British Standard

BRITISH STANDARD

BS 5268-7.3: 1989

Structural use of timber —

Part 7: Recommendations for the calculation basis for span tables —

Section 7.3: Ceiling joists

UDC 624.011.1 + 674.038.5 + 691.1.11]:[692.526:694.5]:001.4

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Civil Engineering and Building Structures Standards Committee (CSB/-) to Technical Committee CSB/32 upon which the following bodies were represented:

British Woodworking Federation
Building Employers' Confederation
Chartered Institute of Building
Department of the Environment (Building Research Establishment, Princes Risborough Laboratory)
Department of the Environment for Northern Ireland
Department of the Environment (Housing and Construction Industries)
Department of the Environment (Property Services Agency)
Health and Safety Executive
Incorporated Association of Architects and Surveyors
Institute of Clerks of Works of Great Britain Inc.
Institute of Wood Science
Institution of Civil Engineers
Institution of Structural Engineers
International Truss Plate Association
National House-building Council
Royal Institute of British Architects
Royal Institution of Chartered Surveyors
Timber Research and Development Association
Timber Trade Federation
Coopted members

This British Standard, having been prepared under the direction of the Civil Engineering and Building Structures Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 June 1989

The following BSI references relate to the work on this standard:
Committee reference CSB/32
Draft for comment 86/10305 DC

ISBN 0 580 16588 4

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This Section of Part 7 of BS 5268 has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee.

The general principles for the design of structural timber components are given in BS 5268-2 and using these principles it is possible for span tables to be prepared for a wide range of components.

Experience has shown that different interpretations of these principles has led to inconsistencies in span tables prepared by different compilers. It is the purpose of BS 5268-7 to eliminate these differences by recommending the design equations and the loading to be used in the preparation of span tables. Part 7 is prepared to ensure that different organizations produce span tables on a consistent basis in the future, and is not necessarily intended for use by designers for individual designs carried out in their day-to-day work, where simplified equations may produce adequate designs. This Section deals with ceiling joists. Other Sections of BS 5268-7, published or in preparation, are as follows.

— Section 7.1: *Domestic floor joists;*

— Section 7.2: *Joists for flat roofs;*

— Section 7.4: *Ceiling binders;*

— Section 7.5: *Rafters;*

— Section 7.6: *Purlins supporting rafters;*

— Section 7.7: *Purlins supporting sheeting or decking.*

BS 5268-2 gives grade stresses for very many combinations of species and grade and it is considered impractical to publish in a British Standard span tables for all possible combinations of species, grades and sizes. BS 5268-7 is therefore restricted to the basis of the calculations.

The solution of the design equations for many combinations of geometry and material is most conveniently undertaken by computer. A program written by the Timber Research and Development Association (TRADA) was used to prepare Appendix A and Appendix B. For users wishing to prepare their own span tables or computer programs Appendix A gives a sample calculation. Appendix B gives span tables for three typical combinations of species and grade. Although the presentation of span tables is not covered in BS 5268-7, it is recommended that tables for predetermined ceiling joist centres and loading follow this format.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Section of BS 5268 recommends a calculation basis for permissible clear span for ceiling joists with access at a maximum spacing of 610 mm centre-to-centre. It does not cater for the design of the ties of trussed rafters, which are dealt with in BS 5268-3.

The uniform and concentrated loads recommended in BS 6399-1 are considered.

This Section of BS 5268 is applicable to both single and continuous span ceiling joists. A typical arrangement is shown in Figure 1.

This Section of BS 5268 is applicable to the species and grades of timber given in BS 5268-2.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Section of BS 5268, the definitions given in BS 6100-4.1 to BS 6100-4.4, BS 6100-2.1 and BS 5268-2 apply, together with the following.

2.1
grade stress

stress that can safely be permanently sustained by material of a specific section size and of a particular strength class or species and grade

2.2
load-sharing system

assembly of pieces or members that are constrained to act together to support a common load

2.3
permissible stress

stress that can safely be sustained by a structural member of a particular cross section under the particular conditions of service and loading

NOTE For the purposes of this Section of BS 5268 it is the product of the grade stress and the appropriate modification factors for section size, service and loading.

2.4
strength class

classification of timber based on particular values of grade stress

2.5
bearing length

length at each end of the joist in contact with the support

2.6
notional bearing length

bearing length required for the calculation of permissible clear spans

2.7
effective span

span from centre-to-centre of the minimum bearing lengths at each end

2.8
permissible effective span

lowest value of effective span found from the calculations for bending strength, shear strength and deflection

2.9
permissible clear span

permissible unsupported span of a joist, measured between the faces of the supports at its two ends

NOTE Permissible clear span is equal to permissible effective span less the notional bearing length.

2.10
point load

concentrated load referred to in BS 6399-1, that is regarded as acting at a point for calculation purposes

3 Symbols

For the purposes of this Section of BS 5268, the following symbols apply.

NOTE The symbols used are in accordance with ISO 3898, published by the International Organization for Standardization, supplemented by the recommendations of CIB-W18-1 "Symbols for use in structural timber design", published by the International Council for Building Research Studies and Documentation, which takes particular account of timber properties.

The symbols used are:

a	Distance (notional bearing length)
b	Breadth of joist
E	Modulus of elasticity
F	Total load per metre length
F_d	Dead load per square metre applied by mass of ceiling materials, insulation etc. (excluding joist self weight)
F_j	Self weight of joist per metre length
F_p	Point load
G	Shear modulus
h	Depth of joist
I	Second moment of area
K	Modification factor (always with a subscript)
L	Effective span
L_{adm}	Permissible effective span
L_{cl}	Permissible clear span
M	Bending moment

s Spacing of joists, centre-to-centre
w Deflection
Z Section modulus
ρ Density
σ Stress
τ Shear stress

The following subscripts are used:

a) **Type of force, stress etc.**

c Compression
m Bending

b) **Significance**

adm Permissible
cl Clear
g Grade
max Maximum

c) **Geometry**

tra or ⊥ Perpendicular (to the grain)

It is recommended that where more than one subscript is used, the categories should be separated by commas.

Subscripts may be omitted when the context in which the symbols are used is unambiguous except in the case of modification factor K.

4 Design considerations

4.1 General

The design calculations recommended by this Section of BS 5268 are based on engineers' bending theory and are consistent with the recommendations of BS 5268-2. The design method ensures that the permissible bending and shear stresses, as given in BS 5268-2, are not exceeded and that the deflection due to bending and shear does not exceed the recommended limit of 0.003 times the span.

NOTE A sample calculation is given in Appendix A and Table 1 to Table 3 in Appendix B contain specimen span tables.

4.2 Qualifying assumptions

Although the calculations given in this Section envisage systems of ceiling joists at a maximum spacing of 610 mm centre-to-centre, it is assumed that lateral load distribution is not adequate to allow stresses to be increased for "load sharing". For members acting alone, i.e. without load sharing, the use of minimum modulus of elasticity is recommended in BS 5268-2. However for ceiling joists long experience has indicated that satisfactory performance can be achieved by the use of mean modulus of elasticity, and this practice is adopted in the equations for limiting deflection.

For roof pitches greater then 20° the axial tension induced by rafter thrust when the ceiling joist is used to tie complementary rafter feet together may be ignored *except* that it should be considered in connection design. The importance of obtaining tensile continuity when the ceiling joist is acting as a tie is emphasized.

The uniformly distributed dead and imposed loads are as given in BS 6399-1 for ceiling joists. Ceilings with access are assumed. The 0.9 kN concentrated load is applied only once to the ceiling joist and not simultaneously in any other position. The design calculations given in this Section do not allow for water tank loads.

Lateral support should be provided in accordance with **14.8** of BS 5268-2:1988.

The bearing length required at each end of the joist, calculated in accordance with **5.5**, may not be sufficient for practical construction purposes.

4.3 Loading

The design calculations provide for ceilings with access which consist of the following.

a) *Imposed load.* 0.25 kN/m^2 uniformly distributed, together with a concentrated load of 0.9 kN which, in accordance with BS 6399-1, is taken as a point load for calculation purposes.

The point load is assumed to act in the position which produces maximum stress or deflection.

The imposed distributed load should be considered as a long term load. The imposed point load should be considered as a short term load, as given in Table 8 of BS 5268-3:1985.

b) *Dead load.* Dead load per square metre F_d (in kN/m^2) to provide for the mass of ceiling materials, insulation etc. Weights of materials are given in BS 648.

c) *Self weight.* Self weight per metre length F_j (in kN/m) to provide for the mass of the joists. The timber densities (in kg/m^3) given in Table 9 and 92 of BS 5268-2:1988 should be used.

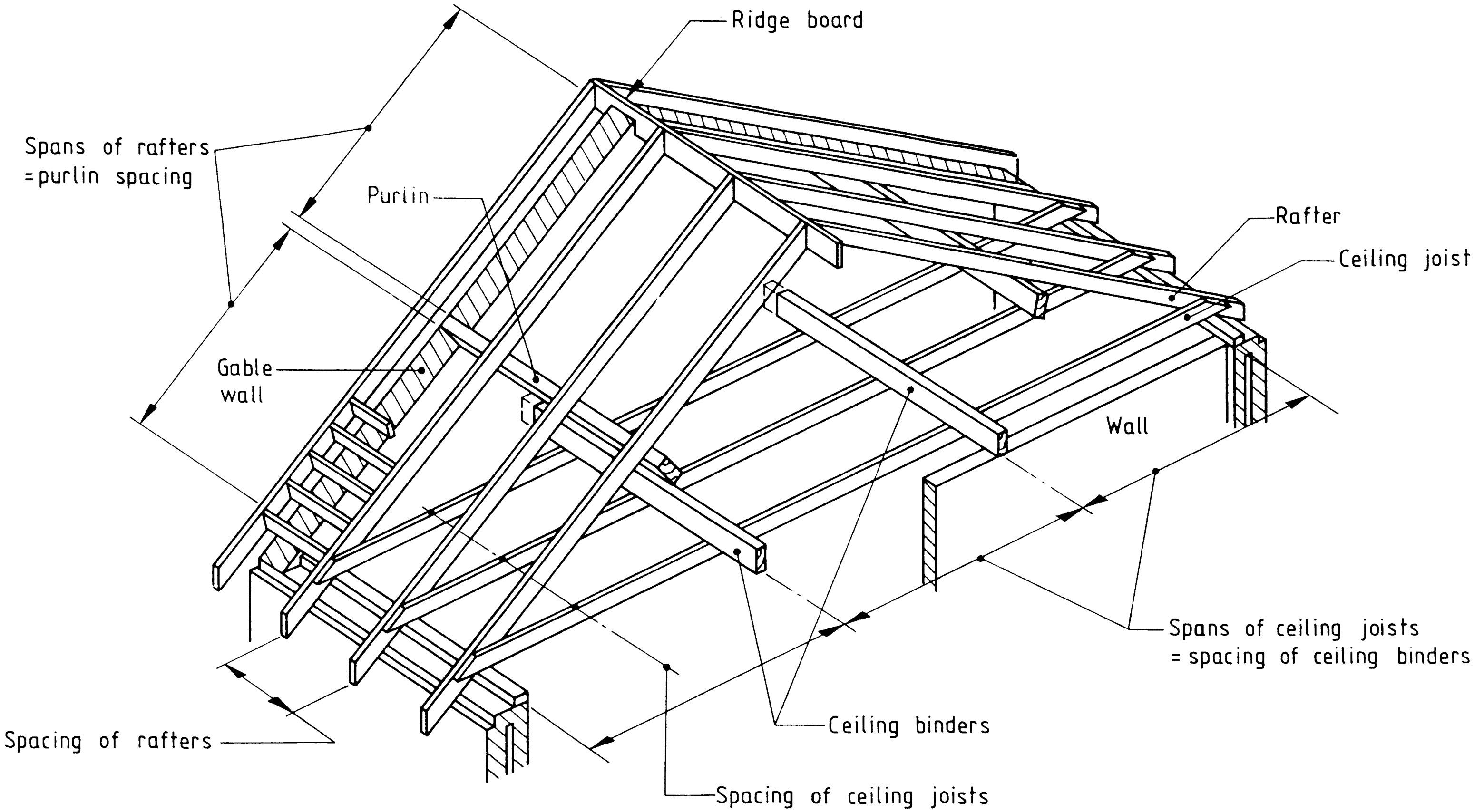

Figure 1 — Roof construction

4.4 Design loads

Two loading conditions should be considered.

a) A point and uniform imposed load condition, the loading consisting of a point imposed load plus uniformly distributed imposed load, dead load and member self weight. This loading should be considered as short term.

b) A uniform imposed load condition, the loading consisting of uniformly distributed imposed load, dead load and member self weight. This loading should be considered as long term.

For the point and uniform imposed load condition

$F_p = 0.9$ kN

acting together with uniform imposed and dead loads and self weight (in kN/m)

$$(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j \qquad (1)$$

For the uniform imposed load condition, F (in kN/m) is given by the equation

$$F = (0.25 + F_d)\left(\frac{s}{1\,000}\right) + F_j \qquad (2)$$

where

s is the joist spacing (in mm);

F_d is the dead load (in kN/m^2);

F_j is the self weight of joist (in kN/m).

The value of F_j (in kN/m) may be found from the equation

$$F_j = 9.80665 \times 10^{-9} \rho b h \qquad (3)$$

where

ρ is the timber density (in kg/m^3);

b is the joist breadth (in mm);

h is the joist depth (in mm).

For the calculation of spans under loading incorporating a point load, the combined effect of uniform and point loads may be obtained using the equivalent uniformly distributed load F.
F (in kN/m) is given by the following equations.

In bending strength calculations

$$F = \frac{1000 \times 2F_p}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j \qquad (4)$$

In shear strength calculations

$$F = \frac{1000 \times 2F_p}{L} + 1.25\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \qquad (5)$$

where the factor 1.25 is inserted to allow for continuity (see **5.1**).

In deflection calculations:

For bending deflection

$$F = \frac{1000 \times 1.6F_p}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j \qquad (6)$$

For shear deflection

$$F = \frac{1000 \times 2F_p}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j \qquad (7)$$

In equations (4) to (7)

$F_p = 0.9$ kN

L is the span (in mm).

5 Permissible spans

5.1 General

The permissible effective span of a timber joist subjected to the applied loads given in **4.3** should be the shortest effective span resulting from calculations for bending strength, shear strength and deflection, as given in **5.2**, **5.3** and **5.4**.

The permissible clear span should be calculated as the permissible effective span less the notional bearing length, calculated in accordance with **5.5**.

Ceiling joists may be single-span beams, i.e. supported only at both ends, or they may be supported within their length by binders or supporting walls. Both configurations are covered by the design equations which recognize that the greatest deflection and bending stress occur in the single-span case while the shear stress is greater for multi-span cases.

5.2 Limitation of bending stress

From BS 5268-2 the permissible bending stress $\alpha_{m,adm}$ (in N/mm^2) is given by the equation

$$\sigma_{m,adm} = \sigma_{m,g} K_3 K_7 \qquad (8)$$

where

$\sigma_{m,g}$ is the grade bending stress (in N/mm^2) (see BS 5268-2);

K_3 is the load duration modification factor, 1.0 for long term or 1.5 short term (see Table 17 of BS 5268-2:1988);

NOTE There is no medium term load case.

K_7 is the section depth modification factor (see **14.6** of BS 5268-2:1988).

Expanding the equation

$$\sigma_{m,adm} = \frac{M}{Z} \quad (9)$$

leads to the following equations.

Point and uniform imposed load condition

$$\sigma_{m,g} \times 1.5 \times K_7 = \left\{\frac{1800}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{L^2}{8} \frac{6}{bh^2} \quad (10)$$

Uniform imposed load condition

$$\sigma_{m,g} \times 1.0 \times K_7 = \left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{L^2}{8} \frac{6}{bh^2} \quad (11)$$

NOTE These equations lead to the following polynomials in L.

Point and uniform imposed load condition

$$\frac{3}{4bh^2}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L^2 + \frac{1350}{bh^2} L - \sigma_{m,g} \times 1.5 K_7 = 0 \quad (12)$$

Uniform imposed load condition

$$\frac{3}{4bh^2}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L^2 - \sigma_{m,g} \times 1.0 \times K_7 = 0 \quad (13)$$

5.3 Limitation of shear stress

From BS 5268-2 the permissible shear stress τ_{adm} (in N/mm^2) is given by the equation

$$\tau_{adm} = \tau_g K_3 \quad (14)$$

where

τ_g is the grade shear stress (in N/mm^2) (see BS 5268-2);

K_3 is the load duration modification factor, 1.0 for long term or 1.5 for short term (see Table 17 of BS 5268-2:1988).

NOTE There is no medium term load case.

Assuming the ceiling tie member is installed to act as continuous over two spans and expanding the equation

$$\tau_{adm} = \frac{3}{2} \frac{F}{2bh} \quad (15)$$

leads to the following equations.

Point and uniform imposed load condition

$$\tau_g \times 1.5 = \frac{3}{2}\left(\frac{900}{L} + 0.625 \times \times \left\{(0.25 + F_d) \frac{s}{1000} + F_j\right\}\right) \frac{L}{bh} \quad (16)$$

Uniform imposed load condition

$$\tau_g \times 1.0 = \frac{3}{2} \times 0.625 \times \times \left\{(0.25 + F_d) \frac{s}{1000} + F_j\right\} \frac{L}{bh} \quad (17)$$

NOTE These equations lead to the following polynomials in L.

Point and uniform imposed load condition

$$\frac{3 \times 0.625}{2bh}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L + \frac{1350}{bh} - \tau_g \times 1.5 = 0 \quad (18)$$

Uniform imposed load condition

$$\frac{3 \times 0.625}{2bh}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L - \tau_g \times 1.0 = 0 \quad (19)$$

5.4 Limitation of deflection

From **14.7** of BS 5268-2:1988, the recommended deflection limitation W_{max} (in mm) for general application is given by the equation

$$W_{max} = 0.003\, L \quad (20)$$

The design equation limiting deflection[1] is:

Point and uniform imposed load condition

$$w_{max} = \frac{5}{384} \frac{FL^4}{EI} + \frac{3}{20} \frac{FL^2}{Gbh} + \frac{1}{48} \frac{F_p L^3}{EI} + \frac{3}{10} \frac{F_p L^3}{Gbh}$$

where E is the mean modulus of elasticity.

Taking G as $\frac{E}{16}$ (see clause **11** of BS 5268-2:1988):

Point and uniform imposed load condition

$$w_{max} = \frac{5}{384} \frac{FL^4}{EI} + \frac{12}{5} \frac{FL^2}{Ebh} + \frac{1}{48} \frac{F_p L^3}{EI} + \frac{24}{5} \frac{F_p L}{Ebh} \quad (21)$$

[1] In addition to the deflection due to bending the shear deflection may be significant and has been taken into account.

or, inserting the expressions for equivalent uniformly distributed load

$$w_{max} = \left\{\frac{1000 \times 1.6F_p}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{5}{384}\frac{L^4}{EI} + \left\{\frac{1000 \times 2F_p}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{12}{5}\frac{L^2}{Ebh} \quad (22)$$

where $F_p = 0.9$ kN.

with a deflection limitation of $0.003\,L$

Point and uniform imposed load condition

$$0.003L = \left\{\frac{1440}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \times \frac{5}{384}\frac{L^4}{E}\frac{12}{bh^3} + \left\{\frac{1800}{L} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{12}{5}\frac{L^2}{Ebh} \quad (23)$$

NOTE This equation leads to the following polynomial in L.

Point and uniform imposed load condition

$$\frac{5}{32Ebh^3}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L^3 + \frac{225}{Ebh^3}L^2 + \frac{12}{5Ebh}\left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L + \frac{4320}{Ebh} - 0.003 = 0 \quad (24)$$

5.5 Permissible clear spans

The calculation of clear span requires the deduction of a notional bearing length from an effective span.

The calculation of the notional bearing length to be deducted from the permissible effective span to produce the clear span is made after finding L_{adm}, the smallest of the effective spans for a given cross section, as limited by:

a) bending stress under point and uniform imposed load;

b) bending stress under uniform imposed load;

c) shear stress under point and uniform imposed load;

d) shear stress under uniform imposed load;

e) deflection under point and uniform imposed load.

From BS 5268-2 the permissible compression perpendicular to the grain stress $\sigma_{c,\perp,adm}$ (in N/mm^2) is given by the equation

$$\sigma_{c,\perp,adm} = \sigma_{c,\perp,g} K_3 \quad (25)$$

where

$\sigma_{c,\perp,g}$ is the grade compression perpendicular to the grain stress (in N/mm^2) (see BS 5268-2)[a];

K_3 is the load duration modification factor, 1.0 for long term or 1.5 for short term (see Table 17 of BS 5268-2:1988).

NOTE There is no medium term load case.

[a] BS 5268-2 provides two values for the grade compression perpendicular to the grain stress. When the specification specifically prohibits wane at bearing areas, the higher value may be used, otherwise the lower value applies. (See footnotes to Table 9, Table 10, Table 11, Table 12 and Table 13 in BS 5268-2:1988.) The span table should indicate whether wane is permitted.

The notional bearing length a (in mm) required at each end should be found from the equation

$$\sigma_{c,\perp,adm}\, ba = \text{Support reaction} \quad (26)$$

where b is the breadth of joist (in mm).

Inserting appropriate expressions for the support reaction, equation (26) gives:

Point and uniform imposed load condition with bending stress or deflection governing

$$\sigma_{c,\perp,g} \times 1.5ba = \left\{\frac{900}{L_{adm}} + (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{L_{adm}}{2} \quad (27)$$

Point and uniform imposed load condition with shear stress governing

$$\sigma_{c,\perp,g} \times 1.5ba = \left\{\frac{900}{L_{adm}} + 0.625 \times (0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} L_{adm} \quad (28)$$

Uniform imposed load condition

$$\sigma_{c,\perp,g} \times 1.0ba = \left\{(0.25 + F_d)\left(\frac{s}{1000}\right) + F_j\right\} \frac{L_{adm}}{2} \quad (29)$$

In equations (27) to (29)

a is the notional bearing length (in mm);

b is the breadth of the joist (in mm);

L_{adm} is the permissible effective span (in mm).

The equation corresponding to the loading condition governing the permissible effective span should be solved for a and half the value of a should be deducted from each end of the span (total deduction a, see Figure 2) to give the permissible clear span. L_{cl} (in mm) is given by the equation

$$L_{cl} = L_{adm} - a \qquad (30)$$

NOTE As the manner of support varies for ceiling joists, the calculation of bearing length assumes support on the underside of the joist and when preparing the span tables in Appendix B the same deduction has been applied to cater for all types of support.

6 Bearing length

Although correct for the calculation of clear span the procedure given in **5.5** for the calculation of bearing length may not ensure that the permissible compression perpendicular to the grain stress is not exceeded for all loading cases.

The design of some members may be governed by a loading case which does not represent the greatest total load of all loading cases. For example, the governing design case may include a concentrated load, but another less critical loading case may consist of a greater total load uniformly distributed along the span.

7 Information to be given in span tables

There are many possible formats for span tables. A typical format suitable for ceiling joists at predetermined centres and for quoted loading is given in Appendix B.

This Section of BS 5268 does not recommend formats for different components but whatever format is used the following information should be given in the heading or in the main body or in the footnotes of the span tables, or in an introduction to the tables:

a) the loading;

b) details of the arrangement of the members;

c) the member sizes and their maximum permissible deviations and/or the standards that define these quantities;

d) the species, stress grade or strength class and/or the standards that define these properties;

e) a statement specifying any requirements additional to those given in the stress grading rules, e.g. whether wane is prohibited at bearings;

f) a statement that the spans have been calculated in accordance with the recommendations of BS 5268-2 and BS 5268-7.3;

g) a statement specifying any structural requirements that may be necessary to comply with the qualifying assumptions made in **4.2**, e.g. lateral support requirements, accommodation of lateral thrust at supports;

h) the permissible clear spans.

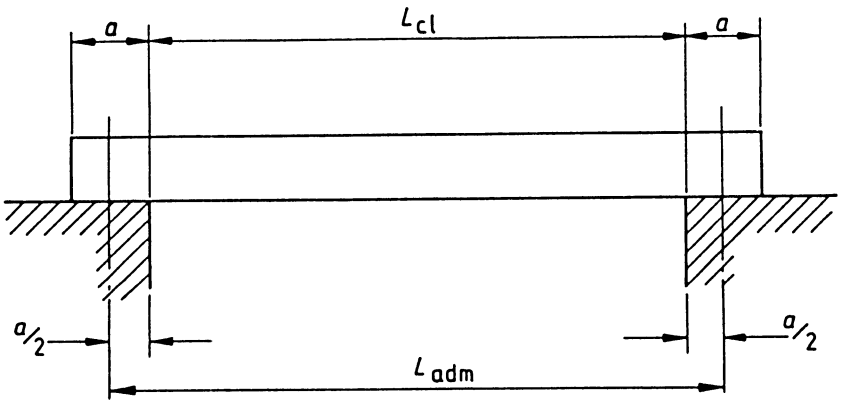

Figure 2 — Bearing length, permissible effective and permissible clear span

Appendix A Sample calculations for a ceiling joist

The object is to find the permissible clear span, given the following data as applicable to a particular design case.

Timber	Strength class SC3		(see Table 3 to Table 6 of BS 5268-2:1988)
Dimensions	Joist breadth, b	= 38 mm	
	Joist depth, h	= 97 mm	
	Joist spacing, s	= 600 mm	
Loading	Dead load, F_d	= 0.25 kN/m^2	[see **4.3** b)]
	Imposed load	= 0.25 kN/m^2	[see **4.3** a)]
	together with 0.9 kN point load		

The following data are given in BS 5268-2:1988.

Grade stresses and density		**BS 5268-2:1988 reference**
Grade bending stress, $\sigma_{m,g}$	= 5.3 N/mm^2	Table 9
Grade shear stress, τ_g	= 0.67 N/mm^2	Table 9
Grade mean modulus of elasticity, E	= 8 800 N/mm^2	Table 9
Grade compression perpendicular to the grain stress (with wane permitted) $\sigma_{c,\perp,g}$	= 1.7 N/mm^2	Table 9
Density, ρ	= 540 kg/m^3	Table 9
Modification factors		
Uniform load, load duration K_3	= 1.0 long term	Table 17
Point load, load duration, K_3	= 1.5 short term	Table 17
Depth, K_7	= $(300/h)^{0.11}$	**14.6**
Permissible stresses and recommended deflection limitation		**BS 5268-7.3 reference**
Permissible bending stress, $\sigma_{m,adm}$ (in N/mm^2)	= $\sigma_{m,g}K_3K_7$	**5.2**
	= 9.001 N/mm^2 for point and uniform load	
	or = 6.001 N/mm^2 for uniform load (long term)	
Permissible shear stress τ_{adm} (in N/mm^2)	= $\tau_g K_3$	**5.3**
	= 1.005 N/mm^2 for point and uniform load	
	or = 0.670 N/mm^2 for uniform load (long term)	
Recommended deflection limitation, W_{max} (in mm)	= 0.003 L	**5.4**
Permissible compression perpendicular to the grain stress, $\sigma_{c,\perp,adm}$ (in N/mm^2)	= $\sigma_{c,\perp,g}K_3$	**5.5**
	= 2.55 N/mm^2 for point load	
	or = 1.7 N/mm^2 for uniform load (long term)	

Application of the design equations from **5.2** to **5.4** leads to the following solutions for effective span, L:

a) limitation of bending stress, point and uniform imposed load L = 1 805 mm [equation (12)];
b) limitation of bending stress, uniform imposed load L = 2 992 mm [equation (13)];
c) limitation of shear stress, point and uniform imposed load L = 7 860 mm [equation (18)];
d) limitation of shear stress, uniform imposed load L = 8 244 mm [equation (19)];
e) limitation of deflection, point and uniform imposed load L = 1 672 mm [equation (24)].

The permissible effective span L_{adm} is therefore

L_{adm} = 1 672 mm

The appropriate equation is selected from **5.5** to calculate the notional bearing length, a, as 7 mm.

The permissible clear span L_{cl} for the joist is then

$L_{cl} = L_{adm} \quad a$

L_{cl} = 1 665 mm

Appendix B Specimen span tables for ceiling joists

There are many possible formats for span tables and Table 1, Table 2 and Table 3 are typical examples. Whatever format is used, the information listed in clause **7** should be given.

Table 1 — Permissible clear spans for ceiling joists: SC3[a]: regularized sizes[b]

Size of joist		**Dead load (in kN/m^2) supported by joist, excluding the self weight of the joist**					
		Not more than 0.25 (25.5 kg/m^2)			More than 0.25 but not more than 0.50 (51 kg/m^2)		
		Centre-to-centre spacing of joists (in mm)					
		400	450	600	400	450	600
		Permissible clear span					
mm		m	m	m	m	m	m
38 ×	72	1.145	1.135	1.108	1.108	1.096	1.058
	97	1.737	1.718	1.665	1.665	1.641	1.577
	122	2.367	2.335	2.250	2.250	2.212	2.112
	147	3.019	2.973	2.850	2.850	2.796	2.658
	170	3.631	3.570	3.411	3.411	3.341	3.164
	195	4.302	4.225	4.024	4.024	3.938	3.718
	220	4.976	4.882	4.639	4.639	4.535	4.273
44 ×	72	1.231	1.220	1.190	1.190	1.176	1.139
	97	1.861	1.839	1.781	1.781	1.754	1.684
	122	2.527	2.492	2.398	2.398	2.357	2.249
	147	3.214	3.163	3.030	3.030	2.972	2.823
	170	3.855	3.790	3.619	3.619	3.545	3.355
	195	4.558	4.476	4.261	4.261	4.169	3.935
	220	5.262	5.162	4.904	4.904	4.794	4.516
47 ×	72	1.271	1.260	1.228	1.228	1.214	1.174
	97	1.918	1.896	1.835	1.835	1.807	1.734
	122	2.601	2.565	2.467	2.467	2.424	2.312
	147	3.304	3.251	3.114	3.114	3.054	2.899
	170	3.959	3.892	3.715	3.715	3.638	3.443
	195	4.676	4.591	4.371	4.371	4.276	4.035
	220	5.393	5.291	5.026	5.026	4.913	4.628

Table 1 — Permissible clear spans for ceiling joists: SC3[a]: regularized sizes[b]

Size of joist		Dead load (in kN/m^2) supported by joist, excluding the self weight of the joist					
		Not more than 0.25 (25.5 kg/m^2)			More than 0.25 but not more than 0.50 (51 kg/m^2)		
		Centre-to-centre spacing of joists (in mm)					
		400	450	600	400	450	600
		Permissible clear span					
mm		m	m	m	m	m	m
50 ×	72	1.310	1.298	1.265	1.265	1.250	1.209
	97	1.973	1.950	1.886	1.886	1.857	1.782
	122	2.672	2.634	2.533	2.533	2.489	2.372
	147	3.389	3.336	3.194	3.194	3.132	2.972
	170	4.058	3.988	3.807	3.807	3.728	3.527
	195	4.788	4.701	4.475	4.475	4.377	4.131
	220	5.517	5.412	5.142	5.142	5.026	4.734
63 ×	147	3.722	3.661	3.502	3.502	3.433	3.255
	170	4.438	4.361	4.160	4.160	4.073	3.852
	195	5.216	5.121	4.875	4.875	4.768	4.500
	220	5.990	5.877	5.585	5.585	5.460	5.144
75 ×	195	5.549	5.448	5.187	5.187	5.075	4.789
	220	6.354	6.236	5.930	5.930	5.798	5.466

NOTE 1 The tables are computed on the basis that the specification does not exclude wane at bearings.
NOTE 2 The spans have been calculated in accordance with the recommendations of BS 5268-2 and BS 5268-7.3. Lateral support should be provided in accordance with **14.8** of BS 5268-2:1988.
NOTE 3 The material should be stress graded in accordance with BS 4978.
NOTE 4 The sizes and their maximum permissible deviations should be in accordance with BS 4471.
[a] For species/grade combinations in this strength class see Table 3 to Table 8 of BS 5268-2:1988.
[b] Regularized sizes are given in BS 4471.

Table 2 — Permissible clear spans for ceiling joists: redwood/whitewood, SS grade, basic sizes[a]

Size of joist		Dead load (in kN/m^2) supported by joist, excluding the self weight of the joist					
		Not more than 0.25 (25.5 kg/m^2)			More than 0.25 but not more than 0.50 (51 kg/m^2)		
		Centre-to-centre spacing of joists (in mm)					
		400	450	600	400	450	600
		Permissible clear span					
mm		m	m	m	m	m	m
38 ×	75	1.325	1.312	1.279	1.279	1.263	1.221
	100	1.970	1.946	1.882	1.882	1.853	1.777
	125	2.651	2.613	2.512	2.512	2.467	2.351
	150	3.352	3.298	3.156	3.156	3.094	2.935
	175	4.064	3.993	3.807	3.807	3.727	3.523
	200	4.782	4.693	4.462	4.462	4.363	4.113
	225	5.502	5.395	5.118	5.118	5.000	4.704
44 ×	75	1.422	1.408	1.370	1.370	1.353	1.306
	100	2.106	2.080	2.010	2.010	1.978	1.895
	125	2.825	2.784	2.674	2.674	2.625	2.500
	150	3.563	3.504	3.351	3.351	3.284	3.113
	175	4.310	4.233	4.034	4.034	3.948	3.731
	200	5.060	4.965	4.720	4.720	4.614	4.349
	225	5.810	5.697	5.404	5.404	5.280	4.966

Table 2 — Permissible clear spans for ceiling joists: redwood/whitewood, SS grade, basic sizes[a]

Size of joist	Dead load (in kN/m^2) supported by joist, excluding the self weight of the joist					
	Not more than 0.25 (25.5 kg/m^2)			More than 0.25 but not more than 0.50 (51 kg/m^2)		
	Centre-to-centre spacing of joists (in mm)					
	400	450	600	400	450	600
	Permissible clear span					
mm	m	m	m	m	m	m
47 × 75	1.467	1.453	1.413	1.413	1.395	1.346
100	2.170	2.143	2.069	2.069	2.036	1.949
125	2.906	2.863	2.749	2.749	2.699	2.569
150	3.661	3.600	3.441	3.441	3.372	3.196
175	4.423	4.344	4.139	4.139	4.051	3.826
200	5.188	5.090	4.838	4.838	4.730	4.457
225	5.952	5.835	5.536	5.536	5.408	5.087
50 × 75	1.511	1.496	1.454	1.454	1.435	1.385
100	2.231	2.202	2.126	2.126	2.091	2.001
125	2.984	2.939	2.821	2.821	2.769	2.634
150	3.754	3.691	3.528	3.528	3.456	3.275
175	4.531	4.450	4.239	4.239	4.148	3.918
200	5.309	5.209	4.951	4.951	4.840	4.561
225	6.085	5.966	5.661	5.661	5.530	5.202
63 × 150	4.113	4.044	3.861	3.861	3.782	3.581
175	4.944	4.855	4.624	4.624	4.524	4.271
200	5.772	5.664	5.383	5.383	5.263	4.960
225	6.594	6.467	6.138	6.138	5.998	5.645
75 × 200	6.131	6.017	5.721	5.721	5.594	5.273
225	6.985	6.852	6.509	6.509	6.362	5.991

NOTE 1 The tables are computed on the basis that the specification does not exclude wane at bearings.
NOTE 2 The spans have been calculated in accordance with the recommendations of BS 5268-2 and BS 5268-7.3. Lateral support should be provided in accordance with **14.8** of BS 5268-2:1988.
NOTE 3 The material should be stress graded in accordance with BS 4978.
NOTE 4 The sizes and their maximum permissible deviations should be in accordance with BS 4471.
[a] Basic sizes are given in BS 4471.

Table 3 — Permissible clear spans for ceiling joists: spruce-pine-fir, joist and plank no. 2 grade, CLS sizes[a]

Size of joist	Dead load (in kN/m^2) supported by joist, excluding the self weight of the joist					
	Not more than 0.25 (25.5 kg/m^2)			More than 0.25 but not more than 0.50 (51 kg/m^2)		
	Centre-to-centre spacing of joists (in mm)					
	400	450	600	400	450	600
	Permissible clear span					
mm	m	m	m	m	m	m
38 × 140	2.872	2.828	2.713	2.713	2.663	2.532
184	4.063	3.990	3.803	3.803	3.721	3.515
235	5.466	5.358	5.079	5.079	4.961	4.663
285	6.844	6.699	6.331	6.331	6.176	5.788

NOTE 1 The tables are computed on the basis that the specification does not exclude wane at bearings.
NOTE 2 The spans have been calculated in accordance with the recommendations of BS 5268-2 and BS 5268-7.3. Lateral support should be provided in accordance with **14.8** of BS 5268-2:1988.
NOTE 3 The material should be stress graded in accordance with NLGA rules.
NOTE 4 The sizes and their maximum permissible deviations should be in accordance with Appendix A of BS 4471:1987.
[a] CLS sizes are given in Appendix A of BS 4471:1987.

blank

Publications referred to

BS 648, *Schedule of weights of building materials.*
BS 4471, *Specification for sizes of sawn and processed softwood.*
BS 4978, *Specification for timber grades for structural use.*
BS 5268, *Structural use of timber.*
BS 5268-2, *Code of practice for permissible stress design, materials and workmanship.*
BS 5268-3, *Code of practice for trussed rafter roofs.*
BS 5268-7.1, *Domestic floor joists*[2)].
BS 5268-7.2, *Joists for flat roofs*[2)].
BS 5268-7.4, *Ceiling binders*[2)].
BS 5268-7.5, *Rafters*[2)].
BS 5268-7.6, *Purlins supporting rafters*[2)].
BS 5268-7.7, *Purlins supporting sheeting or decking*[2)].
BS 6100, *Glossary of building and civil engineering terms.*
BS 6100-2.1, *Structural design and elements.*
BS 6100-4.1, *Characteristics and properties of timber and wood based panel products.*
BS 6100-4.2, *Sizes and quantities of solid timber.*
BS 6100-4.3, *Wood based panel products.*
BS 6100-4.4, *Carpentry and joinery.*
BS 6399, *Loading for buildings.*
BS 6399-1, *Code of practice for dead and imposed loads.*
ISO 3898, *Bases for design of structures — Notations — General symbols.*
CIB-W18-1, *Symbols for use in structural timber design. International Council for Building Research Studies and Documentation, Post Box 20704, 3001 JA Rotterdam, The Netherlands.*
NLGA 1979, *The national grading rules for dimension lumber. National Lumber Grades Authority, 1460-1055 West Hastings Street, Vancouver, British Columbia, Canada V6E 2G8.*

[2)] Referred to in the foreword only.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL