

**LARS Bridge CONNECT Edition V20 Update 20.00.00.32
Release Notes
June 2020**

LARS Bridge CONNECT Edition V20 is a modernized version of LARS using a completely new format and new capabilities.

Prescribed deployment workflow – Existing LARS Users:

- **Guidelines for users of LARS: how to adopt New LARS**
 - LARS users will be able to create new models of steel, concrete, and timber bridges.
 - User can model multi-girder steel bridges, girder floorbeam stringer (GFS) bridges, prestressed concrete bridges, reinforced concrete bridges, and timber bridges.
 - Overview of modeling workflow is given below in this document. Details of each modeling dialog are accessible from help document or by pressing F1 key.
 - Tutorials in New LARS include pre-verified models.
 - How to create girder floorbeam and stringer (GFS) bridge
 - How to create multi girder steel bridge
 - Pre-verified examples in the installer directory:
 - Examples that are used for the verification of different bridge types are in the following directory:

- C:\Program Files\Bentley\LARS Bridge CE V20\Examples
- Importing the existing bmd (LARS) files to New LARS format
 - User can import files using batch import or individual file import:
 - Batch importing of files (no upper limit):

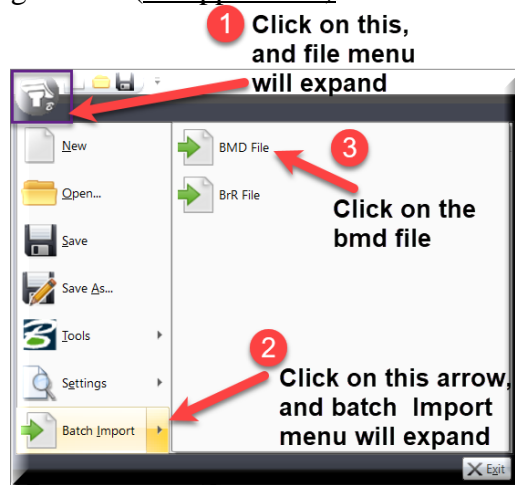


Figure: Expandable file menu

- User can select input folder where files are located, select the output folder where the files to be saved.

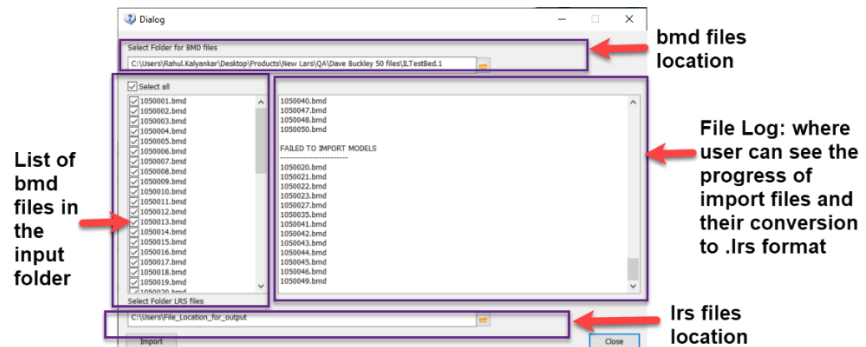


Figure: File import dialog

- In the batch import, user can select any number of files located in the input folder.
- LARS automatically separate the files that it supports for current release from selected list of bmd files and convert them in the New LARS format (.lrs).
- In the output folder, LARS automatically create sub-folders for different bridge types (steel and concrete), and separate/save the Lrs files in them. Sub-folders and the file separation as shown below:

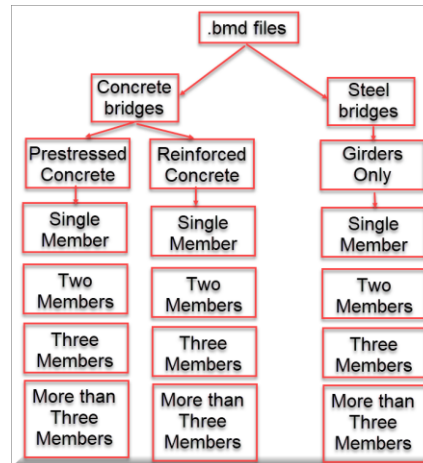


Figure: Sub-folders in the output folder for saving .lrs files

- Importing individual file
 - In the individual file import, user can open the file using following steps:

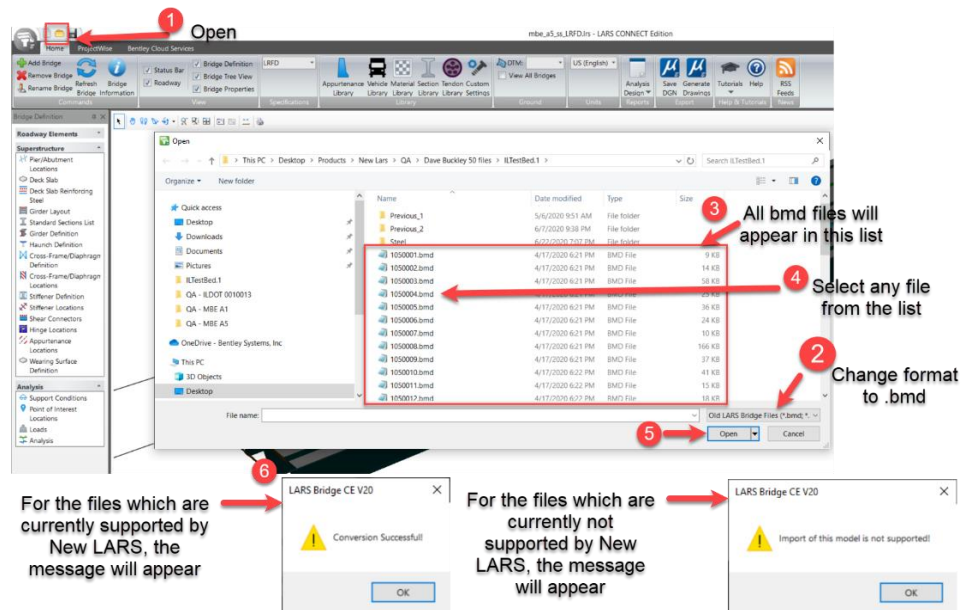


Figure: Import/Open single file

- If batch mode is not used, it converts file but keep in same directory as source file.
- Currently, New LARS support following bridge type imports (bmd to lrs):
 - Steel multi-girder bridges (composite/non-composite).
 - Prestressed concrete I girder bridges.
 - Reinforced concrete T-beam and rectangular bridges.
 - Timber bridges (rectangular sections).
- New LARS will support following bridge type imports in the next release

- In the next release, user will be able to import all the files that are not supported in June release including .dat (old LARS format) to lrs:
 - Prestressed concrete box girders
 - Prestressed concrete T-beam and Double-T beam bridges
 - Reinforced concrete variable cross section beam bridges
 - Girder floorbeam stringer bridges
- In the next release, once the bmd files are selected from input folder (batch or individual), program will automatically convert the files that were left behind in the first successful conversion.
 - This function requires the log file that was saved during first successful conversion. Log files are typically located in D:\Work folder
 - In absence of log file, the New LARS will start the conversion process from the beginning.
- Importing the models from the BrR database to New LARS format
 - LARS support importing the BrR files from database to lrs format.
 - LARS require the secured access to BrR Server. User may choose to save the access credentials

The image shows a dialog box titled "Enter BrR(Virtis) Connection Info". It has three main input fields: a "Data Source" dropdown menu showing "AASHTOWareBr684", a "Username:" text box containing "bridge", and a "Password" text box with six dots. At the bottom left, there is a checked checkbox labeled "Save Settings". To the right of the checkbox are two buttons: "Connect" and "Cancel".

Figure: BrR access window

- User can import individual model/file from database

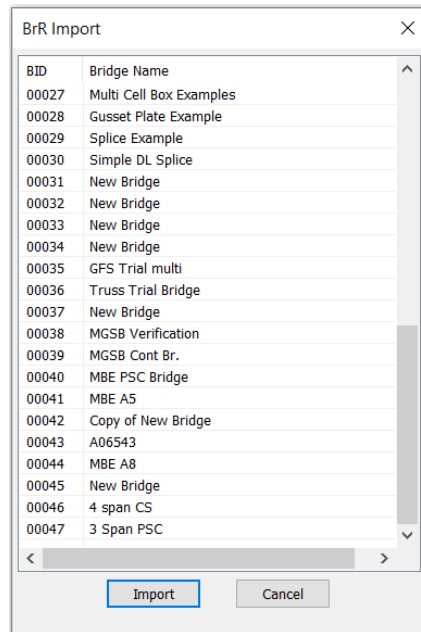


Figure: BrR database window

- User can select the output folder where the converted lrs files can be saved.
- **Tasks under development**
 - Multi-material bridge import (bmd files with multiple different types of bridges will be imported in the same model)
 - New API for users to convert the bmd files to BrR format

Prescribed deployment workflow – Existing SUPERLOAD Users:

- Web-services will be available in future for SL users to run the rating directly on the SL Website.
- Desktop version of SUPERLOAD with integrated New LARS will be available in future.
- Future capabilities
 - SUPERLOAD connectivity with New LARS
 - New LARS and SL will have a single analysis and rating engine.
 - New LARS does not require separate file converter for converting files from bmd/bars to New LARS format. No separate xfr file required. All the results are stored in the LARS (.lrs) files.
 - Users required to convert their bmd files and files from BrR database to New LARS prior using it with SUPERLOAD
 - This is a one-time process, and it can be done in the batch mode
 - New LARS takes the files from the common server (shared between SL and the users), preprocess them (saving the results from Dead Loads, Influence lines in the model itself) and save it to SL preferred location (SL server if available or client server)

- When the rating request is called in the SL in with specific vehicles, NLARS pick up the model saved on the server, perform live load analysis and rating, and provide results in the output folder
 - The original model does not save the live load results or rating results.
 - The rating results are stored in the output folder defined by SL

New welcome screen

- To create new bridges from beginning
- To open recently opened and saved bridges
- To create bridges using wizards (Multi-Girder, GFS, Concrete, and Timber type)
- Truss bridge type and Truss Bridge Wizard will be available in the future

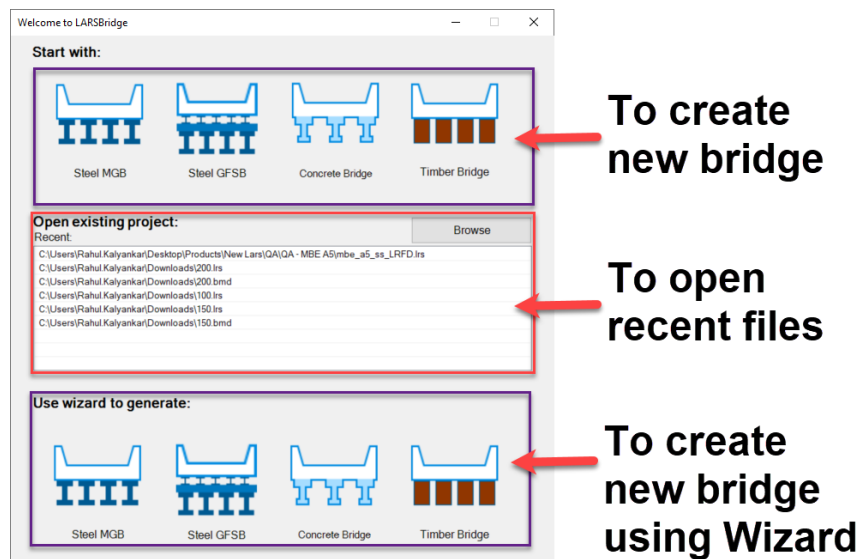


Figure: Welcome screen

Bridge Wizards: wizards for different bridge types

- **Steel Bridges**
 - Multi-girder and girder floorbeam stringer (GFS) bridges
 - Using standard sections and plate girders
 - Supports multi-span bridges and multi-material girders
 - Predefined section library for the standard steel sections
- **Concrete Bridges**
 - Prestressed and reinforced concrete bridges
 - Predefined section library for the standard prestressed concrete sections
 - Support multiple span prestressed and reinforced concrete bridge type

- **Timber Bridges**
 - Shortcut access to timber material library
 - Support timber slab over timber girder or concrete slab over timber girders
 - Support multi-girder timber bridges or girder floorbeam timber bridges
- **Truss Bridges**
 - Truss wizard will be available in the future

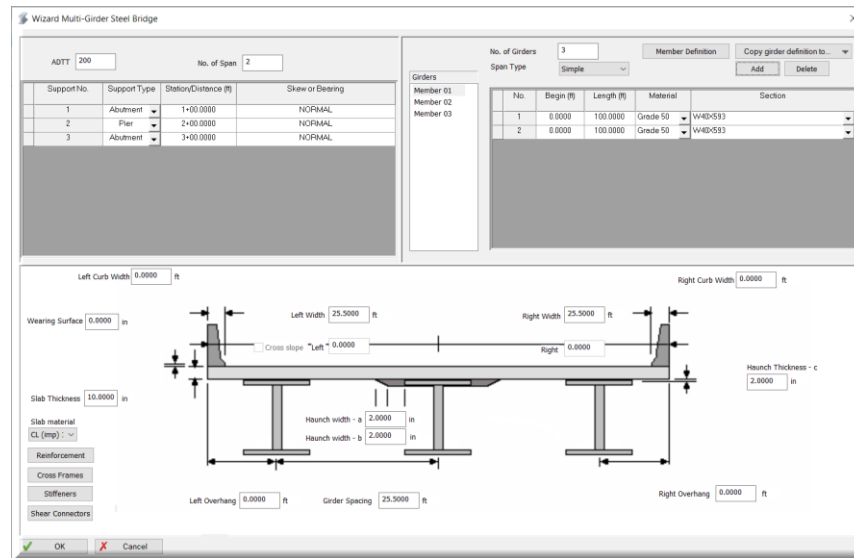


Figure: Multi-girder steel bridge wizard

New Modeling Workflow and 3D Viewer:

- Model the new bridges using following dialogs and visualize bridges in 3D Viewer
 - Cross-section of bridge
 - Sections and materials (timber bridges only)
 - Pier/Abutment locations
 - Deck slab/reinforcement
 - Girders (steel, concrete, timber)
 - Stringers and floorbeams in GFS/GF Bridges
 - Haunch for members supporting the deck slab
 - Cross frames and diaphragms (for multi-girder steel bridges), bracing locations (for GFS/GF bridges)
 - Strand pattern (concrete bridges only)
 - Rebar pattern (concrete bridges only)
 - Stiffeners
 - Shear connectors
 - Hinge locations
 - Appurtenance and median barriers
 - Wearing surface

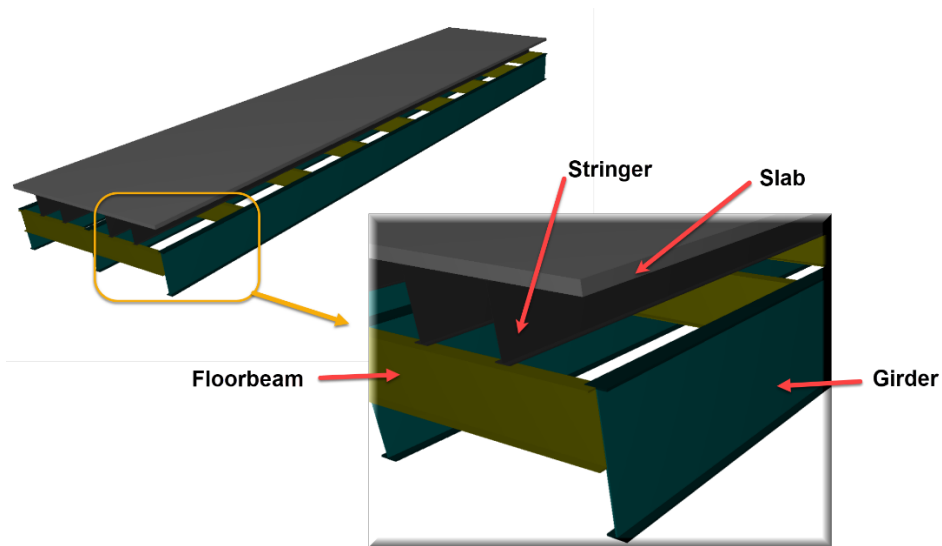


Figure: Girder Floorbeam Stringer (GFS) Bridge

- Variable superstructure link menu – different link menu for different bridge type.
 - Concrete bridge
 - Multi-girder steel bridge
 - Girder floorbeam stringer bridge
 - Timber bridge
 - *Truss bridge (will be available in the future)*

<div style="border: 1px solid gray; padding: 5px;"> <p>Superstructure</p> <ul style="list-style-type: none"> Pier/Abutment Locations Deck Slab Deck Slab Reinforcing Steel Girder Layout Standard Sections List Girder Definition Haunch Definition Cross-Frame/Diaphragm Definition Cross-Frame/Diaphragm Locations Stiffener Definition Stiffener Locations Shear Connectors Hinge Locations Appurtenance Locations Wearing Surface Definition </div> <p style="text-align: center;">Multi-Girder Steel Bridge</p>	<div style="border: 1px solid gray; padding: 5px;"> <p>Superstructure</p> <ul style="list-style-type: none"> Pier/Abutment Locations Deck Slab Deck Slab Reinforcing Steel Girder Layout Standard Sections List Girder Definition Floor Beam Layout Floor Beam Definition Stringer Layout Stringer Definition Haunch Definition Bracing Point Locations Stiffener Definition Stiffener Locations Shear Connectors Hinge Locations Appurtenance Locations Wearing Surface Definition </div> <p style="text-align: center;">Girder Floorbeam Stringer Bridge</p>	<div style="border: 1px solid gray; padding: 5px;"> <p>Superstructure</p> <ul style="list-style-type: none"> Pier/Abutment Locations Deck Slab Deck Slab Reinforcing Steel Girder Layout Standard Sections List Girder Definition Haunch Definition Diaphragm Locations Strand Pattern Definition Rebar Pattern Appurtenance Locations Wearing Surface Definition </div> <p style="text-align: center;">Concrete Bridge</p>	<div style="border: 1px solid gray; padding: 5px;"> <p>Superstructure</p> <ul style="list-style-type: none"> Sections and Materials Pier/Abutment Locations Deck Slab Deck Slab Reinforcing Steel Girder Layout Girder Definition Floor Beam Layout Floor Beam Definition Bracing Point Locations Stiffener Definition Stiffener Locations Hinge Locations Appurtenance Locations Wearing Surface Definition </div> <p style="text-align: center;">Timber Bridge</p>
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Figure: Superstructure workflow for different bridge type

- Analysis
 - Setting up the support conditions (girders only. For stringers and floorbeams, the support criteria are defined in the definition dialog itself)
 - Point of interest locations
 - Setting up the point of interest locations (different POI for each of the girders, floorbeams and stringers).
 - Pre-defined POIs for the most common locations
 - Capability to manually add or change the POI locations for any member in the group and copy function to copy the POIs from one member to another and one group to another.
 - Loads
 - Different rating combinations for different AASHTO specifications (LRFD – design, legal and permit load rating (each of the LRFD rating combination has inventory, operating and service). LFD/ASD – inventory and operating)
 - User can edit any rating combination by right click and then select edit.
 - User can add or delete any of the loads in the rating combination.
 - User can see the magnitude of loads in the rating combinations
 - User can see the system factor and condition factor used for capacity calculation (only for LRFD) by clicking edit on the rating combination
 - User can select rating option (such as only run shear rating or moment rating)

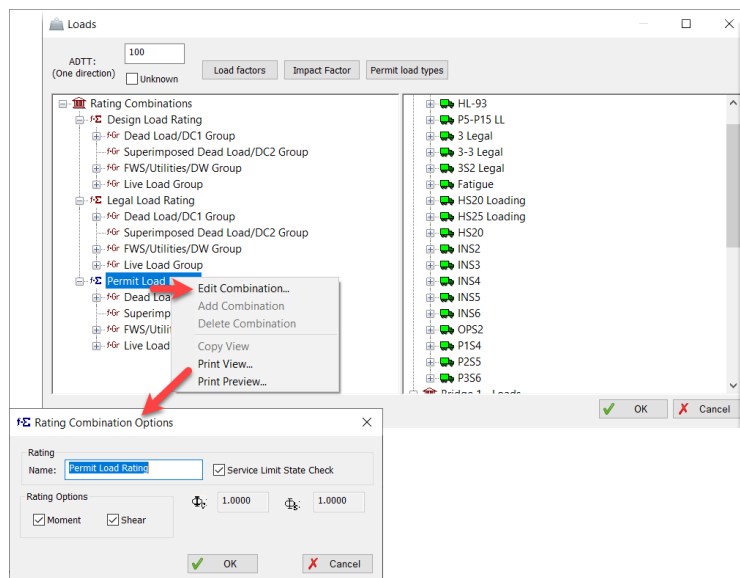


Figure: Rating combinations

- Load factor dialog (different load factors for different AASHTO specifications)

- Override program setting option in the load factor dialog to only bring selective load factors from the custom settings for bridges to the model
- Impact factor dialog with the option to set minimum impact factors (with default values already in place)
- Flexibility to apply different impact factor for different rating combination
- Library live loads – user can see different live loads in the model, and add the live loads to any of the rating combination by simply dragging the loads from right (library live loads) to left (in the rating combinations)

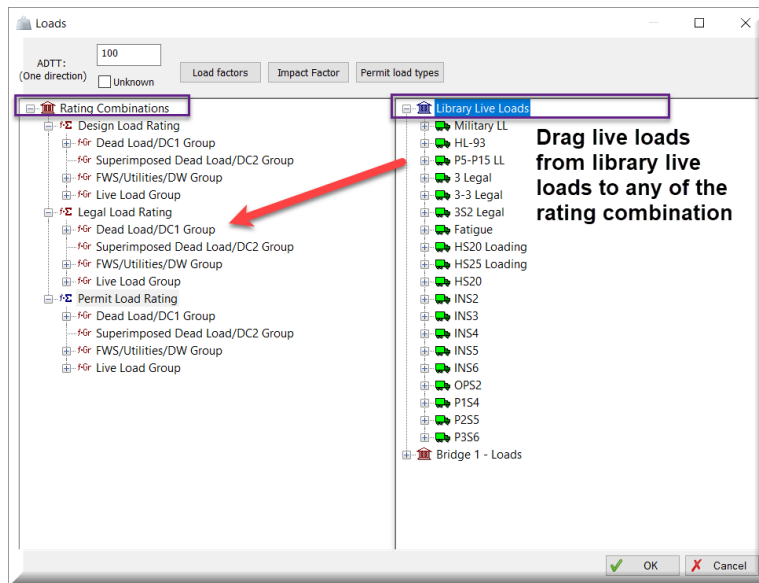


Figure: Adding live loads to rating combinations

- Bridge loads –
 - Automatically generated dead loads that include the self-weight of girder, self-weight of slab, haunch, cross frames, stiffeners (DC1 load category)
 - Automatically generated dead loads that include parapets and sidewalks and median barriers (DC2 load category)
 - Automatically generated dead loads for the wearing surface (DW load category)
 - User can manually change the load magnitude and its type by simply right click and then selecting edit.
 - User can manually add load in any of the DC1, DC2 or DW load category
 - For GFS bridge, program automatically general the dead loads DC1, DC2 and DW based on the geometry and wearing surface definition.
 - For GFS bridges, user can select girders or floorbeams or stringers from the GFS dropdown and manually add the loads
 - User can add vehicle by right click and then select add live load and then right click again to edit the newly added load. In the

window that open after edit option is selected, user can add new load, can define loads with multiple combinations (such as truck, lane in the same live load), or even add project vehicle (specific to current project, with an option to save it in the vehicle library)

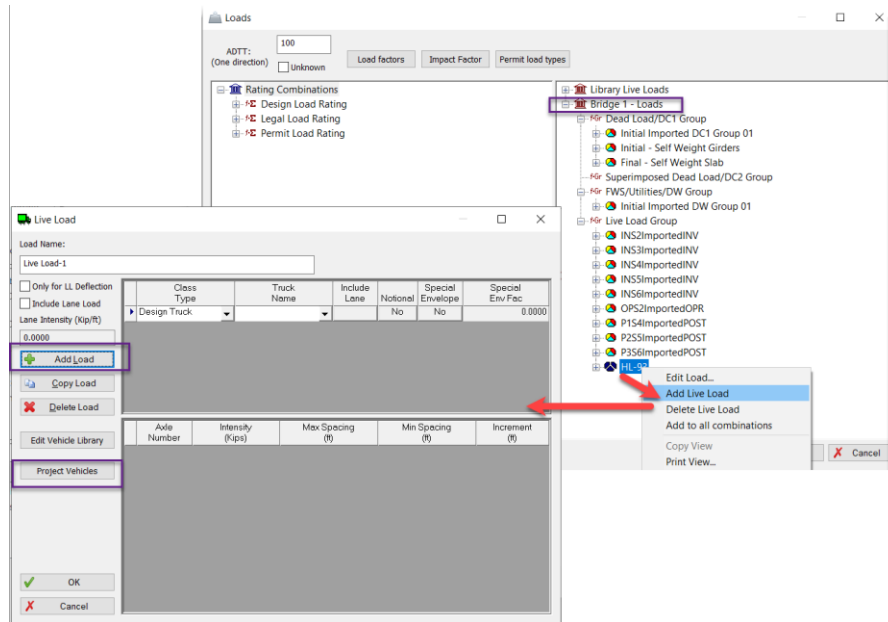


Figure: Bridge loads in the model

- Analysis
 - Line girder analysis for any of the member defined in the model.
 - Dropdown menu with Stringers, Floorbeams, and Girders option (mostly useful for GFS bridges)
 - Flexibility to select members for the analysis and rating (if GFS bridge is defined, user can select any number of girders, any number of floorbeams and any number of stringers present in the model. The selected members are used by LARS for further analysis and rating)
 - Live load distribution factors for different girders and stringers. For the floorbeams, program calculate the reaction factor behind the screen.
 - User can recalculate the distribution factor based on the geometry
 - User can define the specific range of distribution factor for a specific member using edit range.
 - Easy to switch the distribution factor windows between girders and stringers using dropdown.
 - Analysis Control options
- Analytical Results
 - Shear force and bending moments for dead load (DC1, DC2, DW) categories and live loads
 - Flexible view option (user can select single member or multiple members at a time for shear and bending moment results)

- Lane and vehicle option to separate the lane and vehicle results from combined effect.
- All the values are unfactored values.
- Show report: Dead load option
 - To generate the member force report (unfactored member forces)
 - User can generate support reactions
- Show report: Live load option
 - User can generate report for the distribution factor for different girders in the model
 - To generate the member force report (unfactored member forces)
 - User can generate support reactions
 - Option to generate influence lines report
- Show report: Rating option
 - User can generate summary report for different members in the model
 - User can generate detailed report for different members in the model

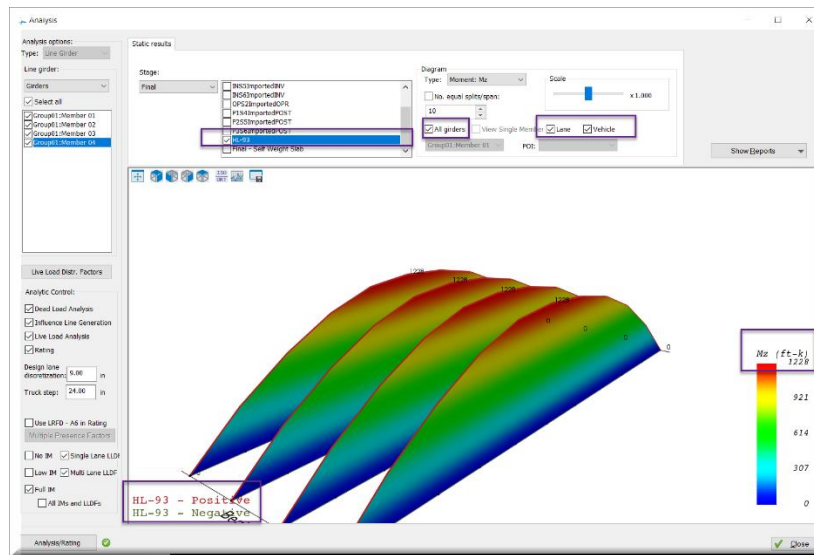


Figure: Analysis results

Top Ribbon options:

- Commands options
 - To add, remove or rename bridges
 - User can add bridge information to each of the model (location, ADTT, system factor and condition factor) and this information is used in the bridge load and capacity calculations.
- View options
 - User can use these options to show the roadway or bridge definition, bridge properties or bridge tree view in the main screen in addition to the 3D model
- Specifications options

- User can select any of the three codes (AASHTO LRFD, LFD and ASD) to run the analysis and rating.
- Library
 - Appurtenance library for parapet, sidewalk, median barriers, railing or generic shapes
 - Vehicle library for different vehicle configurations and combinations
 - Material library that include concrete, reinforced steel, structural steel, timber
 - Section library for different prestressed concrete standard sections.
 - Tendon library for tendons in the prestressed concrete bridges
- Custom Settings
 - LRFD, LFD and ASD specific custom settings where user can override program values with the custom values
 - Bridge specific custom values that user can use for capacity and load calculations
- Analysis and Design
 - Another way to access the reports described in the analytical results above.
- Support modeling of different bridge types in the same file
 - User can create combination of any of the bridge type in the same model (steel and concrete or steel and timber) by simply adding the bridge

Report Generation and Export

- Three ways to generate the report
 - When user run the analysis and rating

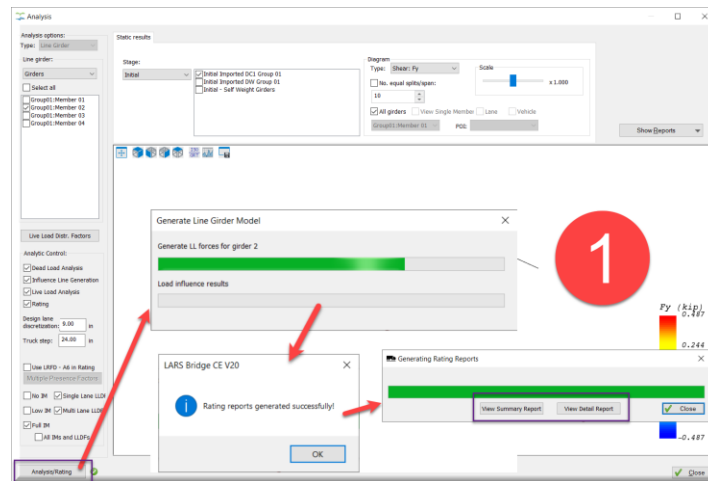


Figure: Accessing report when analysis/rating is run

- When user access the report through the analysis window and show report option

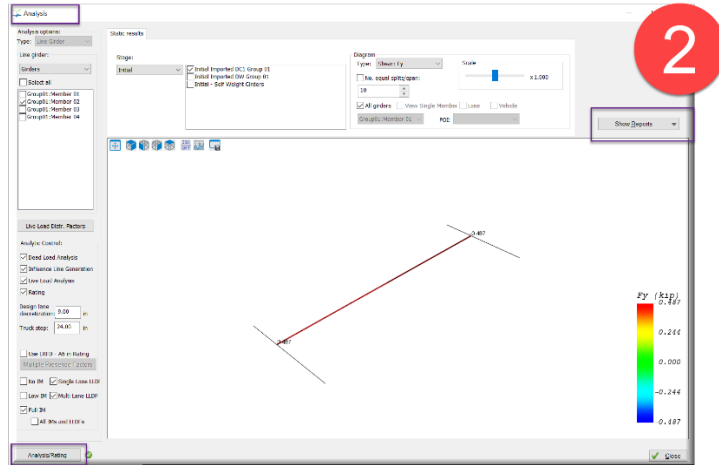


Figure: Accessing report through analysis window: show report

- Using reports tab in the top ribbon

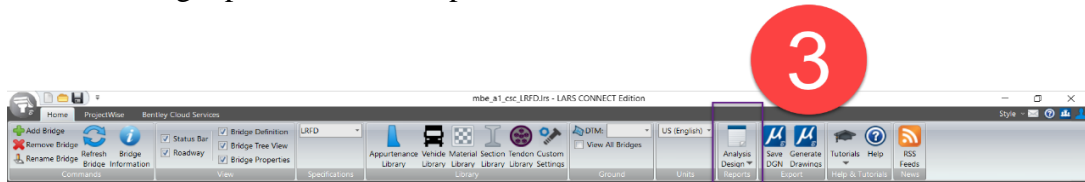


Figure: Accessing report through top ribbon

- Summary report

To export the report

Date: 6/16/2020 mbc_al_esc_LRFD.lrs
 Time: 7:10 AM Bentley LARS Bridge [AASHTO LRFD 8th Ed. with 2017 Interims] v20.00.00.18

Load Rating Report

OVERALL SUMMARY REPORT

Vehicle (LL case)	Rating Type	Rating Level	Limit State	Critical Member	Critical POI Loc. (ft)	Critical POI Span Fraction	Based on	Controlling Equation	Rating Factor	Vehicle Tonnage (Tons)	Rating Tonnage (Tons)	IM Distribution Factor
HL-93	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	1.628	---	---	0.330 0.461 (Single)
HL-93	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	1.195	---	---	0.330 0.628 (Multi)
INS2ImportedDNV	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	2.092	36,000	75,328	0.330 0.461 (Single)
INS2ImportedDNV	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	1.536	36,000	55,296	0.330 0.628 (Multi)
INS3ImportedDNV	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	2.790	27,000	75,328	0.330 0.461 (Single)
INS3ImportedDNV	Design Load Rating	Inventory	Service II	Group01-Member 02	32.50	1.500	Flexure Bottom (LL+Ipos)	Equation 6.10.4.2.2-2	2.048	27,000	55,296	0.330 0.628 (Multi)

Parameter Selection Pane

Group: Group01
 Element: Girder
 Member: Member 02
 POI: Custom, Supports, Mid Brace Points, Cross-F
 Reports: Summary Rating Report, Flexure Rating, Fac
 Type of Rating: Strength, Service
 Rating Combination: Design Load Rating, Legal Load Rating, Per
 Live Loads: HL-93, INS2ImportedDNV, INS3ImportedDNV
 Show Graph?: None

Figure: Summary report format

- Detailed report

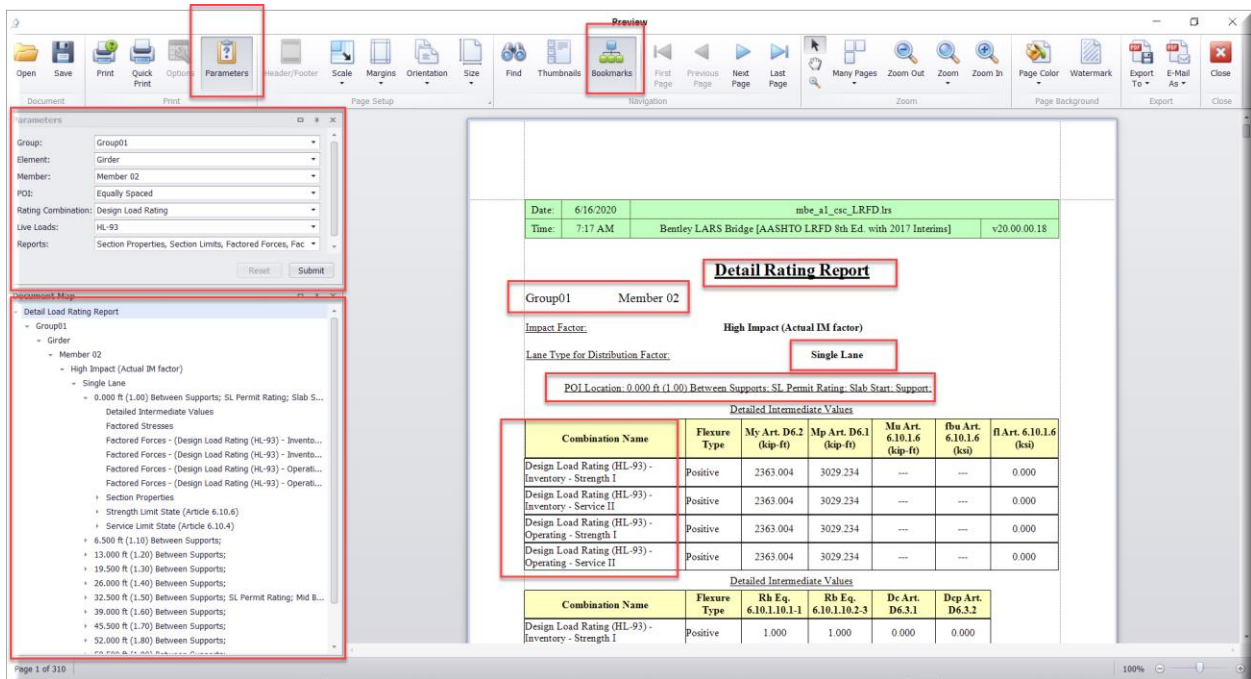


Figure: Detailed report format (Multi-girder steel bridges and GFS bridges)

- Exporting report

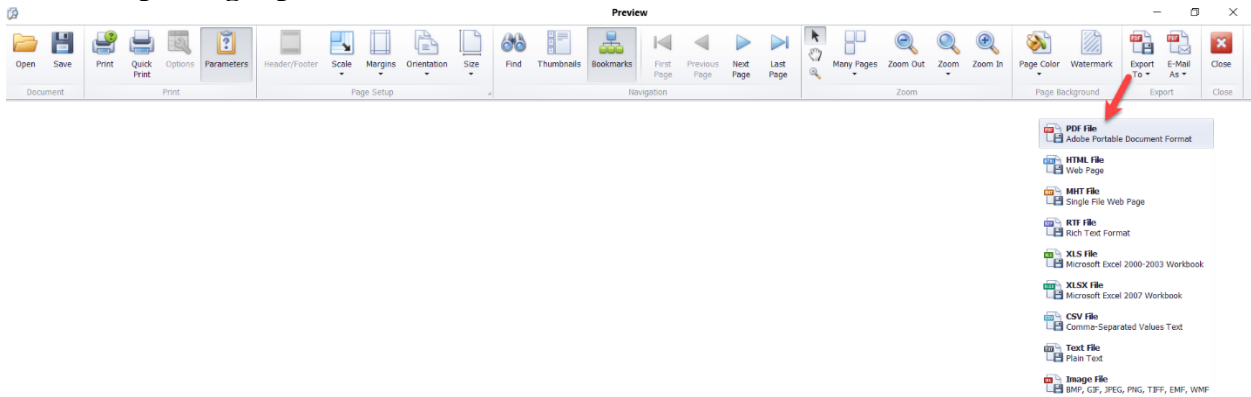


Figure: Export report in different formats