CSiBridge v23.2.0 Release Notes

Notice Date: 18-May-2021

This document lists changes made to CSiBridge since v23.1.0, released 15-March-2021. Items marked with an asterisk (*) in the first column are more significant.

Analysis

Enhancements Implemented

*	Ticket	Description
*	6567	An enhancement has been made to speed up stiffness formation, event determination, and state update operations for Frame elements in presence of many load patterns. Nonlinear static, staged-construction, and nonlinear direct-integration time-history load cases for models with many Frame elements (and many load patterns) should benefit the most especially if the analysis time is governed by state update and/or event determination.
*	6613	An enhancement has been made to speed up calculation of joint-reaction response for influence-based moving load cases. Medium- to large-sized models with many reaction response points should benefit the most, especially, if there are many frame elements and a large number of bridge influence loads. Of the three phases of moving-load analysis (solving influence loads, moving vehicles on lanes, permuting loaded lanes), the second phase is affected by this enhancement.
*	6846	An enhancement has been made to improve the consistency of analysis results on Intel and AMD CPUs with an AVX2 instruction set. Most Intel and AMD CPUs released on 2015 or later support AVX2 instruction set and should benefit from this enhancement. For nonlinear analyses of numerically sensitive models, results should be more consistent when run on different CPUs. For typical well-conditioned models and linear analyses, no significant change is results is expected.

API

Enhancements Implemented

*	Ticket	Description
	6183	The Application Programming Interface (API) now returns a special error code for any function working with database tables that references an obsolete table key, i.e., a table key that was available through the API in a previous version of the software, but which is no longer available. While this will not be common, it is recommended that programmers using the API check the return flag for all API functions referencing tables for this code, and when encountered, check the Release Notes for whether or not the referenced table has been renamed or replaced, or whether feature corresponding to the table is no longer available. An API function, GetObsoleteTableKeyList, has been added to return a list of the obsolete tables in the program.

Bridge Design and Rating

Enhancements Implemented

*	Ticket	Description
	6572	Bridge rating of concrete superstructures per the AASHTO code has been enhanced to allow optional specification of a non-rated live load combination that can be included in the numerator of the rating factor, along with the gravity and other permanent loads. The live load to be rated is still specified in the denominator of the rating factor. This new feature allows explicit consideration of the presence of normal traffic on the bridge alongside the permit or other special vehicles being rated. The enveloped nature of the non-rated live load is taken into account when rating positive and negative effects of the rated vehicles.

*	Ticket	Description
*	6573	The calculation of secondary forces in bridge objects has been improved to reduce the oscillation in values that was present when bridge tendons, modeled as elements, were discretized at points between the section cuts. These secondary forces are those displayed when the option "Include Tendon Forces" is checked on the "Bridge Object Response Display" form. Secondary forces are also used in certain bridge superstructure design and rating checks for prestressed concrete bridge sections, whether pretensioned and post-tensioned. The effect tended to be most pronounced on shear forces in non-straight tendons. Now bridge tendons will be automatically discretized at the section cuts, and corrections will also be made for a single tendon discretization point occurring between section cuts. Finely discretized tendons that have more than one tendon point between section cuts may still exhibit some oscillation in secondary-force values, but the effect will be reduced from before. It is recommended that tendon discretization lengths be on the order of the bridge-segment discretization length to avoid this effect. Note that the change in discretization to capture bridge section cuts may affect all analysis and bridge design/rating results, but aside from the consideration of secondary forces, the change should have little engineering significance. Only bridge tendons modeled as elements are affected.
	6576	An enhancement has been implemented for AASHTO LRFD steel I-girder and U-girder bridge design and rating where the following values have been added to the strength and service design/rating output tables: (1) The steel-based composite-girder moment of inertia for short term positive bending. (2) The concrete-based section modulus of the top fiber of the concrete deck in the short-term condition.
	6829	Bridge rating using the AASHTO LRFD code has been enhanced so that, when determining the shear capacity of concrete sections, the procedure now checks if the provided longitudinal rebar and prestressing tendons on the flexural tensile side of the member are controlling the shear capacity of the section per AASHTO LRFD Eq. 5.7.3.5.-1.

Bridge Modeler

Enhancements Implemented

*	Ticket	Description
*	6079	The Bridge Modeler has been enhanced to add the staged-construction operations Pour Concrete and Remove Forms for Super-T bridge sections. This feature was already available for other composite bridge sections. The Pour Concrete operation applies the weight of the slab to bare Super-T girders, and the Remove Forms operation removes that load while simultaneously adding the slab to the model along with its self-weight. When used in sequential stages, the slab will carry negligible stress due to its own self-weight.
	6446	An enhancement has been implemented for the Bridge Modeler where the panel lengths for each girder are now shown in the Steel Beam Editor form and the Steel Beam Section Variation form. Panel lengths are drawn and labeled in the plan view for the flanges and in the elevation view for the web. This information will help to accurately locate section (plate) transitions within each girder and across multiple girders.

Installation and Licensing

Enhancements Implemented

*	Ticket	Description
*	6493	The version number has been changed to v23.2.0 for a new intermediate release.

Loading

Enhancements Implemented

*	Ticket	Description
*	6093	An enhancement was implemented to add the Chinese JTG/T 2231-01-2020 response-spectrum function.

Analysis

Incidents Resolved

*	Ticket	Description
*	6488	An incident was resolved where, if a nonlinear load case or stage continued from a previous load case or stage that had large unbalanced forces in the frame element due to nonlinear hinges being present, the unbalance in the frame element could grow larger and/or prevent the load case from reaching convergence. This issue only affected CSiBridge v22.2.0 to v23.1.0. This issue only occurred in models where the analysis model for nonlinear hinges (Analyze menu > Analysis Model for Nonlinear Hinges) was set to "Model Hinges within Elements" and could affect nonlinear static, staged construction, and nonlinear direct-integration time-history load cases. When the issue occurred, it would manifest as a significant difference in frame element and hinge results between the zeroth (0th) step of the affected load case or stage and the final step in the previous load case or stage. This difference could also be present in global force results such as base reactions and section cuts. In models affected by this issue, the error could be reduced by using more load or time steps in the previous load case or stage to reduce the frame element unbalance at the end of that previous load case or stage. This error was not common because significant hinge nonlinearity is not common in predecessor load cases.
	6526	An incident was resolved where the mass-proportional damping defined in the material properties (Define menu > Material Properties) that apply to a truss member could include spurious values for the rotational degrees of freedom at the joints of the truss member. A truss member is a frame object with all moments and torsion released, no end offsets, and the default insertion point at the centroid of the section. This error rarely affected results since rotational degrees of freedom are normally not present at joints connected to truss members. Where affected rotational degrees of freedom were present, the effect on the model was generally insignificant compared to other dynamical forces. Affected load cases include direct-integration and frequency-domain time-history, steady-state, and PSD types. Mass-proportional damping in modal (FNA) time-history load cases was not affected.

Bridge Design and Rating

Incidents Resolved

*	Ticket	Description
	6450	An incident was resolved for bridge superstructure design of concrete box-girder bridges where the design could fail for a bridge object with an Advanced Concrete Box Girder bridge section if any of the section edges were coincident with the design cut line for the top or bottom slab, as defined in the bridge-section definition. When this occurred, design results were not available.
	6464	An incident was resolved for bridge design and rating per the AASHTO LRFD 2017 codes where the code section, figure, table, and equation numbers referenced in the output tables and reports, as well as the descriptions provided on the bridge design and rating preference forms, were listing the corresponding numbers from the 2014 code. In all cases, the correct 2017 equations, tables, and code provisions were implemented and enforced. No results were affected. This was a reporting error only for the referenced text numbers.
	6810	An incident was resolved where incorrect values of Mu were being shown in the detailed calculation report in the formulas for the fl amplification factor for positive bending of non-composite sections per AASHTO LRFD section 6.10.1.6-3. Also the formula that derives Fcr was revised to match AASHTO LRFD 6.10.8.2.3-8. These issues only affected the detailed calculation report and had no impact on the resulting amplification factor. The previously reported values were correct. This affected the detailed report for AASHTO LRFD Steel I Constructability design requests for all AASHTO versions.

*	Ticket	Description
	6843	An incident was resolved for bridge superstructure design and rating where user-defined stiffeners specified in the Optimizer after running design or rating were not being saved when exiting the Optimizer. The same changes made in the Steel Beam Editor prior to running the analysis were preserved and could be viewed in the Optimizer after running the design or rating. The Optimizer is accessed using commands Design > Superstructure Design > Optimize or Rating > Superstructure Rating > Optimize. The Steel Beam Editor is accessed using command Bridge > Bridge Objects > Spans > Modify/Show Steel Beam Definitions Along Girder Length.

Bridge Modeler

Incidents Resolved

*	Ticket	Description
	6609	An incident was resolved for the Bridge Modeler where, for area-object models of composite bridge sections, slab area objects generated at the bent location could be incorrect if (1) the bent was located longitudinally at a kink in the bridge layout line, in other words, at an angle change between two straight segments of the layout line, and (2) the bridge superelevation at or near the bent location was non-zero. When this error occurred, some of the slab area objects could be generated at the original elevation before applying superelevation. Results agreed with the model as generated.
	6656	An incident was resolved for the Bridge Modeler where a steel I-girder bridge having a staggered diaphragm with a connection plate that was located very close to a program-generated bridge section-cut could be incorrectly modeled such that the frame object modeling the connection plate might not properly attach to the girder. When this occurred, the behavior was obviously incorrect when viewing the deformed shape. This was not common.
	6763	An incident was resolved for the Bridge Modeler that addressed several issues with curved, steel U-girder bridge models with skewed supports: (1) When there were three or more steel U-girders in the bridge section, and several staggered diaphragms and internal diaphragms were assigned near or after the skewed support, the assigned diaphragms (internal and external) were sometimes generated incorrectly and the stiff links connecting the girder bottoms to the top of the bearings would not be located correctly. (2) When there were two or more steel U-girders in the bridge section, and a staggered diaphragm using the layout line as the reference line was assigned close to the skewed support such that the extension of the staggered diaphragm between two U-girders did not intersect with center line of one of the two girders within the same span, then the generated staggered diaphragm did not properly connect to that girder. (3) A warning message is now provided updating a bridge object if a staggered diaphragm that crosses a skewed support is assigned in the subsequent (up-station) span. Diaphragms that cross a skewed support must be assigned in the previous (down-station) span.

Design – Concrete Frame

Incidents Resolved

*	Ticket	Description
	5712	An incident has been resolved in concrete frame design overwrite form in which the program was failing to identify the non-prismatic column section as a column section. The program took it as a beam section, offering the overwrites of a beam member and not offering the extra overwrites for the column members. All frame design codes are affected. However, the error is visible in the form.

Design – Steel Frame
Incidents Resolved

*	Ticket	Description
	4624	An incident has been resolved in the steel frame design codes AISC 360-16, AISC 360-10, AISC 360-05/IBC2006, AISC-ASD89, AISC-LRFD93, AASHTO LRFD 2007, API RP2A-WSD2000, API RP2A-WSD2014, API RP2A-LRFD 97, AS 4100-1998, CSA S16-09, CSA S16-14, KBC 2009, and KBC 2016 where the expression of Beta_w was wrong, causing inaccurate evaluation of moment capacity for the limit state of lateral-torsional buckling of angle sections with unequal legs.

Documentation
Incidents Resolved

*	Ticket	Description
	6617	An incident was resolved that corrected Equation 3.8 in the "Material Time-Dependent Properties" Technical Note documentation. This was a documentation issue only and did not affect the analysis results.
	6761	An incident was resolved where the AASHTO 2014 and 2017 bridge superstructure design manuals were missing a '2' in the denominator of the torsion reinforcement equations. This was a documentation issue only. The design algorithm was correct.

Loading
Incidents Resolved

*	Ticket	Description
	6098	An incident has been resolved for the Bridge Modeler where bridge line loads and area loads generated for a curved, skewed bridge with staggered diaphragms that use the layout line as the location reference line could be generated incorrectly such that the load applied was applied over a longer or shorter station range than expected. The effect was generally limited to the local region near such staggered diaphragms. Note that this did not affect curved, skewed bridges where all the staggered diaphragms were located using girders as the reference lines.
*	6531	An incident was resolved in the IRC:6-2017 bridge wind loading where previously the pressure values used from Table 12 were only being scaled by (vb/33) instead of (vb/33)^2, where vb is the user input basic wind speed. If the input basic wind speed differed from 33m/s, the pressure would have been conservative if the input value was less than 33m/s, otherwise unconservative if greater than 33m/s. Models analyzed in v23.1.0 using IRC:6-2017 bridge wind loading should be reviewed.
	6708	An incident was resolved for the Bridge Modeler correcting two issues with bridge loads: (1) For all types of bridge sections, the loads directly defined on the bridge section (haunch, barrier, etc.) would not be updated immediately when the bridge model was updated. However, they were updated correctly before running the analysis. This was a display issue only since changes could not be viewed until the first analysis was run after updating the bridge object. Analysis and design results were still correct. (2) For precast I-girder bridge sections, the program-generated haunch load was incorrectly using the thickness of the top flange of the precast concrete I-girder in the case when the concrete haunch height was zero. This error was generally small and conservative. The load was correct when the haunch height was greater than zero.
*	6786	An incident was resolved for the CSA S6-14 bridge wind loading for cases where the structure height was less than 10m. In this scenario, the wind exposure coefficient, Ce, lower-bound limit of 1.0 was not being enforced. This would have resulted in unconservative wind loads. Models with CSA S6-14 wind loading using the auto-calculated Ce factor on a structure less than 10m in height should be reviewed.

Results Display and Output

Incidents Resolved

*	Ticket	Description
	6477	An incident was resolved where the inclined web depth was incorrectly used instead of vertical web depth in the formulas for the Steel U-girder section properties for negative bending as presented in the bridge superstructure design and rating calculation reports. The actual section property values were calculated correctly and used for design. Only the values shown in the formulae in the calculation reports were incorrect. This was a reporting issue only and did not affect results. The impacted calculation reports include Steel U Strength - Design and Rating, Steel U Service - Design and Rating, and Steel U Fatigue, for all versions of AASHTO LRFD.
*	6663	An incident was resolved where requesting to generate a response spectrum at a joint from a time history case would not account for the coordinate system specification. The results were always given in the joint local coordinate system. For the usual case where the joint coordinate system was not overwritten the results were in the global coordinate system.
*	6847	An incident was resolved where the shell soil pressures displayed graphically could be incorrect if springs were applied to the shell that were not in the normal direction of the shell. Also if multiple spring assignments were made to the same shell the soil pressure table would be unavailable due to an error condition. The springs were all applied correctly in the analysis and all other results were unaffected by this error.

User Interface

Incidents Resolved

*	Ticket	Description
*	6275	An incident was resolved where an abnormal condition could cause the program to terminate when modifying a precast I-girder deck section and clicking the tendon layout button when the selected frame section property for the girders was nonprismatic. Now the button is disabled as it is currently not possible to specify the tendon layout for a nonprismatic section.
*	6402	An incident was resolved where an abnormal termination could occur when defining a load combination by the following sequence of steps: (1) Run the analysis for any load cases. (2) Open the Bridge Object Response Display form to display the results for any load case, and then close it. (3) Open the Define Load Combinations form by using the expand button in the lower right corner of the ribbon panel. (4) Create a new load combination, then click OK to exit the Load Combination Data form. (5) Click OK to exit the Define Load Combinations form, at which point the abnormal condition could occur. This issue was machine-dependent. Results were not affected.
	6813	An incident was resolved on the Auto Wind on Bridge Live Load Pattern form where the height value was displayed incorrectly if the current display units were different than the database units. The value stored in the model was correctly displayed in the database tables and used to compute the wind loading.