

CLTdesigner User manual

Version 9.0

General

System requirements

- Java SE Runtime Environment (JRE 8)

A free version of JRE can be downloaded from www.java.com/download/. However, please note the changes regarding the Oracle Java license.

Design methods

Further details to implemented calculation methods can be found [here](#).

Standards and guidelines used

Base documents:

- **DIN EN 1990:2010-12 and ON EN 1990:2003-03 respectively:**
Basis of structural design
- **DIN EN 1991-1-1:2010-12 and ON EN 1991-1-1:2003-03 respectively:**
Actions on structures
Part 1-1: General actions – Densities, self-weight, imposed loads for buildings
- **DIN EN 1995-1-1:2010-12 and ON EN 1995-1-1:2009-07 respectively:**
Design of timber structures
Part 1-1: General - Common rules and rules for buildings
- **DIN EN 1995-1-2:2010-12 and ON EN 1995-1-2:2011-09 respectively:**
Design of timber structures
Part 1-2: General - Structural fire design

National Annexes:

- Germany
- Austria
- Sweden
- Netherlands
- France

Translations

It is specifically stated that the versions of the CLTdesigner in other languages are translations of the Austrian version. Therefore, any potential dissimilarities with engineering design standards in other countries cannot be ruled out. When differences due to translation are identified, the version in German shall take precedence.

General Program build-up

Modules

Currently the CLTdesigner consists of **12 modules**.



The **Module „CLT-Plate 1D - Continuous beam“** offers the required verifications for the ultimate limit state (ULS) with respect to bending and shear for permanent and transient loads as well as accidental (fire) design situations, and the verifications for the serviceability limit state with respect to deflection and vibrations according to EN 1990 or EN 1995 for continuous systems such as cross laminated timber plates.



After specifying the internal forces and buckling lengths, the **Module „CLT-Plate 1D - Internal forces“** carries out the required verifications of the ultimate limit state with respect to normal and shear forces for permanent and transient loads as well as accidental design situations.



The **Module „Compression perpendicular to grain“** calculates the $k_{c,90}$ -coefficients for various load situations (point or line load introduction or transmission) and carries out the required verifications.



The **Module „CLT-Plate loaded in plane“** carries out the required shear stress verifications for a CLT cross-section in the ultimate limit state for permanent and transient loads as well as for accidental design situations based on a given shear force in plane per unit length.



The **Module „Wall“** offers the required verifications for the ultimate limit state (ULS) of walls under vertical and horizontal loads as well as wind perpendicular to the wall plane (cold and hot dimensioning).



The **Module „Ribbed slab“** offers the required verifications for the ultimate limit state (ULS) with respect to bending and shear for permanent and transient loads, and the verifications for the serviceability limit state with respect to deflection and vibrations according to EN 1990 or EN 1995 for ribbed slabs made of CLT plates with ribs of GLT or solid wood.



The **Module „Ribbed slab“** offers the required verifications for the ultimate limit state (ULS) with respect to bending and shear for permanent and transient loads, and the verifications for the serviceability limit state with respect to deflection and vibrations according to EN 1990 or EN 1995 for ribbed slabs made of CLT plates with ribs of GLT or solid wood.



The **Module „Box elements“** offers the required verifications for the ultimate limit state (ULS) with respect to bending and shear for permanent and transient loads, and the verifications for the serviceability limit state with respect to deflection and vibrations according to EN 1990 or EN 1995 for box elements made of CLT plates with ribs of GLT or solid wood.



The **Module „Web plates“** offers the required verifications for the ultimate limit state (ULS) with respect to bending and shear for permanent and transient loads, and the verifications for the serviceability limit state with respect to deflection and vibrations according to EN 1990 or EN 1995 for web plates made of glued ribs and two-layer timber panels.



The **Module „Horizontal load distribution on shear walls“** calculates the distribution of horizontal loads from wind or earthquake on the load-bearing wall elements.



The **Module „Stiffness matrix“** calculates the stiffness values necessary for a two-dimensional FE calculation and offers an export opportunity to Dlubal RFEM 5.

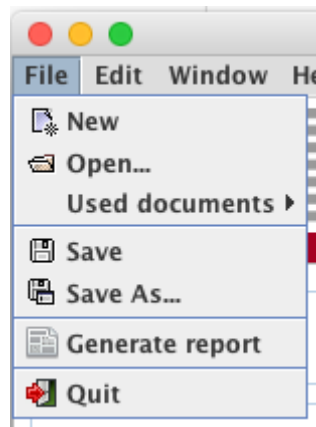


The **Module „SHERPA CLT-Connector“** calculates connections of cross laminated timber elements with the SHERPA CLT-Connector according to the European Technical Assessment ETA-18/0083.

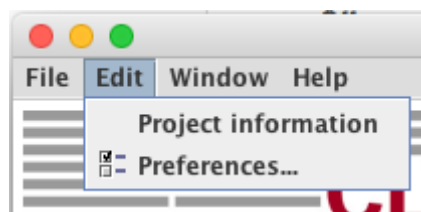
Menu bar

The menu item **File** offers the following selections:

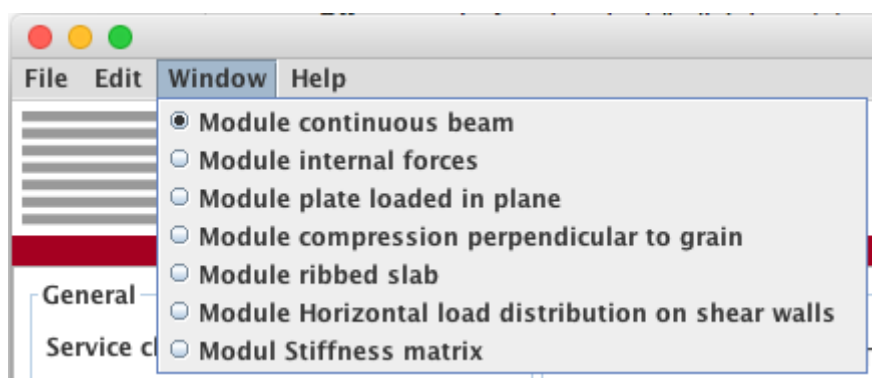
- Creates a new project
- Open a project as well as show recently used projects
- Save a project
- Create a pdf-format summary of the specifications and results
- Quit the program



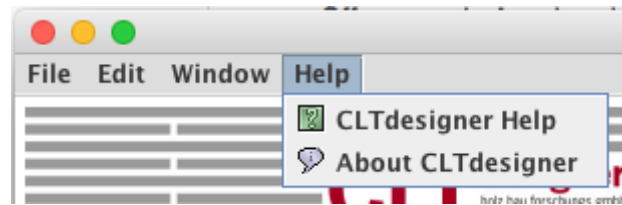
In the menu item **Edit** the [project information](#) and [settings](#) can be entered or changed.



In the menu item **Window**, one can move between the two [modules](#).



In the menu item **Help** the user manual as well as further [information concerning the CLTdesigner](#) can be accessed.



Buttons



The first group (from left to right) consist of **Save**, **Save as ...** and **Generate report** (see [Menu bar](#)).

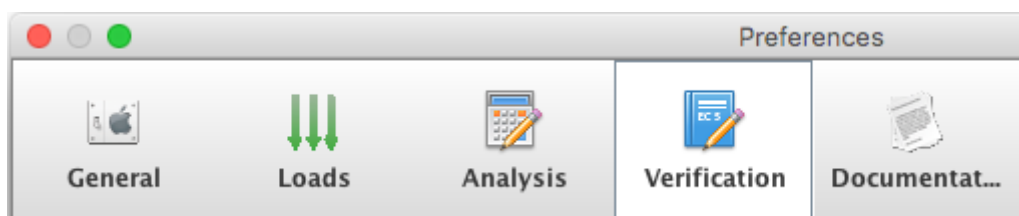
The next button is **Calculate**. The calculation can also be started with the shortcut CTRL+R.

A window with [settings/preferences](#) will open by clicking on the first button in the next group of buttons, another window with [information](#) about the CLTdesigner will pop up by clicking on the second, **help** information can be accessed by clicking on the third button and **More detailed information on the implemented calculation methods** will be available by clicking on the last button.

By clicking on one of the buttons in the second series of buttons shown in the following figure, the **language** can be changed. The current version offers German, English, French, Italian, Spanish and Dutch translations.



Settings/Preferences



The settings are divided into the categories:

- General
- Loads
- Analysis
- Verification
- Documentation

Within the category **General**, it can be specified if the single pages of the report (pdf format with security settings) should be also exported as pictures and if so, in which format (png or jpg). Furthermore, by ticking the second box, one can (de)activate the warning notice for the symmetry conditions of the cross-section. The default units of the cross-section properties can be changed by clicking the "Units..." button.

☐ Calculate automatically

☐ Show warning info for symmetric condition for layered cross section

☐ Export Pdf-report as pictures: Format

png

Units...

The settings regarding the type of calculation for the dead load, as well as the type of load position can be configured within the category **Loads**. The load combinations can be also adjusted here. As for the combination factors, they can be chosen according to EN or NA, but can be also user-defined. Furthermore, an option is offered here to simultaneously apply either snow load or wind actions together with the imposed load on roofs (category H). For the automatic generation of load combinations, it is also necessary to define whether the distributed and single loads should be considered as a one load group. This is due to differences which arise in combinations where the leading actions come from variable loads.

Calculation of plate weight

with p_{mean} of the material

Load position

Plate weight

Total

Permanent loads

Total

Imposed loads

Field-by-field

Snow

Total

Wind

Total

Combinations

Combination factors

according to NA

	ψ_0	ψ_1	ψ_2
Imposed load category A	0.7	0.5	0.3
Imposed load category B	0.7	0.5	0.3
Imposed load category C	0.7	0.7	0.6
Imposed load category D	0.7	0.7	0.6
Imposed load category E	1	0.9	0.8
Imposed load category F	0.7	0.7	0.6
Imposed load category G	0.7	0.5	0.3
Imposed load category H	0	0	0
Snow loads for regions below 1000 m	0.5	0.2	0
Snow loads for regions above 1000 m	0.7	0.5	0.2
Snow loads in FIN, IS, N, S	0.7	0.5	0.2
Wind loads on structures	0.6	0.2	0

☐ Apply imposed loads on roofs (category H) and snow loads or wind actions together simultaneously

Combinations of distributed and concentrated loads

☒ Consider q_k and Q_k as one load group

☒ Consider w_k and W_k as one load group

☒ Consider s_k and S_k as one load group

The method of analysis can be chosen within the category **Analysis**. Currently, three approaches are provided: (i) shear analogy method, (ii) Timoshenko beam theory and (iii) γ -method. The number of calculation points of the field can be specified in two ways: either by specifying the number of subdivisions of the fields or by specifying the maximum size of the subdivisions. When selecting the latter one, it needs to be further chosen between the height of the plate (element size according to

selected cross-section) and a fixed element size.

Furthermore, here you can specify whether the modulus of elasticity E_{90} should be ignored in the calculation.

In the modules for rib and box cross-sections, it is also possible to select the calculation method for the effective width.

The screenshot shows the 'System' and 'Effective width' sections of the software interface. In the 'System' section, the 'Method of analysis' is set to 'Timoshenko'. Under 'Subdivision of the fields', the 'Number of subdivisions' is set to 10, and the 'maximum size of elements' is set to 'plate thickness'. In the 'Effective width' section, the 'Calculation of b_{ef} according to' is set to 'Bogensperger'.

It is also necessary to specify whether the National Annex should be considered in **verification** and if so, which one. Furthermore, partial safety factors for the **ULS verification** need to be specified by selecting either EN, NA or user-defined from a drop-down list. The user also can specify whether the system coefficient k_{sys} should be taken into account or not. For the proof of stability, the imperfection coefficient β_c and the conversion factor mean value to 5% quantile value k_{05} as well as the consideration of the shear deformation can be defined here.

Verifications according to EN 1995-1-1

☒ Consider National Annex DIN EN 1995-1-1/NA:2013-08

ULS verification

Partial safety factors

according to NA

γ_M 1.30
 $\gamma_{M,fi}$ 1.00
 γ_G 1.35
 γ_Q 1.50

System factor

☒ Consider k_{sys}

Stability

β_c 0.1

k_{05} 0.833

☒ Include shear deformation

The deformation factors (values according to either TU Graz, EN, NA or user-defined), as well as the limit values for deformation need to be specified in the "Deformations" tab within the subsection regarding the **SLS verification**. By ticking the first box, the weight of the plate g_0 will not be considered in calculation of instantaneous deformation w_{inst} at $t=0$. Furthermore, here can be also specified whether the Base Document should be taken into account in deformation analysis or not. Likewise, here is also given an option to neglect short cantilevers in deformation analysis.

SLS verification

Deformations

Vibration

☐ Ignore CLT plate weight (g_0) in calculating instantaneous deformation w_{inst} at $t=0$

☒ Take into account the Base Document

☐ Ignore short cantilevers

Deformation factor

k_{def} -values corresponding to

NA

NK 10.8

NK 21.0

l/l_{max}

0.1

Limit values for deformation

Limit values according to EN 1995-1-1

Instantaneous deformation w_{inst} $t = 0: l/$ 250

Final deformation w_{fin} $t = \infty: l/$ 250

Final deformation $w_{net,fin}$ $t = \infty: l/$ 250

Limit values according to ON B 1995-1-1/NA:2014-11-15

Instantaneous deformation w_{inst} $t = 0: l/$ 250

Final deformation w_{fin} $t = \infty: l/$ 250

Final deformation $w_{net,fin}$ $t = \infty: l/$ 250

Additional verifications of vibration can be activated in the **Vibration** tab. In addition to verification according to Eurocode 5, other implemented analysis include: the simplified verification according to DIN ($w_{perm} \leq 6 \text{ mm}$), the verification according to suggestion of Hamm/Richter given in the BSPHandbuch, as well as its modified form. Furthermore, here is offered an option to include or neglect the shear deformation in calculations of the natural frequency and/or the deformation $w(1\text{kN})$ or $w(2\text{kN})$ at the stiffness criterion.

SLS verification

Deformations

Vibration

Additional verifications

☒ Verification according to DIN

☒ Verification according to Hamm/Richter

☒ Verification according to modified Hamm/Richter

Include shear deformation

☒ in calculations of natural frequency

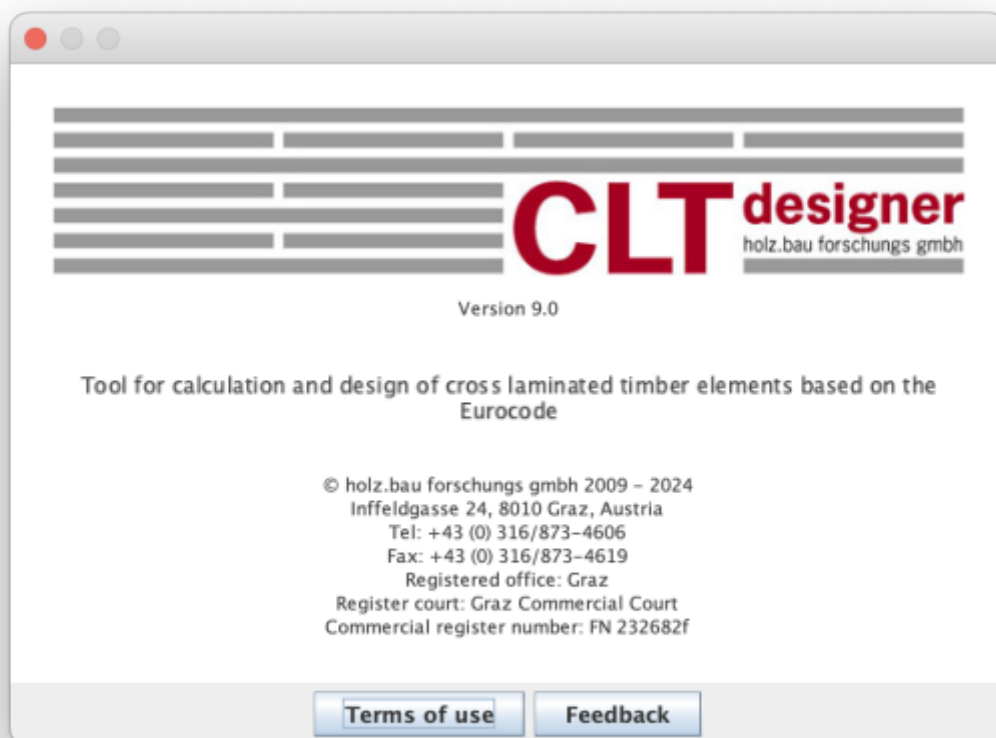
☒ at stiffness criterion

In the **Documentation** settings, one can choose whether, and if so, which detailed results should be included in the pdf report as an appendix.

- ☒ Include detailed results as appendix
 - ☒ Fire
 - ☒ Combinations
 - ☒ Internal forces
 - ☒ Deformations
 - ☒ Supporting forces
 - ☒ Verifications

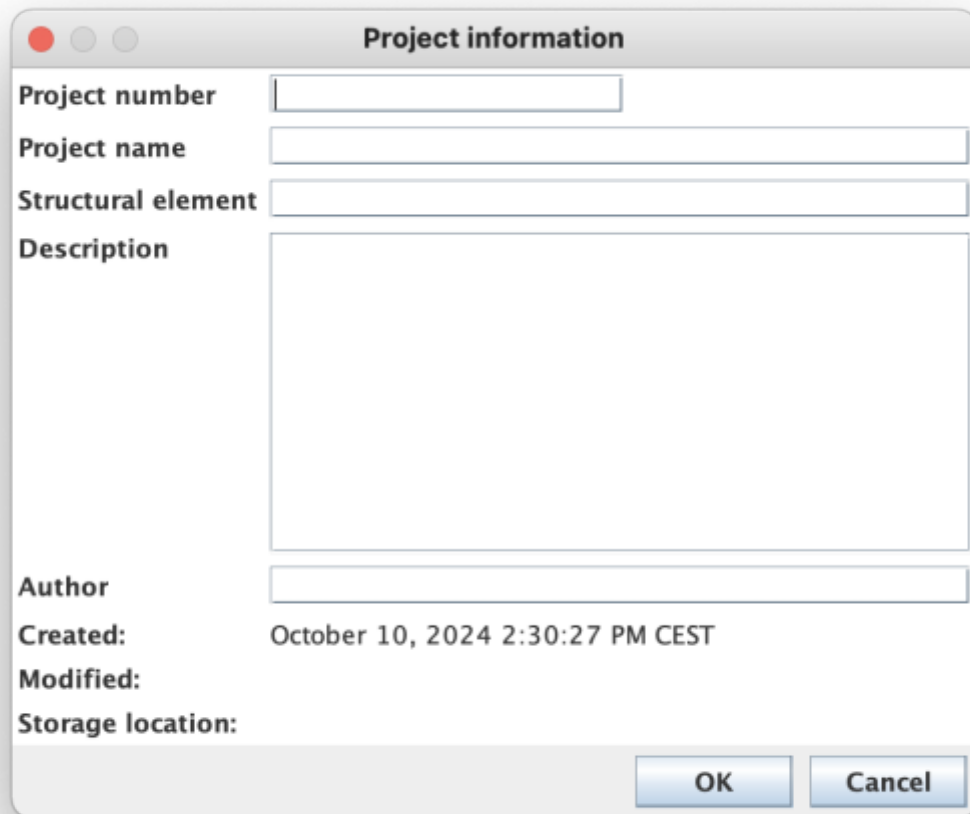
Information

The **information** window includes the contact address, the **terms of use**, and a button for **feedback**.



Project information

Project information can be entered by clicking on „Edit | Project information“. Here, a project name and a description of the component to be examined can be inserted. Furthermore, the name of the author or a person in charge can be included. The date of creation, the date of the latest change in the project, as well as the storage location are created automatically.



Project information

Project number

Project name

Structural element

Description

Author

Created: October 10, 2024 2:30:27 PM CEST

Modified:

Storage location:

OK Cancel

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