

British Board of Agrément

Bucknalls Lane
Garston
Watford
Herts WD25 9BA

Tel: + 44 (0) 1923 665300

Fax: + 44 (0) 1923 665301

e-mail: mail@bba.star.co.uk

website: www.bbacerts.co.uk

Authorised and notified according to Article 10 of the Council Directive (89/106/EEC) of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products.



European Technical Approval ETA-09/0283

*Third issue**

Trade name:	Boise BCI Joists
Holder of approval:	Boise Engineered Wood Products Leaffield Technical Centre Langley, Witney Oxfordshire OX29 9EF United Kingdom Tel: + 44 (0)1993 871235 Fax: + 44 (0) 1993 871236 e-mail: boise.ewp.eu@bc.com website: www.bc.com/eu
Generic type and use of construction product:	Light composite wood-based beams and columns for structural use
Valid from:	23 November 2010
to:	31 October 2014
This version replaces:	ETA-09/0283 valid from 5 May 2010 to 31 October 2014
Manufacturing plant:	Alexandria 8835 Highway 1 North Lena Louisiana 71447 USA
This European Technical Approval contains:	12 pages including five Annexes which form an integral part of the document

I LEGAL BASES AND GENERAL CONDITIONS

1 This European Technical Approval is issued by the British Board of Agrément in accordance with:

- Council Directive 89/106/EEC of 21 December 1988 [Construction Products Directive (CPD)] on the approximation of laws, regulations and administrative provisions of Member States relating to construction products⁽¹⁾, modified by the Council Directive 93/68/EEC of 22 July 1993⁽²⁾
- UK implementation of CPD Statutory Instruments 1991, No 1620. The Building and Building Construction Products Regulations 1991 — made 15 July 1991, laid before Parliament 22 July 1991, coming into force 27 December 1991, and amended by the Construction Products (Amendment) Regulations 1994 (Statutory Instruments 1994, No 3051)
- Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC⁽³⁾
- Endorsed Common Understanding of Assessment Procedures (CUAP) request number 03.04/12 for a timber-based column and beam, under Article 9.2 of the CPD.

2 The British Board of Agrément is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and for their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4 This European Technical Approval may be withdrawn by the British Board of Agrément, in particular after information by the Commission on the basis of Article 5(1) of Council Directive 89/106/EEC.

5 Reproduction of this European Technical Approval, including transmission by electronic means, shall be in full. However, partial reproduction can be made with the written consent of the British Board of Agrément. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 The European Technical Approval is issued by the approval body in its official language. This version should correspond to the version circulated within EOTA. Translations into other languages have to be designated as such.

(1) Official Journal of the European Communities No L40, 11.2.1989, p12.

(2) Official Journal of the European Communities No L220, 30.8.1993, p1.

(3) Official Journal of the European Communities No L17, 20.1.1994, p34.

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

Definition of product

Boise BCI Joists are I-joists of composite construction with LVL flanges and OSB webs and are available in a range of sizes (see Annex 1, Figure 1 and Table 1).

The LVL flanges are to EN 14374 : 2004 comprising veneers of southern pine (*Pinus elliottii*, *Pinus taeda*, *Pinus echinata* and *Pinus palustris*) and eucalyptus (*Eucalyptus grandis* and *Eucalyptus saligna*). The OSB web is in accordance with EN 300 : 2006 and BS EN 12369-1 : 2001 and is placed in the beams in sections 1220 mm long. Web-to-web connections consist of a glued butt joint.

The web-to-flange connection is made by glueing the web into a groove in the centre of the wide face of the flange. A two-part emulsified polymer isocyanate polyurethane adhesive (EPI isocyanate adhesive), is used in the web-to-flange joints and a polyurethane emulsion polymer isocyanate adhesive (PEP isocyanate adhesive) is used in web-to-web and flange finger joints.

The components are machine-assembled in one pass.

Intended use

The product is intended for use as a loadbearing component in building structures, eg construction members or frame elements for walls, roofs, floors and trusses where Essential Requirements 1 *Mechanical resistance and stability*, 2 *Safety in case of fire*, 3 *Hygiene, health and environment* and 6 *Energy economy and heat retention* (CPD, Annex 1), apply.

The product is for use in timber structures subject to the dry, internal conditions defined by service classes 1 and 2 of EN 1995-1-1 : 2004 (Eurocode 5) and for members subject to static or quasi-static loading.

The provisions made in this ETA are based on an assumed intended working life for the joist of 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

The performance of structures in seismic zones has not been assessed and is outside the scope of this ETA and, therefore, No Performance Determined (NPD).

2 Characteristics of product and methods of verification

The assessment of fitness for the intended use (see part II, section 1) with regard to Essential Requirements 1 *Mechanical resistance and stability*, 2 *Safety in case of fire*, 3 *Hygiene, health and environment* and 6 *Energy economy and heat retention* has been made in accordance with request number CUAP 03.04/12. The test and assessment procedures were based on ETAG 011 : 2002 *Guideline for European Technical Approval of light composite wood-based beams and columns*. Additional tests and assessment relating to the

performance and properties of the isocyanate adhesive were undertaken.

The product is available in the range given in part II, section 1, and has the characteristics listed in Annex 2.

ER1 Mechanical resistance and stability

The mechanical properties, characteristic load-carrying capacities and modification factors for the products are given in Annex 2 which have been derived in accordance with ETAG 011. Details for incorporation of holes in the web and axial loading respectively are given in Annexes 4 and 5. They should be used for designs in accordance with EN 1995-1-1 : 2004 (Eurocode 5). The load-carrying capacities have been derived by calculation and calculation assisted by test.

The properties for a range of preferred sizes are given in Annex 2, Table 1. Properties for joist depths between 220 mm and 406 mm can be derived using the protocol given in Annex 3.

ER2 Safety in case of fire

In relation to reaction to fire, the joist materials are classified as D-s2, d0, in accordance with EN 13501-1 : 2007 by reference to EN 13986 and EC Decision 2003/43/EC.

Performance in relation to fire resistance would be determined for the complete structural element with any associated finishes, hence, for this Essential Requirement there are no aspects of performance relevant to a joist and, therefore NPD.

ER3 Hygiene, health and environment

According to the manufacturer's declaration, the product specification has been compared with the dangerous substances detailed in Council Directive 76/769/EEC (as amended) and listed on the database established on the EC construction website to verify that it does not contain such substances above the acceptable limits.

In accordance with EN 300 : 2006, the OSB web is designated Class E1 and the LVL flanges are classified as E1 in accordance with EN 14374 : 2004 with regard to extractable formaldehyde content.

The joists do not contain used wood or pentachlorophenol, and are not preservative-treated.

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

ER4 Safety in use

Not relevant to this product.

ER5 Protection against noise

Not relevant to this product.

ER6 Energy economy and heat retention

Hygrothermal properties in accordance with EN 12524 : 2000, are given in Annex 2, Table 5. The natural

variation of the materials has been accounted for in these values.

Aspects of durability, serviceability and identification

The joists can be used in service classes 1 and 2 as described in Eurocode 5 and in Hazard Classes 1 and 2 as specified in EN 335-1 : 1992. The products may be exposed directly to the weather for a short time during installation.

Attack from insects such as house longhorn beetle, dry wood termites and woodworm may reduce the durability of the product.

The ability of the product to resist loads without undue deflection (serviceability) is dealt with in the section headed *ER1 Mechanical resistance and stability*.

The product bears the manufacturer's identification mark, the product type and the CE Marking as described in section 3.3.

3 Evaluation of Conformity and CE Marking

3.1 Attestation of Conformity system

The system of attestation of conformity applied to this product shall be that laid down in the CPD, Annex III, 2(i) (referred to as System 1).

3.2 Responsibilities

3.2.1 Tasks for the manufacturer, factory production control

The manufacturer continues to operate a factory production control system. All elements, requirements and provisions adopted by the manufacturer are documented to ensure that product conforms with this ETA.

The manufacturer shall only use raw materials supplied with the relevant inspection documents as laid down in the prescribed test plan⁽⁴⁾. The raw materials shall be subject to controls and tests by the manufacturer before acceptance. Checks on incoming materials shall include control of the certificates of conformity presented by suppliers (comparison with nominal values) by verifying dimensions and determining material properties.

The manufactured joists are checked for:

- flange and web material
- dimensional accuracy
- visual quality
- glue spread
- fit of component parts
- bondline thickness (indirect)
- strength of completed joist.

The frequency of controls and tests conducted during production and on the assembled joist is laid down in the prescribed test plan, taking account of the manufacturing process of the joist.

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

(4) The prescribed test plan has been deposited with the British Board of Agrément and is only made available to the approved bodies involved in the conformity attestation procedure.

- designation of the product, basic material and components
- type of control or testing
- date of manufacture of the product and date of testing of the product or basic material and components
- result of control and testing and, if appropriate, comparison with requirements
- signature of person responsible for factory production control.

The records shall be presented to the inspection body involved in the continuous surveillance.

Details of the extent, nature and frequency of testing and controls to be performed within the factory production control shall correspond to the prescribed test plan included in the technical documentation of this European Technical Approval.

3.2.2 Declaration of conformity

The manufacturer shall make a declaration in accordance with the requirements of this European Technical Approval.

3.2.3 Tasks for approved bodies

3.2.3.1 Initial type-testing of the product

For initial type-testing, the results of the tests performed as part of the assessment for the European Technical Approval shall be used unless there are changes in the production line or plant. In such cases the necessary type-testing has to be agreed between the British Board of Agrément and the approved body involved.

3.2.3.2 Initial inspection of factory and of factory production control

The approved body shall ascertain that, in accordance with the prescribed test plan, the factory, in particular the staff and equipment, and the factory production control, are suitable to ensure a continuous and orderly manufacturing of the joist with the specifications given in part II, section 2.

3.2.3.3 Continuous surveillance

The approved body shall visit the factory at least twice per year for routine inspections. It shall be verified that the system of factory production control and the specified manufacturing processes are maintained, taking account of the prescribed test plan.

The results of product certification and continuous surveillance shall be made available on demand by the certification body to the British Board of Agrément. Where the provisions of the European Technical Approval and the prescribed test plan are no longer fulfilled, the certificate of conformity shall be withdrawn by the certification body.

3.3 CE Marking

The CE Marking⁽⁵⁾ shall be affixed to each joist and/or the accompanying documentation. The CE symbol shall be accompanied by the following information:

- identification number of the certification body
- identification of the product
- name or identification mark of producer and the registered address of the producer
- the last two digits of the year in which the CE Marking was affixed
- number of the EC Certificate of Conformity
- number of the European Technical Approval.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The product is manufactured in accordance with the provisions of the European Technical Approval, using the manufacturing processes as identified in the inspection of the plant by the British Board of Agrément and the approved body and as laid down in the technical documentation.

4.2 Installation

A joist is deemed fit for its intended use provided:

- it is designed in accordance with Eurocode 5 or an appropriate national code using the design data given in Annex 2, Tables 1 to 4 or Annex 3. Design and detailing of structures should be carried out by a suitably experienced person in accordance with the manufacturer's instructions and the requirements of this ETA
- verifiable calculation, notes and drawings are prepared taking account of the loads to be resisted
- the minimum end bearing length shall be 45 mm and the minimum intermediate bearing length shall be 90 mm.

4.3 Criteria

The fitness for use of the joist can be assumed if it is installed correctly in accordance with the following requirements:

- installation is carried out by personnel under the direction of supervisors, all appropriately qualified for this work
- installation is in accordance with the manufacturer's specifications and drawings prepared for that purpose, and the appropriate tools used
- the flanges must not be drilled, notched or otherwise altered on site
- the joists should be handled and installed in a similar manner to solid timber beams. However, the strength and stiffness of joists about their minor axis is less than that of corresponding solid timber sections. Therefore, care must be exercised to ensure that joists are not damaged during handling due to bending about their minor axis. In accordance with normal good practice for timber they should be protected from wetting during installation

(5) See EU commission Guidance Paper D CE Marking under the Construction Products Directive.

- the characteristic bending moments given in Annex 2, Table 1, are based on the assumption that lateral bracing to the compression flange (at a spacing not exceeding 400 mm) is in place. Alternative bracing will require separate analysis
- the joists should have a moisture content at the time of installation close to that attained in service
- temporary bracing should be provided to keep the joists in a straight and plumb position during installation
- rigid service pipes can be incorporated within the floor or roof void by passing through site-cut holes in accordance with the manufacturer's literature or software as detailed in Annex 4.

5 Recommendations

5.1 Recommendations on packaging, transport and storage

Delivery and site storage must be carried out in accordance with the manufacturer's instructions.

During transportation the joists must be protected from adverse weather.

The joists should be stored clear of the ground and stacked vertically (within the plane of the spans). Precautions should be taken to minimise changes in moisture content due to the weather. Full cover should be provided whilst permitting free passage of air.

5.2 Recommendations on use, maintenance and repair

The assessment of the fitness for use is based on the assumption that maintenance is not required during the assumed intended working life.

Should repair prove necessary, an assessment must be made in each case.

It is the responsibility of the manufacturer to ensure that the information on the specific conditions given in part II, sections 1, 2, 4.2 and 4.3, is given to those concerned. This information may be made by replicating the respective parts of the European Technical Approval. In addition, all installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).



On behalf of the British Board of Agrément

Brian Chamberlain
Head of Approvals — Engineering

Greg Cooper
Chief Executive

Date of Third issue: 23 November 2010

ANNEX 1 PRODUCT DETAILS

Table 1 Details of standard range of joist sizes

Joist designation	Joist depth H_j (mm)	Flange depth (h_f) x width (b_f) (mm)	LVL designation used in flange
220 BCI4500-1.8E	220	30.0 x 44.5	1.8E SP LVL
220 BCI4500-2.0E	220	30.0 x 44.5	2.0E SP LVL
220 BCI5000-1.8E	220	30.0 x 50.8	1.8E SP LVL
220 BCI5000-2.0E	220	30.0 x 50.8	2.0E SP LVL
220 BCI6000-1.8E	220	30.0 x 58.4	1.8E SP LVL
220 BCI6000-2.0E	220	30.0 x 58.4	2.0E SP LVL
220 BCI6500-1.8E	220	30.0 x 64.4	1.8E SP LVL
220 BCI60-2.0E	220	38.1 x 58.4	2.0E SP LVL
220 BCI90-2.0E	220	38.1 x 88.9	2.0E SP LVL
241 BCI4500-1.8E	241	30.0 x 44.5	1.8E SP LVL
241 BCI4500-2.0E	241	30.0 x 44.5	2.0E SP LVL
241 BCI5000-1.8E	241	30.0 x 50.8	1.8E SP LVL
241 BCI5000-2.0E	241	30.0 x 50.8	2.0E SP LVL
241 BCI6000-1.8E	241	30.0 x 58.4	1.8E SP LVL
241 BCI6000-2.0E	241	30.0 x 58.4	2.0E SP LVL
241 BCI6500-1.8E	241	30.0 x 64.4	1.8E SP LVL
241 BCI60-2.0E	241	38.1 x 58.4	2.0E SP LVL
241 BCI90-2.0E	241	38.1 x 88.9	2.0E SP LVL
302 BCI4500-1.8E	302	30.0 x 44.5	1.8E SP LVL
302 BCI4500-2.0E	302	30.0 x 44.5	2.0E SP LVL
302 BCI5000-1.8E	302	30.0 x 50.8	1.8E SP LVL
302 BCI5000-2.0E	302	30.0 x 50.8	2.0E SP LVL
302 BCI6000-1.8E	302	30.0 x 58.4	1.8E SP LVL
302 BCI6000-2.0E	302	30.0 x 58.4	2.0E SP LVL
302 BCI6500-1.8E	302	30.0 x 64.8	1.8E SP LVL
302 BCI60-2.0E	302	38.1 x 58.4	2.0E SP LVL
302 BCI90-2.0E	302	38.1 x 88.9	2.0E SP LVL
356 BCI5000-1.8E	356	30.0 x 50.8	1.8E SP LVL
356 BCI5000-2.0E	356	30.0 x 50.8	2.0E SP LVL
356 BCI6000-1.8E	356	30.0 x 58.4	1.8E SP LVL
356 BCI6000-2.0E	356	30.0 x 58.4	2.0E SP LVL
356 BCI6500-1.8E	356	30.0 x 64.8	1.8E SP LVL
356 BCI60-2.0E	356	38.1 x 58.4	2.0E SP LVL
356 BCI90-2.0E	356	38.1 x 88.9	2.0E SP LVL
406 BCI6000-1.8E	406	30.0 x 58.4	1.8E SP LVL
406 BCI6000-2.0E	406	30.0 x 58.4	2.0E SP LVL
406 BCI6500-1.8E	406	30.0 x 64.8	1.8E SP LVL
406 BCI60-2.0E	406	38.1 x 58.4	2.0E SP LVL
406 BCI90-2.0E	406	38.1 x 88.9	2.0E SP LVL

Table 2 Tolerances on joist dimensions

Joist dimension	Tolerance (mm)
Joist depth (H_j)	+1.27, - 0.76
Flange depth (h_f)	+1.27, - 1.27
Flange width (b_f)	+0.25, - 0.63
Web thickness (b_w)	+0.89, - 0.89

Figure 1 Cross-section

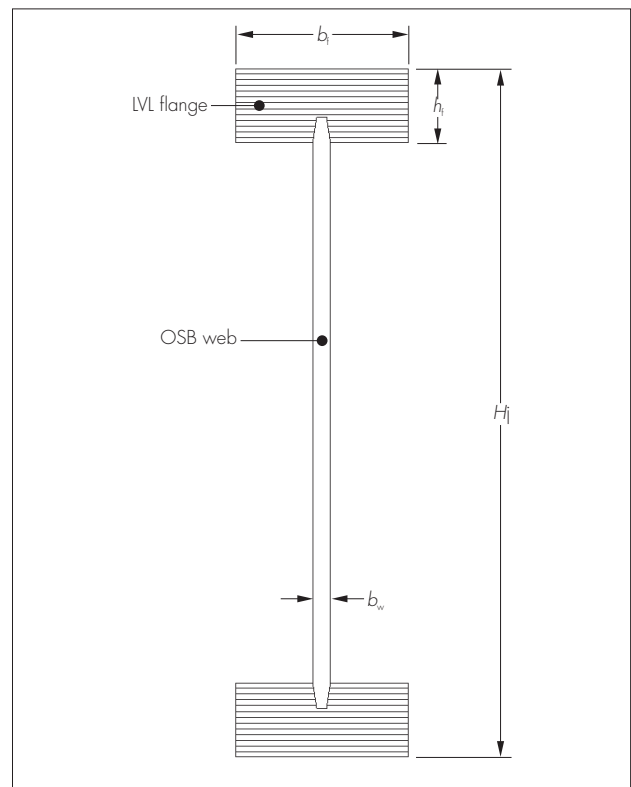


Table 3 Characteristic values for flange LVL

Property	Characteristic value (N·mm ⁻²)	
	Designation 1.8E SP LVL	Designation 2.0E SP LVL
Bending strength ($f_{m,0,k}$)	35	44
Tension strength ($f_{t,0,k}$)	26	30
Compression strength parallel to grain ($f_{c,0,k}$)	40	42
Compression strength perpendicular to grain (flatwise) ($f_{c,90,k}$)	3.0	3.2
Mean modulus of elasticity ($E_{0,m}$)	13300	14600
Lower 5% tile modulus of elasticity ($E_{0,0.05}$)	11650	12650

Table 4 Characteristic values for web OSB

Property	Characteristic value (N·mm ⁻²) for OSB/3
Tension strength, bending calculations ($f_{t,90,k}$)	7.2
Compression strength, bending calculations ($f_{c,90,k}$)	12.9
Panel shear strength ($f_{v,k}$)	6.8
Mean 'axial' modulus of elasticity ($E_{a,90,m}$)	3000
Mean 'bending' modulus of elasticity ($E_{b,0,m}$)	4930
Mean shear modulus (G_m)	1080

ANNEX 2 PRODUCT CHARACTERISTICS

Table 1 Characteristic values for standard range of BCI-joists⁽¹⁾

Joist designation	Bending stiffness (N·mm ⁻²)	Shear stiffness (N)	Characteristic bending strength (kN·m)	Characteristic shear strength (kN)	Characteristic end bearing strength (kN)				Characteristic internal bearing strength (kN)	
					45 mm bearing length		90 mm bearing length		90 mm bearing length	
					without web stiffener	with web stiffener	without web stiffener	with web stiffener	without web stiffener	with web stiffener
220 BCI4500,1.8E	3.18E+11	2.28E+06	6.38	11.01	8.92	10.01	12.44	14.23	20.03	20.03
220 BCI4500,2.0E	3.48E+11	2.28E+06	7.34	11.01	8.92	10.68	12.44	14.23	21.36	21.36
220 BCI5000,1.8E	3.63E+11	2.33E+06	7.30	11.01	8.92	10.71	12.44	14.23	22.86	22.86
220 BCI5000,2.0E	3.98E+11	2.33E+06	8.41	11.01	8.92	10.71	12.44	14.23	24.38	24.38
220 BCI6000,1.8E	4.19E+11	2.36E+06	8.42	11.01	8.92	10.71	12.44	14.23	24.88	26.28
220 BCI6000,2.0E	4.58E+11	2.36E+06	9.70	11.01	8.92	10.71	12.44	14.23	24.88	26.67
220 BCI6500,1.8E	4.62E+11	2.38E+06	9.30	11.01	8.92	10.71	12.44	14.23	24.88	26.67
220 BCI60, 2.0E	5.36E+11	2.56E+06	11.81	11.37	10.38	12.17	13.90	15.69	27.79	28.03
220 BCI90, 2.0E	8.20E+11	2.65E+06	18.14	11.37	10.38	12.17	13.90	15.69	27.79	29.59
241 BCI4500,1.8E	3.92E+11	2.46E+06	7.06	11.94	8.92	10.01	12.44	14.23	20.03	20.03
241 BCI4500,2.0E	4.29E+11	2.46E+06	8.12	11.94	8.92	10.68	12.44	14.23	21.36	21.36
241 BCI5000,1.8E	4.49E+11	2.51E+06	8.08	11.94	8.92	10.71	12.44	14.23	22.86	22.86
241 BCI5000,2.0E	4.91E+11	2.51E+06	9.30	11.94	8.92	10.71	12.44	14.23	24.38	24.38
241 BCI6000,1.8E	5.17E+11	2.54E+06	9.31	11.94	8.92	10.71	12.44	14.23	24.88	26.28
241 BCI6000,2.0E	5.66E+11	2.54E+06	10.72	11.94	8.92	10.71	12.44	14.23	24.88	26.67
241 BCI6500,1.8E	5.74E+11	2.56E+06	10.35	11.94	8.92	10.71	12.44	14.23	24.88	26.67
241 BCI60, 2.0E	6.65E+11	2.71E+06	13.09	12.29	10.38	12.17	13.90	15.69	27.79	28.03
241 BCI90, 2.0E	1.02E+12	2.78E+06	20.09	12.29	10.38	12.17	13.90	15.69	27.79	29.59
302 BCI4500,1.8E	6.57E+11	3.02E+06	9.06	14.62	8.92	10.01	12.44	15.13	20.03	20.03
302 BCI4500,2.0E	7.18E+11	3.02E+06	10.41	14.62	8.92	10.68	12.44	15.13	21.36	21.36
302 BCI5000,1.8E	7.50E+11	3.07E+06	10.36	14.62	8.92	11.43	12.44	15.13	22.86	22.86
302 BCI5000,2.0E	8.20E+11	3.07E+06	11.90	14.62	8.92	11.61	12.44	15.13	24.38	24.38
302 BCI6000,1.8E	8.63E+11	3.10E+06	11.92	14.62	8.92	11.61	12.44	15.13	24.88	26.28
302 BCI6000,2.0E	9.44E+11	3.10E+06	13.71	14.62	8.92	11.61	12.44	15.13	24.88	27.57
302 BCI6500,1.8E	9.58E+11	3.11E+06	13.24	14.62	8.92	11.61	12.44	15.13	24.88	27.57
302 BCI60, 2.0E	1.12E+12	3.19E+06	16.82	14.98	10.38	13.07	13.90	16.59	27.79	28.03
302 BCI90, 2.0E	1.72E+12	3.23E+06	25.76	14.98	10.38	13.07	13.90	16.59	27.79	30.49
356 BCI5000,1.8E	1.09E+12	3.61E+06	12.39	17.00	8.92	11.43	12.44	16.03	22.86	22.86
356 BCI5000,2.0E	1.19E+12	3.61E+06	14.23	17.00	8.92	12.19	12.44	16.03	23.00	24.38
356 BCI6000,1.8E	1.25E+12	3.63E+06	14.24	17.00	8.92	12.51	12.44	16.03	23.00	26.28
356 BCI6000,2.0E	1.36E+12	3.63E+06	16.37	17.00	8.92	12.51	12.44	16.03	23.00	28.03
356 BCI6500,1.8E	1.38E+12	3.64E+06	15.80	17.00	8.92	12.51	12.44	16.03	23.00	28.47
356 BCI60, 2.0E	1.64E+12	3.67E+06	20.13	17.36	10.38	13.97	13.90	17.49	25.74	28.03
356 BCI90, 2.0E	2.50E+12	3.68E+06	30.77	17.36	10.38	13.97	13.90	17.49	25.74	31.38
406 BCI6000,1.8E	1.67E+12	4.15E+06	16.41	19.20	8.92	13.14	11.06	16.93	18.72	26.28
406 BCI6000,2.0E	1.82E+12	4.15E+06	18.85	19.20	8.92	13.41	11.06	16.93	18.72	28.03
406 BCI6500,1.8E	1.85E+12	4.15E+06	18.20	19.20	8.92	13.41	11.06	16.93	18.72	29.16
406 BCI60, 2.0E	2.20E+12	4.15E+06	23.21	19.56	10.30	14.02	12.17	18.38	20.61	28.03
406 BCI90, 2.0E	3.35E+12	4.13E+06	35.41	19.56	10.30	14.86	12.17	18.38	20.61	32.28

(1) These characteristic values relate to a relative humidity of 65%, a temperature of 20°C and a duration of load of 5 minutes.

Table 2 Values of k_{mod} for BCI-joists

Duration of load	Bending (and axial) strengths		Shear strength		Bearing strength	
	Service class 1	Service class 2	Service class 1	Service class 2	Service class 1	Service class 2
	Permanent	0.6	0.6	0.4	0.3	0.4
Long-term	0.7	0.7	0.5	0.4	0.5	0.4
Medium-term	0.8	0.8	0.7	0.55	0.7	0.55
Short-term	0.9	0.9	0.9	0.7	0.9	0.7
Instantaneous	1.1	1.1	1.1	0.9	1.1	0.9

Table 3 Values of k_{def} for BCI-joists

Bending (and axial) deformation		Shear deformation	
Service class 1	Service class 2	Service class 1	Service class 2
0.60	0.80	1.50	2.25

ANNEX 2 PRODUCT CHARACTERISTICS (continued)

Table 4 Recommended values of γ_M to be used with Eurocode 5

Combination	Boise BCI joist
Fundamental	1.2
Accidental	1.0

Table 5 Hygrothermal properties

Material	Mean density ⁽¹⁾	Design thermal conductivity λ W(m·K) ⁻¹	Specific heat capacity c_p J(kg·K) ⁻¹	Water vapour resistance factor ⁽²⁾	
	ρ kg·m ⁻³			μ	
				dry	wet
Laminated veneer lumber flanges	650	0.16	1600	215	85
OSB webs	650	0.13	1700	50	30

(1) The density for timber and wood-based products is the density in equilibrium with 20°C and 65% relative humidity.

(2) Water vapour resistance factors are given as dry cup and wet cup values (see prEN ISO 12572 : 1999 *Hygrothermal performance of building materials and products – Determination of water vapour transmission properties*).

ANNEX 3 PROTOCOL FOR CALCULATION OF CHARACTERISTIC VALUES OF NON-STANDARD BCI-JOISTS

1 Introduction

This protocol provides procedures for the calculation of characteristic values for BCI-joists with depths between 220 mm and 406 mm and with the same web and adhesive specifications as the standard range of BCI-joists, but with a differing LVL flange specification within the following constraints: the flange is to be of an LVL designation between 1.8E and 2.0E with a flange size no less than 30.0 mm by 44.5 mm and no greater than 38.1 mm by 88.9 mm.

BCI-joist web structural properties

The BCI-joist web is of nominal 10.2 mm (0.4") thickness and made of OSB/3. The salient structural properties of the OSB web for this protocol are given in Table 1.

Table 1 Characteristic values for web OSB

Property	Characteristic value (N·mm ⁻²)
Panel shear strength ($f_{w,v,k}$)	4.3
Web compressive (crushing) strength ($f_{w,c,0,k}$)	15.4
Mean 'axial' modulus of elasticity ($E_{w,a,90,m}$)	3000
Mean 'bending' modulus of elasticity ($E_{w,b,0,m}$)	4930
Lower 5th-percentile 'bending' modulus of elasticity ($E_{w,b,0,0.05}$)	4191
Mean shear modulus ($G_{w,m}$)	1080

BCI-joist flange structural properties

The notation for the flange structural properties follows. The values for these structural properties are to be extracted from the relevant EC Declaration of

Conformity associated with EC Certificate of Conformity CPD-0836-0008 for the LVL:

- $E_{f,m}$ = Mean modulus of elasticity of flange
- $f_{f,t,0,k}$ = Characteristic tensile strength parallel to grain of flange
- $f_{f,c,90,k}$ = Characteristic flatwise compression strength perpendicular to grain of flange

BCI-joist dimensions and cross-sectional properties

The notation for the dimensions of the BCI-joist is:

- H_i = Joist depth
- h_f = Flange depth
- h_r = Depth of rout cut in flanges
- b_f = Flange width
- b_w = Web width
- h_w = Web depth
- I_f = $[b_f H_i^3 / 12] - [b_w h_w^3 / 12] - [(b_f - b_w)(H_i - 2h_f)^3 / 12]$
- I_w = $[b_w h_w^3 / 12]$
- A_i = $2b_f h_f + b_w [H_i - 2h_f]$
- p = b_w / b_f
- s = $[H_i - 2h_f] / H_i$
- x_f = $h_f - \frac{[0.5b_f(h_f)^2 - 0.5b_w(h_r)^2]}{b_f h_f - b_w h_r}$

ANNEX 3 PROTOCOL FOR CALCULATION OF CHARACTERISTIC VALUES OF NON-STANDARD BCI-JOISTS (continued)

2 Equations for calculation of BCI-joist characteristic values

The equations for the calculation of the characteristic values of the BCI-joist of dimensions and flange structural properties given in section 1 are as follows. In all cases the units are newtons (N) and millimetres (mm).

Bending stiffness

BCI-joist bending stiffness = $E_{f,m} I_{trans}$

$$I_{trans} = I_f + m I_w$$

$$m = \frac{2221}{E_{f,m}}$$

Shear stiffness

BCI-joist shear stiffness = $\frac{G_{w,m} A_f}{K_{i,form}}$

$$K_{i,form} = 0.55 \{ [1/(1 - 1.35p)] + [1.5(s - s^3)/p] \}$$

Characteristic moment

Characteristic moment, $M_k = \frac{I_{trans} f_{f,t}}{0.5H_i - x_f}$

where: $f_{f,t} = f_{f,t,0,k}$ (Length factor)

$$\text{Length factor} = (3000/18H_i)^{0.06}$$

Characteristic shear

Characteristic shear, $V_k = b_w(H_i + h_f) f_{w,v,k}$

Characteristic end bearing strength without web stiffeners ($B_{end,k}$)

$$B_{end,k} = \min \begin{cases} B_{end,k,fc} \\ B_{end,k,wb} \\ B_{end,k,wc} \end{cases}$$

where:

$$B_{end,k,fc} = (f_{f,c,90,k})(b_f)(L_{supp} + 30)$$

$$B_{end,k,wb} = \frac{(0.5)(2.5)(\pi^2)(E_{w,b,0,0.05})(b_w)^3(L_{supp} + 0.5H_i)}{12(H_i - 2h_f)^2}$$

$$B_{end,k,wc} = 0.5(f_{w,c,0,k})(b_w)(L_{supp} + 2.3h_f)$$

L_{supp} = Length of support

Characteristic internal bearing strength without web stiffeners ($B_{int,k}$)

$$B_{int,k} = \min \begin{cases} B_{int,k,fc} \\ B_{int,k,wb} \\ B_{int,k,wc} \end{cases}$$

where:

$$B_{int,k,fc} = (f_{f,c,90,k})(b_f)(L_{supp} + 60)$$

$$B_{int,k,wb} = \frac{(0.5)(2.5)(\pi^2)(E_{w,b,0,0.05})(b_w)^3(L_{supp} + H_i)}{12(H_i - 2h_f)^2}$$

$$B_{int,k,wc} = (f_{w,c,0,k})(b_w)(L_{supp} + 2.3h_f)$$

Characteristic end bearing strength with web stiffeners ($B_{end,k+stiff}$)

$$B_{end,k+stiff} = \min \begin{cases} B_{end,k,fc} \\ B_{end,k,wc+stiff} \end{cases}$$

where:

$$B_{end,k,wc+stiff} = B_{end,k,wc} + 0.75 N F_{nail,k}$$

N = Number of nails connecting web stiffeners to web

F_{nail} = Characteristic load-carrying capacity of single nail between web stiffeners and web

$$F_{nail,k} = 2(0.5b_w d f_{h,w,k})$$

d = Nail diameter (usually 3.35 mm)

$f_{h,w,k}$ = Characteristic embedment strength of nail in OSB

$$= 65d^{0.7}(b_w)^{0.1}$$

Characteristic internal bearing strength with web stiffeners ($B_{int,k+stiff}$)

$$B_{int,k+stiff} = \min \begin{cases} B_{int,k,fc} \\ B_{int,k,wc+stiff} \end{cases}$$

where

$$B_{int,k,wc+stiff} = B_{int,k,wc} + 0.75 N F_{nail,k}$$

ANNEX 4 EVALUATION OF SHEAR STRENGTHS OF BCI-JOISTS WITH WEB HOLES

The characteristic shear strength of a BCI-joist with a web hole is given by Equation 1.

$$V_{k,\text{hole}} = V_{k,\text{fs}} C_H \quad \text{Equation 1}$$

where: $V_{k,\text{hole}}$ = Characteristic shear strength of BCI-joist with web hole

$V_{k,\text{fs}}$ = Characteristic shear strength of full-section BCI-joist

C_H = Hole strength reduction factor

The hole strength reduction factor is given by Equation 2 for circular holes and Equation 3 for rectangular holes.

Circular holes

$$C_H = 0.95 (1 - \Phi/H_i) \quad \text{Equation 2}$$

where: Φ = Hole diameter

H_i = Joist depth

Rectangular holes

$$C_H = (1 - D_H/H_i)[1 - 0.42(L_H/D_H)^{0.33}] \quad \text{Equation 3}$$

where: D_H = Depth of hole

L_H = Length of hole

ANNEX 5 AXIALLY LOADED MEMBERS

The axial load-carrying capacity of the joists should be calculated in accordance with the procedures given in Eurocode 5. Axial forces are to be resisted by the flanges only. The capacity should be derived from the flange cross-section and characteristic values given in Annex 1. Lateral restraint to prevent buckling must be provided at the spacing assumed in the design.

In the case of combined actions, eg compression and bending, the relevant interaction equations given in Eurocode 5 should be used.



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British Board of Agrément

Bucknalls Lane, Garston, Watford, Hertfordshire WD25 9BA

Tel: + 44 (0) 1923 665300 Fax: + 44 (0) 1923 665301

e-mail: mail@bba.star.co.uk

website: www.bbacerts.co.uk