TIMBERTECH
SOLUTIONS FOR TIMBER ENGINEERING

From research to practice

TimberTech

TimberTech is a company born from the union of resources, know-how and experience of the Timber Research group of **University of Trento** (Italy). Under the leadership of the founders **Prof. Maurizio Piazza, Prof. Roberto Tomasi and Dr Mauro Andreolli**, TimberTech offers to its customers calculation software, structural consulting, research and development services in the field of timber construction.

Software

TimberTech develops structural design softwares used by civil engineers, architects and construction companies. The company develops also specific software solutions customized for companies and manufacturers.

Consulting and research

Our team is **highly specialized in timber structures** and offers efficient consulting services to companies and structural designers. The staff focuses also on **research activities** that are performed closely with university researchers and cover wood technology, technological development of wood and wood-based products, development of innovative mechanical models to be used in structural design of timber structures. Other research topics are: evaluation of the mechanical performances (strength, stiffness and ductility) of different types of connections, as well as the connections influence on the global behaviour of timber structures; static and seismic behaviour of traditional and innovative joints for new or existing timber structures, with a special accent on glued-in steel connections and timber housing.

Teaching and courses

TimberTech offers comprehensive training courses, which are aimed at educating designers and technical personnel about timber structures. The company organizes courses in collaboration with the Associations of Engineers and Architects.

Our Business Partners and Customers

American Hardwood Export Council, Binderholz, CNR-IVALSA, Würth, FederlegnoArredo, Heco, Rotho Blaas, Rubner Holzbau, proholz, University of Trento and many more.

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TIMBERTECH BUILDINGS

Engineering software for the structural analysis and design of timber structures

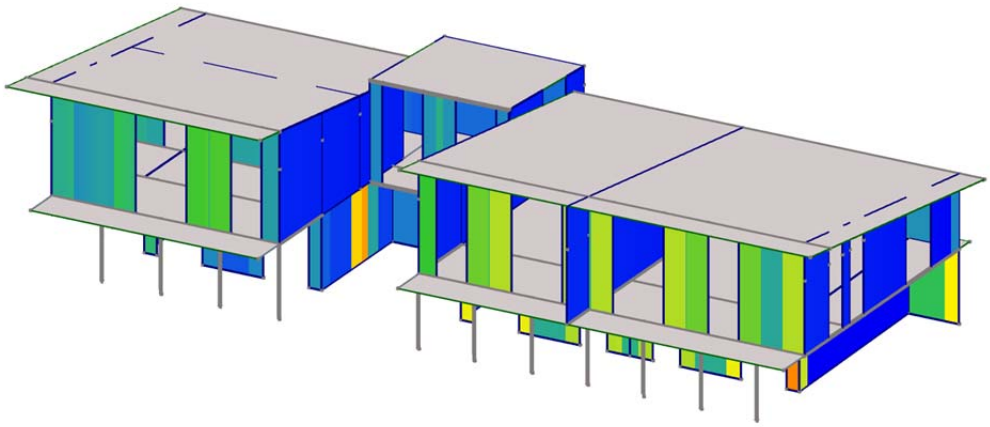
TimberTech Buildings

Timber Tech Buildings is a **structural design software** for analysis of timber shear walls structures realized using both CLT (Cross Laminated Timber) and platform frame systems. The software is constantly evolving and new features are added monthly so as to fully satisfy the needs of customers.

Pro

Nowadays the Finite Element modelling of timber buildings could be complicated due to the bad compliance between the behaviour of the model that schematizes the walls by means of shell elements and that of the real structure. In particular the correct evaluation of **wall lateral stiffness** is difficult to achieve since it depends on different contributions (shear deformations of the panels, deformations of the connections among the panels, rigid body rocking due to hold-down deformation…) which are difficult to calculate and define in the model.

TimberTech Buildings relieves the User from the burden of calculating and assembling the different stiffness and resistance terms related to the various components. The numerical models implemented in the software are the result of the experience and the research performed in the field of timber structures at University of Trento. Such models allow to properly analyse even the aspects **for which specific indications are lacking in the existing rules**.



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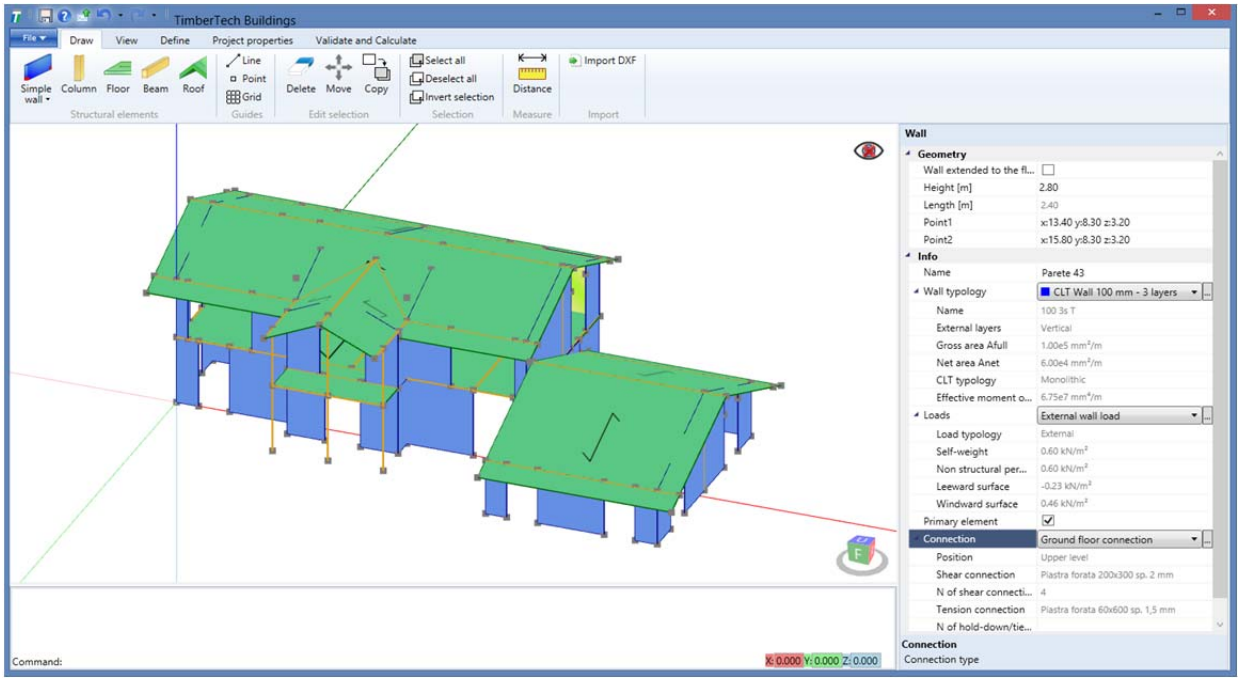
Features

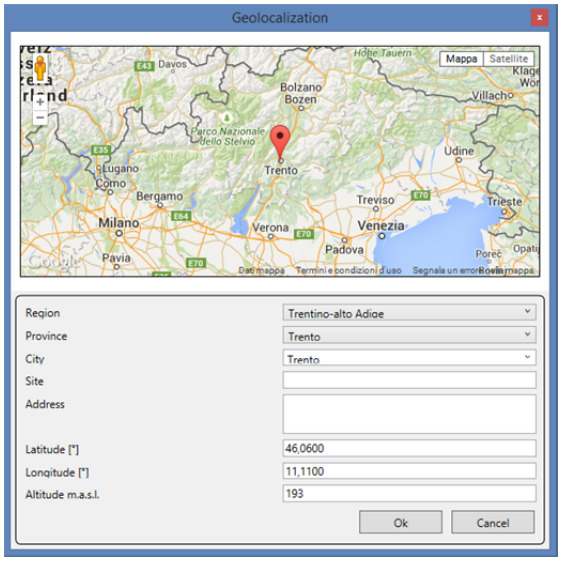
User interface

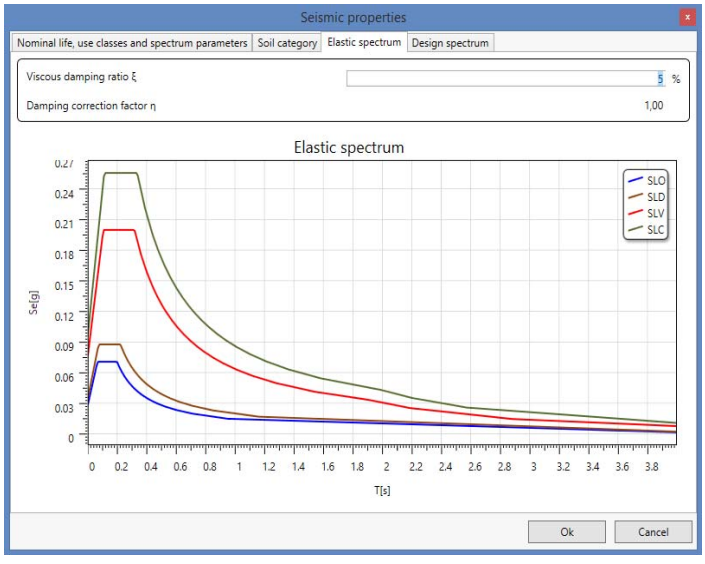
- The software has a **simple and user friendly interface** in order to speed up learning, data entry and check of the structures.
- The effective and powerful **internal 3D tool** allows the user to define the geometry of the structure in few steps simply by drawing different types of element: walls, floors, beams, columns, roofs, etc.
  The user can assign materials, sections, connections or loads to a specific structural element quickly by selecting it and scrolling through a drop-down menu.



Loads and actions

- **Automatic generation of loads used in the analysis:** snow, wind and seismic action are automatically generated according to the site where the structure is located (there is also the possibility of manual inputting the values of the loads). The snow load on every roof element is calculated on the basis of its geometrical configuration and the wind load on every surface is calculated on the basis of the element height above the ground.





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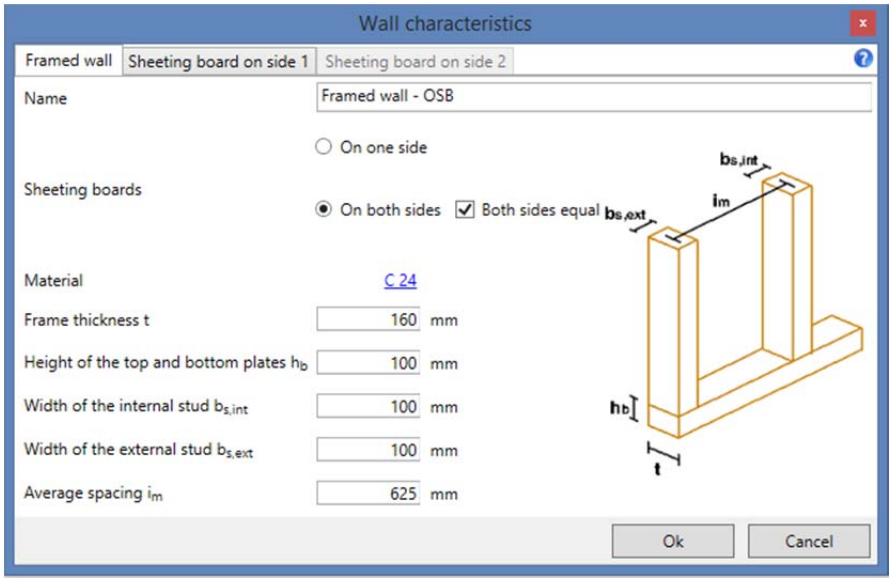
Design and Check

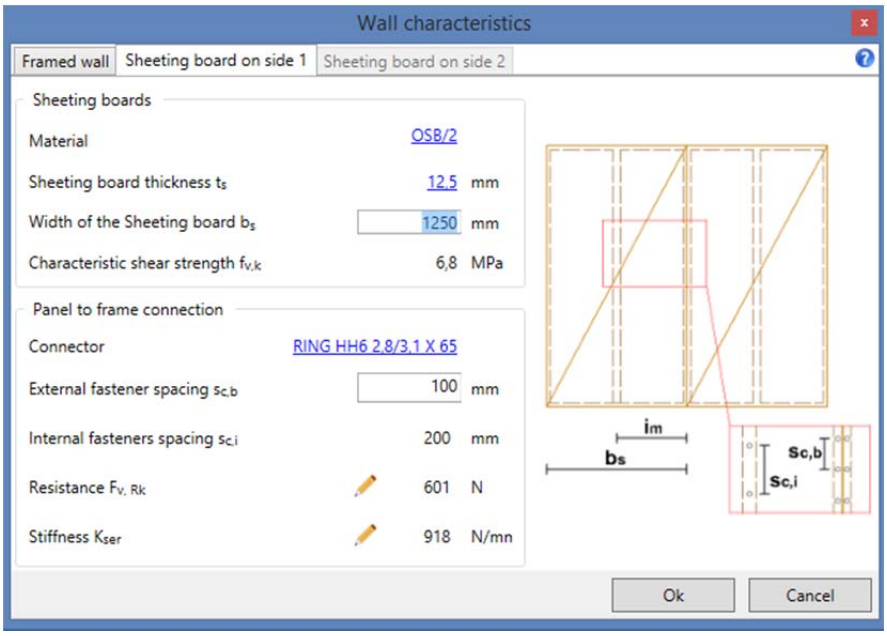
TimberTech Buildings carries out the ULS and SLS checks of the elements of a timber structure: walls, floors, beams, columns, metal fasteners, connections. The load combinations used in the analysis are automatically generated and displayed to the user in a simple and intuitive way.

The checks may be carried out in accordance with Italian standards (NTC '08) or in accordance with the Eurocodes.

The main **structural elements** checked by the software are

- **CLT and framed walls**
  - Framed walls checks: stability of the studs, compression perpendicular to the grain of the bottom plate, shear strength (lateral load-carrying capacity of metal fasteners, shear strength of the sheeting boards, shear buckling of the sheet).





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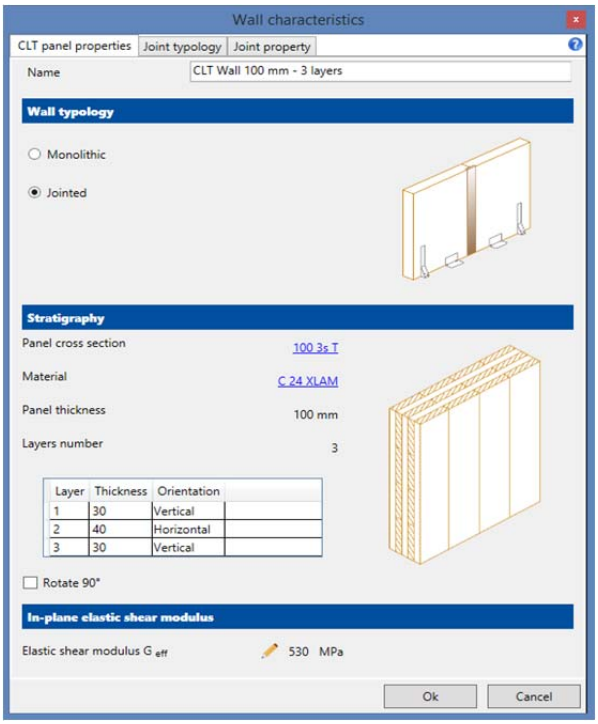
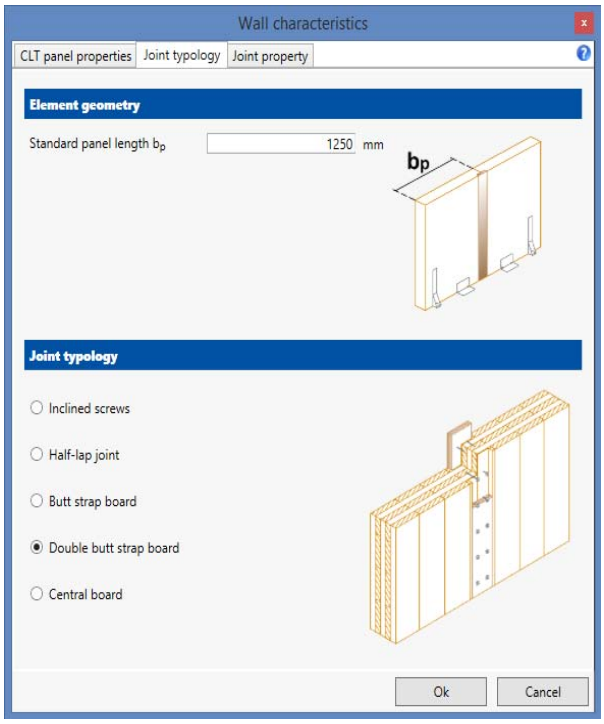
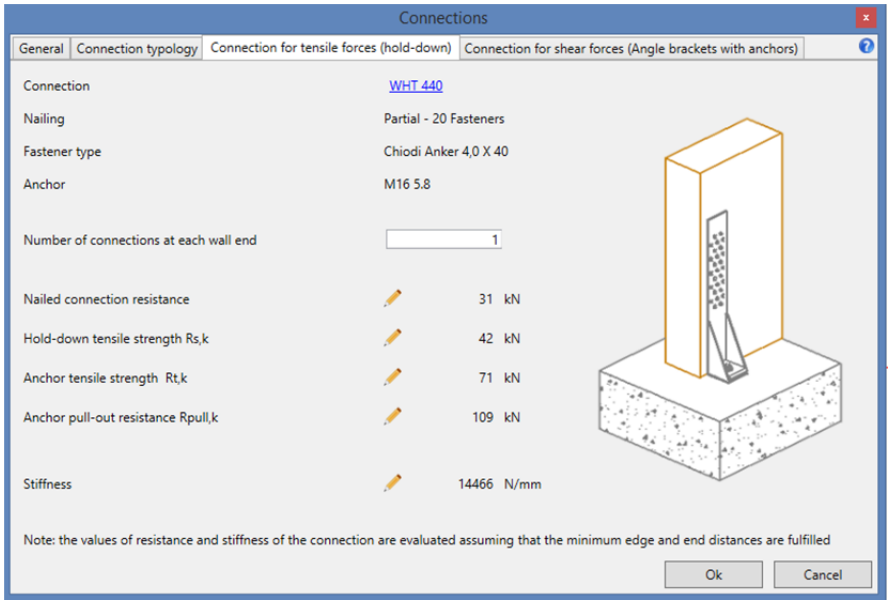
- CLT walls checks: buckling, shear force, vertical joints among CLT panels, load-carrying capacity of the fasteners.





- **Wall connections** (hold down, brackets, screws, nails, punched straps or punched metal plates): the design resistance of every connection is determined as the minimum value among the resistances relating to all the possible failure modes. The check of every failure mode (nailing failure, bracket steel failure, anchor tensile/shear failure, anchor extraction failure) is reported as a percent so as to facilitate the design of the connections.



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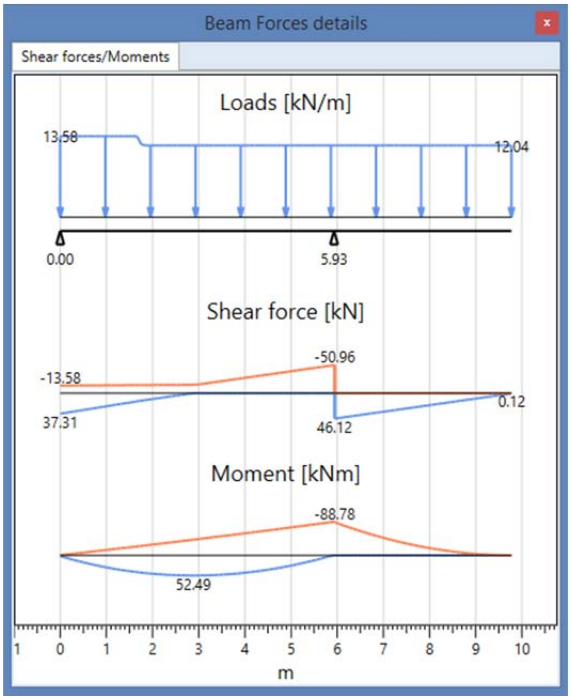
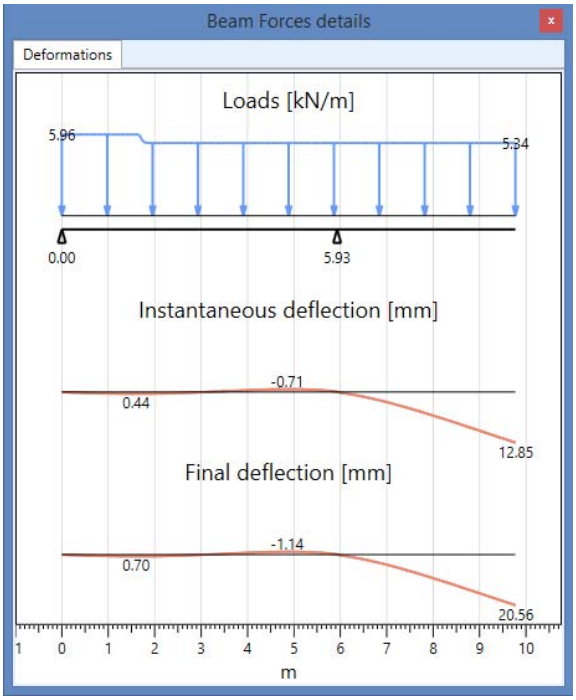
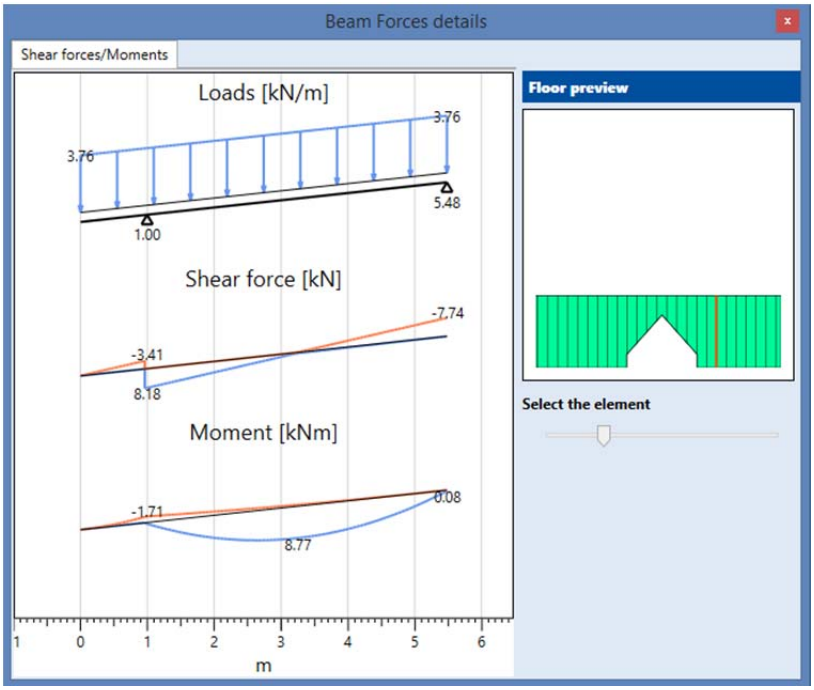
- **Timber beams**: shear, bending and deformation checks





- **Timber columns**: stability
- **Steel beams and columns**
- **Timber floors** (CLT floors, joist floors, solid wood floors): shear, bending, compression perpendicular to the grain and deformation.

  The software calculates the envelopes of shear and moment diagrams for each beam and floor element considering all the different configurations of load on the spans in order to maximize the load effects.
- **Timber pitched roofs**



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CLT calculation models

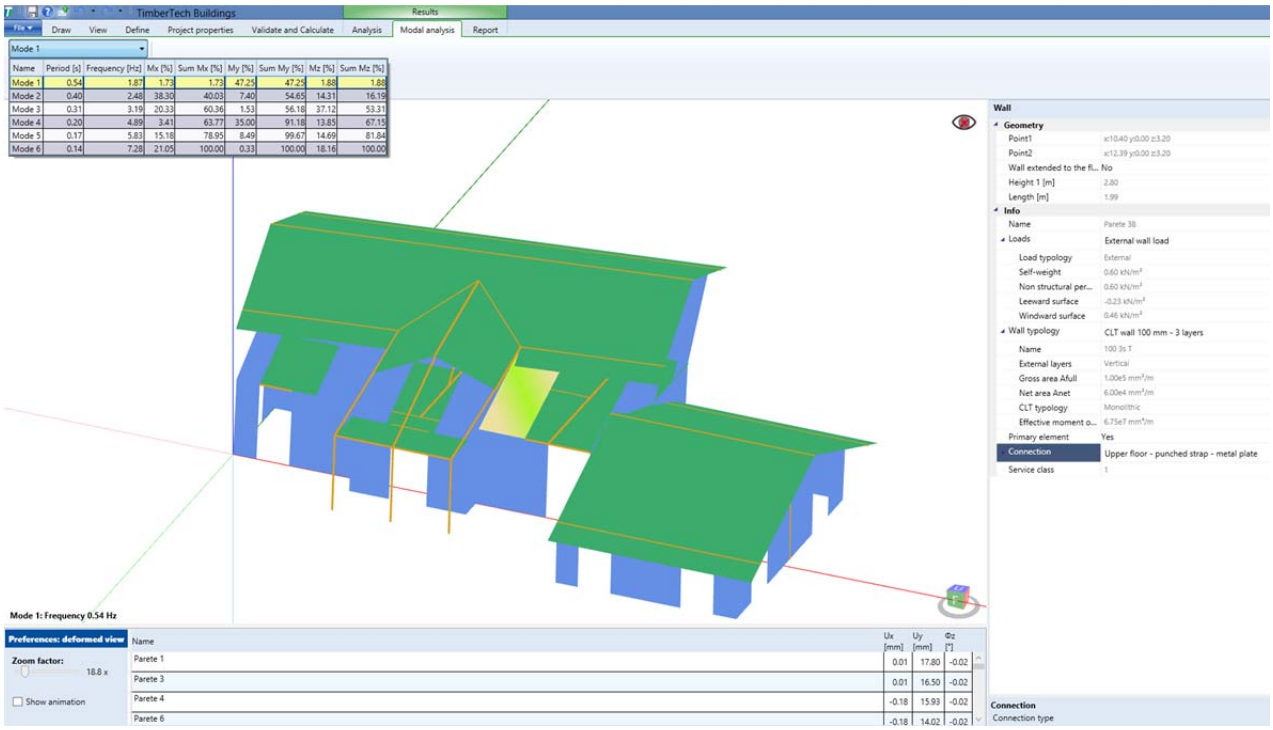
Some different calculation models can be used to analyse CLT elements (wall and ceilings):

- **Design of CLT in bending out-of-plane**:
  - Deformable connection: the calculation model adopted is that of mechanically jointed beams with deformable connection in accordance with Appendix B of EN 1995-1-1. The shear flexibility of the transverse layers is considered using the γ-method (gamma): namely with Möhler theory for CLT panel having up to 3 layers oriented in the direction of calculation and with Shelling theory for CLT panel having more than 3 layers oriented in the direction of calculation.
  - Non-deformable connection: the calculation model adopted is that of mechanically jointed beams with non-deformable connection. The shear flexibility of the transverse layers is not considered.
- **Design of CLT panels subjected to shear (in-plane loading):**
  The internal stress pattern in a CLT element subjected to shear forces can lead to failure of the material in two different mechanisms: shear bearing (mechanism I) in the boards and torsion-like (mechanism II) in the gluing interfaces. The internal torsional moment M_T can be evaluated using two different models:
  - model proposed in different European Technical Assessments (ETA)
  - model proposed in the paper "Mauro Andreolli, Roberto Tomasi, Andrea Polastri, Experimental investigation on in-plane behaviour of cross-laminated timber elements, CIB-W18 Meeting 2012"

Seismic analysis

- **Equivalent linear static analysis**
- **Modal linear dynamic (response spectrum) analysis**

  For both types of analysis the stiffness of each wall is calculated taking into account the contribution of the timber elements and of the connections (hold-down/tie-down, angle bracket and fasteners: nails, screws, staples). The software calculates the shear forces and moments acting on every shear wall and subsequently it uses them to determine the forces acting on the connections.



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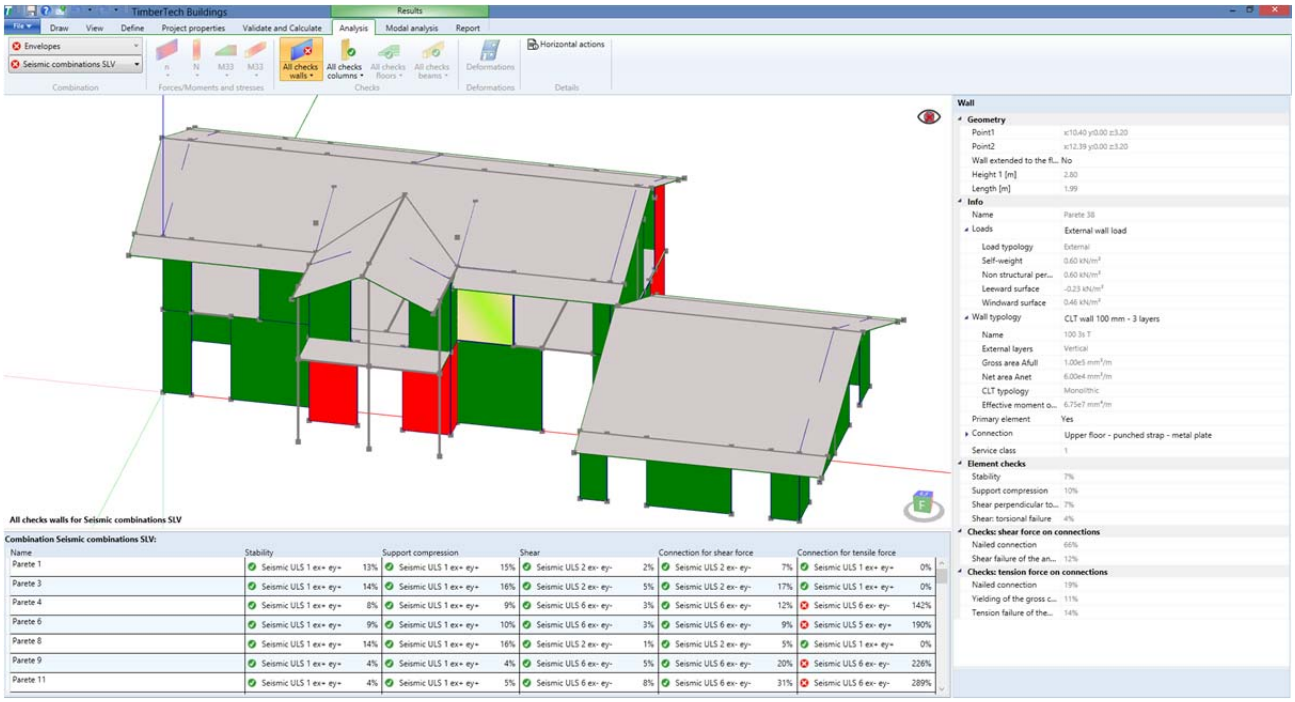
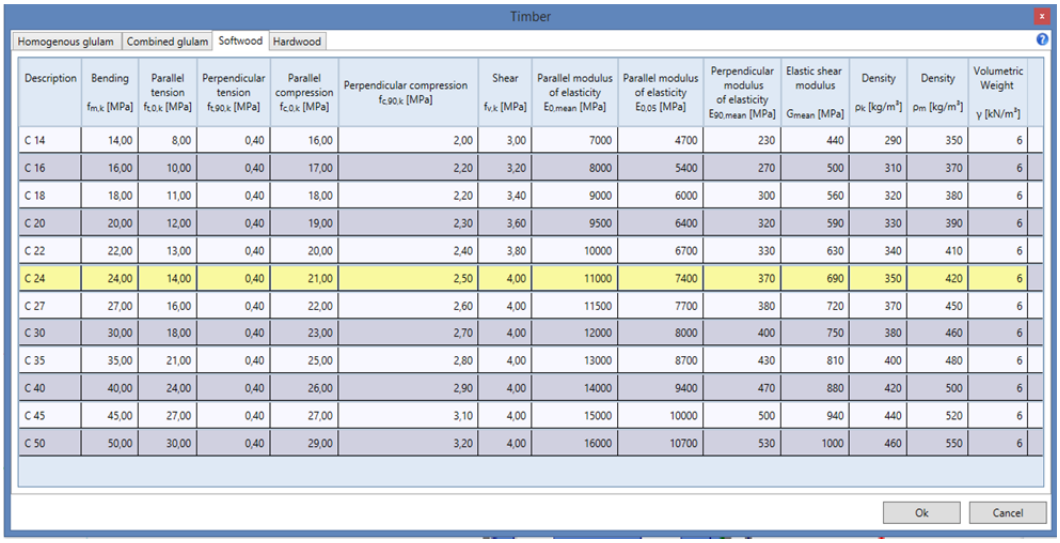


Preloaded material and connection properties

- **Materials database** (solid wood, glued laminated timber, OSB, plywood, XLAM)

  The mechanical properties of wooden materials, typically used in timber structures, are preloaded in the software; the data are defined according to the European standards. The user has only to assign a material to a selected element.



Description	Bending $f_{m,k}$ [MPa]	Parallel tension $f_{t,0,k}$ [MPa]	Perpendicular tension $f_{t,90,k}$ [MPa]	Parallel compression $f_{c,0,k}$ [MPa]	Perpendicular compression $f_{c,90,k}$ [MPa]	Shear $f_{v,k}$ [MPa]	Parallel modulus of elasticity $E_{0,mean}$ [MPa]	Parallel modulus of elasticity $E_{0,05}$ [MPa]	Perpendicular modulus of elasticity $E_{90,mean}$ [MPa]	Elastic shear modulus G_{mean} [MPa]	Density ρ_k [kg/m³]	Density ρ_m [kg/m³]	Volumetric Weight γ [kN/m³]
C 14	14,00	8,00	0,40	16,00	2,00	3,00	7000	4700	230	440	290	350	6
C 16	16,00	10,00	0,40	17,00	2,20	3,20	8000	5400	270	500	310	370	6
C 18	18,00	11,00	0,40	18,00	2,20	3,40	9000	6000	300	560	320	380	6
C 20	20,00	12,00	0,40	19,00	2,30	3,60	9500	6400	320	590	330	390	6
C 22	22,00	13,00	0,40	20,00	2,40	3,80	10000	6700	330	630	340	410	6
C 24	24,00	14,00	0,40	21,00	2,50	4,00	11000	7400	370	690	350	420	6
C 27	27,00	16,00	0,40	22,00	2,60	4,00	11500	7700	380	720	370	450	6
C 30	30,00	18,00	0,40	23,00	2,70	4,00	12000	8000	400	750	380	460	6
C 35	35,00	21,00	0,40	25,00	2,80	4,00	13000	8700	430	810	400	480	6
C 40	40,00	24,00	0,40	26,00	2,90	4,00	14000	9400	470	880	420	500	6
C 45	45,00	27,00	0,40	27,00	3,10	4,00	15000	10000	500	940	440	520	6
C 50	50,00	30,00	0,40	29,00	3,20	4,00	16000	10700	530	1000	460	550	6

- **Connections database** (hold down, brackets, screws, nails)

  There are internal databases with the characteristics of the products of the main European manufacturers. The user can also create new connections and customize them changing their strength and stiffness.

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Importing and exporting

- **Automatic generation of the calculation report**

  A clear and detailed technical design calculation report can be exported in Microsoft Word format (.docx). The calculation report describes all the useful information about the model: the model hypothesis, the design codes and standards, the equations, the analysis result and the corresponding elements checks.

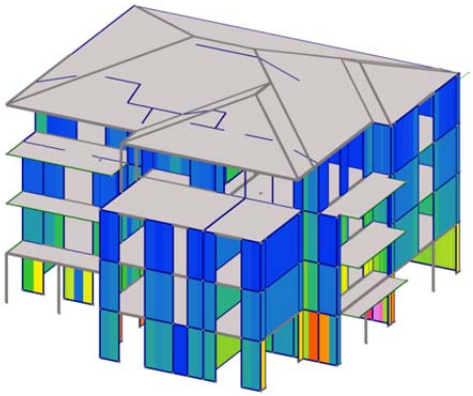
- **Export of DXF files**

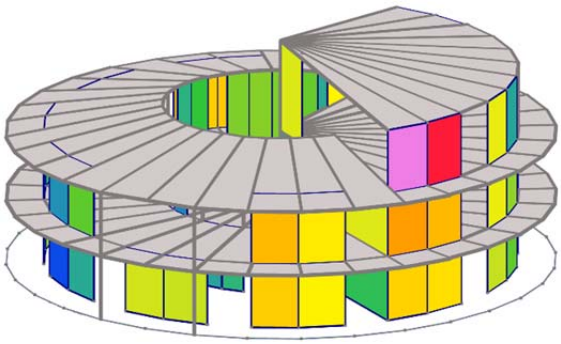
  The distribution of the shear walls with the detail of the connections can be exported in a dxf file provided with legend indicating the number and type of connections used.

- **Export of IFC files**

- **Import of drawings in Autodesk DXF format**

  The software is able to import 3D DXF files in order to help the designer to draw the geometry of the structures.





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