Module "Compression perpendicular to grain"

Input data

The input is divided into:

- definitions of the cross section
- definitions of the plate dimensions
- input of the loads
- type of load configuration
- calculation options

An option for a quick control of the input data is offered by a graphical representation shown on the right side.

Cross-section

Plate dimensions and gap execution

The plate is specified with its dimensions in x and y direction. The plate length is defined with dimension in x direction and the plate width with dimension in y direction.

In addition to plate dimensions, the analysis also considers the way the lamellas are joined into individual layers. Regarding to the joining of the outer layers, one should differ:

- side gluing of lamellas,
- assembly without adhesive where lamellas are placed side by side without the scheduled gaps or the expected occurrence of cracks and
- possible occurrence of gaps or cracks wider than 1 mm.

Load data and design factors

The applied force $F_{c,90}$ (design value) in [N], as well as the design factors can be specified here.

Load configuration

The load situation is described by specifying the load introduction above and below. Thereby, one can define if the load is even applied, and if so, if it is applied locally or continuously (over entire surface).

If the load is applied locally, it needs to be defined by entering the dimensions of the load surface (length $l_{1,2}$ in direction x and width $w_{1,2}$ in direction y) and the position. The position is defined as the distance between the center of a load surface and the origin of the coordinate system (lower left corner of the plate). Currently, centers of the top and the bottom load surface are coupled and cannot be moved relative to each other.

Calculation options

In the calculation options, the load distribution angles for longitudinal layers α_0 and cross layers α_{90} can be changed, and for one-sided load introduction, it can be specified, in which depth (= $k_{ls} \cdot t_{CLT}$) the effective area is to be determined.

Results and Output

The minimum load introduction area $A_{c,min}$ describes the reference area in order to get the effective area $A_{ef,max}$ by multiplying with the factor $k_{c,90}$. For different load introduction areas on each side it is the intersection of these two areas. The effective area $A_{ef,max}$ is described by l_{ef} and w_{ef} in depth z.

The utilisation ratio for compression perpendicular to grain is indicated by $\eta_{c,90}$ in [%].

The following figure shows the distribution of the effective area $A_{ef,max}$ over the cross section (red line) as well as the assumed load distribution (blue line).

Implemented calculation methods

Compression perpendicular to grain - Verification

clt:design:plate_loaded_out_of_plane:compression
brettsperrholz, bemessung, uls, plattenbeanspruchung, querdruck

Model for the determination of the kc,90 factor

clt:design:plate_loaded_out_of_plane:compression:model_brandner_schickhofer_2014
brettsperrholz, bemessung, uls, plattenbeanspruchung, querdruck