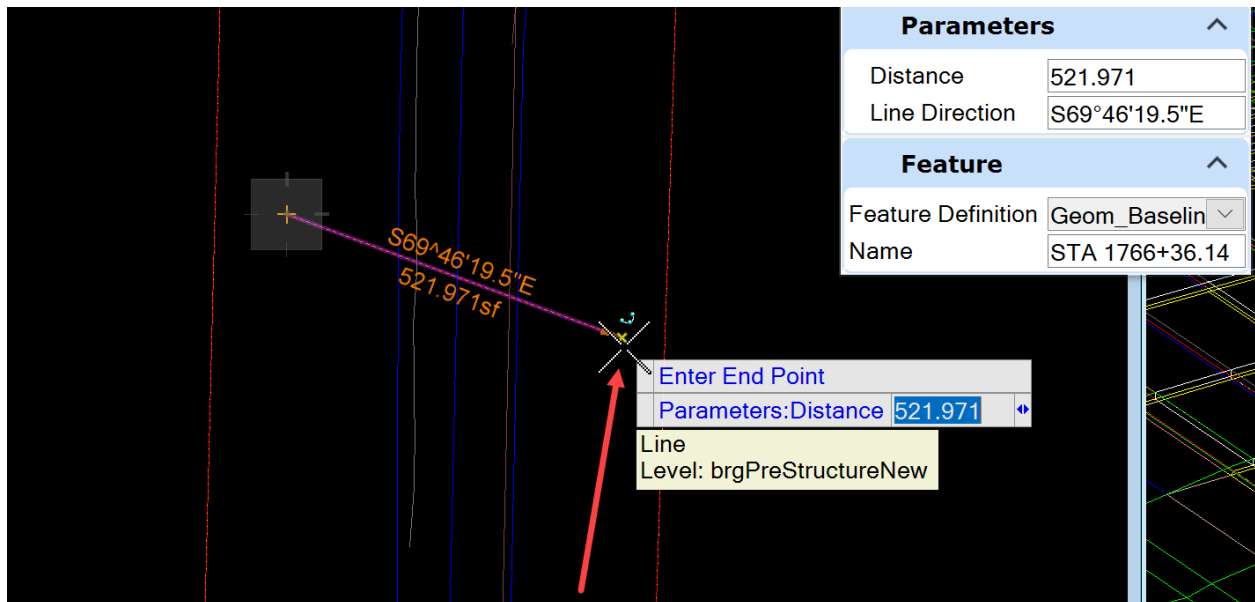Then set the Feature to Geom_Baseline

Name the feature as the station location of the proposed structure in the Feature Name field.

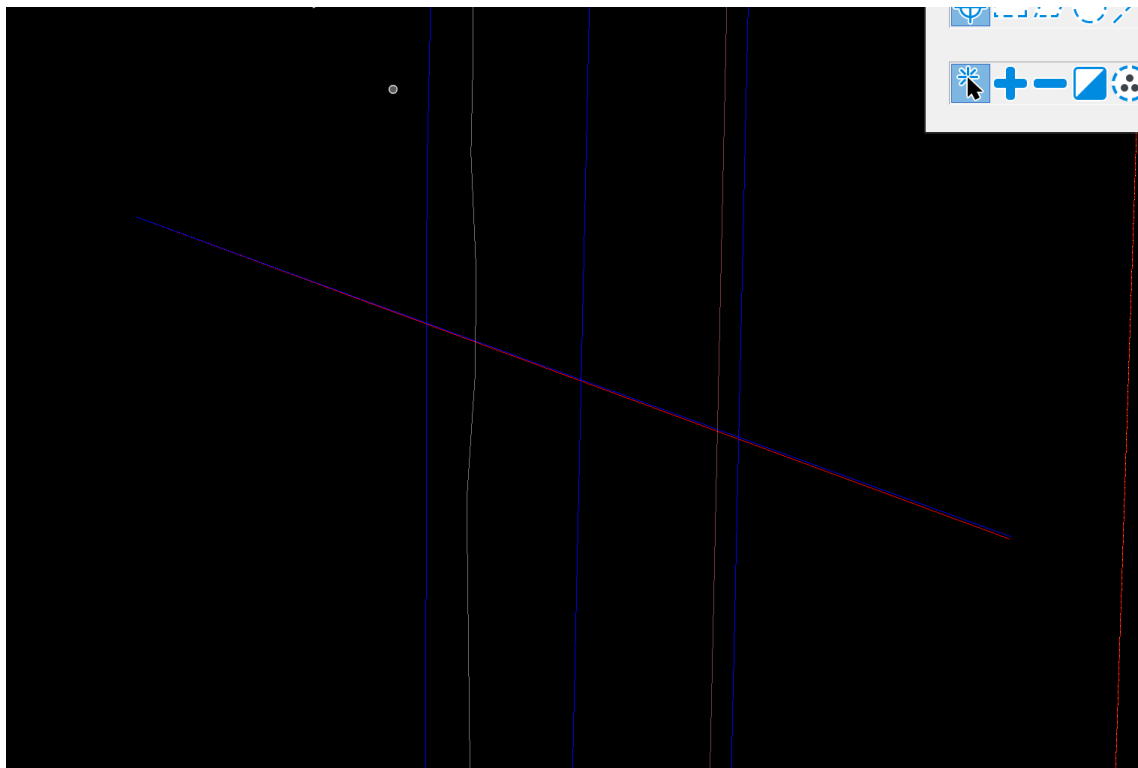For this example, it will be STA 1766+36.14.

Select a start point by snapping on the end of the line placed as the structure alignment, the red line in the image above.
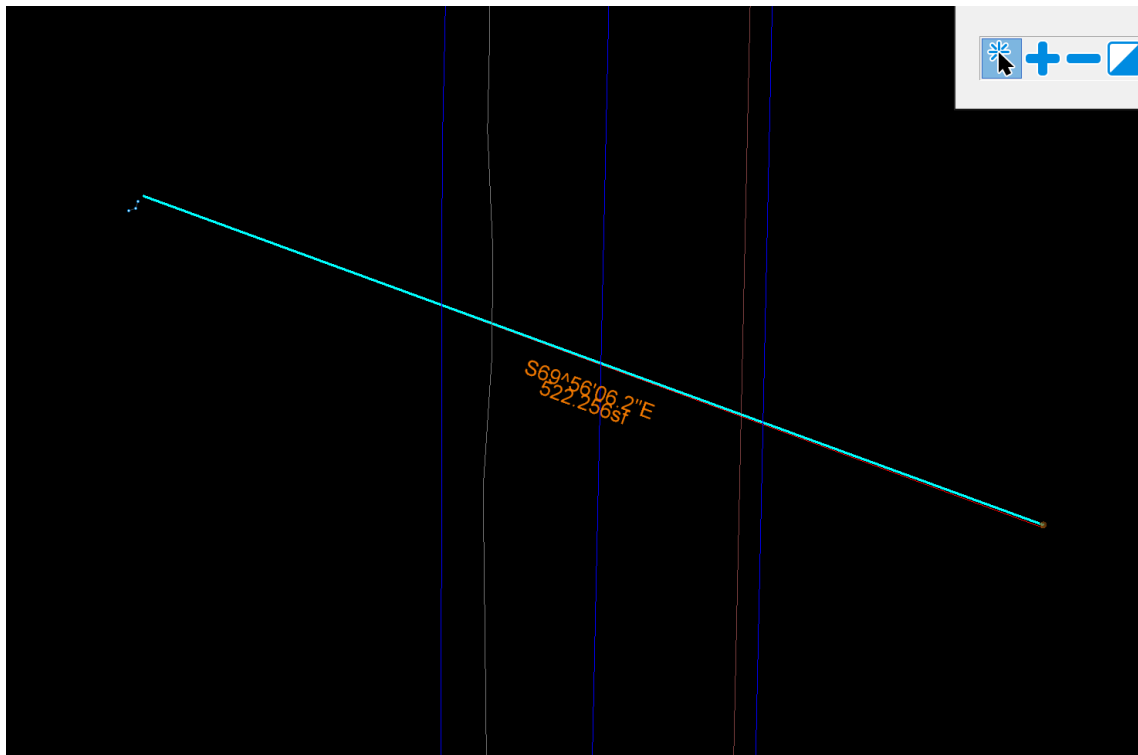
Then enter the end point.

It should look something like this:

Next with the element selection tool, select the geometry just created.

Open a window to view the profile in. The recommendation is to use View 8 for the profile window and View 7 for the cross section window.
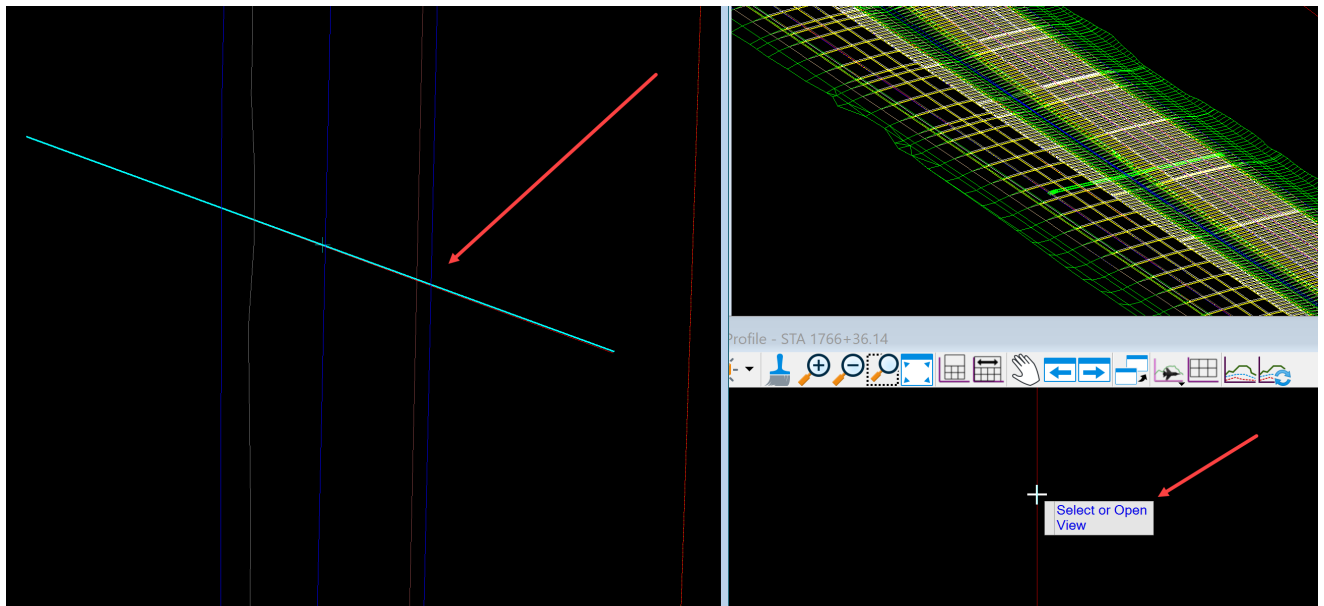
Note: Do not try to use the same window for both.

For this example, use View 8. Once the view is open, return to View 1 that has the geometry just created already selected. Hover over it to open the heads-up tools.
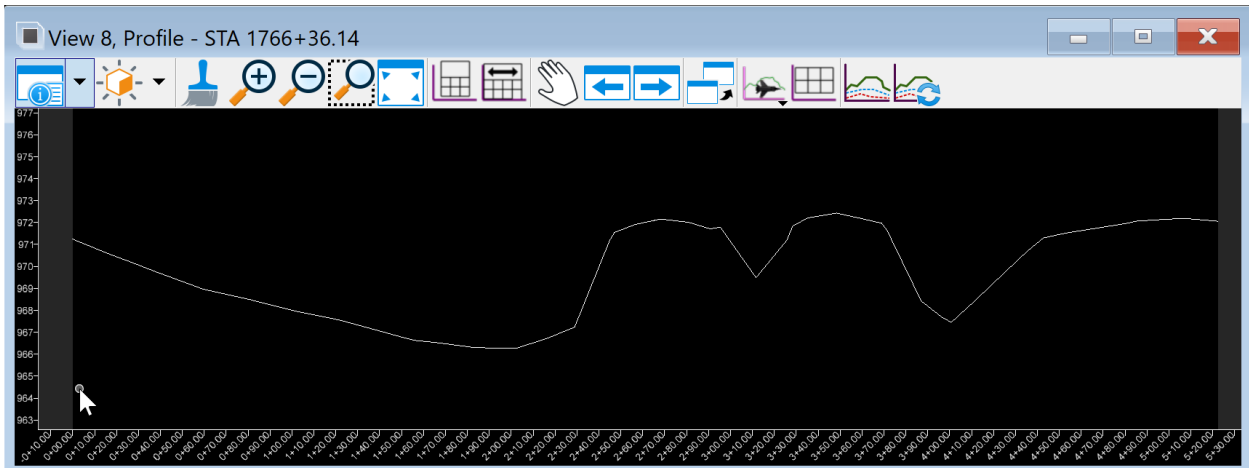
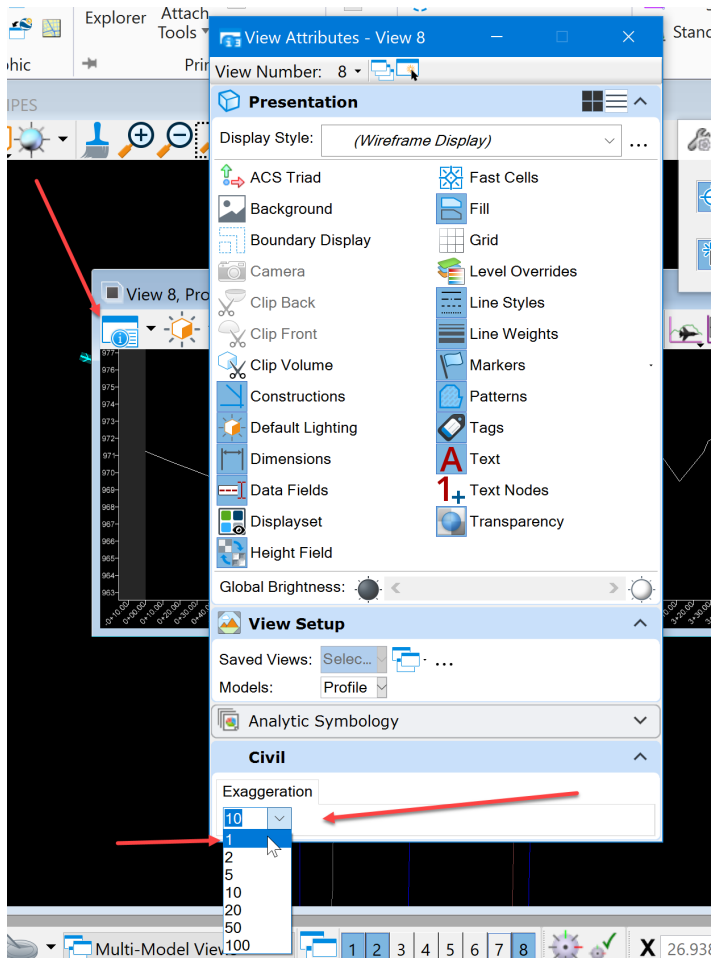Select the Open Profile Model tool.
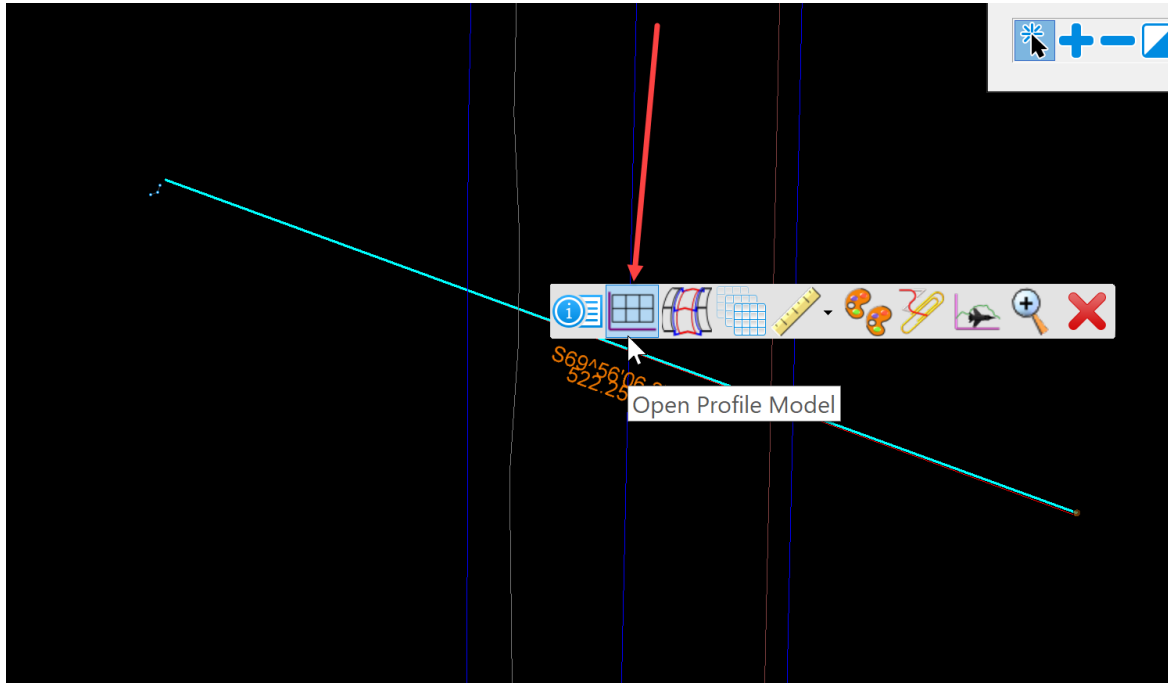
It will prompt to Select or Open View. Data point in the open profile window View 8.
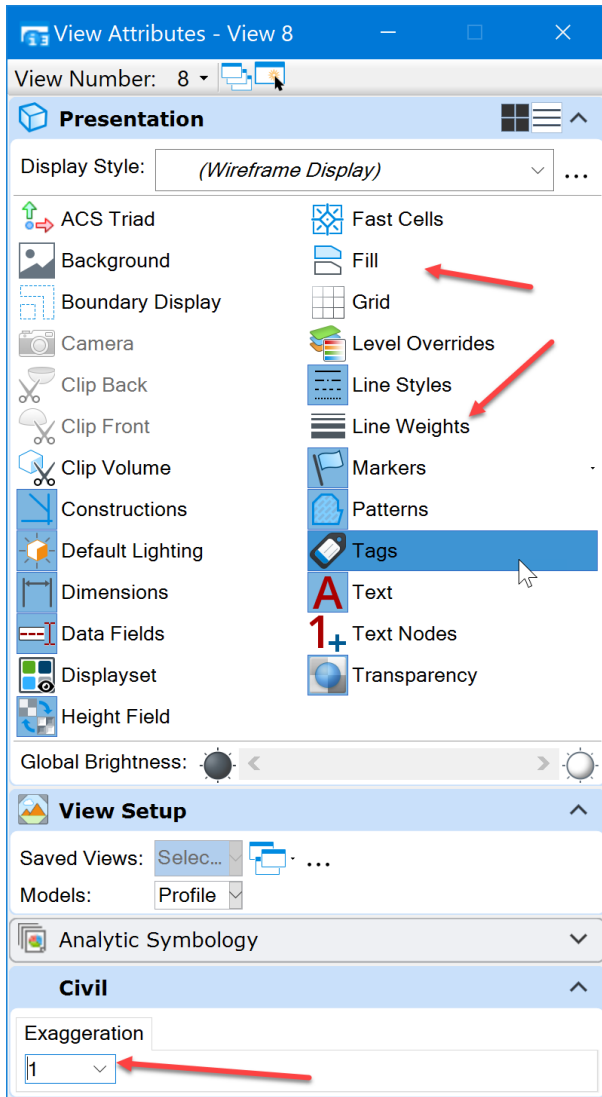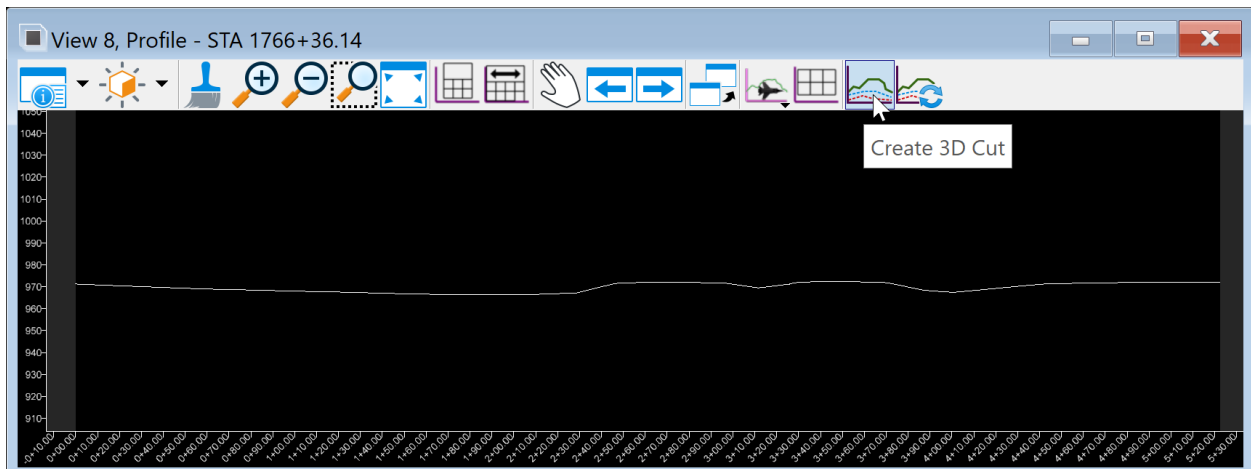
It should look something like this:

Next, set the exaggeration to 1 in the View Attributes dialog box.
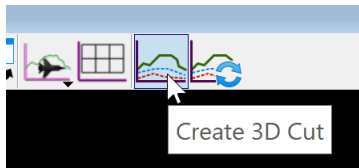
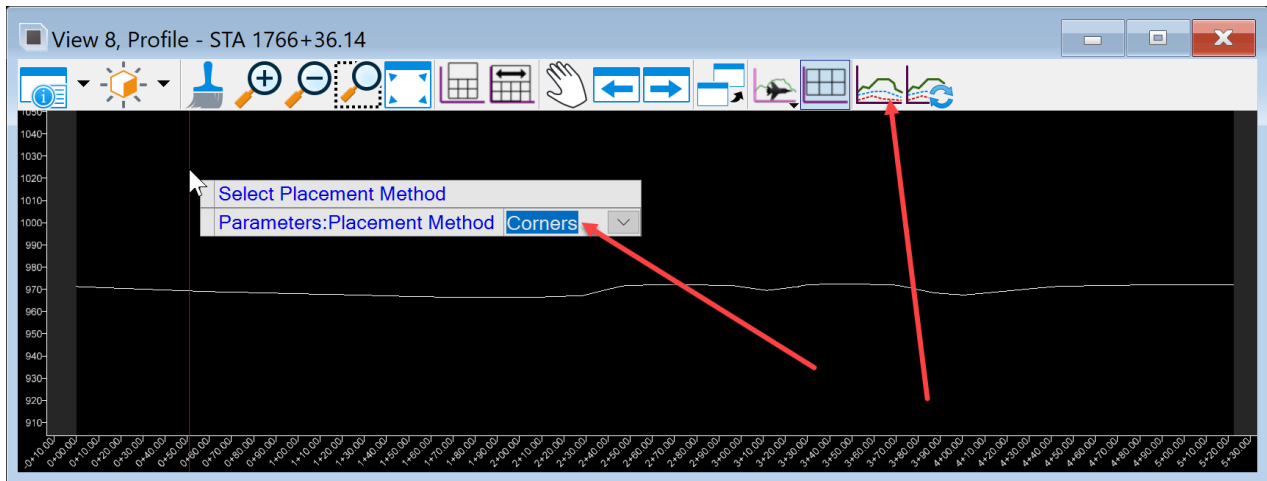It is recommended to have the fill and line weights turned off.

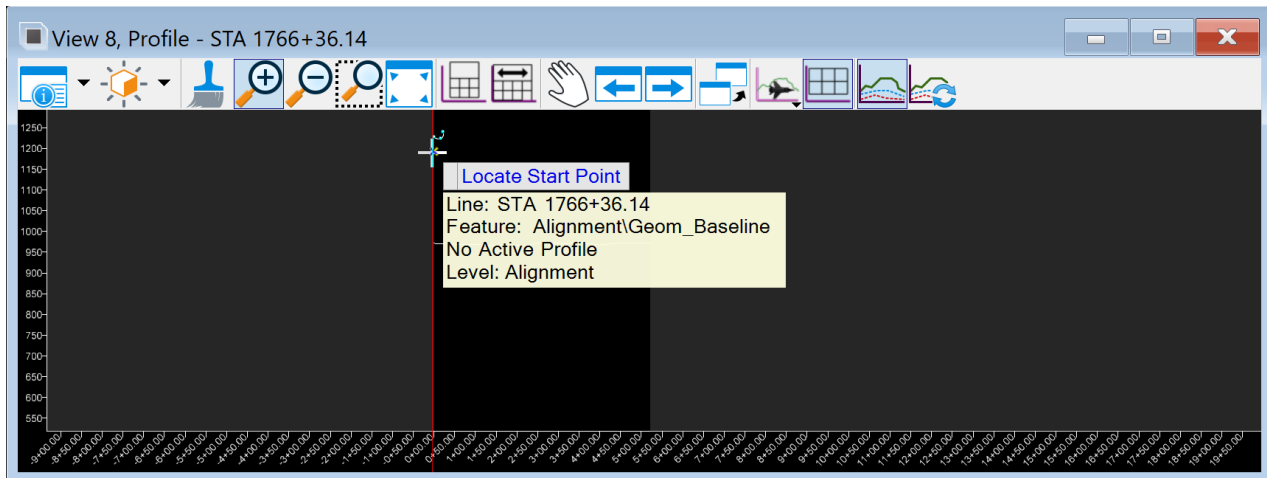Next, create a 3D cut along this geometry.

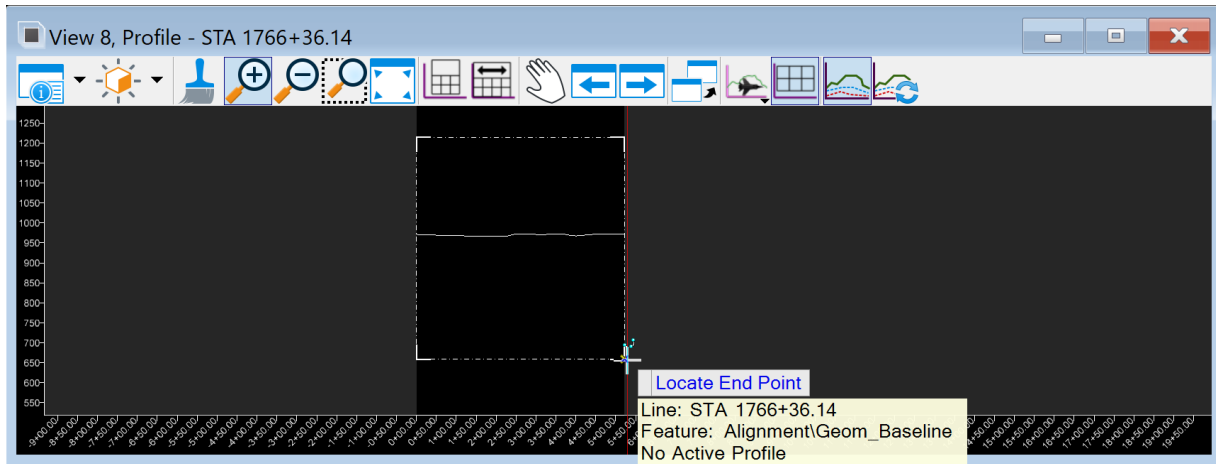To do this, select the Create 3D Cut tool.

Use the Corners method. Data point to accept the method.

It will prompt to locate the start point. Make sure the start is all the way to one side or the other. It is recommended to start at the top right and end at the lower left.
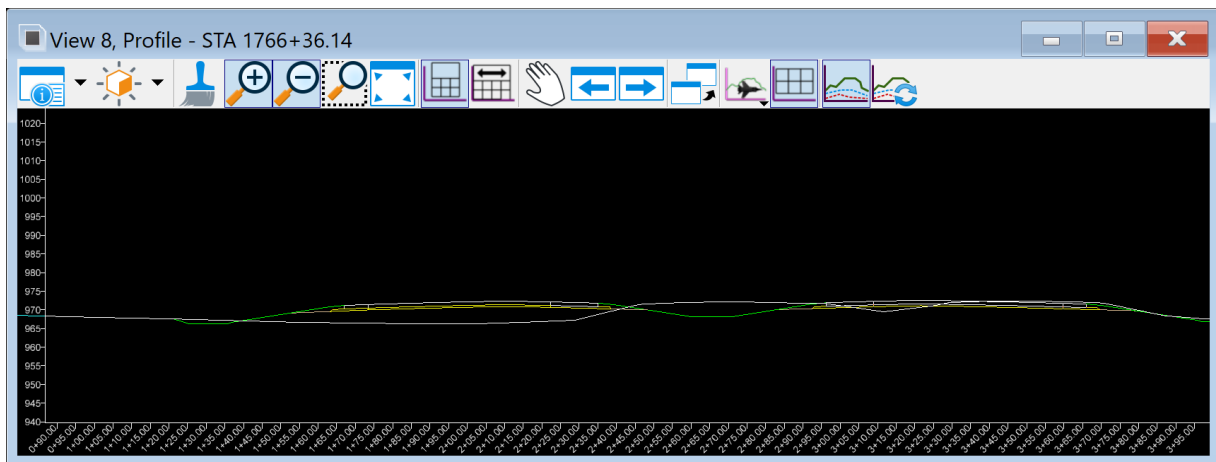
After the data point, it will start drawing a box in the view that the 3D cut is in.

Data point the end point to complete the 3D cut.

It should look something like this:

Now that there is a 3D cut created in the area for placing a structure, one more thing needs added to the view to do the design. Place the headwall cell into the profile model in View 8.

To do this, follow the same steps used in the first method to get the headwall cell into the Dynamic Cross Section view. Move headwall cells to correct design standards locations.

Next, measure the distance and adjust this line between the headwall cells to make it be an even 1' interval.

Once the structure design is as desired, then record the invert elevations and offsets of each key point.

If using the ASCII graphics input file method demonstrated in these instructions, that is the location to record that information. For more information about the ASCII graphics input file, please refer to CW03_ASCII Graphics Import Input File chapter.

To record the invert elevations and offsets of each key point, make sure the AccuDraw is toggled on.
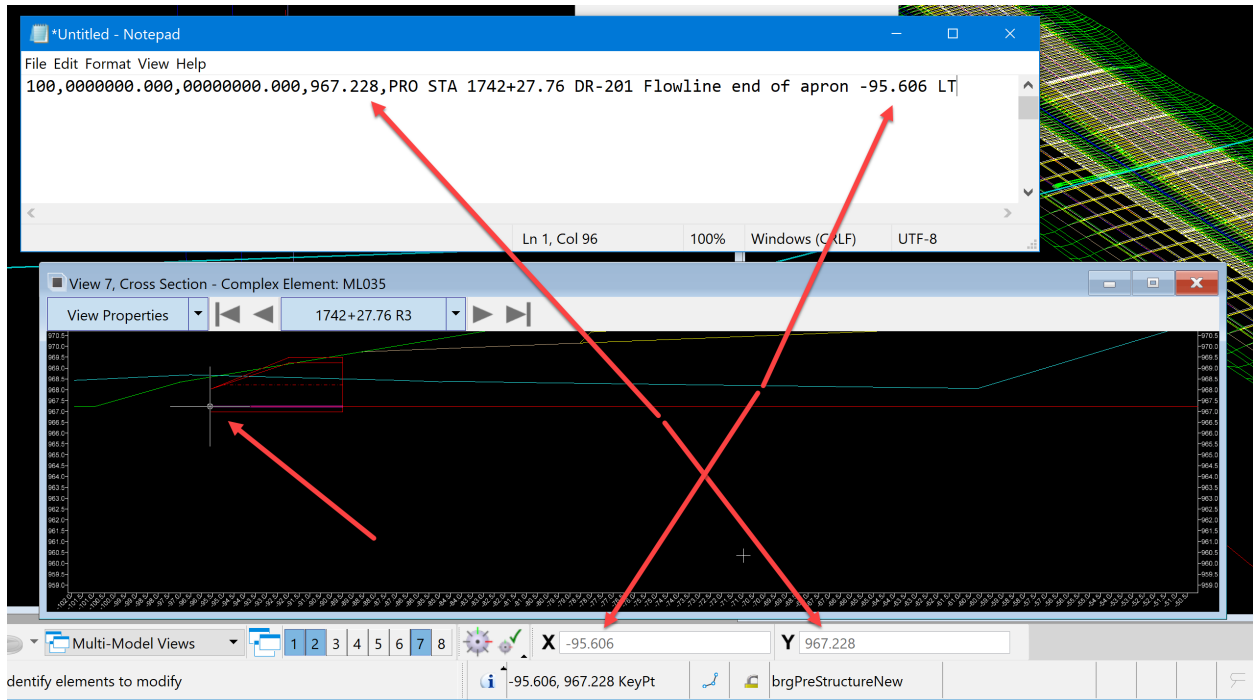
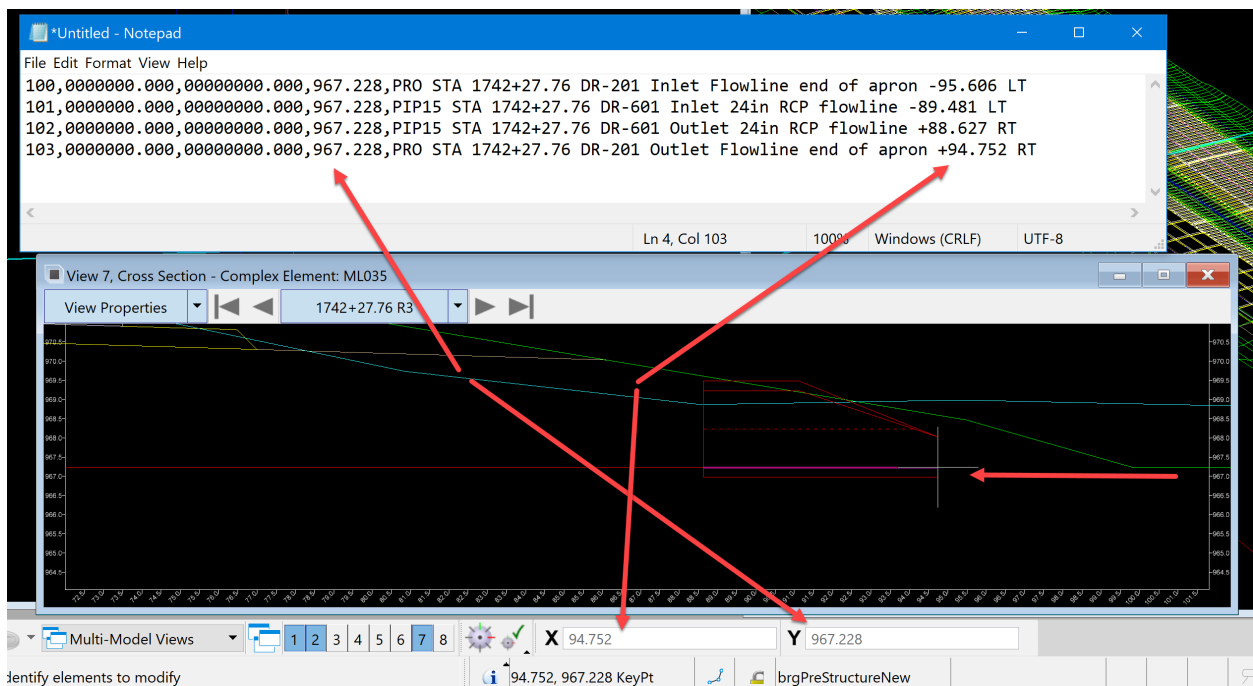**Note:** AccuDraw toggle is located in the Primary group on the More tool pulldown.
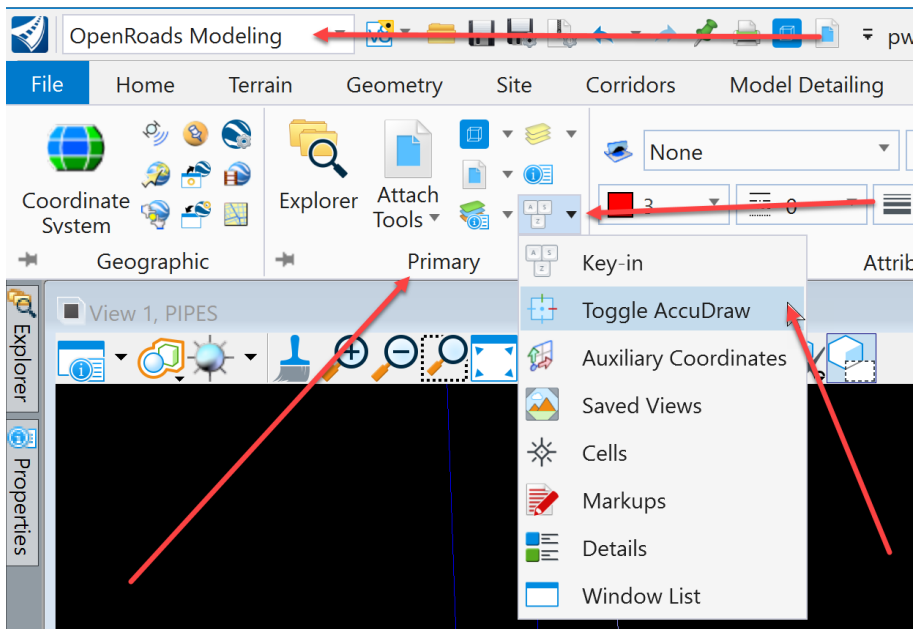
Then snap to each key point. The AccuDraw coordinate readout box will display each point coordinates. The X = offset and the Y = elevation.
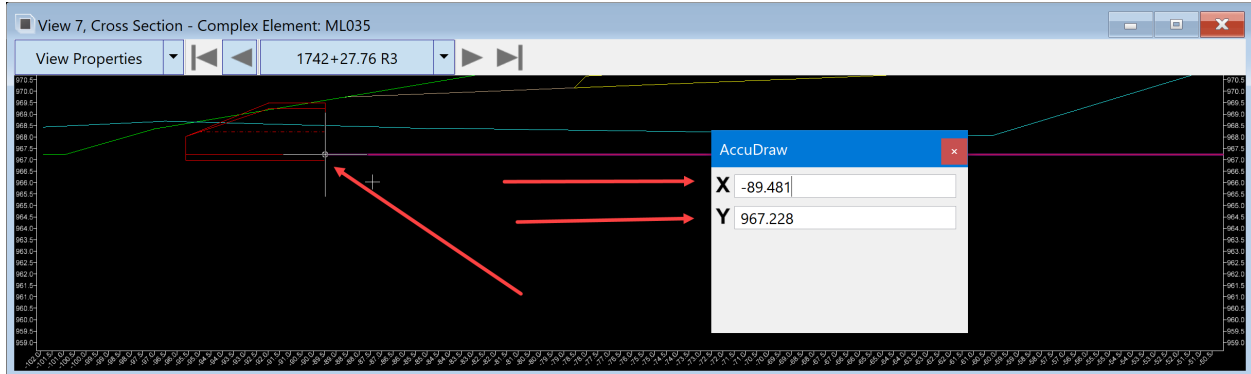
Record each of these values for each point in the ASCII graphics input file.

Next, repeat this for each key point that is needed to model the culvert.


Once all the values are recorded, calculate the X and Y coordinates. Use Civil AccuDraw or standard AccuDraw.

Note: When using Civil AccuDraw make sure standard AccuDraw is turned off before toggling on Civil AccuDraw. MicroStation does not perform well with both toggled on at the same time.

The standard AccuDraw method will be covered in another chapter.

Locate the correct station for the structure along the alignment. For this example, it will be 1742+27.76. Once this location is known, select the smart line tool and snap to that point or station along the alignment to start the line.
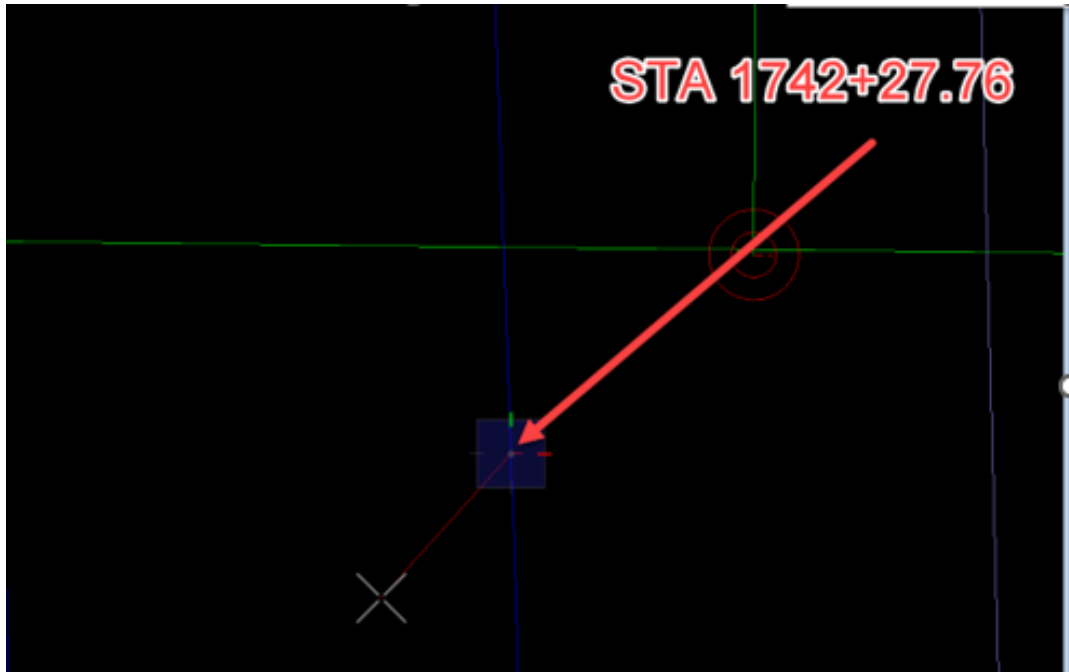

With the line started, type R Q on the keyboard to rotate quick the AccuDraw compass. Then with a Nearest snap, snap to the alignment.
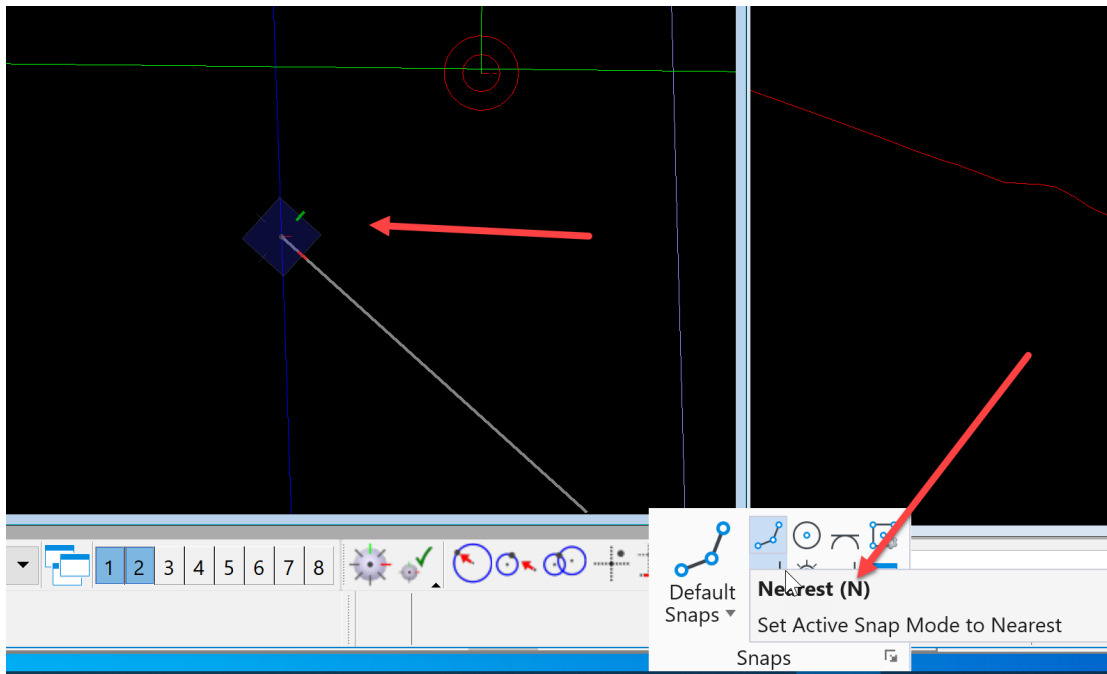
This will rotate the AccuDraw compass so that it is set to the alignment's axis. Pull the line in the direction needed to calculate the coordinate and type in the distance of the offset of that point.

For this example, it will be -95.606. Pull the line to the left of the alignment and type in 95.606.

Note: Negative numbered offsets are to the left and positive numbered offsets are to the right.
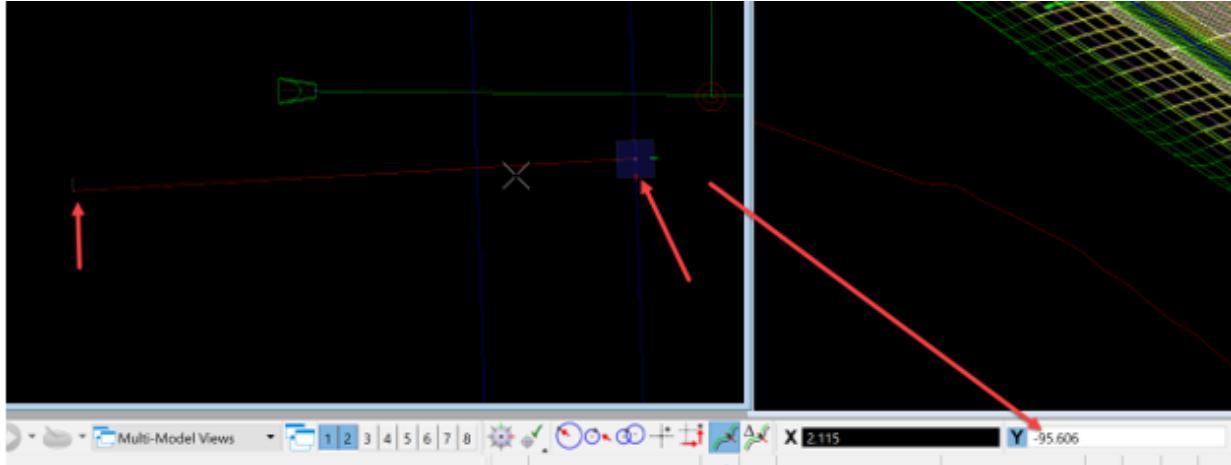
Then data point to accept it. This way, a perfect 90-degree line from the CL is drawn that is the correct distance for the offset. Then snap to the end of this line.
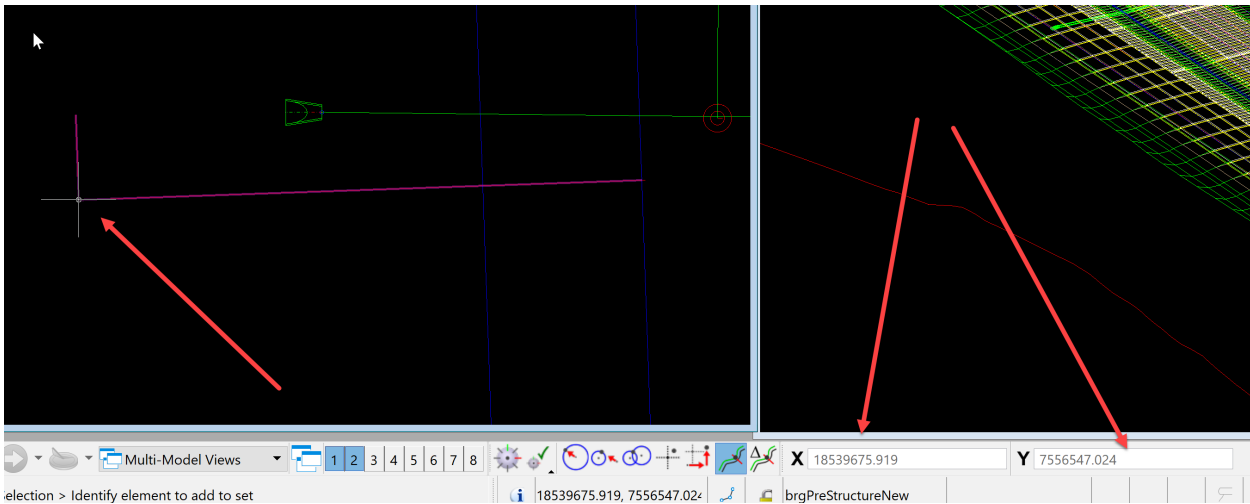
AccuDraw will display the X and Y Coordinates of that point.

Then place these coordinates in the ASCII graphics input file. Repeat this process for each input point.