Opis 6.1

Prestress Bridge Tutorial

****

Entering a New Bridge Using Templates

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3/17/2010

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Introduction

This tutorial will take you through a simple span prestress beam design using a template bridge. The template was created to expedite the data input. All of the standard materials are already in the tree structure. The template bridge is a single span – four beam bridge. You will need to modify this as necessary. You will not want to use the Superstructure Definition Wizard when you use a template bridge. The template bridge already contains a Superstructure Definition that you can modify to fit your bridge. If you have questions or comments on this tutorial, please send them to Jeff Olsen. I will modify this document as necessary to make entering bridges as easy as possible.

Opis 6.1 Tutorial for Prestress Bridge

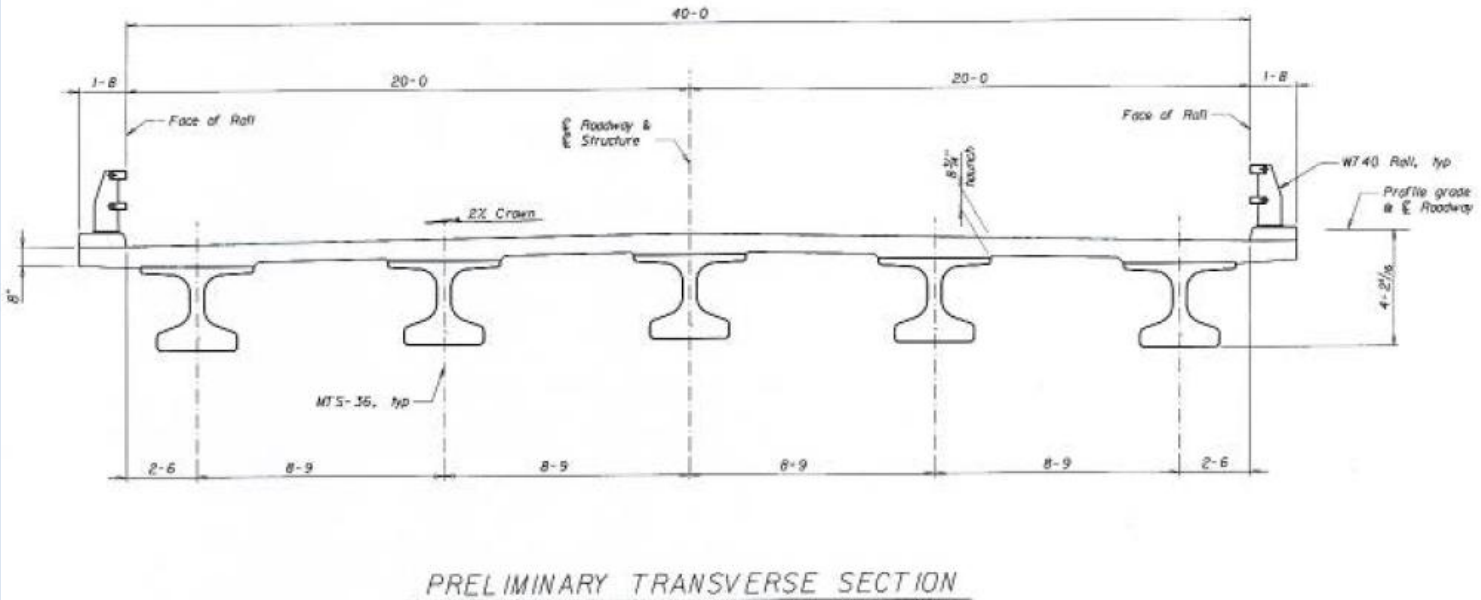
This example will take you through a complete prestressed beam design.

Bridge Data

NH 57-3(42)83
Lewistown-East CN
4067001

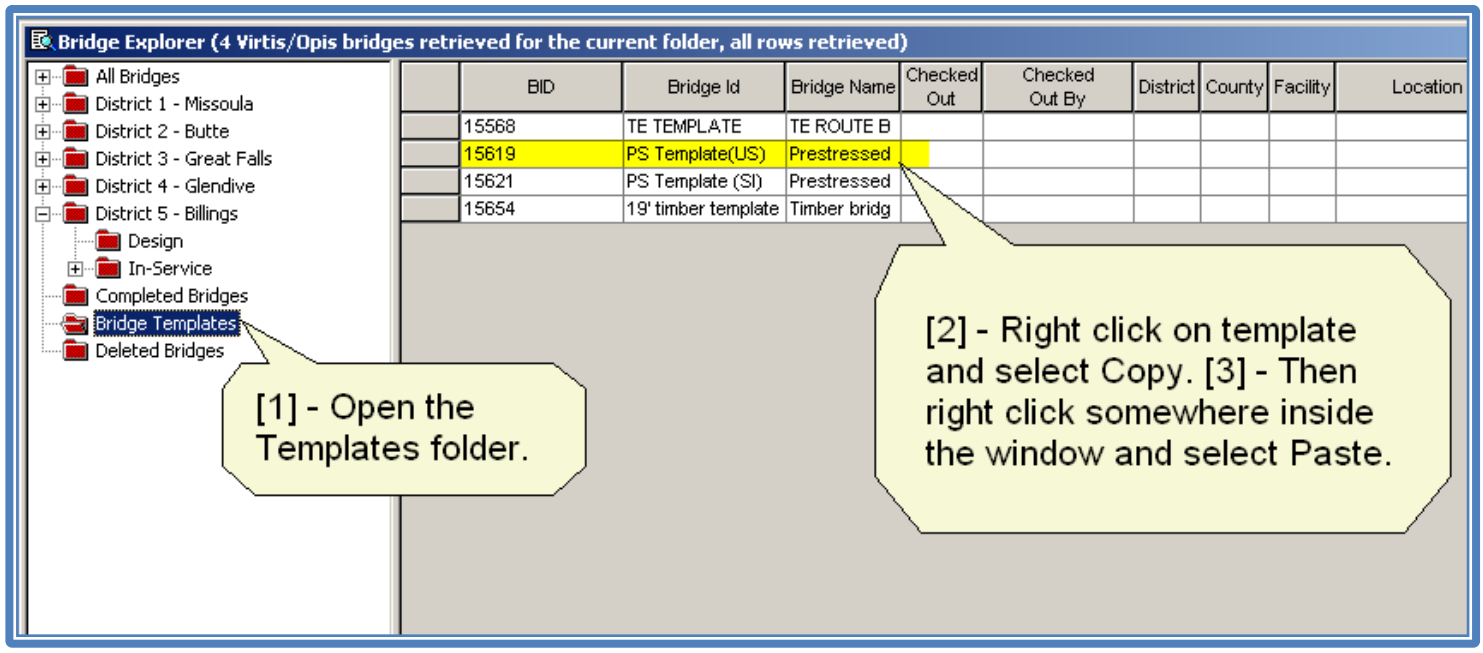
Bridge over Boyd Creek
NBI P00057084+02521

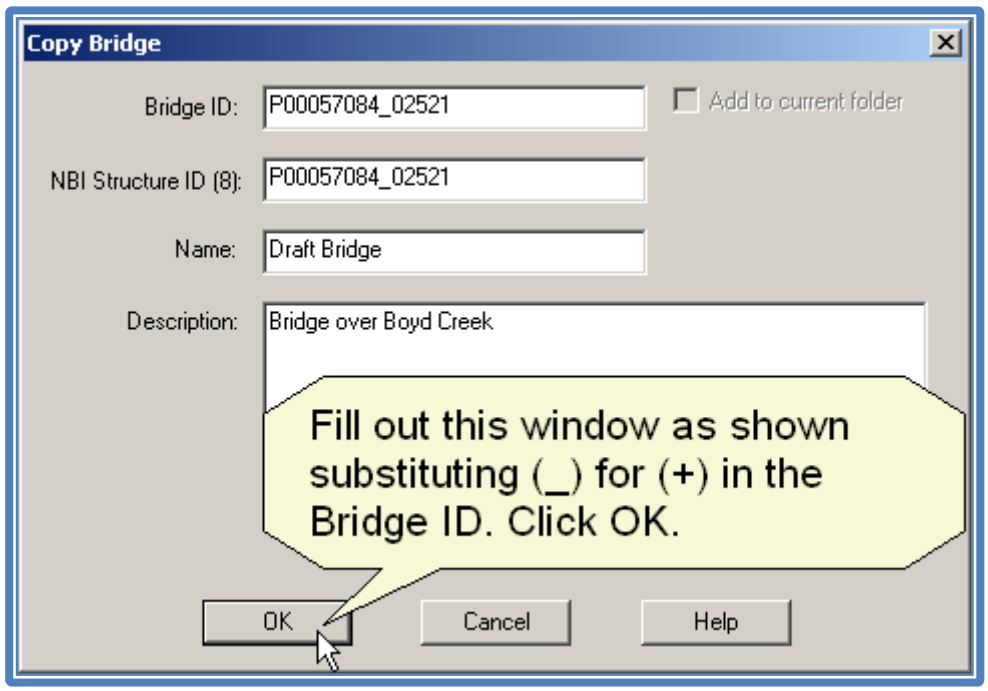
- **Simple Span Prestressed Beam**
- **Type MTS 36**
- **40 ft Roadway Width**
- **Span Length = 83 ft**
- **No Skew**
- **5 Beam Lines at 9'-8" Spacing**
- **8 inch Deck Thickness**
- **W740 Rail**
- **Normal Crown**
- **Assumed ½ "wearing surface**



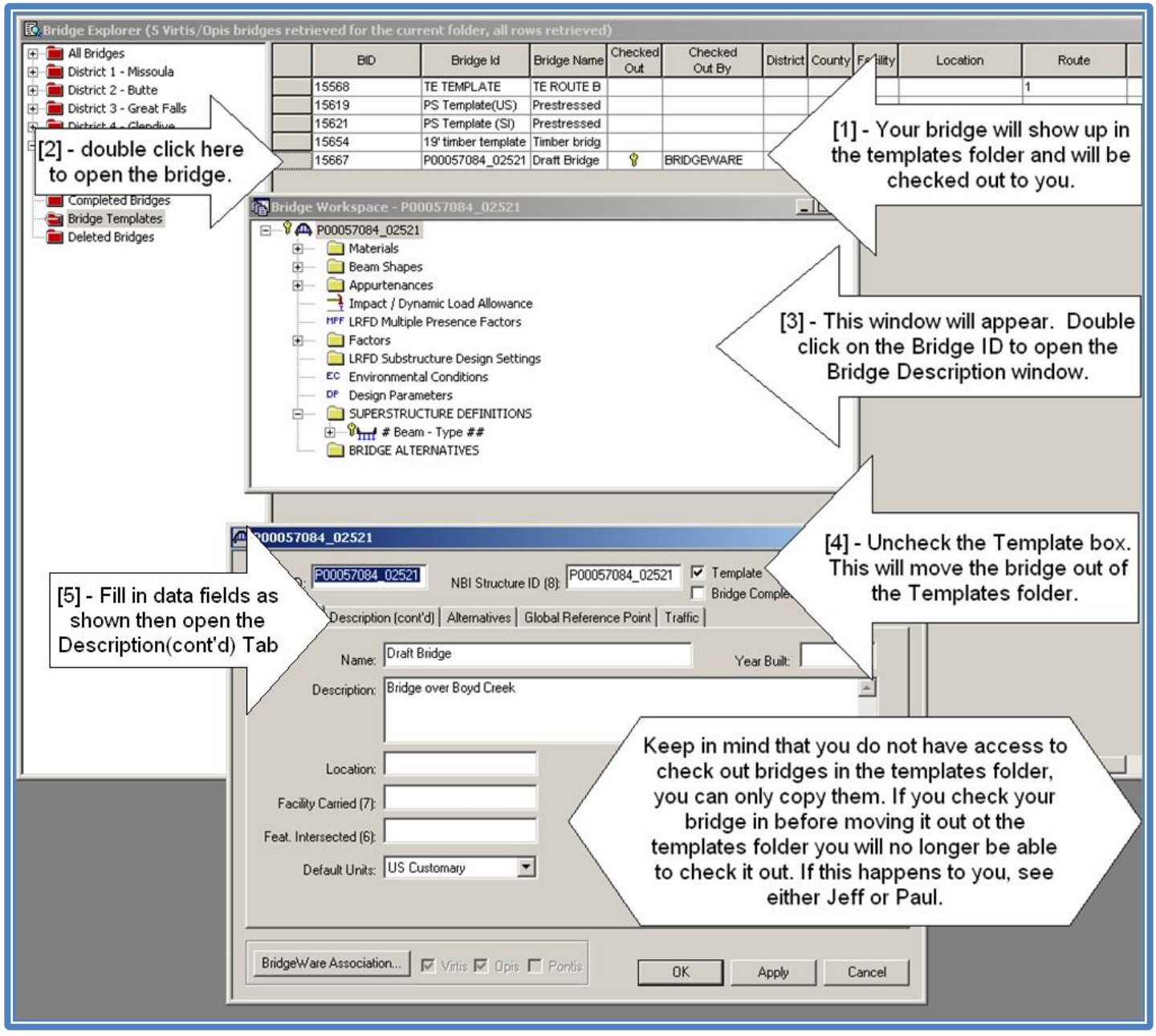
PRELIMINARY TRANSVERSE SECTION

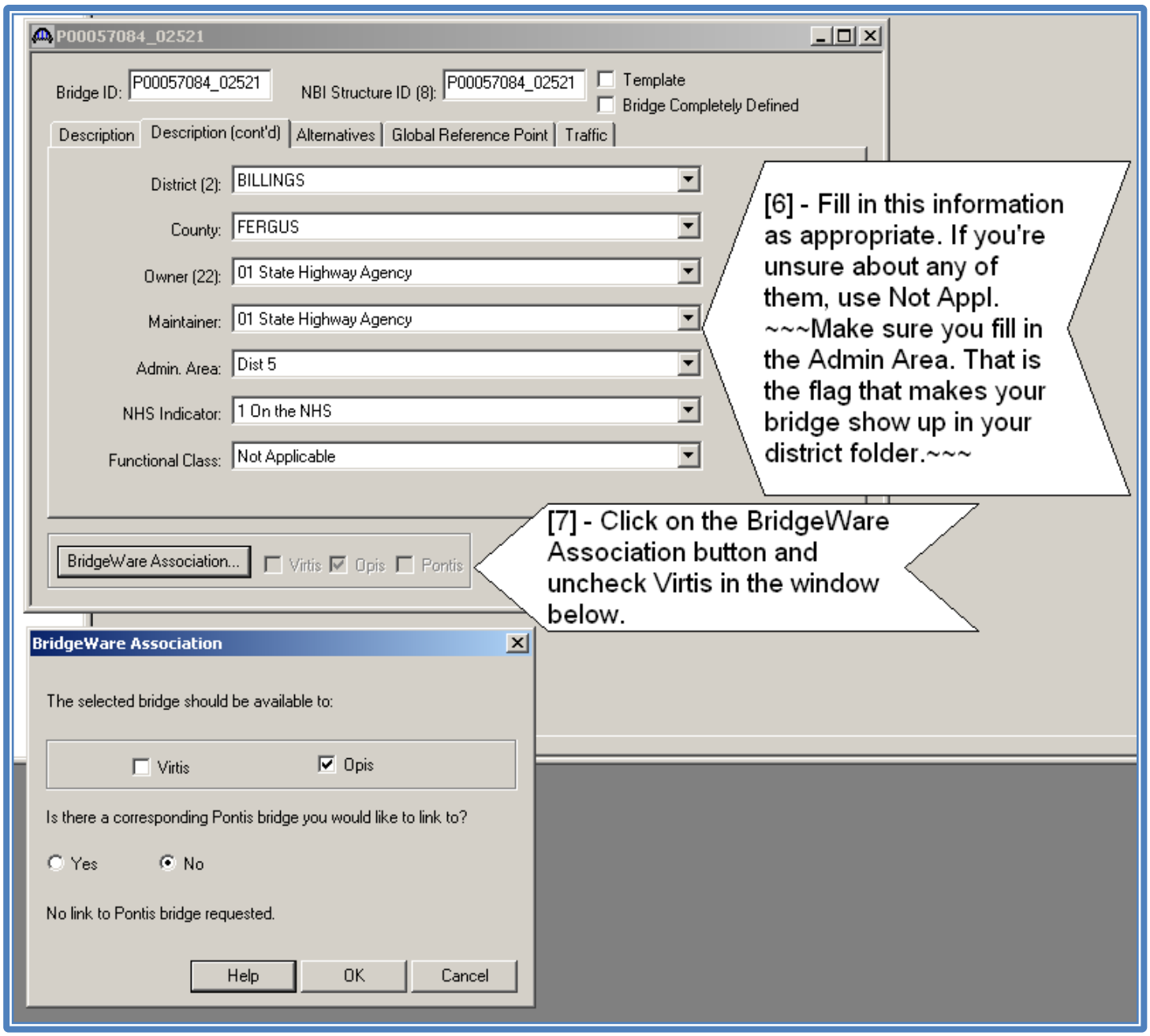
Starting With a Template



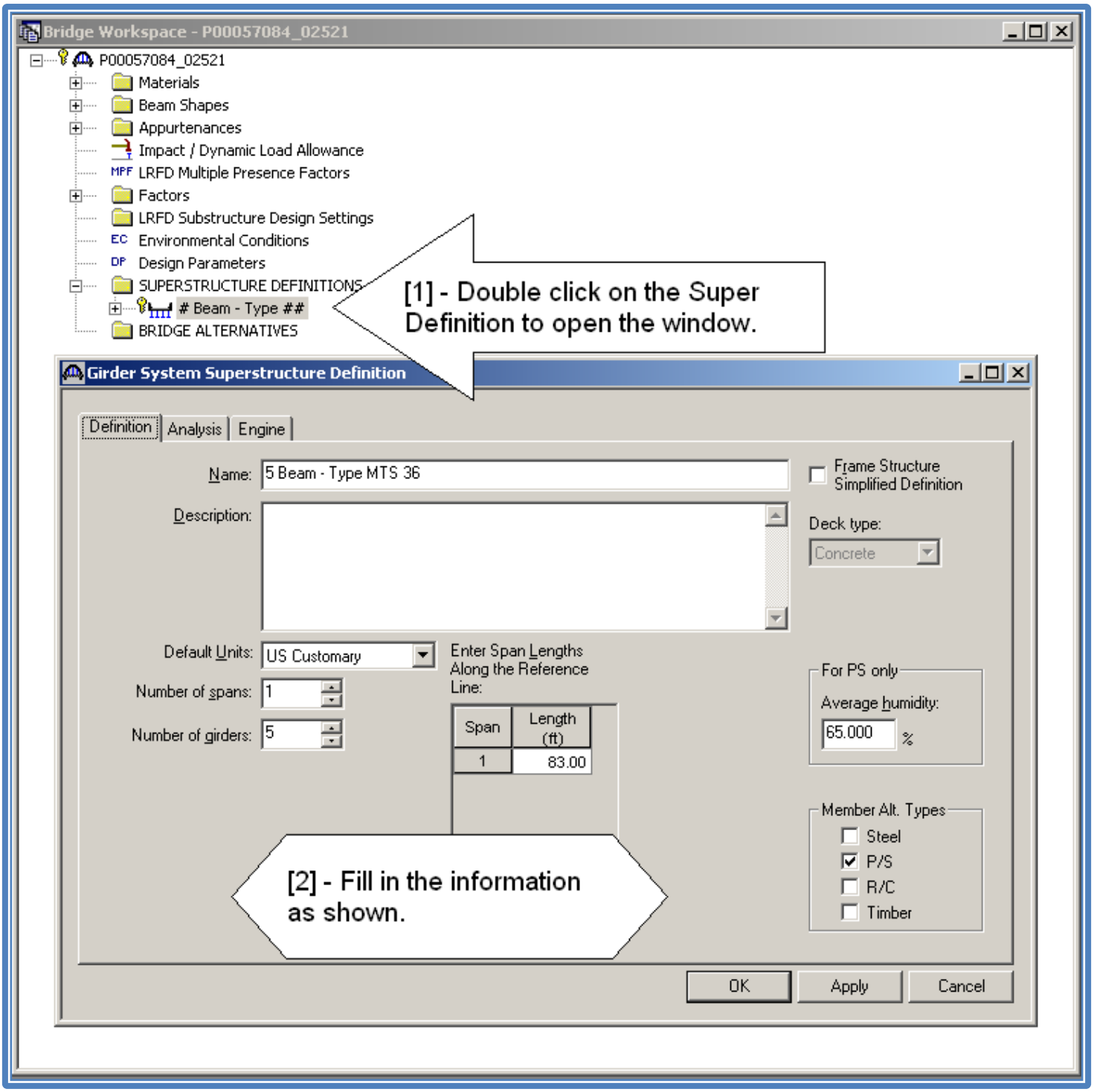


Bridge Description Window – Defining Bridge

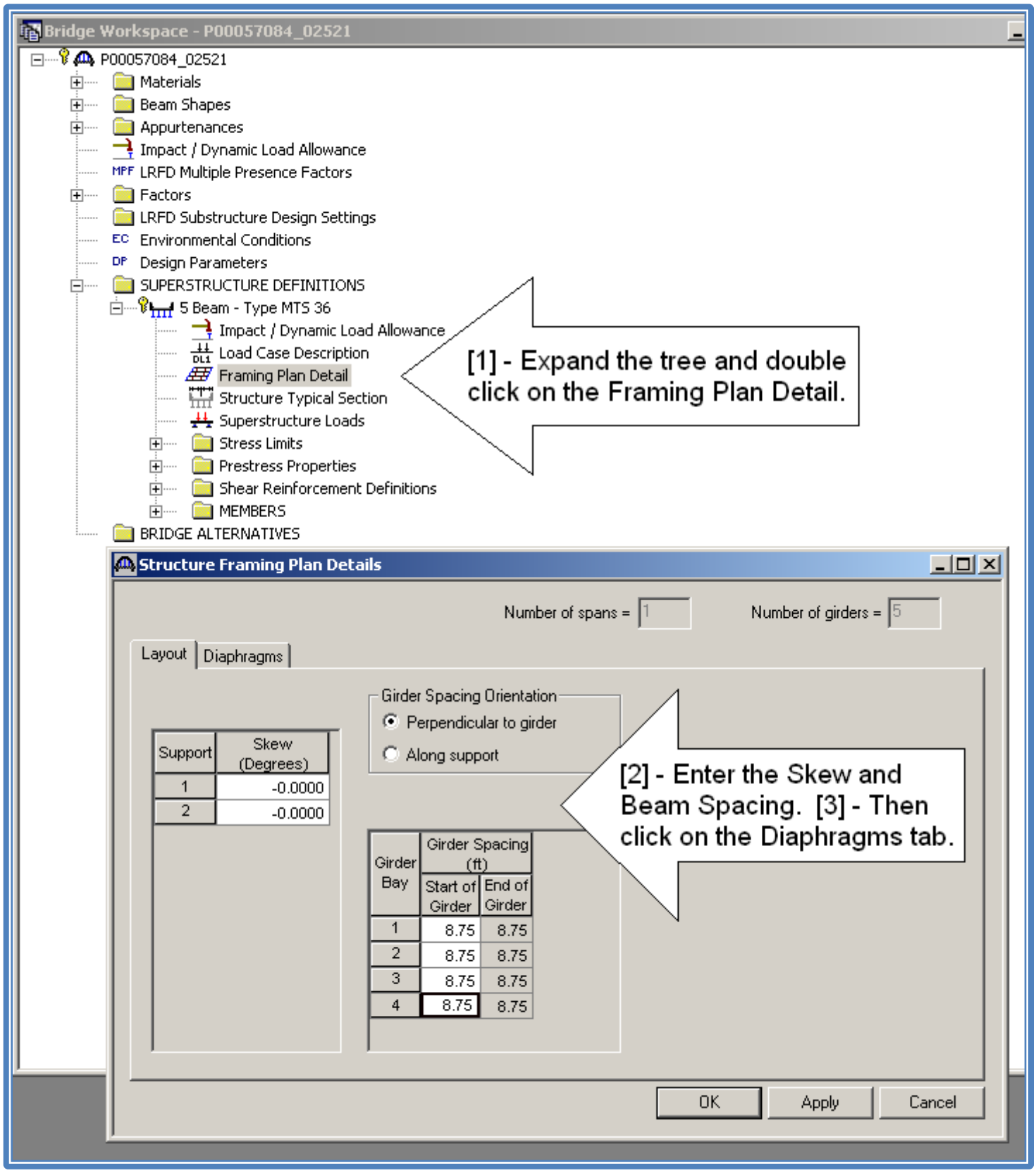


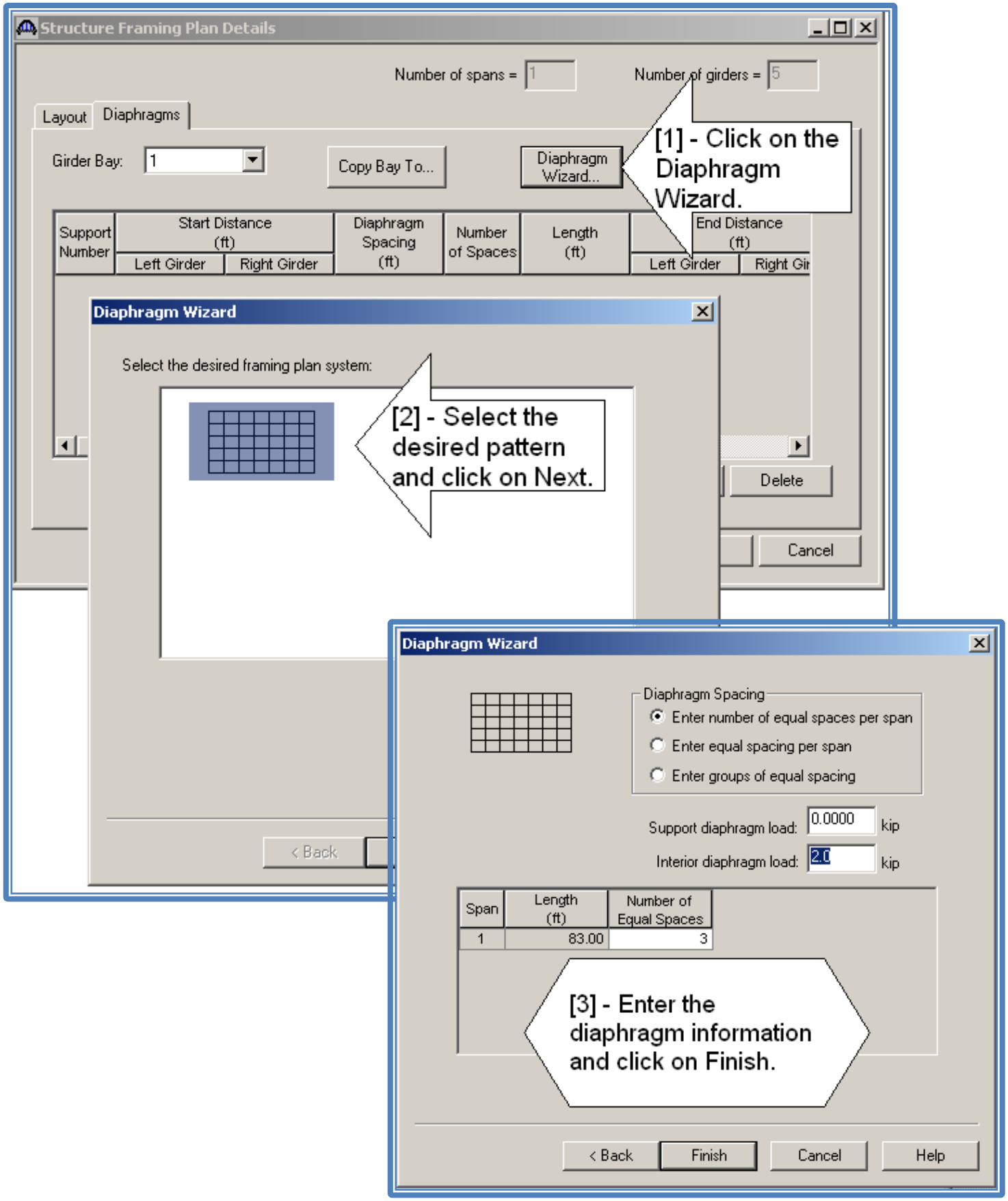

P00057084_02521
Bridge ID: P00057084_02521
NBI Structure ID (8): P00057084_02521
Template
Bridge Completely Defined
Description
Description (cont'd)
Alternatives
Global Reference Point
Traffic
District (2): BILLINGS
County: FERGUS
Owner (22): 01 State Highway Agency
Maintainer: 01 State Highway Agency
Admin. Area: Dist 5
NHS Indicator: 1 On the NHS
Functional Class: Not Applicable
[6] - Fill in this information as appropriate. If you're unsure about any of them, use Not Appl. ~~~Make sure you fill in the Admin Area. That is the flag that makes your bridge show up in your district folder.~~~
BridgeWare Association...
Virtis
Opis
Pontis
[7] - Click on the BridgeWare Association button and uncheck Virtis in the window below.
BridgeWare Association
The selected bridge should be available to:
Virtis
Opis
Is there a corresponding Pontis bridge you would like to link to?
Yes
No
No link to Pontis bridge requested.
Help
OK
Cancel

Superstructure Definition- Define Bridge Geometry



Framing Plan – (Define Erection Plan)




Structure Framing Plan Details
Number of spans = 1
Number of girders = 5
Layout
Diaphragms
Girder Bay: 1
Copy Bay To...
Diaphragm Wizard...
[1] - Click on the Diaphragm Wizard.
Support Number
Start Distance (ft)
Left Girder
Right Girder
Diaphragm Spacing (ft)
Number of Spaces
Length (ft)
End Distance (ft)
Left Girder
Right Gir
Diaphragm Wizard
Select the desired framing plan system:
[2] - Select the desired pattern and click on Next.
Delete
Cancel
< Back
Diaphragm Wizard
Diaphragm Spacing
Enter number of equal spaces per span
Enter equal spacing per span
Enter groups of equal spacing
Support diaphragm load: 0.0000 kip
Interior diaphragm load: 2.0 kip
Span
Length (ft)
Number of Equal Spaces
1
83.00
3
[3] - Enter the diaphragm information and click on Finish.
< Back
Finish
Cancel
Help

Structure Framing Plan Details

Number of spans = 1 Number of girders = 5

Layout | Diaphragms

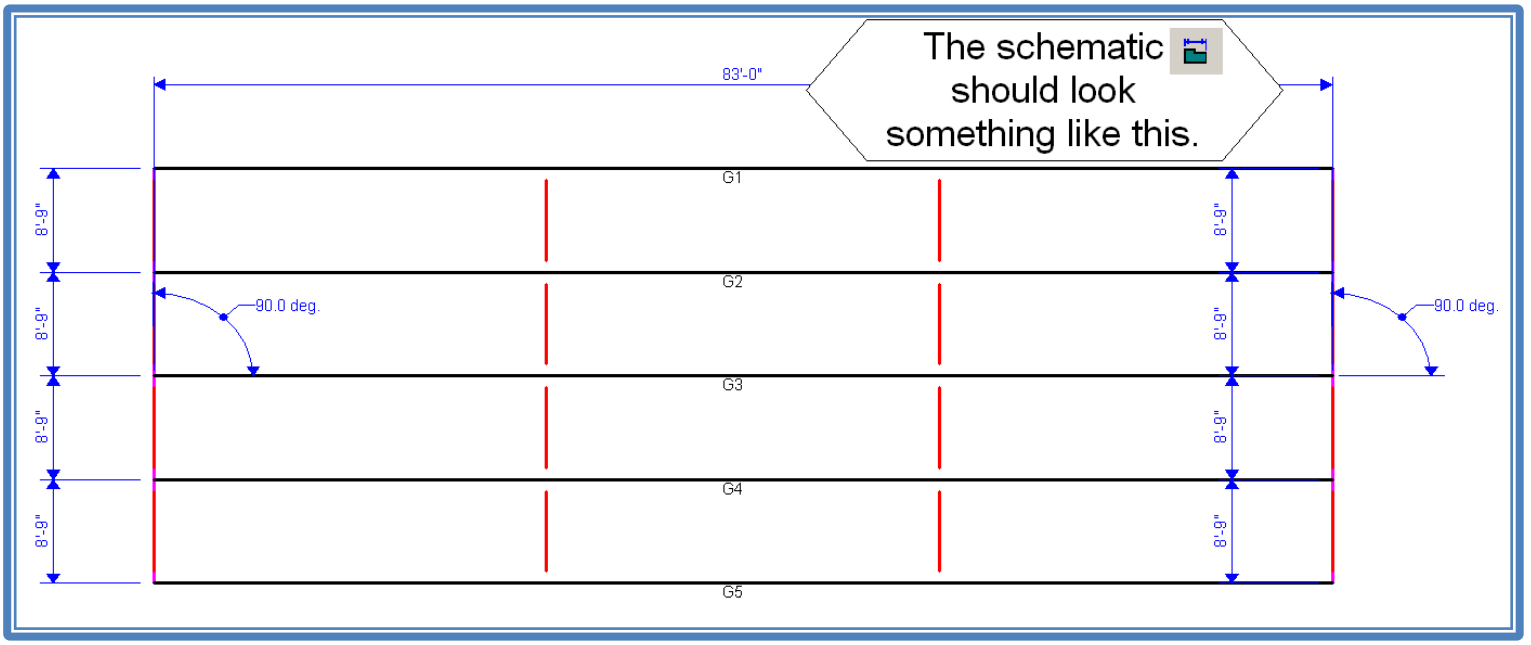
Girder Bay: 1 Copy Bay To... Diaphragm Wizard...

Support Number	Start Distance (ft)		Diaphragm Spacing (ft)	Number of Spaces	Length (ft)	End Distance (ft)		Load (kip)
	Left Girder	Right Girder				Left Girder	Right Girder	
1	0.00	0.00	0.00	1	0.00	0.00	0.00	0.0000
1	0.00	0.00	27.67	2	55.33	55.33	55.33	2.0000
1	83.00	83.00	0.00	1	0.00	83.00	83.00	0.0000

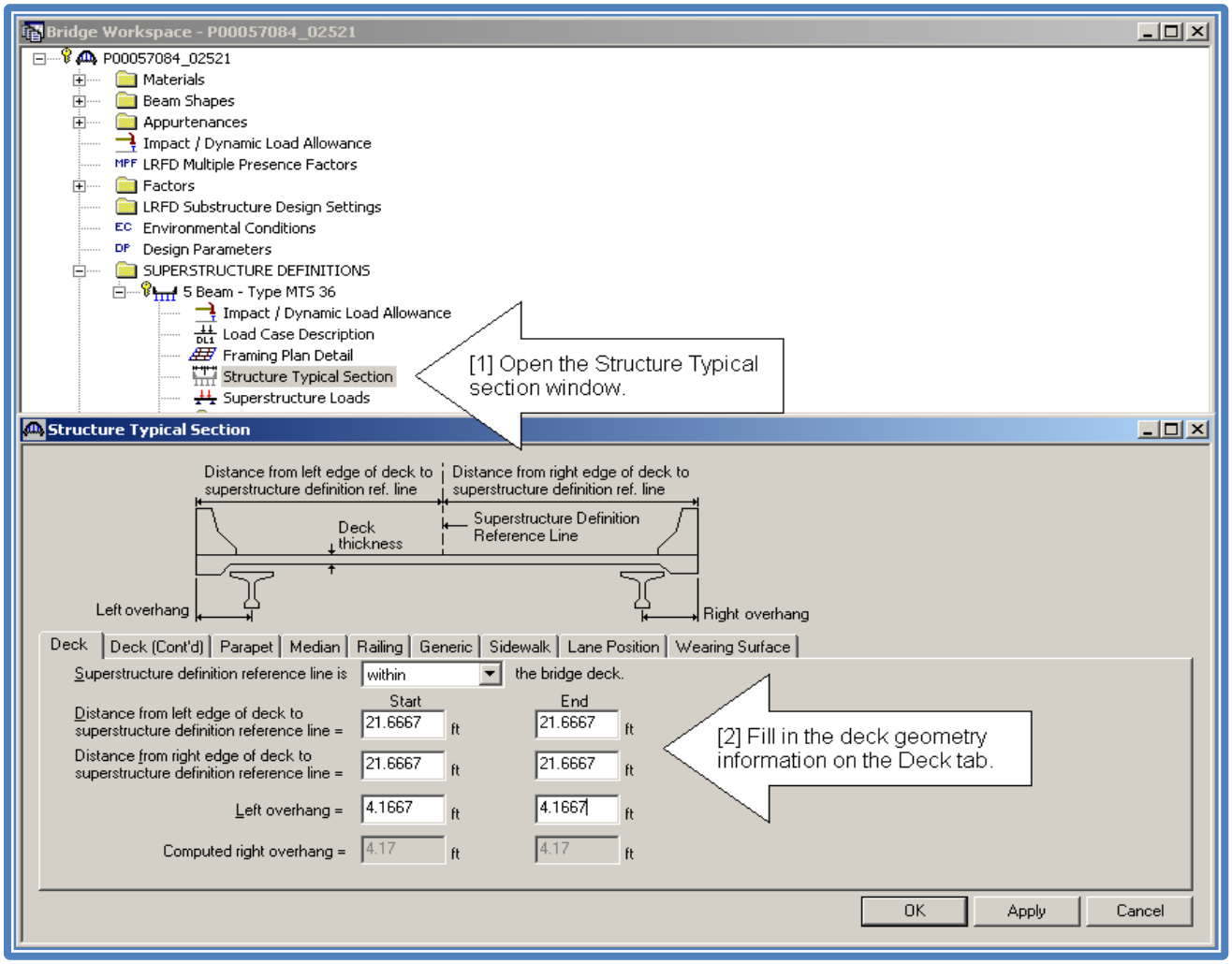
The table will populate as shown above.

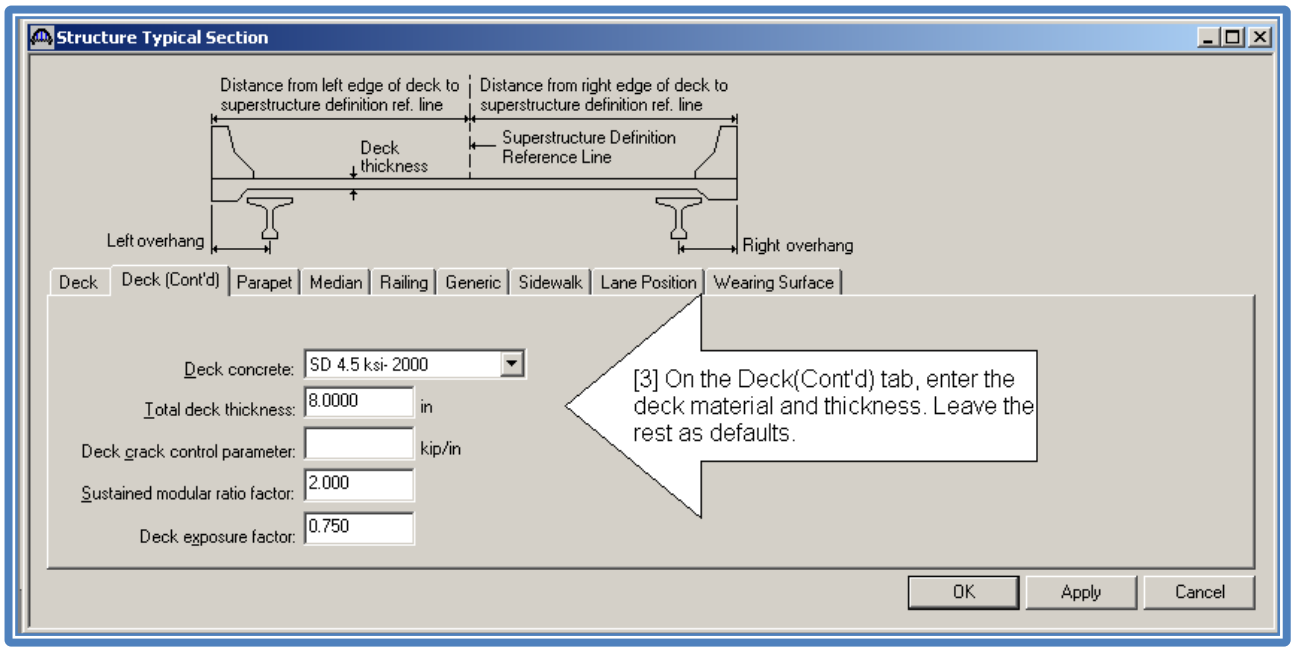
New Duplicate Delete

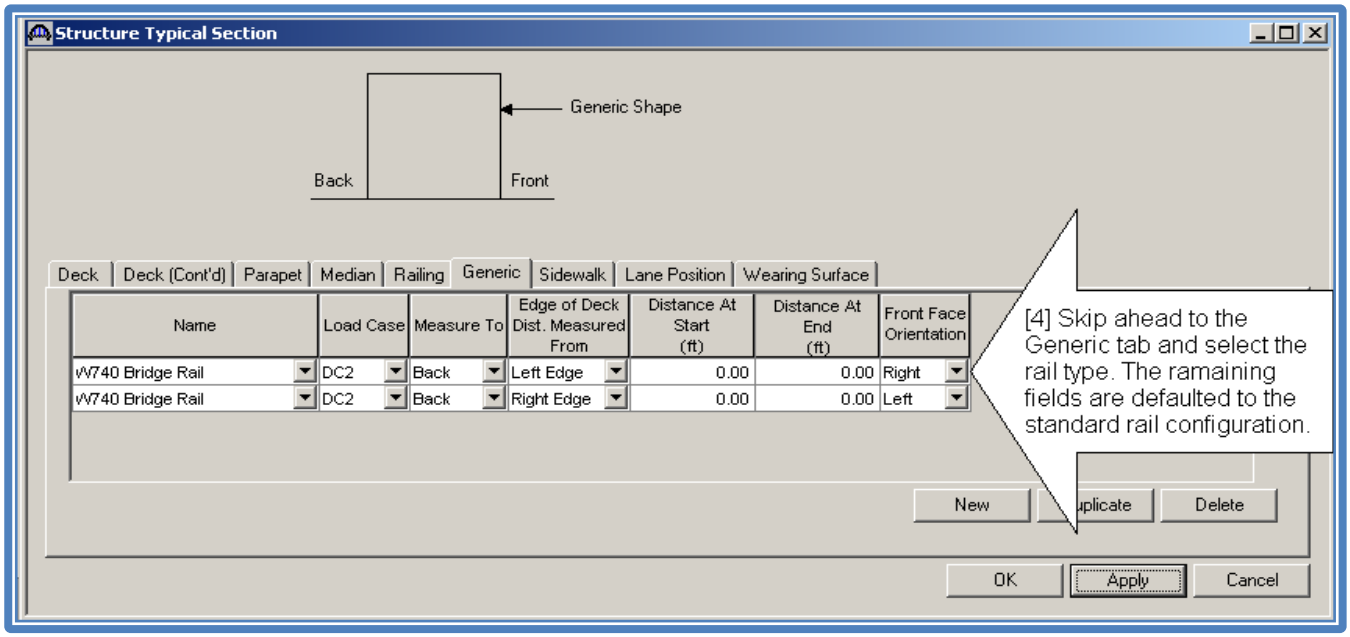
OK Apply Cancel

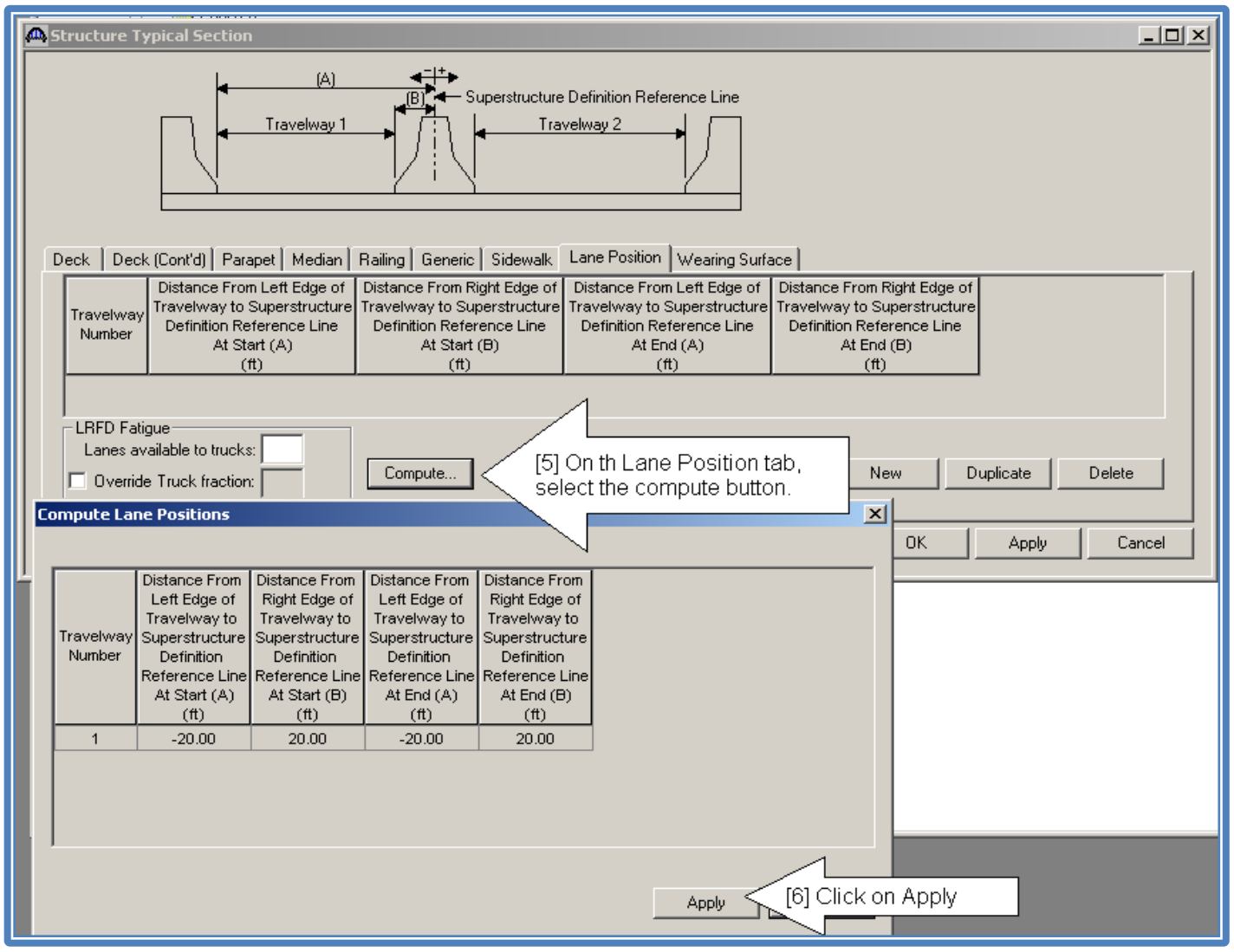


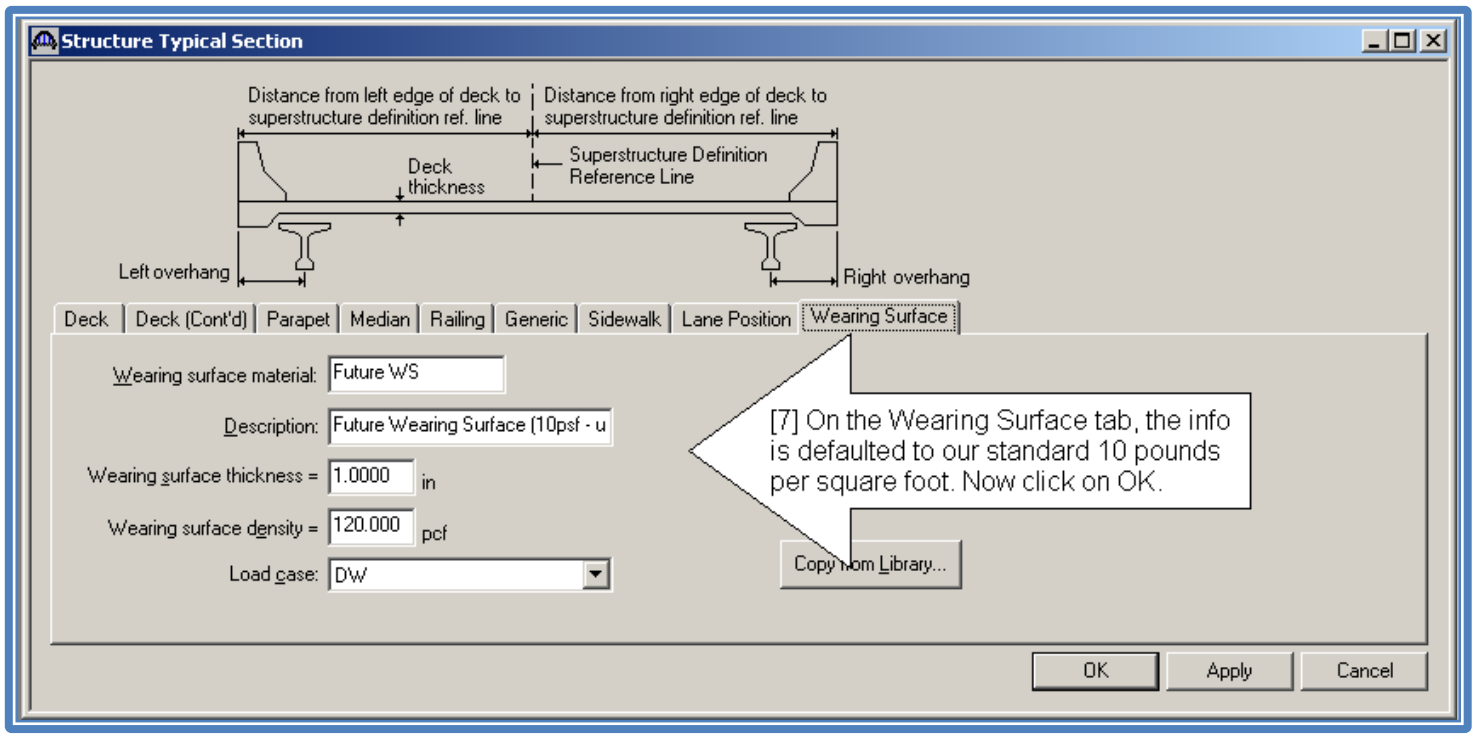
Structure Typical Section – (Define Bridge Cross Section)

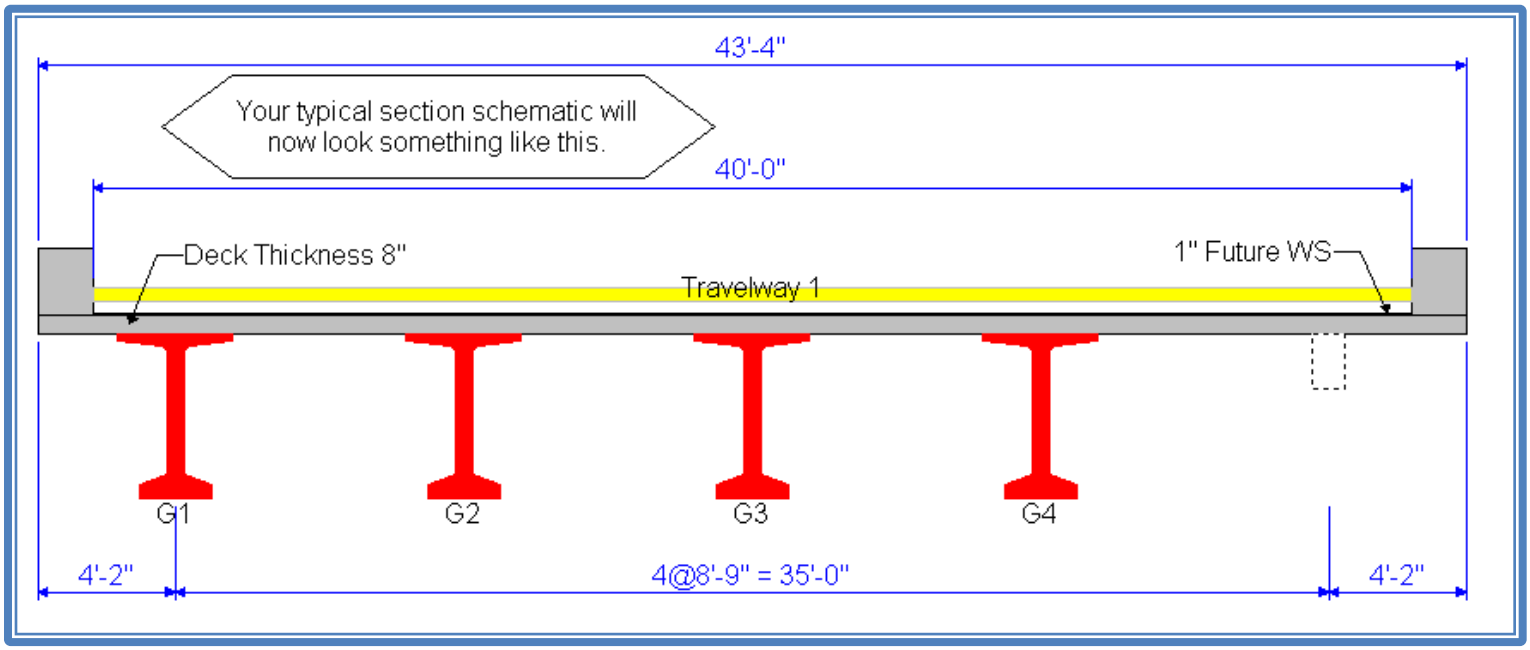




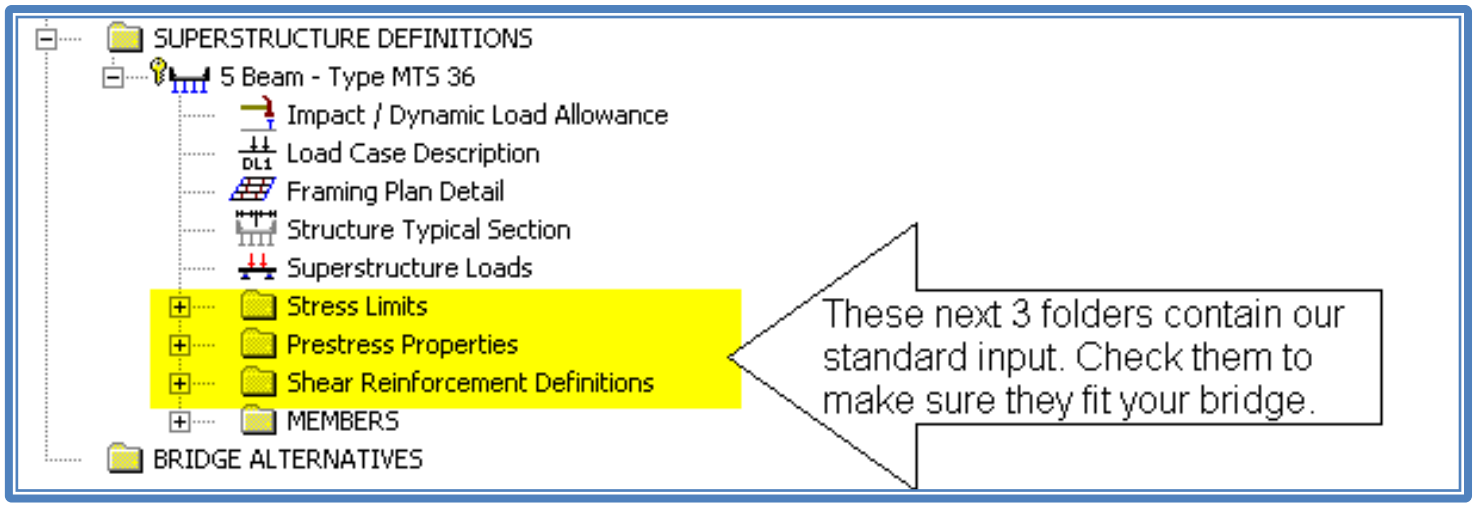

Structure Typical Section
Generic Shape
Back
Front
Deck
Deck (Cont'd)
Parapet
Median
Railing
Generic
Sidewalk
Lane Position
Wearing Surface
Name
Load Case
Measure To
Edge of Deck Dist. Measured From
Distance At Start (ft)
Distance At End (ft)
Front Face Orientation
W740 Bridge Rail
DC2
Back
Left Edge
0.00
0.00
Right
W740 Bridge Rail
DC2
Back
Right Edge
0.00
0.00
Left
[4] Skip ahead to the Generic tab and select the rail type. The ramaining fields are defaulted to the standard rail configuration.
New
Delete
OK
Apply
Cancel


Structure Typical Section
(A)
(B)
Superstructure Definition Reference Line
Travelway 1
Travelway 2
Deck
Deck (Cont'd)
Parapet
Median
Railing
Generic
Sidewalk
Lane Position
Wearing Surface
Travelway Number
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At Start (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At Start (B) (ft)
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At End (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At End (B) (ft)
LRFD Fatigue
Lanes available to trucks:
Override Truck fraction:
Compute...
[5] On th Lane Position tab, select the compute button.
New
Duplicate
Delete
OK
Apply
Cancel
Compute Lane Positions
Travelway Number
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At Start (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At Start (B) (ft)
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At End (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At End (B) (ft)
1
-20.00
20.00
-20.00
20.00
Apply
[6] Click on Apply


Structure Typical Section
Distance from left edge of deck to superstructure definition ref. line
Distance from right edge of deck to superstructure definition ref. line
Deck thickness
Superstructure Definition Reference Line
Left overhang
Right overhang
Deck
Deck (Cont'd)
Parapet
Median
Railing
Generic
Sidewalk
Lane Position
Wearing Surface
Wearing surface material: Future WS
Description: Future Wearing Surface (10psf - u
Wearing surface thickness = 1.0000 in
Wearing surface density = 120.000 pcf
Load case: DW
[7] On the Wearing Surface tab, the info is defaulted to our standard 10 pounds per square foot. Now click on OK.
Copy from Library...
OK
Apply
Cancel


43'-4"
Your typical section schematic will now look something like this.
40'-0"
Deck Thickness 8"
1" Future WS
Travelway 1
G1
G2
G3
G4
4'-2"
4@8'-9" = 35'-0"
4'-2"

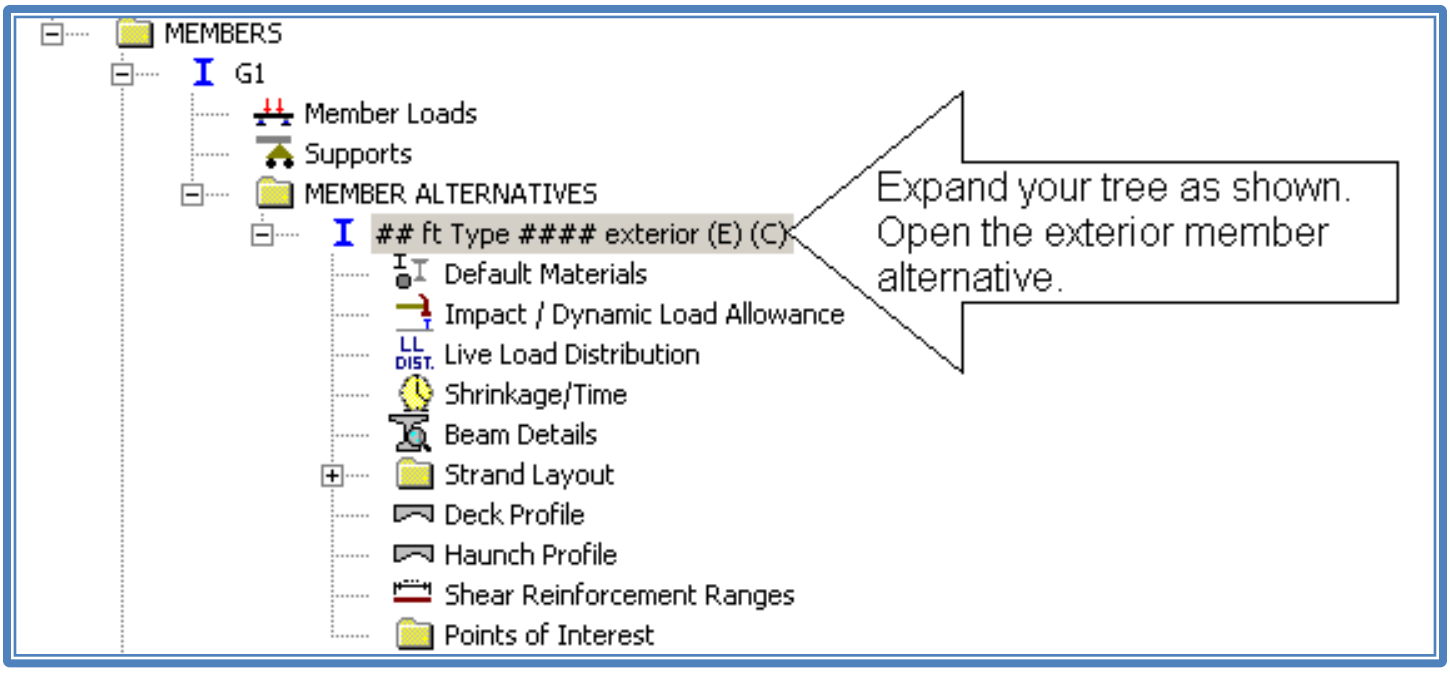
Stress Limits, Prestressed Properties, Shear Reinforcement Definitions

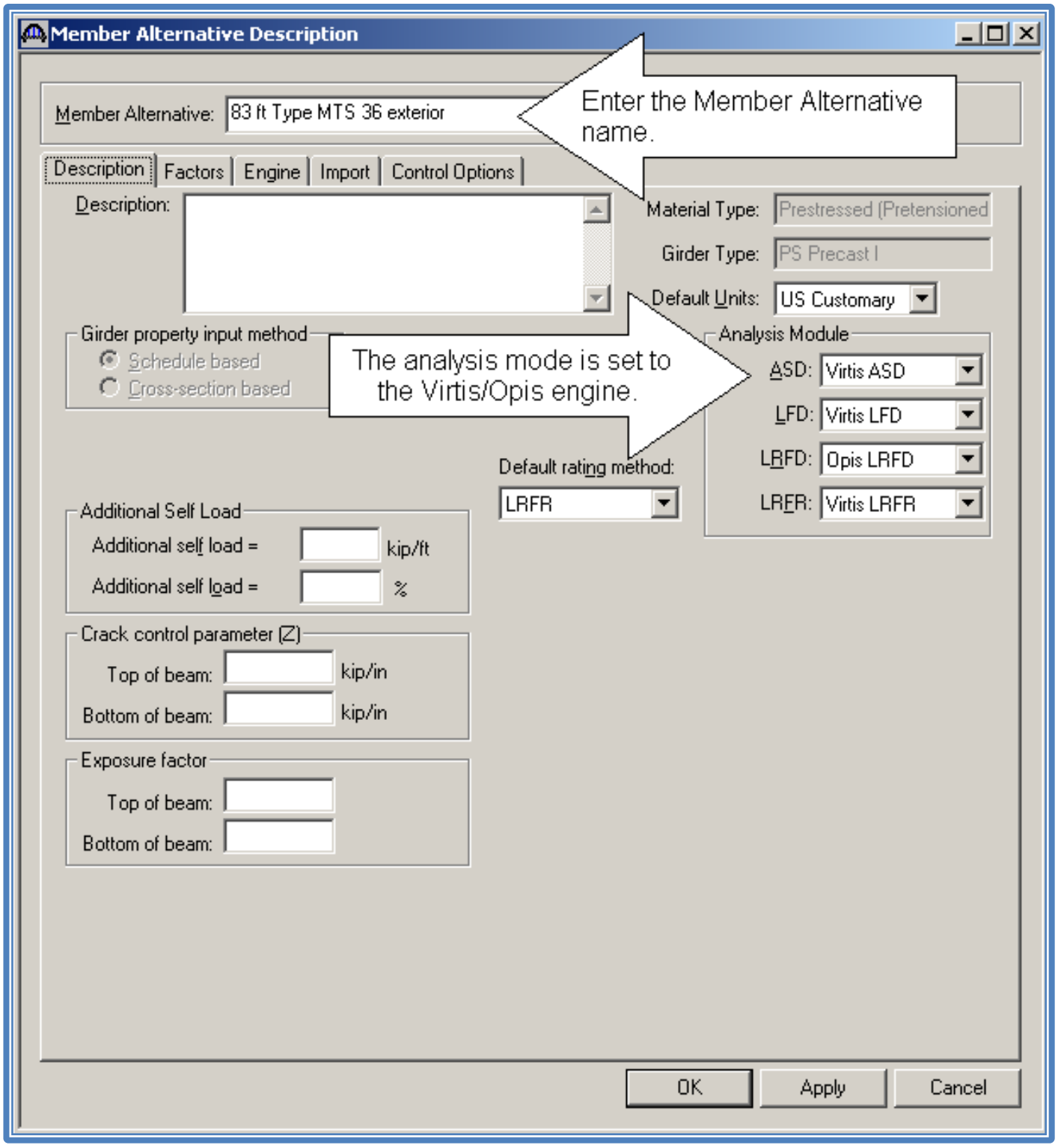


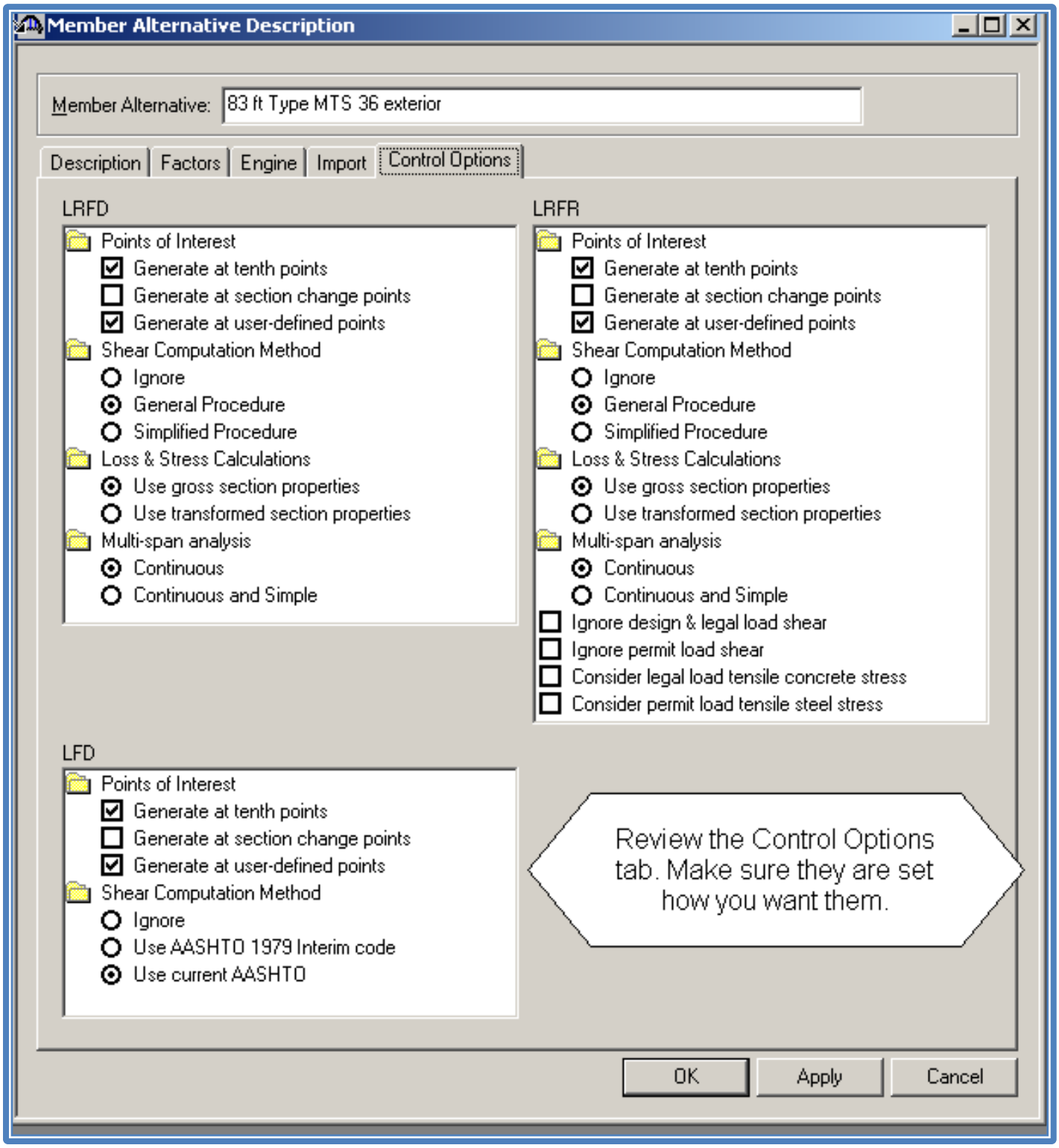
In the Prestress Properties window, you select the prestress loss method. Use the Approximate Loss method for the first run. If you need more capacity out of your beam, you can use the refined loss method (with approval of the Bridge Design Engineer). If you use the refined method, you need to use transformed section properties (in the control options tab in the member window—page 99). With the refined method, you can choose if you want to include elastic gains due to shrinkage of deck. See AASHTO 5.9.5.4 for Refined Loss Method.

Member Alternative – Defining Individual Beams

Now it's time to define the members. For each step, enter the data for both the exterior beam and interior beam before moving on the next step.




Member Alternative Description
Member Alternative: 83 ft Type MTS 36 exterior
Enter the Member Alternative name.
Description
Factors
Engine
Import
Control Options
Description:
Material Type: Prestressed (Pretensioned
Girder Type: PS Precast I
Default Units: US Customary
Girder property input method
Schedule based
Cross-section based
The analysis mode is set to the Virtis/Opis engine.
Analysis Module
ASD: Virtis ASD
LFD: Virtis LFD
LRFD: Opis LRFD
LRFR: Virtis LRFR
Default rating method:
LRFR
Additional Self Load
Additional self load = kip/ft
Additional self load = %
Crack control parameter (Z)
Top of beam: kip/in
Bottom of beam: kip/in
Exposure factor
Top of beam:
Bottom of beam:
OK
Apply
Cancel


Member Alternative Description
Member Alternative: 83 ft Type MTS 36 exterior
Description
Factors
Engine
Import
Control Options
LRFD
Points of Interest
Generate at tenth points
Generate at section change points
Generate at user-defined points
Shear Computation Method
Ignore
General Procedure
Simplified Procedure
Loss & Stress Calculations
Use gross section properties
Use transformed section properties
Multi-span analysis
Continuous
Continuous and Simple
LRFR
Points of Interest
Generate at tenth points
Generate at section change points
Generate at user-defined points
Shear Computation Method
Ignore
General Procedure
Simplified Procedure
Loss & Stress Calculations
Use gross section properties
Use transformed section properties
Multi-span analysis
Continuous
Continuous and Simple
Ignore design & legal load shear
Ignore permit load shear
Consider legal load tensile concrete stress
Consider permit load tensile steel stress
LFD
Points of Interest
Generate at tenth points
Generate at section change points
Generate at user-defined points
Shear Computation Method
Ignore
Use AASHTO 1979 Interim code
Use current AASHTO
Review the Control Options tab. Make sure they are set how you want them.
OK
Apply
Cancel

Explanation of Control Options

As a general guideline, I recommend leaving the settings as defaulted in the templates. For special cases, see the discussion below.

LRFD

Points of Interest

- This is available only for a steel, prestressed or reinforced concrete member alternative.
- Include POI's as section change points if you have a flat slab or a steel bridge.

Shear Computation Method

- This input field is available only for a prestressed or reinforced concrete member alternative.
- Use the **General Procedure** setting.

Loss & Stress Calculations

- This input field is available only for a prestressed concrete member alternative.
- Select the section properties to be used in the concrete loss and stress computations.
- Initially, use **gross section properties**. If you have a situation where you need to stretch out your beam, you may use **transformed section properties**. If you use transformed section properties, also use the refined loss method for your prestress losses. The loss method control is in the Prestressed Properties window.

Multi-span analysis

- This input field is available only for a prestressed concrete member alternative.
- The **Continuous** method considers multi-span structures to be simply supported for beam self-weight and uncured deck, and continuously supported for composite dead and live loads. This method takes

advantage of the continuity connection to reduce the maximum positive moment at mid-spans.

- The **Continuous and Simple** method analyzes the structure as simply supported for beam self-weight and uncured deck, and both continuously and simply supported for composite dead and live loads. The maximum effects from the two analyses are then used in the specification checking. This method accounts for the condition where full continuity is not provided at interior supports.

LRFR

Points of Interest

- This is available only for a steel, prestressed or reinforced concrete member alternative.
- Include POI's as section change points if you have a flat slab or a steel bridge.

Shear Computation Method

- This input field is available only for a prestressed or reinforced concrete member alternative.
- Use the **General Procedure** setting. If you're having shear issues use the following guidelines:
    - For a new bridge, adjust the shear spacing or hoop size until you satisfy the code.
    - For a rehab, redeck, widening, etc, discuss your issue with Bridge Management Section and the Bridge Design Engineer to see if ignoring the shear rating is appropriate.

Loss & Stress Calculations

- This input field is available only for a prestressed concrete member alternative.
- Select the section properties to be used in the concrete loss and stress computations.
- Use the same setting that you used in the LRFD section.

- If you're designing a rehab, redeck, widening, etc, you may sharpen you pencil, if needed, by using transformed section properties and the refined loss method. Discuss this with Bridge Management Section and the Bridge Design Engineer to see if this method is appropriate.

Multi-span analysis

- Use the same setting that you used in the LRFD section.

Ignore design & legal load shear

- This input field is available only for a prestressed or reinforced concrete member alternative. Discuss use with BMS.

Ignore permit load shear

- This input field is available only for a prestressed or reinforced concrete member alternative. Discuss use with BMS.

Consider legal load tensile concrete stress

- This input field is available only for a prestressed concrete member alternative. Discuss use with BMS.

Consider permit load tensile steel stress

- Check this box to check LRFR spec article 6.5.4.2.2.2 in an LRFR rating. This input field is available only for a prestressed or reinforced concrete member alternative. Discuss use with BMS.

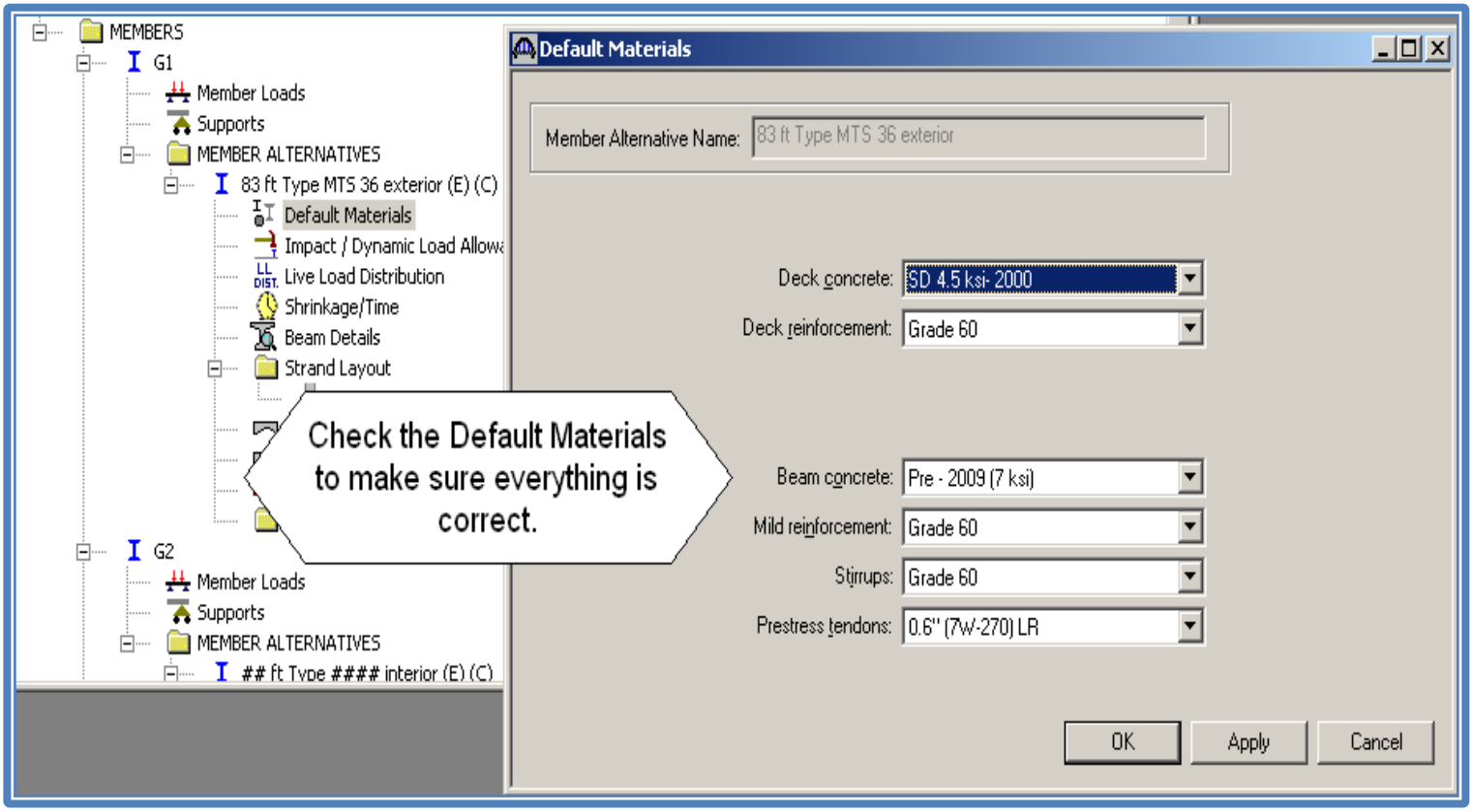
LFD

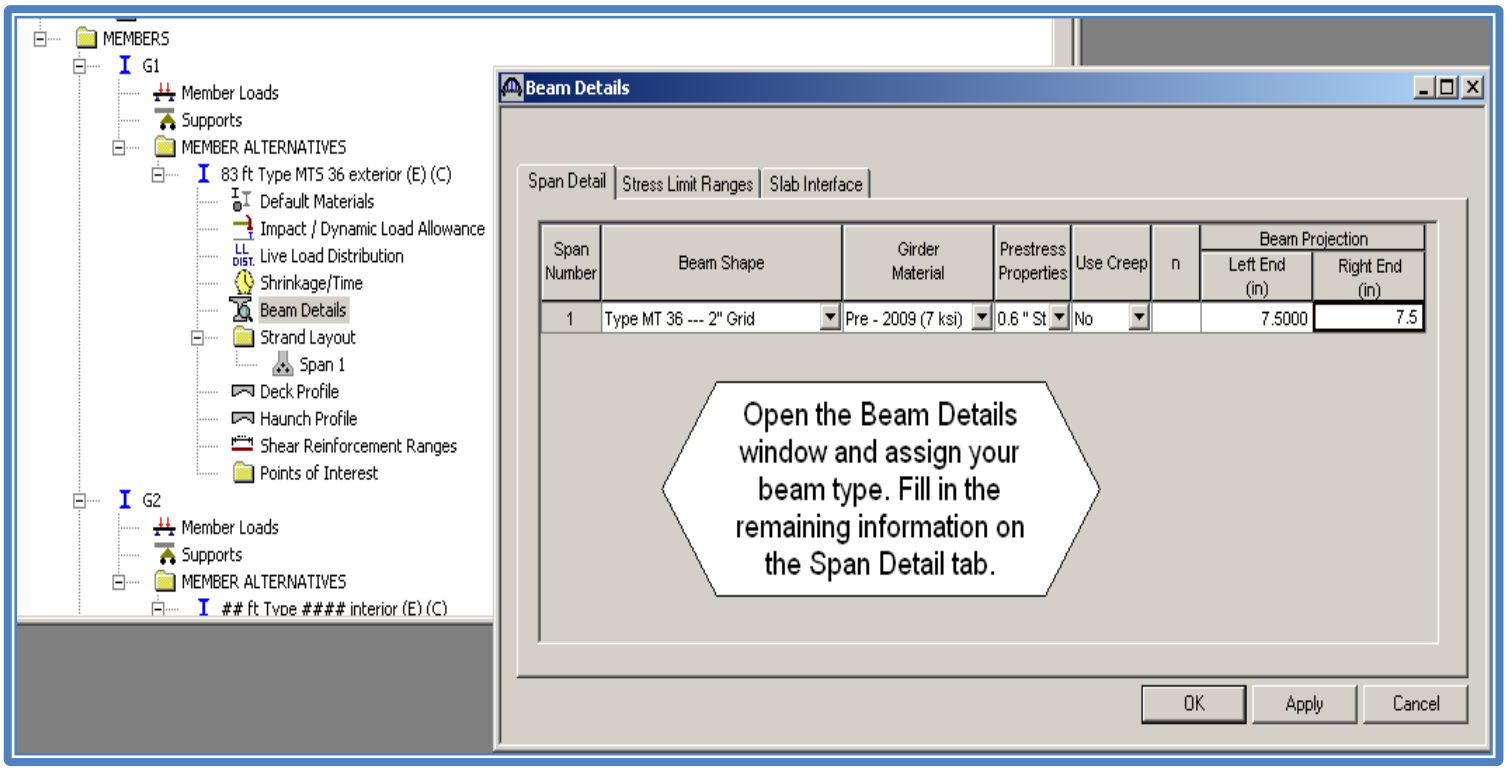
Points of Interest

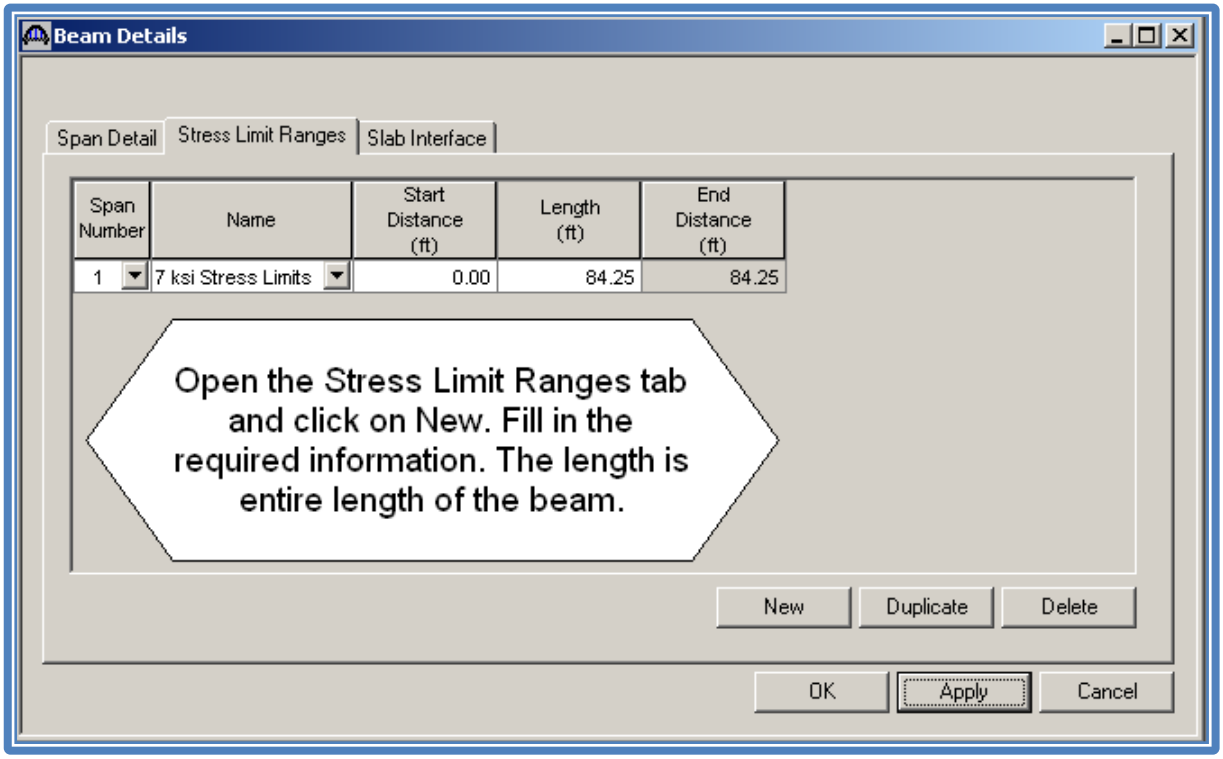
- This is available only for a steel, prestressed or reinforced concrete member alternative.
- Include POI's as section change points if you have a flat slab or a steel bridge.

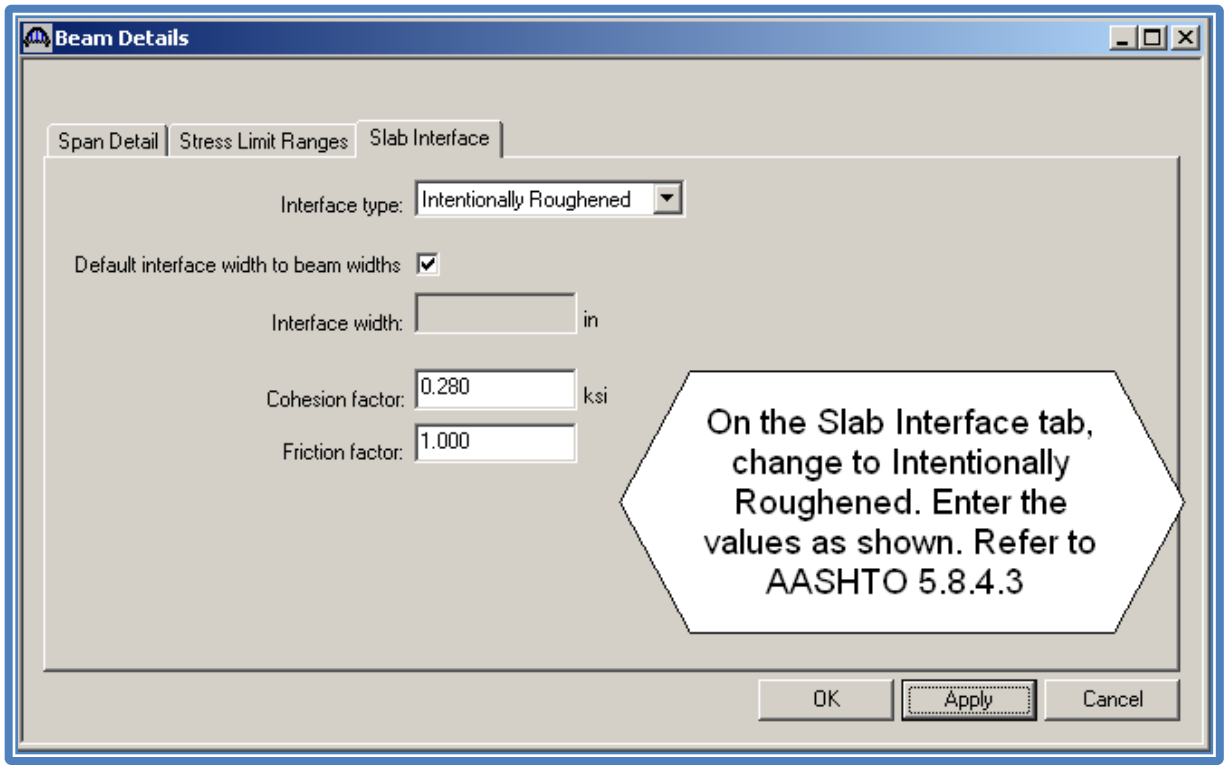
Shear Computation Method

- This input field is available only for a prestressed member alternative.
- A new option was added to check the shear rating using the AASTHO 1979 Interim Code. If you are rehabbing a bridge that was built prior to 1979 and are having shear issues, discuss this option with BMS and the Bridge Design Engineer.

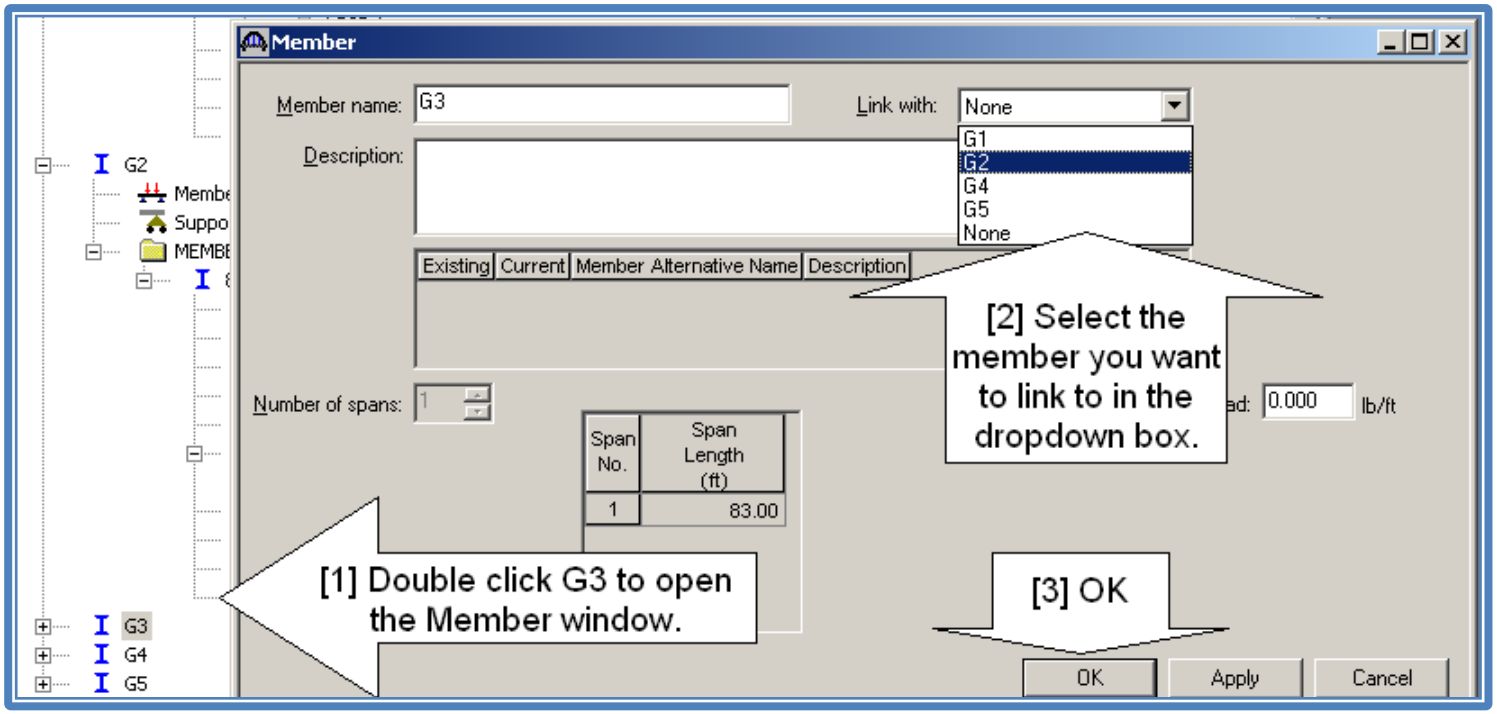

MEMBERS
G1
Member Loads
Supports
MEMBER ALTERNATIVES
83 ft Type MTS 36 exterior (E) (C)
Default Materials
Impact / Dynamic Load Allowa
Live Load Distribution
Shrinkage/Time
Beam Details
Strand Layout
G2
Member Loads
Supports
MEMBER ALTERNATIVES
ft Type #### interior (E) (C)
Check the Default Materials to make sure everything is correct.
Default Materials
Member Alternative Name:
83 ft Type MTS 36 exterior
Deck concrete:
SD 4.5 ksi- 2000
Deck reinforcement:
Grade 60
Beam concrete:
Pre - 2009 (7 ksi)
Mild reinforcement:
Grade 60
Stirrups:
Grade 60
Prestress tendons:
0.6" (7W-270) LR
OK
Apply
Cancel


MEMBERS
G1
Member Loads
Supports
MEMBER ALTERNATIVES
83 ft Type MTS 36 exterior (E) (C)
Default Materials
Impact / Dynamic Load Allowance
Live Load Distribution
Shrinkage/Time
Beam Details
Strand Layout
Span 1
Deck Profile
Haunch Profile
Shear Reinforcement Ranges
Points of Interest
G2
Member Loads
Supports
MEMBER ALTERNATIVES
ft Type #### interior (E) (C)
Beam Details
Span Detail
Stress Limit Ranges
Slab Interface
Span Number
Beam Shape
Girder Material
Prestress Properties
Use Creep
n
Beam Projection
Left End (in)
Right End (in)
1
Type MT 36 --- 2" Grid
Pre - 2009 (7 ksi)
0.6 " St
No
7.5000
7.5
Open the Beam Details window and assign your beam type. Fill in the remaining information on the Span Detail tab.
OK
Apply
Cancel


Beam Details
Span Detail
Stress Limit Ranges
Slab Interface
Span Number
Name
Start Distance (ft)
Length (ft)
End Distance (ft)
1
7 ksi Stress Limits
0.00
84.25
84.25
Open the Stress Limit Ranges tab and click on New. Fill in the required information. The length is entire length of the beam.
New
Duplicate
Delete
OK
Apply
Cancel


Beam Details
Span Detail
Stress Limit Ranges
Slab Interface
Interface type:
Intentionally Roughened
Default interface width to beam widths
Interface width:
in
Cohesion factor:
0.280
ksi
Friction factor:
1.000
On the Slab Interface tab, change to Intentionally Roughened. Enter the values as shown. Refer to AASHTO 5.8.4.3
OK
Apply
Cancel

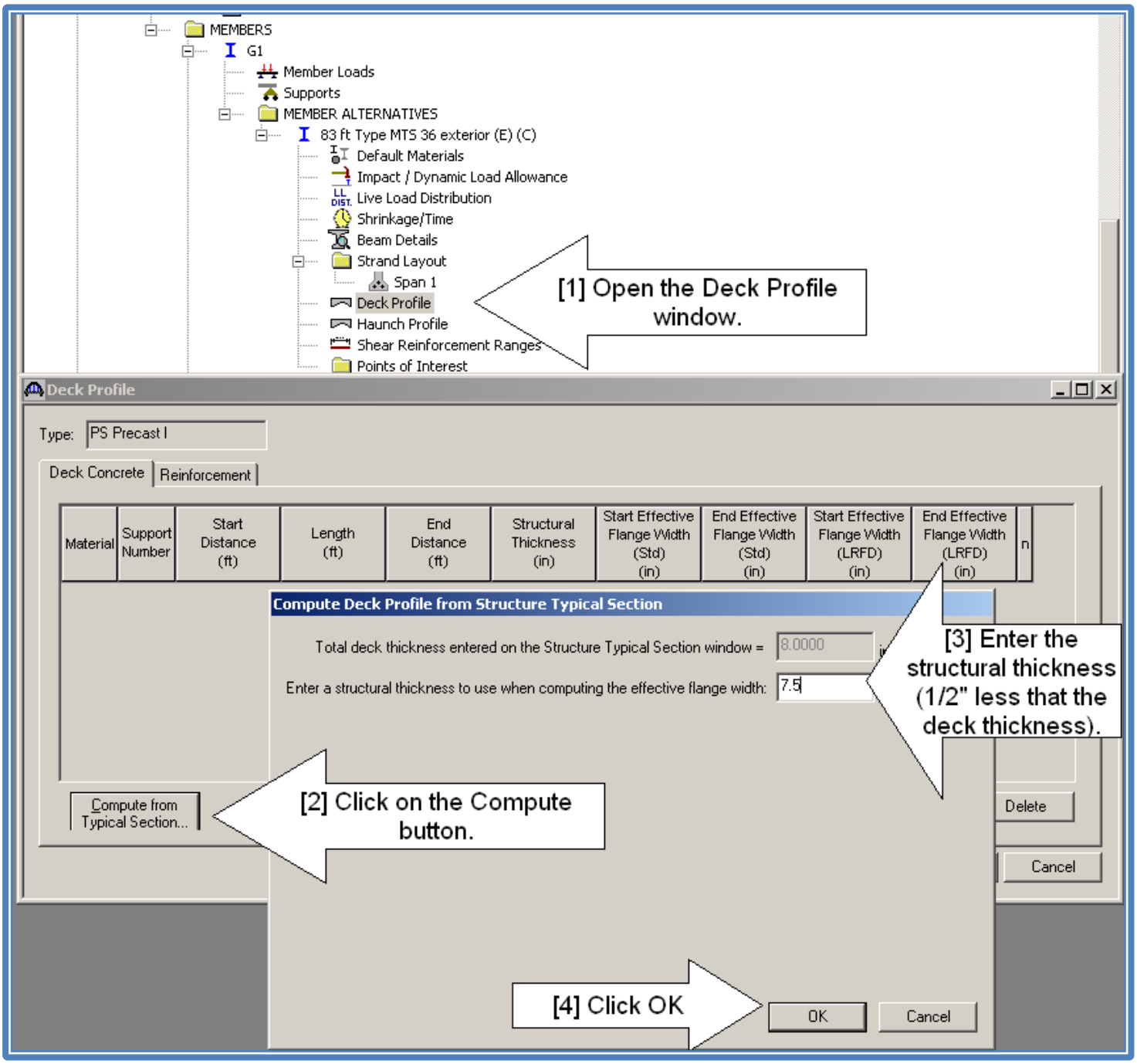
If you have a symmetrical cross section, you can link beams G3 and G4 to G2, and G5 to G1. To do this, follow the steps below.

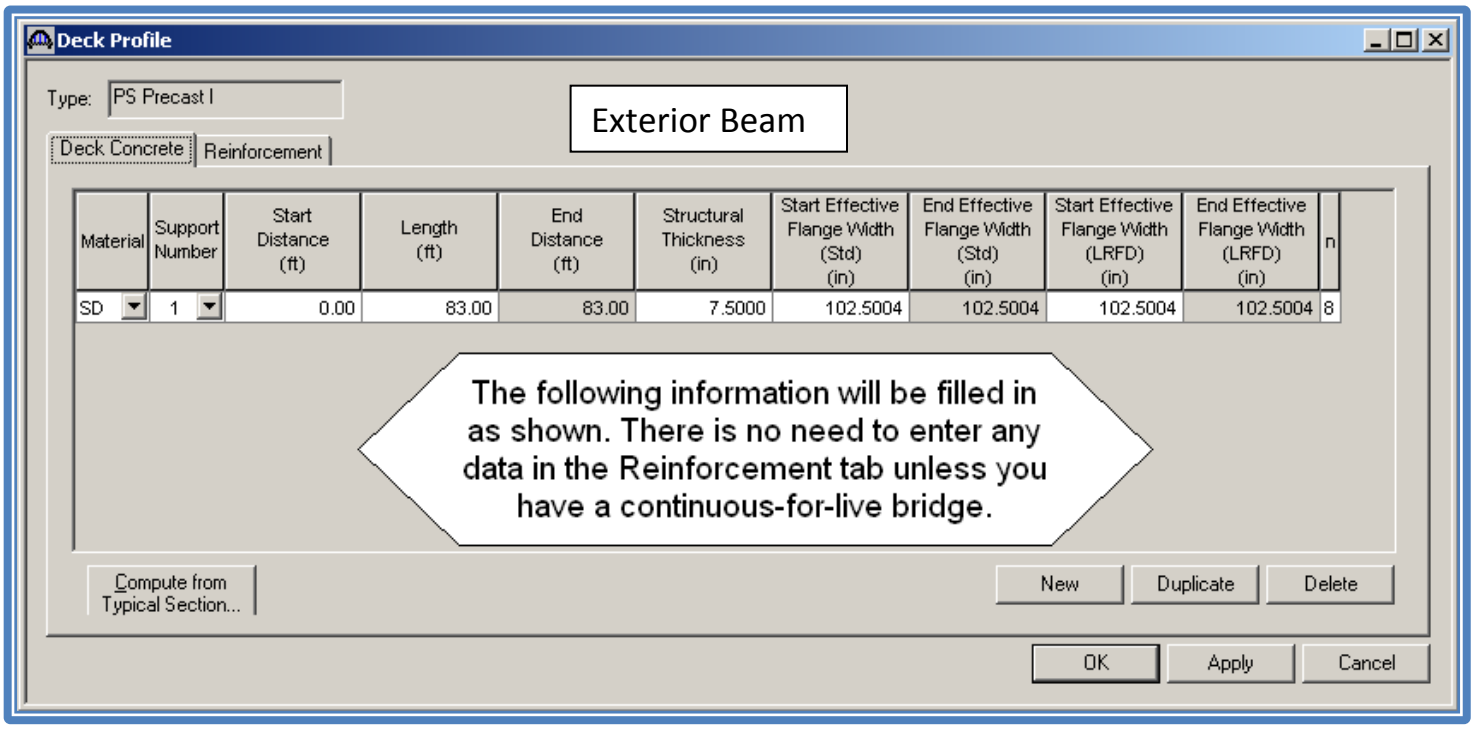


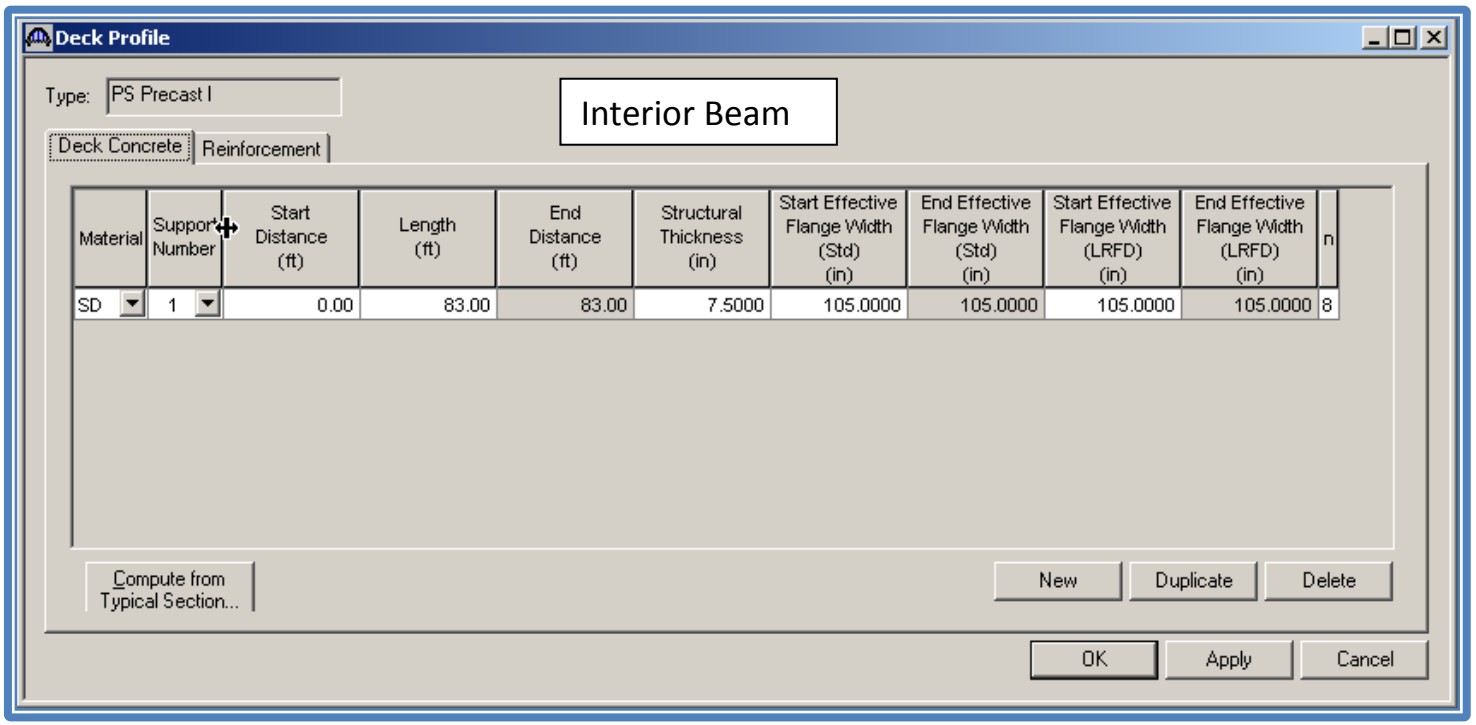
Repeat this procedure for the remaining beams. If your cross section is not symmetrical, enter the beam data individually.

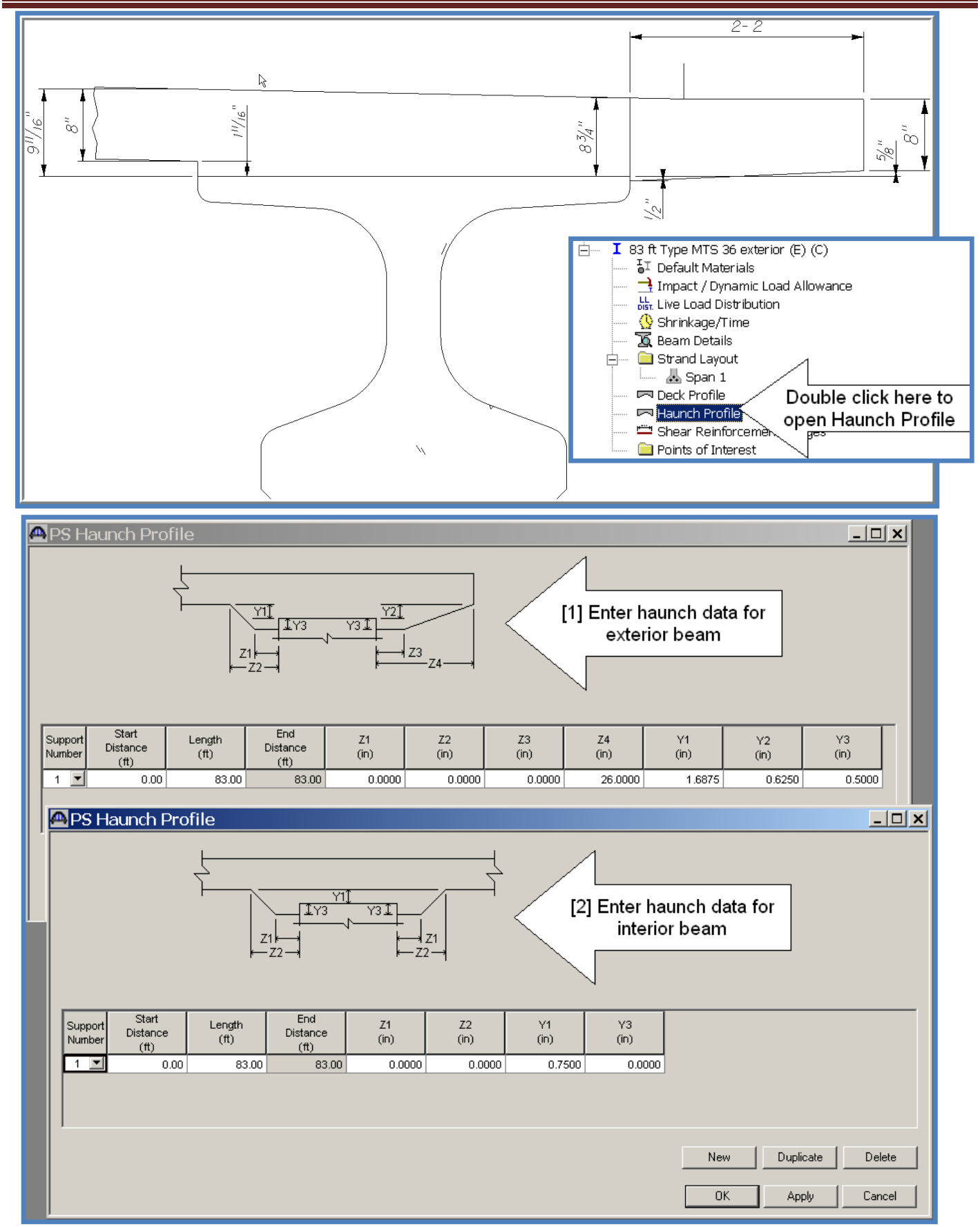
Now go back to page 13 and follow the same steps for G2, the interior beam.

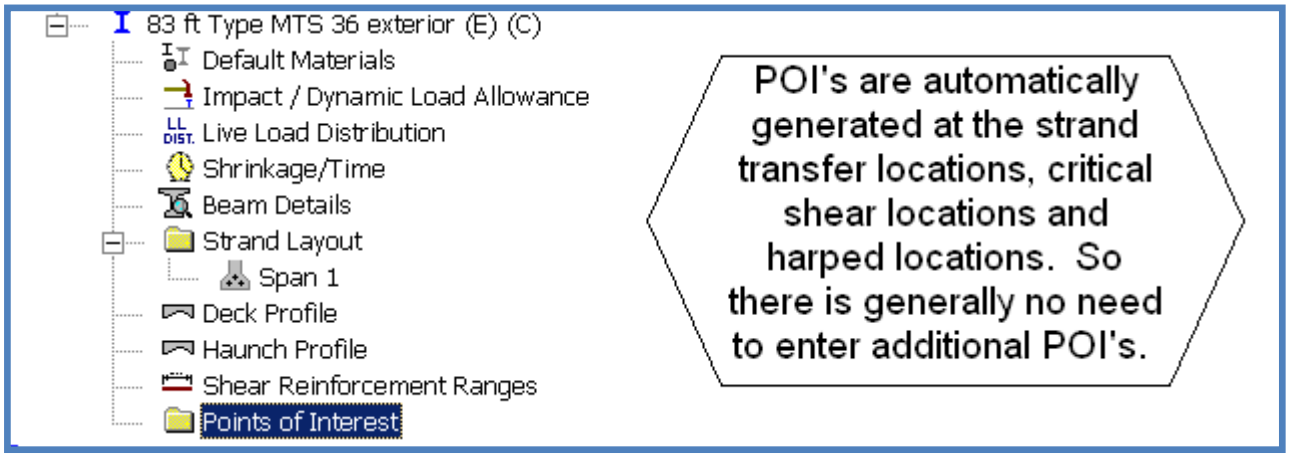
Now enter the deck information for beams G1 and G2.

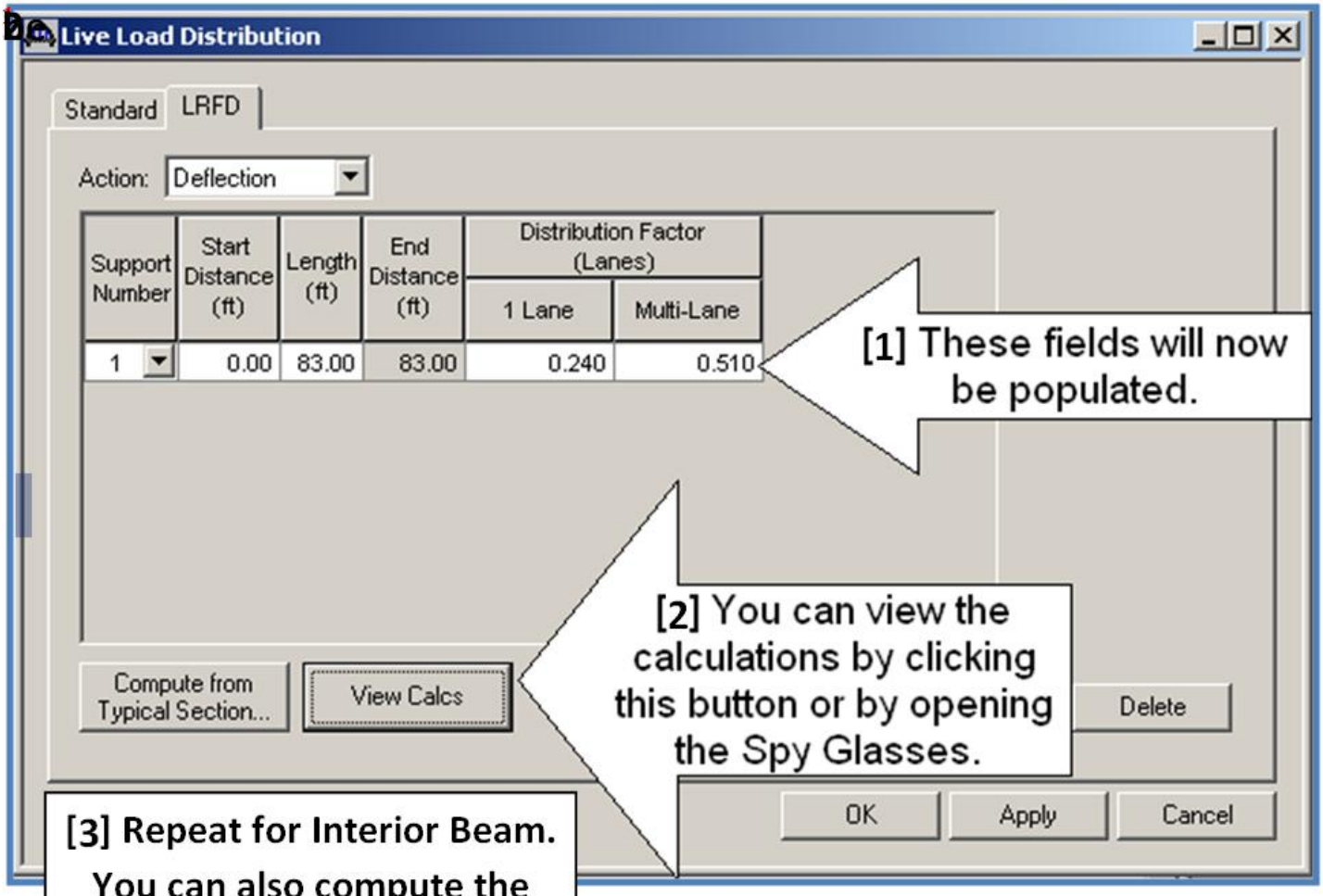



Deck Profile
Type: PS Precast I
Exterior Beam
Deck Concrete
Reinforcement
Material
Support Number
Start Distance (ft)
Length (ft)
End Distance (ft)
Structural Thickness (in)
Start Effective Flange Width (Std) (in)
End Effective Flange Width (Std) (in)
Start Effective Flange Width (LRFD) (in)
End Effective Flange Width (LRFD) (in)
n
SD 1 0.00 83.00 83.00 7.5000 102.5004 102.5004 102.5004 102.5004 8
The following information will be filled in as shown. There is no need to enter any data in the Reinforcement tab unless you have a continuous-for-live bridge.
Compute from Typical Section...
New
Duplicate
Delete
OK
Apply
Cancel


Deck Profile
Type: PS Precast I
Interior Beam
Deck Concrete
Reinforcement
Material
Support Number
Start Distance (ft)
Length (ft)
End Distance (ft)
Structural Thickness (in)
Start Effective Flange Width (Std) (in)
End Effective Flange Width (Std) (in)
Start Effective Flange Width (LRFD) (in)
End Effective Flange Width (LRFD) (in)
n
SD 1 0.00 83.00 83.00 7.5000 105.0000 105.0000 105.0000 105.0000 8
Compute from Typical Section...
New
Duplicate
Delete
OK
Apply
Cancel

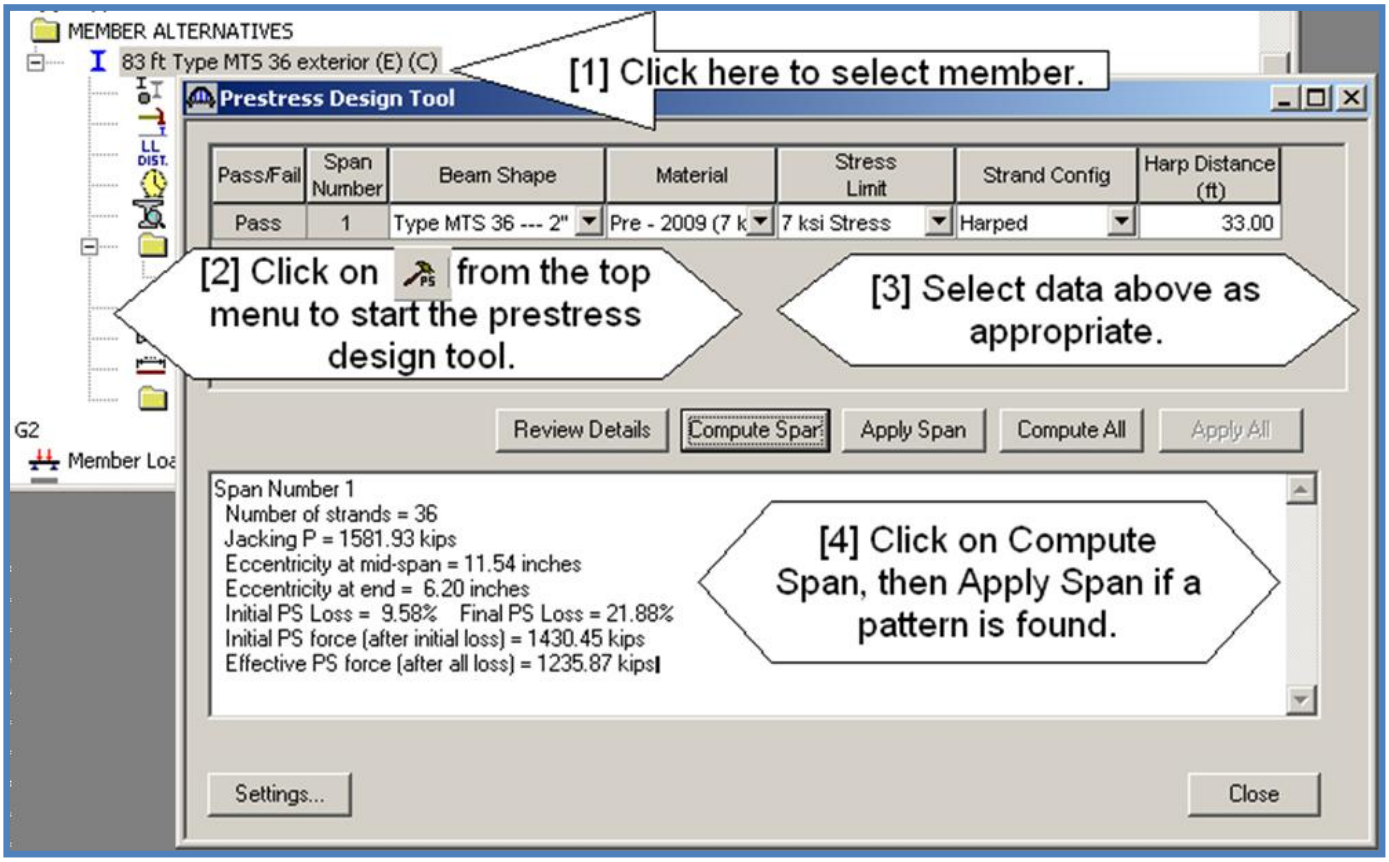

2- 2
9 1/16"
8"
1 1/16"
8 3/4"
5/8"
8"
1/2"
83 ft Type MTS 36 exterior (E) (C)
Default Materials
Impact / Dynamic Load Allowance
Live Load Distribution
Shrinkage/Time
Beam Details
Strand Layout
Span 1
Deck Profile
Haunch Profile
Shear Reinforcemer
Points of Interest
Double click here to open Haunch Profile
PS Haunch Profile
Y1
Y2
Y3
Y3
Z1
Z2
Z3
Z4
[1] Enter haunch data for exterior beam
Support Number
Start Distance (ft)
Length (ft)
End Distance (ft)
Z1 (in)
Z2 (in)
Z3 (in)
Z4 (in)
Y1 (in)
Y2 (in)
Y3 (in)
1
0.00
83.00
83.00
0.0000
0.0000
0.0000
26.0000
1.6875
0.6250
0.5000
PS Haunch Profile
Y1
Y3
Y3
Z1
Z2
Z1
Z2
[2] Enter haunch data for interior beam
Support Number
Start Distance (ft)
Length (ft)
End Distance (ft)
Z1 (in)
Z2 (in)
Y1 (in)
Y3 (in)
1
0.00
83.00
83.00
0.0000
0.0000
0.7500
0.0000
New
Duplicate
Delete
OK
Apply
Cancel





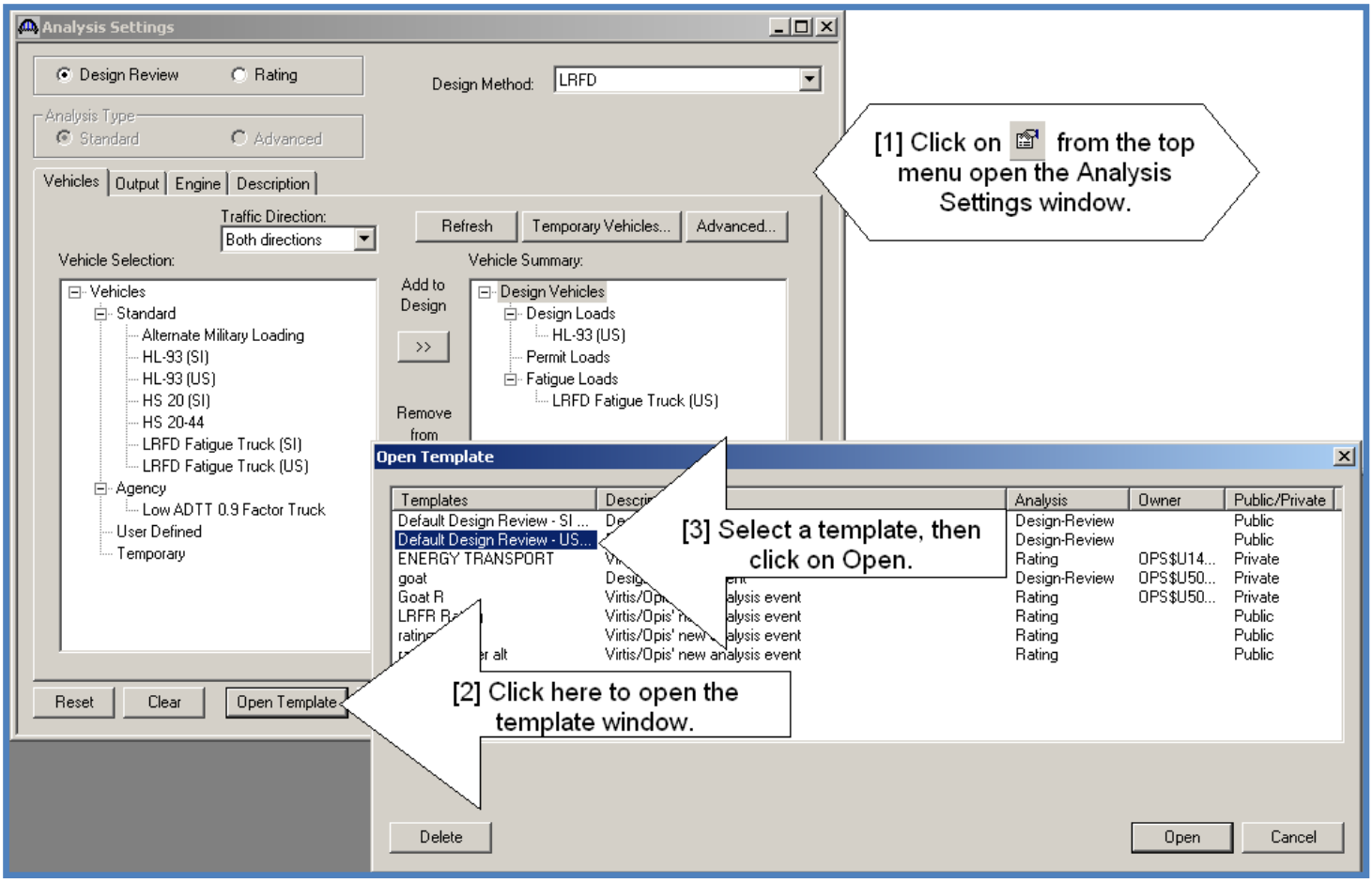
[3] Repeat for Interior Beam. You can also compute the standard dist. factors if you wish, but it is not necessary.

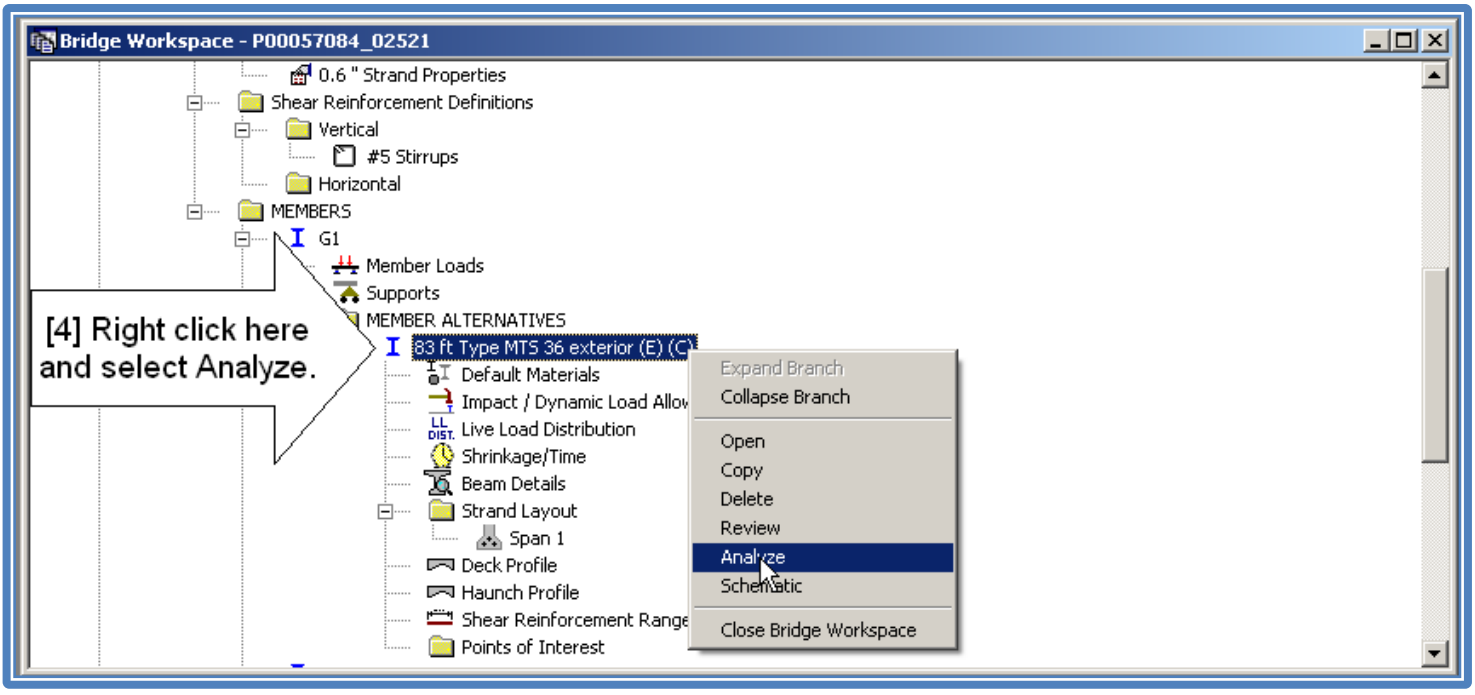
Prestressed Design Tool



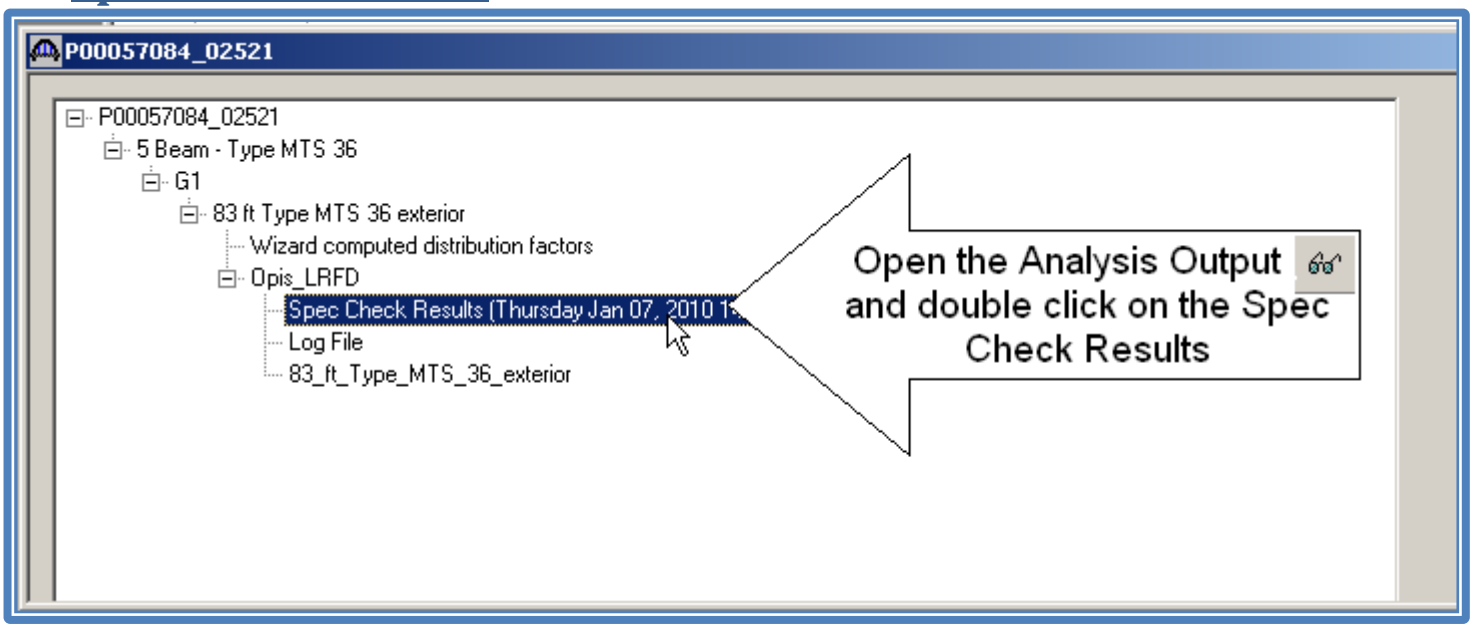
The Prestress Design Tool will calculate both a strand pattern and a shear steel design (if no shear steel has been defined yet). If no strand pattern is found, it doesn't mean that there is not one that will work. You will need to enter one and check it. A good starting point is to fill the bottom two rows, add a few harped strands, and then analyze the beam. See Appendix B for a procedure for designing from scratch. If a strand pattern is found, it is likely to be under designed. You will need to analyze the beam to check for failures and adjust the pattern accordingly. The shear pattern will likely be OK, but will not match our standard spacing. Concentrate on the strand pattern first, then move on to the shear design.

Analyze Beam

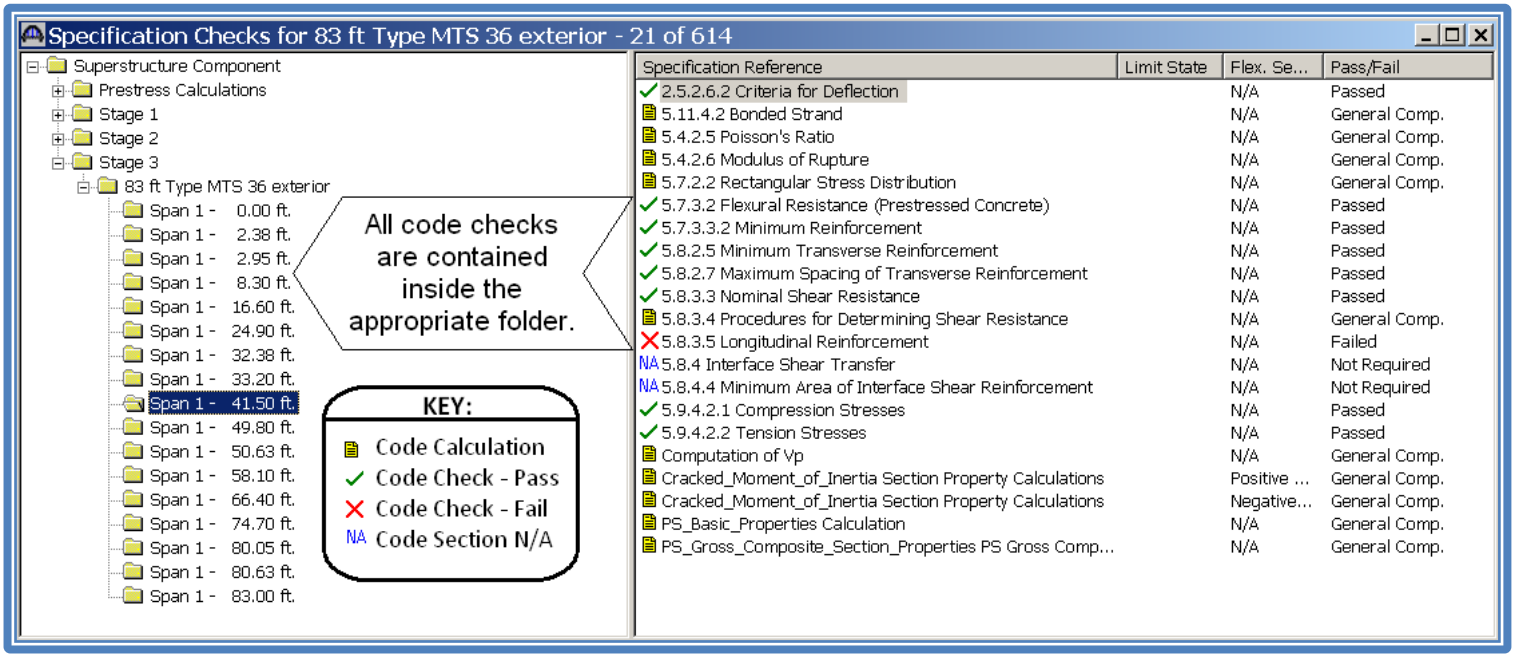




Spec Check Results



This gives you a summary of the Specification Results and a table for each of the articles checked. The next page shows a sample of this report. You can easily zero in on failure locations and adjust the strand pattern accordingly. You can also open the Spec Checker for in depth calculations.



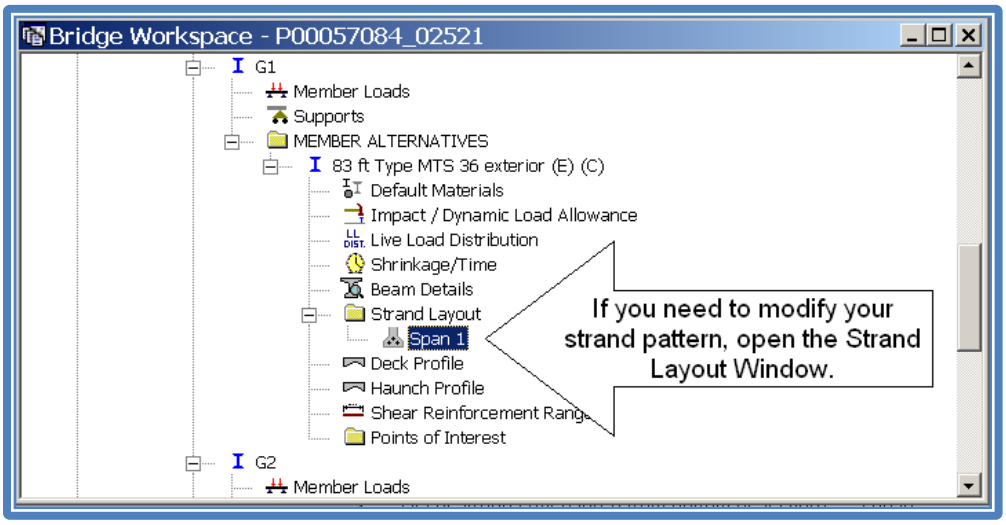
Specification Check Summary

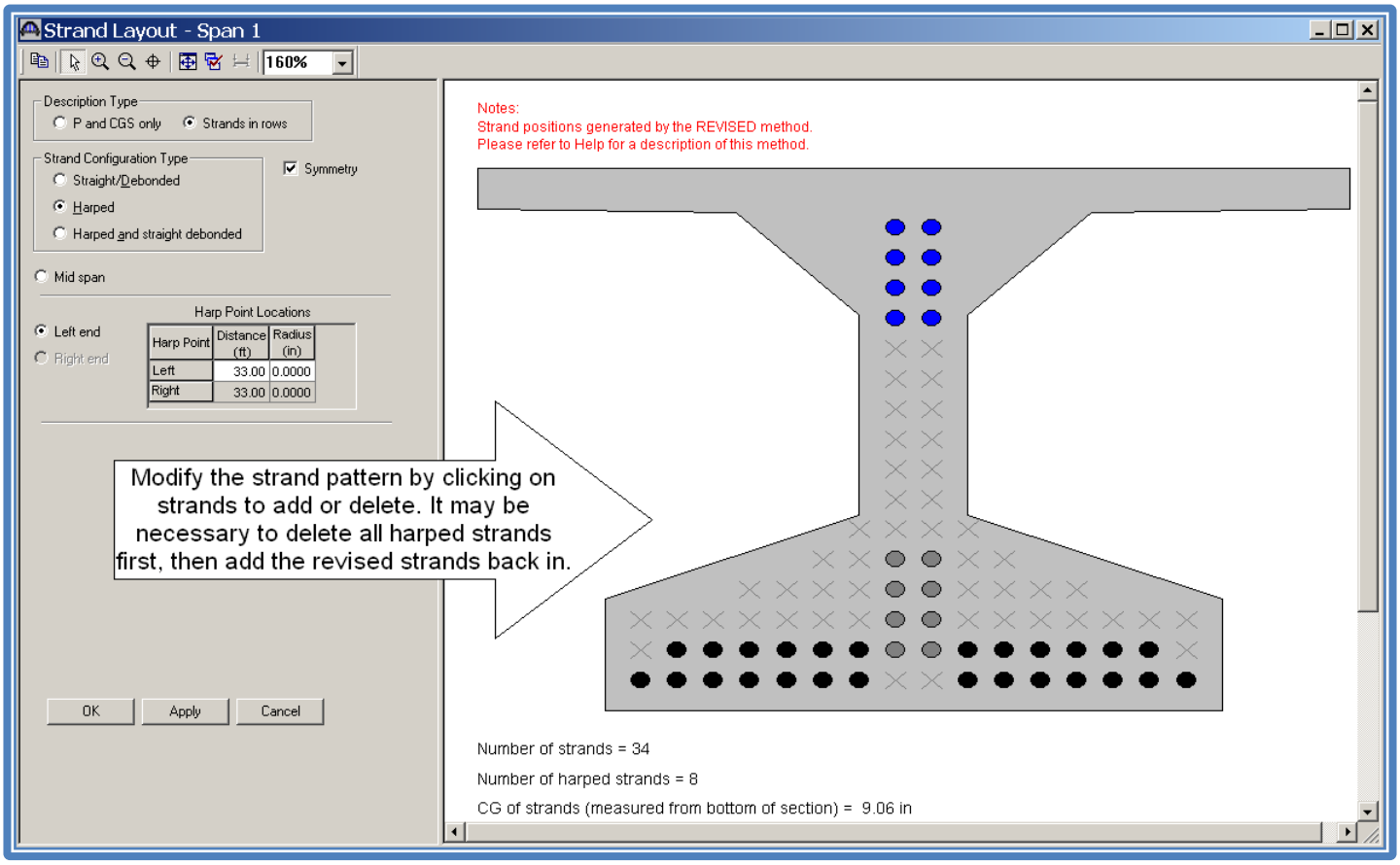
Article	Status
Initial Stress at Transfer (5.9.4.1.1, 5.9.4.1.2)	Pass
Final Stress due to Permanent and Transient Loads (5.9.4.2.1, 5.9.4.2.2)	Fail
Flexure (5.7.3.2, 5.7.3.3.2)	Pass
Shear (5.8.3.3, 5.8.2.5, 5.8.2.7, 5.8.3.5)	Pass
Deflection (5.7.3.6.2)	Pass

Final Tension Stress due to Permanent and Transient Loads

Location (ft)	Allowable Stress (ksi)	Actual Stress Top of Beam (ksi)	Actual Stress Bot of Beam (ksi)	Ratio	Code
0.000	0.50	-0.10	-0.61	99.00	Pass
2.375	0.50	-0.78	-2.47	99.00	Pass
8.300	0.50	-1.44	-1.50	99.00	Pass
16.600	0.50	-2.14	-0.47	99.00	Pass
24.900	0.50	-2.56	0.18	2.75	Pass
32.375	0.50	-2.70	0.46	1.09	Pass
33.200	0.50	-2.73	0.50	1.01	Pass
41.500	0.50	-2.86	0.66	0.77	Fail
49.800	0.50	-2.73	0.50	1.01	Pass
50.625	0.50	-2.70	0.46	1.09	Pass
58.100	0.50	-2.56	0.18	2.75	Pass
66.400	0.50	-2.14	-0.47	99.00	Pass
74.700	0.50	-1.44	-1.50	99.00	Pass
80.625	0.50	-0.78	-2.47	99.00	Pass
83.000	0.50	-0.10	-0.61	99.00	Pass

If you have failures, open the strand layout and modify the strand pattern. Then re-analyze. Repeat this until you have a strand pattern that works all beams.

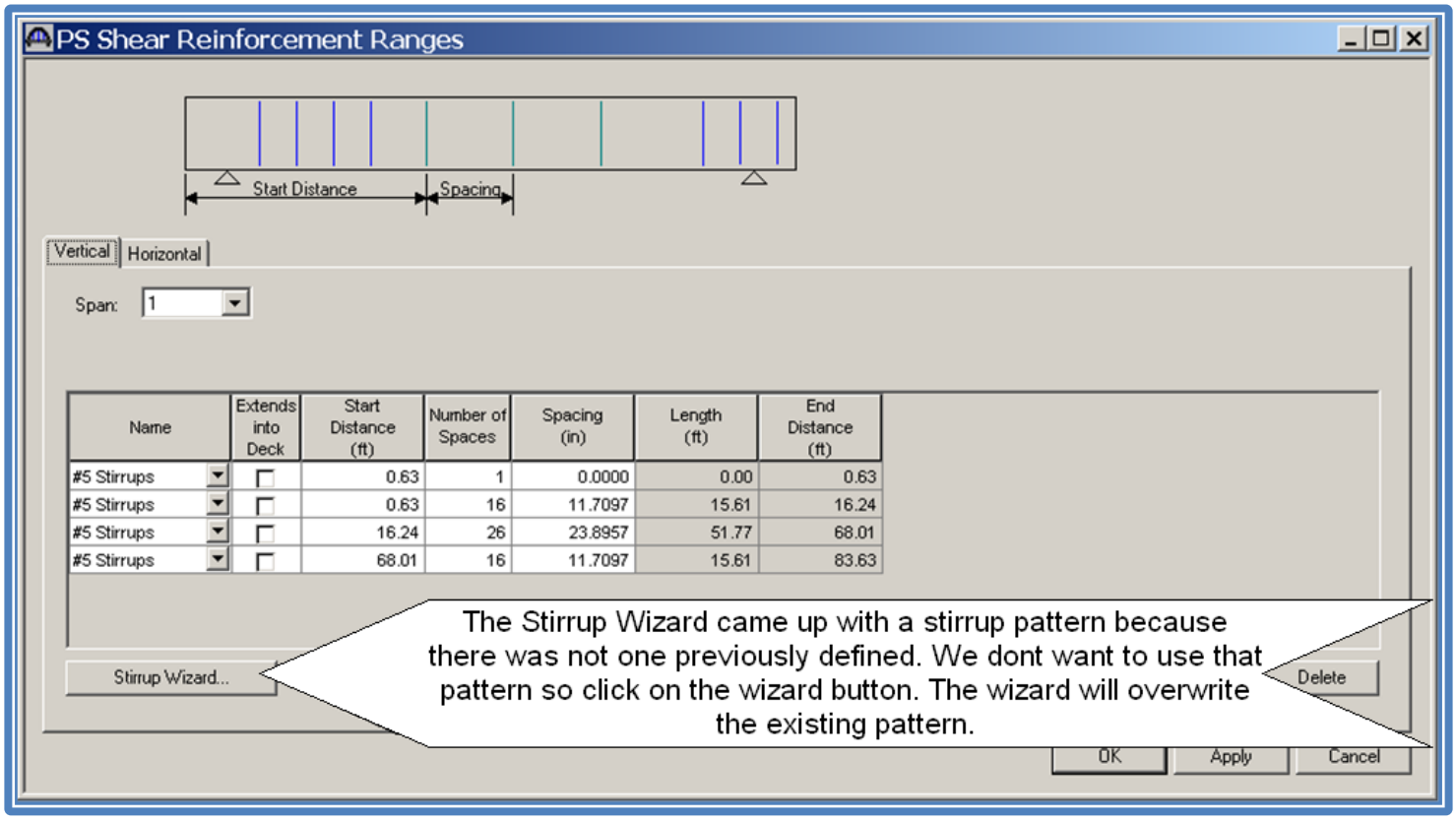


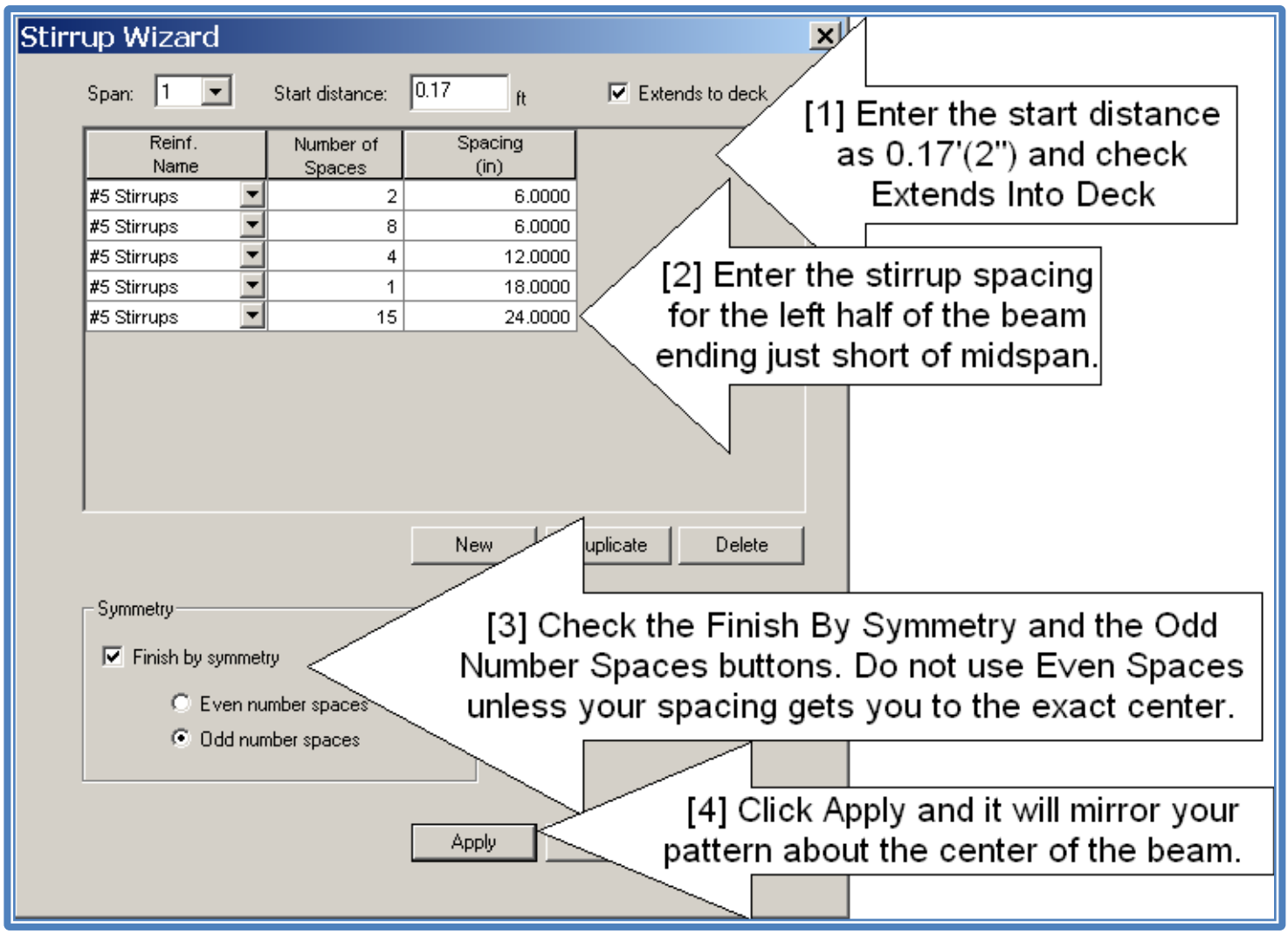


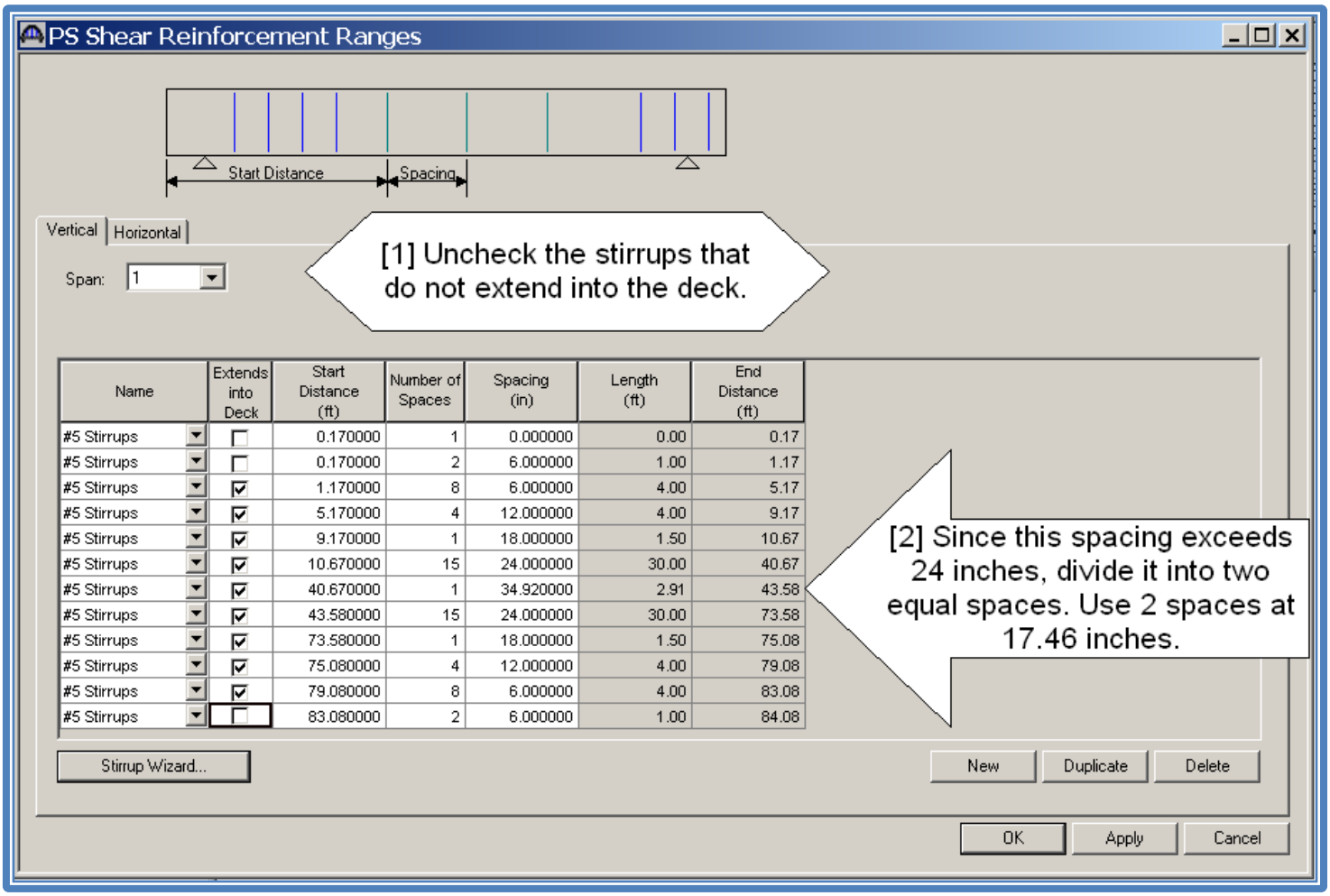
Within a couple iterations, I found a pattern that worked for all stresses and flexure. Next, add this same pattern to the interior beam and analyze it. After doing that, I found it to be satisfactory.

Now I need to add our standard shear reinforcing and analyze it. Since we don't have a standard for the Super Girder shapes yet, I will start with the pattern for the MT-28 and modify as I go.

Shear Reinforcement Ranges




Stirrup Wizard
Span: 1
Start distance: 0.17 ft
Extends to deck
Reinf. Name
Number of Spaces
Spacing (in)
#5 Stirrups 2 6.0000
#5 Stirrups 8 6.0000
#5 Stirrups 4 12.0000
#5 Stirrups 1 18.0000
#5 Stirrups 15 24.0000
New
uplicate
Delete
Symmetry
Finish by symmetry
Even number spaces
Odd number spaces
Apply
[1] Enter the start distance as 0.17'(2") and check Extends Into Deck
[2] Enter the stirrup spacing for the left half of the beam ending just short of midspan.
[3] Check the Finish By Symmetry and the Odd Number Spaces buttons. Do not use Even Spaces unless your spacing gets you to the exact center.
[4] Click Apply and it will mirror your pattern about the center of the beam.



Now re-analyze the exterior beam and check the shear specs.

Keep tweaking the reinforcement until you are able to satisfy shear requirements. If you still have longitudinal reinforcement failures in the mid span region, they can be ignored if they meet AASHTO 5.8.3.5, pg 5-83.

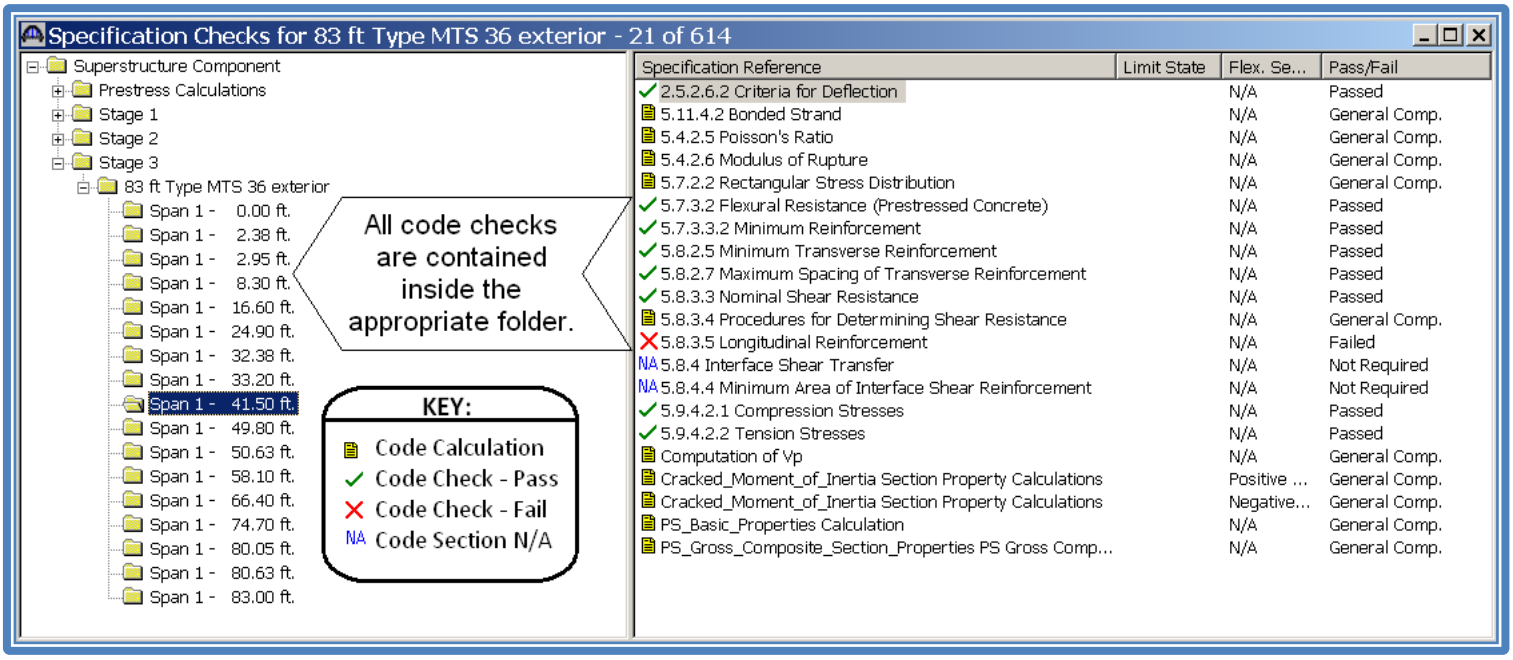
AASHTO 5.8.3.5

Page 5-83

The area of longitudinal reinforcement on the flexural tension side of the member need not exceed the area required to resist the maximum moment acting alone. This provision applies where the reaction force or the load introduces direct compression into the flexural compression face of the member.

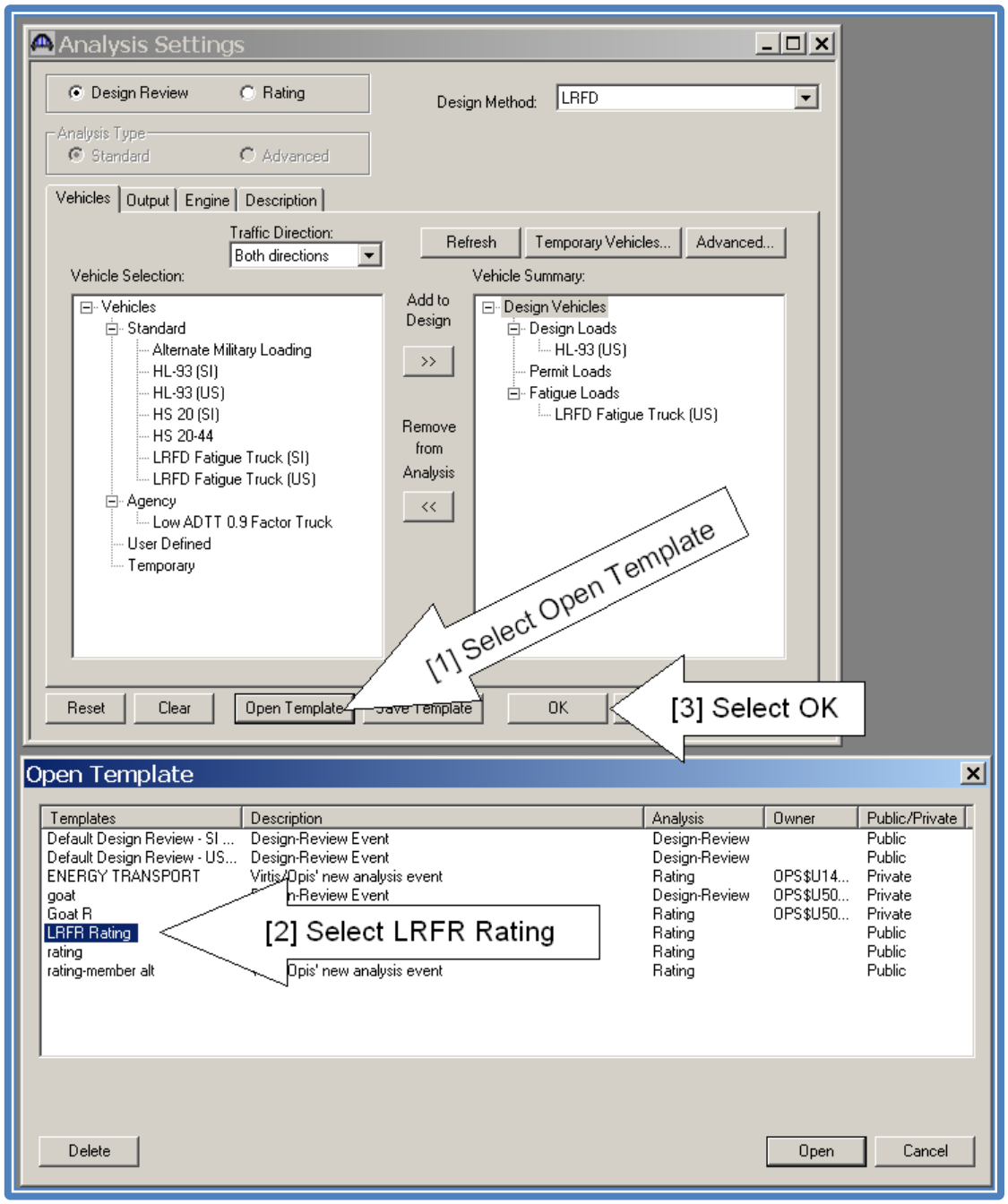
When your shear requirements are met, enter the same shear data for the remaining beams. The easiest way to do this is to open both shear windows side-by-side and transfer the data. Then analyze the remaining beams. Be aware that in the spec check summary shear table, the failures are not colored red as they are in the other tables. This is a bug and has been reported.

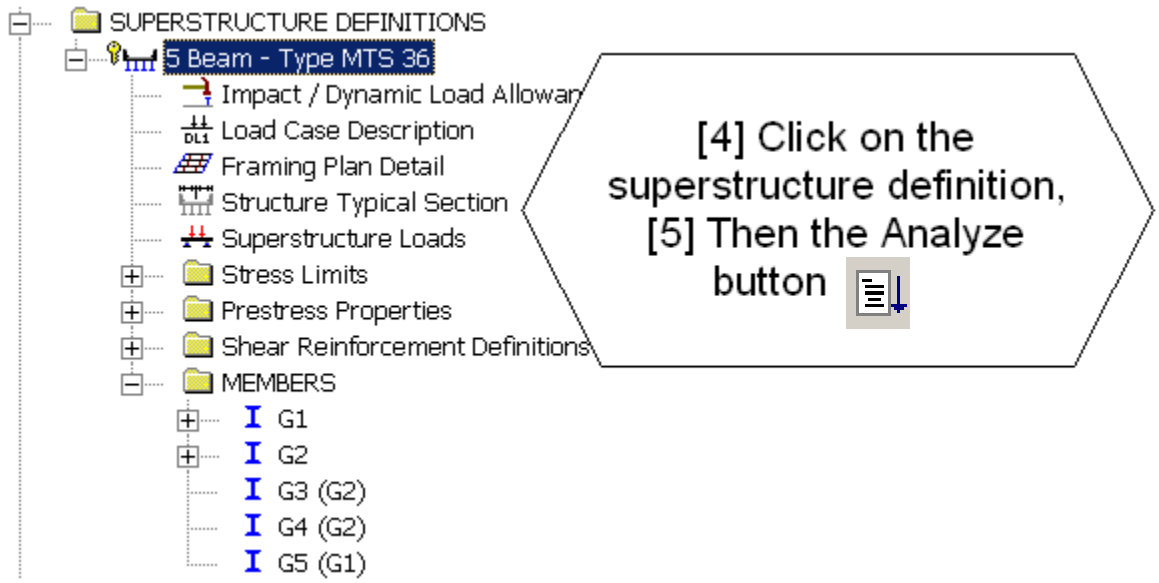
You can also check the actual Spec Checker  *for more information on values of variables and code equations.*

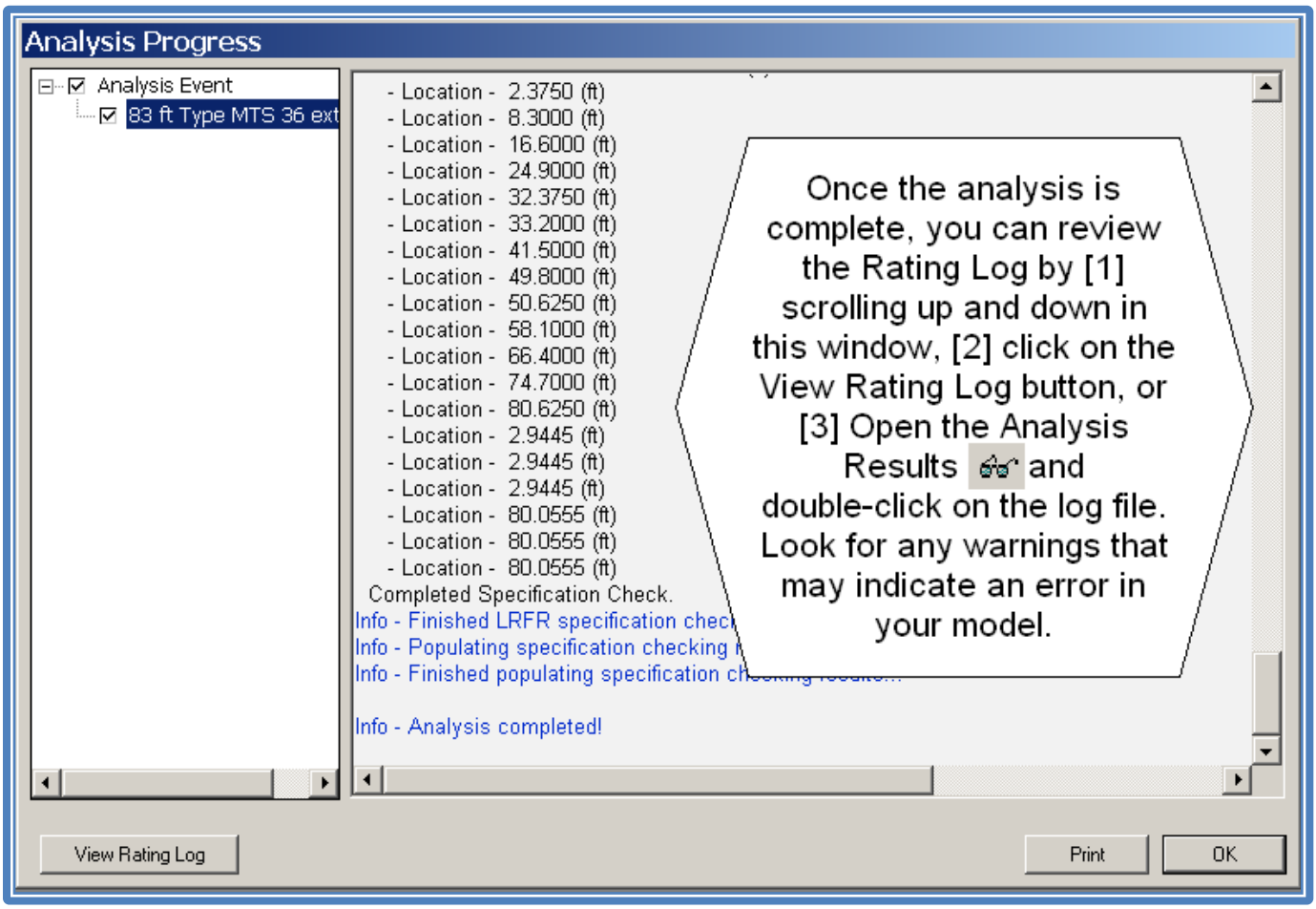


Bridge Rating

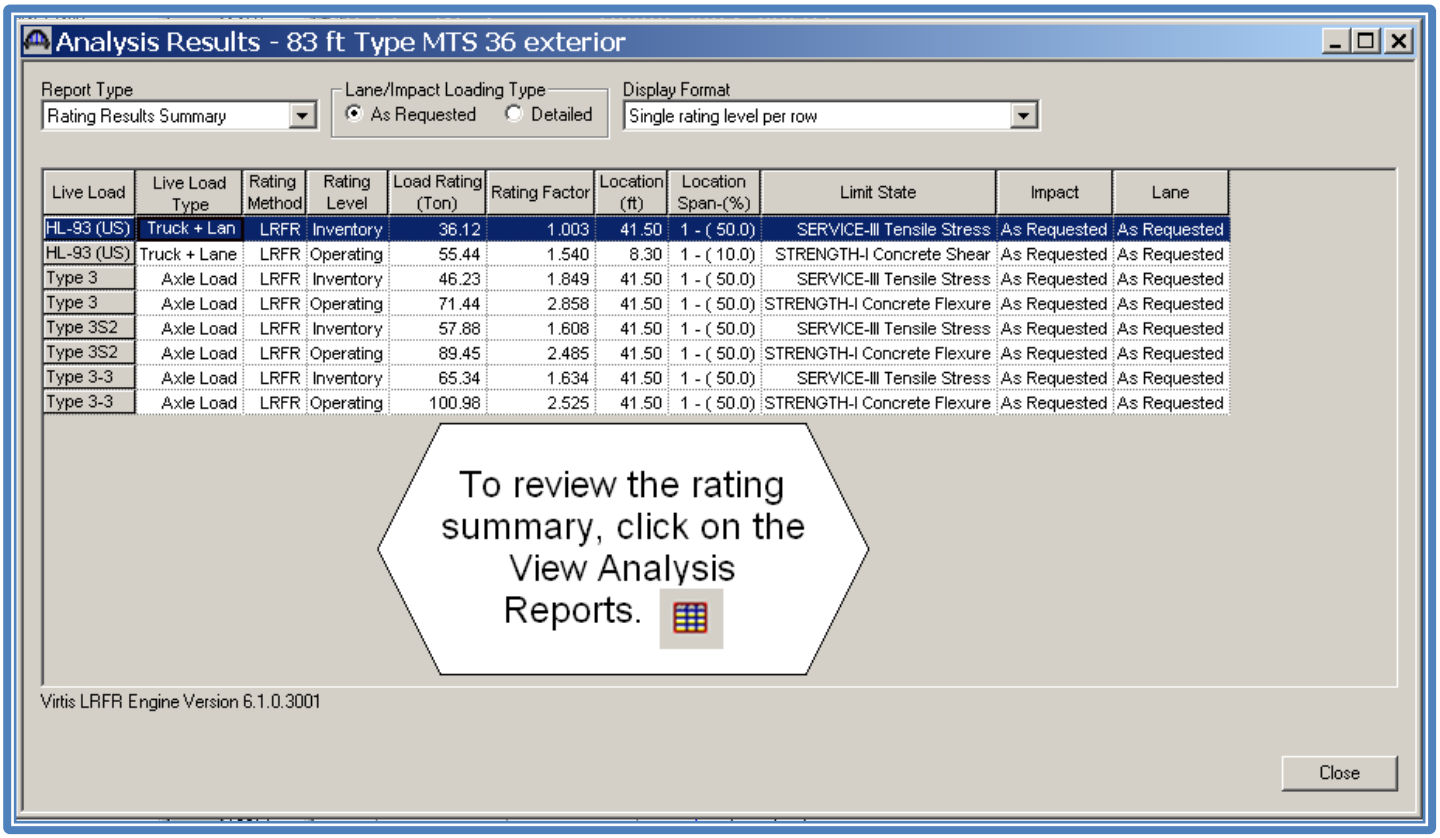
When you are satisfied with the design, check the rating. Open the analysis settings  *and select the LRFR Rating. Then run the Analysis for the entire structure definition.*




SUPERSTRUCTURE DEFINITIONS
5 Beam - Type MTS 36
Impact / Dynamic Load Allowan
Load Case Description
Framing Plan Detail
Structure Typical Section
Superstructure Loads
Stress Limits
Prestress Properties
Shear Reinforcement Definitions
MEMBERS
G1
G2
G3 (G2)
G4 (G2)
G5 (G1)
[4] Click on the superstructure definition, [5] Then the Analyze button


Analysis Progress
Analysis Event
83 ft Type MTS 36 ext
- Location - 2.3750 (ft)
- Location - 8.3000 (ft)
- Location - 16.6000 (ft)
- Location - 24.9000 (ft)
- Location - 32.3750 (ft)
- Location - 33.2000 (ft)
- Location - 41.5000 (ft)
- Location - 49.8000 (ft)
- Location - 50.6250 (ft)
- Location - 58.1000 (ft)
- Location - 66.4000 (ft)
- Location - 74.7000 (ft)
- Location - 80.6250 (ft)
- Location - 2.9445 (ft)
- Location - 2.9445 (ft)
- Location - 2.9445 (ft)
- Location - 80.0555 (ft)
- Location - 80.0555 (ft)
- Location - 80.0555 (ft)
Completed Specification Check.
Info - Finished LRFR specification chec
Info - Populating specification checking
Info - Finished populating specification
Info - Analysis completed!
Once the analysis is complete, you can review the Rating Log by [1] scrolling up and down in this window, [2] click on the View Rating Log button, or [3] Open the Analysis Results and double-click on the log file. Look for any warnings that may indicate an error in your model.
View Rating Log
Print
OK

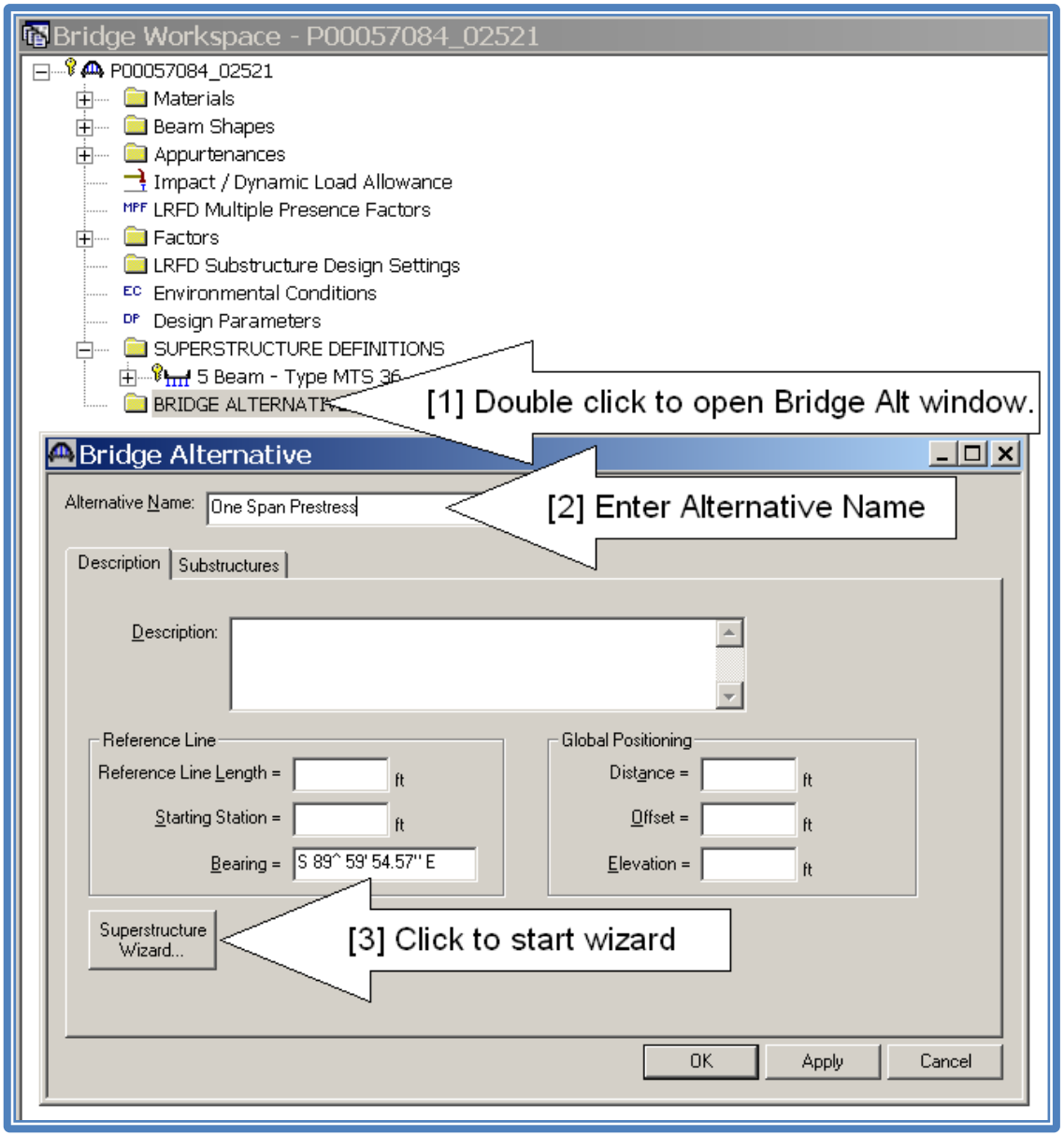
To view the rating results, click on the member in the Member Alternatives folder that you want to view, then the View Analysis Report  *button will activate. Click the button and the following window will appear. You can only view the rating for one member at a time.*

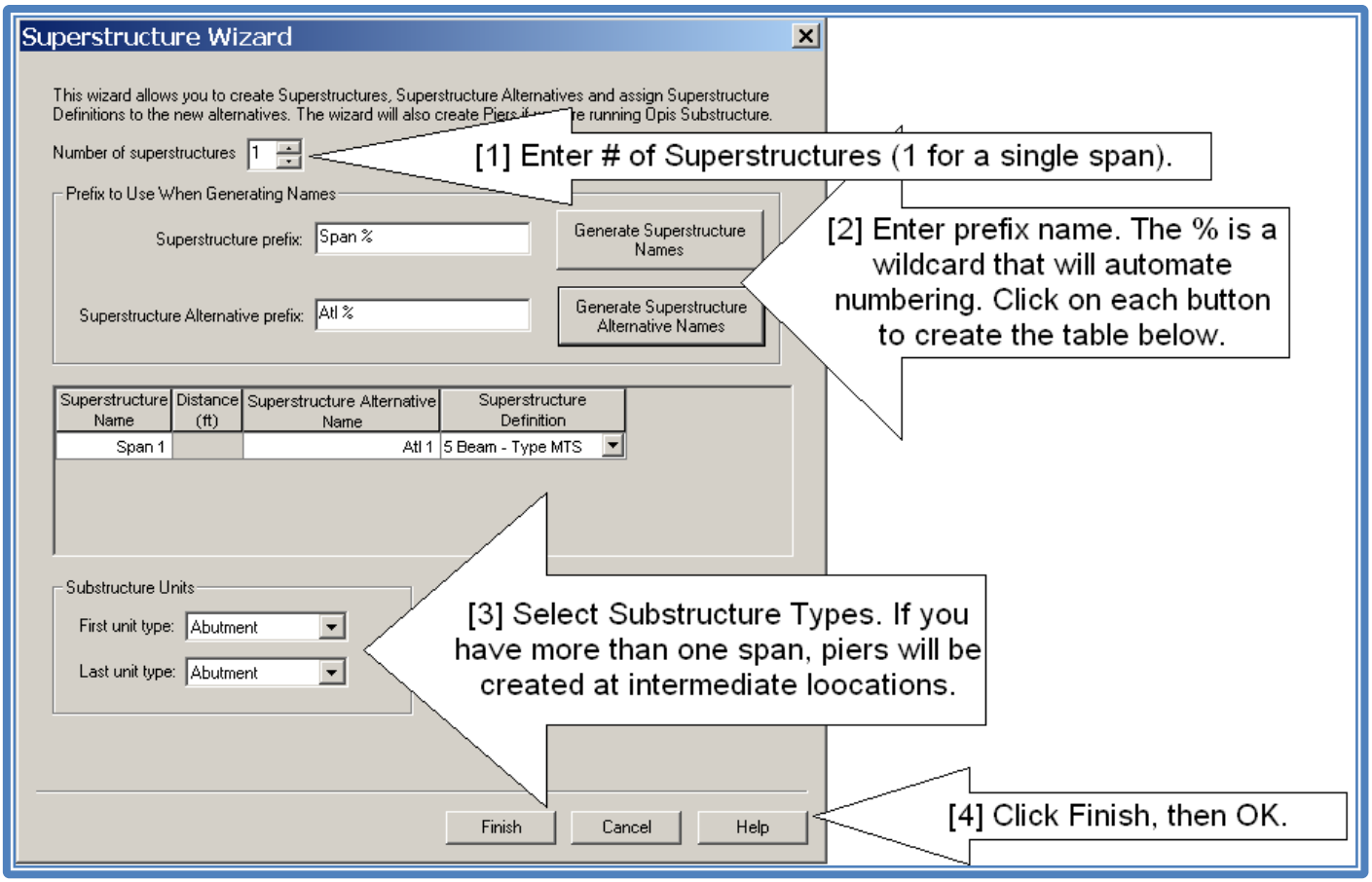


The rating factor needs to be greater than 1.0. You can change the display format to "Single Rating Level per Row" to make the table easier to read. The Location and Limit State columns tell you where and what is controlling the rating.

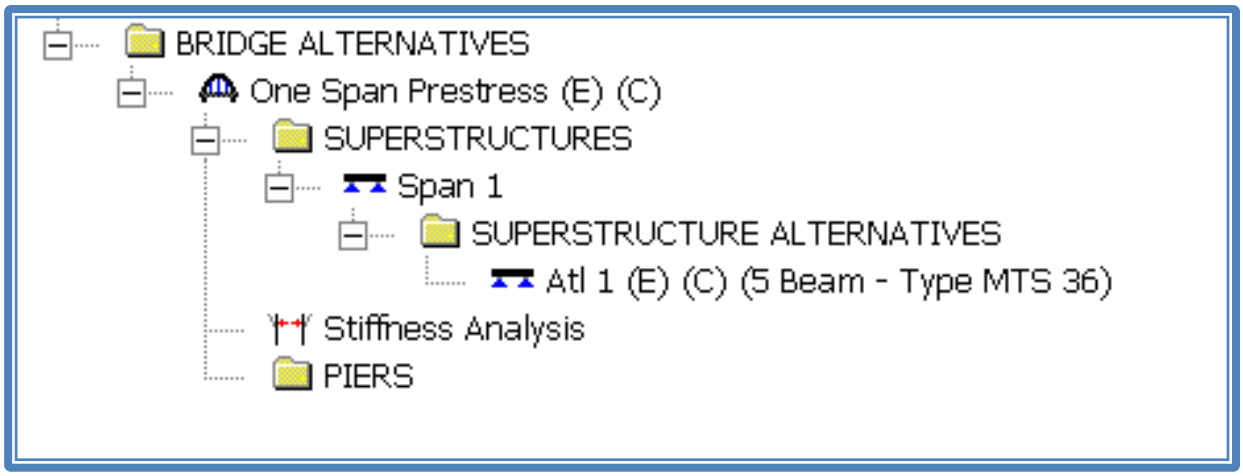
Building the Bridge Alternative Model

The last step in creating the model is to build the Bridge Alternative Tree. This is where you put all the superstructure pieces together to define your complete bridge. This particular example is a single span bridge so there is only one superstructure. Opis 6.1 introduced a wizard to assist in building the tree.



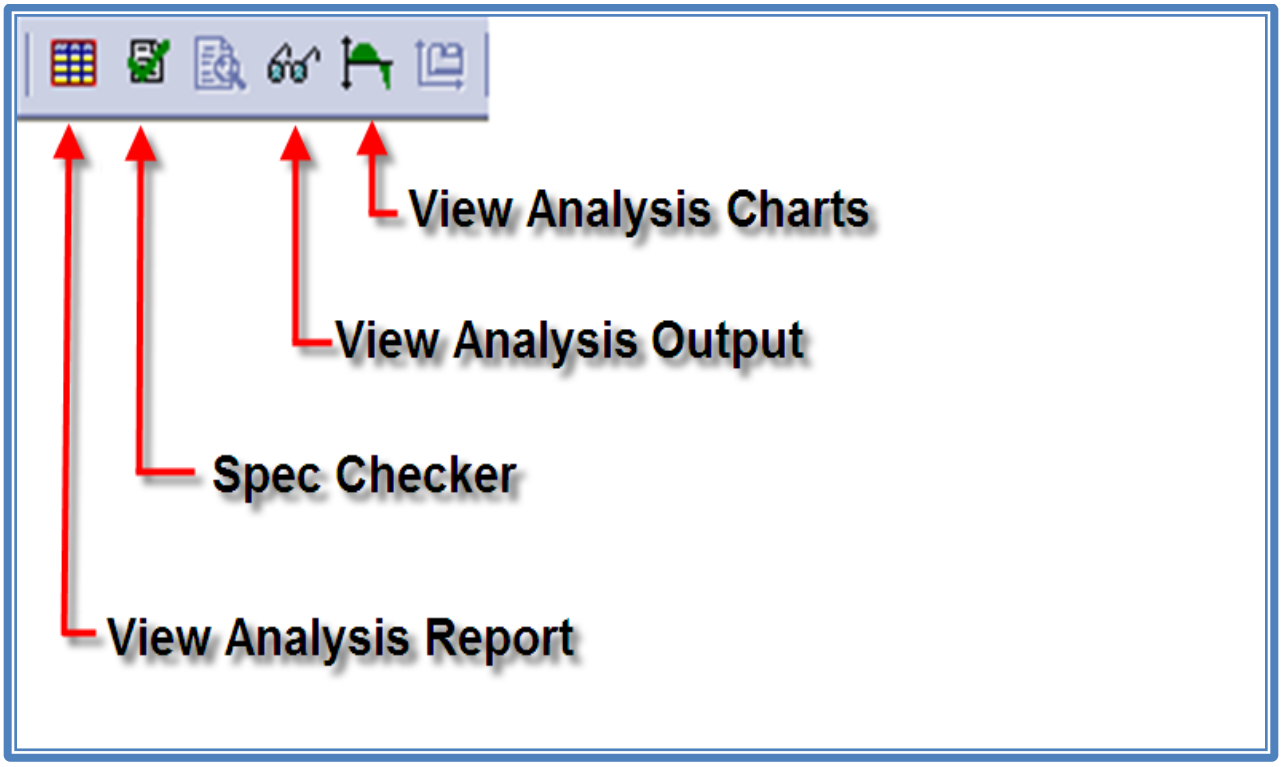


The following tree is created:



When your design is complete and you are satisfied with the design and rating for all beams, open the Bridge Description window (top line in the tree). Change the name from "Draft Bridge" to "Design Complete".

APPENDIX A - Reports



View Analysis Report

Opis: This contains tabular results of all dead and live load actions for all load stages. The actions include Moments, Shears, Axial Loads, Reactions and Deflections. They can be printed or copied and pasted into another document such as Excel.

Virtis: The report contains the rating summary along with the action tables as listed above. The rating factors are found in this table.

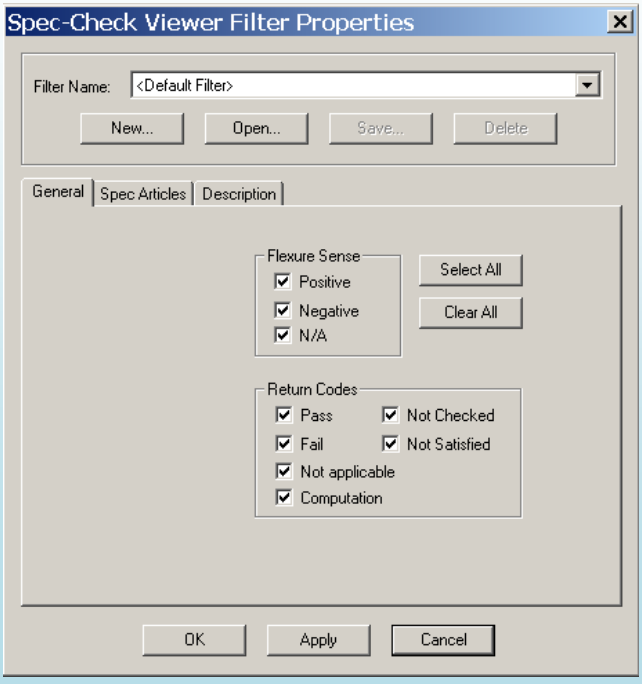
Spec Checker

<u>Opis:</u> This report contains all of the LRFD specification check calculations. They are organized in a logical tree structure. The checks and calculations can be found in the appropriate folder. Any or all of the calculations can be printed using the Reports Tool. 

<u>Virtis:</u> This report contains all of the LRFR specification check calculations. They are organized in a tree structure as described above.

Filter

The filter can be used to refine Spec Check Output. You can turn off certain checks and codes. You can also save the filter for later use.



View Analysis Output

Opis: *This is a customizable report. You can set the reports that you want created in the Analysis Settings Output Tab. The customizable reports are more information than you generally need but they are turned on in the analysis settings templates in case you really want to dig in.* ***The most useful report here is the Spec Check Summary Report****. It puts all the spec checks into a very convenient table. You can use it to quickly find deficiencies in your beam.*

Virtis: *This is also a customizable report again with probably way more information than you will need.*

Report Tool

Opis: *The report tool has many functions.*

1. *Select a BWS (bridge workspace or input file) report from the dropdown box then select either a pre-built report with the "open" button or create your own with the "new" button.*
2. *Select an Analysis Output report from the dropdown box, then click "Generate".*
3. *You can use it to print select articles from inside the Spec Checker. Highlight the articles you want, then click on the Report Tool. Check the "selected articles" button and click "OK".*

Virtis: *This tool functions same in Virtis.*

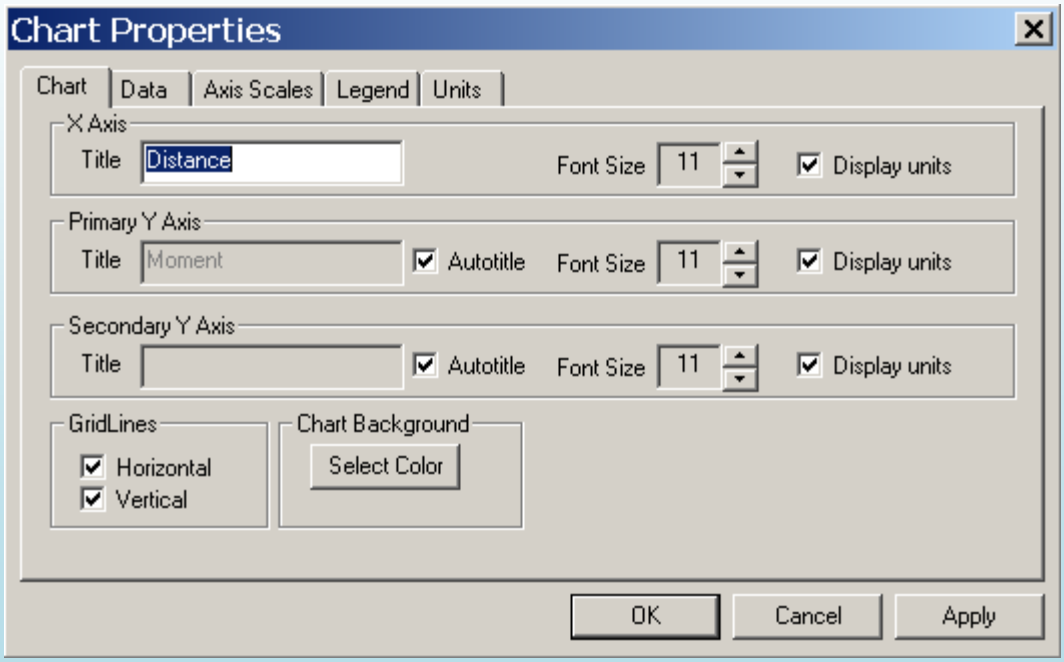
View Analysis Charts

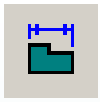
Opis: *This is a handy tool that allows you to plot many different graphs. It uses a tree structure to select the graph data. It also includes a table of data that is plotted in the graph. You can print either the graph or the data directly from the file menu.*

Virtis: *Same as Opis.*

Chart Settings

If you click somewhere inside the graph, the chart setting icon will become active. This allows you to customize the graph.





View Schematic

This tool allows you to view a number of different drawings by highlighting the item in the tree then clicking on the view icon.

1. *Framing Plan Detail*
2. *Structure Typical Section*
3. *Member Alternative Profile*

Validate Model

This tool allows you to check your model at any time. It will give you warnings and errors in your model. Highlight the member you want to check, then click the "validate" icon.

Where Do I Find Results ???

	Summary		Detailed Table	
Data	**Report Type**	**Report Name**	**Report Type**	**Report Name**
Section Properties - Stage 1	----	----	----	----
Section Properties - Stage 2	----	----	----	----
Section Properties - Stage 3	----	----	----	----
Dead Load Actions	*View Analysis Report*	*Dead Load Actions*	----	----
Live Load Actions	*View Analysis Report*	*Live Load Actions*	----	----
Distribution Factors	*Bridge Description Tree*	LRFD Dist. Factors	----	----
Moment Calcs	*Eye Glasses*	*Spec Check Summary*	*View Analysis Charts*	*Moment Tree*
Shear Calcs	*Eye Glasses*	*Spec Check Summary*	*View Analysis Charts*	*Shear Tree*
Prestress Losses	----	----	----	----
Initial Stresses	*Eye Glasses*	*Spec Check Summary*	*View Analysis Charts*	*Concrete Stress Tree*
Final Stresses	*Eye Glasses*	*Spec Check Summary*	*View Analysis Charts*	*Concrete Stress Tree*
Ultimate Moment Capacity	*Eye Glasses*	*Spec Check Summary*	*Report Tool*	*Flexure Analysis Summary*
Shear Capacity	*Eye Glasses*	*Spec Check Summary*	*Report Tool*	*Shear Analysis Summary*
Camber and Deflections	*Eye Glasses*	*Spec Check Summary*	*View Analysis Charts*	*Deflection Tree*

	Detailed Calculation	
Data	**Report Type**	**Calculation**
Section Properties - Stage 1	*Spec Checker- Pres. Properties Stage 1*	*Basic PS Beam Property Calculations*
Section Properties - Stage 2	*Spec Checker- Pres. Properties Stage 2*	*PS Gross Composite Section Properties*
Section Properties - Stage 3	*Spec Checker- Pres. Properties Stage 3*	*PS Gross Composite Section Properties*
Dead Load Actions	----	----
Live Load Actions	----	----
Distribution Factors	Eye Glasses	Wizard Computed Dist. Factors
Moment Calcs	----	----
Shear Calcs	----	----
Prestress Losses	*Spec Checker- Pres. Prop. - Stage 1&2*	*Instantaneous and Long Term Losses*
Initial Stresses	*Spec Checker- Stage 1*	*Tension and Compression Stresses*
Final Stresses	*Spec Checker- Stage 3*	*Tension and Compression Stresses*
Ultimate Moment Capacity	*Eye Glasses*	*Beam Capacity Detail*
Shear Capacity	*Spec Checker- Stage 3*	*Procedures for Determining Shear Resistance, and Nominal Shear Resistance*
Camber and Deflections	*Spec Checker- Stage 3*	*Criteria for Deflection*

Report Type
Eye Glasses
View Analysis Report
View Analysis Charts
Report Tool
Spec Checker
Member Alt. Tree

APPENDIX B - Strand Design Procedure

Procedure for Strand Layout

1. *Fill bottom two rows with strands.*
2. *Analyze beam.*
3. *Check the Spec Check Summary for Final Tension Stresses at center span. You want the design ratio should be just over 1.0. Ignore all other stresses at this point.*
4. *Open the strand layout window again and adjust the number of strands until you achieve a design ratio of just over 1.0.*
5. *Now look for other areas of failure in the Spec Check Summary. You are likely to have compression failures near the end of the beam at release.*
6. *Add harping or debonding to reduce the compression in the bottom of the beam end as necessary. Re-analyze after each adjustment and check the Spec Check Summary.*
7. *If you can't find a pattern that works, talk to your Area Engineer and the Bridge Design Engineer about using the refined prestress loss method or using a continuous for live load design. This may be more economical than adding a beam line or using a deeper beam. You can also contact Jeff for assistance in finding a pattern that works.*

APPENDIX C - Flow Chart

(Still Under Construction)