Michael Baker INTERNATIONAL

We Make a Difference

Implementation of AASHTOWare BrR Program for Rating Iowa Bridges

BrR System and Library Data Summary

Prepared for:

Iowa Department of Transportation

IOWA | DOT

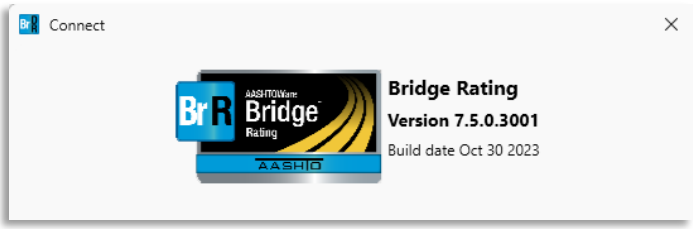
24 June, 2024

Project No. 199238

Table of Contents

1.0 Iowa DOT BrR System and Library Files

The AASHTOWare BrR (BrR) version used to create the files is BrR Version 7.5.0.3001.

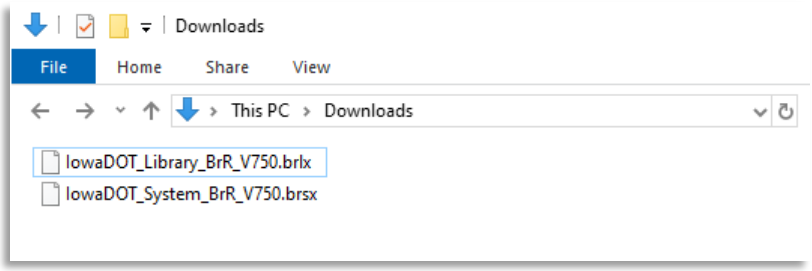


The following files are provided and will be used to import the Iowa DOT System and Library files into the program.

- IowaDOT_System_BrR_V750.brsx
- IowaDOT_Library_BrR_V750.brlx

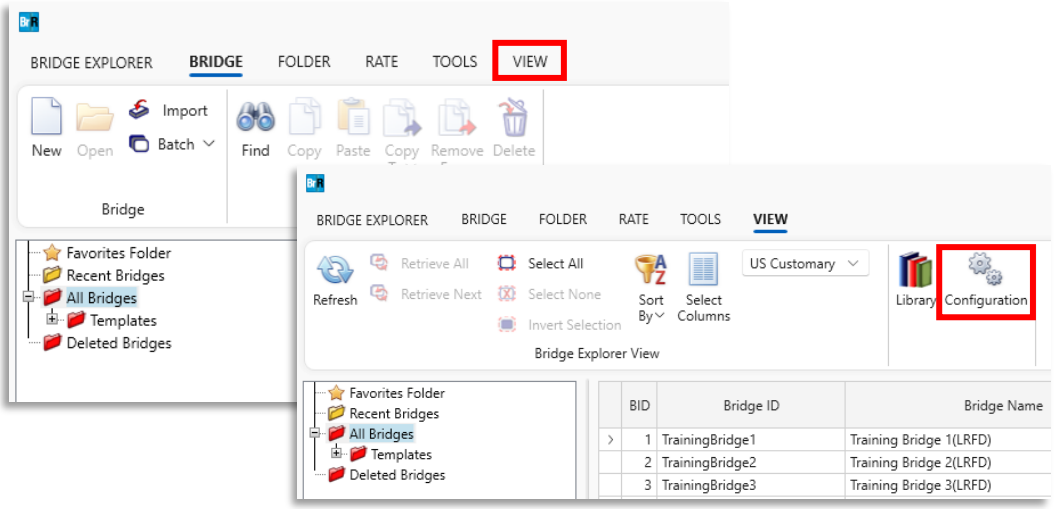
Download and save the above files to the user's desired location for import. In this example, the files are saved in the "Downloads" folder.

Import of the system and library files can only be accomplished by an BrR Administrator in your organization. Refer to ProMiles training material for group license setup and appropriate privilege.



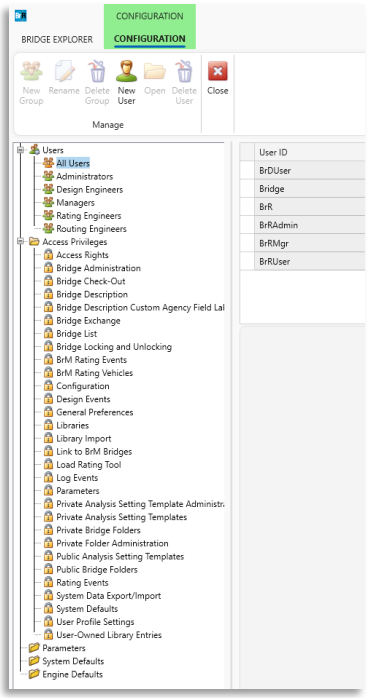
2.0 Configuration Browser in BrR

To access the Configuration browser, click on "VIEW" in the top ribbon and select "Configuration".



The Configuration browser provides access to the configuration features of BrR. The following items are available in the configuration tree.

- Users: Add/modify users and user groups
- Access Privileges: Specify access privileges for each group of users defined in the Users tree
- Parameters: Edit names of counties, districts, etc
- System Defaults: Specify default settings and the analysis engine for the Bridge Workspace
- Engine Defaults: Specify analysis and rating methods for the different superstructure types



"IowaDOT_System_BrR_V750.brsx" contains the following modified data specific for Iowa DOT:

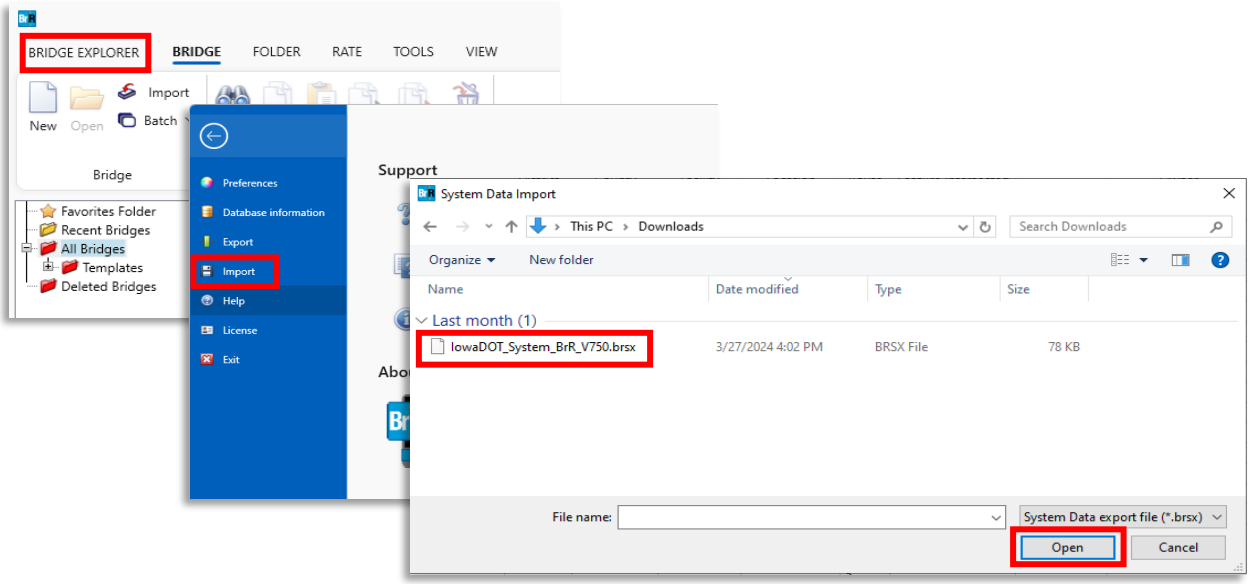
- Analysis Event Template
- System Defaults
- Unit Tolerance
- Parameters
- Custom Agency Fields Labels

Appendix A provides a detailed documentation of the data, specific for Iowa DOT, listed above.

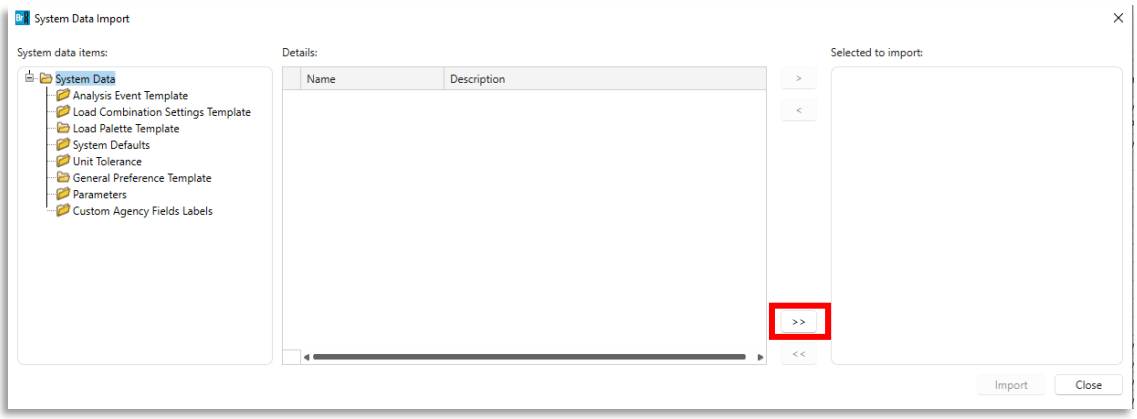
If a consultant performs BrR ratings for multiple states, submit a ticket with ProMiles to set up multiple BrR system data for different clients. This will prevent Iowa DOT's system preferences from conflicting with other states.

2.1 Import Configuration System File

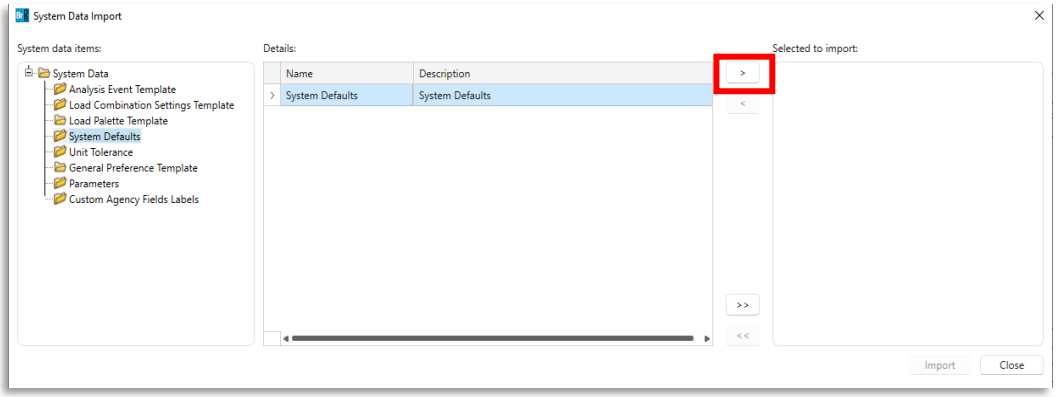
Step 1: After opening and logging into the BrR program, navigate to the Bridge Explorer window. Select "Import" and locate the "IowaDOT_System_BrR_V750.brsx" file in the folder where the file is saved at. Select the file and click "Open".



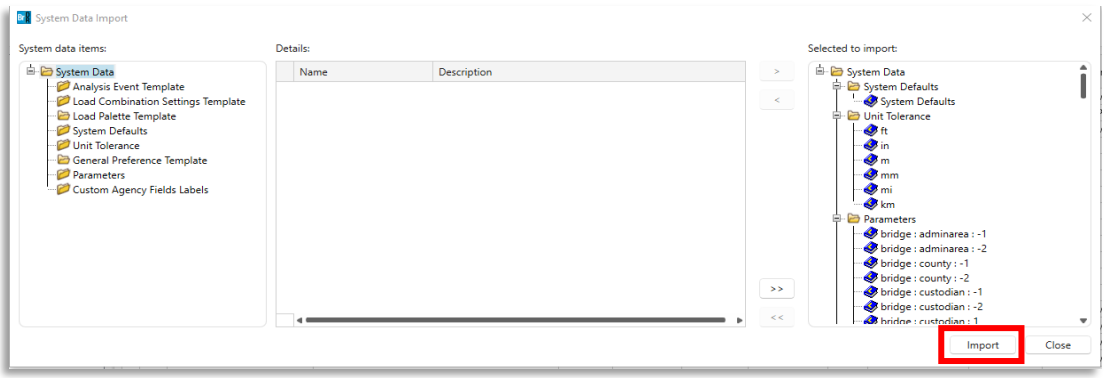
Step 2: : The left pane of the Import window under “System data items” shows the different configuration data categories. Clicking on these categories will show the available configuration system files in the middle pane under “Details”. To import all the configuration data at once, click on “System Data” to highlight it. Then click on the double arrow button “>>”. This selects all the configuration data available under the “System Data” tree for import.



To import a specific configuration data, select the appropriate category under the “System data items” pane and select the setting item under the “Details” pane to highlight it. Then, click on the single arrow button “>” to move the setting into the right pane under “Selected to Import”. Multiple setting items can be selected and imported at the same time.

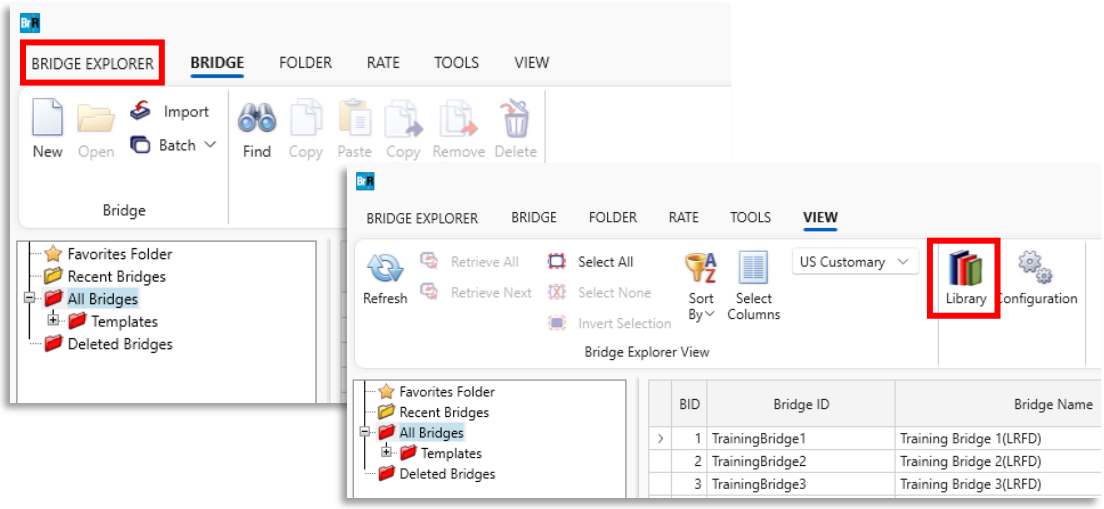


Step 3: Click on the “Import” button on the bottom right to import the configuration data. Once you’ve imported the data, a dialog box will pop up indicating the import is successful.

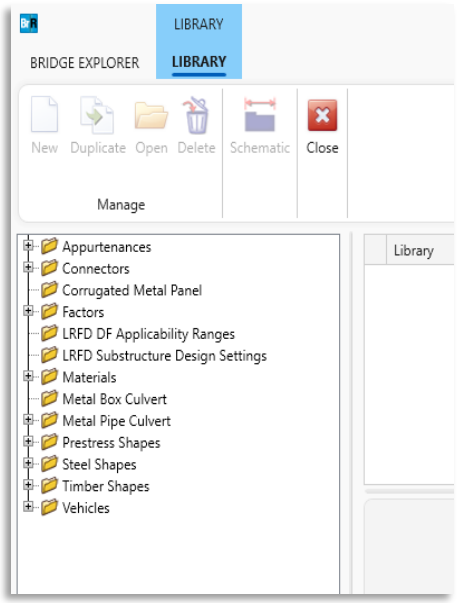


3.0 Library Explorer in BrR

To access the Library Explorer, click on "VIEW" in the top ribbon and select "Library".



The Library Explorer is used to navigate the library module to access the various library windows. The library is used to save commonly used items in the program and eliminate the need to define the same items repeatedly. Library Items can be created, duplicated, modified, and deleted.



There are three types of library items:

- Standard: Default AASHTO database that cannot be modified
- Agency Defined: Items added to the library by a user
- User Defined: Currently only available for vehicles that are added by a user.

"IowaDOT_Library_BrR_V750.brlx" contains Iowa DOT specific data for:

- Appurtenances
- Materials
- Prestress Shapes
- Vehicles

Appendix B provides a detailed documentation of the library data, specific for Iowa DOT, listed above.

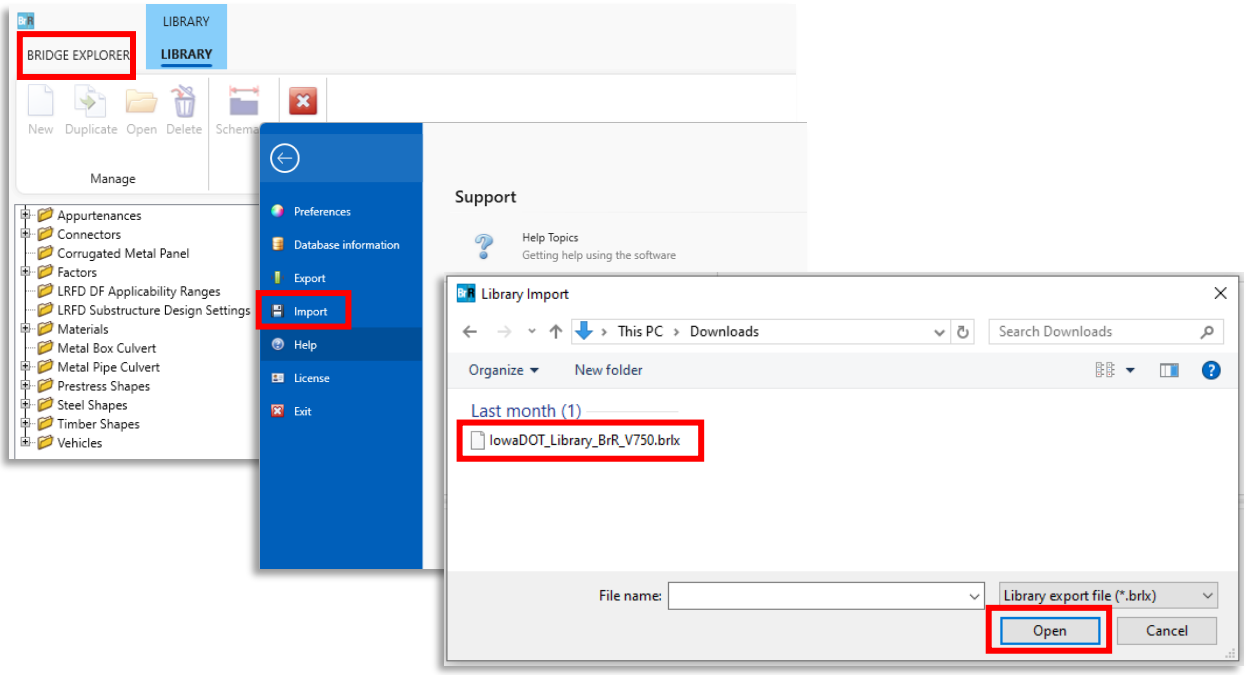
Notes:

1. Updating a library item or importing a new library file does not automatically update the bridge model that used the previous library data. As such, the library data in the bridge model will need to be reselected from the updated library to have the most up-to-date library definition inputs & properties.

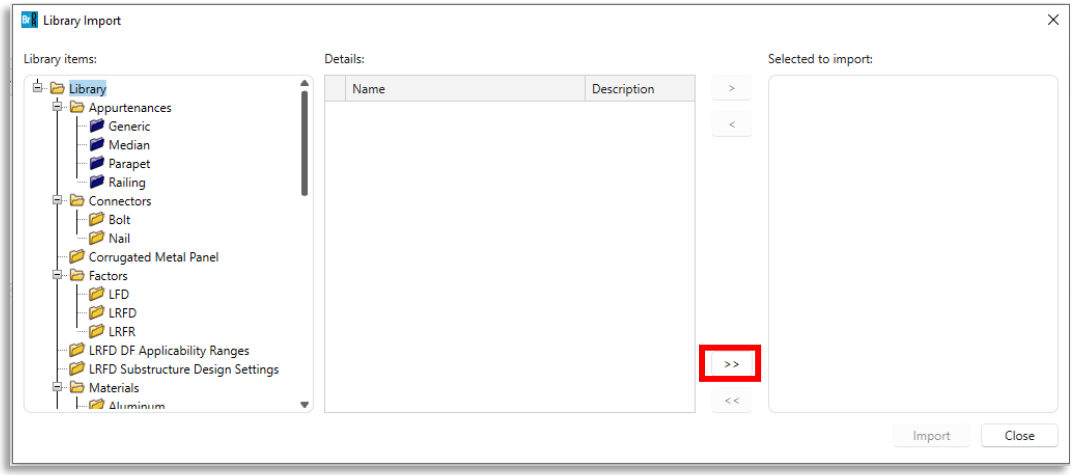
2. The vehicles in the Library File that are used in the Analysis Event Templates will not be imported if the System File is imported first as the vehicles' names are not unique. These vehicles have been imported into the library as part of the System File Import. The rest of the vehicles in this library will be imported with the Library File.

3.1 Import Library File

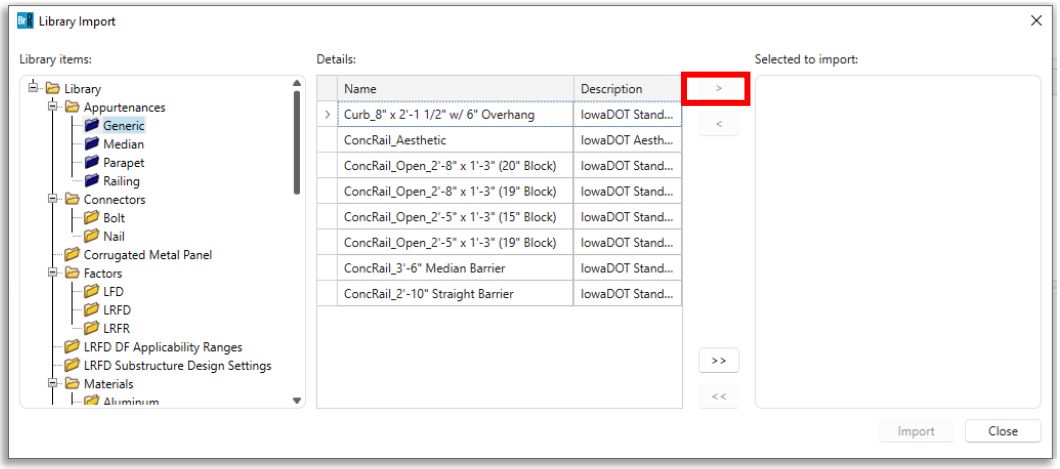
Step 1: In the Library Explorer, click on “Bridge Explorer”. Select “Import” and locate the “IowaDOT_Library_BrR_V750.brlx” file in the folder where the file is saved at, select the file and click “Open”.



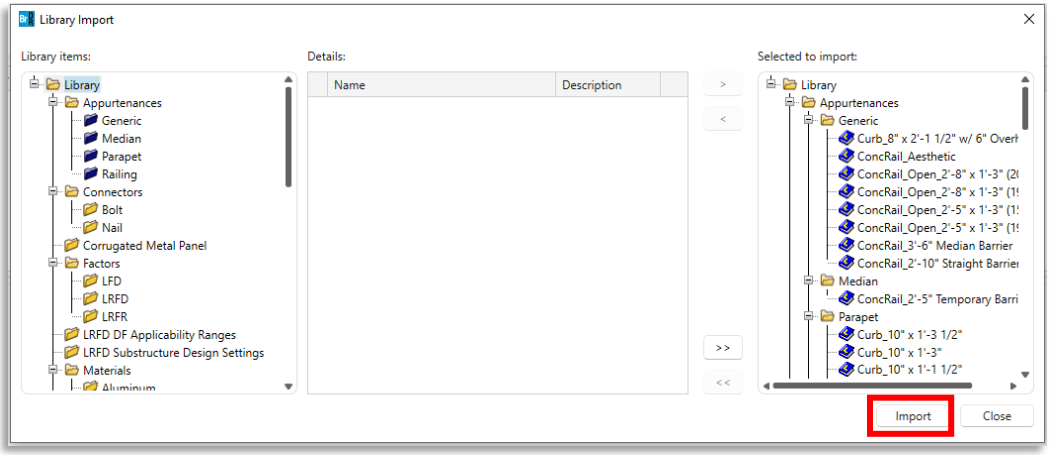
Step 2: The left pane of the Import window under “Library items” shows the different library folders for all the bridge elements. Clicking on the folder will show the contents of each folder under the middle pane under Details. To import all the library data at once, click on “Library” under the left pane to highlight it. Then click on the double arrow button “>>”. This selects all the library files available under the “Library” tree for import.



To import a specific library item, select the appropriate library folder under the “Library items” pane and select the item under Details box to highlight it. Then, click on the single arrow button “>” to move the item into the right pane under “Selected to Import”. Multiple items can be selected and imported at the same time.



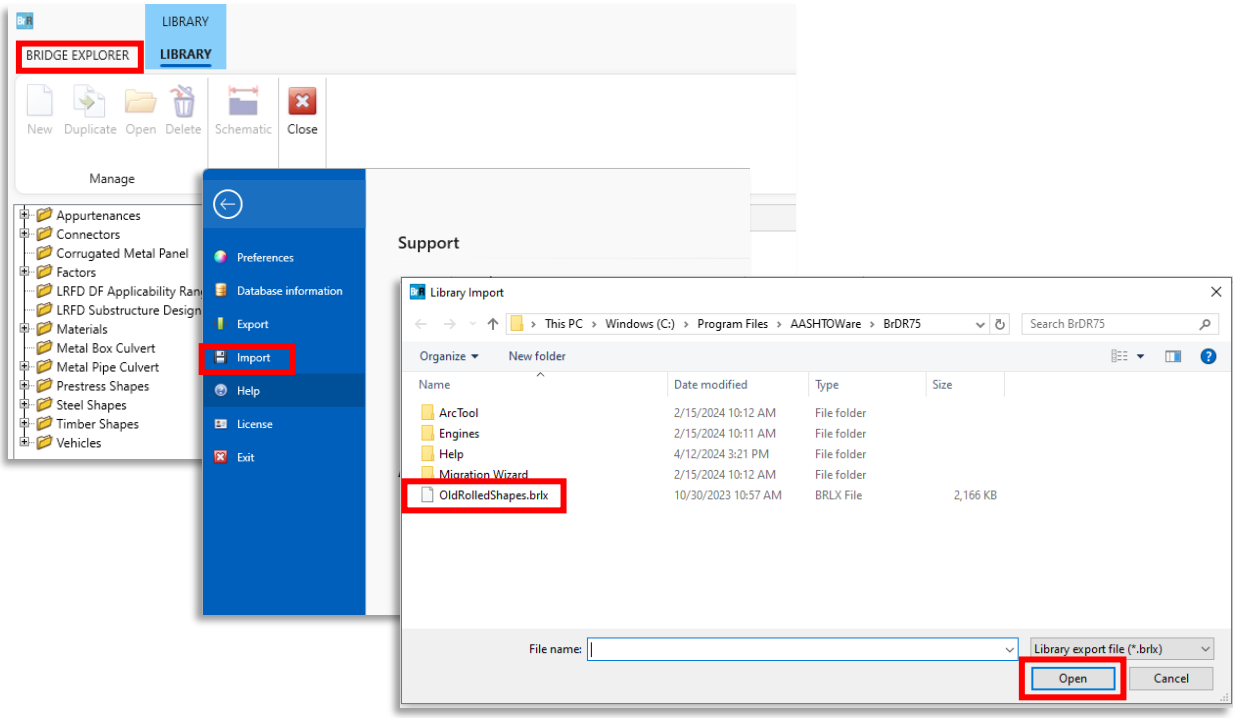
Step 3: Click on the “Import” button on the bottom right to import the library data. Once you’ve imported the data, a dialog box will pop up indicating the import is successful.



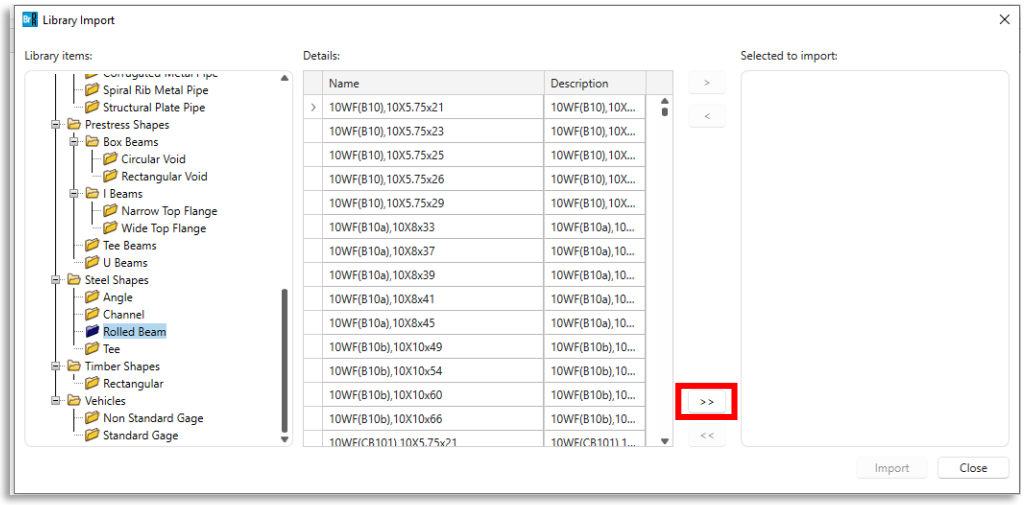
3.2 Import Historic Steel Rolled Beam Shapes Library File

The historic steel rolled beam shapes library file is provided by AASHTOWare but is not imported into BrR library by default. It is optional but if required, contact the BrR Administrator in your organization for import guidance. Below are instructions to import and use these historic shapes.

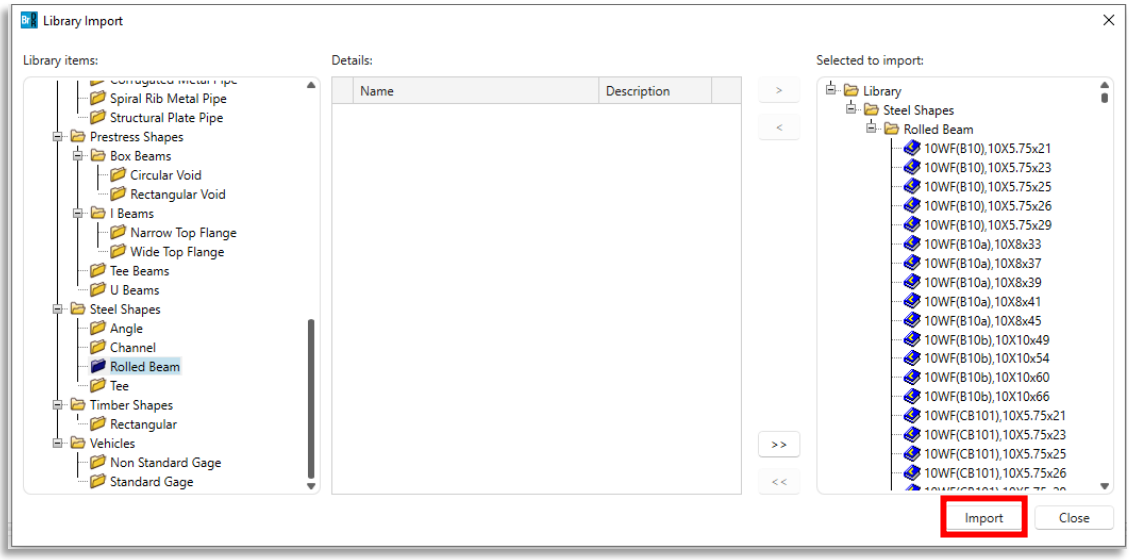
Step 1: In the Library Explorer, click on "Bridge Explorer". Select "Import", navigate to "C:\Program Files\AASHTOWare\BrDR75" and select the file named "OldRolledShapes.brlx". Select the file and click "Open". A dialog box will appear to confirm import, select "Yes".



Step 2: To import historic shapes data, click on "Rolled Beam" under the left pane to highlight it. Then click on the double arrow button ">>". This selects all the historic shapes data available under the "Rolled Beam" branch for import.

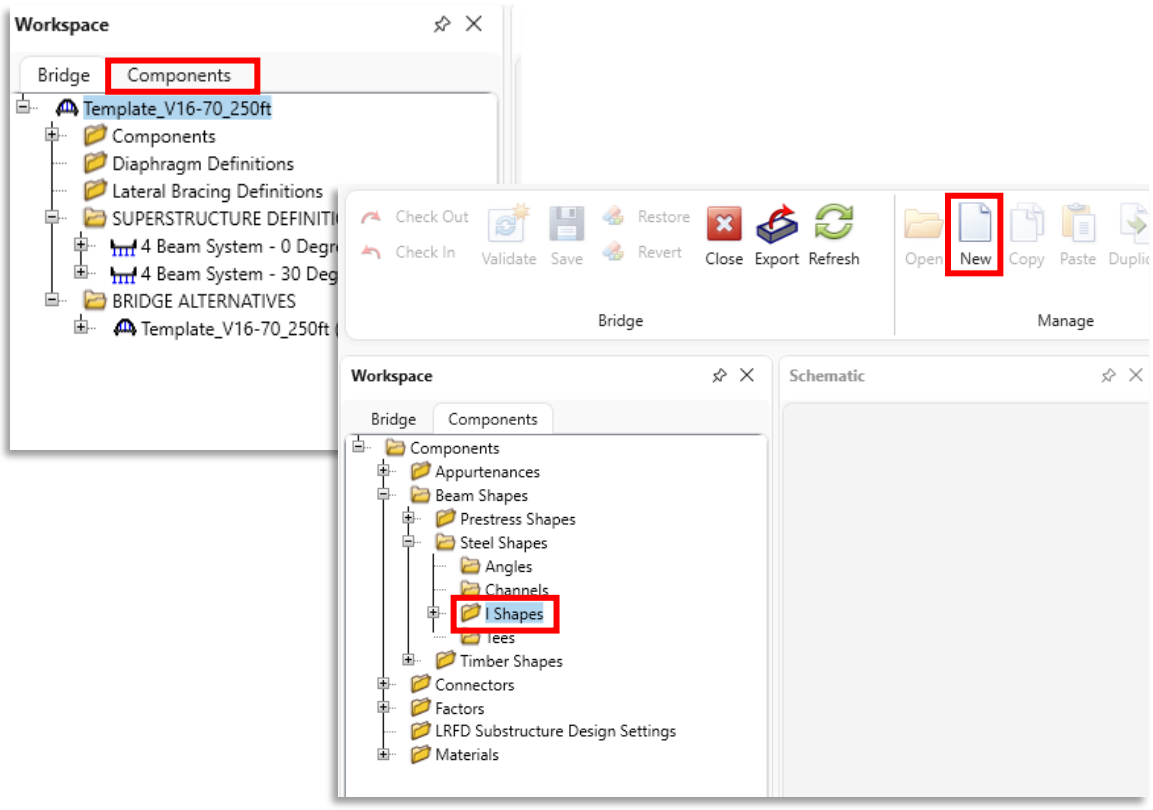


Step 3: Click on the "Import" button on the bottom right to import the historic shapes data. Once you've imported the data, a dialog box will pop up indicating the import was successful.

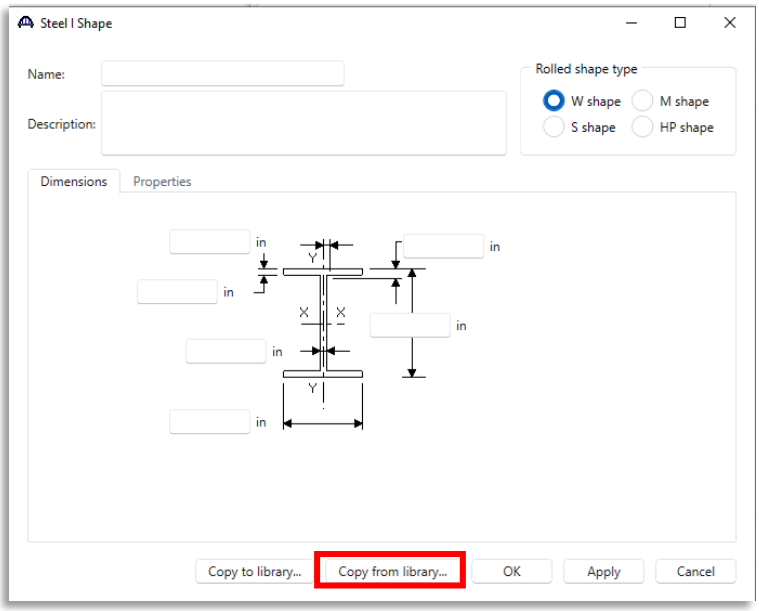


After the import, the historic steel rolled beam shapes are saved in BrR library. The next three steps demonstrates the steps to copy these shapes from BrR library into the Bridge Workspace.

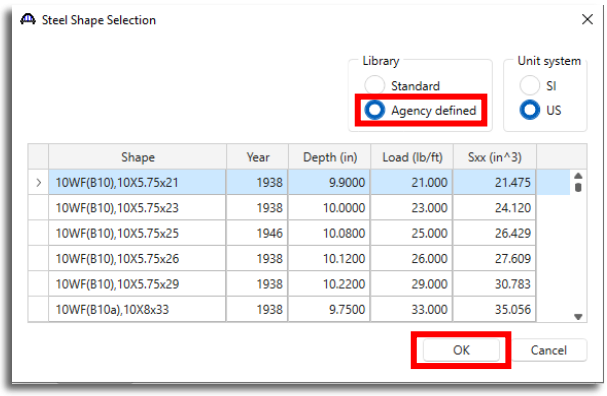
Step 4: In the Bridge Workspace, under "Components" -> "Beam Shapes" -> "Steel Shapes", double click on "I Shapes" or click on "New" in the top ribbon to open the "Steel I Shape" definition window.

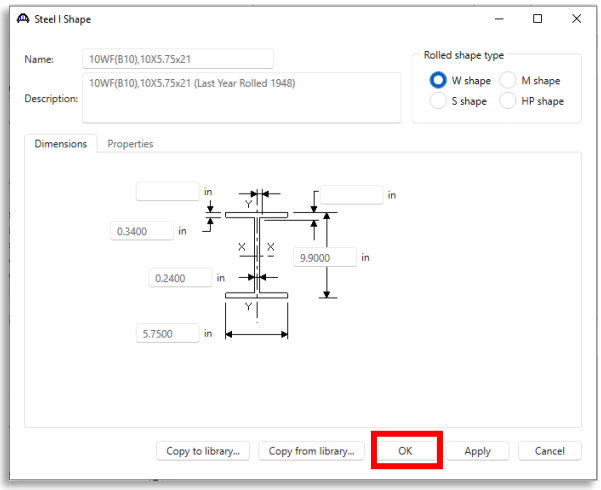


Step 5: Select “Copy from Library” at the bottom of the window to open up the “Steel Shape Selection window”.



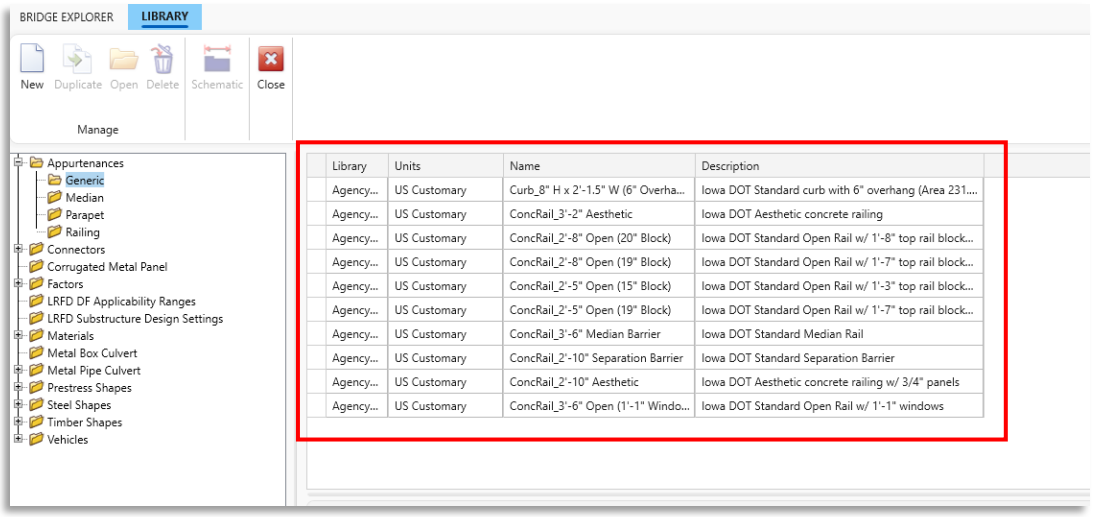
Step 6: The historic shapes data can be found by selecting the “Agency Defined” button under the “Library” box. Select the appropriate shape and select “OK” to copy the shape information into the “Steel I Shape” definition window. Select “OK” to save the definition in the Bridge Workspace.



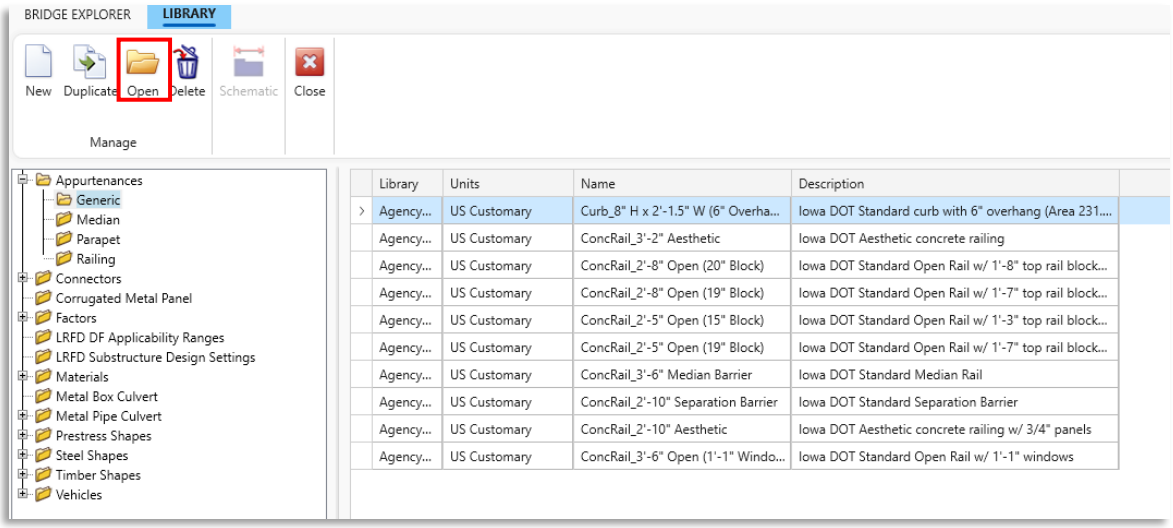


3.3 Modify and Delete Library Items

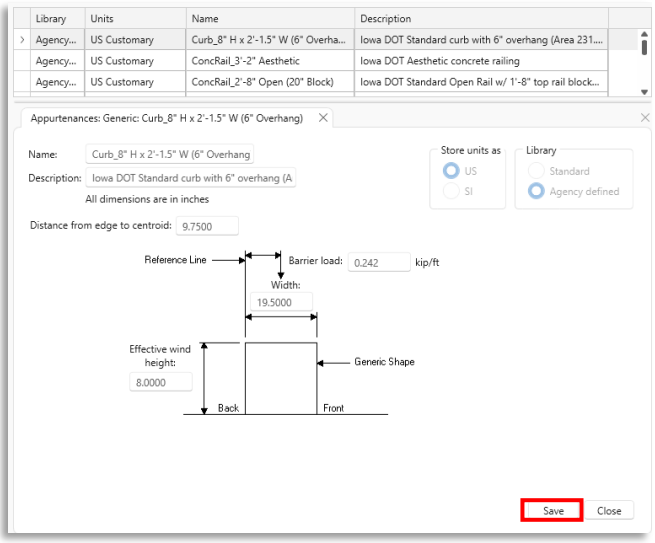
Step 1: In the Library Explorer, select a library folder on the left window pane and a list of library items will show on the right window pane. In this example, select “Appurtenances” -> “Generic” on the left window pane and all Generic appurtenances created under this category will be shown on the right window pane.



Step 2: Double-click on a library item or click on “Open” in the top ribbon and the library item definition window pane will open below the right window pane.



Modfying Library Items: In the library item definition pane, the item's name, description, dimensions and properties can be modified. Once the item information has been updated, click on "Save" on the bottom right corner to save the information in BrR library.

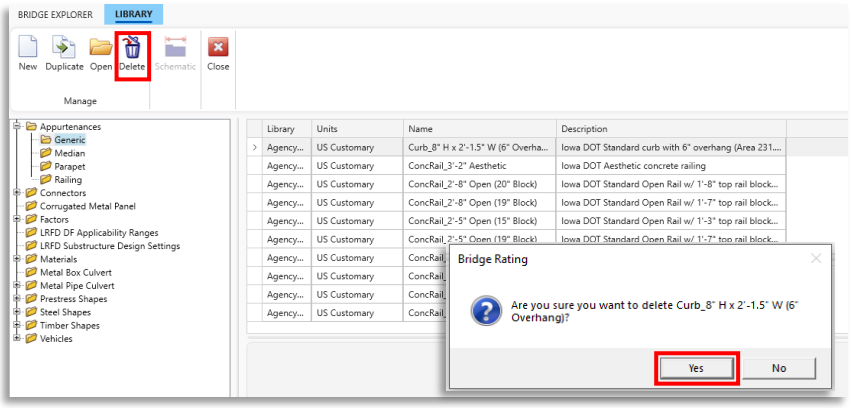


Note:

1. Any updates made to the library items in the Library Explorer will not affect the items used in a bridge model. The items in the bridge model will need to be reselected from the updated library to have the most up-to-date library definition inputs & properties.

2. If the library item needs to be modified for a specific bridge (modifying dimensions, weight of rail etc.), the rater should copy the library item to the specific bridge and modifying the copy instead of modifying the actual library item.

Deleting Library Items: On the right window pane, select a library item to highlight it. In the top ribbon, click on "Delete" to delete the library item and a confirmation dialog box will appear. Click on "Yes" to delete the selected library item. Only one library item can be deleted at one time. Only Agency Defined or User Defined library items can be deleted.



Note: Deleting a library item does not delete the same item in a bridge model. The item in the bridge model will remain in the Bridge Workspace and will need to be deleted manually if that is the intent. Additionally, once a library item is deleted from the BrR library, the only way to retrieve it back is to re-import the library file. See Section 3.1 for details on importing library files.

4.0 Analysis Event Templates

The following analysis event templates are imported into the BrR library after completing Section 2.1, which contain the necessary live load vehicles and analysis settings, specific to Iowa DOT, used to load rate bridge structures in BrR.

- LFR Analysis Template
- LRFR Analysis Template

Assumptions and restrictions for Iowa DOT BrR LFR & LRFR Analysis Templates:

- Set up for multilane and with full impact for all vehicles.
- Set up for bridges with span lengths equal to or less than 200 ft.
- Fluid Milk Truck should be used for state routes only. For LPAs bridges, it is up to the rater to remove the truck in the analysis template when appropriate.
- State specific restrictions of the legal and permit load analysis were not included.

"Advanced" settings in the "Analysis Settings" window allows the rater to override vehicle properties. Refer to the BrR Help Manual for details.

4.1 LFR Analysis Template

Template Name: Iowa DOT LFR

Live loads included in the "Iowa DOT LFR" analysis template are listed below, per Iowa DOT Bridge Rating Manual (BRM), and Instructional Memorandum (IM).

1. Rating Live Load (Inventory & Operating Level)
    a. HS20-44

2. Legal Loads (Legal Operating Level)
    a. Routine Commercial Traffic
        i. Type 4
        ii. Type 3S3A
        iii. Type 3-3 (IowaDOT)
        iv. Type 3S3B
        v. Type 4S3
        vi. Type 5-2
    b. Specialized Hauling Vehicles (SHVs)
        i. SU4
        ii. SU5
        iii. SU6
        iv. SU7
    c. Emergency Vehicles
        i. Type EV2
        ii. Type EV3
3. Permit Trucks (Permit Operating Level)
    a. 90 kip Six-Axle Vehicle
    b. 136 kip (A) Seven-Axle Truck with Triple-Axle Configuration
    c. 136 kip (B) Seven-Axle Truck with a Quad-Axle Configuration
    d. 156 kip Eight-Axle Truck with a Quad-Axle Configuration
    e. Fluid Milk Truck
    f. Quint Axle Crane Truck
    g. Small Annual Crane Truck

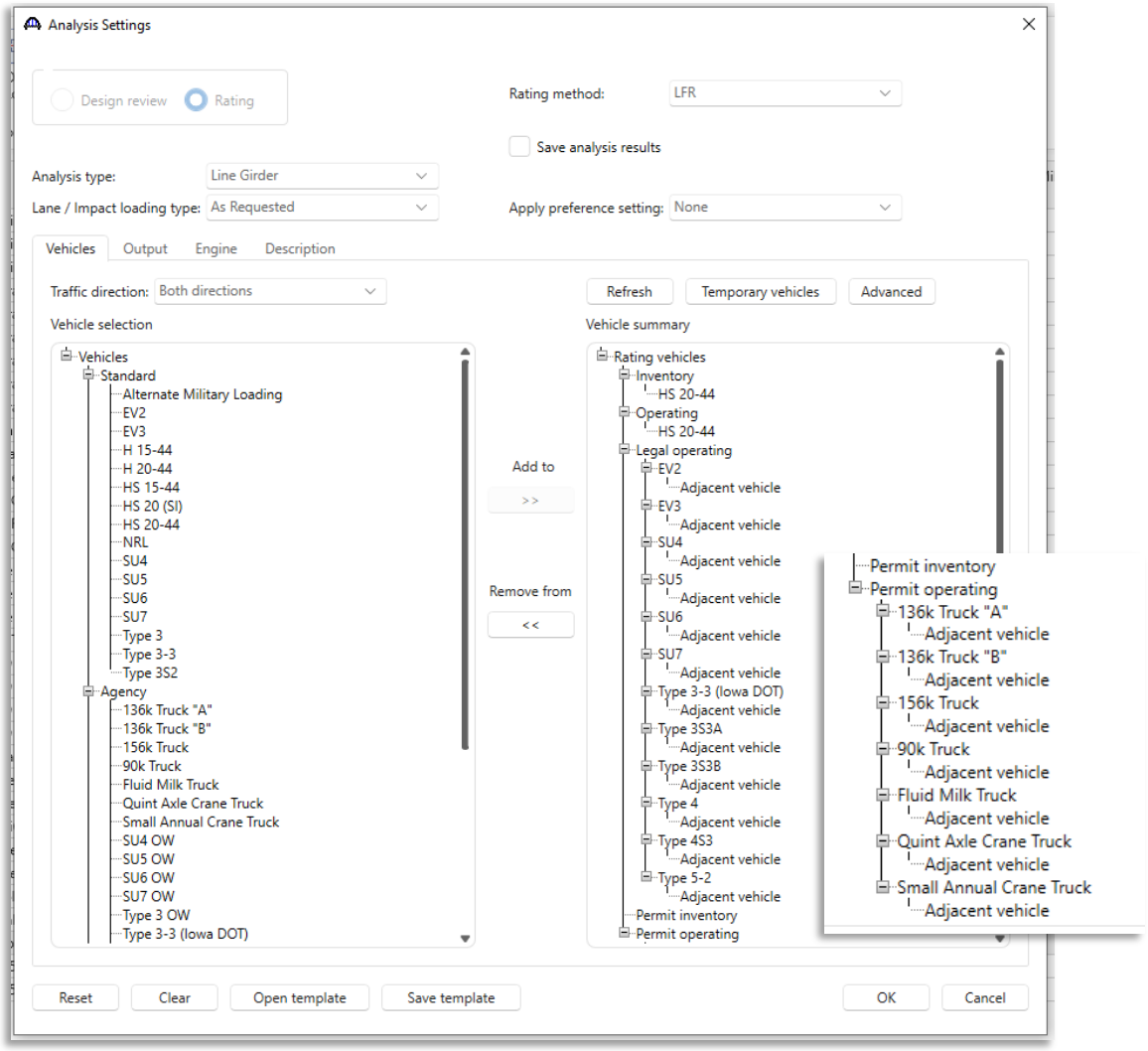


Figure 1: "Analysis Settings" window for the "Iowa DOT LFR" analysis template

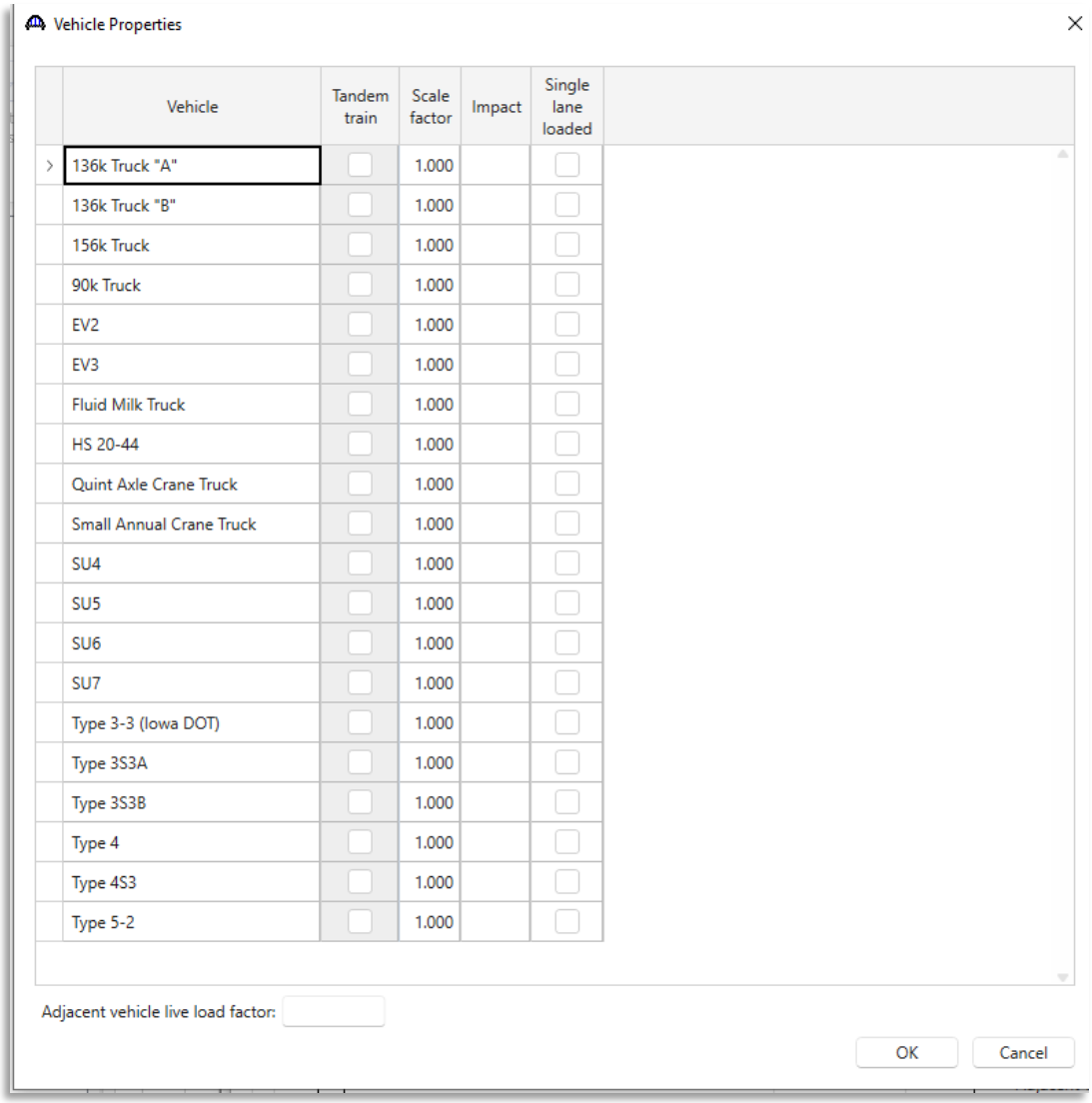


Figure 2: "Advanced" settings window for the "Iowa DOT LFR" analysis template

4.2 LRFR Analysis Template

Template Name: Iowa DOT LRFR

Live loads included in the "Iowa DOT LRFR" analysis template are listed below, per Iowa DOT Bridge Rating Manual (BRM), and Instructional Memorandum (IM).

1. Design Live Load
    a. HL-93 (Inventory & Operating Level)

2. Legal Loads
    a. Routine Commercial Traffic Trucks (RCTT)
        i. Type 4
        ii. Type 3S3A
        iii. Type 3-3 (IowaDOT)
        iv. Type 3S3B
        v. Type 4S3
        i. Type 5-2
        vi. Lane-Type Legal Load
        vii. Type 4 Lane-Type
        viii. Type 3S3A Lane-Type
        ix. Type 3-3 Lane-Type (Iowa DOT)
        x. Type 3S3B Lane-Type
        xi. Type 4S3 Lane-Type
        xii. Type 5-2 Lane-Type
    b. Specialized Hauling Vehicles
        i. SU4
        ii. SU5
        iii. SU6
        iv. SU7
    c. Emergency Vehicle
        i. Type EV2
        ii. Type EV3

3. Permit Trucks
    a. 90 kip Six-Axle Vehicle
    b. 136 kip (A) Seven-Axle Truck with Triple-Axle Configuration
    c. 136 kip (B) Seven-Axle Truck with a Quad-Axle Configuration
    d. 156 kip Eight-Axle Truck with a Quad-Axle Configuration
    e. Fluid Milk Truck
    f. Quint Axle Crane Truck
    g. Small Annual Crane Truck

RCTT (Item 2.a.vii to 2.a.xii) are created for lane-type load and added to the BrR library and the LRFR analysis template for analyzing negative moments and reactions at interior supports per BRM and AASHTO MBE 6A.4.4.2.1a

Modifications include:

- Added "Lane-Type" to Truck Naming to differentiate from the regular RCTT
- Axle weights reduced by a factor of 0.75
- Additional uniform lane load of 0.2 kips/ft
- Selected Legal pair in "Advanced" analysis settings

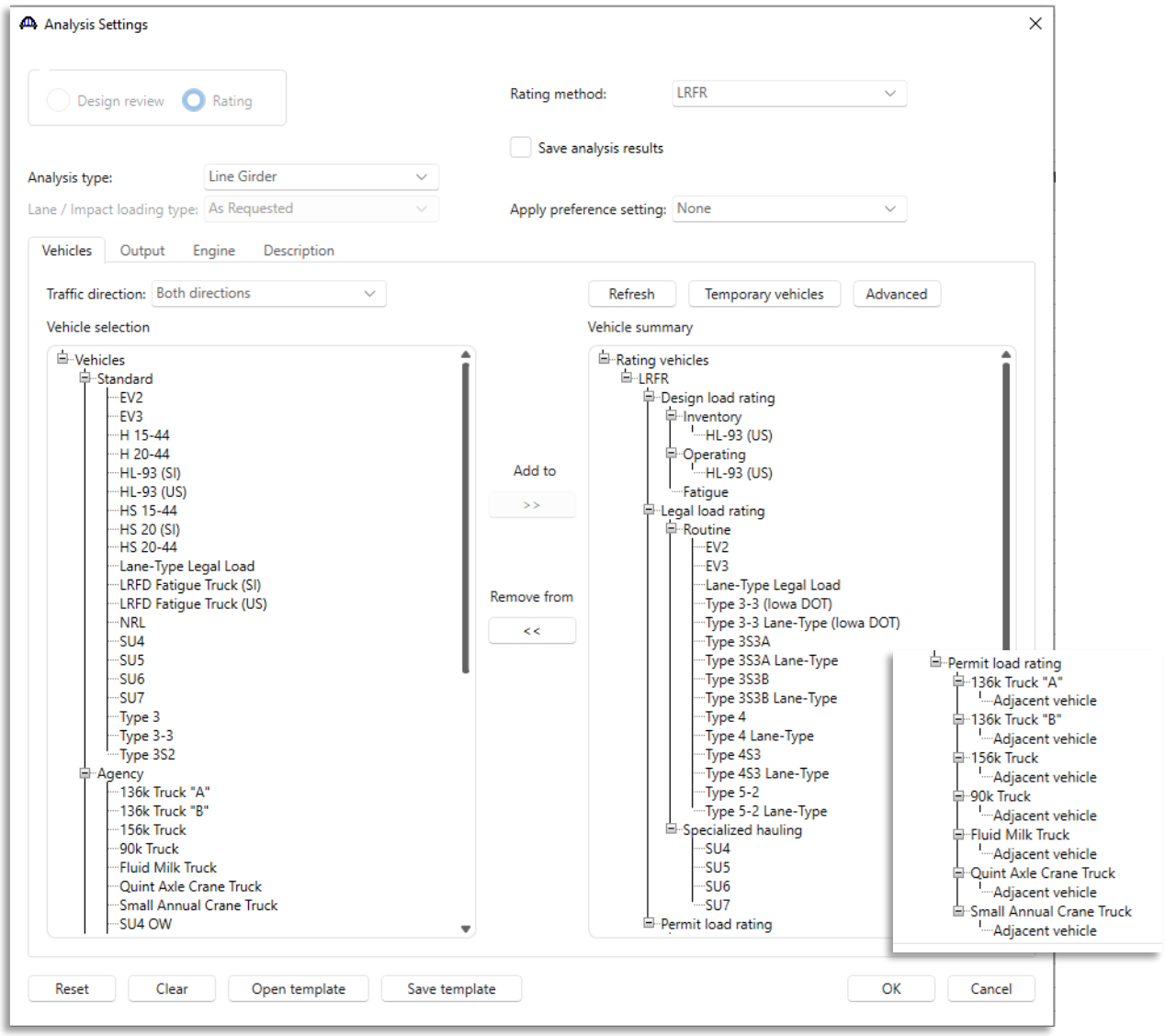


Figure 3: "Analysis Settings" window for the "Iowa DOT LRFR" analysis template

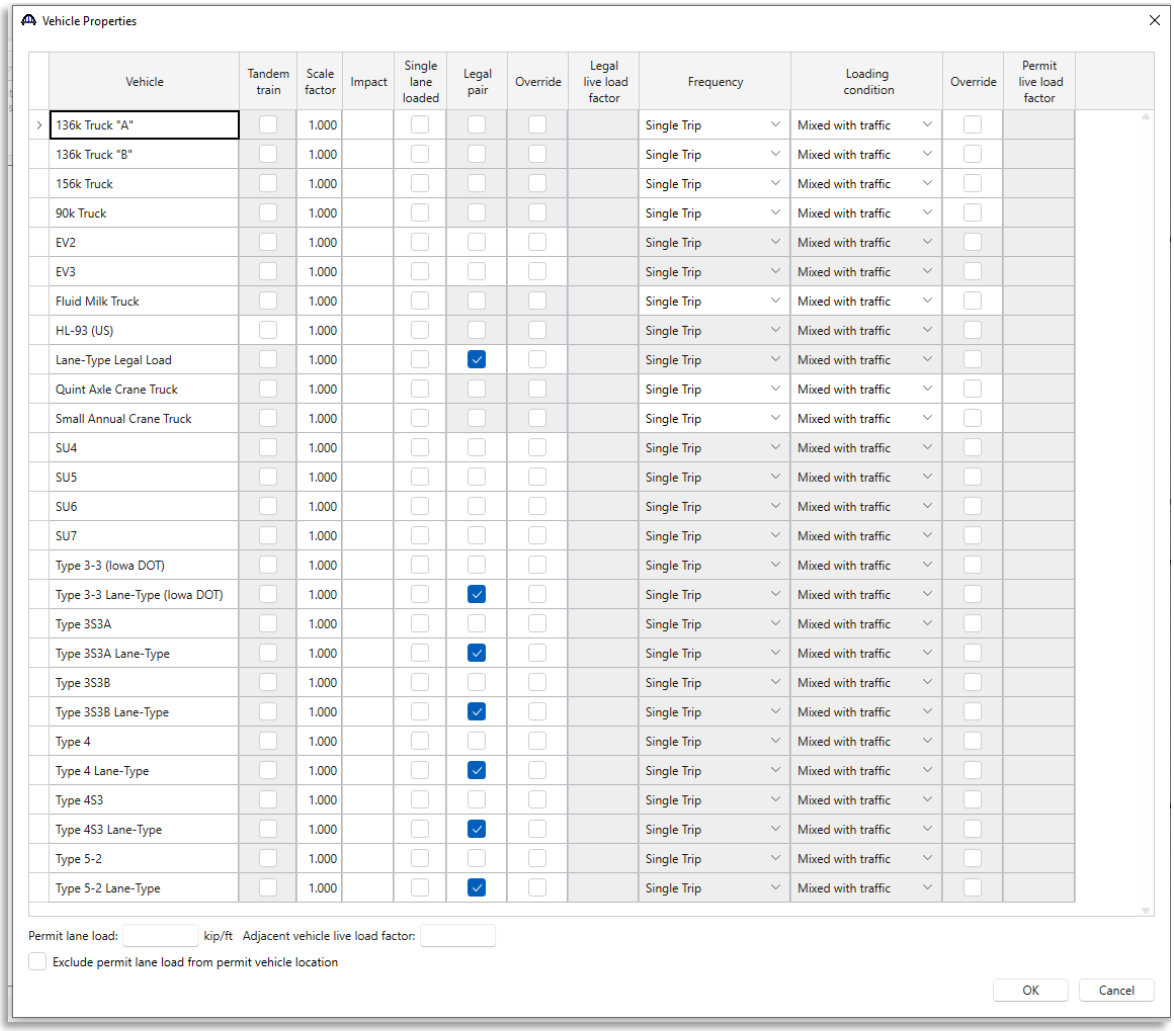


Figure 4: "Advanced" settings window for the "Iowa DOT LRFR" analysis template

4.3 Perform Rating Analysis

There are two ways to perform the rating analysis of a bridge model using the analysis templates – one is in the Bridge Explorer and the other is in the Bridge Workspace.

4.3.1 Perform Rating Analysis In Bridge Explorer

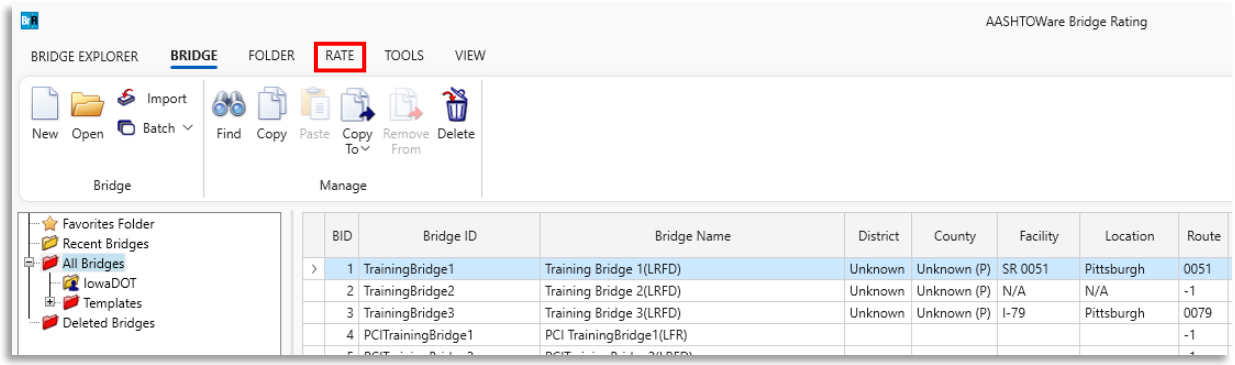
To perform a rating analysis in Bridge Explorer:

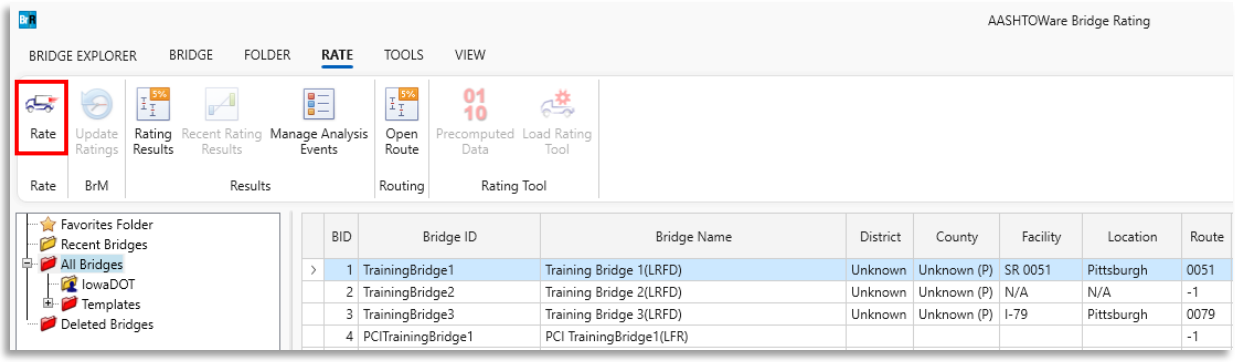
1. After logging into BrR, In the Bridge Explorer, "AASHTOWare Bridge Rating" window is opened showing the Bridge Explorer.

2. In the left pane of Bridge Explorer, a tree view contains multiple folders and subfolders, select the approproate folder that contains the specific bridge for analysis.

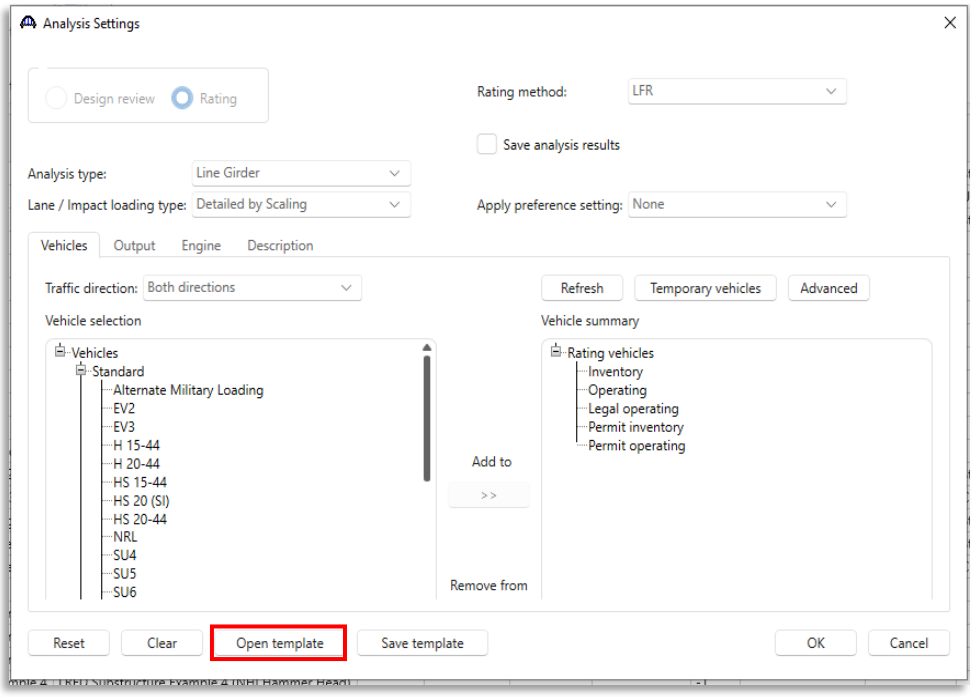
3. In the right pane of Bridge Explorer, click and highlight the specific bridge model.

4. In the top ribbon, select "RATE" and click on the "Rate" icon to bring up the "Analysis Settings" window.

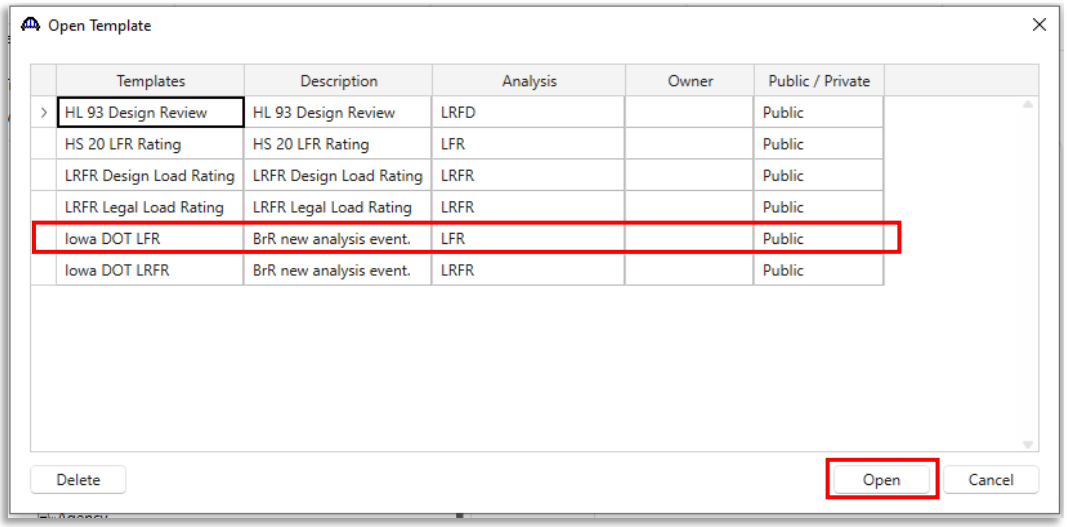




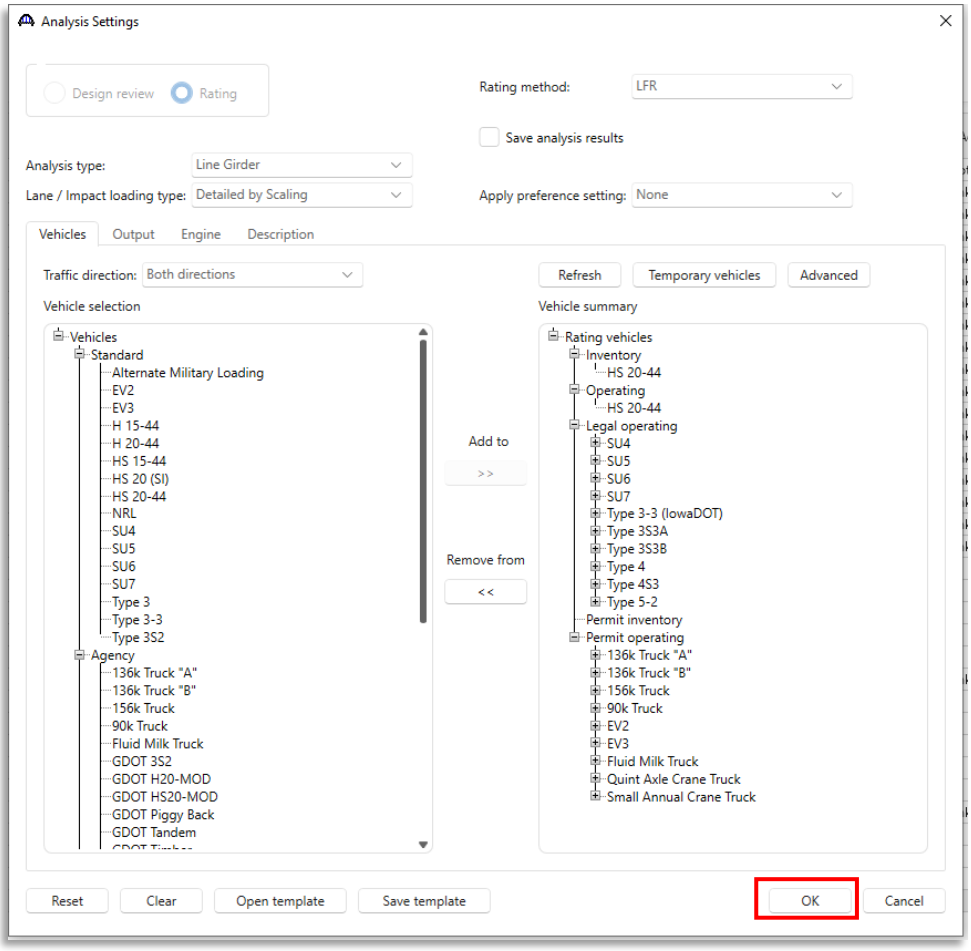
5. In the "Analysis Settings" window, click on "Open template" at the bottom.



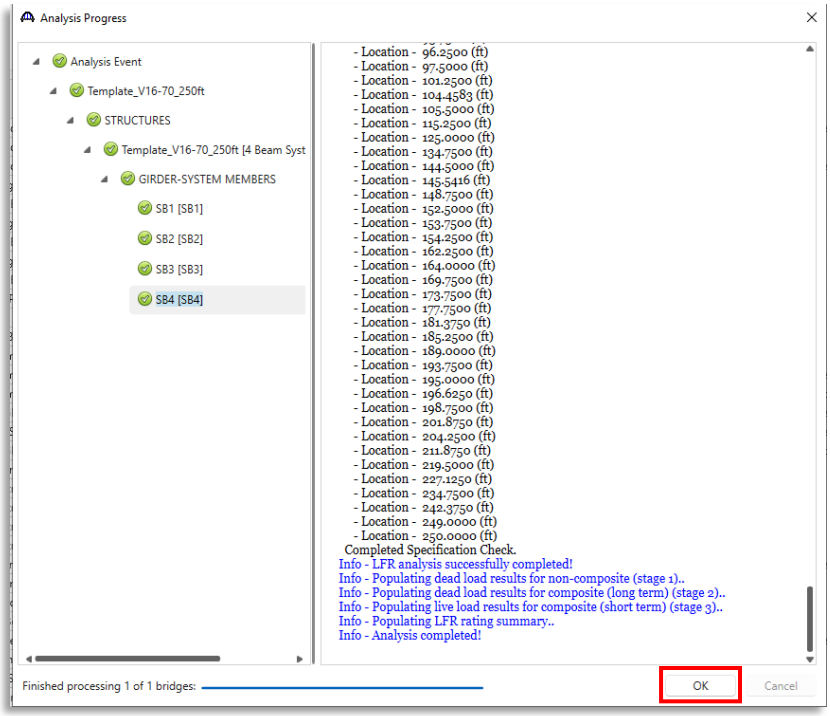
6. Select "Iowa DOT LFR" template fo LFR analysis or "Iowa DOT LRFR" for LRFR analysis and click "Open". In this example, "Iowa DOT LFR" is selected.



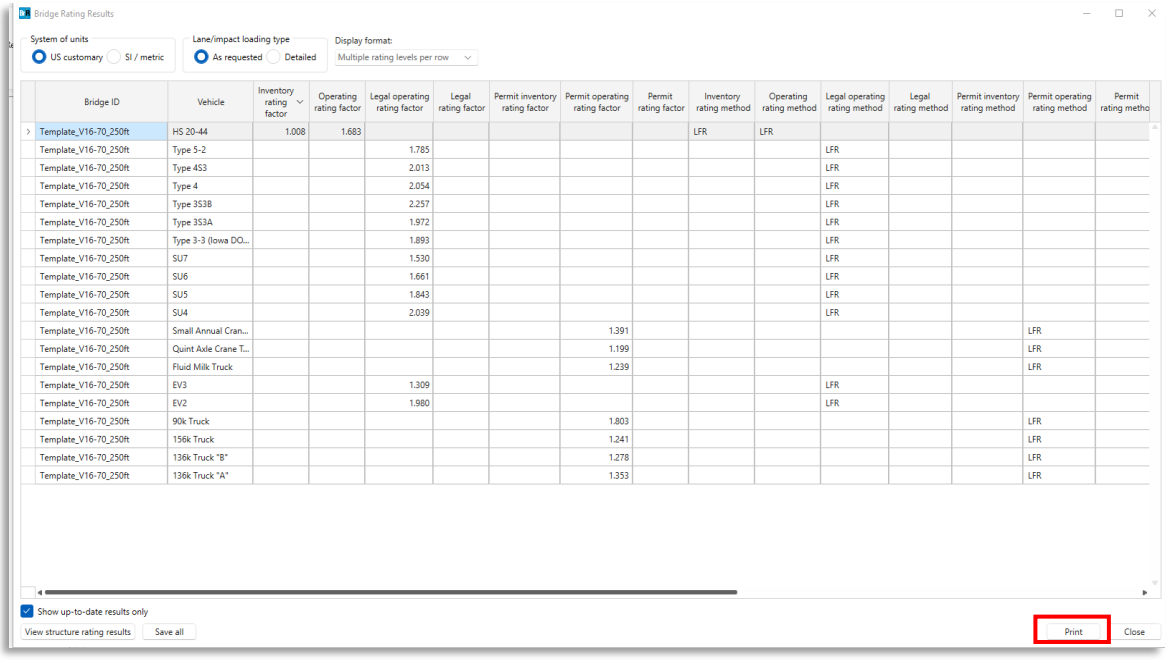
7. The “Vehicle Summary” pane on the”Analysis Settings” window will show all the rating vehicles under their respective rating levels. Click “OK” to begin load rating analysis.



8. Once the analysis begins, a “Analysis Progress” window will appear. When the analysis is completed, select “Ok” on the bottom right of the window to bring up the “Bridge Rating Results” window.

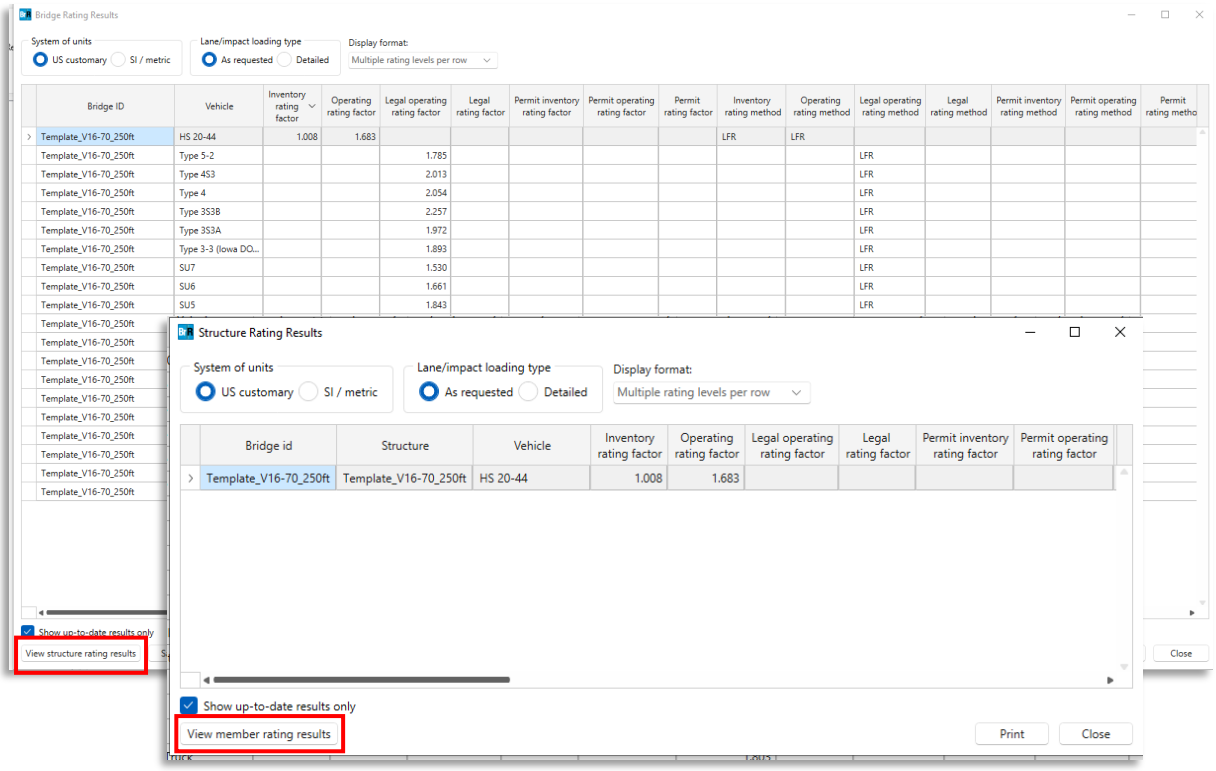


9. The “Bridge Rating Results” window provides the controlling rating results for the bidge model. The rating results can be copied out by highlighting the appropriate (or all) rows and using “Ctrl” + “C” command. Additionally, the rating results can be printed out by clicking on “Print” on the bottom right of the window.

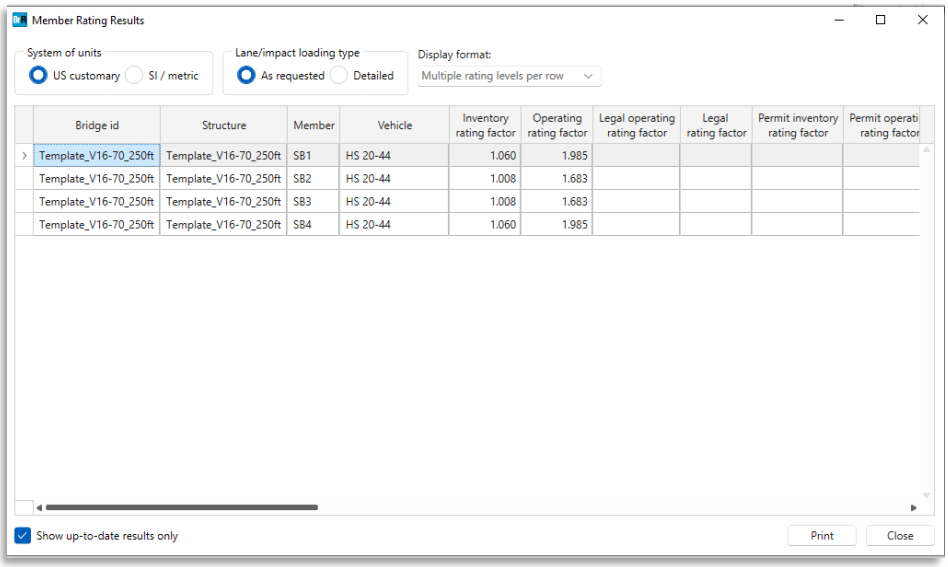


Bridge ID	Vehicle	Inventory rating factor	Operating rating factor	Legal operating rating factor	Legal rating factor	Permit inventory rating factor	Permit operating rating factor	Permit rating factor	Inventory rating method	Operating rating method	Legal operating rating method	Legal rating method	Permit inventory rating method	Permit operating rating method	Permit rating metho
Template_V16-70_250ft	HS 20-44	1.008	1.683						LFR	LFR					
Template_V16-70_250ft	Type 5-2			1.785							LFR				
Template_V16-70_250ft	Type 4S3			2.013							LFR				
Template_V16-70_250ft	Type 4			2.054							LFR				
Template_V16-70_250ft	Type 3S3B			2.257							LFR				
Template_V16-70_250ft	Type 3S3A			1.972							LFR				
Template_V16-70_250ft	Type 3-3 (Iowa DO...			1.893							LFR				
Template_V16-70_250ft	SU7			1.530							LFR				
Template_V16-70_250ft	SU6			1.661							LFR				
Template_V16-70_250ft	SU5			1.843							LFR				
Template_V16-70_250ft	SU4			2.039							LFR				
Template_V16-70_250ft	Small Annual Cran...						1.391							LFR	
Template_V16-70_250ft	Quint Axle Crane T...						1.199							LFR	
Template_V16-70_250ft	Fluid Milk Truck						1.239							LFR	
Template_V16-70_250ft	EV3			1.309							LFR				
Template_V16-70_250ft	EV2			1.980							LFR				
Template_V16-70_250ft	90k Truck						1.803							LFR	
Template_V16-70_250ft	156k Truck						1.241							LFR	
Template_V16-70_250ft	136k Truck "B"						1.278							LFR	
Template_V16-70_250ft	136k Truck "A"						1.353							LFR	

10. To obtain additional rating results for each superstructure member, select the appropriate row and click on “View structure rating results” at the bottom left corner of the “Bridge rating Results Window” to bring up the “Structure Rating Results” Window. Select “View member rating results” at the bottom left corner of the window to bring up the “Member Rating Results” window.



11. The “Member Rating Results” window shows the rating results for each member of the selected truck from the “Bridge Rating Results” window.



4.3.2 Perform Rating Analysis In Bridge Workspace

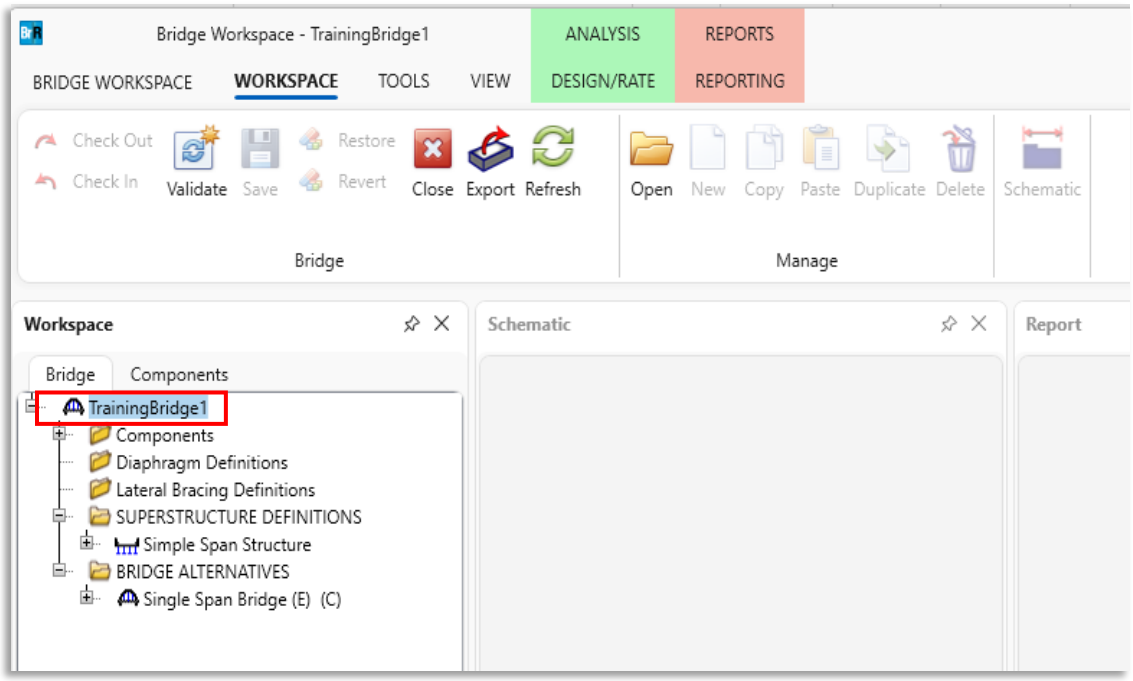
The analysis can also be performed within the Bridge Workspace. Additional specific details of the analysis can be retrieved such as controlling limit states and locations, Specification Check Detail, and Results Graph of each individual member.

1. After logging into BrR, In the Bridge Explorer, "AASHTOWare Bridge Rating" window is opened showing the Bridge Explorer.

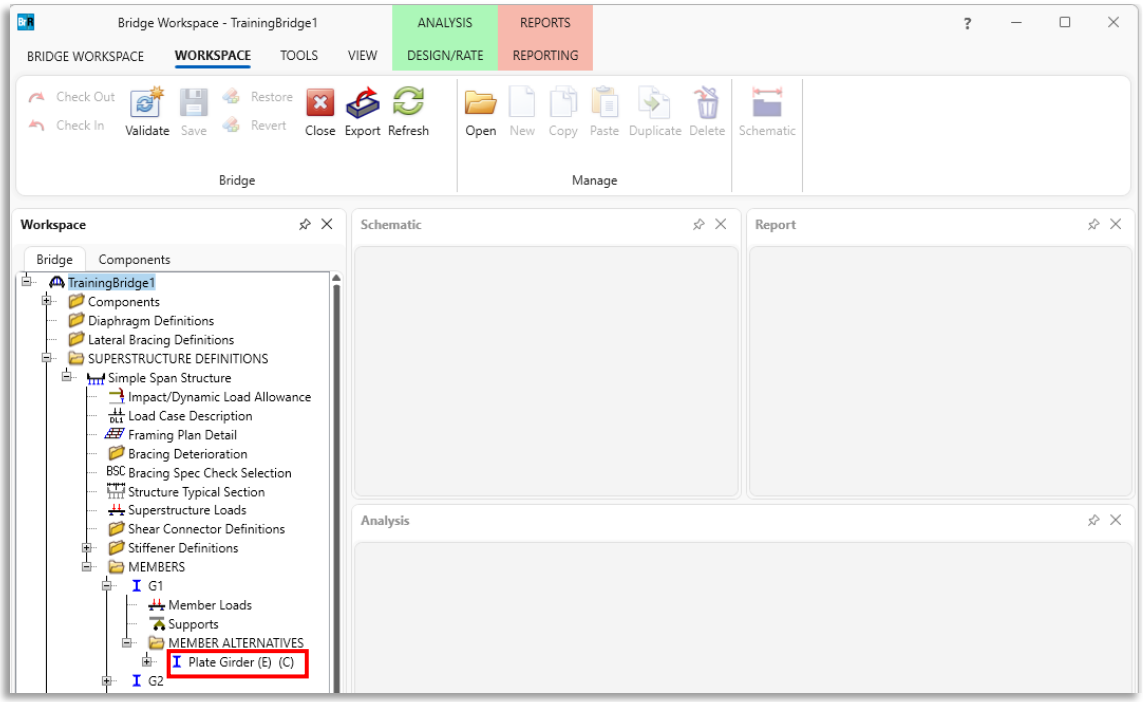
2. In the left pane of Bridge Explorer, a tree view contains multiple folders and subfolders, select the approproate folder that contains the specific bridge for analysis.

3. In the right pane of Bridge Explorer, double-click the specific bridge model to open the model in the Bridge Workspace window.

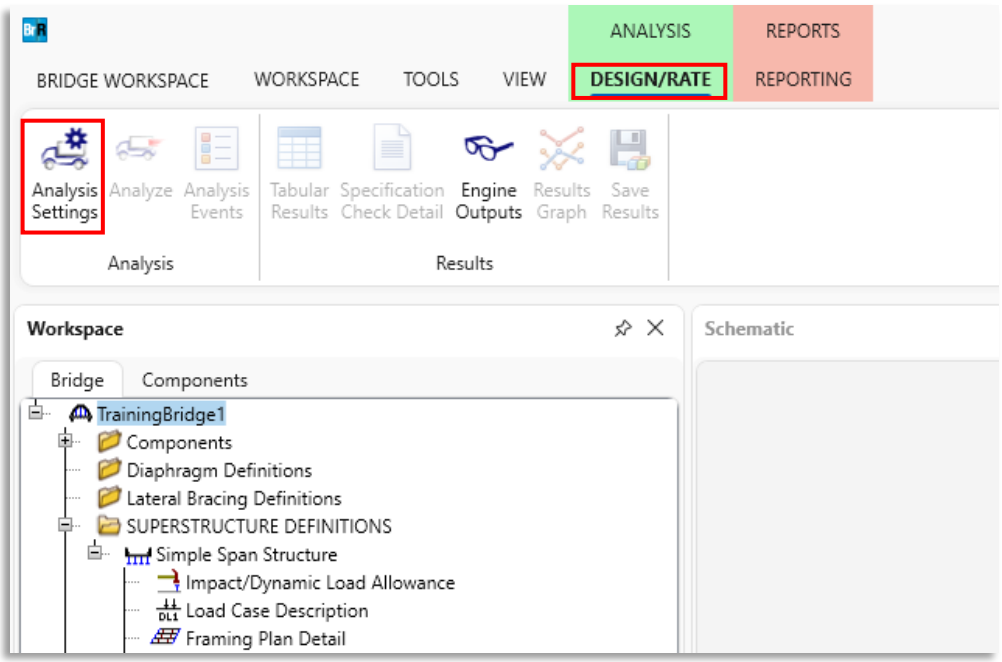
4. Click on the Model Name at the top of the workspace tree to highlight and select the entire model, including all members of the model, for analysis.



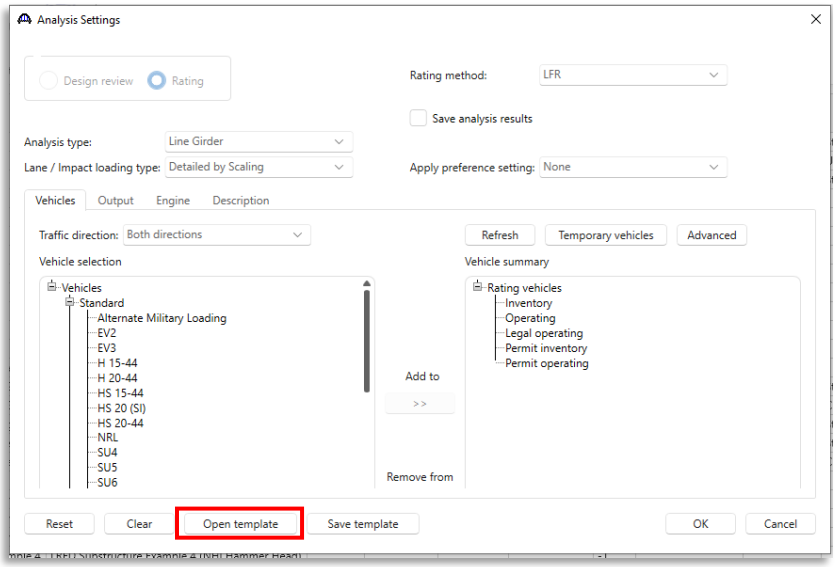
Or select a specific member under the Member Alternative tree to analyze one specific member. In this example, "G1" -> "Plate Girder" is selected for analysis.



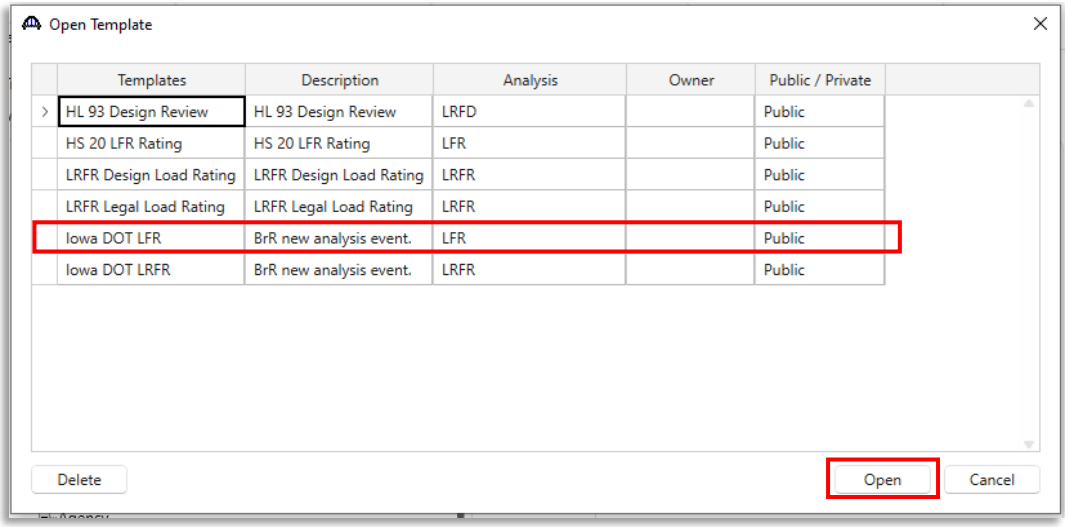
5. In the top ribbon, select "DESIGN/RATE" and click on the "Analysis Settings". Note that the "Analyze" icon is greyed out.



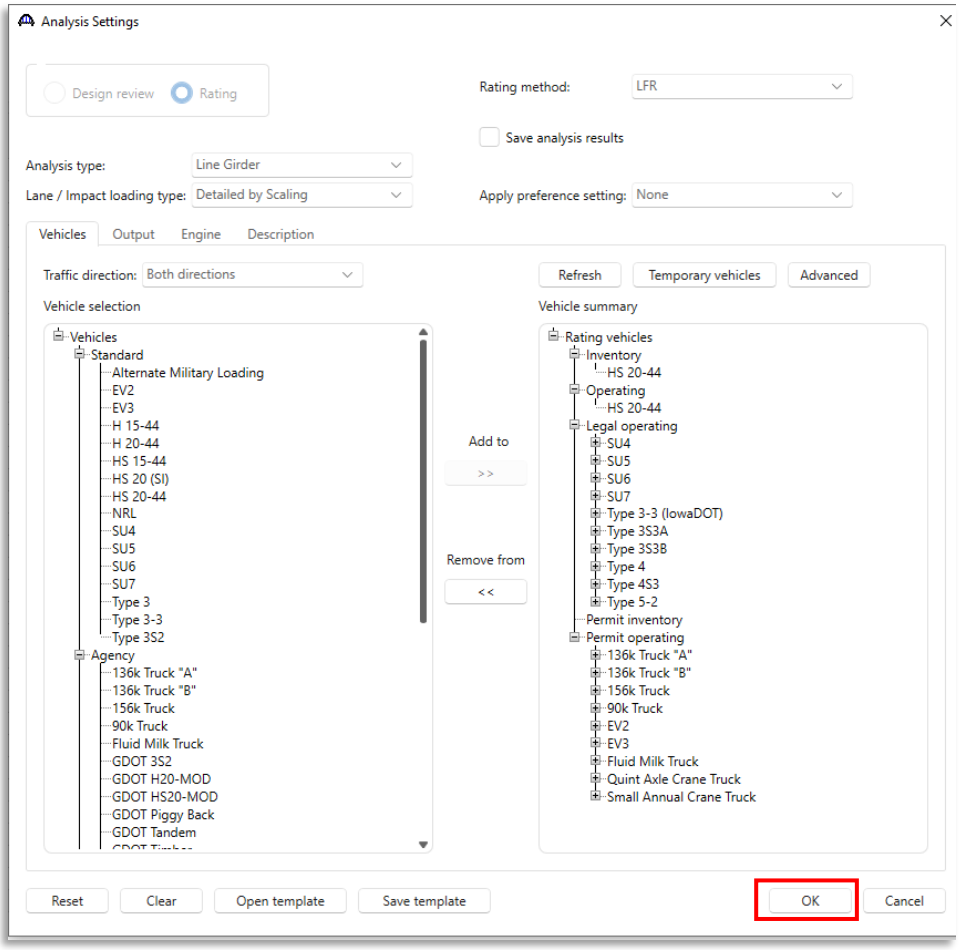
6. In the "Analysis Settings" window, click on "Open template" at the bottom.



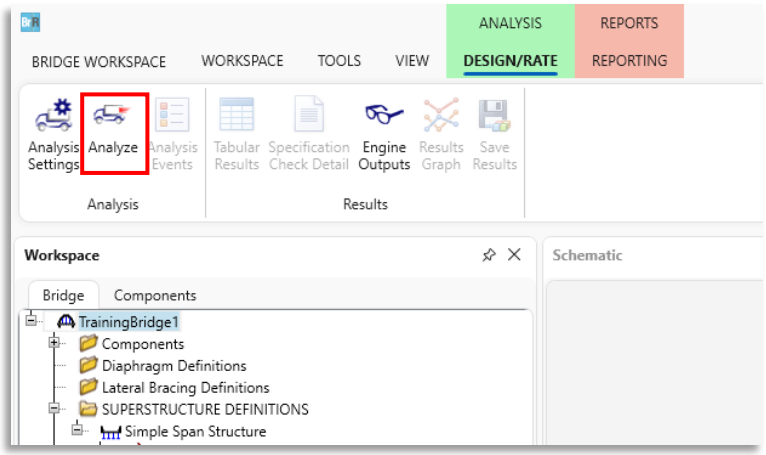
7. Select the appropriate analysis template and click "Open". In this example, "Iowa DOT LFR" is selected.



8. In the "Analysis Settings" window, the "Vehicle Summary" pane will show all the rating vehicles under their respective rating levels. Click "OK".

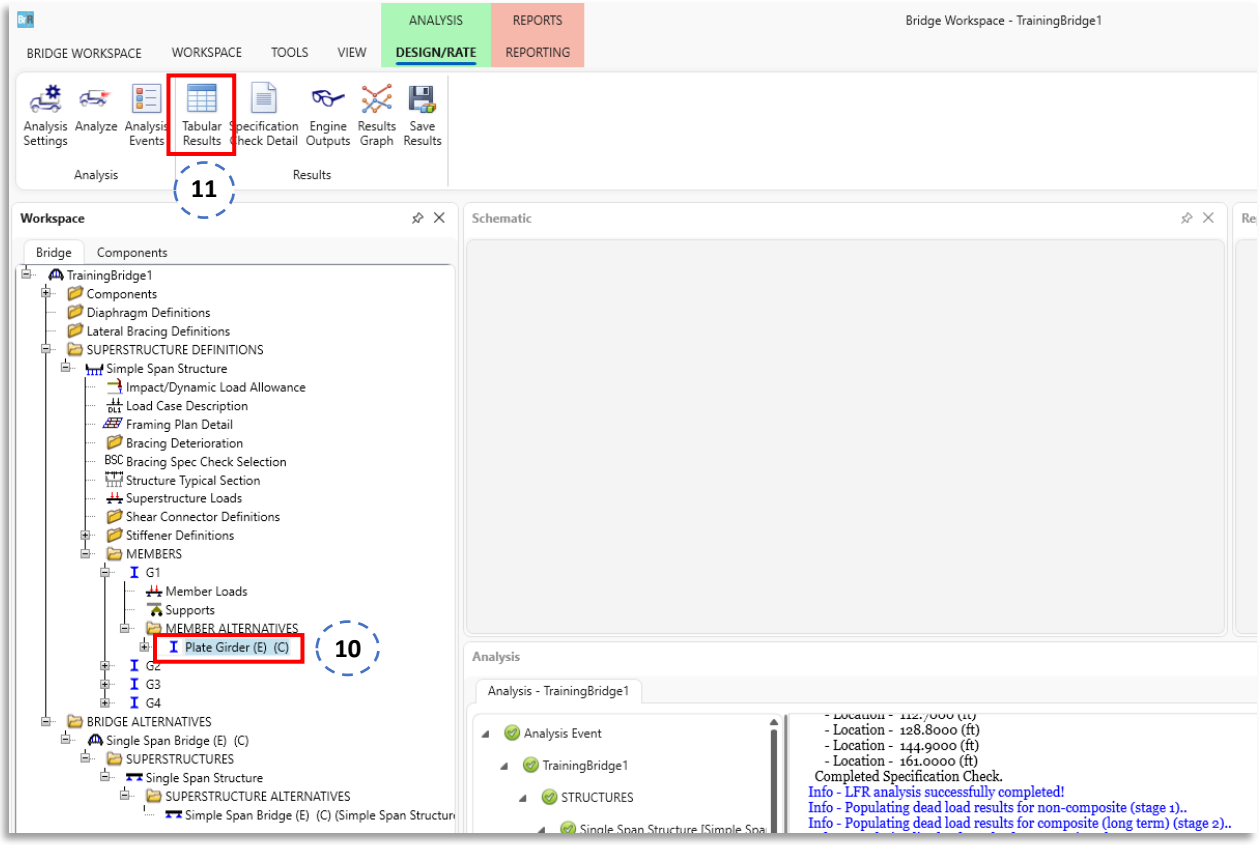


9. In the top ribbon, the "Analyze" icon is now activated, click on the icon to start the analysis.



10. Once the analysis has been completed, in the Bridge Workspace tree, navigate to the Member Alternatives and select the member to highlight it. In this example, “G1” -> “Plate Girder” member alternative is selected.

11. In the top ribbon, click on “Tabular Results” to bring up the “Analysis Results” of the selected member.



APPENDIX A

Iowa DOT BrR System Data File Settings

A1 BrR System Data: Parameters – Districts

Parameters

Selection criteria: District

ID	District [a]
01	01
02	02
03	03
04	04
05	05
06	06
07	07 [b]

A2 BrR System Data: Parameters – Counties

Parameters

Selection criteria: County

ID	County [a]
01	Adair
02	Adams
03	Allamakee
04	Appanoose
05	Audubon
06	Benton
07	Black Hawk
08	Boone
09	Bremer
10	Buchanan
11	Buena Vista
12	Butler
13	Calhoun
14	Carroll
15	Cass
16	Cedar
17	Cerro Gordo
18	Cherokee
19	Chickasaw
20	Clarke
21	Clay
22	Clayton
23	Clinton
24	Crawford
25	Dallas

Parameters

Selection criteria: County

ID	County [a]
26	Davis
27	Decatur
28	Delaware
29	Des Moines
30	Dickinson
31	Dubuque
32	Emmet
33	Fayette
34	Floyd
35	Franklin
36	Fremont
37	Greene
38	Grundy
39	Guthrie
40	Hamilton
41	Hancock
42	Hardin
43	Harrison
44	Henry
45	Howard
46	Humboldt
47	Ida
48	Iowa
49	Jackson
50	Jasper

Parameters

Selection criteria: County

ID	County [a]
51	Jefferson
52	Johnson
53	Jones
54	Keokuk
55	Kossuth
56	Lee
57	Linn
58	Louisa
59	Lucas
60	Lyon
61	Madison
62	Mahaska
63	Marion
64	Marshall
65	Mills
66	Mitchell
67	Monona
68	Monroe
69	Montgomery
70	Muscatine
71	O'Brien
72	Osceola
73	Page
74	Palo Alto
75	Plymouth

Parameters

Selection criteria: County

ID	County [a]
75	Plymouth
76	Pocahontas
77	Polk
78	Pottawattamie
79	Poweshiek
80	Ringgold
81	Sac
82	Scott
83	Shelby
84	Sioux
85	Story
86	Tama
87	Taylor
88	Union
89	Van Buren
90	Wapello
91	Warren
92	Washington
93	Wayne
94	Webster
95	Winnebago
96	Winneshiek
97	Woodbury
98	Worth
99	Wright

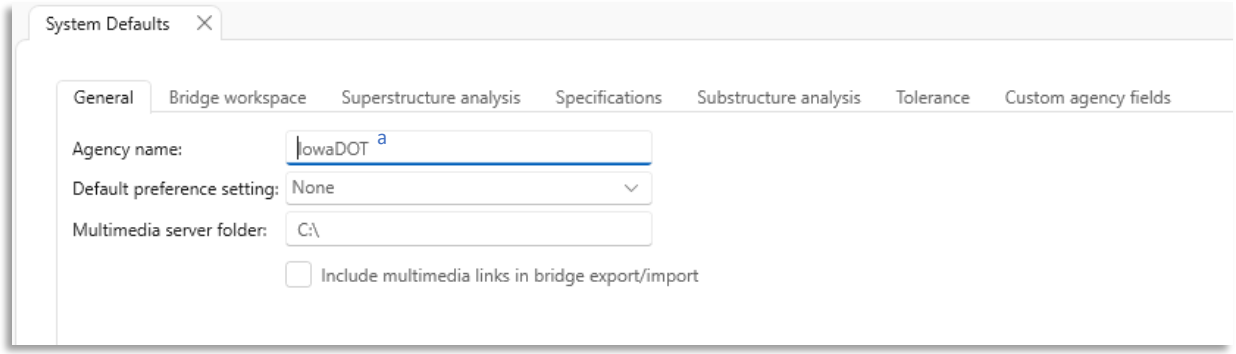
Notes:

[a] Item modified or added for Iowa DOT BrR System File. Otherwise, they are BrR default values or items.

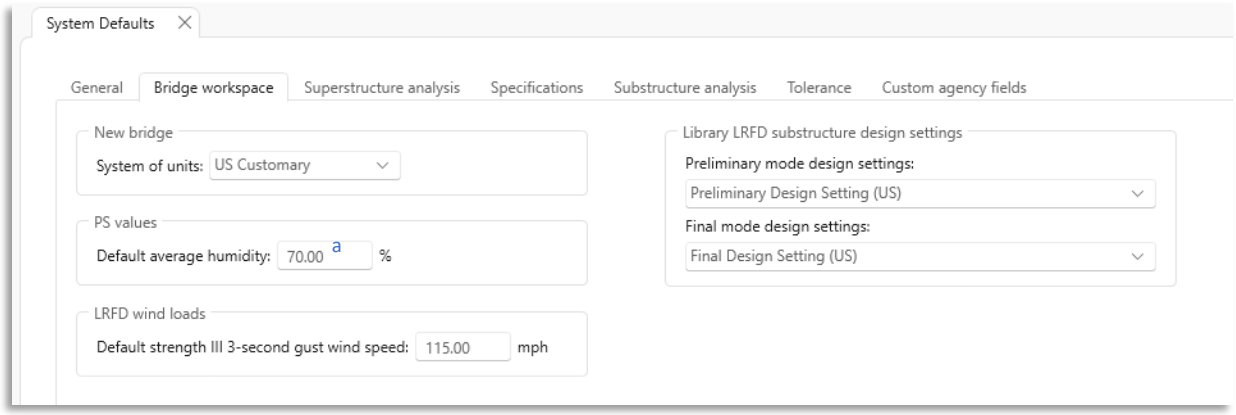
[b] District 7 is for Local Public Agencies (LPA)

A3 BrR System Data: System Defaults

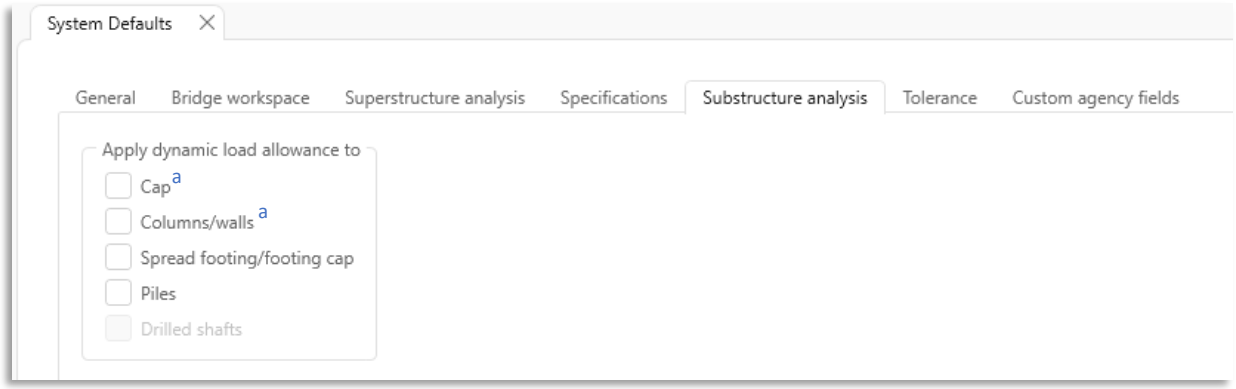
General



Bridge workspace



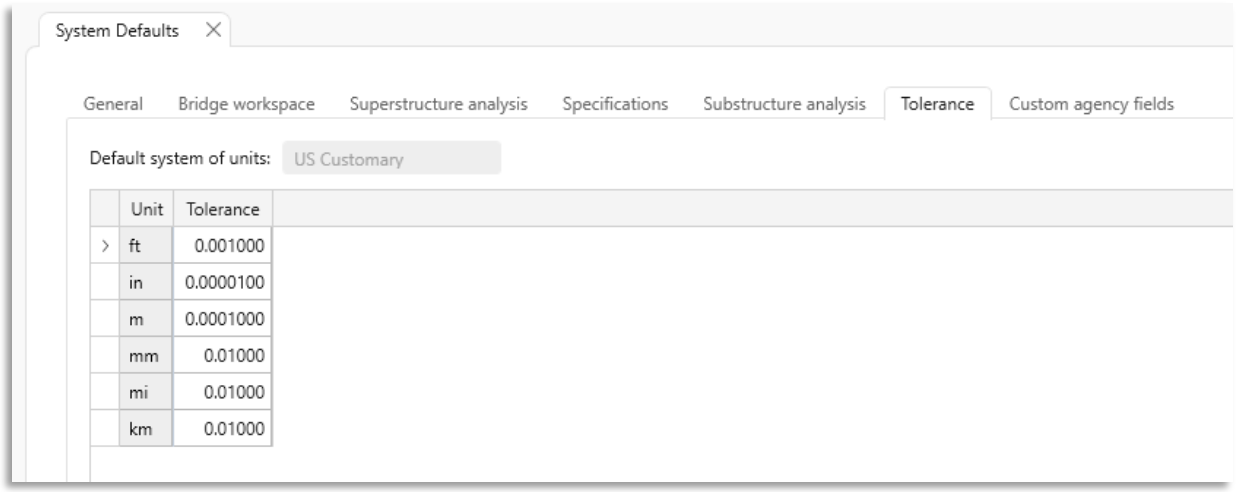
Substructure analysis



Notes:
[a] Item modified or added for Iowa DOT BrR System File. Otherwise, they are BrR default values or items.

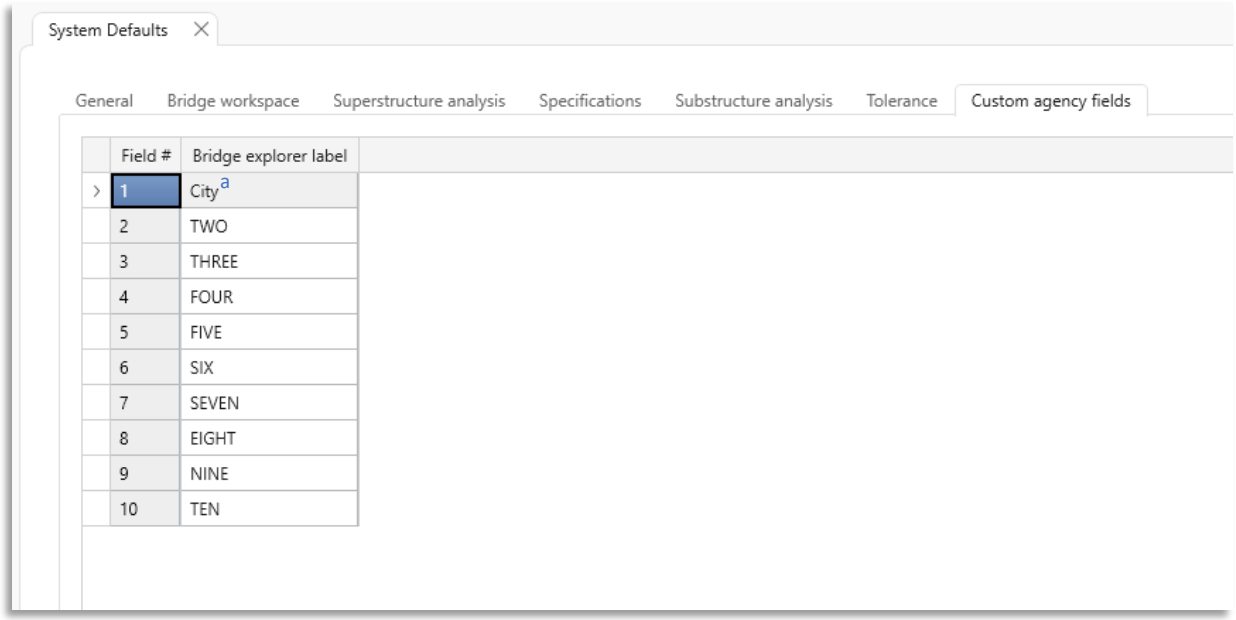
A3 BrR System Data: System Defaults (Cont'd)

Tolerance



Unit	Tolerance
ft	0.001000
in	0.0000100
m	0.0001000
mm	0.01000
mi	0.01000
km	0.01000

Custom agency fields

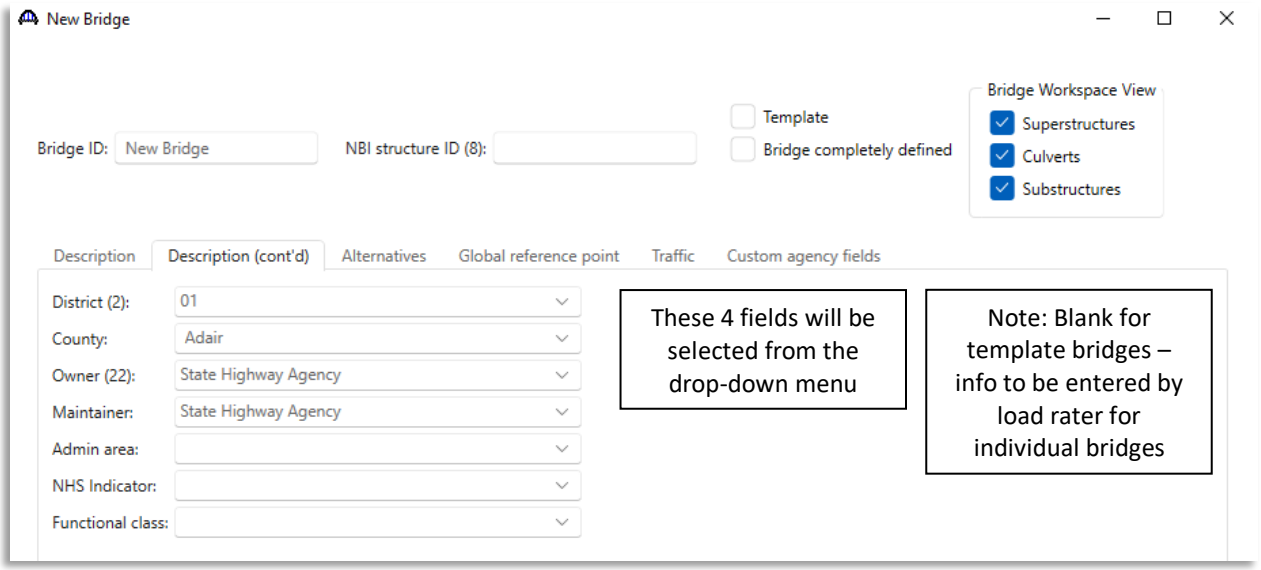


Field #	Bridge explorer label
1	City[a]
2	TWO
3	THREE
4	FOUR
5	FIVE
6	SIX
7	SEVEN
8	EIGHT
9	NINE
10	TEN

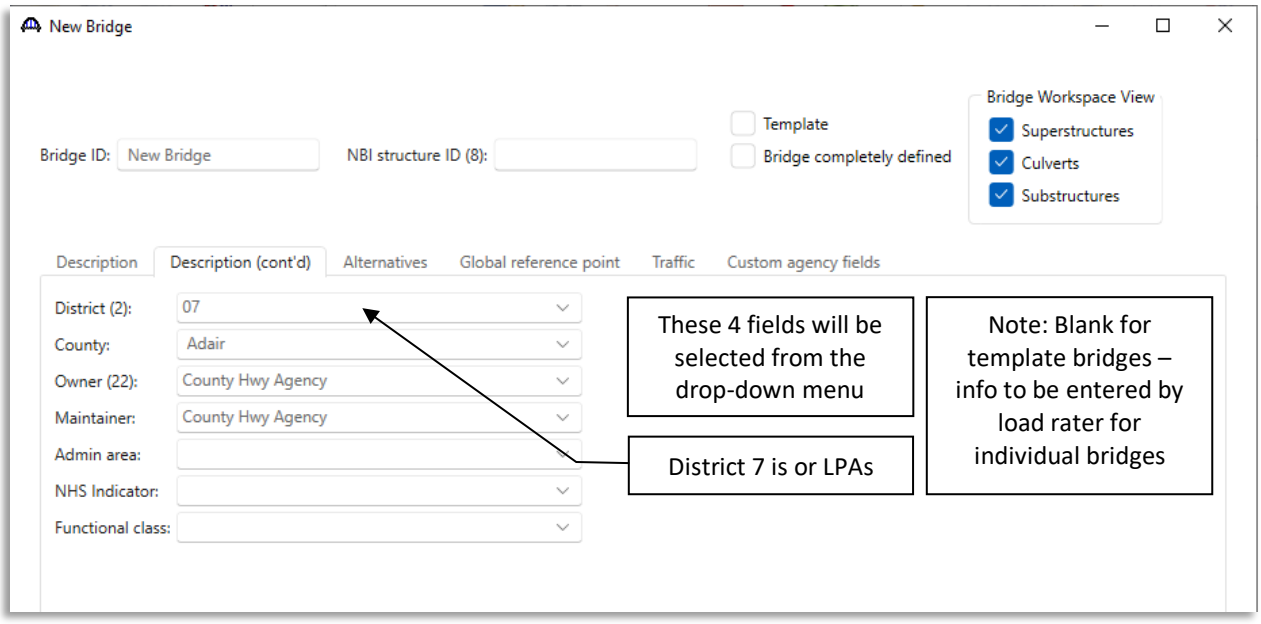
Notes:
[a] Item modified or added for Iowa DOT BrR System File. Otherwise, they are BrR default values or items.

A4 Example of BrR Bridge Model Description Window

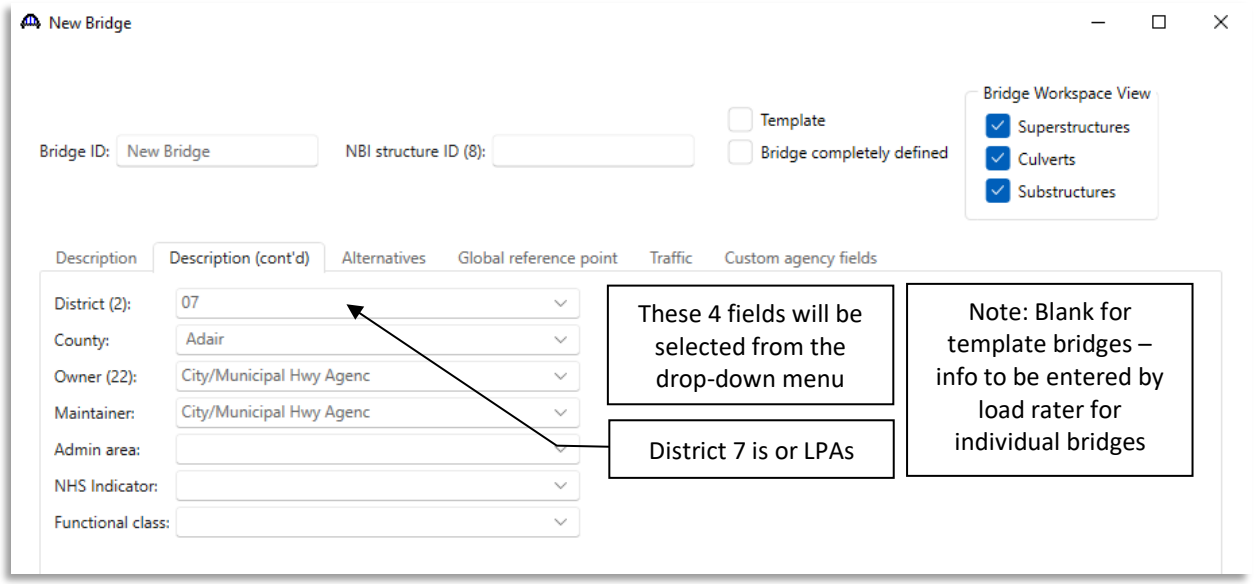
State Bridges

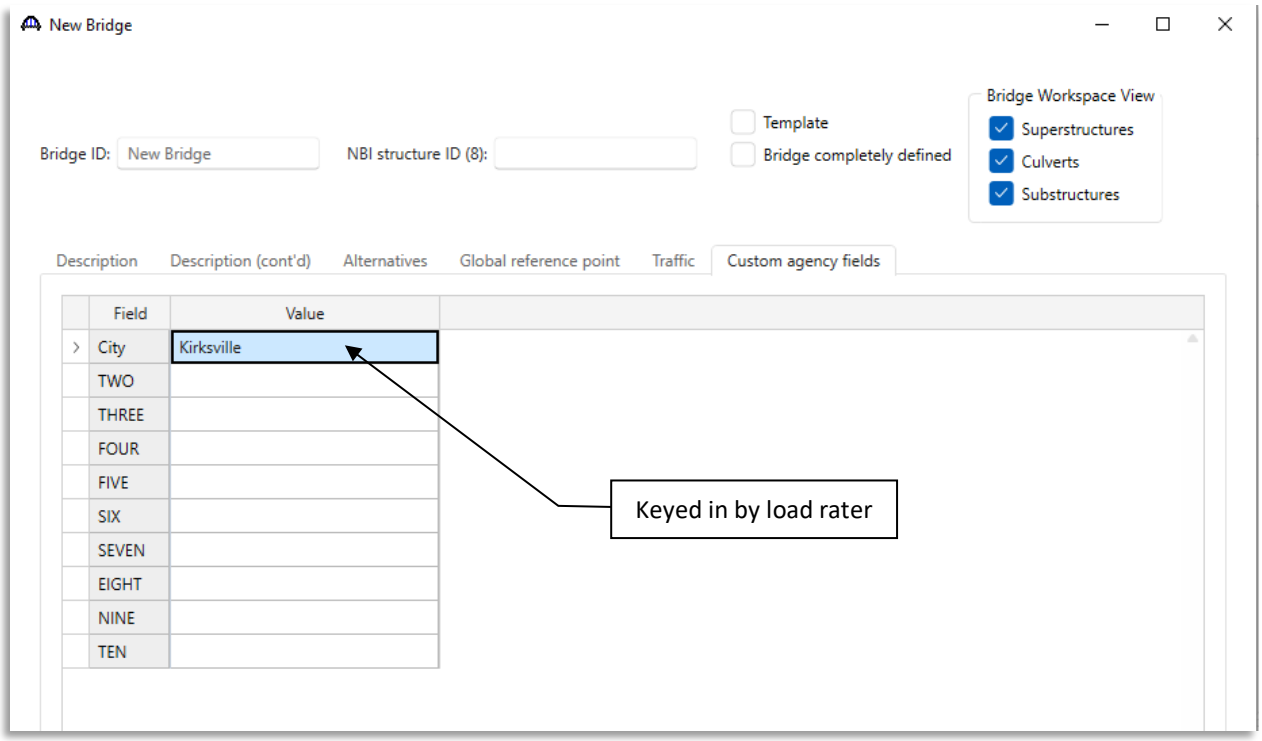


County Bridges



City Bidges


New Bridge
Bridge ID: New Bridge
NBI structure ID (8):
Template
Bridge completely defined
Bridge Workspace View
Superstructures
Culverts
Substructures
Description
Description (cont'd)
Alternatives
Global reference point
Traffic
Custom agency fields
District (2): 07
County: Adair
Owner (22): City/Municipal Hwy Agenc
Maintainer: City/Municipal Hwy Agenc
Admin area:
NHS Indicator:
Functional class:
These 4 fields will be selected from the drop-down menu
District 7 is or LPAs
Note: Blank for template bridges – info to be entered by load rater for individual bridges


New Bridge
Bridge ID: New Bridge
NBI structure ID (8):
Template
Bridge completely defined
Bridge Workspace View
Superstructures
Culverts
Substructures
Description
Description (cont'd)
Alternatives
Global reference point
Traffic
Custom agency fields
Field
Value
City
Kirksville
TWO
THREE
FOUR
FIVE
SIX
SEVEN
EIGHT
NINE
TEN
Keyed in by load rater

APPENDIX B

Iowa DOT BrR Library Data File Settings

B1 BrR Library Data: Appurtenances

Generic

Library	Units	Name	Description
Agency Defined	US Customary	Curb_8" H x 2'-1.5" W (6" Overhang)	Iowa DOT Standard curb with 6" overhang (Area 231.7 sq.in.)
Agency Defined	US Customary	ConcRail_3'-2" Aesthetic	Iowa DOT Aesthetic concrete railing
Agency Defined	US Customary	ConcRail_2'-8" Open (20" Block)	Iowa DOT Standard Open Rail w/ 1'-8" top rail block height
Agency Defined	US Customary	ConcRail_2'-8" Open (19" Block)	Iowa DOT Standard Open Rail w/ 1'-7" top rail block height
Agency Defined	US Customary	ConcRail_2'-5" Open (15" Block)	Iowa DOT Standard Open Rail w/ 1'-3" top rail block height
Agency Defined	US Customary	ConcRail_2'-5" Open (19" Block)	Iowa DOT Standard Open Rail w/ 1'-7" top rail block height
Agency Defined	US Customary	ConcRail_3'-6" Median Barrier	Iowa DOT Standard Median Rail
Agency Defined	US Customary	ConcRail_2'-10" Separation Barrier	Iowa DOT Standard Separation Barrier
Agency Defined	US Customary	ConcRail_2'-10" Aesthetic	Iowa DOT Aesthetic concrete railing w/ 3/4" panels
Agency Defined	US Customary	ConcRail_3'-6" Open (1'-1" Window)	Iowa DOT Standard Open Rail w/ 1'-1" windows

Median

Library	Units	Name	Description
Agency Defined	US Customary	ConcRail_2'-5" Temporary Barrier Rail	Iowa DOT Standard Temporary Barrier Rail

Parapet

Library	Units	Name	Description
Agency Defined	US Customary	Curb_10" H x 1'-3.5" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_10" H x 1'-3" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_10" H x 1'-1.5" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_10" H x 1'-0" W (1.25" Slope Width)	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_10" H x 1'-0" W (7/8" Slope Width)	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_12" H x 1'-0" W (1.25" Slope Width)	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_12" H x 1'-0" W (1.5" Slope Width)	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_18" H x 1'-0" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_18" H x 1'-1.5" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_8" H x 9.5" W	Iowa DOT Standard curb
Agency Defined	US Customary	Curb_10" H x 11.25" W (3" Back Ext.)	Iowa DOT Standard curb with 6" x 3" back extension
Agency Defined	US Customary	Curb_11" H x 9.5" W (1" Back Ext.)	Iowa DOT Standard curb with 7" x 1" back extension
Agency Defined	US Customary	Curb_12" H x 9.5" W (1" Back Ext.)	Iowa DOT Standard curb with 7" x 1" back extension
Agency Defined	US Customary	Curb_9.5" H x 1'-11" W (11" Back Ext.)	Iowa DOT Standard curb with 9" x 11" back extension
Agency Defined	US Customary	Curb_10" H x 2'-0" W (9" Back Ext.)	Iowa DOT Standard curb with 9" x 9" back extension
Agency Defined	US Customary	ConcRail_2'-8" F-Shaped (8" W)	Iowa DOT Standard F-Shaped Barrier Rail w/ 8" top width
Agency Defined	US Customary	ConcRail_2'-10" F-Shaped (9.5" W)	Iowa DOT Standard F-Shaped Barrier Rail w/ 9.5" top width
Agency Defined	US Customary	ConcRail_2'-10" F-Shaped (7.75" W)	Iowa DOT Standard F-Shaped Barrier Rail w/ 7.75" top width
Agency Defined	US Customary	Curb_10" H x 2'-6.75" W (3" Back Ext.)	Iowa DOT Standard curb with 8" x 3" back extension
Agency Defined	US Customary	Curb_10" H x 3'-0.75" W (3" Back Ext.)	Iowa DOT Standard curb wtih 8" x 3" back extenstion
Agency Defined	US Customary	ConcRail_3'-8" F-Shaped (8.5" W)	Iowa DOT Standard F-Shaped Barrier Rail w/ 8.5" top width
Agency Defined	US Customary	ConcRail_2'-10" F-Shaped (3" Back Ext.)	Iowa DOT Standard F-Shaped Barrier Rail with 6" x 3" Back Extension
Agency Defined	US Customary	ConcRail_3'-6" F-Shaped (7" W)	Iowa DOT Standard F-Shaped Barrier Rail w/ 7" top width
Agency Defined	US Customary	ConcRail_3'-8" F-Shaped (6" Back Ribs)	Iowa DOT Standard Barrier Rail w/ 9.5" top width and three 6" ribs as additional load
Agency Defined	US Customary	Curb_10" H x 1'-0" W (3" Back Ext.)	Iowa DOT Standard curb with 6" x 3" back extension

Railing

Library	Units	Name	Description
Agency Defined	US Customary	SteelRail_Pedestrian Hand Rail	Iowa DOT Standard Pedestrian Hand Rail
Agency Defined	US Customary	MetalRail_Steel Railing	Iowa DOT generic steel railing [C]
Agency Defined	US Customary	ConcRail_1'-11" W-Beam Railing	Iowa DOT Side mounted concrete post with W-beam railing 6'-3" spacing
Agency Defined	US Customary	MetalRail_Aluminum Railing	Iowa DOT generic aluminum railing [C]

Notes:
[c] Steel and aluminum bridge railings are defined as generic railings with a conservative railing load of 0.05 kip/ft and 0.03 kip/ft, respectively. Actual railing load can be calculated and keyed in for a more refined analysis if needed.

B2 BrR Library Data: Materials

Concrete

Library	Units	Name	Description
Agency Defined	US Customary	PS Concrete (f'c=5ksi & f'ci=4.5ksi)	Iowa DOT Prestressed concrete [d]
Agency Defined	US Customary	f'c= 3000 psi	Iowa DOT 3000 psi Cement Concrete [d]

Reinforcing Steel

Library	Units	Name	Description
Agency Defined	US Customary	Up to 1905	Iowa DOT reinforcing steel built up to year 1905
Agency Defined	US Customary	1906 to 1944	Iowa DOT reinforcing steel built between year 1906 to year 1944
Agency Defined	US Customary	1945 to 1980	Iowa DOT reinforcing steel built between year 1945 to year 1980
Agency Defined	US Customary	Unknown Grade, After 1980 - 40 ksi	Iowa DOT reinforcing steel unknown grade built after year 1980 - 40 ksi
Agency Defined	US Customary	After 1980 - 60 ksi	Iowa DOT reinforcing steel built after year 1980 - 60 ksi

Structural Steel

Library	Units	Name	Description
Agency Defined	US Customary	ASTM A7 Steel (Up to 1934)	Iowa DOT ASTM A7 Steel built up to year 1934
Agency Defined	US Customary	ASTM A7 Steel (After 1934)	IowaDOT ASTM A7 Steel built after year 1934

Notes:
[d] For other concrete strengths, user can select this library item in the model, update the f'c and fc values, and click the "Compute" button to auto populate other material parameters. The item name can be updated as needed in the model.

B3 BrR Library Data: Prestress Shapes

Box Beams – Rectangular Void

Library	Units	Name	Description	Year
Agency Defined	US Customary	IowaDOT_PPCBB_21Hx48W	IowaDOT Standards B24-16.pdf & B30-16.pdf Height: 21" Width: 48"	2016
Agency Defined	US Customary	IowaDOT_PPCBB_27Hx48W	IowaDOT Standards B24-16.pdf & B30-16.pdf Height: 27" Width: 48"	2016
Agency Defined	US Customary	IowaDOT_PPCBB_33Hx48W	IowaDOT Standards B24-16.pdf & B30-16.pdf Height: 33" Width: 48"	2016

I Beams – Narrow Top Flange

Library	Units	Name	Description	Year
Agency Defined	US Customary	IowaDOT_PPCIB_25Hx9TF	IowaDOT Standard H10 standards .pdf Height: 25" Width: Top flange: 9", Bottom flange: 16"	1954
Agency Defined	US Customary	IowaDOT_PPCIB_28Hx12TF	IowaDOT Standards H11 standards .pdf & PC_S.pdf Height: 28" Width: Top flange: 12", Bottom flange: 16"	1956
Agency Defined	US Customary	IowaDOT_PPCIB_35Hx12TF	IowaDOT Standards H11 standards .pdf & PC_S.pdf Height: 35" Width: Top flange: 12", Bottom flange: 16"	1956
Agency Defined	US Customary	IowaDOT_PPCIB_BeamA_32Hx13TF	IowaDOT Standards H12 standards .pdf, H13 standards .pdf, H14 standards .pdf, H15 sta... Height: 32" Width: Top flange: 13", Bottom flange: 17"	1960
Agency Defined	US Customary	IowaDOT_PPCIB_BeamB_39Hx13TF	IowaDOT Standards H12 standards .pdf, H13 standards .pdf, H14 standards .pdf, H15 sta... Height: 39" Width: Top flange: 13", Bottom flange: 17"	1960
Agency Defined	US Customary	IowaDOT_PPCIB_BeamC_45Hx13TF	IowaDOT Standards H12 standards .pdf, H13 standards .pdf, H14 standards .pdf, H15 sta... Height: 45" Width: Top flange: 13", Bottom flange: 17"	1960
Agency Defined	US Customary	IowaDOT_PPCIB_BeamA_32Hx15TF	IowaDOT Standards H15 standards .pdf, H16 standards .pdf, H24-84 standards .pdf, H24... Height: 32" Width: Top flange: 15", Bottom flange: 19"	1969
Agency Defined	US Customary	IowaDOT_PPCIB_BeamB_39Hx15TF	IowaDOT Standards H15 standards .pdf, H16 standards .pdf, H24-84 standards .pdf, H24... Height: 39" Width: Top flange: 15", Bottom flange: 19"	1969
Agency Defined	US Customary	IowaDOT_PPCIB_BeamC_45Hx15TF	IowaDOT Standards H15 standards .pdf, H16 standards .pdf, H24-84 standards .pdf, H24... Height: 45" Width: Top flange: 15", Bottom flange: 19"	1969
Agency Defined	US Customary	IowaDOT_PPCIB_BeamC_45Hx16TF	IowaDOT Standards H24-06 standards .pdf, H24-87 standards .pdf, , H24S-87 standards .... Height: 45" Width: Top flange: 16", Bottom flange: 20"	1987
Agency Defined	US Customary	IowaDOT_PPCIB_BeamA_32Hx16TF	IowaDOT Standards H24-87 standards .pdf, H24S-87 standards .pdf, H24SI-05 standards... Height: 32" Width: Top flange: 16", Bottom flange: 20"	1987
Agency Defined	US Customary	IowaDOT_PPCIB_BeamB_39Hx16TF	IowaDOT Standards H24-87 standards .pdf, H24S-87 standards .pdf, H24SI-05 standards... Height: 39" Width: Top flange: 16", Bottom flange: 20"	1987
Agency Defined	US Customary	IowaDOT_PPCIB_BeamD_54Hx20TF	IowaDOT Standards H24SI-05 standards .pdf, H30SI-05 standards .pdf, and H30SI-12 sta... Height: 54" Width: Top flange: 20", Bottom flange: 22"	2005

Tee Beams

Library	Units	Name	Description	Year
Agency Defined	US Customary	IowaDOT_PPCDTB_25Hx96TF	IowaDOT Standard H17 standards .pdf Height: 25" Top Width: 96"	1973

B4 BrR Library Data: Vehicles – Standard Gage

Library	Units	Name	Description
Agency Defined	US Customary	Type 4	Iowa DOT Legal Load - Straight Truck 54.5 Kips
Agency Defined	US Customary	Type 3S3A	Iowa DOT Legal Load - Truck + Semi Trailer 80 Kips
Agency Defined	US Customary	Type 3S3B	Iowa DOT Legal Load - Truck + Semi Trailer 90 Kips
Agency Defined	US Customary	Type 4S3	Iowa DOT Legal Load - Truck + Semi Trailer 96 Kips
Agency Defined	US Customary	Type 3-3 (Iowa DOT)	Iowa DOT Legal Load - Truck + Full Trailer 80 Kips
Agency Defined	US Customary	Type 5-2	Iowa DOT Legal Load - Truck + Full Trailer 96 Kips
Agency Defined	US Customary	90k Truck	Iowa DOT Annual Permit Truck 90 Kips - 6-Axle Vehicle
Agency Defined	US Customary	136k Truck "A"	Iowa DOT Annual Permit Truck 136 Kips - 7-Axle Truck with a Triple-Axle Configuration
Agency Defined	US Customary	136k Truck "B"	Iowa DOT Annual Permit Truck 136 Kips - 7-Axle Truck with a Quad-Axle Configuration
Agency Defined	US Customary	156k Truck	Iowa DOT Annual Permit Truck 156 Kips - 8-Axle Truck with a Quad-Axle Configuration
Agency Defined	US Customary	Quint Axle Crane Truck	Iowa DOT Annual Permit Truck 100 Kips - 5-Axle Truck with a Triple-Axle Configuration
Agency Defined	US Customary	Fluid Milk Truck	Iowa DOT Annual Permit Truck 96 Kips - 7-Axle Truck with a Six-Axle Configuration
Agency Defined	US Customary	Small Annual Crane Truck	Iowa DOT Annual Permit Truck 80 Kips - Triple-Axle Configuration
Agency Defined	US Customary	Type 3 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 56 Kips
Agency Defined	US Customary	Type 4 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 61.1 Kips
Agency Defined	US Customary	SU4 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 60.5 Kips
Agency Defined	US Customary	SU5 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 69.4 Kips
Agency Defined	US Customary	SU6 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 77.9 Kips
Agency Defined	US Customary	SU7 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 86.8 Kips
Agency Defined	US Customary	Type 3S2 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 80.6 Kips
Agency Defined	US Customary	Type 3S3A OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 89.6 Kips
Agency Defined	US Customary	Type 3S3B OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 100.8 Kips
Agency Defined	US Customary	Type 4S3 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 107.5 Kips
Agency Defined	US Customary	Type 3-3 OW (Iowa DOT)	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 89.6 Kips
Agency Defined	US Customary	Type 5-2 OW	Iowa DOT Annual All-Systems Permit Truck - Legal Load + 12% OW 107.5 Kips
Agency Defined	US Customary	Type 4 Lane-Type	Iowa DOT Legal Load Lane-Type - Straight Truck 40.875 Kips (0.75 Reduction) [e]
Agency Defined	US Customary	Type 3S3A Lane-Type	Iowa DOT Legal Load Lane-Type- Truck + Semi Trailer 60 Kips (0.75 Reduction) [e]
Agency Defined	US Customary	Type 3-3 Lane-Type (Iowa DOT)	Iowa DOT Legal Load Lane Type - Truck + Full Trailer 60 Kips (0.75 Reduction) [e]
Agency Defined	US Customary	Type 3S3B Lane-Type	Iowa DOT Legal Load Lane-Type - Truck + Semi Trailer 67.5 Kips (0.75 Reduction) [e]
Agency Defined	US Customary	Type 4S3 Lane-Type	Iowa DOT Legal Load Lane-Type - Truck + Semi Trailer 72 Kips (0.75 Reduction) [e]
Agency Defined	US Customary	Type 5-2 Lane-Type	Iowa DOT Legal Load Lane-Type - Truck + Full Trailer 72 Kips (0.75 Reduction) [e]

Assumptions:

- Wheel contact width = P/0.8, where P = Wheel Load
- All added trucks have standard gage distance of 6 ft.

Notes:

[e] Vehicles for negative moments and reactions at interior supports, per AASHTO MBE 3rd Ed. 6A.4.4.2.1a.