Bentley Institute

Practice Workbook

This workbook is designed for use in Live instructor-led training and for OnDemand selfstudy.
The explanations and demonstrations are provided by the instructor in the classroom, or in the OnDemand eLectures of this course available on the Bentley LEARN Server (*learn.bentley.com*).

This practice workbook is formatted for on-screen viewing using a PDF reader.
It is also available as a PDF document in the dataset for this course.

Steel Girder Bridge Modeling for OpenRoads Designers

This workbook contains exercises to walk a designer through the process of quickly modeling a steel girder bridge using LEAP Bridge Steel.

TRNC01367-1/0001

Description and Objectives

Course Description

This workbook contains exercises for modeling a 3 span curved steel girder bridge.

Skills Taught

- Import data for the horizontal and vertical alignments and/or 3D DTM.
- Set the pier line locations.
- Model the girders and cross frames
- Create a 3D MicroStation drawing of the bridge model.

Import Geometry from Bentley Civil products

In this exercise we will import a chain and profile from one of the Bentley Civil products.

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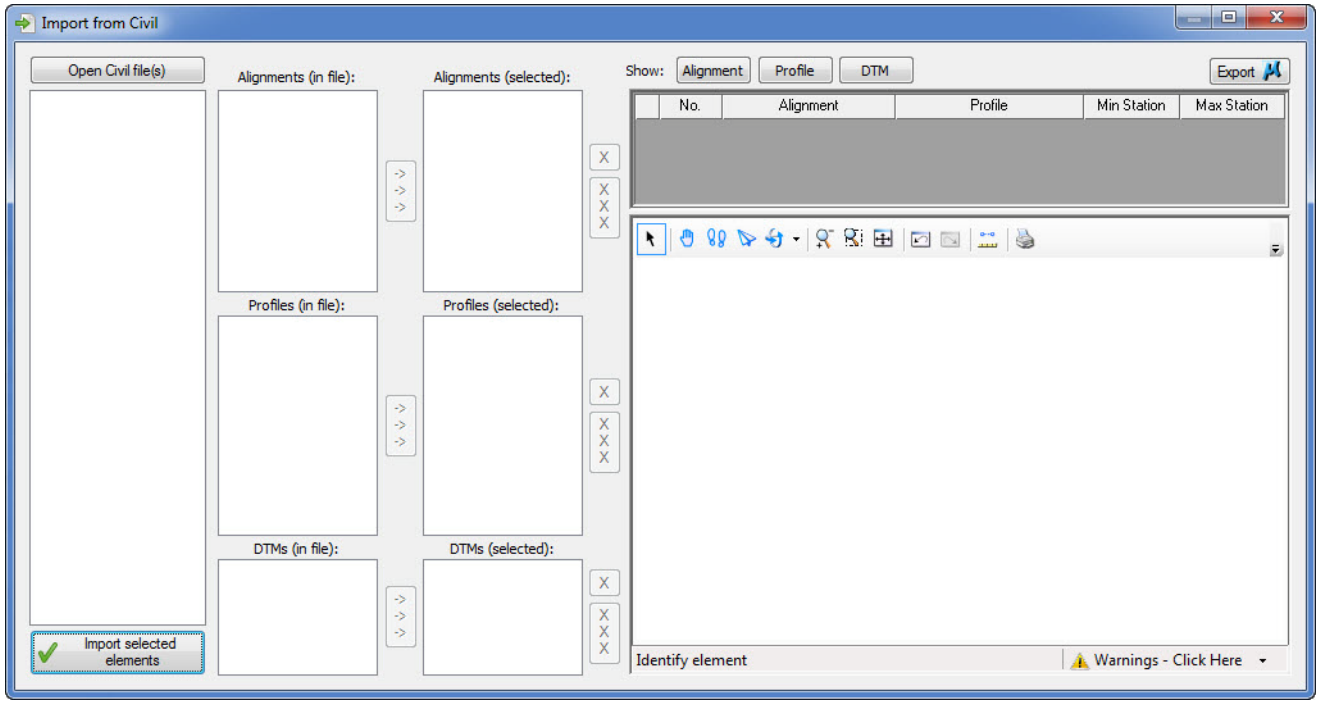
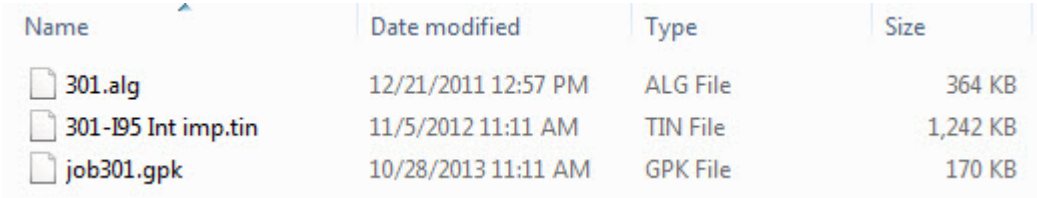
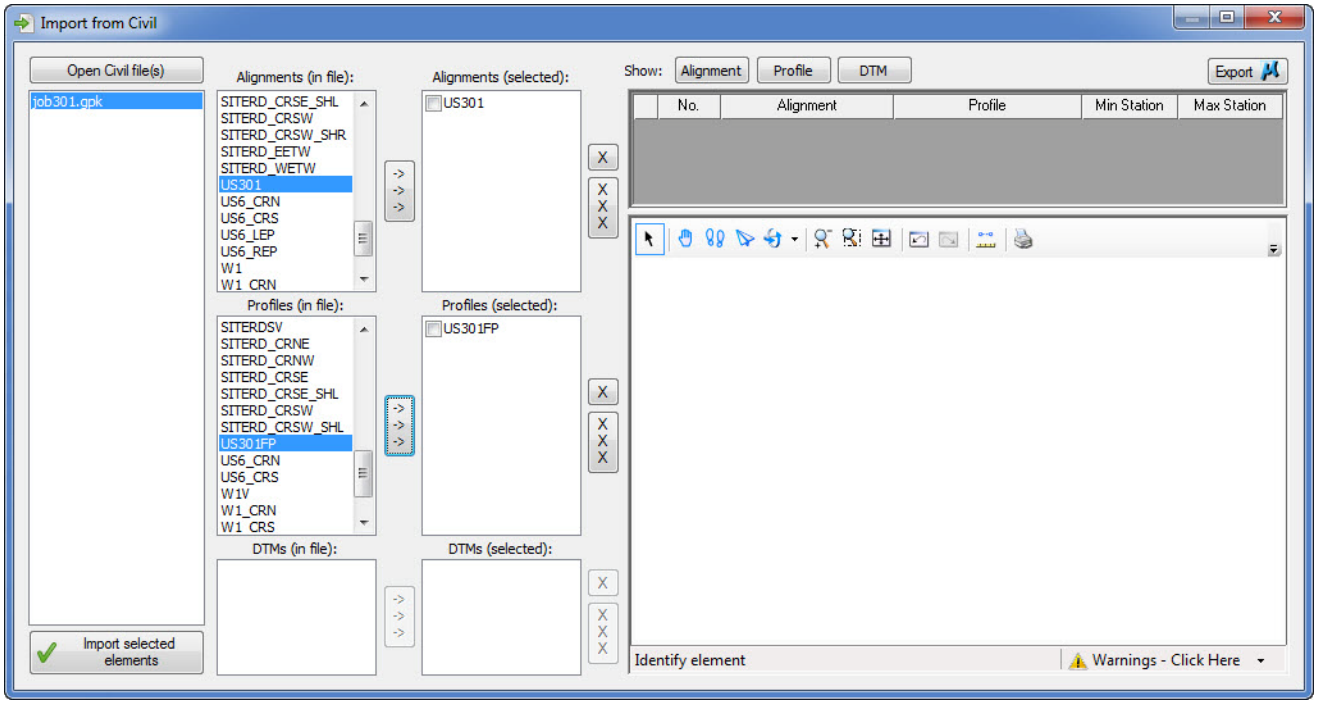
1. Start LEAP Bridge Steel.
2. Select the **Import from Civil** tool.



3. Click on **Open Civil file(s)**.



4. Select the GPK or ALG file from the class folder.
5. Highlight the file name in the Import from Civil window to see a list of the alignments and profiles.
6. Move alignment **US301** and profile **US301FP** to the right.



7. Select the alignment and profile by clicking the box to the left of each one.
8. Select the profile name as shown below.

No.	Alignment	Profile	Min Station	Max Station
1	US301	US301FP	98+00.0000	223+11.3880

9. Select **Import Selected Elements**.

Review Geometry and Define Roadway

This exercise will review the imported geometry as well as define a roadway for the structure. A roadway in LEAP terminology is the combination of an alignment, profile and cross section to define the bridge location.

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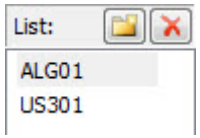
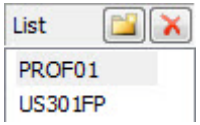
1. Select **Alignments**.
2. Select each alignment from the List window to review the geometry. Fit the view if necessary.

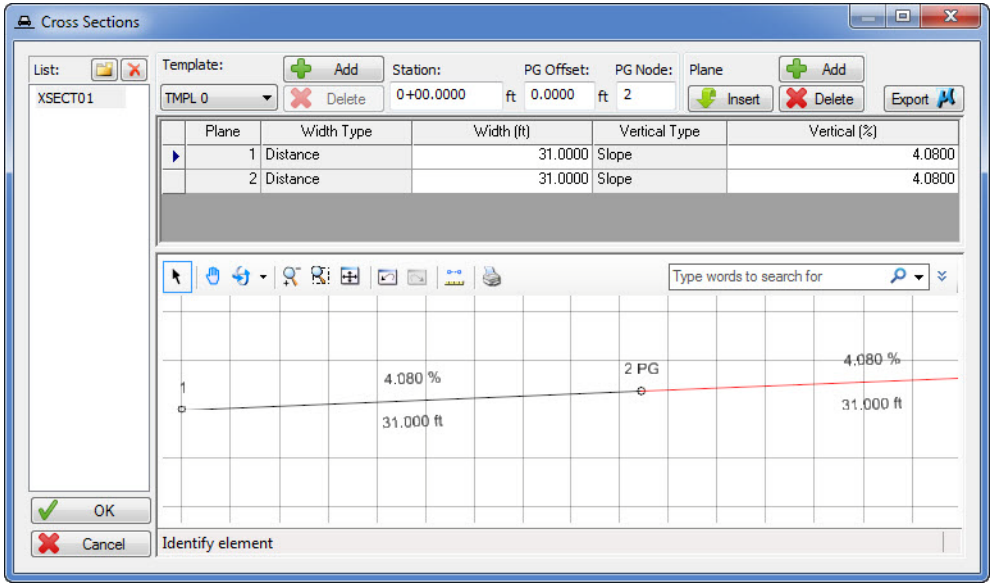


3. Select **Cancel** to close the Alignments dialog.
4. Select **Profiles**.
5. Select each profile from the List window to review the geometry. Fit the view if necessary.



6. Change the **Drawing scale** to *20:1*.
7. Select **Cancel** to close the Profiles dialog.
8. Select **Cross Sections**.

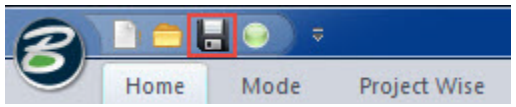
9. Change the **Width** of each plane to *31.0* and the **Vertical %** to *4.080*.



10. Select **OK** to accept the changes.
11. Select **Roadways**.
12. Change the default roadway definition to use the imported alignment and profile.

No.	Name	Show	Alignment	Profile	Cross Section	Min Station	Max Station
1	RDWY01	Yes	US301	US301FP	XSECT01	98+00.0000	223+11.3880

13. Select **OK** to accept the changes.
14. Select the Save icon to save the work completed. Place the file in the training folder. Name the file *3 span I girder.lbs*.



Define the Support Locations and Deck Slab

In this exercise we will use the Pier/Abutment Locations and Deck Slab tools to model the deck. The bridge is a 2 span continuous structure with spans of 90' each.

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1. Continue in the file *3 span I girder.lbs* created in the previous exercise.
2. Select **Pier/Abutment Locations**.
3. Select **Add Support**. Set the **Station** to *191+42.67* and the **Skew** to *-15.63*.
4. Select **Add Support** to add the next support.
   a. Set the **Input Method** to *Station*.
   b. Set the **Station** value to *192+00.10* and the **Skew** to *-14.77*.

	No.	Type	Name	Input Method	Station/ Distance (ft)	Skew/ Bearing	Bearing Line 1	Bearing Line 1 Offset (in)	Bearing Line 2	Bearing Line 2 Offset (in)
▶	1	Pier	Support 01	Station	191+42.6700	SKEW -15 37 48.00	No	-6.0000	Yes	6.0000
	2	Pier	Support 02	Station	192+00.1000	SKEW -14 46 12.00	Yes	-6.0000	No	6.0000

5. Select **Add Support** for the next pier.
   a. Set the **Input Method** to *Station*.
   b. Set the **Station** value to *192+87.10* and the **Skew** to *-13.46*.

	No.	Type	Name	Input Method	Station/ Distance (ft)	Skew/ Bearing	Bearing Line 1	Bearing Line 1 Offset (in)	Bearing Line 2	Bearing Line 2 Offset (in)
▶	1	Pier	Support 01	Station	191+42.6700	SKEW -15 37 48.00	No	-6.0000	Yes	6.0000
	2	Pier	Support 02	Station	192+00.1000	SKEW -14 46 12.00	Yes	-6.0000	No	6.0000
	3	Pier	Support 03	Station	192+87.1000	SKEW -13 27 36.00	Yes	-6.0000	No	6.0000

6. Select **Add Support** for the end abutment.
   a. Set the **Input Method** to *Station*.

b. Set the **Station** value to *193+44.53* and the **Skew** to *-12.60*.

	No.	Type	Name	Input Method	Station/ Distance (ft)	Skew/ Bearing	Bearing Line 1	Bearing Line 1 Offset (in)	Bearing Line 2	Bearing Line 2 Offset (in)
▶	1	Pier	Support 01	Station	191+42.6700	SKEW -15 37 48.00	No	-6.0000	Yes	6.0000
	2	Pier	Support 02	Station	192+00.1000	SKEW -14 46 12.00	Yes	-6.0000	No	6.0000
	3	Pier	Support 03	Station	192+87.1000	SKEW -13 27 36.00	Yes	-6.0000	No	6.0000
	4	Pier	Support 04	Station	193+44.5300	SKEW -12 36 00.00	Yes	-6.0000	No	6.0000

7. Change support 1 and 4to a **Type** of *Abutment*.

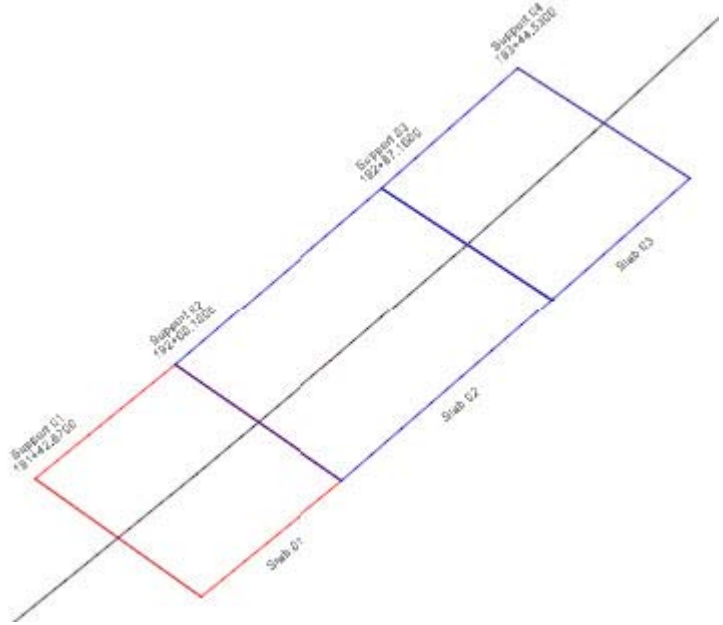
	No.	Type	Name	Input Method	Station/ Distance (ft)	Skew/ Bearing	Bearing Line 1	Bearing Line 1 Offset (in)	Bearing Line 2	Bearing Line 2 Offset (in)
▶	1	Abutment	Support 01	Station	191+42.6700	SKEW -15 37 48.00	No	-6.0000	Yes	6.0000
	2	Pier	Support 02	Station	192+00.1000	SKEW -14 46 12.00	Yes	-6.0000	No	6.0000
	3	Pier	Support 03	Station	192+87.1000	SKEW -13 27 36.00	Yes	-6.0000	No	6.0000
	4	Abutment	Support 04	Station	193+44.5300	SKEW -12 36 00.00	Yes	-6.0000	No	6.0000

8. Select **OK** to accept.
9. Select **Deck Slab**.
   a. Set the **Deck thickness**, **Haunch thickness** and **Sacrificial Wearing Surface** thickness as shown.

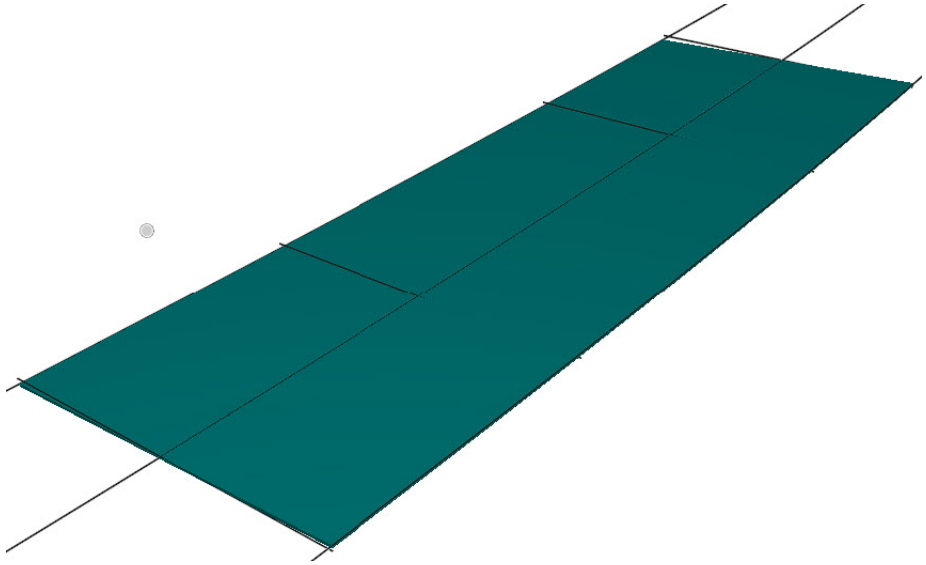
   b. Select **Deck Generator > Pier to Pier Slabs**. This will add 3 slabs total.

	No.	Name	Material	Reference Back	Reference Method	Offset/Station (ft)	Reference Ahead	Reference Method	Offset/Station (ft)
▶	1	Slab 01	CIA	Support 01	Perpendicular to Support	0.0000	Support 02	Perpendicular to Support	0.0000
	2	Slab 02	CIA	Support 02	Perpendicular to Support	0.0000	Support 03	Perpendicular to Support	0.0000
	3	Slab 03	CIA	Support 03	Perpendicular to Support	0.0000	Support 04	Perpendicular to Support	0.0000

c. Select **OK** to accept the final deck arrangement.



10. A 3D model of the deck will be generated.



Set Girder Locations and Define Girder Member

This exercise will set the location of the girders as well as define the girder members.

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1. Select **Member Groups**.

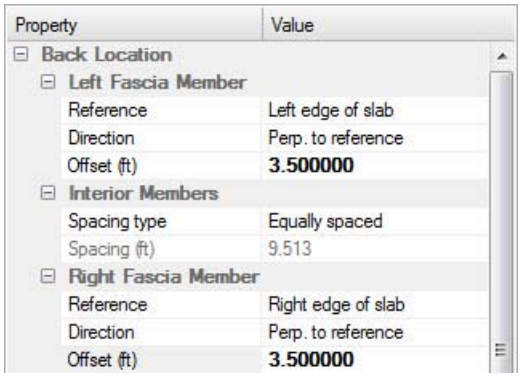
   a. From the List window, select the icon to create a new member group.

   b. Set the **Back reference** to *Support 01* and the **Ahead reference** to *Support 04*.

   c. Set the **Number of members** to *7*.

   d. Set the **Left Fascia Member > Offset** to *3.5*.

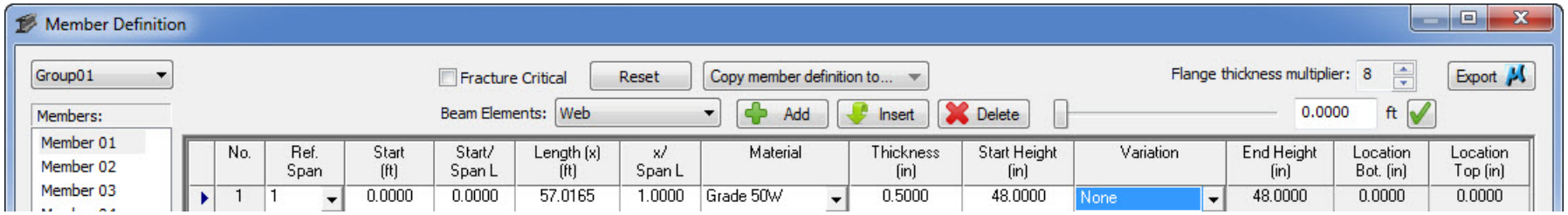
   e. Set the **Right Fascia Member > Offset** to *3.5*.



   f. Select **OK** to accept the Member Group definition.

2. Select **Member Definition**.

a. Set the **Beam Elements** to *Web* and select **Add**. Add the first web element.



No.	Ref. Span	Start (ft)	Start/ Span L	Length (x) (ft)	x/ Span L	Material	Thickness (in)	Start Height (in)	Variation	End Height (in)	Location Bot. (in)	Location Top (in)
1	1	0.0000	0.0000	57.0165	1.0000	Grade 50W	0.5000	48.0000	None	48.0000	0.0000	0.0000

b. Add the remaining Web elements.

No.	Ref. Span	Start (ft)	Start/ Span L	Length (x) (ft)	x/ Span L	Material	Thickness (in)	Start Height (in)	Variation	End Height (in)	Location Bot. (in)	Location Top (in)
1	1	0.0000	0.0000	57.0165	1.0000	Grade 50W	0.5000	48.0000	None	48.0000	0.0000	0.0000
2	2	0.0000	0.0000	86.3736	1.0000	Grade 50W	0.5000	48.0000	None	48.0000	0.0000	0.0000
3	3	0.0000	0.0000	57.0165	1.0000	Grade 50W	0.5000	48.0000	None	48.0000	0.0000	0.0000

c. Set the **Beam Elements** to *Top Flange* and select **Add**. Add all 3 Top Flange elements to the table.

No.	Ref. Span	Start (ft)	Start/ Span L	Length (x) (ft)	x/ Span L	Material	Thickness (in)	Start Width (in)	Variation	End Width (in)	Web Offset (in)
1	1	0.0000	0.0000	57.0165	1.0000	Grade 50W	1.0000	18.0000	None	18.0000	0.0000
2	2	0.0000	0.0000	86.3736	1.0000	Grade 50W	1.0000	18.0000	None	18.0000	0.0000
3	3	0.0000	0.0000	57.0165	1.0000	Grade 50W	1.0000	18.0000	None	18.0000	0.0000

d. Set the **Beam Elements** to *Bottom Flange* and select **Add**. Add all 3 Bottom Flange elements to the table.

No.	Ref. Span	Start (ft)	Start/ Span L	Length (x) (ft)	x/ Span L	Material	Thickness (in)	Start Width (in)	Variation	End Width (in)	Web Offset (in)
1	1	0.0000	0.0000	57.0165	1.0000	Grade 50W	1.2500	20.0000	None	20.0000	0.0000
2	2	0.0000	0.0000	86.3736	1.0000	Grade 50W	1.2500	20.0000	None	20.0000	0.0000
3	3	0.0000	0.0000	57.0165	1.0000	Grade 50W	1.2500	20.0000	None	20.0000	0.0000

e. Select **Copy member definition to ... > Group 1 > All Members**.

f. Select **OK** to accept the current member definition.

3. This will update the 3D model to include the girders, abutments and piers.

Define Cross Frames and Set Cross Frame Locations

This exercise will set the location of the cross frames as well as define the cross frame members.

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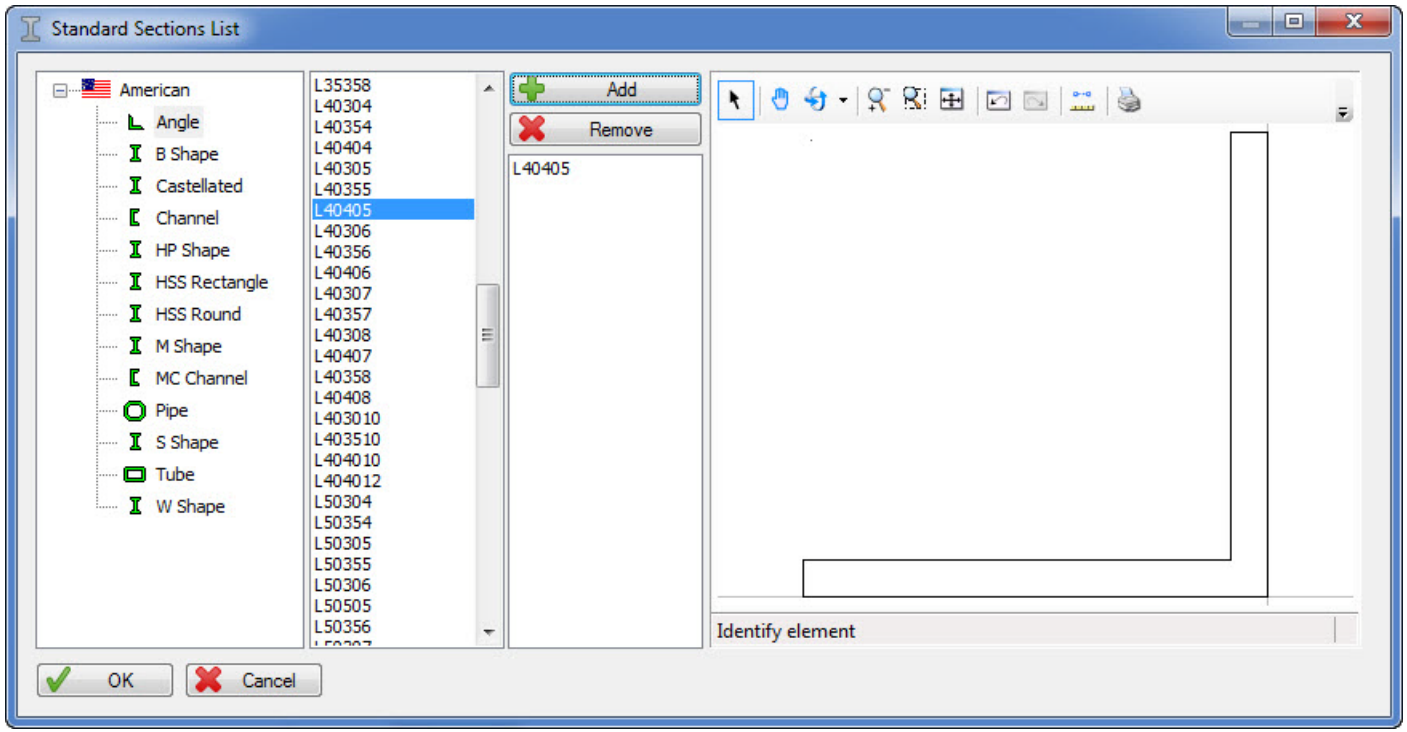
1. Select **Standard Sections List**.
   a. Select Angle from the first column.
   b. Select *L40405* from the second column.
   c. Select **Add**.



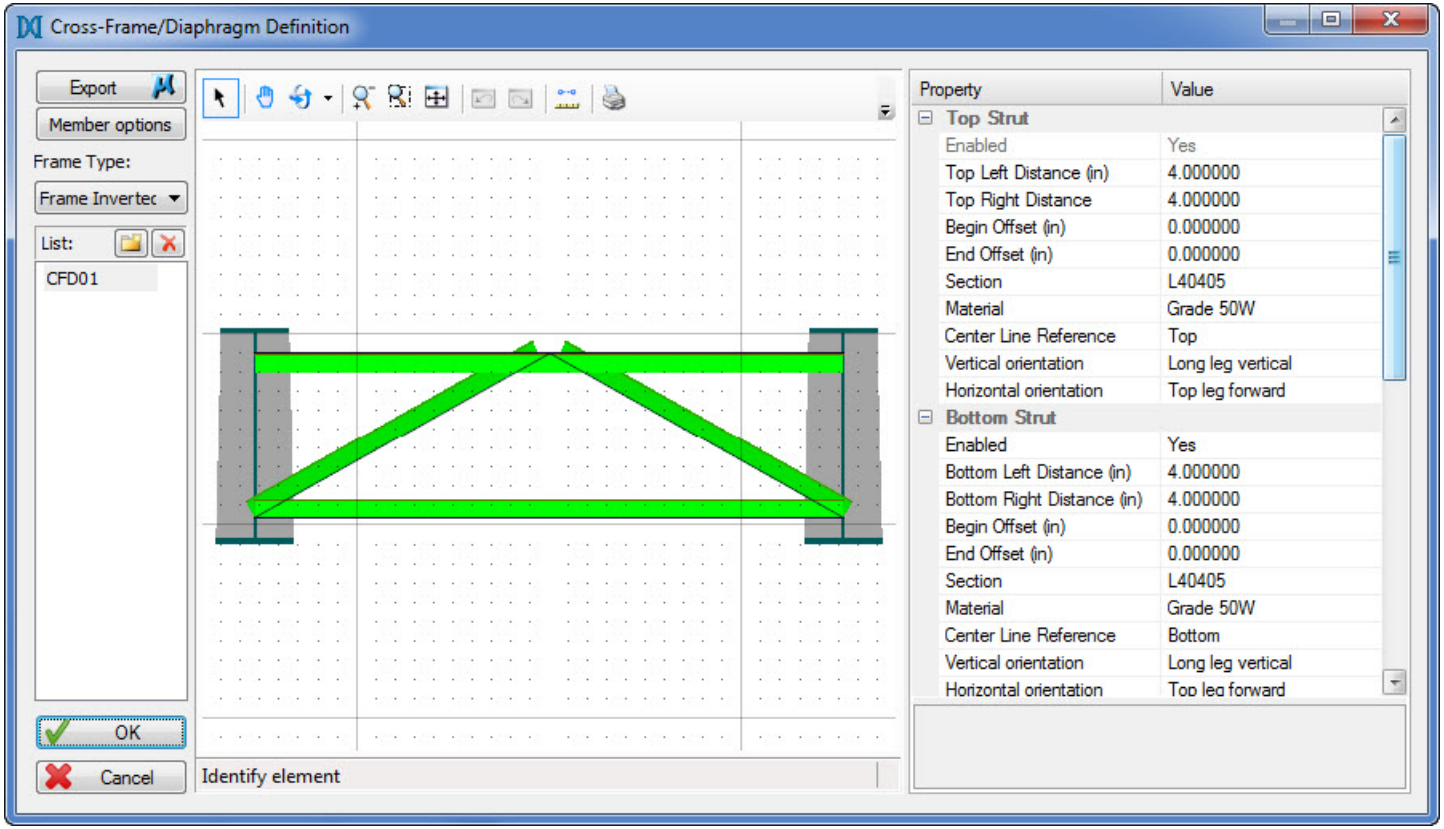
   d. Select **OK**.

2. Select **Cross-Frame/Diaphragm Definition**.

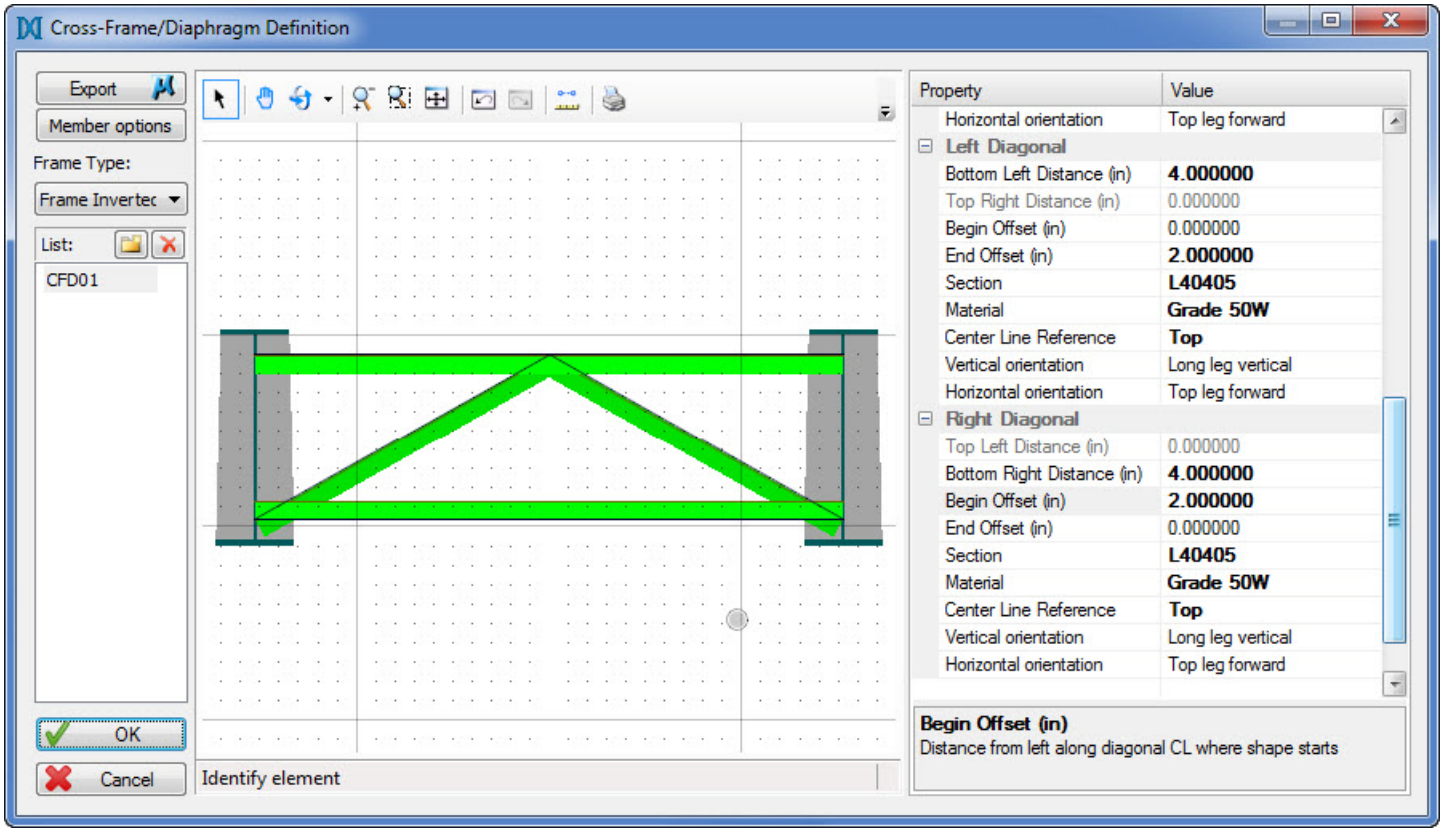
a. Select New icon to create a new cross frame.

b. Change the **Frame Type** to *Frame Inverted V*.

c. Set the **Top Strut** and **Bottom Strut** values as shown.



d. Set the **Left Diagonal** and **Right Diagonal** values as shown.

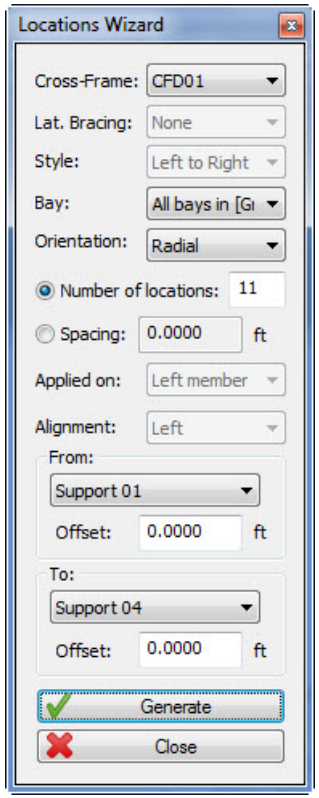


e. Select **OK** to accept the changes.

3. Select **Cross-Frame/Diaphragm Locations**.

   a. Select **Locations Wizard**.

b. Populate as shown to create all cross frames.



c. Select **Generate** to set the cross frame locations.

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

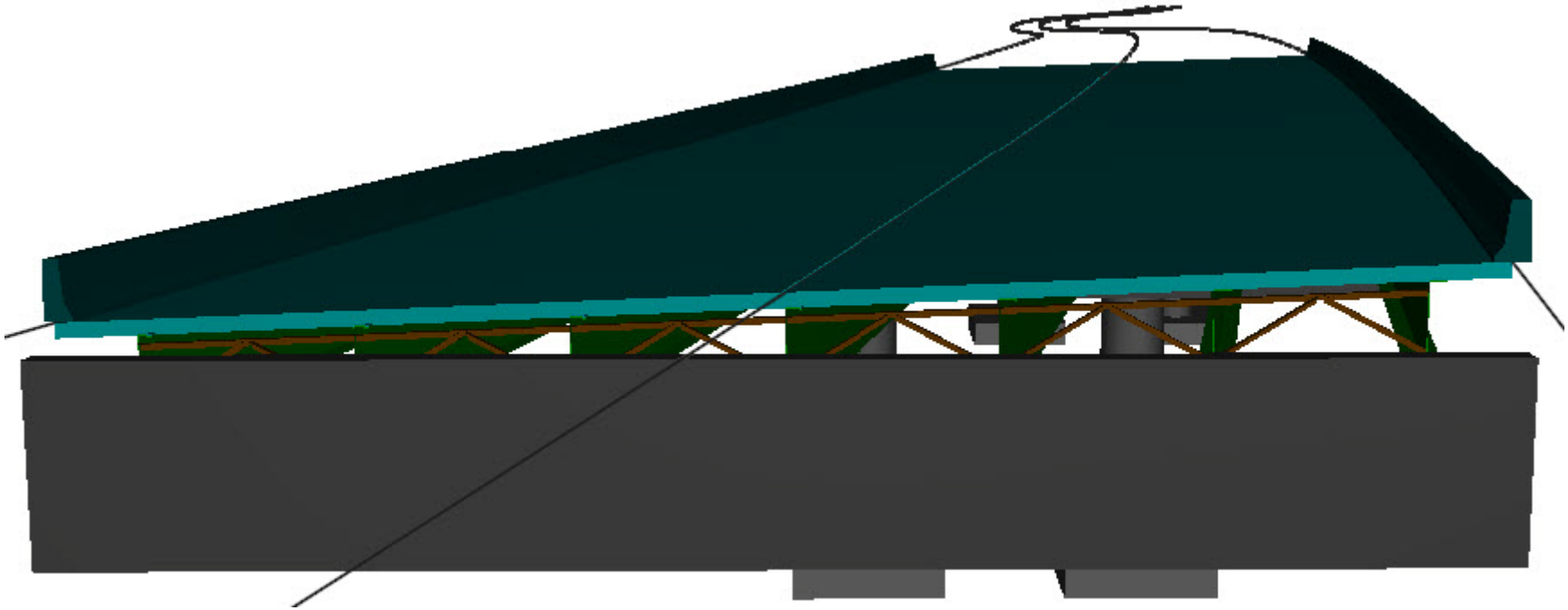
e. Review the updated 3D model.

4. Select **Appurtenance Locations**.

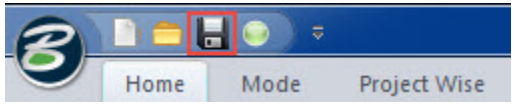
a. With the appurtenance type set to *Parapet*, select **Add** twice. This will add a parapet along both edges of the slab.

	No.	Appurtenance Name	Reference Element	Reference Offset (ft)	Reference Location	Reference Back	Reference Method	Offset (ft)	Reference Ahead	Reference Method	Offset (ft)
	1	Parapet 01	Left edge of slab	0.0000	Outside face	Support 01	Along alignment	0.0000	Support 04	Along alignment	0.0000
▶	2	Parapet 01	Right egde of slab	0.0000	Outside face	Support 01	Along alignment	0.0000	Support 04	Along alignment	0.0000

b. Select **OK** to accept the parapet definition.



5. Select the Save icon to save the work completed.



Create a 3D Drawing of the Bridge

These steps will walk you through exporting the 3D model from LEAP Bridge to create a 3D drawing of the proposed bridge design.

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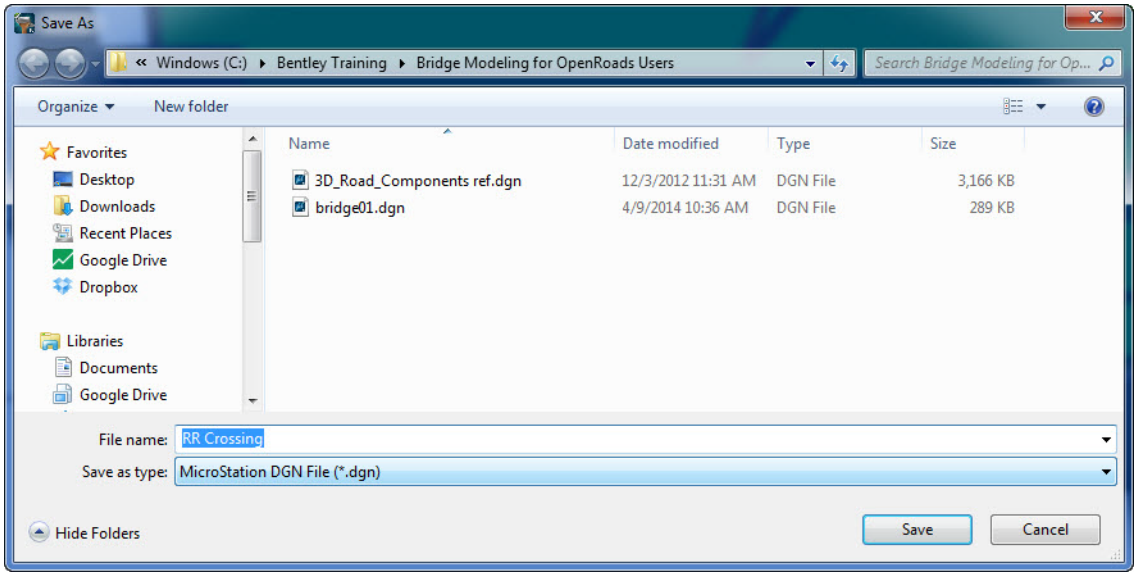
1. Select **Export DGN**.



2. Type in a **file name** of *RR Crossing*.
3. Select **Save**.
4. Select **Yes** upon being prompted to browse the file location.
5. Open the resulting file with MicroStation to review the bridge model.
6. Attach as a reference the file *3D_Road_Components ref.dgn* and *bridge01.dgn*. Review the bridges relative to the surrounding 3D road.