CSiBridge v26.2.0 Release Notes

Notice Date: 02-February-2025

This document lists changes made to CSiBridge since v26.1.0, released 25-October-2024. Items marked with an asterisk (*) in the first column are more significant.

Analysis

Enhancements Implemented

*	Ticket	Description
*	10975	The rotation of link-element local axes with large displacements is now controlled by the P-delta factors defined for the link property. This new behavior only affects nonlinear static, direct-integration, and staged-construction load cases where the geometric nonlinearity parameter has been set to "P-Delta plus Large Displacements". Previously the local-1 axis was always oriented along the deflected line from joint I to joint J. Now the local-1 axis can be specified as determined by the rotation at joint I, the rotation at joint J, the deflected line from joint I to J, or a linear combination of these, all in direct proportion to the specified P-delta factors for the moment at end I, the moment at end J, and the shear-force couple, respectively. The behavior is specified separately for the local 1-2 and local 1-3 planes as part of the link-property definition. While the use of the deflected line is appropriate for braces and truss-like members, the use of end rotations rather than the deflected line is better for gap elements, as well as for certain devices (like friction isolators), where the axial behavior does not change with shear deflection. Note that for zero-length elements, only the joint rotations are used. For one-joint links, the rotation at joint I is assumed to be zero. Previously no large-displacement effect was considered for zero-length or one-joint links. For all links, the local-2 and local-3 axes rotate about the local-1 axis with the average torsional rotation of the two ends, which was the previous behavior as well.

Bridge Design and Rating

Enhancements Implemented

*	Ticket	Description
*	9015	Bridge superstructure design based on IRC 112-2020 has been implemented for all concrete bridge sections, and the load combinations based on IRC 6-2017 have been implemented for all bridge design based on IRC codes. Now when IRC-2020 is selected for bridge superstructure design, program-generated load combinations will be based on IRC 6-2017, concrete bridge design will be based on IRC 112-2020, and steel bridge design will be based on IRC 24-2010. When the previous IRC-2011 is selected instead, program-generated load combinations will be based on the previous IRC 6-2010, concrete bridge design will be based on IRC 112-2011, and steel bridge design will again be based on IRC 24-2010.
	10802	The 2024 Caltrans amendments to AASHTO LRFD bridge design have been implemented. The load factors for the wind load in load combinations are updated accordingly.
*	10966	An enhancement has been implemented to add bridge superstructure design for concrete T-beam bridge sections including checks for stress, flexure, and shear according to Eurocode.

Installation and Licensing

Enhancements Implemented

*	Ticket	Description
*	10971	The version number has been changed to 26.2.0 for a new intermediate release.

Analysis

Incidents Resolved

*	Ticket	Description
	11086	An incident was resolved where a moving load case could not be run if any of the lanes assigned to this moving load case was a floating lane whose direction had been defined opposite the direction of the referenced layout line. When this happened, an error message was displayed and the analysis was terminated. No results were available for the affected load case.
	11090	An incident was resolved where the forces and/or stresses reported in frame, cable, area (shell, plane, asolid), and solid objects did not include the internal forces or stresses due to loads applied to that element in linear direct-integration time-history, steady-state, or power-spectral density (PSD) load cases. For these same load cases, section cuts did not include loads applied directly to the frame, cable, or shell objects that were cut, although loads carried by these elements from the rest of the structure were included (section cuts through plane, asolid, and solid objects were not affected). These errors did not affect the overall structural response or any other reported response quantities, only the reported response for element loading on the element itself and containing section cuts. Joint reactions and base reactions were not affected. This did not affect nonlinear static, staged-construction, or nonlinear direct-integration time-history load cases; it did not affect linear static or linear static multi-step load cases; it did not affect linear or nonlinear (FNA) modal time-history load cases. The response for modal, buckling, and hyperstatic load cases do not include element loading and were not affected.
	11181	An incident was resolved that addressed an inconsistency in section-cut results reported for different types of load cases. Linear load cases, as well as nonlinear (FNA) modal time-history load cases, included loads and accelerations applied to the elements in the section-cut forces in addition to element-stiffness forces. On the other hand, nonlinear static, staged-construction, and linear/nonlinear direct-integration time-history load cases included the loads and stiffness forces from the elements, but excluded the accelerations; for Link elements, the gravity loads were also omitted. This difference was generally insignificant for most models, and the difference would get smaller with further meshing of affected models. Now all accelerations and loads applied to the elements are included in section cuts for all load cases. Loads applied directly to the joints are not included in the section cuts, and are not affected by this change. This was a reporting inconsistency only. No other results are affected.
	11184	An incident was resolved where section-cut forces and base reactions for nonlinear modal time history (FNA) load cases did not include the loads (gravity or acceleration) applied to link objects. Section-cut results could be affected by links included in the section-cut group. Base reactions could be affected by links connected to ground. Results for analysis Verification Example 6-010 show a very small, though expected, change in the reported base reaction for the FNA load case. Documentation and the Excel spreadsheet for running the analysis Verification suite have been updated accordingly. This is noted in the Verification Log under Ticket 11179 (SAP2000). No other results were affected for the Verification examples included with the software.

Bridge Design and Rating

Incidents Resolved

*	Ticket	Description
*	10868	An incident was resolved to improve the stresses computed for bridge superstructure design and rating when using live-load distribution factors (LLDF). Previous stress results tended to be too large and were thus over-conservative. Girder forces and moments were not significantly affected, and stress results were not affected when the option was selected to use analysis results rather than LLDF. In more detail, to comply with the AASHTO code that instructs to distribute dead load evenly to all girders and determine live load demands on individual girders by multiplying single-lane demands on the entire section by the LLDF, the following procedure was used in previous releases for stress evaluation by LLDF: 1) Create internal load combinations where DC, DW and P load cases are multiplied by 1/n and LLIM load cases are multiplied by the LLDF. (n=number of girders). 2) For those load combinations, stresses were evaluated in CSiBridge simultaneously for beams and slabs in the following manner: a) The stress evaluation procedure takes as input a list of elements that are used to determine demands and a separate input of section properties to calculate stresses, based on those demands. To get demands on the section, all the beams and entire composite slab are included and force resultant is reported at the centroid of the entire cross section. To get stresses on individual beams and slabs the procedure calculates section properties based on the entire cross section with stress reporting points located at individual girders. The stress evaluation procedure is called for the entire section and demand based on the individual load combinations. b) The resulting stresses are then multiplied by the number of girders (n) to make up for the fact that the demand was reduced by n in the virtual combinations. However this last step overestimated the stress from the live load demands. After correction, the algorithm follows these steps: 1) No change. 2) For those load combinations, stresses are evaluated in CSiBridge separately for beams and slabs in the following manner: a) The stress evaluation procedure takes as input a list of elements that are used to determine demands and a separate input of section properties to calculate stresses, based on those demands. To get demands on the beams, all the beams are included and force resultant is reported at the centroid of all the beams combined. To get stresses on individual beams the procedure calculates section properties based on one beam at a time. The stress evaluation procedure is called separately for each beam with the individual section properties but the same demand. b) Similarly to get stresses on the slab at each girder. To get demands on the slabs, the entire slab is included and force resultant is reported at the centroid of the entire slab. To get stresses on individual tributary slabs above the beams the procedure calculates section properties based on one tributary slab at a time. The stress evaluation procedure is called separately for each tributary slab with the individual section properties but the same demand.
*	11101	An incident was resolved where bridge seismic design requests could not be run because they were not being displayed in the form "Perform Bridge Design - Seismic". This error affected versions v26.0.0 and v26.1.0.

Bridge Modeler

Incidents Resolved

*	Ticket	Description
	6449	An incident was resolved for the Bridge Modeler where any advanced foundations included in a bridge object were not always updated when the bridge object was updated using the update action 'Update Linked Model'. In particular, the advanced foundations were correctly updated every second time the bridge object was updated. This error did not affect updating the bridge object using the action 'Clear and Create Linked Model'. When this error occurred, the effect was visually obvious because the foundations were missing.

*	Ticket	Description
*	7006	An incident was resolved for Bridge Modeler where the bridge-response display for a bridge object with a user-defined bridge section, modeled as area objects, did not correctly display the forces in the exterior girders or the stresses and displacements in all the girders. This was caused by an incorrectly generated shell layout for the user-defined bridge section in Section Designer. When this error occurred, any bridge superstructure bridge design or rating would also fail to produce results for the affected sections. Available design and rating results were correct and unaffected.
	11028	An incident was resolved for the Bridge Modeler, affecting steel I-girder bridges, where a Single-Beam type of staggered diaphragm would be located at the incorrect vertical location if the diaphragm was assigned between two girders whose spacing between the girders varied significantly due to parametric variation. In particular, one end of the diaphragm would be connected to the bottom of the girder rather than the top. When this occurred, the effect was visually obvious, and results agreed with the model as generated. The Chord and Brace-type diaphragm did not have this problem.
*	11030	An incident was resolved for the Bridge Modeler where, for steel bridge objects, the girder section cuts where girder forces and stresses are calculated could be incorrectly ordered when two or more staggered diaphragms were assigned between two global section cuts and the reference lines of these staggered diaphragms were not the same. When this happened, the coordinates of the girder section-cuts due to those staggered diaphragms could be in the wrong order, depending on the order used to locate the staggered diaphragms. This would then cause the girder forces and stresses in the bridge response display to be missing around those problematic section cuts. The design and rating would also not be calculated at these locations due to these missing data. In cases where the order was not affected, the results were correct.
	11033	An incident was resolved for the Bridge Modeler where a steel I-girder bridge object could not be updated if (1) the "Mesh Slab at Critical Steel I-Girder Locations" check box in "Update Bridge Structural Model" form was checked, (2) staggered diaphragm(s) or girder-section transitions were assigned to the exterior girders between two global section cuts, and (3) a parametric variation was assigned to the bridge-section dimensions {L1, L3 and/or f1} or {L2, L4 and/or f2} that define the slab overhangs such that the distance between bridge deck edge and its fillet was reduced to zero or negative between the same two global section cuts mentioned in condition (2). When this occurred, a triangular slab area object was created at this transition and the Bridge Modeler would fail to subdivide this triangular object for the "Critical Steel I-Girder Locations". Results were not available when this occurred. The previous workaround was to avoid the condition (3), but this is no longer necessary.
	11069	An incident was resolved in the Bridge Modeler for segmental bridges where the form "Tendon Anchors and Ducts Template" was only able to view and edit data for the cantilever tendons, not for the tendons in the top or bottom slab. This error affected versions 26.0.0 to 26.1.0.
*	11080	An incident was resolved in the Bridge Modeler for steel and concrete, I-girder and U-girder composite bridges where the horizontal location of the girder output point could be incorrect if the spacing between girders were not all the same. This could affect the calculated girder moment M2 and torsion T. Moment M3 and forces P, V2, and V3 were not affected. The girder stress calculation for precast concrete U-girder/Super-T bridges would also be affected, but not for the other types of composite bridge sections. No other analysis results were affected. Superstructure design and rating could be impacted for all composite bridge sections if the live-load distribution method was used. Design and rating of concrete U-girder/Super-T sections could be affected in any case because of the effect of this error on stresses. Note that the exterior girders and the first interior girder were not affected by this error. Only interior girders (after the first) whose spacing from the previous girder was different than the first spacing (between the left exterior girder and the first interior girder) were affected. The error in the horizontal spacing was proportional to the difference in girder spacing. The error in M2 depended on the girder axial force P, and the error in T depended on the girder shear V2. The error was generally small, but superstructure design and/or rating should be checked for models that are potentially affected.

*	Ticket	Description
	11145	An incident was resolved in the Bridge Modeler for steel I-girder bridges where the model generated for staggered single-beam diaphragms was not correct when the diaphragm was specified to be modeled as "Mixed Frame and Shell". This did not affect the model of the diaphragm if it was modeled as a single frame. When this occurred, the error was visible in the generated model, and results agreed with the model as generated.

Data Files

Incidents Resolved

*	Ticket	Description
	8942	An incident was resolved to fix corrupt models due to database import related to frame sections. Additional checks were added for area and line objects to assign NULL property if their property is not correct. Additional checks were added for link and solid objects to delete them if their property is not correct.

Database Tables

Incidents Resolved

*	Ticket	Description
*	11168	An incident was resolved where an abnormal termination of the software could occur when attempting to modify an existing Table Export Named Set. This could occur for models saved in v26.0.0 or v26.1.0, but was not common. If the error occurs now, an error message will be displayed, and recreating the affected named sets will remove the error from the model.

Graphics

Incidents Resolved

*	Ticket	Description
	6525	An incident was resolved to control display of lane by setting DirectX advanced parameters line vertical offset to display the lane was hidden by other objects.
	9609	An incident was resolved where the graphical display of bridge lanes could show the width as being wider than actually specified for a lane defined using a curved layout line with nonzero offset and containing multiple straight segments. This was a graphical error only and did not affect analysis or design results.

Results Display and Output

Incidents Resolved

*	Ticket	Description
*	11191	An incident was resolved where a model with restrained joints that have rotated local axes may report incorrect joint-reaction and base-reaction forces for nonlinear static, staged construction, or direct-integration time-history load cases that continue from another nonlinear load case that has non-negligible reactions at the rotated joint. This issue only affected CSiBridge v26.0.0 to 26.1.0, and only affected the reporting of reaction forces.

Section Designer

Incidents Resolved

*	Ticket	Description
*	6796	An incident was resolved for Section Designer where the idealized Caltrans moment-curvature curve could be incorrectly calculated if there was more than one rebar size in the section and the Ultimate Strains were bar-size dependent (the checkbox "Use Caltrans Default Controlling Strain Values (Bar Size Dependent)" was checked in the "Uniaxial Nonlinear Material Data form defining the rebar material). Section Designer was picking the largest ultimate strain among all the rebars to calculate the idealized moment-curvature curve rather than using the appropriate ultimate strain for each different rebar size. This might affect the Caltrans Hinge calculation for frame objects with such Section Designer sections.

User Interface

Incidents Resolved

*	Ticket	Description
	11072	An incident was resolved where the Job Script Definition form did not allow modification of job-script entries when more than one job request was defined in the model. This issue only affected versions v26.0.0 and v26.1.0.