



## Boise Cascade Sales Ltd

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**Agrément  
Certificate  
No 99/3620**

Designated by Government  
to issue  
European Technical  
Approvals

## BCI JOISTS

Poutres pour planchers  
Bodenbalken

## Product



• THIS CERTIFICATE RELATES TO BCI JOISTS.

• The joists are fabricated from reconstituted timber and are for use as structural members, for example as floor or roof joists, beams, rafters, wall studs or ceiling ties.

These Front Sheets must be read in conjunction with the accompanying Detail Sheets, which provide information specific to particular joists.

## Regulations — Detail Sheet 1

### 1 The Building Regulations 1991 (as amended) (England and Wales)



The Secretary of State has agreed with the British Board of Agrément the requirements of the Building Regulations to which joists can contribute in achieving compliance. In the opinion of the BBA, BCI Joists, if used in accordance with the provisions of this Certificate, will contribute to meeting the relevant requirements.

Requirement: **A1**

Comment:

Loading

The joists have adequate strength and stiffness. See sections 9.1 to 9.3 of these Front Sheets and section 2 of the relevant Detail Sheet.

Requirement: **B2**

Comment:

Internal fire spread (linings)

The joists have a Class 3 surface and are combustible. Materials and workmanship

Requirement: **Regulation 7**

Comment:

The joists are acceptable but have been assessed as untreated and therefore their use is restricted in the House Longhorn beetle areas. See sections 10.1 to 10.3 of these Front Sheets.

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## 2 The Building Standards (Scotland) Regulations 1990 (as amended)



In the opinion of the BBA, BCI Joists, if used in accordance with the provisions of this Certificate, will satisfy or contribute to satisfying the various Regulations and Technical Standards as listed below.

Regulation:	10	Fitness of materials
Standard:	B2.1	Selection and use of materials and components
Comment:		The joists are acceptable. See sections 10.1 and 10.2 of these Front Sheets.
Regulation:	11	Structure
Standard:	C2.1	Construction
Comment:		The joists have adequate strength and stiffness. See sections 9.1 to 9.3 of these Front Sheets and section 2 of the relevant Detail Sheet.
Regulation:	12	Structural fire precautions
Standard:	D2.2	Non-combustibility
Comment:		In common with other timber products the joists are of a combustible material and their use will be restricted under this Standard.
Regulation:	13	Means of escape from fire, facilities for fire-fighting and means of warning of fire in dwellings
Standard:	E6.1	Internal fire spread – General
Comment:		The joists have a Class 3 surface.

## 3 The Building Regulations (Northern Ireland) 1994 (as amended)



In the opinion of the BBA, BCI Joists, if used in accordance with the provisions of this Certificate, will satisfy the various Building Regulations as listed below.

Regulation:	B2	Fitness of materials and workmanship
Comment:		The joists are acceptable. See sections 10.1 and 10.2 of these Front Sheets.
Regulation:	D2	Stability
Comment:		The joists have adequate strength and stiffness. See sections 9.1 to 9.3 of these Front Sheets and section 2 of the relevant Detail Sheet.
Regulation:	E4	Internal fire spread – linings
Comment:		The joists have a Class 3 surface.

## 4 Construction (Design and Management) Regulations 1994

Information in this Certificate may assist the client, planning supervisor, designers and constructors to address their obligations under these Regulations.

See sections: *7 Practicability of installation, 11 General, and 12 Procedure of these Front Sheets.*

## Technical Specification

### 5 Delivery and site storage

5.1 This must be carried out in accordance with the manufacturer's instructions and the requirements of this Certificate.

5.2 During transportation the joists must be protected from adverse weather.

5.3 On site, in accordance with normal good practice for timber products, the joists should be stored clear of the ground and stacked vertically. Precautions should be taken to minimise changes in moisture content due to the weather. Full cover should be provided but permit free passage of air.

5.4 The joists bear the BBA identification mark incorporating the number of this Certificate.

## Design Data

### 6 General

6.1 BCI Joists are satisfactory for use as structural members, for example as floor or roof joists, beams, rafters, wall studs or ceiling ties, provided the conditions described in section 9 of these Front Sheets are followed.

6.2 The sound reduction properties of floors incorporating joist units are not covered by this Certificate. Where particular sound insulation properties are required, appropriate testing or assessment, relating to the structure, should be obtained.

### 7 Practicability of installation

7.1 The joists are lighter than solid timber beams of equivalent structural properties and are therefore

more easily handled. Joist weights are given in the relevant Detail Sheet. Normal precautions should be taken when handling, lifting and installing the joists.

7.2 The joists are easily cut to length and fixed using conventional woodworking tools.

7.3 The flanges are nailable for the fixing of flooring and ceiling materials.

7.4 Care should be taken to avoid damage to the flanges and to the webs.

## 8 Behaviour in relation to moisture

8.1 BCI Joists are for use in a service class 1 or 2 environment<sup>(1)</sup>. Tests indicate that the equilibrium moisture content of the product in a given environment is lower than that of solid timber. In these environments, where the moisture content of solid timber does not exceed 18% the moisture content of the product will not exceed 14%. The product will attain on average moisture content of 10% in service class 1 conditions.

(1) As defined in BS 5268 : Part 2 : 1996.

8.2 To ensure that these moisture conditions in a service class 1 or 2 environment are maintained:

(a) flat roof decks must be constructed in accordance with BS 6229 : 1982, BS 8217 : 1994, and where appropriate, NHBC Standards, Chapter 7.1, or the Zurich Building Guarantees Technical Standards, Section 5, clause 5.9.3.19

(b) roof coverings should be the subject of a relevant Agrément Certificate and must be installed and maintained in accordance with that Certificate, the manufacturer's instructions, and the relevant clauses of BS 8000 : Part 4 : 1989 and BS 8217 : 1994

(c) in suspended ground floors, careful attention must be given to the adequate provision of solum treatment, underfloor space and ventilation. Guidance on design is given in CP 102 : 1973 and Zurich Building Guarantees Technical Standards, Section 3, clause 3.9.1.

8.3 Where a building construction is likely to be sensitive to the relative movement of members, it is recommended, in accordance with BS 5268 : Part 2 : 1996, that the members should:

(a) be checked for moisture content at the time of the installation; the determination of moisture content by a calibrated moisture meter will be sufficiently accurate for this purpose

(b) have a moisture content at the time of installation close to the moisture content they will attain in service.

8.4 The joists will arrive on site with a typical flange moisture content of 8% to 10%.

8.5 BCI Joists will not shrink in the same manner as solid timber, therefore care is needed to avoid

problems of differential movement when using different materials.

## 9 Structural performance



9.1 The joists will have adequate strength and stiffness provided they are designed in accordance with the recommendations given in BS 5268 : Part 2 : 1996 and the manufacturer's literature using the design data given in the relevant Detail Sheet.

9.2 The lower flanges of the joists are able to support small loads, for example those associated with normal domestic services and ceilings. The recommended loads relate to the full joist loaded through the top flange.

9.3 Design and detailing of BCI Joists should be carried out by a suitably experienced person in accordance with the manufacturer's instructions and the requirements of this Certificate.

## 10 Durability



10.1 The joists will have a durability comparable to that of board products of similar timber species incorporating phenol-formaldehyde and emulsion polymer isocyanate adhesives [see BS EN 350-2]. Thus, in a service class 1 or 2 environment BCI Joists may be taken to have a service life in excess of 60 years, provided there is no mechanical damage or insect attack.

10.2 Details on maintaining the moisture conditions in a service 1 or 2 environment are described in section 8.2 of these Front Sheets.



10.3 The joists have been assessed as untreated therefore their use is restricted in the House Longhorn beetle areas defined in the Approved Document to Regulation 7 : 1992 of the Building Regulations 1991. Proposals for House Longhorn beetle areas to be covered by a revision to Approved Document A are under consideration, therefore, in the interim, Table 1 of Approved Document to Regulation 7 : 1992 remains valid.

## Installation

### 11 General

11.1 The flanges must not be drilled, notched or otherwise altered on site.

11.2 BCI 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 addition they must be adequately braced during installation to avoid instability. In accordance with normal

good practice for timber they should be protected from wetting during installation.

11.3 The joists can withstand normal site handling and usage but if any are significantly damaged they must not be used.

11.4 In common with similar timber products, when using power tools to cut the joists it is recommended that eye protection and a dust mask are used.

## 12 Procedure

12.1 Installation must be in accordance with the marketing company's installation information.

12.2 Temporary bracing should be provided to keep the joists in a straight and plumb position during installation.

12.3 Rigid service pipes can be incorporated within the floor or roof void by passing through the perforated knockout holes in the BCI Joists or by passing through site-drilled holes in accordance with the manufacturer's literature.

12.4 Any service holes cut in the web are to be in accordance with the manufacturer's instructions.

## Bibliography

BS 5268 *Structural use of timber*

Part 2 : 1996 *Code of practice for permissible stress design, materials and workmanship*

BS 6229 : 1982 *Code of practice for flat roofs with continuously supported coverings*

BS 8000 *Workmanship on building sites*

Part 4 : 1989 *Code of practice for waterproofing*

BS 8217 : 1994 *Code of practice for built-up felt roofing* (supersedes CP 144 : Part 3)

BS EN 350 *Durability of wood and wood-based products. Natural durability of solid wood*

BS EN 350-2 : 1994 *Guide to natural durability and treatability of selected wood species of importance in Europe*

CP 102 : 1973 *Code of practice for protection of buildings against water from the ground*

## Conditions of Certification

### 13 Conditions

13.1 This Certificate:

- (a) relates only to the product that is described, installed, used and maintained as set out in this Certificate;
- (b) is granted only to the company, firm or person identified on the front cover — no other company, firm or person may hold or claim any entitlement to this Certificate;
- (c) has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective;
- (d) is copyright of the BBA.

13.2 References in this Certificate to any Act of Parliament, Regulation made thereunder, Directive or Regulation of the European Union, Statutory Instrument, Code of Practice, British Standard, manufacturers' instructions or similar publication, shall be construed as references to such publication in the form in which it was current at the date of this Certificate.

13.3 This Certificate will remain valid for an unlimited period provided that the product and the manufacture and/or fabricating process(es) thereof:

- (a) are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA;

(b) continue to be checked by the BBA or its agents; and

(c) are reviewed by the BBA as and when it considers appropriate.

13.4 In granting this Certificate, the BBA makes no representation as to:

- (a) the presence or absence of any patent or similar rights subsisting in the product or any other product;
- (b) the right of the Certificate holder to market, supply, install or maintain the product; and
- (c) the nature of individual installations of the product, including methods and workmanship.

13.5 Any recommendations relating to the use or installation of this product which are contained or referred to in this Certificate are the minimum standards required to be met when the product is used. They do not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate or in the future; nor is conformity with such recommendations to be taken as satisfying the requirements of the 1974 Act or of any present or future statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the installation and use of this product.



In the opinion of the British Board of Agrément, BCI Joists are fit for their intended use provided they are installed, used and maintained as set out in this Certificate. Certificate No 99/3620 is accordingly awarded to Boise Cascade Sales Ltd.

On behalf of the British Board of Agrément

Date of issue: 17th August 1999

  
Chief Executive

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Table 1 Types, sizes and weights

Joist type	Flange size (mm)	Joist depth (mm)	Joist weight (kgm <sup>-1</sup> )
BCI 40s	38.1 × 38.1	241	3.3
		302	3.8
		356	4.1
BCI 45s	44.5 × 38.1	241	3.7
		302	4.1
		356	4.5
		406	4.9
BCI 60s	58.7 × 38.1	302	4.9
		356	5.3
		406	5.6

## Design Data

### 2 Structural performance



2.1 The properties given in Tables 2, 3 and 4 apply only in the internal conditions of a service class 1 or 2 environment as defined in BS 5268 : Part 2 : 1996.

2.2 The structural performance of the joists relies upon adequate lateral restraint to the compression flanges. To achieve this on each joist type such restraint should be applied at maximum centres of 400 mm. Lateral restraint is readily achieved for simply-supported beams where battens, boarding or similar provide restraint to the top flange at satisfactorily close intervals. However, in certain conditions additional lateral restraint is required, for example the lower flange can be in compression and therefore may not have boarding to act as lateral restraint. Continuous beams and members subject to wind uplift both fall into this category and may require the addition of diagonal braces or similar to provide the necessary restraint.

2.3 Compared to solid timber joists the strength and stiffness of I joists in the minor axis is considerably less than in the major axis. As such, care must be taken to ensure that adequate bracing/diaphragm action is provided to resist horizontal loads acting on the structural element.

2.4 Long-term bending moment capacity and shear resistances are given in Table 2 for BCI 40s, BCI 45s, and BCI 60s joists, respectively. Bending moment capacity and shear resistances for different durations of loading can be evaluated by multiplying the values in the table by the appropriate value of the  $K_3$  modification factor given in BS 5268 : Part 2 : 1996.

2.5 The values tabulated for load-sharing systems relate to a modification factor  $K_8$ , of 1.04, as defined in BS 5268 : Part 2 : 1996 where four or more joists of the same cross-section are spaced a maximum of 610 mm centre to centre, and have

adequate provision for the distribution of loads by means of purlins, binders, boarding, battens, etc.

2.6 The flexural rigidities and shear rigidities, required for the purpose of evaluating deflections, are given in Table 2 for BCI 40s, BCI 45s, and BCI 60s joists for use in accordance with BS 5268 : Part 2 : 1996. The maximum deflection of a uniformly loaded I joist is given by:

$$y = \frac{5wL^4}{384EI} + \frac{wL^2}{8G_w A_w}$$

where

w = uniform load per unit length

L = effective span

EI = flexural rigidity

$G_w A_w$  = web shear rigidity

2.7 Lightweight I joist floors may require higher deflection control than solid timber (as recommended in BS 5268 : Part 2 : 1996) to avoid undue vibration. Generally, the deflection criterion 0.003 times the span will not impair the strength of the structure nor lead to unsightly damage to the finishes. The manufacturer's literature should be consulted regarding recommended deflection control limits.

Consideration of the deflection criterion should be agreed between interested parties at the design stage.

2.8 BCI Joists are typically installed at 10% flange moisture content. For internal uses up to service class 2 there will be little variation in moisture content. This Detail Sheet relates to maximum flange moisture content of 14%. Where the designer considers there to be a risk of fluctuating moisture content beyond normal service class 1 or 2 conditions, the effect of creep deflection is to be included. For BCI Joists a creep effect of 2.0 times the initial load is suggested. The manufacturer should be consulted in these situations.

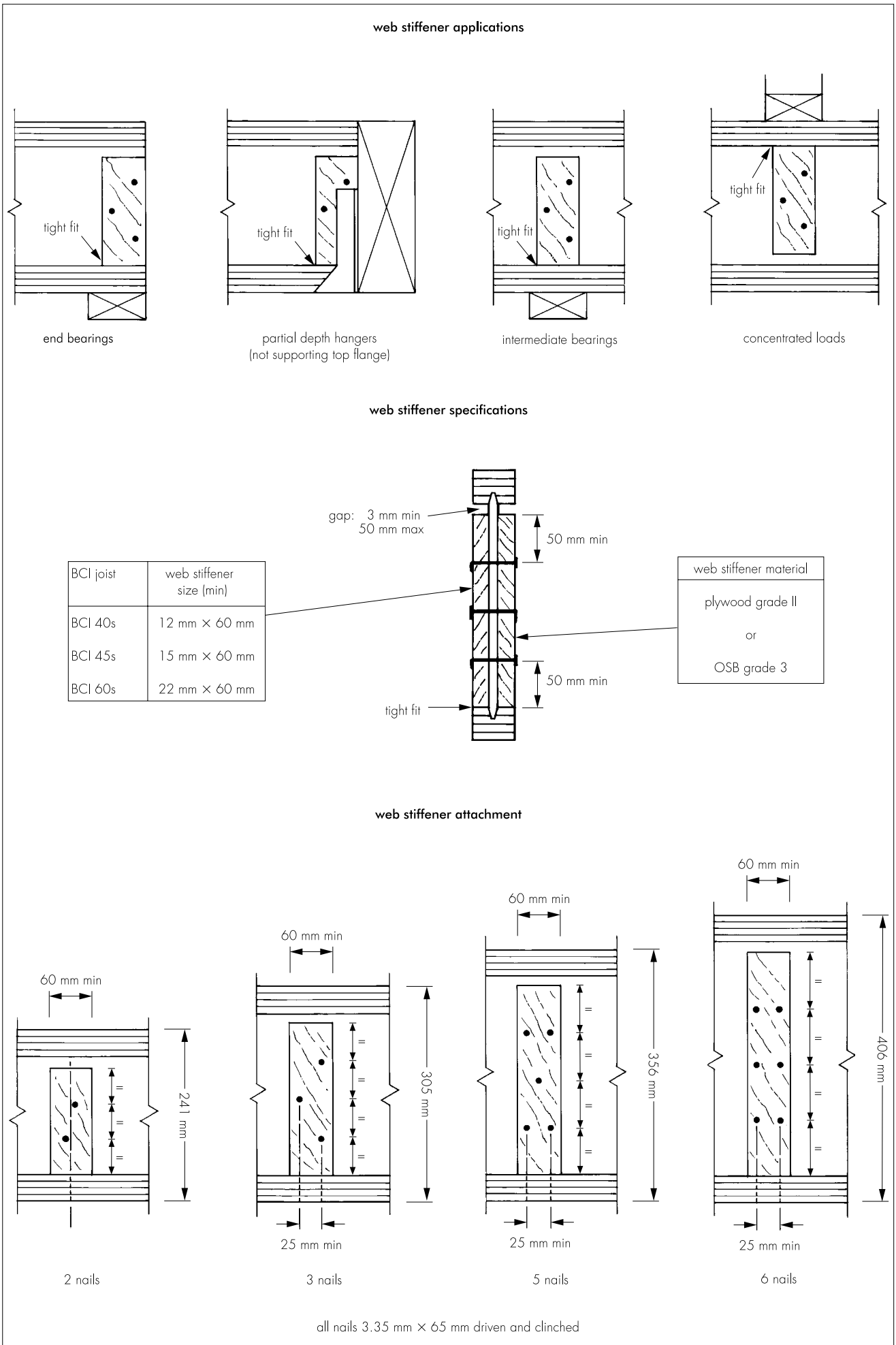
2.9 The minimum bearing lengths for all types of BCI Joist, irrespective of whether web stiffeners are present, are 45 mm for end supports and 89 mm for intermediate supports.

2.10 Details of long-term end and intermediate reactions for joists with and without web stiffeners are given in Table 3.

2.11 Details for web stiffeners are given in Table 3 and Figure 2.

2.12 Details of maximum long-term loads on joists used as a header joist are given in Table 4.

Figure 2 Web stiffener details



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Table 2 Long-term resistance moments and shear resistances

Joist type	Joist depth (mm)	Bending moment capacity		Shear resistance (both loadsharing and non-loadsharing) (kN)	Flexural rigidity (EI) (Nmm <sup>2</sup> x 10 <sup>9</sup> )	Shear rigidity (GA) web (N x 10 <sup>6</sup> )
		Non-loadsharing situations	Loadsharing situations			
		(kNm)	(kNm)			
Service class 1						
BCI 40s	241	3.52	3.66	5.39	423	1.67
	302	4.59	4.77	6.55	726	2.25
	356	5.51	5.73	6.85	1069	2.77
BCI 45s	241	4.14	4.31	5.39	493	1.67
	302	5.39	5.61	6.55	843	2.25
	356	6.48	6.74	6.85	1240	2.77
	406	7.47	7.76	8.34	1681	3.25
BCI 60s	302	7.15	7.43	6.55	1099	2.25
	356	8.59	8.93	6.85	1610	2.77
	406	9.90	10.30	8.34	2177	3.25
Service class 2						
BCI 40s	241	3.17	3.30	5.39	388	1.38
	302	4.13	4.29	6.55	666	1.87
	356	4.96	5.15	6.85	981	2.30
BCI 45s	241	3.73	3.88	5.39	452	1.38
	302	4.85	5.05	6.55	773	1.87
	356	5.83	6.06	6.85	1137	2.30
	406	6.72	6.99	8.34	1543	2.70
BCI 60s	302	6.43	6.69	6.55	1007	1.87
	356	7.73	8.04	6.85	1476	2.30
	406	8.91	9.27	8.34	1997	2.70

Note: Lateral restraint to joist at 400 mm maximum centres

Table 3 Long-term end and intermediate reaction (service class 1 and 2)

Joist type	Joist depth (mm)	End reaction (kN)				Intermediate reaction (kN)			
		45 mm Bearing length		89 mm Bearing length		89 mm Bearing length		133 mm Bearing length	
		Web stiffeners		Web stiffeners		Web stiffeners		Web stiffeners	
		NO	YES	NO	YES	NO	YES	NO	YES
BCI 40s	241	4.15	4.86	5.12	5.39	9.19	10.17	10.80	10.95
	302	4.21	4.95	5.55	6.55	9.29	11.94	11.25	12.31
	356	4.67	5.28	5.85	6.85	9.29	13.41	11.42	15.03
BCI 45s	241	4.15	4.86	5.12	5.39	9.19	10.17	10.80	10.95
	302	4.21	4.95	5.55	6.55	9.29	11.94	11.25	12.31
	356	4.67	5.28	5.85	6.85	9.29	13.41	11.42	15.03
	406	5.17	6.24	6.48	8.34	9.38	15.10	12.62	16.42
BCI 60s	302	4.21	4.95	5.55	6.55	9.29	11.94	11.25	12.31
	356	4.67	5.28	5.85	6.85	9.29	13.41	11.42	15.03
	406	5.17	6.24	6.48	8.34	9.38	15.10	12.62	16.42

Table 4 Maximum long-term load on joist used as a header joist

Depth of joist (mm)	Max udl (kNm <sup>-1</sup> )
241	42.3
302	38.0
356	34.2
406	32.0

## Compression load only

2.13 When using BCI Joists as a strut the flange section only is to be considered and the compression stress value is to be used and modified according to the relevant lateral restraint points and guidance given in BS 5268 : Part 2 : 1996. The admissible long-term compression grade stress parallel to the joist span should be taken as 19.44 Nmm<sup>-2</sup> for service class 1 and 17.50 Nmm<sup>-2</sup> for service class 2.

## Tension load only

2.14 When using BCI Joists as a tie the flange section only is to be considered and the tension stress value is to be used and modified according to the guidance given in BS 5268 : Part 2 : 1996. The admissible long-term tension grade stress parallel to the joist span should be taken as

$$\sigma_{f', \text{ adm, } \parallel} = \sigma_{f', \text{ grade, } \parallel} \times K_3 \times \frac{(2440)^{0.125}}{L}$$

where

$$\begin{aligned} \sigma_{f', \text{ grade, } \parallel} &= 15.0 \text{ Nmm}^{-2} \text{ for service class 1} \\ &= 13.5 \text{ Nmm}^{-2} \text{ for service class 2} \end{aligned}$$

$$L = \text{length (mm) with a minimum value of 2440 mm}$$

## Combined axial and bending loads

2.15 BCI Joists subjected to a small component of axial load in addition to an applied moment must be designed such that each flange satisfies the appropriate interaction formula of BS 5268 : Part 2 : 1996.

## OSB webs

2.16 The OSB webs incorporate partially punched 'knock-outs', of 38 mm diameter at 305 mm centres, to facilitate installation of services within floor or roof depths.

2.17 Holes in the web greater than the provided 'knock-outs' will reduce the shear capacity of the joists. The manufacturer's literature should be consulted for guidance on the size of hole permitted and the reduction in shear capacity.

## 3 Behaviour in relation to fire

3.1 BCI Joists have a Class 3 surface spread of flame classification when tested in accordance with BS 476 : Part 7 : 1997.

3.2 In common with other timber products, the joists are combustible and for ignitability purposes they can be designated P in accordance with BS 476 : Part 5 : 1979.

3.3 The fire resistance properties of a structure are dependent on the design of the construction incorporating the joists. Where fire resistance is a requirement, an appropriate assessment or test must be carried out by a UKAS (United Kingdom Accreditation Service) approved fire testing laboratory.

## Technical Investigations

### 4 Investigations

4.1 Results of tests on BCI Joists over shear critical spans were used to establish their design shear strength and maximum reaction capacities.

4.2 Results of tests on BCI Joists over moment critical spans were examined to confirm theoretical predictions of bending strength.

4.3 The measured deflections from bending tests were used to confirm theoretical deflection predictions.

4.4 Existing data relating to the durability of timber and adhesives in the specified environments were examined.

4.5 Assessments, from existing data, were also made of the practicability of installation.

4.6 The manufacturing processes for both the LVL flanges and the complete beams were examined, including the methods adopted for quality control, and details were obtained of the quality and composition of the materials used.

## Bibliography

BS 476 *Fire tests on building materials and structures*

Part 5 : 1968 *Method of test for ignitability*

Part 7 : 1987 *Method for classification of the surface spread of flame of products*

BS 5268 *Structural use of timber*

Part 2 : 1991 *Code of practice for permissible stress design, materials and workmanship*



On behalf of the British Board of Agrément

Date of issue: 17th August 1999

Chief Executive