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European Technical Assessment

ETA-16/0055 of 15.03.2016

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	RadiusHolz
Product family to which the construction product belongs	Solid wood slab elements to be used as structural elements in buildings
Manufacturer	Holzbau Unterrainer Schlaitenstraße 2 9951 Ainet Austria
Manufacturing plant	Holzbau Unterrainer Schlaitenstraße 2 9951 Ainet Austria
This European Technical Assessment contains	16 pages including 4 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”, Edition March 2015

Remarks

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document and should be identified as such.

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Specific parts

1 Technical description of the product

1.1 RadiusHolz

This European Technical Assessment (ETA) applies to the cross laminated timber "RadiusHolz". RadiusHolz is made of softwood boards which are bonded together in order to form plane and curved cross laminated timber. 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 1 to Figure 3. Surfaces are planned.

The solid wood slab elements consist of at least five and up to nine adjacent layers which are arranged perpendicular to each other. With regard to the thickness of the cross laminated timber, thickness and orientation of individual layers are symmetrically assembled.

RadiusHolz and the boards for its manufacturing correspond to the specifications given in the Annexes 1 and 2. The material characteristics, dimensions and tolerances of RadiusHolz, not indicated in these Annexes, are given in the technical file[1] 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.

1.2.2 Adhesive

The adhesive for bonding RadiusHolz shall conform to EN 301 or EN 15425.

Normally, a PU adhesive is used.

1.3 Wood

Wood species is European spruce or equivalent softwood.

[1] 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.

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

2.1 Intended use

RadiusHolz is intended to be used as a structural or non-structural element in buildings and timber structures.

RadiusHolz shall be subjected to static and quasi static actions only.

RadiusHolz is intended to be used in service classes 1 and 2 according to EN 1995-1-1[2]. 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

RadiusHolz is 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 may be jointed in longitudinal direction by means of finger joints, according to EN 14080. There shall be no butt joints.

Adhesive shall be applied on one face of each board. The edges of the boards need not to be bonded.

Design

The European Technical Assessment only applies to the manufacture and use of cross laminated timber 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 cross laminated timber 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 elements.
- Cross laminated timber elements are installed correctly.

Design of the cross laminated timber elements can be according to EN 1995-1-1 and EN 1995-1-2, 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.

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.

[2] Reference documents are listed in Annex 4.

2.3 Assumed working life

The provisions made in the European Technical Assessment (ETA) are based on an assumed intended working life of RadiusHolz of 50 years, when installed in the works, provided that the cross laminated timber 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 experience[3].

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 reference to the methods used for its assessment

3.1 Essential characteristics of the product

Table 1: Essential characteristics of the product and product performance

№	Essential characteristic	Product performance
Basic Works Requirement 1: Mechanical resistance and stability [1)]		
1	Bending [2)]	Annex 2
2	Tension and compression [2)]	Annex 2
3	Shear [2)]	Annex 2
4	Embedment strength	Annex 2
5	Creep and duration of the load	Annex 2
6	Dimensional stability	Annex 2
7	In-service environment	Annex 2
8	Bond integrity	Annex 2
Basic Works Requirement 2: Safety in case of fire		
9	Reaction to fire	Annex 2
10	Resistance to fire	No performance assessed
Basic Works Requirement 3: Hygiene, health and the environment		
11	Content, emission and/or release of dangerous substances	3.1.1
12	Water vapour permeability – Water vapour transmission	Annex 2
Basic Works Requirement 4: Safety and accessibility in use		
13	Impact resistance	Annex 2
Basic Works Requirement 5: Protection against noise		
14	Airborne sound insulation	No performance assessed
15	Impact sound insulation	No performance assessed
16	Sound absorption	No performance assessed

[3] 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.

Basic Works Requirement 6: Energy economy and heat retention		
17	Thermal conductivity	Annex 2
18	Air permeability	No performance assessed
19	Thermal inertia	Annex 2
[1)] These characteristics also relate to BWR 4. [2)] Load bearing capacity and stiffness regarding mechanical actions perpendicular to and in plane of the solid wood slab element.		

3.1.1 Hygiene, health and the environment

The release of dangerous substances is determined according to the European Assessment Document EAD 130005-00-0304 “Solid wood slab element to be used as a structural element in buildings”, Edition March 2015. No dangerous substances is the performance of the RadiusHolz elements in this respect. A manufacturer’s declaration to this effect has been submitted.

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 cross laminated timber elements for the intended use 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 1 to 6 of Regulation (EU) № 305/2011 has been made in accordance with *European Assessment Document EAD 130005-00-0304 “Solid wood slab element to be used as a structural element in buildings”.*

3.2.2 Identification

The European Technical Assessment for RadiusHolz is issued on the basis of agreed data, deposited with Österreichisches Institut für Bautechnik, which identifies the product that has been assessed. Changes to materials, to the composition or to characteristics of the product, or to the production process, which could result in this deposited data being incorrect, should be immediately notified to Österreichisches Institut für Bautechnik before the changes are introduced. Österreichisches Institut für Bautechnik will decide whether or not such changes affect the European Technical Assessment, and, if so, whether further assessment or alterations to the European Technical Assessment are considered necessary.

4 Assessment and verification of constancy of performance (thereafter 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/EC the system of assessment and verification of constancy of performance to be applied to RadiusHolz is 1. As laid down in the Commission Delegated Regulation (EU) № 568/2014 of 18 February 2014, Annex, 1.2, under System 1 the manufacturer shall draw up the declaration of performance and determine the product-type on the basis of

(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 plan[4];

(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 AVCP for 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).

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable European Assessment Document

5.1 Tasks for the manufacturer

5.1.1 Factory production control

At the manufacturing plant the manufacturer has implemented and continuously maintains a factory production control system. All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written policies and procedures. The factory production control system ensures that the performance of the cross laminated timber elements is in conformity with the European Technical Assessment.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan. The incoming raw materials shall be subject to controls and tests by the manufacturer before acceptance. Check of incoming materials shall include control of inspection documents (comparison with nominal values) presented by the manufacturer of the raw materials by verifying the dimensions and determining the material properties.

The frequencies of controls and tests conducted during manufacturing and on the assembled product are defined by taking account of the manufacturing process of the product and are laid down in the prescribed test plan.

The results of factory production control are recorded and evaluated. The records include at least the following data:

- Designation of the product, basic materials and components
- Type of control or test
- Date of manufacture of the product and date of testing of the product or basic materials or components
- Results of controls and tests and, if appropriate, comparison with requirements

[4] 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.

- Name and signature of person responsible for factory production control

The records shall be kept at least for ten years time after the construction product has been placed on the market and shall be presented to the notified product certification body involved in continuous surveillance. On request they shall be presented to Österreichisches Institut für Bautechnik.

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 ascertain that, in accordance with the prescribed test plan, the factory, in particular personnel and equipment, and the factory production control, are suitable to ensure a continuously and orderly manufacturing of RadiusHolz with the specifications given in the specific parts as well as in the Annexes of the European Technical Assessment.

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 surveillance. It shall be verified that the system of factory production control and the specified manufacturing process are maintained, taking account of the prescribed test plan. On demand the results of continuous surveillance shall be made available by the notified product certification body to Österreichisches Institut für Bautechnik. When the provisions of the European Technical Assessment and the prescribed test plan are no longer fulfilled, the certificate of constancy of performance shall be withdrawn by the notified product certification body.

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by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits

Managing Director

Figure 1: Principle structure of the solid wood slab

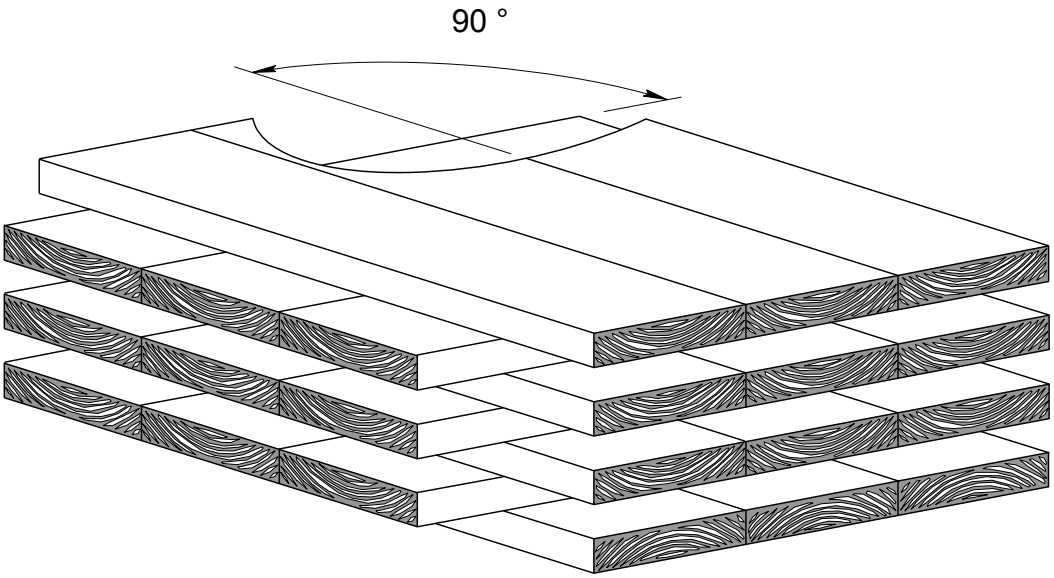
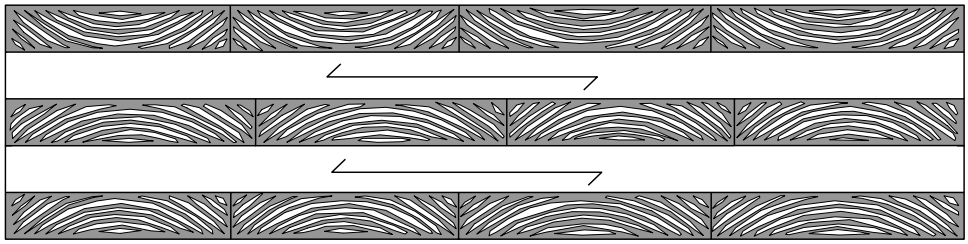


Figure 2: Principle structure of cross laminated timber with 5 layers



RadiusHolz	Annex 1
Structure of cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

Figure 3: Principle structure of curved cross laminated timber

RadiusHolz	Annex 1
Structure of cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

Table 2: Dimensions and specifications

Characteristic		Dimension / Specification
Cross laminated timber		
Thickness	mm	45 to 224
Width	m	≤ 3.0
Length	m	≤ 15.0
Number of layers	—	3 to 9 symmetric assembly
Maximum width of joints between boards within one layer	mm	3
Board		
Surface	—	planed
Thickness (planed dimension)	mm	15 to 40
Maximum finished thickness for curved cross laminated timber	mm	$t \geq \frac{r}{250}\left(1+\frac{f_{m,j,k}}{80}\right)$ 1)
Width	mm	80 to 180
Ratio width to thickness	—	≥ 4 : 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.	—	≥ 90 % C24 2) ≤ 10 % C18 2)
Moisture of wood according to EN 13183-2	%	8 to 15 % Within one member of cross laminated timber the moisture content shall not differ by more than 5 %.
Finger joints	—	EN 14080

1) r radius of the board with the smallest radius in mm
$f_{m,j,k}$ declared characteristic bending strength of the finger joints in MPa
2) or equivalent T-classes according to EN 14080

RadiusHolz	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

Table 3: Product characteristics of the solid wood slab

BR	Essential characteristic	Method of verification	Level / Class / Description	
1	**Mechanical resistance and stability**			
	1. Mechanical actions perpendicular to cross laminated timber			
	Strength class of boards	EN 338	see Table 2	
	Modulus of elasticity		curved	plane
	– parallel to the grain of the boards $E_{0,\,mean}$	I_{eff}, Annex 3 EAD 130005-00-0304, 2.2.1.1	10 200 MPa [1]	11 550 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 (rolling shear modulus) $G_{9090,\,mean}$	EAD 130005-00-0304, 2.2.1.1	50 MPa	
	Bending strength			
	– parallel to the grain of the boards $f_{m,\,k}$	W_{eff}, Annex 3 EAD 130005-00-0304, 2.2.1.1	$1/k_{sys} \cdot 26.4$ MPa [2]	
	Tensile strength			
	– perpendicular to the grain of the boards $f_{t,\,90,\,k}$	EN 338, reduced	0.15 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	2.3 MPa	
	– perpendicular to the grain of the boards (rolling shear strength) $f_{v,\,9090,\,k}$	A_{gross}, Annex 3 EAD 130005-00-0304, 2.2.1.3	1.25 MPa	

NOTE [1] 1 MPa = 1 N/mm²

[2] $k_{sys} = \max\begin{cases} 1{,}1 - 0{,}025 \cdot n \\ 1 \end{cases}$ n … number of boards within cover layer

RadiusHolz	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

BR	Essential characteristic	Method of verification	Level / Class / Description	
1	**Mechanical resistance and stability**			
	2. Mechanical actions in plane of cross laminated timber			
	Strength class of boards	EN 338	see Table 2	
	Modulus of elasticity – parallel to the grain of the boards $E_{0,\,mean}$	A_{net}, I_{net}, Annex 3 EAD 130005-00-0304, 2.2.1.1	curved 10 200 MPa	plane 11 550 MPa
	Shear modulus – parallel to the grain of the boards $G_{090,\,mean}$	A_{net}, Annex 3 EAD 130005-00-0304, 2.2.1.3	curved 570 MPa	plane 690 MPa
	Bending strength – parallel to the grain of the boards $f_{m,\,k}$	W_{net}, Annex 3 EAD 130005-00-0304, 2.2.1.1	24 MPa	
	Tensile strength – parallel to the grain of the boards $f_{t,\,0,\,k}$	EN 338	14 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 $f_{v,\,090,\,k}$	A_{net}, Annex 3 EAD 130005-00-0304, 2.2.1.3	2.7 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.			
	Fasteners	EN 1995-1-1, the direction of grain of the cover layer shall be taken as reference		

BR	Essential characteristic	Method of verification	Level / Class / Description
	In-service environment		
	Durability of timber Service classes	EN 1995-1-1	1 and 2
	Bond integrity	EAD 130005-00-0304	Pass
2	**Reaction to fire**		
	Glued laminated timber products	Commission Decision 2005/610/EC	Mean density of wood ≥ 380 kg/m³ Euroclass D-s2, d0
3	**Hygiene, health and environment**		
	Vapour permeability, μ, of timber	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 and minimum thickness of 60 mm.	
6	**Energy economy and heat retention**		
	Thermal conductivity, λ	EN ISO 10456	0.13 W/(m·K)
	Thermal inertia, specific heat capacity c_p	EN ISO 10456	1600 J/(kg·K)

RadiusHolz	Annex 2
Characteristic data of cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

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

General

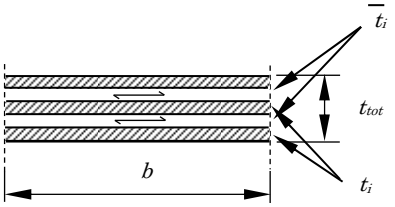
Due to the perpendicular orientation of the boards, cross laminated timber is able to transfer loads in all directions according to its condition of support. For cross laminated timber multi-axle stressed in both principal directions, different stiffness for the two principal directions shall be considered.

For calculation of the characteristic values of the 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.

For curved elements the verification of the bending stress as well as interaction of transverse stress and shear shall be performed according to EN 1995-1-1, 6.4.3.

Mechanical actions perpendicular to cross laminated timber



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 $\frac{\bar{t}_i}{G_{9090} \cdot b}$.

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

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

$$A_i = b \cdot t_i$$

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

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

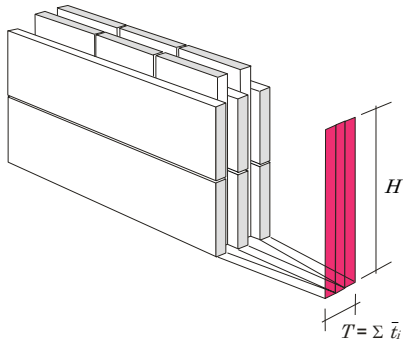
$$A_{gross} = b \cdot t_{tot}$$

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 MPa
b ..... width of the member of cross laminated timber

RadiusHolz	Annex 3
Design considerations for cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

Mechanical actions in plane of the solid wood slab



Where
$H \leq 400$ 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

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

Section modulus

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

Shear strength

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

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

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

RadiusHolz	Annex 3
Design considerations for cross laminated timber	of European Technical Assessment ETA-16/0055 of 15.03.2016

European Assessment Document EAD 130005-00-0304 “Solid wood slab element to be used as a structural element in buildings”, Edition March 2015

EN 301 (10.2013), Adhesives, phenolic and aminoplastic, for load-bearing timber structures – Classification and performance requirements

EN 338 (10.2009), Structural timber – Strength classes

EN 1995-1-1 (11.2004), +AC (06.2006), +A1 (06.2008), +A2 (05.2014), Eurocode 5 – Design of timber structures – Part 1-1: General – Common rules and rules for buildings

EN 1995-1-2 (11.2004), +AC (06.2006), +AC (03.2009), Eurocode 5 – Design of timber structures – Part 1-2: General – Structural fire design

EN 13183-2 (04.2002), Moisture content of a piece of sawn timber –Part 2: Estimation by electrical resistance method

EN 14080 (06.2013), Timber structures – Glued laminated timber and glued solid timber – Requirements

EN 15425 (02.2008), Adhesives – One component polyurethane for load bearing timber structures – Classification and performance requirements

EN ISO 10456 (12.2007), +AC (12.2009), Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values

RadiusHolz	Annex 4
Reference documents	of European Technical Assessment ETA-16/0055 of 15.03.2016