CSiBridge® Version 21.2.0
Release Notes

Notice Date: 2019-11-13

This file lists all changes made to CSiBridge since the previous version. **Most changes do not affect most users.** Items marked with an asterisk (*) in the first column of the tables below are more significant.

The reference number for each change below is now the development Ticket rather than support Incident which was used in previous Release Notes. Emails sent when an Incident is released will now indicate this Ticket number as well.

Changes from v21.1.0 (Released 2019-08-22)

Analysis
Enhancements Implemented

*	Ticket #	Description
*	2853	An enhancement has been implemented to more clearly display and save messages generated during analysis runs. These are the same messages that appear in the analysis LOG file, but provided in a more concise format. Analysis messages are categorized as information, warnings, and errors. After the analysis is run, messages are automatically displayed as text if they are any warnings or errors in the latest run. This same text display is available any time using the command Analysis > Messages. The messages are also available in tabular format under table Analysis Results > Run Information > Analysis Messages. Messages are cumulative with subsequent runs until the model is unlocked, at which time the messages are deleted. Each message includes its type, message text, associated load case or stiffness case, operation being performed, date-time stamp, parallel run tag, run serial number, and machine name. The run serial number counts subsequent runs before the model is unlocked. The parallel run tag indicates which thread was used when analyses are run in parallel during the same analysis run.

Bridge Design and Rating
Enhancements Implemented

*	Ticket #	Description
*	2278	A significant change has been made to how longitudinal stresses are calculated in the steel flanges for steel I-girder bridge sections. This affects the stresses plotted in the Bridge Object Response Display form and used for stress-based design and rating requests. When the bridge object is modeled using area objects and the steel I-girders are modeled using shells or the mixed model (shell web, frame flanges), then stresses are calculated using section cuts. Previously, longitudinal stresses in the flanges were always calculated using a section cut consisting of only the flange itself. Stresses calculated this way account for distortion of the cross section due to shear and torsion, but can also be overly sensitive to local effects, such as change in thickness of the flange plates. Now stresses are calculated as follows: 1. For the stress points at the top center of the top flange and bottom center of the bottom flange, the stresses are calculated based on the entire I-girder section (web plus both flanges) with the reasonable assumption that plane sections remain plane, since there is no warping effect along the center-line of the web, and the web distortion effect on the major-axis bending stresses is insignificant. Some jumps in the stresses between longitudinal stations are to be expected due to shear between the steel I-girder and the slab, if present.

*	Ticket #	Description
		2. For the stress points at the four corners of the I section (ends of the flanges), the section cut includes the web and the corresponding flange. For the top flange, this is a T-section that includes the top flange and web. For the bottom flange, this is an inverse T-section that includes the bottom flange and web. This approach reasonably accounts for warping, but is still not overly sensitive to changes in plate thickness. Some jumps in the stresses between longitudinal stations are to be expected due to shear between the web and the excluded flange. 3. For the flange lateral-bending stress, the previous method of considering only the flange itself in the section cut is maintained. The new results tend to be smoother, exhibiting smaller jumps at longitudinal stations, and yet they still accurately capture warping behavior that can be significant for some models. Design and rating results may be affected, but will generally tend to be slightly less conservative because smoothing tends to reduce the peak stresses. This enhancement does NOT affect: (1) Bridge objects updated as spine models, (2) Steel I-girders modeled as frames (not as shells or mixed models), (3) Stresses in the slabs, or (4) Design and rating requests based on forces and moments, rather than on stresses.
*	2376	A new bridge superstructure design request has been implemented for concrete box girder bridges that can determine the total area of tendon steel required to limit tension and compression stresses under permanent and service load conditions. Typically, a single tendon is drawn for each span or set of spans and a prestress load is defined that produces the desired tension stress in the tendon. The design request will then calculate a single scale factor that multiplies the given tendon area as required to satisfy stress limits specified for both a permanent load combination and separately for a service load combination. Stresses are checked at the top and bottom fibers at the horizontal centroid of the bridge section. Stresses can be plotted before and after scaling at each section cut along the length of the bridge object. Areas where the tendon elevation is such that no scaling can satisfy the stress limits will still be plotted and can be used to guide changes to the tendon profile. If the scale factor found is significantly different from unity, it may be necessary to re-run the analysis and design with the new tendon area, since the tendon itself can have an effect on the stress distribution in the section. Mild steel reinforcement can be added later to satisfy strength limit states. Once the total tendon area is determined, the single tendon can be copied to multiple transverse positions, if desired, and all tendons scaled so that the total calculated tendon area is maintained. This new design request is based on guidelines from the California Department of Transportation (Caltrans); see http://www.dot.ca.gov/des/techpubs/bdp.html. It is available no matter which bridge design code is selected. As part of this enhancement, the default tendon profile generated by the Quick Start template for bridge tendons has been changed so that the vertical location at the start and end of each tendon is at the vertical centroid of the bridge section. This new design request is now automatically created by the New Model template for concrete box girder bridges if design requests are selected to be generated.
*	2879	Bridge rating for the axial capacity of truss members has been implemented as new frame-member rating requests of type Axial Service and Axial Ultimate. Factored axial resistances (tensile and compressive) can be assigned to any frame member for either the Service or Ultimate limit state, or both. Rating requests can be defined that specify the portion of the structure to be considered, the live load to be rated, as well as the existing loads that reduce the capacity available. The resulting rating factors can be plotted as colors on the model with optional numerical values shown, and are available as tabular output. This feature can be used on structures created by the Bridge Modeler or defined manually.

Bridge Modeler
Enhancements Implemented

*	Ticket #	Description
*	1324	The Bridge Modeler has been enhanced for steel I-girder bridges to allow easier specification of girder (steel beam) plates sizes and vertical web stiffeners prior to running analysis and bridge design or rating. Previously these options were only available after running bridge design or rating using the Optimize command. This new feature is accessed using the command Bridge > Spans > Steel Beam Editor. Plate sizes can only be edited when the model is unlocked, but the vertical stiffeners can be edited whether the model is locked or unlocked.
	2993	An enhancement has been implemented for the Bridge Modeler where a default bridge group is now created for each bridge object that is to be used for bridge tendon loading. This bridge group contains all of the superstructure except diaphragms, and bridge tendons now default to using the new group for the parameter Group Loaded By Tendon. This avoids the problem where bridge tendons could load a diaphragm, which would occur in rare cases. For this feature to apply to models created in earlier versions of the software, the bridge object must be updated. All newly created bridge objects will use this feature.

Graphics
Enhancements Implemented

*	Ticket #	Description
	2727	The option View > Display Options > General Options > “Show Guide Structure Response” has been changed to “Show Guide Structure”. Previously guide structure objects, when present in the model, were always shown when plotting the undeformed shape using the Analysis > Show Tree command to view staged construction load cases, and the option "Show Guide Structure Response" only applied to plotting response results. Now the option "Show Guide Structure" will apply to the undeformed shape as well. Note that this option only affects staged construction load cases that use guide structures.

Installation and Licensing
Enhancements Implemented

*	Ticket #	Description
*	2754	The version number has been changed to v21.2.0 for a new intermediate release.

Results Display and Output
Enhancements Implemented

*	Ticket #	Description
	2704	An enhancement has been implemented for bridge superstructure design of concrete flat-slab bridges per the Indian IRC-2011 code in which the calculated total area of reinforcement required at specified distances from the top and bottom of the section to achieve a D/C ratio of unity can now be plotted in the Bridge Response Display form. Note that the calculation of the required total area of reinforcement was previously implemented in the CSiBridge version 21.1.0, but the results were only available in the tables.
*	3204	An enhancement has been made to display load combination results on a step-by-step basis for Linear Add load combinations of load cases that may contain one or more stepped load cases. Both on-screen display and tabulated results are now available. Max/min results were always available. Design is not affected as it already had the option for step-by-step design.
*	3205	An enhancement has been made to output nonlinear energy components (nonlinear hysteretic damping and nonlinear viscous damping) per group for nonlinear load cases. The nonlinear energy is reported separately for model objects (internal element energy) and support elements (support element energy). The energy output is available in the "Element Nonlinear Energy By Group" table and "Energy by Group" type function in using the Display > Plot Functions command.

Structural Model

Enhancements Implemented

*	Ticket #	Description
	2817	The New Model form (command File > New) has been enhanced to allow specification of the region to be used when automatically creating material properties when section properties and/or objects are added to the model. This option is only applicable when the model is initialized from defaults, not from a settings file or an existing model. Materials available for different regions are defined by material-definition files in the Property Libraries sub-folder where CSiBridge is installed, and can be expanded by adding similar files to the Property Libraries sub-folder in the user settings folder for CSiBridge.

Analysis
Incidents Resolved

*	Ticket #	Description
*	2896	An incident was resolved where adding and running a nonlinear staged-construction load case to a model that had already been run and had results available could produce incorrect results if the added load case contained bridge Pour Concrete and Remove Forms operations. When the model was locked, the Pour Concrete and Remove Forms in the newly added load case would act on the entire structure rather than just on the group specified for these operations. Unlocking the model and running again would produce the correct results.
*	2948	An incident was resolved where, for nonlinear static, staged-construction, direct-integration load cases, and sequences of such load cases, the frame member forces and stresses used for display and design could have been incorrect for a specific frame member when the following conditions are met: 1. The load case (or sequence of load cases) contained more than one load pattern that applies loads directly to the frame member, including at least one load pattern with self-weight loads. 2. A load pattern containing self-weight load (A) was applied after another load pattern containing frame loads (B); in other words, A was listed after B in the list of applied loads in the load case definition (or sequence). 3. The load patterns A and B had different scale factors. Frame members that did not meet the above conditions, such as those without frame loads assigned to the load patterns used in the load case sequence, were not affected. Load case sequences without self-weight applied were not affected. Load case sequences having only one self-weight load pattern applied and with that load pattern being listed first in the load case definition were not affected. Note that this error did not affect how the frame loads were transferred to the structure, and therefore all other analysis results were correct (displacements, reactions, forces and stresses in other objects). Nonlinear behavior, including frame hinges and P-delta, was not affected. Only the reported forces and stresses within the affected frame members themselves were in error, including the forces used for frame design of those members. Because self-weight is most commonly applied first, most models were not affected by this error. Linear load cases were not affected, even if they used the stiffness from a nonlinear load case. This error affected CSiBridge versions 20.2.0 to 21.1.0.
*	3035	An incident was resolved where, for nonlinear static, staged-construction, direct-integration load cases, the frame member forces and stresses used for display and design could have been incorrect for a specific frame member when the following conditions were met: 1. Results were requested for multiple load cases at the same time, including situations where one or more requested load combinations referenced multiple load cases. 2. Among all the requested load cases, only one of these was a nonlinear static, staged-construction, or direct-integration time-history load case, and only a single step was requested from that load case. 3. Among all the requested load cases, at least two of these were linear load cases (including modal or response-spectrum), at least two of these load cases used the stiffnesses from different nonlinear load cases (or zero initial conditions), and at least one of these was a linear static, linear multistep static, or modal time-history load case. 4. The affected frame object had loads assigned to it as part of the single nonlinear load case. This could include self-weight. This was not common. When this error occurred, the frame response reported in the affected object could be incorrect at all stations along the length of the object except at the start (I end). For frame objects that were discretized into multiple elements for analysis, the results would be correct at the start of each element and deviate along the length of the individual elements. This deviation in response, when present, was due to using the wrong element load for equilibrium calculations. This error would be most likely to affect table results when multiple load cases or load combinations were requested, and frame design when the load combinations used satisfy the conditions listed above. Note that this error did not affect how the frame loads were applied to the structure, and therefore all other analysis results were correct (displacements, reactions, forces and stresses in other objects).

Bridge Design and Rating
Incidents Resolved

*	Ticket #	Description
*	2589	An incident was resolved for bridge superstructure design and rating of precast concrete I-girder and U-girder bridges where the various design/rating requests could fail to run when a nonprismatic frame section was assigned to be used for the precast girders in a bridge section. This has been corrected. An additional check has been added for nonprismatic precast sections during bridge design and rating: If a different material property is assigned to the sections at beginning and end of a segment in a nonprismatic frame section, the design/rating request will report this as an error for the affected section cuts and they will not be designed or rated. However, unaffected section cuts will proceed with the design/rating process.
	2729	An incident was resolved for bridge rating of steel U-girder bridges per the AASHTO code where a strength rating request created in CSiBridge version 21.0.2 or earlier could not be run when the model was opened in version 21.1.0. The rating request could be run if the complete model was imported from a text file (.B2K or .$BR) or database-table file (Excel, Access, XML). No results were affected for load cases and design requests that could be run.

Bridge Modeler
Incidents Resolved

*	Ticket #	Description
*	2714	An incident was resolved for the Bridge Modeler where bridge line and area loads that were specified to act in a Local or Projected direction with respect to the layout line were generated based on the local coordinate system at the beginning station specified for the load, rather than adjusting to the change in local coordinate system if the layout line was curved or kinked. This did not affect bridge line or area loads assigned to a straight portion of the layout line, nor did it affect loads specified to act in the Global or other fixed coordinate system. Local loads will now change direction with the layout line. Projected loads do not change direction, but will now change magnitude according to the projection of the specified load direction upon the layout line.
*	2719	An incident was resolved for the Bridge Modeler where bridge loads (point, line, and area) assigned near either end of the bridge could be completely or partially ignored if the bridge layout line had non-zero grade near the bridge ends. The affected region was very small, being equal to the grade times the half thickness of the top slab. As such, only point loads at the end of the bridge were significantly affected. Line and area loads were only affected over that small region, and the effect was insignificant for loads of length significantly longer that the slab thickness. This error occurred with negative grade at the bridge start or positive grade at the bridge end.
	2722	An incident was resolved for the Bridge Modeler that corrected two issues associated with haunch loading for composite bridge sections (steel I-girder, steel U-girder, and precast concrete I-girder): (1) When the haunch load method specified in the bridge section was User Defined, the equivalent haunch point loads applied on the girder during the staged-construction operation “Pour Concrete” were calculated incorrectly; the load per-unit-length was not being multiplied by the length of the girder segments. This typically meant that the load was underestimated. (2) When the concrete haunch height was zero anywhere along the length of the girder, the haunch load was typically not calculated along the entire length of the girder. When opening an affected model in the new version of the software, it will be necessary to update the linked bridge model in order to correct these errors.
	2743	An incident was resolved for the Bridge Modeler where, for steel I-girder bridges, the connection plate for a staggered diaphragm would not be properly connected to the girder if the staggered diaphragm was assigned too close to a highly skewed support and the vertical slope (grade) near the support was non-zero. Models that exhibit this issue in an older version of the software will need their bridge objects to be updated after opening them in the new version to correct the issue.

*	Ticket #	Description
	2825	An incident was resolved for the Bridge Modeler where the rigid link objects generated at abutments and bents that connect the top of support bearings to the bridge superstructure were sometime created in the wrong location. This could occur when (1) the bearing assignment type was General, and also (2) bridge tendons modeled as elements were present at the abutment or bent. When this occurred, the connectivity between the superstructure and abutment or bent was lost, and the effect on the behavior of the model was obvious. This error usually only occurred when the bridge object was updated using the "Update Linked Model" command, not the "Clear and Create Linked Model" command.
	2841	An incident was resolved in the bridge modeler in which the bridge object initial station could not be modified when the bridge span data was defined By Station in the Bridge Object Data form. Defining the data By Length was not affected. This was a user interface issue only and did not affect results.
	2842	An incident was resolved in which the program failed to generate the analysis model if any of the tendon line objects in the model were discretized such that the last two tendon layout points were closer than the merge tolerance. This error was introduced in v21.0.2.
	2854	An incident was resolved for bridge model generation where bent bearing link objects could be created in the wrong location when the model was updated as an area object model and the present coordinate system was not the default Global coordinate system.
*	2883	An incident was resolved where modifying a detailed foundation property could result in an abnormal condition error.
*	2954	An incident was resolved for the Bridge Modeler where the frame sections generated for the piles in pile foundations used the material named "4000psi", if present, regardless of the material property assigned when the pile foundation was defined. If there was no material property named "4000psi", then a random existing frame section was assigned to the generated pile frame objects. Results agreed with the model as generated.
	2994	An incident was resolved for the Bridge Modeler where the elevation of the frame object modeling a prismatic bent cap beam was always set based on the mid-height of the cap-beam frame section, which would be incorrect when the cap-beam section was not symmetrical for major bending moment. An example of this would be a T-beam used as a bent cap. The elevation was incorrect by the distance between the centroid and midpoint of the section. This error did not affect nonprismatic cap-beam sections, which are always located with respect to the top of the frame section. Frame sections that are symmetrical for major bending were not affected, since the centroid is at the midpoint of the section.
	3041	An incident was resolved for the Bridge Modeler where spine models of steel I-girder bridges could be incorrectly generated if the bridge object contained staggered diaphragms that were not located at the global (entire-section) section cuts and the option “Mesh Slab at Critical Steel I-GirderLocations” was checked when updating the bridge object. In some cases, frame (line) objects representing the superstructure spine would be missing near the bents of corresponding spans. When this occurred, the error was visually obvious and results agreed with the model as generated. This did not affect models updated as area (shell) objects.
	3079	An incident was resolved for the Bridge Scheduler where closing the form, while editing an individual schedule, using the "X" button at the top right corner of the form would modify the schedule instead of cancelling the changes. In this case, the schedule was duplicated and all operations were repeated at the bottom of the original schedule. Clicking OK or Cancel to close the form behaved as expected.

Data Files

Incidents Resolved

*	Ticket #	Description
	2786	An incident was resolved where CSiLoadOptimizer data files from previous versions could not be loaded into the current version.

*	Ticket #	Description
	3049	An incident was resolved where opening an old model while another model with results was already open would cause the results of the current model to be deleted if the prompt to save current changes was accepted.

Database Tables

Incidents Resolved

*	Ticket #	Description
	2715	An incident was resolved where the table named Tables Automatically Saved After Analysis was not imported from an Excel file.
	3001	An incident was resolved where exporting data from the Tendon Response Form to Excel when the computer region settings used a comma for the decimal separator would result in incorrect results being displayed in the Excel sheet.

Documentation

Incidents Resolved

*	Ticket #	Description
	3188	An incident was resolved where Equation 4-7 of the Material Time-Dependent Properties Technical Notes was incorrect. The equation has been corrected in the documentation. This was a documentation issue and did not affect the results.

Graphics

Incidents Resolved

*	Ticket #	Description
	2310	An incident was resolved where the display of loads on the analysis (element) model did not work when in DirectX graphics mode. Minor corrections were also made for the display of loads on the object model in DirectX. The display of loads on both the element and object model when using Classical Graphics mode was not affected.
	3199	An incident was resolved that addressed several issues with the graphical display in DirectX mode: 1.) Solid face colors were not being displayed. 2.) Frame labels were not centered. 3.) Extruded shells with transparency were sometimes displaying internal triangle edges. 4.) Point and area selection colors sometimes changed when zooming. 5.) Bubble text colors could be incorrect. 6.) The cut line was not displayed while drawing section cuts. 7.) Area local-3 axis was sometimes reversed when drawing in plan and elevation. The local-3 axis should point toward the user when drawing counter-clockwise or using the draw-rectangle option in 2-D. 8.) The window zoom sometimes produced unexpected results when the grid-bubble size was excessively large. 9.) When scrolling for values within the frame force/moment/stress diagram in the right-click "Diagrams for Frame Object" form, the red dot showing the corresponding location on the structural model did not move correspondingly. 10.) The deformed shape display of shell objects was incorrect when the View Type was set to Offset or Extruded in the View Options form. 11.) The option to display area colors by section property in the View Options form did not fill all objects. 12.) The Print Graphics command did not show joint reaction values when they were displayed on the screen. 13.) Area joint offsets were not being considered when displaying extruded view. 14.) Joint pattern values were not being displayed. 15.) The display of frame distributed loads didn't show loading applied in two different

*	Ticket #	Description
		directions for a single load pattern. Only loading in one of the directions was displayed. 16.) When displaying frame hinge assignments in a 2-D view, the text labels were not shown at the correct locations. 17.) The multi-select option was not properly activated by using CTRL + left-mouse-click. 18.) Snapping to a midpoint of another object when drawing an area object in a 3-D view could sometimes create the joint at an unexpected location. 19.) Contour plots of area-object response (forces/moments/stresses) were sometimes incorrect when the joint-averaging option was used. If the value at three corners of an element were nearly equal, the value at the fourth corner would be plotted the same even if it should be different. The error was generally small, and no other results were affected.

Results Display and Output

Incidents Resolved

*	Ticket #	Description
	2745	An incident was resolved in which the display of concrete box bridge stress design check results was not working on the Bridge Object Response Display form. This was inadvertently introduced in v21.1.0, but was only a display issue. The results were still correct and available via the database tables.
	3092	An incident was resolved for bridge superstructure design of steel I-girder bridge sections where the detailed design calculation report incorrectly showed the force in bottom rebar of the concrete slab as zero when calculating the negative plastic moment. This error affected only this single value in the calculation report. Values presented in the tables of design results were not impacted. No other values were affected.
*	3095	An incident was resolved where tabulated analysis results may have been displayed as zero for load combinations that contained one or more Linear Add type load combinations. When this issue occurred, the tabulated results for a Linear Add type load combination that contained another Linear Add type load combination could have been displayed as zero. This issue only occurred when the following conditions were met: 1. The model included multiple load combinations that each contained the same Linear Add type load combination (say "A") in its definition. 2. In the Choose Tables for Display form (Display menu > Show Tables), more than one of the containing load combinations were selected for output. 3. At least one of the selected load combinations containing combination "A" must have been of type Linear Add, and at least one must have been of a different type (e.g. Envelope). Any load combination containing affected load combinations could also be affected. This issue only affected the tables under the Analysis Results section. This issue did not affect visually displayed results or design results. This issue did not affect load combinations that were not nested. This issue was only present in CSiBridge version 21.1.0.
*	3170	An incident was resolved where the plotted deformed shape for mode-based load cases was incorrect at joints having local coordinate systems different from the default (global axes). The displacement values plotted and shown in local coordinates (U1, U2, ..., R3) were actually the values in global coordinates (UX, UY, ... RZ). This affected the plotted shape, the values displayed when the mouse was moved over a joint, the values shown when right-clicking on a joint, and videos made of the deformed shape. Similarly, the joint displacements reported in the two database tables "Joint Displacements" and "Joint Displacements - Absolute" were always the displacements in global coordinates rather than the expected joint local coordinates. Plot functions were not affected. This error affected modal, response-spectrum, and linear and nonlinear (FNA) modal time-history load cases, as well as load combinations containing these load cases. No other types of load cases were affected. All other response quantities (displacements, forces, stresses) and design results throughout the model were correct and unaffected. This reporting error only affected version 21.1.0 of CSiBridge.

User Interface

Incidents Resolved

*	Ticket #	Description
	2898	An incident was resolved where attempting to add the NZS 1170.5-2016 response spectrum function via the New button in the Functions - Response Spectrum pane of the ribbon would incorrectly attempt to add the old NZS 1170.4-2004 function.