SAP2000® Version 19.1.0
Release Notes

Notice Date: 2017-03-10

This file lists all changes made to SAP2000 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 v19.0.0 (Released 2016-11-18)

Graphics
Enhancements Implemented

*	Incident	Description
	100668	Enhancements have been made to DirectX graphics to improve quality and speed. More options to improve quality are now under users control.

Drafting
Enhancements Implemented

*	Incident	Description
	12780 40589 49570	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 menu.
	56117	An enhancement has been implemented, adding an option to the move and replicate edit commands, to allow specifying distances and locations by clicking points on the model.
	84547	An enhancement has been made to the Quick Draw Secondary Beams option to allow beams to be drawn parallel to the nearest edge and also to control the spacing of the first and last beams added.

Modeling
Enhancements Implemented

*	Incident	Description
*	35781 70182 71577 81957	An enhancement has been made to allow assignment of moment and shear releases to the edges of shell-type area objects.
*	60906	An enhancement has been implemented to expand the time-dependent material behavior to include the Eurocode 2-2004, AS 3600-2009, NZS 3101-2006, JTG D62-2004 codes and the GL2000 model. Time-dependent behavior includes creep and shrinkage strains, as well as age-dependent stiffness where appropriate, for concrete materials.
	85570 93361 93384 99422	The pipes and plates templates have been enabled for the 64-bit version.
	100287	An enhancement has been implemented to incorporate a library of concrete and rebar material properties for Vietnam.

Frame Design
Enhancements Implemented

*	Incident	Description
*	90348	An enhancement has been implemented to add steel frame design according to the API RP 2A-WSD 22nd Edition code.

Analysis
Enhancements Implemented

*	Incident	Description
*	75068 89099 97667	Convergence behavior of the triple-pendulum isolator link element has been improved, particularly to deal with large variations in the axial force, which can cause alternating slip-stick behavior during lateral loading. Models that exhibited slow convergence behavior in previous versions should be re-run in the new version to verify the results. The new results will be more accurate in cases where a significant difference is observed between the old and new results. In addition, for linear load cases that use the stiffness from the end of a nonlinear load case, the transverse stiffness of the isolator will be taken as the specified initial stiffness regardless of whether or not the isolator was sliding at the end of the nonlinear load case, provided that the isolator was in compression. Previously the sliding stiffness was used in such cases. For isolators in tension at the end of a nonlinear load case, zero stiffness is used, same as before. Linear load cases starting from zero initial conditions will use the specified linear effective stiffness, unchanged from previous versions.
*	96716	The size of the saved analysis results files has been reduced for multi-step nonlinear static, nonlinear direct-integration time-history, and nonlinear modal (FNA) time-history load cases. This will reduce the amount of disk space required for these types of load cases in models containing frames objects, isotropic frame hinges, parametric P-M-M frame hinges, and layered shell elements using Darwin-Pecknold (coupled) concrete materials. This may also result in some speed increase when running the analysis and displaying results, particularly for load cases with many steps.
*	98052 99061	Convergence behavior of the friction-pendulum isolator link element has been improved, particularly to deal with large variations in the axial force, which can cause alternating slip-stick behavior during lateral loading. Models that exhibited slow convergence behavior in previous versions should be re-run in the new version to verify the results. The new results will be more accurate in cases where a significant difference is observed between the old and new results. Furthermore, the friction model has been changed from the previous Wen formulation that exhibited a gradual transition between stick and slip to a bilinear model that exhibits a sudden transition. Some difference in results can be expected due to the new formulation, particularly for models where the initial stiffness specified for the isolator was small. In addition, for linear load cases that use the stiffness from the end of a nonlinear load case, the transverse stiffness of the isolator will be taken as the specified initial stiffness regardless of whether or not the isolator was sliding at the end of the nonlinear load case, provided that the isolator was in compression. Previously the sliding stiffness was used in such cases. For isolators in tension at the end of a nonlinear load case, zero stiffness is used, same as before. Linear load cases starting from zero initial conditions will use the specified linear effective stiffness, unchanged from previous versions. Results for included Verification Example 6-011 have been updated for the new formulation. This example now exhibits less numerical sensitivity than for previous versions, and results are now largely machine independent, which was not the case before.

Results Display and Output
Enhancements Implemented

*	Incident	Description
*	28025	An enhancement has been made to the deformed shape plot to give an option to plot velocities or accelerations (relative or absolute) instead of displacements for time history load cases.

Application Programming Interface

Enhancements Implemented

*	Incident	Description
	77210 78872	An enhancement was implemented to add new API functions to add and retrieve polygon shapes within a section designer section.
	98359	An enhancement was implemented to add a new API function AssembledJointMass_1 that replaces a previous function for retrieving the assembled joint mass from the model. The new function allows retrieving the assembled joint mass for a specified mass source or all mass sources.
	99681	An enhancement has been implemented in the API cHelper class to automatically detect the installation path of the program executable based on entries in the registry. By default this will result in the last registered version being used. As an alternative, an environment variable can be set to specify the full path to the program executable.

Miscellaneous

Enhancements Implemented

*	Incident	Description
	97946	The version number has been changed to v19.1.0 for a new intermediate update.

User Interface and Display

Incidents Resolved

*	Incident	Description
	83195	An incident was resolved in which the drag and drop operations were not working on the Staged Construction Tree form. This was a user interface issue only.
	99193	An incident was resolved in which the user defined wind and seismic load form used to input the diaphragm and load data did not always work correctly.
	101148	An incident was resolved in which an abnormal termination could occur when trying to add a new tendon section property if the number of tendon sections was greater than the number of frame objects in the model. This was a user interface issue only and did not affect results.

Graphics

Incidents Resolved

*	Incident	Description
	82564	An incident was resolved in which the force diagram was only shown for the first segment of multi-segment cable objects when using DirectX graphics. This was a display issue only and did not affect results.
	85543	An incident was resolved where the bounding box shown on the inactive windows to show the plane of the 2-D plot on the active window would not be cleared if the active window was changed and the view was rotated in DirectX graphics mode.
	87995 90123 93626	An incident has been resolved in which the contour legend alongside various displays was upside down when using DirectX graphics. This was a display issue only and analysis and design results were not affected.
	89600 92882 95160 95364	An incident was resolved in which an error could be generated on machines using regional settings with a comma as the decimal separator when trying to switch to DirectX graphics mode.
	89741	An incident was resolved in which the program would terminate when attempting to draw section cuts on screen in DirectX graphics mode.
	97878	An incident was resolved in which the Assign Colors form appeared to provide a way to set the background color of the model window at the four corners to generate a gradient background, but the option was not working. This option has now been removed from the form.

Drafting

Incidents Resolved

*	Incident	Description
	86015 87888 89192	An incident was resolved in which the quick draw areas and quick draw secondary beams tools would create the object in the wrong location when using DirectX graphics using metric units.

Modeling

Incidents Resolved

*	Incident	Description
	83157 97136	An incident was resolved in which duplicate GUIDs could be generated within a single model. While this has no effect on analysis or design results, it could cause a problem when using certain export/import options.
	97229	An incident was resolved in which an error would occur when changing the number of integration points for a layered shell section definition if the analysis had previously been run and layer stresses displayed on the screen.
	99230	An incident was resolved in which the max size specified for general division of area objects under the Edit > Edit Areas > Divide Areas command was not enforced. Instead a default value was always used irrespective of the input value.

*	Incident	Description
	100527	An incident was resolved in which the solid maximum mesh size assignment was not always correctly enforced when generating the analysis mesh. The results were correct for the analysis mesh that was generated.

Section Designer

Incidents Resolved

*	Incident	Description
	98291	An incident was resolved for section designer where a fiber model of the section was not able to be generated for a concrete section if there was no rebar present in the section. In this case the moment-curvature relationship could not be plotted in section designer. More significantly, fiber hinges assigned to frame members using such a section designer frame section would contain no fibers, and thus have zero strength and stiffness. Assigning rebar with negligible area to the section was one way to avoid this problem in v19.0.0, the only version affected by this issue.
*	99414	An incident was resolved for Section Designer when defining a Caltrans section property that has interlock regions (where concrete cores overlap) where the size of the rebar used in the interlock region might not have been the same as what was assigned. It would depend on the order of input and could be overwritten by the rebar size of the associated core region. Additionally, two enhancements were made: (1) When the number of bundles in the interlock region is more than one, the size of the common rebars (where the two cores intersect) remains the same as assigned, but the size of the remaining rebar will be the same as the associated concrete core region. In other words, the interlock region could have up to three different rebar sizes. (2) For calculating the Mander-confined model of the cores, the number of longitudinal bars was previously set to be the same as the number of bundles of the associated core, but excluded any interlock regions. Now, the number of longitudinal rebars includes all bars in the outer ring plus those in the interlock region(s) that contact the given core's confinement ring.
	100685	An incident was resolved in which an abnormal termination could occur when trying to import certain DXF files into a section designer frame section definition. This happened when the polyline defining the section did not correctly define an area.

Loading

Incidents Resolved

*	Incident	Description
	98021	An incident was resolved where a distributed projected load assigned to a curved line object might, in some cases, be considered as a non-projected load. This tended to apply more load than expected since the projected length of a curved line object must be less than or equal to its arc length. Note that for models created in v19.0.0 and older, the distributed projected loads on curved line objects will need to be reassigned when the model is first opened in later versions in order to correct this error; otherwise the previous behavior will be retained. This reassignment need only be performed once.
	98593	An incident was resolved in which an error creating the analysis model could occur in a model with auto wind loading applied to semi-rigid diaphragms. This only affected v19.0.0.
	99199	An incident was resolved where in some rare cases the auto seismic loads would not get applied to some joints. This happened when the top level for applying seismic loads was at the level of the top joint in the structure, but the internal joints added for meshing at the top level ended up with a level slightly higher due to numerical roundoff. A tolerance has now been added to this check. The error was obvious as the calculated seismic load reported was larger than the sum of reactions reported. Viewing the applied load on the top level will also show the joints where the load did not get applied.

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	99461	An incident was resolved for NBCC 2015 auto seismic loading and response spectrum function where F(2.0) for Site Class B was incorrectly used as 0.58 instead of 0.63. All other Site class results were correct.
	99512	An incident was resolved for the NBCC 2015 auto-seismic load and response-spectrum function where PGAref was always assumed to be PGA instead of 0.8 PGA when Sa(0.2) / PGA < 2.0, as given in NBCC 2015 section 4.1.8.4(4).

Analysis

Incidents Resolved

*	Incident	Description
*	43870	An incident has been resolved where element load applied to a frame element in the global direction may rotate with the element after being applied during analysis with large displacements geometry. This issue only affects Nonlinear Static or Nonlinear Direct-Integration Time history analysis with the Geometric Nonlinear Parameter option "P-Delta plus Large Displacements" selected. When this issue occurred, the computed response was in equilibrium with the rotated load and the issue was reflected in the reported forces and base reactions.
	85177	An incident was resolved where the iteration behavior for nonlinear direct-integration time-history analysis was adversely affected by non-zero linear effective damping specified for nonlinear link elements, even though effective damping is only intended to be used for linear dynamic load cases. The effective damping for nonlinear link elements was correctly excluded from the element force and equilibrium calculations, hence the effect on results was very small and typically within the convergence tolerance. The new convergence behavior should be more efficient.
	88340 91024	An incident was resolved where the joint reactions reported for single-joint (grounded) links was too large for nonlinear modal time-history (FNA) load cases. The value reported was incorrectly adding the response based on the linear effective stiffness to the actual nonlinear response of the link. Only joint reactions were affected. The overall base reactions were correct, and the link forces reported for these supports were correct. No other response was affected. No other type of load case was affected.
	95703	An incident was resolved where warnings about non-positive diagonals or lost accuracy detected when solving the stiffness matrix using the Standard Solver could be overwritten by another message in the analysis monitor that is displayed while the analysis is running. All messages were present in the analysis log (.LOG) file that is available after the analysis was completed. This was a display issue only. No results were affected. The Advanced and Multi-threaded Solvers were not affected.
*	98787	An incident was resolved where the force response for the non-hinge degrees of freedom in frame hinges could be incorrect when there was an internal event for the hinge and the analysis model for nonlinear hinges was set to “Model Hinges as Separate Link Elements”. This issue affected nonlinear static and nonlinear direct-integration time-history load cases using events with iteration. Affected models could experience poor convergence, reduction of global step size, and/or convergence error. When convergence was achieved, the effect on force response was small, with an error usually significantly less than one percent. This issue affected SAP2000 v19.0.0 only.
*	98957	An incident was resolved where element loading assigned to Solid, Plane, or Asolid elements may not be correctly applied for nonlinear static or direct-integration time history analyses that use event-to-event stepping. This issue does not affect load cases where event-to-event stepping is not enabled or time steps where event-to-event stepping, when enabled, is not actually used. When this issue occurs, the results are consistent and in equilibrium with the incorrect loading. This issue effects SAP2000 v19.0.0 only.

*	Incident	Description
	101048	An incident was resolved where the analysis could take a very long time writing the results to file after completing a nonlinear load case. This issue was more noticeable for models with a large number of layered shells elements and/or models using nonlinear material models defined with many stress-strain points. Results were not affected.

Frame Design

Incidents Resolved

*	Incident	Description
	82721	An incident has been resolved in the Eurocode 3-2005, Italian NTC 2008, IS 800:2007, Norsok N-004, and Norsok N-004 2013 steel frame design manuals in which the documentation does not reflect the effects of the choices for the preference item Consider P-Delta Done?. The program is correct as the choice of "Yes" or "No" affects the K2 factor calculation as intended. Only the manuals were updated.
	86355	An incident has been resolved in the Eurocode 3-2005 and Italian NTC 2008 steel frame design codes in which a T-section was being classified as Class 4 even if the section was under axial tension and major axis moment such that both the flange and web were under tension. The classification was conservative. The effective section property calculations were not affected.
	90346	An incident has been resolved for steel design based on the Eurocode 3-2005 and Italian NTC 2008 codes in which the expressions for alpha for section classification of I-shape and channel sections were not given correct limits. The alpha ranges should be from zero to one, and the manuals were showing it ranging from -1 to 1. This was a documentation error only. Design results were not affected.
	98802	An incident was resolved for steel frame design according to the Italian NTC 2008 code where the Chi factors were taken as 1 when the axial compressive force was less than 0.04 times the plastic capacities per NTC Eq 4.2.45, 4.2.4.1.3.1. The code allows this to avoid trivial axial capacity calculations. However, this caused confusion regarding the reported Nb,Rd axial capacity values.
	99495	An incident has been resolved for steel frame design for all codes where members are now not checked for compression if the members were declared to be tension only with a compression limit of zero. If a compression limit was specified as nonzero then the member is checked for compression, but the combination forces in compression are limited to the specified amount.
	99609	An incident was resolved in the Chinese 2010 steel building design code in which the rolled section option in the overwrites form was not initialized correctly. When the default was Yes on the overwrites, the details reported No. However, once the overwrite was toggled, the reported value was shown correctly, and the program used the value correctly.
	99610	An incident was resolved for the Chinese 2010 steel frame building design code in which a continuous beam was incorrectly classified as a cantilever. This occurred under rare conditions for backspans of cantilevers.
	101063	An incident was resolved where the P-M-M interaction diagram for concrete columns in design mode could have been incorrect when the rebar specified in the frame section properties had a large difference compared to what was required for design. Column design using the check mode was unaffected.

Results Display and Output

Incidents Resolved

*	Incident	Description
	97239	An incident was resolved for the display of layered shell stress results which could have been incorrect when the shell section property was defined with more than five integration points for a layer. The analysis considers a maximum of five integration points, and five points were being used for layers that specified more points. All displayed and tabulated results (displacements, forces, moments, stresses) were correct and consistent with the use of five integration points except for the affected layer stresses themselves, which may have referenced

*	Incident	Description
		the wrong integration point when retrieving results. Now the layered shell section property consistently limits the number of integration points that can be specified per layer to five.
	98062	An incident was resolved in which an abnormal termination could occur when showing a table from within the advanced report writer and trying to export the table to Excel.
	99000	An incident was resolved where incorrect principal stresses, forces, and moments were being reported for area elements in envelope combinations when corresponding values were not requested. The principal values were being computed based on the enveloped values, which was not correct. Now the principal values are reported as zero in this case. Principal values were and are correctly calculated when correspondence is requested for load combinations. Correspondence can be requested for tabular output and using the Application Programming interface (API).
	99028	An incident was resolved in which an abnormal termination could occur when attempting to display the individual fiber data for a PMM fiber hinge assigned to a frame with a section designer section.

Database Tables

Incidents Resolved

*	Incident	Description
	96991	An incident was resolved in which the Table and Field Name Overwrites XML File manual listed an incorrect default name of the XML file to be used with SAP2000 and CSiBridge. The default filename should be CSiDefaultTableNameFile.xml.

Application Programming Interface

Incidents Resolved

*	Incident	Description
	99055	An incident was resolved to add missing design codes to the API DesignConcrete.SetCode and DesignSteel.SetCode functions. The documentation of these and the corresponding GetCode functions was also updated.

External Import/Export

Incidents Resolved

*	Incident	Description
	99190	An incident was resolved which affected the import of AutoCAD *.dxf files. When a *.dxf file contained point objects on a layer which was assigned to link objects at import time, an error message was displayed and only a part of the file was imported. Erasing all AutoCAD point objects on that layer, or not assigning that layer to link objects allowed the import to proceed successfully. DXF files containing point objects on the layer assigned to link objects are now successfully imported.
	99957	An incident was resolved which affected the export of some SAP2000 models to IFC architectural coordination view files. When a SAP2000 model contained area objects whose geometric definitions included intermediate points located along the object first sides but away from the object corners, these area objects were not exported. When this occurred, a warning was posted to the log file correctly stating that the floor or wall object had been omitted from the IFC file, but incorrectly stating it was because the objects were not planar. These area objects are now exported, with any intermediate points located away from their corners removed from their IFC geometric definitions.

Documentation

Incidents Resolved

*	Incident	Description
	89221	An incident has been resolved to correct the figure in the concrete shell reinforcement design technical note, showing the slab element sandwich model. The figure was modified where the local 1 and 2 axes in the figure were flipped to be consistent with the local axes of area objects.
	97632	An incident was resolved to correct a couple minor typos in the API documentation for the functions SetStageData_2 and SetStageDefinitions_2.
	98384	A documentation error was corrected in the help file, removing the topic "Assign - Link/Support Loads - Deformation Load", as this load type is not currently present in the software.
	98626	An incident has been resolved for steel frame design based on the Eurocode 3-2005 and Italian NTC 2008 codes in which the documented expressions for alpha for section classification of I-shape and Channel sections were wrong. The term tf-r has been changed to tf+r. This was a documentation error only. Design results were not affected.
	99103	A minor correction was made to the Eurocode 2-2004 concrete frame design manual in section 4.5.1.5 to remove the statement that beam-column flexural capacity ratios are only reported for ductility class high moment resisting frames as they are also reported for ductility class medium.