Generative Component - CCS Abutment

<mark>Note, the following guidance may change as technology developments occur with the CADD modeling software and its use affecting workflows for project development.</mark>

These instructions are used when an OpenBridge Modeler file is opened with the Generative Component (GC) "Computational Design" Workflow enabled. **See the additional document, "General Guidance for Generative Components in OBM" outlining this process.**

In **OpenBridge Modeler** workflow, select the **Utilities** tab, select **Import GCP File** in the GC group.
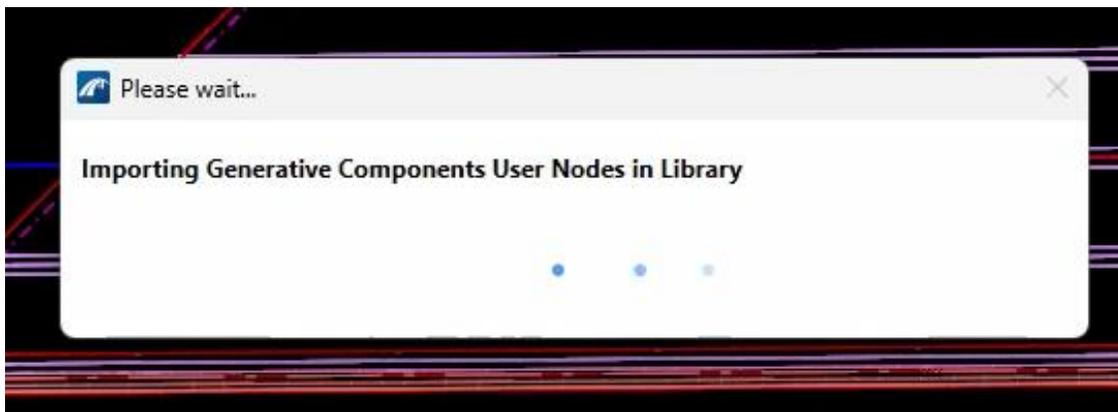

Locate the **IA_CCS_Abut_R6.gcp** file to work with the **IA_BT_CCS** abutment.
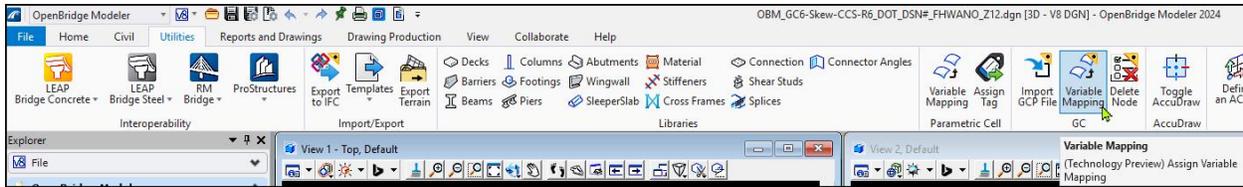

The **IA_CCS_Abut_R6.gcp** file is located on ProjectWise in the following area
pw:\\NTPwint1.dot.int.lan:PWMain\Documents\Resources\ClientWorkspaces\IowaDOT\IowaDOTProduction\Organization-Civil\IowaDOT_Standards\Bridge Templates\GC\IA_CCS_Abut_R6.gcp
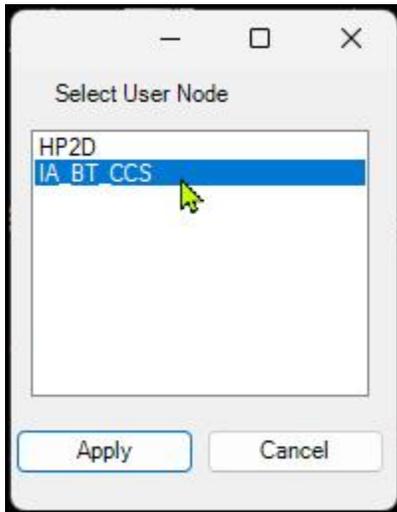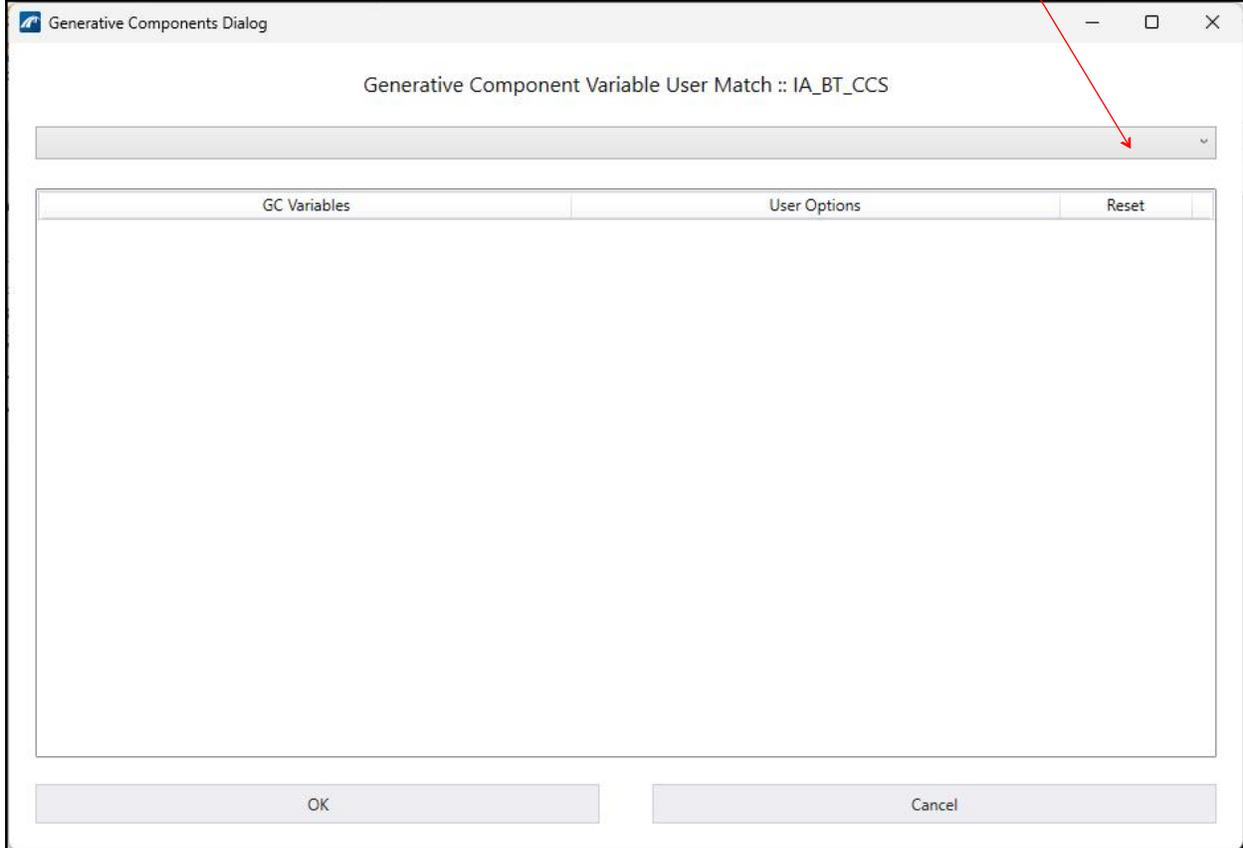
The following dialog box will appear.

In **OpenBridge Modeler** workflow, select the **Utilities** tab, select **Variable Mapping** in the GC group.
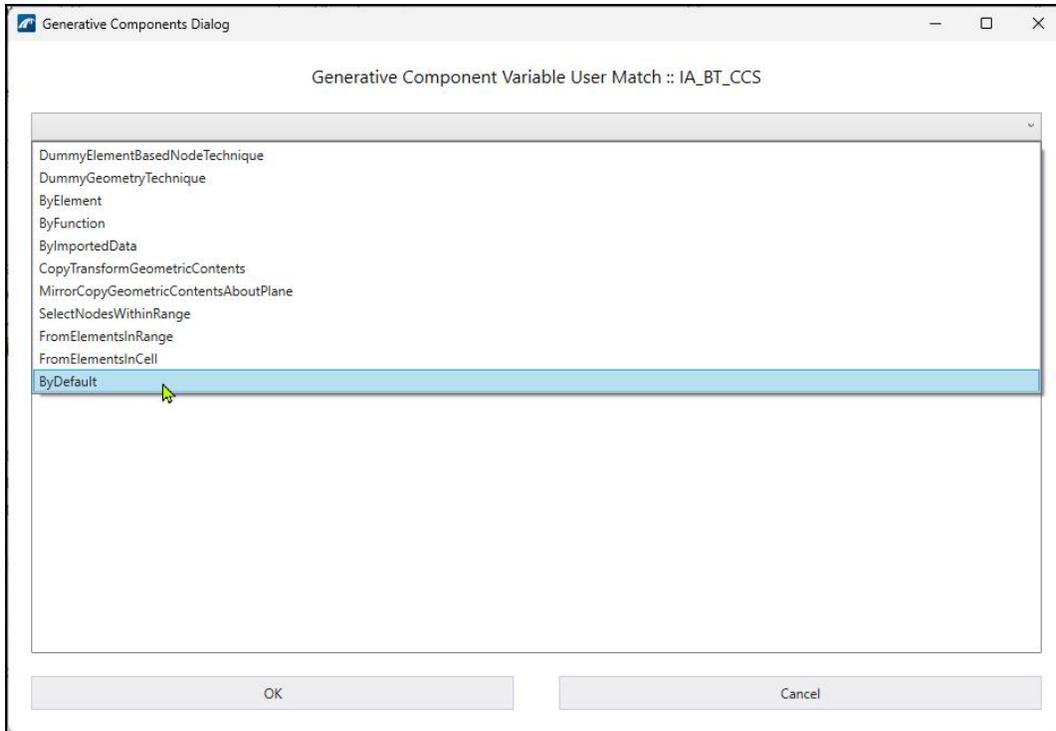
Select **IA_BT_CCS** and "Apply". <mark>Even though the name has "BT" in it, this is not beam related and is used for CCS bridges.</mark>
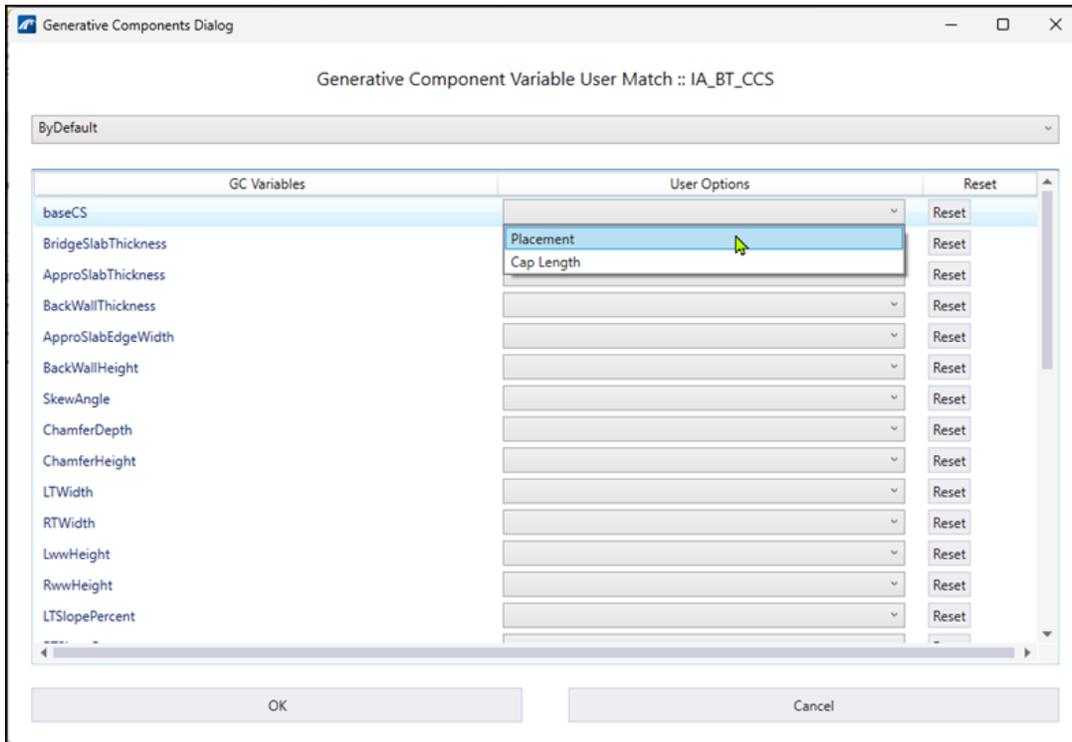
The following dialog box will appear. Select the pull-down arrow in the top gray bar that appears empty, shown below.

Select "**ByDefault**".

From the GC Variables column choose "**baseCS**" and under the User Options column select "**Placement**". Then select "OK".

In the ribbon under the **OpenBridge Modeler** workflow, under the **Home** tab, select **Place Custom Abutment**.
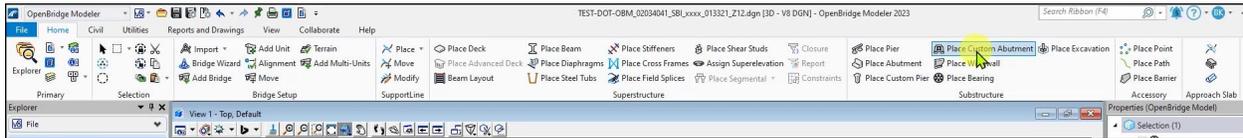
Place Custom Abutment **IA_BT_CCS**.

Note, in the image below the "Cell Type" is "GenerativeComponent" and "Preview is not available for Generative Component Piers or Abutments". Parametric cell types typically will provide a preview of the cell.

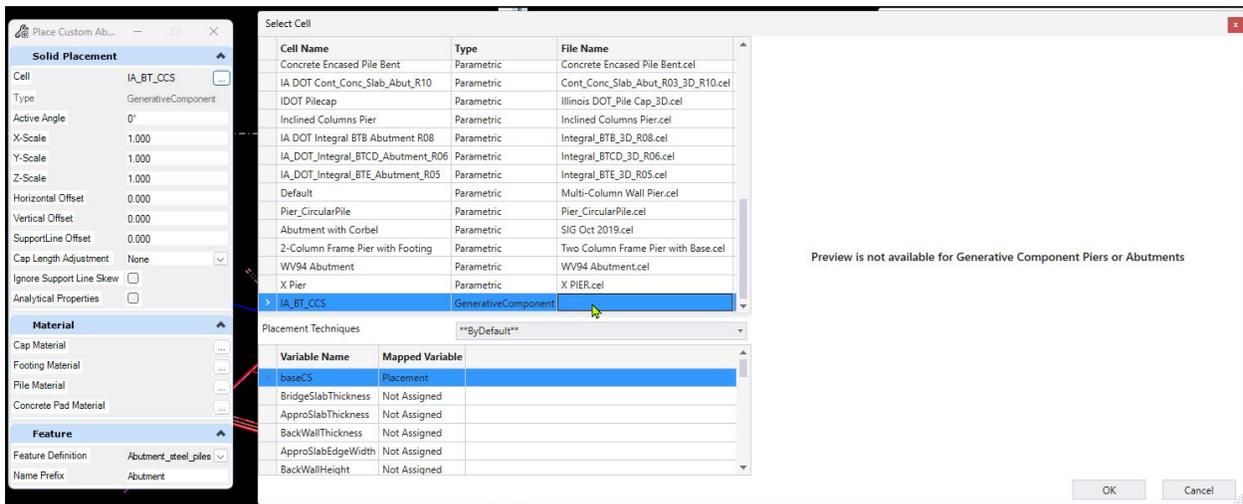Select the "Support Line" to place the GC abutment on. Set "**Ignore Support Line Skew**" - checked **On**. For the near abutment (down station) the Active Angle is set at zero (0). For the opposite far abutment (up station), the Active Angle is set to 180. The GC abutment skews are applied in the Technique Inputs of the Node Properties. If failing to set this upon placement, the Active Angle may also be changed after the abutment is placed, by selecting the abutment and in the **Properties** under **Rule Property**.
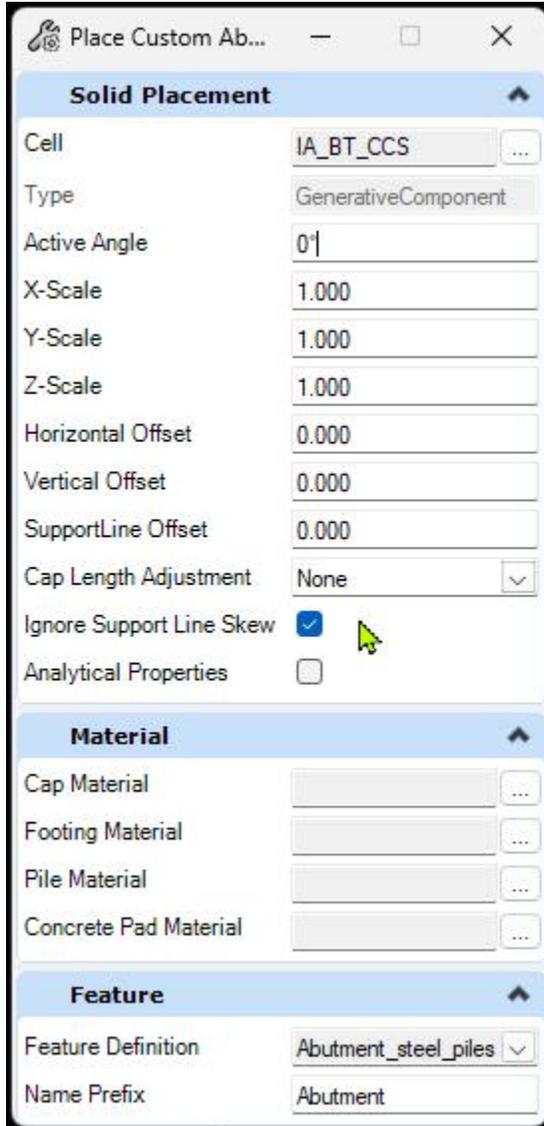
Place Custom Ab...	— □ ✕
Solid Placement	⌃
Cell	IA_BT_CCS ...
Type	GenerativeComponent
Active Angle	0°
X-Scale	1.000
Y-Scale	1.000
Z-Scale	1.000
Horizontal Offset	0.000
Vertical Offset	0.000
SupportLine Offset	0.000
Cap Length Adjustment	None ⌄
Ignore Support Line Skew	☑
Analytical Properties	☐
Material	⌃
Cap Material	...
Footing Material	...
Pile Material	...
Concrete Pad Material	...
Feature	⌃
Feature Definition	Abutment_steel_piles ⌄
Name Prefix	Abutment

If not setting "**Ignore Support Line Skew**" as checked **On** when placing the custom abutment, the skew may need to be set in two locations, the **Rule Property** and the individual Skew variable in the **Node Properties** of the GC "Technique Inputs". The image below is showing the variables to change for a skewed GC abutment, **Rule Property** "Active Angle" and possibly "Vertical Offset".
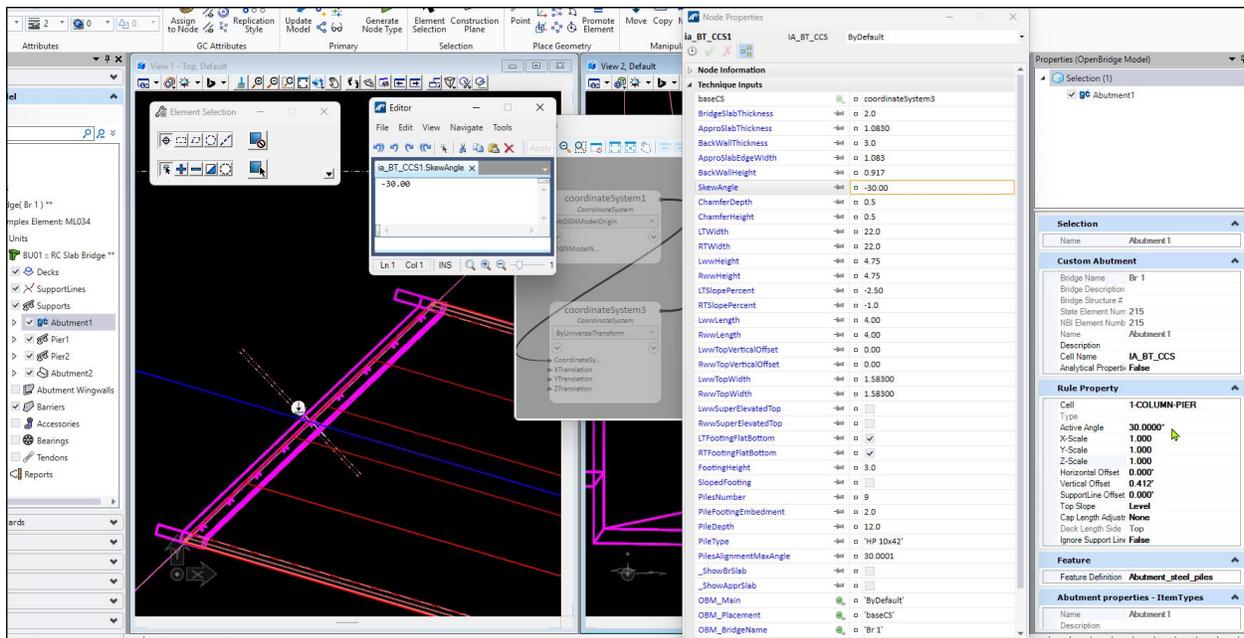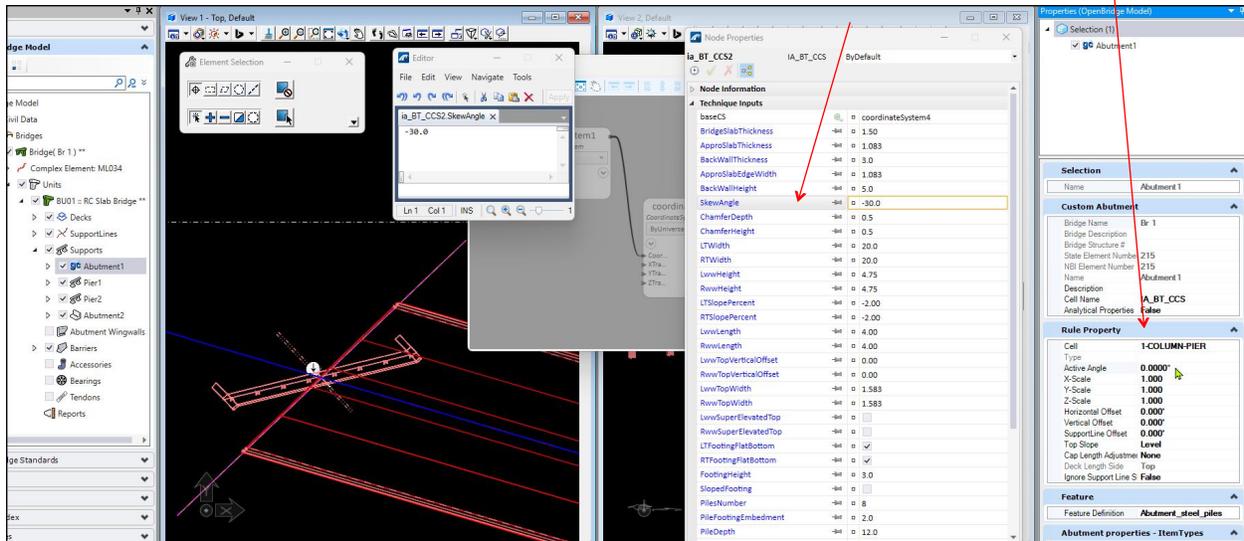
Once the GC custom abutment is placed, in the ribbon change the workflow to **Computational Design** and under the **Model** tab, select **Graph**. Selecting "Graph" will enable the process of editing of the GC abutment geometry. These tools are also located under the **Home** tab.
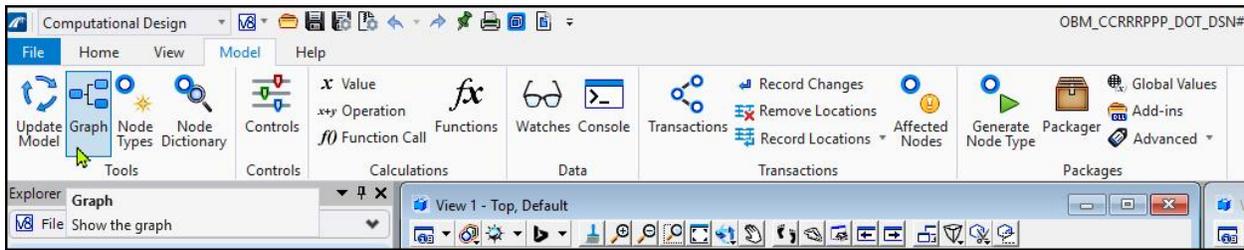
The Graph dialog box will appear, the "Abutment1" box in this example was auto-labeled "Abutment1" *IA_BT_CCS* in the OBM model. Double-clicking the selected "Abutment1" graph dialog box will open the Node Properties dialog to enable the process of editing of the GC abutment geometry.
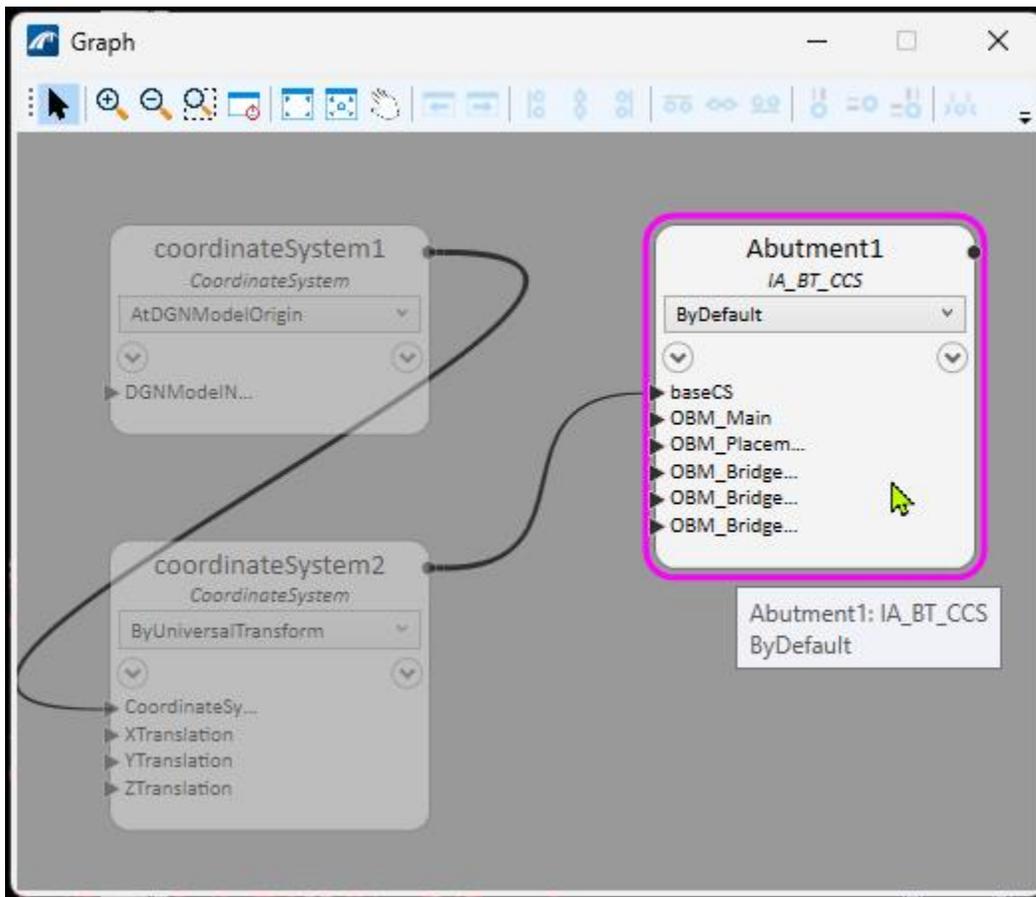
By double-clicking the "Abutment1" Graph box, *IA_BT_CCS*, this will open the Node Properties dialog box.
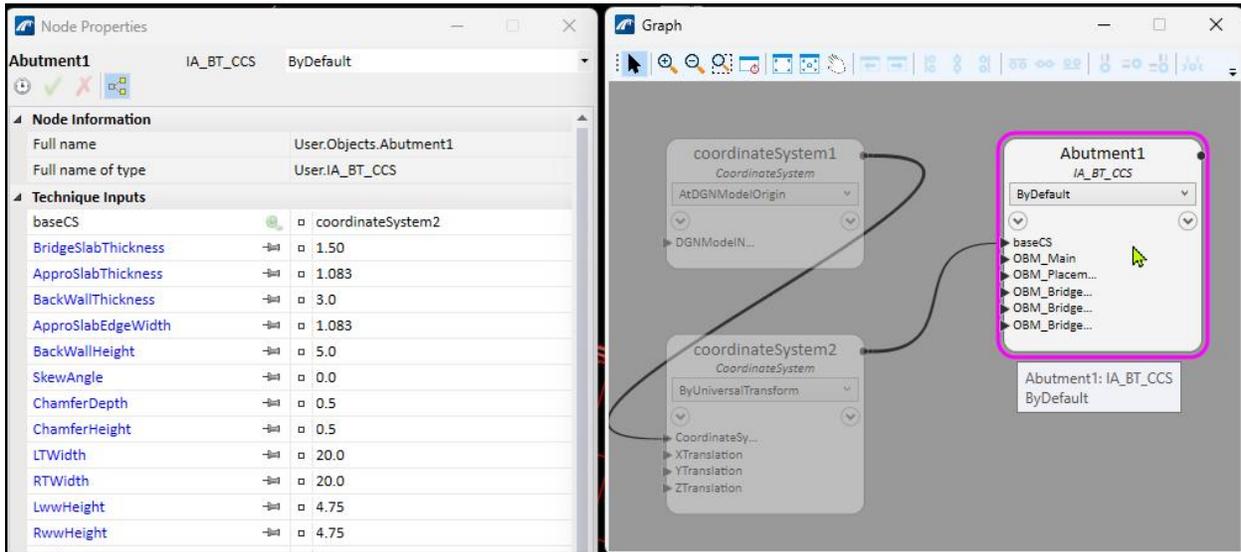
The adjustments of the GC abutment geometry will be made through editing the Technique Inputs in the Node Properties. Edits are done one at a time by either selecting the "box ☐" to open the full script "Editor" or by selecting the values in each line to directly edit them. It is recommended to use the box ☐ selection to edit the Inputs, especially for Inputs with multiple values. Opening the full script "Editor" may be more convenient to make edits and prevent any inadvertent entries by providing a preview of what is keyed-in to ensure the proper value is set before "Apply" is selected.
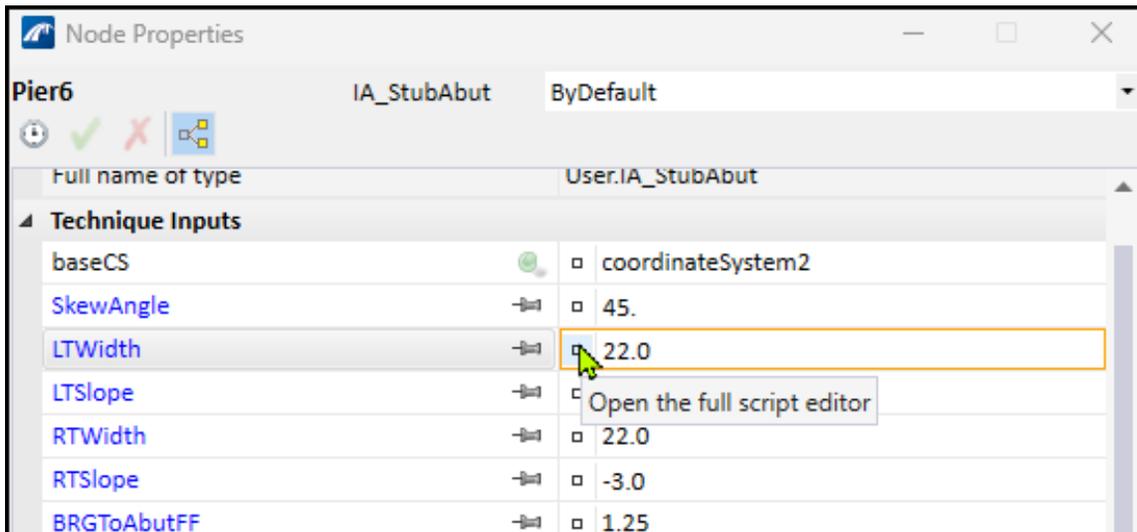
The example image below is showing the full script "Editor" that is used when the box ☐ is selected for changes to Technique Input values. Using the full script "Editor" may be more convenient to make edits and prevent any inadvertent entries. Once the value is entered the "Apply" button will become active, select "Apply" to accept the entered values.
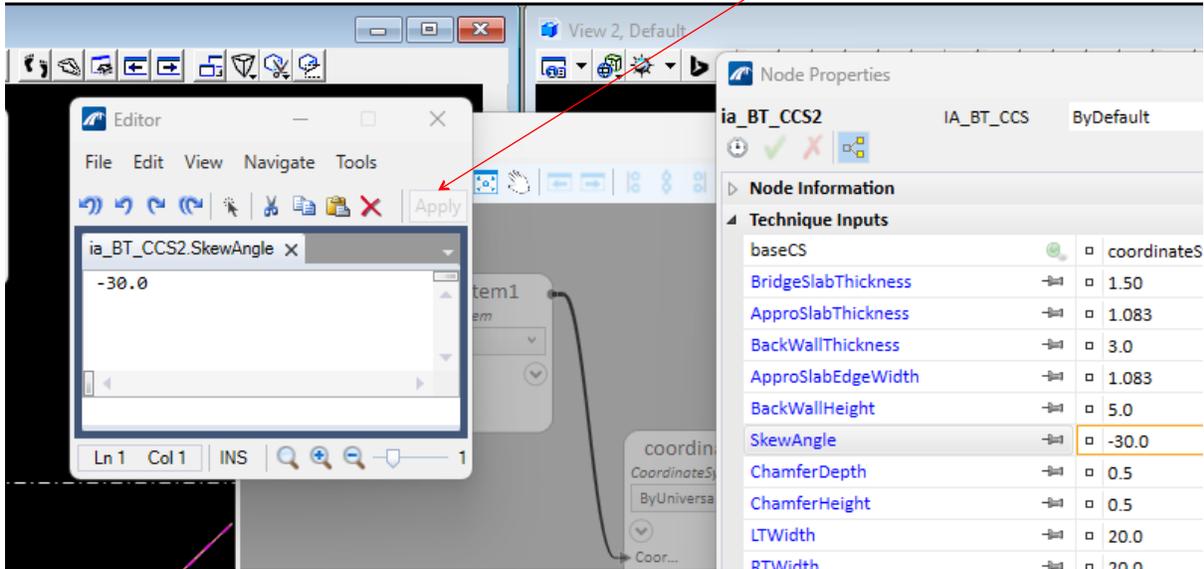
The image below shows a list of the "Technique Inputs" available.
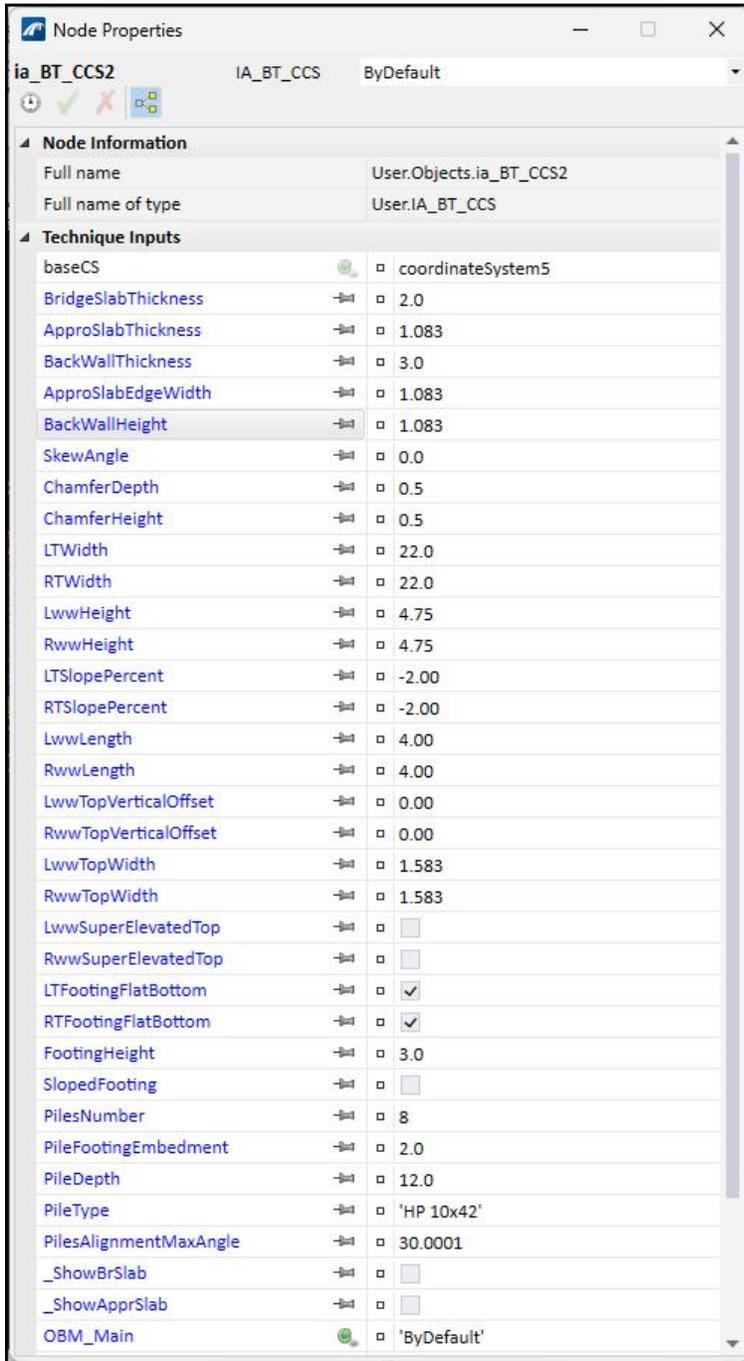
Checking the box of the **SlopedFooting** "On (true)" will enable the abutment to be used for a superelevation design. The **LTSlopePercent** and **RTSlopePercent** inputs will behave accordingly.

This image below is shown for information only; this example shows the list of **PileType** sizes for entering in Technique Inputs in the Node Properties. This pull-down list is only visible in the GC cell file itself where the development of the abutment shape is done. The pull-down list is not available when the GC is placed in OBM with the **.gcp** file. The required pile sizes need keyed-in as listed in the **PileType** node shown in this document.
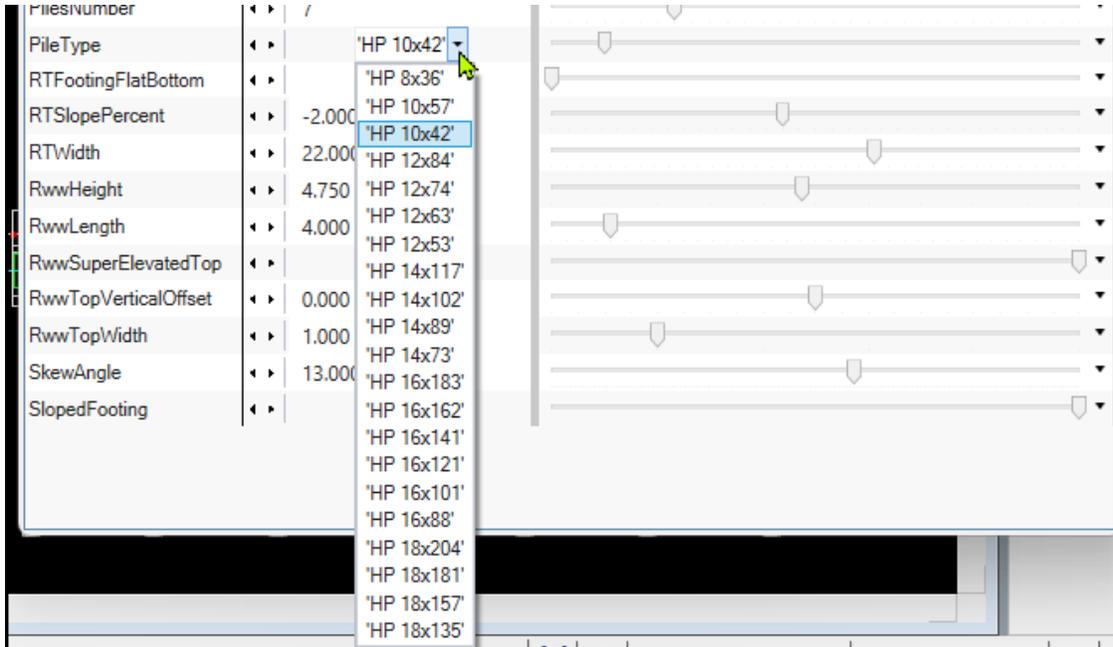
When done with edits to the GC abutment and bridge model, "Exit" and "Check In" the OBM file as would be done normally.

When reopening an OBM file with an existing GC abutment that is already placed in the model, the following dialog box will appear. **Select "Yes, continue".**
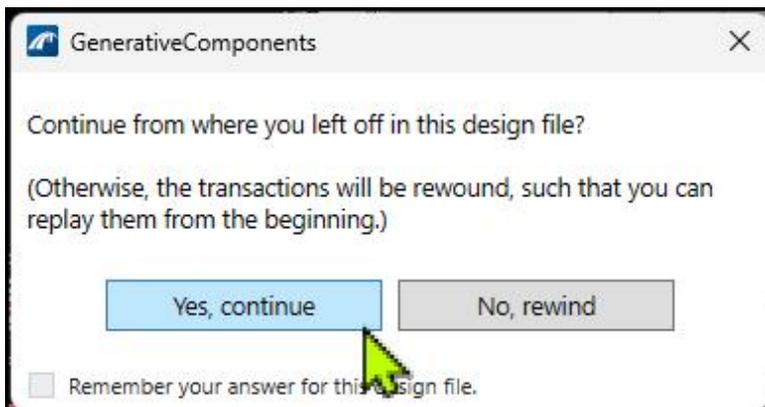
List of the Technique Inputs in the Node Properties are as follows; most are showing the Minimum and Maximum values. These are the inputs that are edited after the GC is placed in the OBM file.

The terms left and right are based off the perspective of viewing the abutment from the back-face of back wall orientation. <u>The Node Properties below are listed in the same sequence as they are displayed in the Node Properties dialog entry in OBM, not alphabetical.</u>

BridgeSlabThickness = Vertical distance measured at centerline (crown) of bridge slab (*min. value=0, max. value=5*).

ApproSlabThickness = (paving notch vertical) Depth, vertical distance, of the approach slab on top of abutment backwall (*min. value=0, max. value=1.21*).

BackWallThickness (abutment footing width) Abutment footing thickness horizontal distance from front to back faces (*min. value=0, max. value=5*).

ApproSlabEdgeWidth = (paving notch horizontal) Distance, horizontally and perpendicular to abutment backwall, of approach slab embedment/overlap on top of abutment (*min. value=0, max. value=3*).

BackWallHeight = Vertical distance at centerline of abutment between top of abutment footing to bottom of deck/slab (*min. value=0, max. value=20*).

SkewAngle = Angle of skew along centerline of abutment. A positive value is Right Ahead, a negative value is Left Ahead (*min. value= -90, max. value=90*).

ChamferDepth = Horizontal distance of chamfer along bottom of slab from front face of abutment backwall (*min. value=0, max. value=2*).

ChamferHeight = Vertical distance of chamfer along front face of abutment backwall and bottom of slab (*min. value=0, max. value=2*).

LTWidth = Left Lane Width from centerline (crown) of bridge slab to left gutter line (*min. value=0, max. value=36*).

RTWidth = Right Lane Width from centerline (crown) of bridge slab to right gutter line (*min. value=0, max. value=36*).

LwwHeight = Left Wing Wall vertical distance (*min. value=0, max. value=10*).

RwwHeight = Right Wing Wall vertical distance (*min. value=0, max. value=10*).

LTSlopePercent = Left Lane Slope in Percent from centerline (crown) of bridge slab to left gutter line (*min. value= -16, max. value=16*).

RTSlopePercent = Right Lane Slope in Percent from centerline (crown) of bridge slab to right gutter line (*min. value= -16, max. value=16*).

LwwLength = Left Wing Wall horizontal distance (longitudinal) along left gutter line (*min. value=0, max. value=36*).

RwwLength = Right Wing Wall horizontal distance (longitudinal) along right gutter line (*min. value=0, max. value=36*).

LwwTopVerticalOffset = Left Wing Wall vertical distance offset (elevation change) at end of wing wall. A positive value moves the top of wing wall at end if wall, vertically up. A negative value moves the top of wing wall at end of wall, vertically down. This Input does not move the bottom of the wing wall, it remains fixed. (*min. value= -10, max. value=10*).

RwwTopVerticalOffset = Right Wing Wall vertical distance offset (elevation change) at end of wing wall. A positive value moves top of wing wall at end of wall, vertically up. A negative value moves the top of wing wall at end of wall, vertically down. This Input does not move the bottom of the wing wall, it remains fixed. (*min. value= -10, max. value=10*).

LwwTopWidth = Left Wing Wall horizontal distance (transverse) from left edge of deck to left gutter line (*min. value=0, max. value=5*).

RwwTopWidth = Right Wing Wall horizontal distance (transverse) from right edge of deck to right gutter line (*min. value=0, max. value=5*).

LwwSuperElevatedTop = Left Wing Wall top surface (Unchecked = false, Checked On = true). When Checked On (true), this will enable the top face/surface of the left-wing wall to be sloped. This would be used for a superelevated design. When Unchecked (false), this will maintain a level top face/surface.

RwwSuperElevatedTop = Right Wing Wall top surface (Unchecked = false, Checked On = true). When Checked On (true), this will enable the top face/surface of the right-wing wall to be sloped. This would be used for a superelevated design. When Unchecked (false), this will maintain a level top face/surface.

LTFootingFlatBottom = (Unchecked = false, Checked On = true) When Checked On (true), this will enable the Left end of abutment footing, top and bottom at the wing wall, to be sloped. This would be used for a superelevated design. When Unchecked (false), this will maintain a level top and bottom of abutment footing, at the wing wall. The slope will be determined by what the most sloped input is set at, based on the LTSlopePercent or RTSlopePercent value.

RTFootingFlatBottom = (Unchecked = false, Checked On = true) When Checked On (true), this will enable the Right end of abutment footing, top and bottom at the wing wall, to be sloped. This would be used for a superelevated design. When Unchecked (false), this will maintain a level top and bottom of abutment footing, at the wing wall. The slope will be determined by what the most sloped input is set at, based on the LTSlopePercent or RTSlopePercent value.

FootingHeight = Vertical distance at centerline of abutment footing (*min. value=2, max. value=4*).

SlopedFooting = (Unchecked = false, Checked On = true) When Checked On (true), this will enable the abutment footing to be sloped. This would be used for a superelevated design. When Unchecked (false), this will maintain a level abutment footing. The slope will be determined by what the most sloped input is set at, based on the LTSlopePercent or RTSlopePercent values.

PilesNumber = Sets the quantity of H-pile, spacing is automatically equal distance between piles. (*min. value=0, max. value=30*).

PileFootingEmbedment = Vertical distance from bottom of abutment footing to top of pile (*does not have min. or max. value, default value = 2.0*).

PileDepth = Vertical distance from bottom of abutment footing to bottom of pile (*min. value=0, max. value=200*).

PileType = **input one of the following options exactly as shown**. *Example* **'HP 10x57'**

{ 'HP 8x36', 'HP 10x57', 'HP 10x42', 'HP 12x84', 'HP 12x74', 'HP 12x63', 'HP 12x53',

'HP 14x117', 'HP 14x102', 'HP 14x89', 'HP 14x73', 'HP 16x183', 'HP 16x162', 'HP 16x141',

'HP 16x121', 'HP 16x101', 'HP 16x88', 'HP 18x204', 'HP 18x181', 'HP 18x157', 'HP 18x135' }

PilesAlignmentMaxAngle = Sets the skew limit, in degrees, that changes the Y-axis of H-pile rotation from along centerline abutment skew to perpendicular to roadway alignment. Set at 30.0001 will cause the pile to rotate when the abutment skew is above 30-degrees.
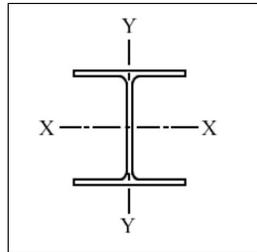
_ShowBrSlab = (Unchecked = false, Checked On = true) This may be used as a visual aid to help model the other inputs of the CCS abutment. When Checked On (true), a short length of the bridge slab will display. **This is not to be kept on display for the final bridge model.**

_ShowApprSlab = (Unchecked = false, Checked On = true) This may be used as a visual aid to help model the other inputs of the CCS abutment. When Checked On (true), a short length of the approach slab will display. **This is not to be kept on display for the final bridge model.**

"IOWA-CCS-Abutment-R6-packaged.dgn"

This is for information only.

The image below is showing the "IOWA-CCS-Abutment-R6-packaged.dgn" GC cell file. This is what appears where the development of the abutment shape is worked on.