Bentley Institute

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 through *CONNECT Advisor* and on the *LEARN Server*.

Introduction to OpenBridge Designer

CONNECT Edition (10.10.00.XX)

About this Practice Workbook...

- This PDF file includes bookmarks providing an overview of the document. Click on the bookmark to quickly jump to any section in the file. You may have to turn on the bookmark function in your PDF viewer.
- The dataset used throughout this Getting Started guide uses imperial and metric units.
- This training uses the *Imperial Standards/Metric Standards* workspace installed with the OpenBridge Modeler software. The workspaces are based on the OpenRoads Designer workspaces.
- 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. 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, submit them to the Bridge Analysis Forum on Bentley Communities where peers and Bentley subject matter experts are available to help.

TRNC03273-1/0005

Module 1: Overview and Terrain

Description

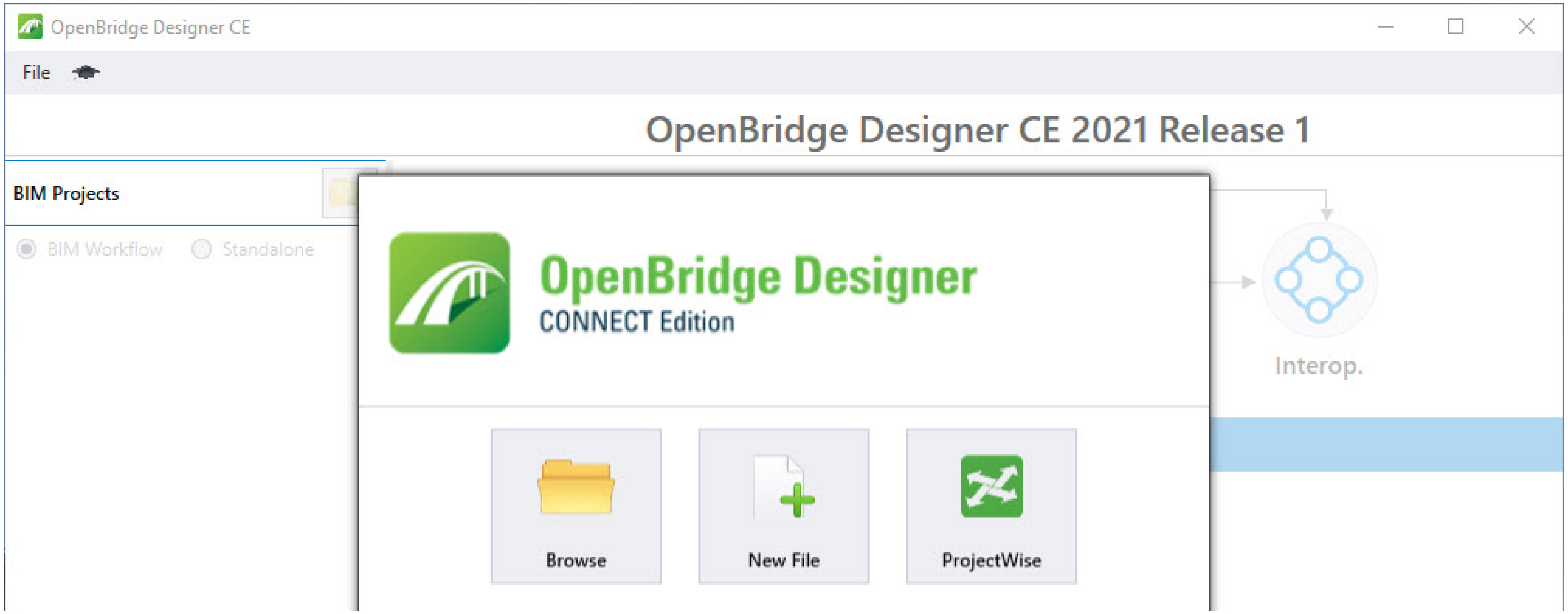
In this module you will review the OpenBridge Designer and OpenBridge Modeler interface and import the existing ground terrain.

Objectives

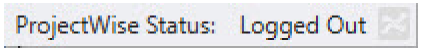
- User Interface
- Search Capability
- Integration with OpenRoads Designer

Start OpenBridge Designer

1. Start the **OpenBridge Designer** software. (Skip this exercise if using OBM)

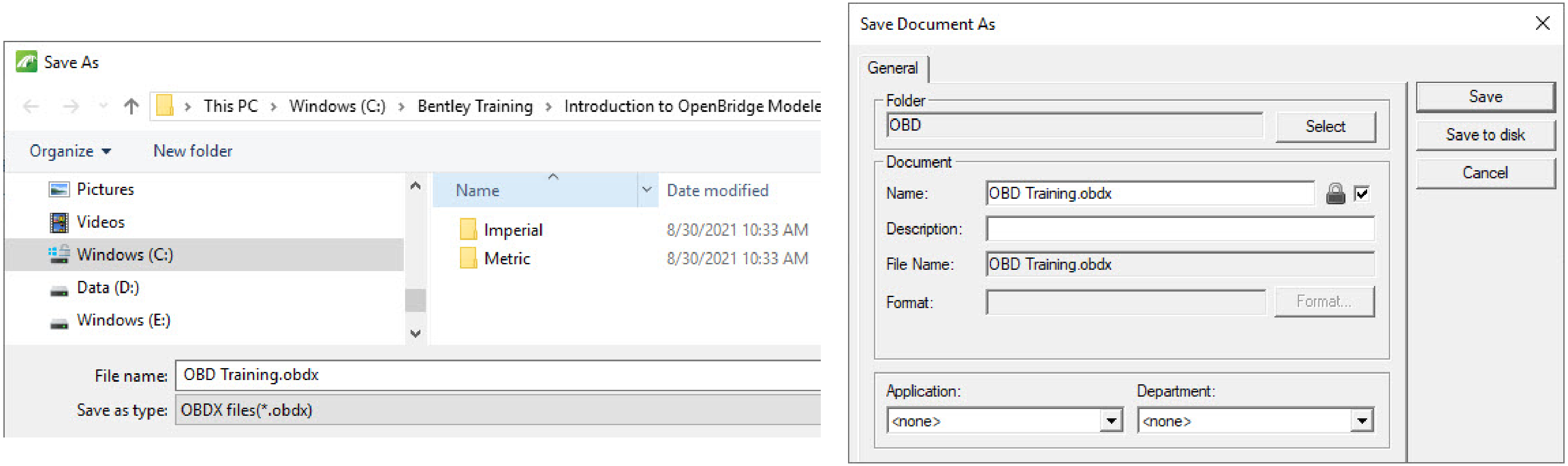


2. At startup, the ProjectWise Status is set to Logged Out as shown in the lower right corner of the OBD window.



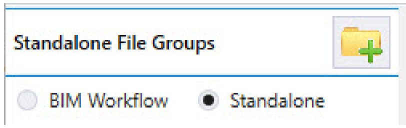
3. Select the **ProjectWise** icon to login to ProjectWise if you are utilizing it for your project. If you login, the PW status will be updated in the lower right corner of the window.

4. Select the **New File** icon to create a new .OBDx file called *OBD Training.obdx*. Select an appropriate folder location for the file.

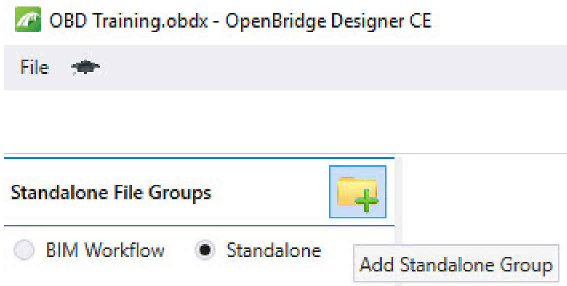


Windows Save As on the left, PW Save Document As window on the right.

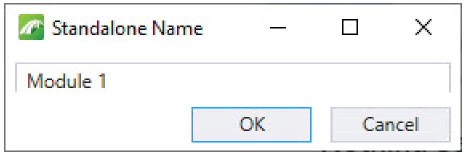
5. Select the **Standalone Workflow**.



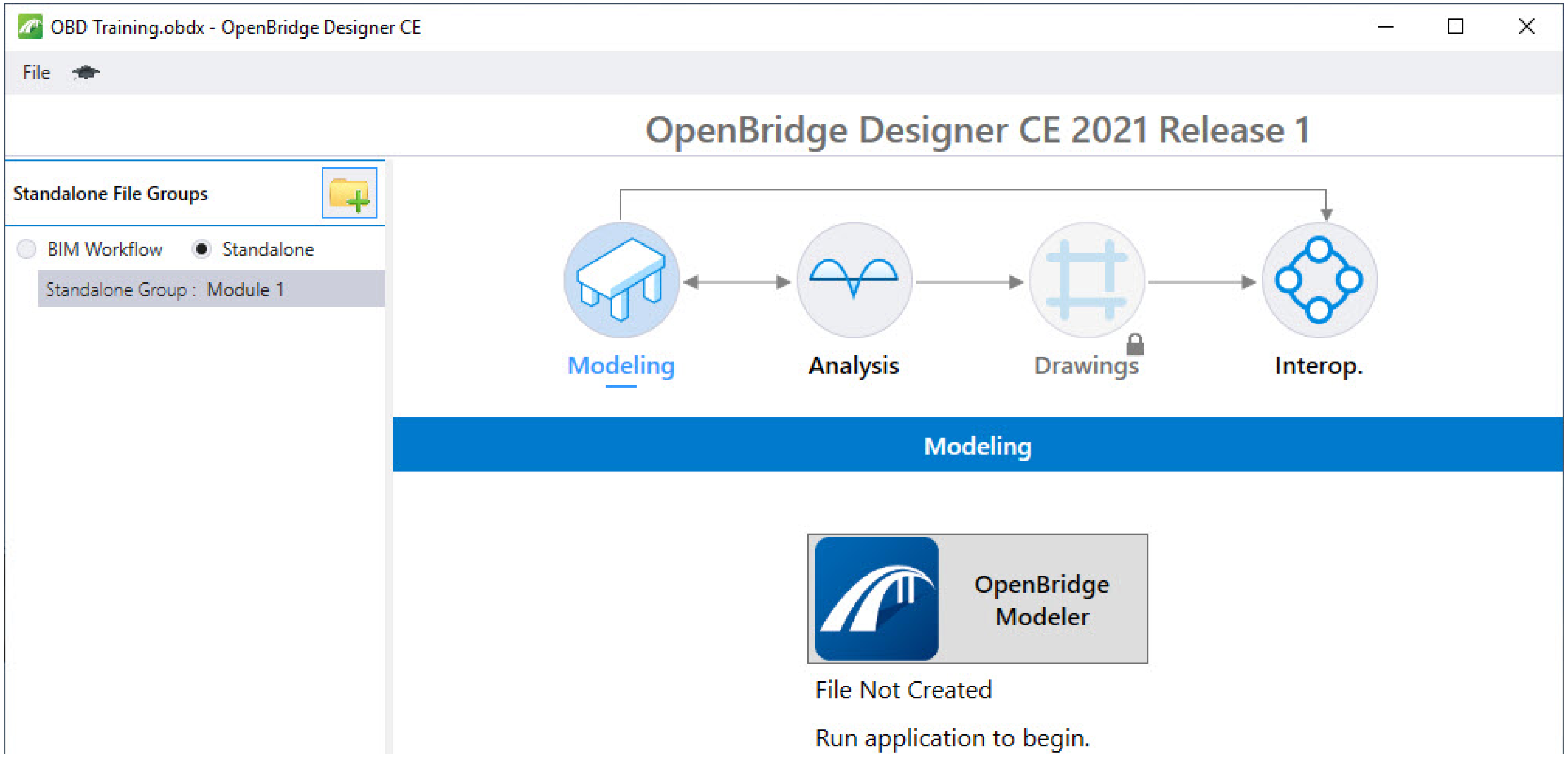
6. Select the **Add Standalone Group** icon.



7. Key-in the Project Name shown and click **OK**.



8. In the next exercise, select the **OpenBridge Modeler** icon to create (or open) a file.



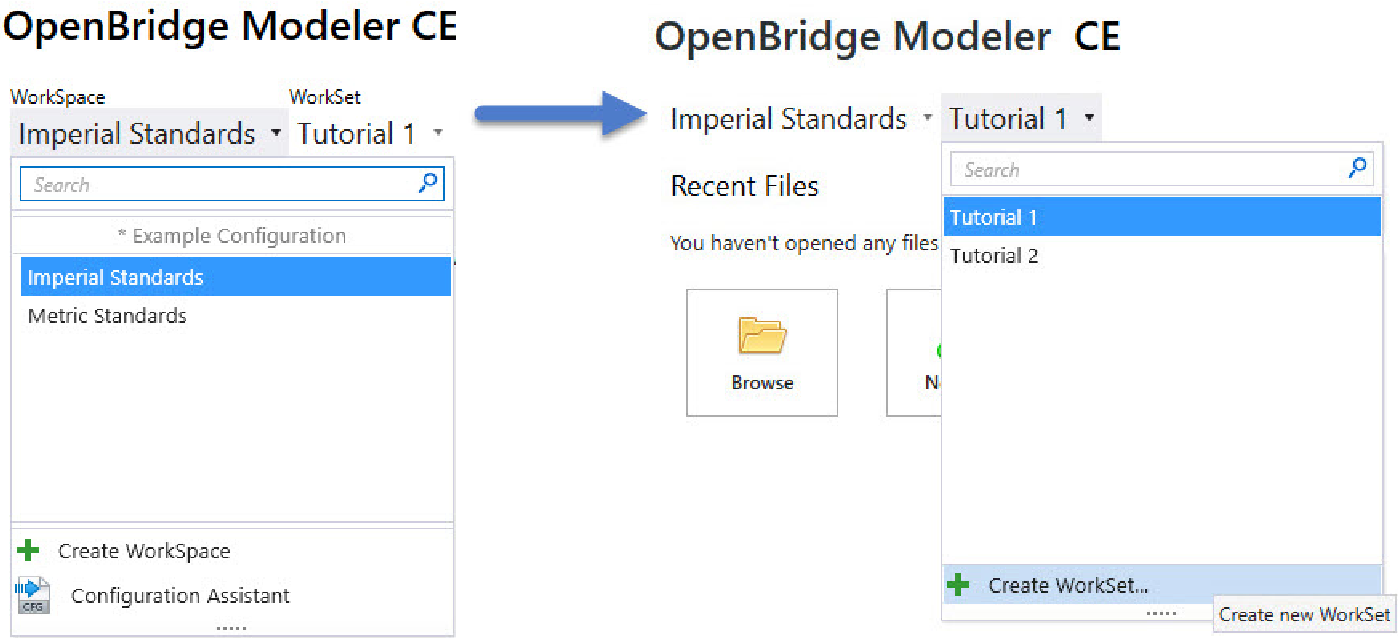
WorkSpace’s and Workset’s

1. Start the **OpenBridge Modeler** software.
2. Set the WorkSpace and WorkSet.

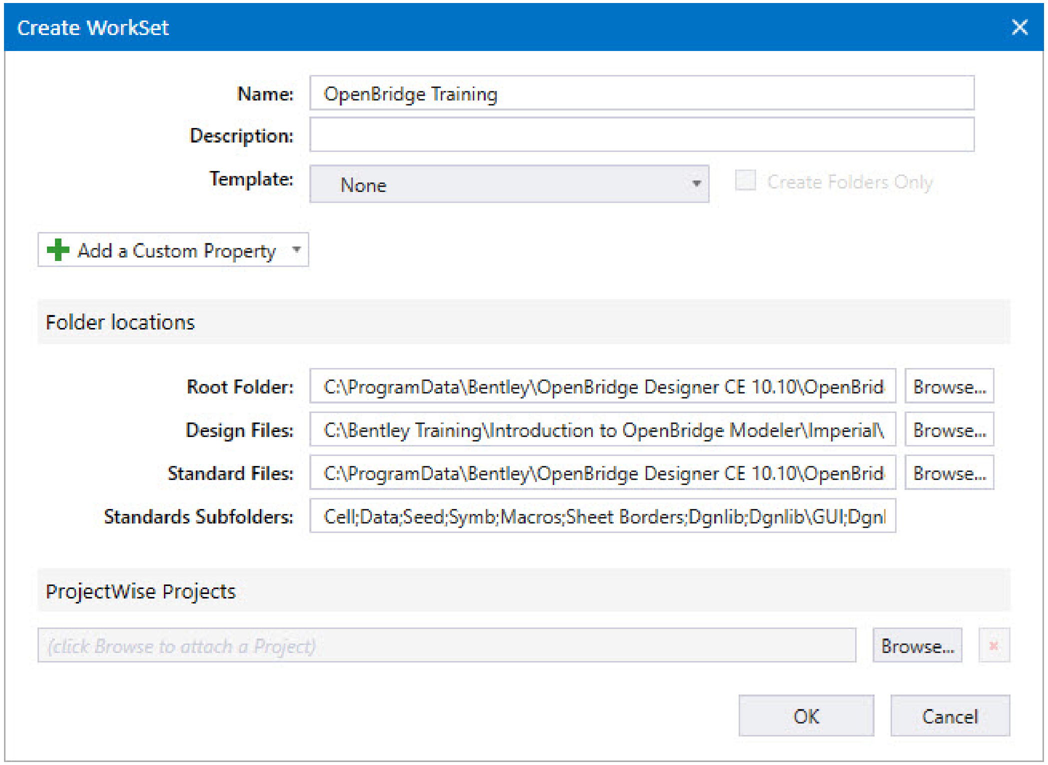
   This workshop requires the **Imperial Standards** *[Metric Standards]* WorkSpace installed with the OpenBridge Modeler software.

   a. Select **Imperial Standards** *[Metric Standards]* from the *WorkSpace* menu.

   b. Select the current Workset, then click **Create a Workset .**

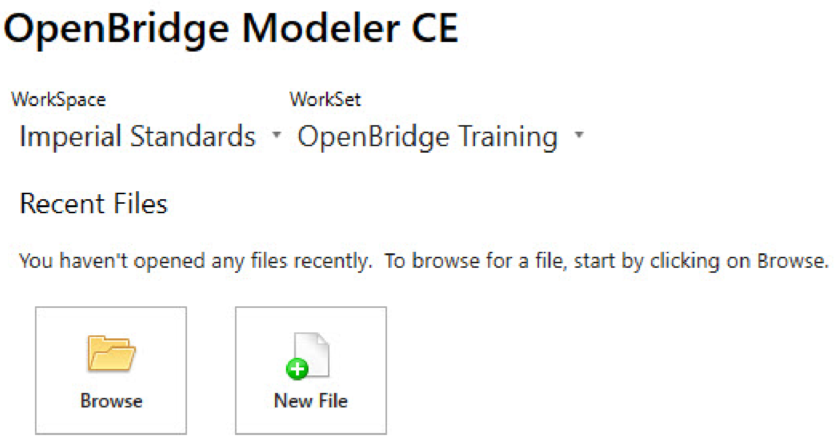


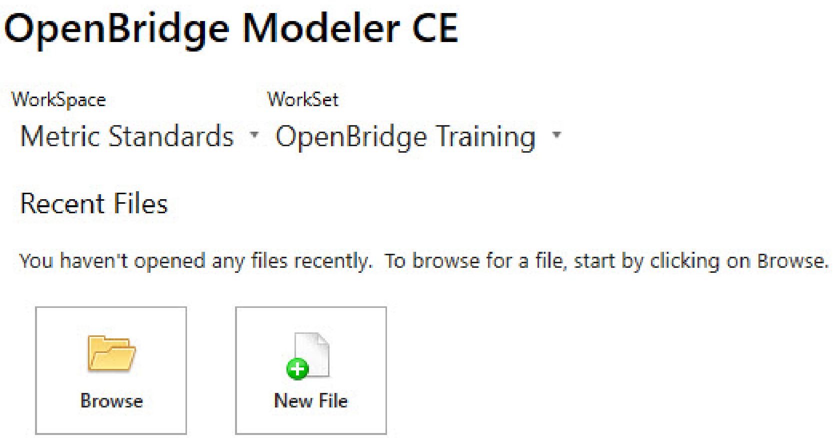
3. Populate the *Name* of the Workset as **OpenBridge Training**.



4. Set the *Design Files* folder as **C:\Bentley Training\Introduction to OpenBridge Modeler\Imperial** *[C:\Bentley Training\Introduction to OpenBridge Modeler\Metric\]*.

5. Click OK to create the Workset.





6. Create a new 3D file for the terrain.

a. Select **New File**.

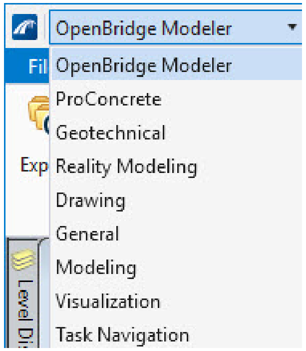
b. Browse to *c:\Bentley Training\Introduction to OpenBridge Modeler\Imperial\Module 1 (Overview and Terrain)* *[c:\Bentley Training\Introduction to OpenBridge Modeler\Metric\Module 1 (Overview and Terrain)]* or other folder where you unzipped the dataset files.

c. Set the *Seed* to **OBM-seed3d-Imperial.dgn** *[OBM-seed3d-Metric.dgn]*.

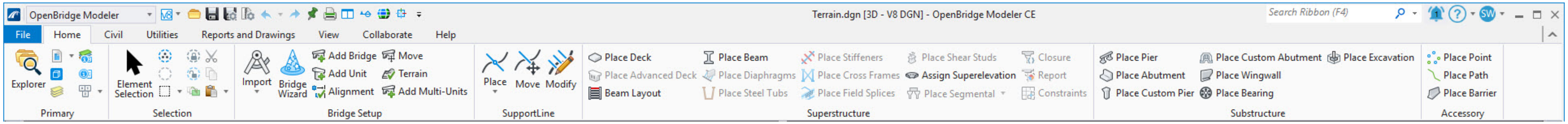
d. Key-in the new file name **Terrain.dgn**.

Review the Interface

1. Activate the **OpenBridge Modeler** *workflow* from the pick list in the upper left corner if it is not already active.



The ribbon menu changes to OpenBridge Modeling tools organized into familiar categories called *ribbon tabs*.



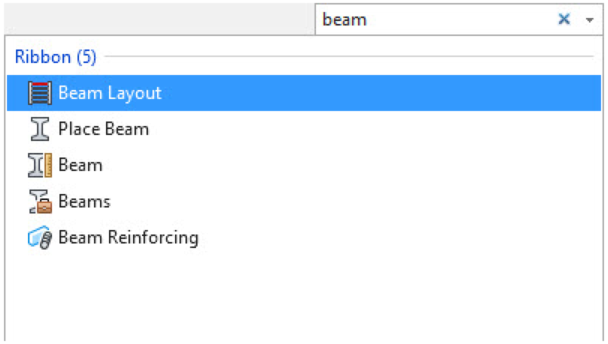
- **Home** - Contains commonly used tools for creating and manipulating bridge objects..
- **Civil** - Tools from OpenRoads Designer including horizontal and vertical geometry tools, superelevation and cross section, terrain modeling and 3D Geometry.
- **Utilities** - Interoperability with Bentley analytical products, Import/Export Library Templates, Libraries, Parametric Cells, AccuDraw Toggle, ACS tools, iTwins Design Review, Item Types and Reports.
- **Reports and Drawings**- Bridge reporting, Drawings tools, Drawing Scale, Measure tools and Placement tools.
- **View** - Commonly used view control tools.
- **Collaborate** - Selection tools, iTwins and ProjectWise Portal tools, Clash Detection and Markup tools.
- **Help** - Online help and Social Media links.

2. Searching the ribbon.

   When you are not sure where to find a tool on the ribbon interface, the Search Ribbon field in the upper right corner is your best option.

   a. Type **Beam** in the search field.

      The matches found in the ribbon menus appear. The search is across all ribbon menus, not just the currently active ribbon.



   b. Hover over **Beam Layout.**

      The search results expand showing where this tool is located on the ribbon.

   c. Select **Beams** to start that tool.

      Notice that the Beam Library tool started but the ribbon menu did not change.

   d. Close the *Template Creation* dialog.

   e. Type **Beam** in the search field again.

   f. Hover over **Beams** to expand the search options.

   g. Select **OpenBridge Modeler → Utilities → Libraries** .

      The ribbon changes to the selected menu which contains the Beam Library tool.

3. Auto hide ribbon.

   a. Double click on any *Ribbon Tab* (such as Civil) to set the ribbon menu in auto hide mode.

   b. Double click a *Ribbon Tab* again disable auto hide mode.

4. Introduction to the Backstage.

   a. Activate the *Back Stage View* by clicking **File** in the ribbon menu.

   b. Select **Settings**.

      Design File settings, preferences, customizations, etc. are found in the Backstage, keeping the ribbon menus focused on the tools.

   c. Click the Arrow in the upper left corner (or press Esc) to return to the design canvas.

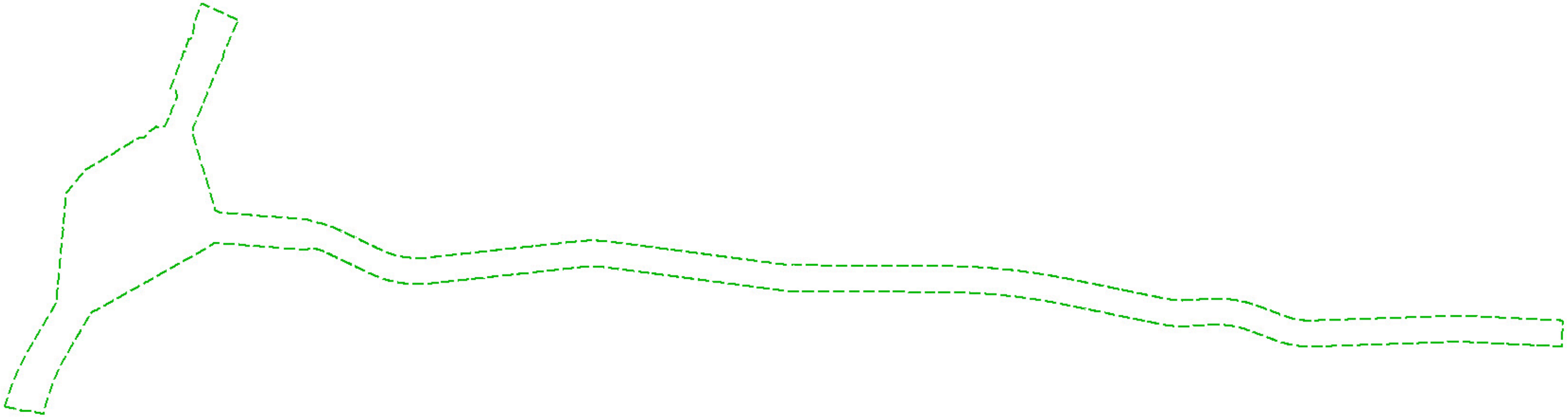
5. Close AccuDraw if it is currently open.

Import Existing Ground Terrain from Bentley Civil

1. Select **Import Terrain** from the *Home > Bridge Setup* tab on the OpenBridge Modeler workflow (ribbon).
2. Select **OG Imperial.tin** *[OG Metric.tin]* from the *Module 1 (Overview and Terrain)* folder and click **Done**.
3. Set the *Feature Definition* to **Terrain > Existing > Existing Boundary**.

   This terrain could have originated in ConceptStation, InRoads, GEOPAK or another application.
4. Set the *Source File Units* to **US Survey Feet** *[Meters]* .
5. Click **Import**.
6. Close the *Import Terrain Model* dialog.

7. Select **Fit View** to see extents of the terrain model.



8. Select **Save Settings**.

   HINT: The icon is found in the Quick Access toolbar at the top of the screen.
9. Close OpenBridge Modeler before proceeding to the next exercise.

Module 2: Geometry

Description

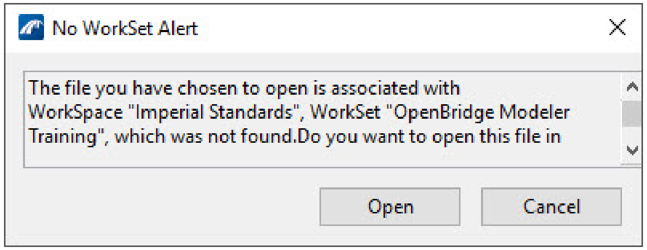
In this module you will import and annotate geometry from InRoads, GEOPAK or MX.

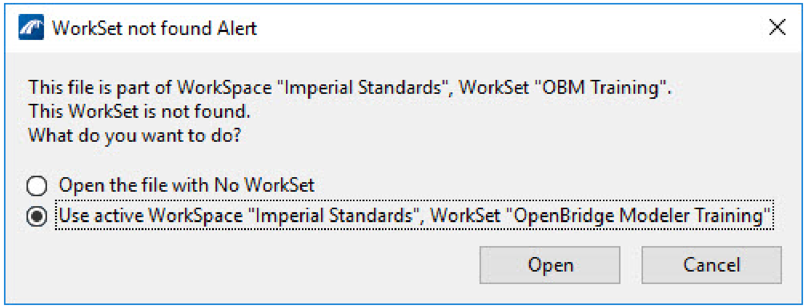
Objectives

- Integration with Bentley Civil products
- Annotation
- Feature Definitions

Attach Original Ground Terrain

1. Select the **Add Standalone Group** icon and name it *Module 2*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Geometry.dgn** from the *Module 2 (Geometry)* folder.
4. If prompted, select Use Active Workset and click **Open**.





5. Attach **Terrain.dgn** as reference using a *Coincident-World* orientation.
   a. Select *Home > Primary > Attach Tools >* **References**
   b. Select **Attach Reference** in the *References* dialog.
   c. Browse to and select the *Terrain.dgn* file.
   d. Use a **Coincident - World** *Orientation*.

6. **Fit** the view.

   The original ground terrain loaded in the previous exercise is displayed.

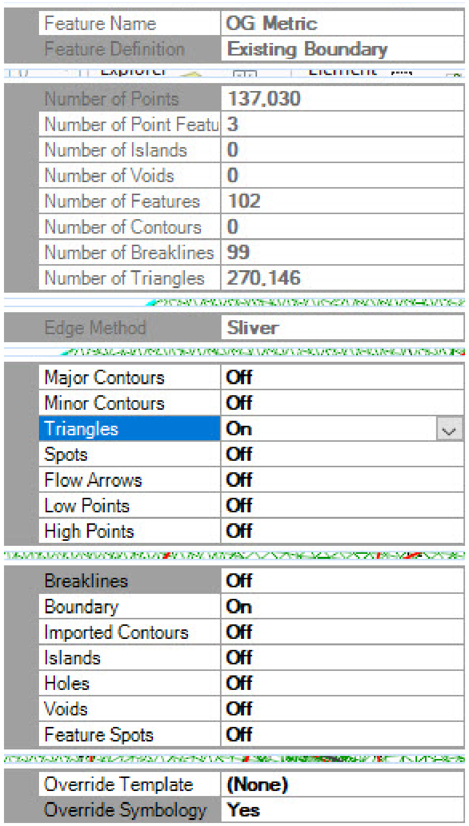
7. **Select** the boundary of the ground terrain.

8. Select the **Properties** tool then set the following:

   - *Override Symbology* = **Yes**
   - *Triangles* = **On**

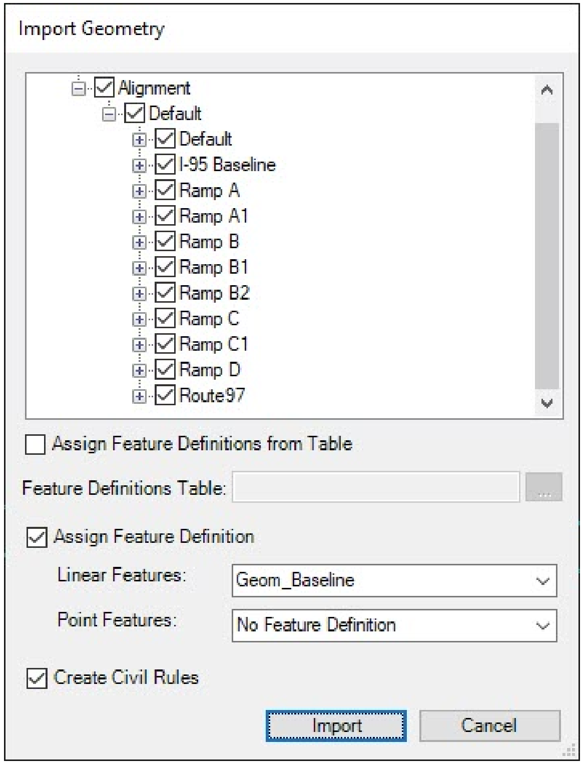
9. Turn the triangles off.

10. Select **Save Settings**.



Import Geometry

1. Import the geometry.
   a. Select **Import Geometry** from the *Home > Bridge Setup* ribbon tab.
   b. Browse to and select the **Geometry.alg** file.
      - You may have to set the file filter to *.alg
   c. Select the check box next to *Default* to select all alignments.
   d. Enable the *Assign Feature Definition* option.
   e. Set the *Linear Features* to **Alignment > Road > Geom_Baseline**
   f. Enable the *Create Civil Rules* option.
   g. Click **Import**.



Annotate Geometry

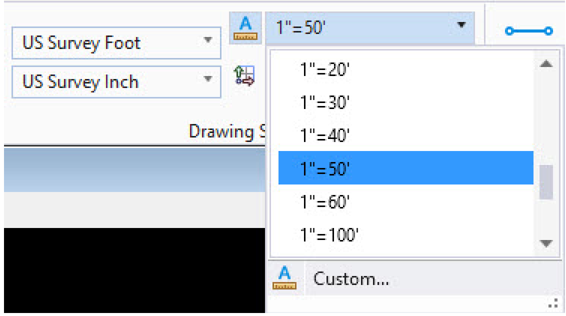
1. Zoom to the area of the interchange.
2. Annotate a single alignment

   a. Select *Reports and Drawings > Drawings > Element Annotation >* **Annotate Element**.

   b. Select any alignment.

   c. Reset to annotate the alignment.

3. Set the **Annotation Scale** in the *Drawing Scale* group to **1" = 50'** *[1:250]* to make the annotations larger.



4. Remove annotation from a single alignment.

   a. Select *Reports and Drawings > Drawings > Element Annotation >* **Remove Element Annotations**.

   b. Select the alignment previously annotated.

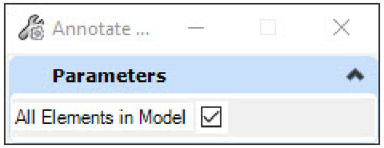
   c. Reset to clear the annotation.

5. Annotate multiple alignments

a. Select *Reports and Drawings > Drawings > Element Annotation >* **Annotate Element**.

b. Enable toggle to annotate All Elements in Model.

c. Data point to annotate the alignments.



6. Set the **Annotation Scale** on the *Drawing Scale* group to **1” = 100’** *[1:500]* to update all annotations to a 100 scale *[1:500 ratio]*.

7. Fit View and Save Settings.

8. Close OpenBridge Modeler before proceeding to the next exercise.

Module 3: Precast Girder 2 Span Straight Bridge Model

Description

In this module you will model a simple 2 span straight prestressed girder bridge.

Objectives

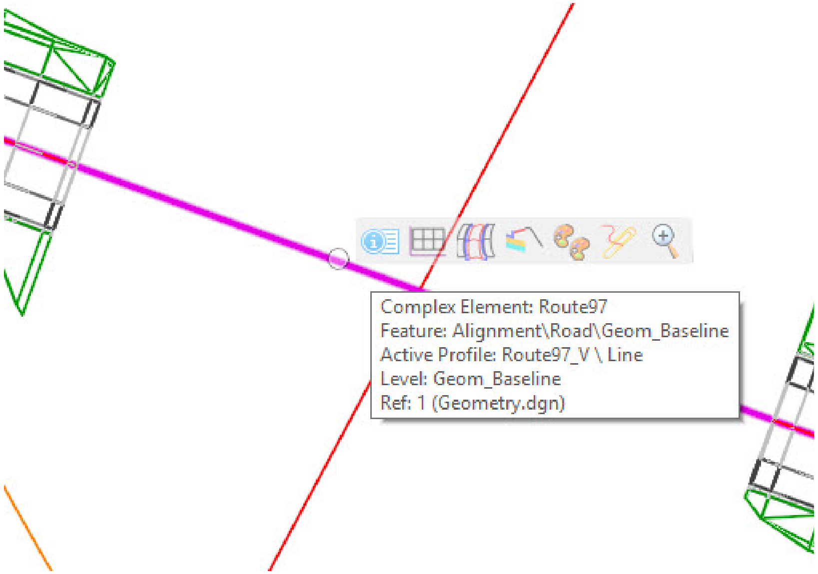
- Reference OpenRoads geometry, terrain model and corridor
- Set pier and abutment locations
- Model deck and beams
- Model piers and abutments and bearings
- Model barriers

Add Bridge to Model

1. Select the **Add Standalone Group** icon and name it *Module 3*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Precast Bridge.dgn** from the *Module 3 (Precast Girder Bridge)* folder.
4. Reference the *Terrain, Geometry and Route97* drawings using Coincident World method.
5. Fit The Views to see the references.

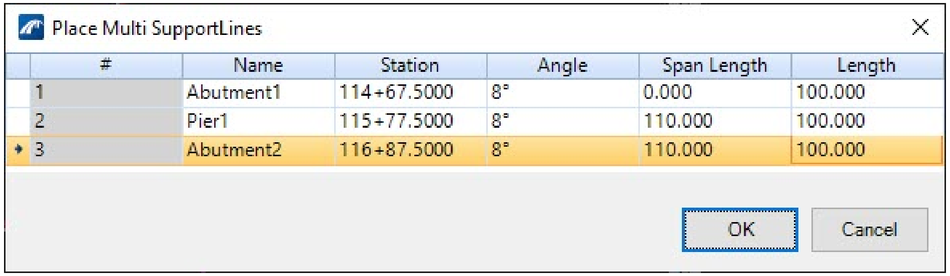
6. Use *Home > Bridge Setup>* **Add Bridge** to create a bridge along Rt 97.
   - *Bridge Type* = **Beam Slab (P/S or RC Concrete Girders)**
   - *Feature Definition* = **Bridge_decorations**
   - *Name Prefix* = **Precast**
7. Select alignment Route97.
8. Data point off the alignment to accept.

9. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active.



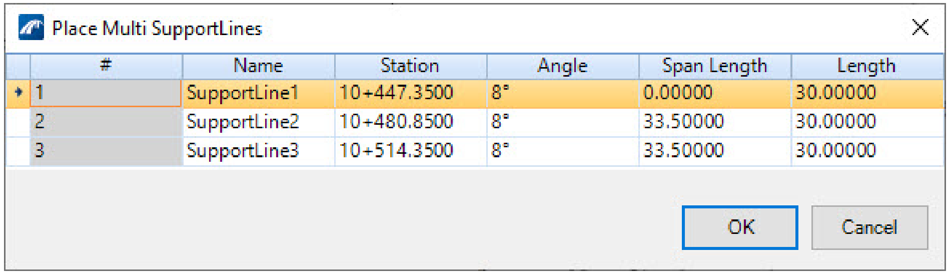
Add Support Lines

1. Continuing in the **Precast Bridge.dgn** drawing.
2. Use *Home > SupportLine >* **Place Multi** to place lines that represent the locations of the piers and abutments.
   - *Skew Angle* = **8** (set in the Tool Settings dialog)
   - *Length* = **100** *[30]*
   - *Span Length* = **110** *[33.5]*
   - *Start Station* = **114+67.50** *[10+447.35]*
   - *Number of SupportLines* = **3**
   - *Direction Mode* = **Skew**
   - *Feature Definition* = **SupportLine**
3. In View 1, data point to start placing the bridge.
4. Data Point to accept the Skew Mode.
5. Data Point to accept the End Location.
6. Rename the SupportLines as shown then click **OK** to continue.


Place Multi SupportLines

#	Name	Station	Angle	Span Length	Length
1	Abutment1	114+67.5000	8°	0.000	100.000
2	Pier1	115+77.5000	8°	110.000	100.000
3	Abutment2	116+87.5000	8°	110.000	100.000

OK Cancel

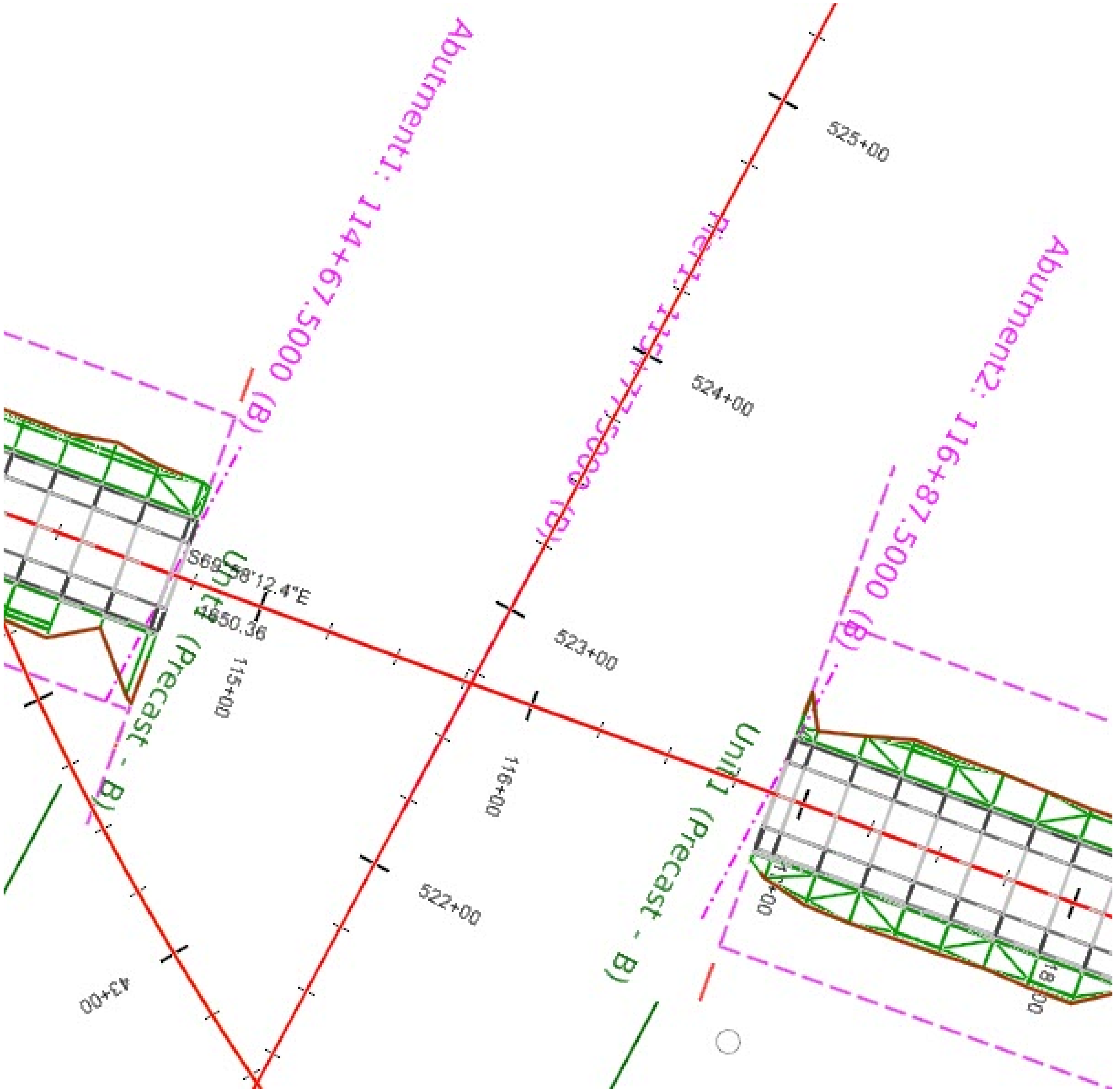

Place Multi SupportLines

#	Name	Station	Angle	Span Length	Length
1	SupportLine1	10+447.3500	8°	0.00000	30.00000
2	SupportLine2	10+480.8500	8°	33.50000	30.00000
3	SupportLine3	10+514.3500	8°	33.50000	30.00000

OK Cancel

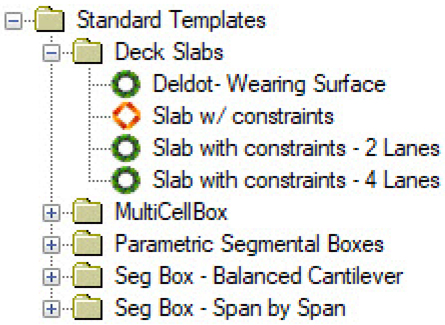
7. Right click to stop placing Support Lines.

8. Review the resulting support lines.



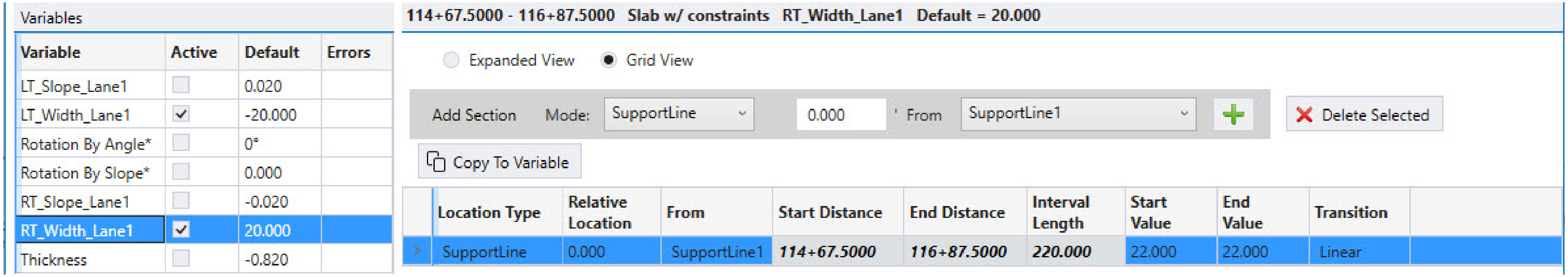
Model the Bridge Deck

1. Continuing in the **Precast Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Place Deck** to place a deck for the length of the structure.
3. Next to Template Name, click the ... icon.
4. Select Slab w/ constraints.

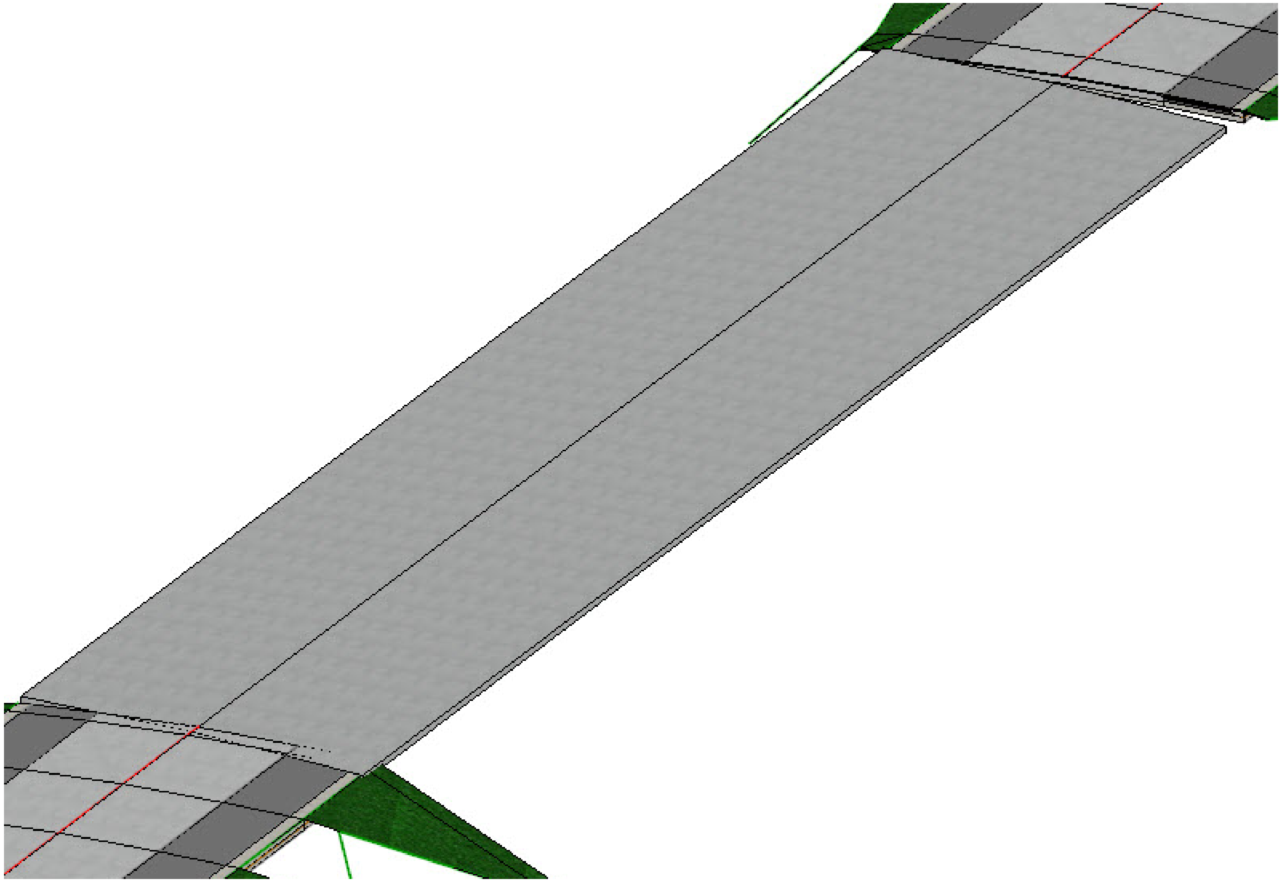


5. Set the following parameters in the Tool Settings window.
   - *Enable* **Add Constraints**
   - *Enable* **Analytical Deck**
   - *Deck Material* = **Deck Concrete-4.0**
   - *Feature Definition* = **Deck**
6. Select the first support line.
7. Select the last support line.
8. Data point to continue.
9. Select the **Variable Constraint** tab.
10. Set the Start Value and End Value for the following variables.

- *RT_Width_Lane1* = **22** *[6.7]*
- *LT_Width_Lane1* = **-22** *[-6.7]*



11. Select **OK** to continue, then *right click* to exit the Place Deck tool. Review the 3D model.



Define the Girders

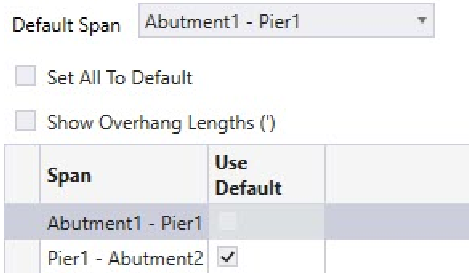
1. Continuing in the **Precast Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Beam Layout** to determine the beam centerlines for the length of the structure.
3. From View 1, Select the first support line.
4. Select the last support line.
5. Data-point to continue.
6. Set the *Number of Beams* to **6**.
7. Set the *Edge Distance* to **3.0** *[1.0]* and click **Apply**.
8. Set the *SL Offset* to **3** *[75]* . This is applied to each end of the beam by default.

Number Of Beams: 6 — Edge Distance ('): 0.000 — Apply — ☑ Equal Edge Distance

☑ Same Beam Start/End Values — ☐ Advanced Bearing Definition

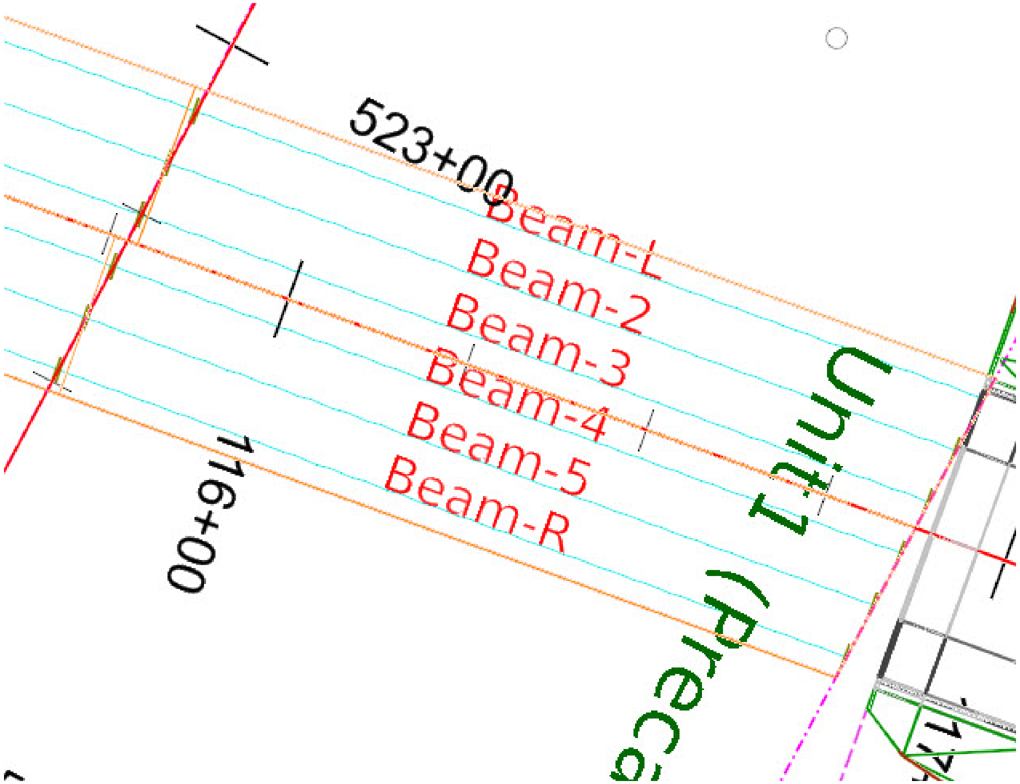
			BEAM START				REFERENCE				
	Beam #	Name	Spacing (')	Method	SL Offset (") 0.000	Skew Ends ☐	Spacing Reference	Beam	Aux Alignment	Use Chord ☑	Beam Length
>	1	Beam-L	3.000	Normal	3.000	☐	Left Deck Edge			☑	109.500
	2	Beam-2	7.600	Normal	3.000	☐	Another Beam	1		☑	109.500
	3	Beam-3	7.600	Normal	3.000	☐	Another Beam	2		☑	109.500
	4	Beam-4	7.600	Normal	3.000	☐	Another Beam	3		☑	109.500
	5	Beam-5	7.600	Normal	3.000	☐	Another Beam	4		☑	109.500
	6	Beam-R	-3.000	Normal	3.000	☐	Right Deck Edge			☑	109.500

9. Enable the *Use Default* toggle for the second span.



10. Select **Validate** to review the proposed beam line locations.

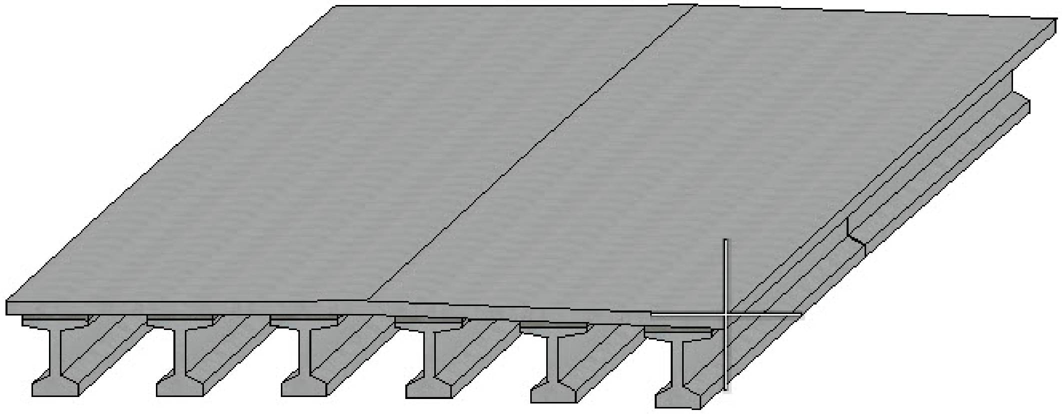
11. Select **Save** to accept the beam layout.



12. Use *Home > Superstructure >* **Place Beam** to select the beam shape.

- *Feature Definition* = **Girder**

13. From the top view, select the beam layout then data point to accept.
14. In the Beam Definition window, set the following:
    - *Beam Type* = **LEAP Concrete**
    - *Enable* the **Compute** toggle
    - *Min. Clearance* to **1** *[25]* .
    - *Camber* to **3** *[75]*.
    - *Template* to **I_Girder\PCEF 5548.**
15. Enable the *Apply to All Beams* toggle (lower left corner of the window).
16. Select OK to model the beams.



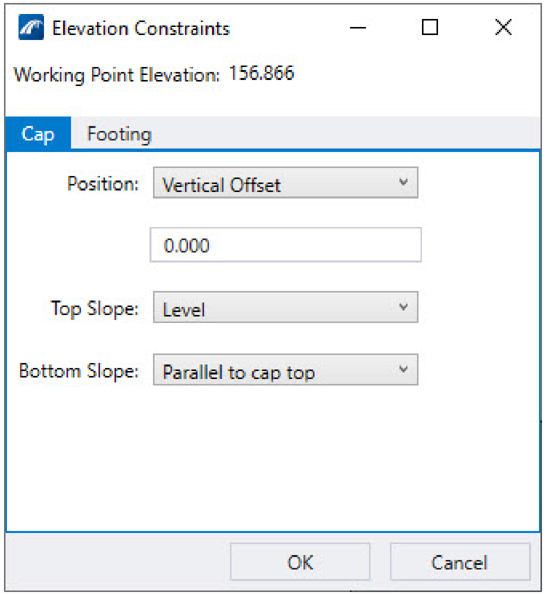
17. Review the resulting model.

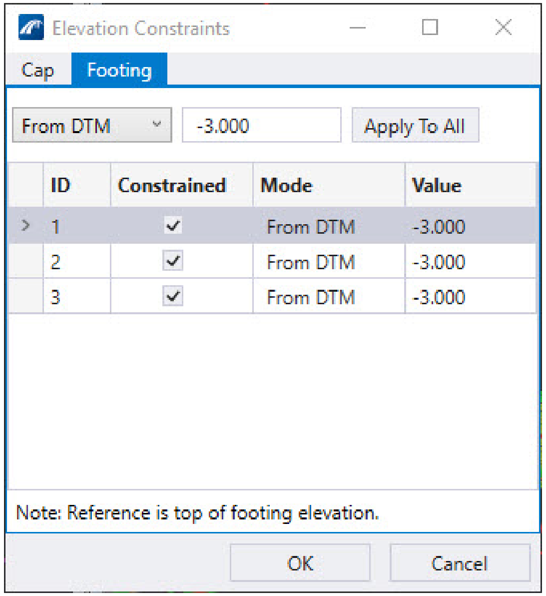
Place the Pier

1. Continuing in the **Precast Bridge.dgn** drawing.

2. Use *Home > Substructure >* **Place Pier** to model the pier for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Multi-Column > Default > 2Lane_30ft** *[2Lane_8m]* pier template, then set the following parameters:
   - *Cap Length Adjustment* = **By Deck**
   - Enable the toggle for *Elevation Constraints*
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Pier_steel_piles**
5. Select the Pier support line, right click in space then data point to place the pier.

6. In the Pier Elevation Constraints window, set the Cap and Footings tabs as shown. Note: Use *-1* for *From DTM* value for metric.





7. Turn on the display of the triangles for the attached terrain model.

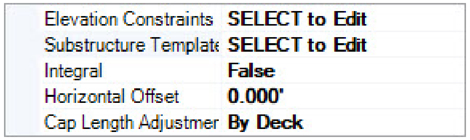
8. Rotate the model so you are viewing the pier footings from under the terrain surface to verify the depth of the footings.

9. Rotate the model back to an isometric view of the structure.

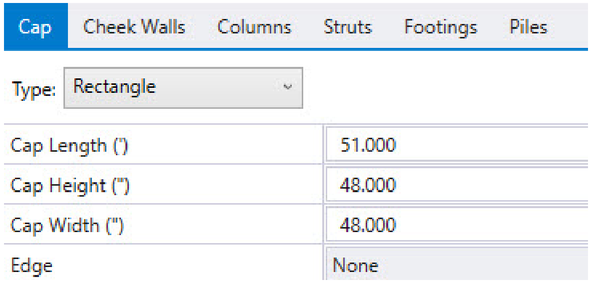
Modify the Pier

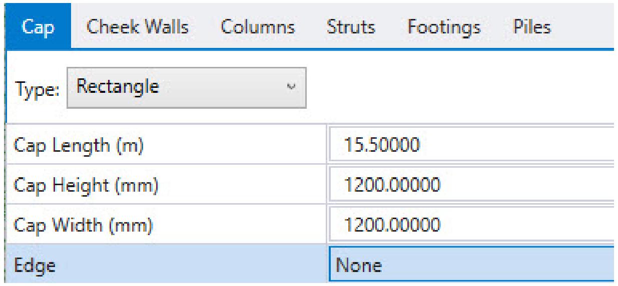
1. Continuing in the **Precast Bridge.dgn** drawing.
2. Select the pier using the Element Selection tool.
3. Select the **Properties** icon.

4. Choose **Select to Edit ...** next to *Substructure Template*.



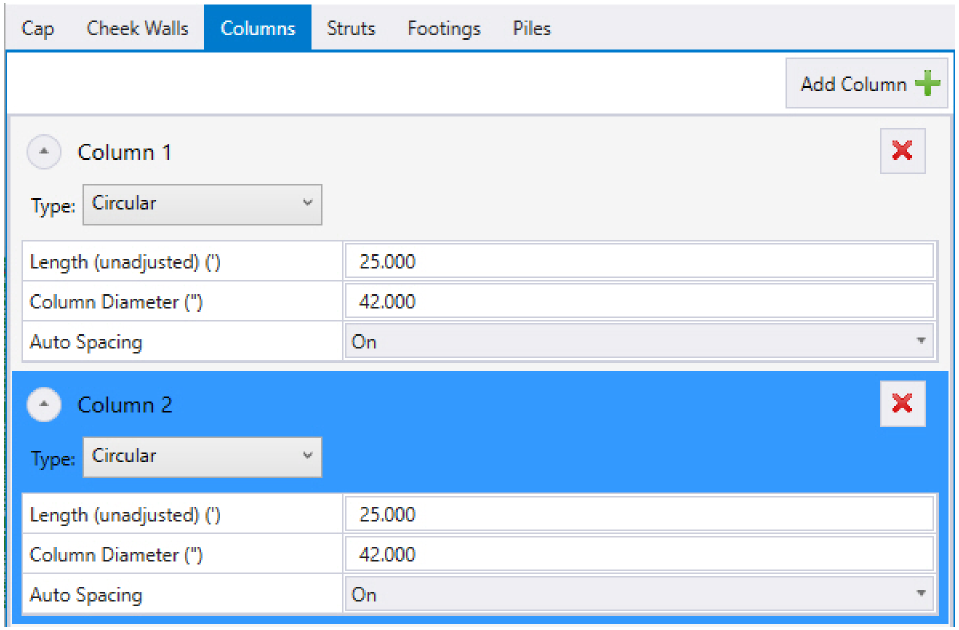
5. Select the **Cap** tab, then set the following parameters:
   - *Type* = **Rectangular**
   - *Cap Height* = **48** *[1200]*
   - *Cap Width* = **48** *[1200]*





6. Select the **Columns** tab, then set the following parameters:

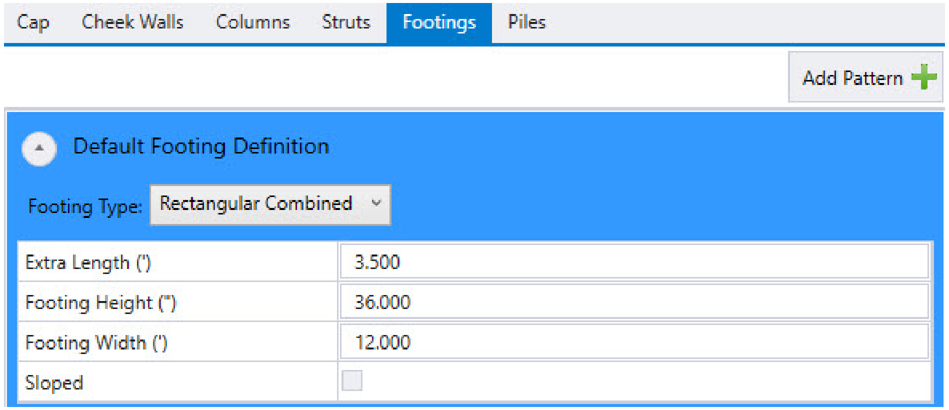
- *Type* = **Circular** for both columns
- *Column Diameter* = **42** *[1050]*



7. Select **Add Column** button to add a third column.

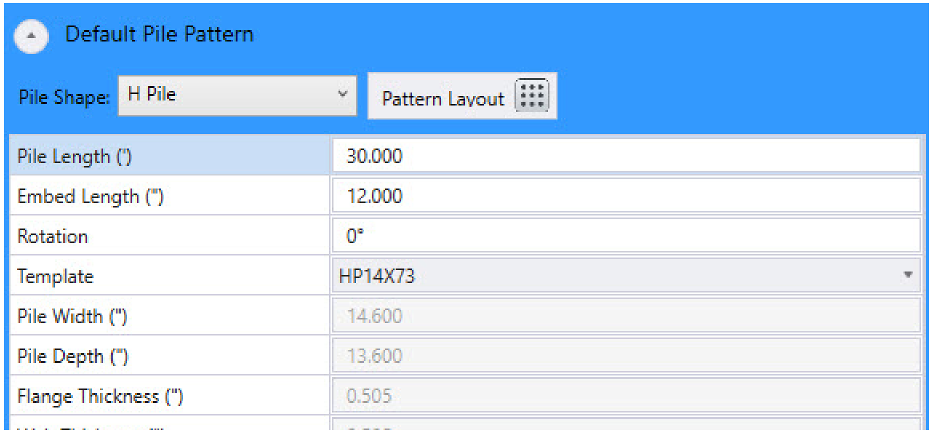
8. Select the **Footings** tab, then set the following parameters:

- *Footing Type* = **Rectangular Combined**
- *Extra Length* = **3.5** *[1.25]*



9. Select the **Piles** tab, then set the following parameters:

- *Pile Type* = **H Pile**
- *Embed Length* = **12** *[300]*
- *Rotation* = **0**
- *Template* = **HP 14x73**

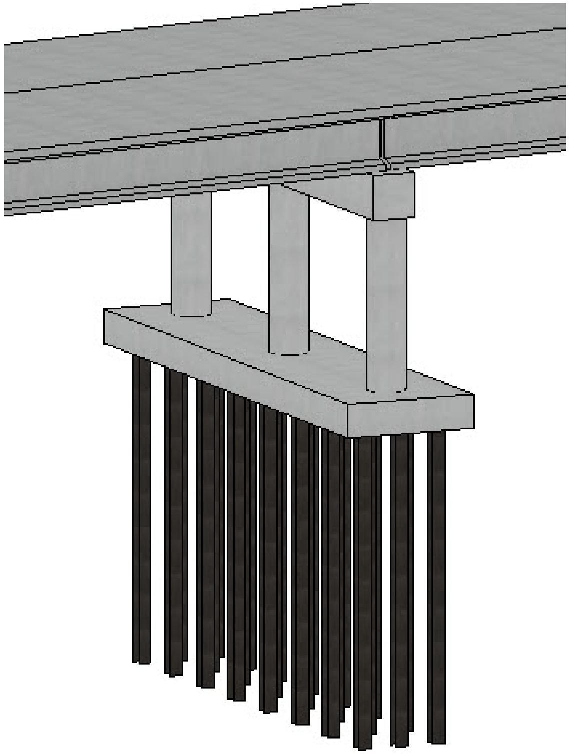


10. Select the **Pattern Layout** button, then set the following parameters:

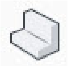
- *Top Margin* = **18** [*500*]
- *Bottom Margin* = **18** [*500*]
- *Left Margin* = **18** [*500*]
- *Right Margin* = **18** [*500*]
- *Number of Rows* = **3**
- *Number of Columns* = **8**

11. Select **Generate Piles** then select **OK** to accept the new pile layout.

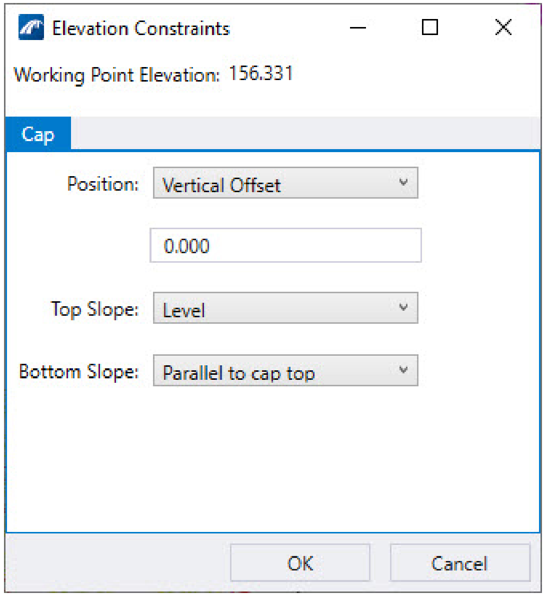
12. Select **OK** to accept the changes. Note: You will need to reapply the elevation constraints.



Place the Abutments

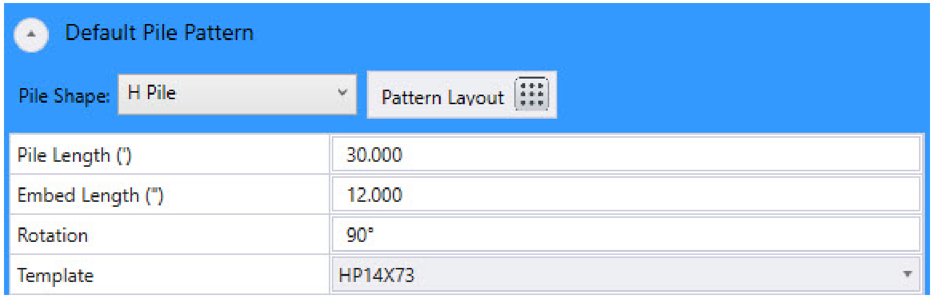
1. Continuing in the **Precast Bridge.dgn** drawing.

2. Use *Home > Substructure >* **Place Abutment** to model the abutments for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Pile Cap > Default > 2 Lane - 27ft** *[2 Lane - 8 m]* abutment template, then set the following parameters:
   - Enable the toggle for *Edit Elevation Constraints*
   - *Cap Length Adjustment* = **By Deck**
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Abutment_steel_piles**
5. Select the first support line, data point in space to place the abutment.

6. In the Pier Elevation Constraints window, set the *Top Slope* and *Bottom Slope* as shown.

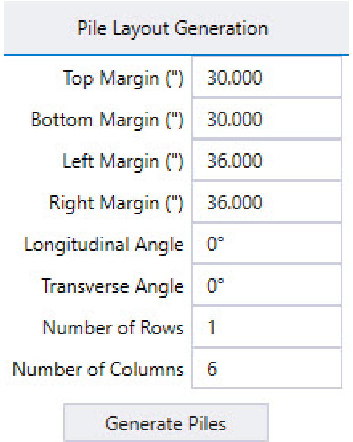


7. Select **OK** to accept Pier Elevation Constraints window values.
8. Select the abutment with the **Element Selection** tool.
9. Select the **Properties** icon.
10. Choose **Select to Edit ...** next to *Substructure Template*.
11. Select the **Piles** tab. Modify the following parameters:
    - *Pile Type* = **H Pile**
    - *Embed Length* = **12** *[300]*
    - *Rotation* = **90**

- **Template** = *HP14X73*.



12. Select **Pattern Layout**.
13. Set the following values, then click **Generate Piles**.
    - *Left Margin* and *Right Margin* = **36** *[1000]*
    - *Number of Columns* = **6**

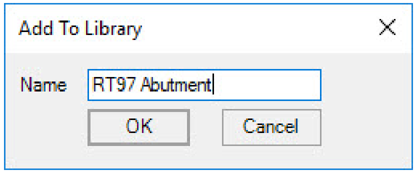


14. Select **OK** to accept pile changes.
15. Select **OK** to accept abutment changes.
16. Select the abutment with the **Element Selection** tool.
17. Select the **Properties** icon.

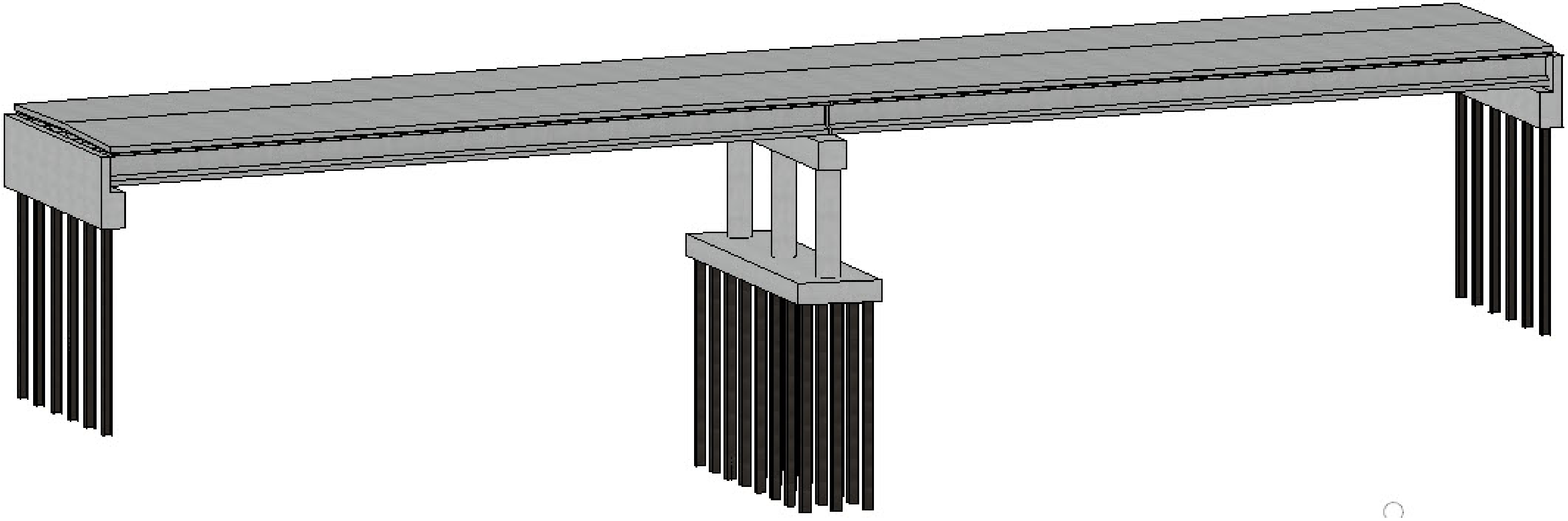
18. Choose **Select to Edit ...** next to *Substructure Template*.

19. Click **Add to Library**.

20. Name the abutment, then click **OK**.

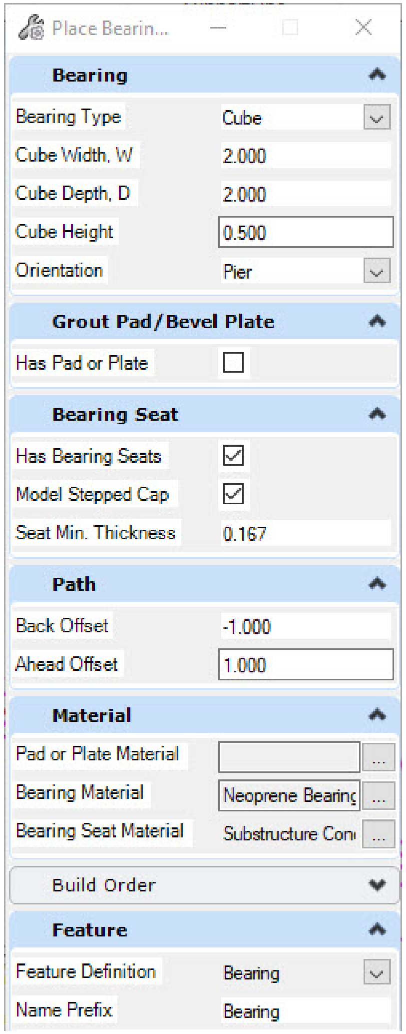


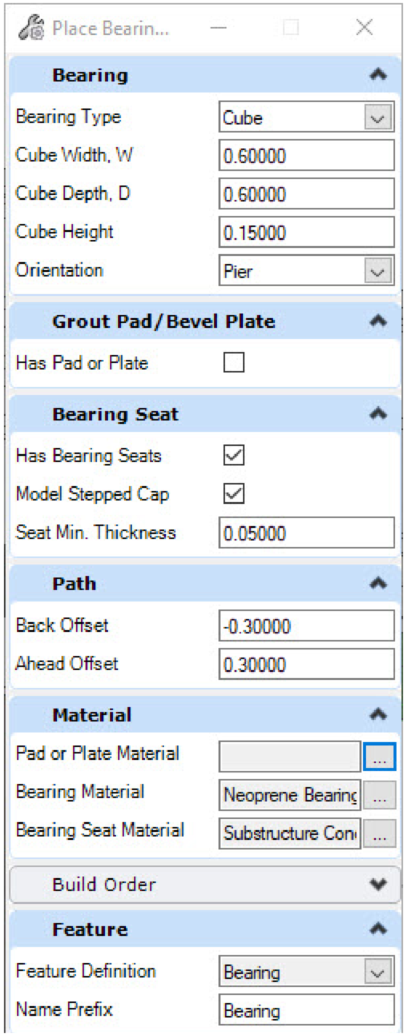
21. Using the Place Abutment tool, place the newly saved abutment at the end of the structure using the same elevation constraints as the first abutment.



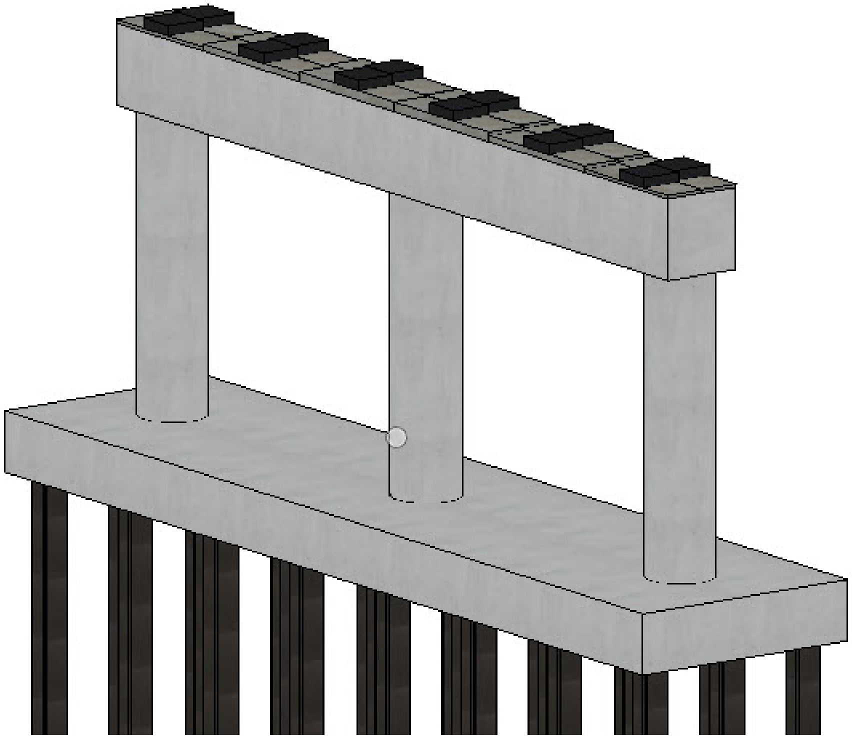
Place the Bearings and Stepped Cap

1. Continuing in the **Precast Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Bearing** to model the bearings and stepped cap for this structure.
3. In the Tool Settings window, set the following values (Imperial and Metric shown respectively):.



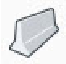


4. Select each of the support lines, reset off of the support lines, then data point to place the bearings.
5. Review the resulting bearings. In explorer, turn off the deck and beams. Turn them back on prior to performing the next set of steps.

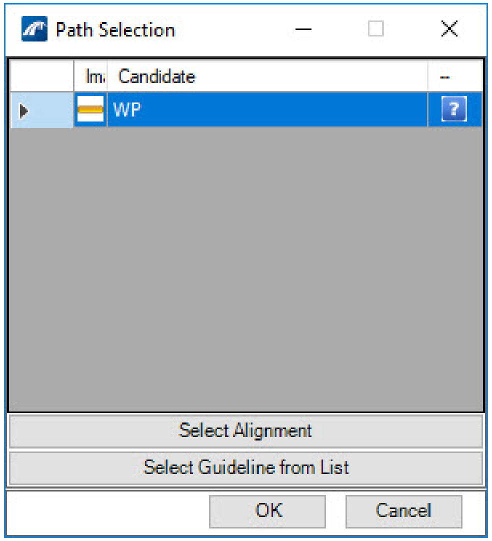


Place the Barriers

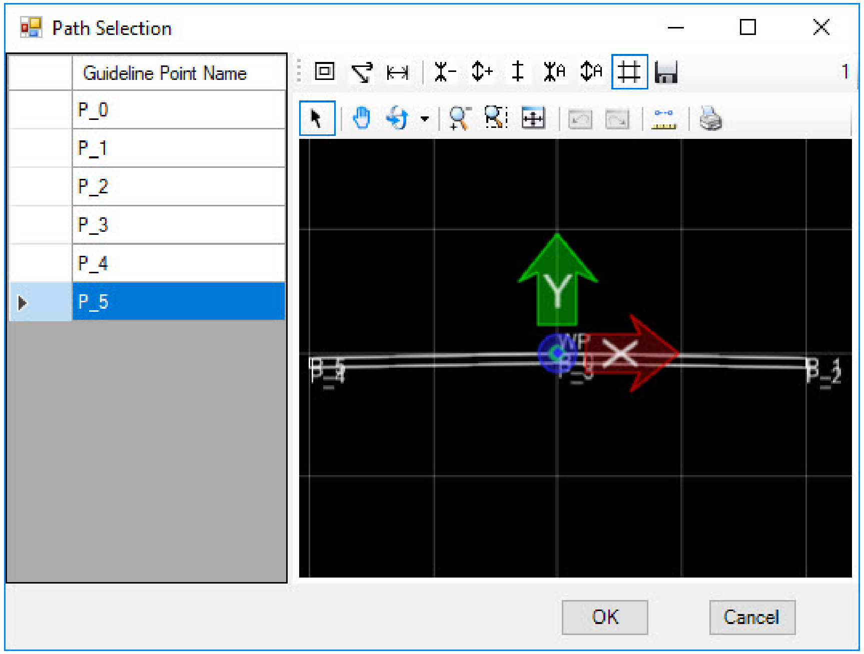
1. Continuing in the **Precast Bridge.dgn** drawing.



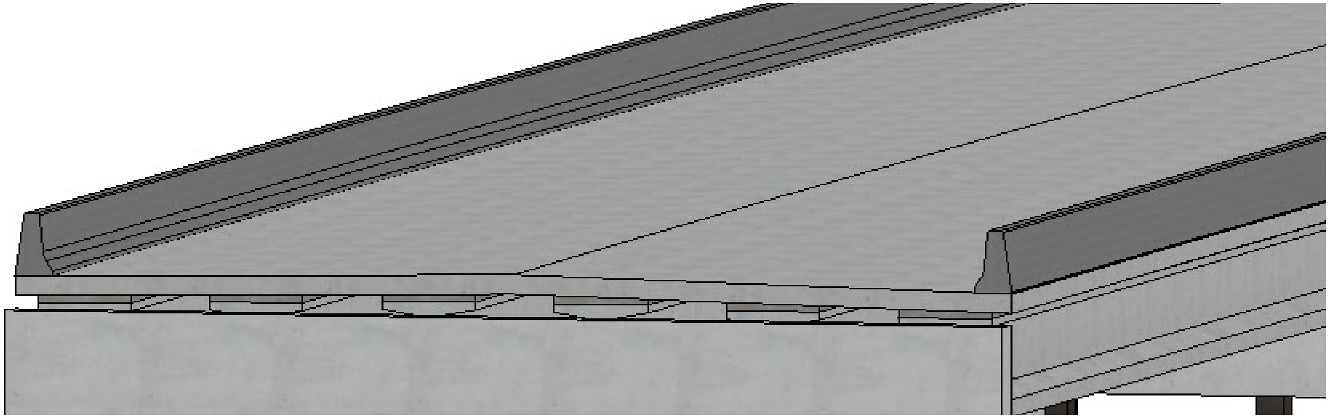
2. Use *Home > Accessory >* **Place Barrier** to model the barriers for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **VDOT\BPB-3 L** barrier template, then set the following parameters:
   - *Barrier Material* = **Traffic Barrier**
   - *Feature Definition* = **Barrier**
5. Select the deck with a datapoint, then off of the deck right-click, then data point to continue.
6. From the *Path Selection* window, click **Select Guideline from List**.



7. Select point **P_5** from the *Guideline Point Name* list. This point represents the upper left point of the deck.



8. Click **OK** in both Path Selection windows to place the barrier.
9. Repeat the process for the right side barrier. Use template **VDOT\BPB-3 R** and point **P_1** for the *Guideline Point Name.*
10. Review the resulting barriers.



11. Close OpenBridge Modeler before proceeding to the next exercise.

Module 3w: Precast Beam 2 Span Straight Bridge Model using Wizard

Description

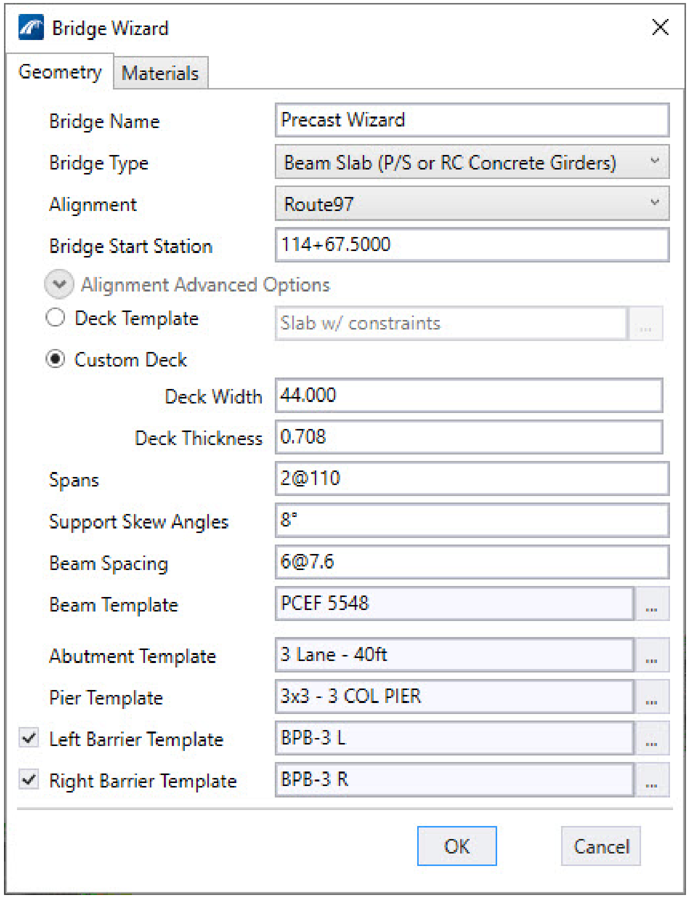
In this module you will model a simple 2 span straight prestressed beam bridge using the Bridge Wizard.

Objectives

- Reference OpenRoads geometry, terrain model and corridor
- Use Wizard to define the model
- Place Excavation
- Place Diaphragms

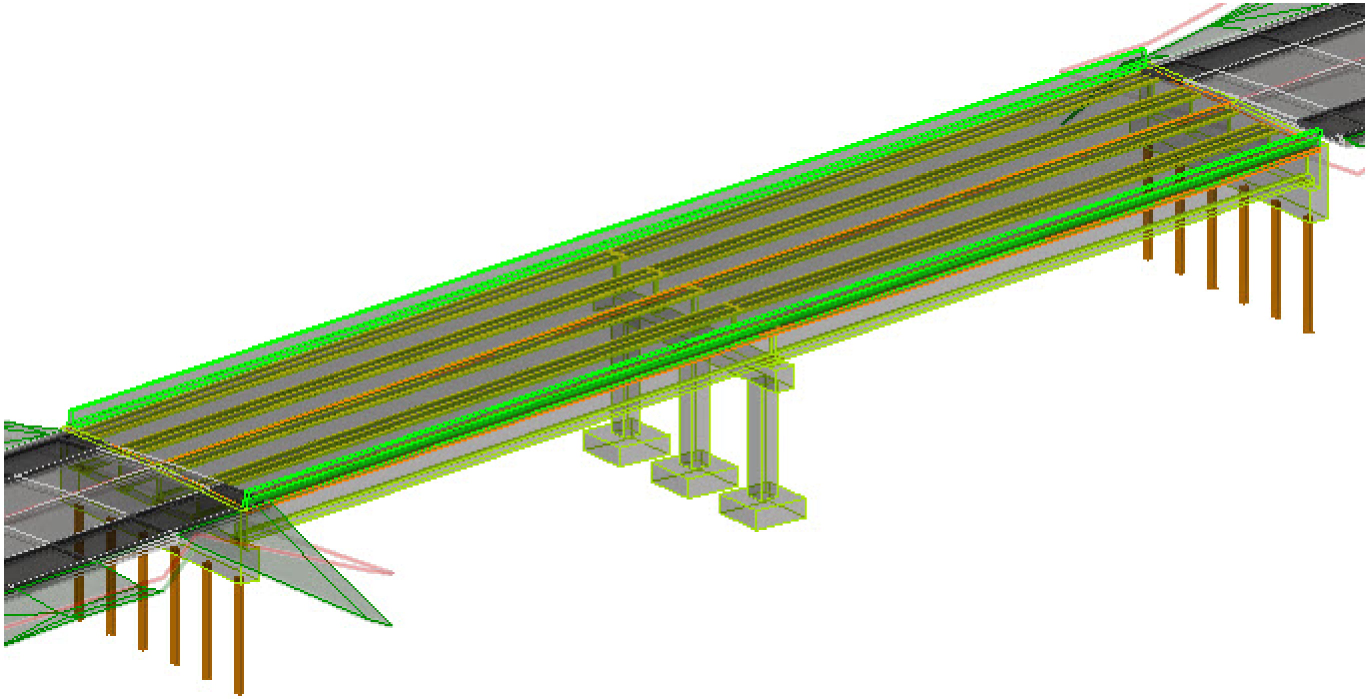
Add Bridge to Model

1. Select the **Add Standalone Group** icon and name it *Module 3w*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Precast Bridge Wizard.dgn** from the *Module 3 (Precast Girder Bridge)* folder.
4. Reference the *Terrain, Geometry and Route97* drawings using Coincident World method. Fit The Views to see the references.
5. Use *Home > Bridge Setup>* **Bridge Wizard** to create a bridge along Rt 97.
   - *Bridge Name* = **Precast Wizard**
   - *Bridge Type* = **Beam Slab (P/S or RC Concrete Girders)**
   - *Alignment* = **Route 97**
   - *Bridge Start Station* = **114+67.50** *[10+447.35]*
   - *Custom Deck*
     - *Deck Width* = **44'** *[13.400m]*
     - *Deck Thickness* = **8.5"** *[0.215m]*
   - *Spans* = **2@110** *[2@33.500]*
   - *Support Skew Angles* = **8**
   - *Beam Spacing* = **6@7.6** *[6@2.5]*
   - *Beam Template* = **LEAP Concrete > I-GIRDER > PCEF-5548**
   - *Abutment Template* = **3 Lane - 40ft** *[3 Lane - 12 m]*
   - *Pier Template* = **3x3 - 3 COL PIER**
   - *Left Barrier Template* = **VDOT > BPB-3 L**



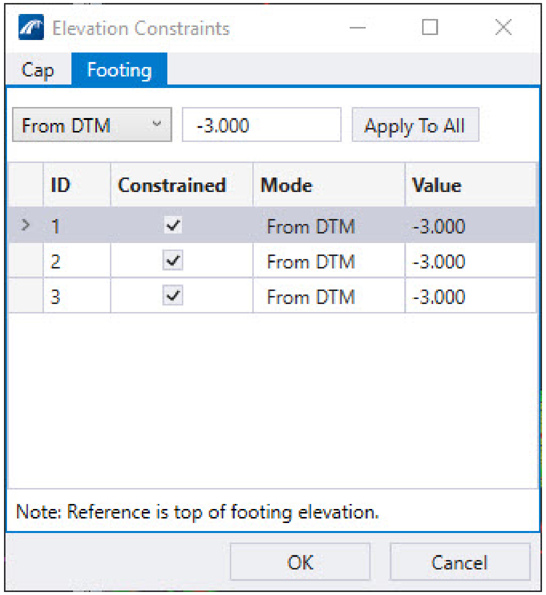
- *Right Barrier Template* = **VDOT > BPB-3 R**

6. Click **OK** to model the bridge.



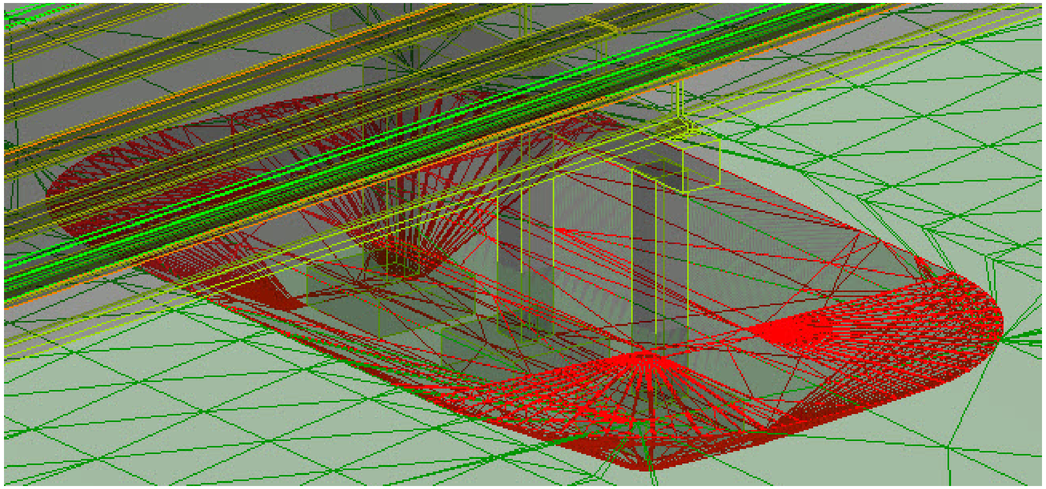
7. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active

8. Change the Pier Elevation Constraints to match image below.

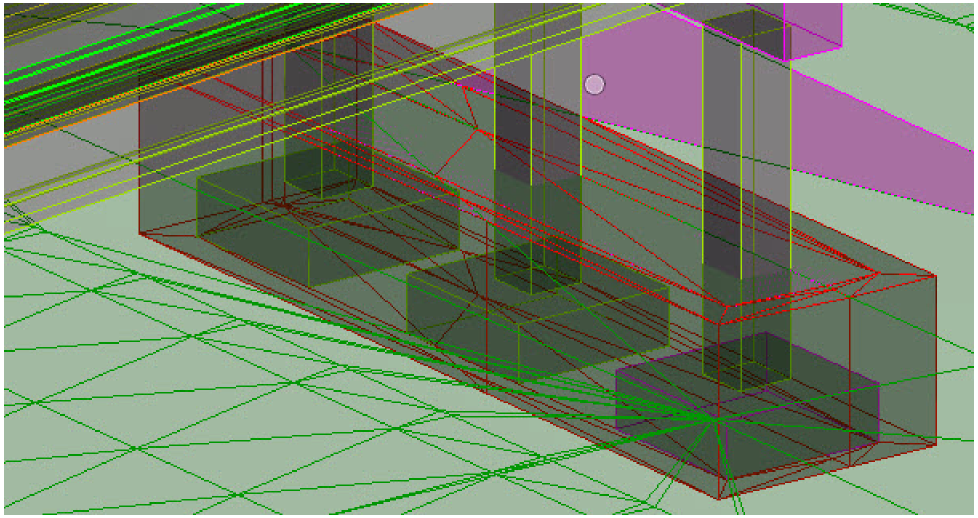


Place Excavation

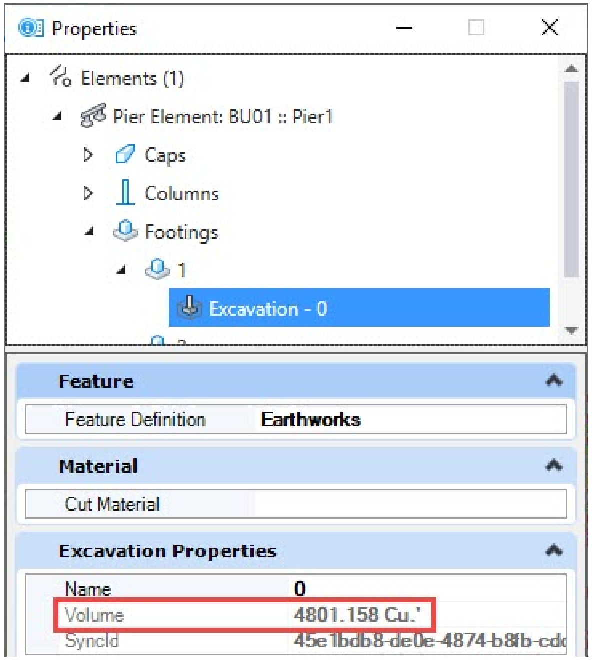
1. Continuing in the **Precast Bridge Wizard.dgn** drawing.
2. Use *Home > Substructure >* **Place Excavation** to model the excavation of the pier footings.
   - *Horizontal Offset* = **2** *[0.6]*
   - *Vertical Sheeting* is **disabled**
   - *Side Slope* = **1:2**
   - *Bottom Vertical Offset* = **0**
   - *Combined Excavation* is **enabled**
   - *Cut Material* = **Miscellaneous > Excavation**
   - *Feature Definition* = **Earthworks**
3. Select the Terrain Model boundary.
4. Select the pier, then right click off the pier, then data point to continue.
5. Enable display of the triangles if you like.

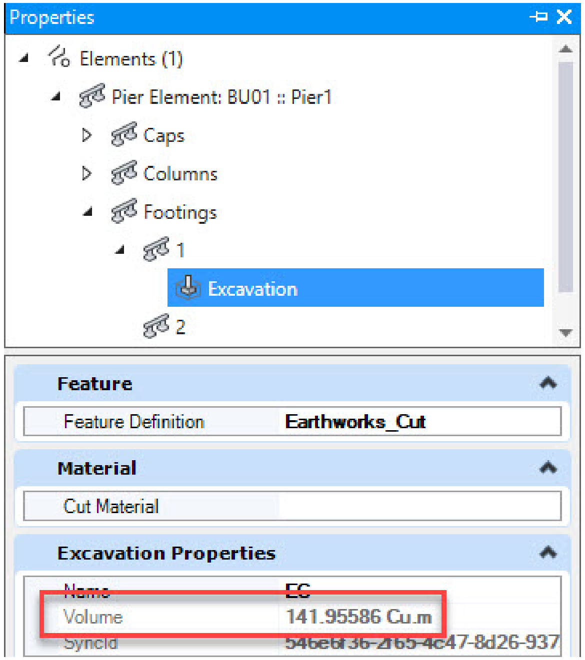


6. Select the Pier, then from the Properties window, change the *Vertical Sheeting* to **True**.



7. From the Properties window, the volume of the excavation is shown as well.





Place Diaphragms

1. Continuing in the **Precast Bridge Wizard.dgn** drawing.

2. Select *Home > Superstructure >* **Place Diaphragms**, then select and accept the beams in the model.
3. Populate the top row of the window with these values:
   - *Thickness* = **1.5** *[0.500]*
   - *Angle* = **8**
   - *SupportLine locations* = **10 25 40 55 70 85 100** *[3.25 7.75 12.25 16.75 21.25 25.75 30.25]*

Defaults

			START BEAM OFFSETS			END BEAM OFFSETS				
Start Beam	End Beam	Thickness	Top Vertical	Bottom Vertical	Horizontal	Top Vertical	Bottom Vertical	Horizontal	Angle	Material
Beam-L	Beam-R	1.500	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A

Add Section Mode: SupportLine | 10 25 40 55 70 85 100 ' From SupportLine1 | + | Delete Selected

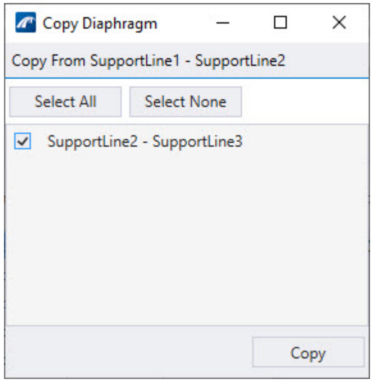
4. Click Plus icon to add to table.

								START BEAM OFFSETS			END BEAM OFFSETS				
Name	Location Type	Relative Location	From	Start Distance	Start Beam	End Beam	Thickness (')	Top Vertical (")	Bottom Vertical (")	Horizontal (")	Top Vertical (")	Bottom Vertical (")	Horizontal (")	Angle	Material
Concrete Dia	SupportLine	10.000	SupportLine1	*114+77.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	25.000	SupportLine1	*114+92.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	40.000	SupportLine1	*115+07.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	55.000	SupportLine1	*115+22.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	70.000	SupportLine1	*115+37.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	85.000	SupportLine1	*115+52.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A
Concrete Dia	SupportLine	100.000	SupportLine1	*115+67.5000*	Beam-L	Beam-R	1.000	0.000	0.000	0.000	0.000	0.000	0.000	8°	AASHTO-II, CL.A

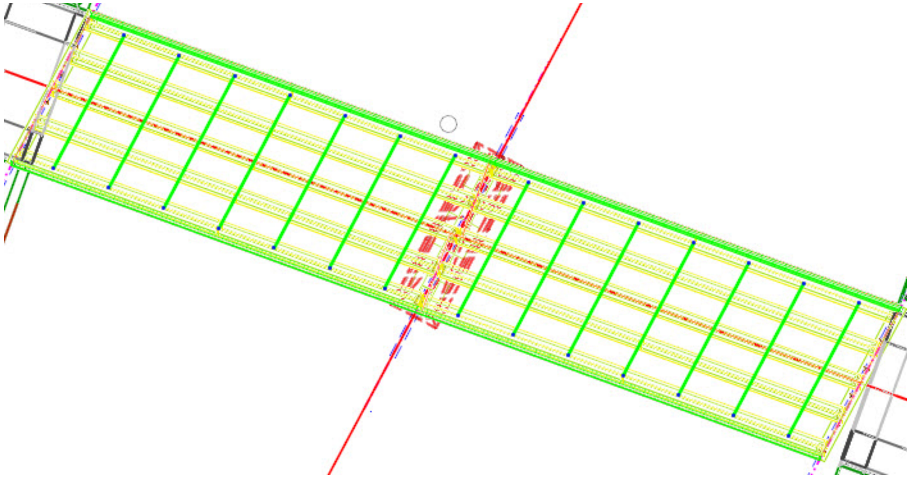
Copy

5. Click **Copy** to copy Span 1 diaphragms to Span 2.

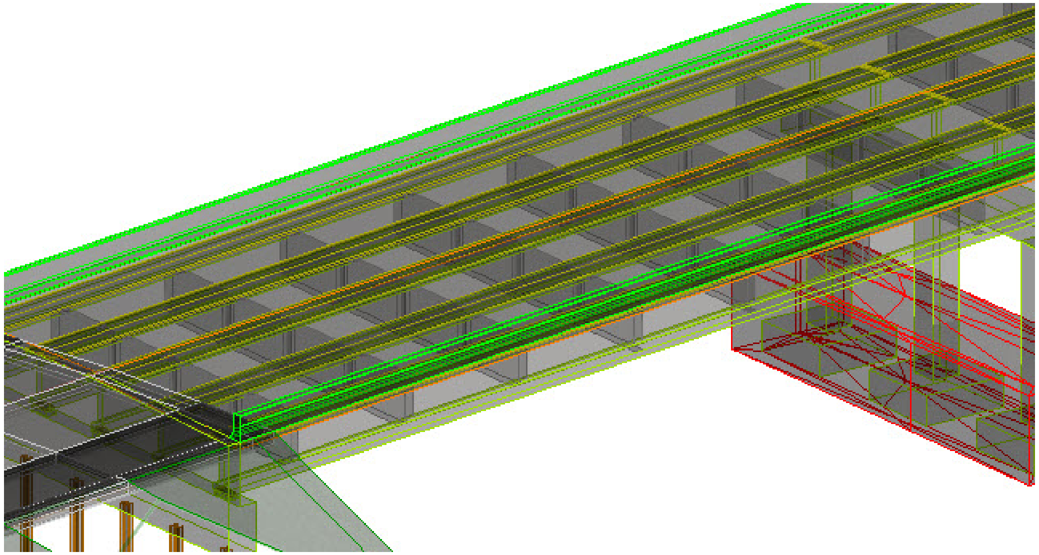
6. Click **Select All** then click **Copy**.



7. Click **Validate** to see the diaphragms as 2D lines to confirm their location.



8. Click **Save** to model the diaphragms.



9. Close OpenBridge Modeler before proceeding to the next exercise.

Module 4: Steel Girder 2 Span Straight Bridge Model

Description

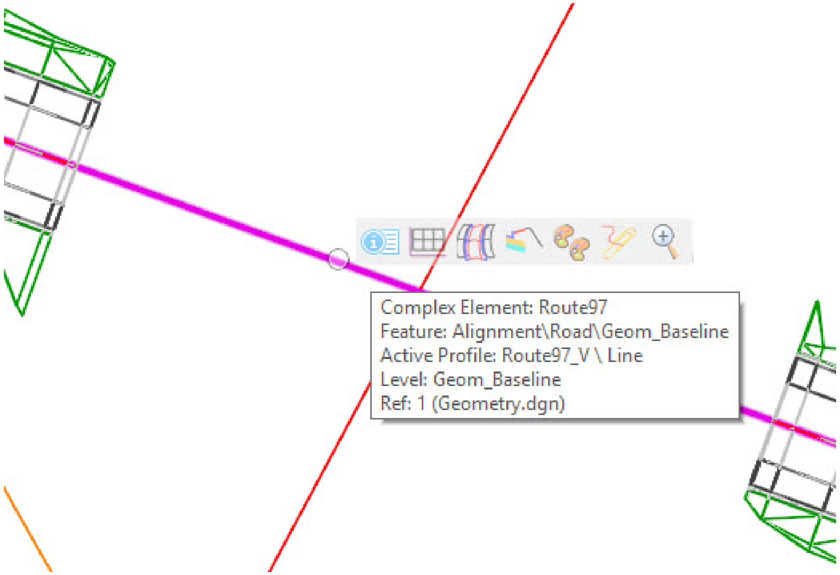
In this module you will model a straight 2 span steel girder bridge.

Objectives

- Reference OpenRoads geometry, terrain model and corridor
- Set pier and abutment locations
- Model deck, beams, cross frames and stiffeners and shear connectors
- Model piers and abutments and bearings
- Model barriers

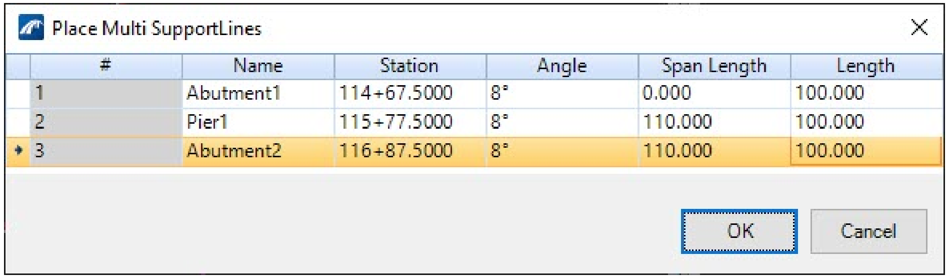
Add Bridge to Model

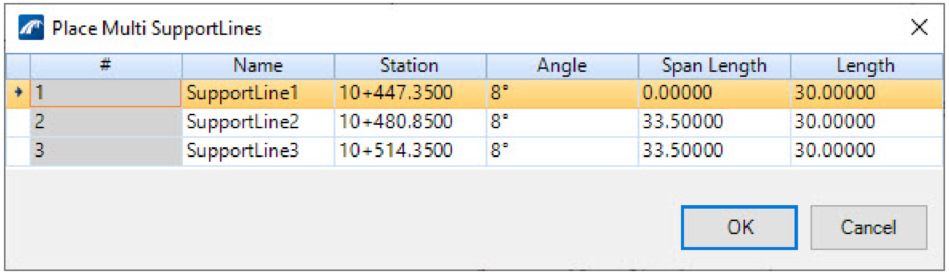
1. Select the **Add Standalone Group** icon and name it *Module 4*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Steel Girder Bridge.dgn** from the *Module 4(Steel Girder Bridge)* folder.
4. Reference the *Terrain, Geometry and Route97* drawings using Coincident World method.
5. Fit The Views to see the references.
6. Use *Home > Bridge Setup>* **Add Bridge** to create a bridge along Route 97.
   - *Bridge Type* = **Beam Slab (Steel Girders)**
   - *Feature Definition* = **Bridge_decorations**
   - *Name Prefix* = **Steel**
7. Select alignment Route97.
8. Data point off the alignment to accept.
9. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active.



Add Support Lines

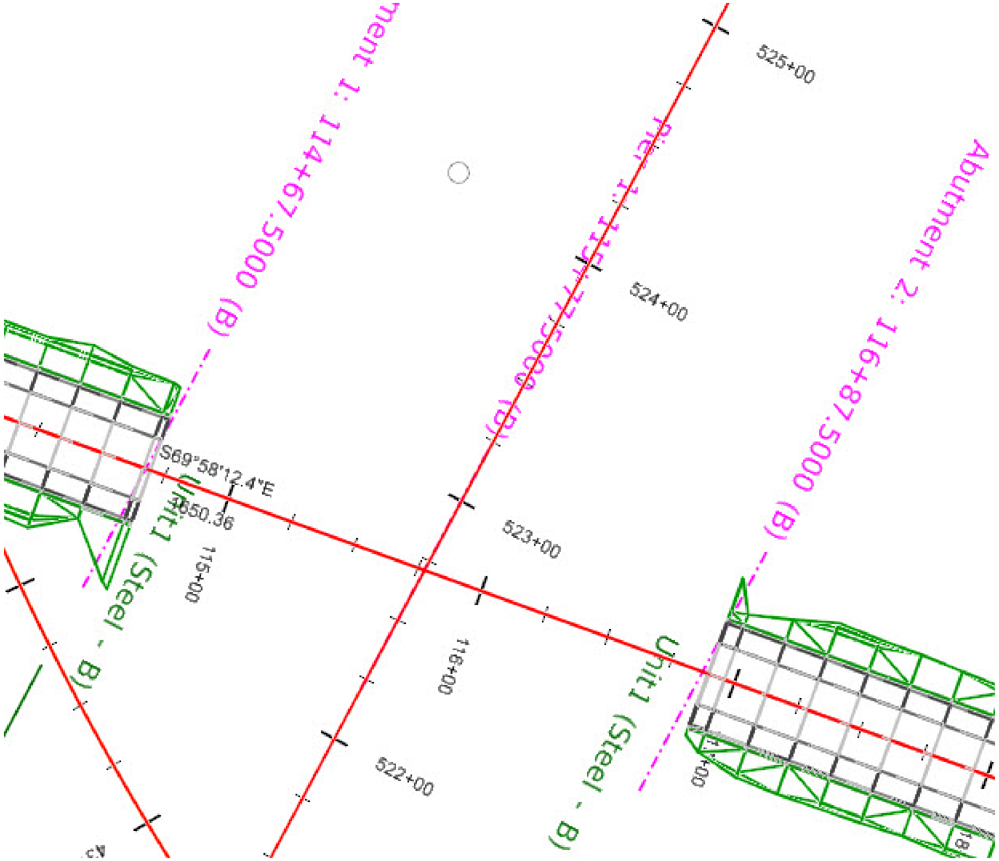
1. Continuing in the **Steel Girder Bridge.dgn** drawing.
2. In *View 1*, zoom to the area of the bridge.
3. Use *Home > SupportLine >* **Place Multi** to place lines that represent the locations of the piers and abutments.
   - *Skew Angle* = **8** (set in the Tool Settings dialog)
   - *Length* = **100** *[30]*
   - *Span Length* = **110** *[33.5]*
   - *Start Station* = **114+67.50** *[10+447.35]*
   - *Number of SupportLines =* **3**
   - *Direction Mode* = **Skew**
   - *Feature Definition* = **SupportLine**
4. In View 1, data point to start placing the bridge.
5. Data Point to accept the Skew Mode.
6. Data Point to accept the End Location.
7. Select **OK** to continue.





8. Right click to stop placing Support Lines.

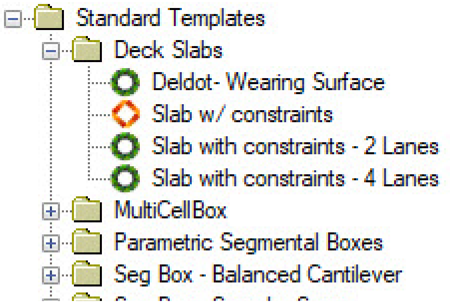
9. Review the resulting support lines.



Model the Bridge Deck

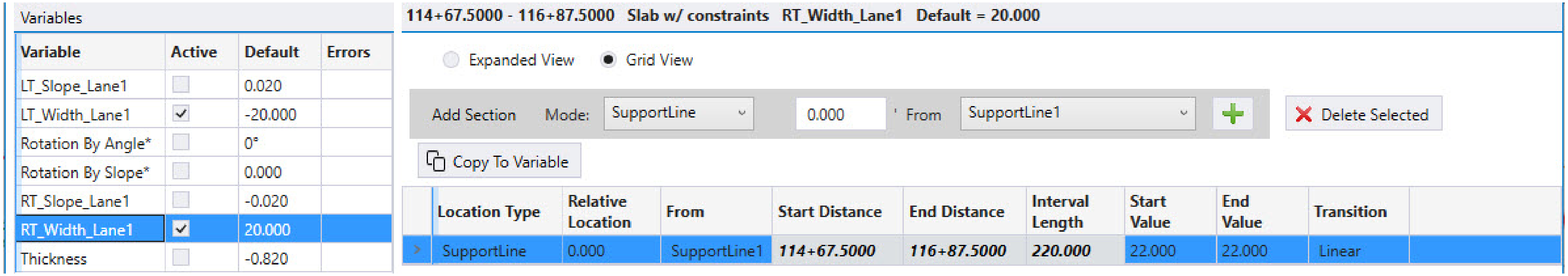
1. Continuing in the **Steel Girder Bridge.dgn** drawing.

2. Use *Home > Superstructure >* **Place Deck** to place a deck for the length of the structure.
3. Next to Template Name, click the ... icon.
4. Select Slab w/ constraints.



5. Set the following parameters in the Tool Settings window.
   - *Enable* **Add Constraints**
   - *Enable* **Analytical Deck**
   - *Deck Material* = **Deck Concrete-4.0**
   - *Feature Definition* = **Deck**
   - *Name Prefix* = **Deck**
6. Select the first support line.
7. Select the last support line.
8. Data point to continue.
9. Select the **Variable Constraint** tab.
10. Set the Start Value and End Value for the following variables.

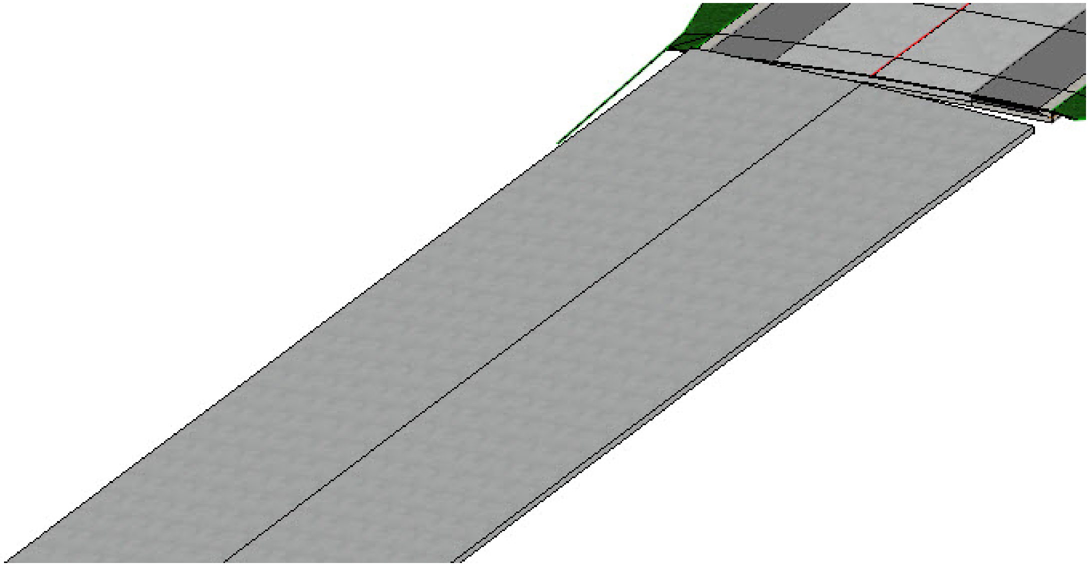
- *RT_Width_Lane1* = **22** *[6.7]*
- *LT_Width_Lane1* = **-22** *[-6.7]*



Variable	Active	Default	Errors
LT_Slope_Lane1	☐	0.020	
LT_Width_Lane1	☑	-20.000	
Rotation By Angle*	☐	0°	
Rotation By Slope*	☐	0.000	
RT_Slope_Lane1	☐	-0.020	
RT_Width_Lane1	☑	20.000	
Thickness	☐	-0.820	

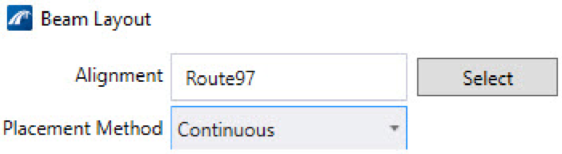
Location Type	Relative Location	From	Start Distance	End Distance	Interval Length	Start Value	End Value	Transition
SupportLine	0.000	SupportLine1	*114+67.5000*	*116+87.5000*	*220.000*	22.000	22.000	Linear

11. Review the 3D model.

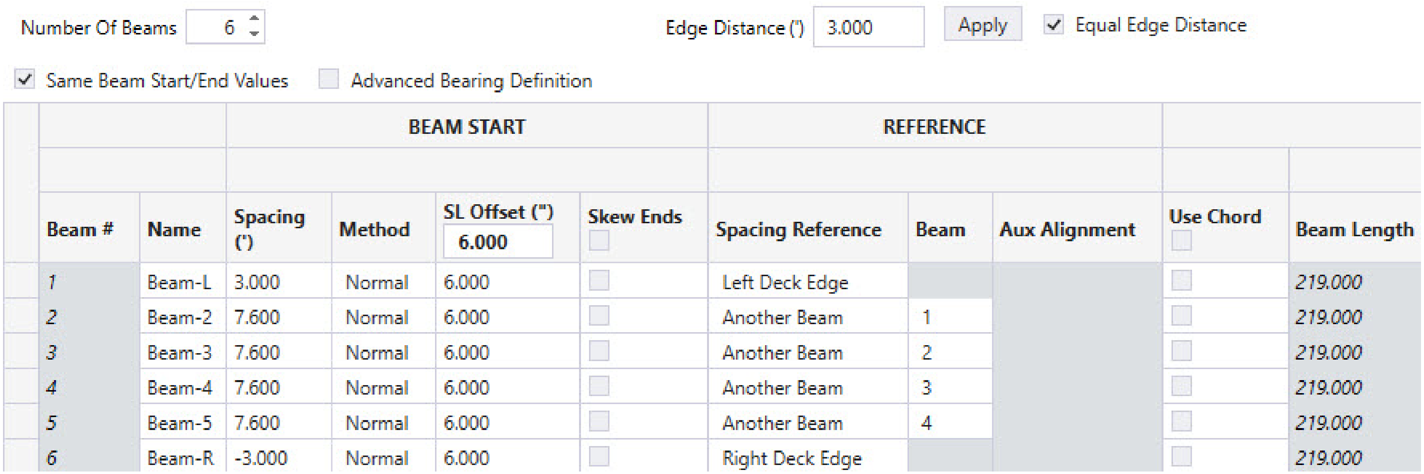


Define the Girders

1. Continuing in the **Steel Girder Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Beam Layout** to determine the beam centerlines for the length of the structure.
3. From View 1, Select the first support line.
4. Select the last support line.
5. Data point to continue.
6. Set *Placement Method* to **Continuous**.



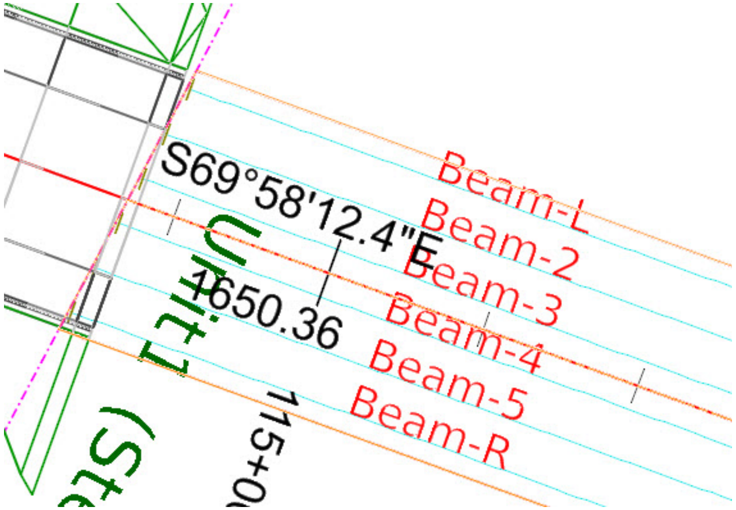
7. Set the *Number of Beams* to **6**.
8. Set the *Edge Distance* to **3.0** *[1.0]* and click **Apply**.
9. Set the *SL Offset* to **6** *[300]* .

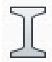


		BEAM START				REFERENCE				
Beam #	Name	Spacing (')	Method	SL Offset (") 6.000	Skew Ends	Spacing Reference	Beam	Aux Alignment	Use Chord	Beam Length
1	Beam-L	3.000	Normal	6.000		Left Deck Edge				219.000
2	Beam-2	7.600	Normal	6.000		Another Beam	1			219.000
3	Beam-3	7.600	Normal	6.000		Another Beam	2			219.000
4	Beam-4	7.600	Normal	6.000		Another Beam	3			219.000
5	Beam-5	7.600	Normal	6.000		Another Beam	4			219.000
6	Beam-R	-3.000	Normal	6.000		Right Deck Edge				219.000

10. Select **Validate** to review the proposed beam line locations and update the Beam Length column.

11. Select **Save** to keep the beam layout.





12. Use *Home > Superstructure >* **Place Beam** to select the beam shape.

 - *Feature Definition* = **Girder**

13. From View 1, select the beam layout then data point to accept.

14. In the Beam Definition window, set the following:

 - *Beam Type* = **Built-Up**
 - *Enable* **Apply to All Beams** toggle
 - *Minimum Haunch* to **3”** *[75 mm]*
 - *Section* to **Web**
 - *Thickness* to **0.5** *[12 mm]*
 - *Start Height and End Height* to **48** *[1050 mm]*

- *Material* to **Straight Plate Girders**

Beam Type: Built-Up | Section: Web | Beam Minimum Haunch (") ☑ 3.000

Copy To Flanges

	Location Type	Relative Location	From	Start Location (')	End Location (')	Start Distance (')	Section Length (')	Thickness (")	Start Height (")	Variation	End Height (")	Material	Min. Haunch (")
>	Head	0.000		114+70.6703	116+89.6703	0.000	219.000	0.500	48.000	Linear	48.000	Straight plate girders	3.000

15. Change *Section* to *Top Flange.*
16. In the Beam Definition window, set the following:
    - *Thickness* to **1.0** *[25 mm]*
    - *Start Width and End Width* to **14** *[350 mm]*
    - *Material* to **Straight Plate Girders**

Beam Type: Built-Up | Section: Top Flange | Beam Minimum Haunch (") ☑ 3.000

	Location Type	Relative Location	From	Start Location (')	End Location (')	Start Distance (')	Section Length (')	Thickness (")	Start Width (")	Variation	End Width (")	Material
	Head	0.000		114+70.6703	116+89.6703	0.000	219.000	1.000	14.000	Linear	14.000	Straight plate girders

17. Add two more rows to the table and set them as shown. Imperial image on top, metric on the bottom.

	Location Type	Relative Location	From	Start Location (')	End Location (')	Start Distance (')	Section Length (')	Thickness (")	Start Width (")	Variation	End Width (")	Material
>	Head	0.000		114+70.6703	115+53.1703	0.000	82.500	1.000	14.000	Linear	14.000	Straight plate girders
	SupportLine	-27.000	Pier 1	115+53.1703	116+07.1703	82.500	54.000	1.500	14.000	Linear	14.000	Straight plate girders
	SupportLine	27.000	Pier 1	116+07.1703	116+89.6703	136.500	82.500	1.000	14.000	Linear	14.000	Straight plate girders

	Location Type	Relative Location	From	Start Location (m)	End Location (m)	Start Distance (m)	Section Length (m)	Thickness (mm)	Start Width (mm)	Variation	End Width (mm)	Material
	Head	0.00000		10+448.4511	10+473.4011	0.00000	24.95000	25.00000	350.00000	Linear	350.00000	Straight plate girders
	SupportLine	-8.25000	Pier 1	10+473.4011	10+489.9011	24.95000	16.50000	40.00000	350.00000	Linear	350.00000	Straight plate girders
>	SupportLine	8.25000	Pier 1	10+489.9011	10+514.8511	41.45000	24.95000	25.00000	350.00000	Linear	350.00000	Straight plate girders

18. Change *Section* to *Bottom Flange.*

19. In the Beam Definition window, set the following:

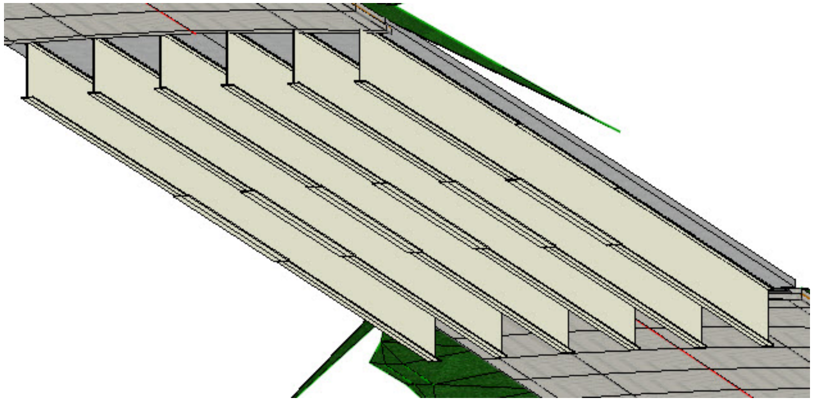
  - *Thickness* to **1.5** *[40 mm]*
  - *Start Width and End Width* to **16** *[400 mm]*
  - *Material* to **Straight Plate Girders**

20. Add two more rows to the table and set them as shown. Imperial image on top, metric on the bottom.

	Location Type	Relative Location	From	Start Location (')	End Location (')	Start Distance (')	Section Length (')	Thickness (")	Start Width (")	Variation	End Width (")	Material
	Head	0.000		114+70.6703	115+53.1703	0.000	82.500	1.500	16.000	Linear	16.000	Straight plate girders
	SupportLine	-27.000	Pier 1	115+53.1703	116+07.1703	82.500	54.000	2.000	16.000	Linear	16.000	Straight plate girders
	SupportLine	27.000	Pier 1	116+07.1703	116+89.6703	136.500	82.500	1.500	16.000	Linear	16.000	Straight plate girders

	Location Type	Relative Location	From	Start Location (m)	End Location (m)	Start Distance (m)	Section Length (m)	Thickness (mm)	Start Width (mm)	Variation	End Width (mm)	Material
	Head	0.00000		10+448.4511	10+473.4011	0.00000	24.95000	40.00000	400.00000	Linear	400.00000	Straight plate girders
	SupportLine	-8.25000	Pier 1	10+473.4011	10+489.9011	24.95000	16.50000	50.00000	400.00000	Linear	400.00000	Straight plate girders
>	SupportLine	8.25000	Pier 1	10+489.9011	10+514.8511	41.45000	24.95000	40.00000	400.00000	Linear	400.00000	Straight plate girders

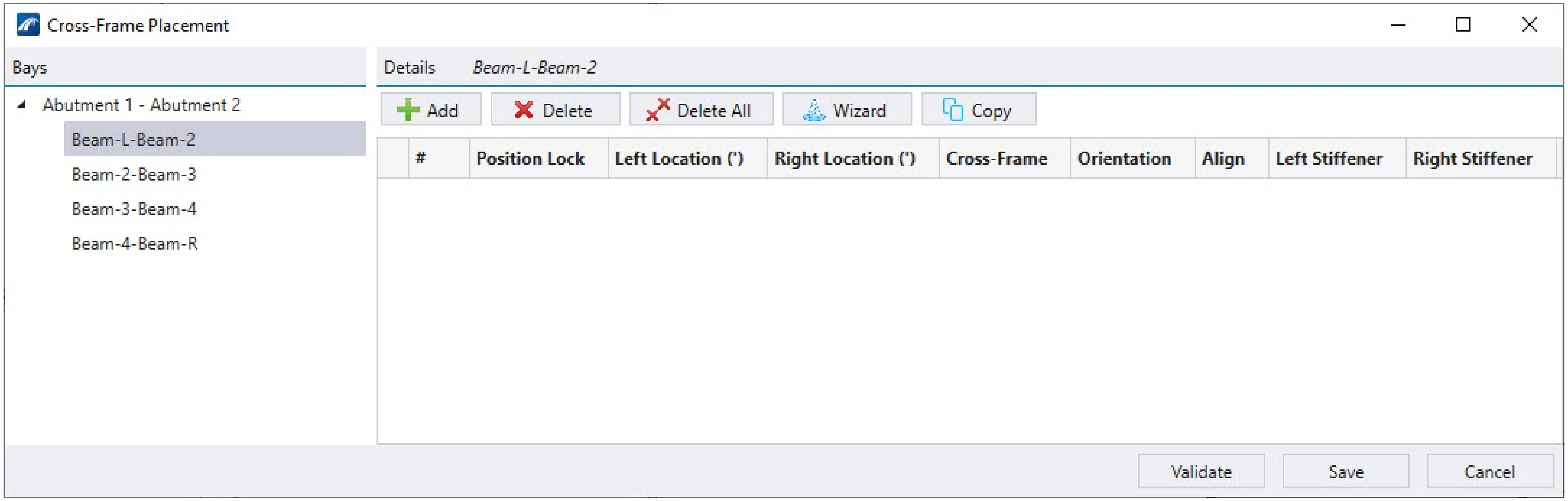
21. Select OK to model the beams.



22. Review the resulting model.

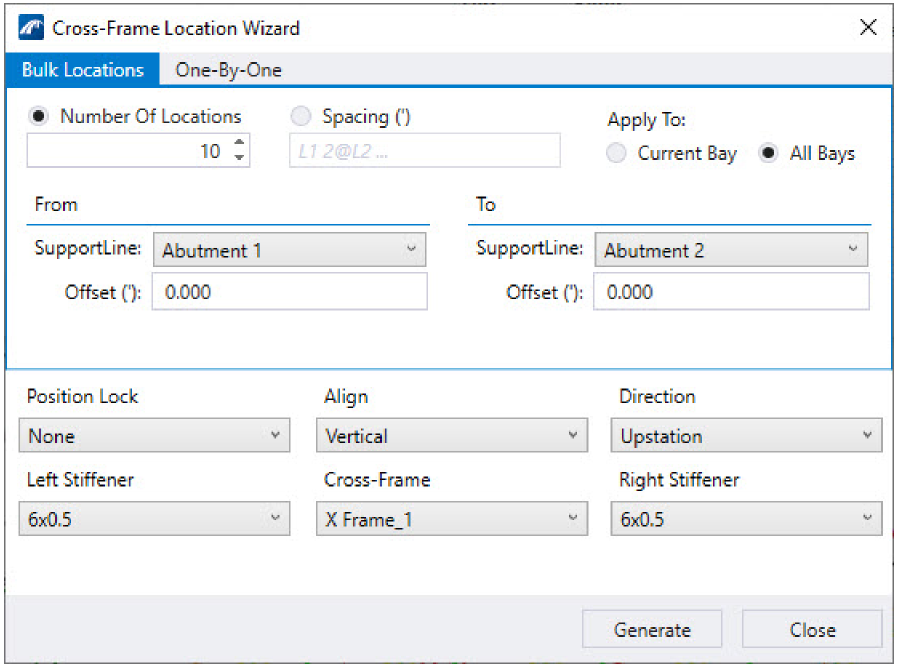
Add the Cross Frames

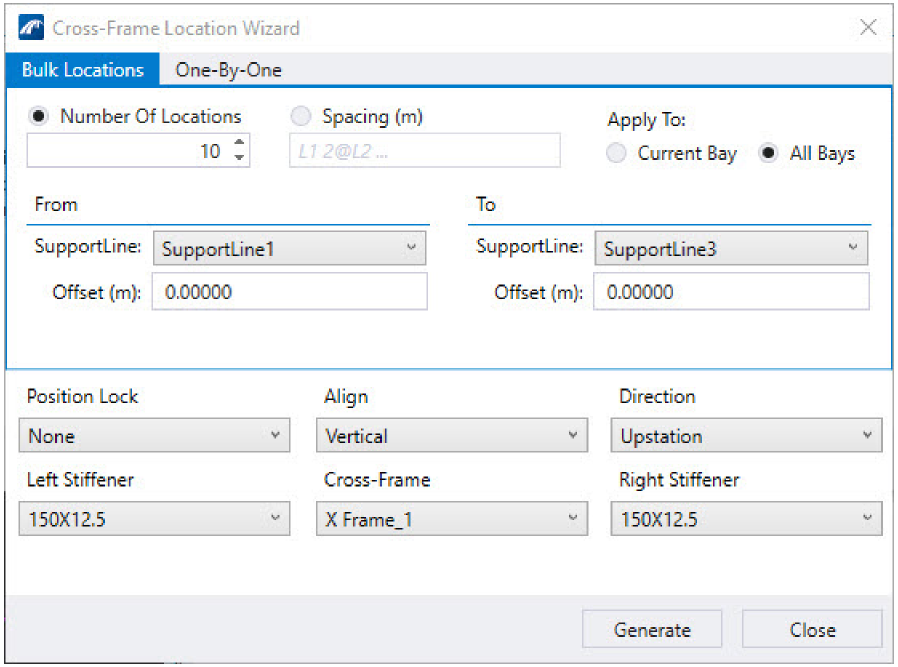
1. Continuing in the **Steel Girder Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Place Cross Frames** to model the cross frames for this structure, then set the following parameters:
   - *Feature Definition* = **Cross-Frame**
3. Select and accept the previously placed beams.



4. Click the **Wizard** button on the *Cross-Frame Placement* window.

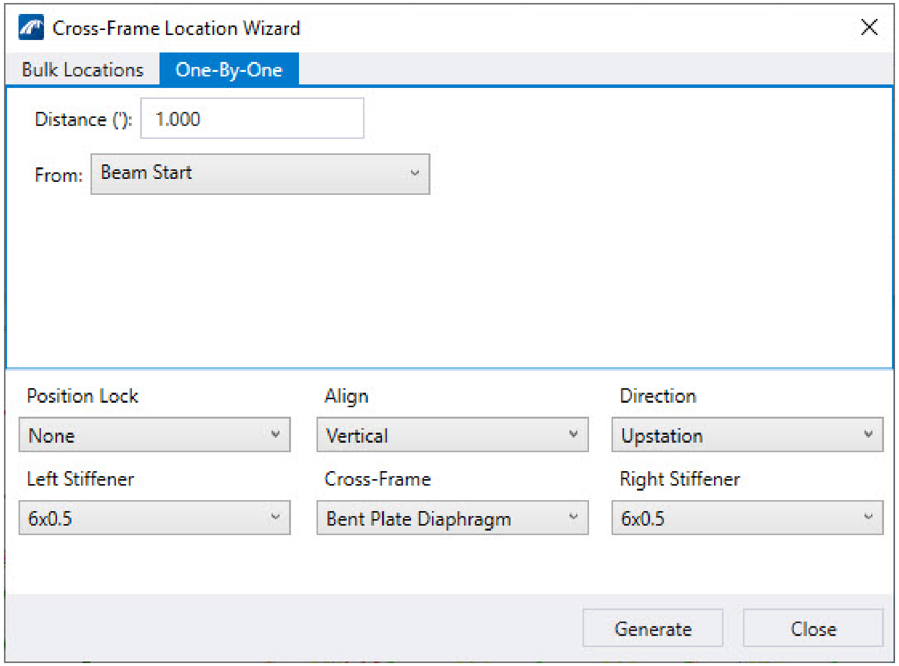
5. Populate the wizard as shown and click **Generate**.





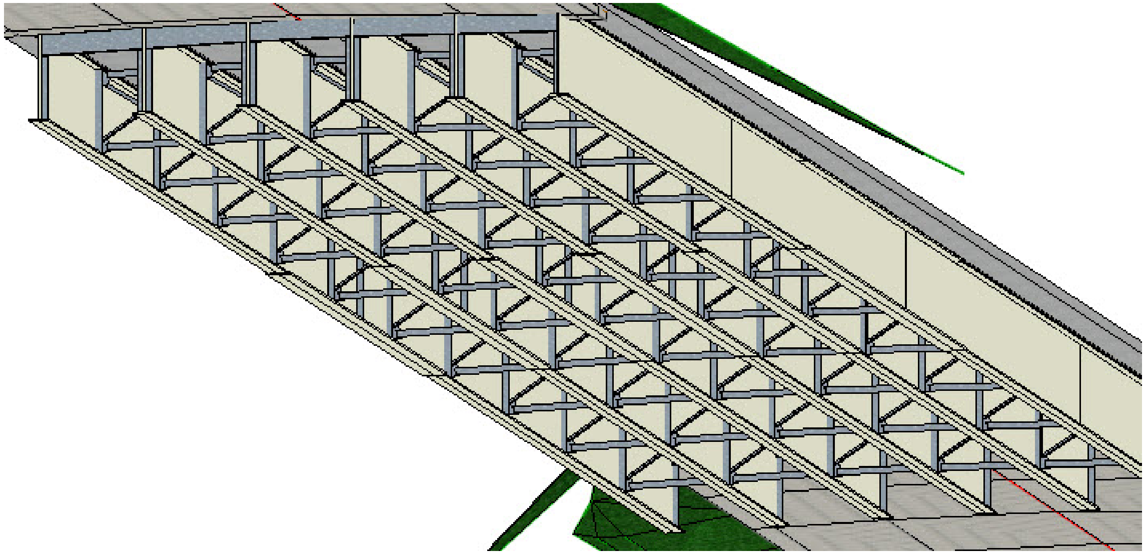
6. Select the **One-By-One** tab to place a cross frame at each support.

7. Populate as shown for a cross frame at the first support and click **Generate**. Use *0.3* m for the metric *Distance* value.



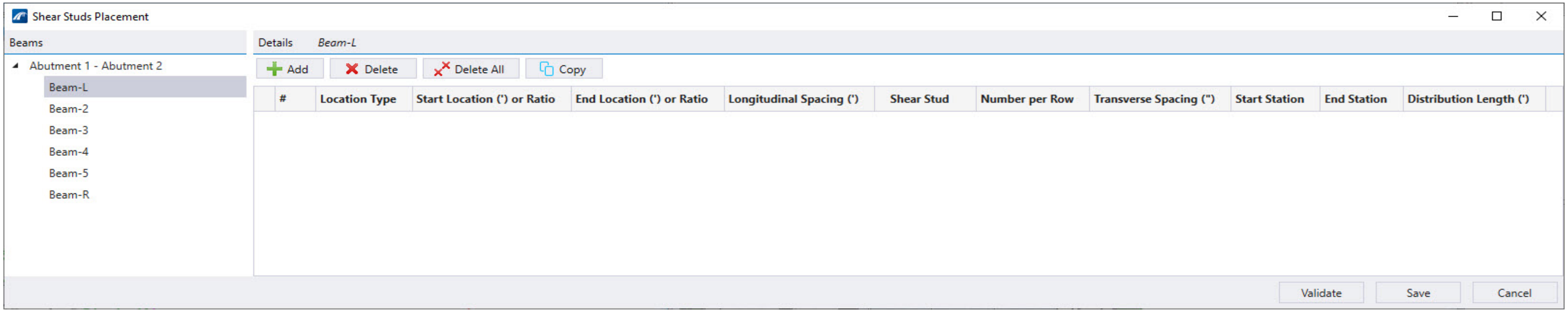
8. Change the following and click **Generate** for the last support.
   - *Distance* = **-1** *[-0.3]*
   - *From* = **Beam End**
9. Change the following and click **Generate** for the pier support.
   - *Distance* = **0** *[0]*
   - *From* = **SupportLine**
   - *SupportLine* = **Pier 1**
10. Close the Wizard.
11. Use the **Validate** button to verify locations.

12. Click **Save** to model the cross frames.

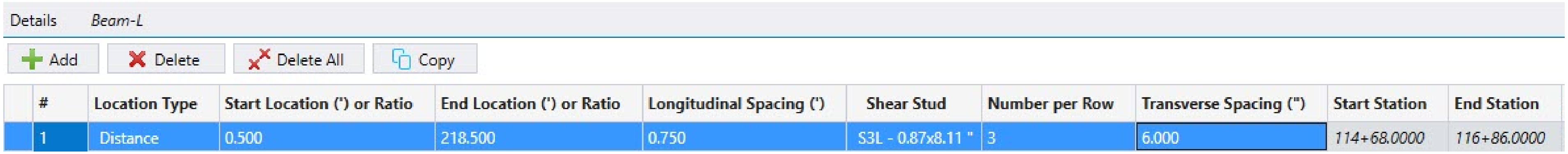


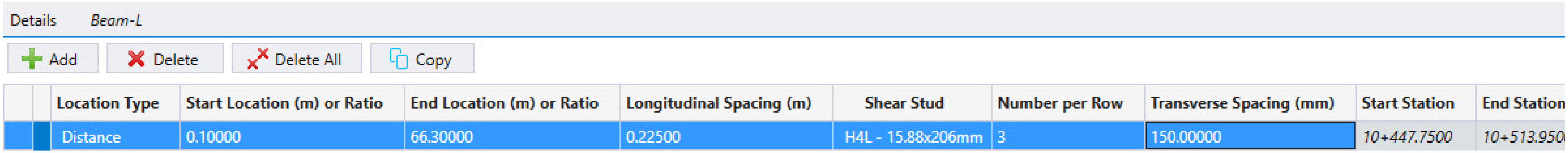
Place the Shear Studs

1. Continuing in the **Steel Girder Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Place Shear Studs** to model the shear studs for this structure.
3. Select then accept the beam group from the top view.

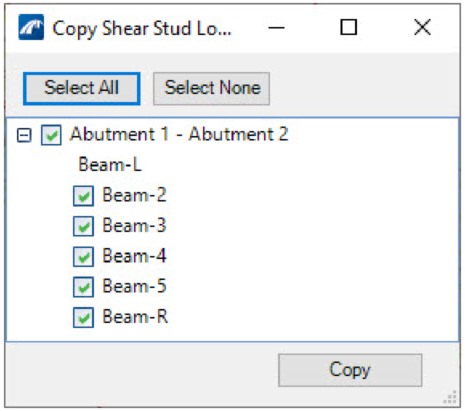


4. Click **Add**. Populate as shown.



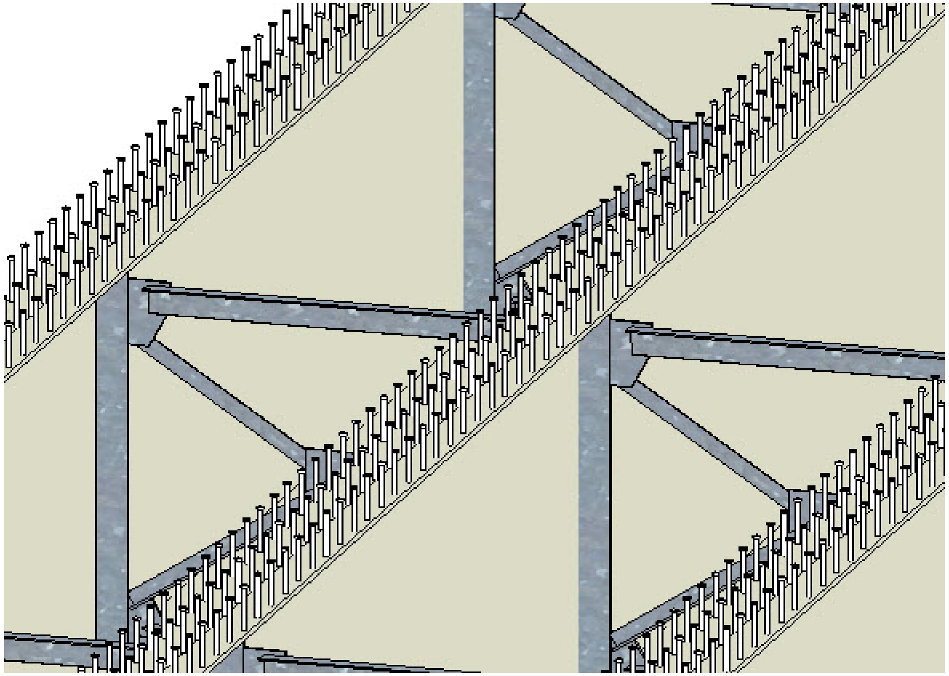


5. Select **Copy**, then **Select All** then **Copy** to copy the shear stud pattern to the remaining beams.



6. Click **Save** to update the model.

7. Turn off display of the deck to see the resulting shear studs.

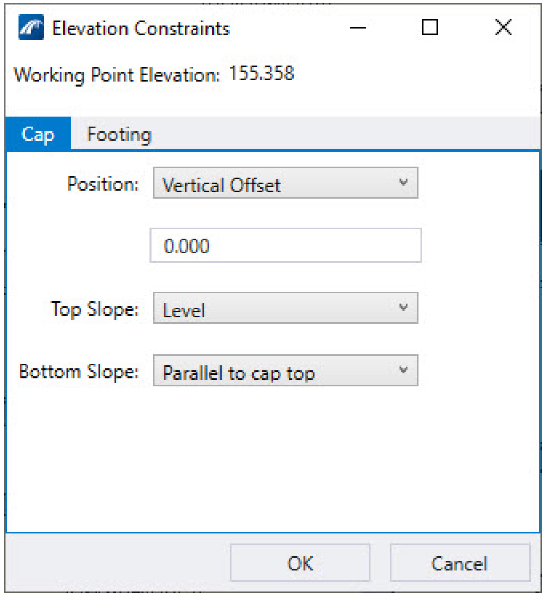


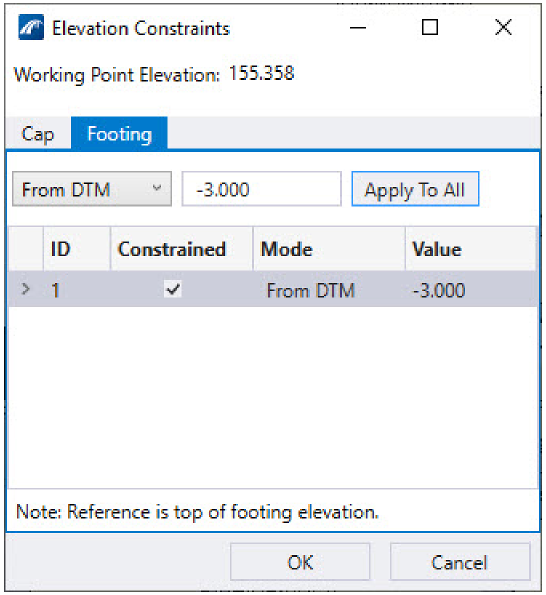
Place the Pier

1. Continuing in the **Steel Girder Bridge.dgn** drawing.

2. Use *Home > Substructure >* **Place Pier** to model the pier for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Multi Column > Default > Hammer_Head1** pier template, then set the following parameters:
    - *Cap Length Adjustment* = **None**
    - Enable the toggle for **Elevation Constraints**
    - *Cap Material* = **Substructure Concrete**
    - *Column Material* = **Substructure Concrete**
    - *Footing Material* = **Substructure Concrete**
    - *Pile Material* = **Steel > 14 x 73 H Section Piles**
    - *Feature Definition* = **Pier_steel_piles**
5. Select the middle support line, right click in space then data point to place the pier.

6. In the Pier Elevation Constraints window, set the Cap and Footings tabs as shown. Note: Use *-1* for From DTM value for metric.





7. Turn on the display of the triangles for the attached terrain model.

8. Set the terrain reference to a transparency of 70 or rotate the model so you are viewing the pier footings from under the terrain surface.

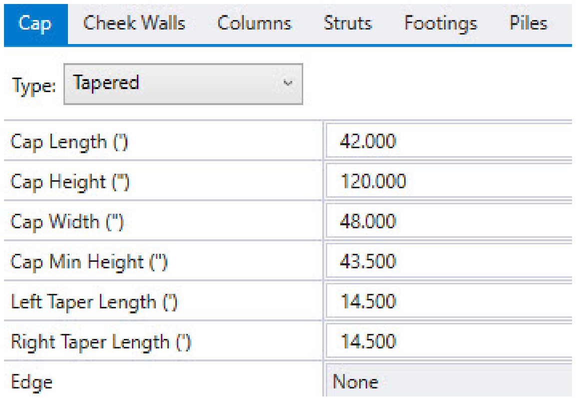
9. Rotate the model back to an isometric view of the structure.

Modify the Pier

1. Select the pier using the Element Selection tool.
2. Select the **Properties** icon.
3. Choose **Select to Edit ...** next to *Substructure Template*.

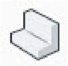
Elevation Constraints	**SELECT to Edit**
Substructure Template	**SELECT to Edit**
Integral	**False**
Horizontal Offset	**0.000'**
Cap Length Adjustmer	**None**

4. Select the **Cap** tab, then set the following parameters:
   - *Cap Length* = **42** *[13.4]*
   - *Cap Width* = **48** *[1200]*
   - *Left Taper Length* = **14.5** *[4.7]*
   - *Right Taper Length* = **14.5** *[4.7]*

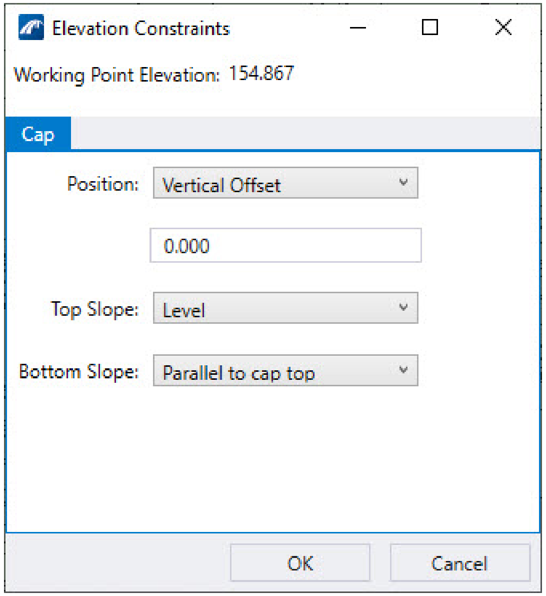


5. Select **OK** to accept the changes.

Place the Abutments

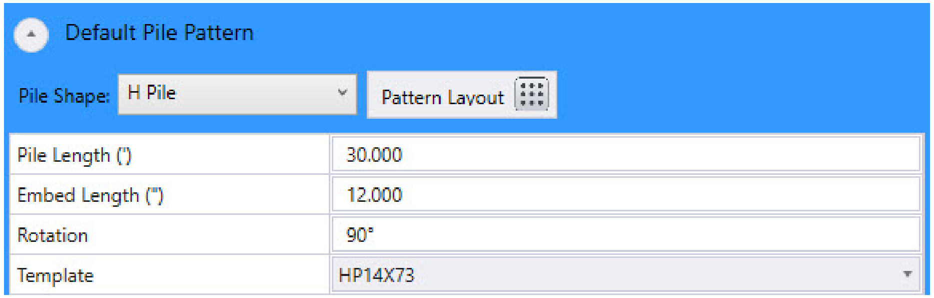
1. Continuing in the **Steel Girder Bridge.dgn** drawing.

2. Use *Home > Substructure >* **Place Abutment** to model the abutments for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Pile Cap > Default > 2 Lane - 27ft** *[2 Lane - 8 m]* abutment template, then set the following parameters:
   - *Cap Length Adjustment* = **By Deck**
   - Enable the toggle for *Edit Elevation Constraints*
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Abutment_steel_piles**
   - *Name Prefix* = **Abutment**
5. Select the first support line, data point in space to place the abutment.

6. In the Pier Elevation Constraints window, set the *Top Slope* and *Bottom Slope* as shown.

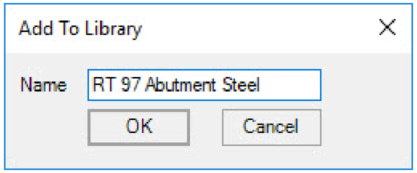


7. Select **OK** to accept changes to Pier Elevation Constraints.
8. Select the abutment with the **Element Selection** tool.
9. Select the **Properties** icon.
10. Choose **Select to Edit ...** next to *Substructure Template*.
11. Select the **Piles** tab.
    - *Pile Shape* = **H Pile**
    - *Embed Length* = **12** *[300]*
    - *Rotation* = **90**

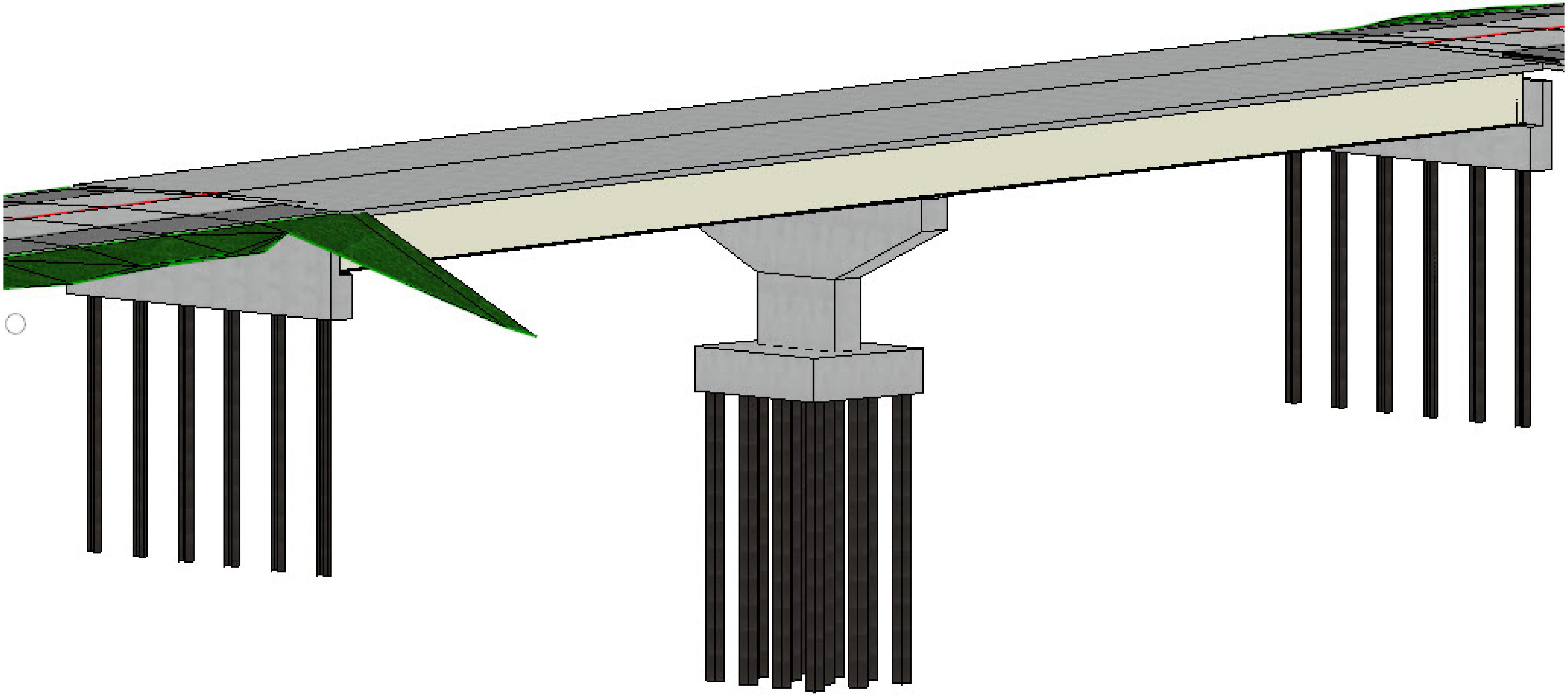
- *Template* = **HP14X73**



12. Select **Pattern Layout**.
13. Set the following values, then click **Generate Piles**.
    - *Left Margin* and *Right Margin* = **36** *[1000]*
    - *Number of Columns* = **6**
14. Select **OK** to accept.
15. Select **OK** to update the model.
16. Select the abutment with the **Element Selection** tool.
17. Select the **Properties** icon.
18. Choose **Select to Edit ...** next to *Substructure Template*.
19. Click **Add to Library**.
20. Name the abutment, then click **OK**.

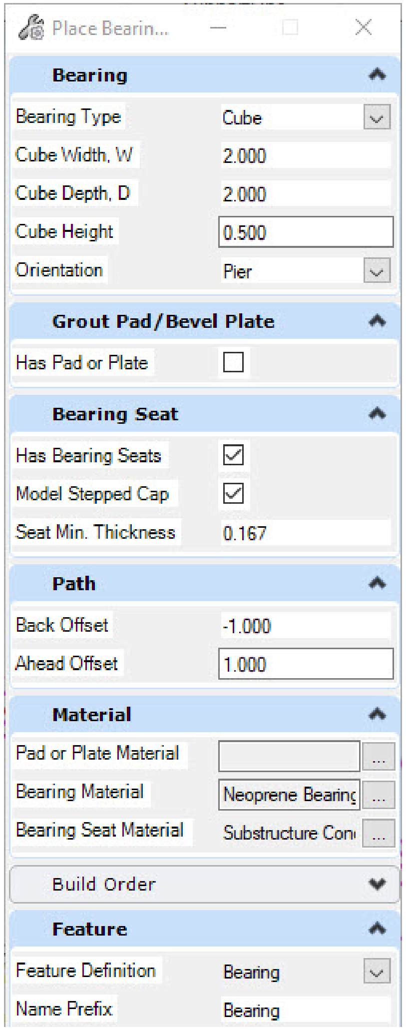


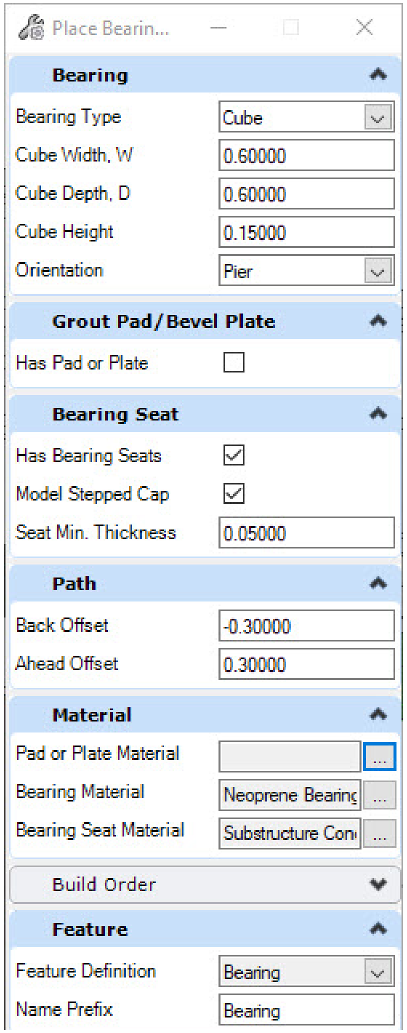
21. Using the Place Abutment tool, place the newly saved abutment at the end of the structure using the same elevation constraints as the first abutment.



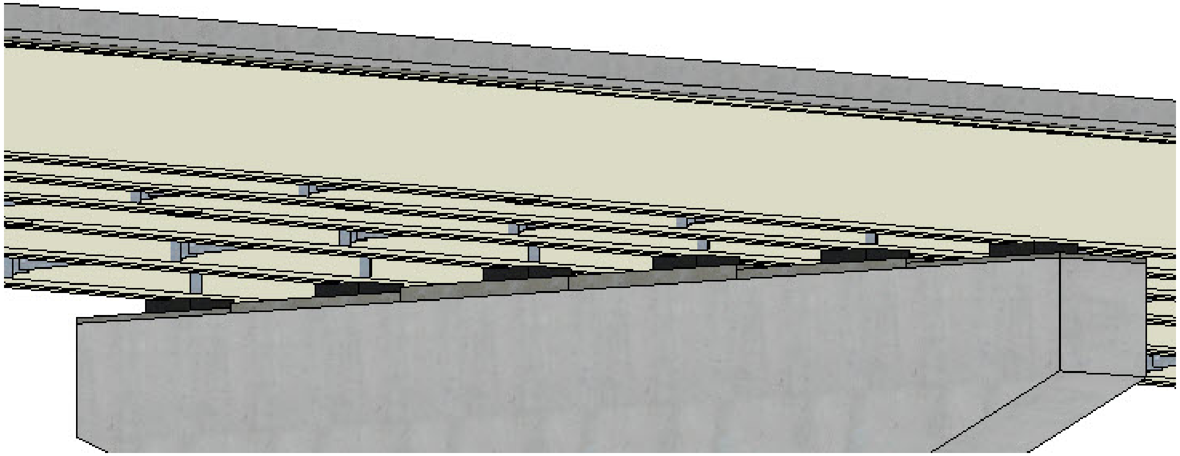
Place the Bearings and Stepped Cap

1. Continuing in the **Steel Girder Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Bearing** to model the bearings and stepped cap for this structure.
3. In the Tool Settings window, set the following values (Imperial and Metric shown respectively):.

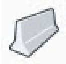


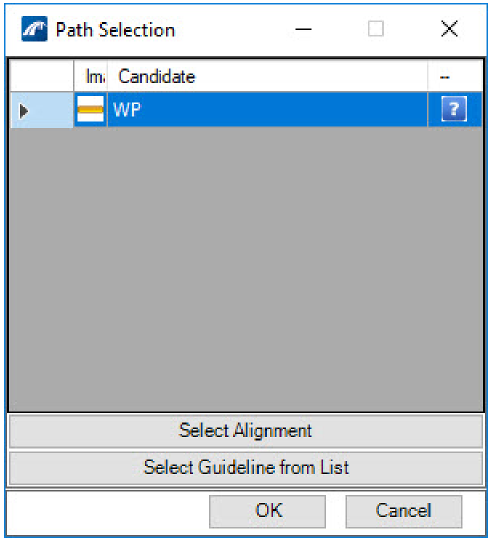


4. Select each of the abutment support lines, reset off of the support lines, then data point to place the bearings.
5. Start the Place Bearing tool again.
6. Change the *Back Offset* and *Ahead Offset* to **0.0** *[0.0]*.
7. Select the pier support line, reset off of the support line, then data point to place the bearings.
8. Review the resulting bearings. In explorer, turn off the deck and beams. Turn them back on prior to performing the next set of steps.

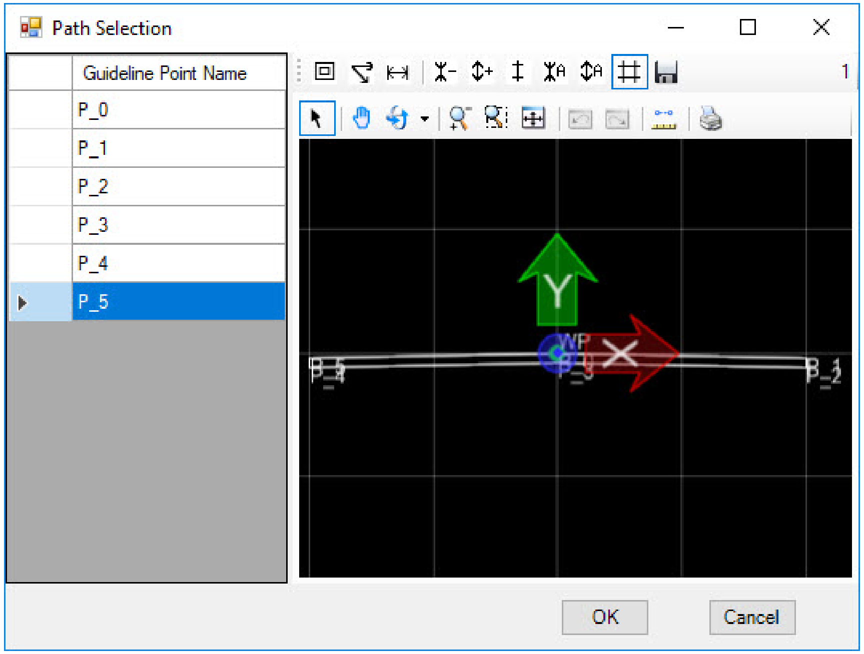


Place the Barriers

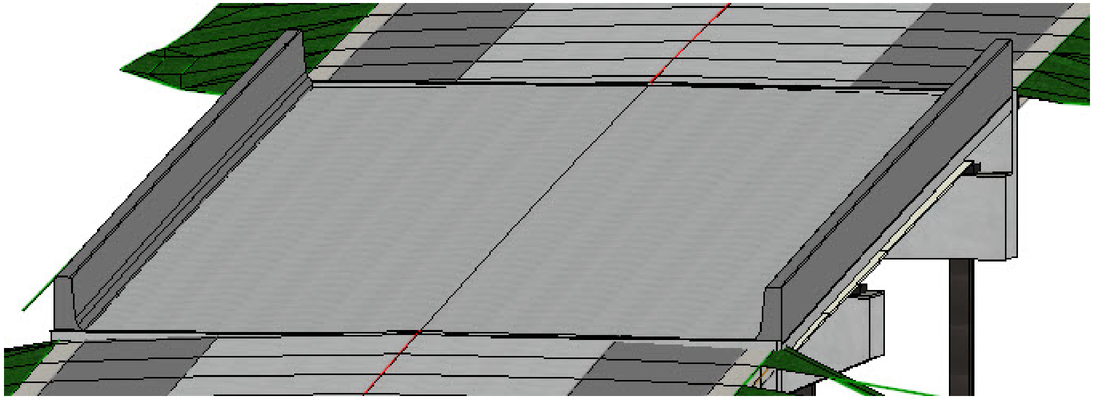
1. Continuing in the **Steel Girder Bridge.dgn** drawing.

2. Use *Home > Accessory >* **Place Barrier** to model the barriers for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **VDOT\BPB-4 L** barrier template, then set the following parameters:
   - *Barrier Material* = **Traffic Barrier**
   - *Feature Definition* = **Barrier**
   - *Name Prefix* = **Barrier**
5. Select the deck with a datapoint, then off of the deck right-click, then data point to continue.
6. From the *Path Selection* window, click **Select Guideline from List**.



7. Select point **P_5** from the *Guideline Point Name* list. This point represents the upper left point of the deck.



8. Click OK in each Path Selection window to place the barrier.
9. Repeat the process for the right side barrier. Use template **VDOT\BPB-4 R** and point **P_1** for the *Guideline Point Name.*
10. Review the resulting barriers.



11. Close OpenBridge Modeler prior to starting the next exercise.

Module 4w: Steel Girder 2 Span Straight Bridge Model using Wizard

Description

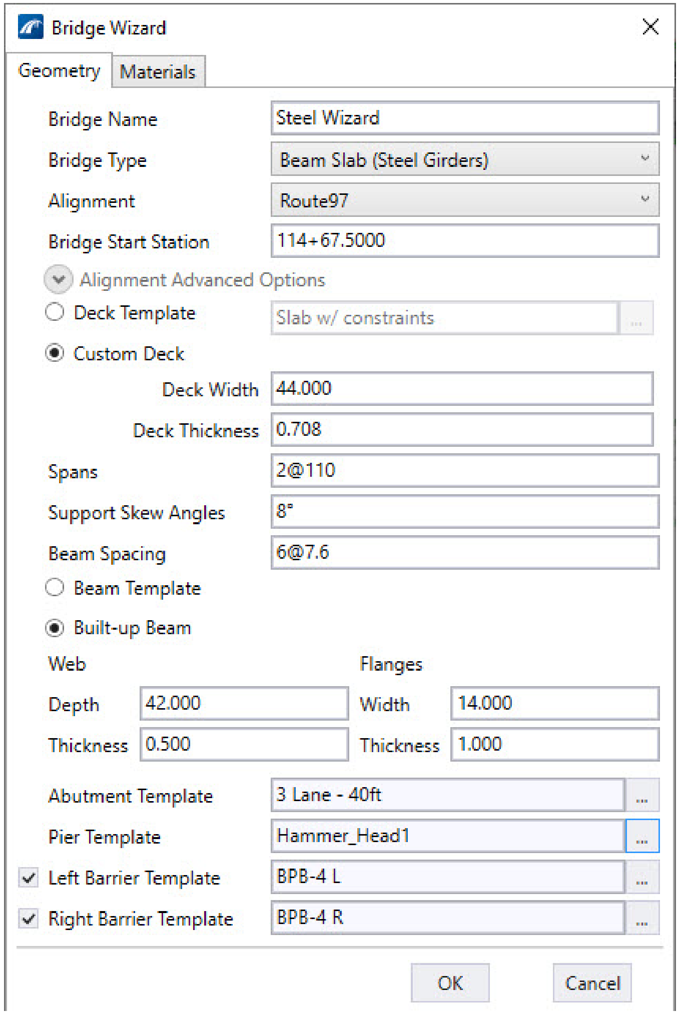
In this module you will model a simple 2 span straight steel girder bridge using the Bridge Wizard.

Objectives

- Reference OpenRoads geometry, terrain model and corridor
- Use Wizard to define the model

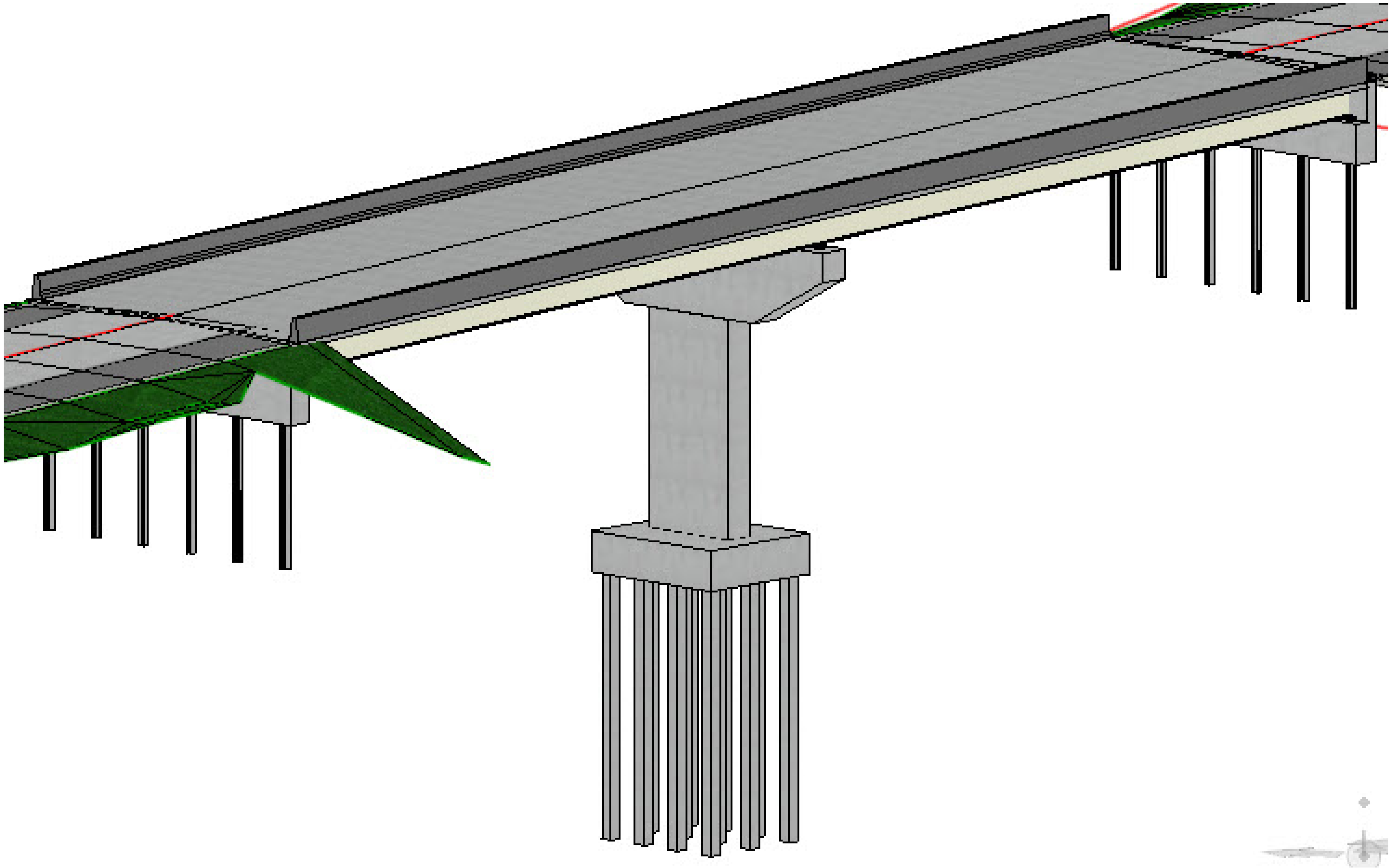
Add Bridge to Model

1. Select the **Add Standalone Group** icon and name it *Module 4w*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Steel Girder Bridge Wizard.dgn** from the *Module 4 (Steel Girder Bridge)* folder.
4. Reference the *Terrain, Geometry and Route97* drawings using Coincident World method. Fit The Views to see the references.
5. Use *Home > Bridge Setup>* **Bridge Wizard** to create a bridge along Rt 97.
   - *Bridge Name* = **Steel Wizard**
   - *Bridge Type* = **Beam Slab (Steel Girders)**
   - *Alignment* = **Route 97**
   - *Bridge Start Station* = **114+67.50** *[10+447.35]*
   - *Custom Deck*
     - *Deck Width* = **44'** *[13.400m]*
     - *Deck Thickness* = **8.5"** *[0.215m]*
   - *Spans* = **2@110** *[2@33.500]*
   - *Support Skew Angles* = **8**
   - *Beam Spacing* = **6@7.6** *[6@2.32]*
   - *Enable* **Built-up Beam**
   - *Depth* = **42** *[1050]*
   - *Thickness* = **0.5** *[15]*
   - *Flange Width* = **14** *[350]*



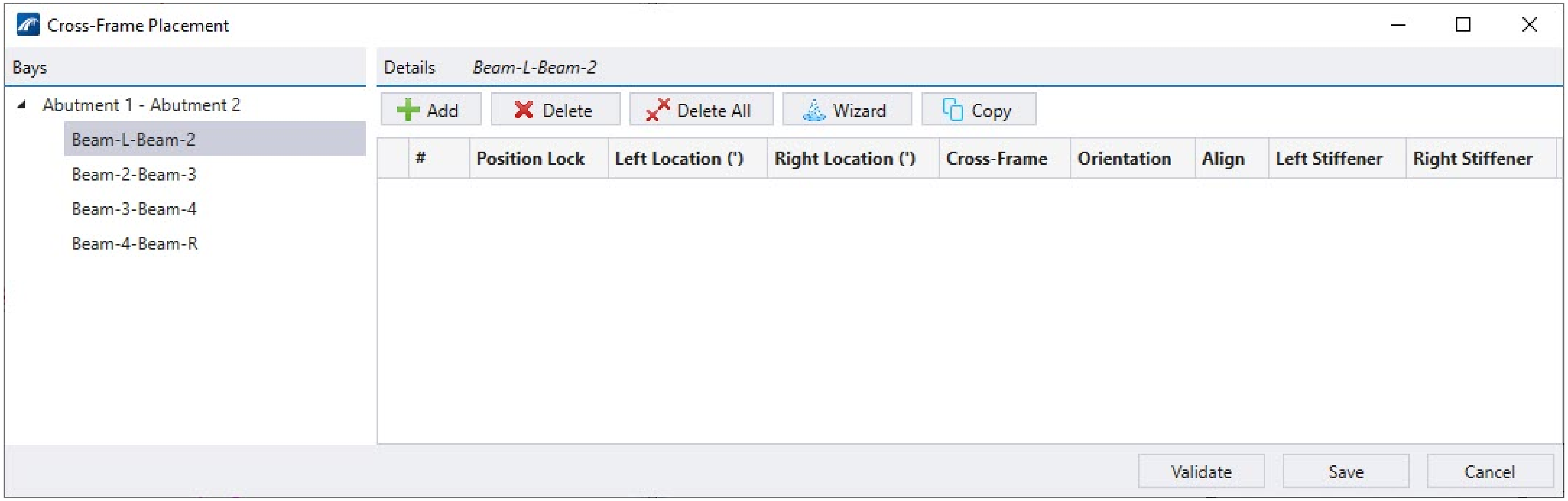
- *Flange Thickness* = **1** *[25]*
- *Abutment Template* = **3 Lane - 40ft** *[3 Lane - 12 m]*
- *Pier Template* = **Hammer_Head1**
- *Left Barrier Template* = **VDOT > BPB-4 L**
- *Right Barrier Template* = **VDOT > BPB-4 R**

6. Click **OK** to model the bridge.



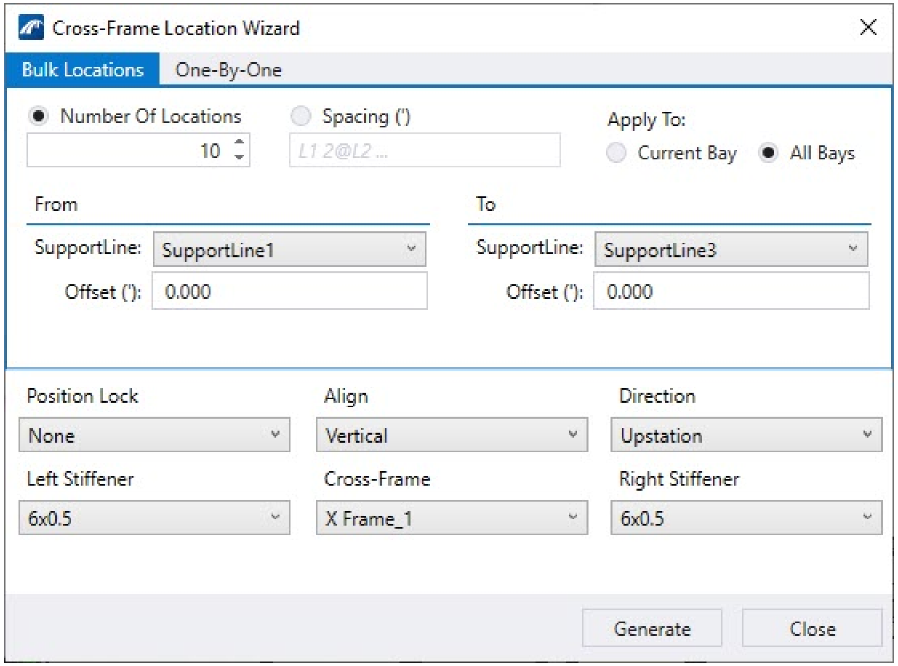
Add the Cross Frames

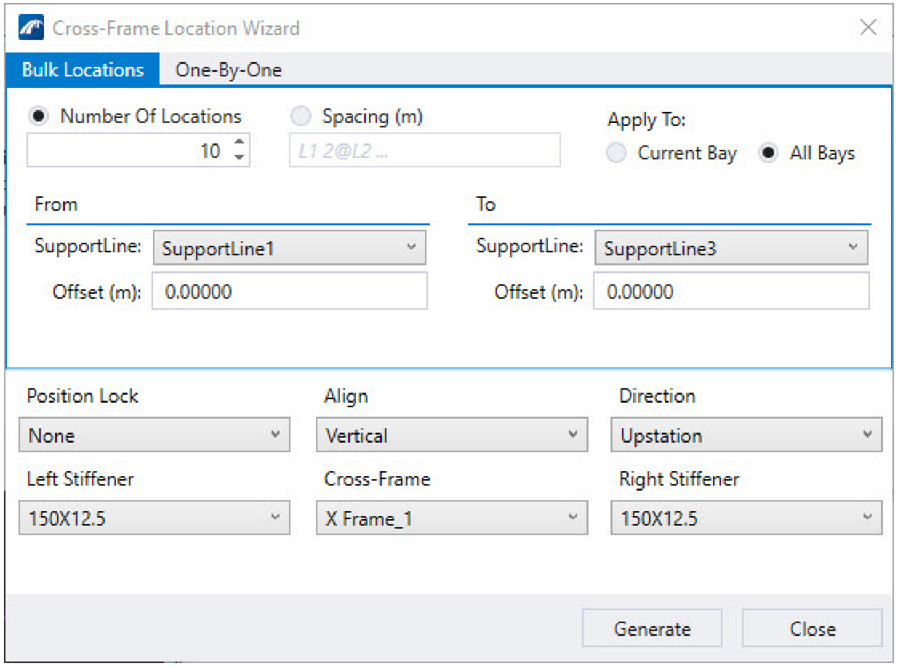
1. Continuing in the **Steel Girder Bridge Wizard.dgn** drawing.
2. Use *Home > Superstructure >* **Place Cross Frames** to model the cross frames for this structure, then set the following parameters:
   - *Feature Definition* = **Cross-Frame**
3. Select and accept the previously placed beams.



4. Click the **Wizard** button on the *Cross-Frame Placement* window.

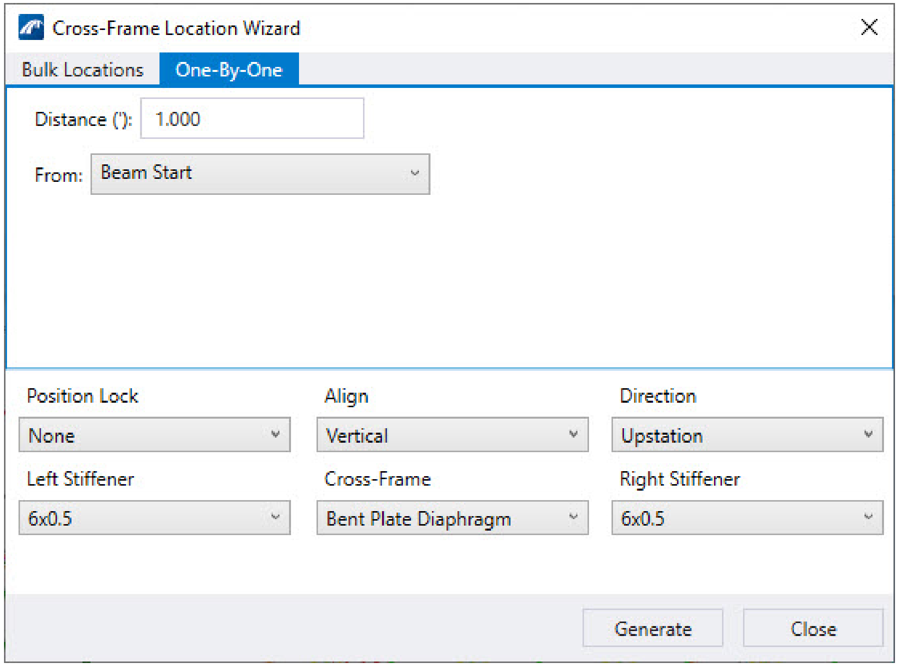
5. Populate the wizard as shown and click **Generate**.





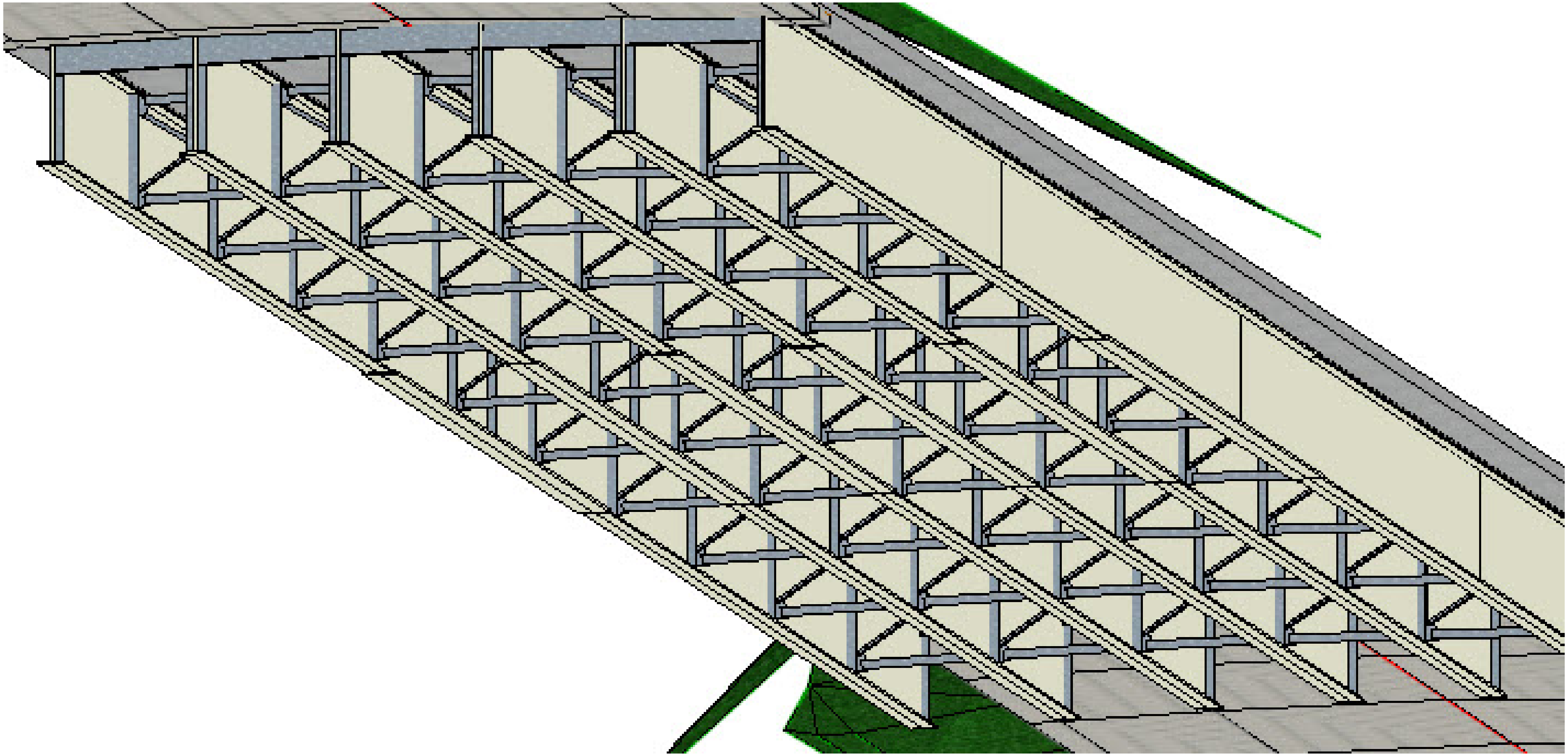
6. Select the **One-By-One** tab to place a cross frame at each support.

7. Populate as shown for a cross frame at the first support and click **Generate**. Use *0.3* m for the metric *Distance* value.



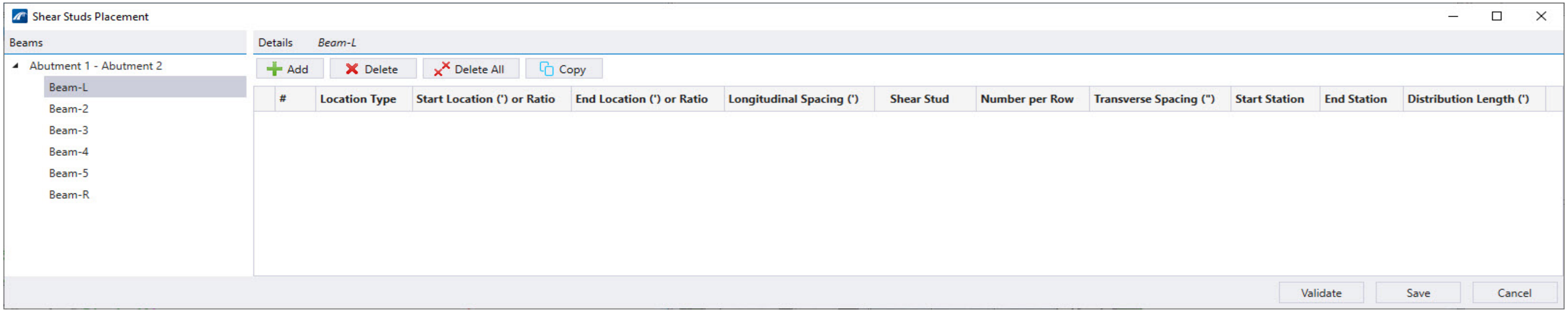
8. Change the following and click **Generate** for the last support.
   - *Distance* = **-1** *[-0.3]*
   - *From* = **Beam End**
9. Change the following and click **Generate** for the pier support.
   - *Distance* = **0** *[0]*
   - *From* = **SupportLine**
   - *SupportLine* = **SupportLine2**
10. Close the Wizard.
11. Repeat the process for the remaining bays or use the **Copy** button to copy the *Bent Plate Diaphragms* to all other bays.
12. Use the **Validate** button to verify locations.

13. Click **Save** to model the cross frames.

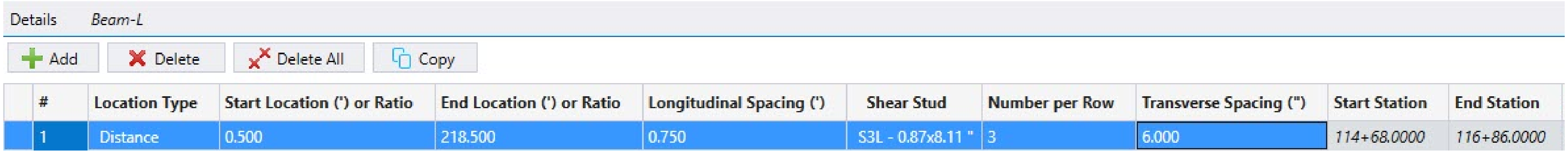


Place the Shear Studs

1. Continuing in the **Steel Girder Bridge Wizard.dgn** drawing.
2. Use *Home > Superstructure >* **Place Shear Studs** to model the shear studs for this structure.
3. Select then accept the beam group from the top view.



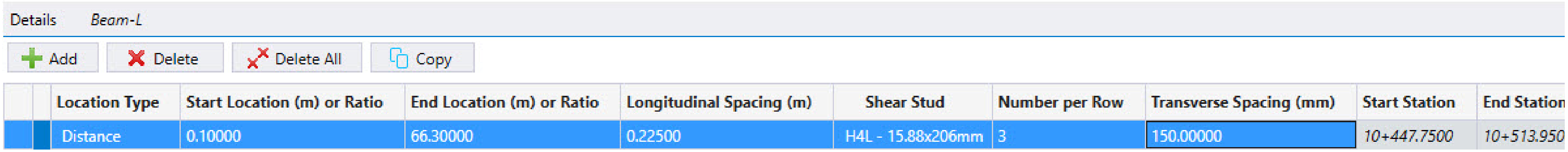
4. Click **Add**. Populate as shown.



Details *Beam-L*

Add | Delete | Delete All | Copy

	#	Location Type	Start Location (') or Ratio	End Location (') or Ratio	Longitudinal Spacing (')	Shear Stud	Number per Row	Transverse Spacing (")	Start Station	End Station
	1	Distance	0.500	218.500	0.750	S3L - 0.87x8.11 "	3	6.000	*114+68.0000*	*116+86.0000*

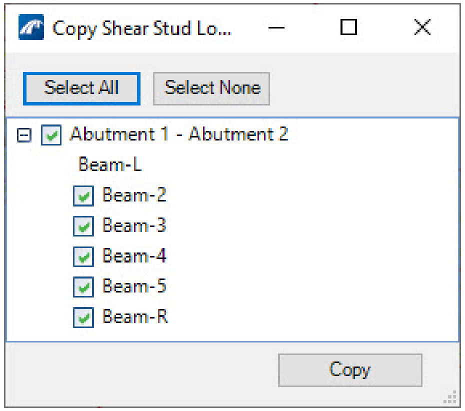


Details *Beam-L*

Add | Delete | Delete All | Copy

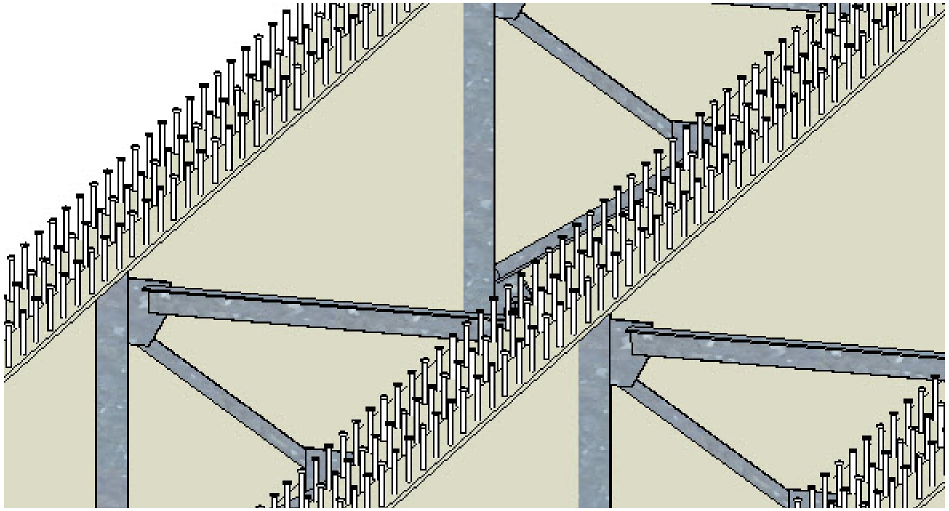
	Location Type	Start Location (m) or Ratio	End Location (m) or Ratio	Longitudinal Spacing (m)	Shear Stud	Number per Row	Transverse Spacing (mm)	Start Station	End Station
	Distance	0.10000	66.30000	0.22500	H4L - 15.88x206mm	3	150.00000	*10+447.7500*	*10+513.950*

5. Select **Copy**, then **Select All** then **Copy** to copy the shear stud pattern to the remaining beams.



6. Click **Save** to update the model.

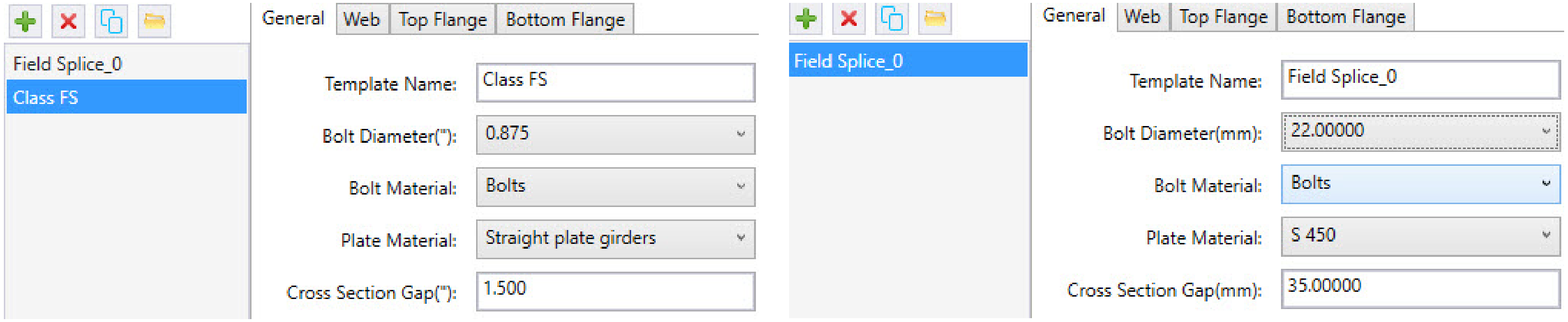
7. Turn off display of the deck to see the resulting shear studs.



Place Field Splices

1. Continuing in the **Steel Girder Bridge Wizard.dgn** drawing.

2. Open *Utilities > Libraries >* **Splices**.
3. Click the *Copy* icon to make a copy of the default **Field Splice_0**.
4. Change the following on the *General* tab:
   - *Template Name* = **Class FS**
   - *Bolt Diameter* = **0.875** *[22.00]*

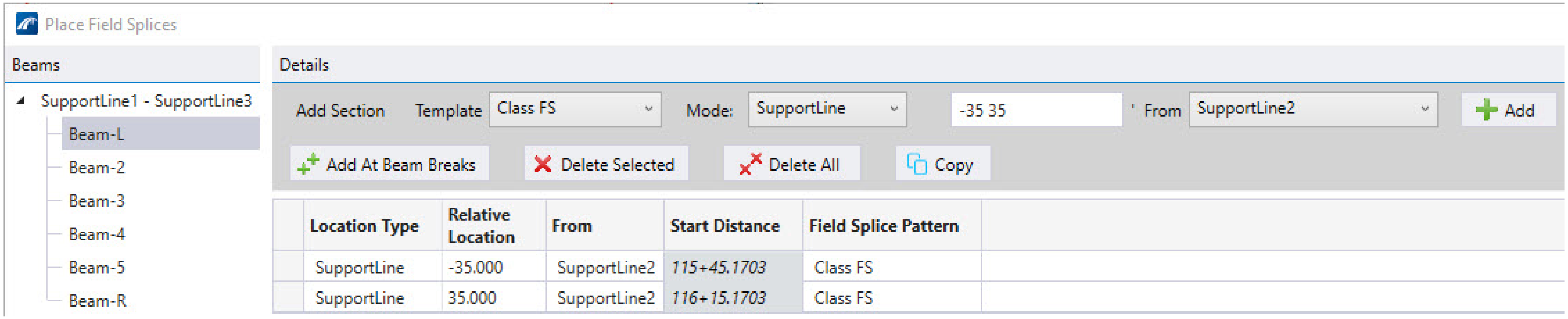


5. Change the following on the *Web* tab:
   - *Bolts Rows* = **6**
6. Click **Save** to save the new field splice template.

7. Select *Home > Superstructure >* **Place Field Splices**.
8. Select and accept one of the beams.
9. Set the following:
   - *Template* = **Class FS**
   - *Mode* = **SupportLine**

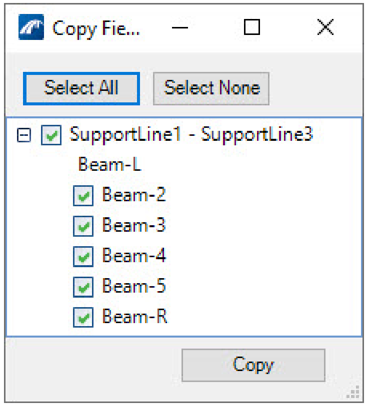
- *Distance* = **-35 35** *[10.5 10.5]*
- *From* =**SupportLine2** (or Pier 1)

10. Click **+ Add** icon.



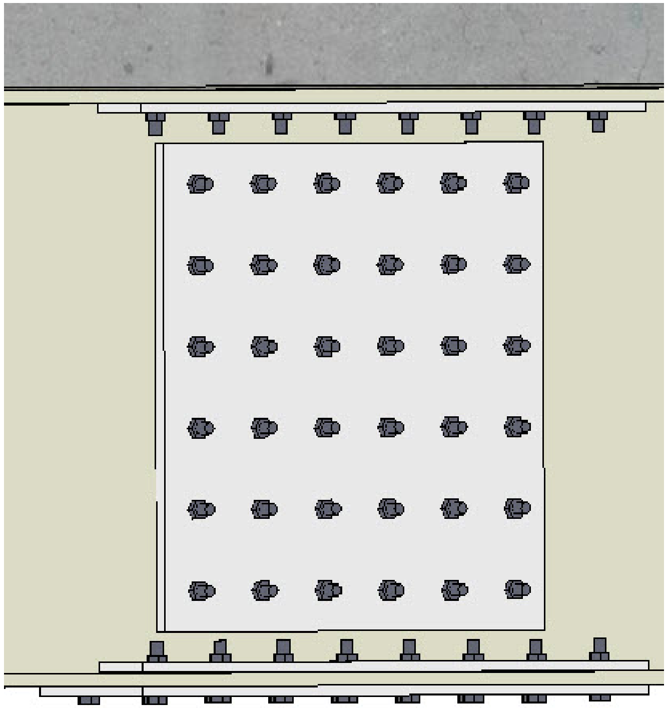
11. Click **Copy** to copy to the remaining girders.

12. Click **Select All** then **Copy** to add to all girders.



13. Click **Validate** to see the Field Splice locations in the model.

14. Click **Save** to add the Field Splices to the model.



15. Close OpenBridge Modeler prior to starting the next exercise.

Module 5: Steel Girder Curved Bridge Model with Wizard

Description

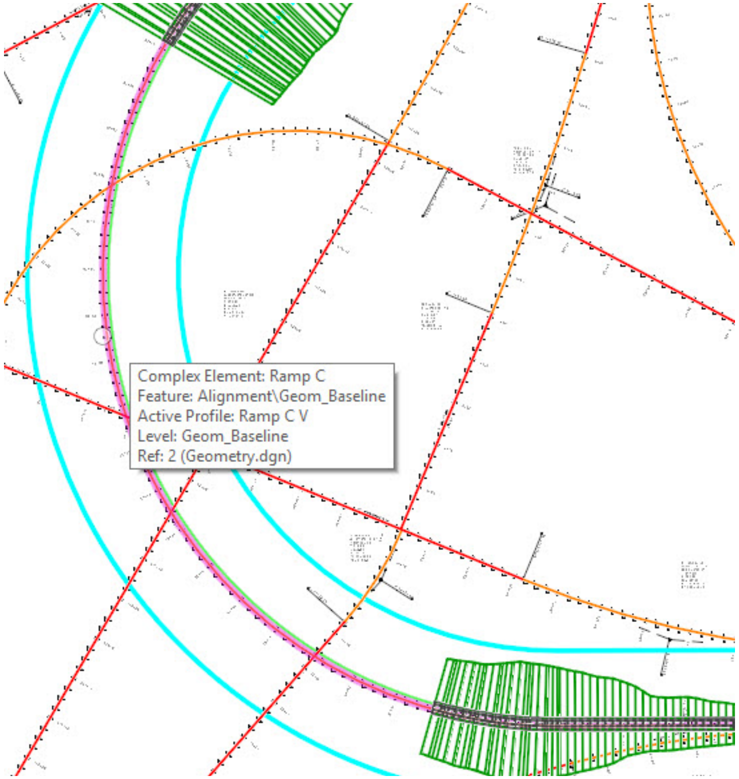
In this module you will model a curved multi-span steel girder bridge using the bridge wizard.

Objectives

- Modify an existing deck template
- Create a pier template
- Model bridge with wizard along ORD alignment

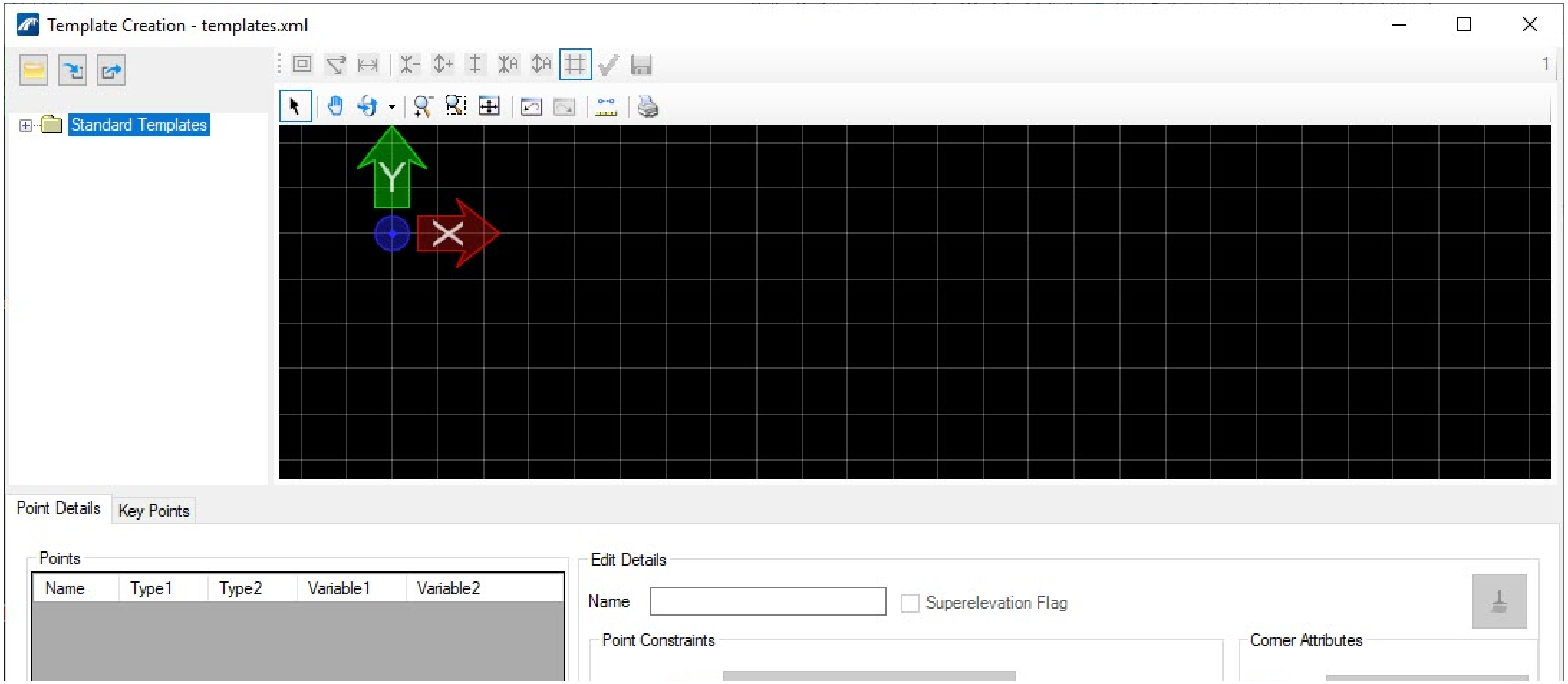
Start Project and Reference ORD Geometry and Terrain Model

1. Select the **Add Standalone Group** icon and name it *Module 5w*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Curved Steel Girder Bridge.dgn** from the *Module 5 (Curved Steel Girder Bridge)* folder.
4. Reference the Terrain and Geometry drawings using Coincident World method.
5. Fit The Views to see the references.
6. Reference Corridor_RampC.dgn drawing to see the limits of the corridor model.
   - *Model* = **Default - 3D**
   - *Method* = **Coincident World**



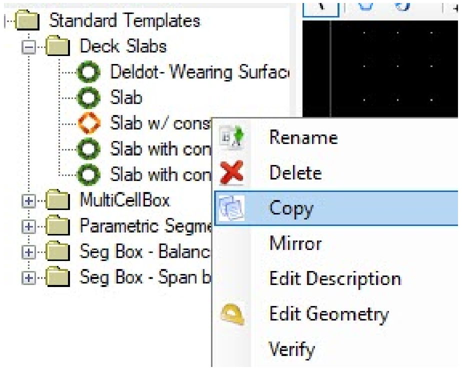
Copy/Modify a Deck Template

1. Continuing in the **Curved Steel Girder Bridge.dgn** drawing.
2. Select *Utilities > Libraries >* **Decks** to open the Template Creation window for decks.



3. Select template *Standard Templates > Deck Slabs >* **Slab w/constraints.** Review the template properties. This is the template we will copy.

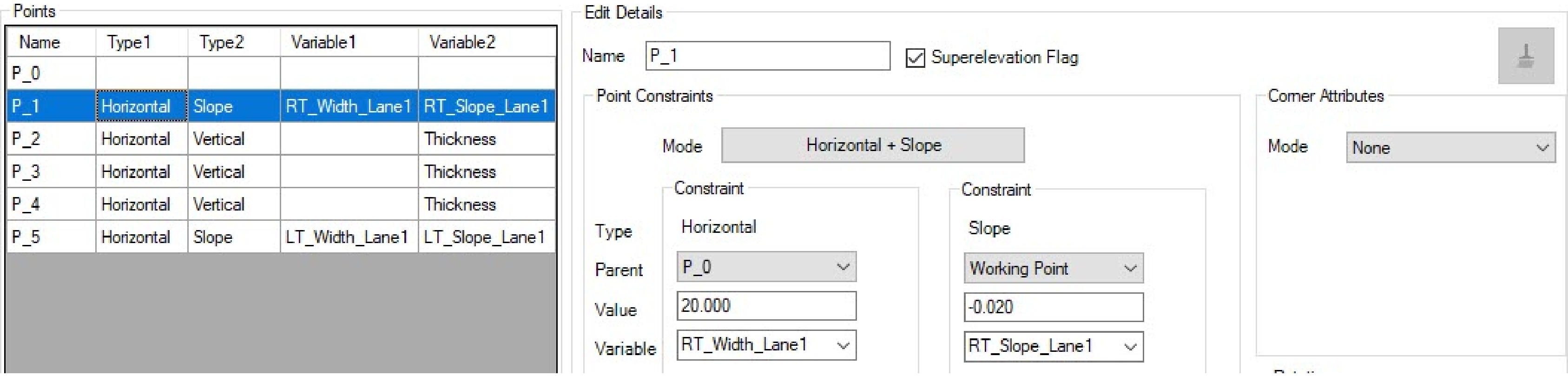
4. *Right click* on the above template and select **Copy**.



5. Click on the new template named *Slab w/ constraints- Copy*, then right click and pick **Rename**.

6. Type in a new name of **Ramp C**.

7. With template Ramp C selected, *click* on point **P_1**.



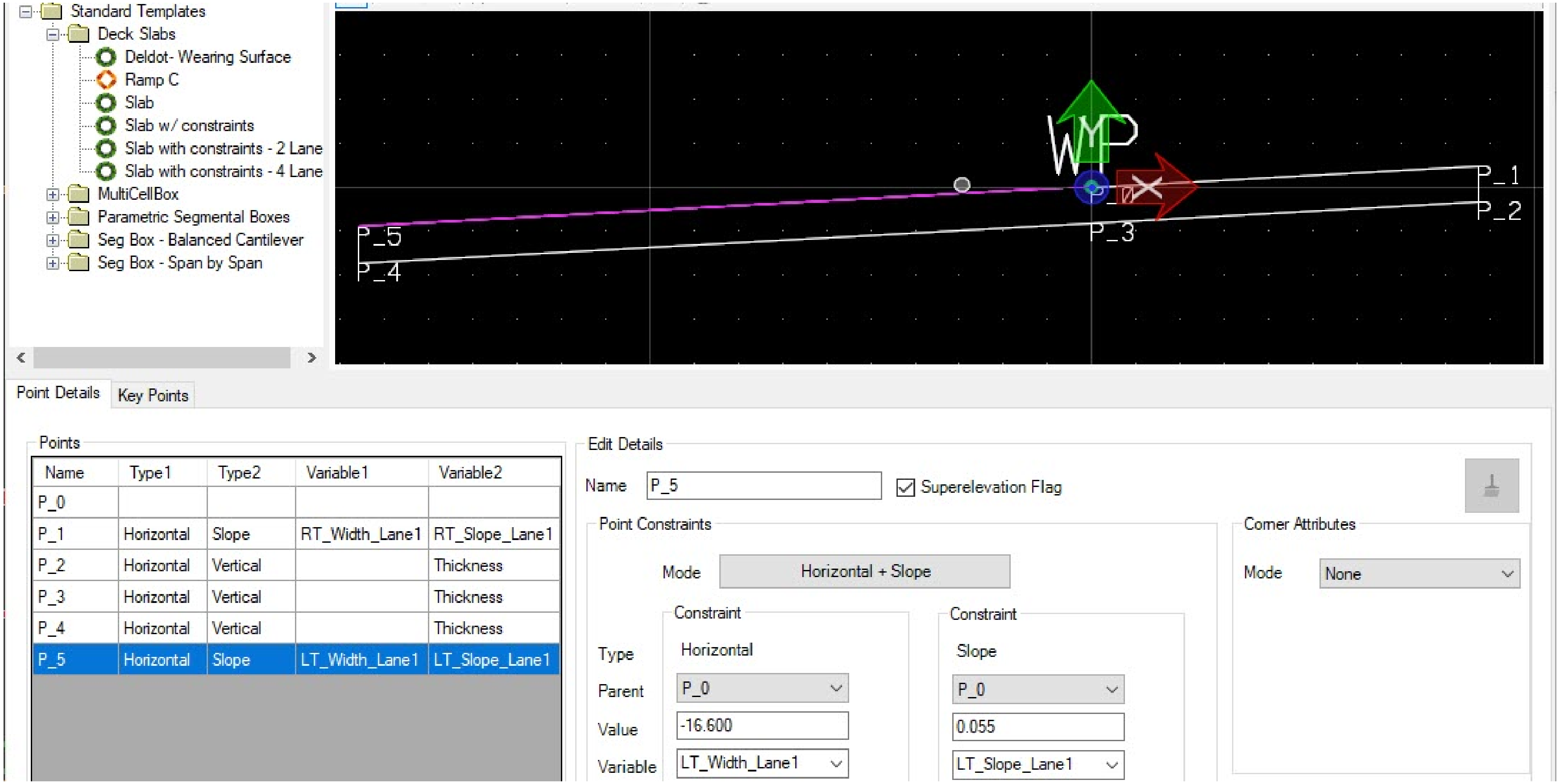
8. Set the Values for the following variables for P_1. Click **Save** when complete.

   - *RT_Width_Lane1* = **8.75** *[2.66]*
   - *RT_Slope_Lane1* = **0.055** *[0.055]*

9. Click on point **P_5**.

10. Set the Values for the following variables for P_5. Click **Save** when complete.

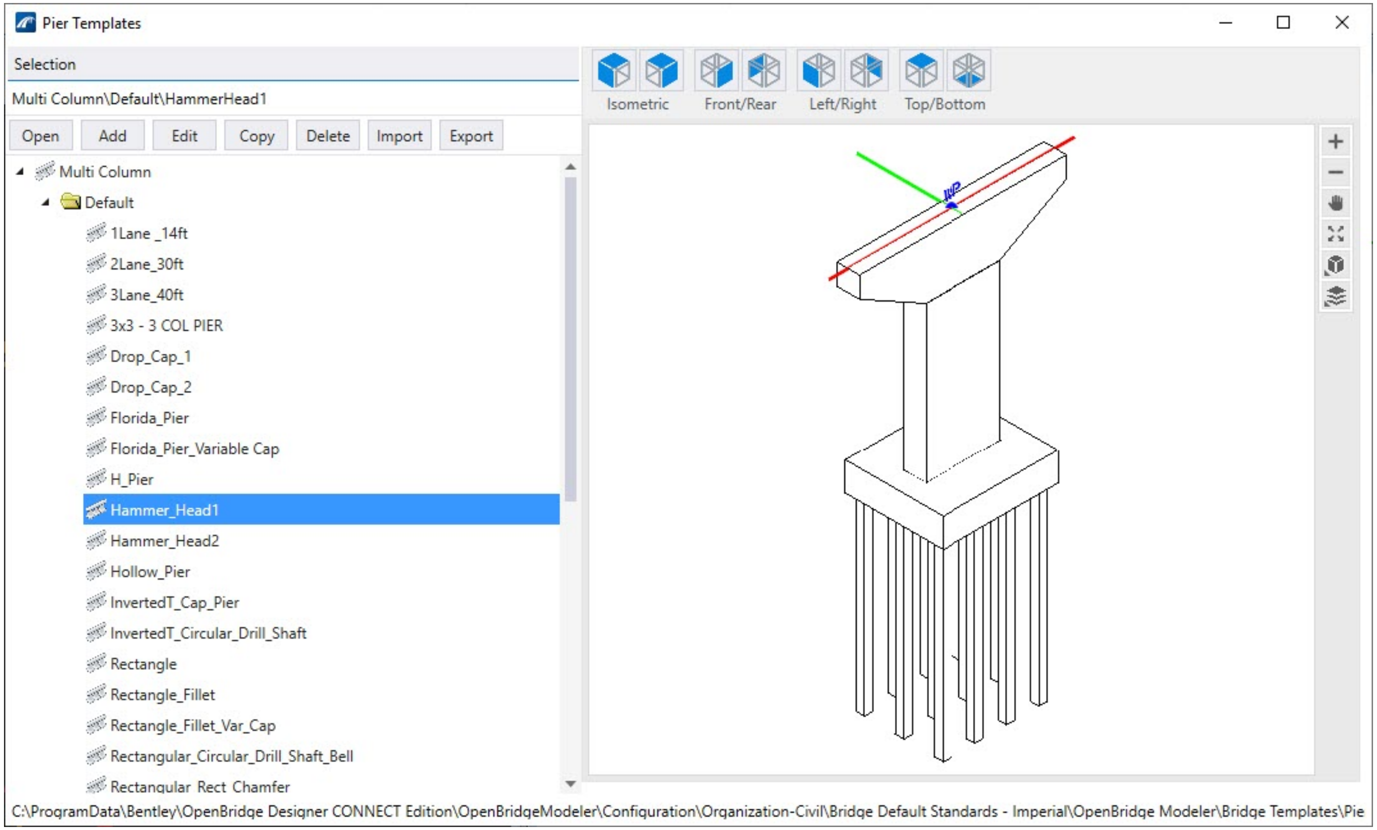
- *LT_Slope_Lane1* = **0.055** *[0.055]*
- *LT_Width_Lane1* = **-16.6** *[-5.10]*



11. Click **Close**.

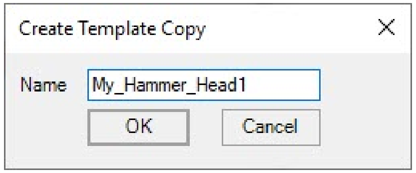
Copy and Modify a Pier Template

1. Continuing in the **Curved Steel Girder Bridge.dgn** drawing.
2. Use *Utilities > Libraries >* **Piers** to open the pier library.
3. Expand *Multi Column > Default*.
4. Select the **Hammer_Head1** Pier.



5. Select **Copy**.

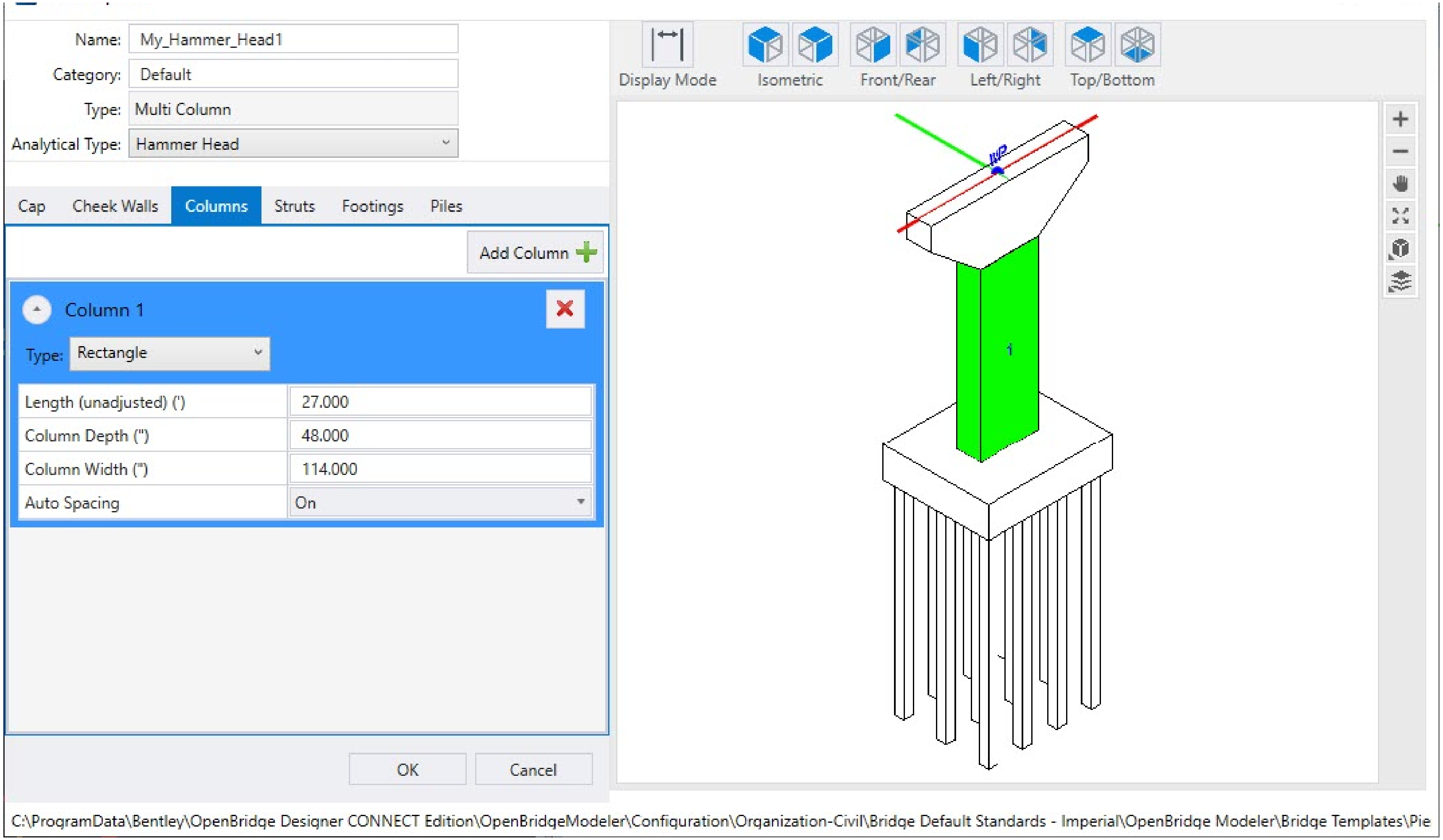
6. Key-in a name of **My_Hammer_Head1** and click **OK**.



7. Select **Edit** to modify My_Hammer_Head1.
8. Change the *Analytical Type* to **Hammer Head**.
9. Change the following values for the cap:
   - *Cap Length* = **25.5** *[7.7]*
   - *Left Taper Length* = **8.0** *[2.50]*
   - *Right Taper Length* = **8.0** *[2.50]*

10. Change the following values for the Column:

- *Column Width* = **114** *[2700]*

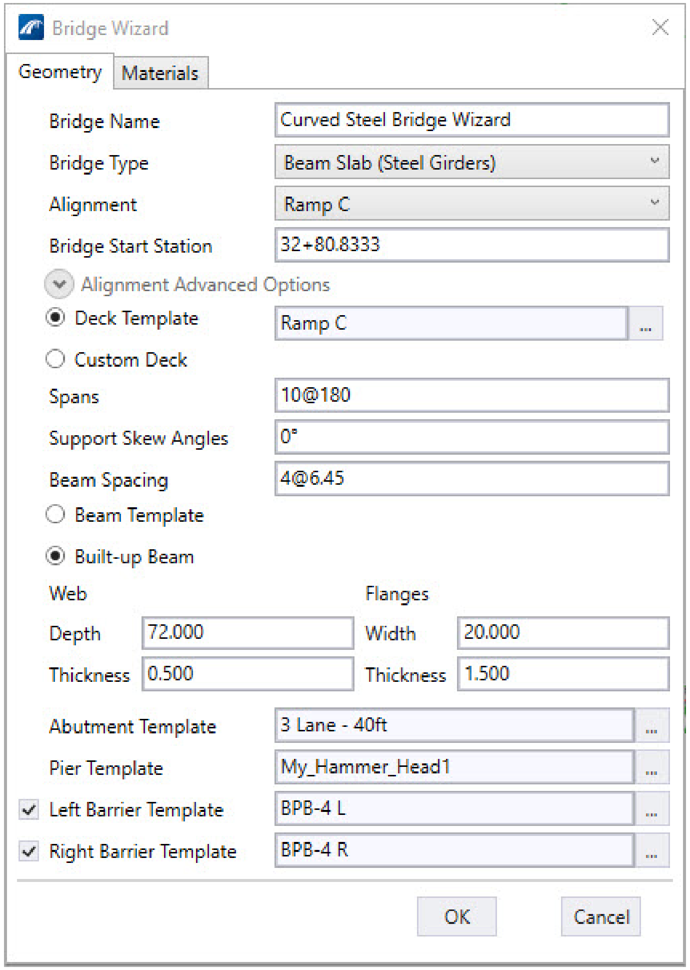


11. Select **OK** to accept the changes to the pier.

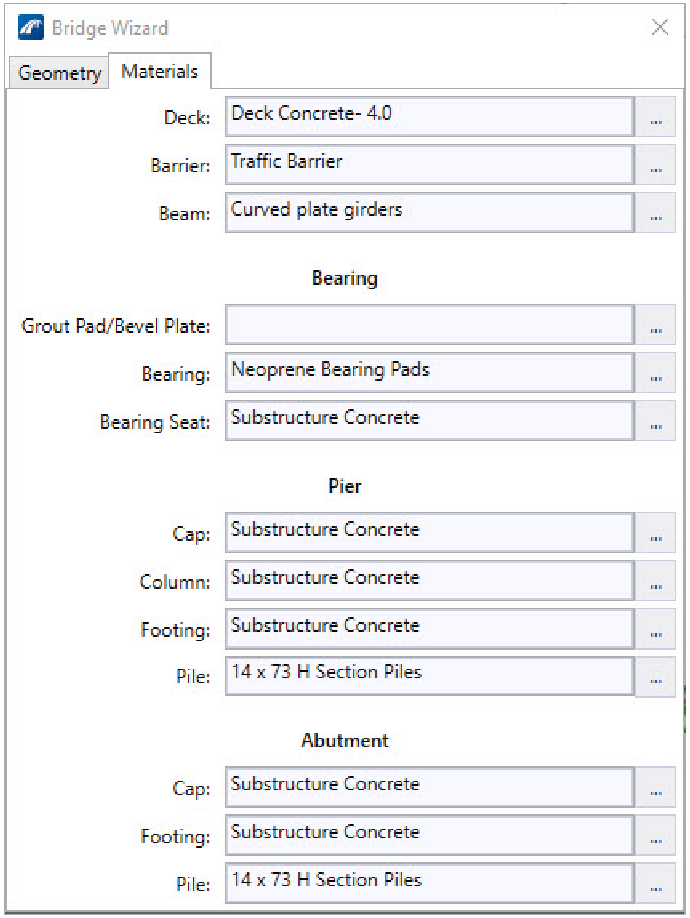
12. Close the Pier Template window.

Model the Curved Steel Bridge

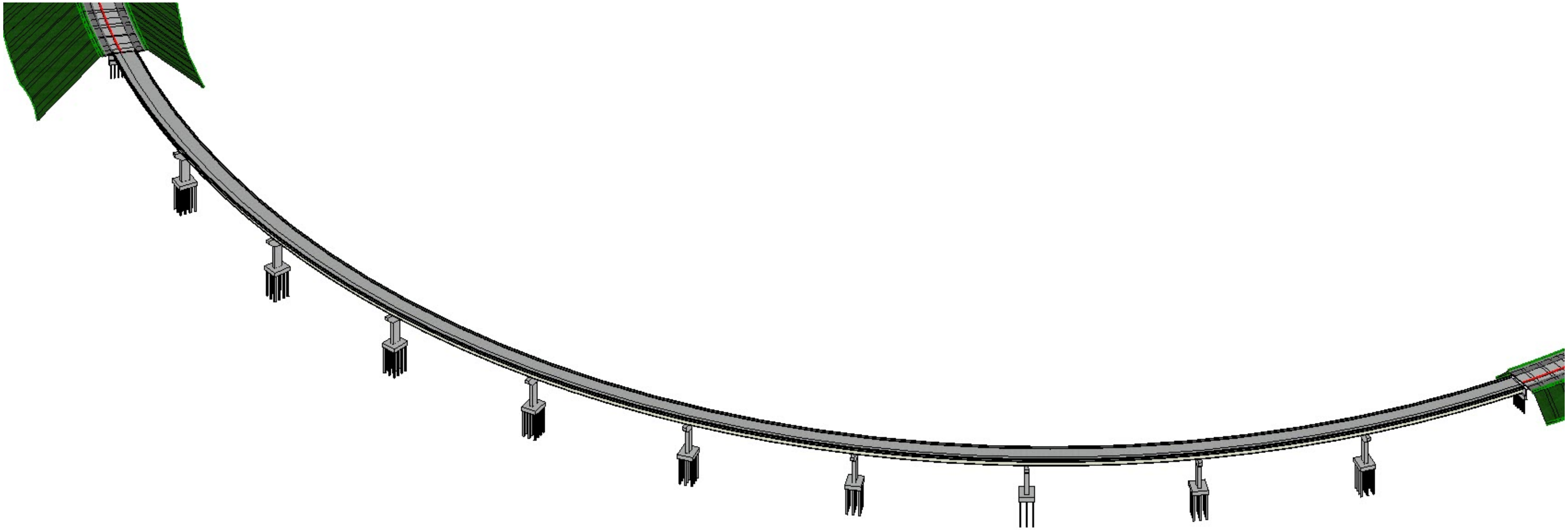
1. Continuing in the **Curved Steel Girder Bridge.dgn** drawing.
2. Use *Home > Bridge Setup>* **Bridge Wizard** to create a bridge along Ramp C.
   - *Bridge Name* = **Curved Steel Bridge Wizard**
   - *Bridge Type* = **Beam Slab (Steel Girders)**
   - *Alignment* = **Ramp C**
   - *Bridge Start Station* = **32+80.833** *[10+447.35]*
   - *Deck Template =* **Ramp C**
   - *Spans* = **10@180** *[10@54.80]*
   - *Support Skew Angles* = **0**
   - *Beam Spacing* = **4@6.45** *[4@2.0]*
   - *Built Up Beam*
     - *Web Depth* = **72** *[1800]*
     - *Web Thickness* = **0.5** *[12.5]*
     - *Flange Width* = **20** *[500]*
     - *Flange Thickness* = **1.5** *[40]*
   - *Abutment Template* = **3 Lane - 40ft** *[3 Lane - 12 m]*
   - *Pier Template* = **My_HammerHead_1**
   - *Left Barrier Template* = **VDOT > BPB-4 L**
   - *Right Barrier Template* = **VDOT > BPB-4 R**



3. Set the Materials tab as shown below.



4. From the Geometry tab, click **OK** to model the bridge.



5. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active.
6. Modify the SupportLine at the end of the structure.

a. Zoom to the end of the structure.

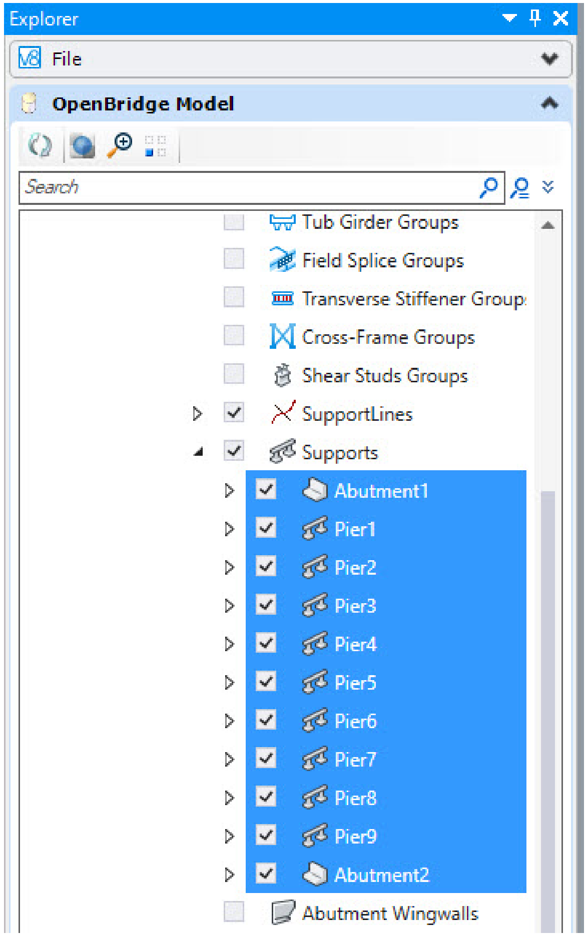
b. Select the line that represents the SupportLine then click near “1” indicated below. The SupportLine should start moving as you move the cursor along the alignment.

c. Snap to a corner of the corridor (yellow X below), then data point to accept the station/location of the SupportLine.

7. Review the resulting model. We have a few items to correct yet including substructure offsets and elevation constraints for the piers.

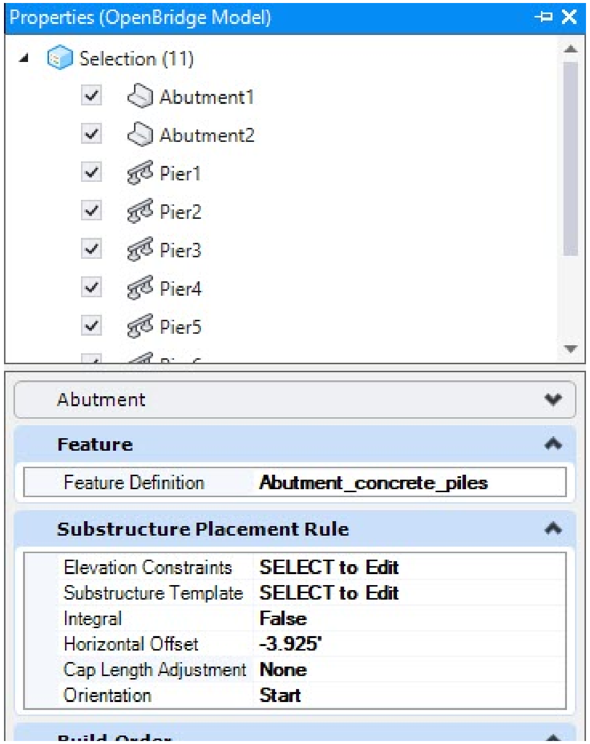
Modify the Substructure Elements

1. Continuing in the **Curved Steel Girder Bridge.dgn** drawing.
2. Open **Explorer**, then expand each level till you see all of the Supports. (
3. Select all of the supports as shown below.

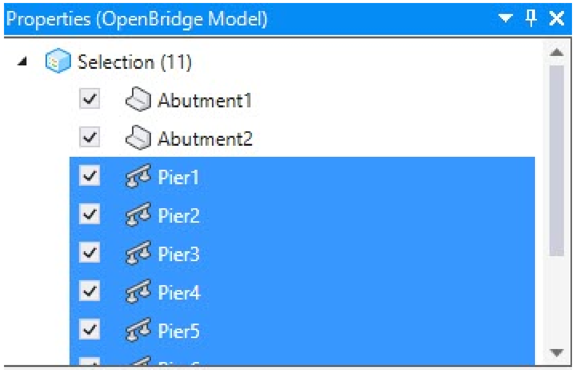


4. In the *Properties* window, Change the following properties:

- *Horizontal Offset* = **-3.925** *[-1.220]*
- *Cap Length Adjustment* = **None**

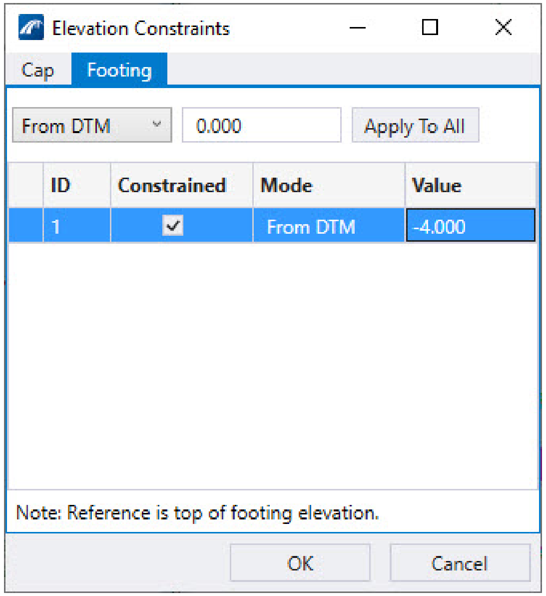


5. Select **Piers 1-9** in the Properties window.

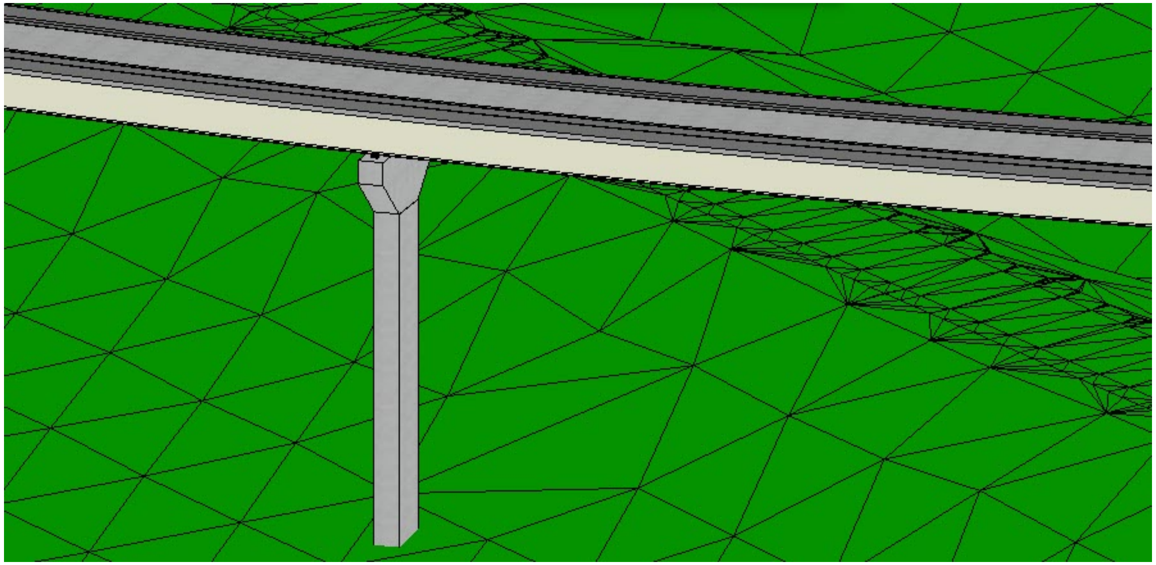


6. Click on **SELECT to Edit** adjacent to *Elevation Constraints*, then click on the "**...**" to continue.

7. Select the **Footings** tab and set as shown below. Note: Use *-1* for *From DTM* value for metric. Click **OK** to modify the piers.



8. Review the resulting model.



9. Close OpenBridge Modeler prior to starting the next exercise.

Module 6: Segmental Bridge Model

Description

In this module you will model a curved balanced cantilever segmental bridge.

Note: A more detailed training guide dedicated to segmental bridges is located on the Bentley LEARN Server.

Objectives

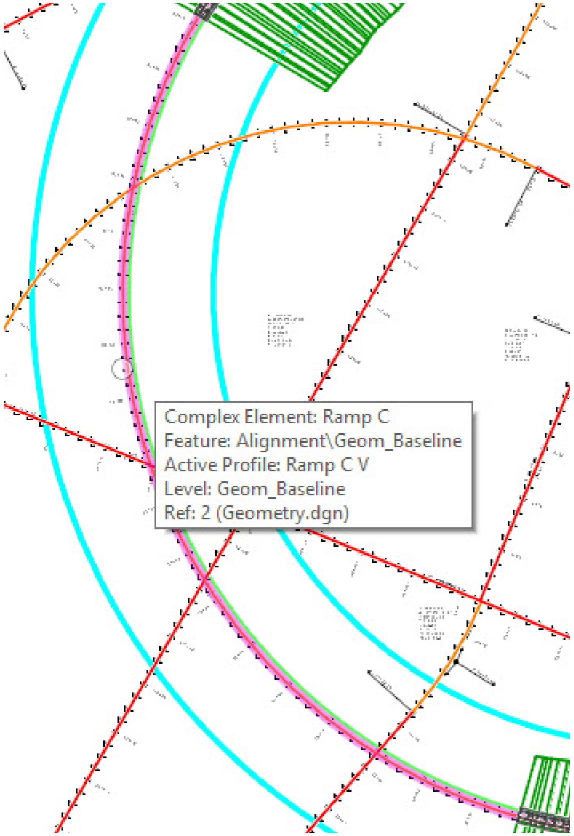
- Reference OpenRoads geometry, terrain model and corridor
- Set pier and abutment locations
- Model balanced cantilever superstructure
- Model piers and abutments
- Model barriers

Add Bridge to Model

1. Select the **Add Standalone Group** icon and name it *Module 6*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Segmental Bridge.dgn** from the *Module 6 (Segmental Bridge)* folder.
4. Reference the Terrain and Geometry drawings using Coincident World method.
5. Fit The Views to see the references.
6. Use *Home > Bridge Setup>* **Add Bridge** to create a bridge along Ramp C.
   - *Description* = **Ramp C** (set in the Tool Settings dialog)
   - *Bridge Type* = **Segmental**

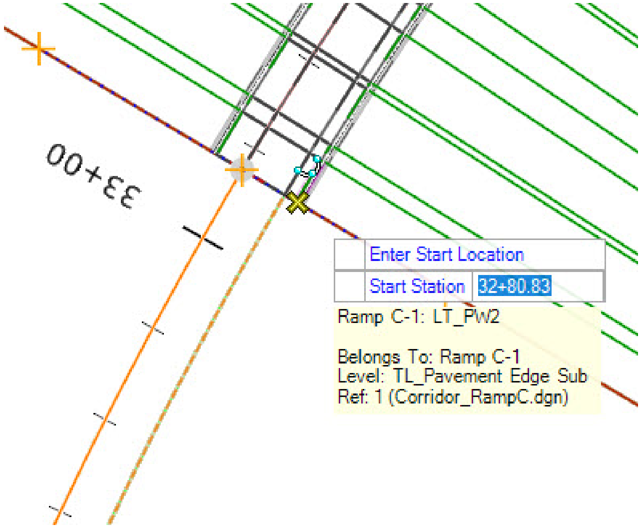
- *Feature Definition* = **Bridge_decorations**

7. Select alignment Ramp C.
8. Data point off the alignment to accept.
9. Reference Corridor_RampC.dgn drawing to see the limits of the corridor model.
   - *Model* = **Default - 3D**
   - *Method* = **Coincident World**
10. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active.



Add Support Lines

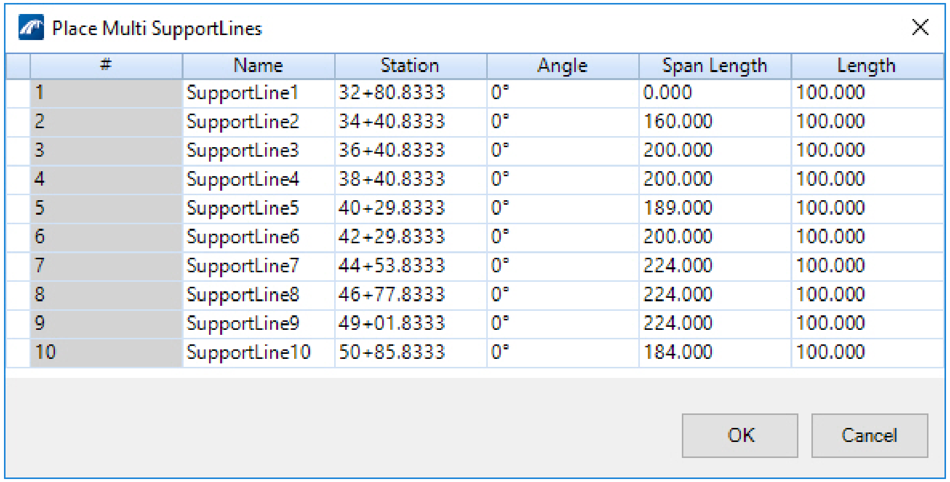
1. Continuing in the **Segmental Bridge.dgn** drawing.
2. In *View 1*, turn on the Ramp C corridor and zoom to the area of the bridge.
3. Use *Home > SupportLine >* **Place Multi** to place lines that represent the locations of the piers and abutments.
   - *Skew Angle* = **0** (set in the Tool Settings dialog)
   - *Length* = **100** *[30]*
   - *Span Length* = **200** *[60]*
   - *Number of SupportLines* = **10**
   - *Direction Mode* = **Skew**
   - *Feature Definition* = **Supportline**
4. In View 1, snap to the end of the corridor gap shown below and accept to set the **Start Station**.



5. Data Point to accept the Skew Mode.

6. Data Point to accept the proposed locations of the remaining support lines.

7. Review the Place Multi Support Lines window. Modify the *Span Lengths* as shown.



Place Multi SupportLines

#	Name	Station	Angle	Span Length	Length
1	SupportLine1	32+80.8333	0°	0.000	100.000
2	SupportLine2	34+40.8333	0°	160.000	100.000
3	SupportLine3	36+40.8333	0°	200.000	100.000
4	SupportLine4	38+40.8333	0°	200.000	100.000
5	SupportLine5	40+29.8333	0°	189.000	100.000
6	SupportLine6	42+29.8333	0°	200.000	100.000
7	SupportLine7	44+53.8333	0°	224.000	100.000
8	SupportLine8	46+77.8333	0°	224.000	100.000
9	SupportLine9	49+01.8333	0°	224.000	100.000
10	SupportLine10	50+85.8333	0°	184.000	100.000

OK Cancel

8. Click **OK** to accept the Support Line locations.

9. Right click to stop placing Support Lines.

10. Review the resulting support lines.

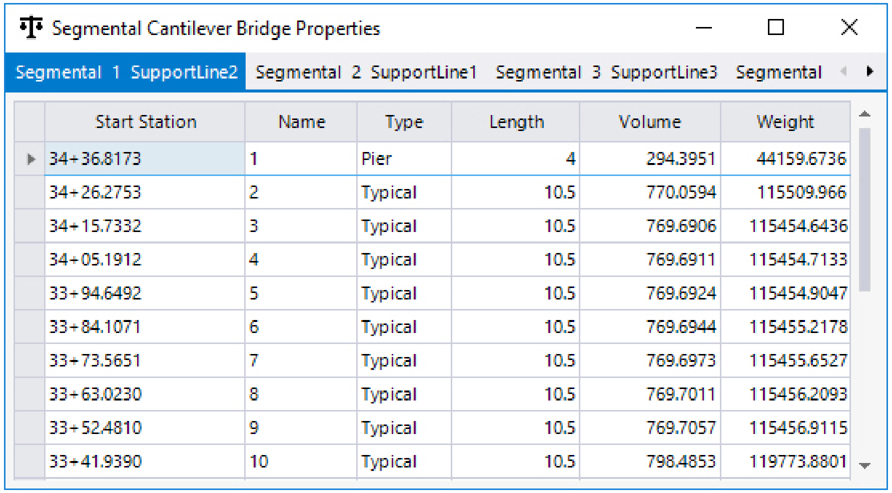
Model the Segments

1. Continuing in the **Segmental Bridge.dgn** drawing.
2. Use *Home > Superstructure > Place Segmental >* **Place Cantilever** to begin placing the superstructure.
3. Set the following values then data point on the second Support Line to define the first cantilever.
   Note: Increment the build order for each bent.
   - *Template name* = **Parametric Seg Box**
   - *Horizontal Offset* = **-3.925** *[-1.2]*
   - *Seg. Length* = **9@10.5** *[9@3.2]*
   - *Pier Seg. Length* = **4:4**
   - *CIP Length* = **0**
   - *Chorded* toggle enabled
   - *Pier Material* = **Concrete > Precast Segmental Box Girders A**
   - *Typical Material* = **Concrete > Precast Segmental Box Girders A**
   - *Expansion Material* = **Concrete > Precast Segmental Box Girders A**
   - *Closure Material* = **Concrete > Precast Segmental Box Girders A**
   - *Pier/Typical/Expansion/Closure Build Order* = **1**
   - *Feature Definition* = **Segment**
   - *Name Prefix* = **Segmental**
4. Set the following values then data point on the first Support Line to define the end span.
   - *Seg. Length* = **5@10.5** *[5@3.2]*
   - *Pier Seg. Length* = **:6**

- *Start Station Offset* = **0.5**
- *Pier/Typical/Expansion/Closure Build Order* = **2**

5. Set the following values then data point on the third and fourth Support Line to define the second and third cantilever. Note: Use the SupportLine number for each successive increment of the build order.
   - *Seg. Length* = **9@10.5** *[9@3.2]*
   - *Pier Seg. Length* = **4:4**
   - *Pier/Typical/Expansion/Closure Build Order* = **3**
6. Set the following values for the fourth cantilever then select Support Line 5.
   - *Seg. Length* = **8@10.5** *[8@3.2]*
   - *Pier Seg. Length* = **4:4**
   - *Pier/Typical/Expansion/Closure Build Order* = **5**
7. Set the following values for SupportLines 6-9.
   - *Seg. Length* = **10@10.5** *[10@3.2]*
   - *Pier Seg. Length* = **4:4**
8. For the final endbent, use the following values:
   - *Seg. Length* = **6@10.5** *[6@3.2]*
   - *Pier Seg. Length* = **:6**
   - *Start Station Offset* = **-0.5**
9. Select the *Home > Superstructure >* **Closure** tool to close out the segments. Data Point to close out the segments.
   - *Max CIP Segment Length* = **8'** *[2.5]*

10. Select the *Home > Superstructure >* **Report** tool to review volume and weight information for each segment.



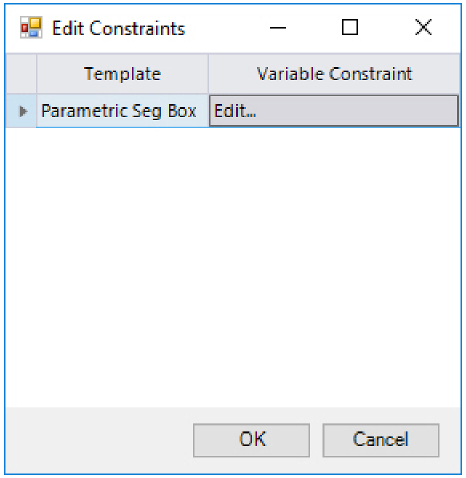
Segmental Cantilever Bridge Properties

Segmental 1 SupportLine2 | Segmental 2 SupportLine1 | Segmental 3 SupportLine3 | Segmental

Start Station	Name	Type	Length	Volume	Weight
34+36.8173	1	Pier	4	294.3951	44159.6736
34+26.2753	2	Typical	10.5	770.0594	115509.966
34+15.7332	3	Typical	10.5	769.6906	115454.6436
34+05.1912	4	Typical	10.5	769.6911	115454.7133
33+94.6492	5	Typical	10.5	769.6924	115454.9047
33+84.1071	6	Typical	10.5	769.6944	115455.2178
33+73.5651	7	Typical	10.5	769.6973	115455.6527
33+63.0230	8	Typical	10.5	769.7011	115456.2093
33+52.4810	9	Typical	10.5	769.7057	115456.9115
33+41.9390	10	Typical	10.5	798.4853	119773.8801

11. Close the properties window.

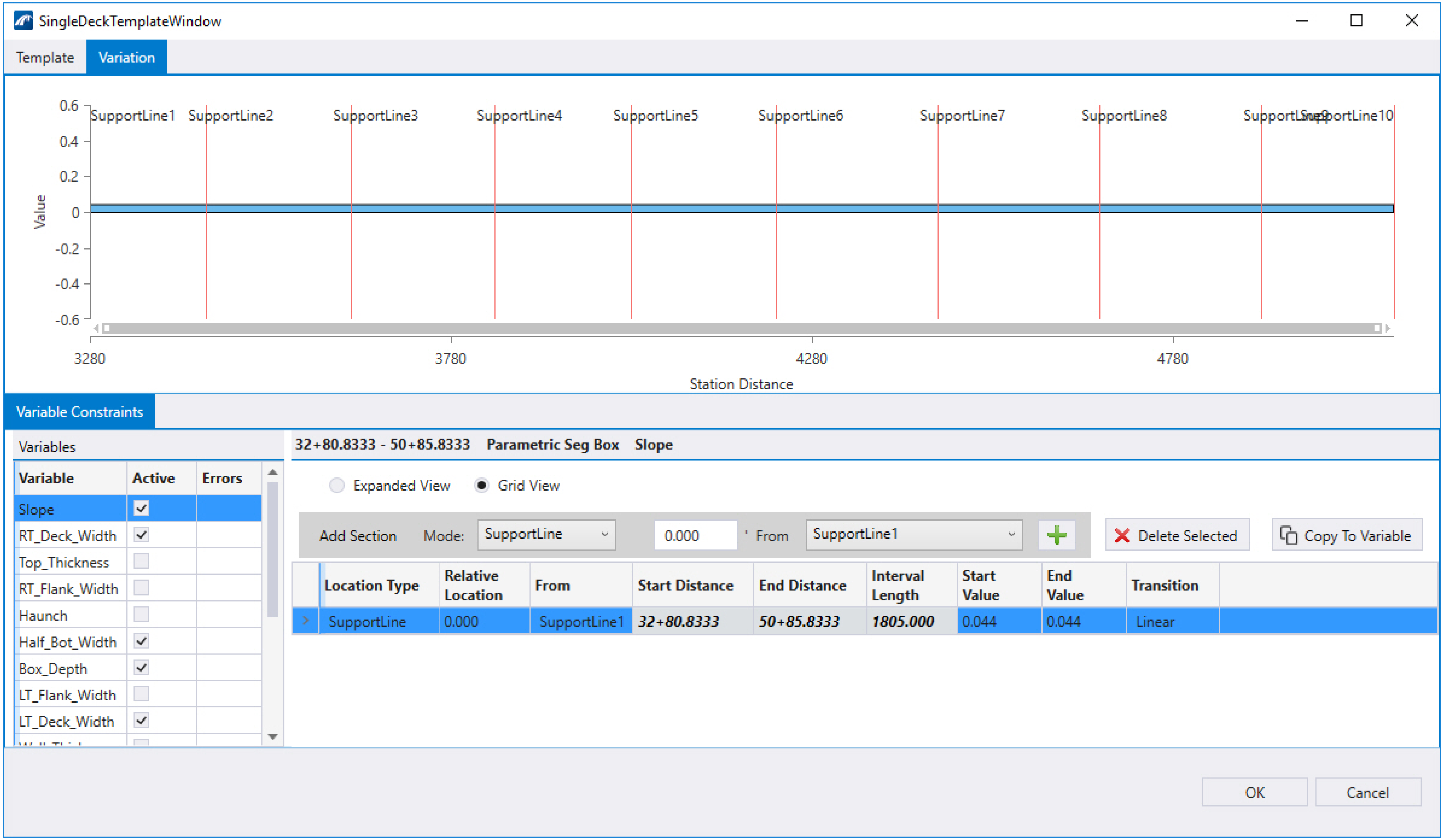
12. Select the *Home > Superstructure >* **Constraints** .



13. Click **Edit...** to modify the variables associated with the template.

- *Box_Depth* = **11.5** *[3.4]*
- *Lt_Deck_Width* = **16.0** *[4.9]*

- *Rt_Deck_Width* = **16.0** *[4.9]*
- *Half_Bot_Width* = **6.833** *[2.1]*
- *Slope* = **0.044**



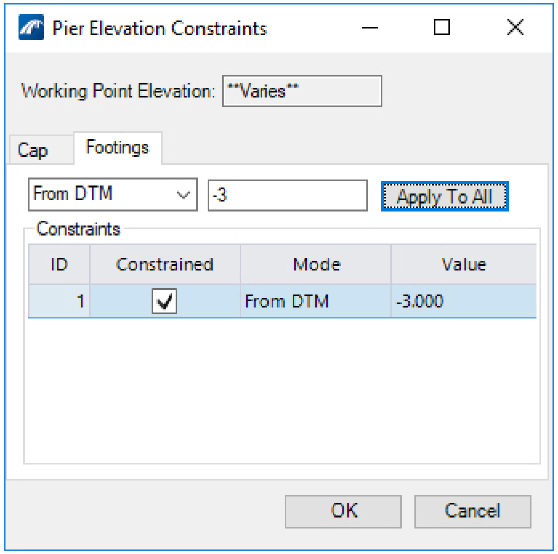
14. Click **OK** to accept variables.

15. Click **OK** to accept constraints and update the model.

Model the Piers

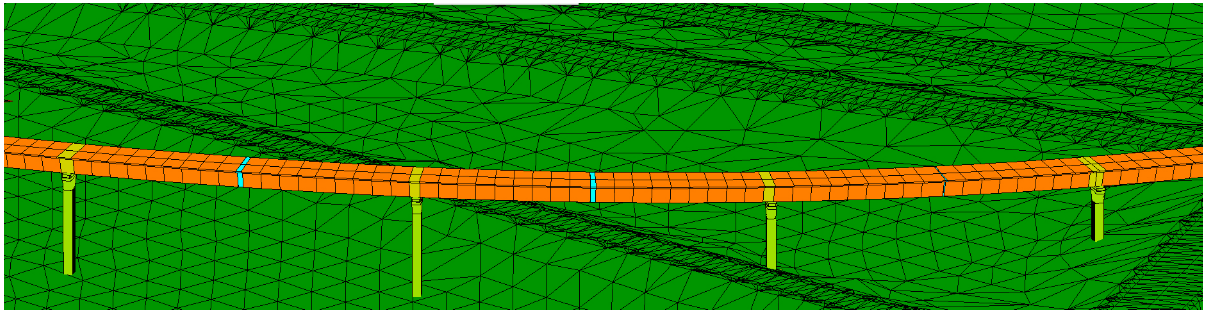
1. Continuing in the **Segmental Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Pier** to begin placing the superstructure.
3. Set the following values then data point on the first Support Line.
   - *Template Name* = **Florida Pier**
   - *Horizontal Offset* = **-3.395** *[1.03]*
   - *Elevation Constraints* enabled
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Pier_steel_piles**
   - *Name Prefix* = **Pier-**
4. Select each Support Line for piers, then reset then data point to accept placing the piers.

5. In the Pier Elevation Constraints window, set the Footings tabs as shown. Note: Use *-1* for From DTM value for metric.



6. Select **OK** to model the piers.

7. Turn on the display of the triangles for the attached terrain model.

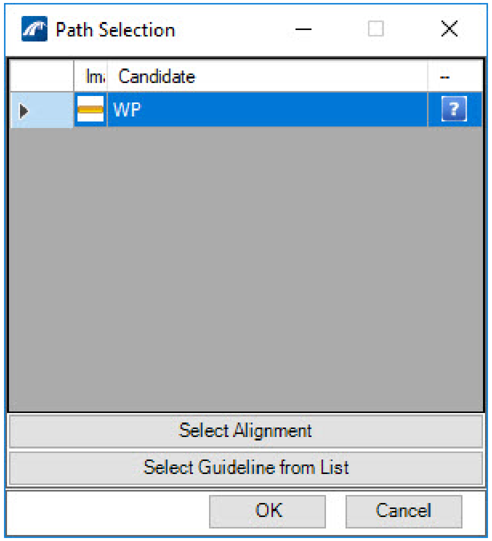


Model the Abutments

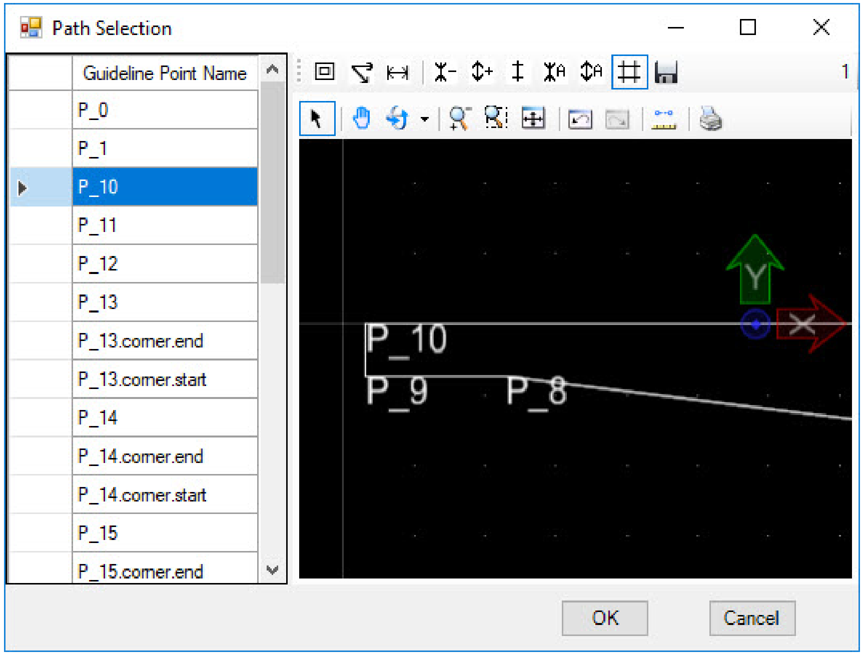
1. Continuing in the **Segmental Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Abutment** to begin placing the superstructure.
3. Set the following values then data point on the first Support Line.
   - *Template Name* = **Pilecap\1-Lane - 14ft**
   - *Horizontal Offset* = **-3.395** *[1.03]*
   - *Elevation Constraints* disabled
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Abutment_steel_piles**
   - *Name Prefix* = **Abutment-**
4. Select the first Support Line for the first abutment, then reset then data-point to accept placing the abutment.
5. Repeat for the end abutment.

Place the Barriers

1. Continuing in the **Segmental Bridge.dgn** drawing.
2. Use *Home > Accessory >* **Place Barrier** to model the barriers for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **VDOT\BPB-4 L** barrier template, then set the following parameters:
    - *Feature Definition* = **Barrier**
    - *Name Prefix* = **Barrier-**
5. Select the decks with a datapoint, then off of the deck right-click, then data point to continue.
6. From the *Path Selection* window, click **Select Guideline from List**.



7. Select point **P_10** from the *Guideline Point Name* list. This point represents the upper left point of the deck.



8. Click OK in each Path Selection window to place the barrier.

9. Repeat the process for the right side barrier. Use template **VDOT\BPB-4 R** and point **P_0** for the *Guideline Point Name.*

10. Review the resulting barriers.

11. Close OpenBridge Modeler prior to starting the next exercise.

Module 7: Libraries

Description

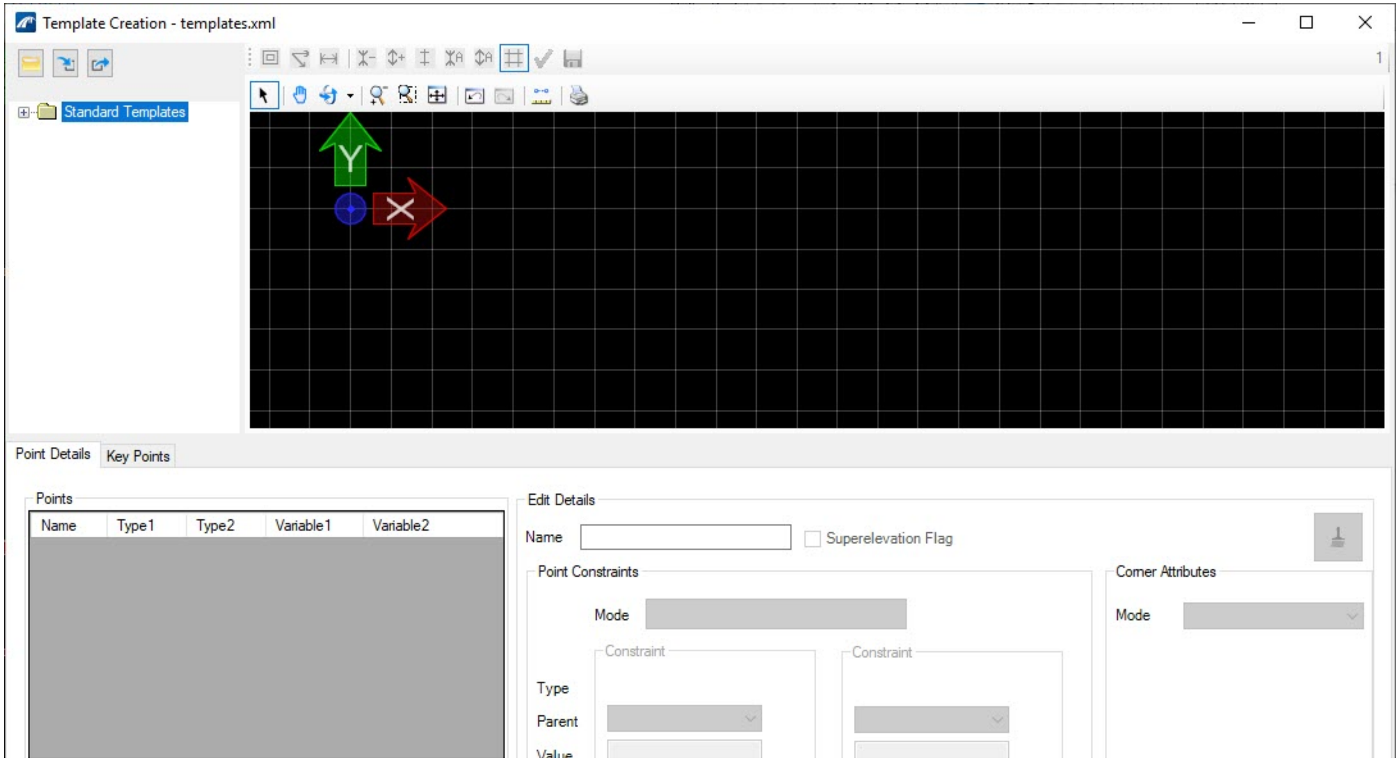
In this module you will learn how to set up the libraries that are included with OpenBridge Modeler.

Objectives

- Create a Deck Template
- Create a Barrier Template
- Create a Pier Template
- Create Material Definitions

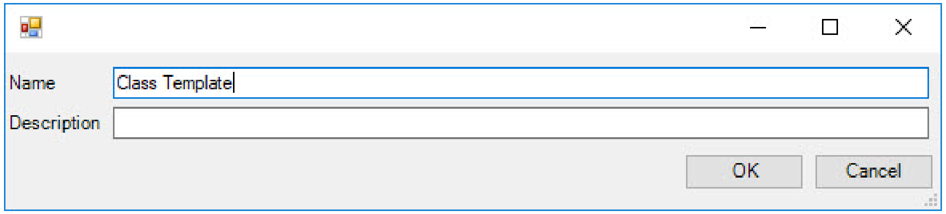
Create a Deck Template

1. Select the **Add Standalone Group** icon and name it *Module 7*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Libraries.dgn** from the *Module 7 (Libraries)* folder.
4. Select *Utilities > Libraries >* **Decks** to open the Template Creation window for decks.



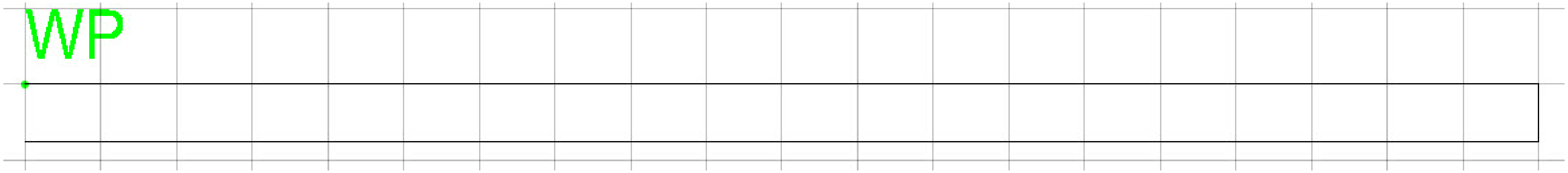
5. Select template *Standard Templates > Deck Slabs >* **Slab w/constraints.** Review the template properties. This is the template we will recreate.
6. Right click the *Deck Slabs* folder and select **Add Template**.

7. Key-in a *Name* for the template. and click **OK**.



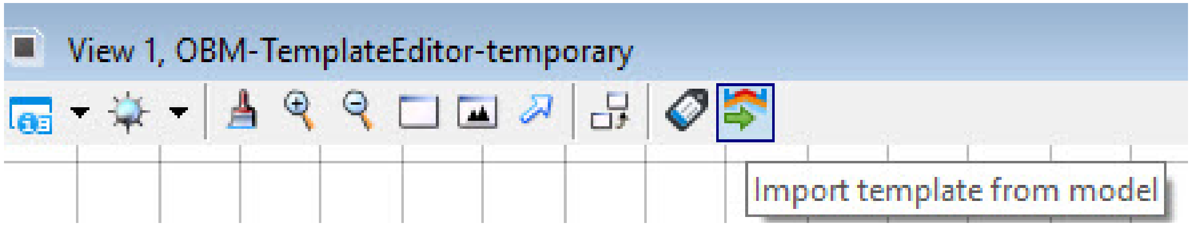
8. Data point in View 1.

9. Starting with the green dot representing the working point (WP), place a line to the right roughly 20' *[6 m]* long. Next, add a vertical line down about 9" *[225 mm]* long, then add a line representing the bottom half of the deck as shown.

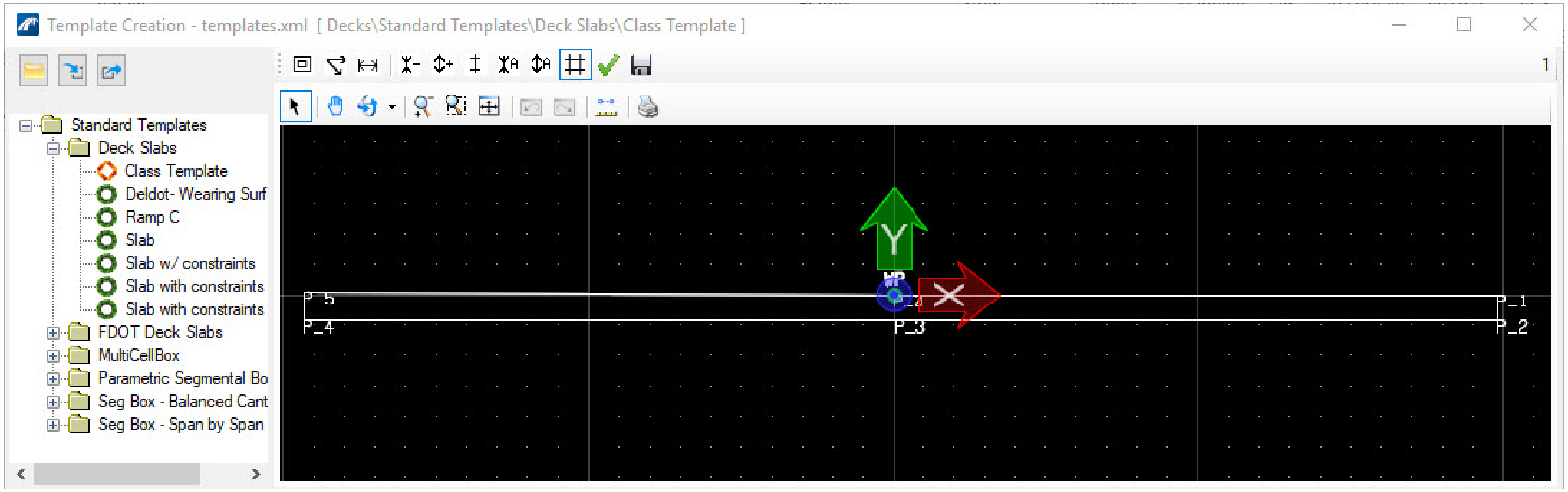


10. Repeat the previous steps to draw the left half of the template. Note that slopes and distances are not important at this time. The key to the process is that the lines that make up the template must form a closed boundary with no gaps or overlapping elements.

11. Select the **Import Template from model** icon to save the template to the library. Select Yes when prompted to accept.



12. The new template now shows in the library.



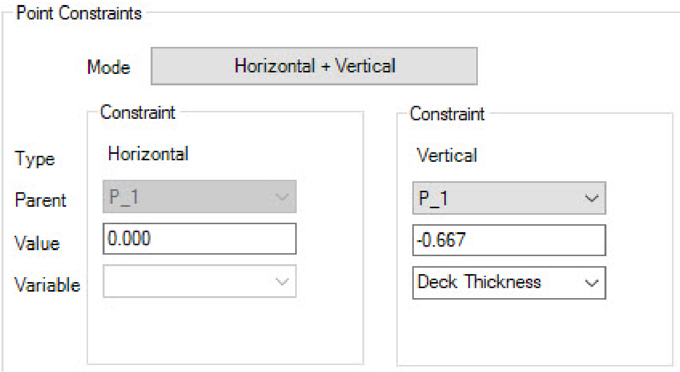
13. Select point **P_2** in the *Points Table*.

Points

Name	Type1	Type2	Variable1	Variable2
P_0				
P_1				
P_2				
P_3				
P_4				
P_5				

14. Set the *Point Constraint* to **Horizontal + Vertical**.

15. Change the *Vertical value* to **-0.667** and set the Variable as shown.

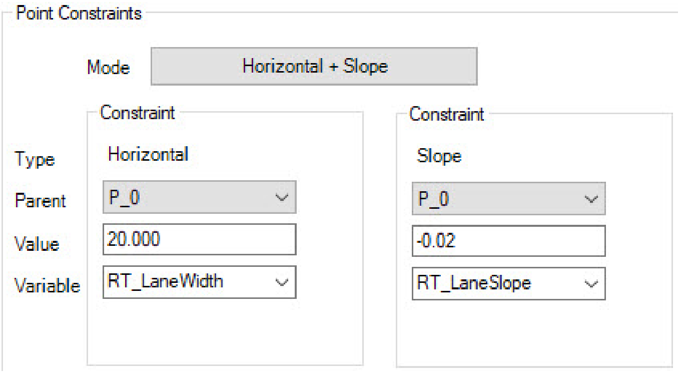


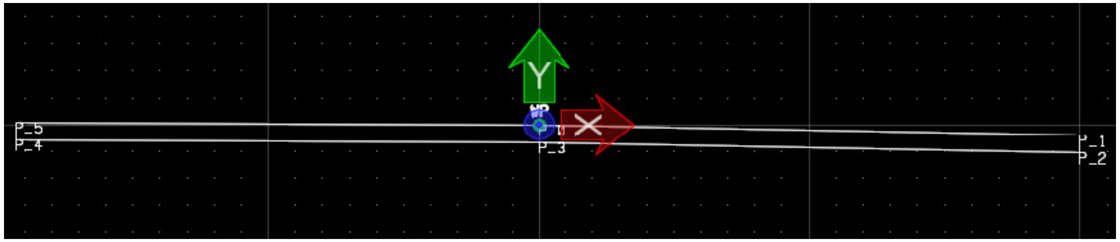
16. Click **Save** to save the vertical value and variable.

17. Repeat the previous step for points P_3 and P_4 setting the Parent point to P_0 and P_5 respectively.

18. Select point **P_1** in the *Points Table*.

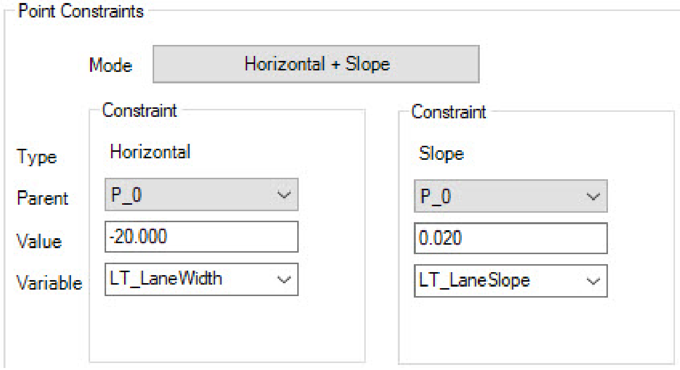
19. Populate the Point Constraints as shown. Click **Save** to save the slope and width value and variables. Note that the slope needs to be a negative number based on the updated graphic.





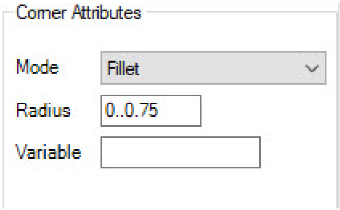
20. Select point **P_5**.

21. Set the point constraints as shown and save.



22. If the deck will be used on a superelevated structure, points *P_0, P_1* and *P_5* should have the **Superelevation Flag** enabled so the left and right lanes can rotate as needed.

23. Add **Corner Attributes** to points *P_1* and *P_5*. Set as shown for a 3/4" chamfer. Select **Save** for each point.



24. Select the Verify icon to try different variable values to see how the typical reacts.

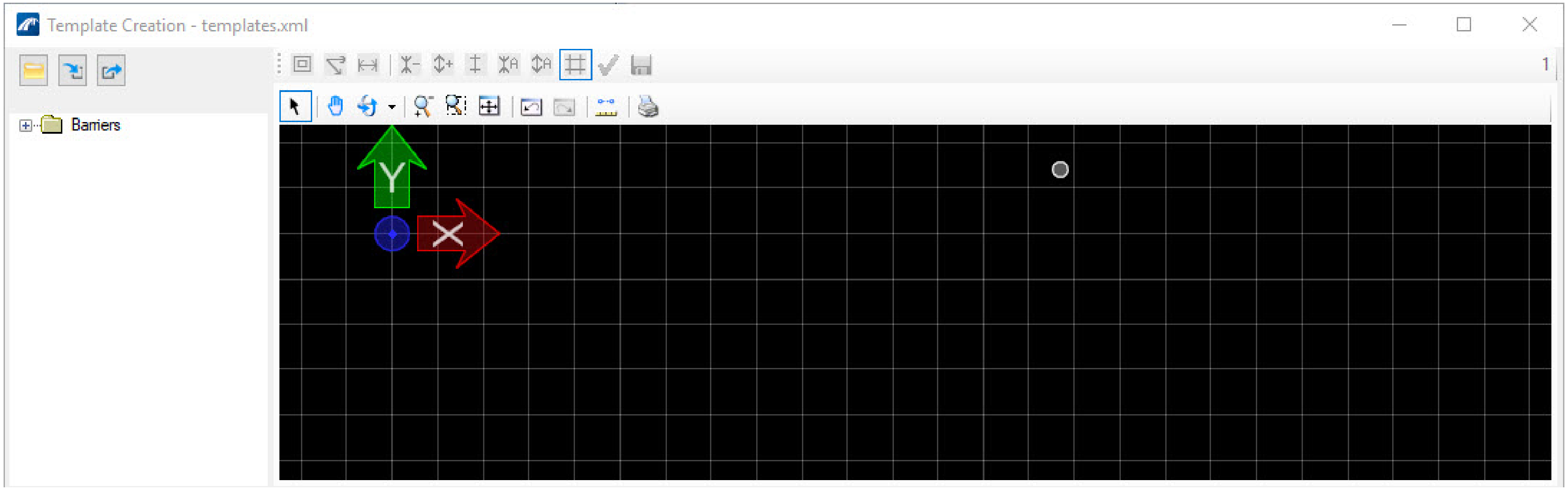
25. Close the template verification window.

26. Select **Close** to finish.

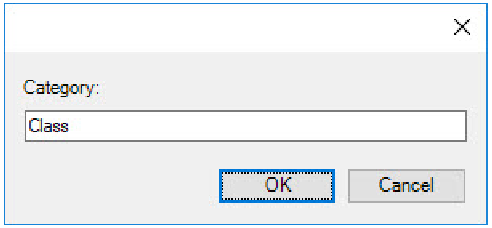
Create a Barrier Template

1. Open the file **Libraries.dgn** from the *Module 7 (Libraries)* folder.

2. Select *Utilities > Libraries >* **Barriers** to open the Template Creation window for barriers.

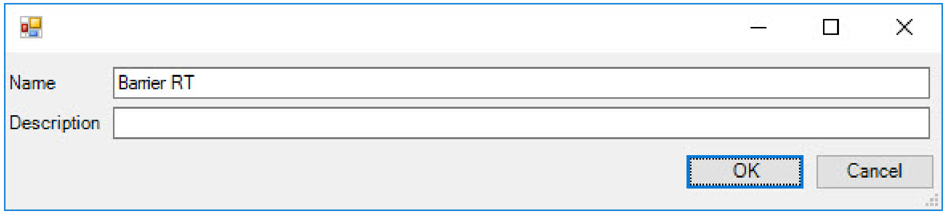


3. Select template *Barriers > VDOT >* **BPB-3 L.** Review the template properties.
4. Right click the *Barriers* folder and select **Add Category**.
5. Key-in a *Name* for the category and click **OK**.



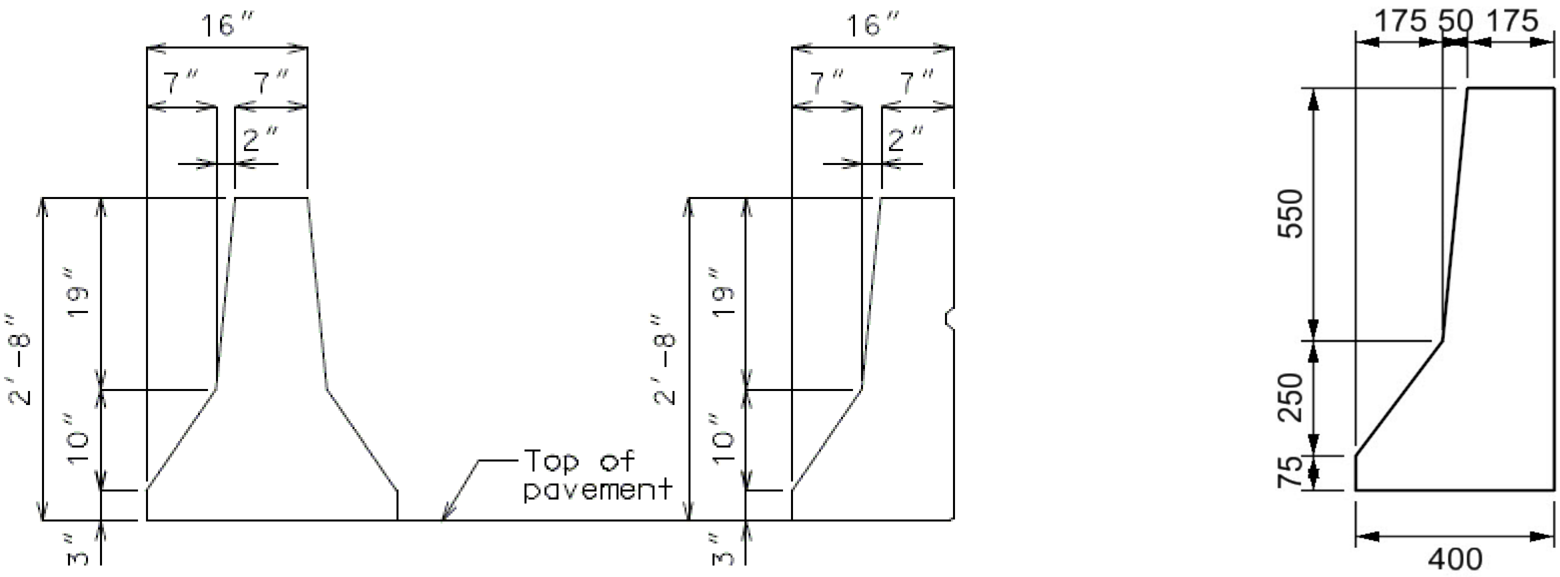
6. Right click the Class category and select **Add Template**.

7. Key-in a *Name* for the Barrier and click **OK**.



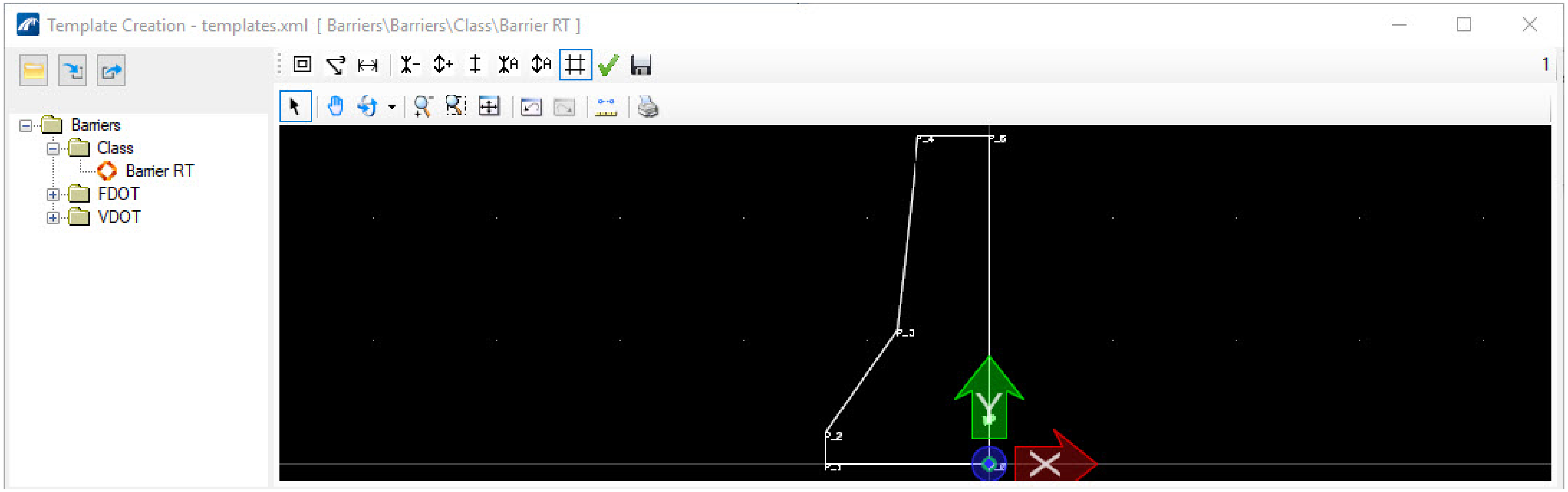
8. Data point in View 1.

9. Starting with the green dot representing the working point (WP), place a line vertically from the back bottom point on the barrier. With the assistance of Accudraw, draw the lines that make up the barrier.



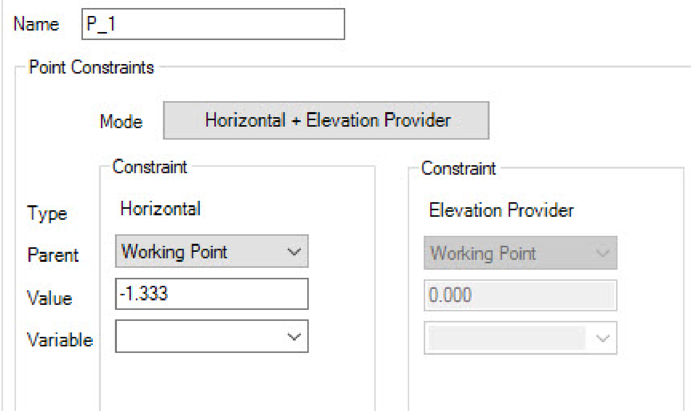
10. Select the **Import Template from model** icon to save the template to the library. Select Yes when prompted to accept.

11. The new template now shows in the library.



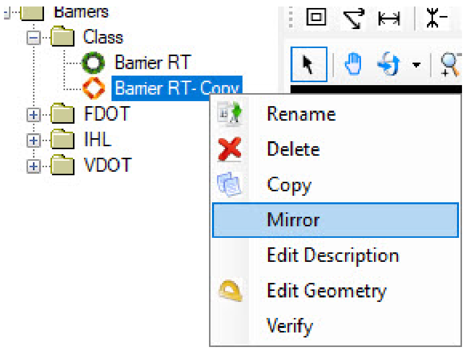
12. Select point **P_1** in the *Points Table*.
13. Set the *Point Constraint* to **Horizontal + Elevation Provider**.

14. Click **Save** to save the constraints as shown.



15. Right click the *Barrier RT* and select **Copy** to make a copy of the barrier.

16. Right click the *Barrier RT-Copy* and select **Mirror** to create a barrier for the left side of the deck.

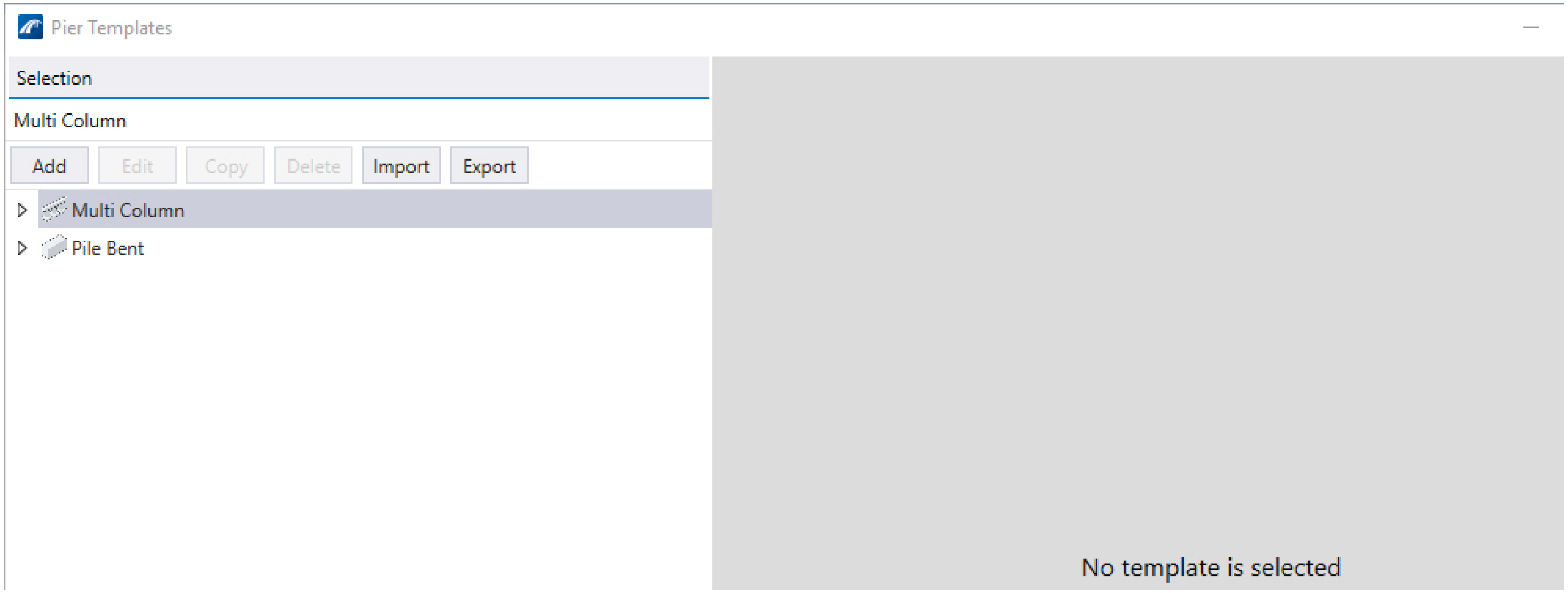


17. Right click the *Barrier RT-Copy* and select **Rename** to rename the barrier to **Barrier LT**.

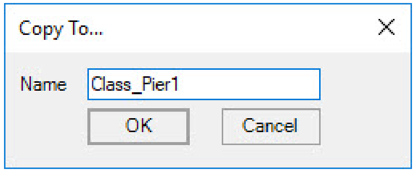
18. Select **Close** to close the *Template Creation* window.

Create a Pier Template

1. Open the file **Libraries.dgn** from the *Module 7 (Libraries)* folder.
2. Select *Utilities > Libraries >* **Piers** to open the Pier Template window.

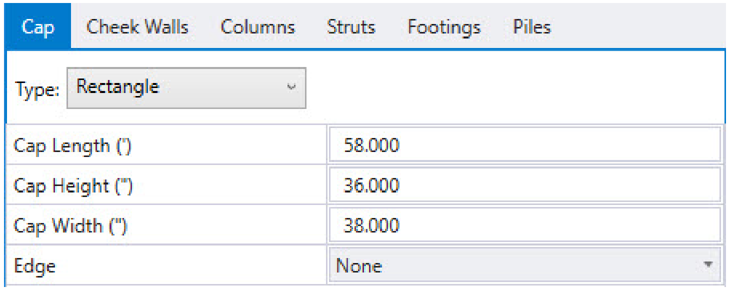


3. Select template *Multi Column > Default >* **3Lane_40ft.** Review the template properties. This is the template we will copy and modify.
4. Select **Copy** to create a new pier called *Class_Pier1*. Click **OK**.

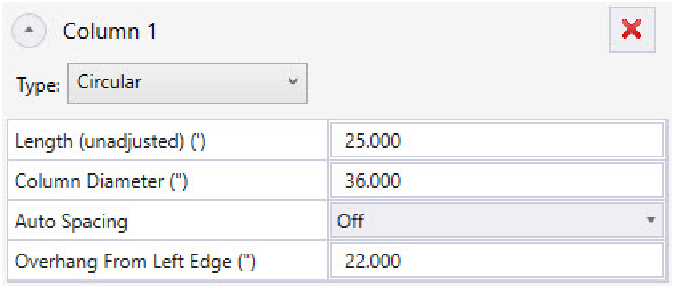


5. Select **Edit** to modify the pier.
6. Set the Cap Properties as shown.
   - *Cap Length* = **58** *[17.500]*

- *Cap Height* = **36** *[1.00]*
- *Cap Width* = **38** *[1.10]*

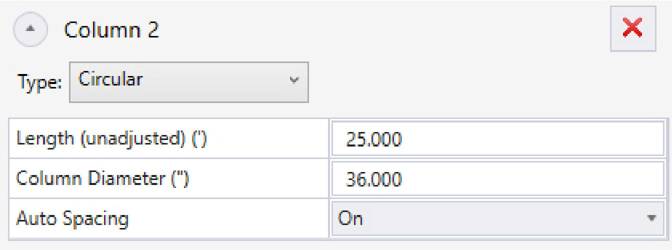


7. Select the **Columns** tab.
8. Select **Add Column** to add a column.
9. Set Columns 1 & 4 as shown:
   - *Length* = **25** *[8.00]*
   - *Column Diameter* = **36** *[1.00]*
   - *Auto Spacing* = **Off**
   - *Overhang* = **22** *[550.0]*



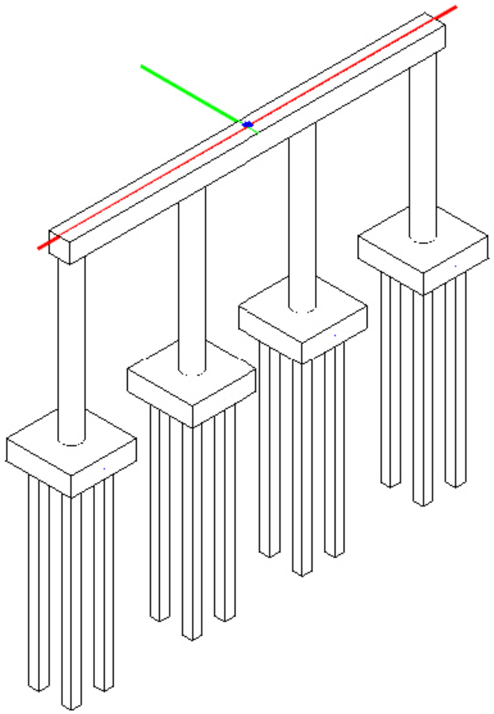
10. Set Columns 2 & 3 as shown:
    - *Length* = **25** *[8.00]*
    - *Column Diameter* = **36** *[1.00]*

- *Auto Spacing* = **On**



11. Select the **Footing** tab and set the *Default Footing Definition*.
    - *Footing Type* = **Rectangular Isolated**
    - *Footing Length* = **10** *[3.3]*
    - *Footing Height* = **36** *[3.0]*
    - *Footing Width* = **10** *[3.3]*

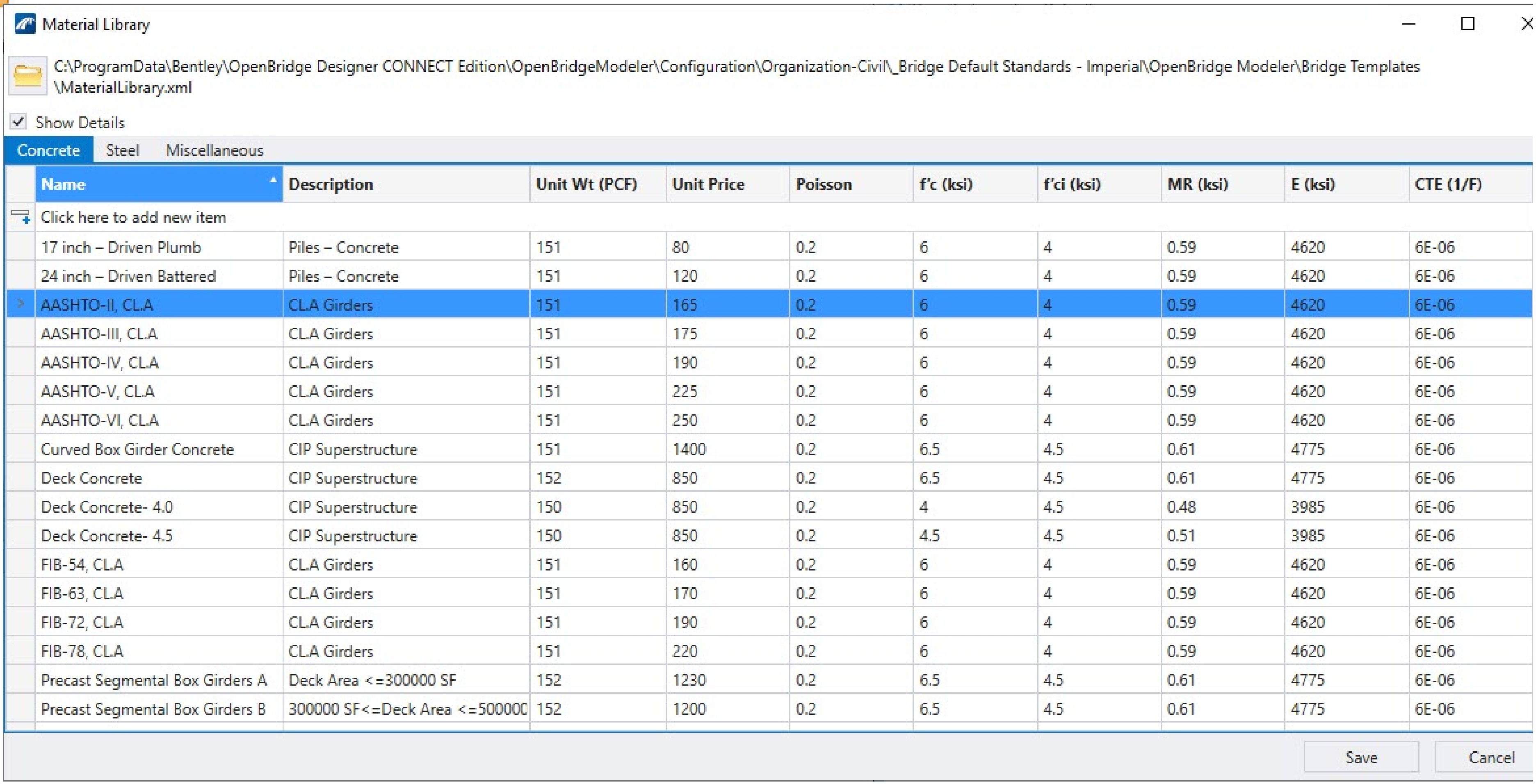
12. Select **OK** to accept the pile layout changes.



13. Select **OK** to accept the pier changes.
14. Review the **Florida Pier_Variable cap.** Review the variable cap and variable pier columns to see a more advanced pier configuration.
15. Close the *Pier Templates* window.

Create a Material Library Entry

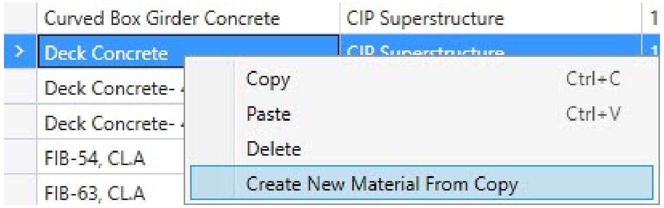
1. Open the file **Libraries.dgn** from the *Module 7 (Libraries)* folder.
2. Select *Utilities > Libraries >* **Material** to open the Material Library window.



Name	Description	Unit Wt (PCF)	Unit Price	Poisson	f'c (ksi)	f'ci (ksi)	MR (ksi)	E (ksi)	CTE (1/F)
17 inch – Driven Plumb	Piles – Concrete	151	80	0.2	6	4	0.59	4620	6E-06
24 inch – Driven Battered	Piles – Concrete	151	120	0.2	6	4	0.59	4620	6E-06
AASHTO-II, CL.A	CL.A Girders	151	165	0.2	6	4	0.59	4620	6E-06
AASHTO-III, CL.A	CL.A Girders	151	175	0.2	6	4	0.59	4620	6E-06
AASHTO-IV, CL.A	CL.A Girders	151	190	0.2	6	4	0.59	4620	6E-06
AASHTO-V, CL.A	CL.A Girders	151	225	0.2	6	4	0.59	4620	6E-06
AASHTO-VI, CL.A	CL.A Girders	151	250	0.2	6	4	0.59	4620	6E-06
Curved Box Girder Concrete	CIP Superstructure	151	1400	0.2	6.5	4.5	0.61	4775	6E-06
Deck Concrete	CIP Superstructure	152	850	0.2	6.5	4.5	0.61	4775	6E-06
Deck Concrete- 4.0	CIP Superstructure	150	850	0.2	4	4.5	0.48	3985	6E-06
Deck Concrete- 4.5	CIP Superstructure	150	850	0.2	4.5	4.5	0.51	3985	6E-06
FIB-54, CL.A	CL.A Girders	151	160	0.2	6	4	0.59	4620	6E-06
FIB-63, CL.A	CL.A Girders	151	170	0.2	6	4	0.59	4620	6E-06
FIB-72, CL.A	CL.A Girders	151	190	0.2	6	4	0.59	4620	6E-06
FIB-78, CL.A	CL.A Girders	151	220	0.2	6	4	0.59	4620	6E-06
Precast Segmental Box Girders A	Deck Area <=300000 SF	152	1230	0.2	6.5	4.5	0.61	4775	6E-06
Precast Segmental Box Girders B	300000 SF<=Deck Area <=50000C	152	1200	0.2	6.5	4.5	0.61	4775	6E-06

3. Right click on the *Deck Concrete* entry.

4. Select **Create New Material from Copy**.



5. Set the *Name* to **Deck Concrete 2**.

6. Change the following:

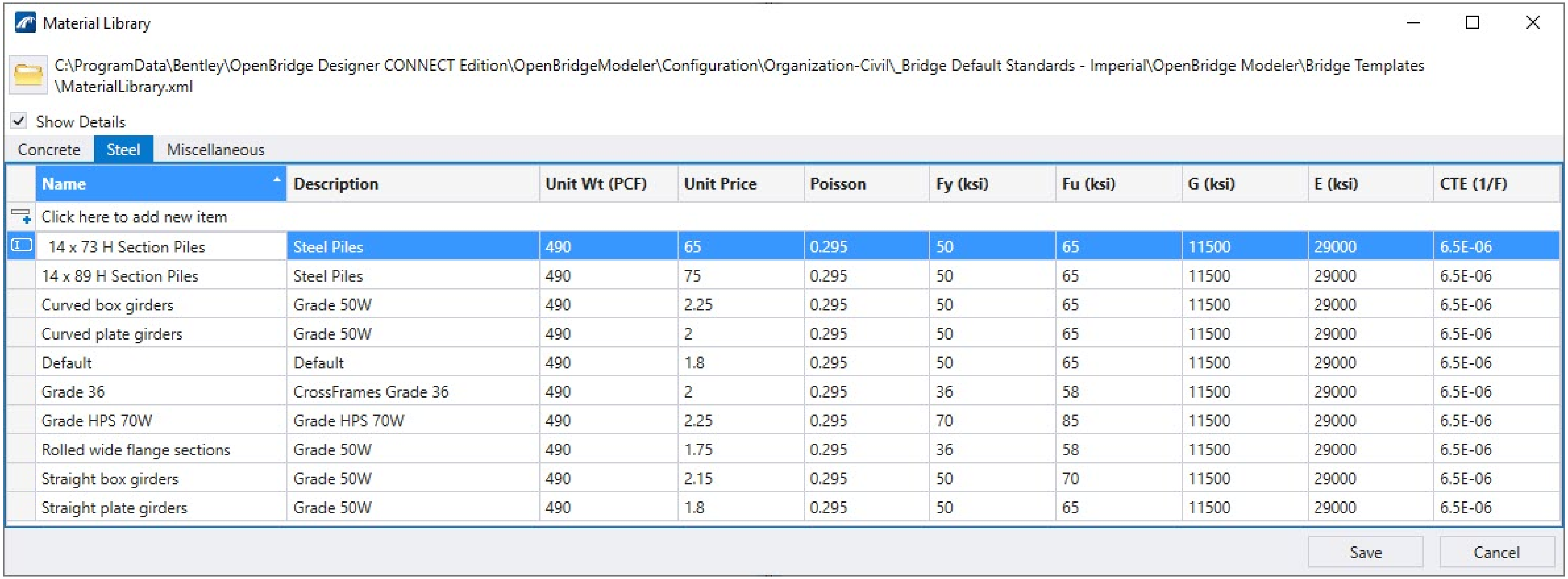
   - *Unit Price =* **750**
   - *f'c* = **4.0**
   - *f'ci* = **3.5**

7. Select the **Steel** tab.

8. Click on the first row to add a new entry. Add the following:

   - *Name* and *Description* = **Grade HPS 70W**
   - *Unit Weight* = **490.00** *[7849.0407]*
   - *Unit Price* = **2.25** *[2.25]*
   - *Poisson* = **0.2950** *[0.2950]*
   - *Fy* = **70.00** *[482.6330]*
   - *Fu* = **85.00** *[586.0544]*
   - *G* = **11,500.00** *[79,289.71]*
   - *E* = **29,000.00** *[199,947.97]*
   - *CTE* = **0.0000065** *[0.00001080]*

9. Click **Save** to save the new entry.



Name	Description	Unit Wt (PCF)	Unit Price	Poisson	Fy (ksi)	Fu (ksi)	G (ksi)	E (ksi)	CTE (1/F)
Click here to add new item									
14 x 73 H Section Piles	Steel Piles	490	65	0.295	50	65	11500	29000	6.5E-06
14 x 89 H Section Piles	Steel Piles	490	75	0.295	50	65	11500	29000	6.5E-06
Curved box girders	Grade 50W	490	2.25	0.295	50	65	11500	29000	6.5E-06
Curved plate girders	Grade 50W	490	2	0.295	50	65	11500	29000	6.5E-06
Default	Default	490	1.8	0.295	50	65	11500	29000	6.5E-06
Grade 36	CrossFrames Grade 36	490	2	0.295	36	58	11500	29000	6.5E-06
Grade HPS 70W	Grade HPS 70W	490	2.25	0.295	70	85	11500	29000	6.5E-06
Rolled wide flange sections	Grade 50W	490	1.75	0.295	36	58	11500	29000	6.5E-06
Straight box girders	Grade 50W	490	2.15	0.295	50	70	11500	29000	6.5E-06
Straight plate girders	Grade 50W	490	1.8	0.295	50	65	11500	29000	6.5E-06

10. Close OpenBridge Modeler prior to starting the next exercise.

Module 8: Reports

Description

In this module you will learn how to create reports for quantities, deck elevations, camber and others that are included with OpenBridge Modeler.

Objectives

- Create a Quantities Report
- Create an Input Report
- Create a Deck Elevation Report
- Create a Beam Report
- Create a Bearing Seat Report
- Create a Camber Report

Create a Quantities Report

1. Select the **Add Standalone Group** icon and name it *Module 8*. (OBD only)
2. Start OpenBridge Modeler.
3. Open the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
4. Select *Reports and Drawings > Bridge Reporting>* **Quantities Report** to open the report Preview window.
5. Click **Submit** to create the quantity report.

Bridge Name: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Materials Quantity Report

Superstructure Quantities

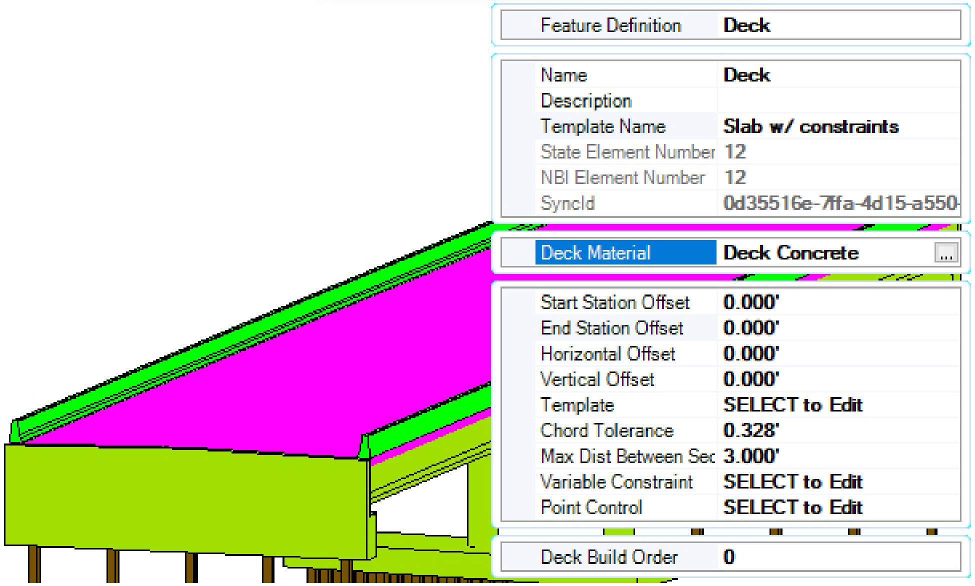
Component Name	Component Type	Material Name	Material Type	Pay Unit	Unit Price	Quantity	Cost
Deck	Deck (Slab w/ constraints)	Deck Concrete-4.0	Concrete	Cubic Yard	850.00	334.161	284036.76
	Haunch	Deck Concrete-4.0	Concrete	Cubic Yard	850.00	41.299	35104.30
BeamSegment1	Beam (PCEF 5548)	AASHTO-II, CL.A	Concrete	LF	165.00	1494.000	246510.00
						Total	565651.07

Substructure Quantities

Component Name	Component Type	Material Name	Material Type	Pay Unit	Unit Price	Quantity	Cost
Abutment1	Cap	Substructure Concrete	Concrete	Cubic Yard	800.00	38.366	30692.84
	Piles	14 x 73 H Section Piles	Steel	LF	65.00	180.000	11700.00
	Bearing Seat	Substructure Concrete	Concrete	Cubic Yard	800.00	1.130	904.05
Pier1	Cap	Substructure Concrete	Concrete	Cubic Yard	800.00	26.330	21064.38

6. Close the Preview Window.

7. Select the bridge deck then open the properties window.



8. Set the *Material Name* to **Deck Concrete 4.5**.

9. Select *Reports and Drawings > Bridge Reporting>* **Quantities Report** to open the report Preview window.

10. Click **Submit** to create the quantity report. Note that the deck Material Name has changed.

Bridge Name: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Materials Quantity Report

Superstructure Quantities

Component Name	Component Type	Material Name	Material Type	Pay Unit	Unit Price	Quantity	Cost
Deck	Deck (Slab w/ constraints)	Deck Concrete-4.5	Concrete	Cubic Yard	850.00	294.062	249952.65
	Haunch	Deck Concrete-4.5	Concrete	Cubic Yard	850.00	30.240	25704.21
BeamSegment1	Beam (PCBT-61)	AASHTO-II, CL.A	Concrete	LF	165.00	1095.000	180675.00

11. Export the report to a PDF format and XLS file.

12. Close the Print Preview window.

Create an Input Report

1. Continue using the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
2. Select *Reports and Drawings > Bridge Reporting>* **Input Report** to open the report Preview window.
3. Select **Submit** to create the report.

Bridge Name: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Bridge Type and Geometry	
Bridge Type	Beam Slab (P/S or RC Concrete Girders)
Requires Road Alignment	No
Road Alignment	Not Set
Use Road Alignment For Stationing	No
Bridge Alignment	Route97
Active Profile	Route97_V

Deck Input Report

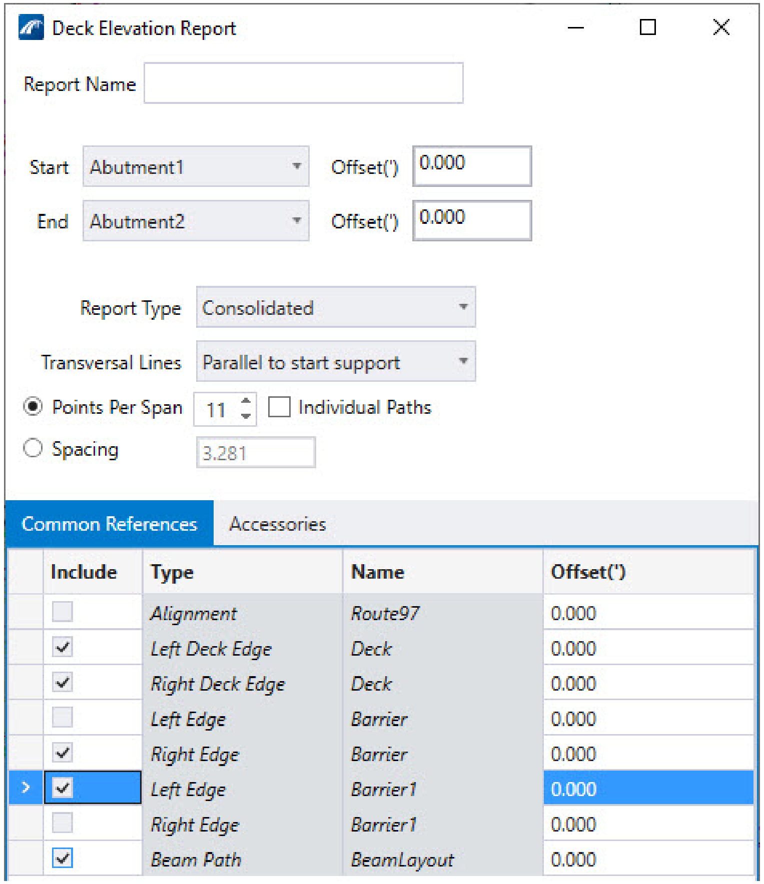
Deck	
Name	Deck
Start SupportLine	Abutment1
End SupportLine	Abutment2
Template Name	Slab w/ constraints
Start Station Offset (')	0.000
End Station Offset (')	0.000
Horizontal Offset (')	0.000
Vertical Offset (')	0.000
Solid Placement	

4. Close the Print Preview window.

Create a Deck Elevation Report

1. Continue using the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
2. Select *Reports and Drawings > Bridge Reporting>* **Deck**.
3. Select the first and last support lines and accept.

4. Populate the *Deck Elevation Report* window as shown and click **Generate**.



Deck Elevation Report

(Parallel to start support)

Span 1 (')															
Location	Start Support Line	Start Bearing Line	1	2	3	4	5	6	7	8	9	10	11	End Bearing Line	End Support Line
DeckEdgeLeft with offset = 0.000 (Deck)P_5	162.017	162.024	162.017	162.088	162.154	162.217	162.275	162.330	162.381	162.429	162.472	162.512	162.547	162.544	162.547
Barrier - RightEdge with offset = 0.000 (Deck)P_3	162.049	162.056	162.049	162.119	162.186	162.249	162.308	162.363	162.414	162.461	162.505	162.544	162.580	162.577	162.580
BeamPath with offset = 0.000 (Deck) Beam-L	162.074	162.081	162.074	162.145	162.212	162.274	162.333	162.388	162.440	162.487	162.531	162.570	162.606	162.603	162.606
BeamPath with offset = 0.000 (Deck) Beam-2	162.256	162.262	162.256	162.327	162.394	162.457	162.516	162.572	162.624	162.671	162.715	162.756	162.792	162.789	162.792
BeamPath with offset = 0.000 (Deck) Beam-3	162.437	162.443	162.437	162.508	162.576	162.639	162.699	162.755	162.808	162.856	162.900	162.941	162.978	162.974	162.978

5. **Export** the report to an XLS file and review.
6. Close the *Print Preview* window.
7. Close the *Deck Elevation Report* window.

Create a Beam Report

1. Continue using the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
2. Select *Reports and Drawings > Bridge Reporting>* **Beam**.
3. Review the results in the *Preview* window.

Bridge Name: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Beam Report

Span	Beam	True Length (')	Projected Length (')	Bearing to Bearing (')	Beam Grade (%)	Direction	Rotation
Abutment1 - Pier1	Beam-L	109.501	109.500	107.980	0.483	-20.0299°	0°
	Beam-2	109.501	109.500	107.980	0.488	-20.0299°	0°
	Beam-3	109.501	109.500	107.980	0.492	-20.0299°	0°
	Beam-4	109.501	109.500	107.980	0.496	-20.0299°	0°
	Beam-R	109.501	109.500	107.980	0.500	-20.0299°	0°
Pier1 - Abutment2	Beam-L	109.500	109.500	107.980	0.133	-20.0299°	0°
	Beam-2	109.500	109.500	107.980	0.137	-20.0299°	0°
	Beam-3	109.500	109.500	107.980	0.142	-20.0299°	0°
	Beam-4	109.500	109.500	107.980	0.146	-20.0299°	0°
	Beam-R	109.500	109.500	107.980	0.150	-20.0299°	0°

Note that the Beam Elevations are computed and directly related to the defined haunch values for the beams. If the Compute toggle is enabled, the elevations are computed based on the values stored on each beam. If the Compute toggle is disabled, no camber is considered and beam elevations are computed using the inputted haunch values and assumes the beams are straight from one support to the next.

Create a Bearing Seat Report

1. Continue using the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
2. Select *Reports and Drawings > Bridge Reporting>* **Bearing Seat**. The report is generated and opened.
3. Review the report.

Bridge Name: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Bearing Seats and Grout Pads or Bevel Plates Report

Precast

Bearing Seats

Elevation

Support Line Name	Bearing Line	Girder1(')	Girder2(')	Girder3(')	Girder4(')	Girder5(')
Pier2	Ahead	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R
		155.351	155.533	155.714	155.515	155.316
Pier1	Back	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R
		155.873	156.059	156.245	156.051	155.856
	Ahead	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R
		155.879	156.065	156.251	156.057	155.863
Pier3	Back	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R
		156.023	156.214	156.404	156.214	156.025

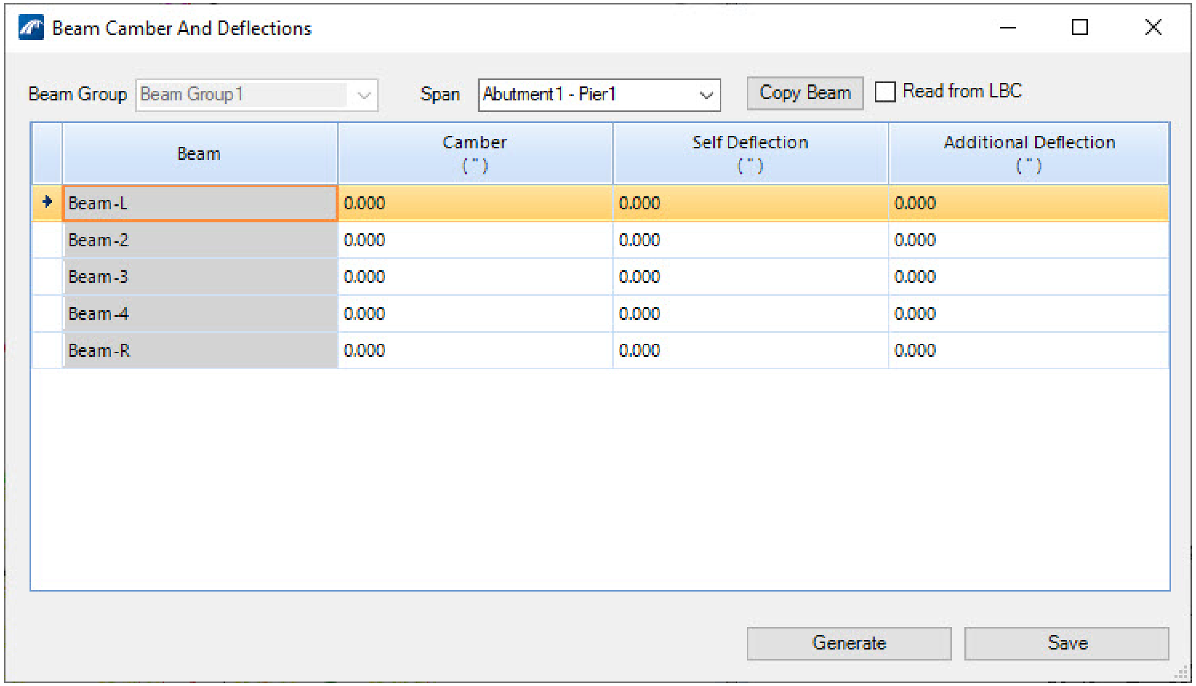
Thickness at Center

Support Line Name	Bearing Line	Girder1(')	Girder2(')	Girder3(')	Girder4(')	Girder5(')
Pier2	Ahead	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R
		0.202	0.383	0.565	0.366	0.167
Pier1	Back	Beam-L	Beam-2	Beam-3	Beam-4	Beam-R

4. Close the *Preview* window.

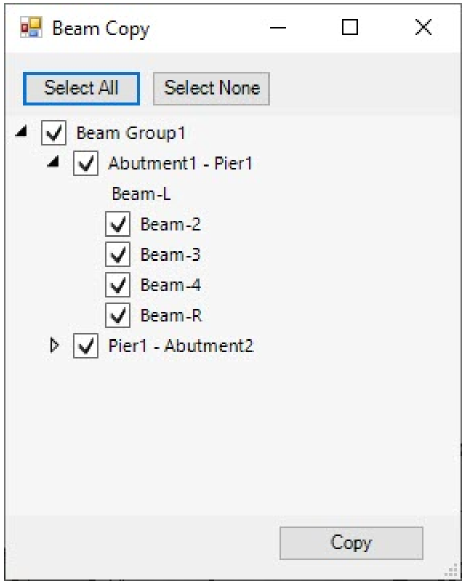
Create a Camber Report

1. Continue using the file **Precast Bridge.dgn** from the *Module 8 (Reports)* folder.
2. Select *Reports and Drawings > Bridge Reporting>* **Camber**.



3. Input a *Camber* of **2.6** *[66]* and a *Self Deflection* of **-1** *[-25]* for Beam-L.

4. Click Copy Beam, then click Select All, then click Copy to copy the camber and deflection information to all beams.



5. Click **Generate** to open the *Preview* window.

6. Click **Submit** to create the report.

Bridge: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Group: Beam Group1

Span: Abutment1 - Pier1

Beam: Beam-L
Input: Camber = 2.600 ", Self. Defl. = -1.000 ", Add'l. Defl. = 0.000 "

Check Point	Dist. Along CL WPT-WPT ()	Final Deck Elevation ()	Screed Elevation ()	Girder Top Elevation (Erected) ()	Screed Ht. Above Girder ()
1	0.000	162.076	162.076	160.931	1.145
2	10.950	162.146	162.176	161.062	1.114
3	21.899	162.212	162.266	161.176	1.090
4	32.849	162.275	162.345	161.272	1.073
5	43.798	162.334	162.414	161.351	1.063
6	54.748	162.388	162.472	161.412	1.059
7	65.697	162.439	162.519	161.457	1.063
8	76.647	162.487	162.557	161.483	1.073
9	87.596	162.530	162.583	161.493	1.090
10	98.546	162.570	162.600	161.485	1.114
11	109.495	162.605	162.605	161.460	1.145

Beam: Beam-2
Input: Camber = 2.600 ", Self. Defl. = -1.000 ", Add'l. Defl. = 0.000 "

Check Point	Dist. Along CL WPT-WPT ()	Final Deck Elevation ()	Screed Elevation ()	Girder Top Elevation (Erected) ()	Screed Ht. Above Girder ()
1	0.000	162.257	162.257	161.112	1.145
2	10.950	162.328	162.358	161.244	1.114
3	21.899	162.395	162.448	161.358	1.090
4	32.849	162.457	162.527	161.454	1.073

7. Close the *Preview* window.

Module 9: Interoperability

Description

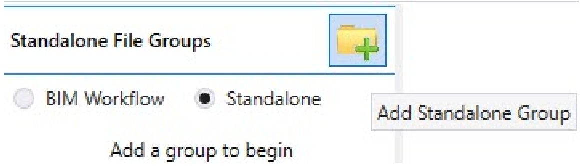
In this module you will learn how to transfer the 3D physical model from OBM to the appropriate analytical product for analysis, design and load rating.

Objectives

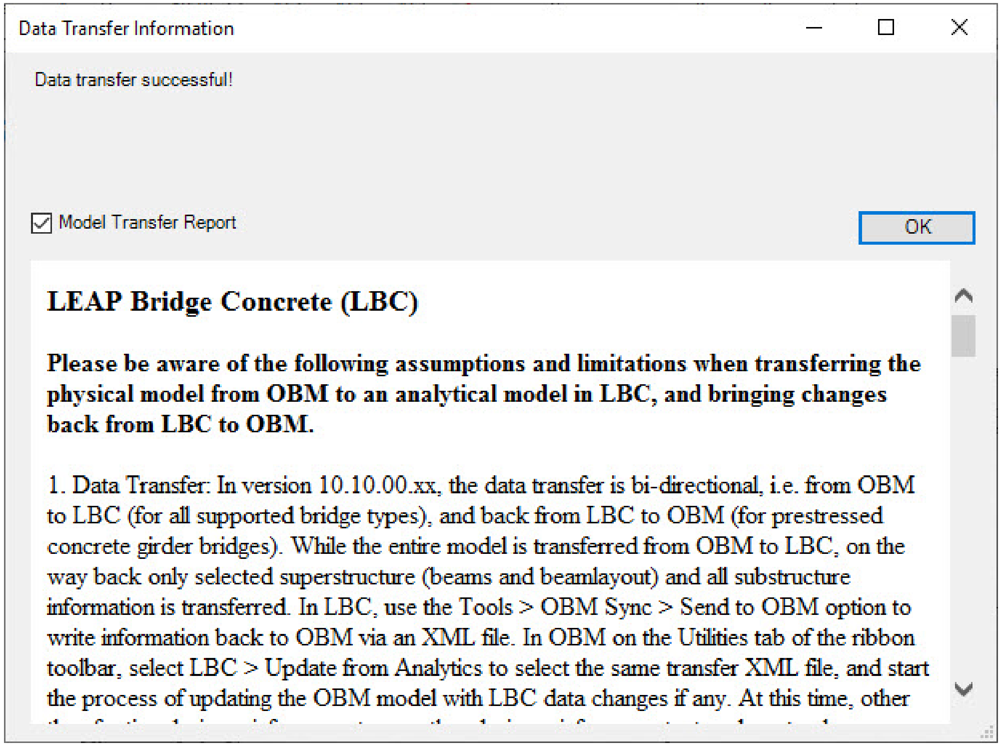
- Send a P/S Concrete Girder bridge to LEAP Bridge Concrete
- Send a Steel Girder bridge to LEAP Bridge Steel

P/S Concrete Girder Bridge - Send to OBM/Geometry

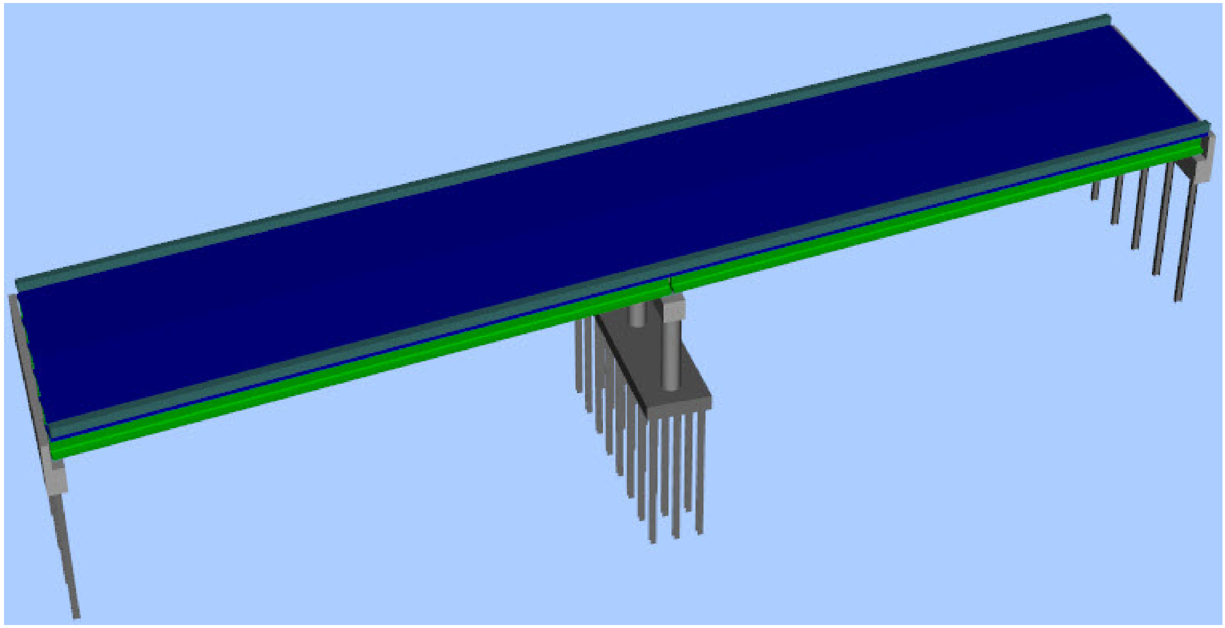
1. Create a Standalone project by selecting the **Add Standalone Group** icon and name it *Module 9 - LBC*. (OBD only)



2. Start OpenBridge Modeler.
3. Open the file **Precast Bridge.dgn** from the *Module 9 (Interoperability)* folder.
4. Select *Utilities > Interoperability > LEAP Bridge Concrete >* **Send To** to open the Data Transfer Information window.

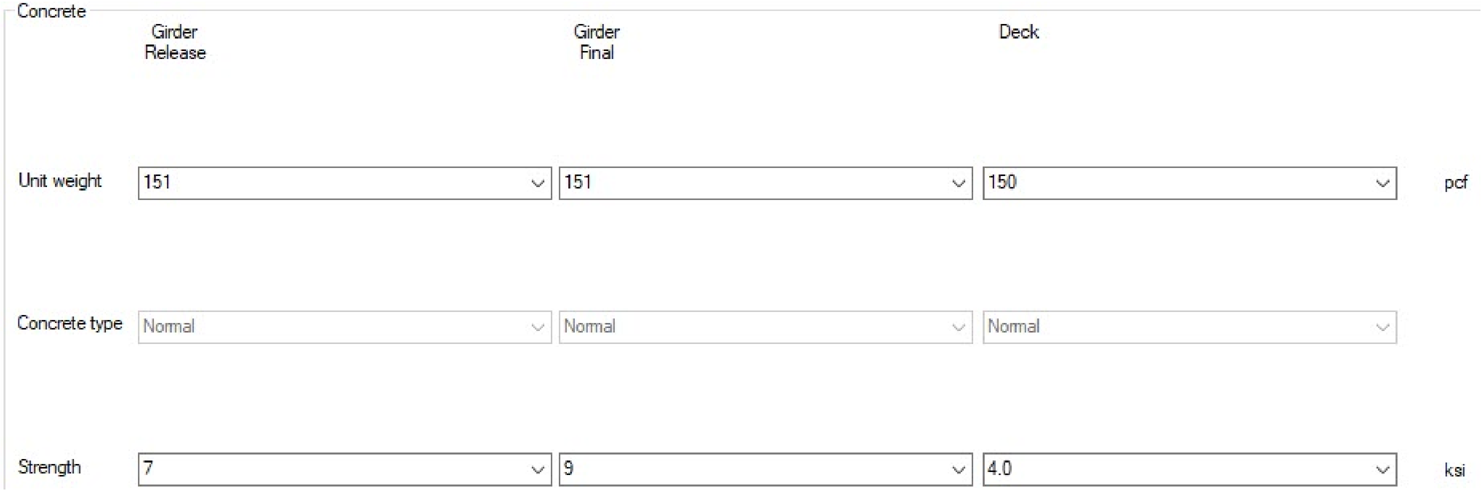


5. Review the **Model Transfer Report** option to review the assumptions made when sending the physical model to the analytical software.
6. Click **OK** to send the bridge to LEAP Bridge Concrete.
7. Once LEAP Bridge opens, click **OK** when prompted to confirm the successful data transfer.
8. Select the *Geometry* tab. Fit the view to see the bridge model.



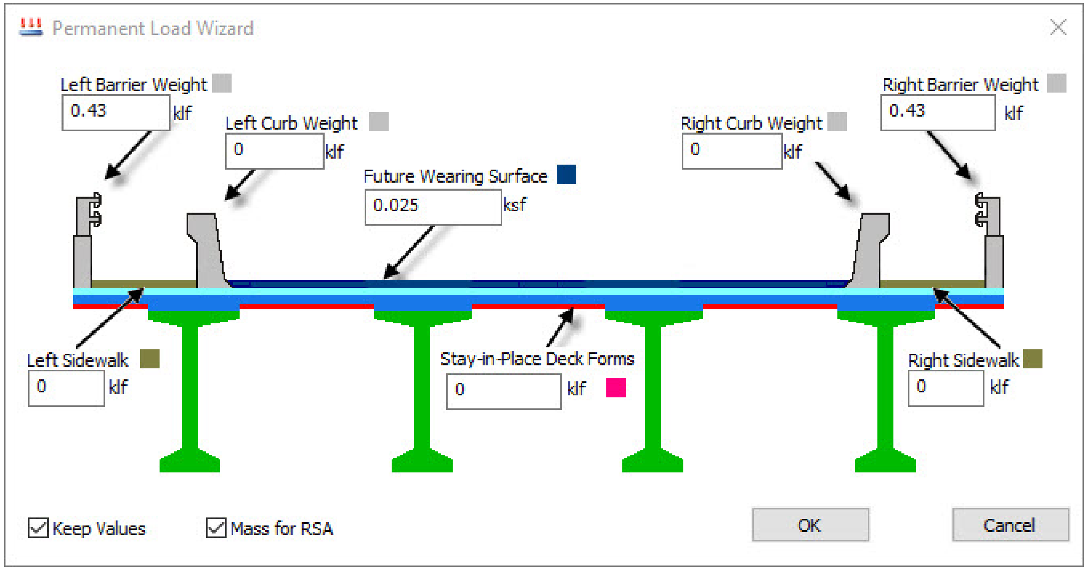
9. Select the **Superstructure** tab.
10. Select the **Precast/Prestressed Girder** button.
11. From Precast/Prestressed Girder, select the **Geometry** tab.
12. Change the *Topping Data* as shown to the right.
13. Select the **Materials** tab.

14. Set the Concrete properties as shown below.

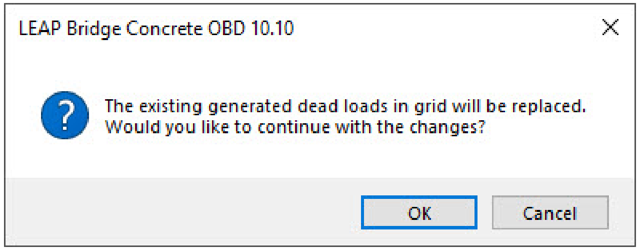


15. Select **6/10-270K-LL** *Prestressing Tendon* as the default tendon.

1. Continuing in LEAP Bridge Concrete.
2. Select **Loads** tab. Notice that the defined barrier loads are pre-populated.
3. Select **Wizard...** and populate as shown.

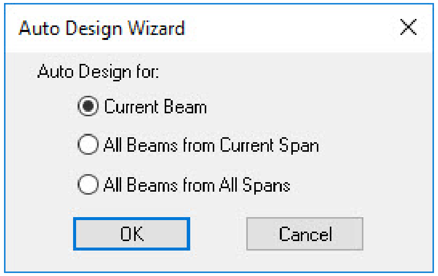


4. Click **OK** to accept the new superimposed dead loads.
5. Click **OK** to replace the automatically generated loads for the barriers.



P/S Concrete Girder Bridge - Beam Design

1. Continuing in LEAP Bridge Concrete.
2. Select **Beam** tab.
3. Select **Strand Pattern…**.
4. Select **Auto Design**. Click **OK** to design the current beam.



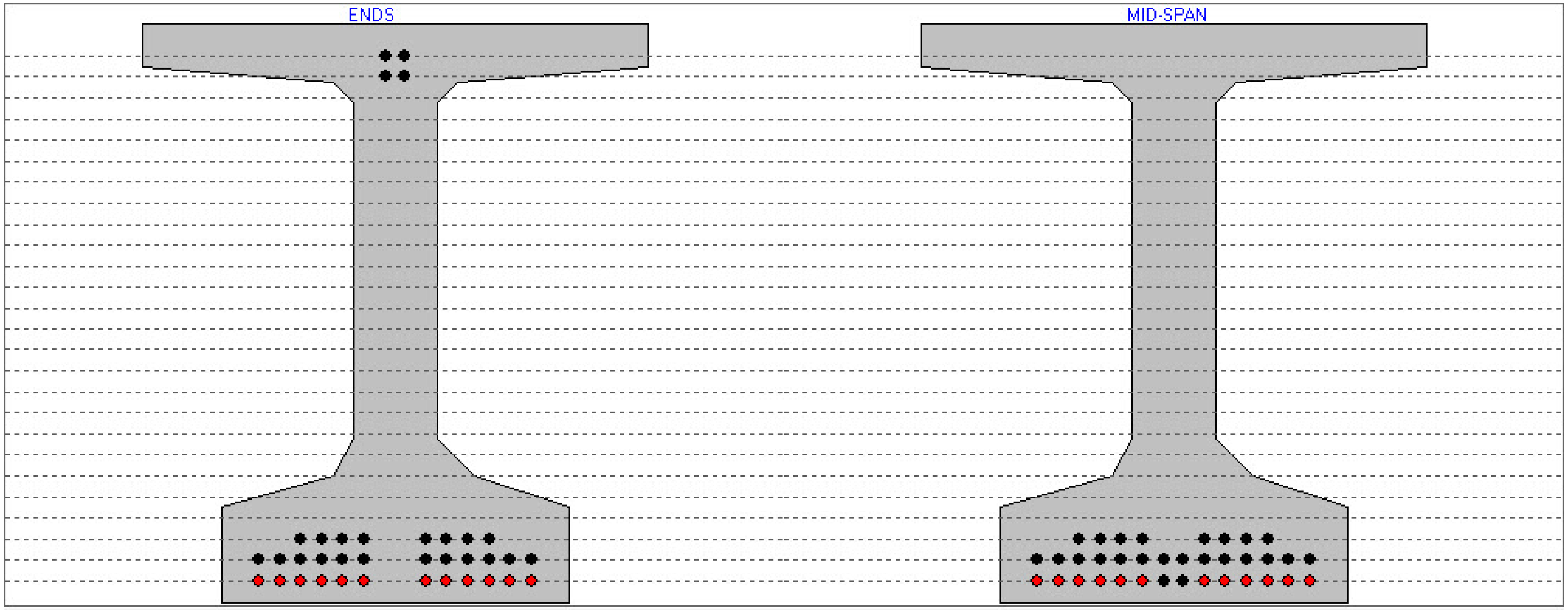
5. While reviewing the design you will see that the designed strand pattern works fine but the Camber/Deflection at Midspan is a negative value.

CAMBER / DEFLECTION (in) at Midspan (0.5 x L = 54.00 ft)

Release Stress, computed vs. limiting	OK
Final Stress, computed vs. limiting	OK
Ultimate Moment, required vs. provided	OK

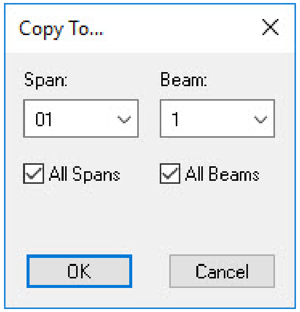
SERVICE I					
	Release	Mult	Erection	Mult	Final
Prestress	2.689	1.80	4.839	2.20	5.915
Self Wt.	-1.626	1.85	-3.009	2.40	-3.903
Deck + Haunch			-1.205	2.30	-2.772
DL-Prec. (DC)			-0.125	3.00	-0.374
Diaphragm			0.000	3.00	0.000
DL-Prec. (DW)			0.000	3.00	0.000
DL-Comp. (DC)			-0.041	3.00	-0.123
DL-Comp. (DW)			-0.049	3.00	-0.146
Total	1.062		0.411		-1.404

6. Using the Wizard or by modifying the table, change the strand layout as shown. This will result in a positive camber but also require about 1 sq inch of steel in the top flange of the beam.



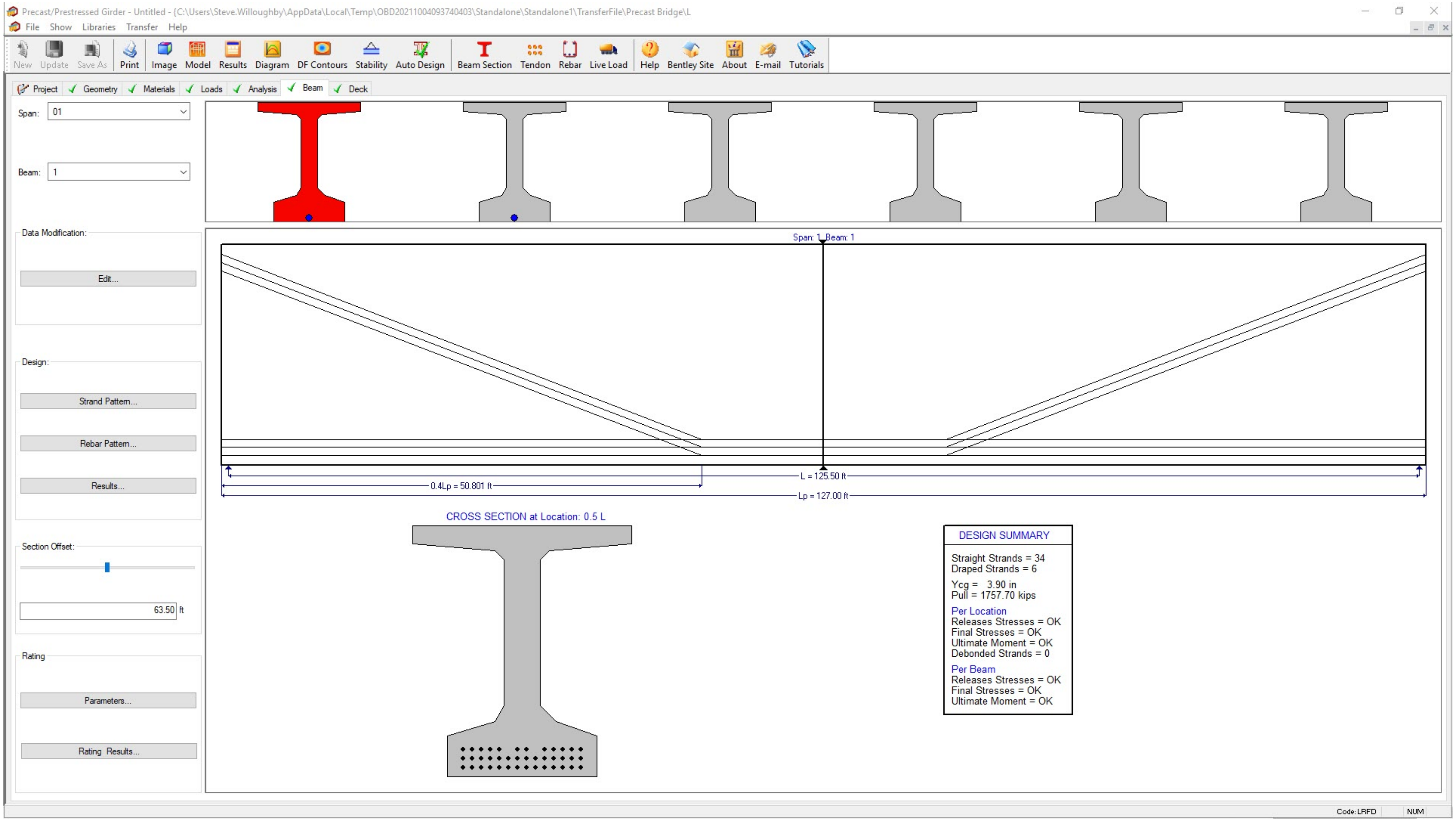
Type	End Template	End Height	Middle Height	# of Strands
Straight	14	2.00	----	12
Straight	14	4.00	----	12
Straight	12	6.00	----	8
Draped	2	50.00	2.0000	2
Draped	2	52.00	4.0000	2

7. Use the **Copy to...** button to copy the design too all girders in all spans.



8. Select **OK** to accept the strand design.

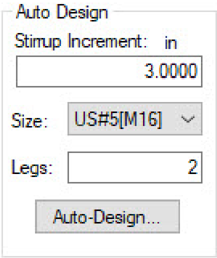
9. Select Beam 2 graphically. Notice that the Design is sufficient.



10. Select Beam 2 in Span 01.

11. Select the **Rebar Pattern ...** tool.

12. Populate the Auto Design section as shown and click **Auto-Design...** .



13. Modify the values through the 24” spacing as shown. Then click the **Make Symmetrical** button.

Number of Legs	Stirrup Size	Stirrup Area (in^2)	Stirrup Spacing (in)	Extends to Deck	Start (ft)	End (ft)
2	US#5[M16]	0.620	3.00	✗ No	0.0000	6.0000
2	US#5[M16]	0.620	6.00	✗ No	6.0000	8.0000
2	US#5[M16]	0.620	9.00	✗ No	8.0000	10.0000
2	US#5[M16]	0.620	12.00	✗ No	10.0000	12.0000
2	US#5[M16]	0.620	24.00	✗ No	12.0000	97.5016
2	US#5[M16]	0.620	12.00	✗ No	97.5016	99.5016
2	US#5[M16]	0.620	9.00	✗ No	99.5016	101.5016
2	US#5[M16]	0.620	6.00	✗ No	101.5016	103.5016

14. Use the **Copy to...** button to copy the design too all girders in all spans.

15. Select the **Rebars in Beam** tab. Add two rows to the table as shown to satisfy the mild steel requirement for the top flange.

Number of Bars	Rebar Size	Rebar Dist. From Top (in)	Rebar Area (in^2)	Start (ft)	End (ft)	Side Cover (in)
4	US#5[M16]	2.00	1.240	0.0000	8.0000	3.00
4	US#5[M16]	2.00	1.240	101.5000	109.5000	3.00

16. Click **OK** to close the *Rebar Pattern* window.

17. Select **Strand Pattern...** to verify that the *Ast_prvd, in2* requirement is satisfied.

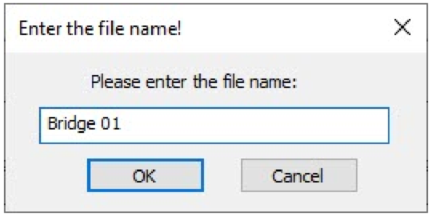
Computed Stresses	
	Trans
Location, ft	3.000
Precast-top	-0.270
Bottom	3.289
As_top, in2	0.903
Ast_prvd, in2	1.240

18. Close the **Strand Pattern** window.

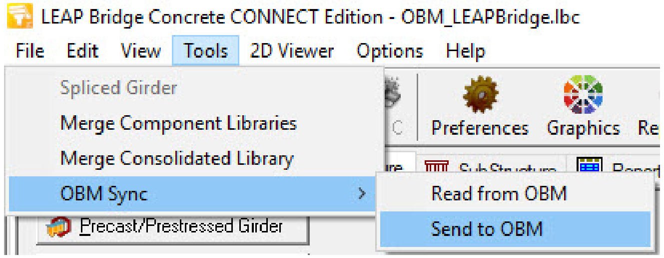
19. Close the **Precast/Prestressed Girder** window.

20. Select **Yes** to update the LEAP Bridge Concrete model and **No** to the Generate Reports prompt.

21. Select *File >Save* to save the LBC file. Key-in a file name and click **OK**. This will save the file to the OBDx file.

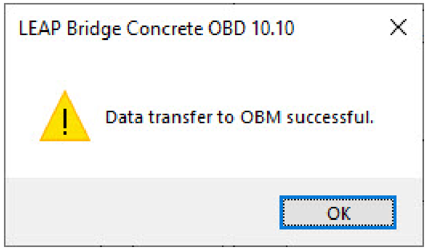


22. Select *Tools > OBM Sync >* **Send to OBM**.



23. When prompted, enter a file name **LEAP2OBM** and click *Save*. Save the file to the same folder as the dgn file to locate easily in a future step.

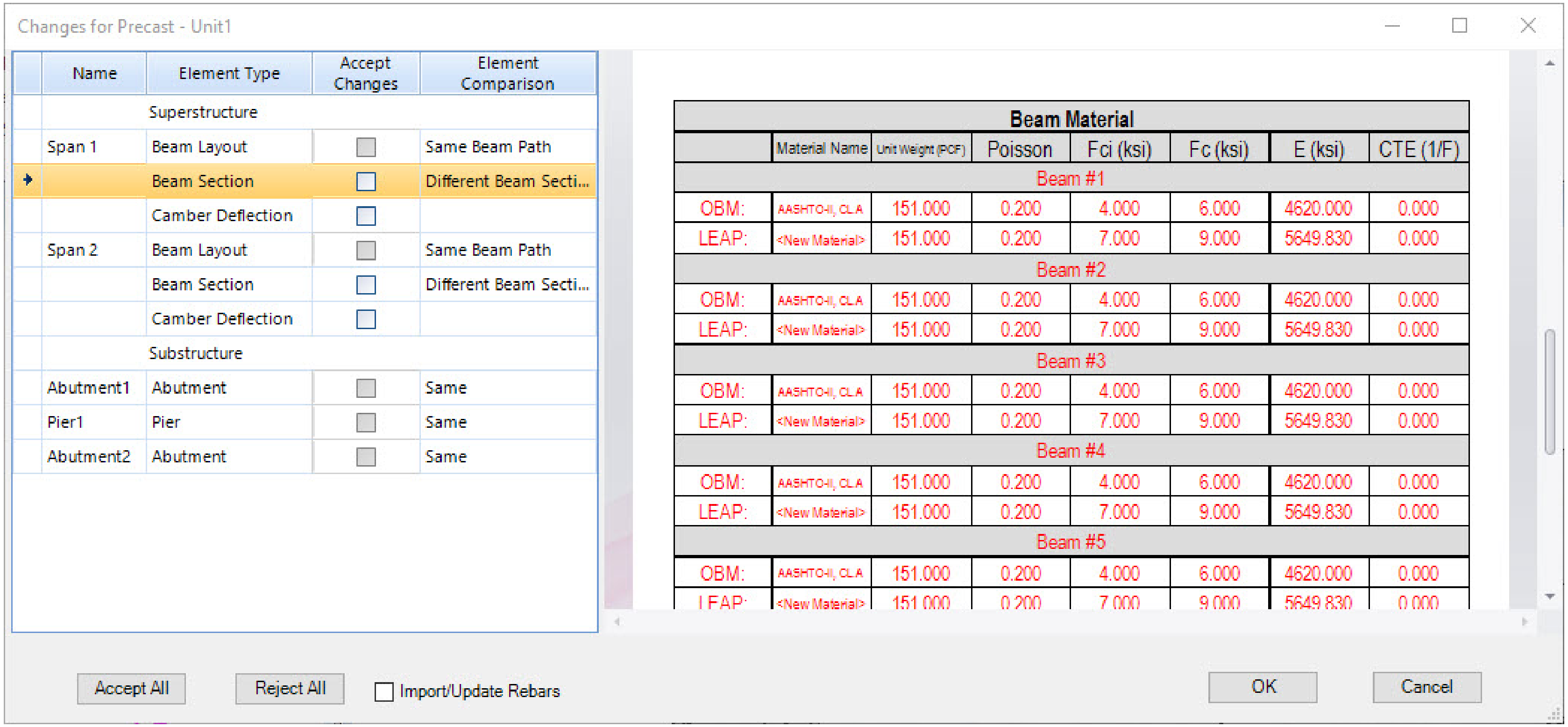
24. Click **OK** to note the successful data transfer.



25. Close LBC.

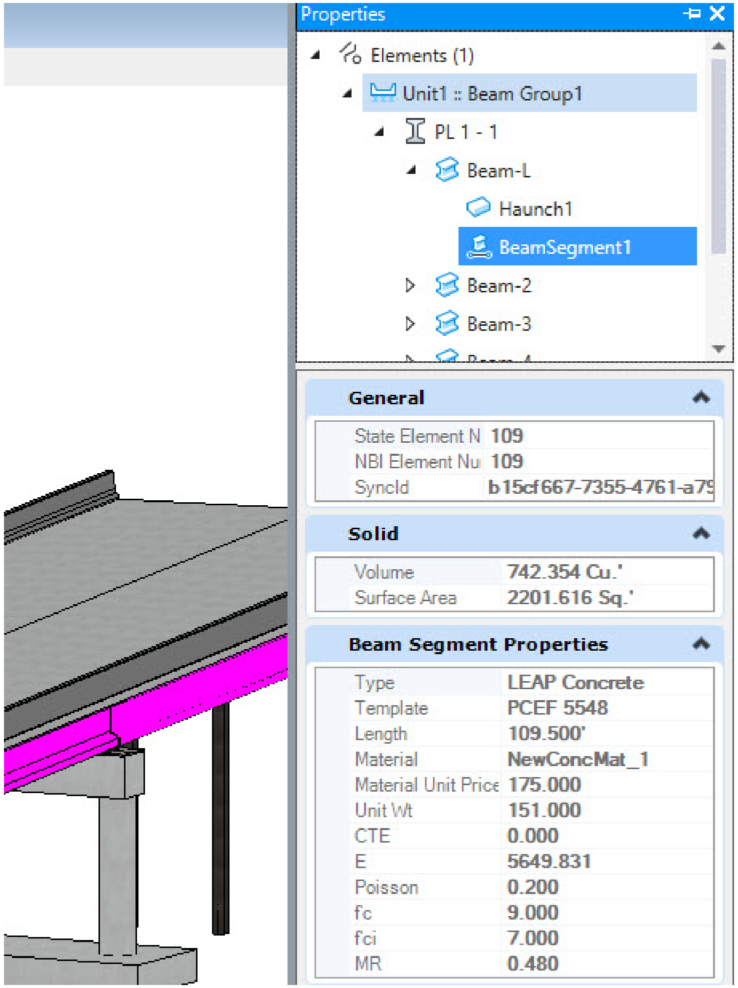
P/S Concrete Girder Bridge - Update OBM Model

1. Continuing in OpenBridge Modeler...
2. From the OpenBridge Modeler workflow, select the *Utilities > Interoperability > LEAP Bridge Concrete >* **Update From Analytics** tool.
3. Select the **LEAP2OBM.xml** file created in the previous exercise.
4. Click **Open** to start the update process.
5. Select **Beam Section** from the *Element Type* column. Review the changes to the beams.



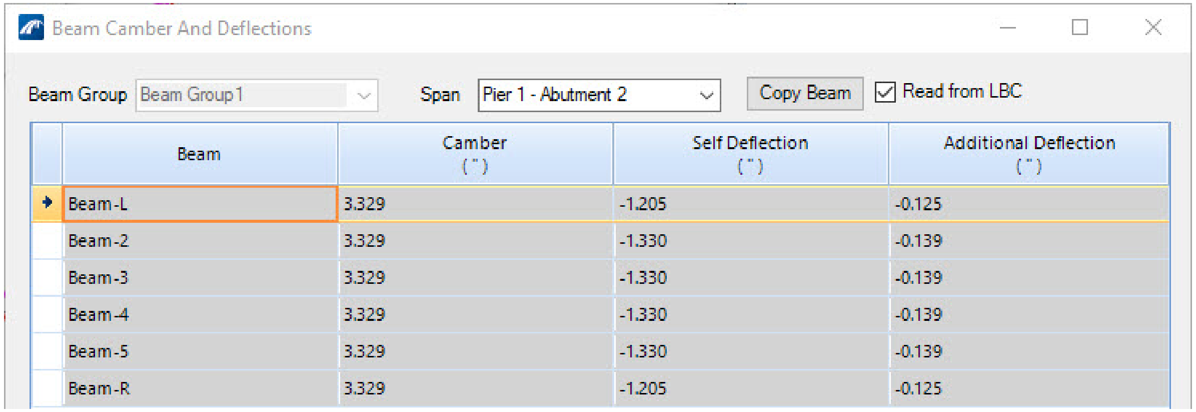
6. Click **Accept All** to accept all analytical model changes.
7. Click **OK** to update the physical model in OBM.

8. Select one of the beams and review the properties to see the changes to the material properties.



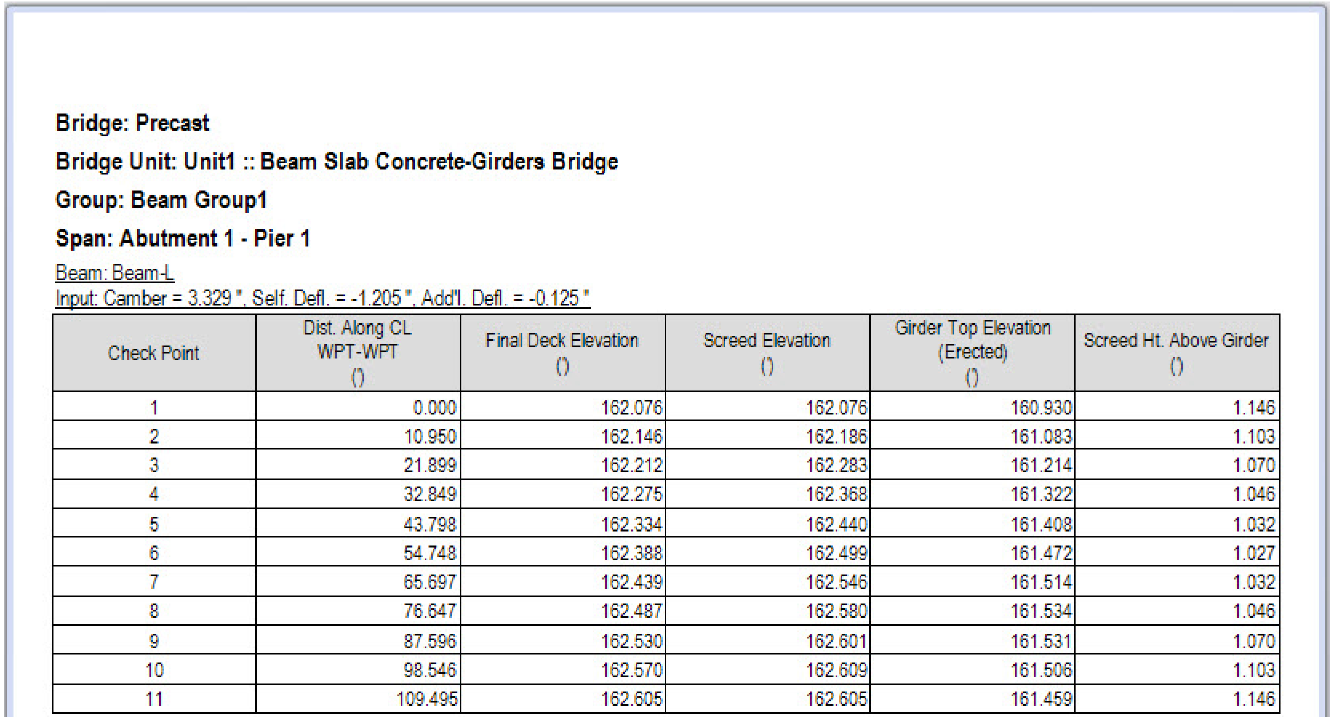
9. Select *Reports and Drawings > Bridge Reporting>* **Camber** tool.

10. Enable the **Read from LBC** toggle to populate the table.



Beam	Camber (")	Self Deflection (")	Additional Deflection (")
Beam-L	3.329	-1.205	-0.125
Beam-2	3.329	-1.330	-0.139
Beam-3	3.329	-1.330	-0.139
Beam-4	3.329	-1.330	-0.139
Beam-5	3.329	-1.330	-0.139
Beam-R	3.329	-1.205	-0.125

11. Select **Generate** to open the Preview window. Select **Submit** to create the report.



Bridge: Precast

Bridge Unit: Unit1 :: Beam Slab Concrete-Girders Bridge

Group: Beam Group1

Span: Abutment 1 - Pier 1

Beam: Beam-L

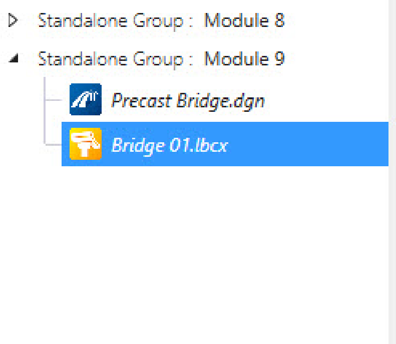
Input: Camber = 3.329 ", Self. Defl. = -1.205 ", Add'l. Defl. = -0.125 "

Check Point	Dist. Along CL WPT-WPT ()	Final Deck Elevation ()	Screed Elevation ()	Girder Top Elevation (Erected) ()	Screed Ht. Above Girder ()
1	0.000	162.076	162.076	160.930	1.146
2	10.950	162.146	162.186	161.083	1.103
3	21.899	162.212	162.283	161.214	1.070
4	32.849	162.275	162.368	161.322	1.046
5	43.798	162.334	162.440	161.408	1.032
6	54.748	162.388	162.499	161.472	1.027
7	65.697	162.439	162.546	161.514	1.032
8	76.647	162.487	162.580	161.534	1.046
9	87.596	162.530	162.601	161.531	1.070
10	98.546	162.570	162.609	161.506	1.103
11	109.495	162.605	162.605	161.459	1.146

12. Close the Preview window after reviewing.

LEAP Concrete - Substructure Design

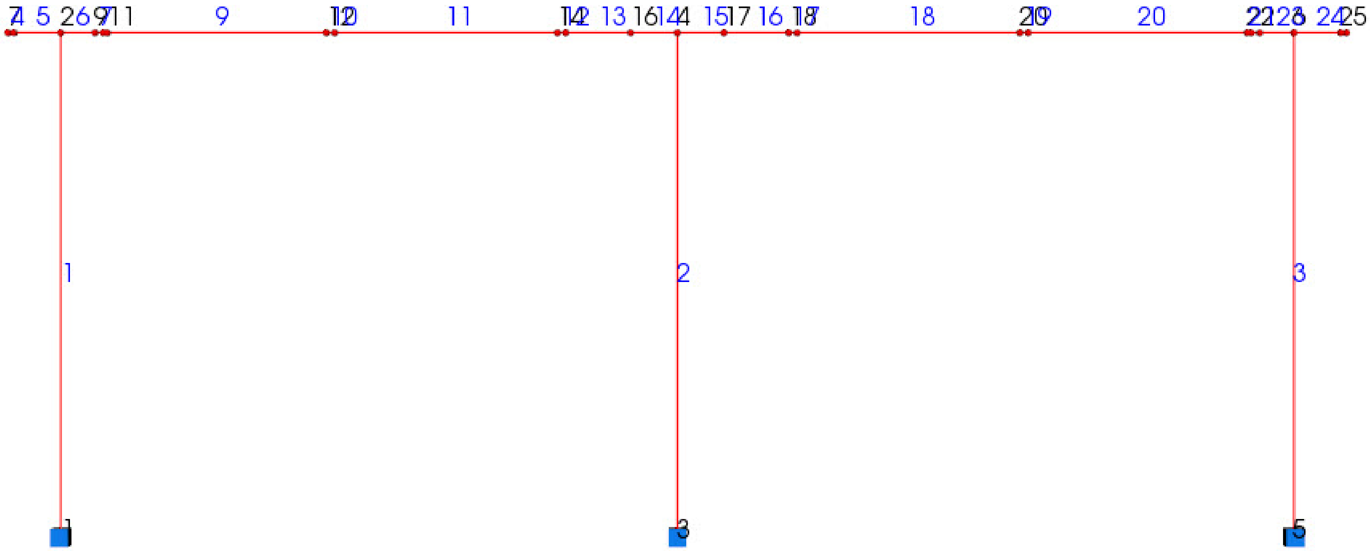
1. From the OpenBridge Designer window, select the *Bridge 01.lbcx* file created previously.



2. Launch **LEAP Bridge Concrete** .
3. Select the **Substructure** tab with Pier 1 highlighted.
4. Select the **Geometry** tab to review and verify the pier geometry. Note that the geometry can be changed in the standalone workflow and sent back to OBM to update the 3D physical model of the structure.

5. Select the **Model** button.

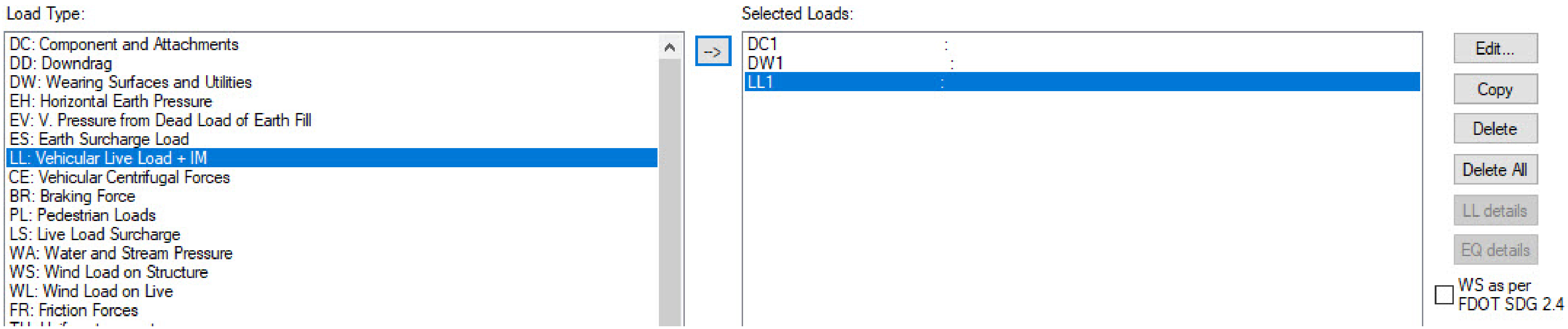
6. Enable the **Node Number** and **Model Number** toggles.



7. Close the *Model* view.

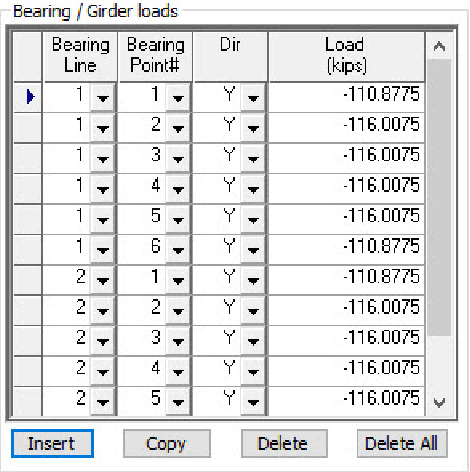
Define Substructure Loads

1. Select the **Loads** tab.
2. From the **Load Type** window, select the *DC*, *DW* and *LL* loads one at a time and push them to the **Selected Loads** window using the arrow icon between the windows.



3. Click the **DC1** load from the *Selected Loads* window.
4. Click **Edit...** .
5. Click the **Generate** button.
6. From the *Auto Load Generation* window, enable the radio button for **Read composite dead load reaction from Superstructure**, then click **Read**.

7. Click **Generate** at the bottom of the window to create the bearing loads.



8. Click **OK** to accept the generated *DC1* loads.

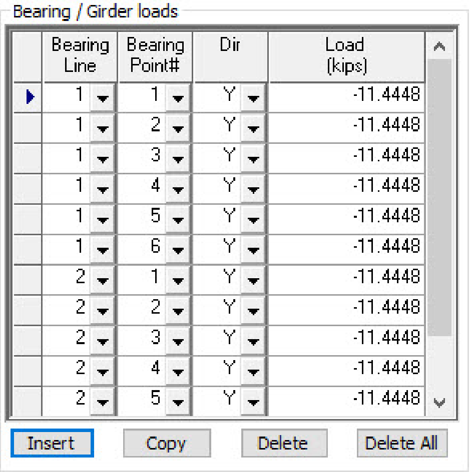
9. Click the **DW1** load from the *Selected Loads* window.

10. Click **Edit...** .

11. Click the **Generate** button.

12. From the *Auto Load Generation* window, enable the radio button for **Read composite dead load reaction from Superstructure**, then click **Read**.

13. Click **Generate** at the bottom of the window to create the bearing loads.



Bearing / Girder loads

Bearing Line	Bearing Point#	Dir	Load (kips)
1	1	Y	-11.4448
1	2	Y	-11.4448
1	3	Y	-11.4448
1	4	Y	-11.4448
1	5	Y	-11.4448
1	6	Y	-11.4448
2	1	Y	-11.4448
2	2	Y	-11.4448
2	3	Y	-11.4448
2	4	Y	-11.4448
2	5	Y	-11.4448

14. Click **OK** to accept the generated *DW1* loads.

15. Click the **LL1** load from the *Selected Loads* window.

16. Click **Edit...** .

17. Click the **Generate** button.

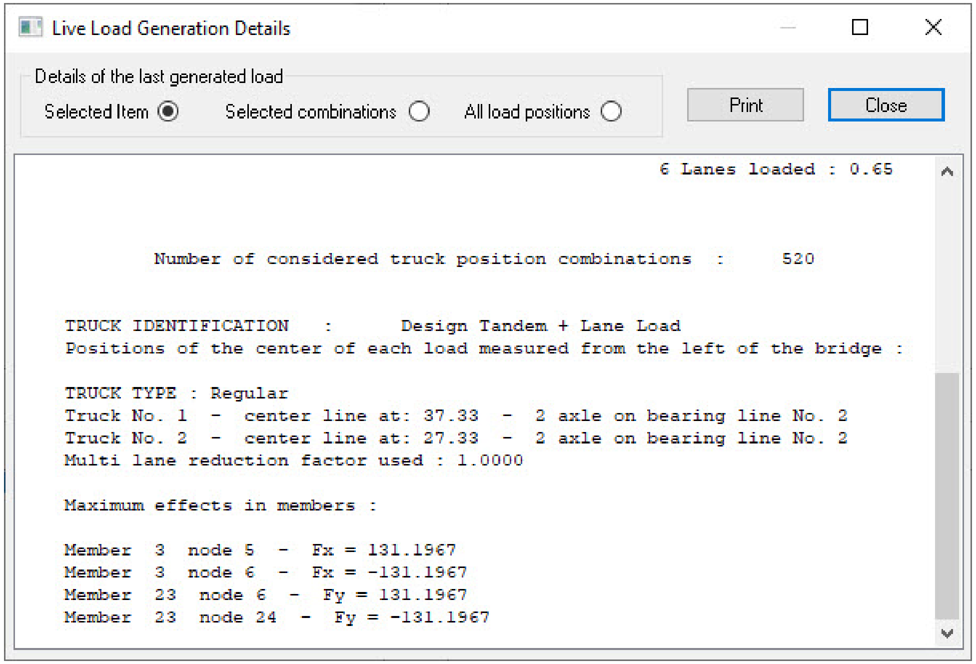
18. From the *Auto Load Generation* window, select the **Design Tandem + Lane Load** , then click **Add->** button.

19. Enable the toggle for the **Generate Braking Load Cases**.

20. Click **Generate** at the bottom of the window to create the bearing loads. This will create a series of LL and BR loads.

21. Click **OK** to accept the generated **LL** and **BR** loads.

22. Click **LL details** to review the live load information for the *LL1* load. This will show the truck position(s) used for this load case in addition to the maximum effect in various members and nodes.

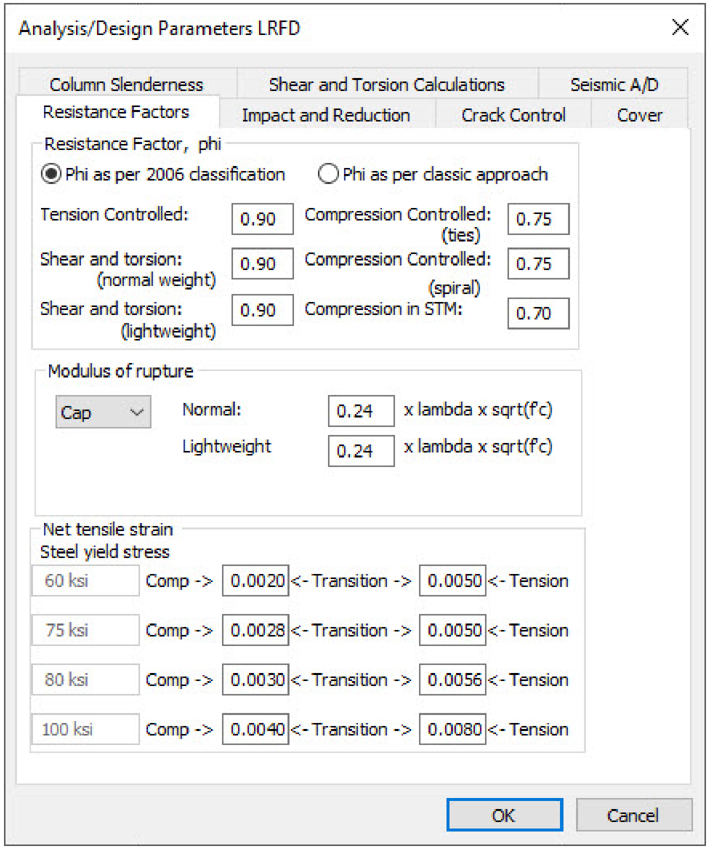


23. Add **Strength Group I** and **Strength Group III** to the Selected Groups window.

24. Select the **Combinations** button.

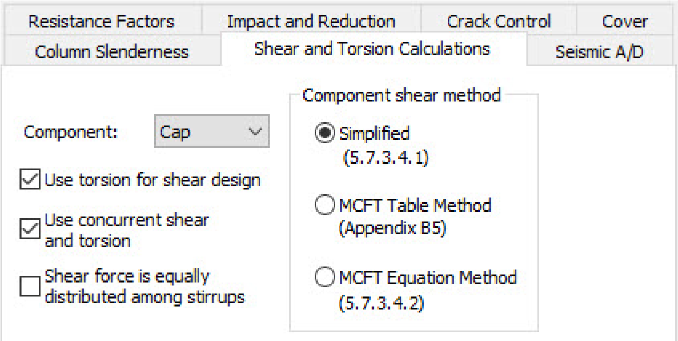
25. Click **Default Comb** to create the Load combinations. Close the *Load Combinations* window.

1. Select the **Analysis** tab.
2. Select the **A/D Parameters** button. Review the default values on the various tabs.



3. Select the **Shear and Torsion Calculations** tab.

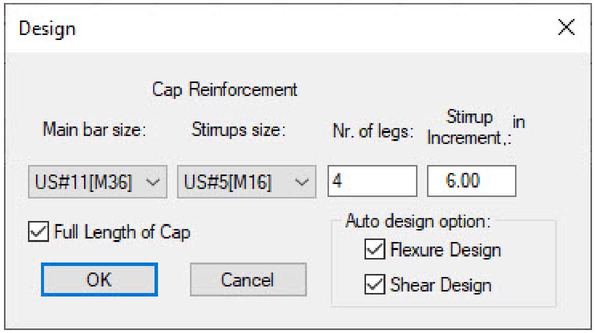
4. Toggle on the **Use concurrent shear and torsion** option and the **Simplified** component shear method.



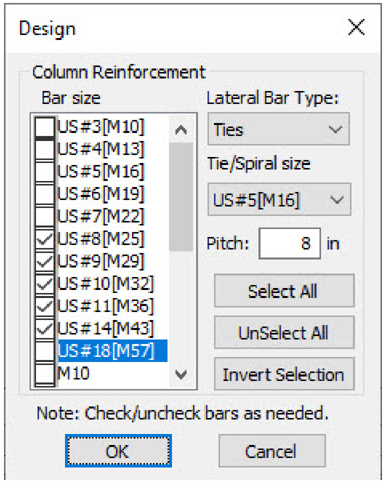
5. Select **Run Analysis...**

6. Select the **Diagrams** button to review the shear and moment diagrams for the caps and columns.
7. Close the **Diagrams** window.

1. Select the **Cap** tab.
2. Select the **Auto Design** button. Set as shown below, then click **OK**.



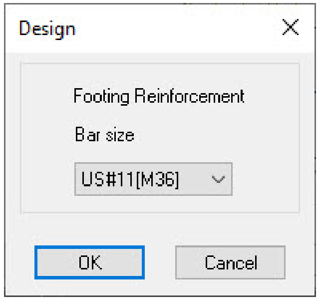
3. Review the design of the *Main bars* and *Stirrups*.
4. Select the **Column** tab.
5. Enable the **Auto Design All** toggle.
6. Select the **Auto Design** button. Set as shown below, then click **OK**.



7. Review the design of the *Columns*.

8. Select the **Footings** tab.

9. Select the **Auto Design** button. Set as shown below, then click **OK**.

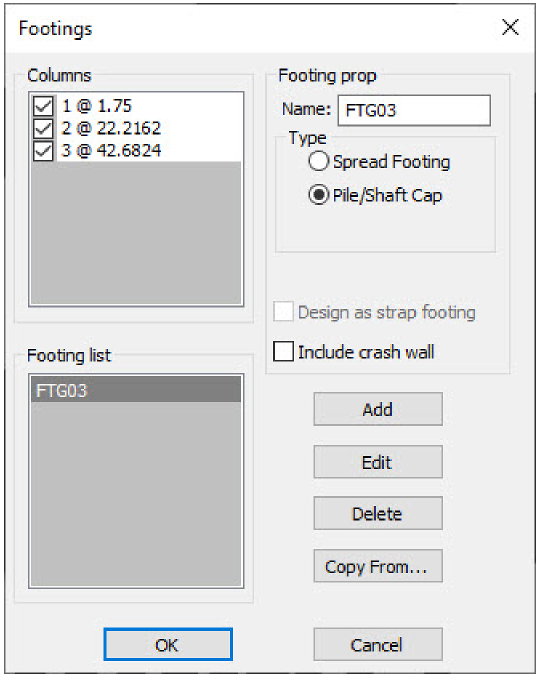


10. Review the design of the footing. Note the *Pile Reac.* values are all in red. Close the design status report window.

Pile Reactions, Factored					Load Effect @ Footing Bot.					
Pile	X in	Z in	Batter X degree	Batter Z degree	comb	Ovs	P kips	Mxx kft	Mzz kft	Pile Reac. kips
1	18.00	-54.0	-0	-0	39	---	-3016.55	-1847.07	2777.20	162.49*
					410	---	-2022.81	1741.25	-3277.85	46.94*
2	101.03	-54.0	-0	-0	39	---	-3016.55	-1847.07	2777.20	159.31*
					380	---	-2103.83	2220.09	-2282.50	50.28*
3	184.05	-54.0	-0	-0	39	---	-3016.55	-1847.07	2777.20	156.12*
					380	---	-2103.83	2220.09	-2282.50	52.90*
4	267.08	-54.0	-0	-0	39	---	-3016.55	-1847.07	2777.20	152.94*
					380	---	-2103.83	2220.09	-2282.50	55.52*
5	350.11	-54.0	-0	-0	7	---	-3016.55	-1843.00	-2258.60	152.58*
					392	---	-2103.83	2220.09	1763.89	55.81*
6	433.13	-54.0	-0	-0	7	---	-3016.55	-1843.00	-2258.60	155.17*
					392	---	-2103.83	2220.09	1763.89	53.79*

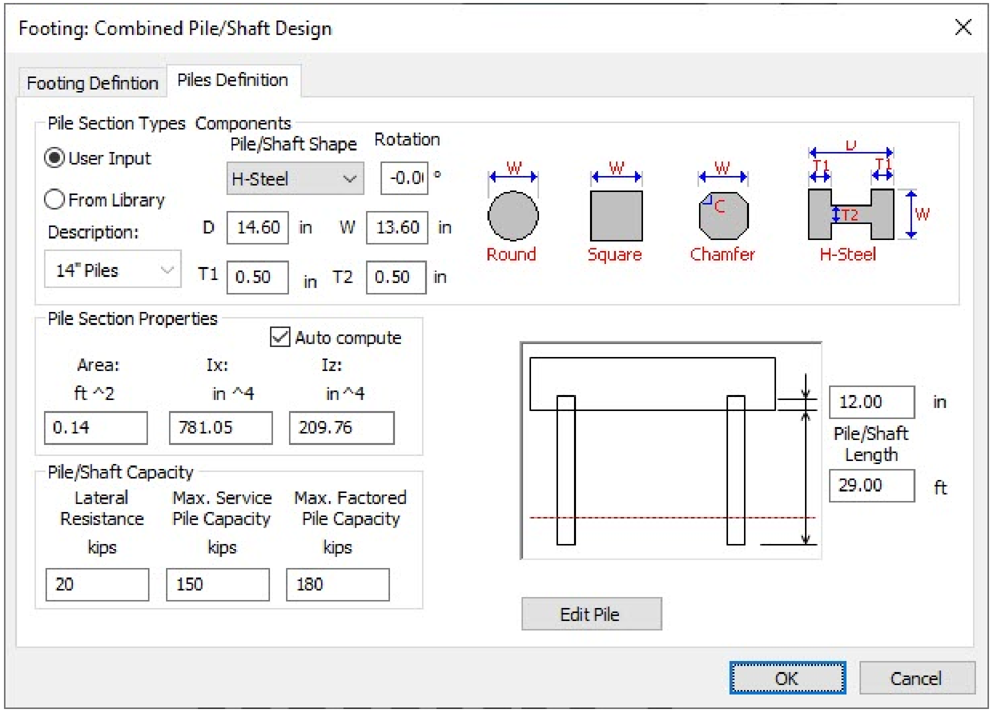
11. Select the **Geometry** tab.

12. Select the **Footing Pile** button.



13. Select *FTG03* and click **Edit**.

14. Populate the *Pile/Shaft Capacity* as shown and click **OK**. Click **OK** on the footings window as well.



15. Back on the Footing tab, click **Design Status** to review the updated *Pile Reac* values.

16. Close the **Substructure** window.

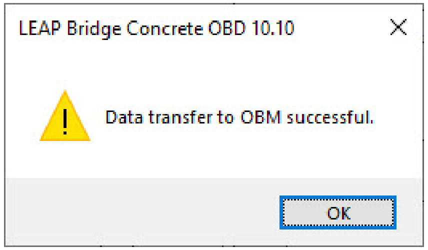
17. Select **Yes** to update the LEAP Bridge Concrete model and **No** to the Generate Reports prompt.

18. Select *File >Save* to save the LBC file.

19. Select *Tools > OBM Sync >* **Send to OBM**.

20. When prompted, enter a file name **LEAP2OBM Pier 1** and click *Save*. Save the file to the same folder as the dgn file to locate easily in a future step.

21. Click **OK** to note the successful data transfer.



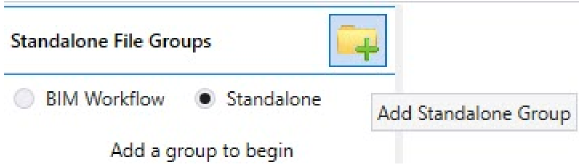
22. Close LBC.

P/S Concrete Girder Bridge - Update OBM Model

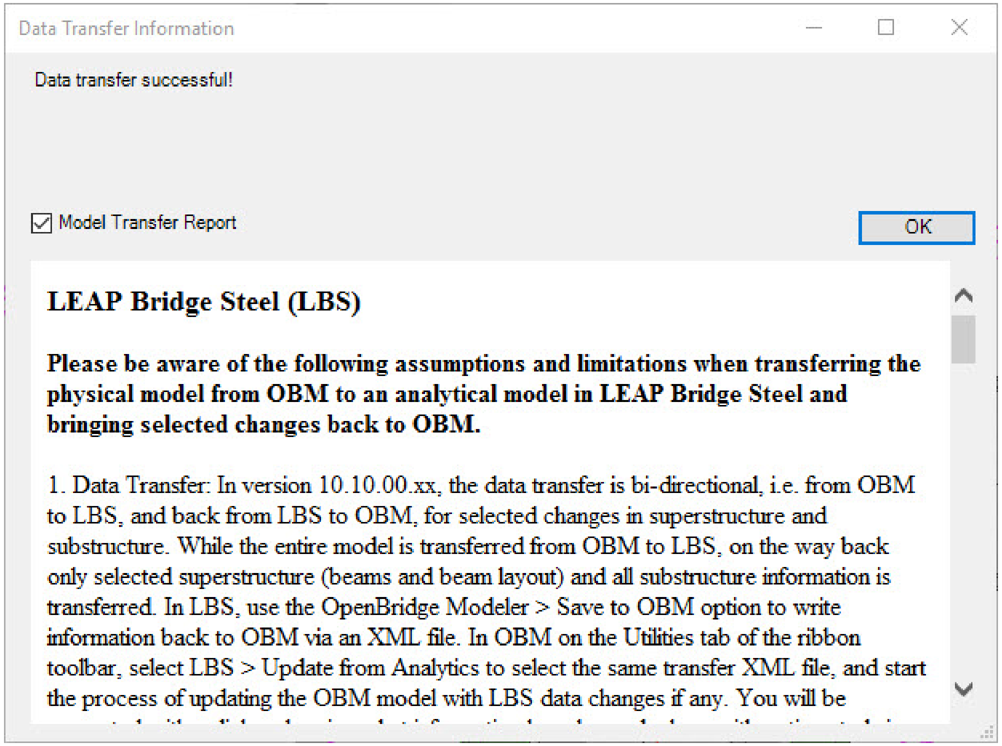
1. Continuing in OpenBridge Modeler...
2. From the OpenBridge Modeler workflow, select the *Utilities > Interoperability > LEAP Bridge Concrete >* **Update From Analytics** tool.
3. Select the **LEAP2OBM Pier 1.xml** file created in the previous exercise.
4. Click **Open** to start the update process.
5. Toggle on **Import/Update Rebars to model the footing reinforcement** . Click **Accept All** to accept all analytical model changes.
6. Click **OK** to update the physical model in OBM.

Steel Girder Bridge - Send to OBM

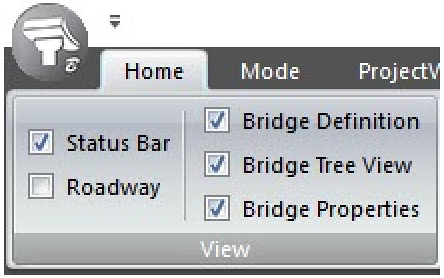
1. Create a Standalone project by selecting the **Add Standalone Group** icon and name it *Module 9 - LBS*. (OBD only)



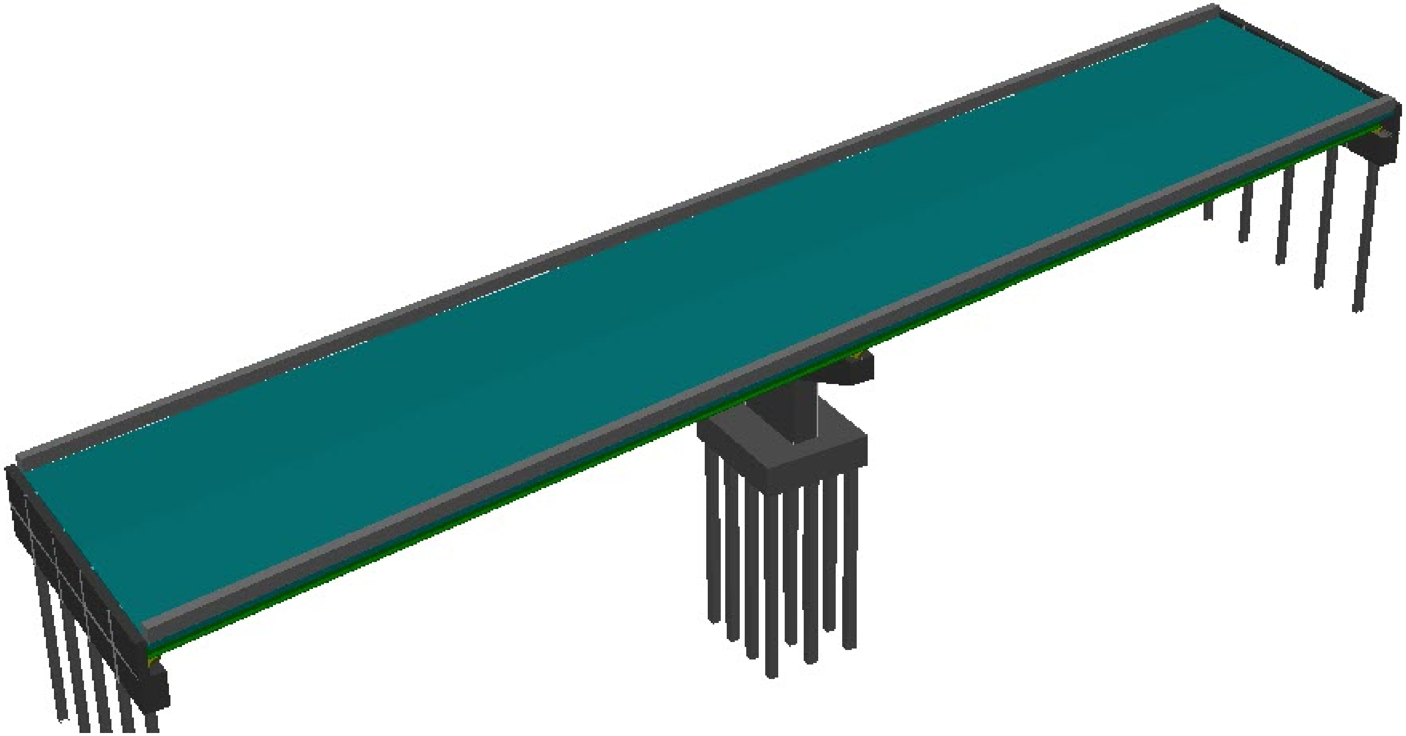
2. Start OpenBridge Modeler.
3. Open the file **Steel Girder Bridge.dgn** from the *Module 9 (Interoperability)* folder.
4. Select *Utilities > Interoperability > LEAP Bridge Steel >* **Send To** to open the Data Transfer Information window.



5. Review the **Model Transfer Report** information to review the assumptions made when sending the physical model to the analytical software.
6. Click **OK** to send the bridge to LEAP Bridge Steel.
7. Click **OK** when prompted to confirm the successful data transfer.
8. Turn off Display of the **Roadway**.

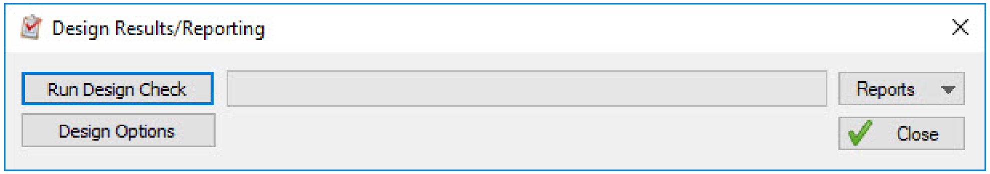


9. Fit the view and review the transferred bridge model.

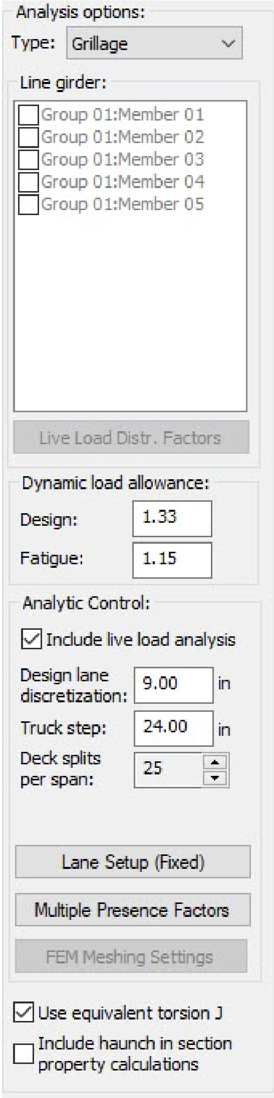


Steel Girder Bridge - Run Analysis

1. Select **Analysis**.
2. Set the Analysis **Type** to *Grillage*.
3. Select **Run Analysis**.
4. Close the **Analysis** window.
5. Select **Design**.
6. Click **Run Design Check**.



7. Select **Reports > Summary - Under Design**.



8. Select **Submit** to create the report. Review the report.

Date:	9/17/2021	OBM_LEAP_Geometry.lbsx	
Time:	3:05 PM	Bentley LEAP Bridge Steel [AASHTO LRFD 9th Ed. with 2020 Interims]	v21.01.00.22

Design Summary Report - Under Design

Strength I Initial Default

Threshold Performance Ratio = 1.00

Strength I Stage 01 Default

Threshold Performance Ratio = 1.00

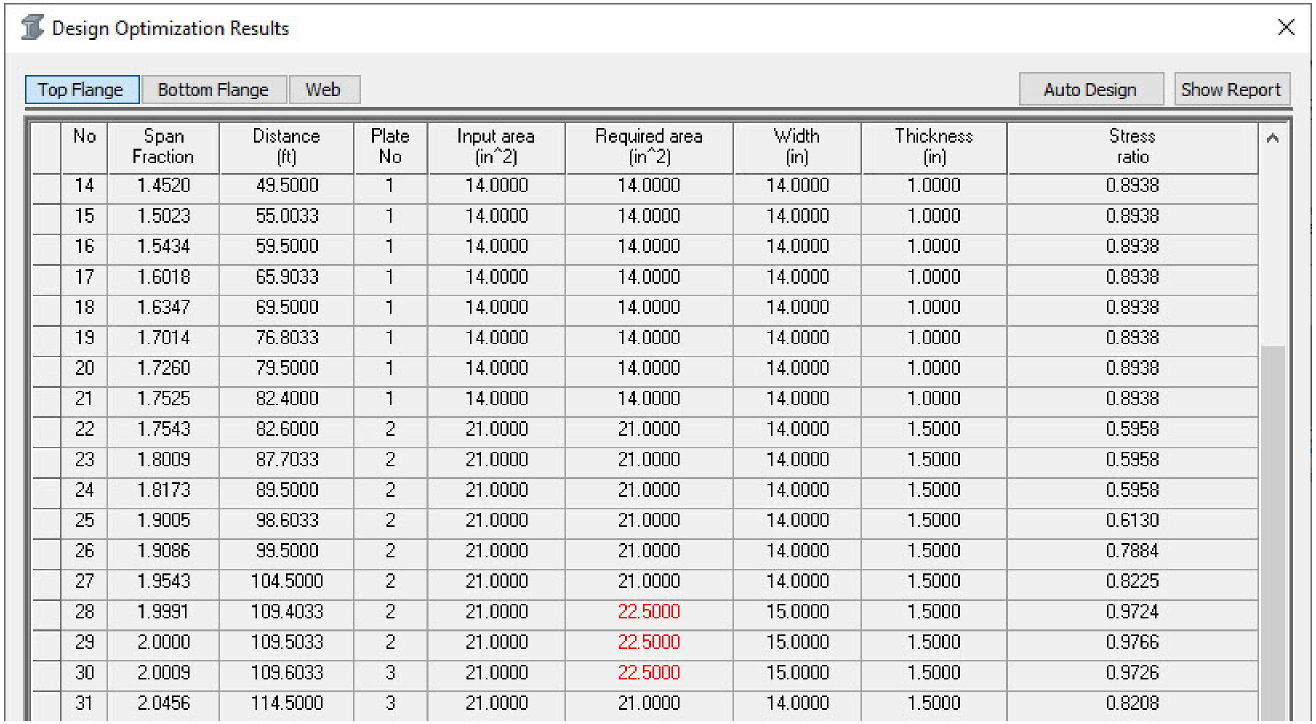
Strength I Final Default Strength I

Threshold Performance Ratio = 1.00

Group	Member	POI Loc. (ft)	Failed Article/Equation	Details	Performance Ratio
Group 01	Member 01	109.403	Equation 6.10.8.1.3-1	Flexural resistance	1.023
Group 01	Member 01	109.503	Equation 6.10.8.1.3-1	Flexural resistance	1.027
Group 01	Member 01	109.603	Equation 6.10.8.1.3-1	Flexural resistance	1.023
Group 01	Member 06	109.403	Equation 6.10.8.1.3-1	Flexural resistance	1.024
Group 01	Member 06	109.503	Equation 6.10.8.1.3-1	Flexural resistance	1.028
Group 01	Member 06	109.603	Equation 6.10.8.1.3-1	Flexural resistance	1.023

9. Close the *Report* window and the *Design Results/Reporting* window.

1. Select **Member Definition** from the *Superstructure* group of tools.
2. Select **Design Optimization > Selected Member**.
3. Click **OK** when the optimization is complete.
4. Select **Design Results**.
5. Review the results for the Top Flange, Bottom Flange and Web. **Close** this window.



No	Span Fraction	Distance (ft)	Plate No	Input area (in^2)	Required area (in^2)	Width (in)	Thickness (in)	Stress ratio
14	1.4520	49.5000	1	14.0000	14.0000	14.0000	1.0000	0.8938
15	1.5023	55.0033	1	14.0000	14.0000	14.0000	1.0000	0.8938
16	1.5434	59.5000	1	14.0000	14.0000	14.0000	1.0000	0.8938
17	1.6018	65.9033	1	14.0000	14.0000	14.0000	1.0000	0.8938
18	1.6347	69.5000	1	14.0000	14.0000	14.0000	1.0000	0.8938
19	1.7014	76.8033	1	14.0000	14.0000	14.0000	1.0000	0.8938
20	1.7260	79.5000	1	14.0000	14.0000	14.0000	1.0000	0.8938
21	1.7525	82.4000	1	14.0000	14.0000	14.0000	1.0000	0.8938
22	1.7543	82.6000	2	21.0000	21.0000	14.0000	1.5000	0.5958
23	1.8009	87.7033	2	21.0000	21.0000	14.0000	1.5000	0.5958
24	1.8173	89.5000	2	21.0000	21.0000	14.0000	1.5000	0.5958
25	1.9005	98.6033	2	21.0000	21.0000	14.0000	1.5000	0.6130
26	1.9086	99.5000	2	21.0000	21.0000	14.0000	1.5000	0.7884
27	1.9543	104.5000	2	21.0000	21.0000	14.0000	1.5000	0.8225
28	1.9991	109.4033	2	21.0000	22.5000	15.0000	1.5000	0.9724
29	2.0000	109.5033	2	21.0000	22.5000	15.0000	1.5000	0.9766
30	2.0009	109.6033	3	21.0000	22.5000	15.0000	1.5000	0.9726
31	2.0456	114.5000	3	21.0000	21.0000	14.0000	1.5000	0.8208

6. Set the *Member elements* to **Top Flange**.

7. Change the *Flange Thickness* to **1.75”** for the two segments shown.

No.	Ref. Span	Begin (ft)	Span/ Fraction	Length (x) (ft)	Length/ Fraction	Material	Thickness (in)	Max Thick. (in)	Start Width (in)	Variation	End Width (in)	Max Width (in)	Web Offset (in)
2	1	0.0000	0.0000	82.5000	0.7534	Straight plate girder	1.0000	4.0000	14.0000	Linear	14.0000	96.0000	0.0000
3	1	82.5000	0.7534	27.0032	0.2466	Straight plate girder	1.7500	4.0000	14.0000	Linear	14.0000	96.0000	0.0000
4	2	0.0000	0.0000	26.9968	0.2465	Straight plate girder	1.7500	4.0000	14.0000	Linear	14.0000	96.0000	0.0000
5	2	26.9968	0.2465	82.5000	0.7534	Straight plate girder	1.0000	4.0000	14.0000	Linear	14.0000	96.0000	0.0000

8. Select **Copy member definition to ... Group 01 > All Members**.

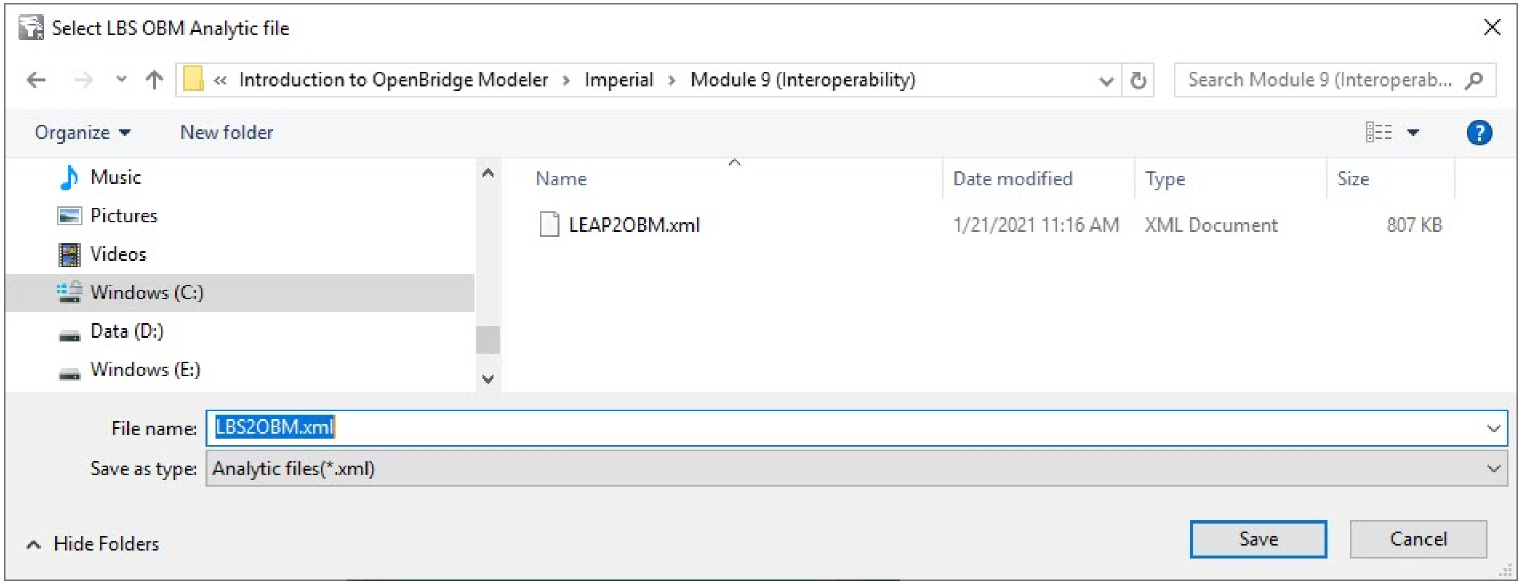
9. Select **OK** to accept the changes.

10. Click the LBS icon in the upper left, then select **Save**.

11. Key in a file name and click **OK**.

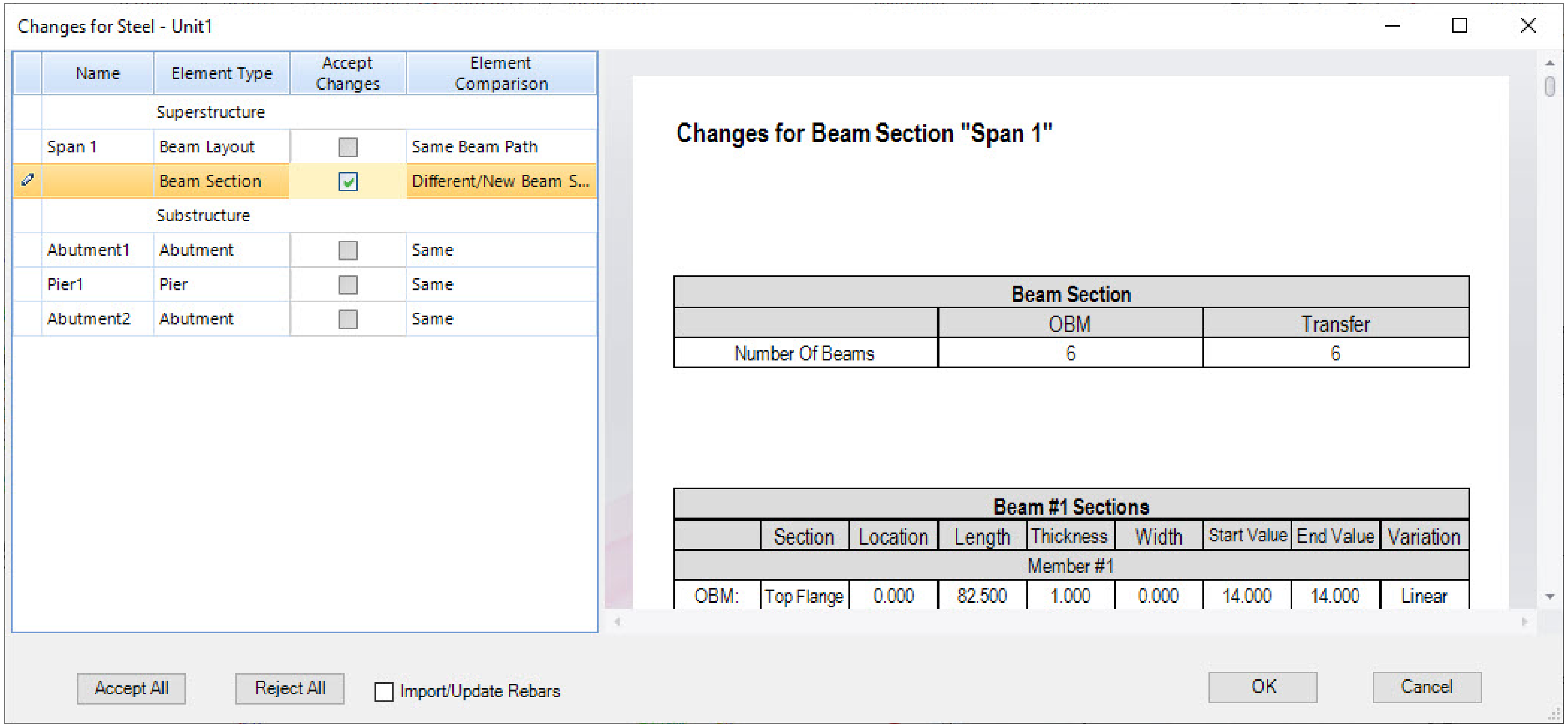
Steel Girder Bridge - Send Changes to OBM

1. Select the **OpenBridge Modeler** tab.
2. Select **Save to OBM**.



3. Key in a file name and click **Save** to create the file.
4. From OBM, select **Utilities > Interoperability > LEAP Bridge Steel > Update from Analytics**.
5. Select the file created in the previous steps. Click **Open**.

6. Enable the toggle to accept the Beam Section changes. Review the changes.



7. Click **OK** to accept the beam section changes.

8. Close OpenBridge Modeler prior to starting the next exercise.

Module 10: Plans Production

Description

In this module you will learn how to utilize the 3D physical model from OBM to begin the drawing creation process.

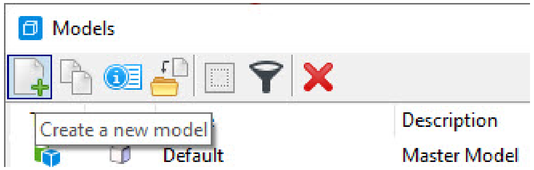
Objectives

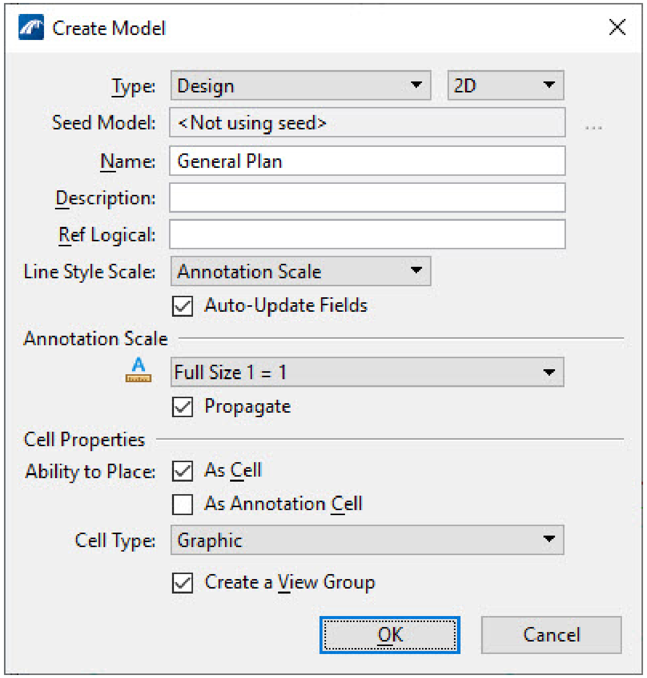
- Create a Plan and Elevation view of the structure
- Create a Pier sheet including elevation, plan of cap and footing and right elevation views
- Create a typical section sheet

Plan and Elevation Sheet

1. Create a Standalone project by selecting the **Add Standalone Group** icon and name it *Module 10 - Plans Production.* (OBD only)
2. Start OpenBridge Modeler.
3. Create a new file called **Precast Bridge Drawings.dgn** in the *Module 10 (Plans Production)* folder. Use the default 3D seed file.
4. Attach the **Precast Bridge.dgn** and **Geometry.dgn** files as a reference.

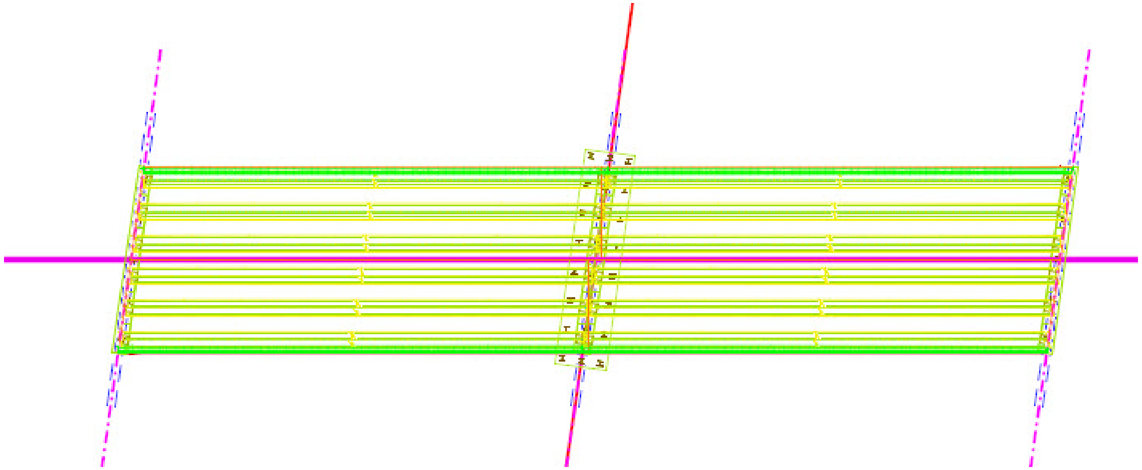
5. From the Models dialog, select the **Create a New Model** icon. Populate as shown on the right, then click OK.





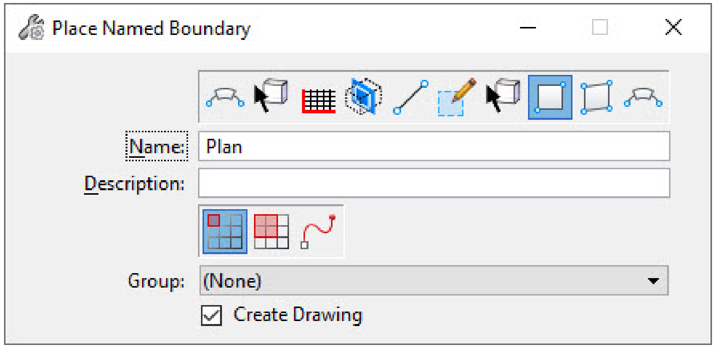
6. Attach the **Precast Bridge.dgn** and **Geometry.dgn** files as references to this model.

7. Using the key-in command, **Rotate View Element**, select the tangent portion of the alignment on either side of the bridge, then data point to accept. This will rotate the view so the alignment is horizontal in the view.



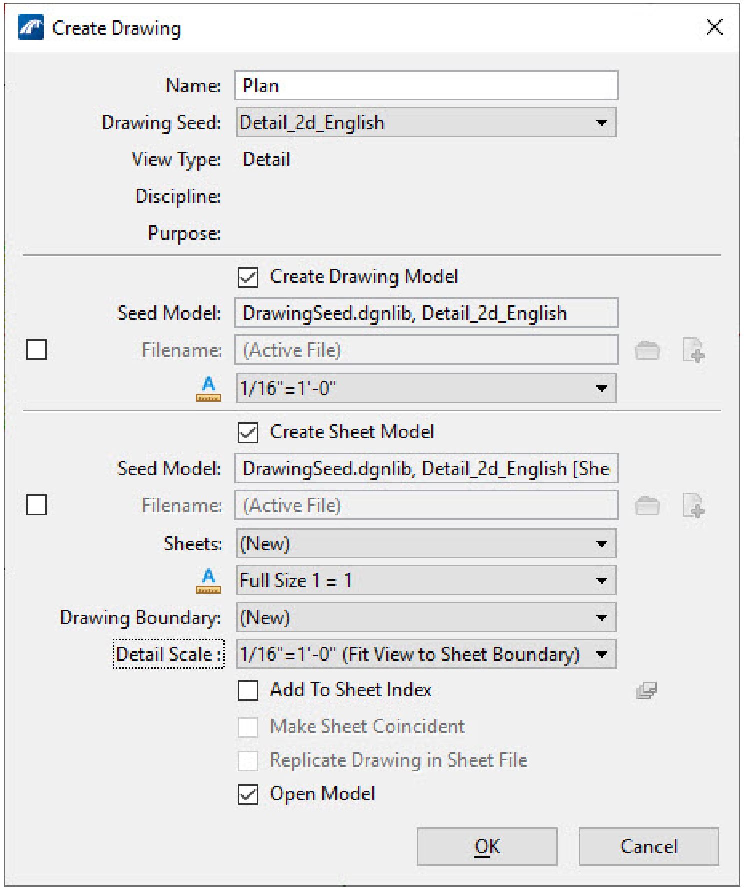
8. Select *Reports and Drawings > Drawings >* **Place Named Boundary** tool.

9. Select the **By 2 Points** icon, then populate as shown.



10. Follow the prompts to place a rectangle around the structure.

11. Populate as shown and click **OK**.

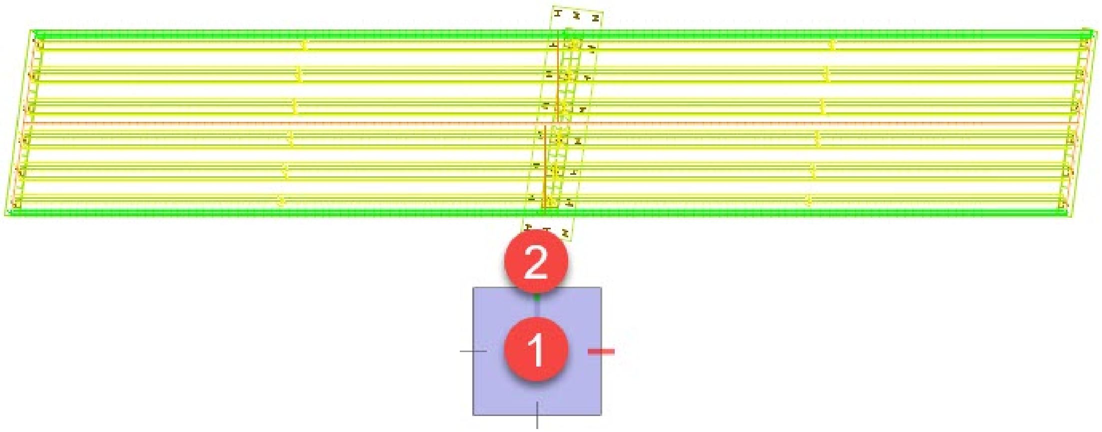


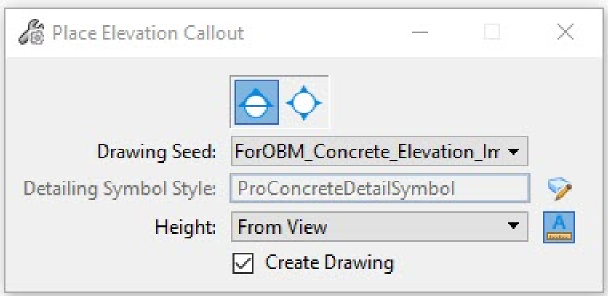
12. Place the cursor over the bridge and hold down the right mouse button. Select **Move Reference** from the pop up menu, then move to the top center of the sheet.

13. Turn off display of the following levels from the referenced model: *Default*, *OBM_D_**, and *OBM_SupportLines*.

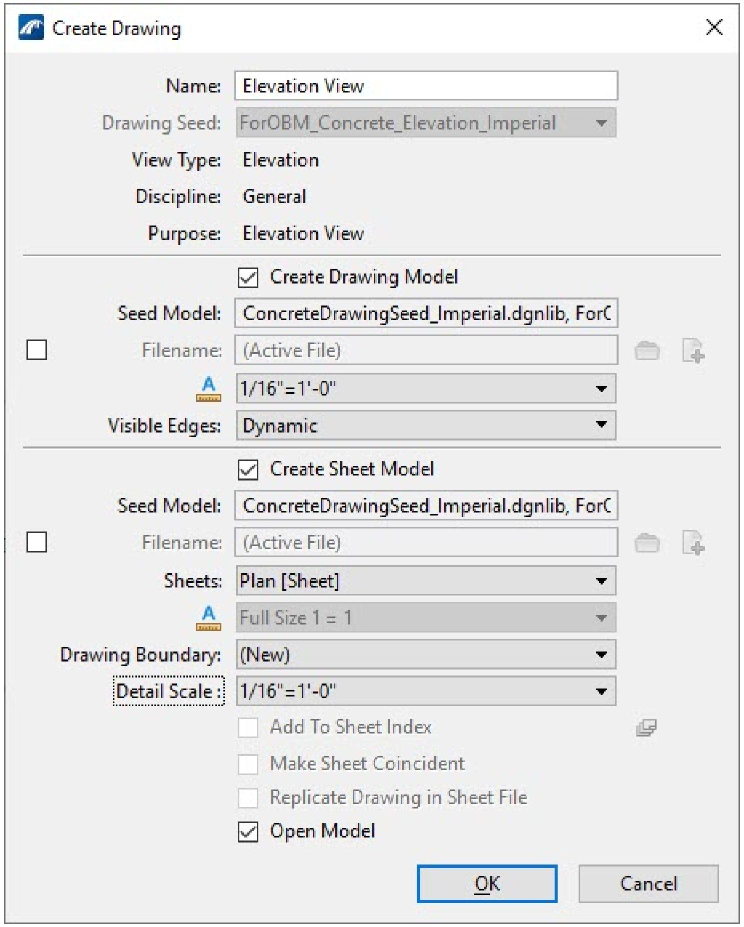
14. Open the *General Plan* model.

15. Select *Drawing > Annotate > Detailing >* **Elevation Callout** tool. Populate as shown then data point at locations 1 and 2 shown below.



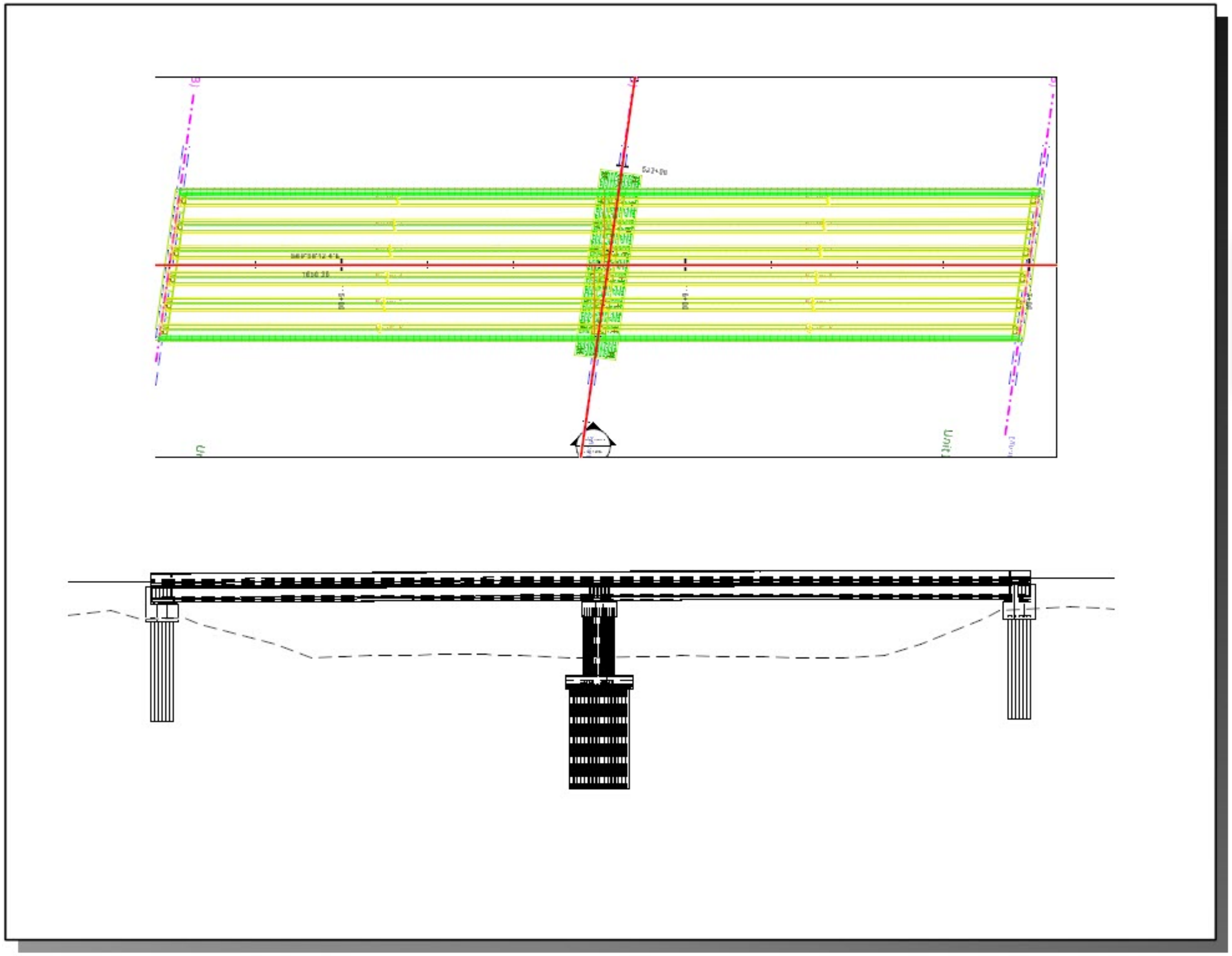


16. Populate as shown and click **OK**.



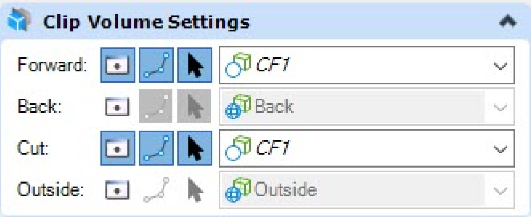
17. Place the cursor over the elevation view and hold down the right mouse button. Select **Move Reference** from the pop up menu, then move to the bottom center of the sheet.

18. Resulting Sheet model.



19. Open the *Elevation View Views* model.

20. Hover over the isometric reference, then hold down the right mouse button. Select **Set Reference Presentation**.

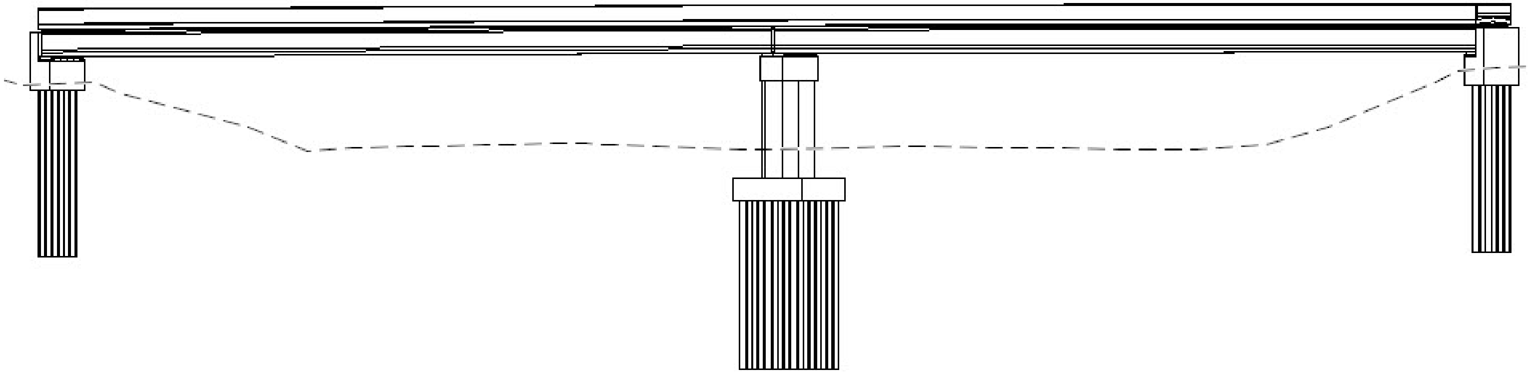


21. Note the *Forward* display style is set to **CF1**. Cancel out of this window.

22. Open the *Display Styles* window and select display style **CF1**.

23. Turn off the toggle next of *Hidden Edges*, then update View 1. Notice the difference.

24. Click the **View Previous** icon to go back to the sheet model. Zoom in and notice the difference in the elevation view.



25. Change the scale of both references to 1:360 then move the references to the left side of the sheet.

26. Attach the *Precast Bridge.dgn* as a reference using the following parameters. Click **OK** to accept, then data point in View 1 to place.

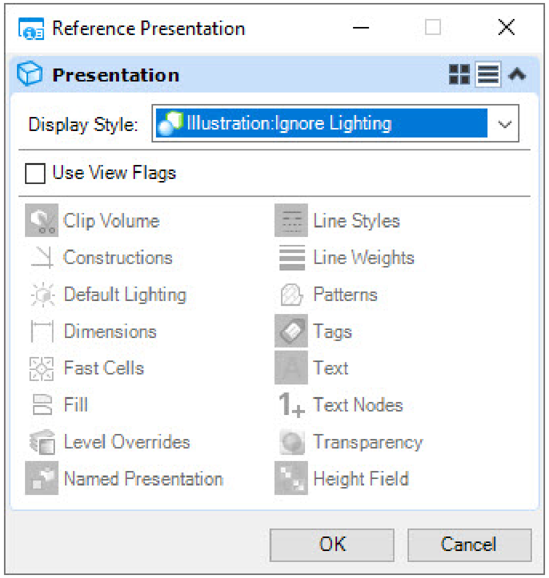
- *Orientation* = **Standard View > Isometric**
- *Detail Scale* = **1/32” = 1’-0”**
- *Nested Attachments* = **No Nesting**

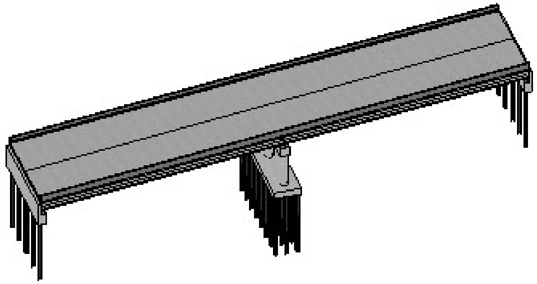
27. Fit the view, then zoom to the new attachment.

28. Turn off display of the following levels from the referenced model: *Default*, *OBM_D_**, and *OBM_SupportLines*.

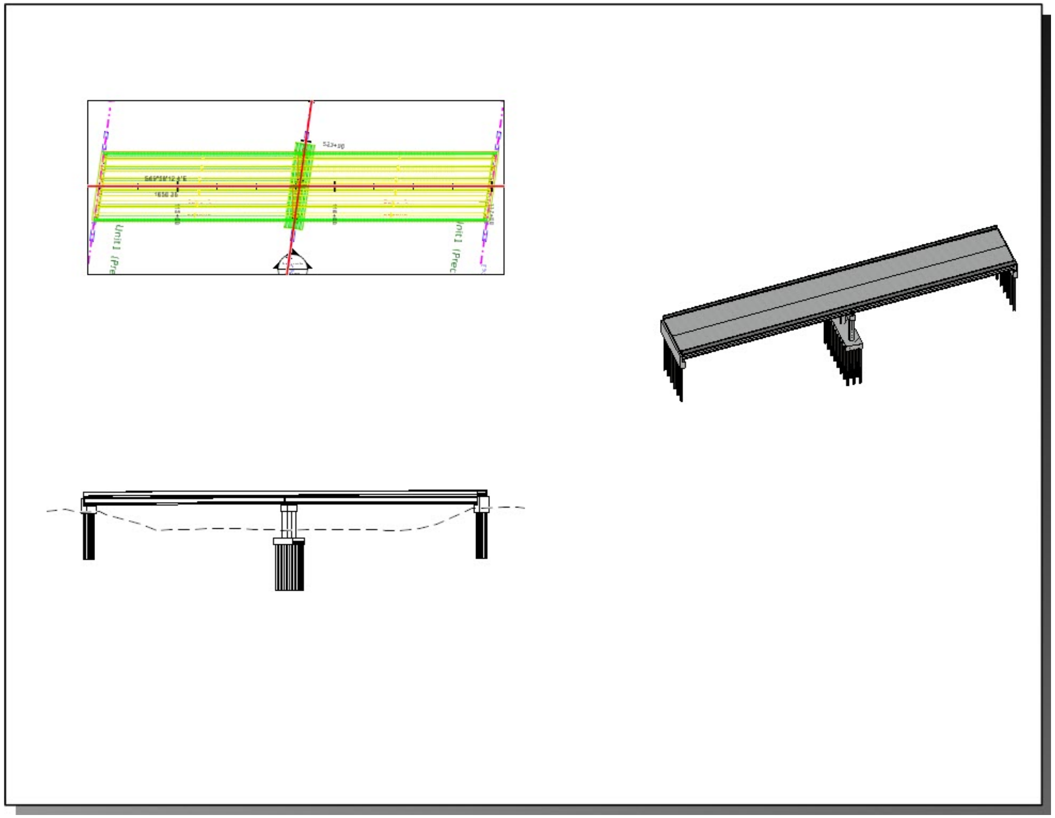
29. Hover over the isometric reference, then hold down the right mouse button. Select **Set Reference Presentation**.

30. Change the *Display Style* to **Illustration: Ignore Lighting** and click **OK**.





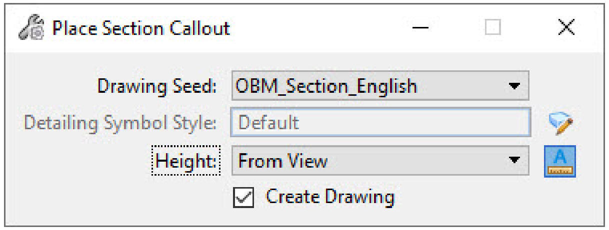
31. Move to a desired location on the sheet.



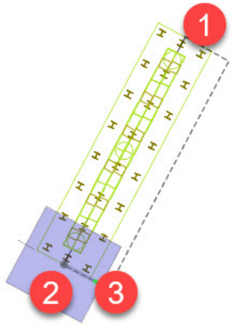
32. Return to the *Default* model.

Pier Sheet

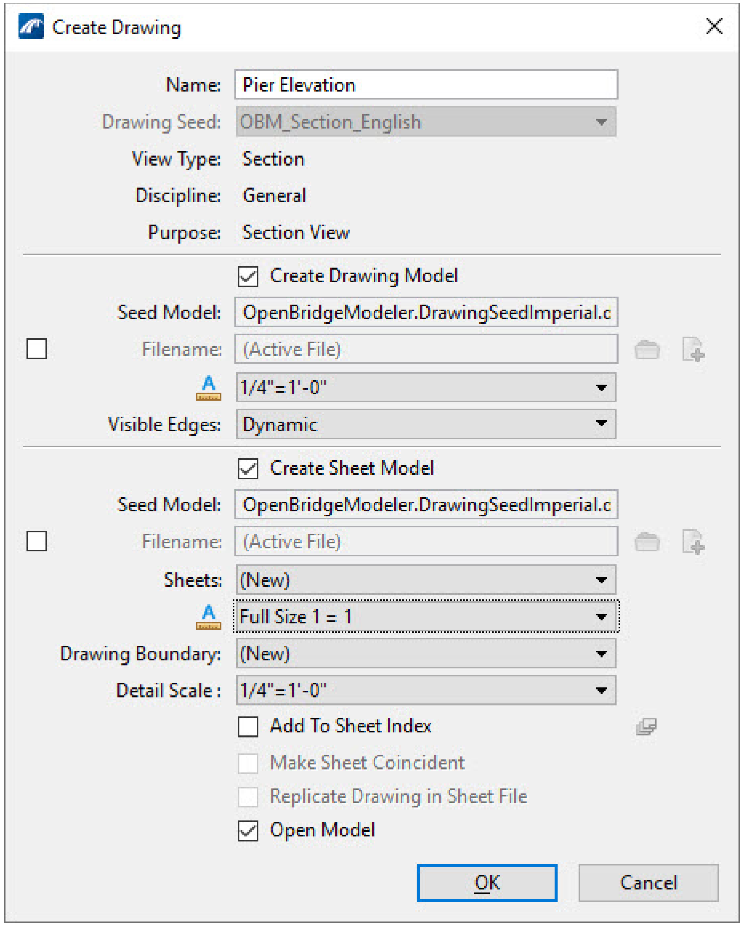
1. From the Default model, turn off display of the following levels from the referenced model: *Default*, *OBM_D_**, any superstructure related levels and *OBM_SupportLines*.
2. Fit the view.
3.  Select *Drawing > Annotate > Detailing >* **Section Callout** tool. Populate as shown.

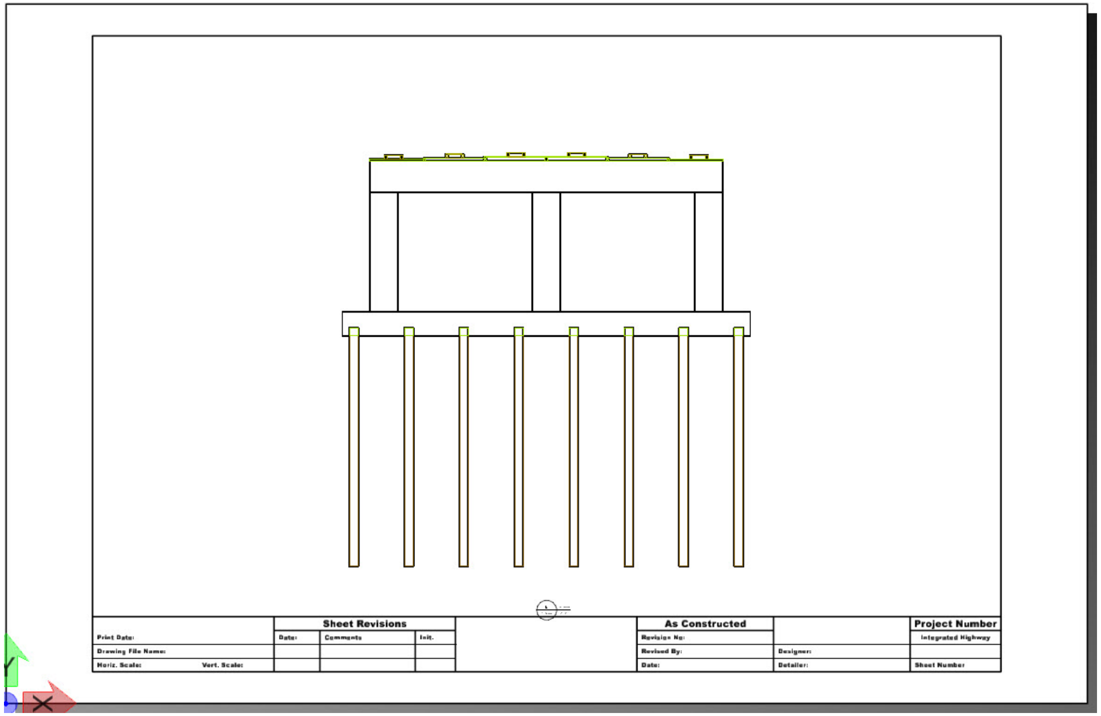


4. Snap to/data point each end of the pier footing then data-point at location 3.



5. Populate the Create Drawings window as shown, then click **OK**.





6. Move the Pier Reference to the left side of the sheet.

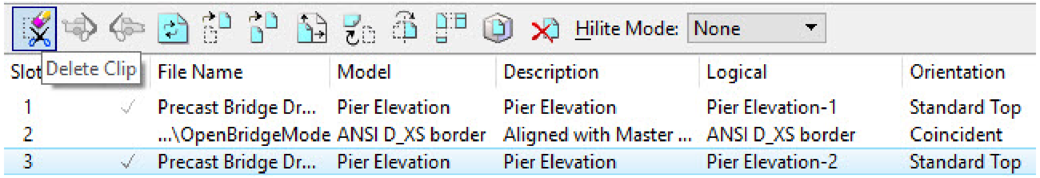
7. Place a fence around the cap and top **2-3'** *[1m]* of the columns.

8. Clip the reference to the fence.

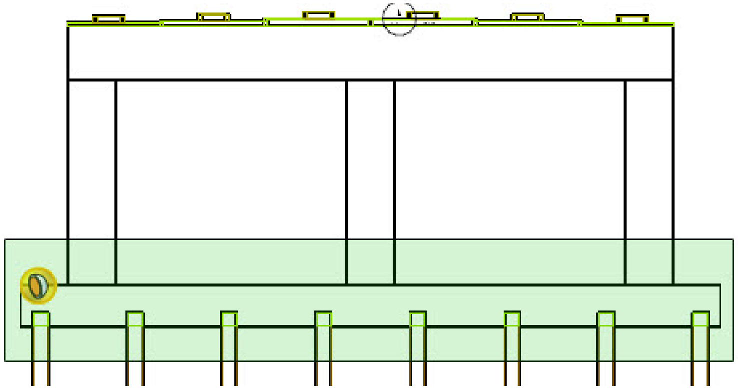
9. With the *Element Selection* tool activated, right click and hold, then select **Copy Reference**. Copy the reference directly below itself.

10. From the references window, highlight the reference with a *Logical* of **Pier Elevation-2**.

11. Select the **Delete Clip** tool, then data point on the copy of the reference, then data point in the view.



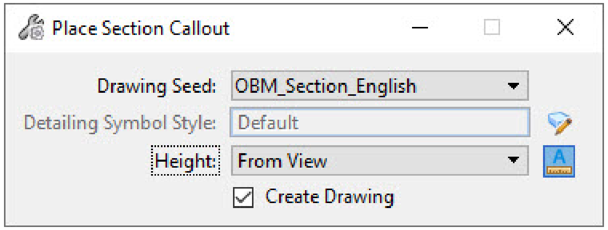
12. Repeat the steps above to clip out everything but the footing, bottom **2-3’** *[1m]* of the columns, top **2-3’** *[1m]* of the pile.

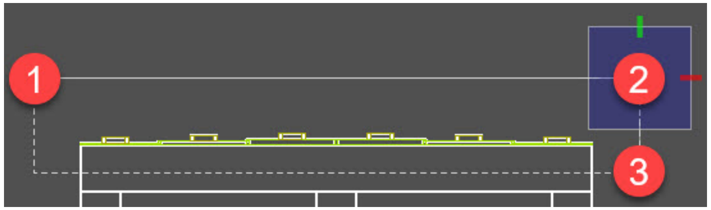


13. Move the clipped footing closer to the top half of the pier.

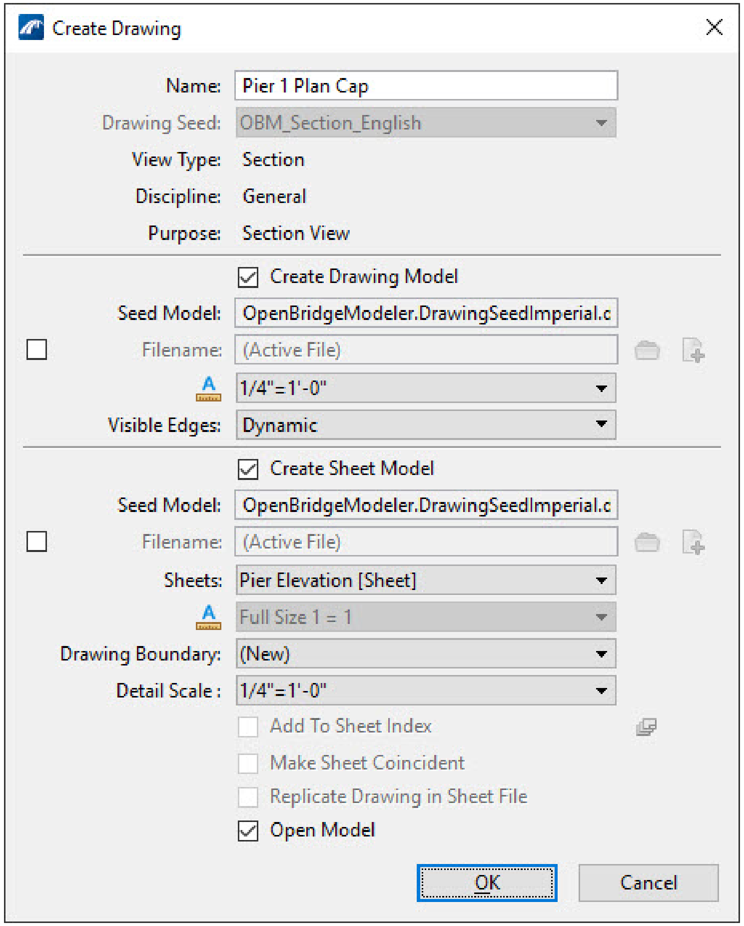
14. Open the Pier Elevation Views drawing model.

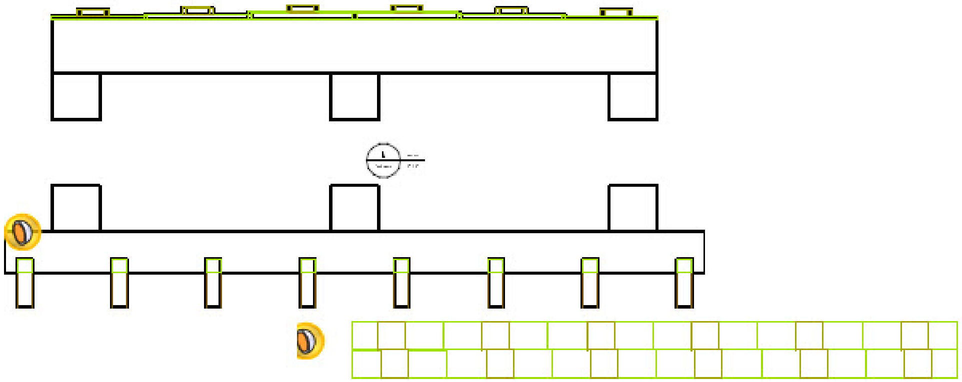
15. Select *Drawing > Annotate > Detailing >* **Section Callout** tool. Populate as shown then data point as shown on the right.





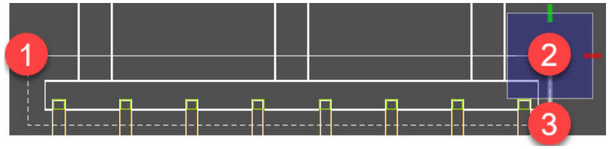
16. Populate the *Create Drawing* window as shown and click **OK**. The plan view of the cap will initially appear in the middle of the sheet.





17. Move the reference of the plan of the cap directly above the elevation view on the sheet.

18. Using the Section Callout tool, create a plan view of the footing. Name the new model **Pier 1 Plan Footing**.

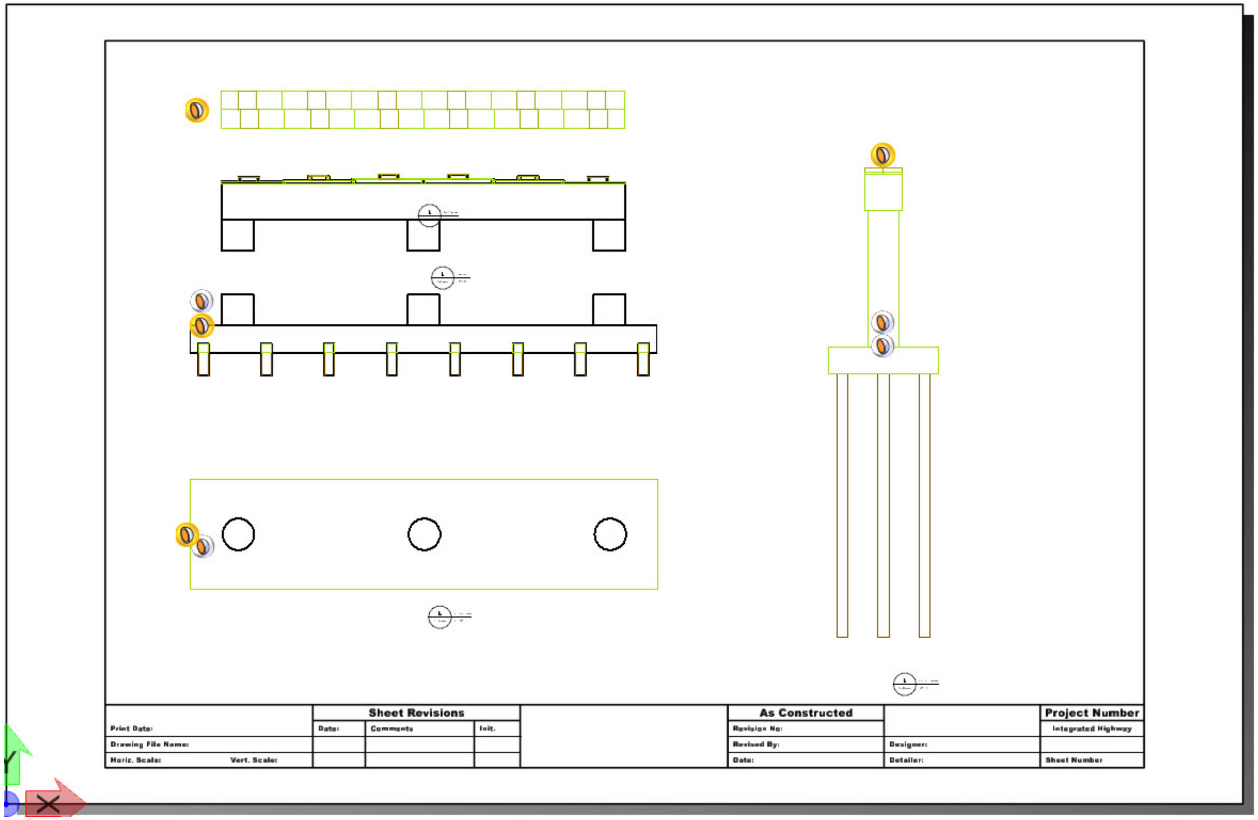


19. Repeat the steps above to create the drawing model and move it below the elevation view on the sheet.

20. Go back to the *Pier Elevation View* drawing model.

21. Using the Section Callout tool, create a right elevation of the pier. Name the new model **Pier 1 Right Elevation**.

22. Repeat the steps above to create the drawing model and move it to the right of the elevation view on the sheet.

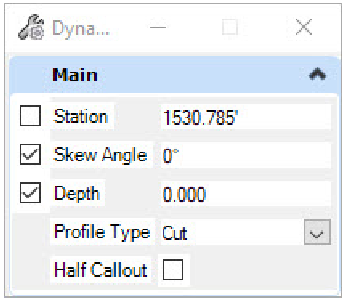


23. Return to the *Default* model.

Typical Section Sheet

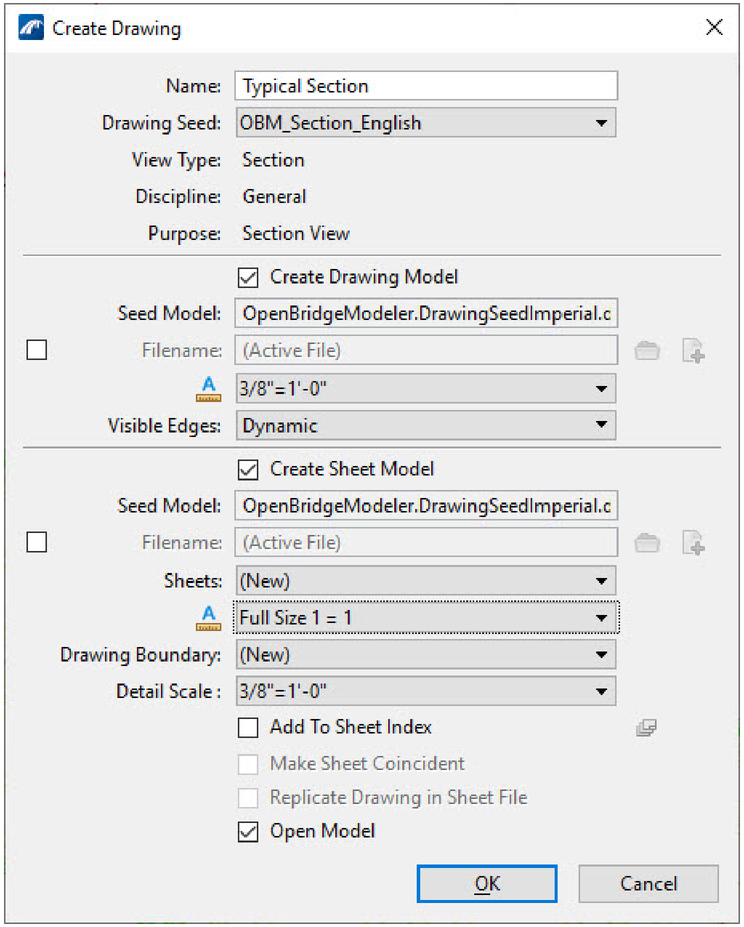
1. From the Default model, turn off display of the following levels from the referenced model: *Default*, *OBM_D_**, any substructure related levels and *OBM_SupportLines*.

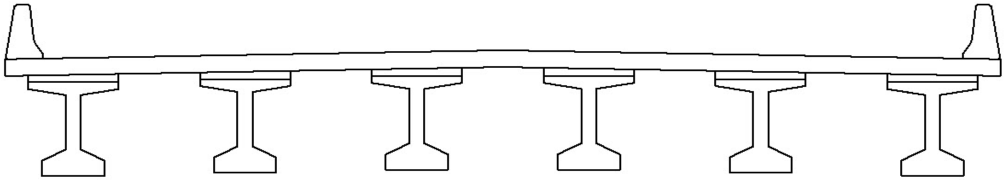
2. Select *OpenBridge Modeler > Reports and Drawings > Bridge Reporting >* **Dynamic View by Station** tool. Populate as shown.



3. Select the alignment, then data point to the left of the bridge, just outside of the barrier near mid span. Data point two more times to accept the locked values in the tool settings window.

4. Populate the *Create Drawing* window as shown and click **OK**. The typical section will initially appear above the sheet.

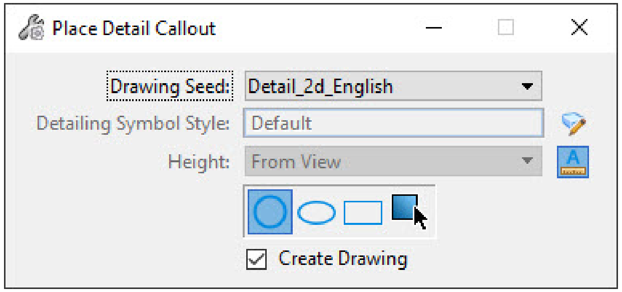


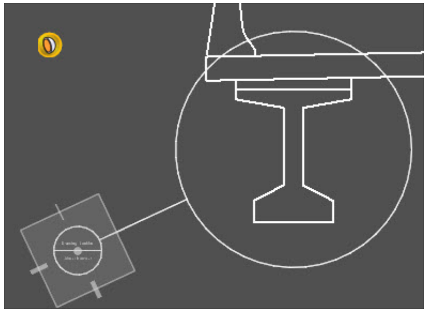


5. Move the typical on to the sheet.

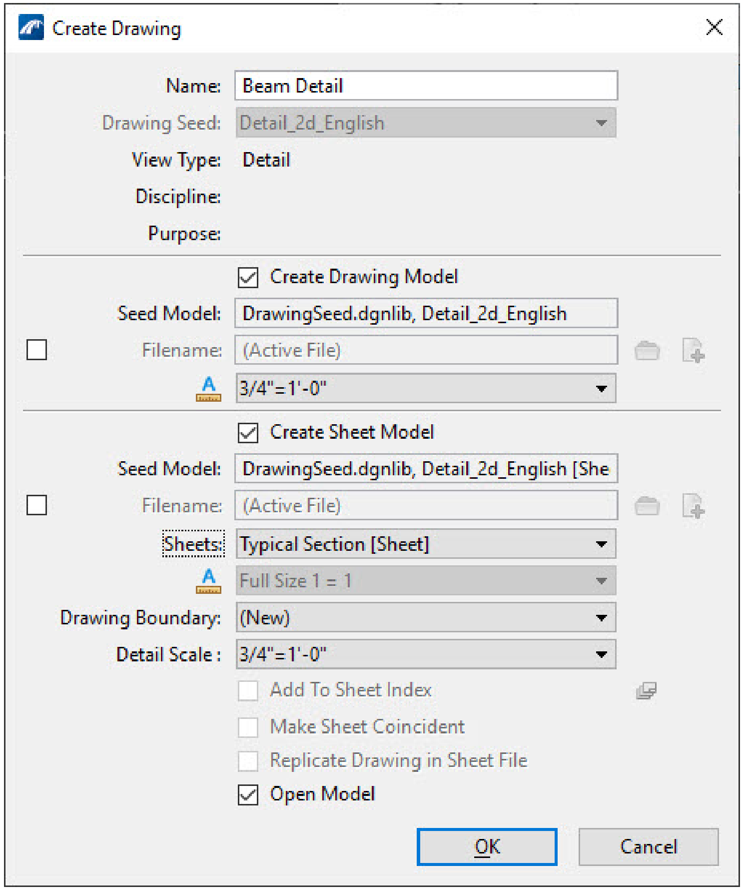
6. Open the *Typical Section View* drawing model. Zoom to the typical section.

7. Select *Drawing > Annotate > Detailing >* **Detail Callout** tool. Populate as shown then follow the prompts to create a detail similar to below.





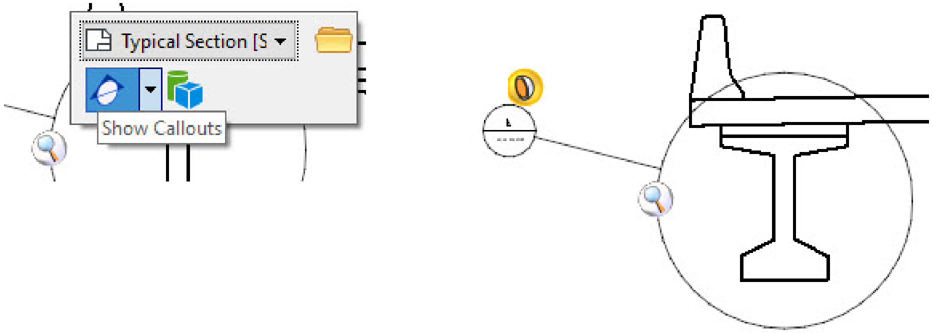
8. Populate the *Create Drawing* window as shown and click **OK**. The detail will initially appear in the center of the sheet.



9. Move the detail on to the sheet as needed.

10. Turn off all levels for that reference other than the *OBM_GirderConcrete* level.

11. Click on the magnifying glass icon by the beam that was detailed, then click **Show Callouts**.



Module 11: Visualization with LumenRT

Description

In this module you will learn how to utilize the 3D physical model from OBM to create an animated model of the structure complete with materials, vehicles, people and trees.

Objectives

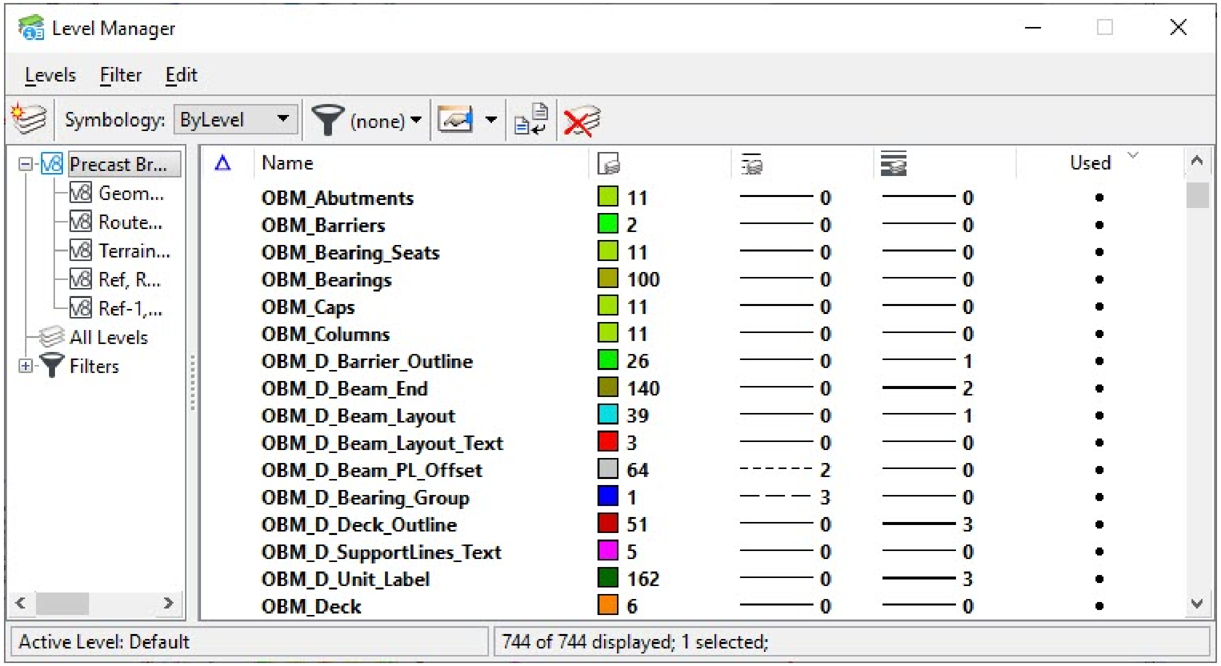
- Assign Materials to the Structure
- Add Pavement Markings to the Road and Bridge
- Export Bridge and Road to LumenRT
- Add Traffic to the Roadway
- Add Trees to the project
- Adjust the environment
- Create an animation

Assign Materials

1. Create a Standalone project by selecting the **Add Standalone Group** icon and name it *Module 11 - Visualization.* (OBD only)
2. Start OpenBridge Modeler.
3. Open file **Precast Bridge Completed.dgn** from the *Module 11 (OBM and LumenRT)* folder.

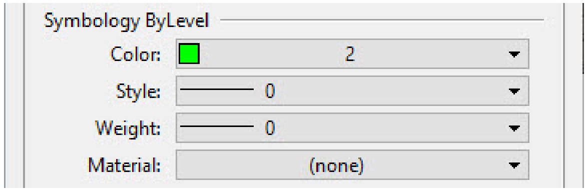
   Note: The bridge materials were defined as part of the element templates. If you want to assign materials to any other elements of the project use the following steps.

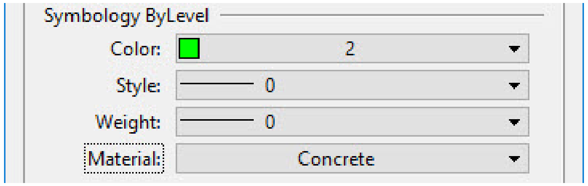
4. Select *Home > Primary > Level Manager* to open the Level Manager dialog to assign materials to levels.



5. Right click any level and select **Properties**.

6. Modify the Material in the Symbology ByLevel area to the desired look.

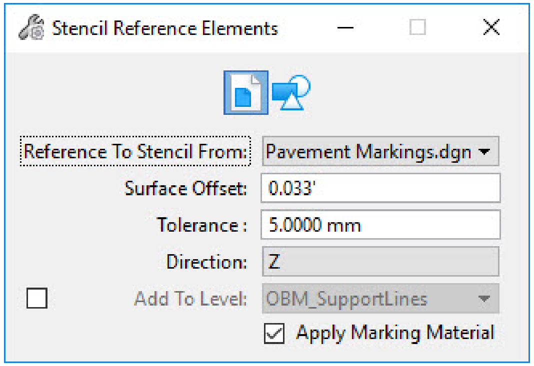




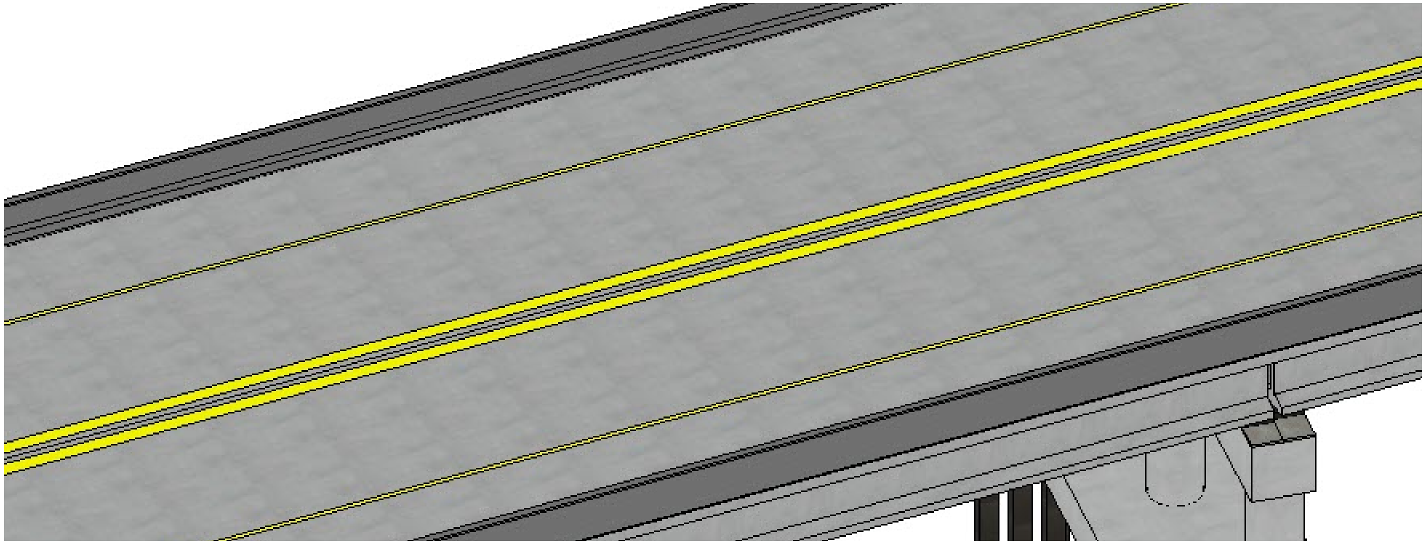
7. Select **OK** to complete changes to the *Material*.

Pavement Markings

1. Attach as a reference file *Pavement Markings.dgn* to **Precast Bridge.dgn**
2. Pavement markings are drawn in 2D. We need to place them on top of our bridge model. From the Ribbon menu search tool, find and start the *Stencil 2D Elements on 3D Geometry* command. Populate the dialog as shown.

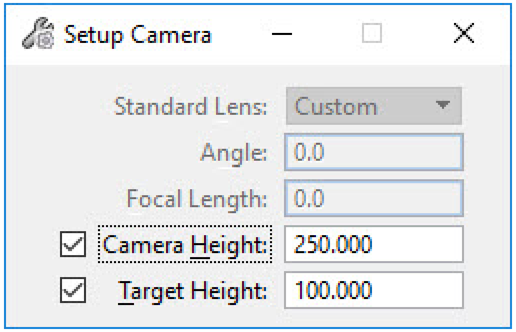


3. Data point to start processing the pavement markings. All 2D pavement marking will be placed on top of the corresponding surface.

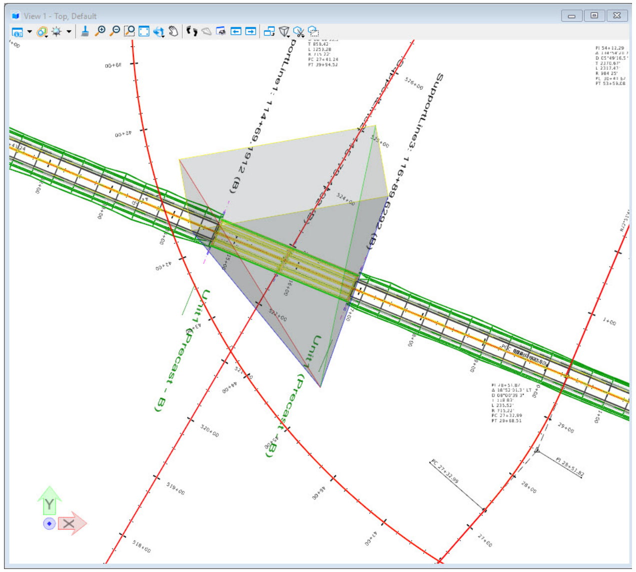


Camera Setup

1. Select the **Visualization** workflow.
2. Select *Home > Camera > Place Camera*. Populate the dialog as shown.

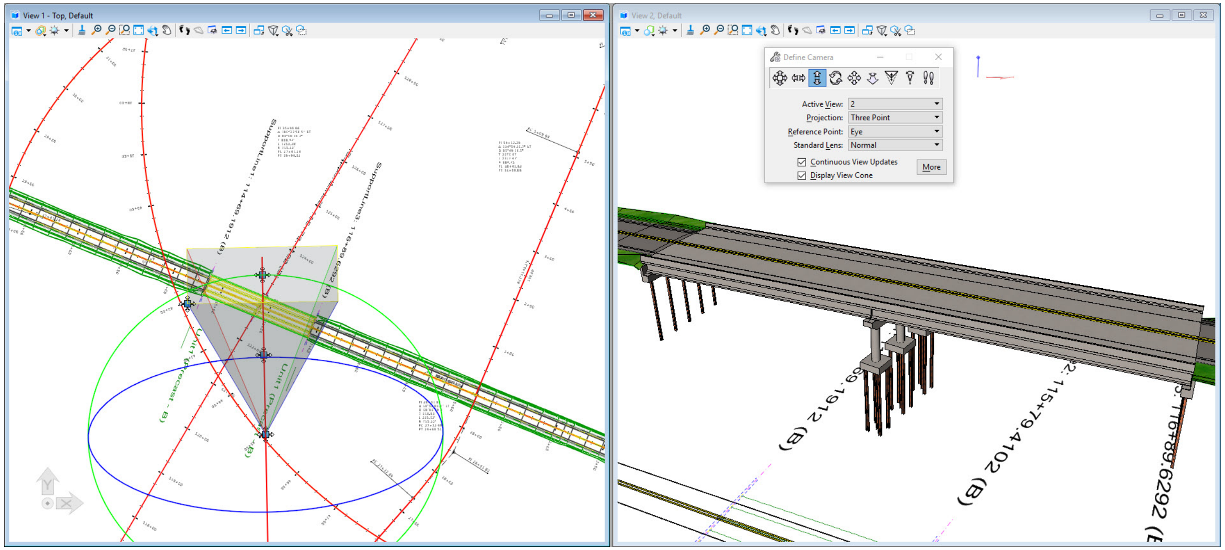


3. Enter a data point in view 2 (the Isometric view). This will be the view that perspective will be applied to.
4. In the Top view enter a data point to set the location of the camera and the target (where the camera is pointed).



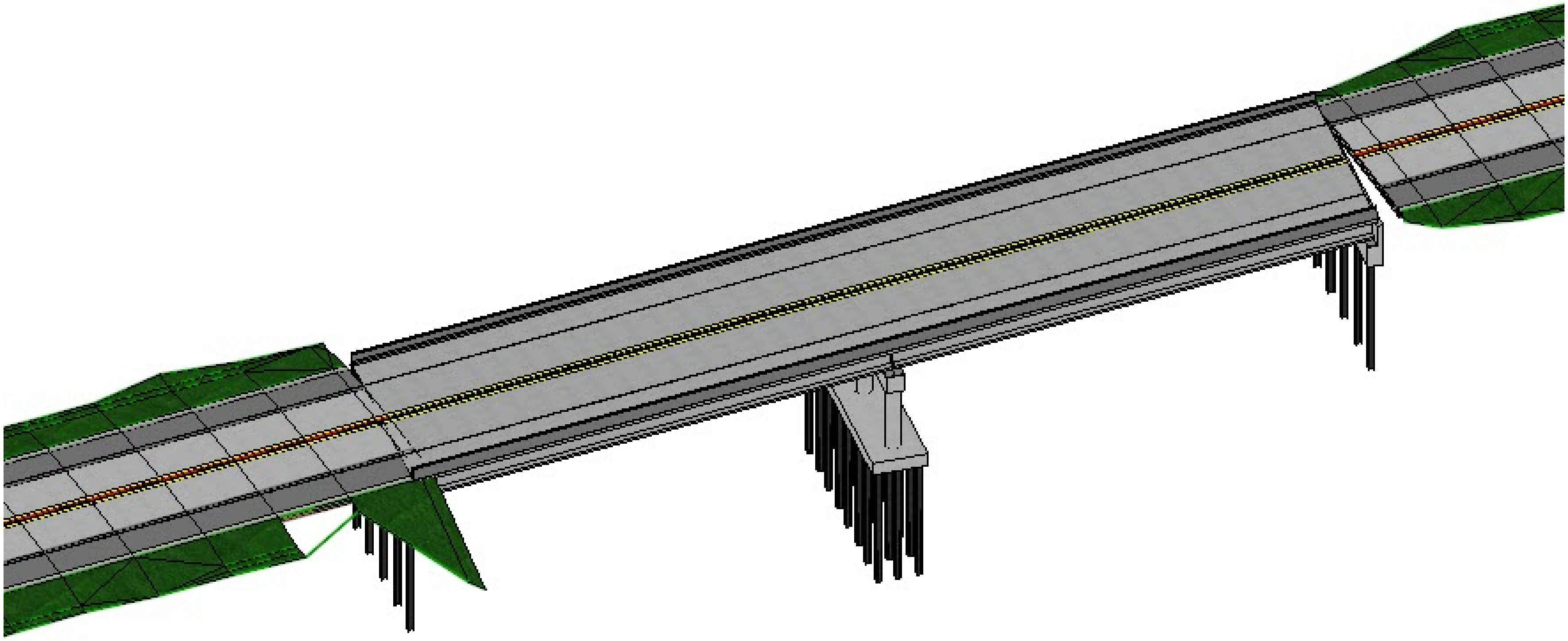
5. Adjust the camera position by selecting the *Home > Camera > Edit > Define Camera tool.*

6. Select the handles on the camera view to modify different aspects of the camera position.



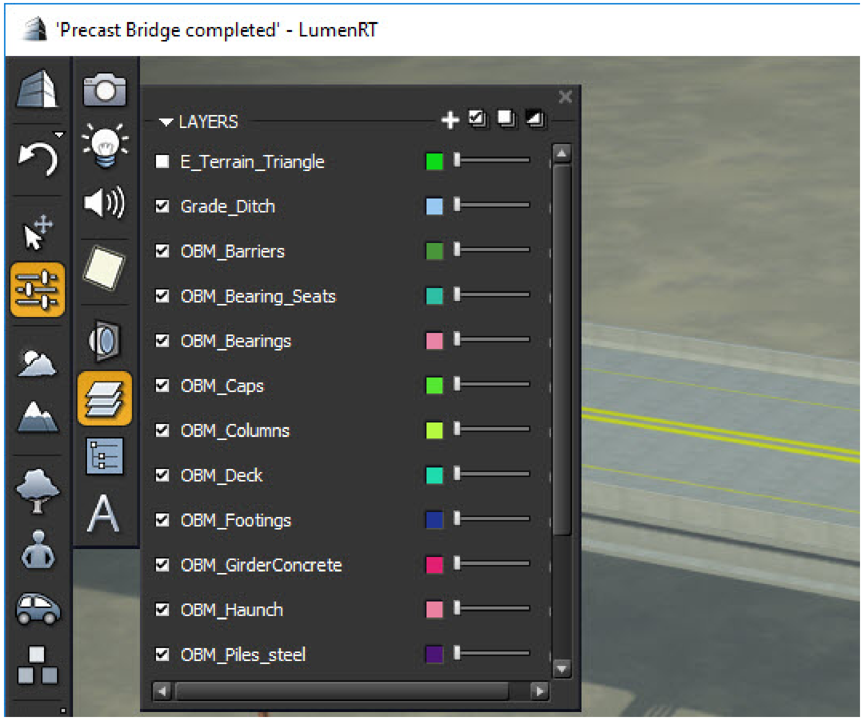
Export to LumenRT

1. Once the camera is setup, make View 2(Isometric view) the active one by clicking on the views title bar.
2. Adjust the Level Display and Reference files to display in the view to show only the elements to be exported to LumenRT.



3. From the Visualization workflow, select *Home > LumenRT > LumenRT*.
4. Familiarize yourself with the LumenRT navigation tools.

5. Select the *Setup* tool and deactivate the level for the terrain, to facilitate the selection of the bridge elements.

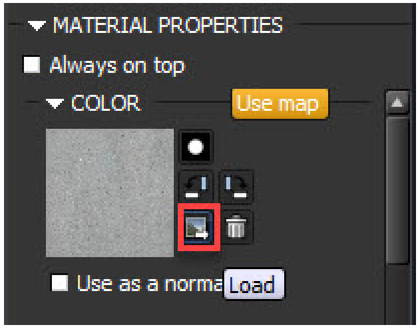


6. Turn off all levels except the OBM_Deck level.

7. Close the **Layers** dialog.

8. Use the **Selection** tool to select the deck.

9. Select the deck.
10. Select the **Load** icon in the *Color* group.

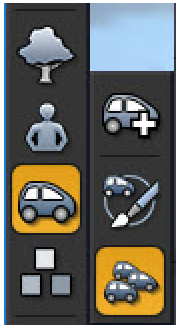


11. Select *asphalt_top_course.jpg*, then click **Open**.
12. Review the resulting deck element.
13. Turn on the other levels with the exception of the existing terrain.

Add Traffic to the Model

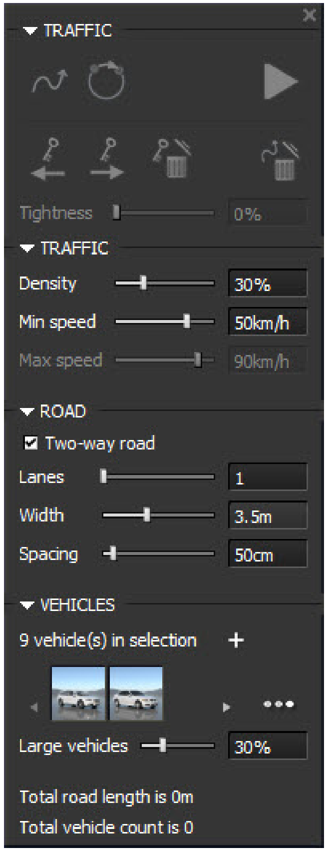
1. Adjust the view to visualize the traffic lanes on the bridge.

2. Select the **Create Traffic** tool.

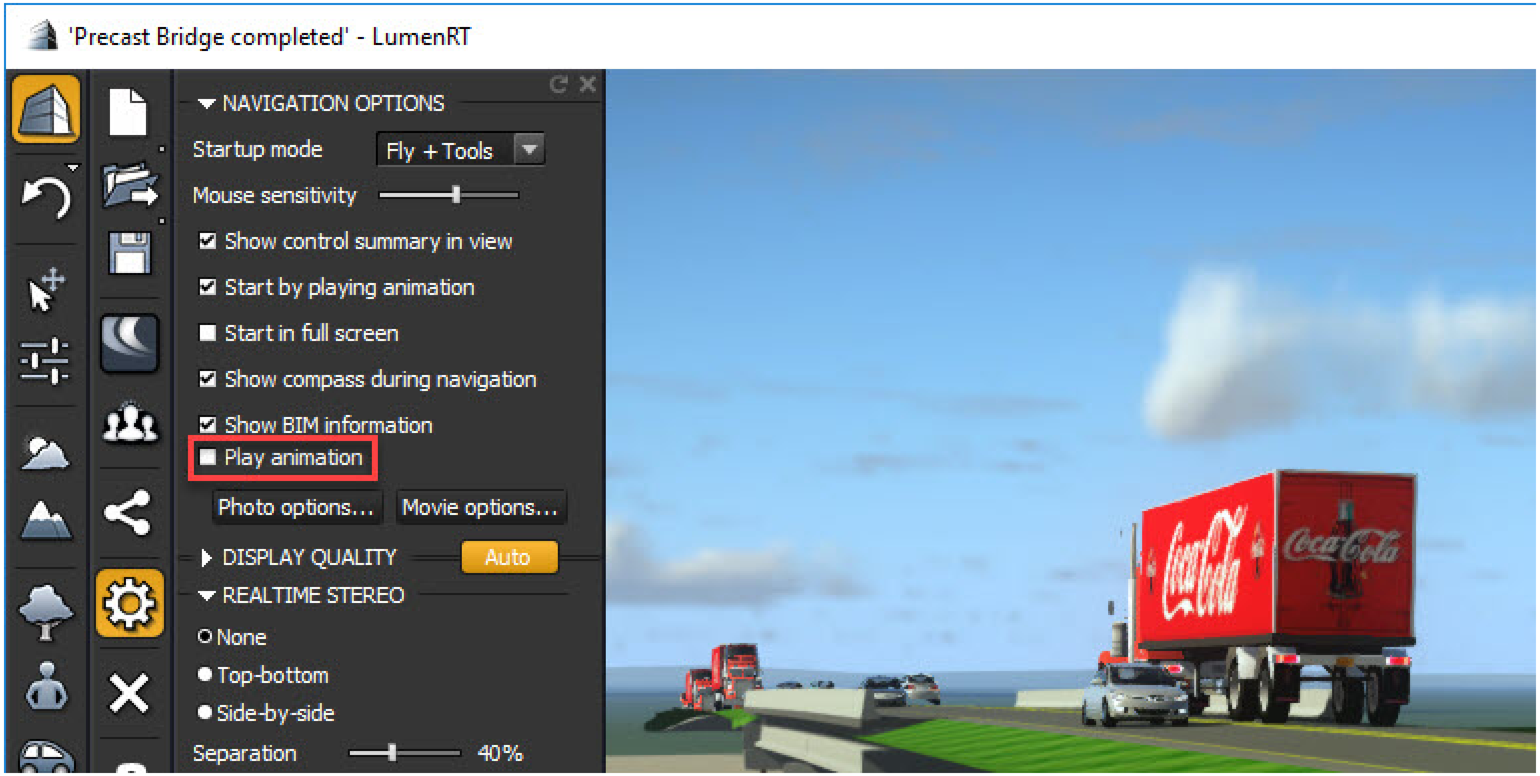


3. Select vehicles to place on the road/bridge.

4. Populate the Traffic window as shown.



5. Click in the view where you want the traffic to start. Hint: DP on the CL of the roadway.
6. Continue to add data points to set the location of the traffic flow.
7. Click the **Create Traffic** (arrow in the upper right of the window) to begin seeing the traffic animation.
8. The animation can be stopped in the settings menu shown below.

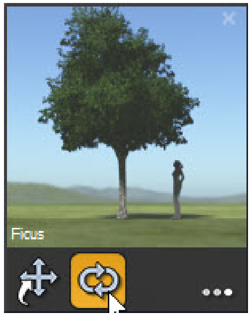


Add Trees to the Model

1. Activate the level for the terrain.
2. Adjust the view to visualize the bridge from the side.
3. Select the **Add Plant** icon, and pick the type of tree to add.

4. Click on the terrain to place the tree.

5. Select the **Add Multiple Items** to "plant" more trees into the terrain.



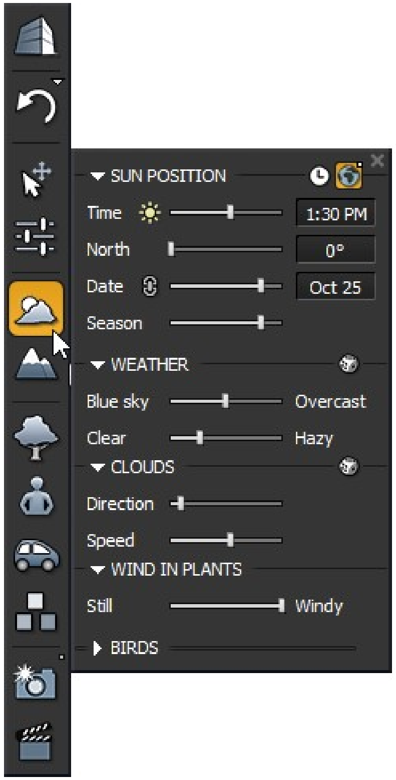
6. Click on the terrain to continuously place trees.

7. Select the **Paint Instances** icon to brush the trees into the terrain.

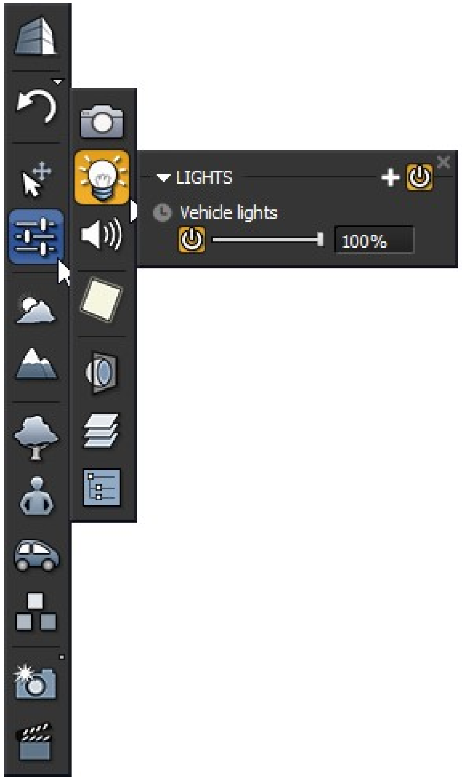
8. Click on the terrain and drag the cursor across the terrain.

Adjusting the Environment

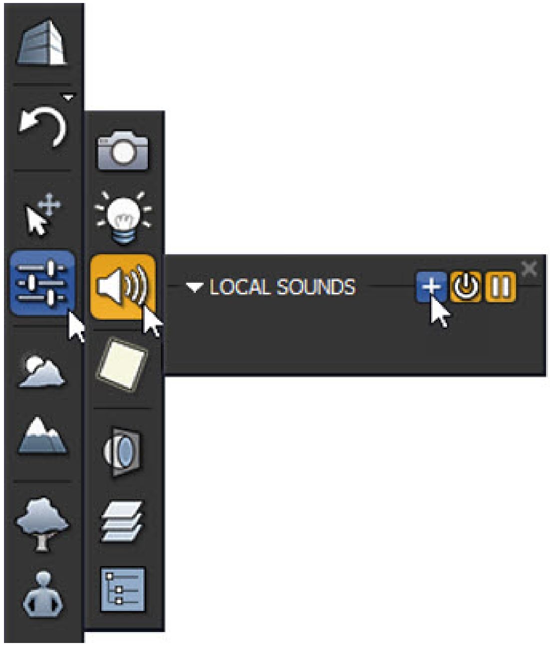
1. Select the **Sun & Atmosphere Settings** icon and adjust the sun position, weather, clouds and wind in plants.

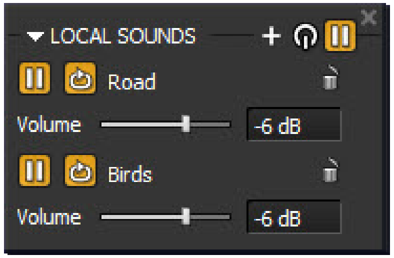


2. Select *Setup > Lights* and activate the vehicle lights during night time.

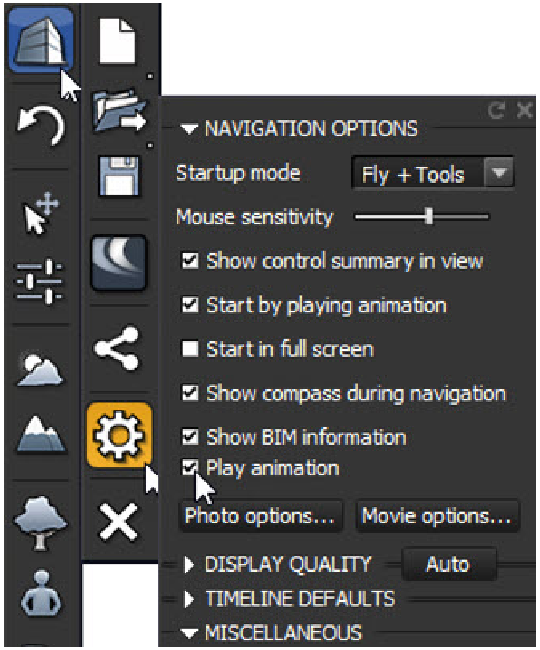


3. Select *Setup > Sounds* and add sounds to the environment.



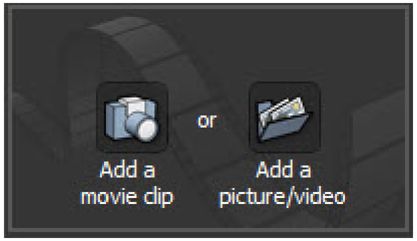


4. Activate the *Play Animation* option.



Creating an Animation

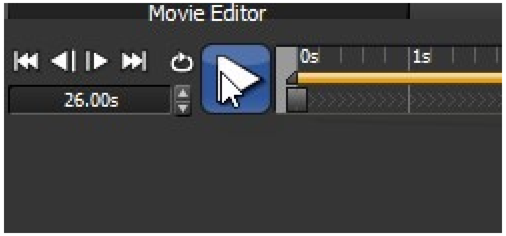
1. Select the **Movie Editor** icon.
2. Deactivate levels to display only the terrain.
3. Click on *Add a movie clip* to get a screenshot of the scene.



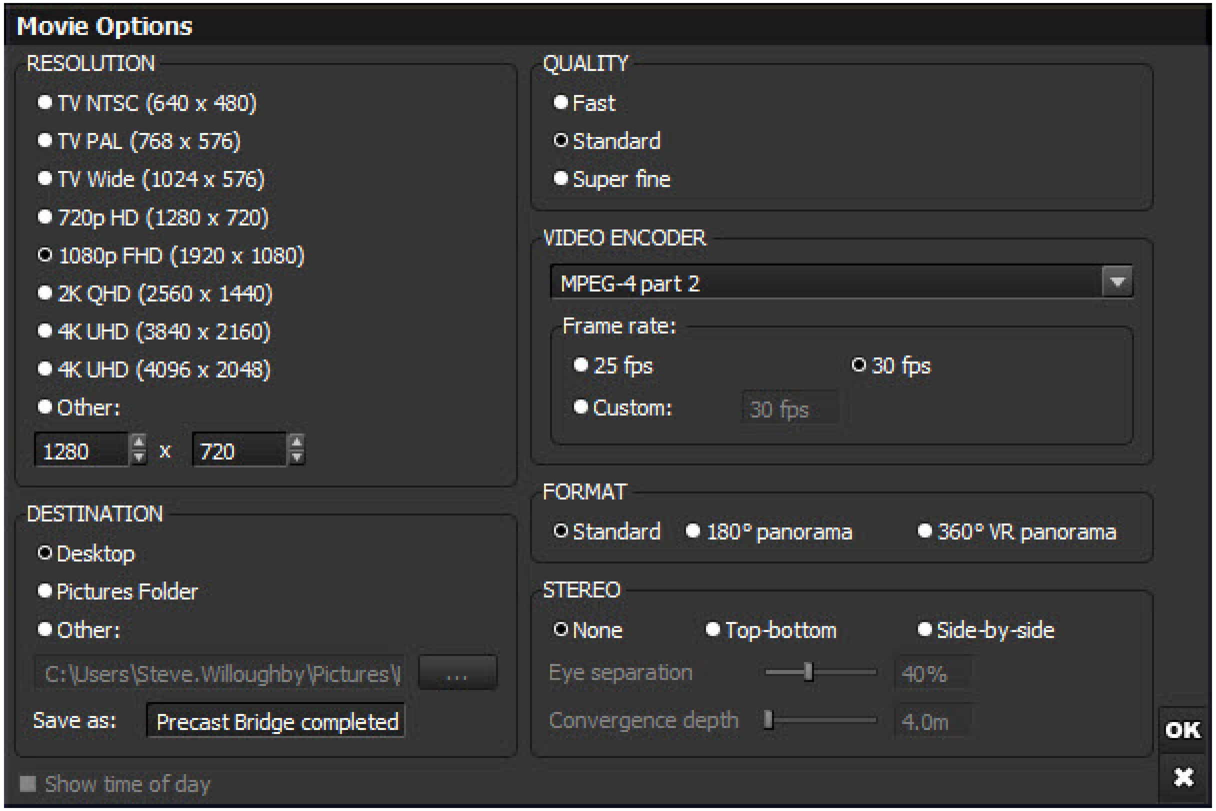
4. Activate the *TC** layers and click on the **Add Keyframe** icon.

Hint: If you zoom or rotate the view before adding the keyframe, LumenRT will pan from one location to the next as the movie is created.

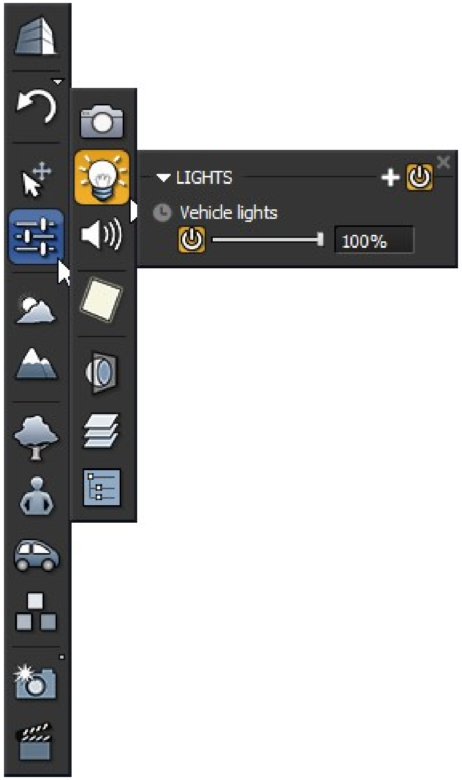
5. Activate the *OBM** layers, creating a keyframe for each one of significance to create a movie that will show the sequencing of the structure.
6. When complete, click on the **Play** icon to animate the clip sequence.



7. Click on **Tools > Export Clip** to save the movie in a format you can share.



Select *Setup > Lights* and activate the vehicle lights during night time.



Module 12: Precast Girder 3 Span - Divided Highway Example

Description

In this module you will model a 3 span straight prestressed girder bridge.

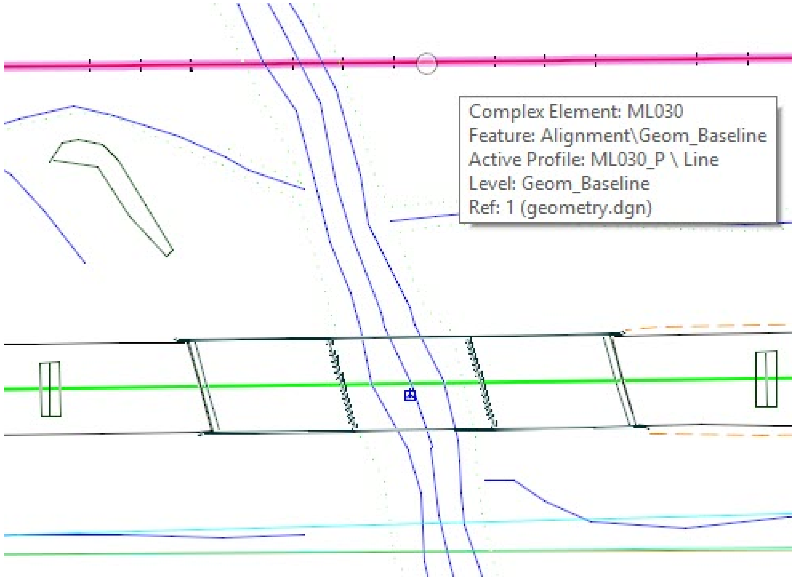
Objectives

- Reference OpenRoads geometry, terrain model and corridor
- Set pier and abutment locations
- Model deck and beams
- Model piers and abutments and bearings
- Model barriers

Add Bridge to Model

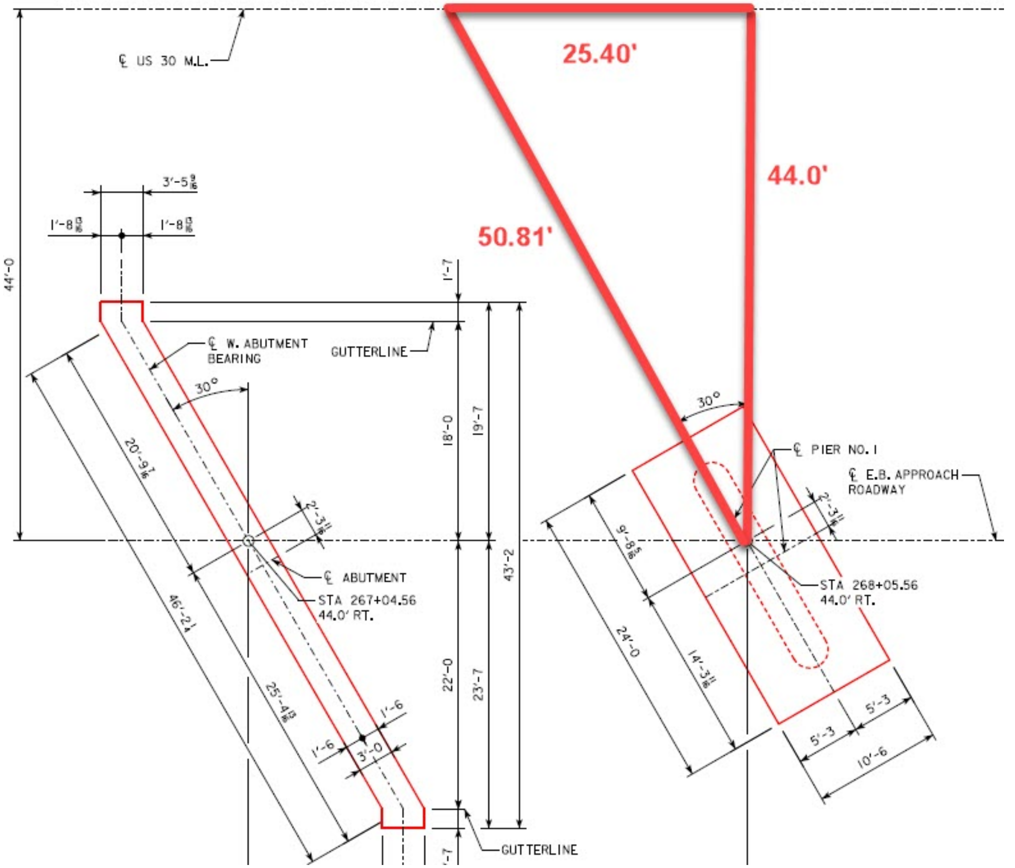
1. Select the **Add Standalone Group** icon and name it *Module 12*. (OBD only)
2. Open the file **EB Bridge.dgn** from the *Module 12(Divided Highway)* folder.
3. Reference the Topo, Terrain and Geometry drawings using Coincident World method.
4. Fit The Views to see the references.

5. Use *Home > Bridge Setup>* **Add Bridge** to create a bridge along ML030.
   - *Bridge Type* = **Beam Slab (P/S or RC Concrete Girders)**
   - *Feature Definition* = **Bridge_decorations**
   - *Name Prefix* = **ML030_EB**
6. Select alignment ML030.
7. Data point off the alignment to accept.
8. Select the *Home > Bridge Setup >* **Terrain** icon, then data point on the edge of the terrain to make it active.

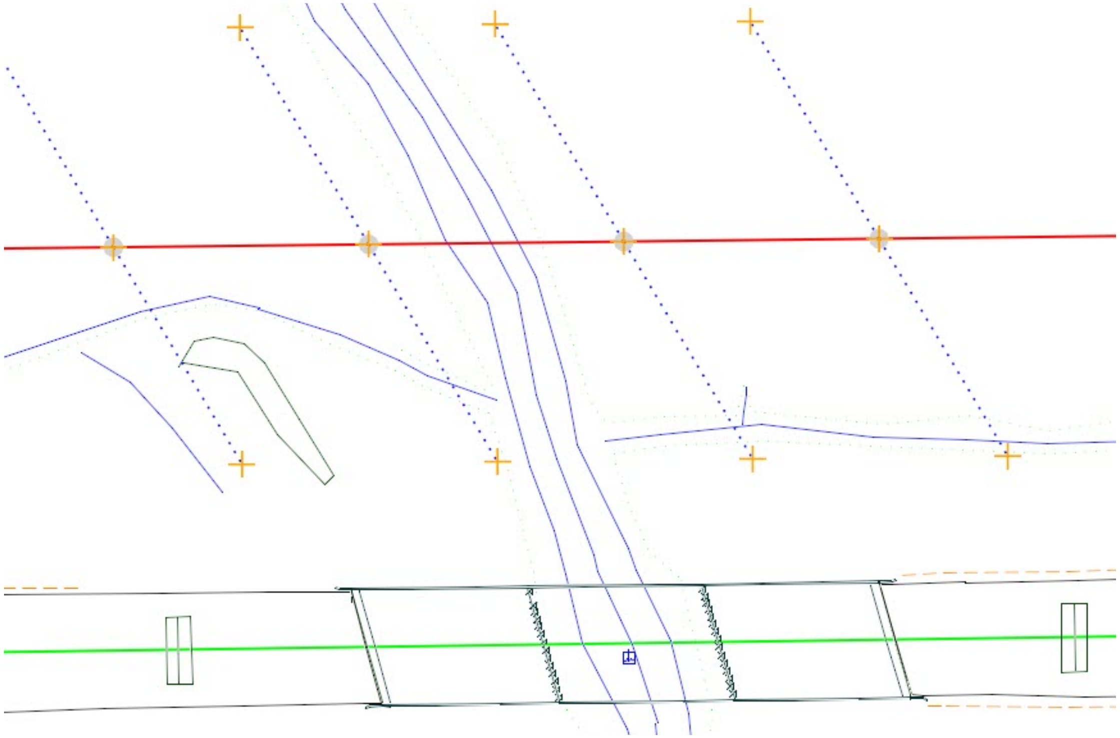


Add Support Lines

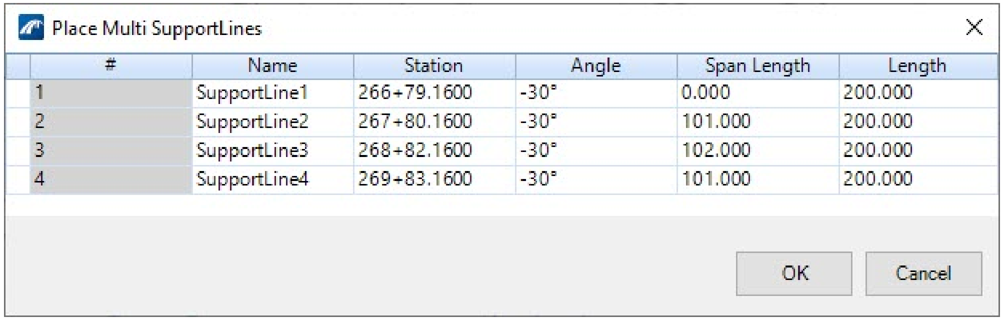
1. Continuing in the **EB Bridge.dgn** drawing.
2. Look at Sheet 34 of the PDF included in the workshop folder. The supports are all offset 44’ to the right of the alignment and skewed 30° right ahead (-30° in OBM). Because of the offset and skew, basic trig is required to compute the station where the Support Line crosses the chain.
3. Given the 44’ offset and 30° angle, the lengths of the other 2 sides of the triangle can be computed. The 25.40’ value will be subtracted from the station of the Support Lines to locate them properly. The 50.81’ will be used to assist in calculating the correct horizontal offset for each of the supports.



4. Use *Home* > *SupportLine* > **Place Multi** to place lines that represent the locations of the piers and abutments.
   - *Skew Angle* = **-30** (set in the Tool Settings dialog)
   - *Length* = **200** *[60]*
   - *Span Length* = **101** *[30.785]*
   - *Start Station* = **266+79.16** *[8+132.030]*
   - *Number of SupportLines* = **4**
   - *Direction Mode* = **Skew**
   - *Feature Definition* = **SupportLine**
5. In View 1, data point 3 times to temporarily place the Support Lines.



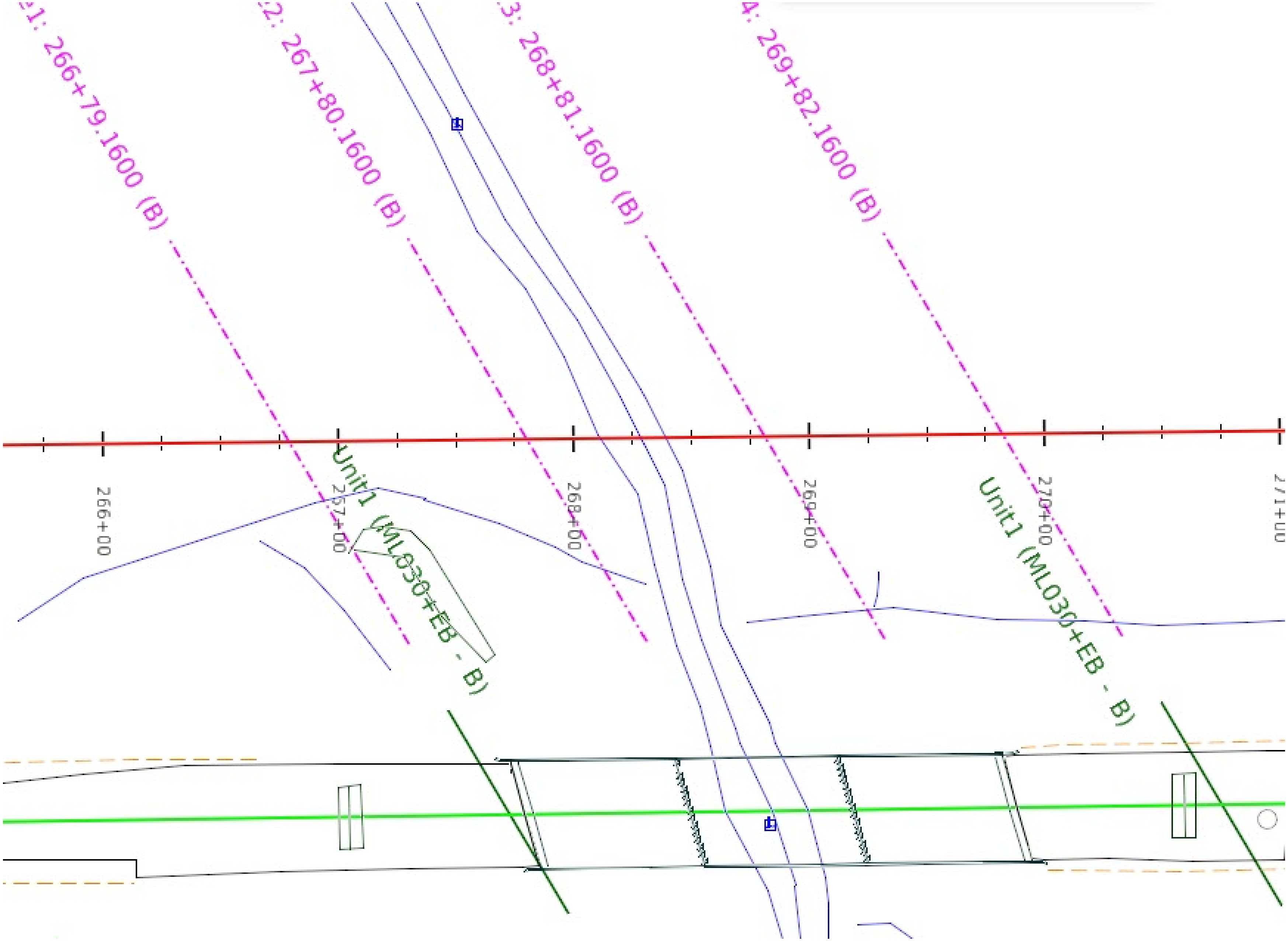
6. In the Place Multi Support Lines window, change the **Span Length** of SupportLine3 to *102.0*.



#	Name	Station	Angle	Span Length	Length
1	SupportLine1	266+79.1600	-30°	0.000	200.000
2	SupportLine2	267+80.1600	-30°	101.000	200.000
3	SupportLine3	268+82.1600	-30°	102.000	200.000
4	SupportLine4	269+83.1600	-30°	101.000	200.000

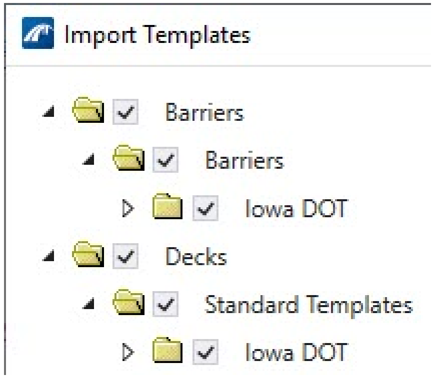
7. Click **OK** to accept the Support Line locations.
8. Right click to stop placing Support Lines.
9. Change the *Reports and Drawings > Drawing Scale > Annotation Scale* to **1”=50’**

10. Review the resulting support lines.

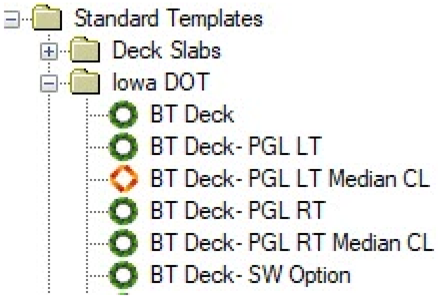


Model the Bridge Deck

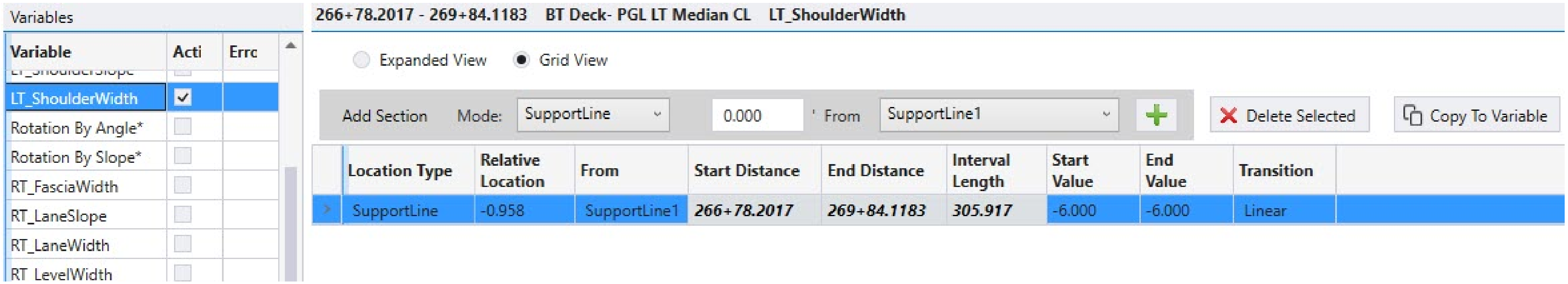
1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Utilities > Import/Export > Templates > Import >* **Superstructure** to import new templates into the delivered libraries.
3. Select the file **Iowa DOT Superstructure Templates.xml** from the *Module 12 (Divided Highway)* folder, then click Open.
4. Select Barriers and Decks to be imported as shown.



5. Click **Import**.
6. Use *Home > Superstructure >* **Place Deck** to place a deck for the length of the structure.
7. Next to Template Name, click the ... icon.
8. Select *BT Deck - PGL LT Median CL*.

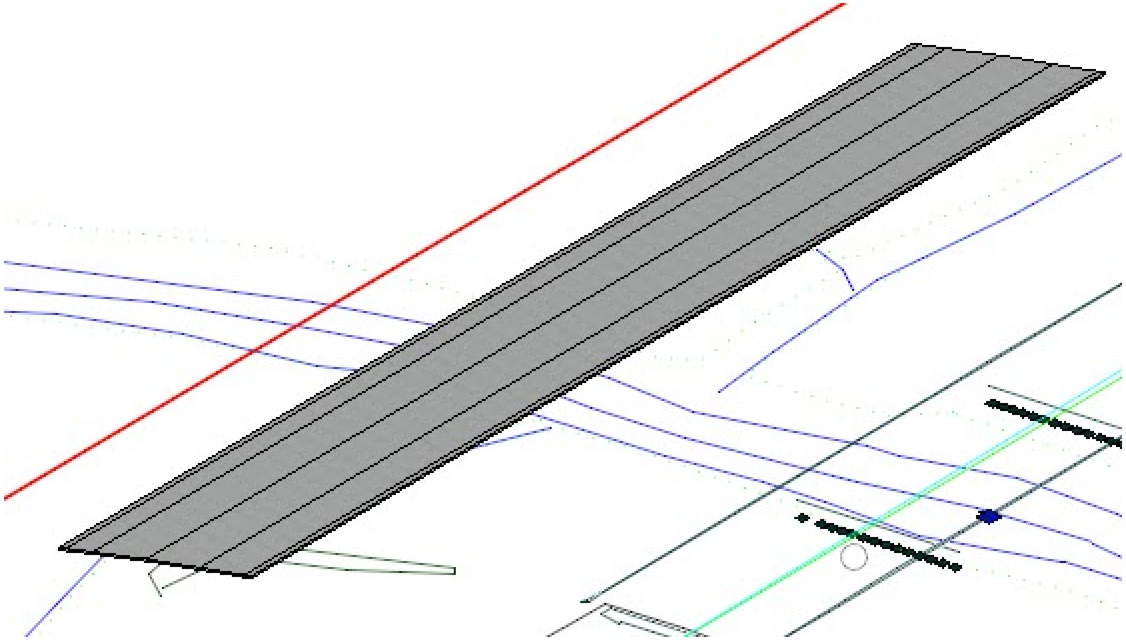


9. Set the following parameters in the Tool Settings window.
    - *Start Station Offset* = **-1.5** *[0.5]*
    - *End Station Offset* = **1.5** *[0.5]*
    - **Enable** *Add Constraints*
    - **Enable** *Analytical Deck*
    - *Deck Material* = **Deck Concrete - 4.0**
    - *Feature Definition* = **Deck**
10. Select the first support line.
11. Select the last support line.
12. Data point to continue.
13. Select the **Variable Constraint** tab.
14. Set the Start Value and End Value for the following variables.
    - *RT_ShoulderWidth* = **10** *[3.0]*
    - *LT_ShoulderWidth* = **-6** *[-1.8]*



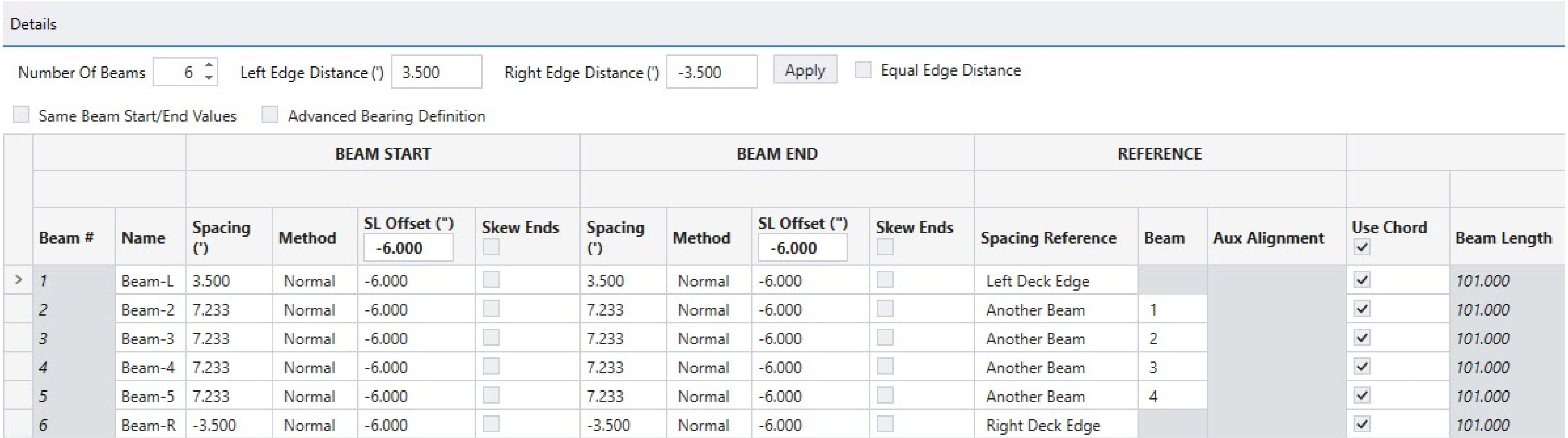
15. Click OK to accept the variable constraints and to model the deck.

16. Review the 3D model.



Define the Girders

1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Home > Superstructure >* **Beam Layout** to determine the beam centerlines for the length of the structure.
3. From View 1, Select the first support line.
4. Select the last support line.
5. Datapoint to continue.
6. Set the *Number of Beams* to **6**.
7. Disable the **Equal Edge Distance** and **Same Beam Start/End Values** toggles.
8. Set the *Left Edge Distance* to **3.5** *[1.05]* and set the *Right Edge Distance* to **-3.5** *[-1.05]* and click **Apply**.
9. Set the *SL Offset* to **-6** *[150]* for the start of the beam and **-6** *[-150]* to the end of the beam.



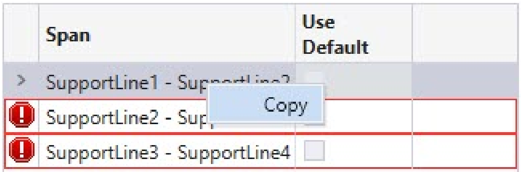
Details

Number Of Beams: 6 | Left Edge Distance ('): 3.500 | Right Edge Distance ('): -3.500 | Apply | Equal Edge Distance

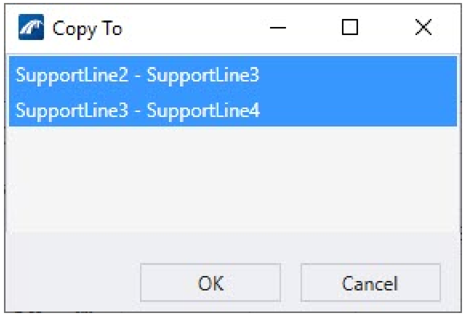
Same Beam Start/End Values | Advanced Bearing Definition

		BEAM START				BEAM END				REFERENCE				
Beam #	Name	Spacing (')	Method	SL Offset (") -6.000	Skew Ends	Spacing (')	Method	SL Offset (") -6.000	Skew Ends	Spacing Reference	Beam	Aux Alignment	Use Chord	Beam Length
1	Beam-L	3.500	Normal	-6.000		3.500	Normal	-6.000		Left Deck Edge			✓	101.000
2	Beam-2	7.233	Normal	-6.000		7.233	Normal	-6.000		Another Beam	1		✓	101.000
3	Beam-3	7.233	Normal	-6.000		7.233	Normal	-6.000		Another Beam	2		✓	101.000
4	Beam-4	7.233	Normal	-6.000		7.233	Normal	-6.000		Another Beam	3		✓	101.000
5	Beam-5	7.233	Normal	-6.000		7.233	Normal	-6.000		Another Beam	4		✓	101.000
6	Beam-R	-3.500	Normal	-6.000		-3.500	Normal	-6.000		Right Deck Edge			✓	101.000

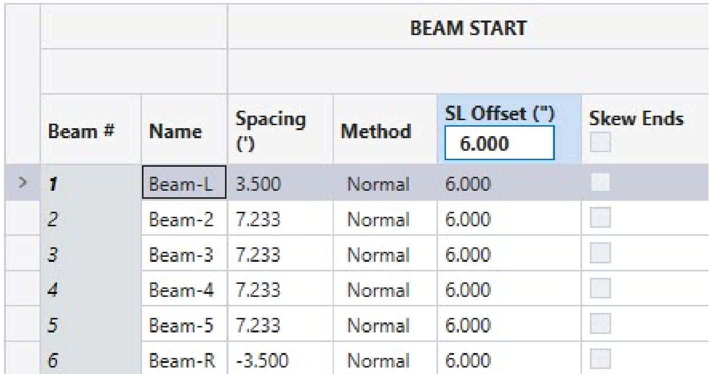
10. Right click Span *SupportLine1 - SupportLine2* and select **Copy**



11. In the Copy To window, select *SupportLine2 - SupportLine3* and *SupportLine3 - SupportLine4* then click **OK**.



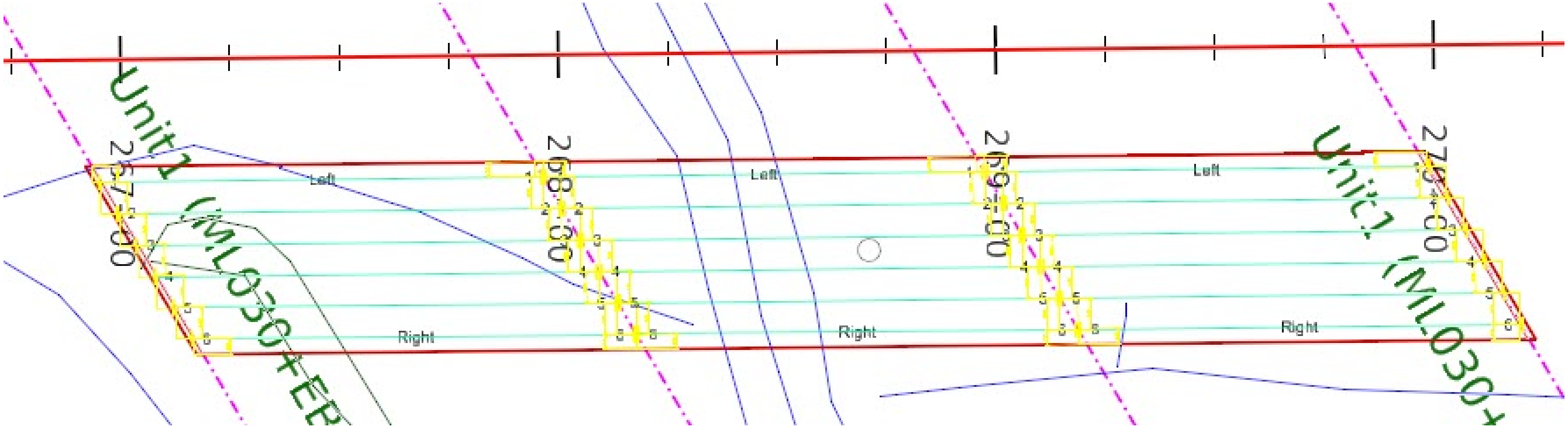
12. Click Span *SupportLine2 - SupportLine3,* then change the *BEAM START > SL Offset* to **6.0** *[150]*.



13. Click Span *SupportLine3 - SupportLine4,* then change the *BEAM END > SL Offset* to **6.0** *[150]*.

14. Select **Validate** to review the proposed beam line locations.

15. Select **Save** to keep the beam layout.



16. Use *Home > Superstructure >* **Place Beam** to select the beam shape.

   - **Enable** *Custom*
   - *Feature Definition* = **Girder**

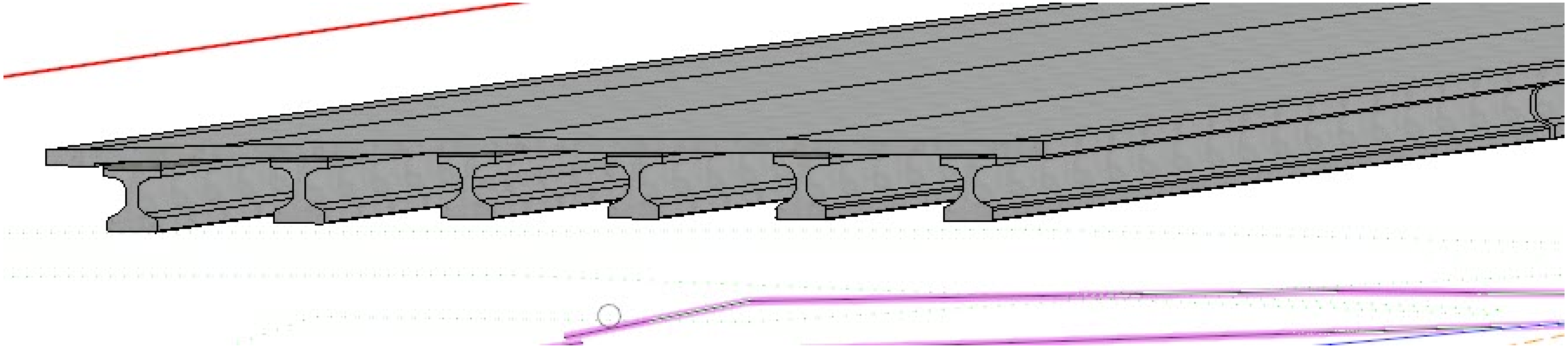
17. From View 1, select the beam layout then data point to accept.

18. In the Beam Definition window, set the following:

   - *Beam Type* = **Custom**
   - *Enable* the **Compute** toggle
   - *Min. Clearance* to **0.5** *[15]* .
   - *Camber* to **2** *[50]*.
   - *Start Template* to **Beams > Standard Sections > Iowa DOT > IA-BTB**

19. Enable the *Apply to All Beams* toggle (lower left corner of the window).

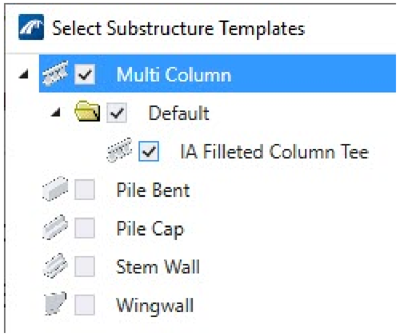
20. Select OK to model the beams.



21. Review the resulting model.

Place the Pier

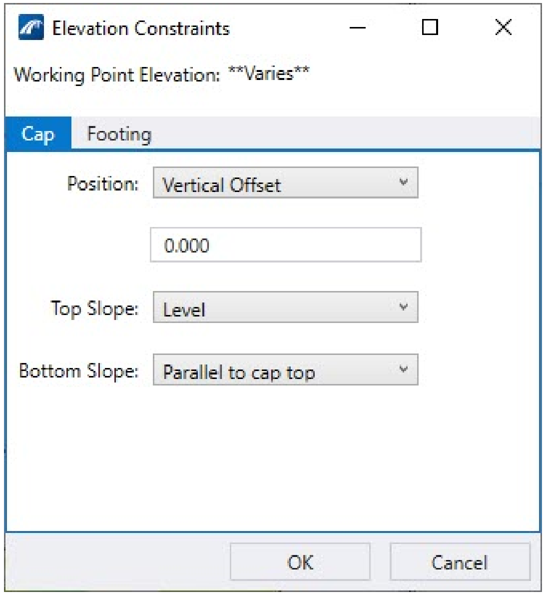
1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Utilities > Import/Export > Templates > Import >* **Substructure** to import new templates into the delivered libraries.
3. Select the file **Iowa DOT Substructure Templates.xml** from the *Module 12 (Divided Highway)* folder, then click Open.
4. Select *Multi Column* as shown.

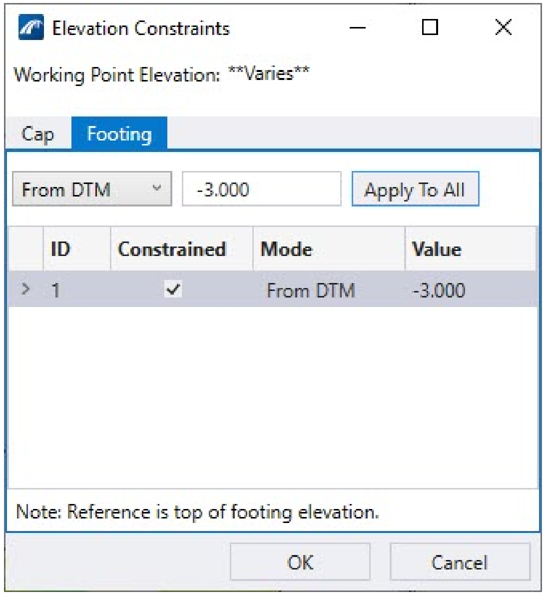


5. Click **Import**.
6. Use *Home > Substructure >* **Place Pier** to model the pier for this structure.
7. Select the ... icon to the right of *Template Name*.
8. Select the **Multi-Column > Default > IA Filleted Column Tee** pier template, then set the following parameters:
   - *Horizontal Offset* = **53.117** (50.81'+2' 3 11/16")
   - *Cap Length Adjustment* = **None**
   - Enable the toggle for *Elevation Constraints*
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**

- *Footing Material* = **Substructure Concrete**
- *Pile Material* = **Steel > 14 x 73 H Section Piles**
- *Feature Definition* = **Pier_steel_piles**

9. Select the middle 2 support lines, right click in space then data point to place the piers.
10. In the Elevation Constraints window, set the Cap and Footings tabs as shown. Note: Use *-1* for From DTM value for metric.



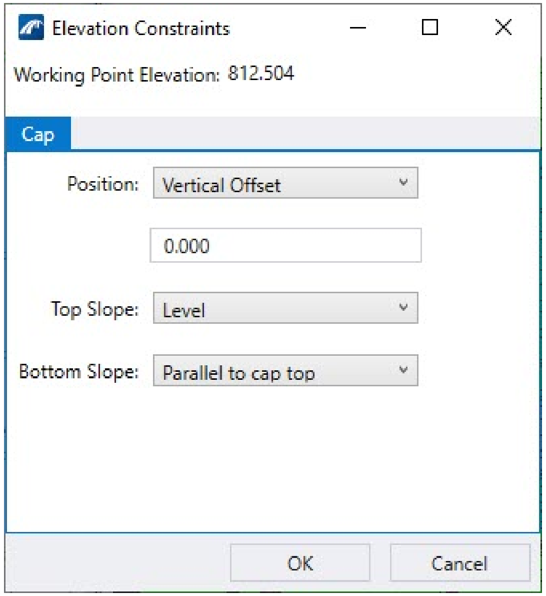


11. Turn on the display of the triangles for the attached terrain model.
12. Rotate the model so you are viewing the pier footings from under the terrain surface to verify the depth of the footings.
13. Rotate the model back to an isometric view of the structure.

Place the Abutments

1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Abutment** to model the abutments for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Pile Cap > Default > 2 Lane - 27ft** *[2 Lane - 8 m]* abutment template, then set the following parameters:
   - *Horizontal Offset* = **53.117** (50.81’+2’ 3 11/16”)
   - *Cap Length Adjustment* = **By Deck**
   - Enable the toggle for *Conform Backwall with Deck Top*
   - Enable the toggle for *Edit Elevation Constraints*
   - *Cap Material* = **Substructure Concrete**
   - *Column Material* = **Substructure Concrete**
   - *Footing Material* = **Substructure Concrete**
   - *Pile Material* = **Steel > 14 x 73 H Section Piles**
   - *Feature Definition* = **Abutment_steel_piles**
5. Select the first support line, data point in space to place the abutment.

6. In the Elevation Constraints window, set the *Top Slope* and *Bottom Slope* as shown.



7. Select **OK** to accept Pier Elevation Constraints window values.

8. Select the abutment with the **Element Selection** tool.

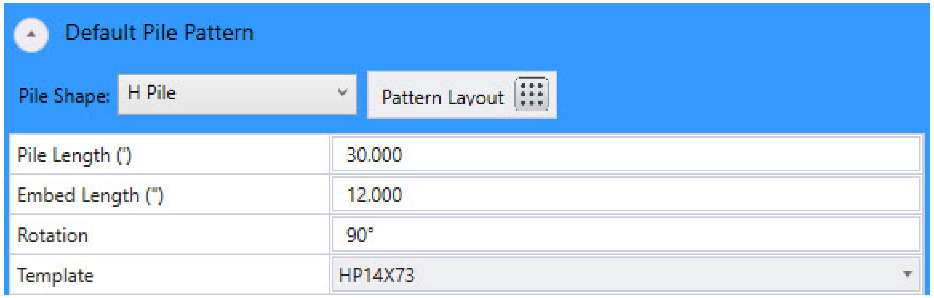
9. Select the **Properties** icon.

10. Choose **Select to Edit ...** next to *Substructure Template*.

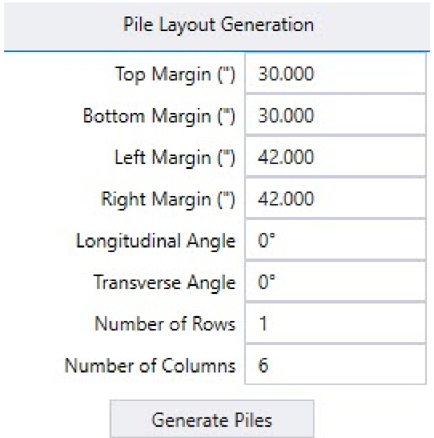
11. Select the **Piles** tab. Modify the following parameters:

    - **Pile Type** = *H Pile*
    - **Pile Length** = *100*
    - **Embed Length** = *24 [600]*
    - **Rotation** = *90*

- **Template** = *HP14X73*.



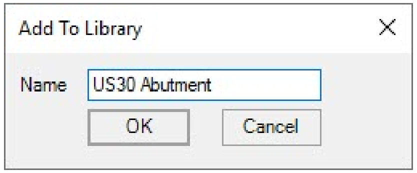
12. Select **Pattern Layout**.
13. Set the following values, then click **Generate Piles**.
    - *Left Margin* and *Right Margin* = **42** *[1000]*
    - *Number of Columns* = **6**



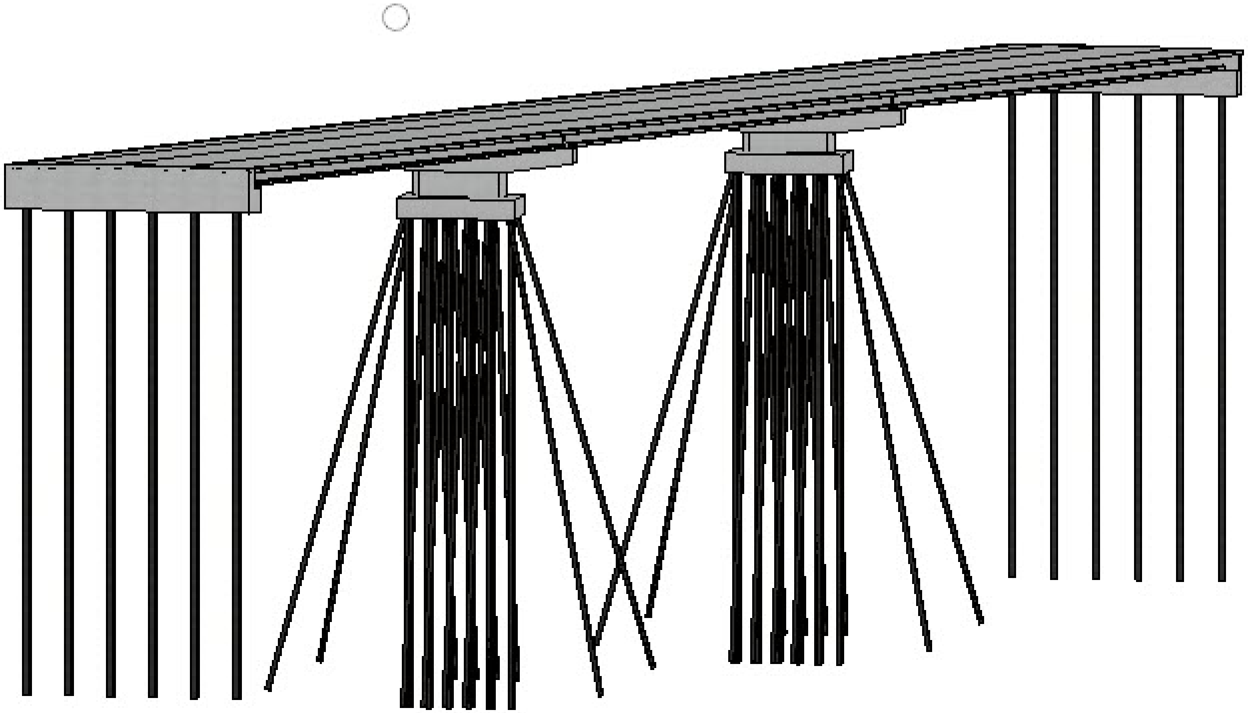
14. Select **OK** to accept pile changes.
15. Select **OK** to accept abutment changes.
16. Select the abutment with the **Element Selection** tool.
17. Select the **Properties** icon.
18. Choose **Select to Edit ...** next to *Substructure Template*.

19. Click **Add to Library**.

20. Name the abutment, then click **OK**.

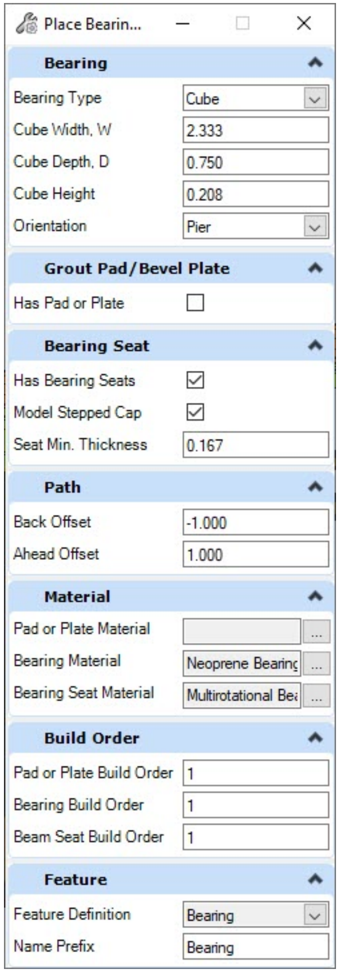


21. Using the Place Abutment tool, place the newly saved abutment at the end of the structure using the same elevation constraints as the first abutment.

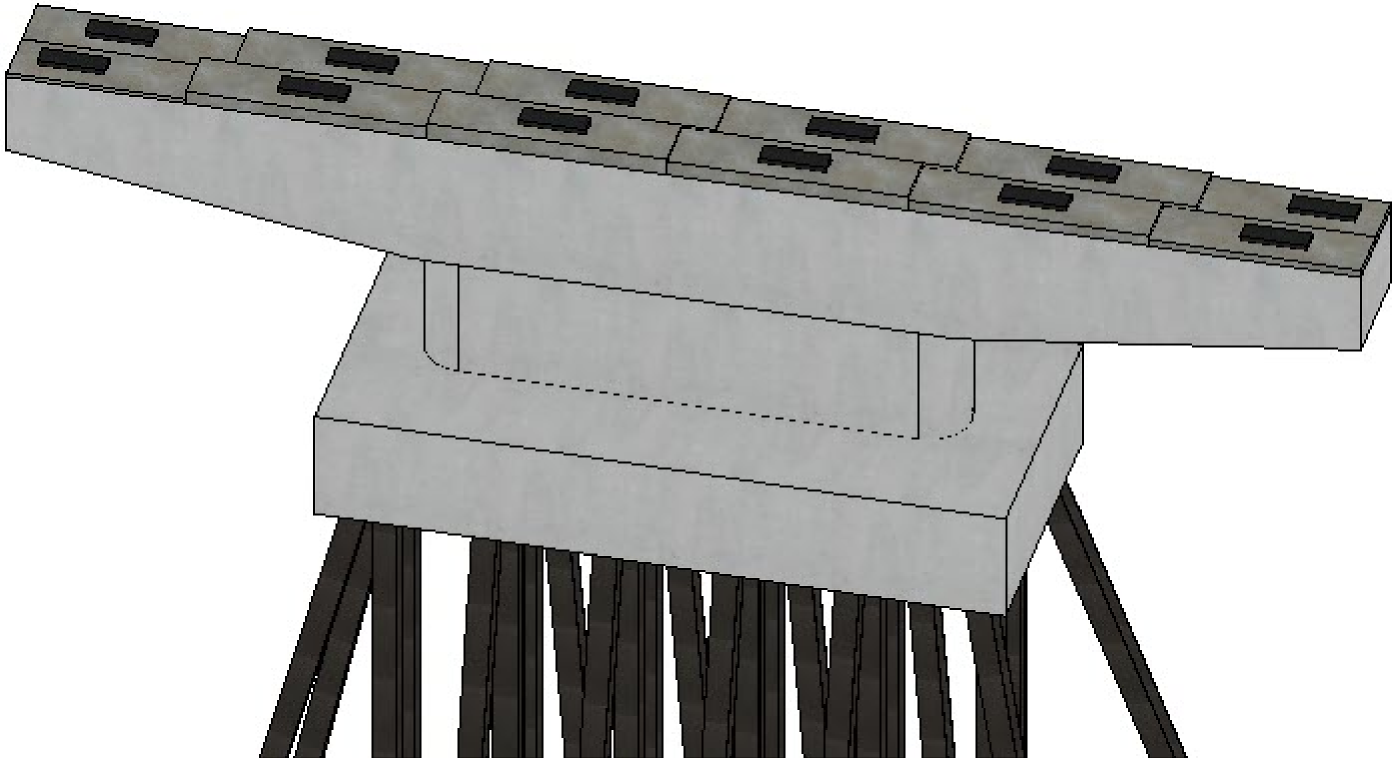


Place the Bearings and Stepped Cap

1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Bearing** to model the bearings and stepped cap for this structure.
3. In the Tool Settings window, set the following values:



4. Select each of the support lines, reset off of the support lines, then data point to place the bearings.
5. Review the resulting bearings. In *Explorer*, turn off the **deck** and **beam groups**. Turn them back on prior to performing the next exercise.

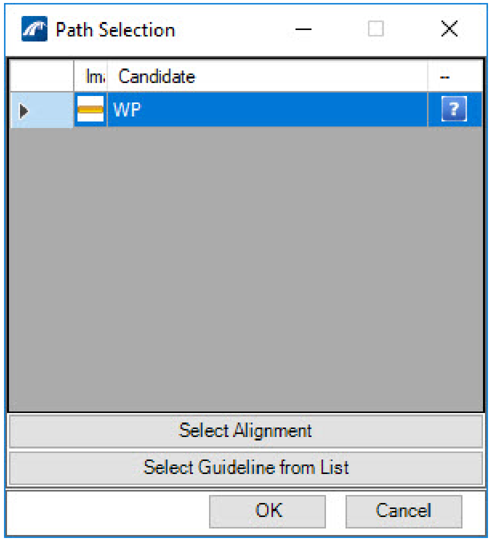


Place Excavation

1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Home > Substructure >* **Place Excavation** to model the excavation for the piers.
3. Set the following parameters:
   - *Horizontal Offset* = **2**
   - Enable the *Vertical Sheeting* toggle
   - *Barrier Material* = **Excavation** (Miscellaneous tab)
   - *Feature Definition* = **Earthworks**
4. Select the perimeter of the terrain model when prompted.
5. Then select each pier with a data point, then off of the piers right-click, then data point to continue.
6. Review the resulting excavation elements.

Place the Barriers

1. Continuing in the **EB Bridge.dgn** drawing.
2. Use *Home > Accessory >* **Place Barrier** to model the barriers for this structure.
3. Select the ... icon to the right of *Template Name*.
4. Select the **Iowa DOT > Barriers > TL-4 L** barrier template, then set the following parameters:
   - *Barrier Material* = **Traffic Barrier**
   - *Feature Definition* = **Barrier**
5. Select the deck with a data point, then off of the deck right-click, then data point to continue.
6. From the *Path Selection* window, click **Select Guideline from List**.



7. Select point **LT_EdgeofDeck** from the *Guideline Point Name* list. This point represents the upper left point of the deck.
8. Click **OK** in each Path Selection window to place the barrier.

9. Repeat the process for the right side barrier. Use template **Iowa DOT > Barriers > TL-4 R** and point **RT_EdgeofDeck** for the *Guideline Point Name.*

10. Review the resulting barriers.