AASHTOWare BrD 6.8

BrR and BrD Tutorial

CNVRT1 – Converting Girder Line to Girder System Example

BrR and BrD Training

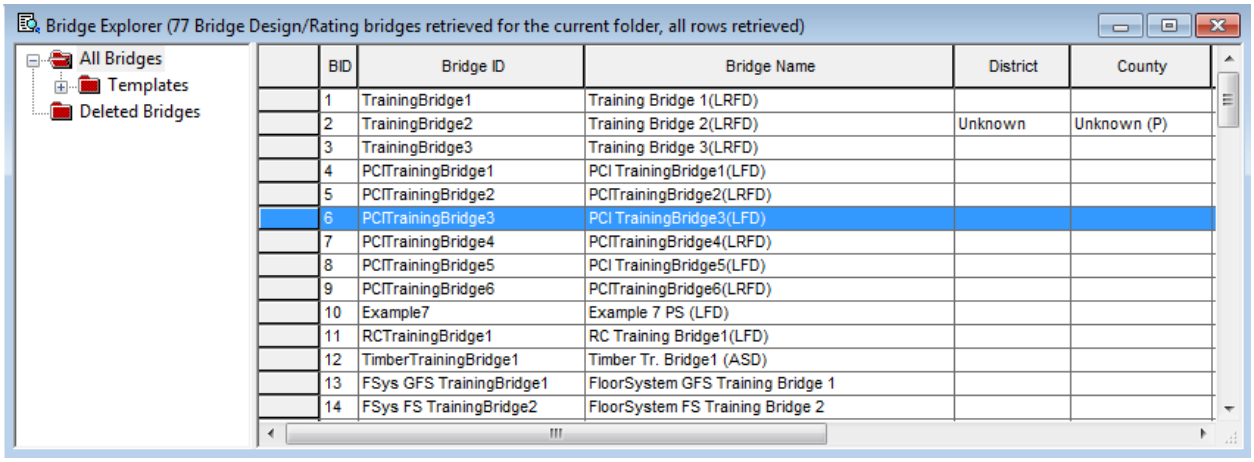
CNVRT1 – Converting Girder Line to Girder System Example

This example illustrates how to convert a girder line superstructure definition to a girder system superstructure definition.

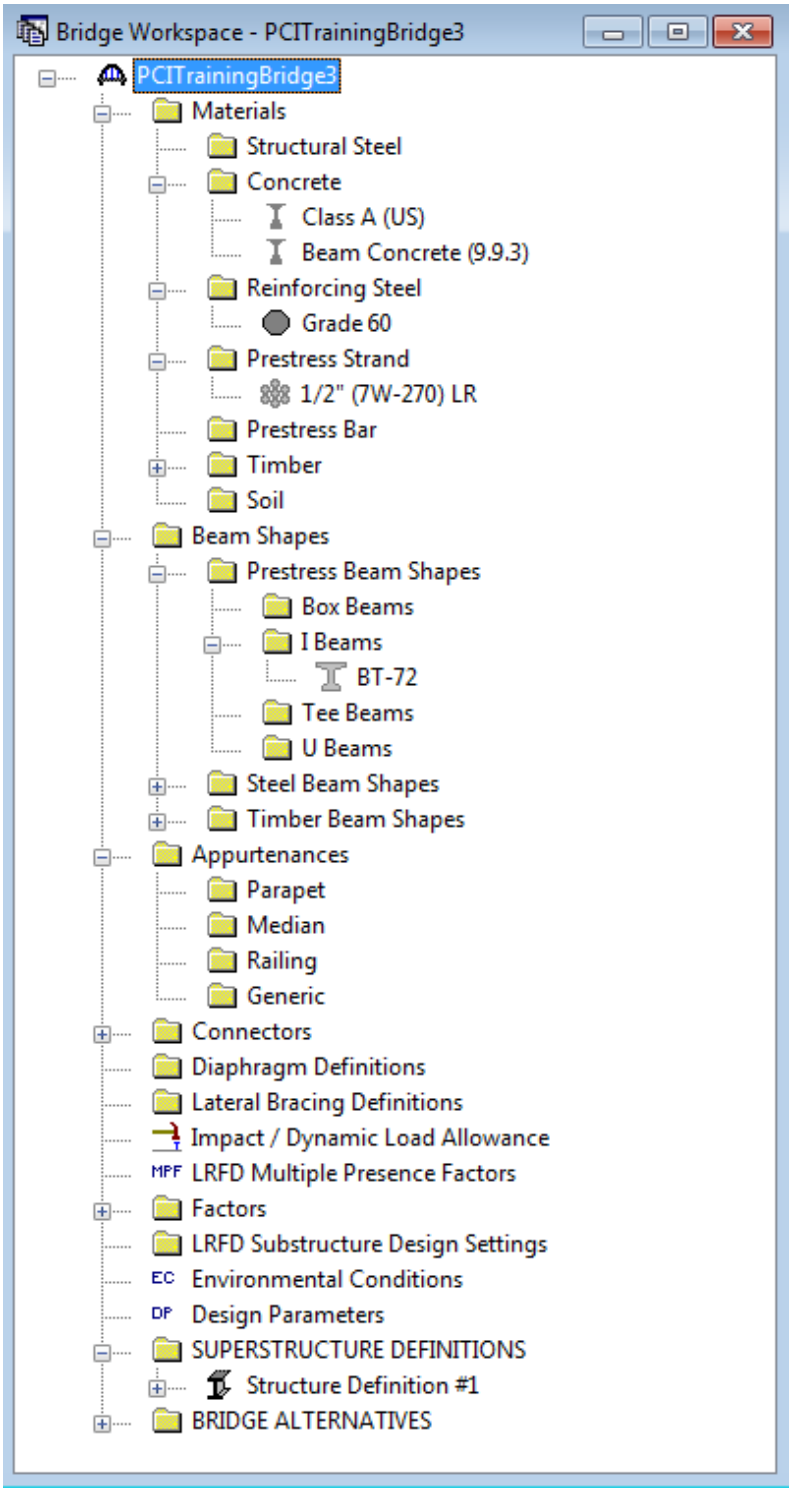
You will need to consult the design plans for the bridge to obtain the following types of items to convert a girder line to a girder system:

- Overall width of deck, location of travelway lanes, etc.
- Appurtenance dimensions
- Number of girders
- Framing plan skews

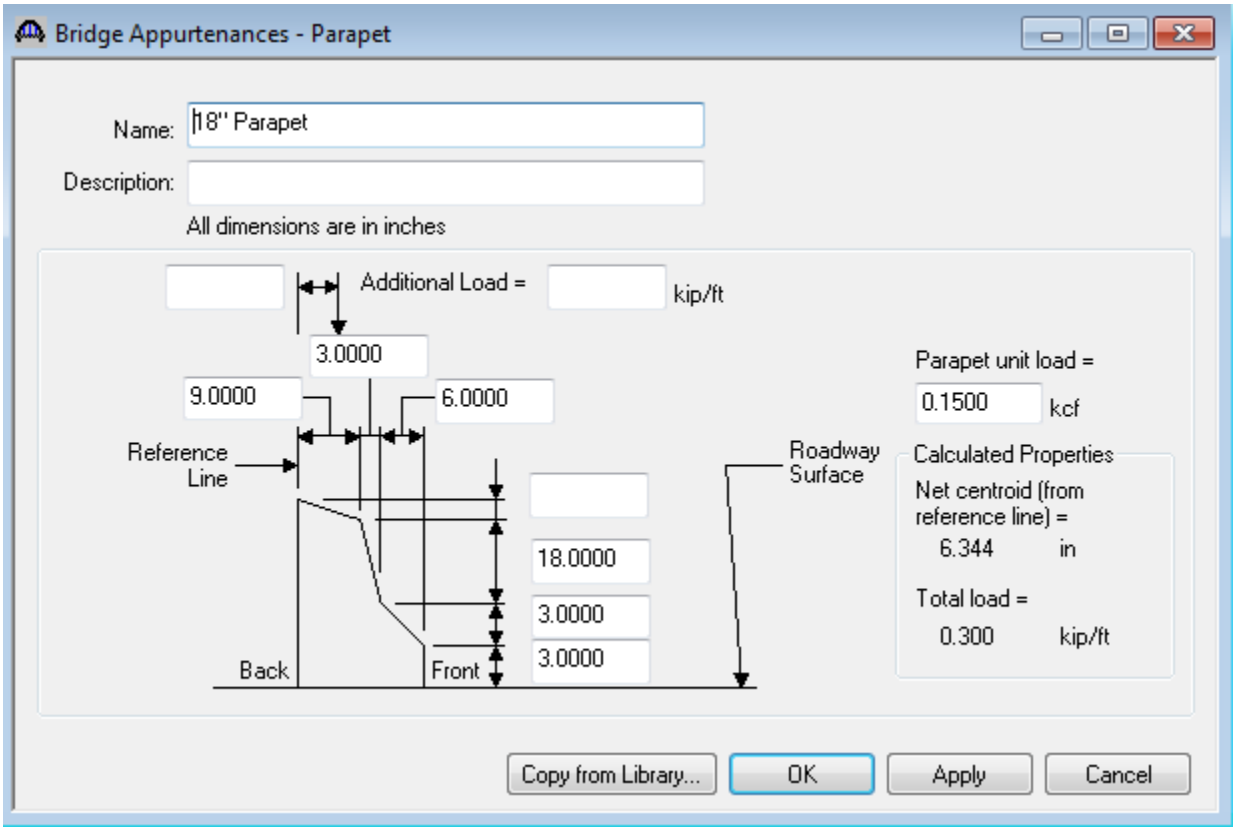
In this example we will convert PCITrainingBridge3 from a girder line to a girder system structure definition. PCITrainingBridge3 is a single span prestressed I beam. Select PCITrainingBridge3 on the right portion of the Bridge Explorer and open its Bridge Workspace tree.



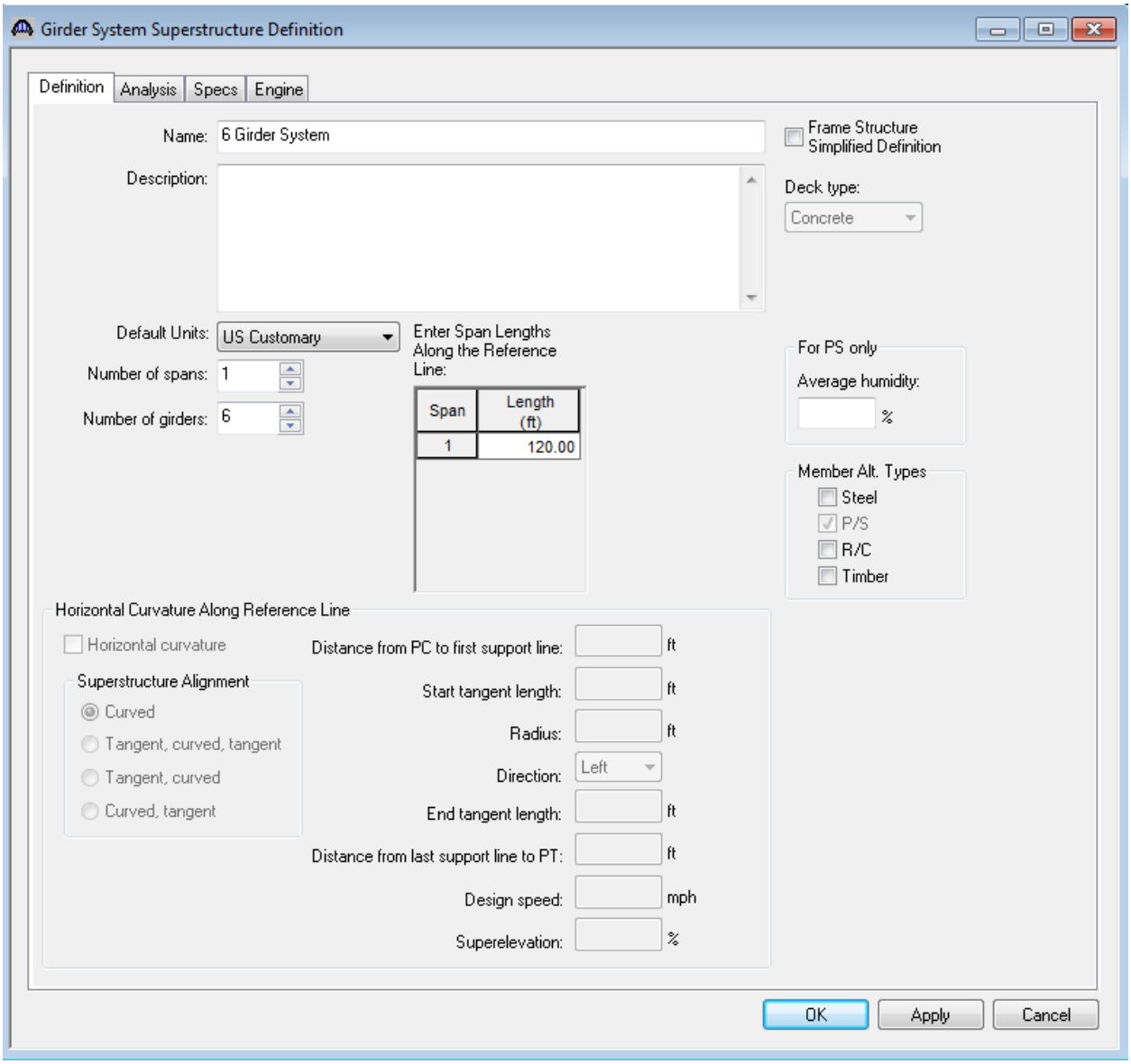
The following view of the expanded Bridge Workspace tree shows the materials and beam shapes that currently exist for this bridge. Any superstructure definitions that belong to this bridge will have access to these materials and beam shapes so we do not need to add any materials or beam shapes to the bridge to convert this girder line structure definition.



Add a parapet to this bridge by selecting “Parapet” in the Bridge Workspace tree and selecting New. Enter the following data to describe the parapet:

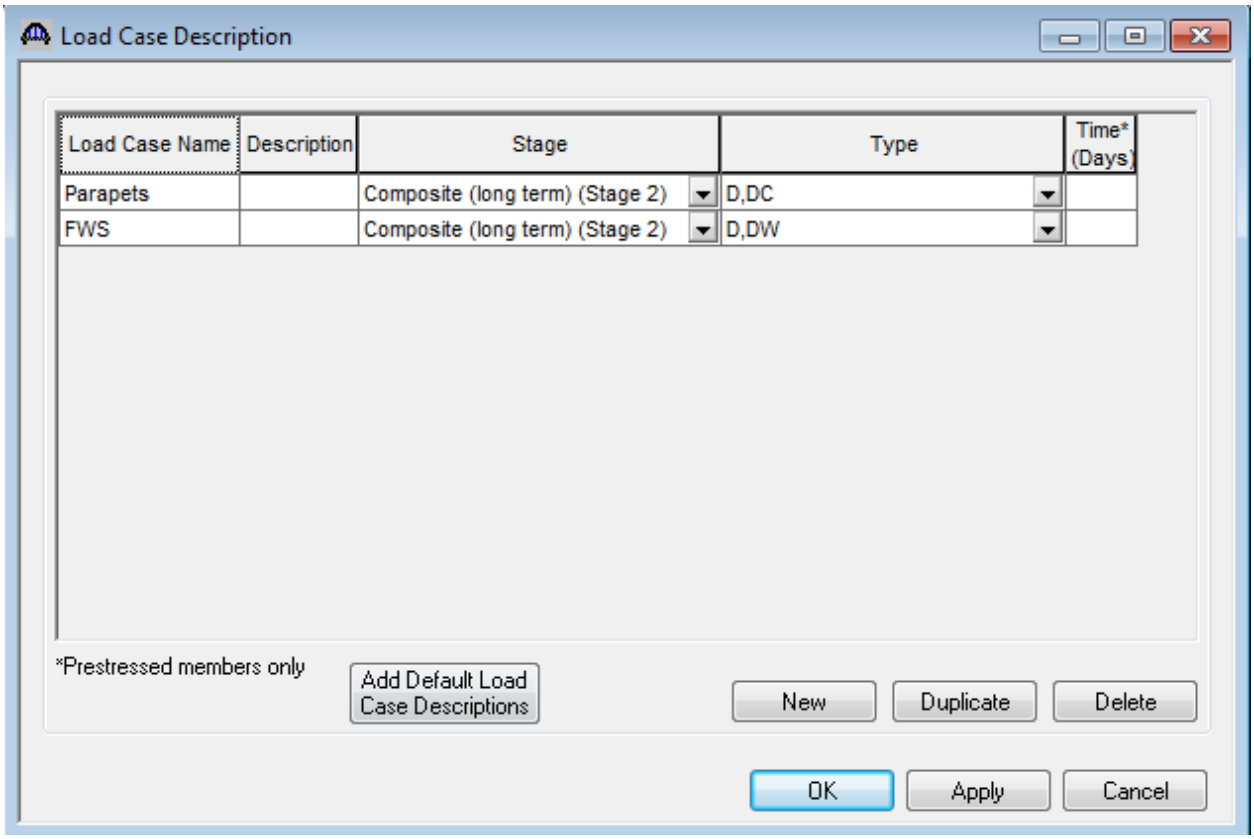


Now create a new girder system superstructure definition and enter the following data:



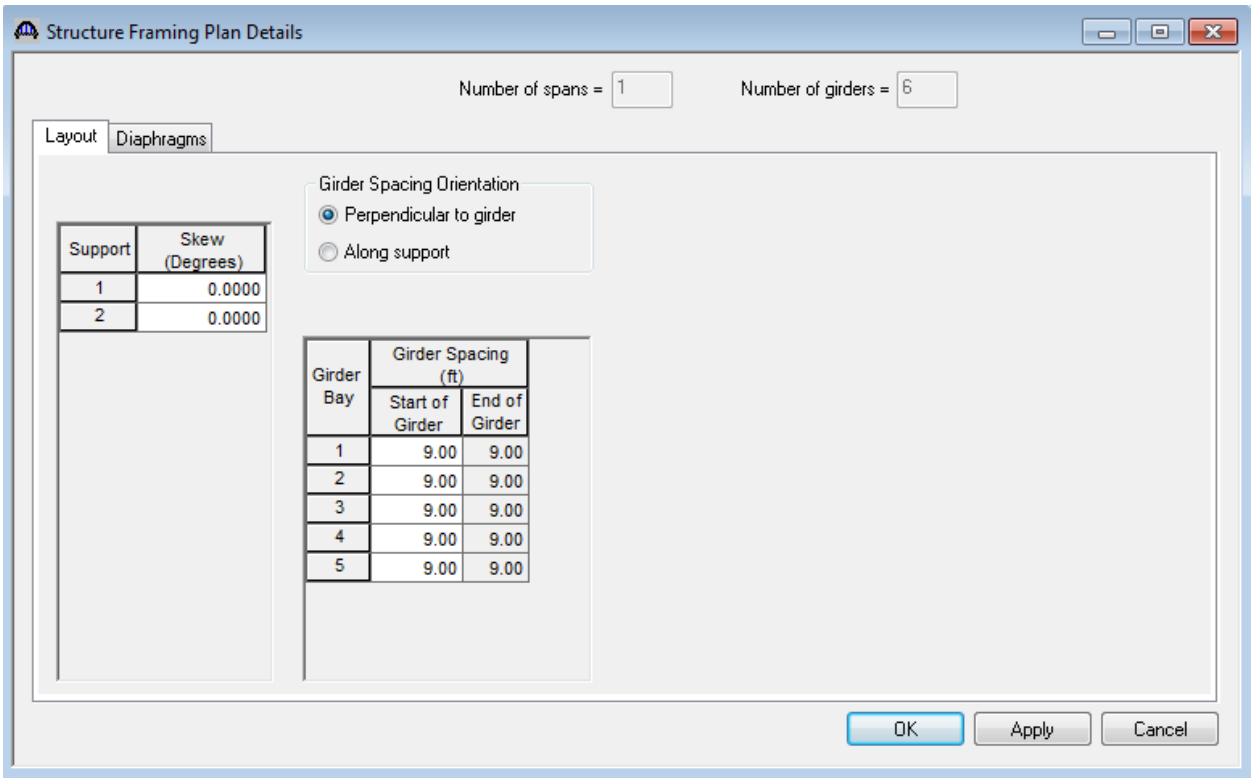
As we enter data for the new girder system superstructure definition, we will need to open windows for the original girder line superstructure definition to determine if there is data that needs to be copied from the original girder line superstructure. The Average Humidity on the superstructure definition window is an example of such data. Open the "Structure Definition #1" girder line window to determine that the original superstructure does not have any data for that item. If it did, we would need to copy that data to the new girder system superstructure definition.

Now add Load Case Descriptions to the new superstructure definition. Open the Load Case Description for the original girder line "Structure Definition #1" and you will see the following window:

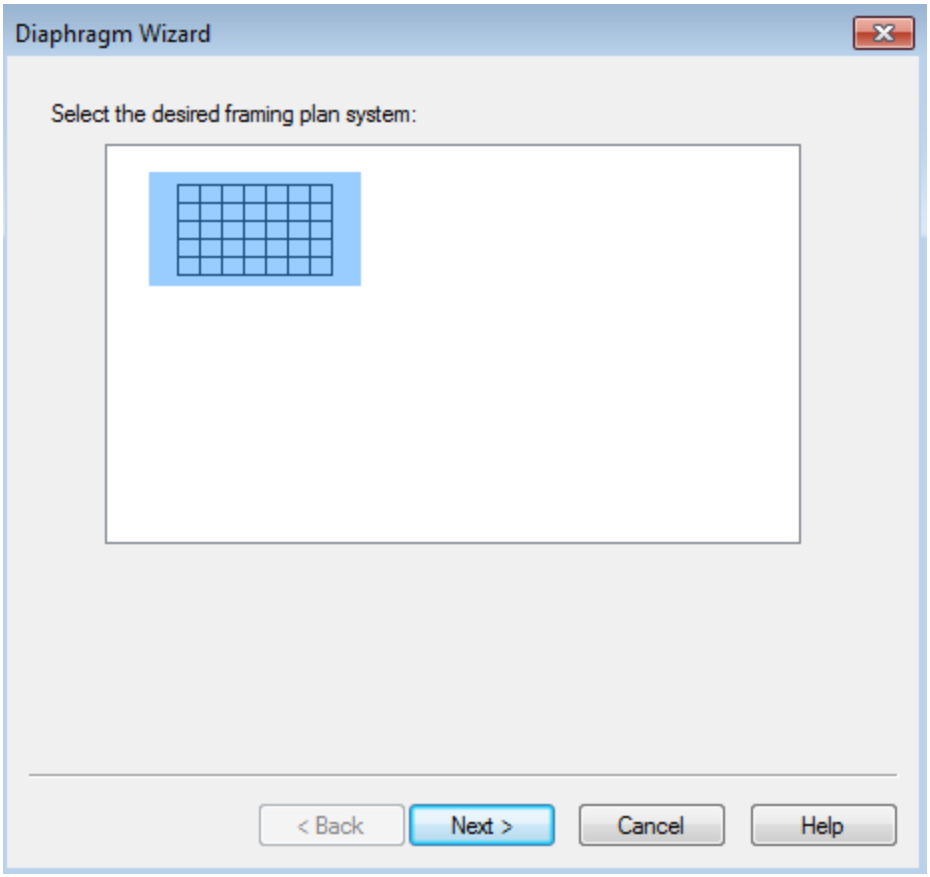


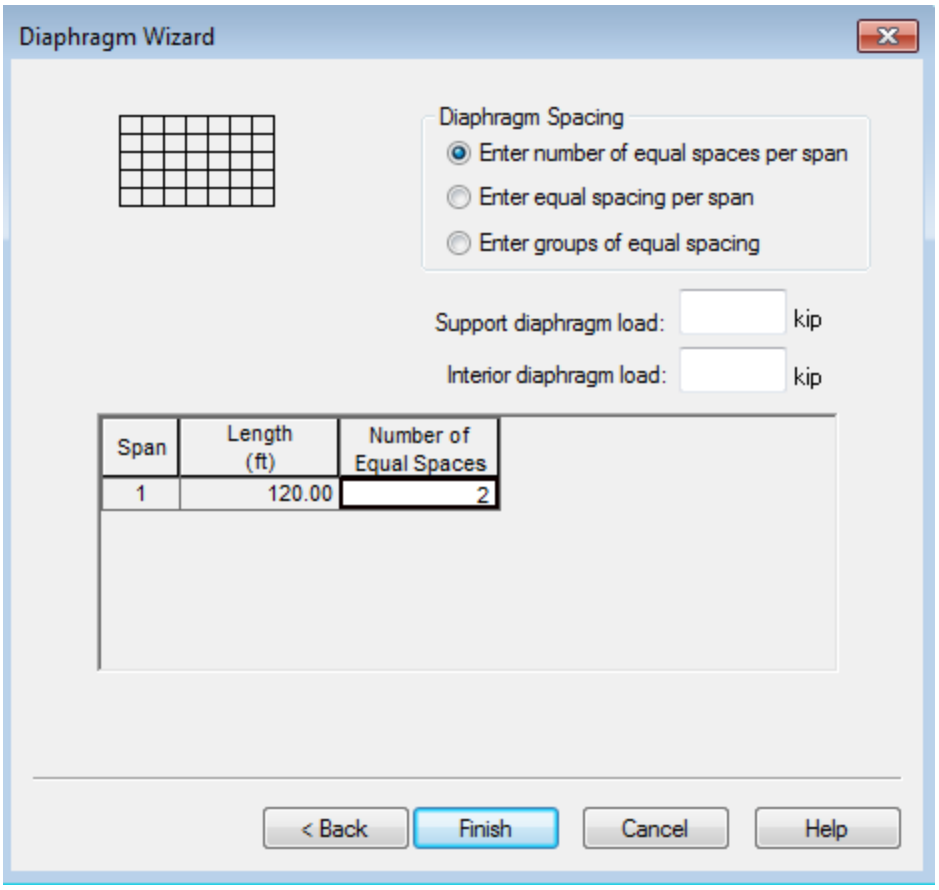
Enter these same load cases for the new "6 Girder System" superstructure definition. Open the Load Case Description window belonging to the new "6 Girder System" superstructure definition and enter these same load cases. Click the OK button to save these load cases to the new superstructure definition and close the window.

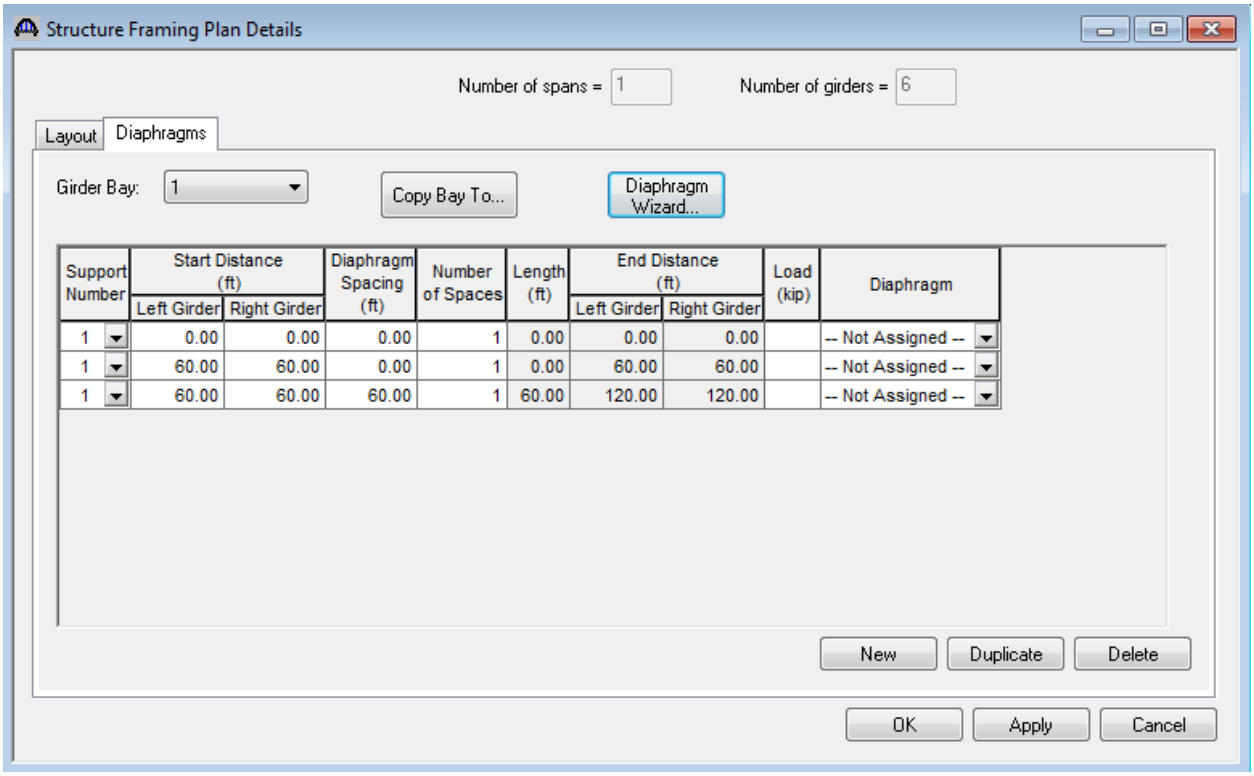
Open the Structure Framing Plan Details window for the “6 Girder System” and enter the following data:



Select the Diaphragms tab and use the Diaphragm Wizard as follows to create the diaphragms:

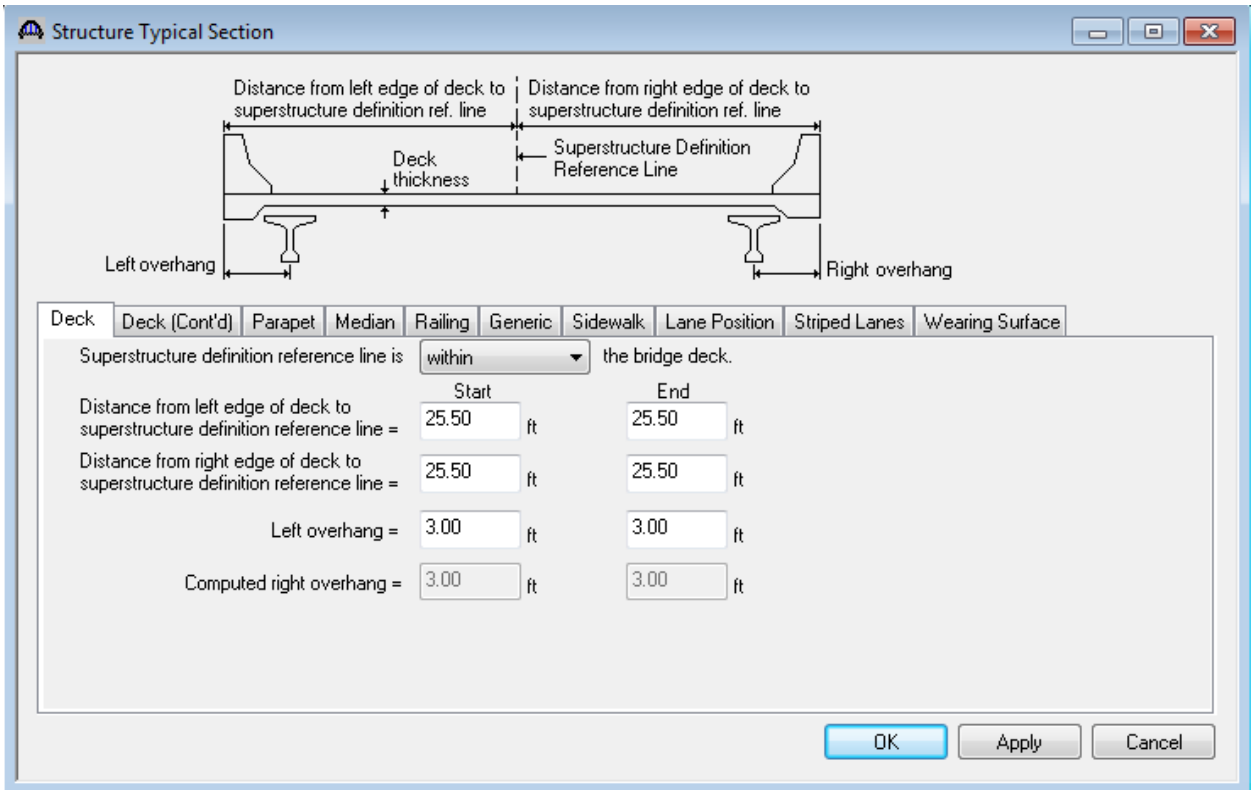



Diaphragm Wizard
Diaphragm Spacing
Enter number of equal spaces per span
Enter equal spacing per span
Enter groups of equal spacing
Support diaphragm load:
kip
Interior diaphragm load:
kip
Span
Length (ft)
Number of Equal Spaces
1
120.00
2
< Back
Finish
Cancel
Help

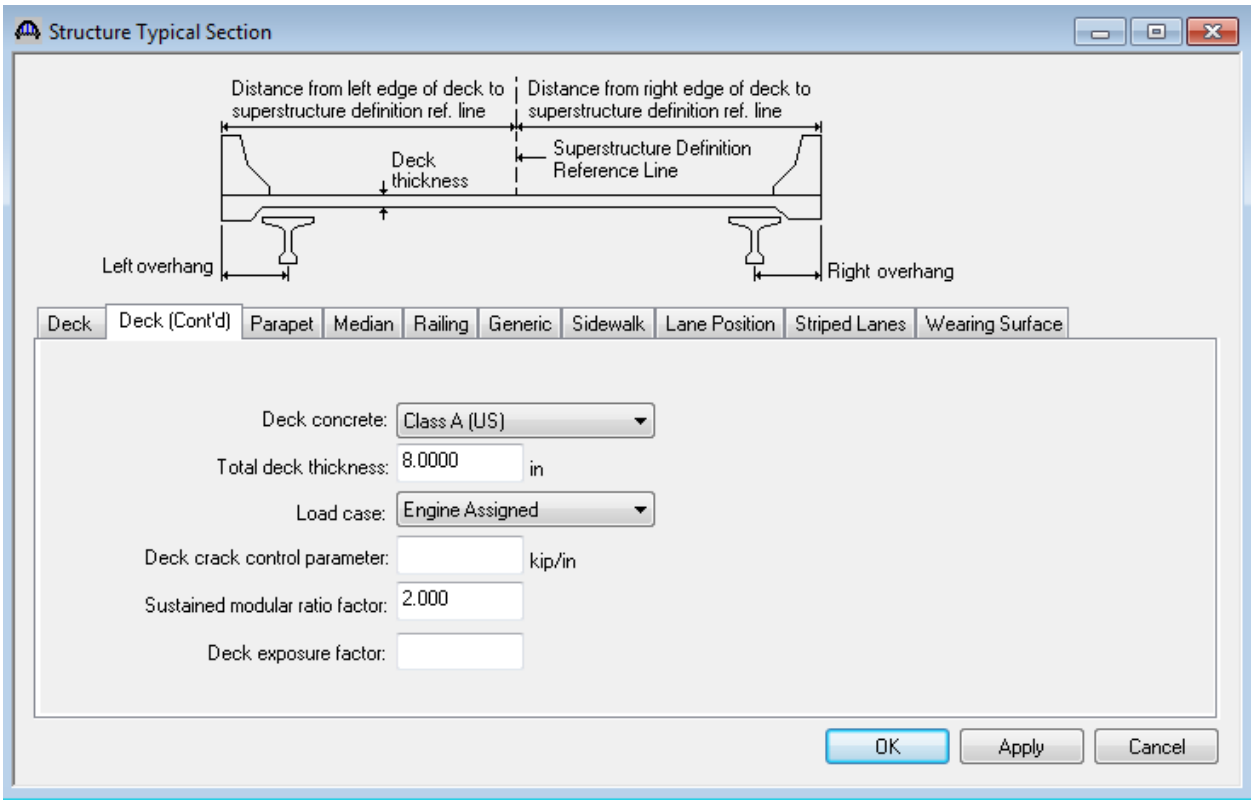

Structure Framing Plan Details
Number of spans = 1
Number of girders = 6
Layout
Diaphragms
Girder Bay: 1
Copy Bay To...
Diaphragm Wizard...
Support Number
Start Distance (ft)
Left Girder
Right Girder
Diaphragm Spacing (ft)
Number of Spaces
Length (ft)
End Distance (ft)
Left Girder
Right Girder
Load (kip)
Diaphragm
1 0.00 0.00 0.00 1 0.00 0.00 0.00 -- Not Assigned --
1 60.00 60.00 0.00 1 0.00 60.00 60.00 -- Not Assigned --
1 60.00 60.00 60.00 1 60.00 120.00 120.00 -- Not Assigned --
New
Duplicate
Delete
OK
Apply
Cancel

(Note: PCITrainingBridge3 as delivered in your sample database does not have any diaphragms entered in the Bracing Ranges window for Member Alternative "Member Alternative #1 (9.9.3)". That is in error, it should have diaphragms.)

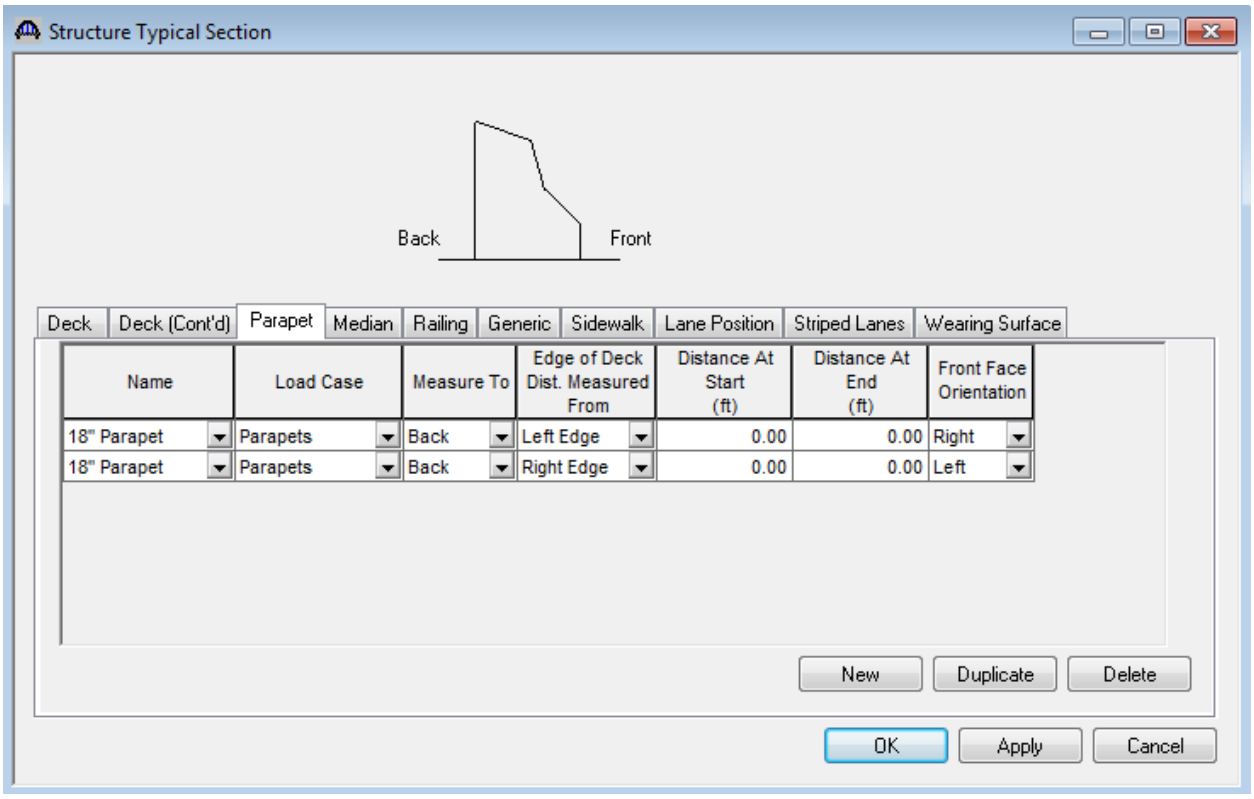
Open the Structure Typical Section window for "6 Girder System" and enter the following on the Deck tab:



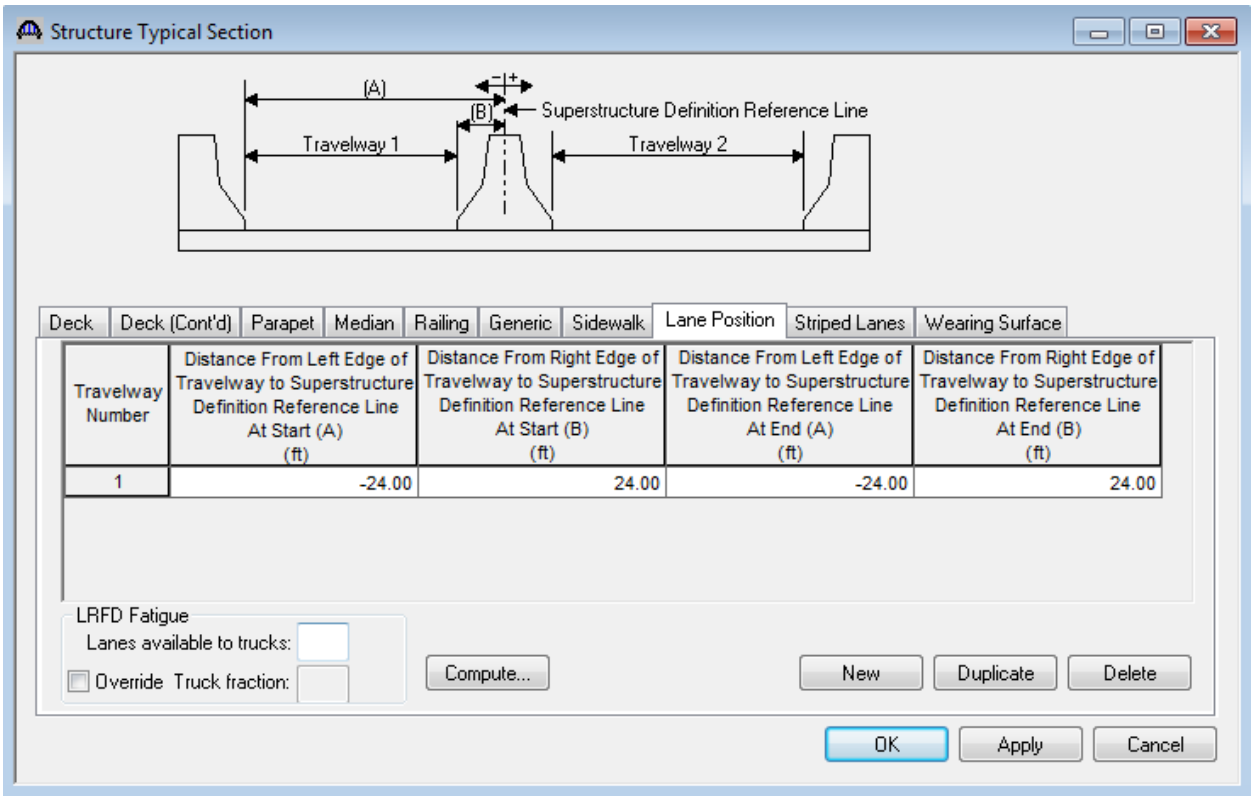
Next, select the Deck (Cont'd) tab and enter the following:



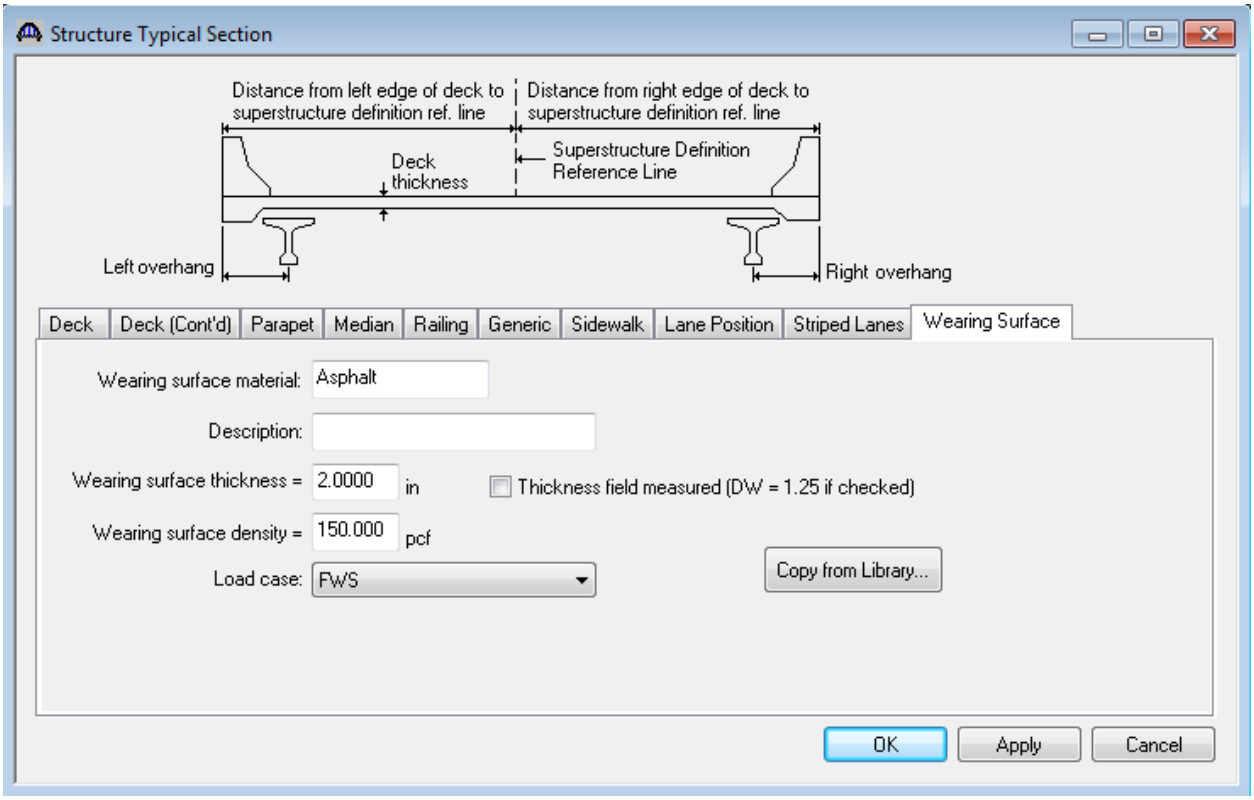
The parapet locations are entered as follows on the Parapet tab:



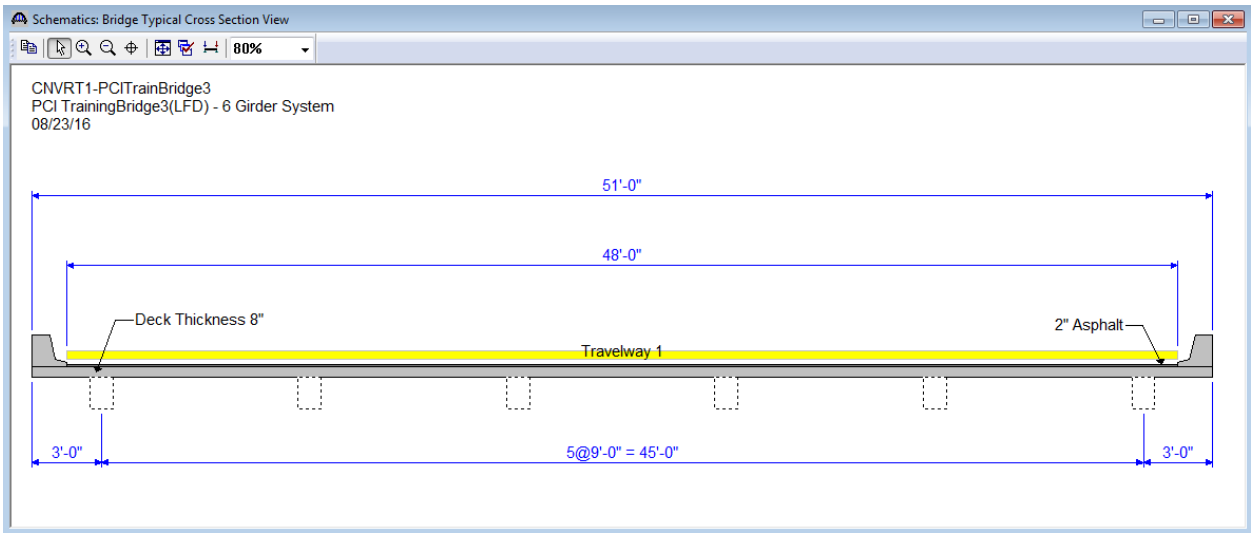
Open the Lane Position tab and and use the Compute button to compute the travelway locations.



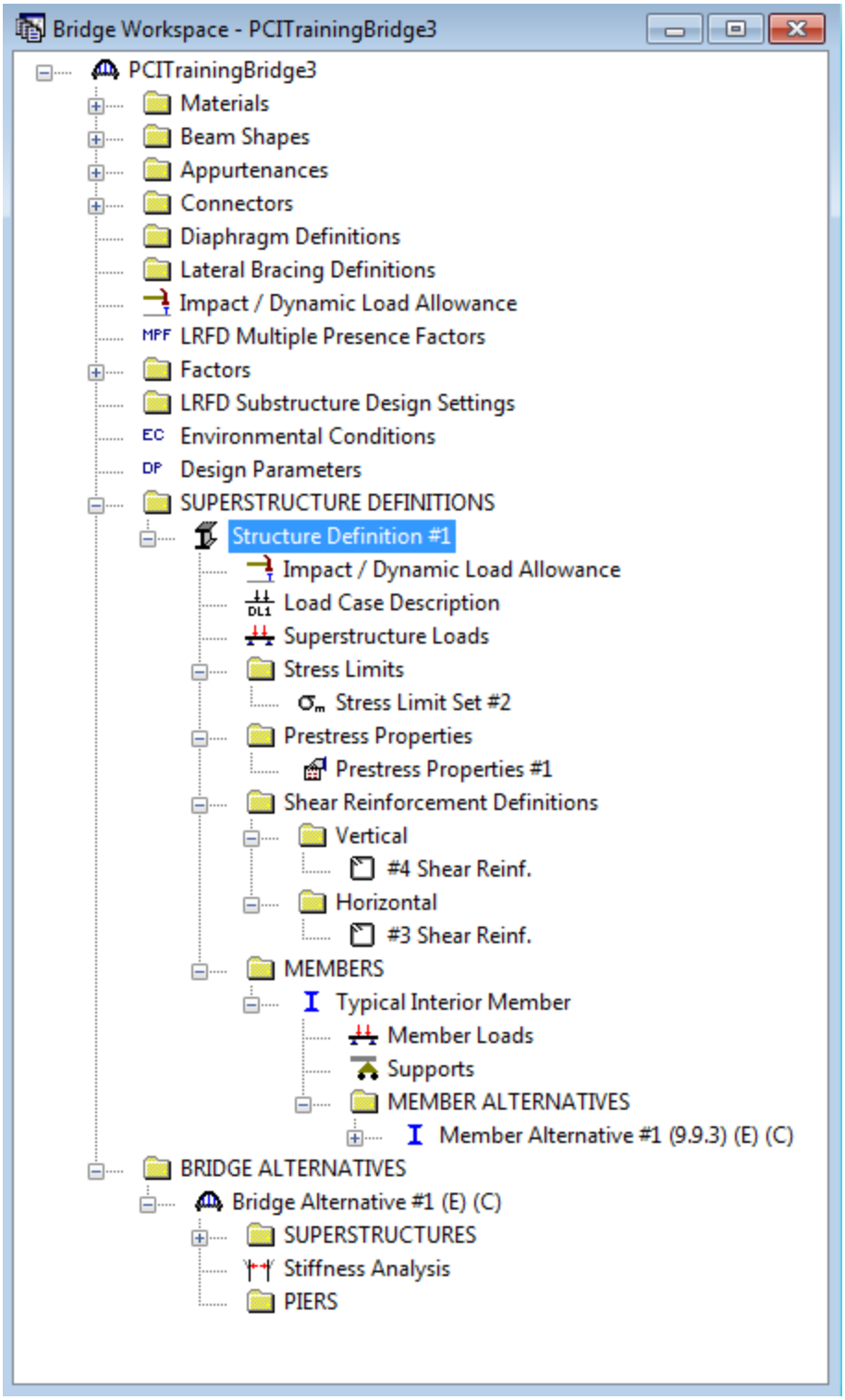
Enter the wearing surface data as follows on the Wearing Surface tab:



Now view the schematic for the Structure Typical Section for "6 Girder System".

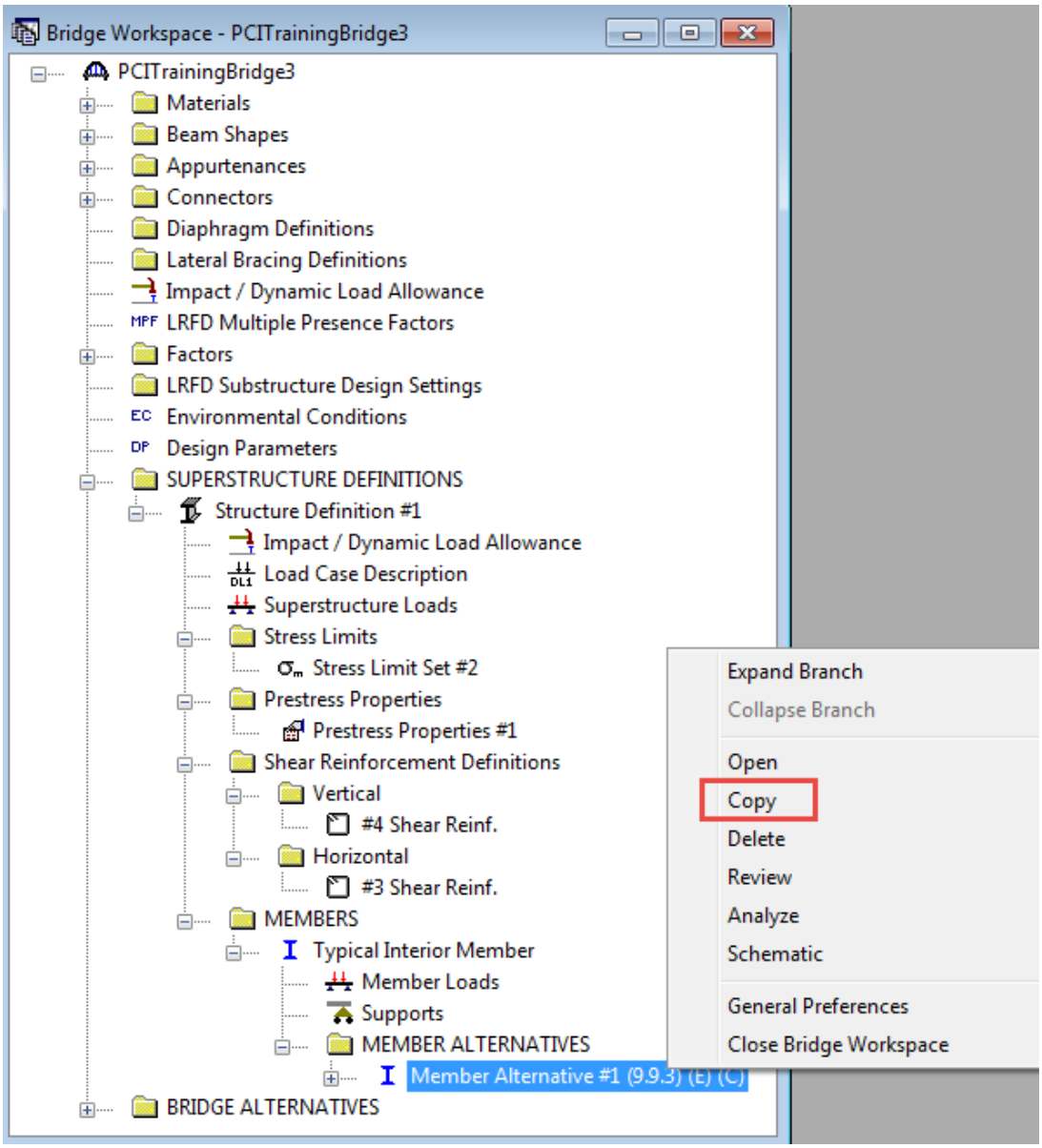


Expand the BWS tree for the original girder line “Structure Definition #1”.

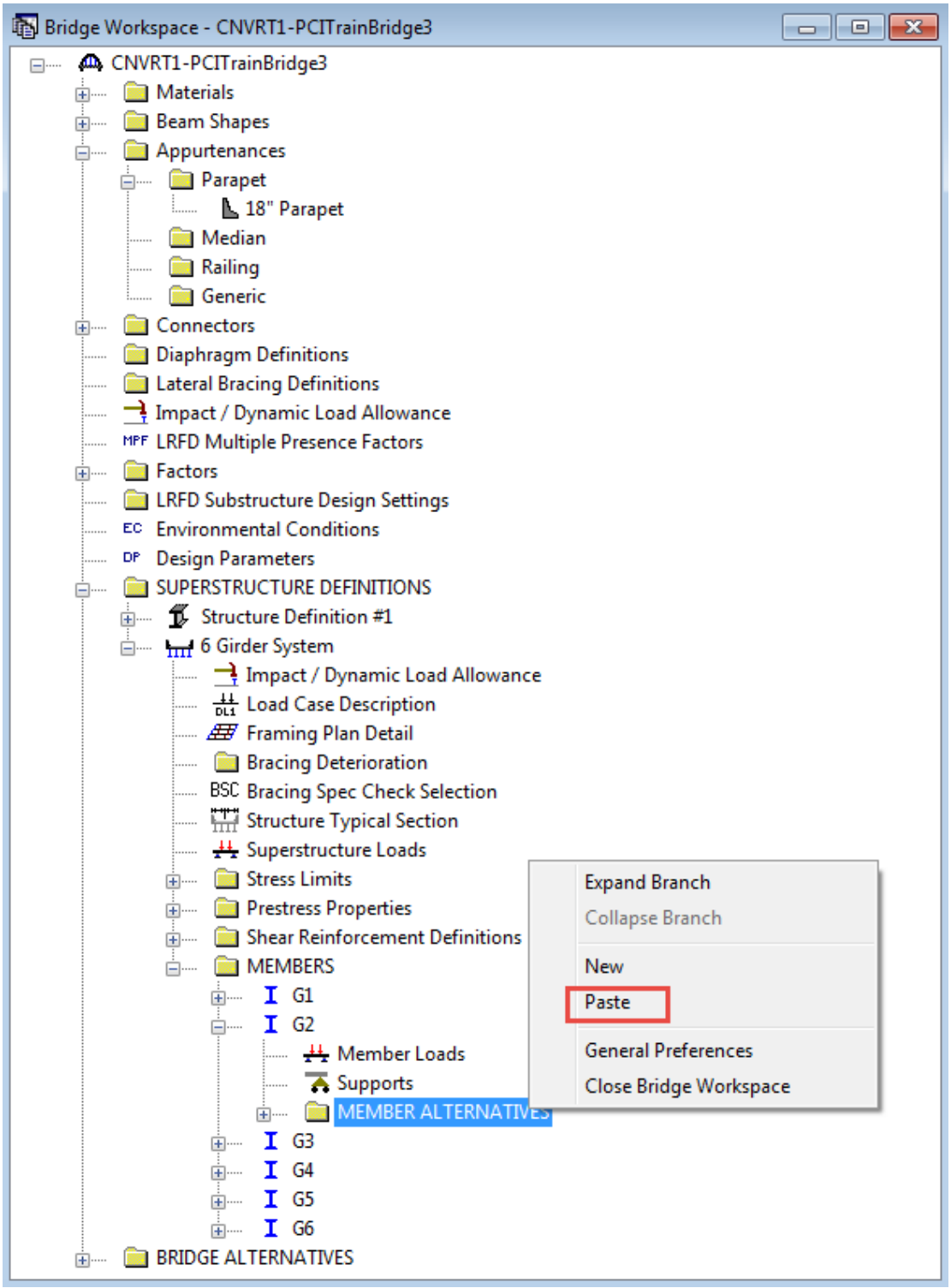


This structure already has data defined for the Stress Limits, Prestress Properties and Shear Reinforcement Definitions. It also has a Member Alternative for an interior member. The Member Alternative can be copied from this original superstructure definition to the new "6 Girder System" superstructure definition. When the Member Alternative is copied, the Stress Limits, Prestress Properties and Shear Reinforcement definitions belonging to the girder line superstructure will also be copied.

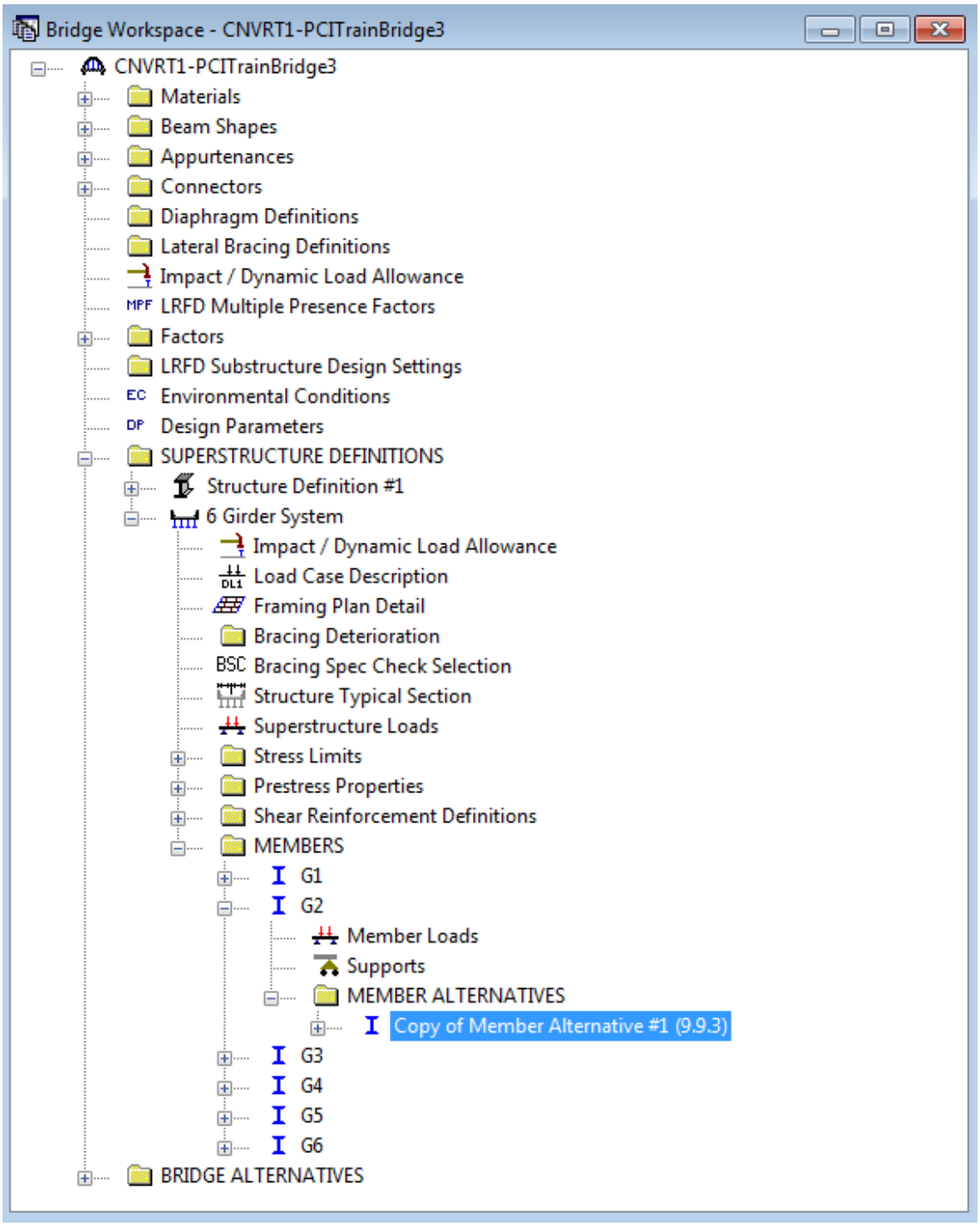
Select "Member Alternative #1 (9.9.3)" in the tree and right click the mouse. Select "Copy" from the menu that appears.



Now select “MEMBER ALTERNATIVES” under the Member G2 in the “6 Girder System” superstructure definition, right click the mouse and select Paste.



"Copy of Member Alternative #1 (9.9.3)" will now appear under Member G2 in the "6 Girder System" Bridge Workspace tree. The Stress Limit, Prestress Properties, and Shear Reinforcement Definitions will also now appear under the "6 Girder System" BWS tree.



We should now check for differences between the original girder line member and the new girder system member. Open the "Typical Interior Member" window and review the data on it to determine if any data such as the "Pedestrian Load" should be entered for the new "G2" member. You will need to compare such data in many locations. You can open each window or you can use the Report Tool to compare the data.

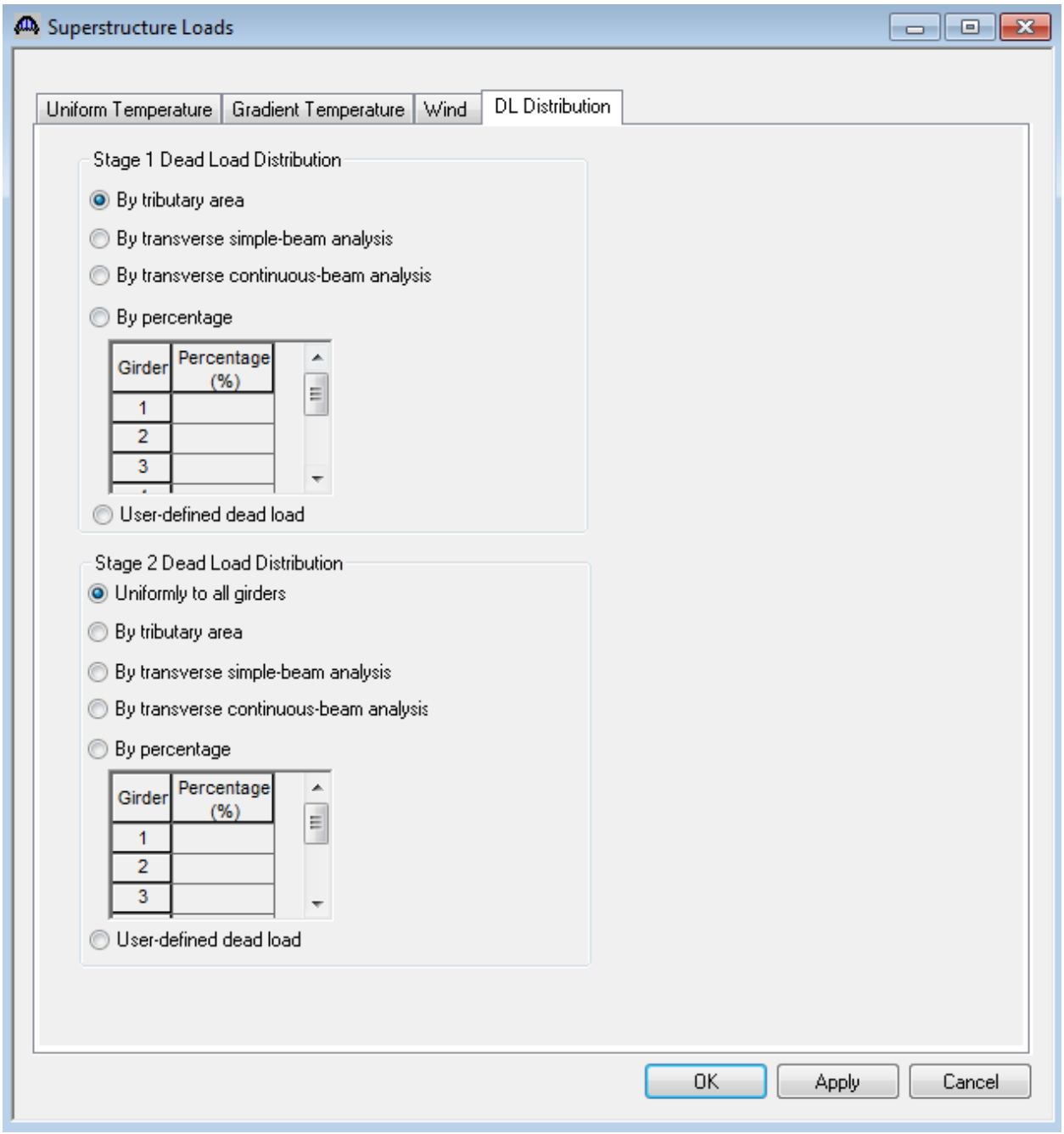
You have two choices as to how the dead loads will be entered and distributed in the new girder system superstructure definition. The method you choose will depend on the original girder line member's Member Load data and the amount of calculations you wish to perform.

Method 1: You can let BrR compute and distribute the superstructure load. You will need to compute any additional loads that should be applied to the members (stay-in-place forms, e.g.). Some of these loads may already be entered for the original girder line member lumped together with parapet loads, etc. It may take come computations to determine what portion of the original girder line member loads is due to loads that can be computed and distributed by BrR.

Method 2: You can tell BrR not to compute and distribute the deck load. You can copy the original girder line Member Loads to the new girder system member. You will need to compute dead load due to the deck slab that acts on that particular girder and enter that as a member load for the new girder system member.

We will follow Method 1 first in this example.

Method 1: In a girder system superstructure, BrR will determine the dead load due to the deck slab and appurtenances located on the deck. BrR uses the data on the Superstructure Loads window to determine how to distribute this dead load.



Open the "Member Loads" window for the original girder line member and review the data on that window. This original member has two uniform load cases, one for the "FWS" load case and one for the "Parapets" load case. For this example, these loads are easily verifiable with the data we have entered on the Structure Typical Section window.

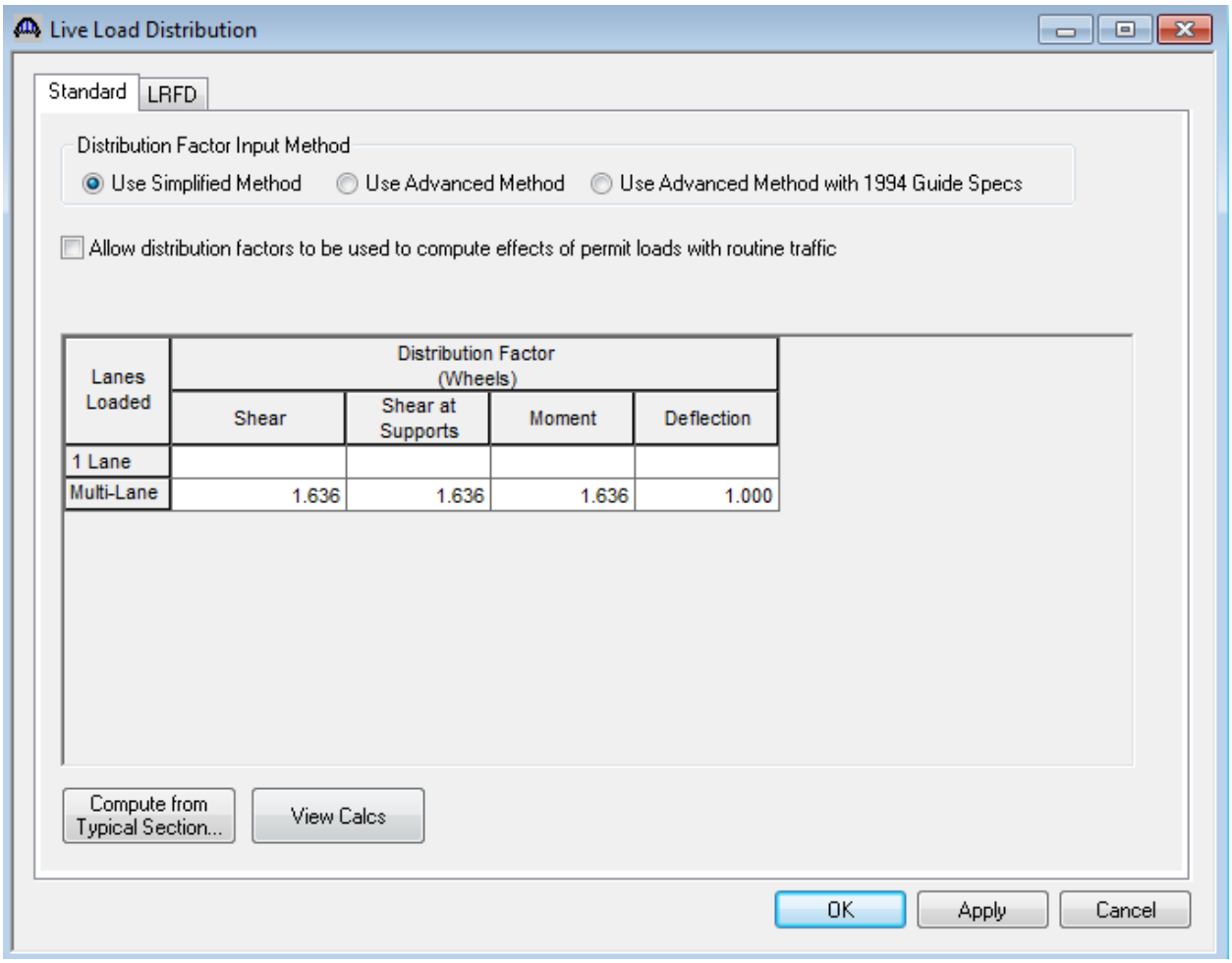
FWS(Future Wearing Surface): $0.2k/ft = \frac{\left(\frac{2''}{12}\right)(48')(0.150kcf)}{6girders}$

Parapets: $0.1k/ft = \frac{2*0.3klf}{6girders}$

For our girder system superstructure, the future wearing surface load and parapet load applied to each member will be computed by BrR based on the data entered in the Structure Typical Section window. Therefore we do not need to enter any Member Loads for the new girder system members. For this example, determining the source of the original girder line Member Loads was easy. If the original girder line member was imported from BARS, it may not be as easy to determine what portion of the Member Load is due to the deck slab, appurtenances and wearing surface. You will need to do some investigation and calculations to determine what member loads you should enter into BrR for new girder system members when you are converting existing girder line members.

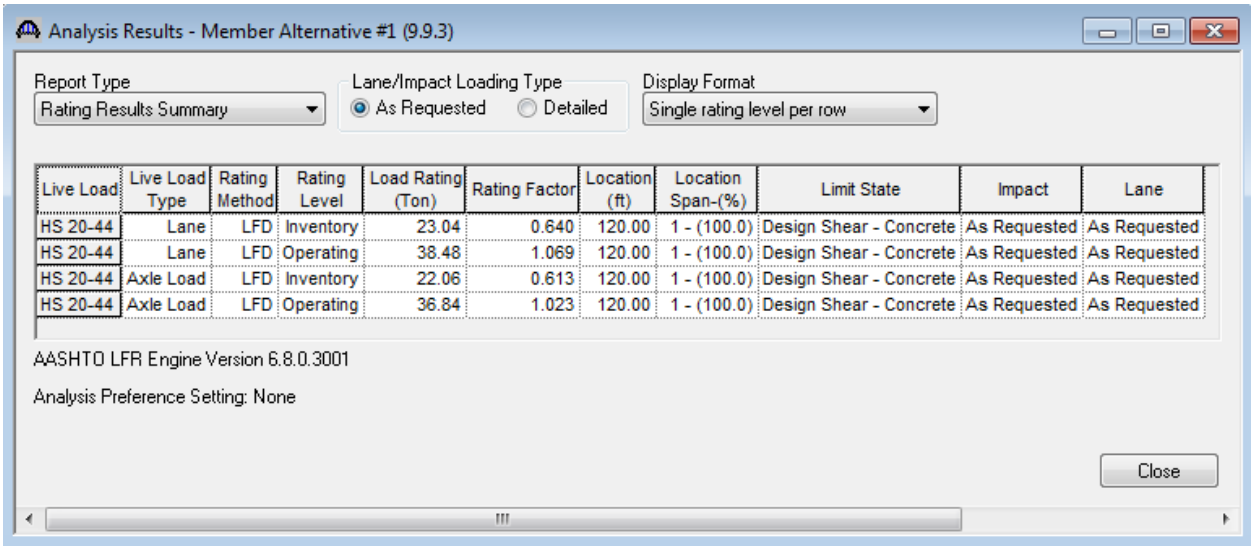
We should also open the Supports window for the original girder line member to see if any data should be copied to the new girder system members.

The Live Load Distribution window for the new girder system member alternative contains the following data based on being copied from the original girder line member alternative. This data can remain or you can use the "Compute from Typical Section" to update these values now that we know where the travelways are in relation to the girder member location.



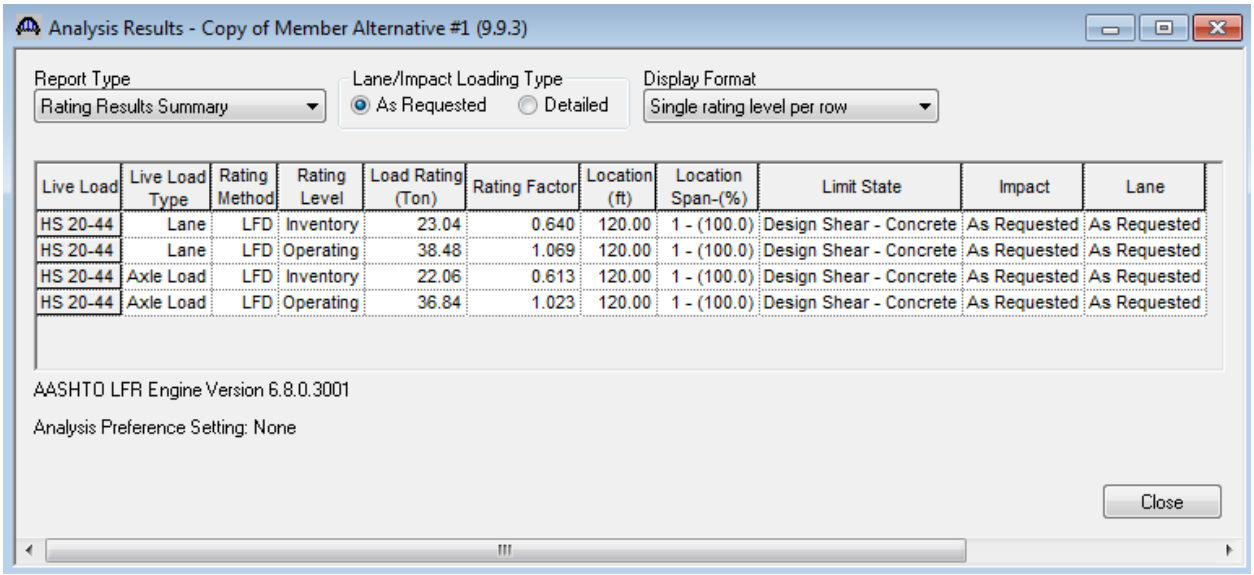
The data in the remaining windows under the girder member alternative should be acceptable based on being copied from the girder line member alternative. The following two windows show a comparison of the rating factors obtained for the original girder line and the new girder system member alternatives.

Original girder line member alternative:



Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HS 20-44	Lane	LFD	Inventory	23.04	0.640	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	38.48	1.069	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	22.06	0.613	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	36.84	1.023	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested

Newly copied girder system member alternative:

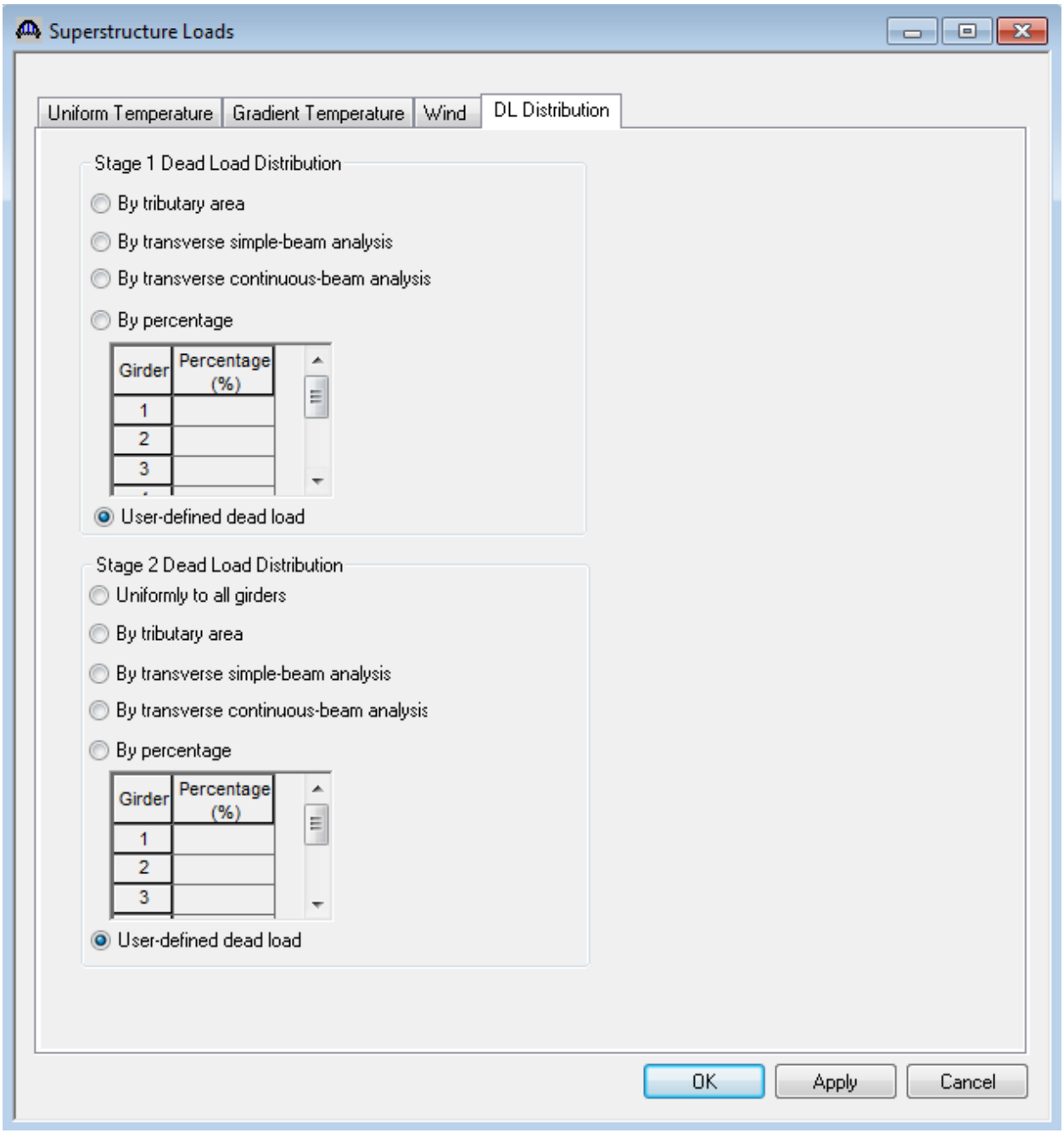


Live Load	Live Load Type	Rating Method	Rating Level	Load Rating (Ton)	Rating Factor	Location (ft)	Location Span-(%)	Limit State	Impact	Lane
HS 20-44	Lane	LFD	Inventory	23.04	0.640	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	38.48	1.069	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	22.06	0.613	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	36.84	1.023	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested

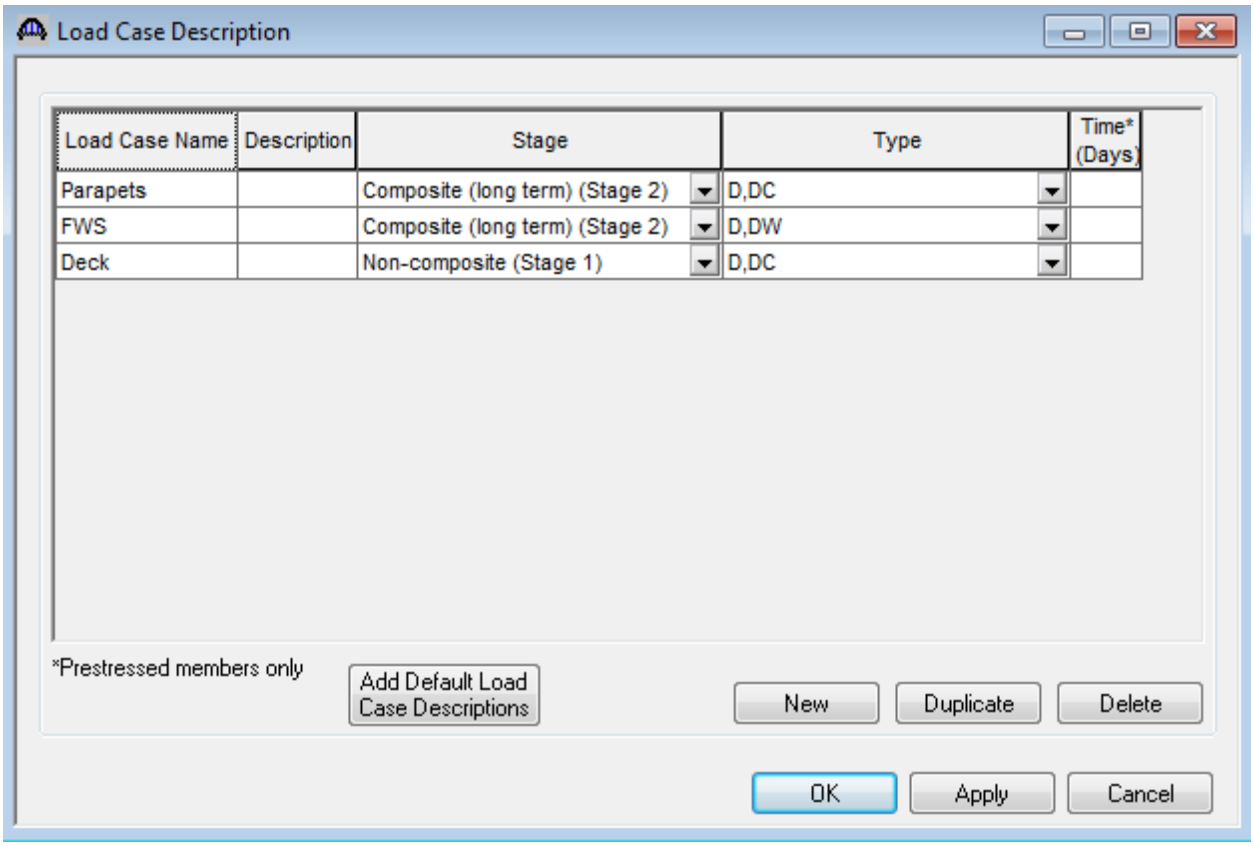
The newly created member alternative for Member G2 can now be copied to or linked with the other members in the "6 Girder System" superstructure definition. After copying this interior member alternative to one of the exterior members, you should visit the Live Load Distribution Factors and Haunch windows to enter the correct data for an exterior member.

We will now use Method 2 to enter the loads in BrR.

Method 2: We can tell BrR not to distribute the superstructure loads for us on the Superstructure Loads window.



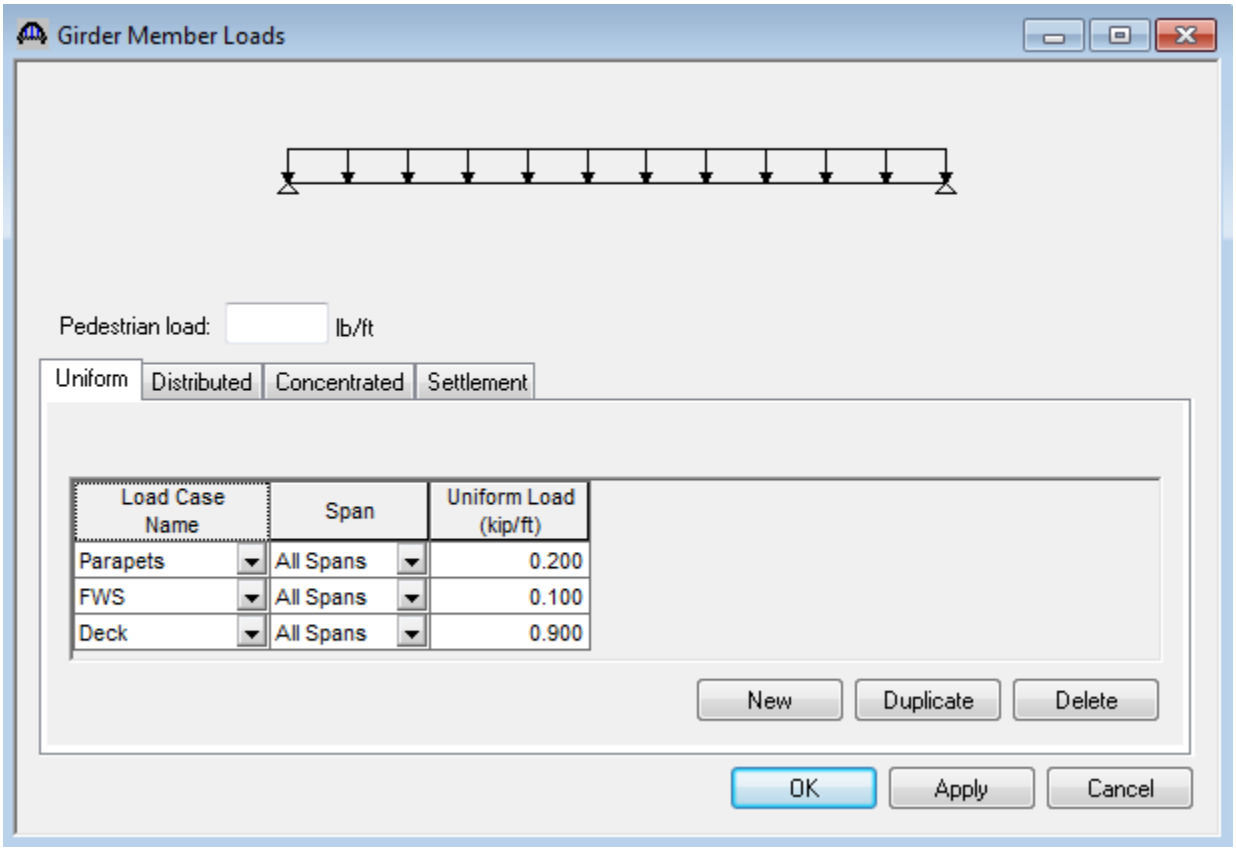
We need to compute the dead load on each girder system member due to the deck slab since it will not be computed by BrR now. We first need to create an additional Load Case Description for the deck slab. Open the Load Case Description window and add the following load case:



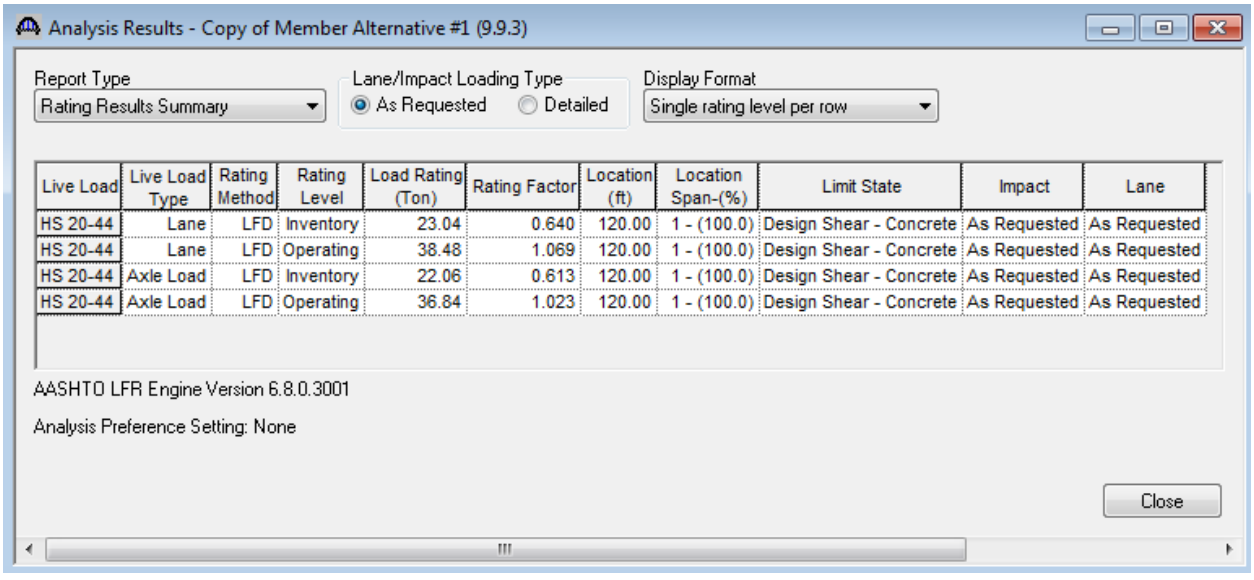
The deck slab dead load acting on Member G2 is:

$$0.9k/\ ft = \left(\frac{8''}{12}\right)(9')(0.150kcf)$$

Open the Member Loads window and enter each of the following three load cases. The first two load cases are those that exist in the original girder line member.



We can now analyze Member G2 and we will get the same rating results as we did following Method 1.



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HS 20-44	Lane	LFD	Inventory	23.04	0.640	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Lane	LFD	Operating	38.48	1.069	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Inventory	22.06	0.613	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested
HS 20-44	Axle Load	LFD	Operating	36.84	1.023	120.00	1 - (100.0)	Design Shear - Concrete	As Requested	As Requested