



## EUROPEAN ASSESSMENT DOCUMENT

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# LAMINATED SEGMENT TIMBER WITH RECTANGULAR CROSS SECTION MADE FROM RADIALY CUT LOGS

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

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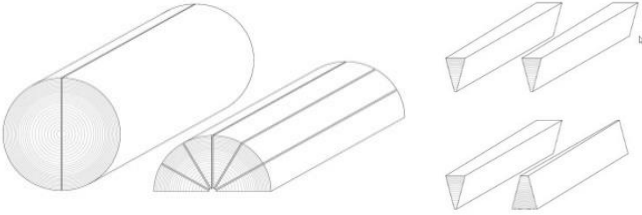
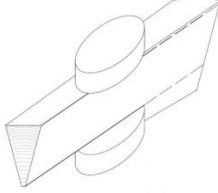
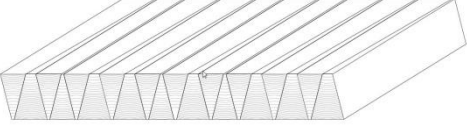
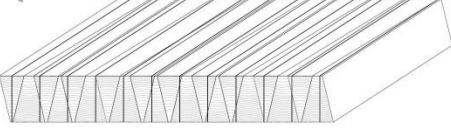
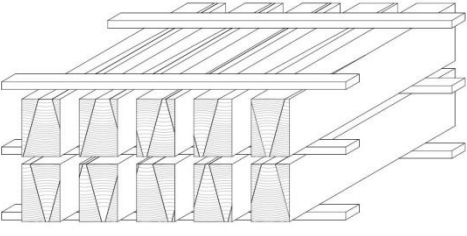
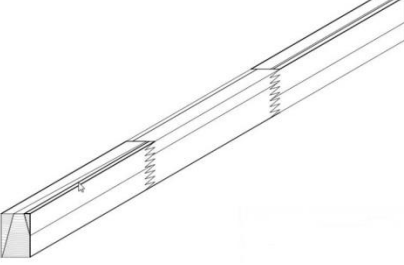
# 1 SCOPE OF THE EAD

## 1.1 Description of the construction product

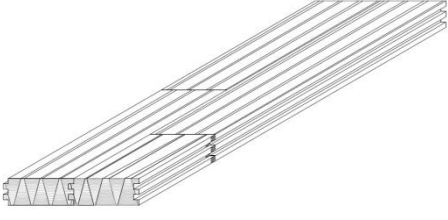
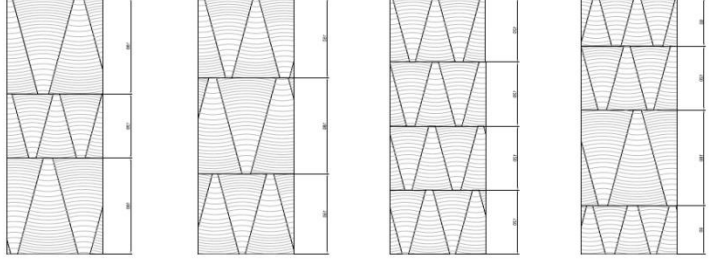
The product, “Laminated segment timber” (timber beams made from radially cut logs) is a structural timber with rectangular cross section with defined characteristic strength and stiffness properties to be used in the design methods given in EN 1995-1-1<sup>1</sup>. Each laminated segment timber member will be made of lamellas of the same strength class.

The product is made from European spruce and fir in a specific way, influencing the product properties and not covered by standards:

Table 1.1: Production

<p>Cutting from logs visually or machine graded</p>	
<p>planing of the segments</p>	
<p>gluing after surface drying</p>	
<p>re-cutting</p>	
<p>kiln drying</p>	
<p>finger jointing and planing: <b>Beams (SLH)</b></p>	

<sup>1</sup> All undated references to standards or to EADs in this EAD are to be understood as references to the dated versions listed in clause 4

profiling: <b>Decking elements SLD</b>	
block gluing: <b>Solid SSH</b>	

The EAD applies to products that are:

- Without preservative treatment,
- Without flame retardant and
- Exclusively made in virgin wood; no recycled wood is used.

Segments are glued with one of the following structural adhesives:

- Adhesives type I 70 GP 0,3 w according to EN 15425 and EN 14080, Annex B.2.

Finger joints and glued solid timber are glued with one of the following structural adhesives:

- Adhesives type I tested according to EN 301 or EN 15425 for the application area given in EN 301 table 1 or EN 15425 table 1.

The product is not covered by a harmonised European standard (hEN). The product is not a deviation from any existing harmonized technical specification.

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.

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.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

## 1.2 Information on the intended use(s) of the construction product

### 1.2.1 Intended use(s)

Laminated segment timber made from radially cut logs is intended for load bearing uses in buildings and civil engineering works.

The product is subjected to static and quasi static actions only.

The product is intended to be used in service class 1 or 2 according to EN 1995-1-1.

### 1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the strength graded and steam-cured structural timber for the intended use of 50 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works<sup>2</sup>.

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 when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

## 1.3 Specific terms used in this EAD (if necessary in addition to the definitions in CPR, Art 2)

### 1.3.1 Segments

12 equal leg triangle pieces of timber are cut from graded logs with 3 - 4 m length. These pieces are planed on two sides, the pith side and the bark side, in order to form symmetric trapezoids (segments) with a height between 90 and 180 mm. The lengths of the segments are between 3 and 4 m.

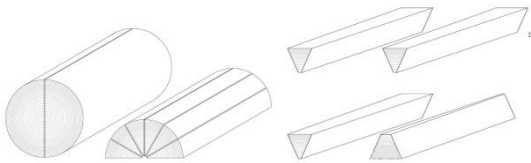


Figure 1: Segments

### 1.3.2 Wood billet

A wood billet consists of segments oriented alternating and glued in a continuous process.

### 1.3.3 Wet-gluing

Before gluing the segments to a wood slab only the surfaces of the segments are pre-dried by a stream of heated air

### 1.3.4 Re-cutting

The wood slabs are re-cut into lamellas or slab elements with rectangular cross section and a width at least 50 % of the height. After re-cutting the lamellas are kiln-dried to adequate wood moisture content.

### 1.3.5 Finger-jointing of the lamellas and planing

The pre-dried lamellas are finger-jointed to an endless string and then cut before subsequent planing.

<sup>2</sup> The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

### **1.3.6 Lamellas**

Lamellas may be used as single timber beams (designated SLH) or be glued to timber slabs (designated SLD) or to glued solid timber (designated SSH).

### **1.3.7 Glued solid timber**

Glued solid timber in this context is made from lamellas and may consist of lamellas with different heights.

## 2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

### 2.1 Essential characteristics of the product

Table 2.1 shows how the performance of the laminated segment timber (lamellas and glued laminated timber) is assessed in relation to the essential characteristics.

**Table 2.1: Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics**

No	Essential characteristic	Method of assessment	Type of expression of product performance
<b>Basic Works Requirement 1: Mechanical resistance and stability</b>			
1	Bending strength	2.2.1	Level
2	Tension strength parallel to grain	2.2.2	Level
3	Tension strength perpendicular to grain	2.2.3	Level
4	Compression strength parallel to grain	2.2.4	Level
5	Compression strength perpendicular to grain	2.2.5	Level
6	Shear strength	2.2.6	Level
7	Modulus of elasticity parallel to grain	2.2.7	Level
8	Modulus of elasticity perpendicular to grain	2.2.8	Level
9	Shear modulus	2.2.9	Level
10	Density	2.2.10	Level
11	Bond integrity of finger joints	2.2.11	Description
12	Dimensional stability	2.2.12	Level
13	Durability of bonding strength	2.2.13	Level
<b>Basic Works Requirement 2: Safety in case of fire</b>			
14	Reaction to fire	2.2.14	Class

### 2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

For the assessment of the below mentioned characteristics, the following general provisions apply:

- The sizes for the specimens of the lamellas and the glued solid timber shall cover the whole size range.
- For assessment of the characteristics in Clauses 2.2.1 to 2.2.10 each sub-sample shall consist of at least 40 specimens and be of one source (if specific clause does not specify otherwise).



- For bending tests, specimens shall have sufficient length so that critical defects can be located in the critical test zone.

### **2.2.1 Bending strength**

The tests with SLH and SLD are carried out in accordance with Clause 19 of EN 408. The tests are performed with finger joints in both radial and tangential direction.

Calculation of the characteristic value of the lamellas is performed according to Clauses 5.4 and 5.5 of EN 384 and the level is stated in the ETA.

Tests with glued solid timber (SSH) shall be carried out in accordance with EN 14080, Annex F.

### **2.2.2 Tension strength parallel to grain**

Calculation of the characteristic tension strength of the lamellas (SLH and SLD) is performed according to EN 384, Table 2.

The characteristic tension strength in direction of the grain of the glued solid timber (SSH) are taken from EN 338 for the respective strength class of the glued solid timber (see EN 14080, clause 5.2.5.3) and the level is stated in the ETA.

20 tensile tests with one exemplary cross section are performed additionally according to EN 408 to confirm the calculation of the characteristic tensile strength based on the bending strength.

If more than 5% of the tension test results are below the calculated value, further tests in accordance with EN 408 have to be carried out (40 tests for each influencing parameter). From these tests the characteristic values for the ETA have to be derived.

The characteristic value of the tension strength parallel to the grain is stated in the ETA.

### **2.2.3 Tension strength perpendicular to grain**

Calculation of the characteristic tension strength of the lamellas (SLH and SLD) is performed according to EN 384, Table 2.

The characteristic tension strength in direction perpendicular to the grain of the glued solid timber (SSH) are taken from EN 338 for the respective strength class of the glued solid timber (see EN 14080, clause 5.2.5.3) and the level is stated in the ETA.

Note: According to EN 14080 the tensile strength perpendicular to the grain of glued laminated timber is independent of the strength class. The same applies to laminated segment timber because it is cut from the same logs as the boards for glued laminated timber. The above method is the reference method. The assessment can also be based on tests in accordance with EN 408, which is considered to be equivalent to the above method.

### **2.2.4 Compression strength parallel to grain**

Calculation of the characteristic compression strength of the lamellas (SLH and SLD) is performed according to EN 384, Table 2.

The characteristic compression strength in direction of grain values of the glued solid timber (SSH) are taken from EN 338 for the respective strength class of the glued solid timber (see EN 14080, clause 5.2.5.3) and the level is stated in the ETA.

20 compression tests with one exemplary cross section are performed additionally according to EN 408 to confirm the calculation of the characteristic compression strength based on the bending strength. This assessment method is the reference method.

The assessment can be based solely on tests in accordance with EN 408, and the result is considered to be equivalent to the reference method.

### **2.2.5 Compression strength perpendicular to grain**

According to EN 14080 the characteristic compression strength perpendicular to direction of grain is assumed to 2,5 N/mm<sup>2</sup>.

Note: According to EN 14080 the compression strength perpendicular to the grain of glued laminated timber is independent of the strength class. The same applies to laminated segment timber because it is cut from the same logs as the boards for glued laminated timber. The above method is the reference method. The assessment can also be based on tests in accordance with EN 408, which is considered to be equivalent to the above method.

### **2.2.6 Shear strength**

According to EN 14080 the characteristic shear strength is assumed to 3,5 N/mm<sup>2</sup>.

Note: The basis for the applicability of the tabulated value in EN 14080 is that the shear strength of glued laminated timber is independent of the strength class. The same applies to laminated segment timber because it is cut from the same logs as the boards for glued laminated timber.

### **2.2.7 Modulus of elasticity parallel to grain**

The tests are carried out in accordance with Clause 9 of EN 408. The tests are performed with finger joints in both radial and tangential direction.

Calculation of the mean value is performed according to Clauses 5.5 of EN 384.

Calculation of the characteristic value of the modulus of elasticity parallel to grain is performed according to EN 384:2016, Table 2.

The characteristic values are stated in the ETA.

### **2.2.8 Modulus of elasticity perpendicular to grain**

According to EN 14080 the mean (characteristic) modulus of elasticity perpendicular to grain is assumed as 300 (250) N/mm<sup>2</sup>.

Note: The modulus of elasticity perpendicular to grain is independent of the strength class. The same applies to laminated segment timber because it is cut from the same logs as the boards for glued laminated timber. The modulus of elasticity perpendicular to grain of the glued solid timber is taken from EN 338 for the respective strength class of the glued solid timber (see EN 14080:2013, clause 5.2.5.3) and the characteristic values are stated in the ETA. The above method is the reference method. The assessment can also be based on tests in accordance with EN 408, which is considered to be equivalent to the above method

### **2.2.9 Shear modulus**

According to EN 14080:2013 the mean (characteristic) shear modulus is assumed as 650 (540) N/mm<sup>2</sup>.

Note: The shear modulus is independent of the strength class. The same applies to laminated segment timber because it is cut from the same logs as the boards for glued laminated timber.

The shear modulus of the glued solid timber is taken from EN 338 for the respective strength class of the glued solid timber (see EN 14080, clause 5.2.5.3) and the characteristic values are stated in the ETA. The above method is the reference method. The assessment can also be based on tests in accordance with EN 408, which is considered to be equivalent to the above method

### **2.2.10 Density**

The tests are carried out in accordance with Clause 5.3.4 of EN 384

Calculation of the mean value shall be performed with the densities of the individual specimens determined according to Clause 5.3.4 of EN 384

Calculation of the characteristic value of density as 5 % percentile shall be performed according to Clause 5.4 and 5.5 of EN 384

The characteristic values are stated in the ETA.

### 2.2.11 Bond integrity of finger joints

The tests are carried out in accordance with Annex F of EN 14080.

The characteristic values are stated in the ETA.

### 2.2.12 Dimensional stability

#### Tolerances of dimensions

The tolerances of the glued laminated timber beams shall be in accordance with table 12 of EN 14080, and the tolerances shall be stated in the ETA.

#### Stability of dimensions

Dimensional stability is considered as swelling and shrinkage due to changes of its moisture content. Hence the swelling and shrinkage value may be regarded as constant values in the perpendicular to grain and parallel to grain directions as given in EN 14080, table 14.

The moisture content at delivery and the nominal dimensions is stated in the ETA.

### 2.2.13 Durability of bonding strength

#### 1. Resistance to delamination and creep

Only one-component polyurethane adhesives which are classified as EN 15425 I 70 GP 0,3 according to EN 15425 are covered by this EAD. In addition, the adhesive is tested according to EN 15416-4 and EN 15416-5.

Assessment of applicability for wet gluing is required by assessment of the properties of performance of bond-lines produced under perused conditions and to be consistent with the estimated working life described in section 1.2.2 of this EAD.

- 1.) Delamination tests on laminated segment timber produced under industrial conditions with a moisture content in the vicinity of the bond-lines of 18 to 24% shall be performed using the high temperature procedure for type I adhesives according to EN 302-2. The size of the specimens for the delamination tests shall be equal or larger than the specimens given in EN 302-2.
- 2.) Creep deformation tests at cyclic climate conditions with specimens loaded in bending shear referring to EN 15416-3 shall be performed. The specimens for the creep tests shall be cut out of defect free parts of laminated segment timber produced under industrial conditions with a moisture content in the vicinity of the bond-lines of 18 to 24%. The orientation of the annual ring differs from the specimen described standard. Reference specimens shall be produced of similar timber (density and annual ring orientation) as the test specimens with a glue line thickness of 0.3 mm using a PRF adhesive under conditions given in EN 15416-3.

Because the curing period of these adhesives will be influenced due to the excess of water the adhesive use properties such as minimum pressure time referring to EN 15416-5 and the open assembly time referring to EN 15416-4 will be determined covering the conditions given in the industrial process.

Bonding pressure and minimum spread rate are determined in the assessment procedure.

Note. The minimum value of bonding pressure, minimum and maximum values of open and closed assembly time and minimum spread rate are stated in the ETA. The maximum time between cutting of segments and the gluing after surface drying is stated in the ETA.

#### 2. Ratio of the relative creep to the creep deformation

The glued laminated timber made from segment timber are tested in accordance with EN 302-2 and EN 15416-3. The maximum delamination referring to EN 302-2 is not more than 5% of total bond-line length according to the requirements given in EN 15425 table 4. The maximum average ratio of the relative creep to the creep deformation test referring to EN 15416-3 shall be matched the requirements given in EN 15425 table 5 for general purpose and to be consistent with the estimated working life described in section 1.2.2 of this EAD.

The performance of the adhesive is stated in the ETA in accordance with EN 15425 table 1.

#### **2.2.14 Reaction to fire**

The beams are considered to satisfy the requirements for performance class D-s2, d0 of the characteristic reaction to fire in accordance with the EC Decision 2005/610/EC without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

The beams not covered by the above decision shall be tested, using the test method(s) referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified according to Commission Delegated Regulation (EU) No 2016/364.

### 3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

#### 3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is: Decision 97/176/EC as amended by 2001/596/EC.

The system is: 1 for all uses.

#### 3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.1.

**Table 3.1 Control plan for the manufacturer; cornerstones**

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Factory production control (FPC)</b>					
1	Strength grading of logs				
2	Resistance to delamination	EN 302-2	Specified in control plan	2	per 20m <sup>3</sup> or (minimum) per shift, adhesive system, press and species
3	Finger joints	EN 15497	Specified in control plan	EN 15497 Tab 4	EN 15497
4	Bonding strength of glue lines in glued laminated timber or glued solid timber	EN 14080	Specified in control plan	EN 14080, Tab. 16	EN 14080, Tab. 16
5	Resistance to delamination and creep	See 2.2.13	Specified in control plan	See 2.2.13	See 2.2.13
6	Ratio of the relative creep to the creep deformation	See 2.2.13	Specified in control plan	See 2.2.13	See 2.2.13

### 3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for laminated segment timber are laid down in Table 3.2.

In this case the cornerstones of the tasks to be undertaken by the notified body under AVCP system 1 are laid down in Table 3.2.

**Table 3.2 Control plan for the notified body; cornerstones**

Subject/type of control (product, raw/constituent material, component - indicating characteristic concerned)	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
<b>Initial inspection of the manufacturing plant and of factory production control</b>				
The Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing.	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
<b>Continuous surveillance, assessment and evaluation of factory production control</b>				
The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in table 3.1	According to Control plan	According to Control plan	1/year

## 4 REFERENCE DOCUMENTS

EN 301:2017	Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements
EN 302-2:2017	Adhesives for load-bearing timber structures-Test methods-Part 2: Determination of resistance to delamination
EN 338:2016	Structural timber – Strength classes
EN 384:2016+A1:2018	Structural timber – Determination of characteristic values of mechanical properties and density
EN 408:2010+A1:2012	Timber structures – Structural timber and glued laminated timber – Determination of some physical and mechanical properties
EN 1912:2012	Structural Timber – Strength classes — Assignment of visual grades and species
EN 1995-1-1:2004/A2:2014	Eurocode 5 – Design of timber structures — Part 1-1: General – Common rules and rules for buildings
EN 14080:2013	Timber structures – Glued laminated timber and glued solid timber – Requirements
EN 15416-3:2017+A1:2019	Adhesives for load bearing timber structures other than phenolic and aminoplastic – Test methods – Part 3: Creep deformation test at cyclic climate conditions with specimens loaded in bending shear
EN 15416-4:2017	Adhesives for load bearing timber structures other than phenolic and aminoplastic – Test methods – Part 4: Determination of open assembly time under referenced conditions
EN 15416-5:2017	Adhesives for load bearing timber structures other than phenolic and aminoplastic – Test methods – Part 5: Determination of minimum pressing time under referenced conditions;
EN 15425:2017	Adhesives – One component polyurethane for load bearing timber structures – Classification and performance requirements
EN 15497:2014	Structural finger jointed solid timber – Performance requirements and minimum production requirements
EN 13501-1 :2018	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests