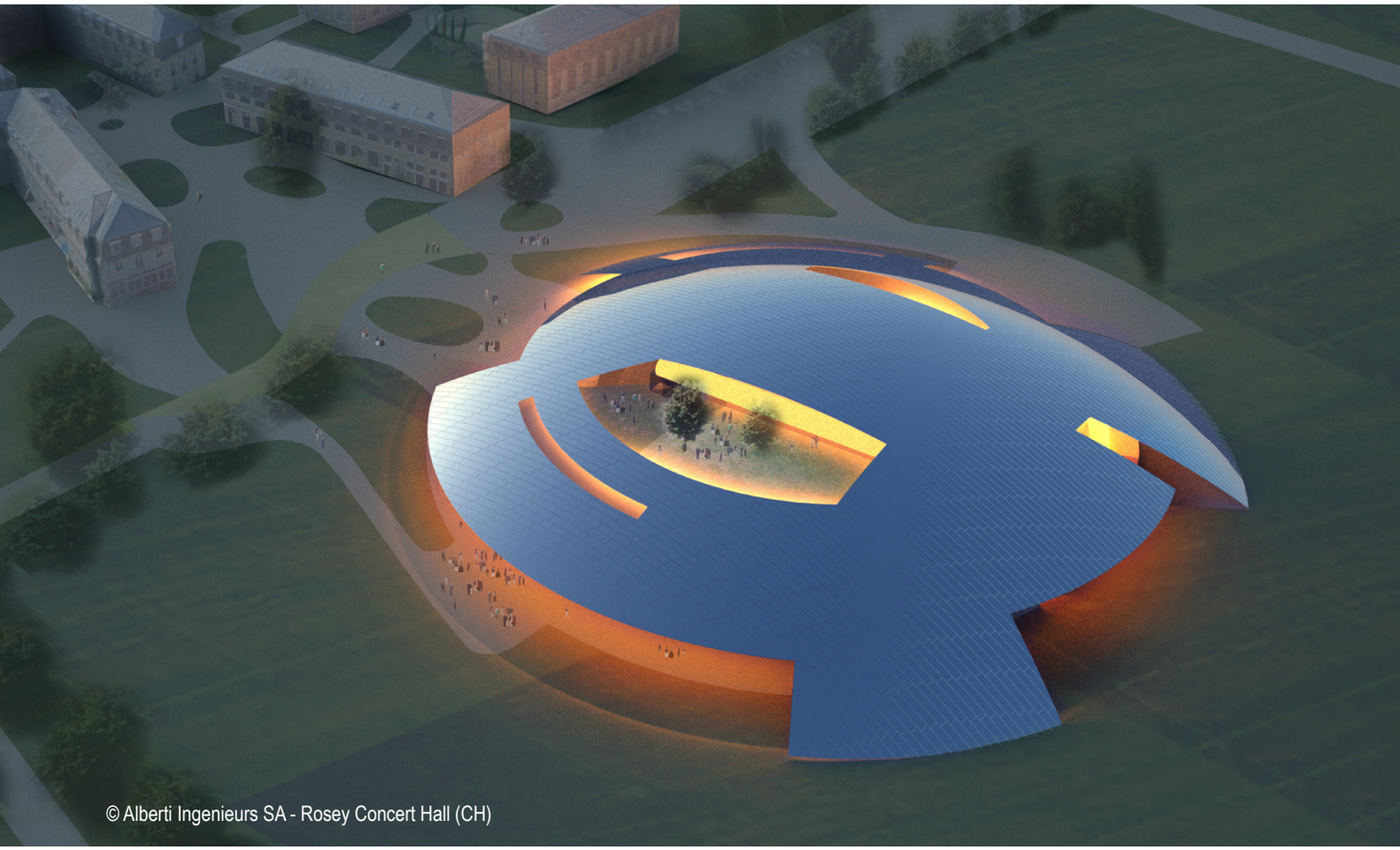
What's New in Scia Engineer 15

Transparent Concrete | Open Platform | Engineering Report | User Improvements



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Fast and transparent concrete design

A revolutionary solution for design & checking of reinforced concrete columns & beams in compliance with EN 1992 for standard and general cross-sections. Includes new functions, clear & transparent reporting and reviewed performance.

Open platform

Easily integrate your design workflow: Your tailor made calculations and code checks connected into the Scia Engineer platform. Includes transparent output with formulas and dynamic drawings. Enables a better collaboration with partners.

Engineering report

Your integrated and dynamic reporting tool further enhanced with new functionality. Extended import capabilities, higher speed and layout options, fully replacing the old Document. A brand new detailed window replacing the old preview.

User improvements

A large number of new features, improvements and extensions in many parts of Scia Engineer: 3D results, Open Design, dynamic analysis, plasticity, steel design, steel connections, Table Input, Table Results, ...

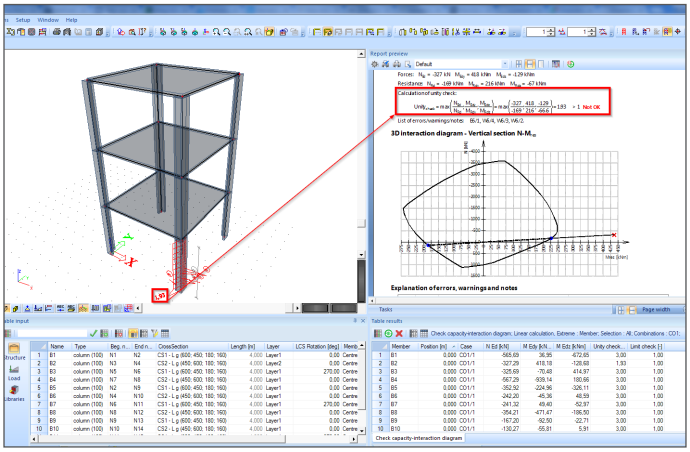
15.scia-engineer.com

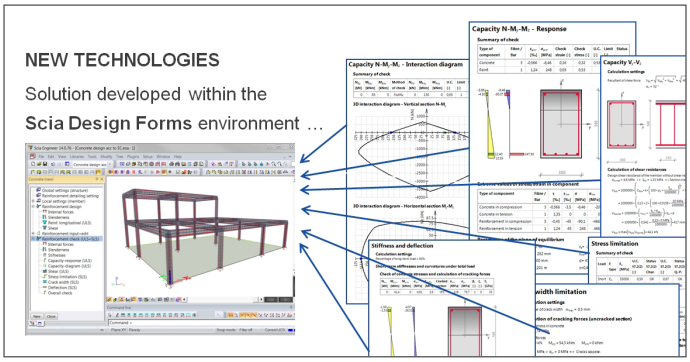
Transparent Concrete

EN 1992

Comprehensive solution for 1D concrete

- Revised and updated generic functions for design & checking of reinforced concrete columns & beams.
- Compliance with EN 1992-1-1:2004/AC:2010-11 including National Annexes.
- Support of standard and general cross-section shapes including openings & arbitrary reinforcement positions.
- Support of interaction of all internal forces (N, My, Mz, Vy, Vz, T).
- High performance.
- Clear & transparent reporting: assisting in dealing with EN 1992-1-1 via references to the standard.
- Revised global and member settings, including 'quick search' function in the concrete setup window.





Open Design technology

- The newly implemented Open Design technology replaces the current design approaches in the market.
- Main advantages of this new approach are:
- Comprehensive and transparent output covering all performed intermediate calculation steps.
- Possibility to process more than one combination of load (combination of biaxial shear and torsion).
- No limits concerning the shape of a beam or column cross-section.
- Support of modern technologies such as multicore CPU and parallelisation.

Clear presentation of results

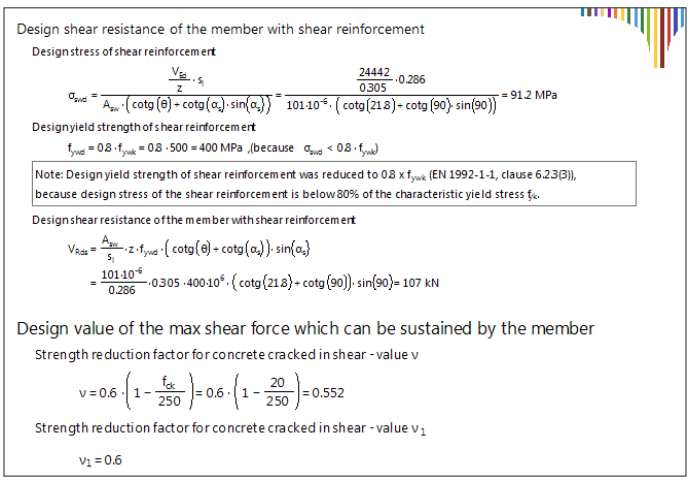
The level of detail in printed outputs can be easily adjusted to reflect the needs: from brief table summary to comprehensive report with all calculation steps.

Brief

A simple table with unity check values or with required area of reinforcement. It can be also displayed in Table Results.

Detailed

Overview of input data, followed by a detailed calculation report. It also includes dynamic images displaying cross-sections including reinforcement layout, stress and strain distributions in different limit states, interaction diagrams and clear references to the articles in the EN 1992 standard.

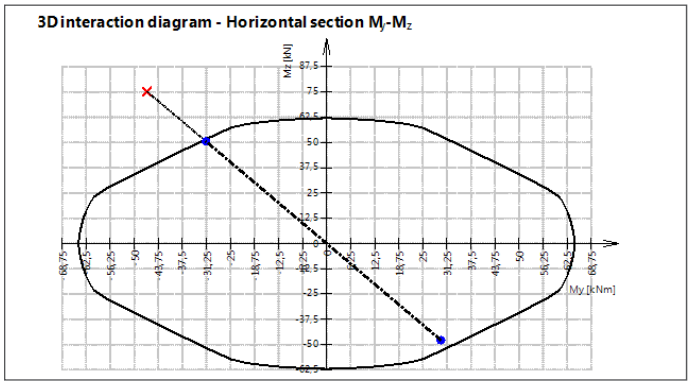


Redesigned dialogues for parameters-setup

- Table with 9 columns (description, symbol, value, default, unit, chapter, code, structure and check type).
- Search and filter functions.
- Several types of view - concrete commands view, code chapter view or list view.
- Option to create tailor made user-views.
- Also the member data dialogue has been redesigned to correlate with the setup dialogue.

Design of longitudinal reinforcement

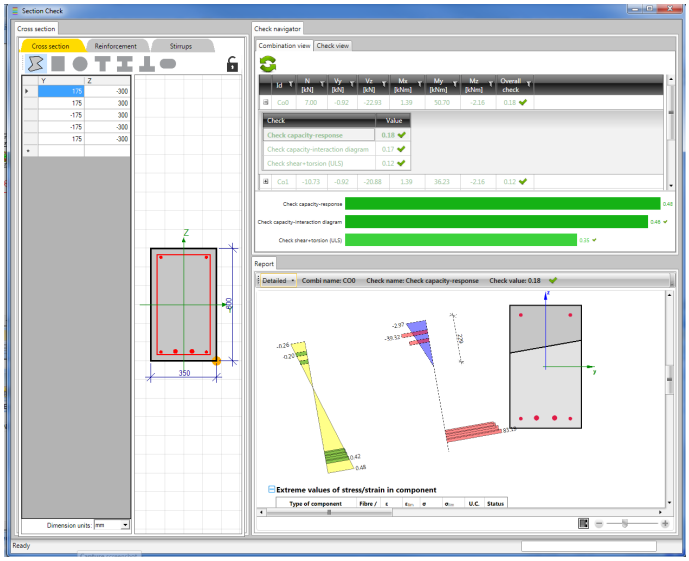
- Taking into account the bending moment with respect to the z-axis (the previous solution respected just one moment – around the y-axis).
- Reinforcement designed to more than one layer (if necessary).
- Recalculation of the statically required reinforcement into real bars.
- Calculation of reinforcement with respect to shear and torsion – additional tensile force.
- Display of reinforcement for each axis y+, y-, z+, z-.



What's New in Scia Engineer 15

Design of reinforcement for columns

- Design for an arbitrary shape of the cross-section.
- Calculation of reinforcement with respect to shear and torsion – additional tensile force.
- Display of reinforcement for each axis y+, y-, z+, z-.



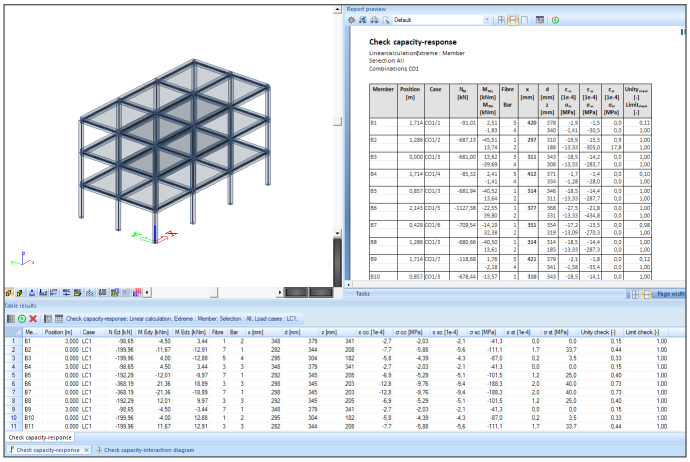
Shear reinforcement

Beams

- Support of biaxial shear and torsion.
- Automatic calculation of the angle of compressive strut to satisfy the condition of minimal amount of designed reinforcement.
- Improved generation of the effective thin-walled cross-section.

Columns

- In the past, the design was based only on detailing provisions.
- The new solutions is able to design statically required reinforcement with respect to the acting load - biaxial shear, torsion and their interaction.



Checks

Ultimate Limit State

- Capacity check for N-My-Mz interaction - based on the resistance calculated from the interaction diagram.
- Response check - based on the check of ultimate stresses and strains for N-My-Mz interaction.
- Check of shear and torsion – check of biaxial shear, torsion and interaction of shear and torsion. Improved creation of the effective thin-walled cross-section.

Serviceability Limit State:

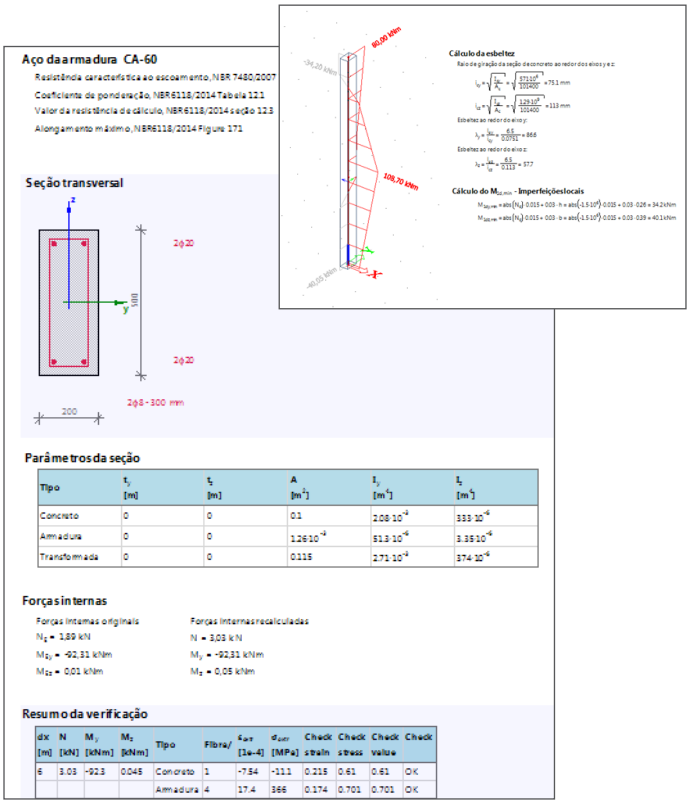
- Stress limitation (for concrete as well as reinforcing steel).
- Crack width limitation – with the possibility to input the user value of limit crack width.
- Simple check for deflection - based on the calculation of stiffness ratio, without necessity to calculate Code Dependent Deflections.

NBR 6118:2014

Enhancements in design according to Brazilian code NBR 6118:2014

Several new features have been implemented in the module for the design of concrete members in compliance with NBR 6118:2014.

- Calculation of design values of internal forces for columns, taking geometrical imperfections and 2nd order effects into account.
- Design of reinforcement for 1D members, consisting of a predefined or arbitrarily shaped cross-section.
- Design of longitudinal reinforcement for 2D member according to ULS.
- Input of practical reinforcement: longitudinal bars, stirrups and/or free reinforcement bars.
- Response check for 1D member (based on check of the limit values of concrete and steel stresses and strains).
- Graphical and numerical display of all results, with the level of detail chosen the by user.
- Bill of reinforcement.
- Generation of simple reinforcement schemes.



Open Platform

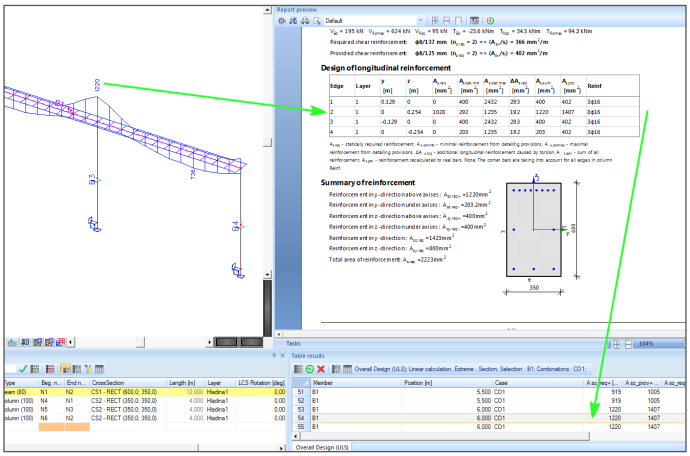
Open Checks Platform, integrating scripts from Scia Design Forms

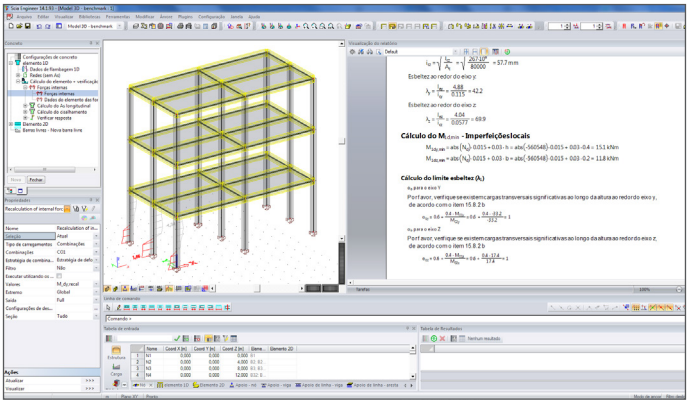
Via the Open Checks Platform, users can extend Scia Engineer with custom calculations and tailor-made design checks, created in Scia Design Forms scripts. These user-defined checks and scripts run analogously to in-house solutions - they are addressed via the tree service, their results are plotted directly on the structure in the 3D window and listed in tables in Engineering Report (including the new Preview) showing all desired formulae.

All that needs to be done is:

- script the formulas and conditions that describe the engineering problem in Scia Design Forms, and
- format the output to a layout you like.

The Open Checks Platform is compatible with the powerful features of the 3D graphical environment and interactive modelling, adaptive FE meshing, different types of advanced analysis, table input and results, etc.





Integration of tailor-made calculations

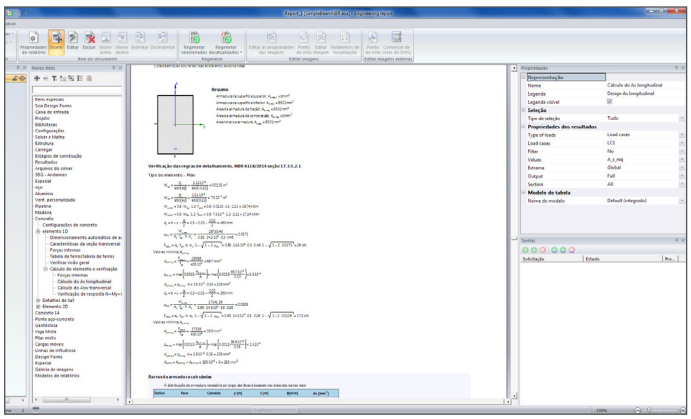
The Open Checks Platform delivers capabilities to move beyond traditional 3D structural analysis. It creates an integrated design workflow, where FEM-based computing is seamlessly incorporated in specialised engineering calculations.

- WYSIWYG rendering of formulas; customizable numerical and graphical output.
- Ability to generate dynamic 2D drawings based on the outcome of design checks - drawn elements assume values and dimensions obtained after the design and optimisation.
- Intellectual property protection - license codes may be generated to protect a design check or sets of design checks.

The benefits are transparency, insight into the used calculation methods, customizable design routines, simplified sharing and collaboration between specialists.

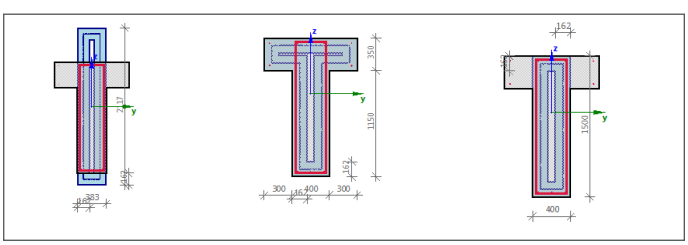
Checks for beams, columns, slabs, walls and nodes

2D Open Checks allow for custom calculations performed on 2D members such as plates and shells. The functionality is analogous to its 1D counterpart with the additional contour plots for fast evaluation of results in and around mesh nodes. 0D Open Checks are intended for verification of e.g., steel connections, foundations, punching in concrete plates. While creating and using a 0D check, the user can access and reference data from adjacent members that connect to the 0D joint.



Usability improvements

Linked checks may now be opened in the Scia Design Forms script editor directly from within Scia Engineer, via a button in the Check Manager. Therefore, it is no longer necessary to open and search for a file path when editing a check. The user may now select to run a check using model data files. This allows the user to review all variables and values that are being transferred between Scia Engineer and Scia Design Forms, i.e. it is no longer necessary to use application switches during debugging. Member data defaults can now be saved from the menu in Scia Engineer.



Other improvements

It is now possible to use all layouts defined in Scia Design Forms as an output in Scia Engineer. This allows the user to report his checks in different levels of detail (suitable for different purposes). For example, one can create a detailed, normal, and summary output in Scia Design Forms, and customise these to his needs; meanwhile, a tabulated, 'brief' output will be created automatically in Scia Engineer containing designated 'result variables'. A better error/warning/note message system improves user experience…

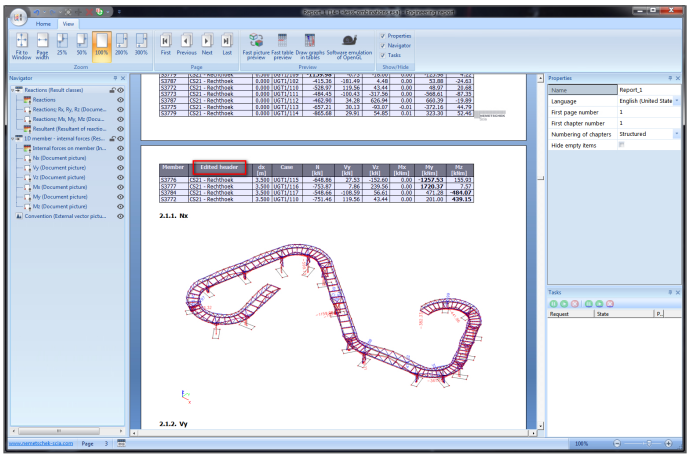
Example scripts and calculations

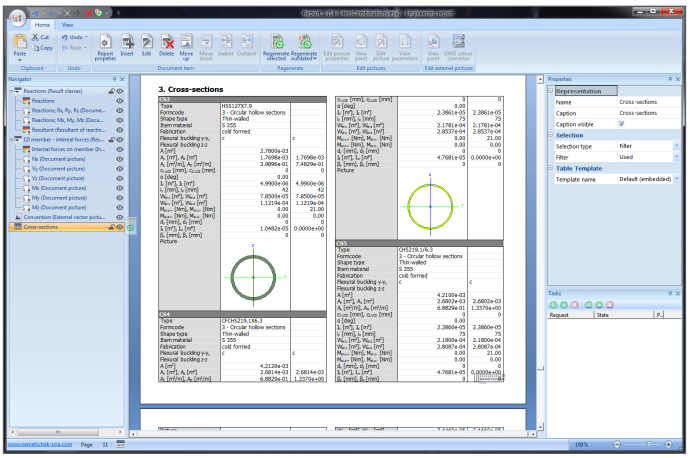
A set of example scripts and calculations have been added into the Open Checks service in Scia Engineer.

Engineering Report

New functionality and improvements in Engineering Report

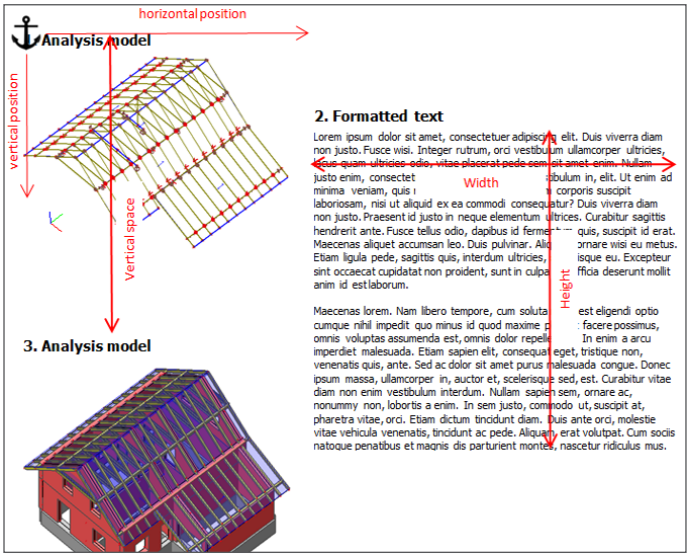
- Relative size of pictures (one at page, two at page or fit to page width). When sending or inserting an image to Engineering Report - be it a 'live' image of the model, or an external image - the user may specify the image size.
- DWG import is extended with colour recognition.
- Inserting of saved reports into other reports.
- Regeneration of reports in batch analysis.
- Quick image settings - when inserting pictures from Scia Engineer to Engineering Report it is possible to read values of the properties from one of four predefined sets defined by the user.
- Improved scrolling. Images in reports are now only rendered if scrolling does not continue. This speeds up the viewing and handling of long reports.
- Splitting of long PDFs. The user may now select to split a report into multiple files when exporting to PDF.
- Fonts for formatted text. The font and size of formatted text can now be changed via the property window of the item in Engineering Report.
- More effective handling of external pictures. In the background, external images are now stored as JPG files, while these were previously stored as BMP files. The change results in memory savings, and in smaller ESA files.
- Hiding empty tables. A checkbox in the report properties determines whether empty tables should be skipped, and thus, not displayed and printed with other report items.
- Removing corrupt and empty items. The data structure of Engineering Report is checked for corrupt and empty items which are, if needed, removed from the report.
- F1 hotkey. The keyboard shortcut opens the up-to-date Scia Engineer help.





New Preview window in Scia Engineer

The new Preview window (now identical to Engineering Report window) offers higher performance in display of results in tabular form, including adaptable header, footers, page format, styles...



Highlights of Engineering Report

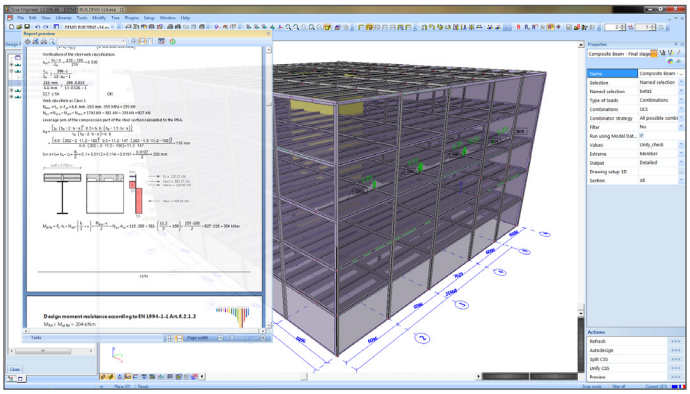
- Easy-to-use application, completely integrated with Scia Engineer.
- Separate processes ensure parallel handling of Scia Engineer and the report itself.
- Possibility to have multiple documents active at the same time.
- On-demand regeneration of report items for up-to-date project data, results, pictures and tables.
- Clear indication of outdated pictures and tables by means of a red exclamation mark.
- Extensive list of report items available; internal Scia Engineer data as well as user-defined items (e.g. external pictures).
- Easy creation of header and footer with user defined content and company logos.
- Option to apply different styles for the layout of tables and other parts of the Engineering Report.
- Integrated text editor for additional content: bold, italic, font selection, bulleting....
- The predictive text mode in the "Insert items" list helps find the right item.
- Clipboard support for fast and easy inserting of copied items into the report.
- Customizable keyboard shortcuts.
- Option to add pictures and tables into the selected report or Inbox.
- Dynamic pictures are updated after changes in the Scia Engineer model. All generated images are dynamic.
- ChapterMaker functionality ensures automatic generation of indented pictures and tables.
- Easy editing of tables: adding or removing columns from the selected table.
- Result tables have the option to show the status of the results values: coloured cells depending on the value of the result.
- Detailed checks can be displayed in Engineering Report.
- Clear legend of all symbols used in each table.
- Import of gallery (overview) drawings into Engineering Report.
- Engineering Report manager gives an overview of all created and available reports and shows a preview for each of them.
- Publishing in several kinds of formats: MS Excel/Word, HTML, 3D pdf...
- Professional, clean and modern look and impression.
- A full document (content + layout) or only a 'snippet' (block of Engineering Report items) may be stored as a template for later use in another project.

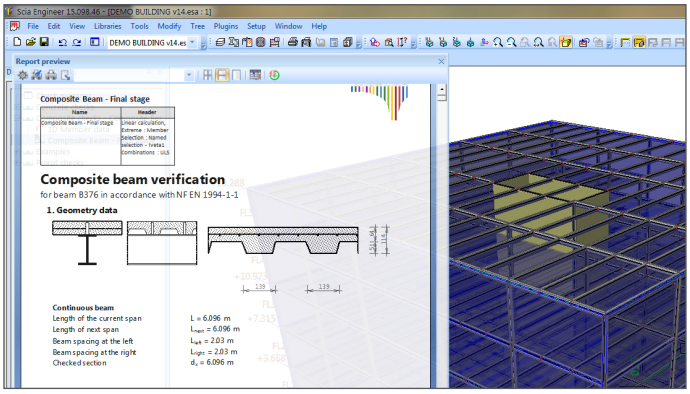
User Improvements

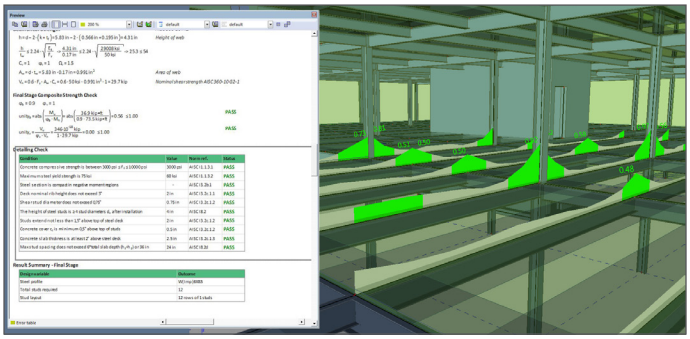
Composite improvements

Design of composite members according to EN 1994

- The multi-model approach of Composite Analysis Model allows for parallel checks for construction and composite stages to be performed without modifications to the model.
- A partial connection between composite slab and steel beams will be taken into account both during the FEM analysis and code checks.
- Creep in concrete slabs is taken into account during the FEM analysis (using a modular ratio for the concrete Young's modulus).
- Calculated resistances are based on a plastic distribution of stresses in the section.
- Section classification takes into account the actual position of the neutral axis in the composite cross-section.
- Support for both longitudinal and transverse alignment of the steel sheeting.
- Additional checks control minimal degree of shear connection, minimum area of longitudinal reinforcement as per EN 1994-1-1 5.5.1(5), etc.
- National annex support.
- Detailing provisions, e.g. on spacing and diameter of shear connectors, are taken into account.
- All unity check values may be plotted along the beams in the 3D window, or listed in tables.
- Brief and summary calculation outputs in table form.
- A detailed calculation output with rendered formulas, intermediate calculation steps, realistic dynamic drawings of the composite system, derivation of plastic moment resistance and location of plastic neutral axis.

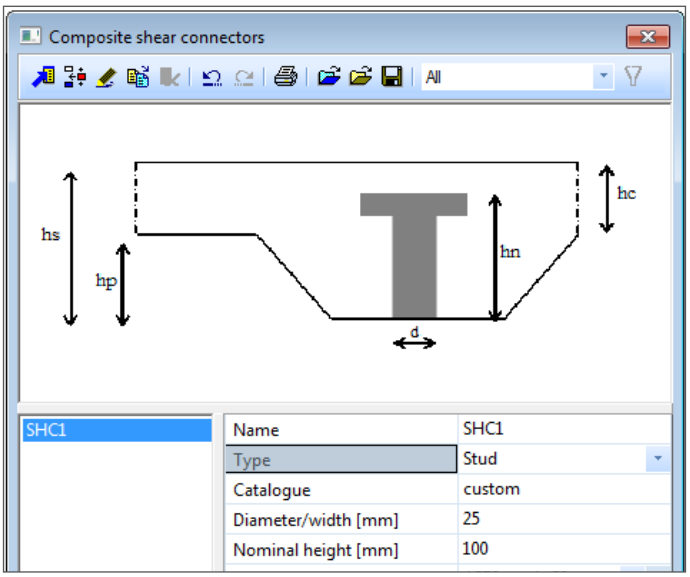


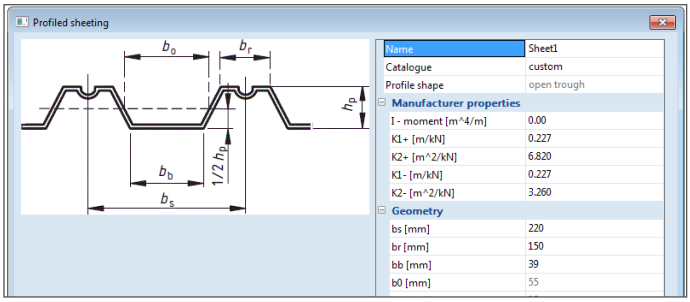




Design of composite members according to AISC 360-10

- The multi-model approach of the Composite Analysis Model allows for parallel checks for construction and composite stages to be performed without modifications to the model.
- A partial connection between composite slab and steel beams will be taken into account both during the FEM analysis and code checks.
- Creep in the concrete slabs is taken into account during the FEM analysis (using a modular ratio for the concrete Young's modulus).
- Calculated resistances are based on a plastic distribution of stresses in the section.
- Support for both longitudinal and transverse alignment of the steel sheeting.
- Detailing provisions, e.g. on spacing and diameter of shear connectors, are taken into account.
- All unity check values may be plotted along the beams in the 3D window, or be listed in tables.
- A brief calculation output in table form.
- A detailed calculation output with rendered formulas and intermediate calculation steps.



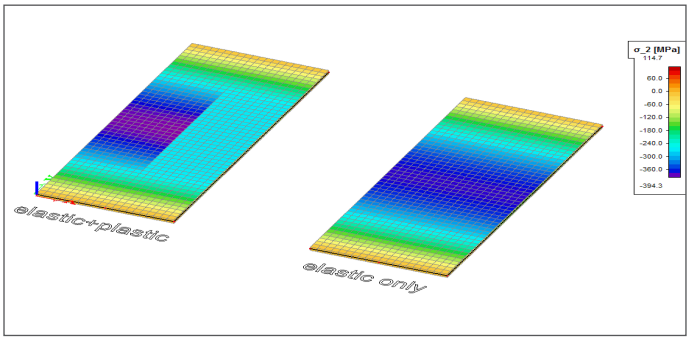


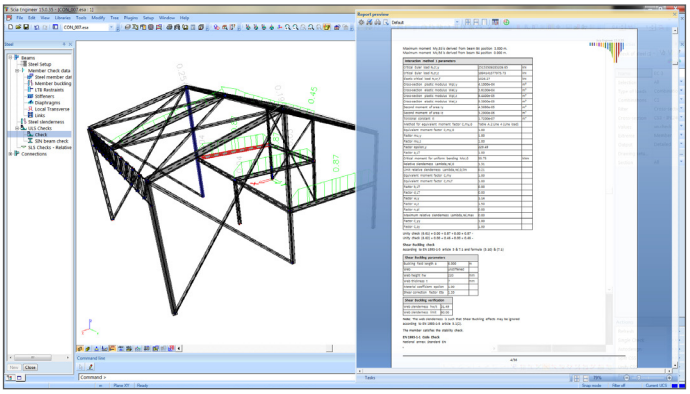
Steel improvements

General plasticity

Scia Engineer 15 comes with a brand new development related to non-linear calculations. This non-linearity lies in the behaviour of material. Scia Engineer 15 implements a new type of material behaviour for 2D members: plasticity. The plastic zone is based on the Von Mieses yield condition (J2 plasticity condition).

This calculation can be useful for users dealing with steel pressure vessels and also other analyses that require to take into account the plastic (non-nlinear) material behaviour.





Design of steel structures

Version 15 of Scia Engineer features new EN 1993 stability checks for heavy gauge and cold-formed steel elements featuring increased speed and more transparency in the calculations.

In addition, version 15 focuses on torsional-flexural buckling, lateral-torsional buckling, shear buckling (with or without stiffeners), and stability under a combination of load effects.

Moreover, calculation reports have been improved significantly. Tabulated overviews have been extended with additional clarifications, intermediate calculation steps, warnings and notes, and clear references to used clauses from the design code (or other technical publications).

The changes pertain to both checks at ambient temperatures and under fire conditions.

Design of steel connections

Extended end-plate with multiple bolt-rows outside of beam

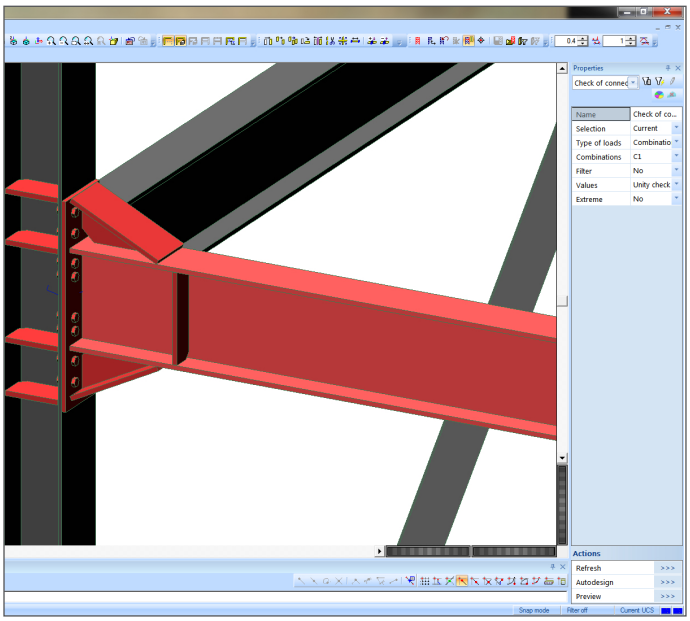
The Eurocode exclusively addresses moment-rigid connections with a single bolt-row outside the tension flange of a connected beam. However, the SCI publication "Moment-resisting joints to Eurocode 3" gives additional rules for the case of multiple bolt-rows outside the beam. The design method is based on the plastic yield-line theory.

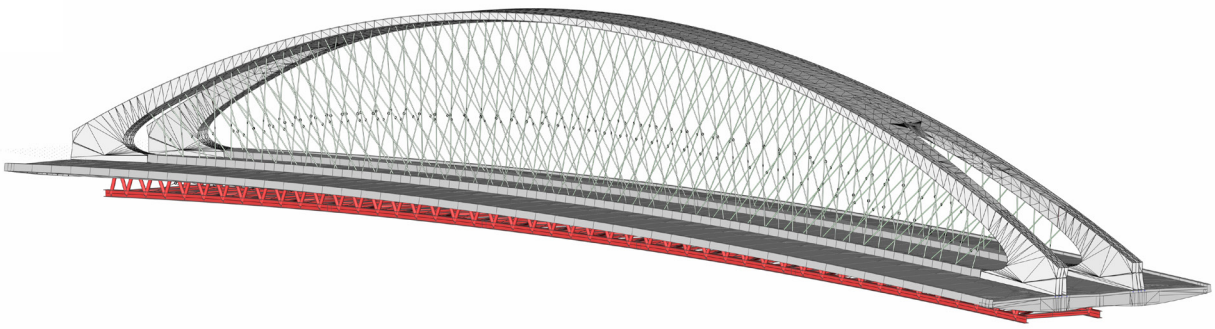
Haunch on top

This version brings the possibility to define a haunch (flanged or from a single plate) at the top of a beam. Henceforth, the user may define a haunch at the top of the steel connection, at the bottom of the connection, or both at the top and bottom of the connection.

Improved base plate design

In previous versions, the interaction check for simultaneous action of bending moment and axial force was performed during the design of base connections. After a careful review of the design code EN 1993-1-8, however, it was established that the effect of normal force on the connection is already taken into account in the calculation of the moment resistance. Therefore, the interaction check was removed from the base-plate design.





Various improvements

3D Stress / Displacement - extension

New extension to 3D Stresses and 3D Displacements functionality in the Results service:

- correct display of results also on 1D members with openings,
- the same feature for 2D members - the values have been increased by membrane stress and stress components typical for 2D members,
- display of 3D results for ribs.

All this together provides a unique possibility to see 1D and 2D results together in one view. Engineers can display global deformed structure and obtain clear view of the behaviour of the structure.

Extension of 2D results for Open Design

The possibility to display results for 2D members calculated via Open Design have been extended. Now it is possible to use averaging strips and show results on edges and along selected sections.

For the latter it is possible to select:

- diagram type (none, precise, trapezoidal),
- diagram position (section or element plane),
- either total or average values,
- units in drawing.

New type of solver for eigenvalue problems

It is now possible to select different eigen value solver for dynamics and stability.

Moreover, a new type of solver for eigenvalue problems have been introduced in version 15. It is called polynomial method and is based on a widely-known theory. This method can lead to shorter calculation time in comparison to the Lancosz method. The polynomial method is recommended for eigen value problems in dynamics.

Design of timber members

- It is now possible to disable the check for compression perpendicular to the grain when executing a timber check.
- The environmental class may now also be defined via the member data settings (i.e., per member).

General Table Input / Results improvements

- Tables can now be exported to Engineering Report directly from the toolbar ribbon.
- Member selection can be filtered via the Table Input menu based on the cross-section name or other properties, e.g. structural type.
- Numbers are now aligned by decimal delimiter.
- All Table Input and Table Results settings can be restored to defaults.

Table Input

- The Table Input structure has been reorganised to avoid tabs overcrowding the screen. The new arrangement includes primary tabs (vertical) - representing the categories Structure/Load/Libraries - and secondary tabs (horizontal).
- New secondary tabs have been added: 'Load cases,' 'Generated Force,' and 'Nonlinear Combinations'.
- Selection of multiple rows can be used to create named selections of members. Selections can be saved.

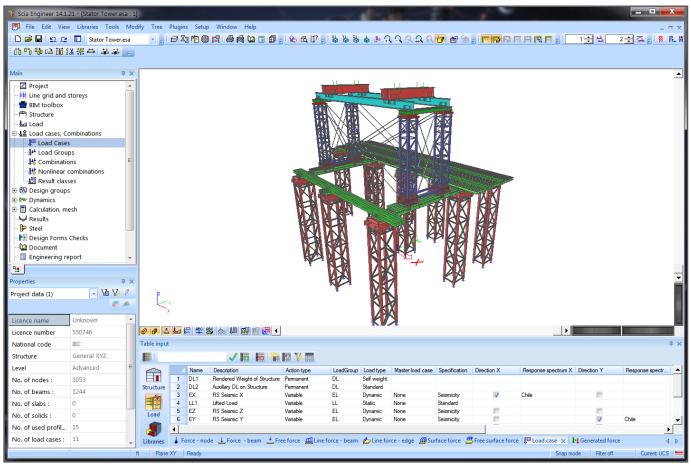
Table Results improvements

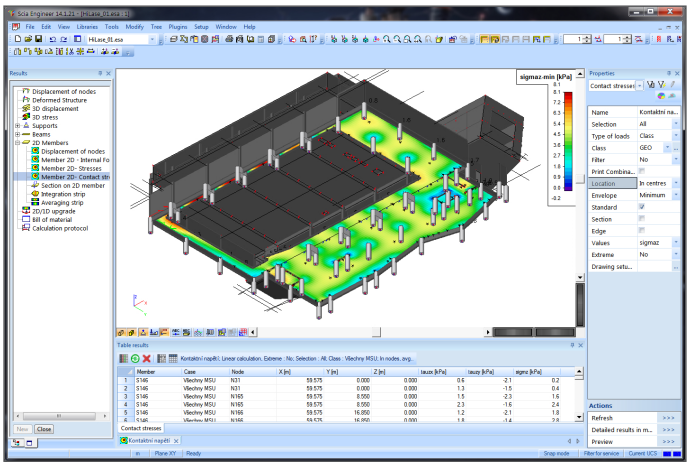
- New layout of the Table Results toolbar. Multiple tabs allow the user to open and consult multiple result tables at the same time.
- Button "Delete all tabs" is added to clear Table Results.
- Selection via properties window - it is now possible to determine the selection of members for which results are to be shown via the properties window of the result item.
- Table Results now displays colour-coded extremities in each column of a table.
- New tabs were added - 1D concrete design for EC2 and NBR 6118, Subsoil C-parameters, Subsoil - other data, 2D members - contact stresses.
- Progress bar is now a part of the Table Results toolbar..

Hot keys

Scia Engineer 15 offers the possibility to use hot-keys for a set of most common commands:

- Ctrl + C to copy selected objects
- Ctrl + X to move selected objects
- Ctrl + Z to undo action
- Ctrl + Y to redo action
- Enter / Space - to repeat the last command





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