

Biomedicum, Karolinska Institute, Stockholm
Architect: C.F. Møller Architects
Construction: Skanska



FEM-Design

StruSoft



FEM-Design | Intuitive structural analysis and design software

What makes FEM-Design unique is easy and quick-to-use user interface, reliable and robust non-linear solver, and well-implemented versatile and designer tools. FEM-Design let us design structures made of reinforced concrete, steel, composite materials, timber, CLT and masonry bricks and mortar. In case of RC concrete, FEM-Design is an excellent program for the design of both in-situ and precast concrete structures thanks to its advanced non-linear cracked-section, creep, shrinkage, and detailed connection-based analysis.

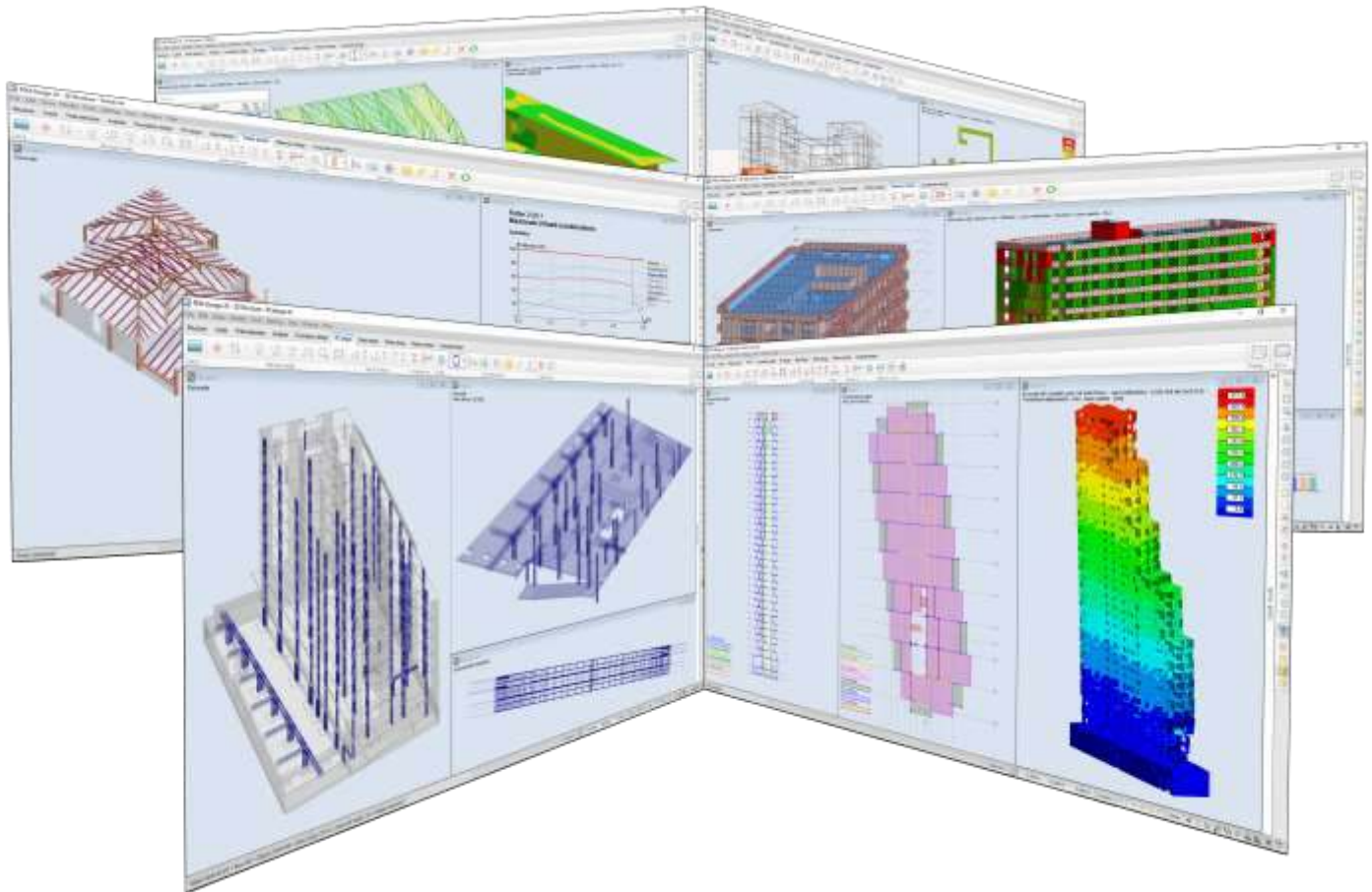
The FEM-Design toolkit allows the complete calculation of both element-level and simple elements as well as complex spatial structures (including stability, seismic, dynamic and time history analysis). With FEM-Design, we can participate in design workflows such as 3D BIM-based (IFC, SAF, Revit and Tekla), 2D CAD-based (DWG and DXF), and automated with custom programming (API, XML, XLS, C#, Grasshopper and Dynamo).

“Even if we can make calculations by hand, we get a better picture with the results from the global analysis. We save so much time with FEM-Design 3D Structure, especially if the design is advanced and complex. But overall, the benefit with the global analysis is to ensure quality. Quality is necessary to succeed, this way, the engineers save time and resources, and the building is designed correctly.”

Topi Valtonen, Sitowise Finland

“The software is user-friendly and it was fully implemented in our office from day one. Our new engineers learned the software quickly, which convinced us not to use 2D design software anymore.”

Ole Steen, ProCon Danmark



3D Structure | Trustworthy and reliable global structural analysis application

Experience a structural analysis and design application perfect for every project's needs. In FEM-Design 3D Structure we can perform structural modelling and design of different structure types like concrete, steel, masonry, timber, CLT and composite structures, which can occur separately or together in a single project.

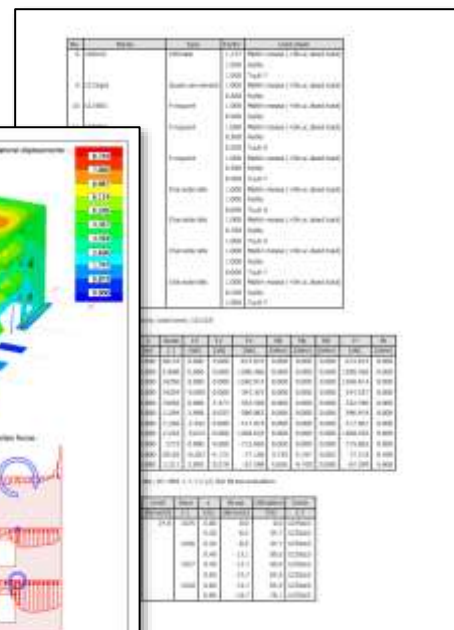
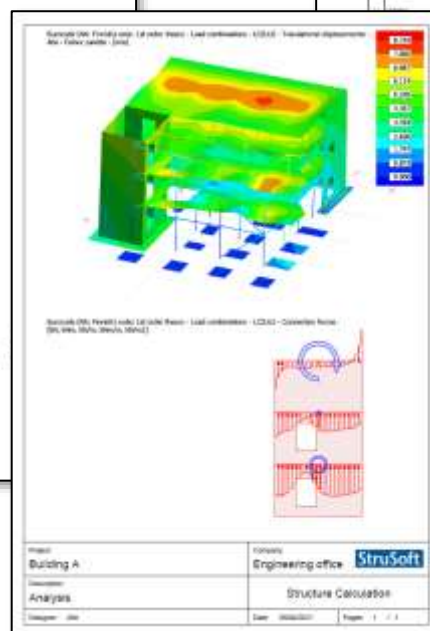
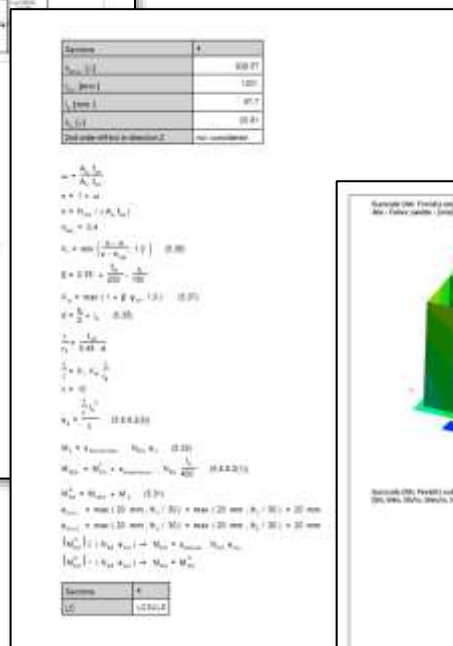
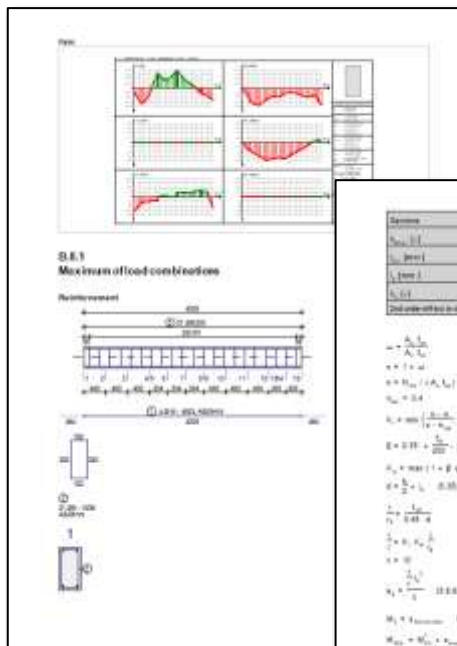
3D Structure allows us to model all essential real non-linearities of a structure - such as code-specific stiffnesses - that is often cumbersome with other software available on the market. With 3D Structure, structure modelling is intuitive, editing is easy, and results come quickly at hand. We can define typical structures with their parameters or import projects started with other modelling or design applications. Smart conversion and editing functions help us in positioning and connecting analysis members quickly and accurately in 3D, and so we can run immediate calculations shortly after import.

- Design of structures made of concrete, steel, timber, CLT, composite and masonry brick materials
- Modelling of hollow-core and prefabricated elements, corbels, eccentric joints and connections
- Nonlinear calculation: cracked concrete, creep and shrinkage, geometric non-linearity, and initial curvature
- Wide range of analysis and load effects: dynamic, seismic, time-history and footfall analysis, construction stages
- Modelling of element joints: plastic model, joint stiffness, and dimensioning for connection forces
- Global or local stability check by considering Eurocode specific reductions and cracking
- Focus only on relevant results by monitoring the critical or individually selected locations
- Non-load-bearing load distribution, automatic wind load, moving loads and lateral loads

"I have worked with FEM-Design since 2001 and it is the main program we use for 3-dimensional structural design."
Martin Rienholdsson, Integra Engineering



3D Structure



Calculation reports are generated quickly and automatically up-to-dated and clean. The report can include tables, figures, diagrams, texts, and other components in user-defined styles stored in templates.

Documentation | Never lose a minute or a detail

FEM-Design Documentation lively link the report to the structure, which is updated upon any modification. All design reports including calculation and checking formulas defined by the applied design code are available. The content and the viewpoint of the model views can be live set and edit in 3D or 2D. They can be extended with dimensions and unique texts.

By automatically locating and monitoring critical parts of your construction, we can always focus on the essentials, so we don't get lost in a sea of numerical values! Automate our documentation using templates, perfectly tailored to company requirements and project type.

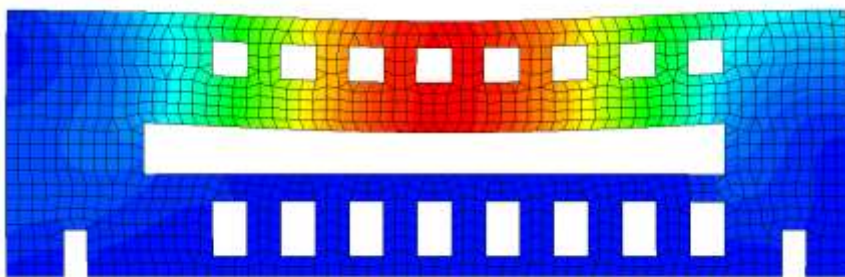
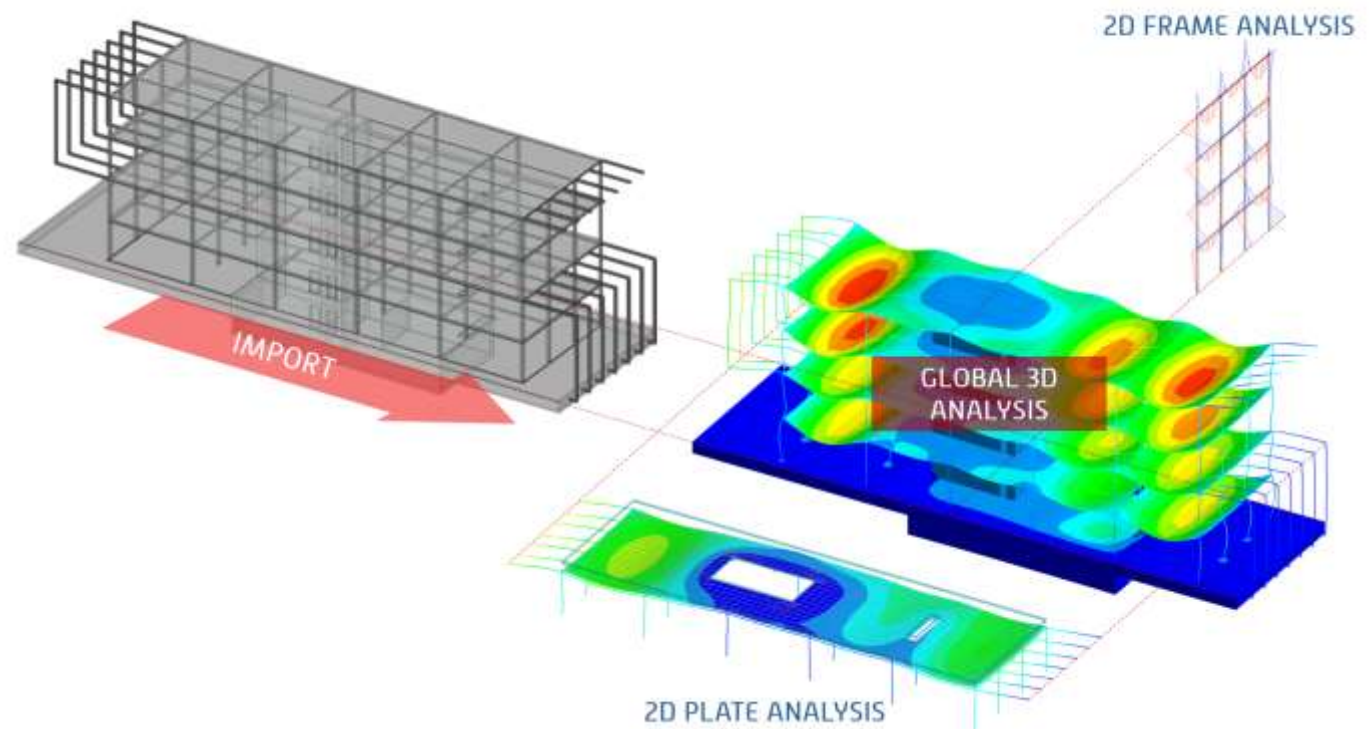
- Quick report of analysis, design and check with always up-to-date content
- Calculation formulas can extend your documentation with details
- Live edit of image content and model views
- Wide range of result display: graphs, colour and contour palettes, numeric results, tables, details of element-level calculations and design items (like reinforcement, etc.)
- Report customization via templates by project and design types and company restrictions (including header, footer, cover page with project information table, logos, colours, table of content, etc.)
- Reports can be printed as PDF, as editable Word document, as Mathcad input or placed to clipboard (Excel)

"We have learned to appreciate how easy it is to check the results in detail assisted by colour maps, 3D graphs, contour lines, colour palettes and so on."

Massimo D'Ignazio, Waterman Group, UK



Plate / Wall / Plane Strain



Grab parts, elements or segments from your global structure and perform quick but detailed calculations on their simplified planar models.

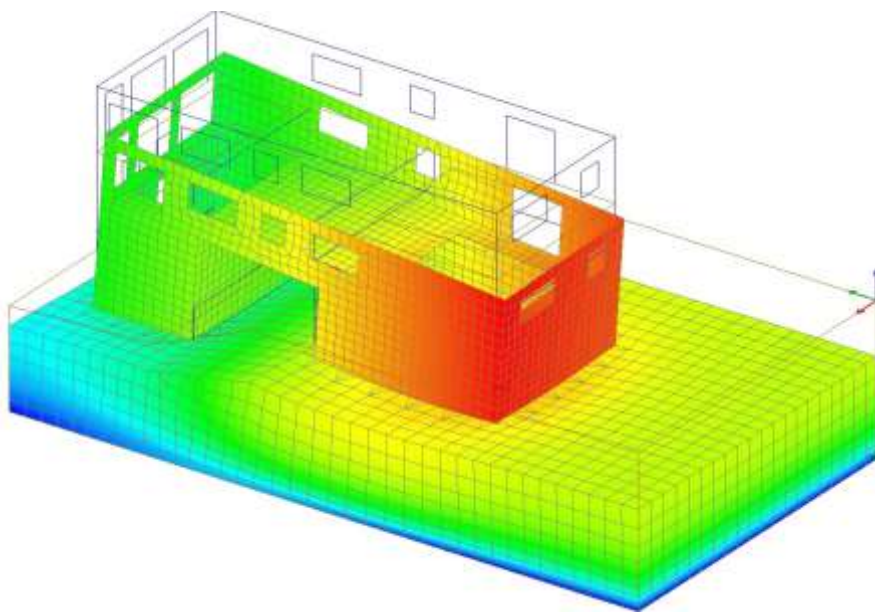
2D Wall calculates shear walls that have displacement and loads in the plane of their region/membrane.

2D Plate | 2D Wall | Plane strain

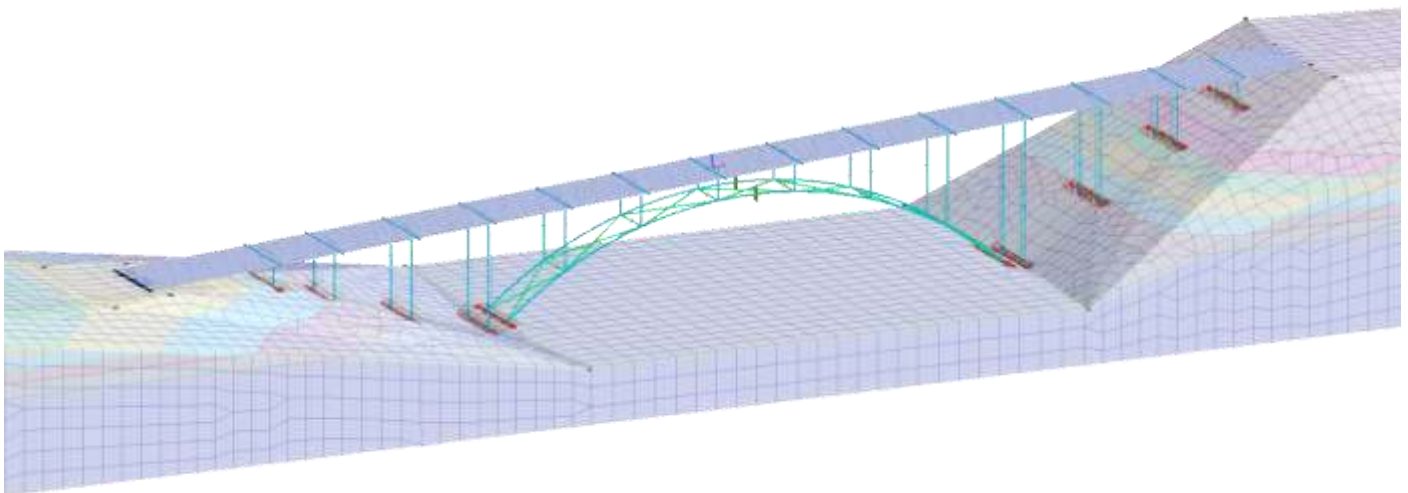
Apply the precise structural design feature set for single construction members

With FEM-Design 2D Plate | 2D Wall | Plane strain we'll never miss a detail, because the most relevant features of 3D Structure are included. Despite their ease of use, all FEM-Design planar solutions provide all the design details we need, including non-linear behaviour, cracked-section structure and eigenfrequencies for single reinforced concrete slabs, slab-system, shear and load-bearing walls, web of deep beams, steel plates, dam, retaining wall, pipe, rail section, etc., so structures having loads perpendicular to or parallel with their regions.

- Calculation of structures modelled as planar regions and with specific load perpendicular to or perpendicular with them
- Import elements from 3D projects
- Planar calculation of Slabs supported by columns, walls and beams
- Non-linear elastic, plastic and cracked section analysis of 2D planar regions model slabs, walls and unit-section of structures having constant long extension
- Automatic design and utilization check of surface and punching reinforcement for RC slabs
- Automatic design and utilization check of surface reinforcement for RC walls
- Automatic design and utilization check of bar reinforcement for beams that support 2D slabs
- Eigenfrequency calculation of planar structural elements



The deformation and settlement profile are more accurate and the internal forces of a superstructure are also more realistic according to interaction between the non-linear 3D soil model and 3D superstructure.



3D Soil | Non-linear interaction of structure and soil as unique solution

FEM-Design 3D Soil allows us to add an impact to the finished construction model or to model building with originally realistic soil model based on their common interaction. Soil works non-linearly as does the calculation model. The bearing capacity data is entered into the soil, so the bearing capacity of the soil must be ensured with the same model. The effect of depressions and displacements can be considered even in a cracked concrete structure.

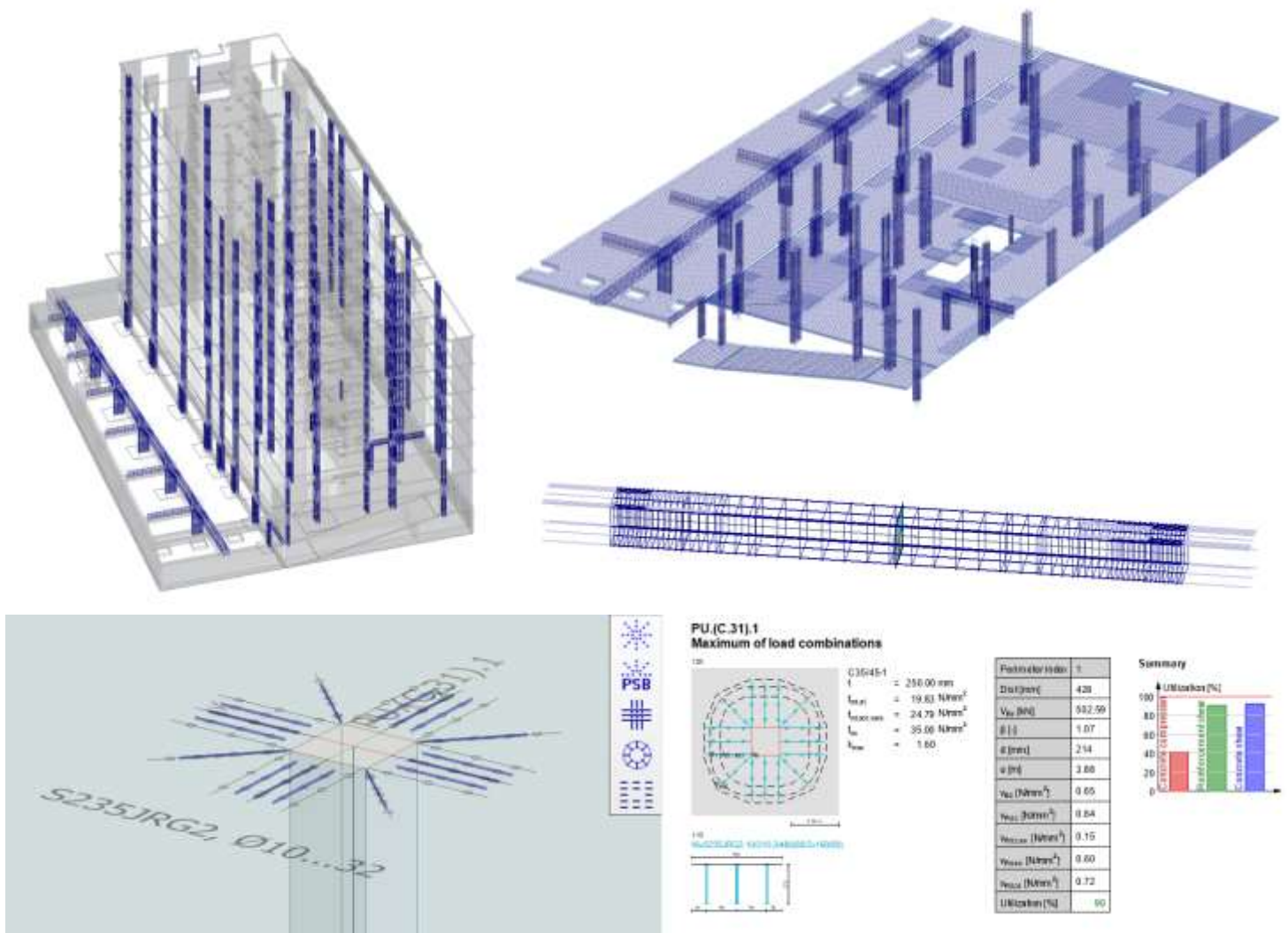
- Soil modelled as nonlinear 3D volume model (Mohr-Coulomb)
- Multiple layers of various soil types can be fed into the soil to fulfil the needs of our structural design project
- Groundwater effect
- Demanding basement structures, embankments, interaction of adjacent foundations, bearing capacity of the ground
- Statistically indeterminate structures and demanding foundation conditions
- Strong soil slope and layer thickness variations
- Insulation added to base plate model is considered in calculations with its load bearing capacity

"The geotechnical module in FEM-Design is a very big help. In an easy way, we are able to produce displacements, not only underneath the building, but also from nearby buildings."

Tanel Kullamägi, PPC Projekt



Reinforced Concrete Design



RC Design | A look into concrete elements through reinforcement and modelling techniques

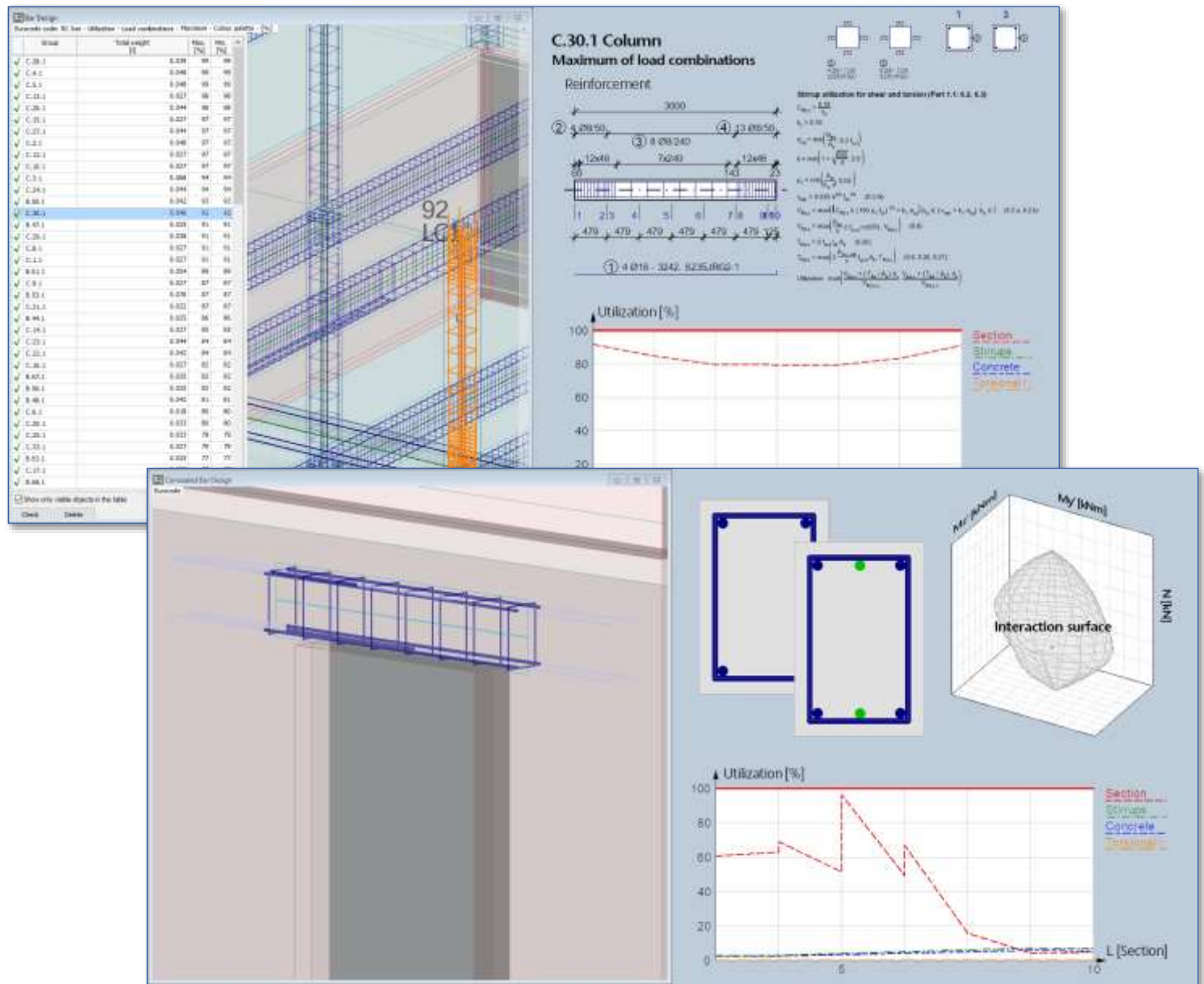
FEM-Design Reinforced Concrete Design allows tracking of the realistic behaviour (like cracks) of structural concrete components. Reinforcement can be designed by automatic optimization or manually for specific needs and circumstances, for all types of concrete elements (shells and bars) or for a wide range of sections. Transparent documentation of design and check results is available for both 3D and 2D design modules and applications. Professional products like Peikko's high-capacity punching prevention system (PSB plus) can be used for bearing punching loads in design and check.

- Detailed manual or automatic design and check of concrete model members in 3D or 2D according to Eurocode 2
- Minimum and required surface, punching and bar reinforcement
- Re-distribution of bending moments and peak value handling
- Reinforcement can be designed according to deflection and crack-width criteria as well as ultimate limit state design
- Auto-optimization of details based on fix restrictions like bar diameter or spacing
- Analysis and design of precast concrete construction elements by considering non-linear behaviour of connections and supports (compression, tension and detach)

"Reinforcement for shear walls has been a challenge, but FEM-Design is handling that really well... We often work with shell structures, and this is the strong point of FEM-Design. The goal is to automate the design process in one place"
 Jacob Andersen, NIRAS DK



Reinforced Concrete Design



RC Design | Versatile dimensioning of pillars and beams

RC Design of columns and beams either with an easy-to-use reinforcement editor or automatically, considering anchoring and second-order effects and other essential inspections in accordance with Eurocode 2. Internal forces of compressed elements can be calculated either by code specific curvature or stiffness method or second-order effects of nonlinear 3D model. Buckling coefficients of pillars can be set manually or calculated automatically.

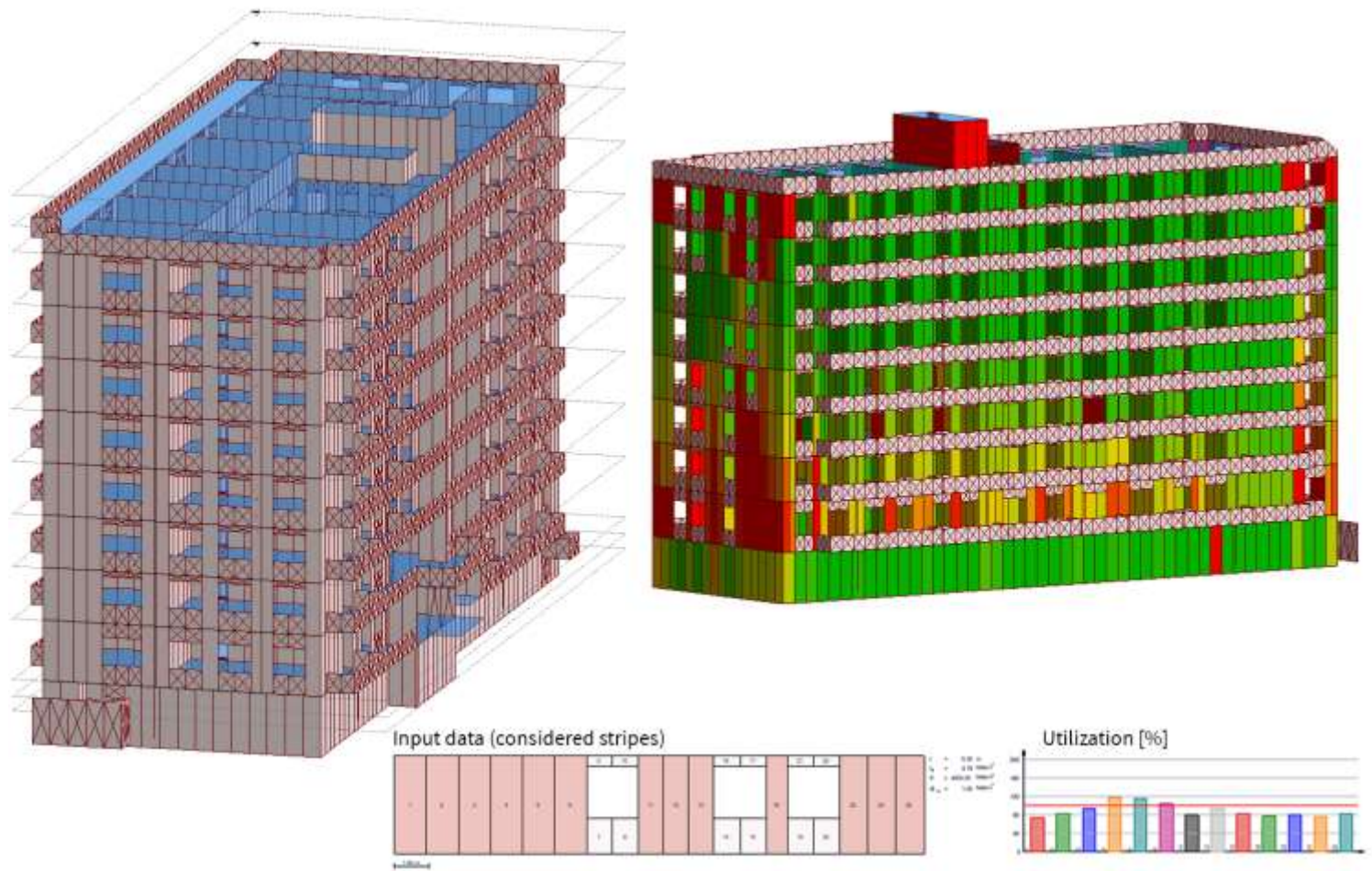
- Concrete bar design for crack and fire effect
- Various selection of typical concrete cross section
- Reinforcement editor
- Second order effects on dimensioning with a nonlinear 3D model or nominal stiffness or nominal curvature
- Concealed bar - strips or column-like objects inside walls - can be designed and checked as beam or column
- Considering eccentricities in different ways for dimensioning
- Designed reinforcement can be applied for calculating cracks, creep and shrinkage effect
- Utilization of section, stirrups, longitudinal, torsional reinforcement, and shear capacity

"It saves a lot of time, manual input errors are eliminated, and this helps ensure the required prefabricated concrete elements are of high quality."

Marco Binfaré, Sweco



Masonry Design



Masonry Design | Brick and mortar are ready for detailed checks

FEM-Design Masonry Design is a professional design tool dedicated to load-bearing masonry structures (both lightweight concrete and brick walls) according to Eurocode 6. Mortar effect can be considered in calculations. The first-order stresses of the structure – both bending and compression – are automatically applied in second-order effects. Non-load-bearing parts – regions above and below openings – are automatically detected. The peak values of finite element model are removed, and the average bending and compression of walls are considered in design. The strips – elementary part of calculation method – are created automatically, but optionally can be edited manually. The detail of wall connections with each other and slabs can be considered in load-bearing capacity.

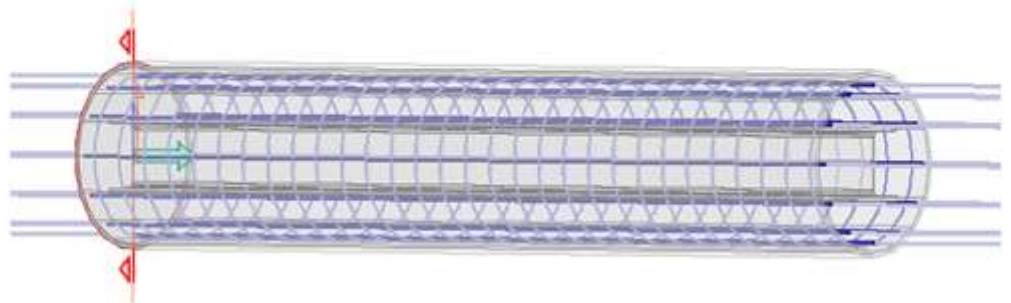
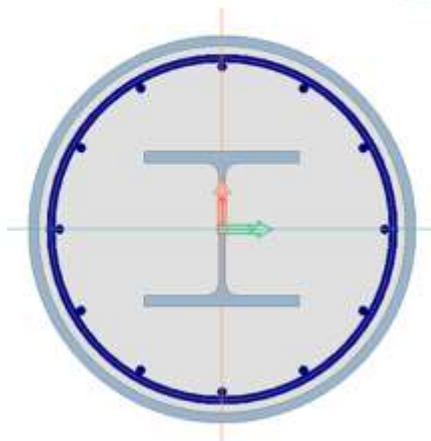
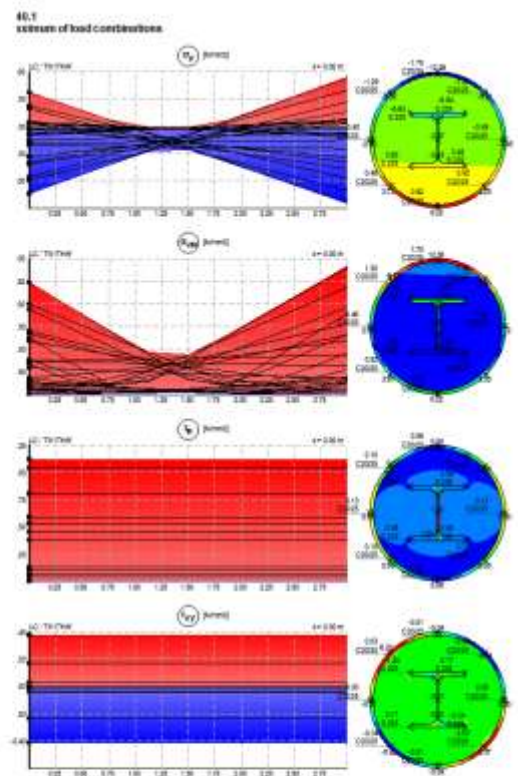
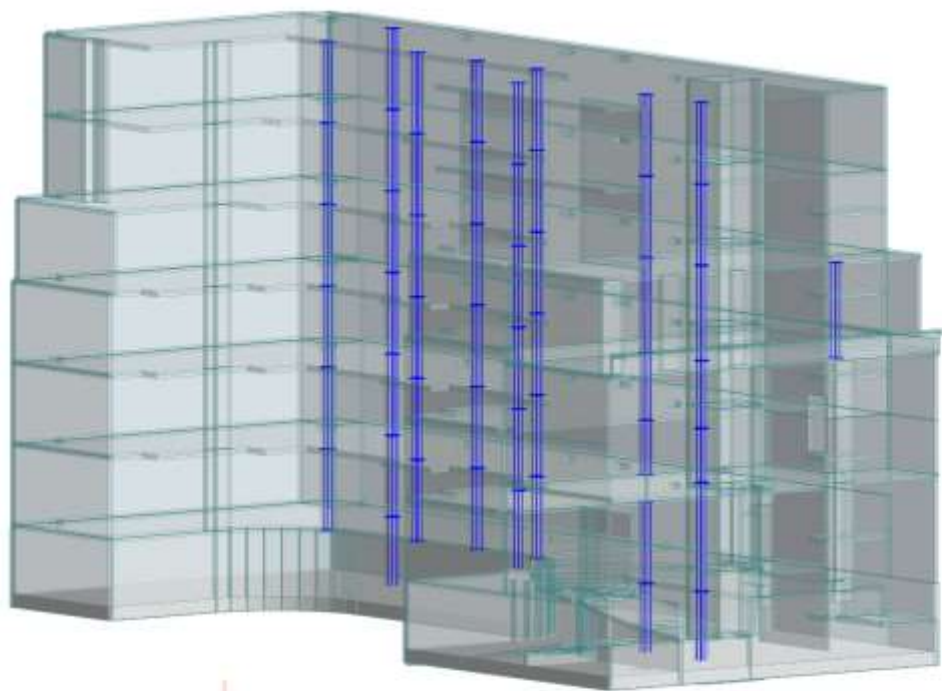
- Dimensioning of masonry wall systems according to Eurocode 6
- Custom settings for the connection between walls and slabs including eccentricity
- Automatic division of walls into stripes that are used to determine internal forces and utilization
- Automatic removal of non-load-bearing parts in calculations
- Possibility of entering the strength of any masonry unit, mortar and brick
- Buckling coefficient and second-order effects added to static first order effects

"I chose FEM-Design, because I was looking for powerful finite element software with design capabilities according to Eurocode standards. The support I got was amazing. I got a meeting with two specialists on-line. Within one hour they had shown me mistakes that I have been making with my modelling."

Teknik Consulting Engineers, Iceland



Composite Design



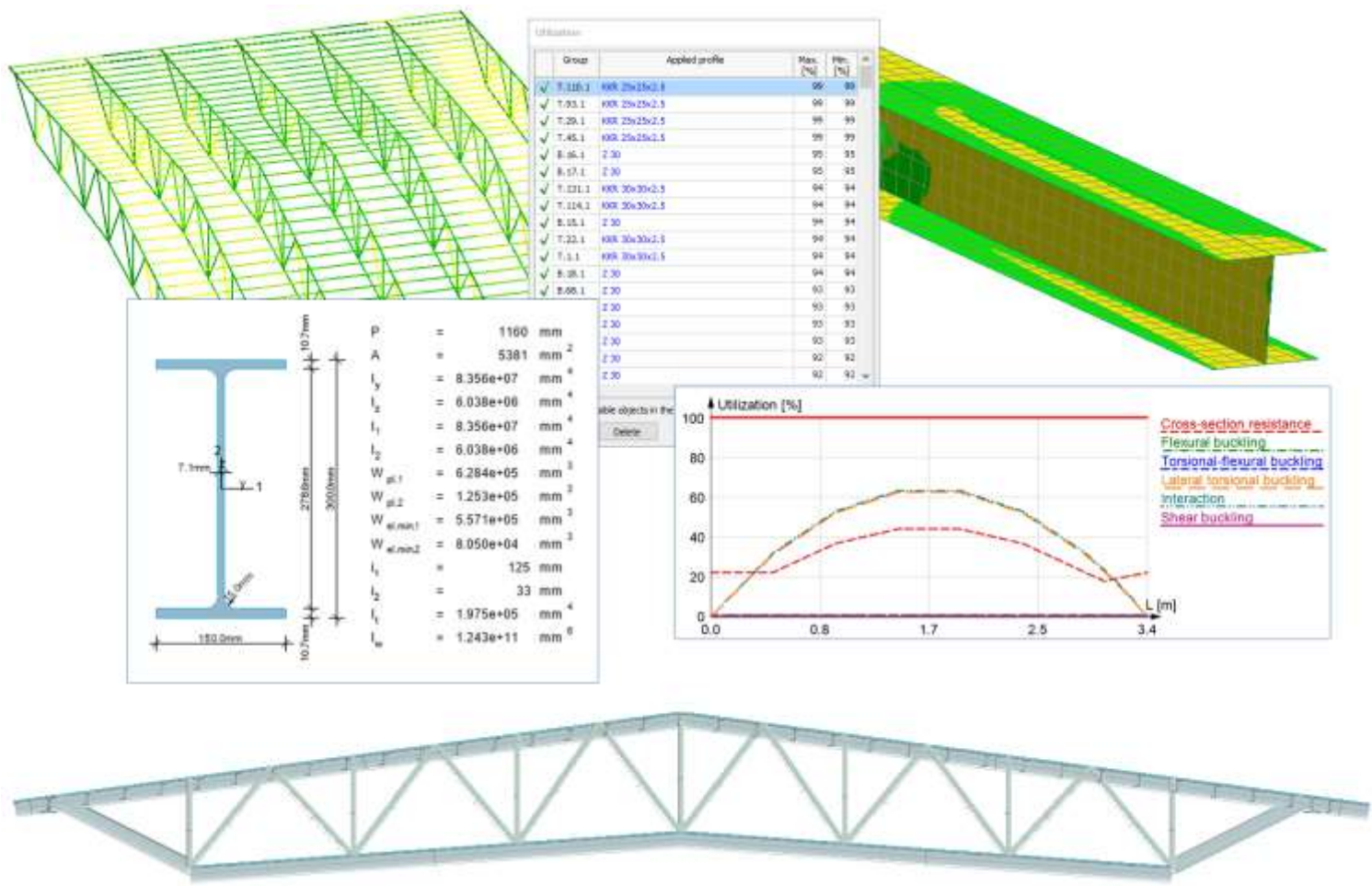
Composite Design | Trustworthy joint checks of multi-material structural components

FEM-Design Composite Design enables the detailed design according to Eurocode 4, check and documentation of composite columns, beams and delta beams having different cross-sectional types and shapes. Using Composite Design, we also gain access to FEM-Design's versatile reinforcement editor, which can be used for assigning unique reinforcement to concrete part of columns and beams. The calculations can be performed for fracture limit state, second-order analysis and service limit state, cracking and for shear strength.

- Dimensioning of multi-material composite bar members according to Eurocode 4
- Circular or rectangular hollow sections, concrete-enclosed I-beams, and large selection of other composite profiles
- Reinforcement editing inside composite member
- Buckling dimensioning
- Stress distribution within composite cross-section
- Total, bi-axial cross-sectional and shear capacity
- Cracked-section analysis

"To have an advanced but never-the-less simple and easy to use program for 3D modelling is very important when it comes to major tall buildings."

Anders Klittmar, Integra Engineering



Steel Design | Versatile section design of steel components in simple or complex structures

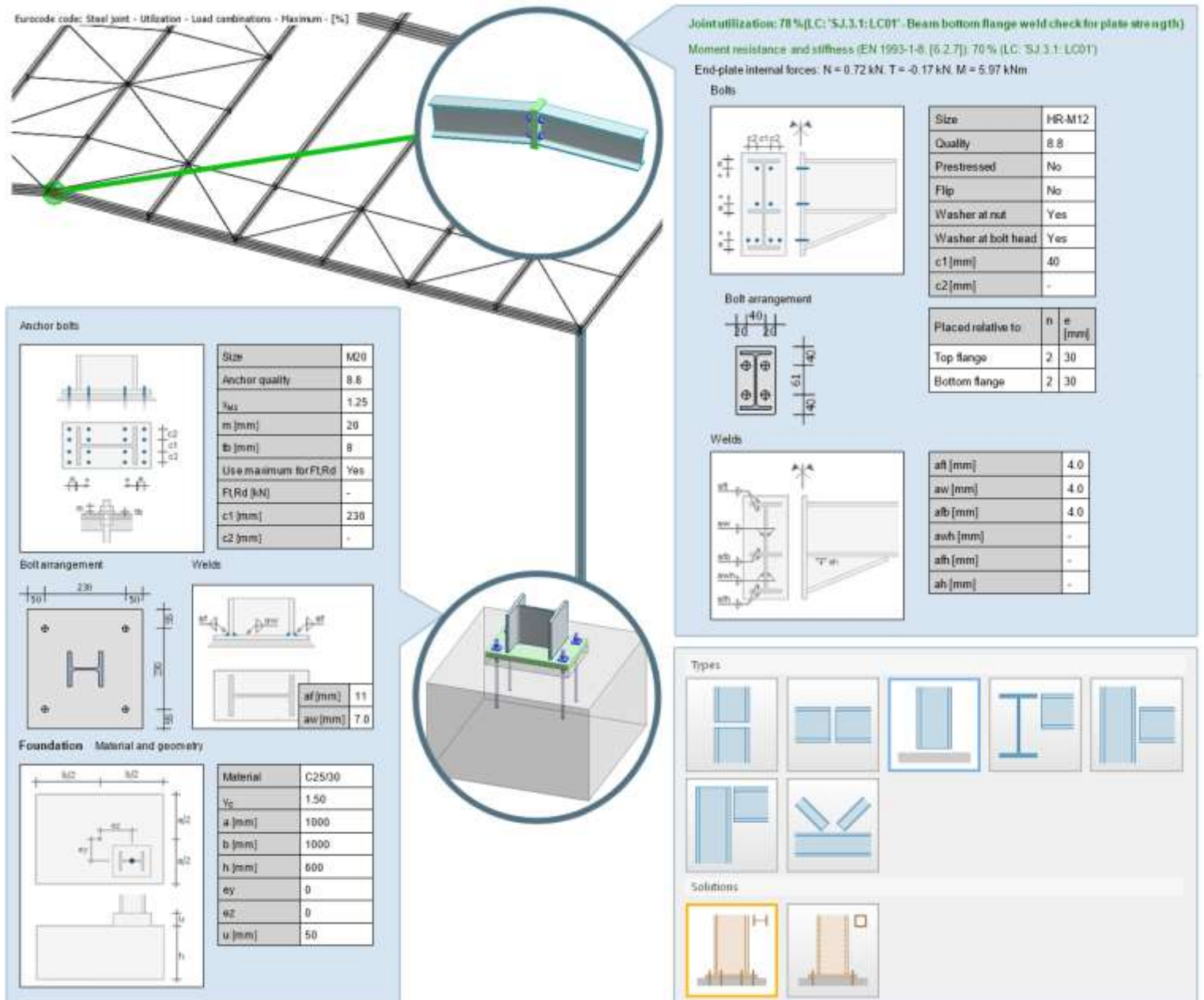
FEM-Design Steel Design allows design and check of steel bars – columns, beams, truss members – of any 3D or 2D structural model. Experimenting fast auto-design finds the most suitable cross-sections. All section shapes and classes – including class 4 profiles – can be checked for all relevant effects (for example all types of buckling and stability) and for utilization. Perform manual or auto-design calculations to find the most suitable steel bar cross-sections. Run a check to verify or design steel structures for fire effect. Thickness optimization can be done for bars modelled with 3D shell components.

- Manual and auto design to find the most suitable steel bar profiles according to Eurocode 3
- Utilization check of all section shapes and classes including class 4 profiles
- Stability checks, shear buckling and inspection of web stiffeners
- Automatic calculation of buckling coefficient that used to define structural stiffnesses
- Auto-conversion of steel bars to 3D shell model to find proper component thickness and consider web openings
- Check for fire effect and design of fire protection
- Ability to calculate and design structure nonlinearly with initial curvatures
- Applied detailed steel joints can be considered in global 3D model analysis and design

“Because of the speed, we now use FEM-Design for calculations and design of simple beam-, steel frame- and roof constructions. We are using the documentation templates, which makes it fast and easy to print the calculation report.”
Ole Steen, ProCon DK



Steel Joint Design



Steel Joint Design | Model and check real connection behaviour

FEM-Design Steel Joints gives us the possibility to model and set real connection conditions between steel bars or between columns and foundation. Verified connection types – together with plates, bolts, welds, eccentricity settings – can be used in the global or detailed design and check of steel components in 3D complex projects.

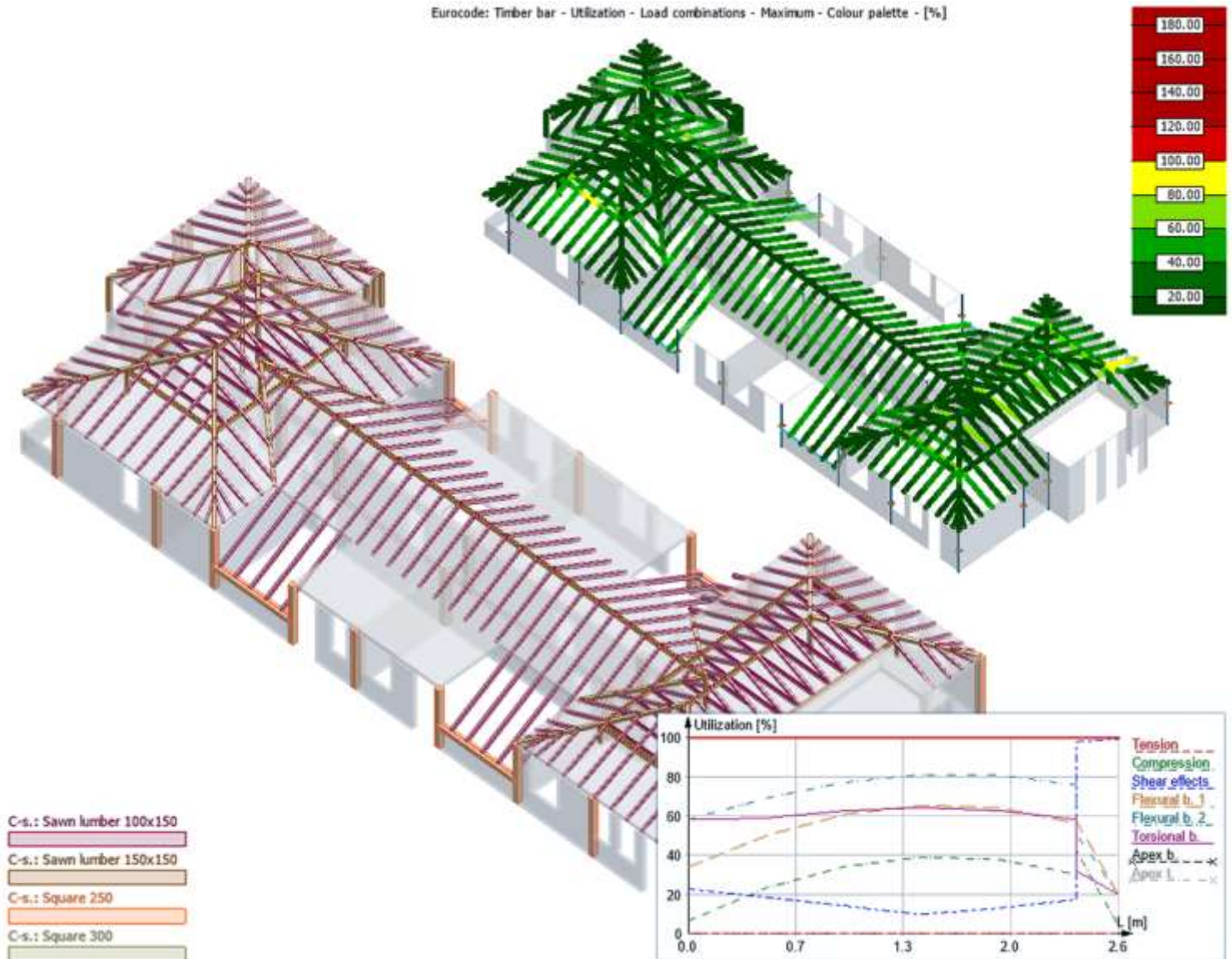
- Design of bolted and welded steel joints according to EN 1993-1-8
- Calculation methods provided by the Swedish Institute of Steel Construction
- Wide range of joint types: column splice, beam splice, column base, beam-beam, column-beam, knee, bracing
- Capacity calculations are performed to joints such as the failure modes of bolts and anchors with the base plate, as well as the welds and trough thickness properties of plates
- Joints of wall braces, tubular beams and hot rolled profiles
- Stiffness classification can be performed according to EN 1993-1-8, or stiffnesses can be updated back to the entire 3D project to provide a more realistic calculation model

"We've been working together with the companies responsible for the prefabricated parts, like steelwork and hollow core slabs, and shared certain FEM-Design 3D models with them. One example is the roof structure for the prefabricated steel."
Olof Hallström, NCC



Timber Design

Eurocode: Timber bar - Utilization - Load combinations - Maximum - Colour palette - [%]



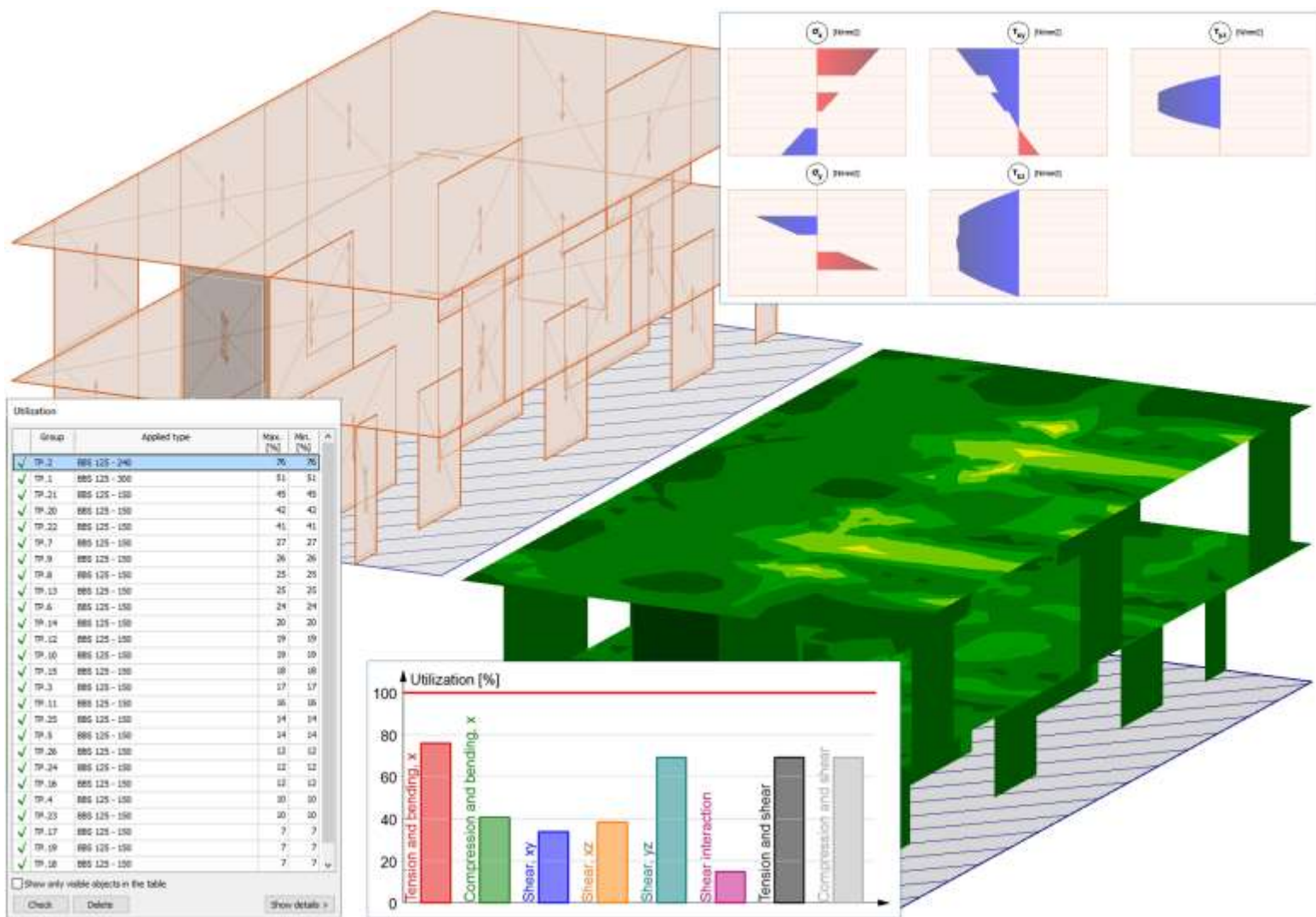
Timber Design | Optimize wood sections of bars and panels

FEM-Design Timber Design finds the most suitable timber bar cross-sections and panel types – made of cross-laminated, fibre, oriented strand (OSB) and/or particle boards – through fast auto-design and utilization checks according to Eurocode 5. An easy-to-use user interface helps us to examine our bar and panel systems in 3D space considering the realistic behaviour of wood materials such as buckling and fire effect.

- Timber dimensioning according to Eurocode 5
- It is easy to check the transitions and bends, as the time classes and reduction factors for stiffness have already been considered in 3D models
- Automatic calculation of the buckling coefficient considering structural stiffnesses
- Lateral torsional buckling and other essential stability checks
- Ability to calculate model nonlinearly with initial curvature
- Automatic profile optimization, and design for fire effect
- Beams with variable cross section, and apex check

“FEM-Design has given us the opportunity to analyse and design all the timber and steel elements in one single model, as well as understanding global structural movements, short and long term, and vibration performances.”

Eloi Duran, Eckersley O’Callaghan



CLT Design | Precise design of innovative timber panels

FEM-Design places a strong focus on analysing the behaviour of 3D structures made of the latest wood technology in the construction market. Gradually gaining attention, Cross Laminated Timber (CLT) stands out for its strength, appearance, versatility, and sustainability. The CLT module enables stress analysis and dimensioning of CLT elements according to the Eurocode 5. CLT elements are easy to model using ready-made CLT types or custom CLT elements set layer by layer. In CLT definition, the transverse tensile strength of the layers – gluing from the long side of the timber – can also be considered, if desired. In structure modelling of the element structure, we can use joint stiffnesses, model shell panels as one continuous region or made up of panel members.

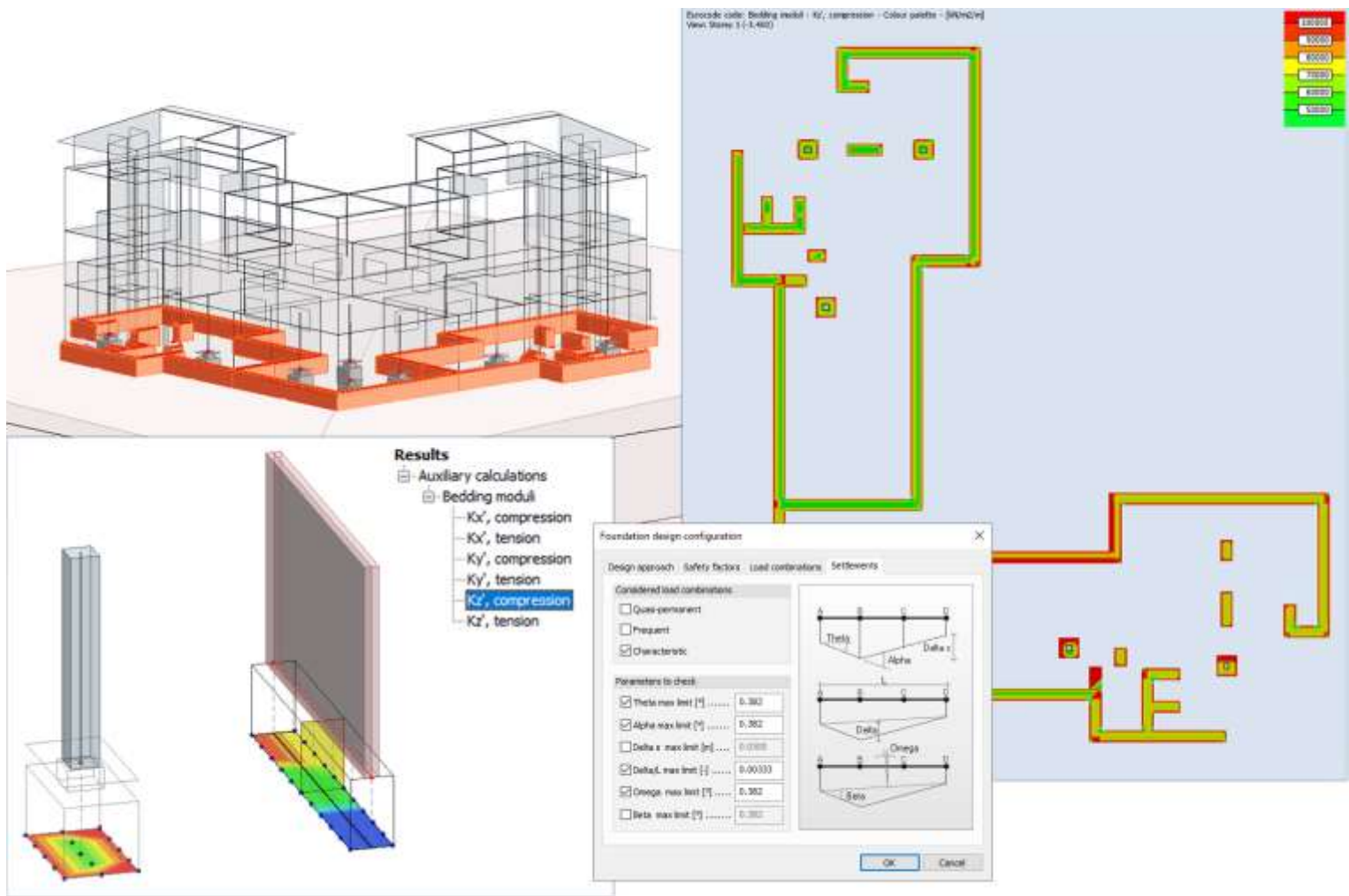
- CLT panel dimensioning according to EN 1995-1-1
- Calculation of joint forces between CLT elements
- Easy modelling and configuration of custom CLT panels
- Complete library of typical CLT panels
- Stress analysis and report of CLT panels by layers
- Interaction of bending / shear / torsion
- Input of buckling lengths to compressed walls and buckling dimensioning

“The ability to model and check two way-spanning CLT panels, with any build-up, is very powerful. That means we are not limited to simple one-way spanning panels checked as beams. The software also allows us to check such designs as, for instance, panels with penetrations, notches, and covered geometries, which offers a lot of flexibility”

Eloi Durand, Eckersley O’Callaghan



Foundation Design



Foundation Design | A tool for modelling varying stiffness in different foundations

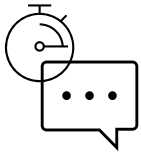
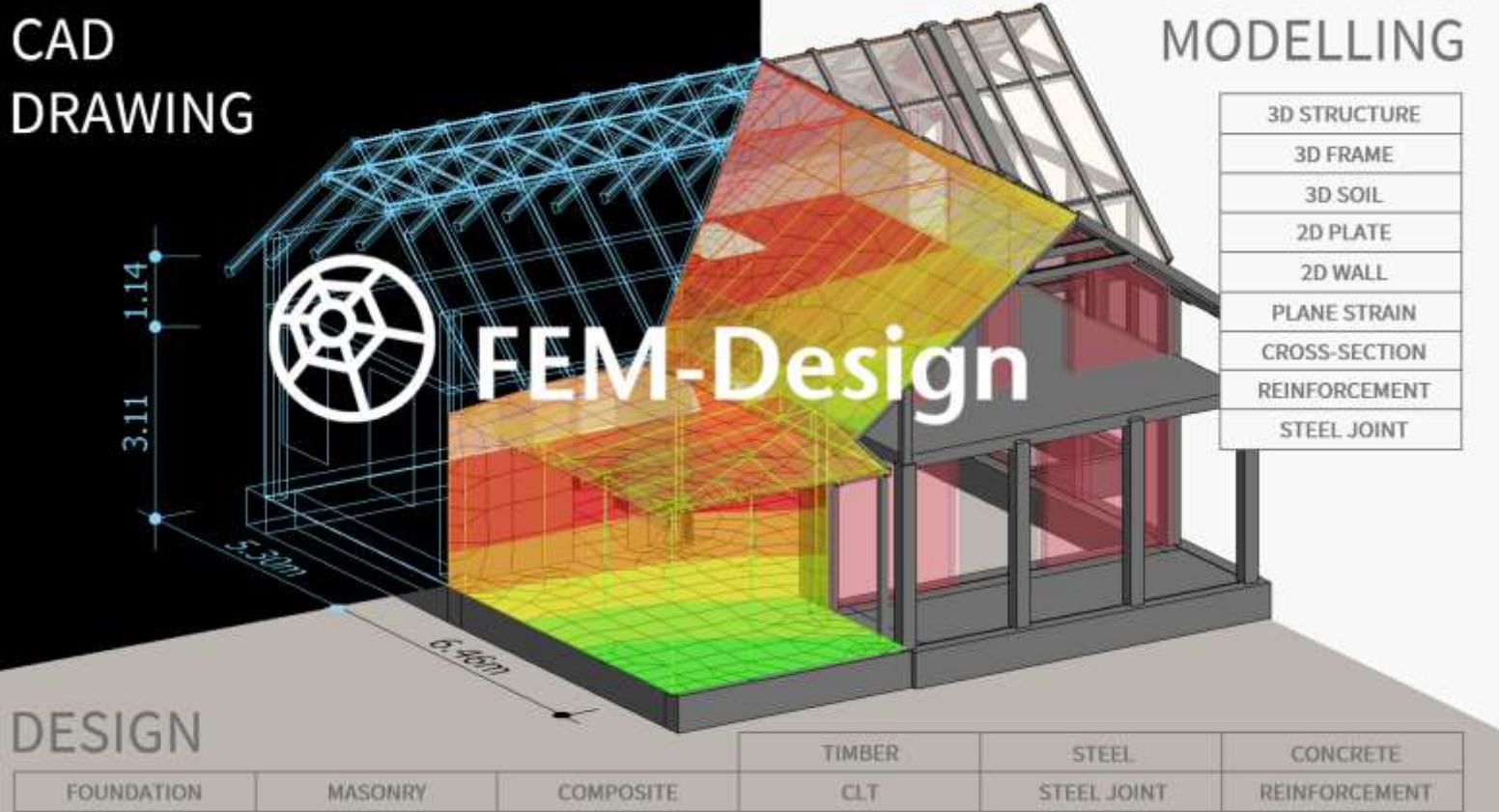
The study and modification of soil and rocks are top priorities when we are running complex structure designs and want to assure overtime sustainability, stability and safety and to make sure that even the most detailed analysis is being taken care of to prevent eventual negative construction outcomes.

FEM-Design Foundation Design performs geotechnical checks of foundations such as column and strip foundation, foundation slab and pile. It makes possible to calculate bedding modulus based on the interaction with soil modelled in 3D with different layers and ground water. Insulation under foundations can be considered too. Model data are used in calculation of ground load bearing capacity, the slip resistance and in check of foundation eccentricity and settlements.

- Soil strength and layers can be fed into the overall 3D model
- The rigidity of the foundations is updated in calculation model
- Possibility to supply groundwater level as well as open or closed conditions
- Possibility to supply base insulation with strength and stiffness settings
- Eccentricity check
- Load capacity check
- Slip safety
- Deflection inspection
- Insulation check
- Automatic calculation of the variable chassis number using the interaction of soil and adjacent points
- Input and automatic stiffness calculation of piles

CAD
DRAWING

MODELLING



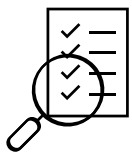
Fast and reliable customer support

Do you need help to get started, encounter technical problems or you just need a piece of advice? Get in touch with our efficient customer service team with structural engineer members only. We continuously strive to provide the best assistance, in the shortest time.



Personalized training

Are you switching from another software to FEM-Design? Or are you just initiating yourself in structural design field? We'll be your background support. Schedule on demand trainings with our customer success management team and get FEM-Design expert title in no time.



Free trial upon request

Investing in structural analysis software is not a child's play and we know how disappointed one can be when the software just purchased doesn't add up to expectations. Start a free trial to convince yourself that FEM-Design is the optimal and right choice for your structural engineering needs.

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