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European Technical Assessment

ETA-20/0843
of 12.12.2023

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
Austrian Institute of Construction Engineering

Trade name of the construction product

Theurl CLTPLUS

Product family to which the construction product belongs

Solid wood slab elements to be used as structural elements in buildings

Manufacturer

Theurl Timber Structures
Industriezone 1
9754 Steinfeld
AUSTRIA

Manufacturing plant

Theurl Timber Structures
Industriezone 1
9754 Steinfeld
AUSTRIA

This European Technical Assessment contains

16 pages including 3 annexes which form an integral part of this assessment.

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of

European Assessment Document (EAD)
130005-00-0304 "Solid wood slab element to be used as a structural element in buildings".

This European Technical Assessment replaces

European Technical Assessment ETA-20/0843 of
16.11.2020.

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Specific parts

1 Technical description of the product

1.1 General

This European Technical Assessment (ETA)¹ applies to the cross laminated timber "Theurl CLT-PLUS". Theurl CLTPLUS is made of softwood boards which are bonded together in order to form cross laminated timber (solid wood slab elements). Generally, adjacent layers of the softwood boards are arranged perpendicular (angle of 90 °) to each other, see Annex 1, Figure 1.

The principle structure of the cross laminated timber is shown in Annex 1, Figure 2 to Figure 3. Surfaces are planed.

The solid wood slab elements consist of at least three and up to nine adjacent layers which are arranged perpendicular to each other. With regard to the thickness of the solid wood slab element, thickness and orientation of individual layers are symmetrically assembled. In case of serious deviations from symmetry potential effects should be investigated.

The individual boards of the layers are side-glued.

In multilayer elements with at least five layers, a maximum of two consecutive board layers may be arranged in the same direction if their all over thickness does not exceed 90 mm.

Single board layers (maximum 50 % of the cross section) may be replaced by one- and multilayer solid wood panels. The solid wood panels shall be suitable for structural use.

The surfaces of the solid wood slabs may be provided with additional layers without load-bearing function. These panels are not part of this European Technical Assessment. Strength and stiffness characteristics for mechanical actions perpendicular to and in plane of the cross laminated timber are only assigned to the cross laminated timber without covering.

Theurl CLTPLUS and the boards for its manufacturing correspond to the specifications given in the Annexes 1 and 2. The material characteristics, dimensions and tolerances of Theurl CLT-PLUS, not indicated in these Annexes, are given in the technical file² of the European Technical Assessment.

The application of wood preservatives and flame retardants is not subject of the European Technical Assessment.

1.2 Components

1.2.1 Boards

The specification of the boards is given in Annex 2, Table 2. Boards are visually or machine strength graded. Only technically dried wood shall be used.

Wood species is European spruce or equivalent softwood.

1.2.2 Adhesive

The adhesive for bonding of the cross laminated timber and the finger joints of the individual boards shall conform to EN 301³ or EN 15425⁴.

Normally a PU adhesive is used.

¹ In 2020 ETA-20/0843 was firstly issued as European Technical Assessment ETA-20/0843 of 16.11.2020 and xxxx amended to ETA-20/0843 of 12.12.2023.

² The technical file of the European Technical Assessment is deposited at Österreichisches Institut für Bautechnik and, in so far as is relevant to the tasks of the notified product certification body involved in the assessment and verification of constancy of performance procedure, is handed over to the notified product certification body.

³ EN 301:2023

⁴ EN 15425:2023

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

The solid wood slab is intended to be used as a structural or non-structural element in buildings and timber structures.

The solid wood slab shall be subjected to static and quasi-static actions only.

The solid wood slab is intended to be used in service classes 1 and 2 according to EN 1995-1-1⁵. Members which are directly exposed to the weather shall be provided with an effective protection for the solid wood slab element in service.

2.2 General assumptions

The solid wood slab elements are manufactured in accordance with the provisions of the European Technical Assessment using the manufacturing process as identified in the inspection of the manufacturing plant by Österreichisches Institut für Bautechnik and laid down in the technical file.

The manufacturer shall ensure that the requirements in accordance with the Clauses 1, 2 and 3 as well as with the Annexes of the European Technical Assessment are made known to those who are concerned with planning and execution of the works.

Layers of planed boards shall be bonded together to the required thickness of the cross laminated timber. The individual boards shall be jointed in longitudinal direction by means of finger joints according to EN 14080⁶, there shall be no butt joints.

Adhesive shall be applied on one face of each board. The edges of the boards need to be bonded.

Design

The European Technical Assessment only applies to the manufacture and use of solid wood slab elements. Verification of stability of the works including application of loads on the products is not subject to the European Technical Assessment.

The following conditions shall be observed:

- Design of the solid wood slab elements is carried out under the responsibility of an engineer experienced in such products.
- Design of the works shall account for the protection of the cross laminated timber.
- The cross laminated timber elements are installed correctly.

Design of the cross laminated timber elements can be according to EN 1995-1-1 and EN 1995-1-2⁷, taking into account of Annexes 2 and 3 of the European Technical Assessment. Standards and regulations in force at the place of use shall be considered.

Packaging, transport, storage, maintenance, replacement and repair

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

Installation

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

⁵ EN 1995-1-1:2004 +AC:2006 +A1:2008 +A2:2014

⁶ EN 14080:2013

⁷ EN 1995-1-2:2004 + AC:2006 + AC:2009

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of Theurl CLTPLUS of 50 years, when installed in the works, provided that the solid wood slab elements are subject to appropriate installation, use and maintenance (see Clause 2.2). These provisions are based upon the current state of the art and the available knowledge and experience⁸.

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA nor by the Technical Assessment Body, but are regarded only as a means for choosing the appropriate products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Performance of the product

Table 1: Performance of the product in relation to the essential characteristics

Essential characteristic	Method of assessment	Performance
Basic requirement for construction works 1: Mechanical resistance and stability		
Bending	EAD 130005-00-0304, Clause 2.2.1.1	Annex 2
Tension and compression	EN 338 ⁹	Annex 2
Shear	EAD 130005-00-0304, Clause 2.2.1.3	Annex 2
Embedment strength	EAD 130005-00-0304, Clause 2.2.1.4	Annex 2
Creep and duration of the load	EAD 130005-00-0304, Clause 2.2.1.5	Annex 2
Dimensional stability	EAD 130005-00-0304, Clause 2.2.1.6	Annex 2
In-service environment	EAD 130005-00-0304, Clause 2.2.1.7	Annex 2
Bond integrity	EAD 130005-00-0304, Clause 2.2.1.8	Annex 2
Basic requirement for construction works 2: Safety in case of fire		
Reaction to fire	Commission Decision 2005/610/EC ¹⁰ , as amended	Annex 2
Resistance to fire	EAD 130005-00-0304, Clause 2.2.2.2	Annex 2

⁸ The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, and the particular conditions of the design, execution, use and maintenance of that works may be outside this ETA. Therefore, it cannot be excluded that in these cases the real working life of the product may also be shorter than the assumed working life.

⁹ EN 338:2016

¹⁰ Official Journal of the European Communities OJ L 208, 11.8.2005, p. 21

Essential characteristic	Method of assessment	Performance
Basic requirement for construction works 3: Hygiene, health and environment		
Content, emission and/or release of dangerous substances	EAD 130005-00-0304, Clause 2.2.3.1	Clause 3.1.1
Water vapour permeability – Water vapour transmission	EN ISO 10456 ¹¹	Annex 2
Basic requirement for construction works 4: Safety and accessibility in use		
Impact resistance	EAD 130005-00-0304, Clause 2.2.4.1	Annex 2
Basic requirement for construction works 5: Protection against noise		
Airborne sound insulation	No performance assessed.	
Impact sound insulation	No performance assessed.	
Sound absorption	No performance assessed.	
Basic requirement for construction works 6: Energy economy and heat retention		
Thermal conductivity	EN ISO 10456	Annex 2
Air permeability	EN 12114 ¹² and EN 12207 ¹³	Annex 2
Thermal inertia	EN ISO 10456	Annex 2

3.1.1 Hygiene, health and the environment

3.1.1.1 Content, emission and/or release of dangerous substances

The release of dangerous substances is determined according to EAD 130005-00-0304, “Solid wood slab element to be used as a structural element in buildings”. No dangerous substances is the performance of the Theurl CLTPLUS in this respect.

NOTE In addition to the specific clauses relating to dangerous substances contained in the European Technical Assessment, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the Construction Products Regulation, these requirements need also to be complied with, when and where they apply.

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 of Theurl CLTPLUS for the intended use, and in relation to the requirements for mechanical resistance and stability, for safety in case of fire, for hygiene, health and the environment, for safety and accessibility in use, for protection against noise and for energy economy and heat retention in the sense of the basic requirements for construction works № 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with the European Assessment Document EAD 130005-00-0304, Solid wood slab element to be used as a structural element in buildings.

¹¹ EN ISO 10456:2007 + AC:2009

¹² EN 12114:2000

¹³ EN 12207:2016

3.2.2 Identification

The European Technical Assessment for Theurl CLTPLUS is issued on the basis of agreed data that identify the assessed product. Changes to materials, to composition, to characteristics of the product, or to the production process could result in these deposited data being incorrect. Österreichisches Institut für Bautechnik should be notified before the changes are implemented, as an amendment of the European Technical Assessment is possibly necessary.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

4.1 System of assessment and verification of constancy of performance

According to Commission Decision 97/176/EC¹⁴, as amended, the system of assessment and verification of constancy of performance to be applied to Theurl CLTPLUS is System 1. System 1 is detailed in Commission Delegated Regulation (EU) № 568/2014¹⁵ of 18 February 2014, Annex, 1.2., and provides for the following items

- (a) the manufacturer shall carry out:
 - (i) factory production control;
 - (ii) further testing of samples taken at the manufacturing plant by the manufacturer in accordance with a prescribed test plan¹⁶;
- (b) the notified product certification body shall decide on the issuing, restriction, suspension or withdrawal of the certificate of constancy of performance of the construction product on the basis of the outcome of the following assessments and verifications carried out by that body:
 - (i) an assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product;
 - (ii) initial inspection of the manufacturing plant and of factory production control;
 - (iii) continuous surveillance, assessment and evaluation of factory production control.

4.2 Construction products for which a European Technical Assessment has been issued

Notified bodies undertaking tasks under System 1 shall consider the European Technical Assessment issued for the construction product in question as the assessment of the performance of that product. Notified bodies shall therefore not undertake the tasks referred to in point 4.1 (b)(i).

¹⁴ Official Journal of the European Communities OJ L 073, 14.3.1997, p. 19

¹⁵ Official Journal of the European Communities OJ L 157, 27.5.2014, p.76

¹⁶ The prescribed test plan has been deposited with Österreichisches Institut für Bautechnik and is handed over only to the notified product certification body involved in the procedure for the assessment and verification of constancy of performance. The prescribed test plan is also referred to as control plan.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

5.1 Task for the manufacturer

5.1.1 Factory production control

In the manufacturing plant the manufacturer establishes and continuously maintains a factory production control. All data, procedures, and specifications adopted by the manufacturer are documented in a systematic manner in the form of instructions manual (user's guides) and process instructions. Purpose of factory production control is to ensure the constancy of performances of the product with regard to the essential characteristics.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to controls by the manufacturer before acceptance. Check of incoming materials includes control of inspection documents presented by the manufacturer of the raw materials.

The frequency of control and testing performed within factory production control as well as on the finished product, is in accordance with the determined manufacturing process and the prescribed test plan. The factory production control's results of testing are recorded and evaluated. The records are kept at least for ten years after the product has been placed on the market and are presented to the notified factory production control certification body involved in continuous surveillance. On request the records are presented to Österreichisches Institut für Bautechnik. The records shall include at least:

- Designation of the product, the materials and components
- Type of control and testing
- Date of manufacture of the product and the date of inspection of the product, materials or components
- Results of control and examination and, if applicable, comparison with requirements
- Name and signature of person responsible for factory production control

If test results are unsatisfactory, the manufacturer immediately implements measures to eliminate the defects. Products or components that are not in conformity with the requirements are removed. After elimination of the defects, the respective test – if verification is required for technical reasons – is repeated immediately.

5.1.2 Declaration of performance

The manufacturer is responsible for preparing the declaration of performance. When all the criteria of the assessment and verification of constancy of performance are met, including the certificate of conformity issued by the notified product certification body, the manufacturer shall draw up a declaration of performance.

5.2 Tasks for the notified product certification body

5.2.1 Initial inspection of the manufacturing plant and of factory production control

The notified product certification body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of Theurl CLTPLUS according to the European Technical Assessment. In particular the following items shall be appropriately considered

- Personnel and equipment
- The suitability of the factory production control established by the manufacturer
- Full implementation of the control plan

5.2.2 Continuous surveillance, assessment and evaluation of factory production control

The notified product certification body shall visit the factory at least once a year for routine inspection. In particular the following items shall be appropriately considered

- The manufacturing process including personnel and equipment
- The factory production control
- The implementation of the control plan

The results of continuous surveillance are made available on demand by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the control plan are no longer fulfilled, the certificate of constancy of performance is withdrawn by the notified product certification body.

Issued in Vienna on 12.12.2023
by Österreichisches Institut für Bautechnik

The original document is signed by:

Thomas Rockenschaub
Deputy Managing Director

Figure 1: Principle structure of the solid wood slab

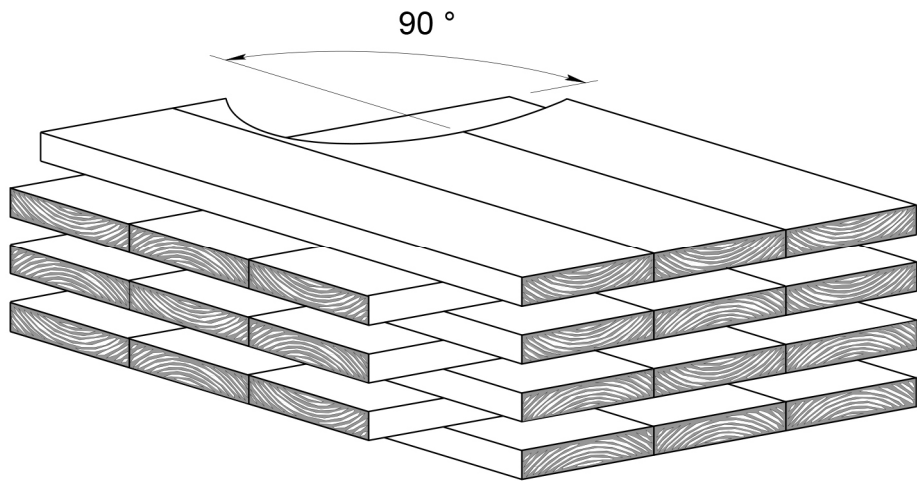


Figure 2: Principle structure of cross laminated timber with 3 layers

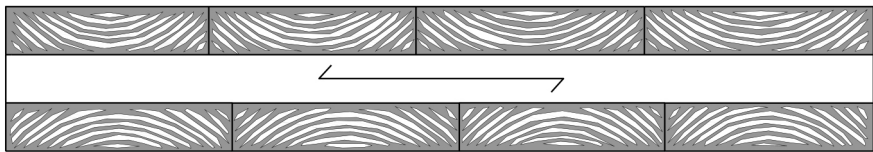


Figure 3: Principle structure of cross laminated timber with 5 layers

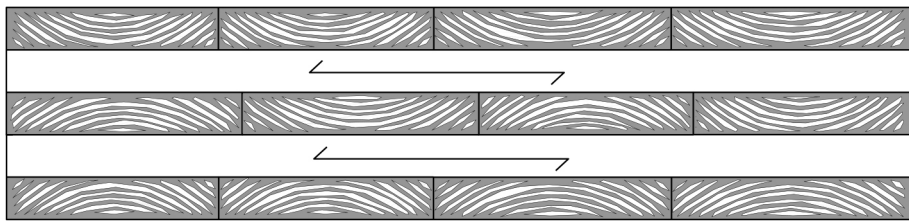


Table 2: Dimensions and specifications

Item	Unit	Dimension/Specification
Cross laminated timber		
Thickness	mm	60 to 360
Width	m	$\leq 3,5$
Length	m	≤ 16
Number of layers	-	3 to 9 symmetric assembly
Maximum value of joint width between boards within one layer	mm	2
Board		
Surface	-	planed
Thickness (planed dimension)	mm	18 to 45
Width	mm	78 to 250
Ratio width to thickness	-	$\geq 2,6 : 1$
Boards shall be graded with suitable visual and/or machine procedures to be able to assign them to a strength class according to EN 338.	-	
Cover layer		C24
Inner layer		$\leq 10 \% \text{ C16}$ $\geq 90 \% \text{ C24}$
Moisture of wood according to EN 13183-2	%	6 to 15 % Within one member of cross laminated timber the moisture content shall not differ by more than 5 %.
Finger joints	-	EN 14080

Table 3: Product characteristics of the solid wood slab

BWR	Essential characteristic	Assessment method	Level / Class / Description
1	Mechanical resistance and stability		
	1. Mechanical actions perpendicular to the cross laminated timber		
	Strength class of boards	EN 338	C24
	Modulus of elasticity		
	- parallel to the grain of the boards $E_{0,mean}$	EAD 130005-00-0304, Clause 2.2.1.1 I_{eff} , Annex 3	11600 MPa
	- perpendicular to the grain of the boards $E_{90,mean}$	EN 338	370 MPa
	Shear modulus		
	- parallel to the grain of the boards $G_{090,mean}$	EN 338	690 MPa
	- perpendicular to the grain of the boards $G_{9090,mean}$	EAD 130005-00-0304, Clause 2.2.1.1 and 2.2.1.3 W_{eff} , Annex 3	50 MPa
	Bending strength		
	- parallel to the grain of the boards $f_{m,k}$	EAD 130005-00-0304, Clause 2.2.1.1 W_{eff} , Annex 3	$1/k_{sys} \cdot 24 \text{ MPa}^*$
	Tensile strength		
	- perpendicular to the grain of the boards $f_{t,90,k}$	EN 338, reduced	0,12 MPa
	Compressive strength		
	- perpendicular to the grain of the boards $f_{c,90,k}$	EN 338	2,5 MPa
	Shear strength		
	- parallel to the grain of the boards $f_{v,090,k}$	EN 338	4,0 MPa
	- perpendicular to the grain of the boards (rolling shear strength) $f_{v,9090,k}$	EAD 130005-00-0304, Clause 2.2.1.3 A_{gross} , Annex 3	1,3 MPa

$$* k_{sys} = \begin{cases} 1,1 - 0,025 \cdot n \\ 1 \end{cases} \text{ with } n \text{ as the number of boards within the cover layer}$$

Theurl CLTPLUS
Characteristic data of cross laminated timber

Annex 2 of ETA-20/0843
of 12.12.2023

Table 3 continued: Product characteristics of the solid wood slab

BWR	Essential characteristic	Assessment method	Level / Class / Description
1	Mechanical resistance and stability		
	2. Mechanical actions in plane of the cross laminated timber		
	Strength class of boards	EN 338	C24
	Modulus of elasticity - parallel to the grain of the boards $E_{0,mean}$	EAD 130005-00-0304, Clause 2.2.1.1 A_{net} , I_{net} , Annex 3	11600 MPa
	Shear modulus - parallel to the grain of the boards $G_{090,mean}$	EAD 130005-00-0304, Clause 2.2.1.3 A_{net} Annex 3	450 MPa
	Bending strength - parallel to the grain of the boards $f_{m,k}$	EAD 130005-00-0304, Clause 2.2.1.1 W_{net} , Annex 3	24 MPa
	Tensile strength - parallel to the grain of the boards $f_{t,0,k}$	EN 338	14,5 MPa
	Compressive strength - parallel to the grain of the boards $f_{c,0,k}$	EN 338	21 MPa
	Shear strength - parallel to the grain of the boards $f_{v,090,k}$	EAD 130005-00-0304, Clause 2.2.1.3 W_{net} , Annex 3	5,0 MPa
	3. Other mechanical actions		
	Creep and duration of load	k_{mod} and k_{def} according to EN 1995-1-1 for glued laminated timber	
	Dimensional stability	Moisture content during service shall not change to such an extend that adverse deformation will occur.	
	Embedment strength	Embedment strength of fasteners may be calculated according to EN 1995-1-1. The direction of grain of the cover layer shall be taken as reference.	
	In-service environment	Service classes 1 and 2 according to EN 1995-1-1	
	Bond integrity	EAD 130005-00-0304, Clause 2.2.1.3	Fulfilled

Theurl CLTPLUS
Characteristic data of cross laminated timber

Annex 2 of ETA-20/0843
of 12.12.2023

Table 3 continued: Product characteristics of the solid wood slab

BWR	Essential characteristic	Assessment method	Level / Class / Description
2	Safety in case of fire		
	Reaction to fire		
	Glued laminated timber products	Commission Decision 2005/610/EC, as amended	Mean density of wood ≥ 380 kg/m³ Euroclass D-s2, d0
	Resistance to fire		
	Charring rate - Charring of the cover layer β ₀ - Charring of more layers than the cover layer β _n **	EAD 130005-00-0304, Clause 2.2.2.2	0.65 mm/min 1,3 mm/min
3	Hygiene, health and environment		
	Vapour permeability, μ, of wood	EN ISO 10456	50 (dry) to 20 (wet)
4	Safety and accessibility in use		
	Impact resistance	Soft body resistance is assumed to be fulfilled for walls with a minimum of 3 layers.	
6	Energy economy and heat retention		
	Thermal conductivity, λ, of wood	EN ISO 10456	0,12 W/(m·K)
	Air permeability	EN 12114	Class 4 according to EN 12207
	Thermal inertia, specific heat capacity c _p of wood	EN ISO 10456	1600 J/(kg·K)

****** Until 25 mm of charring. Afterwards the charring rate 0.65 mm/min applies up to the next glue line.

Mechanical actions perpendicular to plane and in plane of cross laminated timber

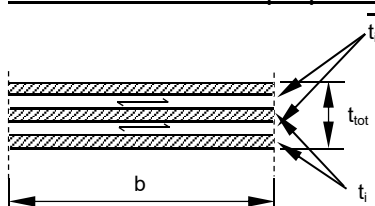
General

Due to the perpendicular orientation of the boards, cross laminated timber is able to transfer loads in all directions according to its condition of support. For cross laminated timber multi-axle stressed in both principal directions, different stiffness for the two principal directions shall be considered.

For calculation of characteristic values of cross-section, only boards which are oriented in direction of the mechanical action may be employed.

For design of cross laminated timber according to EN 1995-1-1, characteristic strength and stiffness of solid wood according to Annex 2 shall be taken.

Mechanical actions perpendicular to the solid wood slab



Where

t_i Thickness of board layers in direction of mechanical actions

\bar{t}_i Thickness of board layers perpendicular to direction of mechanical actions

The bending stiffness is specified in relation to the effective moment of inertia I_{eff} .

The calculation of the effective moment of inertia and therewith of the effective bending stiffness is according to EN 1995-1-1.

For I_{eff} see clause 9.1.3 and Annex B of EN 1995-1-1.

The term $\frac{S_i}{K_i}$ of EN 1995-1-1 should be substituted by $\frac{\bar{t}_i}{G_{9090} \cdot b}$.

$$I_i = \frac{b \cdot t_i^3}{12}$$

$$W_{eff} = \frac{2 \cdot I_{eff}}{t_{tot}}$$

$$A_i = b \cdot t_i$$

$$h_{tot} = \sum_i (t_i + \bar{t}_i)$$

$$\tau_{v,d} = \frac{1.5 \cdot V_d}{A_{gross}}$$

$$A_{gross} = b \cdot t_{tot}$$

Where

I moment of inertia

I_{eff} effective moment of inertia

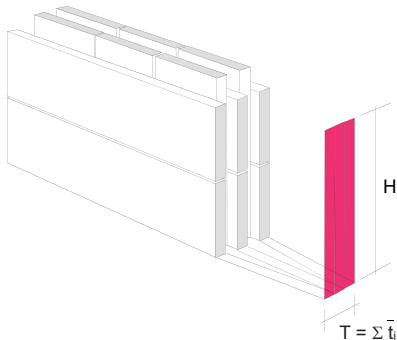
s spacing of fasteners according to EN 1995-1-1 (not relevant for solid wood slab)

K slip modulus according to EN 1995-1-1 (not relevant for solid wood slab)

G_{9090} shear modulus of the board perpendicular to grain (rolling shear modulus); $G_{9090} = 50 \text{ MPa}$

b width of the member of cross laminated timber

Mechanical actions in plane of the solid wood slab



Where
 $H \leq 400\text{ mm}$
 t_i Thickness of board layers in direction of mechanical actions
 \bar{t}_i Thickness of board layers perpendicular to direction of mechanical actions
 V Shear force

Under the terms of the technical beam theory the following equations may be used.

Moment of inertia

$$I_{\text{net}} = \frac{T \cdot H^3}{12}$$

Section modulus

$$W_{\text{net}} = \frac{T \cdot H^2}{6}$$

Shear strength

$$\tau_{v,d} = \text{Maximum} \begin{cases} \frac{3}{2} \cdot \frac{V_d}{A_{x,\text{net}}} \\ \frac{3}{2} \cdot \frac{V_d}{A_{z,\text{net}}} \end{cases}$$

$$A_{x,\text{net}} = H \cdot \sum_i \bar{t}_i$$

$$A_{z,\text{net}} = H \cdot \sum_i t_i$$