CSiBridge® Version 20.0.0
Release Notes

Notice Date: 2017-12-14

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

Changes from v19.2.2 (Released 2017-12-12)

Drafting
Enhancements Implemented

*	Incident	Description
	59339	An enhancement was implemented to add an on-screen measuring tool to measure the length of lines, area of polygons, or angle between two lines, in all views including 3-D views. The measure tools can be accessed from the View ribbon panel or menu.

Bridge Modeler
Enhancements Implemented

*	Incident	Description
*	201655	The Bridge Modeler has been enhanced to better model superelevation of the cap beam for skewed bents. Previously, the inclination of the bent cap was being calculated as if the bent cap was normal to the layout line, and then applied to the skewed bent. This tended to underestimate the difference in elevation between the two ends of the bent. Now the superelevation of the bent cap takes into account the skew angle of the bent. The superelevation of the bent cap is assumed to be constant, using the value specified for the superstructure at the insertion point of the bent.
	204582	An enhancement has been implemented affecting bridge objects that are assigned a user-defined bridge section and updated as a spine model. The weights of the assigned bridge diaphragms are now included in the spine model. The weight of the diaphragm will be calculated as the bridge cross-section area at the diaphragm location multiplied by the diaphragm thickness and the weight per unit volume of the diaphragm material. Note that only the weight of a solid diaphragm will be considered regardless of the type of the user-defined bridge section. The user is responsible for back-calculating the solid diaphragm thickness to account for the desired diaphragm weight.

Modeling
Enhancements Implemented

*	Incident	Description
*	203387	An option was added to control the limiting negative stiffness ratio for Frame Hinges. This option is available as a Hinge Overwrite for frame elements, under Assign > Frame > Hinge Overwrites in the menu. The limiting negative stiffness ratio defaults to 0.1, which is identical to previous versions of the program. This means that the descending slope is only 10% as stiff as the initial elastic stiffness. This ratio may now be increased up to 1.0. Using larger descending stiffness values increases the risk of elastic snap-back, which can cause convergence difficulties. Additionally, the Hinge Overwrites assignment form was enhanced to allow assignment of the Auto Subdivide and Hinge Behavior Parameters independently.

Loading

Enhancements Implemented

*	Incident	Description
*	07264 86184	The transverse position of vehicle lanes has now been automated for influence-based moving load analysis. Floating Lane Sets can be defined where a specified number of floating lanes will be moved transversely to find their location that causes the most extreme maximum and minimum result for each response quantity (displacement, force, moment, stress). Floating lanes do not cross or overlap. The transverse positions of the lanes are optimized based on the shape of the vertical influence surface at each station along the length of the lanes, independent of the actual vehicles to be considered. This floating lane positions may be different at each station along the length, such that the lanes can meander down the length of the bridge. At each station, all floating lanes in a floating lane set will be immediately adjacent (no gaps) or separated into at most two adjacent groups (one gap). For bridge superstructure response, the transverse position of the lanes at the point of maximum longitudinal influence will be tabulated along with the vehicle locations causing the maximum and minimum responses.
*	101059	An enhancement has been implemented to more efficiently determine the location of lane influence loading points for multiple-span bridges. By way of background, the longitudinal discretization of lane influence loading points is specified by three parameters in the definition of the lane: maximum distance, fraction of the span length, and fraction of the lane length. The smallest of these three distances governs. Previously, the fraction of the span length was determined based on the shortest span in the bridge object and applied to the entire lane. This could lead to an excessive number of loading points in longer spans. Now the fraction of the span length is applied separately to each span. All influence loading points that fall within the longitudinal range of a span will be governed by that span; that range is measured between the farthest points of the two ends of the span, accounting for skew. If a potential lane loading point falls within the range of two or more spans due to skew, the smallest discretization size will be used. Results for moving-load cases could change for models created in previous versions and run in the new version due to the change in discretization. This effect will generally be small. Results for published Verification Example 1-030 that is installed with the software have changed slightly from the previous version, and now provide an even closer match to the theoretical values. The Verification manual and automated Excel spreadsheet have been updated to reflect the new results.

Analysis

Enhancements Implemented

*	Incident	Description
*	43945 96397	An enhancement has been made to account for effect of reinforcing steel on the axial creep and shrinkage behavior of concrete in columns and walls. The users can specify the rebar in individual columns and walls, or they can be taken from the most recent concrete frame or wall design. This enhancement only affects time-dependent staged-construction load cases. This formulation utilizes the steel reinforcement correction factor as described in "Creep and Shrinkage and the Design of Supertall Buildings - A Case Study: The Burj Dubai Tower" by W.F. Baker, D.S. Korista, L.C. Noval, J. Pawlikowski, and B. Young (2007), ACI Special Publications, 246.

*	Incident	Description
*	203151	An enhancement was made to add a pure event-to-event option for nonlinear static analysis, which can be particularly useful for static pushover analysis. This is similar to the pure event-to-event method available for nonlinear direct-integration time history analysis, and is in addition to the iterative event-to-event stepping strategy already available for nonlinear static load cases. Load steps will be automatically subdivided where changes occur in the stiffness of nonlinear elements. In contrast to the iterative method, more events will typically be generated, but iteration for equilibrium will not be performed under the assumption that the deviation from linearity will be small between events. Instead, any equilibrium errors are carried forward to the next load step and applied as a corrective load. This is similar to the method used in Perform-3D. This method may not be appropriate in cases with a large degree of geometric nonlinearity. Pure event-to-event stepping can be more efficient than iterative methods for small to medium sized models, but may not be so for large models with many nonlinear elements. Pure event-to-event stepping can also be helpful for models where convergence cannot be achieved with iterative methods, although the results should be reviewed for equilibrium. Additional minor changes have been made to the iterative methods used in nonlinear static and direct-integration time history load cases to improve convergence behavior. Results may change slightly compared to previous versions, but should be within the convergence tolerance for stable models.

Bridge Design

Enhancements Implemented

*	Incident	Description
*	61020	Bridge design checking has been implemented for concrete slab superstructure sections according to the AASHTO LRFD code. Separate design checks are provided for stress, shear strength and flexural strength. The effect of mild reinforcing is included as well as that for prestress tendons. Design results are displayed graphically for the entire concrete slab bridge section. Detailed tables showing all results and intermediate values are available for display, printing, and export to Excel or Access.
*	96083	An enhancement has been implemented for superstructure design of concrete box-girder bridges using the AAHSTO LRFD code where a new method has been added for performing shear design using MCFT (Modified Compression Field Theory including torsion) according to AASHTO article 5.8.3.4.2. The Design Request Parameters form now provides the option to select shear design based on the new method, called "MCFT including Torsion", and the existing method, called "Segmental Box Girder". The existing method is based on AASHTO article 5.8.6.
*	100653	Bridge superstructure design and rating of steel I-girder bridge sections can now account for local girder effects when the bridge object is updated as a spine model. Local girder effects include staggered diaphragms (cross frames), section transitions with abrupt changes in steel-girder plate sizes, and girder-splice locations. Previously, global (full-width) section cuts for calculating superstructure forces and moments and performing design checks were only created where diaphragms, section transitions, and girder splices occurred at the same layout-line station for all girders, which meant that critical local girder regions could not be checked. Now global section cuts are created for local girder effects as well as for full-width effects. When two or more global section cuts are found to be close to each other (within a 2 inch or 5 cm tolerance), they will be merged into a single global section cut where forces and moments will be calculated, but the correct local properties will be used for calculating stresses and performing design checks. This enhancement only affects spine models. Bridge objects updated as area (shell) models were already able to handle local girder effects by generating local section cuts.

*	Incident	Description
	202452	Bridge superstructure design of steel I-girder bridges per the AASHTO (2007, 2012 and 2014) codes has been enhanced by adding a new parameter to the fatigue design request to specify whether or not longitudinal stiffeners are present. When set to indicate that longitudinal stiffeners are present, the web proportion limits will be checked against AASHTO LRFD 6.10.2.1.2-1. Otherwise, the web proportion limits will be checked against AASHTO LRFD 6.10.2.1.1-1. Previous versions of the software always assumed that stiffeners were not present, which is more conservative.
*	203131	Bridge design checking has been implemented for concrete precast I-girder and precast U-girder superstructure sections according to British code BS5400. Separate design checks are provided for stress, flexural and shear strength checks. The effect of mild reinforcing is included as well as the prestress tendons. Live-load distribution factors can be specified by the user, or determined from detailed 3-D live-load analysis. Design results are displayed graphically for each of the individual girders. Detailed tables showing all results and intermediate values are available for display, printing, and export to Excel or Access.

Frame Design

Enhancements Implemented

*	Incident	Description
*	200697	An enhancement was implemented to add steel frame design according to the AISC 360-16 code and the AISC 341-16 seismic provisions.

Database Tables

Enhancements Implemented

*	Incident	Description
	207444	A change has been made in the database tables for the field (column) names that refer to bridge-object section cuts. The purpose is for greater consistency and to distinguish between bridge-object section cuts and user-defined section cuts. Models exported from previous versions will automatically be translated upon import to the new version; this applies to files with text (.B2K, .$BR), Excel, and Access formats. (1) The bridge-object section cut number "SectCutNum" in the tables "Bridge Section Cuts 01 - General", "Bridge Section Cuts 02 - Groups", "Bridge Section Cuts 03 - Stress Points", "Bridge Section Cuts 04 - Girder Data - General", "Bridge Section Cuts 05 - Girder Data - Groups"; and the bridge-girder section cut number "GCutNum" in the tables "Bridge Girder Section Cuts 01 - General", "Bridge Girder Section Cuts 02 - Slab Data - Groups" and "Bridge Girder Section Cuts 03 - Beam Data - Groups" are now renamed as "ImportIndex." This index is used to order the section cuts defined in the individual tables, but is not used for identification of the section cut elsewhere in the model. (2) A new field called "BridgeCut" has been added to these tables. It is the ID of the bridge-object section cut at the current location for the current bridge object. Bridge section cut ID's are unique within each bridge object and include all entire-bridge (full-width) section cuts and all girder-local section cuts." (3) The field name "CutID" in all the steel girder bridge design result output tables has also been renamed as "BridgeCut", and it has the the same definition as above for item (2.). It is also consistent with the "Bridge Cut" label in the Bridge Response Display form.

Documentation

Enhancements Implemented

*	Incident	Description
	201656	The AASHTO LRFD superstructure design manual has been modified to clarify that torsion is ignored in shear design requests for multi-cell concrete bridge sections.

Miscellaneous

Enhancements Implemented

*	Incident	Description
*	202893	The version number has been changed to v20.0.0 for a new major release.

User Interface

Incidents Resolved

*	Incident	Description
	77177	An incident was resolved in which the message "Cannot Close Last Window" could be displayed even when other windows were present. This was a user interface issue only and did not affect results.
	82563 93309	An incident was resolved in which the toolstrips for the advanced menus, when in menu mode, did not contain any buttons.
	204558	An incident was resolved to add missing ribbon and menu commands to access the display of soil pressure contours. This display command was accessible from the toolbars if using the menu interface, but not from the ribbon or menu dropdown.
	207270	An incident was resolved where, in the Segmental Tendon Definition form (cantilever, top, and bottom span), when the PT Duct Template was modified and then later the Tendon Parameters form was displayed the material and load pattern lists were blank and did not allow selecting items.

Graphics

Incidents Resolved

*	Incident	Description
	203017	An incident was resolved where DirectX graphics display was not accounting for shell joint thickness overwrites or joint offsets. This was a graphical issue only. GDI+ graphics was working as expected. This affected versions v19.2.0 through v19.2.2 only.
	203018	An incident was resolved where bridge travelers assigned to a segmental bridge object were only being shown for the first stage of a staged construction load case that the travelers were present, but not for subsequent stages. The affected command was Analysis > Load Cases > Show Tree > Show Active Structures. This display issue was only present in versions 19.2.0 and 19.2.1. No results were affected.

Bridge Modeler

Incidents Resolved

*	Incident	Description
	201103	An incident was resolved for the Bridge Modeler where the location of the support bearings at an abutment could be slightly offset in the bridge longitudinal direction for a curved bridge with non-zero grade and non-zero super-elevation. This offset was generally small and the effect upon results was negligible, except that when a grade beam was assigned to the abutment the bearings might not be connected to the grade beam as expected. In such a case, the bearings were still grounded so the structure remained stable, but the grade beam would not bear any of the load from the bridge.

*	Incident	Description
	204244	An incident was resolved for the Bridge Modeler when defining segmental bridges where the presence of longitudinal locations like layout-line control points, in-span hinges, diaphragms, or user-discretization points very close to a segment boundary (by the distance equal or less than 10 times merge tolerance) could cause the segment boundary to merge into the other point. This, in turn, could cause difficulties when defining tendons, using the erection scheduler, or running bridge design. The new version will instead merge such locations that are very near a segment boundary into the segment boundary to avoid such problems. When this error occurred, a message was displayed, and the results were consistent with the model as generated.

Modeling

Incidents Resolved

*	Incident	Description
*	203153	An incident was resolved where the deformation-type hysteresis parameters for types Degrading and BRB Hardening were specified as a ratio of yield for rigid-plastic frame hinges, which have no yield deformation. The affected parameters are "Moderate Deformation Level" and "Maximum Deformation Level" for Degrading hysteresis; "Maximum Plastic Deformation at Full Hardening" and "Accumulated Plastic Deformation at Full Hardening" for BRB Hardening hysteresis. These parameters have been revised to specify these deformations (displacements or rotations) normalized by the hinge deformation scale factors instead of yield deformation. This only affects models with frame hinges that use Degrading or BRB Hardening hysteresis and non-default hysteresis parameters. For affected models, please review the specified hysteresis parameters in the new version of the software.
*	203739	An incident has been resolved to correct the following issues for the NZS 3101 time dependent properties: (1) The user-defined basic drying shrinkage strain is used directly for shrinkage computation and Eqn 8.14 in the documentation is removed. (2) The fc > 100 MPa condition for coefficient k5 for is removed and Eqn. 8.6 in the documentation is corrected.

Loading

Incidents Resolved

*	Incident	Description
*	203993	An incident was resolved where the generation of bridge loads in internal spans may have failed for curved bridge objects with two or more spans and non-zero superelevation. When this happened, the results agreed with the generated model that had missing loads.

Section Designer

Incidents Resolved

*	Incident	Description
	202388 203797	An incident was resolved in which the program would terminate import of a DXF file from within section designer if one or more of the DXF layer names was blank.

Analysis

Incidents Resolved

*	Incident	Description
*	47756	An incident has been resolved where the results of a moving-load load case may not have been correct for a vehicle having variable axle spacing and with the option "Vehicle Remains Fully in Lane" selected. The results would be correct for an axle spacing within the specified range, but it may not have been the most critical spacing. This error did not affect fixed axle spacing, and it did not affect the most common, default case where the option "Vehicle Remains Fully in Lane" was not selected.

Bridge Design
Incidents Resolved

*	Incident	Description
*	201277	An incident was resolved where the automatic load combinations created for the Canadian bridge design codes CAN/CSA-S6-06 and CAN/CSA-S6-14 were not revised for the most recent scale factors to be used for wind loads. The software and documentation have now been revised according to the following: (1) For the May 2010 Supplement No. 1 to CAN/CSA-S6-06, the wind load factor has been changed to 0.45, 1.5 and 0.8 for ULS combo 3, 4 and 7, respectively. Based on code section 3.10.5.2, for Wind Tunnel Tests, the factors for ULS 3 and 7 are now multiplied by (alpha_w / 1.5). The load factor for wind load on structure has been changed to 1.5. (2) For the December 2014 version of CAN/CSA-S6-14, the wind load factor has been changed to 0.45, 1.4 and 0.75 for ULS combo 3, 4 and 7, respectively. Based on code section 3.10.5.2, for Wind Tunnel Tests, the factors for ULS 3 and 7 are now multiplied by (alpha_w / 1.4). The load factor for wind load on structure has been changed to 1.4. These revisions will affect new load combinations generated in this release of the software. For existing models opened in the new version, existing load combinations will not be changed, but should be deleted and recreated to affect these changes.
	202964	An incident was resolved for the superstructure design and rating of steel I-girder bridge sections where an error could occur when the design tried to determine the length of an unbraced panel for some of the interior girders. This could happen when (1) there were four or more girders in a span, and (2) in this span, three or more staggered diaphragms (cross frames) were assigned to the girders such that the girder distances at these diaphragms all mapped to the same station on the layout line. This was not common. When this occurred, an error message was displayed and the design request would fail to run. In such a case, no results were available. This error affected all design/rating requests for all codes, but for steel I-girder sections only.
*	203241	An incident was resolved for superstructure design of steel I-girder bridges using the AASHTO LRFD code (all versions) where girder splices assigned to the bridge object using the "All Girders" type of assignment were not being considered during design if the option "Mesh Slab at Critical Steel I-Girder Location" was selected in the Update Bridge Structural Model form (command Bridge > Update > Update). In this case, the design always used 1.0 for the flange area reduction factor at the "All Girders" splice locations, which could be unconservative if the desired reduction ratio was less than 1.0. This error only affected the strength design check of type "Steel-I Comp Strength". No other design or rating requests were affected. Splices specified for individual girders rather than "All Spaces" were not affected. This error did not occur if the option "Mesh Slab at Critical Steel I-Girder Location" was not selected.
	207099	An incident has been resolved for superstructure design of steel-I-girder bridge section per the Eurocode code where the calculated stiffener spacing was not including diaphragms that were present within the span, which could result in over-conservative shear capacities being reported for the web. This issue affected Steel I Comp Ultimate and Steel U Comp Ultimate design requests.
*	207372	An incident was resolved for superstructure design of steel I-girder bridge sections where the design could fail when (1) the bridge model was updated as an area object model with the option “Mesh Slab at Critical Steel I-Girder Locations” selected, and (2) girder-section transitions, staggered girder splices, and/or staggered diaphragms were assigned individually to all the girders and/or girder spaces at the same station where an entire-bridge (full width) section cut did not exist, and (3) the design request was set to calculate girder force responses based on live load distribution factors (LLDF) instead of directly from analysis. When this error occurred, results were not available for that design request. Note that LLDF cannot be used for local section cuts, only entire-bridge section cuts. Now an error will no longer be generated during design when a set of local cuts all occur at the same station, but the design will not be performed unless an entire-bridge section cut is also defined at the same location. The simplest way to do this is to assign a user-discretization point at that station.

Results Display and Output

Incidents Resolved

*	Incident	Description
	71122	An incident was resolved where the stress averaging was not working when displaying stresses for Asolid elements. This was a display issue only and did not affect results.
	203270	An incident was resolved where the 64-bit version would sometimes stop working when attempting to create a cyclic animation video showing results.
*	207014	An incident was resolved for the response output of steel I-girder bridge sections where the moment M3 for individual composite girders could be plotted incorrectly in the Bridge Response Display form if (1) the bridge section or girder section dimensions were varied along the span length, and (2) the checkbox “Mesh Slab at Critical Steel I-girder Locations” in the Bridge Object Update form was checked. The error was due to an incorrect location of the centroid about which the moment M3 was being taken. The magnitude of the error at a given location was dependent on the amount of variation in vertical section dimensions along the length and the magnitude of the axial force at that location. This was a display error only and did not affect the design results.

Data Files

Incidents Resolved

*	Incident	Description
	203803	An incident was resolved where an error would occur when importing from a CSiBridge database table file (.B2K, .$BR, Excel, Access) if the model contained a bridge section of type concrete solid girder that had more than four girders. When this occurred, the model could not be imported.