

# ***2011 IBUG North Conference***

## **LEAP Bridge**

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**Lesson Name: Create a 3D Model of a Bridge**

**LESSON OBJECTIVE:**

In this lesson the student will learn how to easily model a precast girder bridge in 3D.

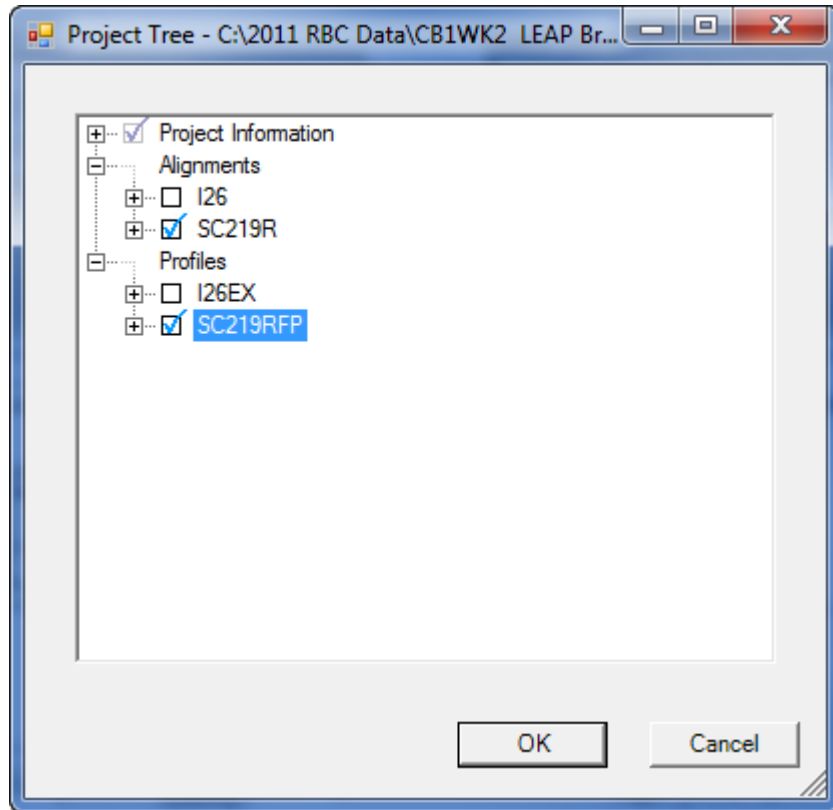
**EXERCISE: USE ABC WIZARD TO CREATE A 2 SPAN STRUCTURE**

This exercise will guide you through the steps to get started

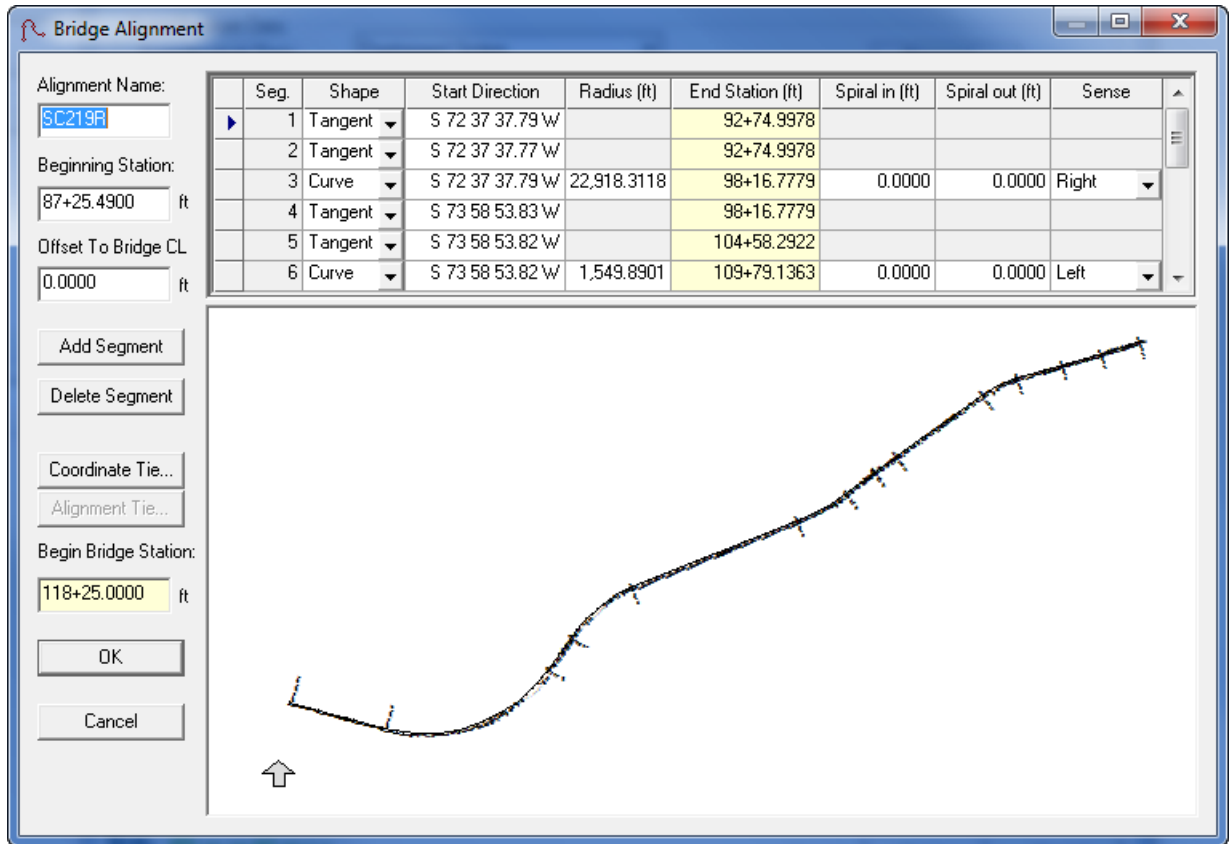
1. Start LEAP Bridge.
2. Start the **ABC Wizard**.



3. Select **LandXML**. Select *C:\Bentley Training\LEAP\SC219 and I26.xml* from the Browse button. Select **Connect**.
4. Expand the Alignments and Profiles toggles and toggle on the alignment and profile as shown below. Select **OK** to import the geometry. Select **OK** when prompted to acknowledge the information has been imported.



5. The bridge begins at station 118+25. Select **Alignment...** and set the **Begin Bridge Station** to *118+25*. Select **OK** to accept this value.



- The Cross slope of the structure is normal crown of 2%. Select **Cross Section...** from the Step 1 of 3 dialog. Populate the Bridge Cross Section dialog as shown and select **OK** when completed.

Workshop: LEAP Bridge

Bridge Cross Section

Section Set: XSCT01

Template: TMPL 0

Station: 0+00.0000 ft

PG Offset: 0.0000 ft

PG Node: 2

Plane	Width Type	Width (ft)	Vertical Type	Vertical (%)
1	Distance	25.5000	Slope	2.0000
2	Distance	25.5000	Slope	-2.0000

Add Template

Delete Template

Add Plane

Insert Plane

Delete Plane

Manual Width Control

OK

Cancel

1 — 2.0000 % — 2 PG — -2.0000 % — 3  
25.5000 25.5000

7. Populate the Step 1 of 3 dialog as shown below.

LEAP Bridge - ABC: Step 1 of 3

SuperStructure Data:

Superstructure Type:

Number of Spans:

Support Data:  Use station as input

No.	Station (ft)	Skew or Bearing	Span Length (ft)
▶ 1	118+25.0000	SKEW -14 24 00.00	0.000
2	119+35.0000	SKEW -14 24 00.00	110.000
3	120+50.0000	SKEW -14 24 00.00	115.000

Girder Type:  Girder ID:  Number of Girders:

Curb Width Left  ft Right  ft

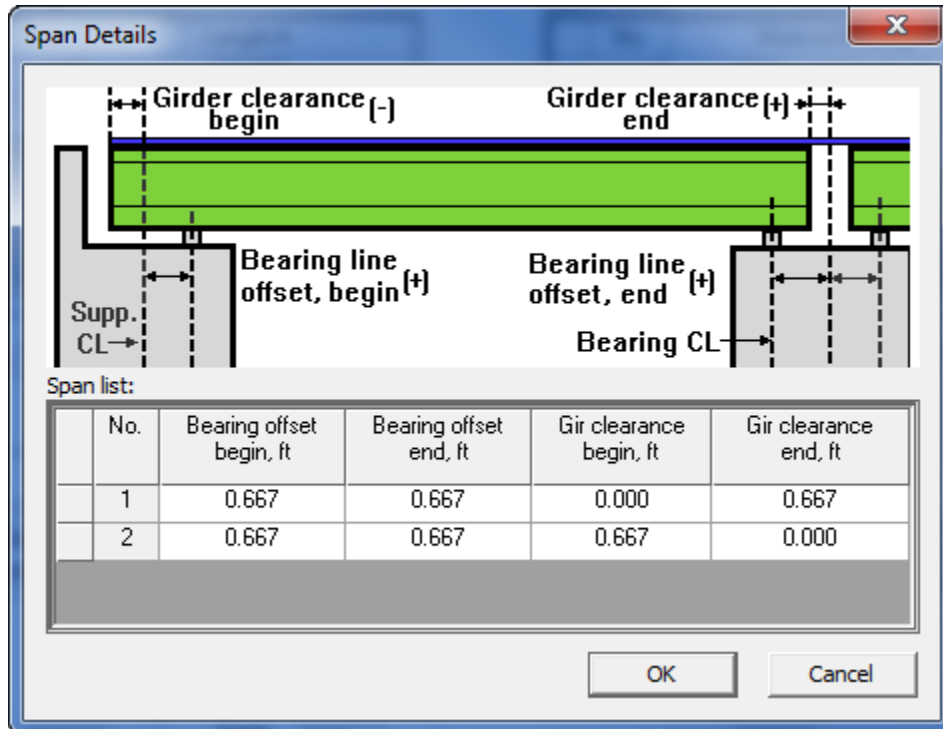
Overall width  ft

Deck Thickness  in Haunch Thickness  in

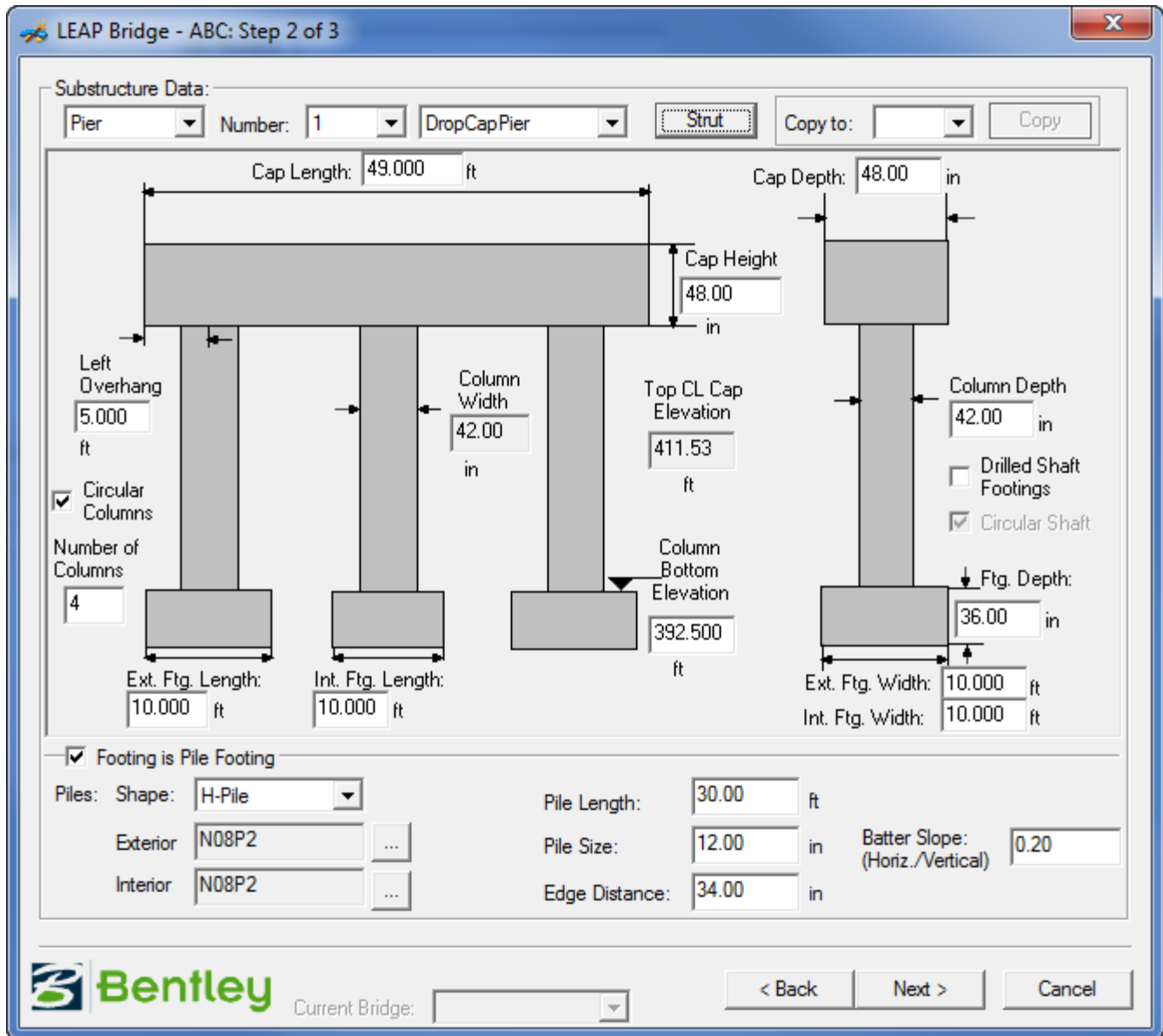
Overhang Left  ft Girder Spacing  ft Right  ft

Bentley Current Bridge:

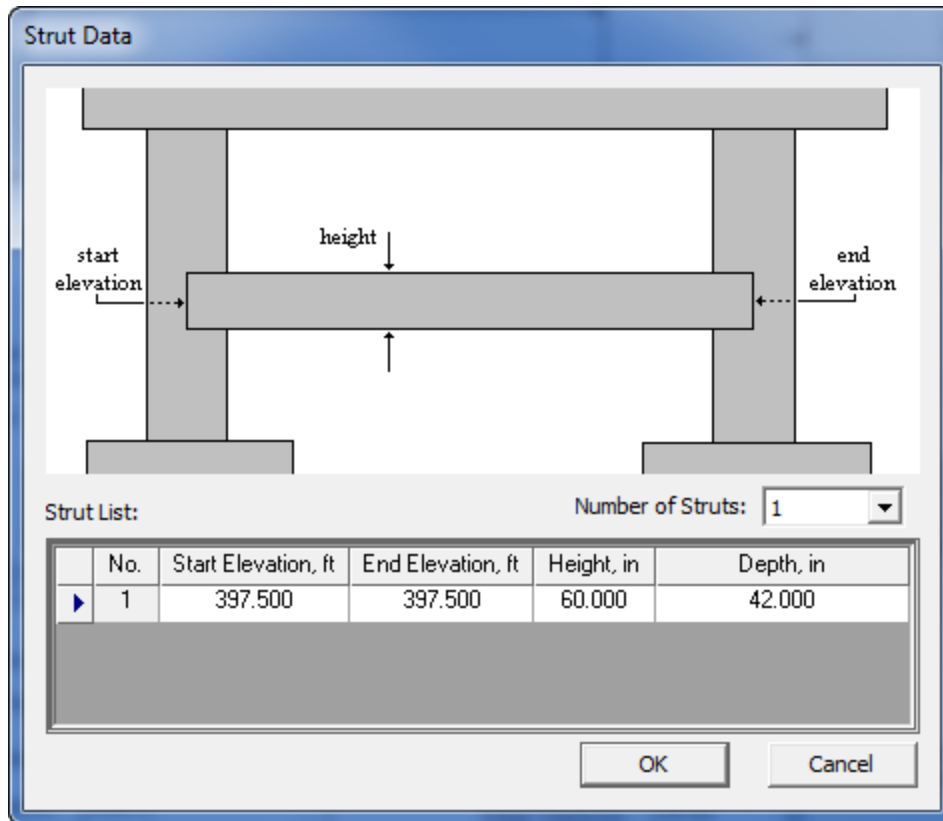
8. Select **Span Details**. Populate as shown below. Select **OK** to save the values.



- 9. Select **Next** to move on to Step 2 of 3.
- 10. For Pier 1, complete the dialog as shown.



11. Select **Strut** and populate as shown. Select **OK** to accept.



12. Select **Next**. Select **Finish** completing the wizard.
13. Select the **Geometry** tab to view a 3D model of structure.
14. Right click in the view and select **Export**. Set the **Save as Type** to *DGN Files*. Set the folder location to *C:\Bentley Training\LEAP* and key-in a file name of *sc219br.dgn*.
15. Open the drawing in MicroStation to review. Close MicroStation.
16. Select **File > Save As...** . Set the folder location to *C:\Bentley Training\LEAP* and key-in a file name of *sc219br.xml*.

**Lesson Name: Use CONSPAN to Analyze and Design the Superstructure**

**LESSON OBJECTIVE:**

In this lesson the student will learn how to apply LRFD loads to a precast girder structure as well as analyze and design the beams.

**EXERCISE: SUPERSTRUCTURE DESIGN**

This exercise will guide you through the steps to get started

1. From the **SuperStructure** tab in LEAP Bridge, select **CONSPAN**.
2. Select the **Materials** tab. Change the values noted below.

The screenshot shows the 'Materials' tab in the LEAP Bridge software. It is divided into two main sections: 'Concrete' and 'Prestressing Tendon'.

**Concrete Section:**

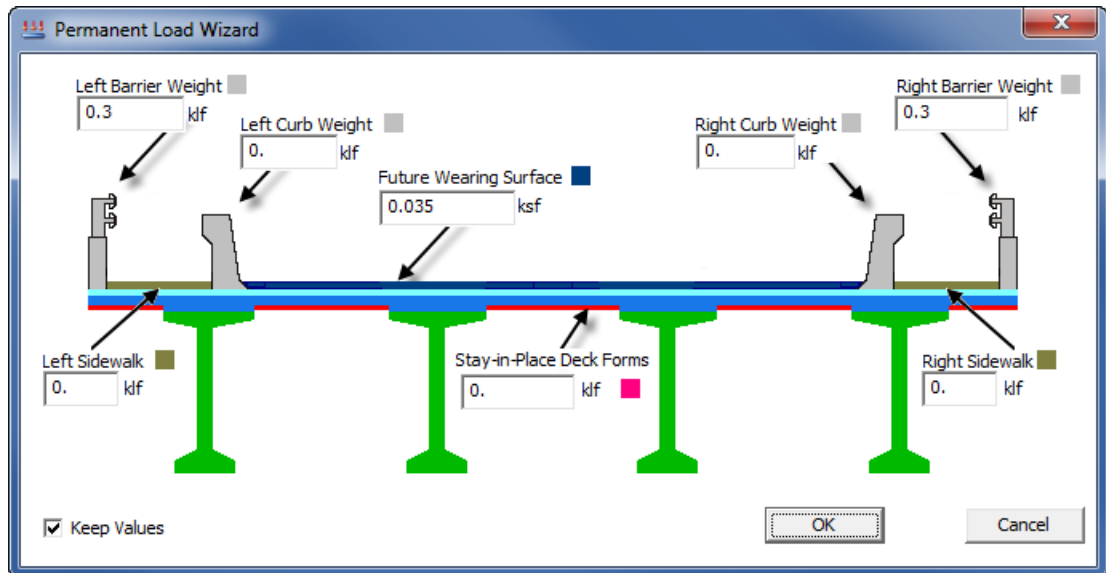
- Concrete:** Unit weight: 150 pcf; Strength: 6 ksi; K1: 1; Elasticity: 4695.98 ksi; Poisson's Ratio: 0.2.
- Girder Release:** Unit weight: 150 pcf; Strength: 8 ksi; K1: 1; Elasticity: 5422.45 ksi.
- Girder Final:** Unit weight: 150 pcf; Strength: 8 ksi; K1: 1; Elasticity: 5422.45 ksi.
- Deck:** Unit weight: 150 pcf; Strength: 4 ksi; K1: 1; Elasticity: 3834.25 ksi.

**Prestressing Tendon Section:**

- Tendon ID list: 0.5", 0.6", 1/2-250K-1, 1/2-250K-LL-1, 1/2-270K, 1/2-270K-1, 1/2-270K-LL, 1/2-270K-LL-1, 1/2-270K-LL-M, 1/2-270K-SP, 1/2-270K-SP-1, 3/8-250K-1, 3/8-270K, 3/8-270K-LL, 6/10-270K, **6/10-270K-LL** (highlighted), 7/16-270K, 7/16-270K-LL, 9/16-270K, 9/16-270K-LL.

3. Select the **Loads** tab.
4. Select the **Wizard...** button at the upper right.
5. Fill out the Permanent Load Wizard using the following values. Enable the **Keep Values** toggle. Select **OK** when completed.

LOAD TYPE	MAGNITUDE
Left and Right Barrier	0.3 klf each
Future Wearing Surface	0.035 ksf



This will populate the **Permanent Loads** section of the dialog.

6. Enable the **Include LL Deflection** toggle.
7. Select the **Beam** tab.
8. Select Beam 2, Span 01.
9. Select **Strand Pattern...**
10. Select **Auto Design** to design the strand pattern. Review the Design Status results. Use the **Wizard...** tool to modify the strand pattern to see the effect on the Design Status. **OK** the results when completed.

Workshop: LEAP Bridge

The screenshot displays the 'Strand Pattern' software interface for 'Span 1, Beam 2, Beam ID: BT-63'. The main window is divided into several sections:

- Diagram:** Shows two cross-sections of a beam, labeled 'ENDS' and 'MID-SPAN', with a grid of strands.
- Table:** A table with columns: Type, End Template, End Height, Middle Height, and # of Strands.
 

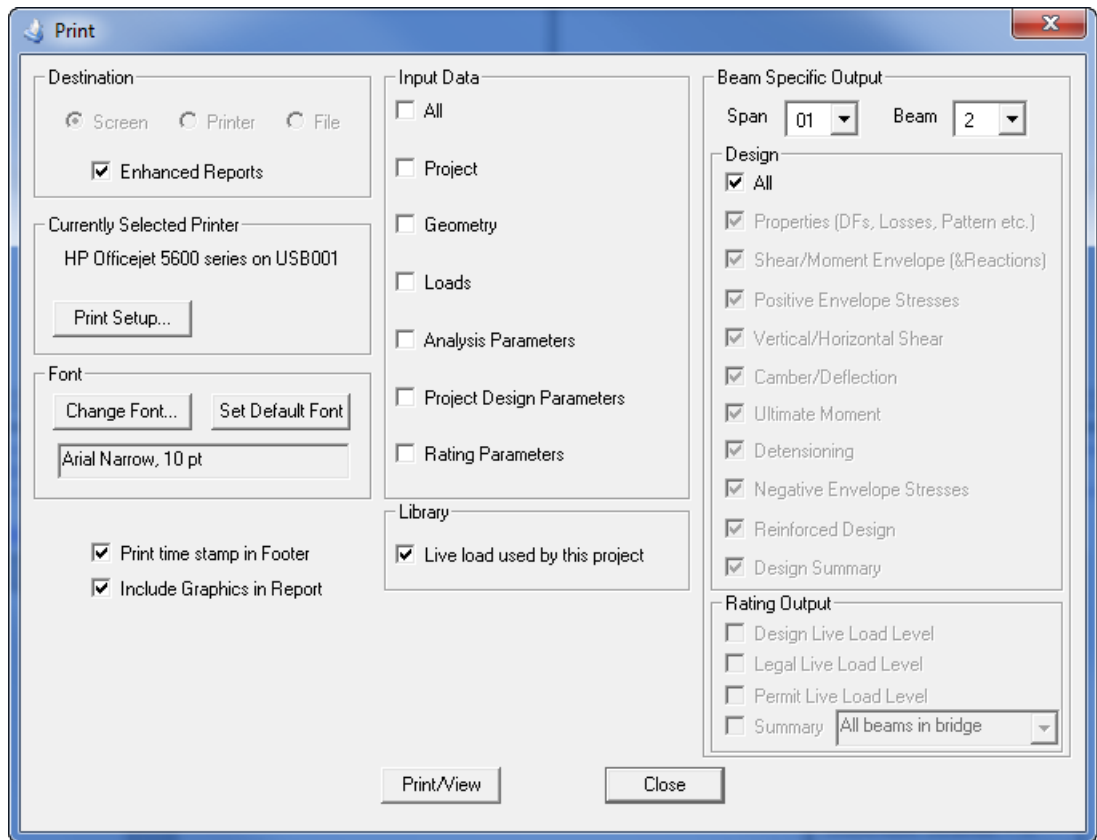
Type	End Template	End Height	Middle Height	# of Strands
Straight	12	2.50	....	10
Straight	12	4.50	....	8
Draped	2	58.50	2.5000	2
Draped	2	60.50	4.5000	2
- Buttons:** 'Add Row', 'Delete Row', 'Wizard...', 'Copy to...'
- Strand Pattern Library:** Includes 'Save/Load Strand Patterns'.
- Pattern:** 'SYMMETRICAL DRAPED'. Includes 'Initial Pull/CG Method' checkbox.
- Kern Points (in):** Lower: 14.29, Upper: 49.26, End: 13.59, Mid: 3.41, Total Strands: 22.
- Design:** Includes 'Increment', 'Decrement', 'Auto Design', 'Debond/Pull%', 'Reset Pattern' buttons.
- DESIGN STATUS:**
  - Span:1, Beam:2
  - Release Stress, computed vs. limiting: OK
  - Final Stress, computed vs. limiting: OK
  - Ultimate Moment, required vs. provided: OK
- RELEASE STRESSES (ksi):**
  - Limiting Stresses:
 

Compression	Tens with Reinf	Tens without Reinf
3.600	-0.588	-0.200
  - Computed Stresses:
 

Location, ft	Trans	0.10L/0.90L	0.20L/0.80L	0.30L/0.70L	0.40L/0.60L	Midspan
Precast-top	0.013	0.147	0.259	0.288	0.233	0.274
Bottom	2.571	2.431	2.314	2.285	2.342	2.298
As_top, in2	0.000	0.000	0.000	0.000	0.000	0.000
As_t_prvd, in2	0.000	0.000	0.000	0.000	0.000	0.000
- FINAL STRESSES (ksi):**
  - Limiting Stresses:
 

Final 1 (P/S+DL+LL)	Final 1	Final 2 (P/S+DL)	Final 3 (0.5(P/S+DL)+F_LL)	Precast
Compression	4.800			
Tension	-0.537			
Compression		3.600		
Compression			3.200	
  - Computed Stresses: (Empty table)
- Buttons:** 'Print...', 'OK', 'Cancel'.

11. Select **File > Print...** from the Conspan menu. Enable the toggles as shown then select **Print/View**.



12. Close the report viewer window and the Print dialog.
13. Close Conspan. When Prompted update the LEAP Bridge model but do not generate any reports.
14. From the Geometry tab, enable transparent mode to review the strands in the beam.

### Lesson Name: Use RC-PIER to Analyze and Design the Substructure

#### LESSON OBJECTIVE:

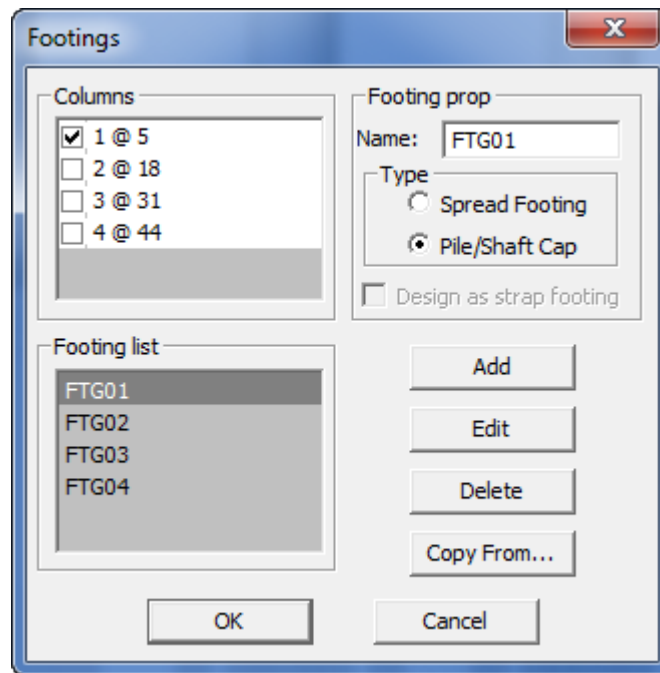
In this lesson the student will learn how to modify the footing geometry, apply LRFD loads to the pier, graphically review the loads and then analyze and design the cap, column and footing.

#### ***EXERCISE: SUBSTRUCTURE DESIGN***

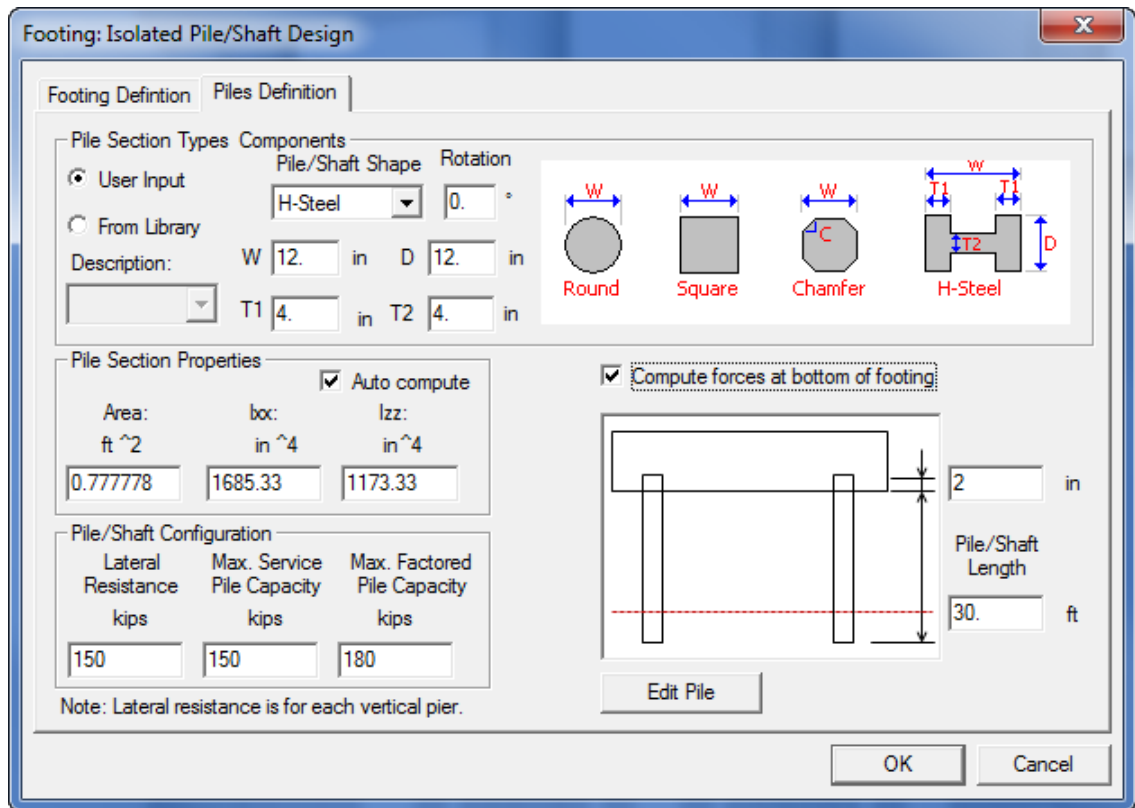
This exercise will guide you through the steps to get started

1. From the **SubStructure** tab in LEAP Bridge, select **RC-PIER**.

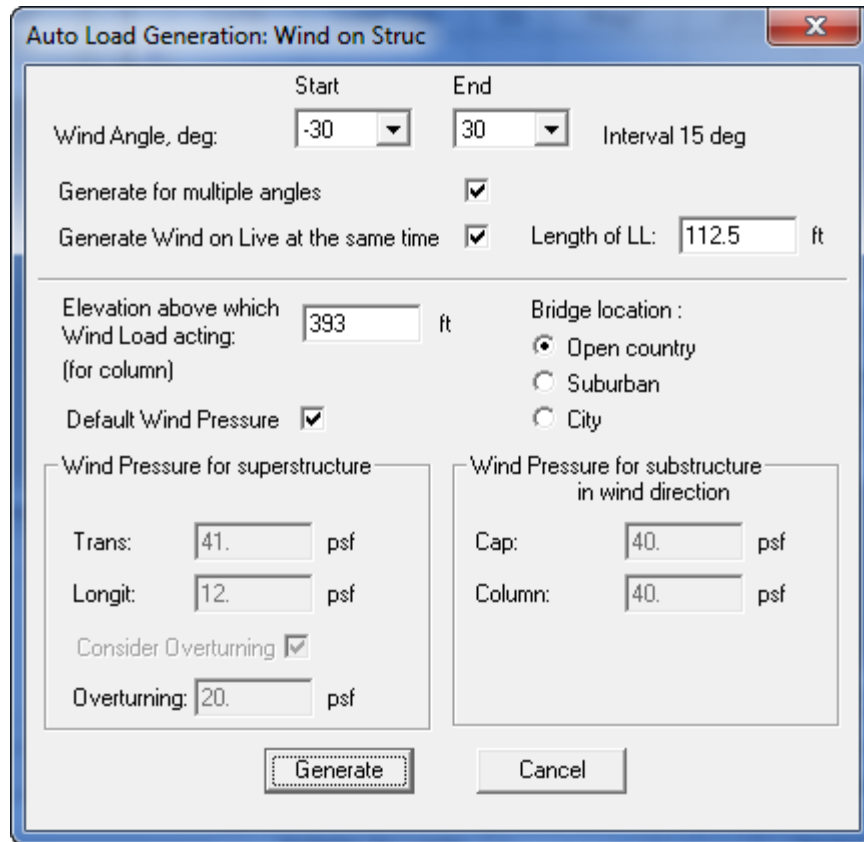
2. From the Geometry tab, select **Footing Pile** tool.
3. Select Column 1 and Footing FTG01. Select **Edit** to modify the pile definition.



4. Populate the Pile Definitions tab as shown.



5. **OK** the new values. Make the same changes to the remaining pile definitions.
6. From the Loads tab, add the *DC*, *DW*, *LL* and *WS* loads to the right pane.
7. For the first 3 loads, auto-generate the loads from Conspan.
8. For the *WS1* load, populate the Generate dialog as shown.



9. Add *Strength Group I*, *Service Group I* and *Service Group III* to the Selected Groups pane.
10. Select the Geometry tab and review the resulting loads graphically.

