

To mark our 30<sup>th</sup> anniversary as an independent provider of structural engineering software solutions, we are pleased to announce the release of Structural Office R10. R10 is a major new release of S-FRAME<sup>®</sup>, S-STEEL<sup>™</sup>, S-CONCRETE<sup>™</sup> and S-LINE<sup>™</sup> with a host of new features and enhancements that expand Structural Office's capabilities in many areas, some of which were specifically requested by our valued customers. Here is an overview of the R10 enhancements:

- The S-FRAME enhancements focus particularly on supporting the trend of building codes and engineering practice towards more advanced forms of dynamic analysis, especially for seismic loading. A parallel trend is towards larger and more complex models, due to more prevalent use of 'shell' finite elements (FE's) and the influence of BIM (Building Information Modeling). Such models present challenges both in terms of organization and processing. To assist, S-FRAME R10.00.1 includes enhanced automatic meshing algorithms and processing power by leveraging the potential of new 64-bit operating systems and multi-core processors. Further assistance is provided by new automated processing of FE results, enhanced organization and productivity functions and improved BIM links.
- Design Codes are always changing, and so the design modules S-STEEL R10 & S-CONCRETE R10 feature both completely new and significantly updated codes, as well as expanded coverage of existing codes. At the same time enhancements to output and efficiency have also been made.
- The analysis & design module B-LINE R10 similarly features code updates and improved operation.

As some of you may have already noticed we are beginning to use the name **S-FRAME Software** as our company name instead of **SOFTEK Services** in some of our market communications. This is our first step in creating a better market awareness and establishing a more recognizable brand for our company and our products. Please note that we felt that a name change was necessary at this time since the name **SOFTEK** had already been registered by a global computer company. The change to **S-FRAME Software** was a logical one since (a) the majority of our customers world-wide use **S-FRAME** and recognize the name and (b) we had successfully registered the name **S-FRAME** in key global markets. So, please rest assured that **S-FRAME Software** and **SOFTEK Services** represent one and the same company still owned by its founder, George Casoli, who is looking forward to serving your structural engineering needs even better for many more years to come.

## S-FRAME

### *Improved Seismic and Dynamic analysis features*

- New Analysis Option; Nonlinear Time History Analysis with support for geometric and material nonlinearity. For the dynamic analysis of nonlinear models for example those with cables and/or nonlinear spring elements or supports. This analysis type is also required for seismic and dynamic analysis.
- New Direct Analysis Method (DM): S-FRAME now supports the rigorous second-order analysis required by the new AISC 360-10 specification that accounts for both P- $\Delta$  and P- $\delta$  effects. Notional loads are calculated and applied at each beam-column intersection for all gravity load 'strength' combination and for non-gravity load 'strength' combinations that exceed B2 deflection limits. These notional loads are automatically applied in the most destabilizing lateral direction as per code requirements. Both axial and flexural stiffness are automatically reduced to account for out-of-plumbness and  $\tau_b$  can optionally be computed to further reduce the flexural stiffness of all 'Lateral Force Resisting Members'. S-FRAME performs all these calculations in a single analysis run; no need for multiple runs!
- New Element; 'Multi-Linear elastic' Link-beam element. This new element is used in conjunction with the new Nonlinear Time History Analysis for advanced seismic analysis-
- New Analysis Option; Multi-Support Base motion Time History analysis. This is required for example for the seismic analysis of long span bridges or structures with large footprints where supports may require different input accelerograms.
- New Feature; one or more dynamic Time History load cases can now be included in load combinations in the same way as static cases. This makes production of static and dynamic load combinations much easier and is added in response to requests from our user-community.
- New Feature; Automatic time history response charts. A response graph is automatically produced for any joint in the structure, enabling rapid assessment of the nature and magnitude of the structure's response to dynamic loading.
- New Feature; Automatic response spectrum. Following a time history analysis, a response spectrum for any joint in the model can be automatically produced and written to file. This can be used for the simpler separate analysis of components or machinery at certain points or levels in a structure.
- Improved operation; for Time History Analysis, all time steps are now automatically output both graphically and numerically when a primary Time History case is selected (individual time steps can also still be viewed) thus making the assessment of time history results more efficient.

### *Improved modeling, organization and results*

- New Feature; Pier Element Tool. Wall Integration Lines can now be grouped to produce a 'pier' for finite element modeled sections composed of multiple panels/plates such as shear walls (C-shapes, T-shapes, boxes, etc.). Integrated overall sectional force results are automatically calculated and output both numerically and graphically. For FE-modeled shear walls these pier results can be used directly for example for sectional design forces in S-CONCRETE.
- Improved automatic shell meshing algorithms for complex geometries.
- New Feature: Continuous Member Tool. The engineer can graphically assemble Physical Members from existing analytical members. Can be used to quickly convert existing analytical models to

physical models which; produce more immediately useful results, facilitate design checks and link more effectively with AEC 3D BIM tools such as Autodesk Revit Structures.

- New Feature: can now represent member imperfections with the support of curved physical members. Joints can be placed such that they are not co-linear to the physical member.
- Improvement: enhanced organizational folders. Objects can now be added to or removed from existing folders that are already populated by the addition of "Add To" and "Remove From" commands. This feature is added in response to requests from our user-community to make organizational folders even more powerful.

### *New technology utilization for more powerful and efficient analysis*

- S-FRAME's new 64-bit analysis engine harnesses the power of 64-bit Windows operating systems to access much more RAM and to use it more efficiently (see table below). This makes possible the solution of very large models which could not be solved at all with the previous 32-bit solver and/or operating systems.

#### **Physical Memory Limits: Windows 7 (source Microsoft)**

The following table specifies the limits on physical memory for Windows 7.

Version	Limit in 32-bit Windows	Limit in 64-bit Windows
Windows 7 Professional	4 GB*	192 GB
Windows 7 Home Premium	4 GB*	16 GB

\*only around 2GB actually available to a program process

- Parallel Processing (multi-thread) capability. Addition of multi-core support to S-FRAME's SPARSE analysis engine accesses the parallel processing capability of the latest multi-core processors for potentially much faster analysis especially of large models and/or for advanced analysis.

### *Improved interoperability (support for BIM)*

- Completely re-written and much enhanced bi-directional Autodesk Revit Structures Link supports Revit Structures 2011 and 2012 and both 32-bit and 64-bit versions. The link supports the following model aspects:
  - ✓ Load cases and combinations
  - ✓ Slabs and Walls of any shape and thickness, and material properties including rectangular holes for walls and holes of any arbitrary shape for slabs.
  - ✓ Material Properties
  - ✓ Member releases and supports (boundary conditions)
  - ✓ Steel section shapes are automatically mapped to Revit families.
  - ✓ Custom sections produced by S-FRAME's tapered section tool
  - ✓ Use of Revit's unique member ID's to avoid duplication and improve round-tripping.
  - ✓ Unit conversion
- Updated link for TEKLA Structures supports the new 64-bit versions.

## S-STEEL







### (R10.00.1 only) New analysis integration with S-FRAME

- New: Support for Nonlinear Base Motion Time History, Nonlinear Multi-Support Base Motion Time History and Nonlinear Time History analyses.
- New Feature: can now represent member imperfections with the support of curved physical members. Joints can be placed such that they are not co-linear to the physical member.







### New & Updated Design Codes

- Eurocode EC3 2005 UK Annex: Comprehensive coverage of the new European EC3 code using the UK Annex and including support for class 4 (slender) sections (see table below).







KEY	
Supported	
Beyond Scope	
Not Applicable	

S-STEEL support for EUROCODE EC3 2005 UK Annex																		
SHAPE																		
		I Section		Channel		Angle		Double Angle		Tee		Circular		Square		Rectangular		
Classification		1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	
LOAD CONDITION	AXIAL Only: Tension or Compression																	
	SHEAR and [Combined Shear+Axial]																	
	BENDING and [Combined Bending + Axial]	Laterally Supported																
		Laterally Unsupported (LTB)																

- Canadian CSA-S16-2009: Includes expanded code coverage (see table below) as well as new and changed clauses, for example; the new method for calculating the coefficient of increased moment resistance  $\omega_2$  and new Cl.13.3.3 for single angle members in compression.

S-STEEL support for Canadian CSA S16-2009																		
SHAPE																		
		I Section		Channel		Angle		Double Angle		Tee		Circular		Square		Rectangular		
Section Classification		1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	
LOAD CONDITION	AXIAL Only: Tension or Compression																	
	SHEAR and [Combined Shear+Axial]																	
	BENDING and [Combined Bending + Axial]	Laterally Supported																
		Laterally Unsupported (LTB)																

- (R10.00.1 only) American AISC 360-2010 ASD and LRFD: Slender sections for all load conditions. Bending (lateral torsional buckling) check is supported for Tees (including Tees with stem in compression), Rectangular Hollow Sections, Double Angles (including support for modified slenderness accounting for different connector types), and Channels. Sideway amplification (Delta 2<sup>nd</sup>-order, Delta 1<sup>st</sup>-order and B2) based on the reduced stiffness is also reported when using the **Direct Analysis Method**.







S-STEEL support for USA AISC 360-2010 LRFD & ASD															
SHAPE															
		I Section		Channel		Angle		Double Angle		Tee		Circular	Square		Rectangular
Classification		1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4
LOAD CONDITION	AXIAL Only: Tension or Compression														
	SHEAR and [Combined Shear+Axial]														
	BENDING and [Combined Bending + Axial]	Laterally Supported													
		Laterally Unsupported (LTB)													

### Improved Output

- Eurocode EC3 2005 UK Annex: expanded code check details. A new feature optionally shows fuller working and equations. These can be collapsed and expanded and will prove especially useful for those familiarizing themselves with the fine details of new code.
- All supported design codes: in addition to custom I-beams, rectangular hollow sections, square hollow sections and circular hollow sections, the '.TBL' file now supports custom single angles, tees and channel definitions.

### Enhanced Design Code Coverage

- Canadian CSA-S16-2001: for class 4 (slender) sections axial compression is now supported for all section types.
- Canadian CSA-S16-2001: For class 4 (slender) sections unsupported bending (lateral torsional buckling) is now supported for following section types; I-sections, Channels, Rectangular Hollow Sections.

S-STEEL support for Canadian CSA S16-2001															
SHAPE															
		I Section		Channel		Angle		Double Angle		Tee		Circular		Square	
Classification		1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4	1~3	4
LOAD CONDITION	AXIAL Only: Tension or Compression														
	SHEAR and [Combined Shear+Axial]														
	BENDING and [Combined Bending + Axial]	Laterally Supported													
		Laterally Unsupported (LTB)													

## S-CONCRETE

### Updated Design Codes

- Support for CSA-A23.3-04 Update #3: this update to the design code includes numerous adjustments for shear walls and new seismic provisions for beams and columns which are not specifically part of the lateral force resisting system (so called 'gravity' elements). Some engineers may not be aware of the latter. S-CONCRETE's shear wall checks have been updated accordingly and additional seismic provisions have been added for beam and column sections.

### Enhanced automated load calculation

- Enhanced Minimum Moments. S-CONCRETE will now automatically generate additional load cases for minimum moments in each principle direction as required. Minimum moments are not produced by an analysis model and hence must generally be separately calculated. S-CONCRETE's enhanced feature performs this time-consuming calculation automatically hence reducing workload and producing the additional code-required load conditions that an engineer may not have considered.
- For CSA-A23.3-04 or CSA-A23.3-94 seismic design; enhanced seismic shear magnification. For a cantilever lateral load resisting system, S-CONCRETE automatically computes the overstrength factors for each load case and uses these to determine the design shear force on a load case by load case basis. The lowest nominal overstrength factor is stored and used to evaluate the ductility or rotational demand and shear resistance for the section. This practical new approach is based on collaborative discussions with our experienced engineering user-base.

### Improved operation

- For ACI 318-02/05/08; improved axial load and moment interaction diagrams for the factored resistance envelopes ("normal envelopes"). A new more accurate approach has been developed and implemented replacing the previous more conservative approach.
- Improved output; when exporting axial load and moment interaction (N vs M) diagrams to a text file, there is now the option to export all available diagrams or a single diagram depending on the section configuration and loading conditions. This feature is added in response to requests from our user-community

### **B-LINE/S-LINE**

We are changing this product's name to **S-LINE** but during the rest of 2011 both names will co-exist until we fully transition to the new name. What's important to remember is that **B-LINE** and **S-LINE** are one and the same product. We apologize for any inconvenience this may cause.

#### *Updated Design Codes*

- Support for CSA-A23.3-04 Update #3. This update includes an important adjustment for deflection estimation. Clause 9.8.2.3 of CSA-A23.3-04 Update #3 gives a new formula for computing the cracking moment,  $M_{cr}$ , used in the formula for the effective moment of inertia,  $I_e$ . This has been implemented for the CSA-A23.3-04 design code and documented in the on-line help system.

#### *Improved operation*

- Additional input option; the engineer can now enter specific values for the elastic modulus ( $E_c$ ) and shear modulus ( $G_c$ ) to be assigned to the beam and support members. Alternatively the program will automatically estimate  $E_c$  and  $G_c$  using the specified building standard or code. This allows modification of the analysis model and gives the engineer more flexibility in terms of shifting the bending moment and shear diagrams to and away from the supports.