10-1 INTRODUCTION TO RATING STEEL BRIDGES

This section together with Section 1, presents the policies and guidelines for rating steel girders. Policies are covered in subsection 10-2, while supporting guidelines are presented in subsections 10-2, 3, and 4.

The types of girders covered by this section are:

CI	Concrete on I-Beam
CIC	Concrete on I-Beam Continuous
CIK	Concrete on I-Beam Composite
CICK	Concrete on I-Beam Continuous and Composite
SBG	Steel Box Girder
SBGC	Steel Box Girder Continuous
SDG	Steel Deck Girder
SDGC	Steel Deck Girder Continuous
SSD	Steel Stringer - Concrete Deck
SSE	Steel Stringer - Earth Filled
SSM	Steel Stringer - Metal Plank Floor
SSMC	Steel Stringer Continuous - Metal Plank Floor
SSS	Steel Stringer - Timber Floor
SSSC	Steel Stringer Continuous - Timber Floor
STG	Steel Through Girder
WG	Welded Girder
WGC	Welded Girder Continuous
WGK	Welded Girder Composite
WGCK	Welded Girder Continuous and Composite

10-2 POLICIES AND GUIDELINES FOR RATING STEEL BRIDGES

I. General

A. All steel girders (except for girders in Truss Bridges) shall be rated by the VIRTIS program or one acceptable to the CDOT Bridge Branch.

B. Steel girders with considerable stress/strain effects due to horizontal curvature, skew, temperature, or other influences shall be modeled as simple, straight beams on pin or roller supports. The VIRTIS output results can then be supplemented with hand calculations to consider any of these significant influences, as necessary. *Also, when appropriate, steel girders having or lacking horizontal curvature effects and depending on the type of girder to be analyzed, DESCUS I or DESCUS II may also be used to perform the rating.*

C. All steel bridges shall be rated by the load factor method.

D. Use the minimum design yield strength value (Fy) and the minimum compressive strength of concrete (F'c) from plans.

E. For SSE, SSM and SSS structure types, it is acceptable to disregard AASHTO's allowable stress reduction formula for unsupported compression flanges. If the condition of the girder indicates that full yield strength should not be used, the rating stresses should be reduced as appropriate.

F. Steel box girder template has not been incorporated in the current version of Virtis 4.0.4. However, steel box girders can be rated using ½ the single-girder parameters in the analysis. The live load distribution factor and the dead load shall be adjusted accordingly.

II. Girders Requiring Rating

A. Interior Girders - A rating is required for the critical interior girder. More than one interior girder may require an analysis due to variation in span length, girder size, girder spacing, differences in loads or moments, grade of structural steel, etc.

B. Exterior Girders - An exterior girder shall be rated under the following guidelines.

1. When the section used for an exterior girder is different than the section used for an interior girder.

2. When the overhang is greater than S/2.

3. When the plans indicate that the curb and floor slab were poured monolithically, the live load distribution factor for the exterior girder should be calculated and compared to the live load distribution factor (LLDF) for the interior girders. If the LLDF for the exterior girder is equal to or greater than 75% of the LLDF for the interior girders, the exterior girder shall be rated.

4. When the rater determines the rating would be advantageous in analyzing the overall condition of a structure.

III. Calculations

A. A set of calculations, separate from computer output shall be prepared and submitted with each rating. These calculations shall include derivations for dead loads, derivations for live load distribution factors, and any other calculations or assumptions used for rating.

B. Dead Loads

1. The final sum of all the individual weight components for dead load calculations may be rounded up to the next 5 pounds.

2. Dead loads applied after a cast-in-place concrete deck has cured shall be distributed equally to all girders and, when applicable, treated as composite dead loads. Examples include asphalt, curbs, sidewalks, railing, etc.

3. Use 5 psf for the unit weight of permanent steel bridge deck forms.

4. Dead loads applied before a cast-in-place concrete deck has cured shall be distributed to the applicable individual supporting girders and treated as non-composite loads. Examples of this type of dead load are deck slabs, girders, stiffeners, splices and diaphragms. The weight of diaphragms may be treated as point loads or as an equivalent uniform dead load for the span under consideration.

EXAMPLE: For two diaphragms (P) at 1/3 points

$(PL)/3 = M = (wL \times L)/8$

Equivalent uniform load . . . $w = (8P)/3L$

5. The method of applying dead loads due to utilities is left to the rater's discretion.

IV. Rating Reporting/Package Requirements

The rater and checker shall complete the rating documentation as described in Section 1 of this manual. Additionally, yield strength (Fy) of structural steel used in the analysis and any variation from the original design assumptions shall be added to the Rating Summary Sheet. The rating package requirements shall be per Section 1-13 of this manual and as amended herein:

Consultant designed projects – Before finalizing the rating package and when VIRTIS is used as the analysis tool, the Rater shall verify with the Staff Bridge Rating Coordinator that the version number of the program being used is identical to CDOT'S version number. Data files created using a lower version of the program shall be rejected. It is required for the CDOT data archive, since the data base management feature inside the program would not work satisfactorily. After the analysis is completed, the rater shall save the data file. When saving is finalized, the rater shall export the data file in *.bbd format (i.e., F-17-IE.bbd format; bbd = BRIDGEWare Bridge Data File) on an IBM- compatible 3.5" PC Disk for delivery with the rating package. Also, the version number used during analysis shall be written on the diskette label. This ensures proper importation of bridge data archive by Staff Bridge at a later date.

10-3 GUIDELINES FOR USING THE VIRTIS RATING PROGRAM

The VIRTIS computer program performs the analysis and rating of simple span and multi-span steel girder bridges. It uses the BRASS ASD or the BRASS LFD engine for analysis. This program was developed in accordance with the AASHTO STANDARD SPECIFICATIONS, 16TH EDITION AND THE AASHTO MANUAL FOR CONDITION EVALUATION OF BRIDGES.

A maximum of thirteen (13) spans can be modeled using the program. Linear or parabolic girder web depth variation over the length of a defined cross-section can be modeled using Virtis. When a structure model is finalized, it can be rated using the ASD or the LFD method. The LRFD rating module is currently being developed and will be available in the future. When a structure model is being generated and before any analysis can be performed, it is recommended that Virtis users save the data to memory periodically. This can be accomplished by using the File and Save feature of this program.

The library explorer can be used to save commonly used items (beam shapes, non standard vehicles, materials, appurtenances etc.) and this eliminates the need for all users to define the same items repeatedly throughout the program. Once a new girder shape is defined or copied from the library, Virtis automatically computes the required section properties and beam constants.

Dead load from the girder self weight, deck slab and appurtenances (i.e. rails, median barrier etc.) are calculated automatically by the program. Dead load from the haunch, wearing surface and stiffener weight (for steel bridges) is defined by the user. For a detailed description of the girder loads, refer to the Opis/Virtis Help Menu index item - dead loads. When a structure is being modeled, the help menu can be activated by using the F1 key if the user requires clarification on a particular item in the GUI window.

In the Live Load Distribution Factor window, when the compute button is used to calculate the DF’s automatically by the program, Virtis users shall verify that these numbers are accurate and matches their calculated numbers.

All Colorado BT girder shapes, W-beam shapes, the Colorado permit vehicle, the Colorado posting trucks, and the Interstate posting trucks have been added to the Virtis library explorer and may be copied by the user. The Staff Bridge Rating Coordinator shall be responsible for updating existing information or adding new information (i.e. beam shapes, vehicles, etc.) to the library explorer.

The configuration browser provides access to the configuration features of Virtis. It may be employed to provide specific access privileges, i.e. read, write, delete etc., to the users. This feature is extremely powerful, since Virtis/Opis uses and shares the bridge data from one common source. Therefore, it is required that users of this program create a folder from the bridge explorer window (**EXAMPLE: MY FOLDER OR YOUR LAST NAME)** before creating the model for a new structure.

10-4 RATING STEEL BRIDGES WITHOUT PLANS

It is possible that the only information a rater may have to rate an old steel bridge is field measurements of the members and the directions of the AASHTO MANUAL FOR CONDITION EVALUATION OF BRIDGES 1994, Second Edition. A convenient source of beam information is the book titled “Historical Record-Dimensions and Properties-Iron and Steel Beams 1873 to 1952”, published by the American Institute of Steel Construction (AISC). This book can help the rater determine the approximate year the beams were rolled. The rater can then determine the section properties and the allowable stresses to be used to rate the steel beams.

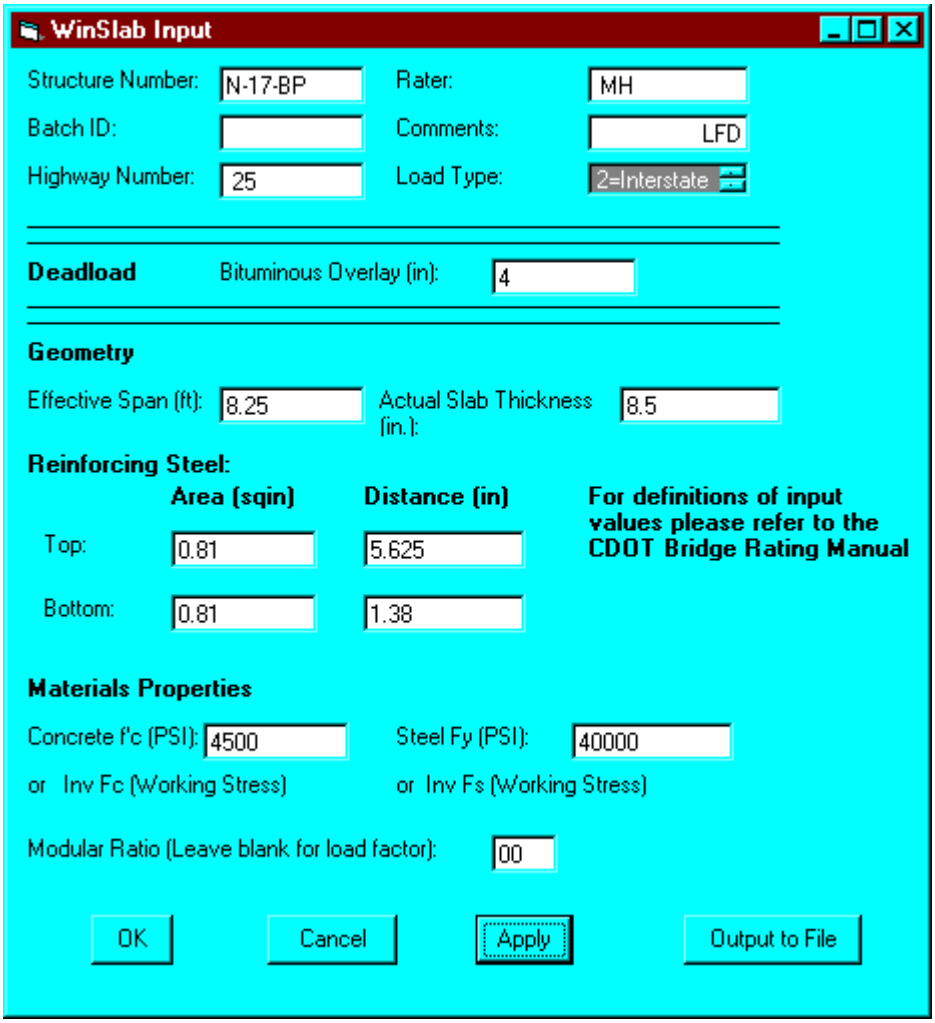
10-5 STEEL GIRDER BRIDGE RATING EXAMPLE

One example is presented in this section. Structure N-17-BP is a two (2) span continuous composite welded girder bridge with a skew of 0° degrees. Note that the girder web varies linearly near the pier. For simplicity, only the interior girder has been modeled for this structure.

One curved welded girder example using Descus-I will be presented at a later date.

Also, one curved welded box girder example using Descus-II will be presented at a later date.

Slab Rating Program Input, Structure No. N-17-BP



Effective Span Length: Per AASHTO Article 3.24.1.2(b)

Clear distance between flanges + 1/2 flange width = (105-12)+1/2(12)=93.0″
=8.25′

Slab Rating Program Output, Structure No. N-17-BP

WinSlab Rating Version 1 Date: 2/20/2002

Structure NO. N-17-BP Rater: MH State HWY NO. = 25
Batch ID= Description: LFD

LOAD FACTOR RATING-COMP STEEL NOT USED

INPUT DATA

Bituminous Overlay(in)=	4.000		
Eff. Span(ft)=	8.250	Slab Thickness(in)=	8.500
Top Reinf. (sq.in)=	0.81	Eff. Depth(in) =	5.625
Bottom Area(sq.in)=	0.81	Bottom Dist.(in)=	1.38
Conc. Strength(PSI) Inv =	4500	Oper. =	4500
Steel Yield (PSI) Inv =	40000	Oper. =	40000
Modular Ratio =	8		

Dead Load Moment 1.05 K-Ft
LL+I Moment 5.33 K-Ft
Gross Weight 36.0 Tons

		Inventory	Operating
Actual Concrete Stress	(PSI)	1141.11	1775.74
Actual Reinf. Steel Stress	(PSI)	19303.62	30039.23
Actual Comp. Steel Stress	(PSI)	4306.93	6702.21
Member Capacity	(K-Ft)	12.81	12.81
Member Capacity (LL+I)	(K-Ft)	11.45	11.45
Rating	(Tons)	35.68	59.47

Virtis Bridge Rating Example, Structure No. N-17-BP

Effective slab width: Per AASHTO Article 10.38.3.1

0.25(L)= 0.25(114.167*12)= 342.5″
12*(t) = (12*8.5)= 102″ Controls
C.L. - C.L. of girder= 8.75′= 105″

Distribution Factor:

Interior Girder (Multi-Lane) = S/5.5 = 8.75/5.5 = 1.591

Interior Girder (Single-Lane) = S/7.0 = 8.75/7.0 = 1.250

Exterior Girder = [(8.75+0.5)+3.25]/8.75 = 1.428

Dead Load:

HBP = 4″

Curb = (8/12)*(1.25)*(150) = 125 lb/ft

Rail:
Assumed 38 Posts @ 70.55 Lbs each
Posts = 38*(70.55)/228.33 = 11.74 Lb/ft
Channel = 40.68 Lb/ft
3A Rail = 7.81 Lb/ft

$\sum$ = 60.23 Lb/ft ~ 0.060 Kip/ft

Interior (D-2 on plan sheet) Diaphragms:

Angles L3x3x5/16 @ 6.1 lb/ft Length = 2(8.75)+2(5.71)=28.92′
Weight = (28.92)*(6.1) = 176.41 Lbs
Stiffener Plate 5x5/16x4.5′
Weight = 2(5.32)(4.5) = 47.88 Lbs
∑ = 224.29 Lbs ~ 0.225 Kips

Pier (D-2 on plan sheet) Diaphragm:

Angles L3x3x5/16 @ 6.1 lb/ft Length = 2(8.75)+2(5.71)=28.92′
Weight = (28.92)*(6.1) = 176.41 Lbs
Stiffener Plate 9x1x7.135′
Weight = 2(30.625)(7.135) = 437.04 Lbs
∑ = 613.40 Lbs ~ 0.614 Kips

End (D-1 on plan sheet) Diaphragms:

Angles L3.5x3.5x5/16 @ 7.2 lb/ft Length = 2(9.839)=19.68′
Weight = (19.68)*(7.2) = 141.70 Lbs
Stiffener Plate 6.5x5/8x4.5′
Weight = 2(13.817)(4.5) = 124.3 Lbs
∑ = 266.0 Lbs ~ 0.266 Kips

Intermediate Stiffeners:

Assumed length = depth of web = 54″; Neglect longer stiffeners in girder taper
Stiffener Plate 5x5/16x4.5′ @ 5.32Lbs/ft = 23.94 Lbs each
21 Stiffeners/Span = 21*(23.94)/114.167 = 4.4 Lbs/ft

Longitudinal Stiffeners:

Stiffener Plate 4.5x5/16 = 4.79 Lbs/ft
Stiffener Plate 3.5x5/16 = 3.72 Lbs/ft
Average Weight = 4.2 Lbs/ft
∑ Transverse + Longitudinal Stiffeners = 4.4+4.2 = 8.6 Lbs/ft ~ 0.009 Kip/ft

1

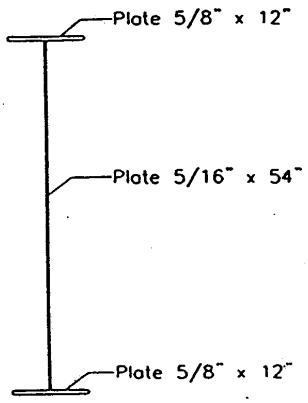


Plate 5/8" x 12"
Plate 5/16" x 54"
Plate 5/8" x 12"

2

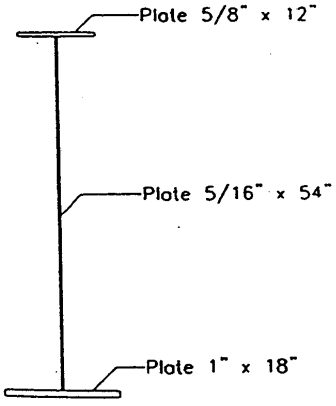


Plate 5/8" x 12"
Plate 5/16" x 54"
Plate 1" x 18"

3

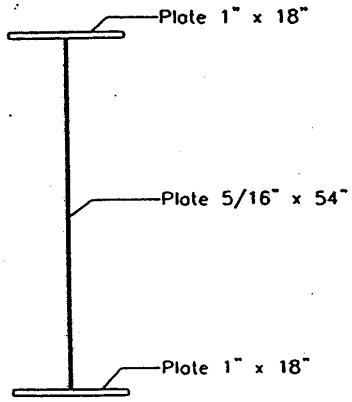


Plate 1" x 18"
Plate 5/16" x 54"
Plate 1" x 18"

4

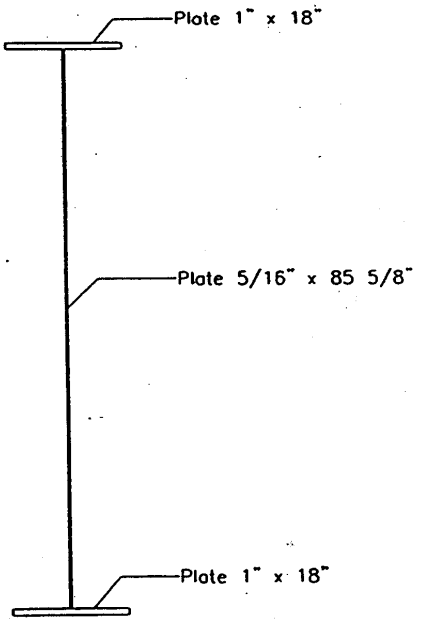
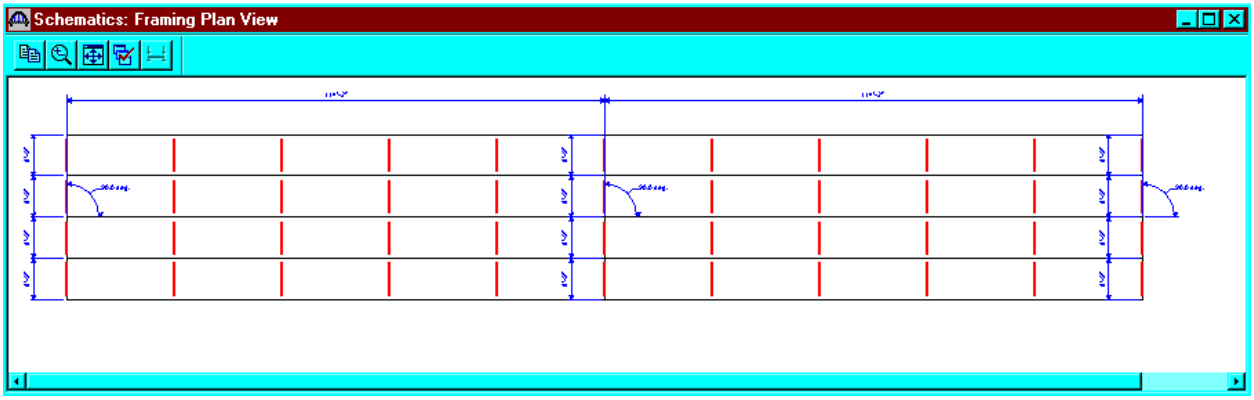
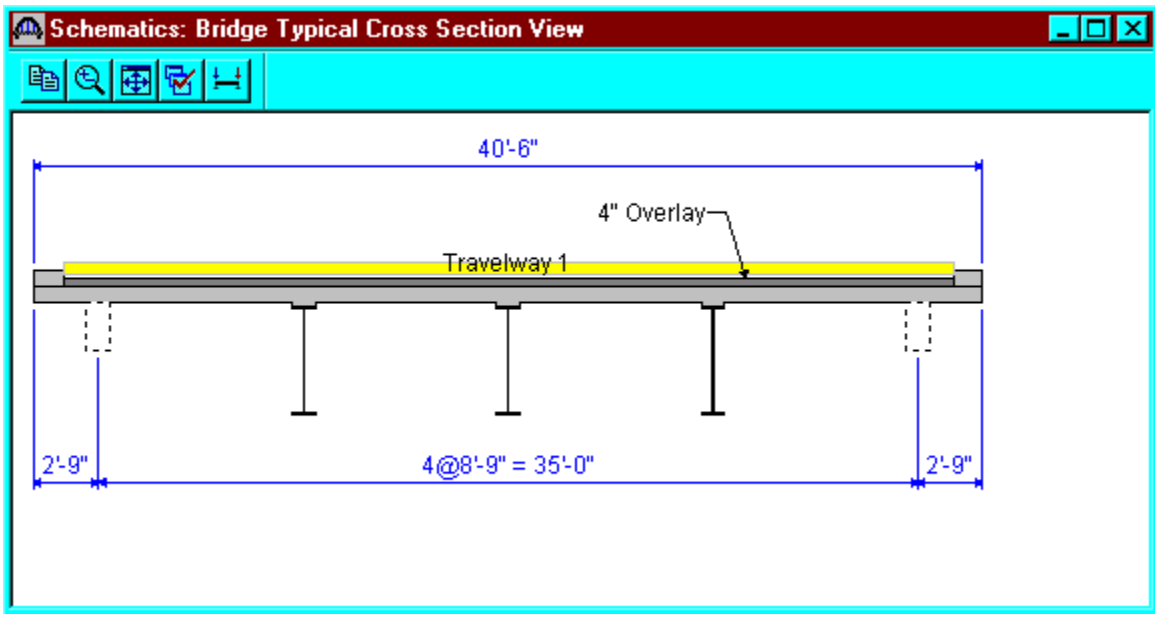


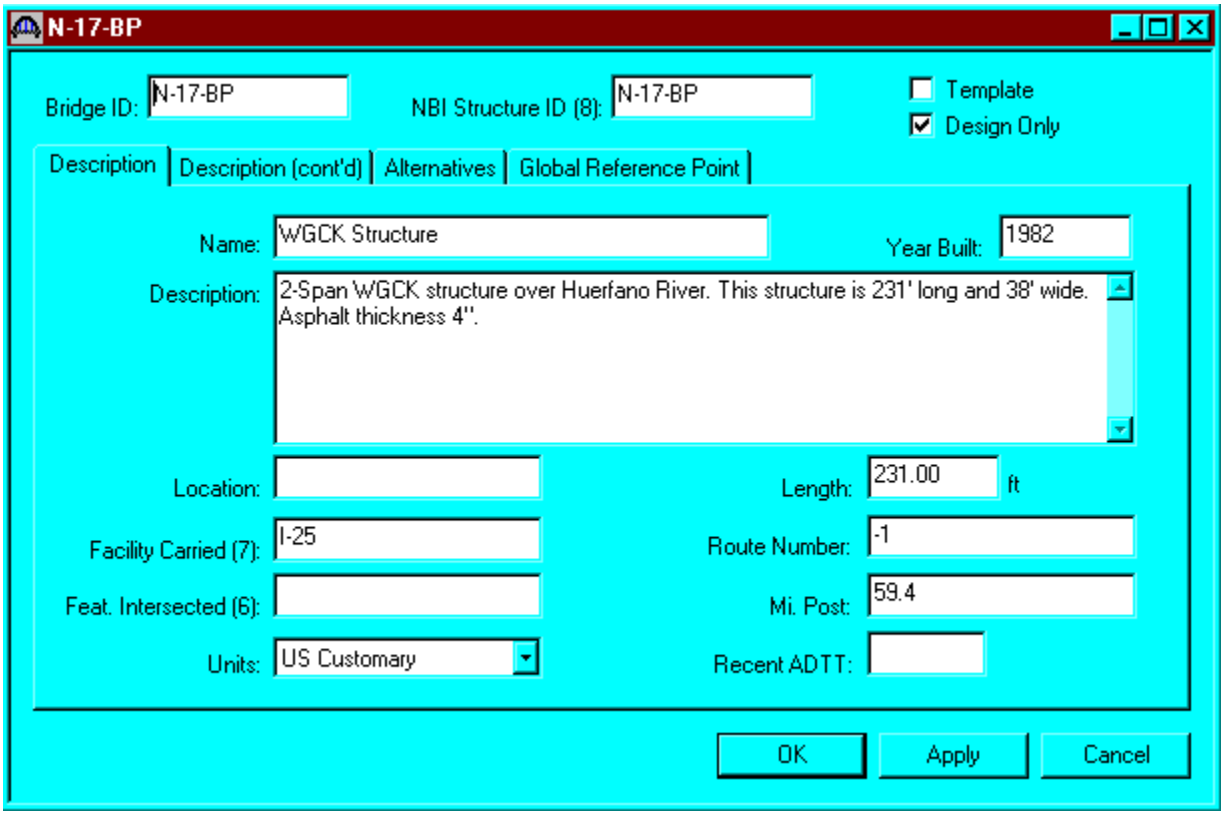
Plate 1" x 18"
Plate 5/16" x 85 5/8"
Plate 1" x 18"

Virtis Bridge Rating Example, Structure No. N-17-BP (contd.)





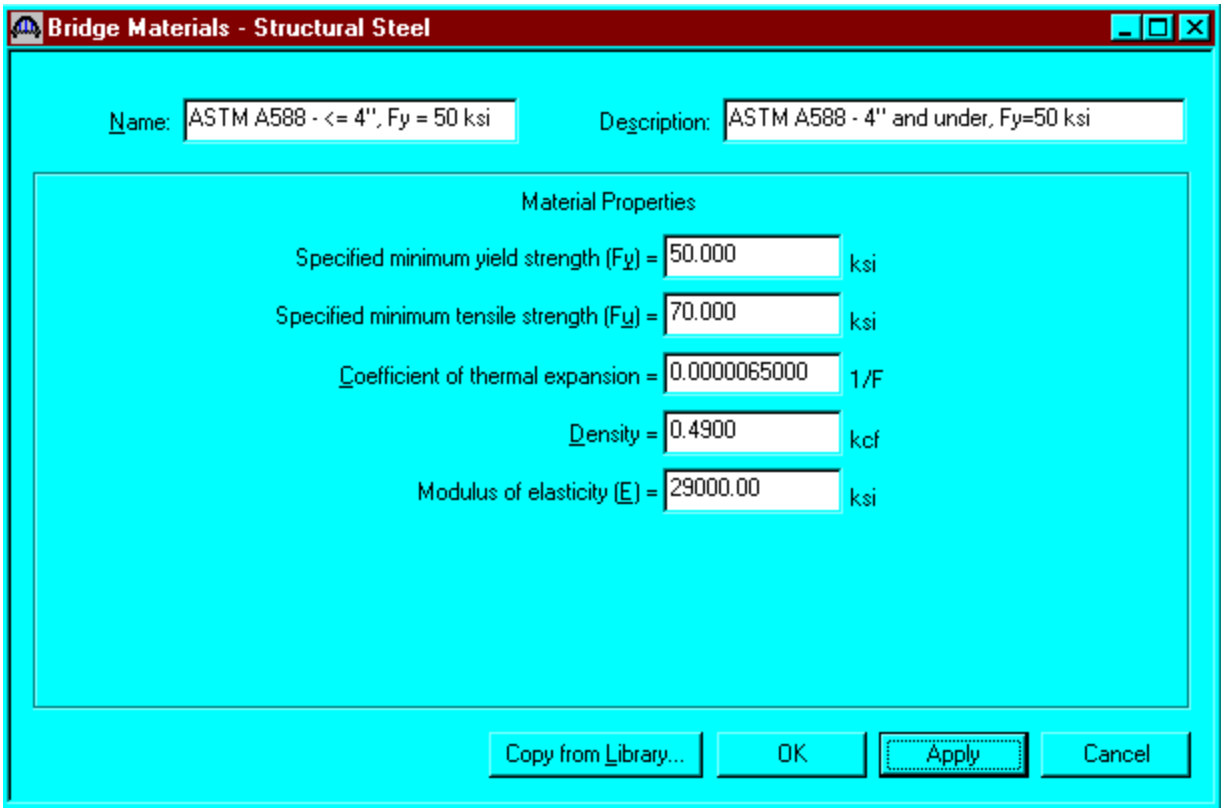
From the bridge explorer, create a new bridge and enter the following information.



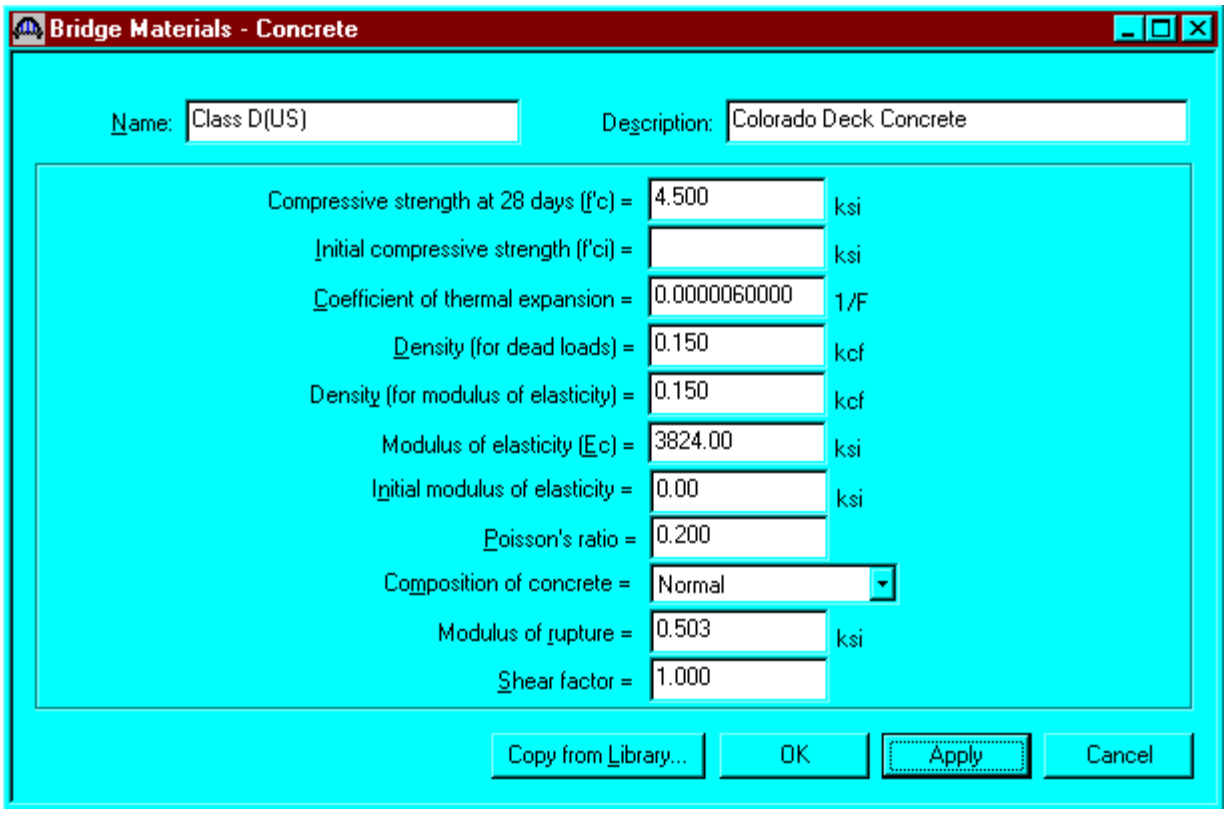
Click OK. This saves the data to memory and closes the window.

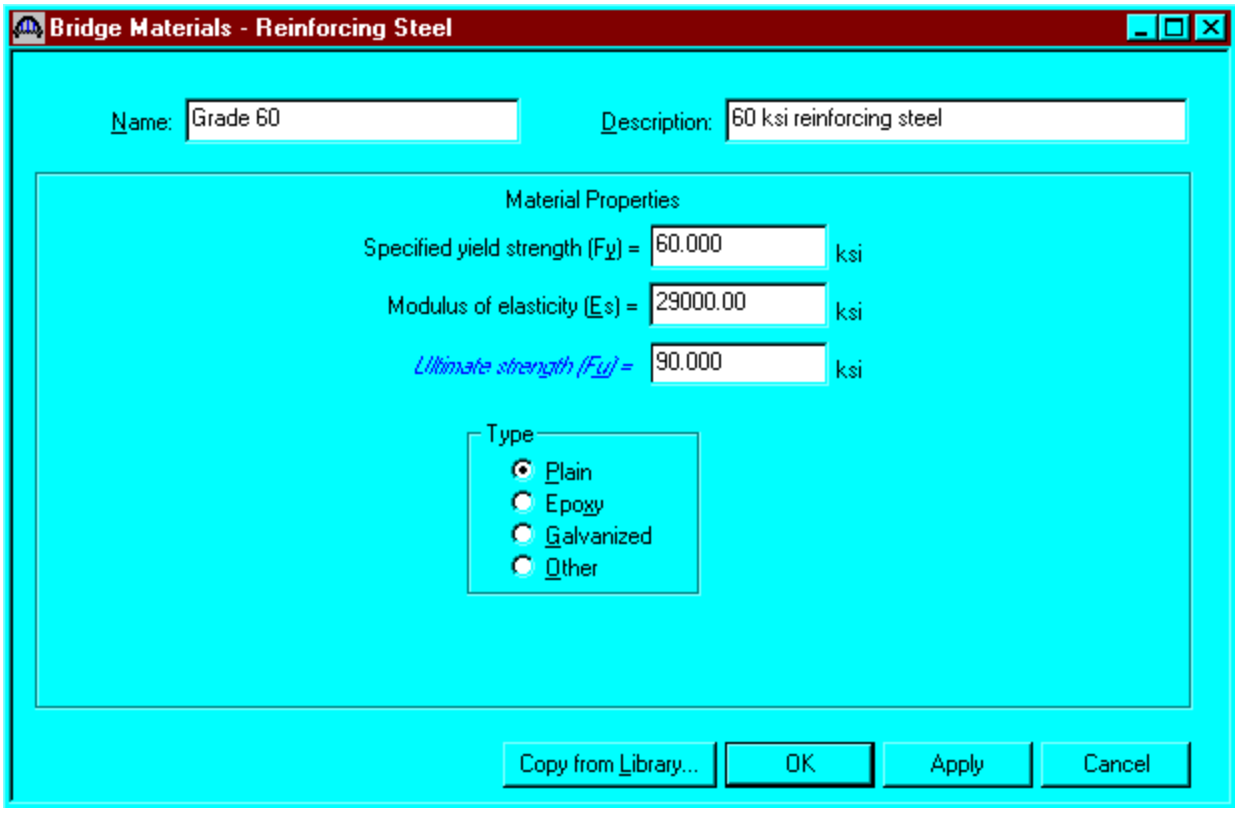
NOTE: Since Virtis uses a common/shared database, it is required that users of this program create a folder from the bridge explorer window **(EXAMPLE: MY FOLDER OR YOUR LAST NAME)** before creating the model for a new structure.

To add a new structural steel material, click on Materials, Structural Steel, in the tree and select File/New from the menu (or right click on Structural Steel and select New). Click Copy from Library button and select the appropriate structural steel from the library. Click OK and the following window will open. Click OK to save this structural steel material to memory and close the window.

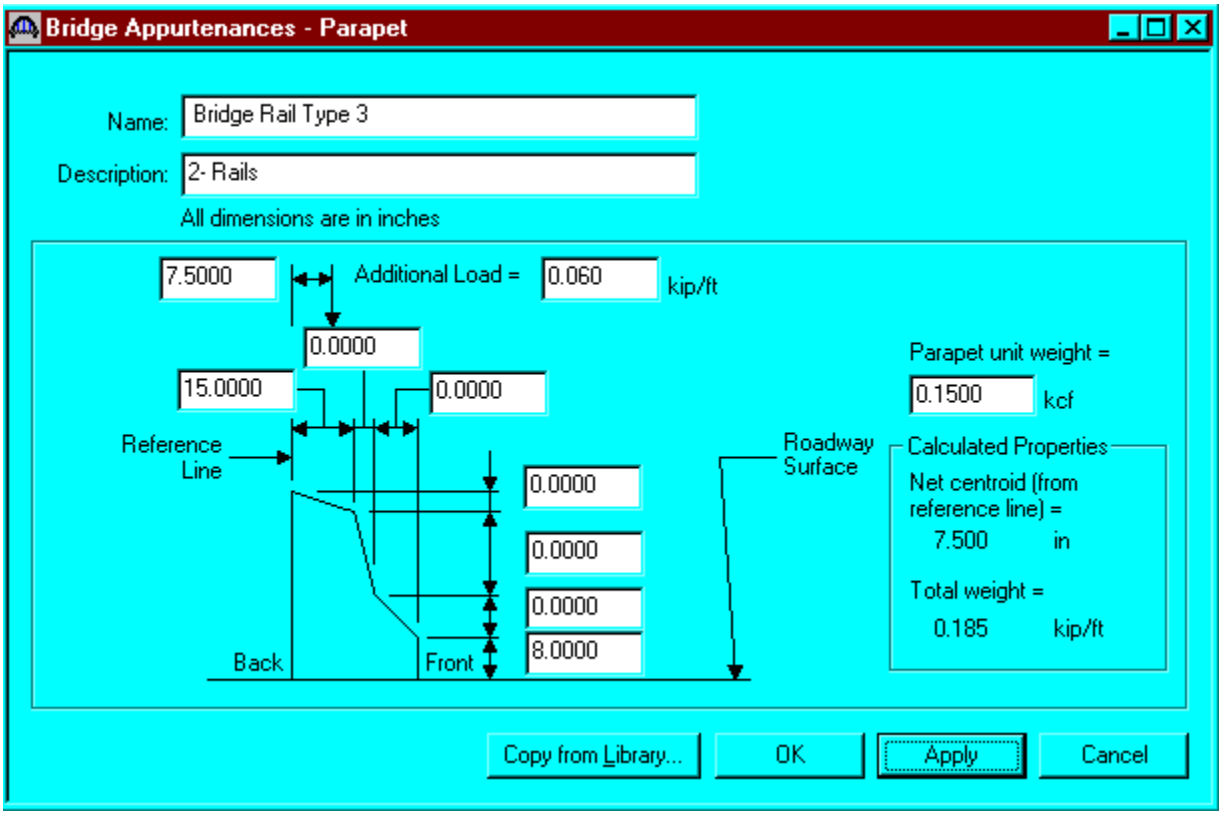


Using the same techniques, create the following Concrete Materials and Reinforcing Steel Materials. The windows are shown in the following page.

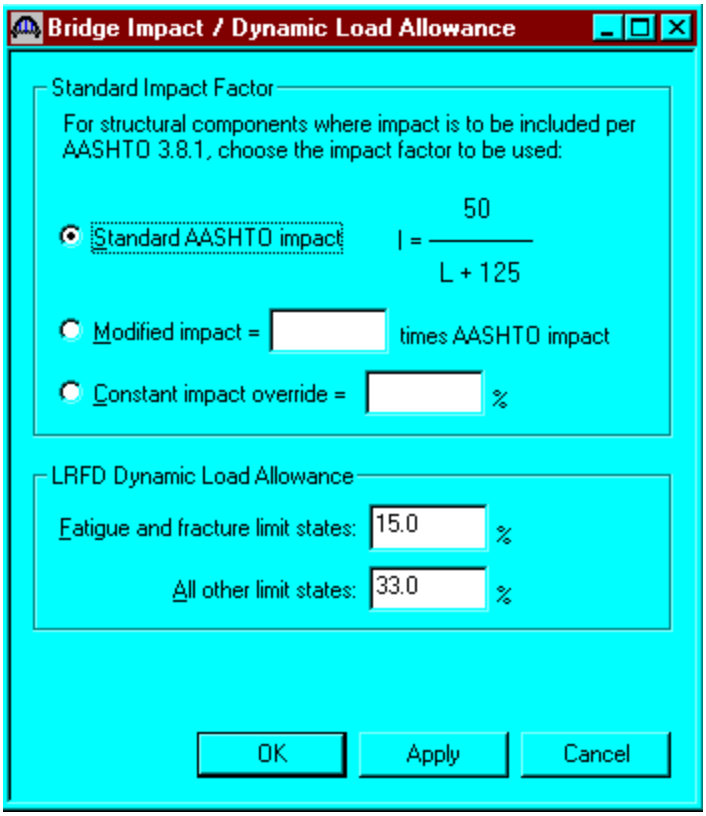

Bridge Materials - Concrete
Name: Class D(US)
Description: Colorado Deck Concrete
Compressive strength at 28 days (f'c) = 4.500 ksi
Initial compressive strength (f'ci) = ksi
Coefficient of thermal expansion = 0.0000060000 1/F
Density (for dead loads) = 0.150 kcf
Density (for modulus of elasticity) = 0.150 kcf
Modulus of elasticity (Ec) = 3824.00 ksi
Initial modulus of elasticity = 0.00 ksi
Poisson's ratio = 0.200
Composition of concrete = Normal
Modulus of rupture = 0.503 ksi
Shear factor = 1.000
Copy from Library...
OK
Apply
Cancel


Bridge Materials - Reinforcing Steel
Name: Grade 60
Description: 60 ksi reinforcing steel
Material Properties
Specified yield strength (Fy) = 60.000 ksi
Modulus of elasticity (Es) = 29000.00 ksi
Ultimate strength (Fu) = 90.000 ksi
Type
Plain
Epoxy
Galvanized
Other
Copy from Library...
OK
Apply
Cancel

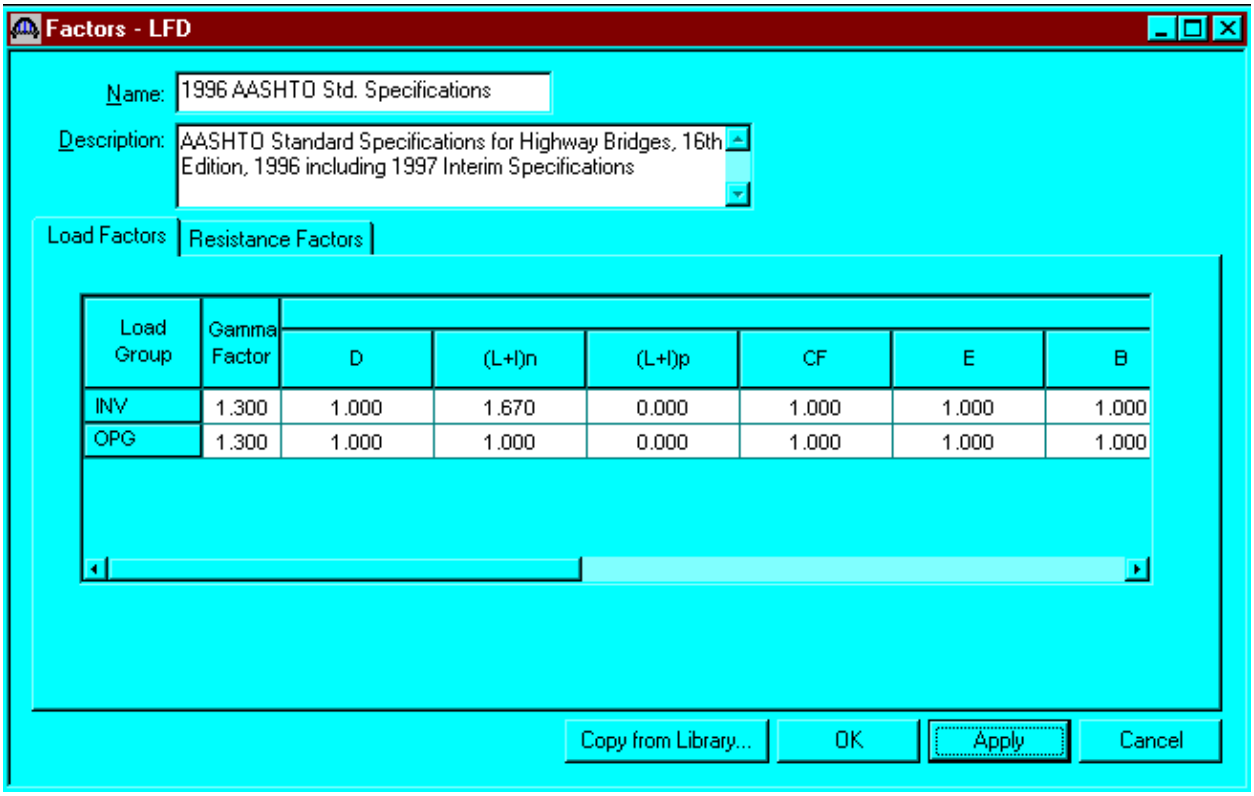
To enter the appurtenances to be used within the bridge, expand the explorer tree labeled Appurtenances. Right mouse click on Parapet in the tree, and select New. Fill in the parapet properties as required. Click OK to save the data to memory and close the window.



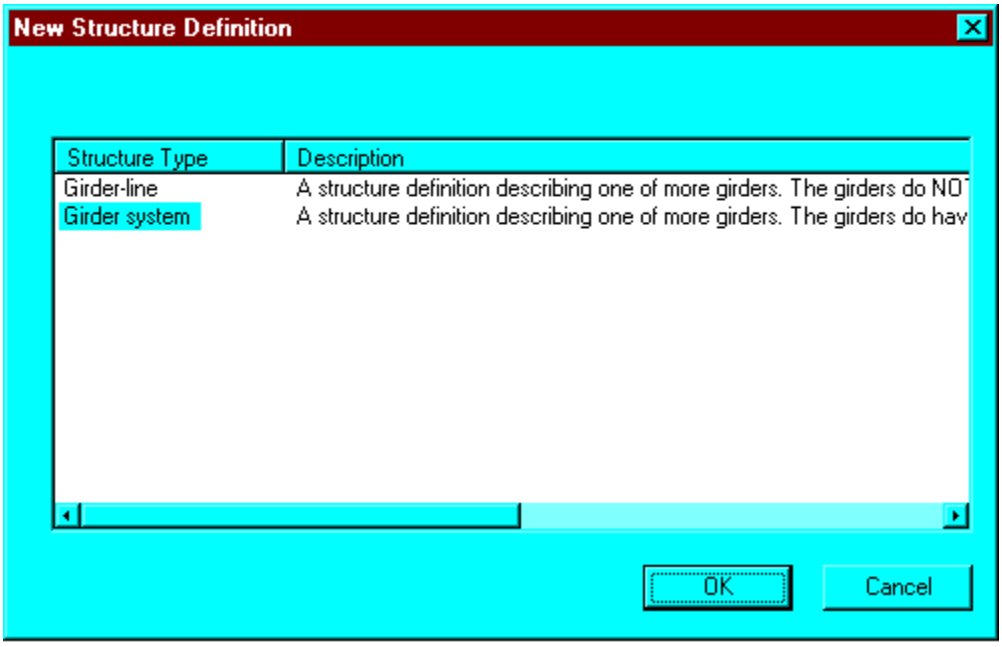
Double click on Impact/Dynamic Load Allowance in the tree. The Bridge Impact window shown below will open. Accept the default values by clicking OK.



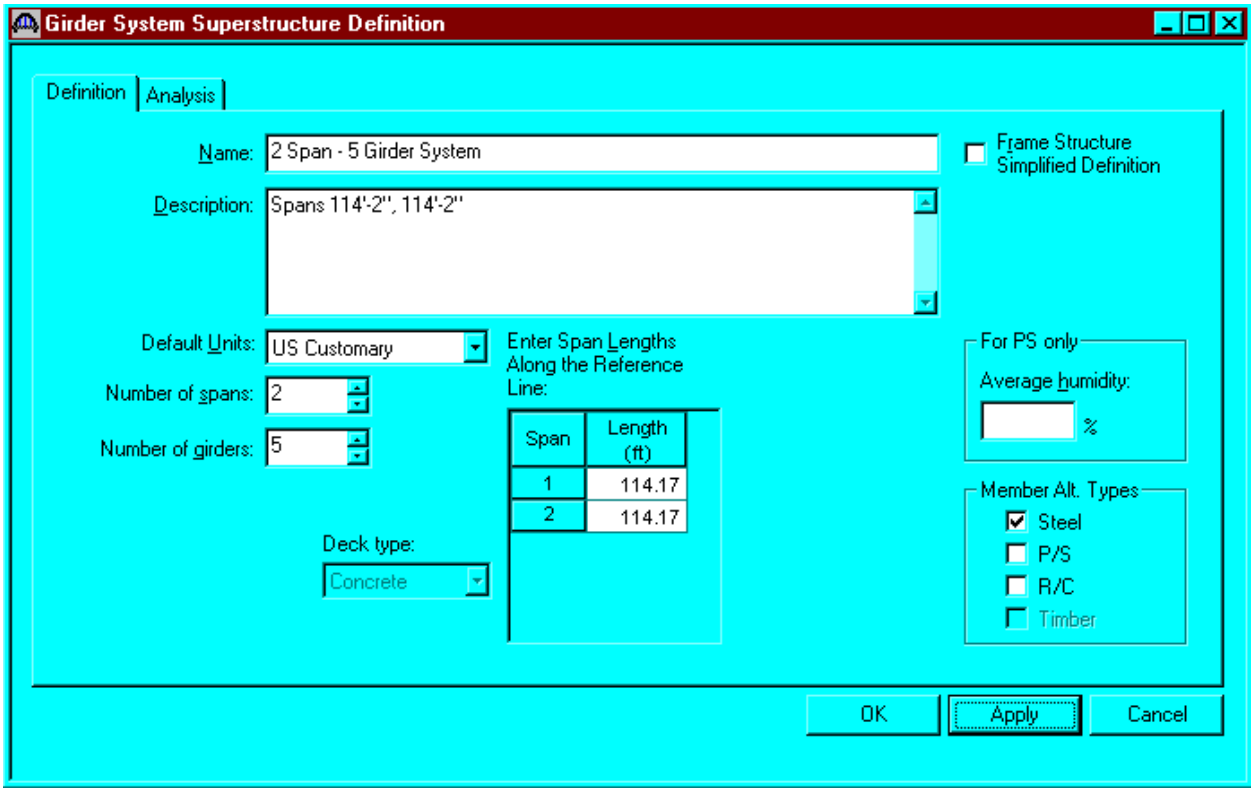
Click on Factors, right mouse click on LFD and select New. The LFD-Factors window will open. Click the Copy from Library button and select the 1996 AASHTO Standard Specifications from the library. Click Apply and then OK to save data to memory and close the window.



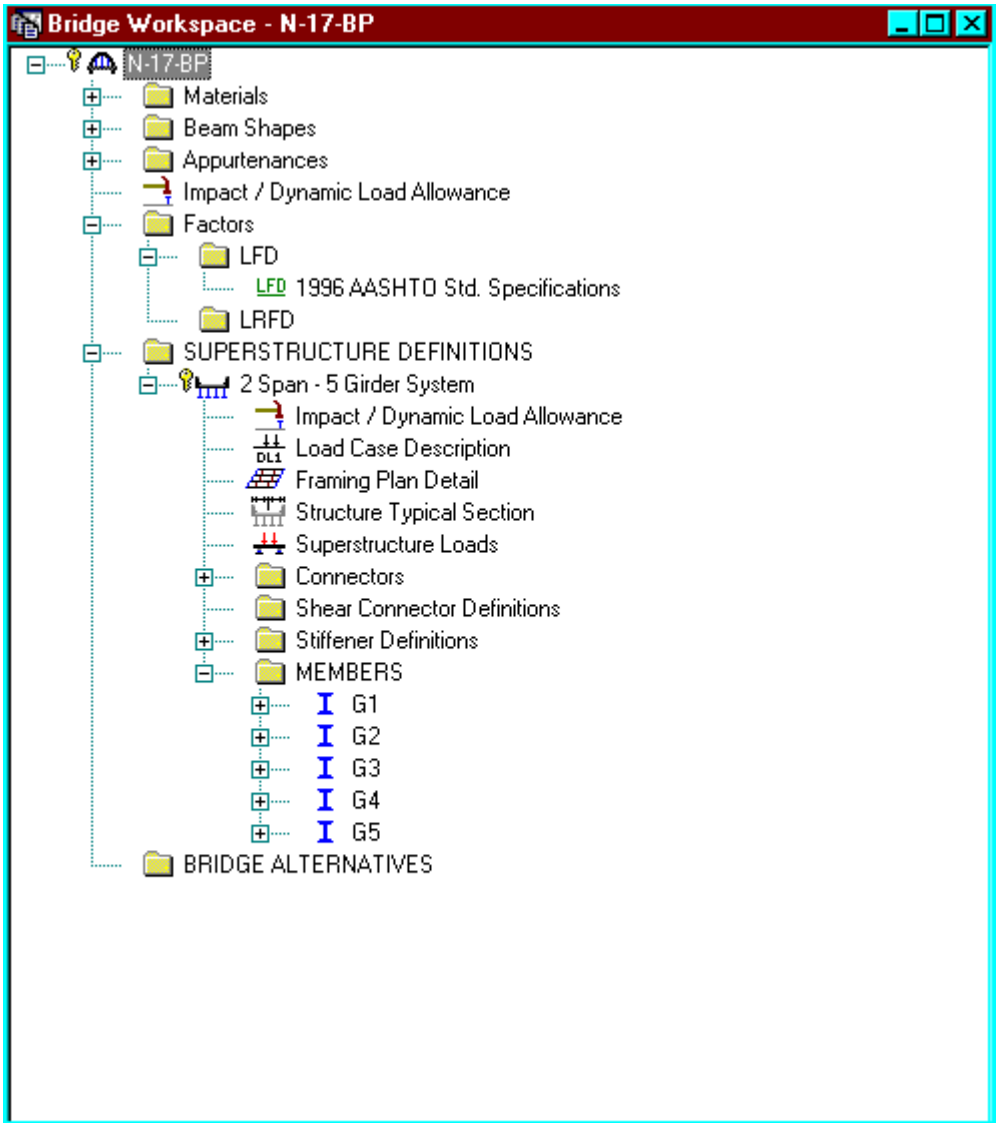
Double click on SUPERSTRUCTURE DEFINITION (or click on SUPERSTRUCTURE DEFINITION and select File/New from the menu or right mouse click on SUPERSTRUCTURE DEFINITION and select New from the popup menu) to create a new structure definition. The following dialog box will appear.



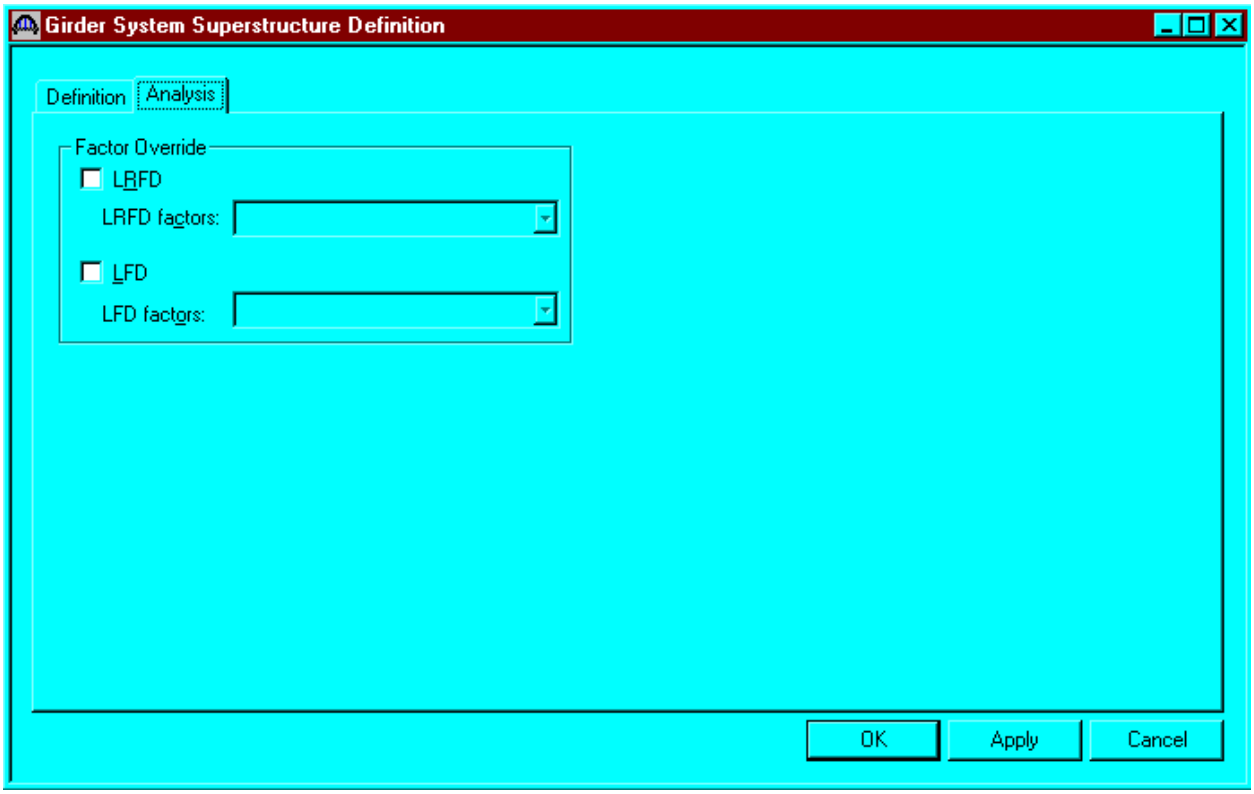
Select Girder System and the following Structure Definition window will open. Enter the appropriate data as shown below. Press F1 while on this tab to view the help topic describing the use of this information.



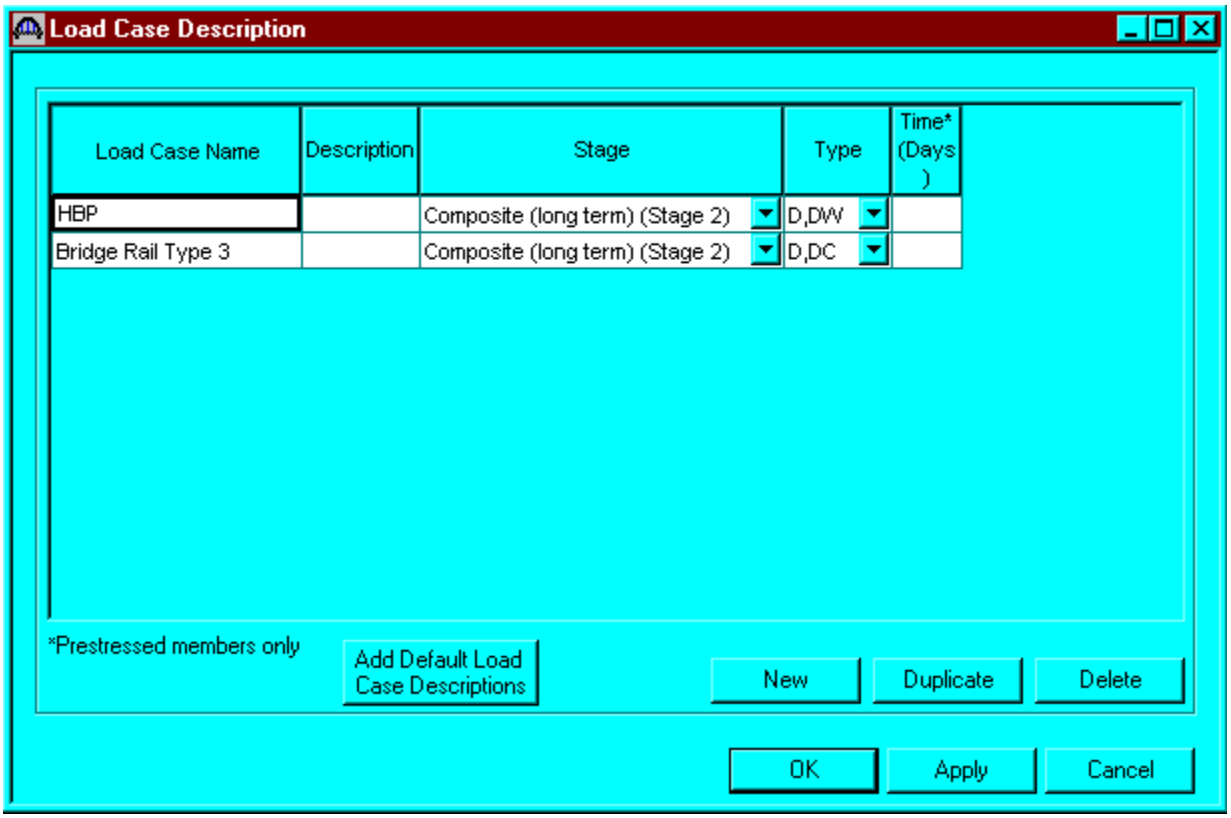
The partially expanded Bridge Workspace tree is shown below:



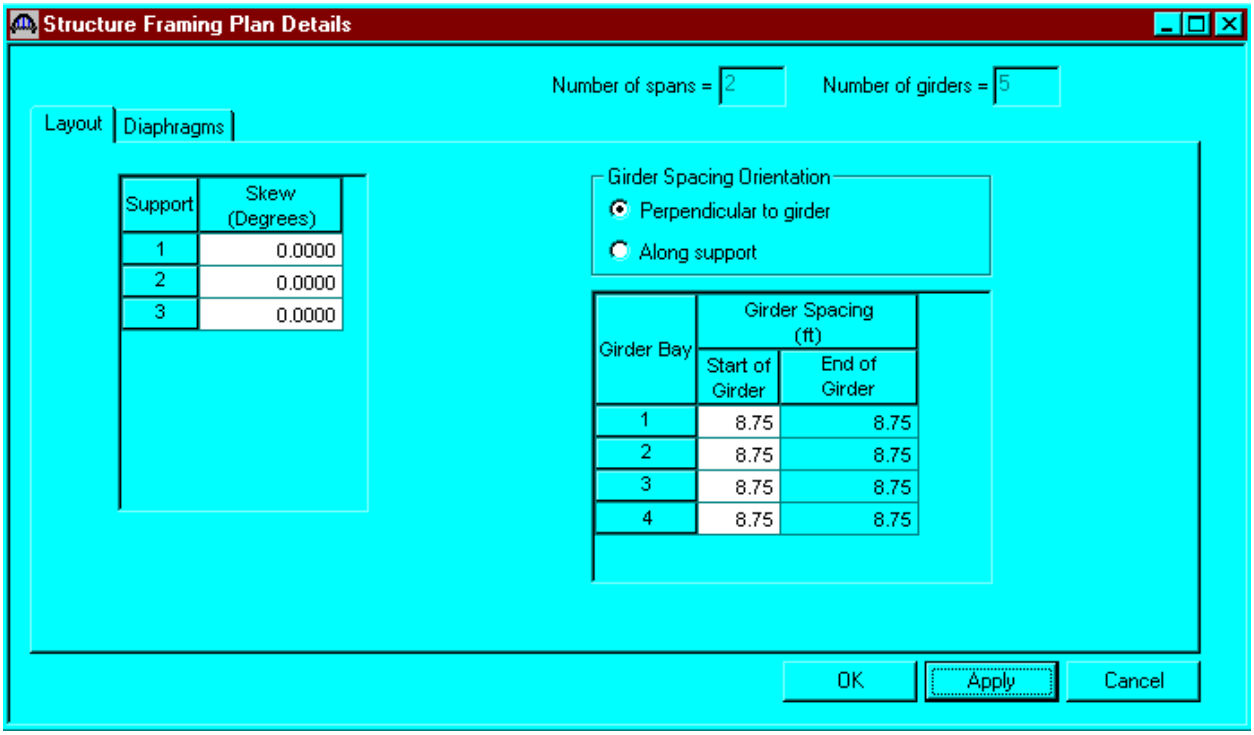
The Analysis tab in the Girder System Superstructure Definition window is used to override system default factors. Since default factors are used here, click OK to save the data to memory and close the window.



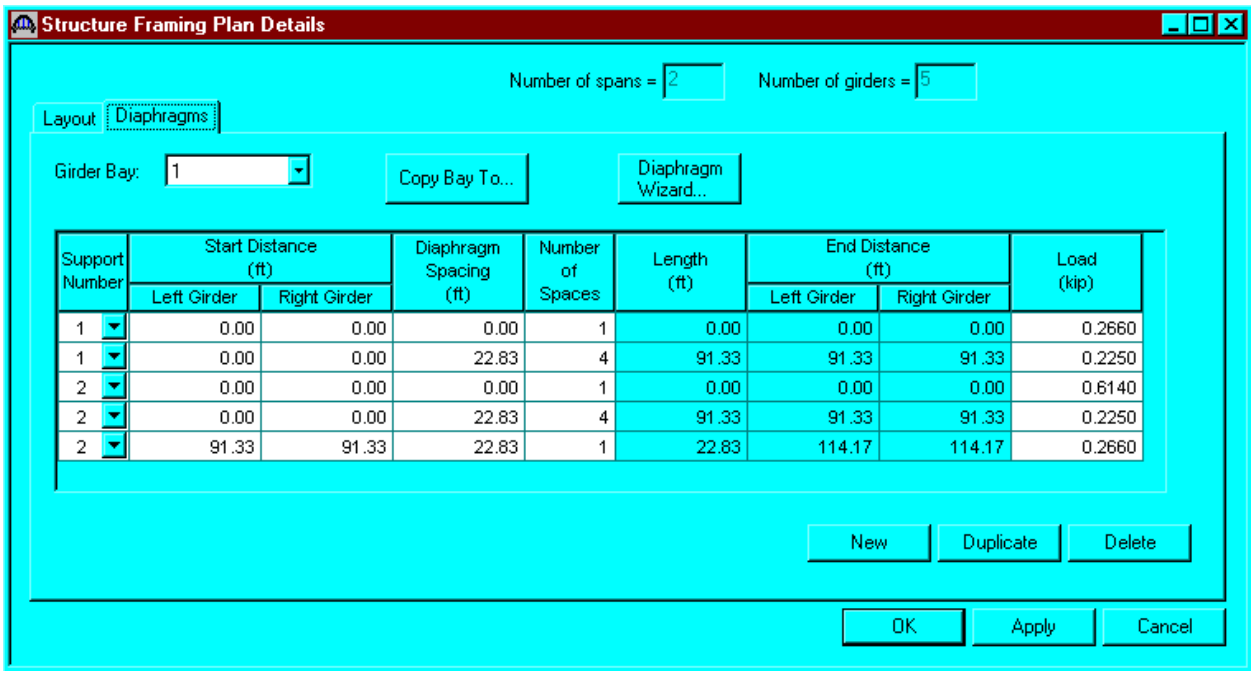
Click Load Case Description to define the dead load cases. The load types are presented in a single row separated by a comma. The first type applies to the LFD design and the second type applies to the LRFD design and it corresponds with the load types presented in the AASHTO Specifications. The completed Load Case Description window is shown below.



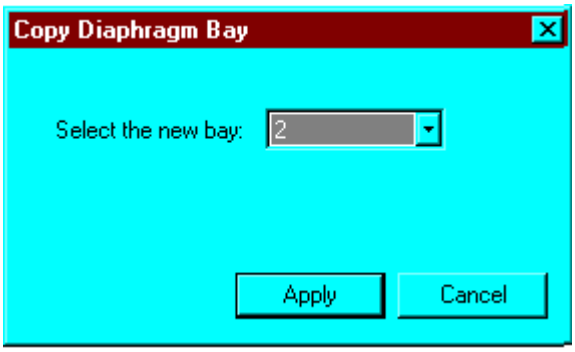
Double click on Framing Plan Detail to describe the framing plan. Enter the appropriate data to describe the framing plan.



Switch to the Diaphragms tab to enter diaphragm spacing. Enter the following diaphragms data for Girder Bay 1:

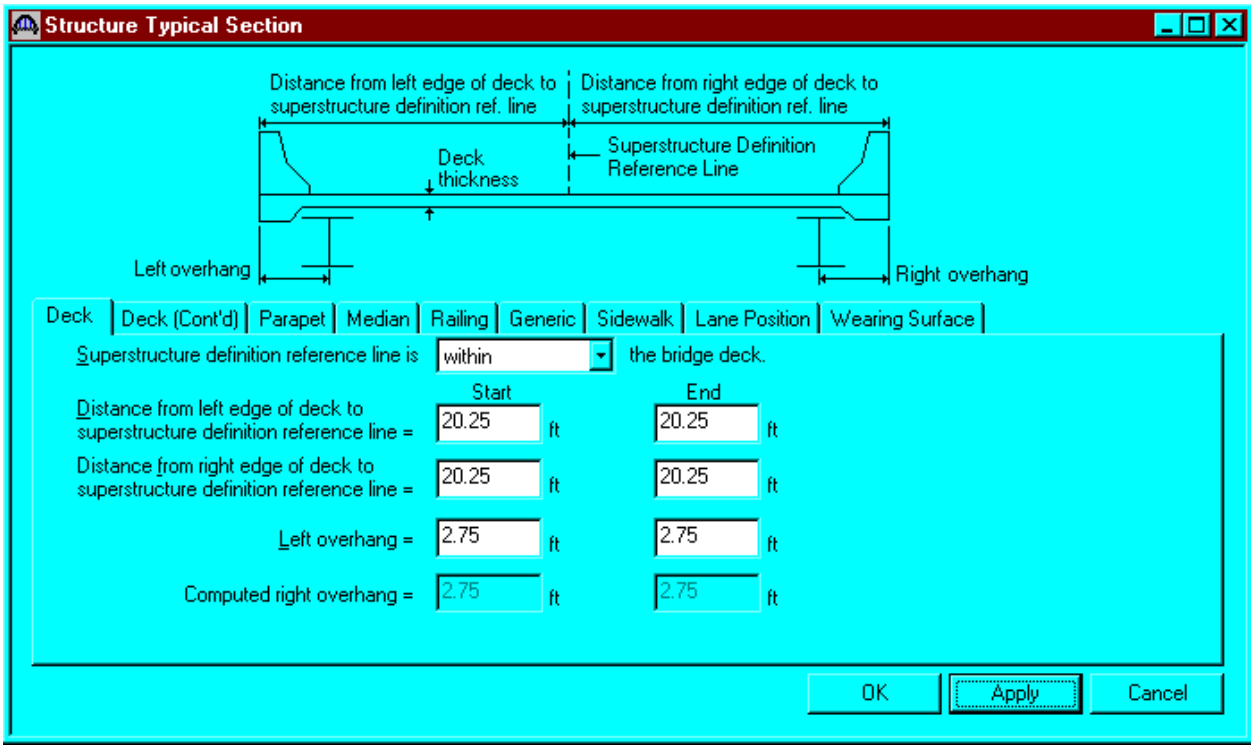


Click the Copy Bay To button to copy the diaphragms entered for Bay to the other bays. The following dialog box will appear. Click Apply to copy the diaphragms to girder bay 2. Repeat the same techniques for girder bay 3 and 4.

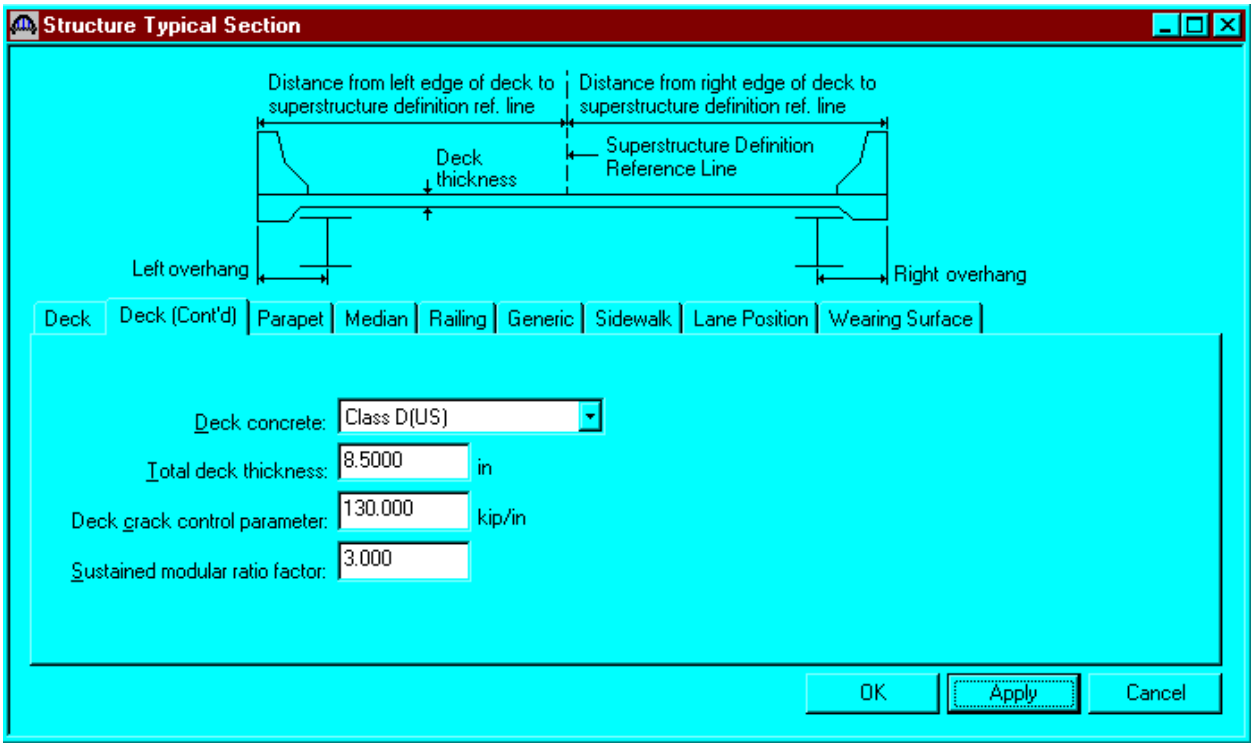


Select OK to close Structure Framing Plan Details window.

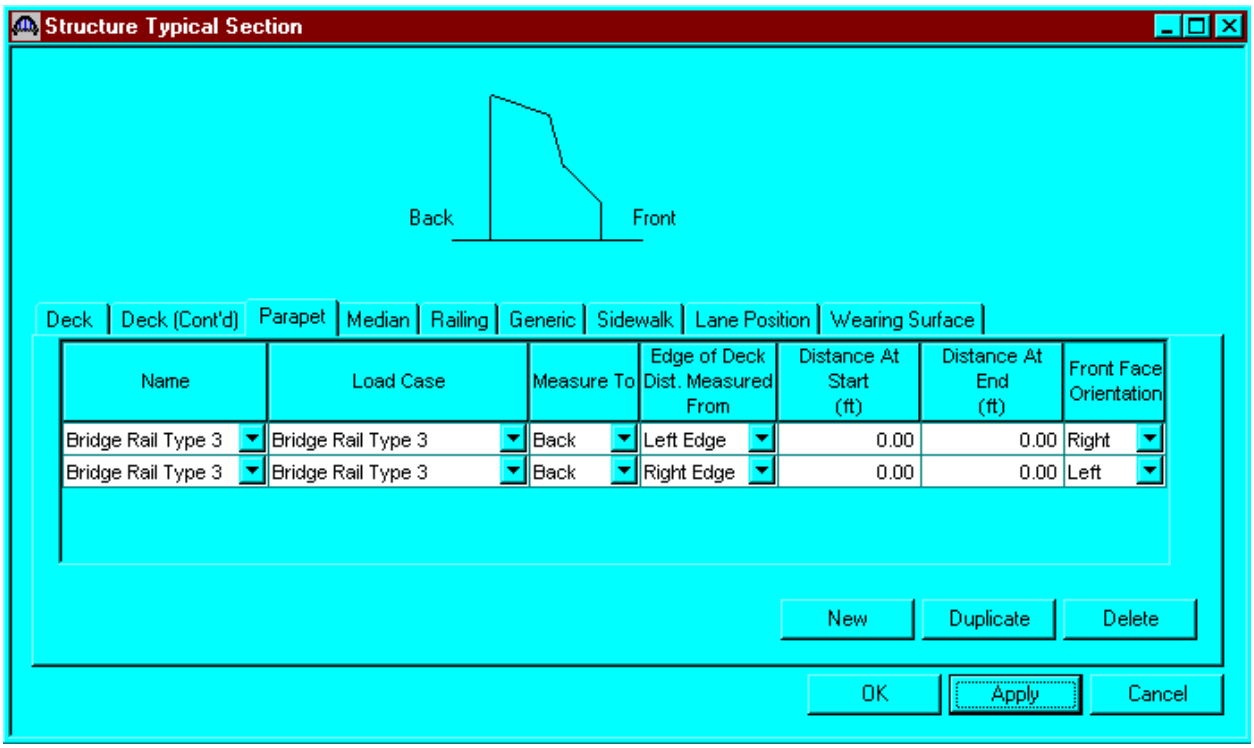
Double click on Structure Typical Section in the Bridge Workspace tree to define the structure typical section. Input the data describing the typical section as shown below.



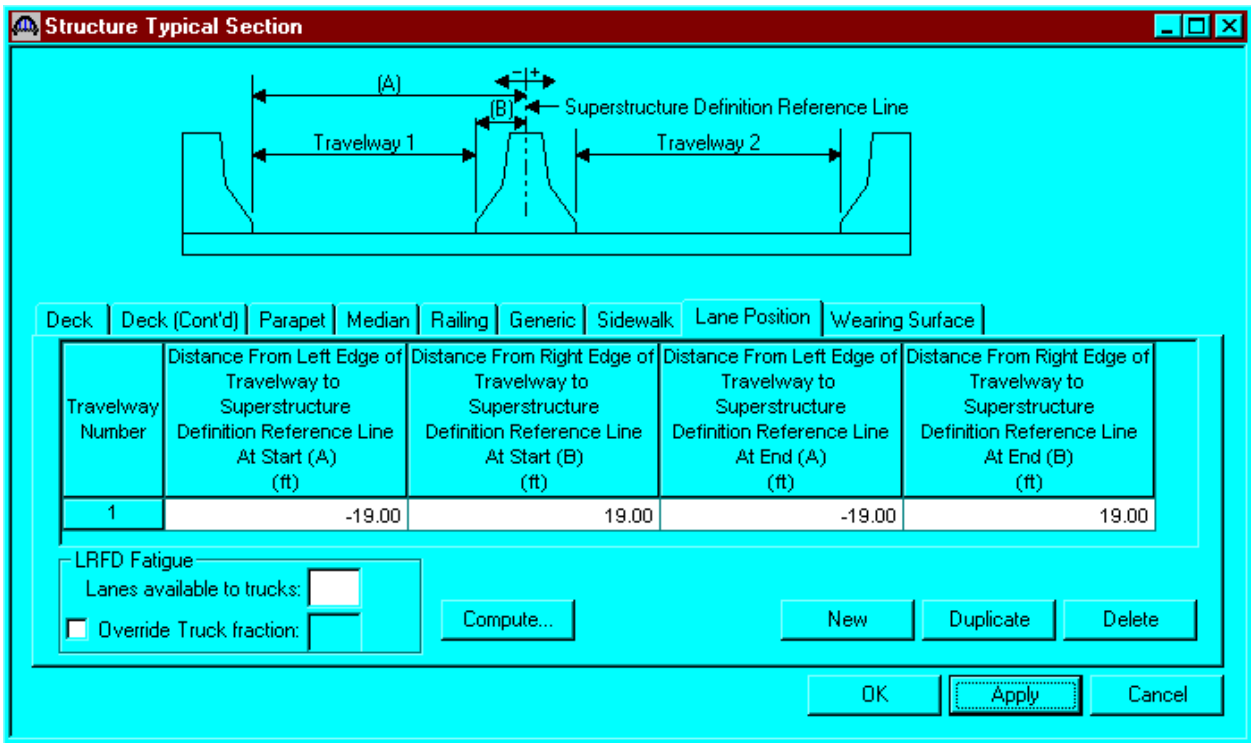
The Deck (Cont'd) tab is used to enter information about the deck concrete and thickness. The material to be used for the deck concrete is selected from the list of bridge materials described previously.



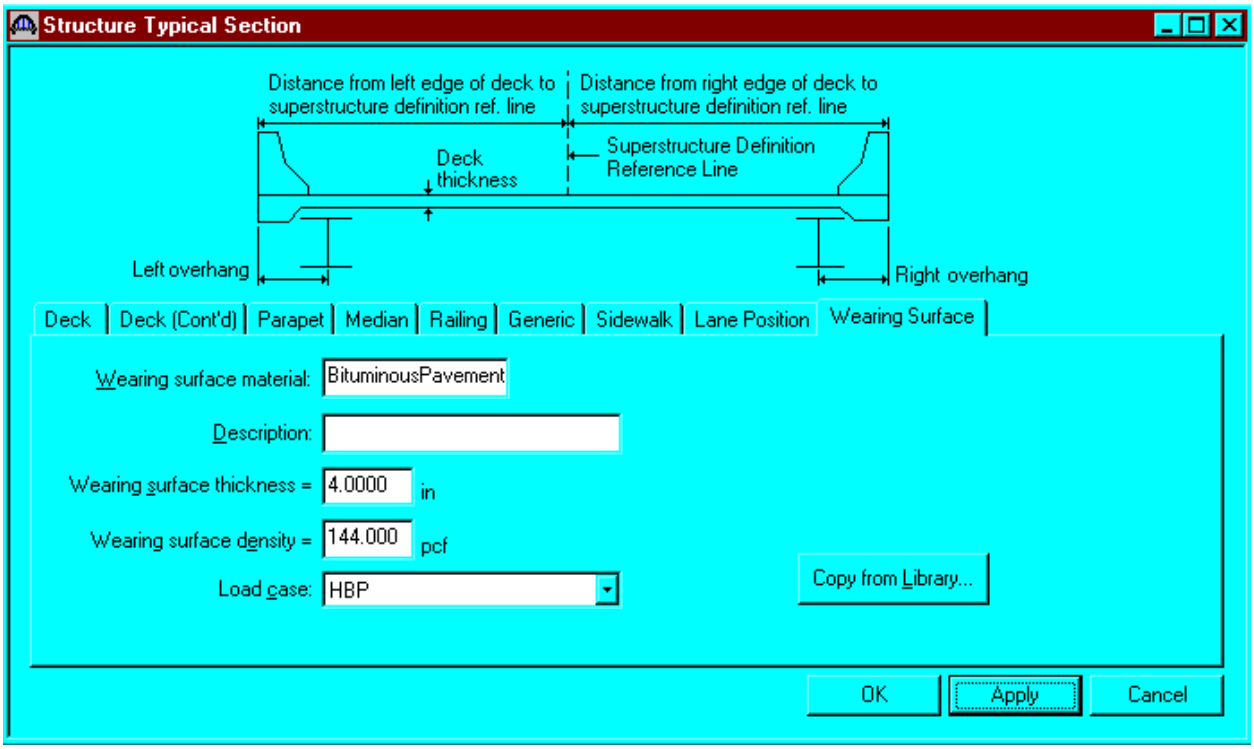
Parapets:
Add two parapets as shown below.



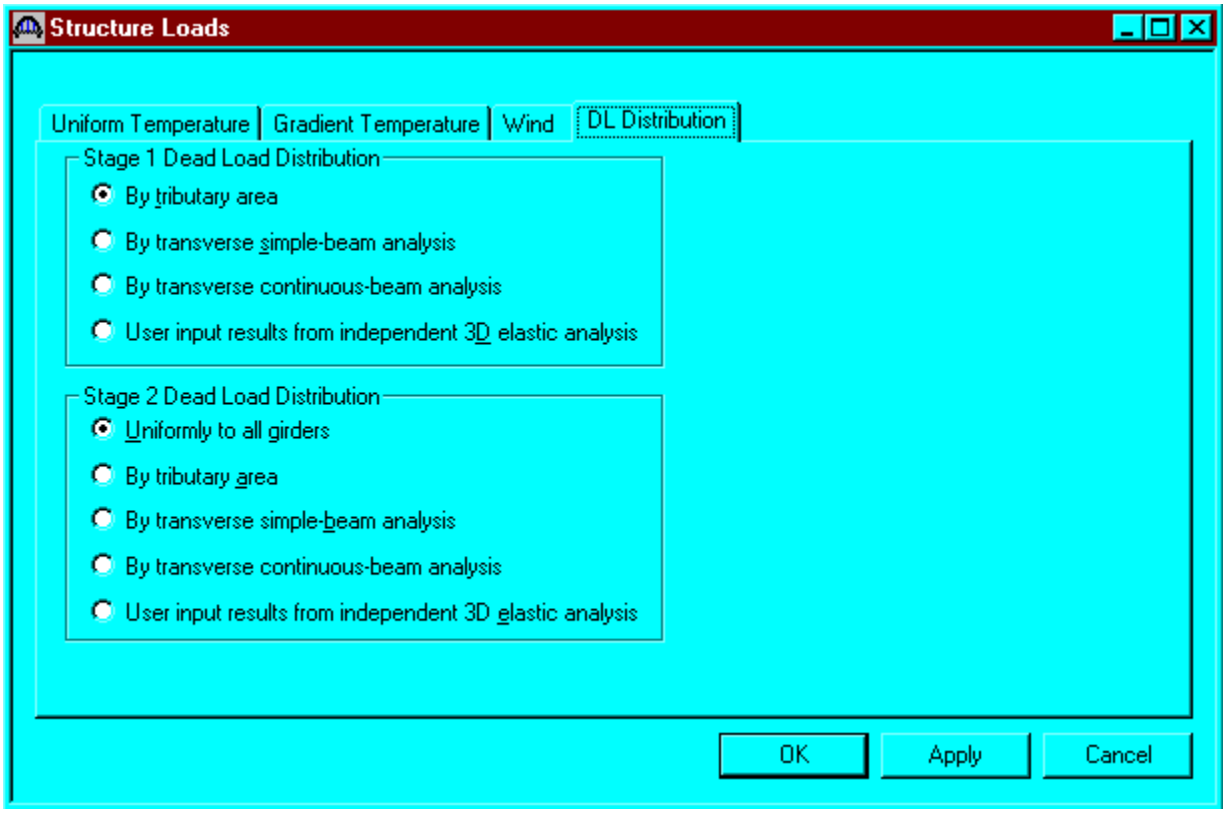
Lane Positions:
Select the lane position tab and use the Compute… button to compute the lane positions. A dialog showing the results of the computation opens. Click Apply to accept the computed values. The Lane Position tab is populated as shown below.



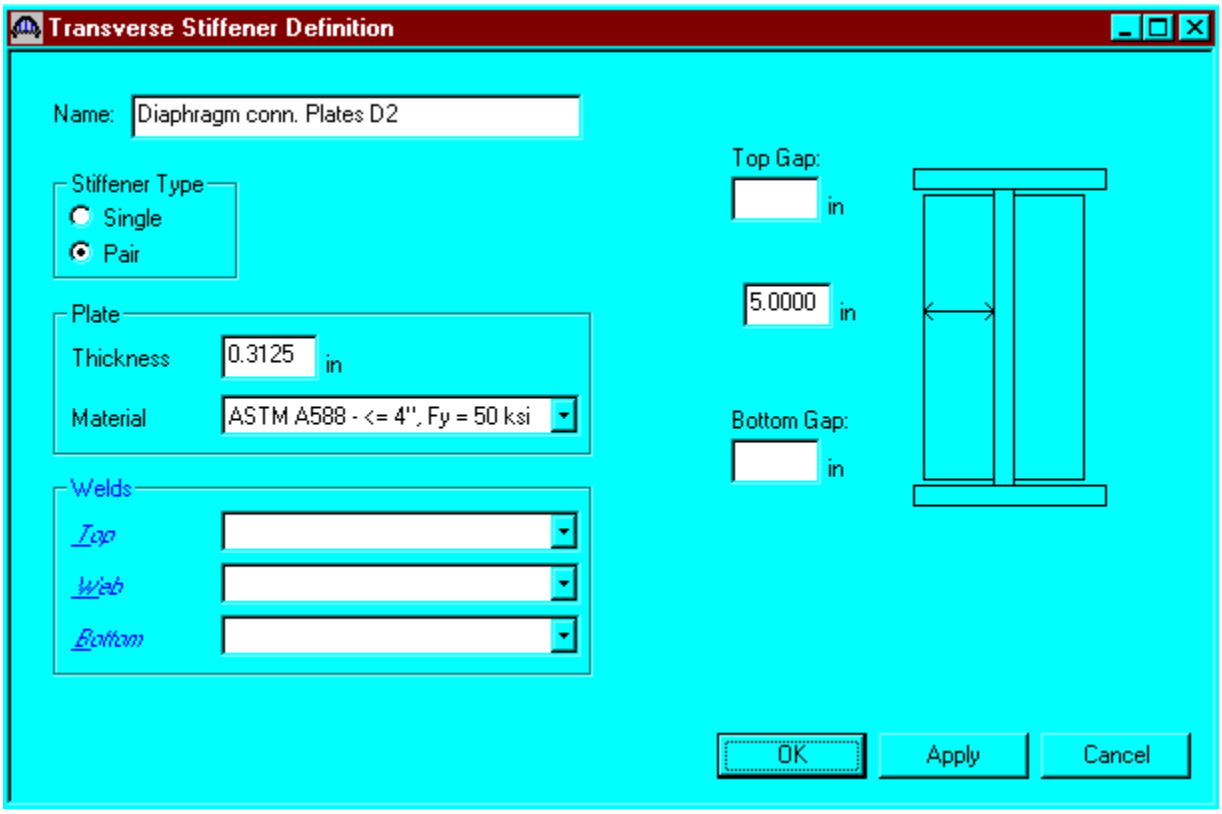
Enter the following wearing surface information on the Wearing Surface tab.

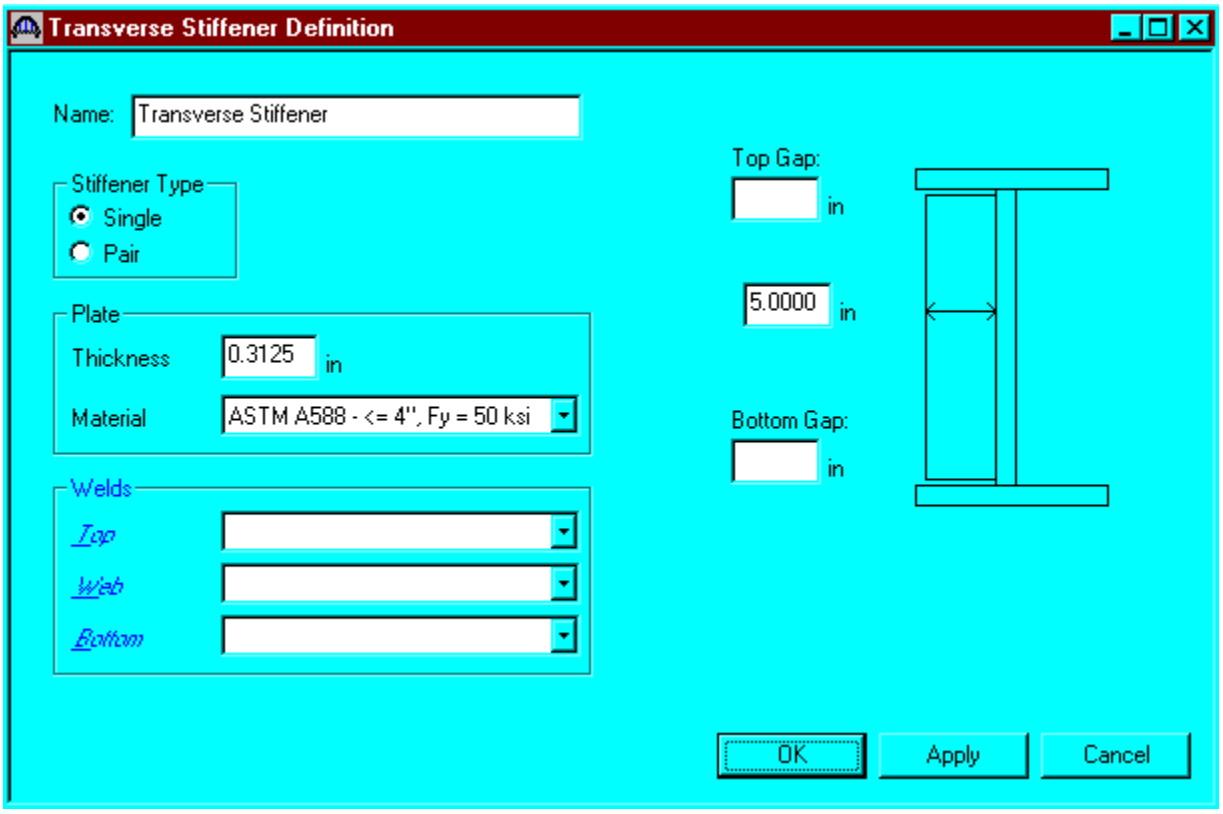


Double click on the Structure Loads tree item to define the DL Distribution. Select the required DL Distribution. Click OK to save this information to memory and close the window.

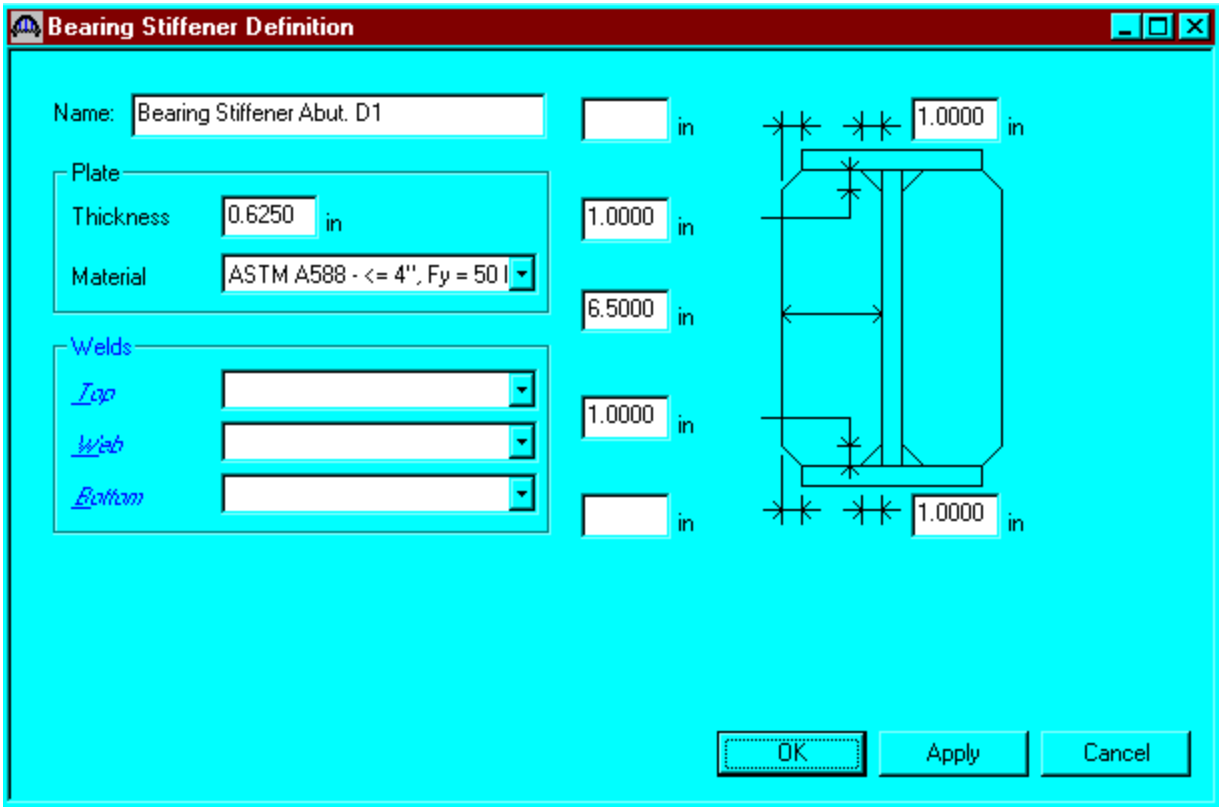


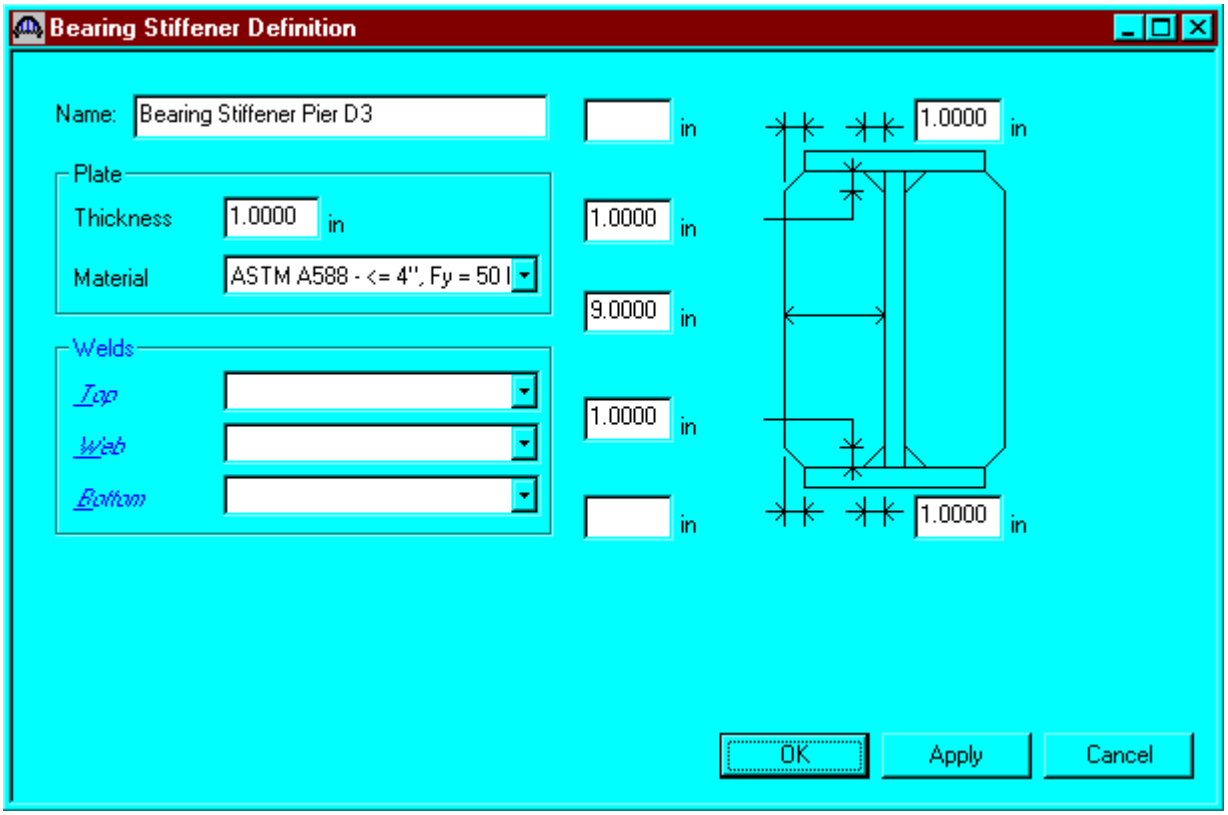
Expand the Stiffener Definitions tree item and double click on Transverse. Define the stiffener as shown below. Click OK to save to memory and close the window.



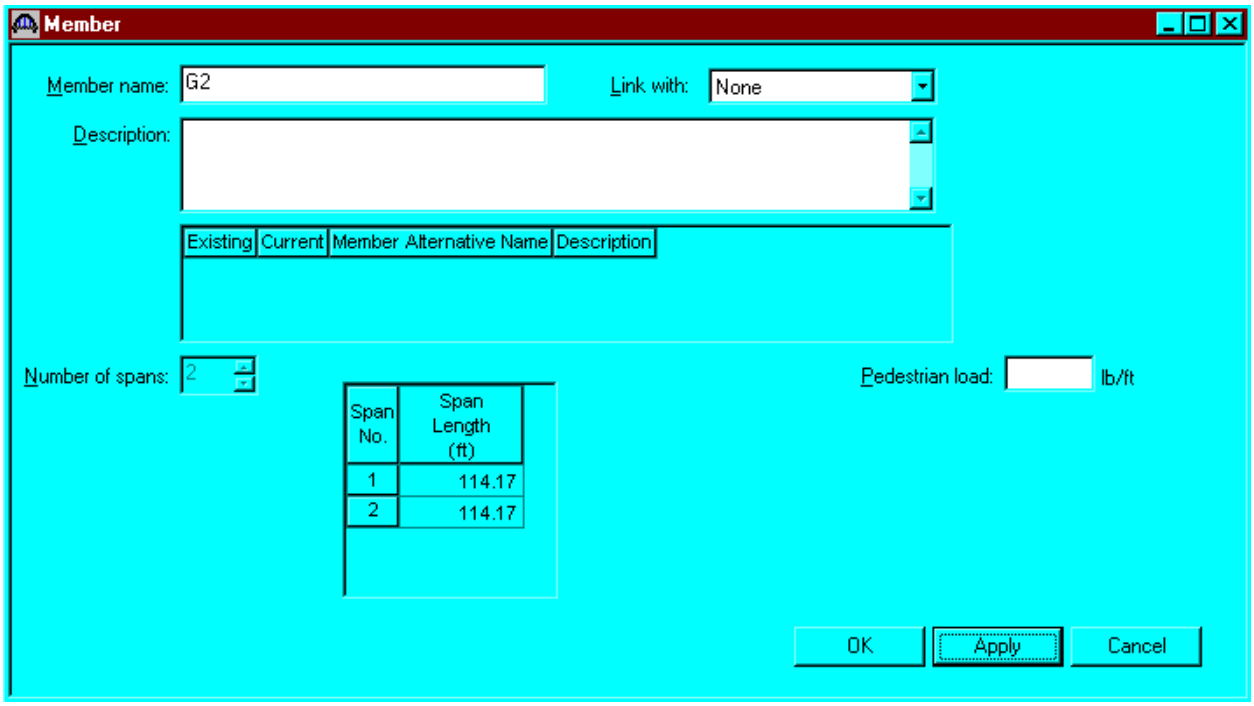


Similarly, define bearing stiffeners by double clicking on Bearing in the tree. Click OK to save to memory and close the window.

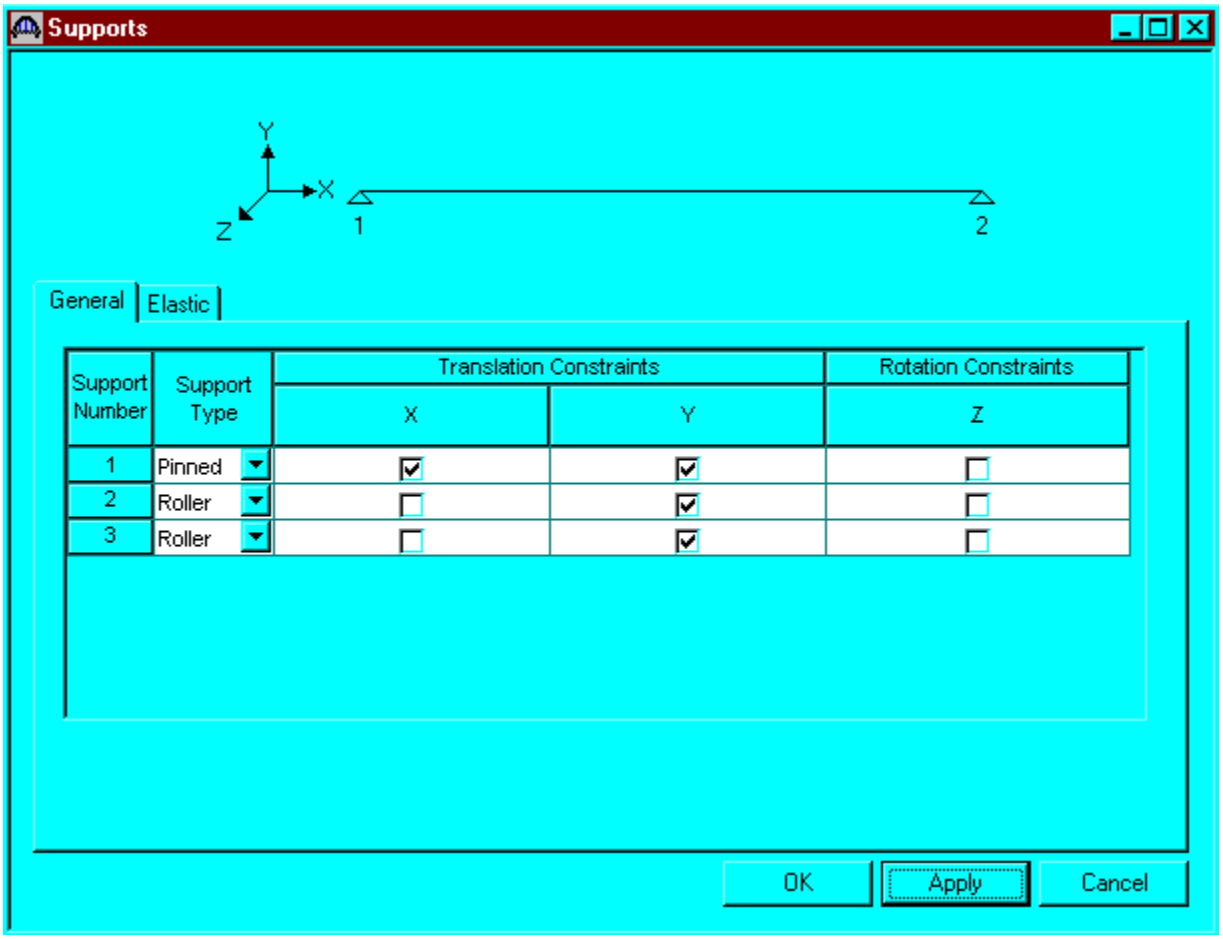

Bearing Stiffener Definition
Name: Bearing Stiffener Abut. D1
Plate
Thickness 0.6250 in
Material ASTM A588 - <= 4", Fy = 50 I
Welds
Top
Web
Bottom
in
1.0000 in
6.5000 in
1.0000 in
in
1.0000 in
1.0000 in
OK
Apply
Cancel


Bearing Stiffener Definition
Name: Bearing Stiffener Pier D3
Plate
Thickness 1.0000 in
Material ASTM A588 - <= 4", Fy = 50 I
Welds
Top
Web
Bottom
in
1.0000 in
9.0000 in
1.0000 in
in
1.0000 in
1.0000 in
OK
Apply
Cancel

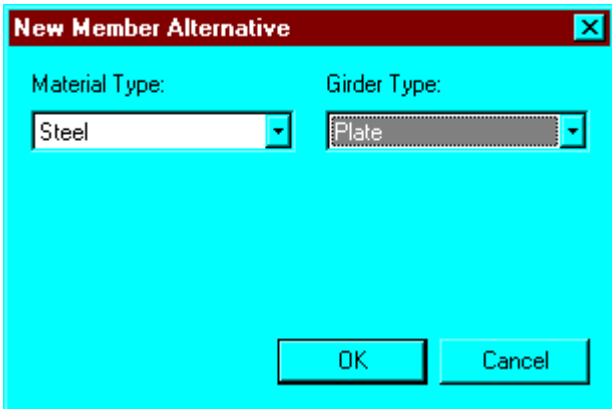
Describing a member:
The member window shows the data that was generated when the structure definition was created. No changes are required at this time. The first Member Alternative that we create will automatically be assigned as the Existing and Current Member alternative for this member.



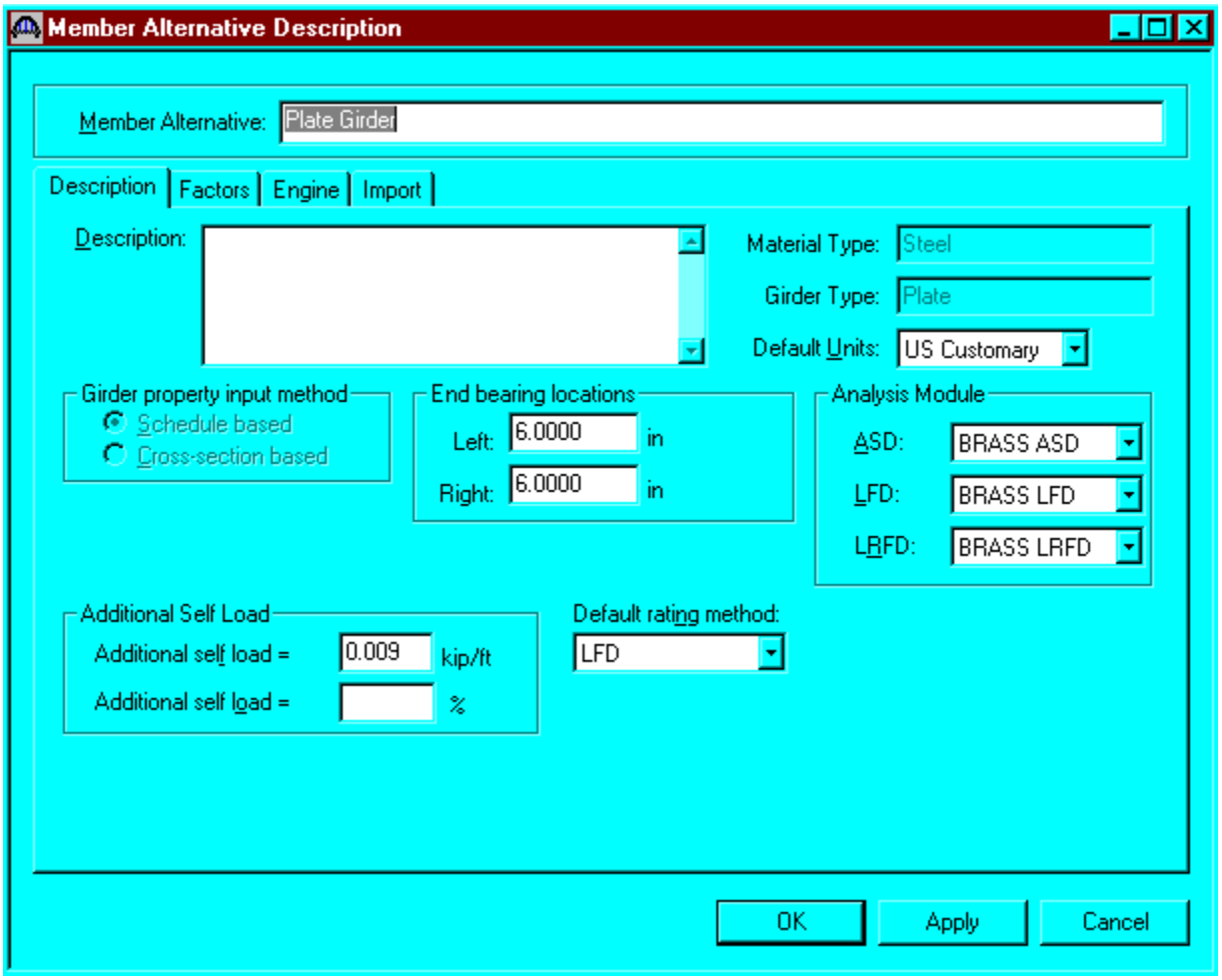
Double click on Supports to define support constraints for the girder. Support constraints were generated when the structure definition was created and are shown below. Click OK to save data to memory and close the window.



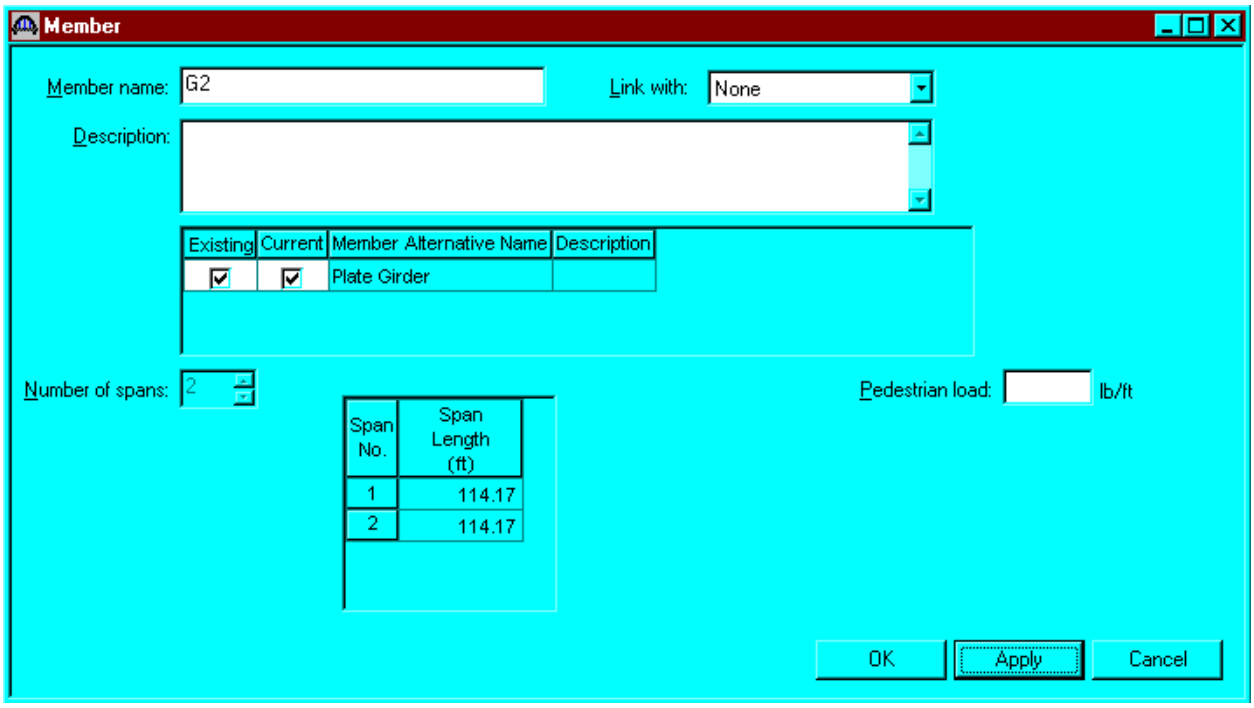
Defining a Member Alternative:
Double click MEMBER ALTERNATIVES in the tree to create a new alternative. The New Member Alternative dialog shown below will open. Select steel for the Material Type and Plate for the Girder Type.



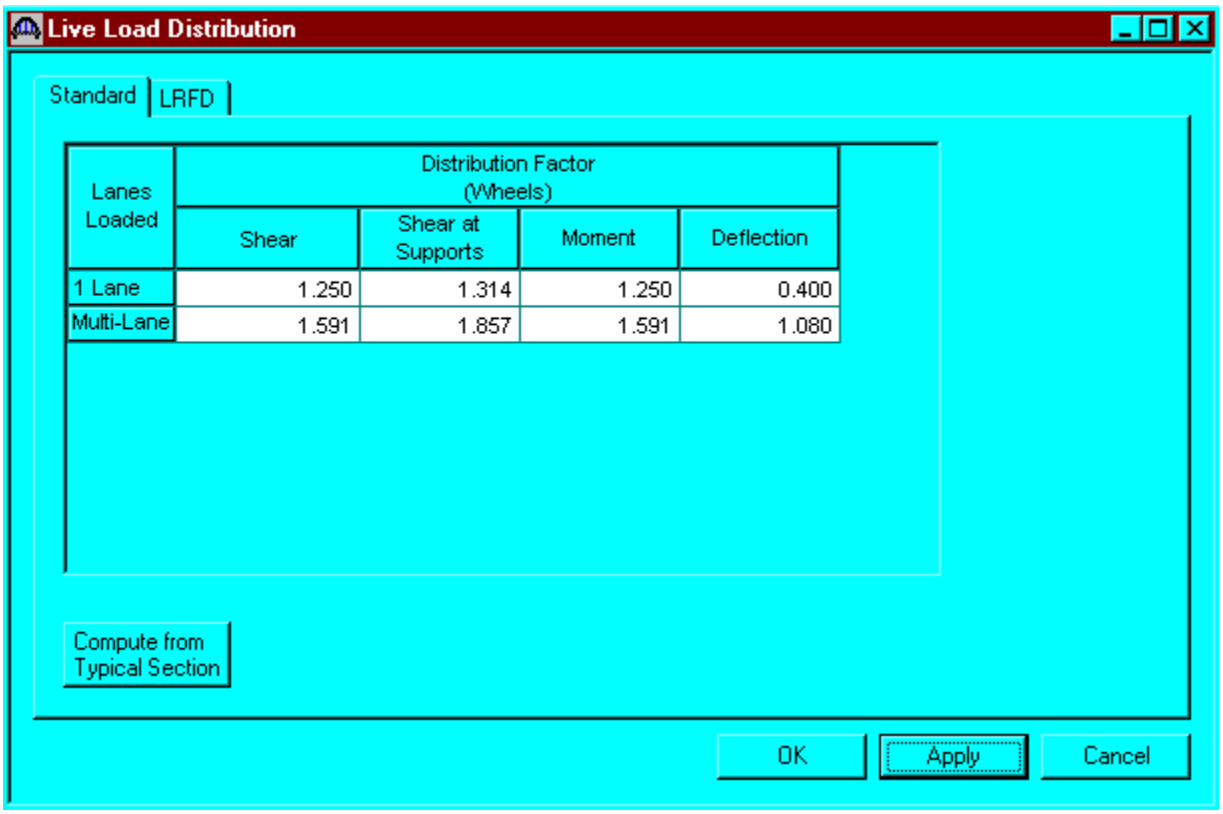
Click OK to close the dialog and create a new member alternative.


Member Alternative Description
Member Alternative:
Plate Girder
Description
Factors
Engine
Import
Description:
Material Type:
Steel
Girder Type:
Plate
Default Units:
US Customary
Girder property input method
Schedule based
Cross-section based
End bearing locations
Left:
6.0000
in
Right:
6.0000
in
Analysis Module
ASD:
BRASS ASD
LFD:
BRASS LFD
LRFD:
BRASS LRFD
Additional Self Load
Additional self load =
0.009
kip/ft
Additional self load =
%
Default rating method:
LFD
OK
Apply
Cancel

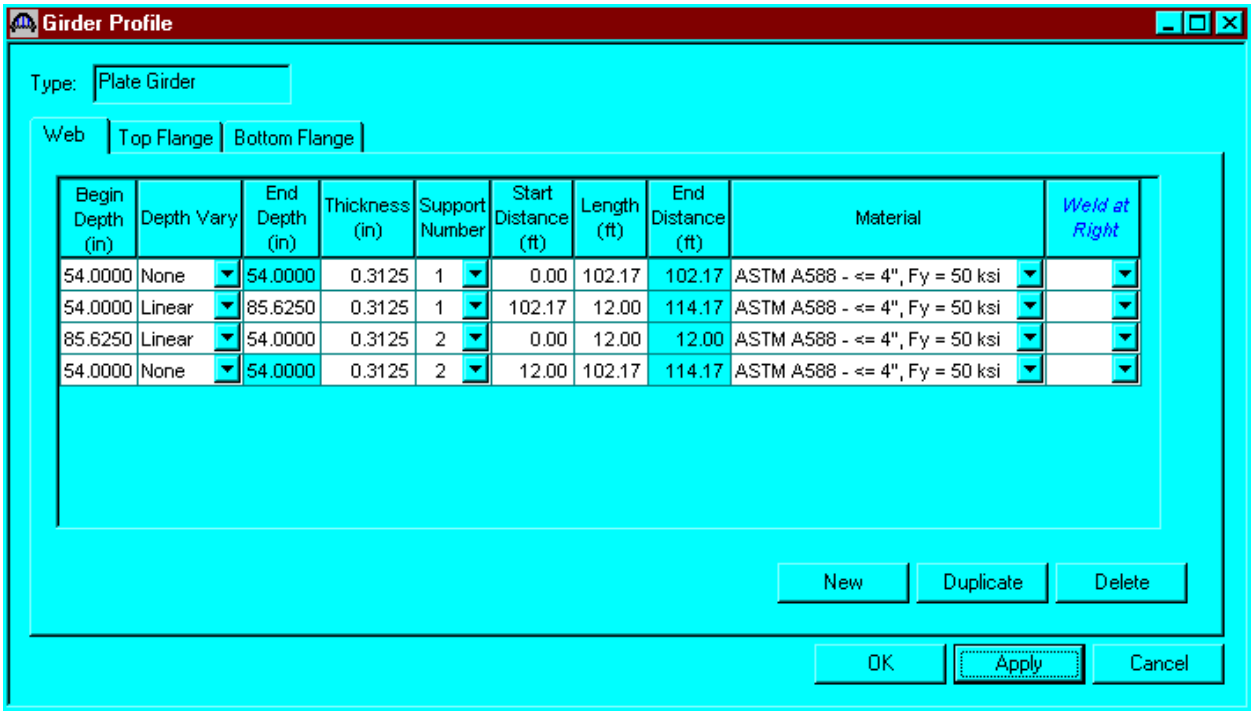
Now re-open the Member G2 window, we will see this Member Alternative designated as the existing and current member alternative for this Member.



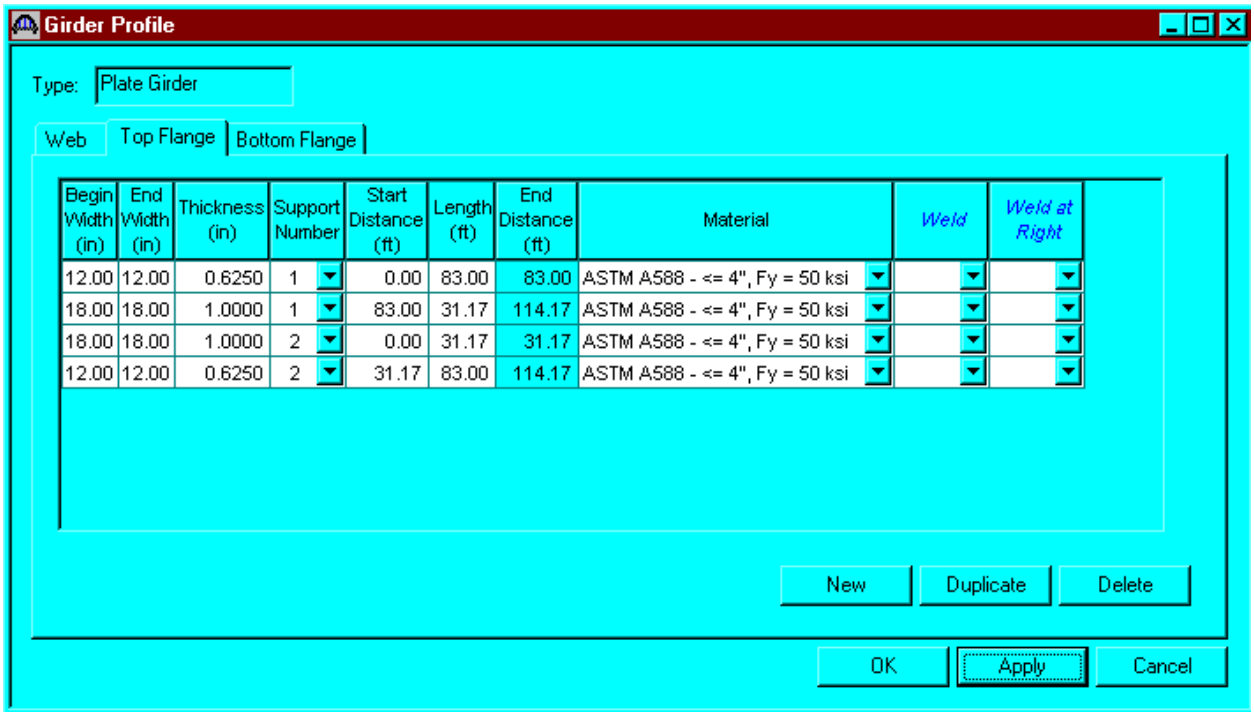
Double click on Live Load Distribution to enter live load distribution factors. Click the Compute from Typical Section button to compute the live load distribution factors. The distribution factors are computed based on the AASHTO Specifications, Articles 3.23. Click Apply and then OK to save data to memory and close the window.

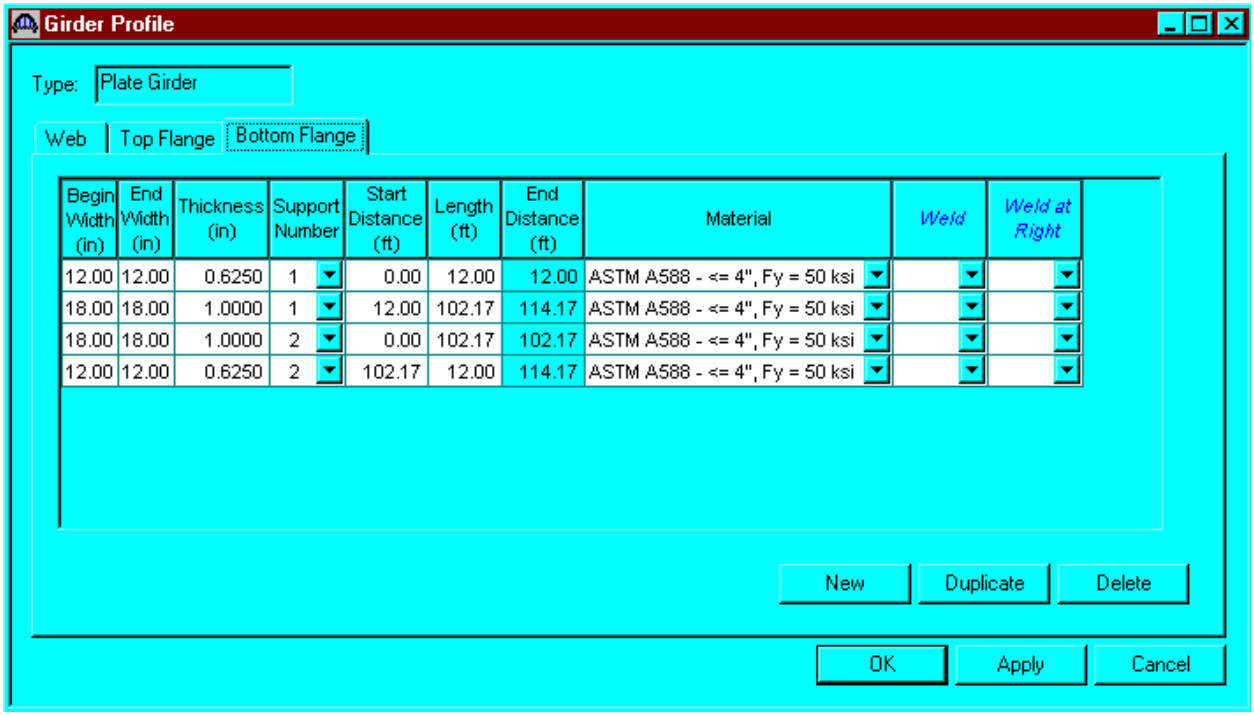


Double click on Girder Profile in the tree to describe the girder profile. The window is shown below with the data describing the web.

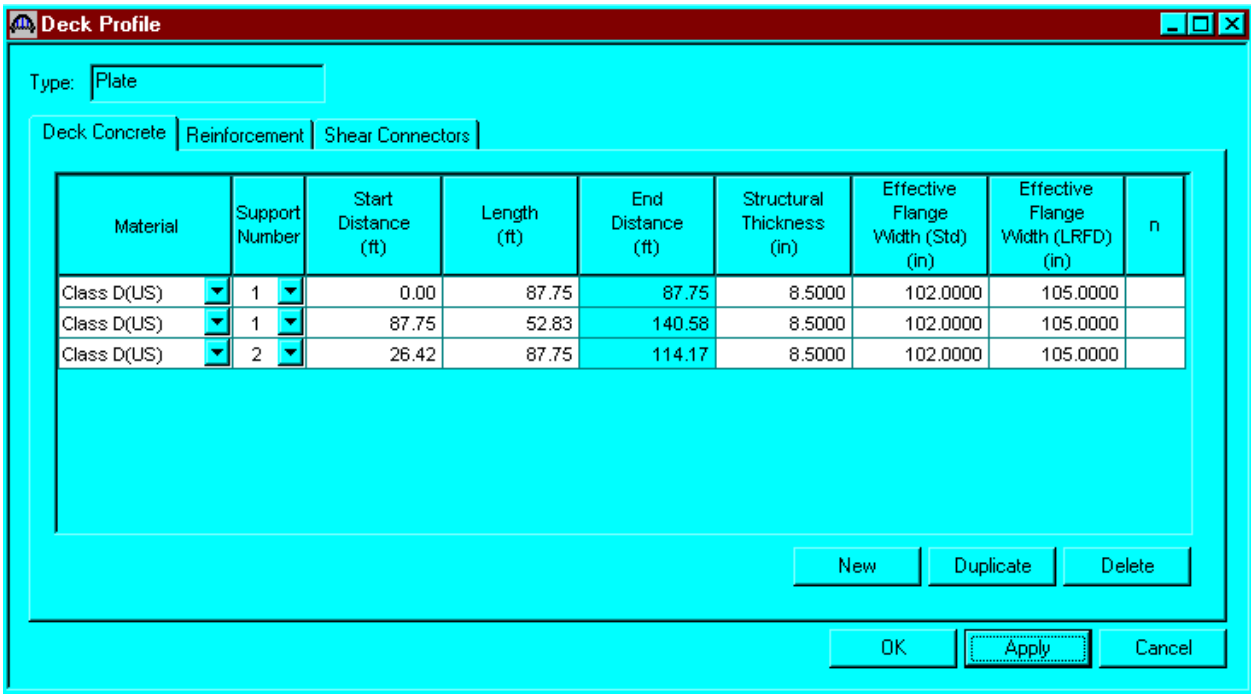


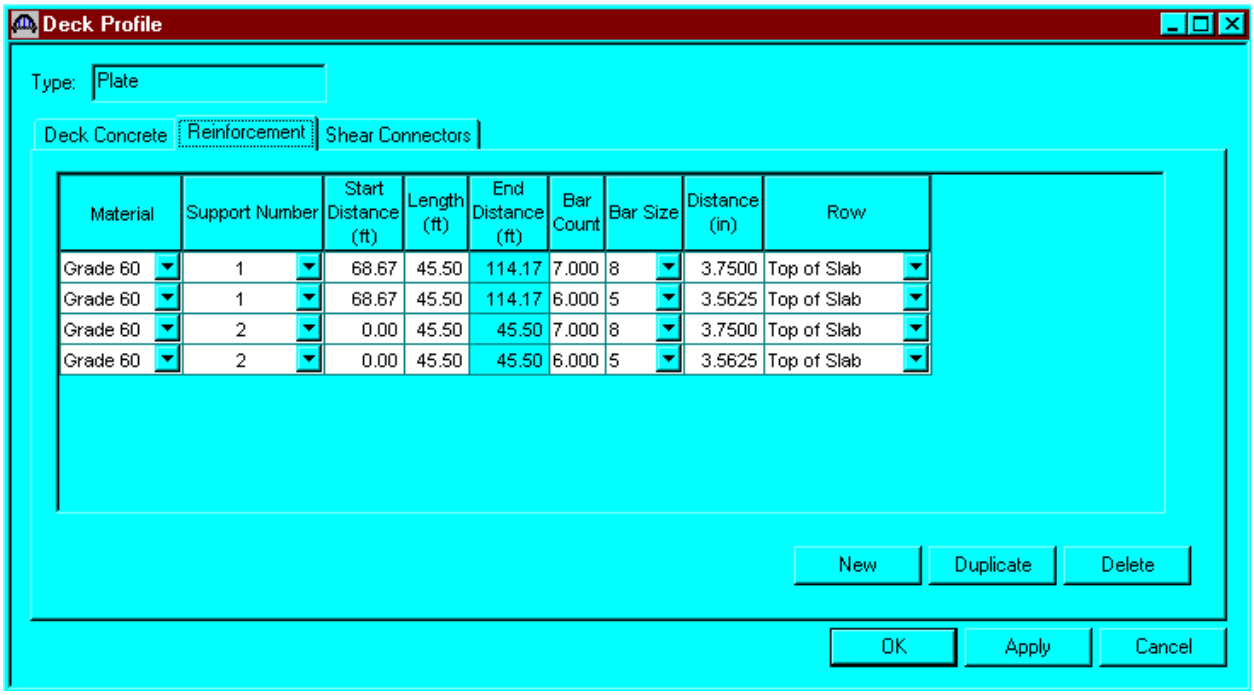
Describe the flanges as shown below.



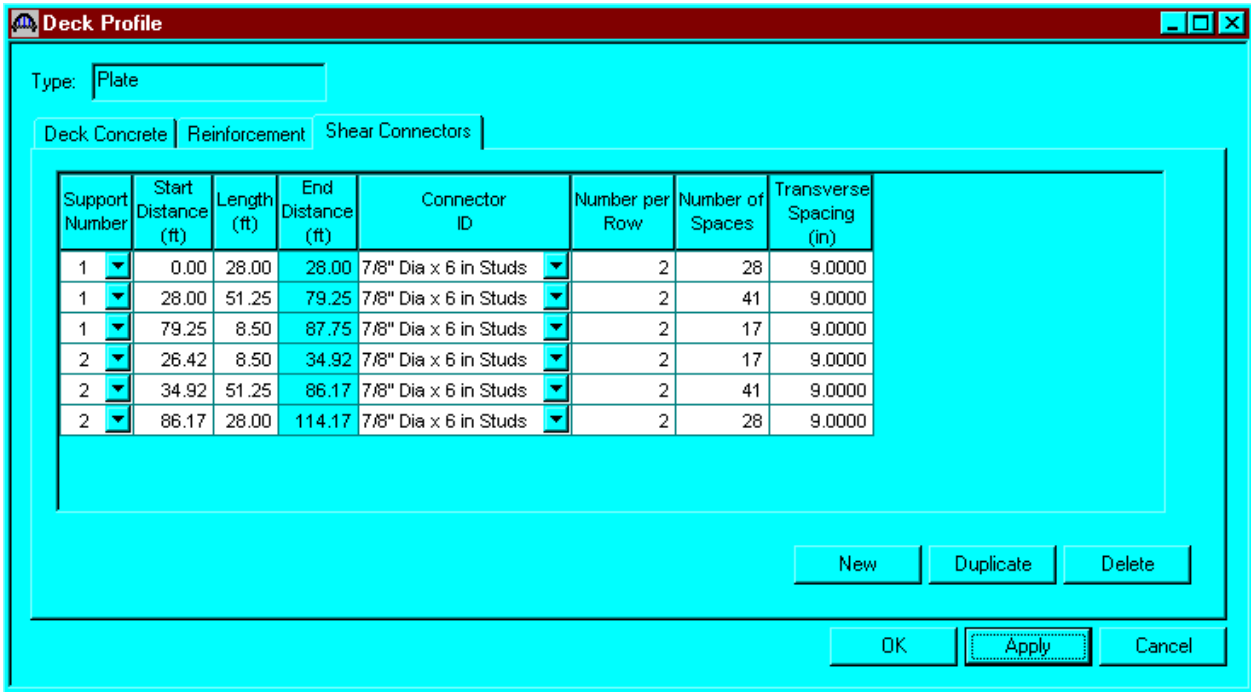


Double click on Deck Profile and enter data describing the structural properties of the deck. The deck concrete and reinforcement windows are shown below.

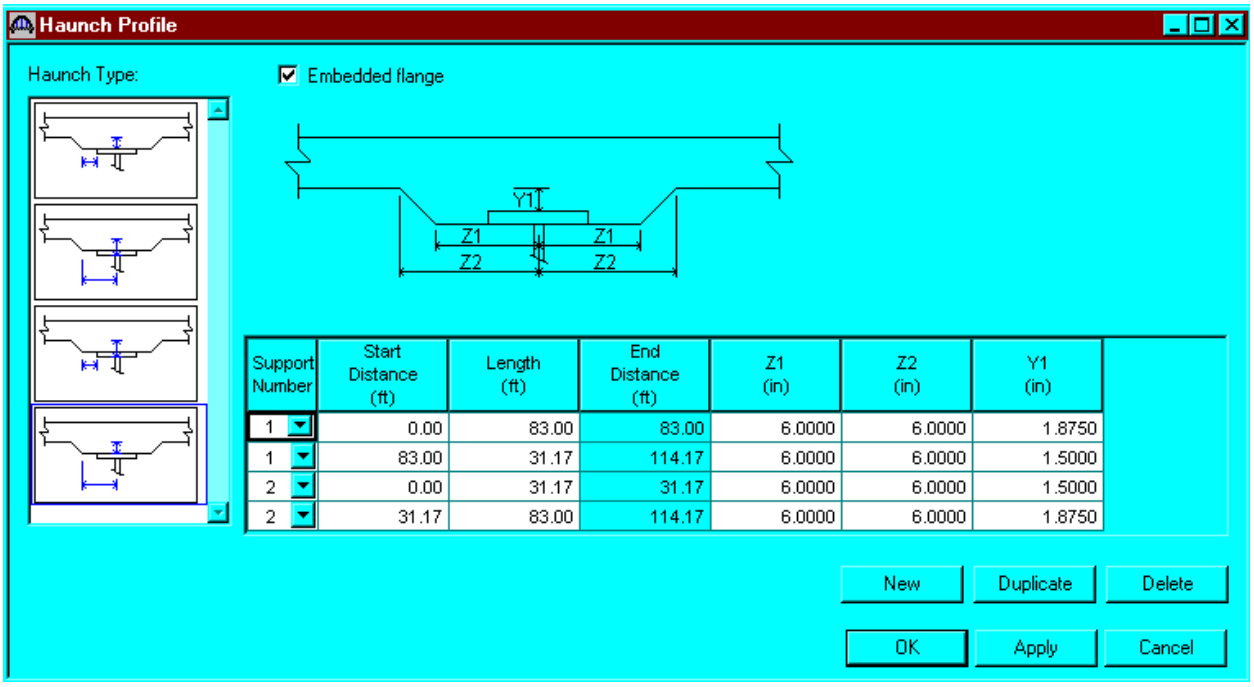




Composite regions are described using the Shear Connectors tab as shown below.

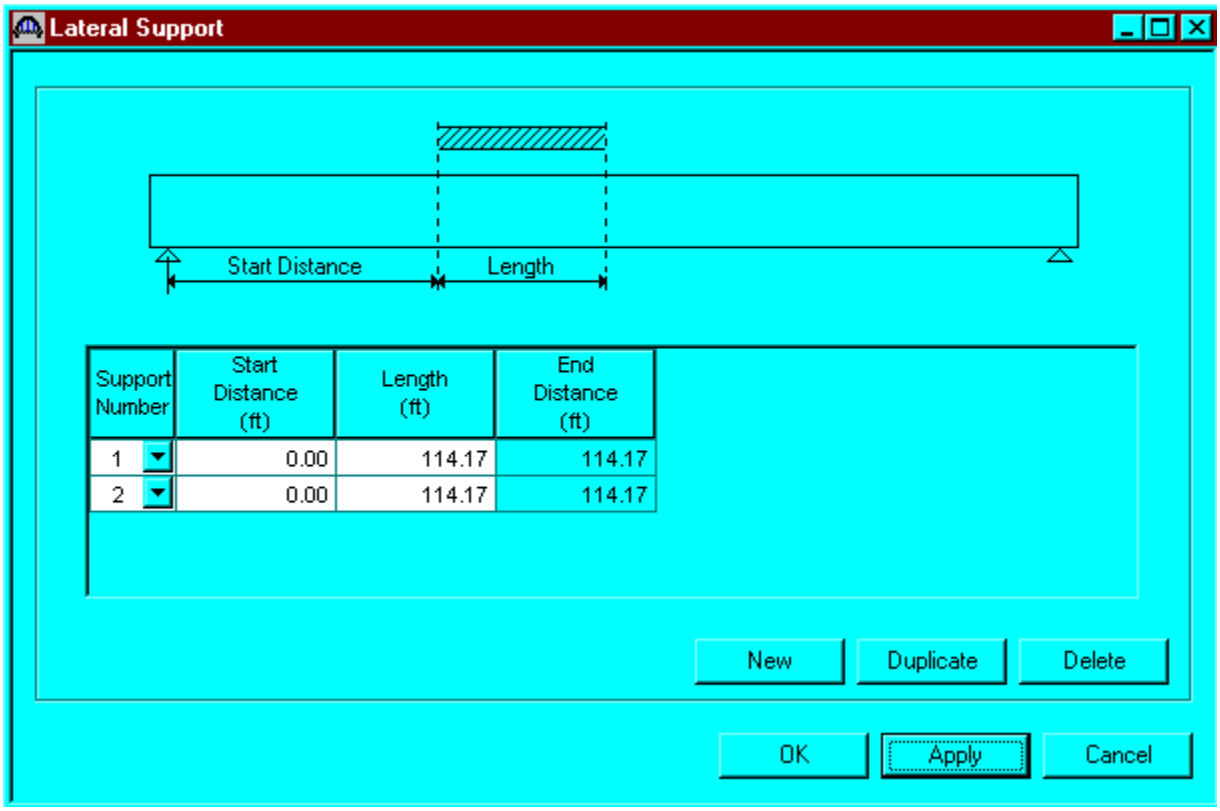


Double click on Haunch Profile in the tree to define the haunch profile. Check the box ‘embedded flange’ if the top flanges of the girder is embedded in the concrete haunch.

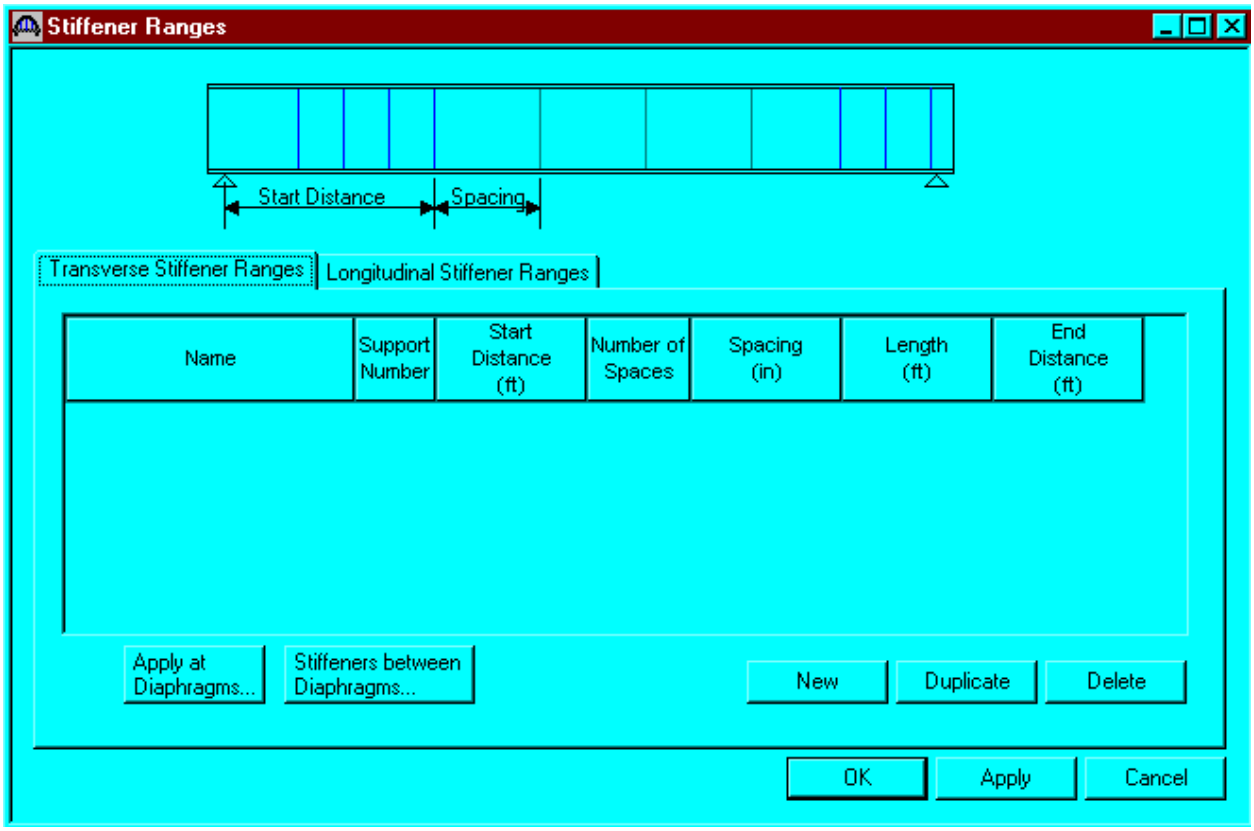


Support Number	Start Distance (ft)	Length (ft)	End Distance (ft)	Z1 (in)	Z2 (in)	Y1 (in)
1	0.00	83.00	83.00	6.0000	6.0000	1.8750
1	83.00	31.17	114.17	6.0000	6.0000	1.5000
2	0.00	31.17	31.17	6.0000	6.0000	1.5000
2	31.17	83.00	114.17	6.0000	6.0000	1.8750

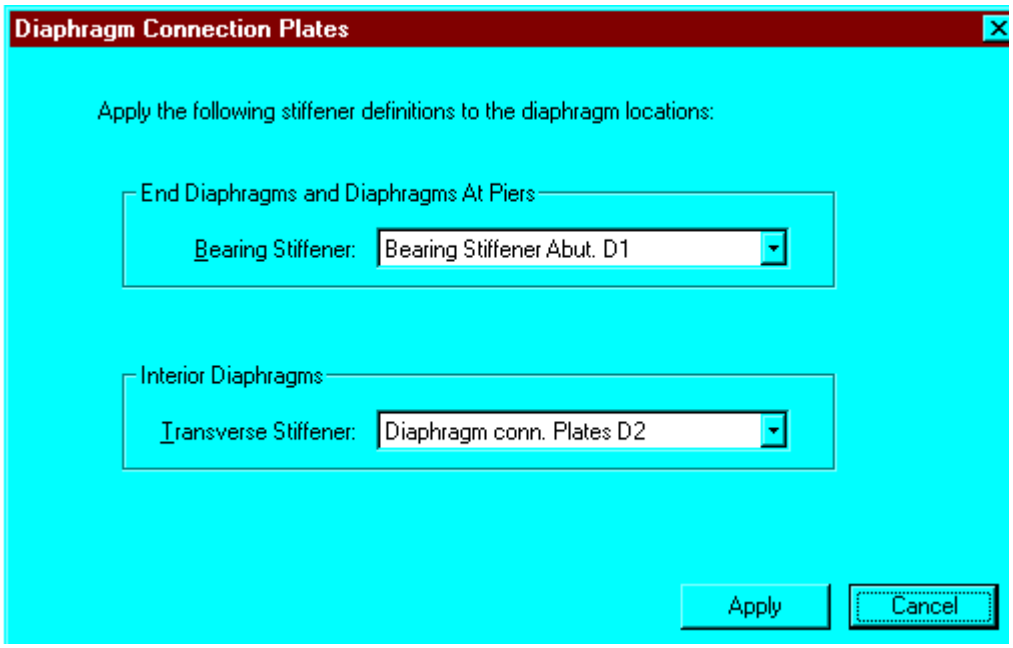
Regions where the hardened concrete deck slab is considered to provide lateral support for the top flange are defined using the Lateral Support window.



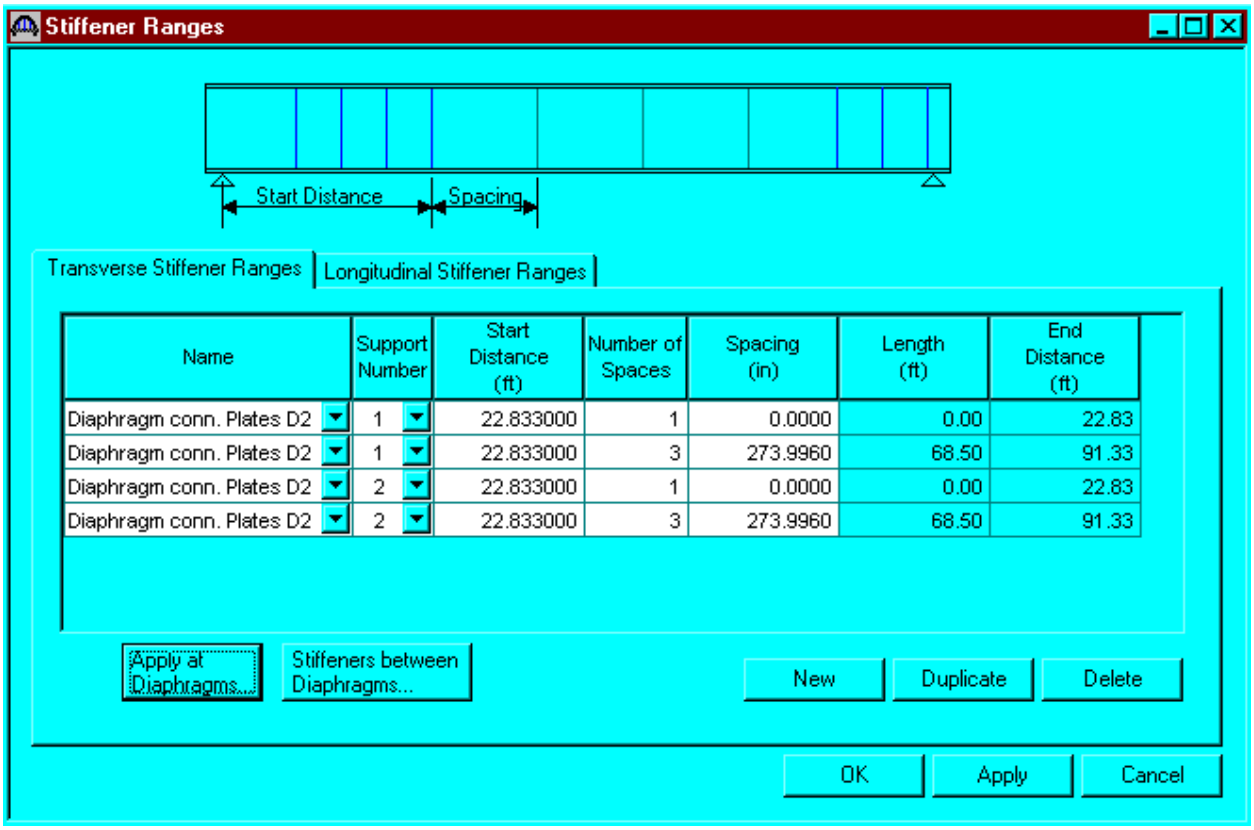
Define stiffener locations using the Stiffener Ranges window shown below.



Click on the Apply at Diaphragms... to open the following dialog box. Select the Diaphragm connection Plates D2 as the stiffener to be applied at interior diaphragms.

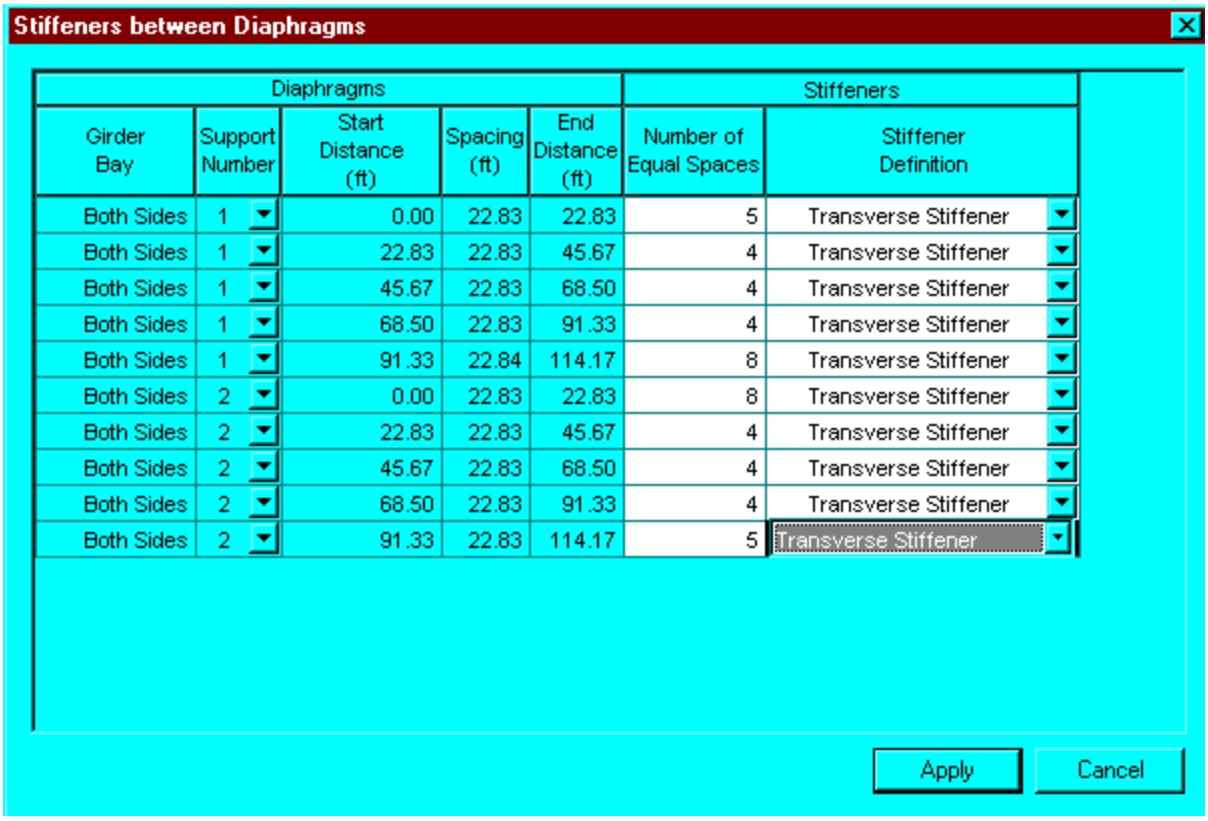


Selecting Apply button will create the following transverse stiffener locations.



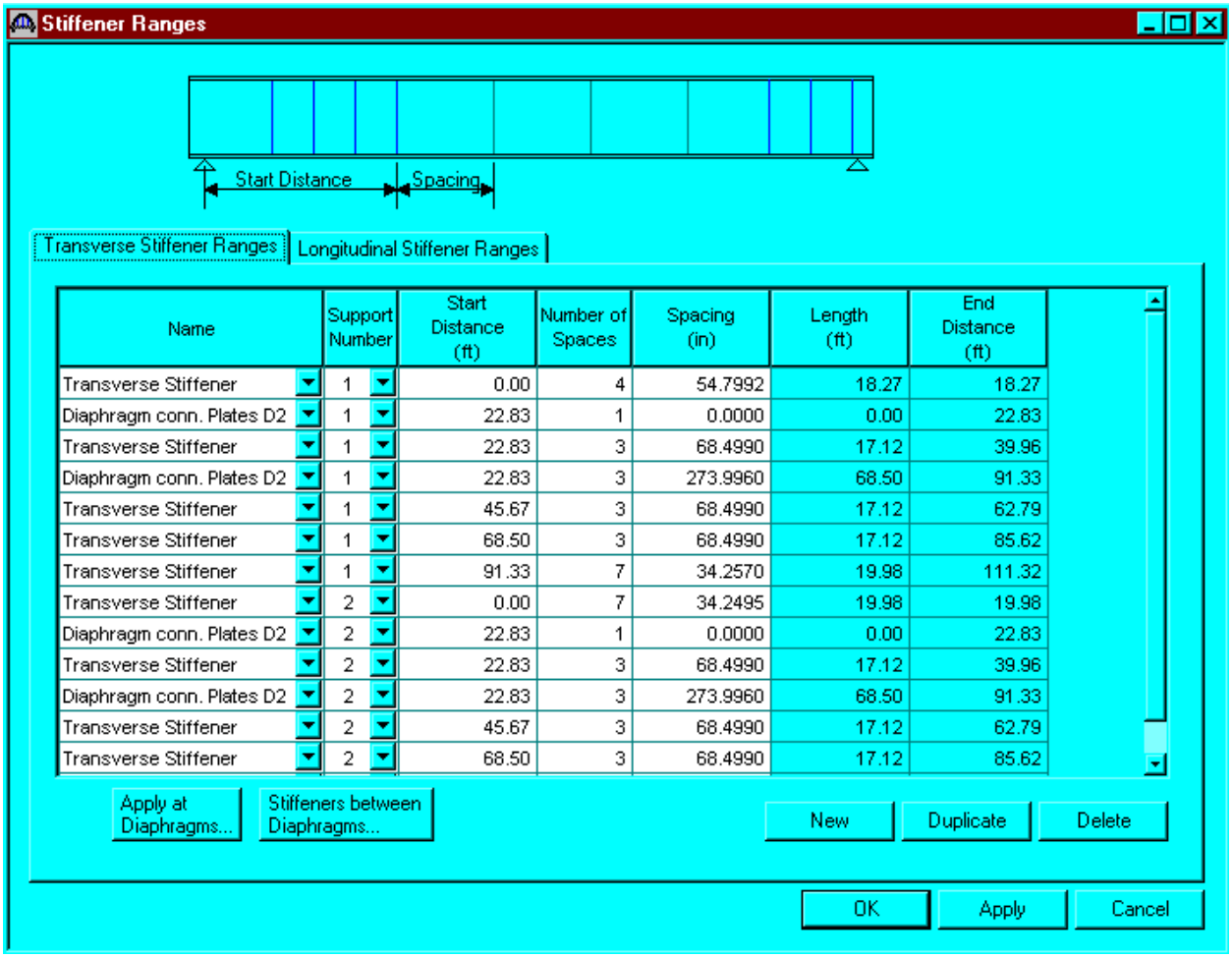
This structure has intermediate transverse stiffeners between diaphragms. Click on the Stiffeners between Diaphragms... button to open the following window.

Enter the appropriate stiffener data i.e., the number of equal spaces between diaphragms and the stiffener definition.



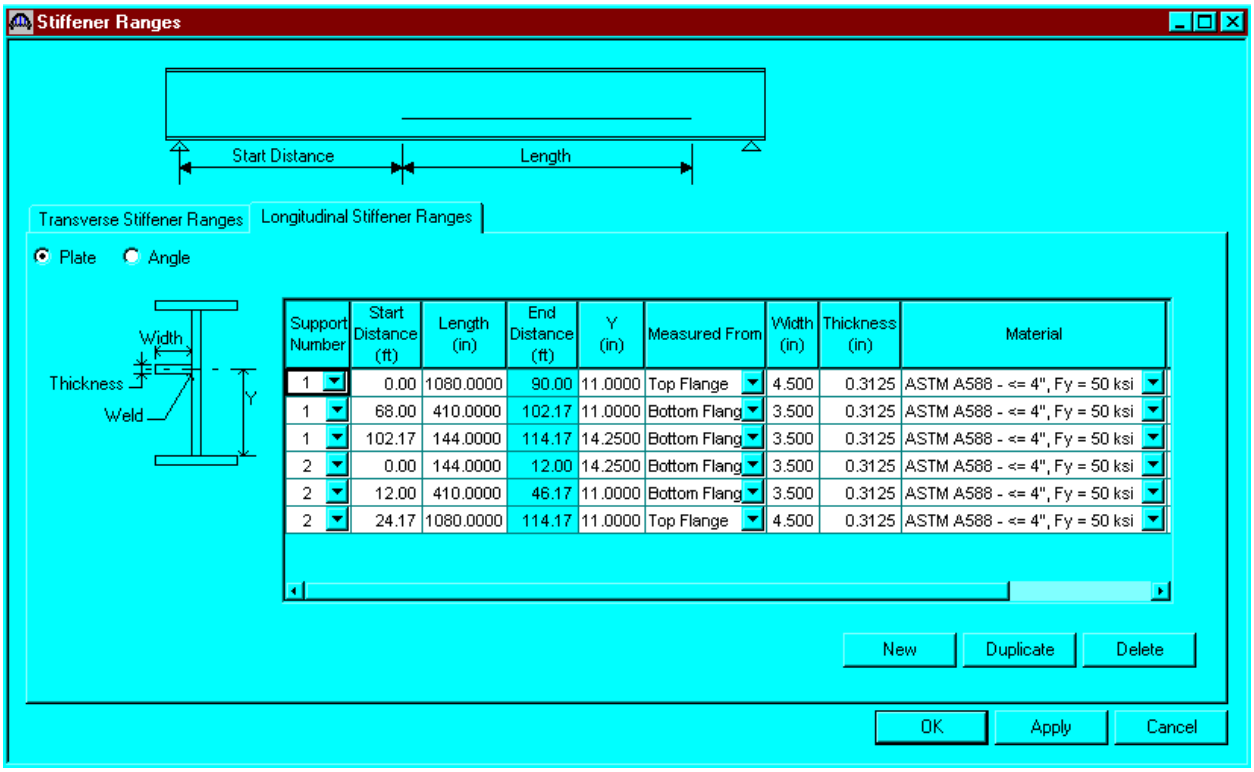
Click the Apply button.

The populated Transverse Stiffener Ranges window is shown below. Click on the Apply button to save the data to memory.

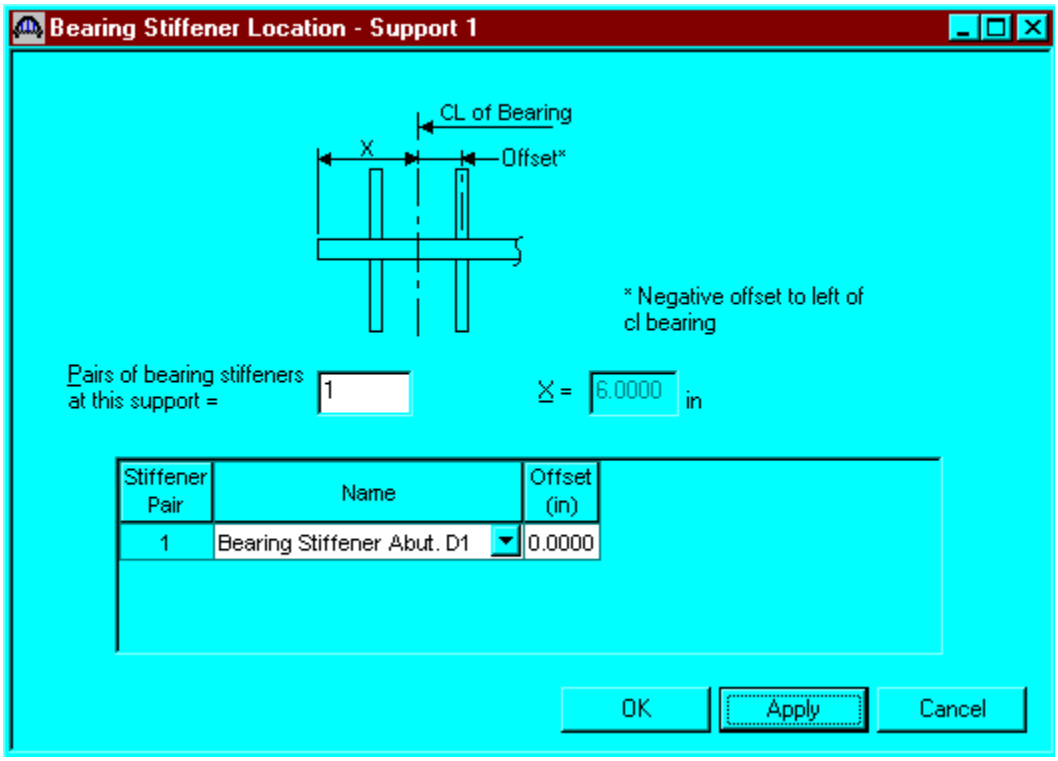


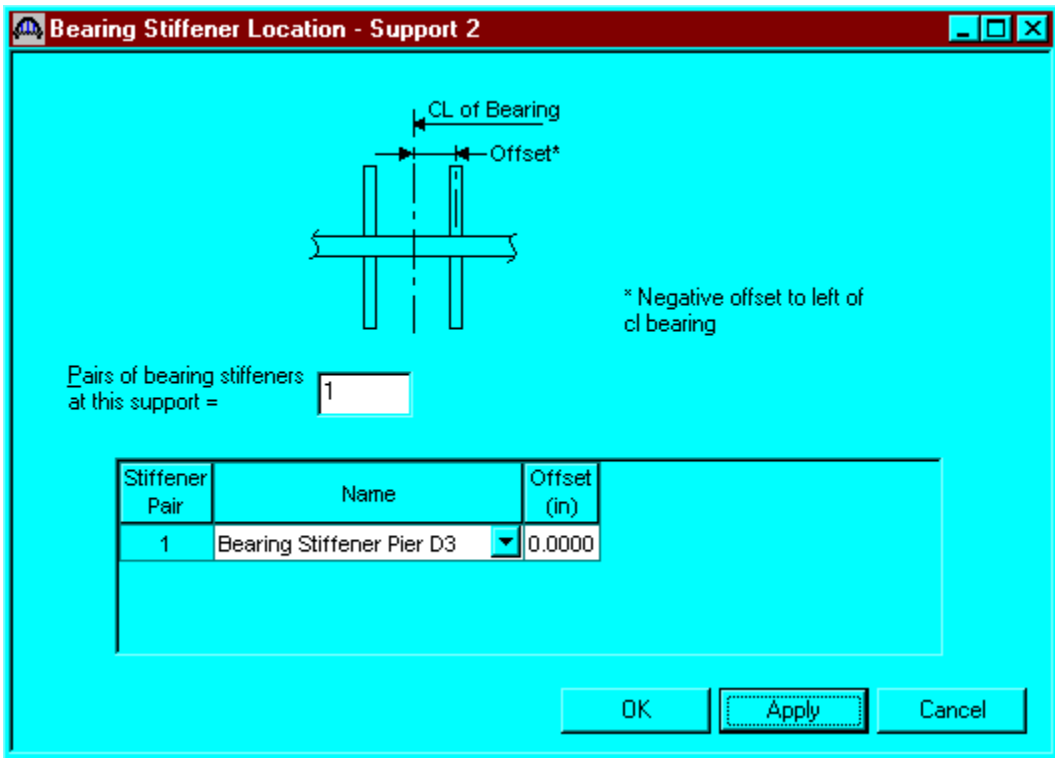
Click on the Longitudinal Stiffener Ranges tab to define the limits of longitudinal stiffeners.

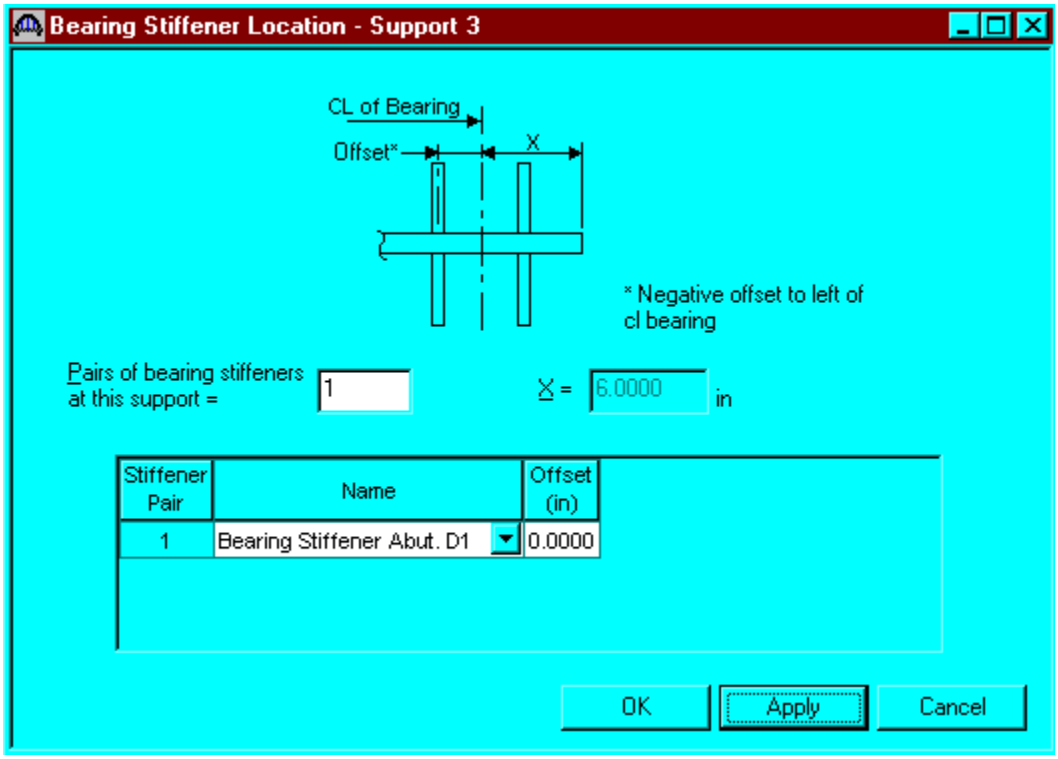
Enter the appropriate stiffener data and click the Apply button to save the data to memory and close the window.



Bearing stiffener definitions were assigned to locations when we used the Apply at Diaphragms... button on the Transverse Stiffener Ranges window. Open the window by expanding the Bearing Stiffener Locations branch in the tree and double clicking on each support. The assignment for support 1, 2 and 3 are shown below.






Bearing Stiffener Location - Support 3
CL of Bearing
Offset*
X
* Negative offset to left of cl bearing
Pairs of bearing stiffeners at this support =
1
X =
6.0000
in
Stiffener Pair
Name
Offset (in)
1
Bearing Stiffener Abut. D1
0.0000
OK
Apply
Cancel

Select Plate Girder (E)(C) in the Bridge Workspace tree; open the schematic for the girder profile by selecting the View Schematic toolbar button or the Bridge/Schematic from the menu.

The results of the control LFD rating analysis are as follows:

Wyoming Department of Transportation, Bridge Design Division Page 144
Date 04/10/2002
Member: G2

RATING FACTOR REPORT
ANALYSIS POINT NO. 5: 104.00

LOAD LEVELS	TRUCK DESCRIPTION
1: 1.30(1.00 * D + 1.67 * L)	1. Truck: AASHTO H 20-S 16 Loading, 1944 Ed
2: 1.00(1.00 * D + 1.67 * L)	2. Truck: AASHTO H 20-S 16 Loading, 1944 Ed
3: 1.30(1.00 * D + 1.00 * L)	3. Truck: 96 Tons Vehicle
4: 1.00(1.00 * D + 1.00 * L)	4. SPECIAL-LOAD

STRENGTH

	LOAD LEVEL 1	LOAD LEVEL 2	LOAD LEVEL 3	LOAD LEVEL 4
FLEXURE				
TRUCK 1	01.22	N/A	02.04	N/A
TRUCK 2	01.45	N/A	02.42	N/A
TRUCK 3	00.68	N/A	01.13	N/A
CRITICAL	00.68	N/A	01.13	N/A
REINFORCEMENT				
TRUCK 1	N/A	N/A	N/A	N/A
TRUCK 2	N/A	N/A	N/A	N/A
TRUCK 3	N/A	N/A	N/A	N/A
CRITICAL	N/A	N/A	N/A	N/A
SHEAR				
TRUCK 1	01.58	N/A	02.65	N/A
TRUCK 2	02.00	N/A	03.35	N/A
TRUCK 3	01.12	N/A	01.87	N/A
CRITICAL	01.12	N/A	01.87	N/A
BEARING				
TRUCK 1	N/A	N/A	N/A	N/A
TRUCK 2	N/A	N/A	N/A	N/A
TRUCK 3	N/A	N/A	N/A	N/A
CRITICAL	N/A	N/A	N/A	N/A

I = 1.22(36) = 43.9 TONS

O = 2.04(36) = 73.4 TONS

Permit = 1.13(96) = 108.5 TONS

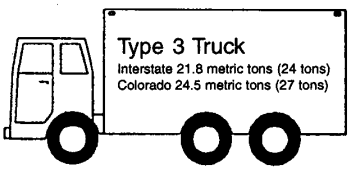
COLORADO DEPARTMENT OF TRANSPORTATION

LOAD FACTOR RATING SUMMARY

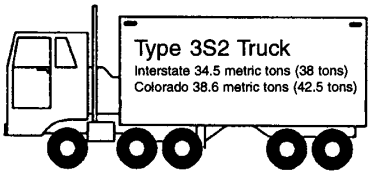
Structure #	N-17-BP(N.B.)
State highway #	I-25
Batch I.D.	
Structure type	WGCK
Parallel structure #	N-17-AM(S.B.)

Rated using
Asphalt thickness: 100 mm (4 in.)
☐ Colorado legal loads
☒ Interstate legal loads

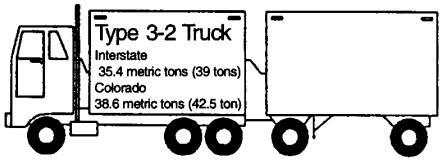
Structural member	INTERIOR GIRDER	SLAB		
	Metric tons (Tons)			
Inventory	40.0 (44)	32.7 (36)	( )	( )
Operating	66.4 (73)	53.6 (59)	( )	( )
Type 3 truck	( )	( )	( )	( )
Type 3S2 truck	( )	( )	( )	( )
Type 3-2 truck	( )	( )	( )	( )
Permit truck	98.2 (108)	( )	( )	( )



_____ (_____)
Metric tons Tons



_____ (_____)
Metric tons Tons



_____ (_____)
Metric tons Tons

Comments

Control Member: Deck; Rated for 4" HBP
Load Capacity: 59 Tons
Girder: Only Interior Girder Rated; Rated for 4" HBP

Color Code: White

Project No: I25-1(88)
Note: Although Virtis performs the required flexure, shear and bearing capacity check during analysis, shear check has been omitted in the determination of girder load capacity.

Rated by	Date	Checked by	Date

Previous editions are obsolete and may not be used

CDOT Form #1187a 1/95