# SAP2000 Version 14.1.0

## *Release Date: 2009-07-29*

SAP2000 Version 14.1.0 is an update to Version 14.0.0. It is available as a full installation on DVD, or from the ftp as a full installation or a patch.

## PLEASE READ THIS FILE!

It contains important information about this new release.

## Contents

1. Installation Instructions for SAP2000 Version 14.1.0
2. Patching from Version 14.0.0
3. Installation Instructions for License Manager 8.0.5
4. File Compatibility with Older Versions
5. Significant Changes from Previous Versions
6. New Features in SAP2000 Version 14
7. Important Note for Users of Version 11 and Earlier

## 1. Installation Instructions for SAP2000 Version 14.1.0

SAP2000 Version 14.1.0 is available as a full installation from DVD or downloaded from the ftp. Installing SAP2000 Version 14.1.0 will uninstall Version 14.0.0, but will not uninstall older versions of SAP2000 (Version 12.0.2 and earlier).

The installation instructions are available in three places:
- The "SAP2000 Installation Card" link on the SAP2000 DVD browser.
- A printed document included with the program package.
- In the file *SAP_Install_Instructions.pdf* in the root folder of the DVD.

The instructions include information about the software protection system used and installation options and instructions. You can choose between a Standalone or Network installation.

When installing the Standalone version on a Vista system with UAC (User Account Controls) enabled, you should expect to be prompted twice to allow the installation of the following components: "SAP2000 14" and "Sap2000TrialLicense". Please allow these to continue so that the installation can complete.

When installing the Workstation version on a Vista system with UAC (User Account Controls) enabled, you should expect to be prompted three times to allow the installation of the following components: "SAP2000 14 WS", "Sap2000TrialLicense", and "Caspol.exe". Please allow these to continue so that the installation can complete.

Silent installation is also available for the Standalone and Workstation installations. Please contact CSI Technical Support if you need further information.

## 2. Patching from Version 14.0.0

Whenever possible, full installation is recommended. However a patch is available that can be downloaded from the ftp and used to modify an existing SAP2000 V14.0.0 installation. If this fails for any reason, you should instead download and install the complete Version 14.1.0, as described in Section 1 above. The patch cannot be applied to versions prior to 14.0.0.

The patch is a compressed zip file that contains only the files that have changed or been added since Version 14.0.0. Unzip the contents of the patch into the folder where SAP2000 Version 14.0.0 is installed, allowing the new files to overwrite the existing files. You will need administrative rights to do this.

This patch can be applied to a Standalone or Server installation. No change is needed for a Workstation installation that references a patched Server installation. All Workstation users should close SAP2000 before patching a Server installation, or the patch will fail.

## 3. Installation Instructions for License Manager 8.0.5

The information in this section does not apply if you are using standalone licenses.

For new Network installations, see the *System Administrator's Help* for more detailed information about the License Manager and the License Manager Administration program "WlmAdmin.exe".

This installation contains Sentinel RMS License Manager 8.0.5.
- If you are currently running Version 8.0.5 or higher of SentinelLM you do not need to re-install License Manager.
- If you are currently running a version that is older than 8.0.5 then you **must** install version 8.0.5. Uninstall the older version prior to installing this version. *IMPORTANT!* All commuter licenses should be checked in before uninstalling the old version. Note that Sentinel RMS License Manager 8.0.5 will recognize older licenses for Computers and Structures products. Please refer to the SAP2000 Installation Card or the SAP2000_*Install_Instructions* file for information on how to do this.
- If you are serving licenses on a Windows Vista system, you will need to use Sentinel RMS License Manager 8.1.1, which is available from Computers and Structures, Licensing Department, upon request. This version cannot be locked to a disk ID, but instead requires a

computer ID key. Note that version 8.1.1 is only required when the license server is running on Vista. It does not matter what operating system is used to run SAP2000.

To speed up finding a network license when SAP2000 is launched, you can do either or both of the following:

- Create a text file, LEVEL.TXT, and enter the *ProgramLevel* in a single line. The *ProgramLevel* should be one of the following:

    BASIC/PLUS/ADVANCED/BASICC/PLUSC/ADVANCEDC/ADVANCEDI

    Save this file to the folder where SAP2000 is installed. This file will cause the program to find the license faster. Note that this file will be included when a new license is sent.
- Create a text file, LMHOST.INI, and enter the network name or IP address of the machine that is running the License Manager. If you are serving licenses on more than one machine, enter each name or IP address on a separate line of text. Save this file to the folder where SAP2000 is installed.

If you experience problems with the license please refer to the appropriate "*License Trouble Shooting Guide...*" located in the SAP2000 program folder.

## 4. File Compatibility with Older Versions

SAP2000 Version 14.1.0 can open model files (*.SDB) from older versions of SAP2000, as well as import older SAP2000 database files (*.S2K, *.$2K, *.XLS, and *.MDB.) Note that once you save or run these models in Version 14.1.0, they will not be usable by older versions of the program, so you should save them under a new name after opening or importing them in V14.1.0.

## 5. Significant Changes from Previous Versions

We have listed only significant changes here. For a complete list of changes, please see the separate file ReleaseNotes.PDF in the SAP2000 folder and available by using the *Help > Documentation* command in SAP2000. Note that most changes do not affect most users.

**Changes from Version 14.0.0 to Version 14.1.0 (issued 07/29/2009)**

*Enhancements Implemented*
- *Incident 17537 (User Interface and Display):* The Rotate 3D View command has been enhanced to rotate about the center coordinate of the current view, accounting for zoom and pan. Previously the rotation was always the center of the structure for perspective views, and about the origin for orthographic views.

- *Incident 18152 (Modeling):* Automated wind lateral loading for Australia and New Zealand has been implemented according to the AS/NZS 1170.2 2002 code.

- *Incident 18523 (Bridge Modeler):* The U-girder frame section can now be used to model steel tubs in the Bridge Modeler. When a steel material is chosen for the frame section, the

generated linked bridge model will treat the alignment of the top and bottom flanges similarly to how they are treated for steel I-girders: The haunch distance is measured to the bottom of the top steel flange, rather than to the top of the top flange as is the case for concrete U-girders. One or two bearings will be created for each steel U-girder depending on the definition of the frame section. A single bearing is used for concrete sections. Significant further specializations for steel U-girders are under current development.

- *Incident 17972 (Design):* "AASHTO LRFD 1997" concrete frame design, which had been removed with Version 12, has now been reinstated after updating it to "AASHTO LRFD 2007".

- *Incident 18008 (Design):* Steel frame design has been added for "NORSOK N-004", including punching checks. The design of non-tubular sections is in accordance with Eurocode 3-2005 with the Norwegian National Annex. The SAP2000 Offshore add-on license is required to use this feature.

- *Incident 17922 (Bridge Design):* Detailed design checking has been implemented for multi-cell prestressed concrete box-girder bridge superstructures according to the "AASHTO LRFD 2007" code. Separate design checks are available for stress, flexural capacity, and shear capacity using MCFT (modified compression field theory). Live-load distribution factors can be automatically calculated using code formulae, specified by the user, or determined from detailed 3-D live-load analysis. Results are reported for each girder, and include plots of stress, moment demand and capacity, shear demand and capacity, and shear-rebar requirements. Detailed tables showing all results and intermediate values are available for display, printing, and export to Excel or Access. These new checks are in addition to the whole-section checks that were previously released.

- *Incident 18280 (Database Tables):* The "Floating Point Number Format" and "Units" settings have both been removed from the database table format file. Now all displayed tables, printed tables, and tables in formatted reports will use the corresponding settings that are controlled using the menu command Options > Set Program Default Display Units. This makes it easier to format the tables and provides more consistent formatting.

- *Incident 18155 (External Import/Export):* The capability to export a model to SAFE V12 has been implemented. A single global-Z elevation is chosen, and all objects connected to joints within a tolerance of that elevation are exported. Linear static and response-spectrum load cases and associated data are also exported.

- Other minor enhancements as detailed in *ReleaseNotes.PDF*.

**Incidents Resolved**

- *Incident 18157 (User Interface and Display):* An Incident was resolved in which the license was sometimes lost during creation of the analysis model for certain types of models. This only affected network licenses.

- *Incident 18376 (Modeling):* An Incident was resolved in which some of the "Uniform to Frame" loading was lost when assigned to an area object that could not be meshed by cookie-cutting into 3- and 4-noded areas the using existing frame objects. Now a warning message is given to the user if this problem is detected while assigning the load or while creating the analysis model. If the warning is issued when creating the analysis model, the user is given the option of either converting the load to a uniform area load, in which case no load is lost, or canceling the creation of the analysis-model.

- *Incident 15873, et al (Analysis):* An Incident was resolved for bridge moving-load cases in which the vehicle axle loads were not being restricted to remain within the lane-edge distances specified for the vehicle, but instead were allowed to move to the edge of the lane. The effect of this was conservative.

- *Incident 18277 (Analysis):* An Incident was resolved in which the P-delta force in frame elements was assumed to be constant over the element using the value at the I-end of the element rather than at the center of the element. The P-delta force is used for nonlinear static analysis, nonlinear direct-integration analysis, and buckling analysis. This means that different P-delta effects or buckling loads could be calculated when the local 1 axis is reversed (i.e., by switching the ends I and J) for the case where there is significant axial load applied to the element itself compared with the total axial force being carried by the element.

- *Incident 16491 (Design):* An Incident was resolved for steel frame design in which the panel-zone design shear force used to determine the doubler plate thickness was sometimes calculated incorrectly. This design shear force is the difference |Vb|-|Vc|, where Vb is the shear force from the beam flanges connecting to the joint, and Vc is the shear force from the column above the joint. Vb is calculated as the larger of the capacity moment or the factored moment from the beams, divided by their mean flange distance. Normally the capacity moment governs, and this was being calculated correctly. However, when the factored moment governed, the design could be unconservative, since the moments from the two beams were added algebraically, but should have been added using their absolute values. The affected codes are "AISC-ASD 01", "AISC-LRFD99", "UBC97-ASD", "UBC97-LRFD", "CAN/CSA-S16-01".

- *Incident 18147 (Design):* An Incident was resolved for steel frame design using codes "Eurocode 3-1993" and "Eurocode 3-2005" in which the section classification was sometimes incorrect for sections in pure compression.

- *Incident 18347 (Design):* An Incident was resolved in which superimposed dead load patterns were not being included in auto-generated strength design load combinations for all types of design and all design codes.

- *Incident 18402 (Design):* An Incident was resolved for concrete frame design using code "ACI 318-05/IBC 2003" in which column shear forces were not being properly amplified when Sway Ordinary frame design procedure was chosen and the Seismic Design Category was greater than or equal to B. Now the shear design of columns will be performed in this

case according to the Sway Intermediate Frame procedure. In addition, for such cases (Ductility=OMF, SDC >= B), the shear design of beams was previously being performed as beams in Sway Intermediate Frame. Now such beams are designed as Sway Ordinary beams irrespective of SDC.

- *Incident 18403 (Design):* Steel frame joint design has been improved to now consider whether the joint being designed is at the top of the column or not. Previously the joint was always assumed to have a column above it, which could lead to an unconservative design for the topmost joint where there is less restraint. The affected codes are "AISC360-05/IBC2006", "AISC-ASD 01", "AISC-LRFD99", "UBC97-ASD", "UBC97-LRFD", "CAN/CSA-S16-01".

- *Incident 18404 (Design):* An Incident was resolved for steel frame design in which the panel-zone design shear force used to determine the doubler plate thickness was sometimes calculated incorrectly. This design shear force is the difference |Vb|-|Vc|, where Vb is the shear force from the beam flanges connecting to the joint, and Vc is the shear force from the column above the joint. Previously Vc was taken as the shear force from the column below rather than above the joint. This error could be slightly unconservative, since Vc is usually much smaller than Vb. The affected codes are "AISC360-05/IBC2006", "AISC-ASD 01", "AISC-LRFD99", "UBC97-ASD", "UBC97-LRFD", "CAN/CSAS16-01".

- *Incident 18408 (Design):* An Incident was resolved in which the D/C ratio calculated for design could be incorrect for unsymmetrical Section Designer sections due to an error in interpolating the capacity from P-M-M surface. Sections which are symmetrical for major (M3) bending were not affected.

- *Incident 18457 (Design):* An Incident was resolved in which the punching shear overwrites were being ignored for steel frame design using the API design codes.

- *Incident 18498 (Design):* An Incident was resolved for steel frame design using code "Eurocode 3-2005" in which the buckling moment capacity was not being considered in the PMM interaction equation.

- *Incident 17910 (Bridge Design):* An Incident was resolved for bridge design of precast-girder superstructures in which the live-load distribution factors calculated from code equations sometimes gave a zero value for the interior girder of a three-girder section.

- *Incident 17945 (Bridge Design):* An Incident was resolved for the bridge superstructure shear check of precast girder superstructures in which the correct controlling results for shear rebar were not always presented in the output tables. Results were presented for the correct demand set and load combination, but not always for the correct correspondence set, e.g., maximum or minimum moment with maximum or minimum shear. The plotted results were shown for the correct controlling case. .

- Other minor Incidents as detailed in *ReleaseNotes.PDF*.

## 6. New Features in SAP2000 Version 14

SAP2000 Version 14.0.0 is a major new release. Significant new features added or enhanced since Version 12 include the following:

**Nonlinear and Pushover**
- A nonlinear, layered shell element using a directional material model has been added for pushover analysis of shear-wall structures and similar applications. A Quick-Start option is provided for easy modeling of reinforced concrete sections.
- Plot functions have been added for shell layer stresses.
- Frame hinges for Section Designer sections "To be Designed" have been enhanced to use the designed amount of rebar when available.
- Section Designer has been enhanced for the display of fiber-model PMM surface.
- The default material properties for concrete have been modified to improve convergence behavior.
- The tangent stiffness used for the iteration of fiber hinges and multi-linear links has been changed to improve convergence.

**Dynamics**
- Material-based damping is now available for linear and nonlinear direct-integration time-history analysis.
- Material-based damping is now available for steady-state and PSD analysis.
- Stiffness-proportional damping now uses initial stiffness instead of tangent stiffness to improve the consistency of results and convergence behavior.
- The rigid-response calculation in response-spectrum analysis has been enhanced for NRC and general use.
- Base reactions for response-spectrum and modal time-history analysis have been improved for springs and grounded link supports to better capture missing-mass effects.
- Base reactions no longer include constraint forces at restraints, for consistency.

**Bridge Modeling and Design**
- AASHTO LRFD 2007 superstructure design for precast concrete composite sections has been implemented. Checks include: stress, flexure, and shear (using MCFT).
- Fully automated bridge design check per AASHTO Guide Specifications for LRFD Seismic Bridge Design 2009 has been implemented, including pushover analysis when required.
- Automated handling of secondary prestress force has been implemented for the AASHTO LRFD 2007 superstructure flexural design check for prestressed concrete box girder sections.
- The AASTHO/USGS 2007 response-spectrum function has been added.
- Variable girder spacing along the length of the bridge superstructure is now available.
- Variable reference-point location along the length of the bridge superstructure is now available.
- Alignment of shell local axes in generated bridge models has been enhanced.

- The longitudinal discretization of bridge models is now more uniform in complex models.
- Tendons modeled as elements now allow elastic, creep, shrinkage, and steel-relaxation losses to be directly specified.
- The displacements for constrained joints in staged construction are no longer updated for deflection until they are actually added to the model.

**Design**
- Eurocode-2 2004 concrete frame design added, without seismic provisions.
- Eurocode-3 2005 steel frame design added, without seismic provisions.
- Australian concrete frame design per code AS 3600-2001 added, including seismic provisions.
- Multiple enhancements made for Indian concrete frame design per code IS 456-2000.
- Multiple enhancements made for Chinese 2002 concrete frame design.
- Multiple enhancements made for Chinese 2002 steel frame design.
- Auto-lateral loads added for Eurocode: Wind, Seismic, and Response-spectrum.
- Auto-lateral loads added for Australia: Seismic and Response-spectrum.
- Auto-lateral loads added for New Zealand: Seismic and Response-spectrum.

**General**
- Multiple enhancements have been made to the graphical display for clarity and speed.
- Multi-stepped static analysis of Bridge Live loads acting on frame elements is now available in Plus/Advanced levels without the Bridge license for modeling crane loads, footfall, etc.
- Single-stage construction cases starting from zero are now available in Plus/Advanced levels without the Staged-construction license for modeling separate gravity and lateral configurations, different support conditions, etc.
- The import of StruCAD*3D data files is now available.
- New and updated API functions have been implemented.

More detail on these and other enhancements can be found in the separate file ReleaseNotes.PDF in the SAP2000 folder and available by using the *Help > Documentation* command in SAP2000.

## 7. Important Note for Users of Version 11 and Earlier

If you are upgrading from Version 11 or earlier, you should be aware that there was a significant change in nomenclature regarding loading starting with Version 12:

- The term "load pattern" replaces "load case" of older versions
- The term "load case" replaces "analysis case" of older versions
- The term "load combination" has not changed

These changes are being made consistently in all future releases of CSI products. These are simply changes in terminology; the concepts and behavior remain the same, and models from Version 11 and earlier will open in Version 14 without any action required by you.