

Prokon® Sumo

Leveraging Prokon Sumo for faster and easier structural modelling and analysis

The constant pressure of responding timeously to project changes has always been great in the construction and consulting industry, as well as delivering projects more effectively whilst reducing project timescales. Lately, the increasing adoption of Building Information Modelling (BIM), has also made data re-use vital.

This white paper explores how the use of Sumo, a 3D structural modelling and analysis software package, shields you from the time-intensive complexities of finite-element analysis while still keeping you in control of the finer details. Sumo also offers interoperability with other structural engineering products.

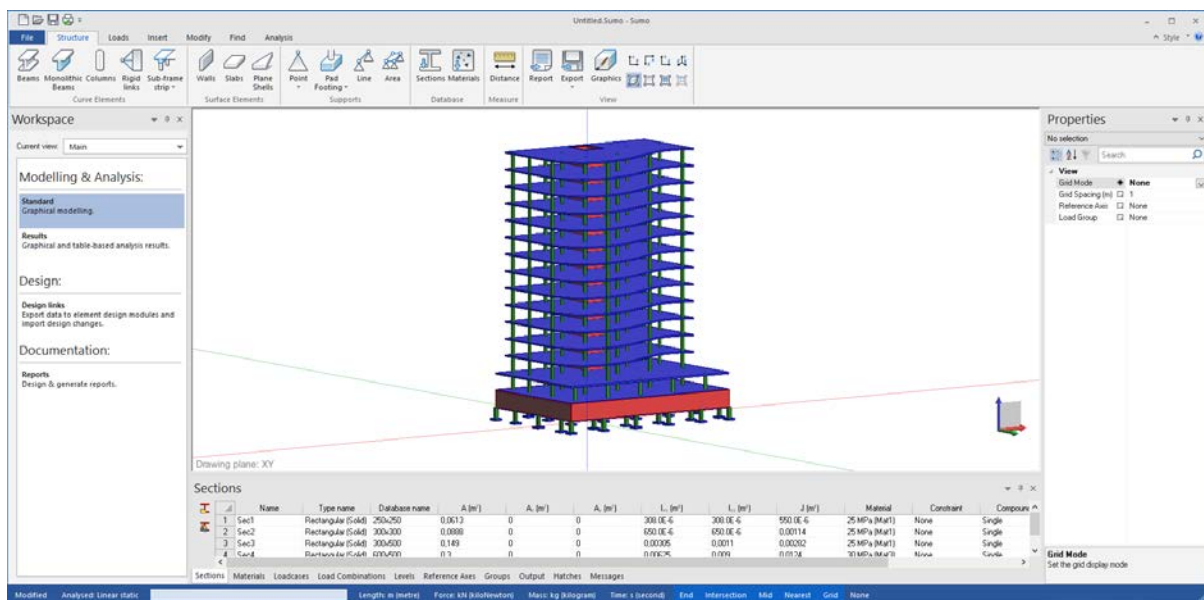


Figure 1: Sumo is a 3D structural analysis program which allows you to build and analyse models using a CAD-like interface on the BIM platform.

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Business challenges

Structural engineering requires the balancing of safety, elegance and economy on all fronts. With the current tough economic environment, resulting in a reduction of planned expenditure on infrastructure development, it causes many challenges for the engineering industry, for example:

- Increasing pressure on engineers and designers to improve efficiency and productivity, whilst saving time and money. This requires the reduction of project time cycles where a better collaboration between multiple disciplines is vital, which in turn requires new ways of working with interoperable software tools.
- Engineers and designers need to be able to easily access each other's models. For example, if the architect makes any changes to the model, the structural engineer should quickly and easily be able to update and re-analyse his structural model and make the necessary changes.
- Interoperability between software packages should be used to save time and avoid mistakes when taking project information from modelling to analysis and then design.
- Analysis results should be easily understandable by all parties involved in the designing of a structure. For example, an architect or draughtsmen would not necessarily know how to interpret engineering calculations and results thus, being able to visually view results and proposed changes, would improve collaboration a great deal.
- As more of the building industry starts to adopt the Building Information Modelling (BIM) technology, which provides an opportunity to improve; quality of work, check for conflicts and avoid coordination problems that might occur. Transition to BIM can be challenging, due to the high cost of software as well as the resources required to train staff members.



Figure 2: Business challenges

Overcoming challenges with Sumo

Prokon Software Consultants offers Sumo structural analysis software, which overcomes all of the above-mentioned challenges and supports the increasing adoption of the BIM workflow for structural engineering.

Sumo is a 3D structural modelling and analysis tool which allows users to easily build and modify structural models using a graphical interface with physical structural components such as beams,

columns and slabs. Sumo runs in a user-friendly environment, with a ribbon-based interface, which is easy to learn, use and understand, compared to most engineering software.

Prokon provides training and support to all Prokon software users via telephone, TeamViewer, an online support portal and e-mail. The Prokon YouTube Channel provides users with monthly technical videos that showcase 'Tips & Tricks' on various software modules.

Dedicated Tools for Structural Modelling

Sumo completely breaks away from the traditional tabular input techniques with its 3D structural environment. Instead of defining nodal coordinates in a table, structural elements such as beams, columns, slabs, supports and loads, are placed and modified using their actual dimensions connecting elements and grid lines or construction lines with graphical steps which are similar to CAD. Sumo automatically takes care of the underlying details, such as keeping track of the nodes and their numbering for you.

Making changes to your model can either be done with a click and drag option or using the properties palette. The connectivity between model elements is maintained by the software automatically. Sumo automatically generates a mesh of continuous finite elements within the outlines of slabs, walls and plane shells; with the user only having to specify the size of the mesh. These shell finite elements have plate bending and membrane characteristics. The automated surface meshing takes connecting elements and their different mesh sizes into account, avoiding the painstaking task of manual finite element mesh input.

If you are familiar with a recent version of Autodesk® Revit®, you will find the setting and modifying properties of elements, such as material grades, sections and geometry, very quick and easy. Sumo provides a properties palette, which contains the relevant attributes of selected elements.

The tables palette helps you keep track of beam sections and materials, as well as defining levels, reference axes and load combinations. You can either model an entire structure or use levels and reference axes to separately model layers or floors, or components such as beams, columns, slabs,

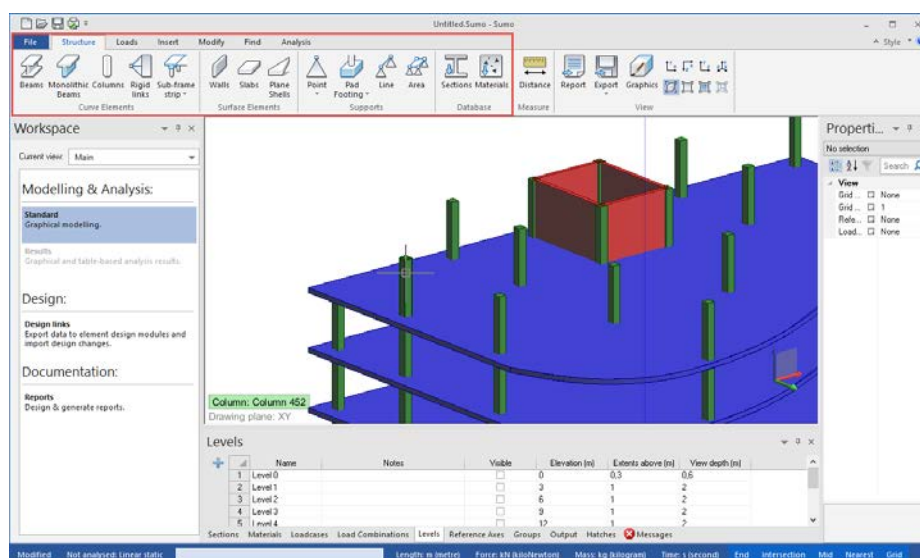


Figure 3: Build models using physical structural elements such as beams, columns and slabs.

walls or shells. Sumo comes with extensive material and section libraries, which also allow you to enter user defined custom sections and materials.

Placing Loads on Your Structure

The latest development in Sumo allows you to easily apply various types of loads. With the wind loading option, you can set the wind code and its associated location, specific wind parameters and thereafter draw in the area wind load on your structure. The hosted loads options allow you to anchor loads to specific elements like beams, slabs and walls. You also have the option to draw in custom floating point, line and area loads.

Analysis, Results and Documentation Options

Sumo is capable of static (linear, second-order, non-linear and buckling) as well as dynamic (modal and harmonic) analysis of complex structures.

The analysis results are provided in a graphical, numerical and tabular format, which includes database features such as sorting, filtering and exporting to Microsoft Excel. On completion of the analysis and design, the results can be sent to the built-in design report and displayed simultaneously with other output results.

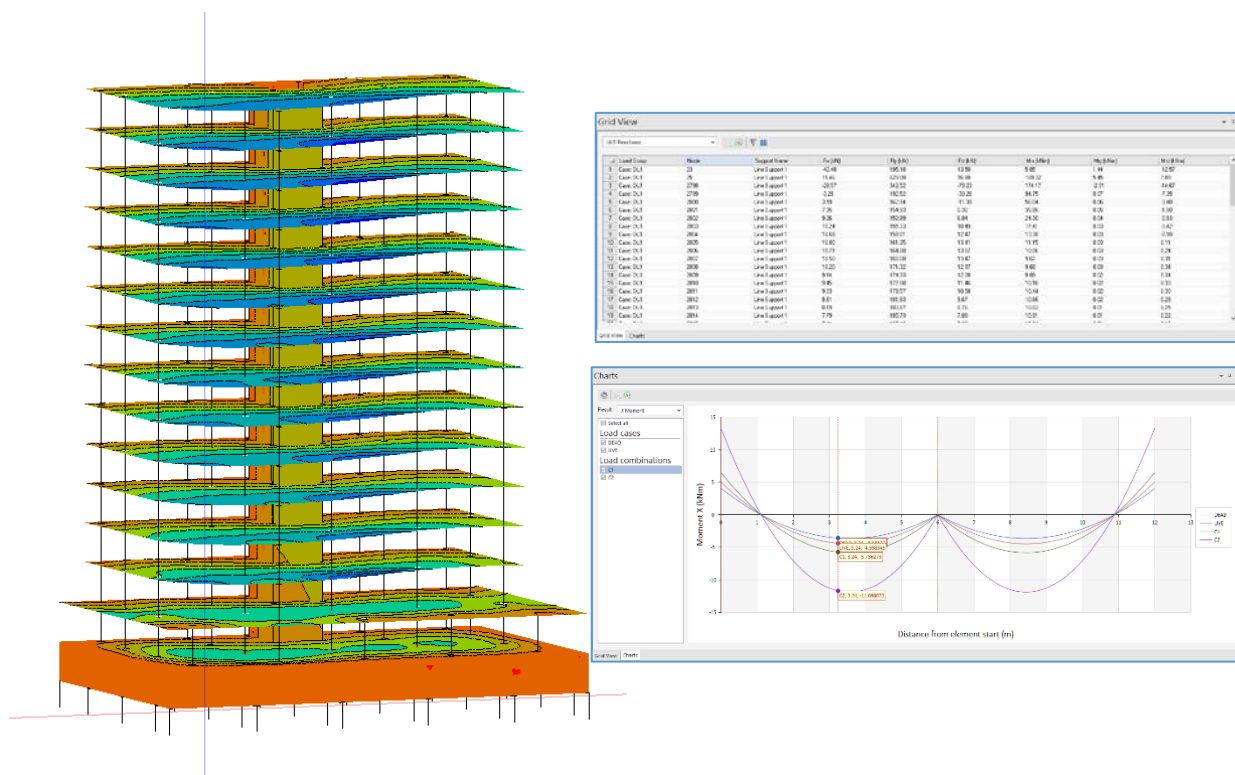


Figure 4: Analysis results can be viewed in many different ways

Due to the fact that most people have access to Word processor compatible documents, with rich text formats, such as Microsoft Word and Excel, Sumo has a native RTF or XLS file with a simple word processor embedded. All changes can be made inside the software and then exported to the package of your choice. This simple feature makes it easy to set up a company template, that will only display the information you need. This will automatically update your design report.

Design links

Once the analysis is complete, the program can transfer relevant design information, such as geometry and design forces, to the Prokon design links. The software integrates with the steel, concrete and timber design modules for further processing, thereby saving time and avoiding errors.

New development in Sumo includes the automatic update of the Sumo model when designing concrete bases and rectangular columns in the Prokon Base Design and Rectangular Column Design Modules. For example, you can model foundations in your structure as Prokon Base Elements. After running the analysis on the entire structure, you can export the foundation elements to the Prokon Base Design Module and design the bases according to the relevant design code. On completion, saving and closing of the base design, all changes are automatically imported back into Sumo and the model will be updated with the new base geometry.

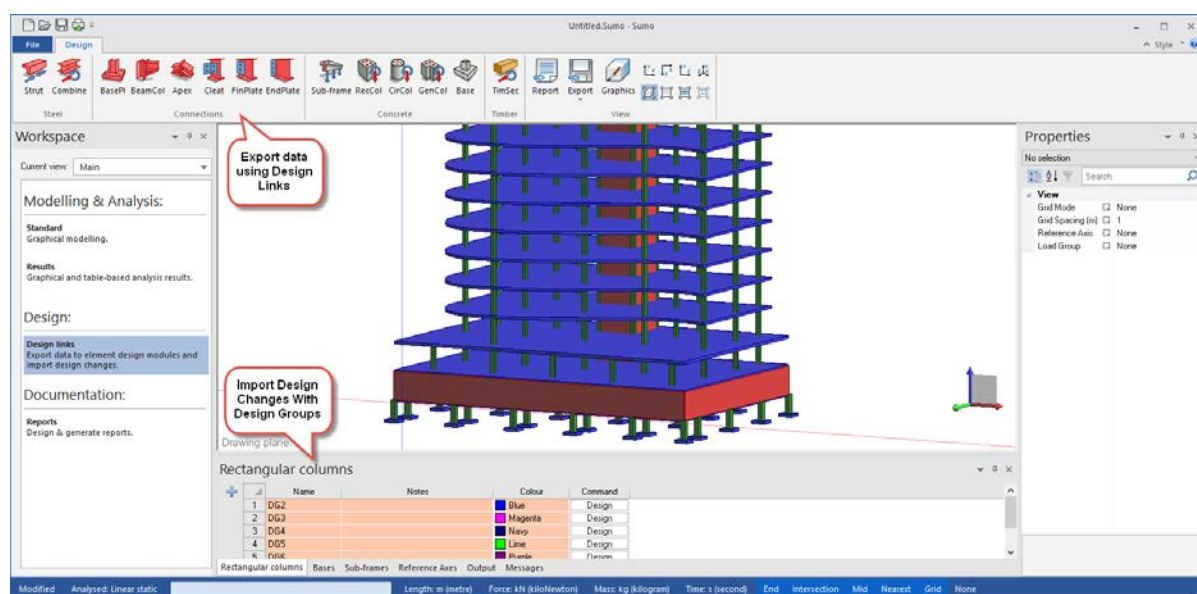


Figure 5: Export data to element design modules and import design changes back to Sumo.

Interoperability

Sumo can easily export and import Prokon Frame Analysis models, resulting in seamless collaboration between users. Prokon also offers Prodesk, which allows you to share models between Autodesk® Revit® Structure and Sumo. DWG files are supported by Sumo. Importing of DWG files into Sumo allows you to import drawings from other programs and then create your structural model accordingly. Sumo also allows you to import DWG drawings onto different levels of your model.

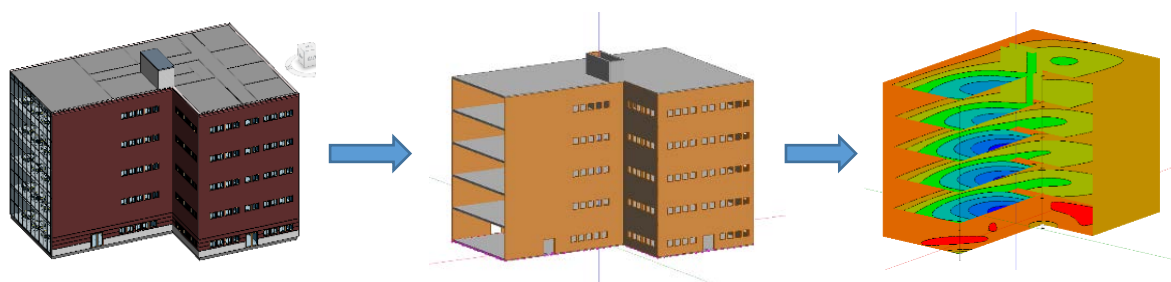


Figure 6: Export models from Autodesk® Revit® Structure to Sumo for analysis.

Conclusion

Sumo's intuitive and graphical interface makes it user-friendly. The easy modelling tools provide information-rich 3D-capabilities that help keep engineers focussed on their tasks, rather than spending an unnecessary amount of time trying to learn a new system. Structural and Civil Engineers can now model simple structural elements or total buildings with a wide variety of materials, loads and conditions. The finite element method that Sumo uses for stress analysis is also one of the smartest and fastest methods available.

Sumo's ability to import/export to a wide range of file formats offers great benefits for Engineers. Interoperability opens new doors for structural optimisation and performance, ensuring time-saving and thus cost saving. Sumo is a part of a new generation BIM compatible analysis and design tools that are constantly evolving. Sumo is priced very competitively compared to other structural analysis programs allowing it to match any budget requirement.

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