

SAP2000 v22.1.0 Release Notes

© 2020 Computers and Structures, Inc.

Notice Date: 04-June-2020

This document lists changes made to SAP2000 since v22.0.0, released 15-January-2020. Items marked with an asterisk (*) in the first column are more significant.

Analysis

Enhancements Implemented

*	Ticket	Description
*	3786	An enhancement was made to add a plane-stress plasticity model with von Mises (J2) yield criteria for modeling multi-axial yielding and strain-hardening behavior for metallic materials. This model has options for linear isotropic and kinematic hardening as well as isotropic saturation hardening. The material property data (Define menu > Materials) has been expanded with two types of nonlinear material data, Uniaxial and Coupled. The nonlinear material specification called "Nonlinear Material Data" in previous versions of the software is now called "Uniaxial Nonlinear Data". This data defines the stress-strain curve and hysteresis type used in fiber hinges and directional layers of nonlinear layered shell properties. The "Coupled Nonlinear Data" defines the coupled modeling type and associated parameters and is used in coupled layers of nonlinear layered shell properties. A concrete material will use the existing coupled concrete model "Modified Darwin-Pecknold Concrete". All other materials will use the new coupled model "Von Mises Plasticity".
	3893	Optimizations have been made to speed up the plotting of deformed shapes and generation of .AVI files for multi-stepped load cases. This will primarily affect direct-integration and staged construction load cases in models with a large number of elements.
*	4152	The number of processors that can run load cases in parallel in a given session is now limited to eight. This prevents excessive competition for disk resources and allows for more internal parallelization of certain algorithmic processes. It is still recommended to limit the number of parallel load cases to the number of physical cores on the machine if less than eight. Load cases for a given model can still be run on multiple machines and combined into a single set of results on one machine.
*	4351	A change was made to clarify the behavior of a link element when the effective stiffness is used for stiffness-proportional damping - this occurs when "Stiffness Used for Stiffness-proportional Viscous Damping" in the Link Property Data (Define menu > Section Properties > Link/Support Properties) is set to "Effective Stiffness (KE)" or if a linear direct-integration time-history load case starts from the unstressed state (zero initial conditions). When this setting is used, the effective stiffness will be used for stiffness-proportional damping at all times, even if the link has zero nonlinear stiffness and zero nonlinear force. Previously, nonlinear direct-integration time-history load cases set the damping due to effective stiffness to zero when both the stiffness and force in the link was zero, and linear direct-integration time-history load cases set the damping due to effective stiffness to zero if the same condition was met in the initial condition (either the initial state or the end of a nonlinear load case that the linear load case continues from). This change does not affect nonlinear direct-integration time-history load cases where the link has "Stiffness Used for Stiffness-proportional Viscous Damping" set to "Initial Stiffness" or "Tangent Stiffness".

API

Enhancements Implemented

*	Ticket	Description
*	3470	The SAP2000 API can now be used to start and/or connect to a running instance of SAP2000 on a Remote Computer that is running the new API Service for distributed computing. Simultaneous runs can be started on multiple Remote Computers using an API script or plug-in, and results can be merged to the Main Computer programmatically, without user

* Ticket	Description
	intervention, as they become available. Possible applications that can be sped up by distributed computing include parameter studies, Monte Carlo simulations, or performance-based design requiring a large number of load cases to be run.
3811	An enhancement has been implemented to allow all Eurocode 3-2005 steel frame design preference to be set using the API function SapObject.SapModel.DesignSteel.Eurocode_3_2005.SetPreference. The API functions SapObject.SapModel.DesignSteel.Eurocode_3_2005.SetOverwrite and SapObject.SapModel.DesignSteel.Eurocode_3_2005.SetPreference have also been updated to allow specifying all 11 framing types available to the Eurocode 3-2005.
4005	An enhancement was made to the Application Programming Interface (API) to add the functions SapModel.PropArea.GetShellLayer_2 and SetShellLayer_2, which get and set the definitions of all the layers in a layered-shell property. These new functions include the option to get and set the material behavior type, either Directional or Coupled, which was not available in the now superseded functions GetShellLayer_1 and SetShellLayer_1. If the function SetShellLayer_1 is used, the material behavior type defaults to Directional for all layers.
4068	The examples included in the API documentation have updated instructions for attaching to a running instance of SAP2000. The C++ example has also been modified with clearer guidance on creating a forward-compatible client.

Design – Aluminum Frame

Enhancements Implemented

* Ticket	Description
1122	An enhancement has been made to add aluminum frame design according to the Aluminum Design Manual 2015 by the Aluminum Association.

Design – Concrete Frame

Enhancements Implemented

* Ticket	Description
3373	An enhancement has been made to update the calculation of shear strength Vc using the effective shear depth (dv) as defined in the Canadian CSA A23.3-2014 code for rectangular and circular sections. Previously, the shear strength Vc was calculated using the shear area from the section properties, leading to results that did not completely match the design code. The design was slightly unconservative.

Design – Steel Frame

Enhancements Implemented

* Ticket	Description
3019	An enhancement has been made to implement the load combinations from NBCC 2015 into the Canadian steel and concrete frame design codes "CSA S16-14" and "CSA A23.3-14". The earlier implementation was based on NBCC 2010. The manuals have also been updated.
3108	An enhancement has been made to add Russian Steel Frame Design Code SP16.13330.2017. This is an enhancement of SP16.13330.2011.
3589	An enhancement has been made to speed up the design process for steel frames using Eurocode 3-2005, Italian NTC2008, and Italian NTC2018. In the previous release, the new implementation of the Mcr calculation resulted in a considerable increase in design time.

Graphics

Enhancements Implemented

* Ticket	Description
3197	A change has been made to the display of contour plots to improve the readability of the colors representing numerical values. Transparency has now been turned off for both

* Ticket	Description
	DirectX and GDI+ (Classical) graphics modes. In addition, the directional and specular light options are also turned off in DirectX graphics mode. These settings remain enabled when viewing the model without contour plots.
3802	Enhancements have been made to DirectX graphics by using Direct2D in conjunction with Direct3D. Specifically,1) Plan and elevation (XY, XZ, YZ and developed) views are generated much faster and are clearer.2) Line quality for dashed lines, wide lines and selection lines during editing, drafting and display has been improved for both 2D and 3D views.3) Windows True Type fonts including foreign language fonts are available in both 2D and 3D views. Previously only Arial fonts were available and did not cover some languages.
4215	Additional control has been provided for the animation of the deformed shape shown in the model window. The number of frames to be used for the cyclic animation of a single step can now be specified, as well as whether to display the animation scaled from +1 to -1 or only positive values scaled from +1 to 0. The number of frames is controlled by specifying the number of angular increments in a quarter cycle, ranging from 1 (every 90 degrees) to 6 (every 15 degrees). The default is 3 (every 30 degrees), which is a compromise between detailed resolution and speed to generate the animation.

Installation and Licensing

Enhancements Implemented

* Ticket	Description
3560	The version number has been changed to v22.1.0 for a new intermediate release.

Loading

Enhancements Implemented

* Ticket	Description
1633	An enhancement was implemented to allow specifying a load distribution option when applying wind pressure loading to area objects. Previously load was always distributed to the joints of the area object. Now it is also possible to distribute the wind pressure load to frames, using either one-way or two-way distribution.
2286	The auto wind loading for the Russian code SP 20.13330.2011 code has been extended to include the dynamic methodology.

Section Designer

Enhancements Implemented

* Ticket	Description
3774	An incident was resolved for Section Designer where, for Caltrans sections, the ultimate unconfined concrete strain "ecu" textbox was not disabled when viewing the generated stress-strain curve for the Core and Casing concrete models of the section. Changing this value had no effect on the actual stress-strain curve used for this material. Now the "ecu" textbox is disabled, like all the other parameters on the form, and the OK button is disabled as well. No results were affected.

Structural Model

Enhancements Implemented

* Ticket	Description
2067	An enhancement was made to frame hinge assignments so that a hinge can be assigned at an absolute distance from either end of the clear length of the object, in addition to the existing option of relative distance. Starting with SAP2000/CSiBridge version 22.1.0, the relative-distance assignment for frame hinges is relative to the clear length of the frame object, whereas previously this assignment was relative to the total length of the frame object. When a model from a previous version is opened in SAP2000/CSiBridge v22.1.0, the relative-distance value in the hinge assignment will be adjusted so that the true position of

*	Ticket	Description
		the hinge does not change. Note that in previous versions, hinges located in the end offsets (if any) were moved to the beginning or end of the clear length, so behavior will not be changed. Frame hinge assignments can be made in the Assign Frame Hinges form (Assign > Frames > Hinges) and through interactive database editing of the Frame Hinge Assigns tables. Correspondingly for the Application Programming Interface (API), the function cFrameObj.GetHingeAssigns has been deprecated and replaced with cFrameObj.GetHingeAssigns_1 which will extract the hinge location as either a relative distance or an offset distance based on the assignment.
	3008	The join frames action (Edit > Edit Lines > Join Frames) has been enhanced so that hinge assignments in the resulting single frame object will reflect the hinge assignments and positions from the frame objects that have been joined. If a hinge was specified with the location type "Distance From I/J End Offset" corresponding to one end of a frame object that is being joined with other frame objects, the hinge will be converted to an equivalent hinge with a location type "Relative To Clear Length" so that the resulting final hinge location is unchanged.
	3900	An enhancement has been implemented where the IPN and UPE sections were added to the European section database that is supplied with the program.

Analysis
Incidents Resolved

*	Ticket	Description
	926	An incident was resolved where the absolute displacement, velocity, and acceleration response for steady-state and PSD load cases did not include the ground motion due to acceleration loading, such that the absolute response reported was identical to the relative response. Now the applied ground motion is included in the absolute joint response. In addition, it is now possible to plot the load functions, including ground acceleration, for steady-state and PSD load cases using the command Display > Show Plot Functions. Previously these were plotted as zero. No other results were affected.
*	3932	An incident was resolved where the nonlinear stiffness of Damper-Exponential type links was being included in linear and modal load cases that used the stiffness from a nonlinear load case, including P-delta load cases. This issue only affected SAP2000 versions 21.0.0 to 22.0.0 when the option "Stiffness Used for Linear and Modal Load Cases" in the Damper-Exponential type link property was set to "Effective Stiffness from Zero, Else Nonlinear" or "Nonlinear Stiffness". This had the effect of stiffening the model for the affected load cases. Now the stiffness will bet to zero for linear and modal load cases using the stiffness from a nonlinear load case unless the option "Effective Stiffness" is chosen for Damper-Exponential type link properties.

API
Incidents Resolved

*	Ticket	Description
	1238	An incident was resolved in the Application Programming Interface (API) where the PointElm.GetObj and LinkElm.GetObj functions could return undocumented values that corresponded to elements rather than objects. These values are now documented in the API help file, and the functions now also return the name of the corresponding element.
	1597	An incident was resolved in the Application Programming Interface (API) where the section properties of a Section Designer section created via the API could be shown as zero. If the section was later viewed in the Section Designer user interface then the section properties would get recalculated. The section properties were also recomputed when the analysis was run, so results were not affected. This issue only affected section properties viewed in the tables or gotten from the API before the analysis was run.
	2173	An incident was resolved to update the API documentation for the use of the eMatType enumeration in certain the functions. This enumeration change was made in version 17.0.0 and these locations in the documentation were missed. This was a documentation issue only. The behavior of the API has not been changed.
	3532	An incident was resolved for the Application Programming Interface (API) where the function PropLink.SetTriplePendulumIsolator, which is used to define a triple-pendulum isolator link property, was incorrectly setting the axial stiffness for nonlinear analysis to the first item in the input parameter K. This has been corrected so the axial stiffness used for nonlinear analysis is now set to the input parameter K1.
	3621	An incident was resolved for the Application Programming Interface (API) where the function SapObject.SapModel.Results.SolidStrain was returning solid stress results instead of strain results. The database tables contained the correct results. This was only an issue with this API function.
	4023	An incident was resolved in the API function SAPModel.EditArea.ChangeConnectivity where it would process an input array argument incorrectly, causing the function to return an error code.
	4155	An incident was resolved for the Application Programing Interface (API) where the function cLinkObj.AddByCoord added the coordinates of the J-end using database units instead of converting to the specified present units. This issue affected the API function only and did not affect the behavior of the link objects drawn or added in the graphical user interface.

Data Files

Incidents Resolved

*	Ticket	Description
	3776	An incident was resolved where importing of models that used Eurocode 3-2005, NTC 2008, or NTC 2018 steel frame design would generate an import error for the ZaOption steel design overwrite and set it to default. The design results would then correspond to the imported or last assigned overwrite value.
	3883	An incident was resolved to correct the DB(STO)_45B1 I-section in the Russian.pro section property library where it previously had a web thickness of 9mm instead of 8mm. While making this correction, two new libraries have been added which contain newly available sections, with one library using English names (Russian2020_en.pro) and the other using Russian names (Russian2020_ru.pro).
	4235	An incident has been resolved for Eurocode 3-2005, Italian NTC 2008, and NTC 2018 steel frame design. Previously, the location of load application value, Za, had its sign flipped through the exporting and importing model text file process.

Database Tables

Incidents Resolved

*	Ticket	Description
	1992	An incident has been resolved for steel frame design according to Eurocode 3-2005 where some code check parameters with 'Yes/No' values were imported incorrectly from Excel. This happened for 'Consider Torsion', 'Consider P-delta Done', 'Ignore special seismic load', and 'Ignore seismic code'. This also affects other steel frame design codes which have code check parameters 'Ignore special seismic load' and 'Ignore seismic code'.
	3391	An incident has been resolved in the concrete frame design code ACI 318-14 in which the program terminated when displaying the tabular data from concrete design details.

Design – Aluminum Frame

Incidents Resolved

*	Ticket	Description
	4219	An incident was resolved for aluminum frame design of members with an auto select section assigned. Previously, the design section and the design details that passed the design requirements, shown in the form by right-clicking the already designed member, were not updated.

Design – Concrete Frame

Incidents Resolved

*	Ticket	Description
	3351	An incident has been resolved for CSA A23.3-2014 concrete frame design in which the concrete clear cover for section designer sections was previously taken as zero. In addition, an enhancement has been made to determine the concrete core dimensions and effective depth properly for section designer sections containing object shapes rectangular, circular, I, channel, tee, angle, double-angle, or polygon. For pie and pie arc shapes, these dimensions are defaulted to zero. The user has the option to input user defined values for these dimensions in the form by right-clicking on the shape in the section designer section. The default values of these dimensions are summarized in the design manual.
	3564	An incident has been resolved in concrete frame design codes ACI 318-14, ACI 318-11, and ACI 318-08 in which the program did not produce an error message when P_u is greater than $0.75 \cdot P_c$ for certain conditions. A similar problem has been fixed for the following other codes too: Mexican RCDF 2017, Mexican RCDF 2004, CSA A23.3-14, CSA A23.3-04, NZS 3101:2006, SP 63.13330.2012, TS 500-2000, TS 500-2000(R2018), and Chinese 2010. This error was a reporting problem only. All calculations were correct.

Design – Steel Frame

Incidents Resolved

*	Ticket	Description
	1606	An incident has been resolved in steel frame design codes Eurocode 3-2005, Italian NTC 2008, and Italian NTC 2018 in which the program now calculates the design end shear for connections in dissipative zones in DCH and DCM moment-resisting frames based on $R_d \geq 1,1 \cdot \gamma_{ov} \cdot R_{fy}$ where R_d is the resistance of the connection and R_{fy} is the plastic resistance of the connected dissipative member based on the design yield stress ($F_{yd} = F_{yk}/\gamma_{M0}$) of the material as defined in EN 1993 (EC8 6.5.5(3), Eq 6.1, EC3 6.2.5(2), EC3 6.1.(1), NTC 7.5.3.3). Similarly, the design end axial force for connections in DCH and DCM concentrically braced frames is calculated based on $R_d \geq 1,1 \cdot \gamma_{ov} \cdot R_{fy}$ where R_d is the resistance of the connection and R_{fy} is the plastic resistance based on the design yield stress ($F_{yd} = F_{yk}/\gamma_{M0}$) of the material as defined in EN 1993 (EC8 6.7.3(7), 6.5.5(3), Eq 6.1, EC3 6.2.5(2), EC3 6.1.(1), NTC 7.5.3.3). Previously, R_{fy} was based on F_{yk} instead of F_{yk}/γ_{M0} and was conservative. The manuals are also updated.
	1685	An enhancement has been made in the concrete frame design documentation for Eurocode 2-2004 and Italian NTC 2008 in which it is now clearly stated that the angle between the concrete compression strut and the member axis, θ , is taken as 45 deg for all column shear check, 45 deg for all beam shear check when the beam carries significant shear force or the beam carries a seismic load, and the θ is optimized for beam shear check when the beam does not carry any significant torsion load or any seismic load. It is also emphasized that if the user overwrites the value of θ , the overwritten value is used. This is a documentation-only change.
	1710	An incident has been resolved in the steel frame design code AISC 360-10 in which an error message was not being issued for the beams when the unsupported length is larger than $0.17(E/F_y)r_y$ in a SCBF beam and when the structure is seismically loaded. Now an error message is given.
	2030	An incident has been resolved in concrete frame design code AS 3600-2009 in which the torsion design rebar calculation for A_{sw}/s and A_l may be incorrect as the limits of θ of $\pi/6$ and $\pi/4$ were not being applied per AS 3600-2009 8.3.5(b). The program was okay for members carrying no torsion. Verification Example AS 3600-2009 Ex001 was updated to reflect this minor change.
	2053	An incident has been resolved in concrete frame design codes BS8110 97, Hong Kong CP 2013, and Singapore CP 65:99 in which a trivial amount of negative bending moment which is close to zero or essentially zero but not identically zero could prompt the design to calculate the minimum flexural reinforcement, which is undesirable. The tolerance has been improved based on the section dimensions and material properties. The effect of this change is none for critical cases and is rational for trivial forces.
*	2225	An incident was resolved for steel frame design per the code "Italian NTC 2018" where the torsional loads on a span were not interpreted correctly when the J end was continuous, the I end was free, and the span was loaded with constant torsion. This caused design errors. This did not affect any steel frame design where torsion was not present or where torsion was not to be considered.
	2254	An incident was resolved for the CSA S16-14 steel frame design code in which the b/t limit in the axial mode for the Class 3 Angle and Double-Angle sections was taken as $200/\sqrt{F_y}$ instead of $250/\sqrt{F_y}$. This was conservative.
*	3017	An incident has been resolved in the US steel frame design code "AISC 360-16" in which the flexural design capacity of HSS and Box sections for the limit state of Flange Local Buckling (FLB) was based on original section modulus (S_{33} or S_{22}) instead of the effective section modulus (S_{e33} or S_{e22}) when the member axial force is zero or tension. The design was unconservative for this case. Design was calculating the flexural capacities of FLB limit states correctly when the axial force was compressive. Now a different formula is used for effective width (b_e): formula F7-4 for HSS and formula F7-5 for box sections. Previously, the equation F7-4 was being used for both HSS and Box sections. For the latter change, the design was marginally conservative. Now design also considers the LTB for flexure based on

* Ticket	Description
	section F7.4. This section rarely governs for practical Rectangular HSS and Box sections. The design was correct for other limit states.
* 3591	An incident has been resolved to correctly assign the calculated value of Z_j used in the new M_{cr} formulation for Eurocode 3-2005, Italian NTC 2008, and Italian NTC 2018. The effect on design results could have been unconservative in some scenarios.
3596	An incident has been resolved in CSA S16-14 steel frame design to correctly compute the effective area to be used in calculation of axial compression capacity for slender pipe sections. Previously, the effective area was reduced by twice what it should have been, resulting in a smaller effective area. This caused the result to be conservative.
* 3668	An incident was resolved in which the following items were corrected in the NZS 3404 steel frame design algorithm: (1.) The alternative design procedure of Cl. 8.4.4.1.2 is now allowed if $kl = 1.0$. (2.) Several corrections were made to the calculation of section classification for the various shapes and elements in compression. (3.) The calculation of the effective section modulus, Z_e , for slender sections has been updated to consider the correct subsection of Cl. 5.2.5 based on the element that is in compression. (4.) The design manual has been updated.
3899	An incident was resolved for AISC 360-16 steel frame design in which channel and double-channel sections could have been incorrectly classified as slender when they were not slender. This classification was coming from classification for minor axis bending and was not used further in the design algorithm, so this was only a reporting issue. No other results were affected.
* 3984	An incident was resolved affecting steel frame design and aluminum frame design where the axial capacity of unequal-legged angle sections was sometimes overestimated if the lateral-torsional or torsional buckling mode governed. If any of the flexural modes governed, the results were correct. The capacity calculation for the lateral-torsional and torsional buckling mode is based on the solution of a cubic equation. For certain situations, the largest root of the cubic equation was being used instead of the minimum roots.
4087	An incident has been resolved in the Indian steel frame design code IS 800:2007 in which the section classification for box sections was wrong when the section was loaded with flexure and compression together. A certain section was classified as Class 4 instead of Class 2. The program was conservative.
4088	An incident has been resolved in the Canadian steel frame design code CSA S16-14 in which the program was erroneously reporting an error message 'Error: Section is too slender -- leff negative' for a box section even though the section was a Class 2 section.

Documentation

Incidents Resolved

* Ticket	Description
3363	An incident was resolved to correct the Python example in the API documentation for the latest release, including use of the SAP2000v1.dll.
3886	An incident has been resolved in the documentation of steel frame design code SP 16.13330.2011 in which the manual used to claim that 'A rigorous second-order analysis or the amplification of first-order analysis results to estimate the effect of second-order effects is required (SP16 4.2.4, 4.2.5). The program has the capability of performing both.' The program can do a 'rigorous second-order analysis' based on users' choice. However, the program does not perform 'the amplification of first-order analysis' for this code. The manual has been updated to reflect this capability. Also, the manual is updated to remove any references to the framing type. This is a documentation-only change.

Drafting and Editing

Incidents Resolved

*	Ticket	Description
*	3620	An incident was resolved in which the software would terminate abnormally when attempting to replicate frame members containing fireproofing load assignments.
	3757	An incident was resolved where the Edit > Divide Frames option to divide based on visible grid planes was only working for vertical members intersected by XY planes.

External Import and Export

Incidents Resolved

*	Ticket	Description
	3781	An incident was resolved where export to CIS/2 would not work and give an error message for certain models that contained cables or tendons or area element meshes that relied on edge constraints for connectivity.
	3897	An incident was resolved which affected the import of .EXR files that were exported from Revit using CSI/Revit. Only .EXR files exported with the option 'Export to ETABS v17, SAP2000 v21, SAFE 2016 or earlier' selected could be imported. Attempting to import files exported without that option triggered an error message. Now .EXR files exported from Revit with or without that option selected can now be imported into SAP2000.
	3930	An incident was resolved where SAP2000 models could not be exported to Revit in the following case: (1) The model was initially defined using millimeter, centimeter, or inch length units, (2) the model contained one or more area (shell) objects that were not planar to within a tolerance greater than one hundredth of the length unit but less than one hundredth of a foot, and (3) area loads were requested to be exported. When this occurred, the exported .EXR file was not created. Turning off the export of area loads allowed the .EXR file to be generated for such models.

Graphics

Incidents Resolved

*	Ticket	Description
	661	An incident was resolved where auto generated wind loads on rigid diaphragms were not displayed graphically. Wind loads on semi-rigid diaphragms were not affected. Also, analysis results and tabulated data were not affected by this error.
	1550	An incident was resolved where frame loads displayed on a curved frame object may be in an incorrect location. The loads were displayed in the correct locations on frame elements when viewing the analysis model. This was a display issue only. No results were affected.
	2744	An incident was resolved where double angle and box sections defined through the section designer would not display correctly in extruded views. This was a display issue only and results were not affected.
	3212	An incident was resolved in DirectX graphics mode where perpendicular snap during drafting would not work correctly.
	3344	An incident was resolved where labels of frames would not display correctly when displaying the analysis model in DirectX graphics mode. No results were affected.
	3392	An incident was resolved where areas assigned Null properties would not fill correctly if the display was set to show colors based on section properties. No results were affected.
	3393	An incident was resolved where assigned frame end offsets were not displayed when using DirectX graphics mode. This did not affect GDI+ (Classical) graphics mode. No results were affected.
	3417	An incident was resolved where in DirectX graphics mode frame distributed loads would sometimes not scale correctly and would show distorted when the model was rotated on screen. No results were affected.
	3447	An incident was resolved in DirectX graphics mode where the deformed shape of solid objects would not render correctly and showed some black regions. This issue did not affect Standard graphics. No results were affected.

* Ticket	Description
3458	An incident was resolved where loads assigned to a load case could not be displayed graphically from the Load Case Tree form (with the Show Loads option checked) when clicking on the name of a load case that continued from a previous staged-construction load case. The loads could only be displayed for such a load case when clicking the individual load patterns inside this load case. No results were affected. In addition, a minor change was made to the Load Case Tree form such that load cases continuing from a staged construction load case now show at the same tree level as the stages in that load case rather than at the level below the last stage.
3608	An incident was resolved where the display of cable load assignments could be slow when using DirectX graphics mode. The speed has been improved by limiting the amount of detail displayed depending upon the zoom level.
3881	An incident was resolved where the Set 3D View form did not allow negative elevations.
3944	An incident was resolved where in DirectX graphics view when moving the mouse over a stress contour would not show the correct value if the view had been zoomed. The contour colors were correct. This issue did not affect the value shown in "Standard" graphics mode which was correct. No results were affected.

Loading Incidents Resolved

* Ticket	Description
4491	An incident was resolved where importing a new ASCE 7-16 Response Spectrum function from a text file (.S2K, \$2K), database-table file (Excel, Access, XML), or the interactive database editor caused the two specified site coefficients Fa and Fv to be ignored and set to 1.0. This generated an incorrect response-spectrum function that could significantly affect analysis results when used in a response-spectrum load case. Using the menu command Define > Functions > Response Spectrum Functions to modify/show the function would restore the affected site coefficients to correct program calculated values, and the curve displayed correctly. Clicking OK would then save the correct values for analysis, but clicking Cancel would not. Opening an affected model in the new version of the software will now correct any affected response-spectrum functions automatically.

Results Display and Output Incidents Resolved

* Ticket	Description
3003	An incident was resolved where frame end release symbols would be missing in the printed output if the display graphics was set to DirectX. This was not the case when the display graphics was set to Standard. No results were affected.
3768	An incident was resolved where the contour color range picked for displacement contours with the option to show colors based on displacement values normal to the shell surface would not cover the full range of values. This was not common and would only happen in cases where the displacements in the X, Y, and Z directions were opposite to the sign of the area normal. The shells would then all show the same color.
3873	A change was made to the virtual-work onscreen display to show values based on objects instead of analysis elements to be consistent with the way the tables show these values. In addition, an incident was resolved where the plot of absolute virtual work was labelled incorrectly as relative virtual work.
3922	An incident was resolved where if the program switches to Standard graphics from DirectX graphics (due to inadequate resources) during the creation of an AVI file the program in some instances would not keep the desired view direction.
4141	An incident was resolved where, in the Hinge Results form, the 'Show Hinge Backbone' checkbox could be checked when viewing results for Parametric P-M2-M3 hinges and a backbone curve of zero force was being shown. However, the backbone curve for Parametric P-M2-M3 hinges should not be shown due to its dependency on multiple hinge

* Ticket	Description
	degrees of freedom. Now the 'Show Hinge Backbone' checkbox is disabled for Parametric P-M2-M3 hinges.
4145	An incident was resolved where the hinge state for concrete parametric P-M2-M3 hinges was reported incorrectly as 'C to <=D', 'D to <=E', and '>E' when the hinge passed the U, C, and D points respectively. This also caused hinge status to be incorrectly reported as '>CP' when the hinge state actually became 'C to <=D'. This was a reporting issue only and did not affect the analysis behavior of the hinge. This issue did not affect the steel parametric P-M2-M3.

Section Designer

Incidents Resolved

* Ticket	Description
3554	An incident has been resolved for Section Designer where the rebar area entered in the property-grid form shown when drawing or editing rebar was not converted to the current units when the units were changed within Section Designer itself. This error did not affect unit conversion when units were changed in the main window before entering Section Designer.

Structural Model

Incidents Resolved

* Ticket	Description
1230	An incident was resolved where auto PMM fiber hinge assignments to reinforced concrete beams were placing equal rebar at the top and bottom of the beam equal to the average even when the top and bottom rebar were specified or designed differently.
* 3584	An incident was resolved where the software would sometimes terminate when generating a model using the underground templates where circular openings were specified in the slab sections. The generation of a model with a rectangular opening in the slab was not affected by this issue.
* 3742	An incident was resolved for the drawing of strip-type foundation assemblies where the foundations were sometimes not created correctly when intermediate points were to be connected and the location ordering of the intermediate points between the two control points did not match the internal ordering of these points (usually based on the order in which the points were initially created). When this occurred, the error was obvious. Affected foundation assemblies in older models should be redrawn in the new version.
3769	An incident was resolved where the shear reinforcement ratio used for generating ASCE 41-13 concrete column auto hinges was sometimes incorrectly taken as smaller than the values specified in design or in the frame section property data. This issue occurred only when the shear reinforcing ratio option in the Auto Hinge Assignment Data form was set to "From Current Design". When this issue occurred, the generated hinge properties accessible through the Define Frame Hinge Properties form were the actual properties used for analysis. Results agreed with the generated hinges, including the effect of the incorrect shear reinforcement ratio.

User Interface

Incidents Resolved

* Ticket	Description
3549	An incident has been resolved where a frame section definitions notional size data, defined in the Time Dependent Properties form, was not being saved. Analysis results would be based on the values shown when returning to the Time Dependent Properties form.
3747	An incident was resolved where in some rare cases specifying a response spectrum function based on the NTC2008 or NTC2018 codes and using the option to specify data by latitude and longitude would result in an error condition.

*	Ticket	Description
	3887	An incident was resolved where in DirectX graphics mode rearranging display windows would sometimes result in an error condition.