

SAP2000® Version 20.2.0 Release Notes

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Notice Date: 2018-09-17

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 v20.1.0 (Released 2018-05-03)

Loading

Enhancements Implemented

*	Incident	Description
*	222043	Automated seismic loads and response spectrum functions have been implemented for the Turkish Seismic Code (TSC-2018).

Modeling

Enhancements Implemented

*	Incident	Description
	222142	A change has been made to default the modeling of tendons to be modeled as elements instead of loads. Old models opened in the new version will not be changed. This change only applies to newly generated tendons.

Analysis

Enhancements Implemented

*	Incident	Description
*	18263	Rotational degrees of freedom will no longer be generated for frame (line) objects that represent truss members. Previously these zero-stiffness rotational degrees of freedom could generate instability warnings during analysis, even though the accuracy of the solution was not affected unless moment loads or rotational moments of inertia were applied at these degrees of freedom. A frame object is now automatically determined to be a truss member if (1.) End releases are assigned for moments M2 and M3 at both ends and for torsion at either end, (2.) The end offsets are zero at both ends, and (3.) The insertion points at both ends are at the centroid with no joint offsets. Note that a truss member may still exhibit internal bending moments due to transverse loading, including self-weight, but no moments will be transferred to the structure at the two ends of the member.
*	19076 95387	Tendons will now be treated as axial-only members, such that rotational degrees of freedom will no longer be generated for tendons modeled as elements. Previously these rotational degrees of freedom could generate instability warnings during analysis for straight tendons, even though the accuracy of the solution was not affected. This change also means that the small amount of torsion and bending moment that previously could be carried by a tendon will no longer be considered. This may result in a small change in analysis results compared to previous versions of the software when running the same model. This effect will generally be negligible. Tendons modeled as loads are not affected by this change. The calculated results for Verification Examples 1-009, 2-020, and 5-009 have changed due to this enhancement, and the published results have been updated for the new values. The difference was less than 0.03% for all three examples.

* Incident	Description
217067	The speed of the analysis has been increased for nonlinear static and direct-integration time-history load cases where a very large number of load patterns is applied. However, it is still more efficient to use the minimum number of unique load patterns required for any given purpose, rather than using duplicated load patterns.
221318	An enhancement has been implemented to allow objects to be removed during a nonlinear direct integration time history analysis for the purpose of simulating dynamic collapse. One or more objects can be removed from the structure at specified times during the load case. When an object is removed, it is replaced with equivalent forces that are then ramped down to zero over a specified duration. This feature can be used, among other purposes, to satisfy building-code requirements that structures remain stable after removal of individual columns.

Frame Design

Enhancements Implemented

* Incident	Description
212482	An enhancement has been implemented to add steel frame design according to the Chinese code named "Chinese 2018". The new code is based on the GB50017-2017 steel-frame code, GB50011-2010 seismic code, and JGJ99-2015 tall-building code.
217064	Concrete frame design for the Indian IS 456:2000 code has been enhanced by implementing the IS 13920:2016 code clauses for Ductile Seismic Design. This includes the following changes to design: (1.) Concrete capacity is ignored for beam shear design when the beam is a part of a ductile moment resisting frame and seismic load is present in the design combination (IS 13920:2016 section 6.3.4(c)). (2.) Beam-capacity shear is scaled up by 1.4 (IS 13920:2016 section 6.3.3). (3.) At each beam-column joint of a moment-resisting frame, the sum of the nominal design strength of columns meeting at a joint along each principal plane is 1.4 times the sum of the nominal design strength of beams meeting at that joint in the same plane (IS 13920:2016 Section 7.2.1). (4.) Updated the minimum rebar to be based on $b*d$ instead of $b*h$ (IS 26.5.1.1, IS 13920:2016 6.2.1).

Results Display and Output

Enhancements Implemented

* Incident	Description
220832	An enhancement was made to add a message to inform users if a particular video compression codec for generating AVI video files will not work on their computer.

External Import/Export

Enhancements Implemented

* Incident	Description
219169	An enhancement has been made to speed up the export to SAFE when many area objects are present on the exported level.

Application Programming Interface

Enhancements Implemented

* Incident	Description
203773	New functions have been added to the Application Programming Interface (API) for getting the design forces. These are accessed through the API interface <code>SapModel.DesignResults.DesignForces</code> .

Installation and Licensing
Enhancements Implemented

*	Incident	Description
*	216254	The version number has been changed to v20.2.0 for a new intermediate release.

Modeling
Incidents Resolved

*	Incident	Description
*	220877 221547	An incident was resolved in the AISC15M.pro steel section properties database file where some of the properties were incorrect. Models that include sections from this library should be reviewed.

Section Designer
Incidents Resolved

*	Incident	Description
*	217402	An incident was resolved for Section Designer in which the angle specified between the Section Designer X axis and the frame-section local 2-axis, as well as the maximum mesh sizes specified to determine the mesh used to calculate the torsional and plastic section properties, are now all saved in the model file (.SDB) and in database table "Section Designer Properties 01 - General". These parameters may be different for each Section Designer section. Previously the angle was saved in the model file, but not in the database table, so it would be lost upon import from text file. The maximum mesh sizes were not being saved at all, and were reset to default values each time the model was opened or the section was opened in Section Designer. In addition, the specification of the maximum mesh sizes in Section Designer has now been moved from the Options > Preferences form to the Display > Section Properties form, where the angle was already being specified.
*	218112	An Incident was resolved for Section Designer where the numbers on the color contour legend for the command Display > Show Stresses might not be shown correctly if the selected display units were not the same as the database units. Database units are those in effect when the model is first created or imported. The stress display itself was correct. No results were affected.

**Analysis
Incidents Resolved**

*	Incident	Description
	215596	An incident was resolved where a material property, hinge property, or nonlinear-plasticity link property using the Pivot-type hysteresis model and having a backbone curve with compression-only or tension-only behavior (i.e., zero force and stiffness in one direction) would produce undefined analysis results after yielding occurred. These analysis results would be reported as "NaN" (not a number) instead of as numerical values. Graphical displays of such analysis results would be blank. This behavior could affect all response quantities reported for the model, not just for those objects using the nonlinear material, hinge, or link property itself. Only nonlinear load cases and linear load cases using the stiffness at the end of a nonlinear load case could be affected. Nonlinear material properties only affect fiber hinges and layered shells. This error was not common since the Pivot model is not really applicable to tension-only or compression-only behavior.
*	215894 217830	An incident was resolved where the direct strain reported for a layered shell with nonlinear directional material was incorrect for nonlinear static and nonlinear direct-integration time-history load cases. This typically affected strains E11, E22, Emax, Emin, and Evm, and the reported values were half of the expected value. The only layers affected those where the material was specified as Directional and one or more of the components S11, S22, and S12 were set to Nonlinear. Layers where the material was specified as Coupled, or where all three components were set to Linear, were not affected. Linear load cases were not affected, nor were nonlinear modal (FNA) time-history load cases.
	216323	An incident was resolved where a material property defined with nonlinear hysteresis type "Isotropic" was being treated as a "Pivot" hysteresis model with the following properties: Alpha1 = 100, Alpha2 = 100, Beta1 = 1, Beta2 = 1, and Eta = 0. This would only affect nonlinear static and direct-integration time-history load cases for models where such a material was used in fiber hinges (frame or wall) and/or in layered shells. The energy dissipation would be less than expected for an "Isotropic" hysteresis model, and would be similar to that for the "Takeda" hysteresis model.
*	216608	An incident was resolved where the transverse shear stiffness was too flexible by a factor of two for layered shell elements with nonlinear properties (both Directional and Coupled types). Layers where the components S11, S22 and S12 were all specified as Linear and/or Inactive were not affected. For a shell element with multiple layers, only those layers with one or more components specified as Nonlinear contributed to the excess flexibility. For most models, where flexural flexibility dominates, the effect of this error was negligible.
*	217190	An incident was resolved where element loads on a shell element and specified to act in a fixed coordinate direction (such as gravity) would be incorrect after a change modifier command from a nonlinear staged construction load case was used to change the weight modifier of the element. This issue was not present if the weight modifier was not changed in the current or prior load cases. This issue only affected nonlinear static and nonlinear direct-integration time history load cases with the "Geometric Nonlinear Parameters" set to "P-Delta plus Large Displacements".
*	222053	An incident was resolved where mass-proportional damping specified in the material property definitions was not being considered for shell elements in nonlinear direct-integration time-history load cases. Additionally, this issue sometimes required extra iteration to reach convergence. Mass-proportional damping specified in the load case itself was not affected. Models without shell elements or without mass-proportional damping in materials used by shell elements were not affected.

Frame Design Incidents Resolved

*	Incident	Description
	218498	An incident was resolved in concrete frame design codes ACI 318-14, ACI 314-11, and ACI 318-08/IBC2009 where in rare cases an inconsistency would appear in the design flexural rebar areas of beams and the flexural rebar used to calculate beam capacities for joint shear checks. The design flexural rebar was correct, but a higher rebar value may have been used for calculating beam capacities for joint shear checks. The error occurred when some combos were initially selected for concrete design, but were later removed.

Results Display and Output Incidents Resolved

*	Incident	Description
*	214576 220889	An incident was resolved where the request for ATC-40 Capacity Spectrum and FEMA 440 Equivalent Linearization pushover plot types resulted in an error condition if the monitored displacement was a generalized displacement.
	217356	An incident was resolved where the default automated report did not include design tables for the recently added AISC 360-16 steel frame design or SP 63-13330-2012 concrete frame design when those codes were selected for use. This was a reporting issue only and did not affect results.

Graphics Incidents Resolved

*	Incident	Description
	100571	An incident was resolved where some joints were not shown when displaying the analysis model and the joints were connected to one or more elements that were not in view. Now joints will show if any element connected to it is in view even if other elements are not.
	217970	An incident was resolved where the line springs would not show on the analysis model display. This was a display issue only and was inadvertently introduced in v19.1.0. No results were affected.
	220151, 220222, 221894	An incident was resolved in which area objects were not always shown when displaying the deformed shape. This was a graphical issue only, did not affect results, and was present in SAP2000 v20.1.0 only.

User Interface and Display Incidents Resolved

*	Incident	Description
	216821	An incident was resolved where the toolbutton Show Forces/Stresses > Soil Pressure was always enabled after an analysis was run, even if there were no area springs assigned that would produce soil-pressure response. The corresponding menu command Display > Show Forces/Stresses > Soil Pressure was correctly disabled when not applicable. No results were affected.
	218441	An incident was resolved where the pop-up form shown when right-clicking an area object while displaying results was always titled 'Shell Stresses' even when it was showing other result types. This was a user interface issue only and did not affect results.
	219750	An incident was resolved where the default CSiDefaultTableNameFile.xml file located in the program installation directory, as customized by the user, was not being used by SAP2000. Now the updated file will be used once a new model is created, an existing model is opened, or the user goes to the Set Current Table Name Source form and clicks OK.

* Incident	Description
220826	An incident was resolved where linear and nonlinear modal time history load case definitions with the initial conditions set as “Zero Initial Conditions – Start from Unstressed State” always showed the default mass source, which was incorrect if the selected modal load case was defined to use a mass source other than the default. This was a user interface issue only and did not affect results.
221218	An Incident was resolved for the NBCC 2015 response spectrum function where the input parameters were hidden on the form. This was a user interface issue.

Data Files

Incidents Resolved

* Incident	Description
218385	An incident was resolved where some frame members with Section Designer sections in some cases may not have any design overwrites imported from text files because their material classification to determine the design procedure was not initialized prior to importing the overwrites. The material classification was done later before analysis and the design was based on the correct design procedure, but the overwrites were lost and default values for those items were used.
* 217292	An incident was resolved where the software could terminate abnormally when trying to open a model file that had previously been saved after deleting a coordinate/grid system that was being used for display without refreshing the corresponding display window. When this occurred, the model could still be imported from the model text file (.S2k). This error was not common.
220604	An incident was resolved where frame hinge assignments were lost when importing frame section properties tables to add to an existing model.

Application Programming Interface

Incidents Resolved

* Incident	Description
218310	An incident was resolved in which the API function cPropLink.SetTriplePendulumIsolator always assumed that the outer top and bottom surfaces were symmetric, even when different values were passed into the API function. Symmetry is now determined by comparing the values for the top and bottom surface. Note, the inner surfaces are always considered to be symmetric and use the supplied inner top sliding surface values.
221156	An incident was resolved in the API function cFrameObj.GetSpring in which an error would occur and properties were not retrieved when a frame had more than one spring assignment.

Documentation

Incidents Resolved

* Incident	Description
215059	An incident was resolved correcting an error in the CSA S16 steel frame design manuals in which the value of L in the equation of M _u (CISC 13.6(a)) was incorrectly defined as L ₂₂ instead of L _{LTB} . This was a documentation error only and did not affect the design results.