



Department of
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Building Regulations (Northern Ireland) 2011

Proposed Guidance Edition

of

Technical Booklet D

Structure

Draft for Consultation

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Technical Booklet D

Draft for Consultation

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Introduction

Technical Booklets

Purpose of Technical Booklets

This Technical Booklet is one of a series that has been prepared by the Department of Finance and Personnel (the Department) for the purpose of providing practical guidance with respect to the technical requirements of the Building Regulations (Northern Ireland) 2011 (the Building Regulations).

Technical Booklets give practical guidance for most of the more common building situations. If this guidance is followed there will be a presumption of compliance with the requirements of the Building Regulations covered by the guidance. For example, if one particular case is unusual in some way, then 'normal' guidance may not be applicable. It is also important to note that there may be alternative ways of achieving compliance with the relevant requirements. There is therefore no obligation to follow the methods or comply with the standards set out in a Technical Booklet if you prefer to meet the requirements in some other way.

This Technical Booklet

Requirements

The guidance contained in this Technical Booklet relates only to the requirements of regulations D1 and D2. The work will also have to comply with all other requirements of the relevant Building Regulations.

Diagrams

The diagrams in this Technical Booklet supplement the text. They do not show all the details of construction and are not intended to illustrate compliance with any other requirement of the Building Regulations. They are not necessarily to scale and should not be used as working details.

British Standards and European Technical Specifications

The Building Regulations are made for the following specific purposes: securing the health, safety, welfare and convenience of people; furthering the conservation of fuel and power; furthering the protection and enhancement of the environment; and promoting sustainable development. Standards and technical approvals are relevant guidance to the extent that they relate to these purposes. However, they may also address other aspects of performance such as serviceability, or aspects which although they relate to health and safety are not covered by the Building Regulations.

In this introduction and throughout this Technical Booklet any reference to a British Standard shall be construed as a reference to –

- (a) a British Standard or British Standard Code of Practice;
- (b) a harmonised standard or other relevant standard of a national standards body of any Member State of the European Economic Area;

- (c) an international standard recognised for use in any Member State of the European Economic Area;
- (d) any appropriate, traditional procedure of manufacture of a Member State of the European Economic Area which has a technical description sufficiently detailed to permit an assessment of the goods or materials for the use specified; or
- (e) a European Technical Approval issued in accordance with the Construction Products Directive,

provided that the proposed standard, code of practice, specification, technical description or European Technical Approval provides, in use, equivalent levels of safety, suitability and fitness for purpose as that provided by the British Standard.

The Department intends from time to time to review the guidance in its Technical Booklets to reflect emerging European harmonised standards. Where a national standard is to be replaced by a European harmonised standard, there will be a co-existence period during which either standard may be referred to. At the end of the co-existence period the national standard will be withdrawn.

Products conforming with a European Council Directive

Any product designed and manufactured to comply with the requirements of a European Council Directive does not have to comply with any other standard or part of a standard, whether British, international or other, which relates to the same characteristic or specific purpose as the EC Directive.

CE marked construction products

Any construction product (within the meaning of the Construction Products Directive) which bears a CE marking shall be treated as if it satisfied the requirements of any appropriate British Standard, British Standard Code of Practice or British Board of Agrément Certificate relating to such a product, where the CE marking relates to the same characteristic or specific purpose as the Standard, Code of Practice or Certificate.

(It is the intention of the Department to review this Introduction to recognise the implementation of new arrangements regarding construction products and CE marking under Regulation (EU) No 305/2011 which will come fully into effect on 1 July 2013.)

Named standards

Where this Technical Booklet makes reference to a named standard, the relevant version of the standard is the one listed in the Appendix. However, if this version has been replaced or updated by the issuing standards body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Building Regulations.

Materials and workmanship

Any work to which a requirement of the Building Regulations applies must, in accordance with Part B of the Building Regulations, be carried out with suitable materials and in a workmanlike manner. You will find guidance in relation to this in Technical Booklet B (Materials and workmanship).

Interaction with other legislation

The Workplace (Health, Safety and Welfare) Regulations (Northern Ireland) 1993

The Workplace (Health, Safety and Welfare) Regulations (Northern Ireland) 1993 (the Workplace Regulations) contain some requirements which affect building design. The main requirements are now covered by the Building Regulations, but for further information see – The Workplace Regulations and the *Workplace Health, Safety and Welfare Approved Code of Practice*.

The Workplace Regulations apply to the common parts of flats and similar buildings if people such as cleaners, wardens and caretakers are employed to work in these common parts. Where the requirements of the Building Regulations that are covered by this Part do not apply to dwellings, the provisions may still be required in the situations described above in order to satisfy the Workplace Regulations.

Construction (Design And Management) Regulations (Northern Ireland) 2007

The Construction (Design and Management) Regulations (Northern Ireland) 2007 impose requirements which affect building design. These include, amongst other things, the need for coordination, co-operation and communication between all parties in the construction process. The regulations also require –

- (a) those undertaking design works, as part of a business, to be competent.
- (b) an indication of the proposed construction sequence, if this is not obvious to a competent contractor. This is particularly relevant to refurbishments and new basements to existing buildings.

Note that these regulations apply to non-domestic clients, designers and contractors no matter what the duration or size of the project.

Part D Regulations

It should be noted that the following regulations are the requirements of Part D of the Building Regulations (Northern Ireland) 2011. All parts of the regulations must be read in conjunction with Part A: Interpretation and general of those regulations.

PART D

Structure

D1 Stability

A building shall be designed and constructed so that the combined dead, imposed and wind loads are sustained and transmitted to the ground, taking into account the nature of the ground —

- (a) safely; and
- (b) without impairing the safety of any part of another building.

D2 Disproportionate collapse

A building shall be designed and constructed so that in the event of damage occurring to any part of the building, the extent of any resulting collapse will not be disproportionate to the cause of the damage.

Guidance - Performance and introduction to provisions

Regulation D1 - Stability

Performance

- 0.1 In the Department's view the requirements of regulation D1 will be met when the structure of a building is designed and constructed so as to ensure the safety of people in or about the building.

Codes and standards relevant to all building types

For all building types, following the recommendations given in the documents listed in paragraphs 2.2 to 2.10 will demonstrate compliance with the requirements of regulation D1. However, where they do not give precise guidance, consideration should be given to paragraph 0.2. Alternative codes and standards to those listed in paragraphs 2.2 to 2.10 may be used to satisfy the requirements of the Building Regulations.

Further considerations

- 0.2 The safety of a structure depends on the successful combination of design and completed construction, particularly —
- (a) identification of hazards to which the structure is likely to be subjected and assessment of the risks using the conditions that can reasonably be foreseen during future use;
 - (b) the self-weight of the building;
 - (c) the loads imposed on the building including those arising from climatic conditions;
 - (d) combinations of (a) (b) and (c);
 - (e) properties of materials;
 - (f) safety factors;
 - (g) the nature of the ground;
 - (h) impact on and by other buildings; and
 - (j) workmanship.

The numeric values of safety factors, whether expressed explicitly or implicitly in design equations, or design values, should be derived from considerations of the above aspects of design and construction as a whole. A change in any one of these aspects may disturb the safety of the structure.

Actions used in calculations should allow for possible dynamic, concentrated and peak load effects that may occur. The design should ensure that the effects of actions do not cause a situation of irreversible serviceability limit states.

Alternative approach to satisfying Regulation D1 in relation to single family houses, annexes and small single storey buildings

- 0.3 For a single family house of not more than 3 storeys in height, an annex or a small single storey building, a designer may wish to follow the guidance given in Section 4 of this Technical Booklet to demonstrate compliance with the requirements of Regulation D1.

Introduction to provisions in Section 4

Part 4A of Section 4 provides guidance on the basic requirements for stability

The guidance in Part 4B of Section 4 is concerned with various timber members. Provisions are given in relation to the strength, loadings, sizes and spacings of those timber members.

Part 4C of Section 4 provides guidance on the design of masonry walls. Provisions are given regarding conditions relating to the building, conditions relating to the wall and wall thickness.

Part 4D of Section 4 provides guidance on the proportions for masonry chimneys above the roof surface.

The guidance in Part 4E of Section 4 is concerned with the design of concrete strip foundations.

Regulation D2 - Disproportionate collapse

Performance

- 0.4 In the Department's view the requirements of regulation D2 will be met when a building is designed and constructed so as to ensure the safety of people in or about the building taking into consideration accidental actions to which the structure may be subjected and the buildings ability to sustain a limited extent of damage or failure without a disproportionate level of collapse.

All building types

Following the procedures given in Section 3 and implementing the determined measures required to ensure robustness will demonstrate compliance with the requirements of regulation D2.

Introduction to provisions in Section 3

Section 3 gives the procedure to determine the measures required for ensuring that the building is sufficiently robust to sustain a limited extent of damage or failure, depending on the class of the building, without collapse.

Section 1 General

General

- 1.1 The general rules in paragraph 4A.1 should be complied with when using Parts 4B and 4C of Section 4. Sections 3 and 4 may be used independently of each other.

Definitions

- 1.2 In this Technical Booklet the following definitions apply –

Annex – a single storey adjunct to a house (e.g. a veranda, garage, tool shed, fuel store, lavatory etc.) with dimensions not greater than those given in paragraph 4C.40.

Buttressing wall – a wall designed and constructed to afford lateral support to another wall perpendicular to it, support being provided from the base to the top of the wall.

Cavity width – the horizontal distance between the two leaves of a cavity wall.

Compartment wall – a wall constructed as a compartment wall to meet the requirements of regulation E4(3).

Dead load – the load due to the weight of all walls, permanent partitions, floors, roofs and finishes, including services, and all other permanent construction.

Imposed load – the load assumed to be produced by the intended occupancy or use, including the weight of movable partitions, distributed, concentrated, impact, inertia and snow loads, but excluding wind loads.

Pier – a member which forms an integral part of a wall, in the form of a thickened section at intervals along the wall so as to afford lateral support to the wall to which it is bonded or securely tied.

Separating wall – a wall or part of a wall which is common to adjoining buildings, and constructed to meet the requirements of regulation E4(2).

Small single storey building – a building that is not a dwelling having dimensions not greater than those given in paragraph 4C.40.

Spacing – the distance between the longitudinal centres of any 2 adjacent timber members of the same type, measured in the plane of floor, ceiling or roof structure of which the members form a part.

Span – the distance measured along the centre line of a member between the centres of any two adjacent bearings or supports.

Note: the spans given in Part 4B of Section 4 for floor joists, rafters, purlins, ceiling joists, binders and roof joists are clear spans, i.e. spans between the faces of the supports.

Supported wall – a wall to which lateral support is afforded by a combination of buttressing walls, piers or chimneys acting in conjunction with floor(s) or roof.

Wind load – the load due to the effect of wind pressure or suction.

Section 2 Codes and standards relevant to all building types

- 2.1 This Section is relevant to all building types and lists Codes and Standards for structural design and construction which if followed, will demonstrate compliance with the requirements of regulation D1 and regulation D2.

Demonstrating compliance with regulation D1: Stability

Loadings

- 2.2 Eurocode 1 - Action on structures
- BS EN 1991-1-1:2002 General actions - Densities, self-weight, imposed loads for buildings⁽¹⁾.
 - BS EN 1991-1-3:2003 General actions - Snow loads⁽¹⁾.
 - BS EN 1991-1-4:2005 General actions - Wind actions⁽¹⁾.

Design and construction

Reinforced prestressed or plain concrete

- 2.3 Eurocode 2 - Design of concrete structures
- BS EN 1992-1-1:2004 General rules and rules for building⁽¹⁾.
 - BS EN 1992-1-2:2004 Structural fire design⁽¹⁾.

Steel

- 2.4 Eurocode 3 - Design of steel structures
- BS EN 1993-1-1:2005 General rules and rules for building⁽¹⁾.
 - BS EN 1993-1-2: Structural fire design⁽¹⁾.
 - BS EN 1993-1-3:2006 Supplementary rules for cold formed members and sheeting⁽¹⁾.
 - BS EN 1993-1-5:2006 Plated structural elements⁽¹⁾.
 - BS EN 1993-1-8:2005 Design of joints⁽¹⁾.
 - BS EN 1993-1-10:2005 Material toughness and through-thickness properties⁽¹⁾.

Composite steel and concrete

- 2.5 Eurocode 4: Design of composite concrete and steel structures
- BS EN 1994-1-1:2004 General rules and rules for building⁽¹⁾.
 - BS EN 1994-1-2: 2005 Structural fire design⁽¹⁾.

(1) To be read in conjunction with the associated National Annex and BS EN 1990.

Timber (Generally)

- 2.6 Eurocode 5 - Design of timber structures
BS EN 1995-1-1:2004 Common rules and rules for building⁽¹⁾.
BS EN 1995-1-2:2004 Structural fire design⁽¹⁾.

Masonry

- 2.7 Eurocode 6 - Design of masonry structures
BS EN 1996-1-1:2005 Rules for reinforced and unreinforced masonry structures⁽¹⁾.
BS EN 1996-1-2:2005 Structural fire design⁽¹⁾.
BS EN 1996-3:2006 Simplified calculations method⁽¹⁾.

Foundations (Generally)

- 2.8 Eurocode 7 - Geotechnical Design
BS EN1997-1: General rules⁽¹⁾.

Aluminium

- 2.9 Eurocode 9 - Design of aluminium structures
BS EN 1999-1-1:2007 General structural rules⁽¹⁾.
BS EN 1999-1-2:2007 Structural fire design⁽¹⁾.
BS EN 1999-1-3:2007 Structures susceptible to fatigue⁽¹⁾.

Demonstrating compliance with regulation D2 - Disproportionate collapse

Robustness

- 2.10 Eurocode 1 - Action on structures
BS EN 1991-1-7:2006 Accidental actions⁽¹⁾.

(1) To be read in conjunction with the associated National Annex and BS EN 1990.

Using alternative codes and standards to satisfy regulation D1

All buildings

- 2.11 As an alternative to the codes and standards referenced in paragraphs 2.2 to 2.9, the documents referred to in paragraphs 2.12 to 2.19, which were withdrawn by the British Standards Institution on 31 March 2010, may be used to satisfy the requirements of the Building Regulations. However, designers will be required to demonstrate appropriate use of withdrawn standards in the circumstances of the building work. Using withdrawn British Standards may continue to be acceptable where it can be demonstrated that design reliability can be achieved. Particular care must be exercised in relation to withdrawn codes used to calculate wind and snow loads where the effects of climate change may render these unsafe. Consistency of design approach is required and designs should not inappropriately mix Eurocodes and withdrawn British Standards.

Structural loadings

- 2.12 BS 6399: Part 1:1996 Loading for buildings. Code of practice for dead and imposed loads (excluding imposed roof loads).
- BS 6399: Part 2:1997 Loading for buildings. Code of practice for wind loads.
- BS 6399: Part 3:1998 Loading for buildings. Code of practice for imposed roof loading.

Reinforced prestressed or plain concrete

- 2.13 BS 8110: Part 1:1997 Structural use of concrete. Code of practice for design and construction.
- BS 8110: Part 2:1985 Structural use of concrete. Code of practice for special circumstances.
- BS 8110: Part 3:1985 Structural use of concrete. Design charts for singly reinforced beams, doubly reinforced beams and rectangular columns.

Steel

- 2.14 BS 5950: Part 1:2000 Structural use of steelwork in building. Code of practice for design in simple and continuous construction: hot rolled and welded sections.
- BS 5950: Part 2:2001 Structural use of steelwork in building. Specification for materials, fabrication and erection, hot rolled sections.
- BS 5950: Part 5:1998 Structural use of steelwork in building. Code of practice for design of cold formed thin gauge sections.

Composite steel and concrete

- 2.15 BS 5950: Part 3:1990 Section 3.1 Structural use of steelwork in building. Design in composite construction. Code of practice for design of simple and continuous composite beams.

BS 5950: Part 4:1994 Structural use of steelwork in building. Code of practice for design of composite slabs with profiled steel sheeting.

Timber (Generally)

- 2.16 BS 5268: Part 2:2002 Structural use of timber. Code of practice for permissible stress design, materials and workmanship.

BS 5268: Part 3:2006 Structural use of timber. Code of practice for trussed rafter roofs.

Masonry

- 2.17 BS 5628: Part 1:2005 Code of practice for use of masonry. Structural use of unreinforced masonry

BS 5628: Part 2:2005 Code of practice for use of masonry. Structural use of reinforced and pre-stressed masonry.

BS 5628: Part 3:2005 Code of practice for use of masonry. Materials and components, design and workmanship.

Foundations (Generally)

- 2.18 BS 8004:1986 Code of practice for foundations

Aluminium

- 2.19 BS 8118: Part 1:1991 Structural use of aluminium. Code of practice for design.

BS 8118: Part 2:1991 Structural use of aluminium. Specification for materials, workmanship and protection.

For single family houses and small buildings

General

- 2.20 For a house of not more than 3 storeys in height, an annex or a small single storey building, an alternative way of meeting the requirement of regulation D1 is to follow the recommendations given in the publications listed in paragraphs 2.21 to 2.24

Foundations for houses and small buildings

- 2.21 BS 8103: Part 1:1995 Structural design of low-rise buildings. Code of practice for stability, site investigation, foundations and ground floor slabs for housing

Suspended concrete floors for houses

- 2.22 BS 8103: Part 4:1995 Structural design of low-rise buildings. Code of practice for suspended concrete floors for housing

Timber floors and roofs for houses

- 2.23 BS 8103: Part 3:2009 Structural design of low-rise buildings. Code of practice for timber floors and roofs for housing.

Masonry walls for housing and small single storey buildings

- 2.24 BS 8103: Part 2:2005 Structural design of low-rise buildings. Code of practice for masonry walls for housing.

Section 3 Disproportionate collapse

Application

- 3.1 This Section gives the procedure to determine measures to ensure the robustness of any building.

Procedure

Determination of measures to ensure robustness

- 3.2 To ensure that a building is sufficiently robust to sustain a limited extent of damage –
- (a) the class of building **should** be determined using Table 3.1; and
 - (b) the required measures, described in paragraphs 3.4 to 3.11 for the class of building determined, **should** be followed.

The design of the required measures must be undertaken by a suitably qualified person, such as a chartered structural engineer.

Designation of different building classes within a building

- 3.3 In some circumstances it may be appropriate to treat some parts of a building as belonging to a different building class. The designation of parts of a building as belonging to different classes **should** only be undertaken on the recommendation of a suitably qualified person, such as a chartered structural engineer.

Table 3.1 Building classes

Class	Building type by height, floor area and/or occupancy
1	Single family houses of not more than 4 storeys Agricultural buildings Buildings into which people rarely go, provided no part of the building is closer to another building, or area where people do go, than a distance of 1.5 times the building height
2A	5 storey single family houses. Hotels, flats, maisonettes and other residential buildings not more than 4 storeys. Offices not more than 4 storeys. Industrial buildings not more than 3 storeys. Shops and enclosed shopping centres not more than 3 storeys, with each storey having a floor area of not more than 2000 m ² . Educational buildings of not more than one storey. All other buildings not more than 2 storeys, to which members of the public are admitted, with a floor area not greater than 2000 m ² at each storey.
2B	Hotels, flats, maisonettes and other residential buildings more than 4 storeys but not more than 15 storeys. Educational buildings more than 1 storey but not more than 15 storeys. Shops and enclosed shopping centres more than 3 storeys but not more than 15 storeys. Hospitals not more than 3 storeys. Offices more than 4 storeys but not more than 15 storeys. Car parking not more than 6 storeys. Grandstands accommodating not more than 5000 spectators. All other buildings to which members of the public are admitted which contain floor areas greater than 2000 m ² but not greater than 5000 m ² at each storey.
3	Grandstands accommodating more than 5000 spectators. Buildings containing hazardous substances and/or processes. All buildings defined above as Class 2A and 2B that exceed the maximum limits on the number of storeys and/or floor area.
Note:	
<ol style="list-style-type: none"> 1 For buildings intended for more than one type of use, the Class should be that pertaining to the most onerous type 2 In determining the number of storeys in a building, each basement storey shall be counted as a storey. However, basement storeys which fulfill the robustness requirements of Class 2B can be excluded 3 This table is not intended to be exhaustive so the Class of any building not falling into any of the groups listed shall be agreed with the district council 	

Measures required to ensure robustness

Class 1 buildings

- 3.4** For a Class 1 building, provided the building has been designed and constructed in accordance with the publications specified in [Section 1](#) or, in the case of a single family house of not more than 3 storeys, the guidance given in [Section 4](#), to satisfy the requirements of regulation D1, no additional measures are necessary.

Class 2A buildings

- 3.5** For a Class 2A building, effective horizontal ties should be provided, or effective anchorage of suspended floors to walls, as described in the codes and standards listed under paragraph 3.8 for framed and load-bearing wall construction; the latter being defined in paragraph 3.11.

Class 2B buildings

- 3.6 For a Class 2B building either (a) or (b) **should be followed** –
- (a) provide effective –
 - (i) horizontal ties, as described in the codes and standards listed under paragraph 3.8 for framed and load-bearing wall construction; (the latter being defined in paragraph 3.11); and
 - (ii) vertical ties, as defined in the codes and standards listed under paragraph 3.8, in all supporting columns and walls; or
 - (b) check that upon the notional removal of each supporting column and each beam supporting one or more columns, or any nominal length of load-bearing wall (one at a time in each storey of the building) that the building remains stable and that the area of floor at any storey at risk of collapse does not exceed 15% of the floor area of that storey or **100 m²**, whichever is smaller, and does not extend further than the immediate adjacent storeys (see Diagram 3.1).

Where the notional removal of such columns and lengths of walls would result in an extent of damage in excess of the above limit, then any such element should be designed as a “key element” as described in paragraph 3.10.

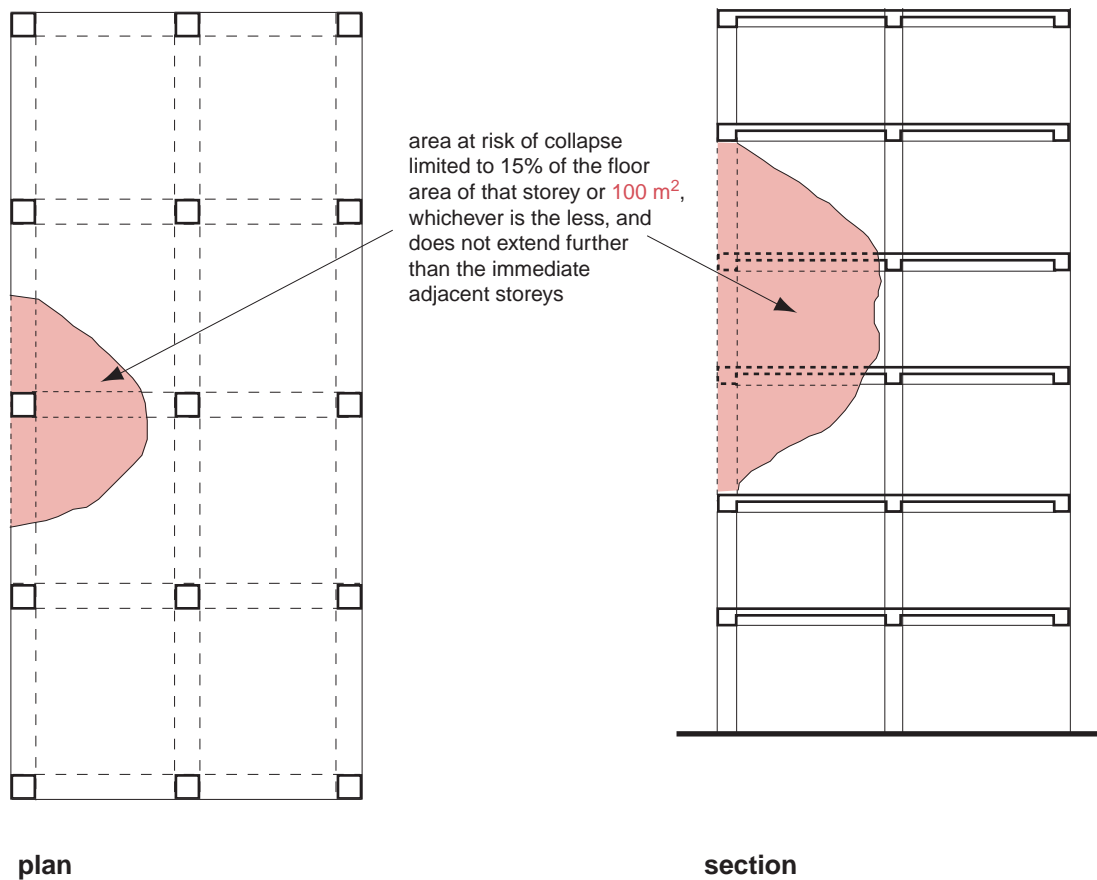
Class 3 buildings

- 3.7 For Class 3 buildings, a systematic risk assessment of the building **should** be undertaken taking into account all the normal hazards that may reasonably be foreseen, together with any abnormal hazards.

Critical situations for design should be selected that reflect the conditions that can reasonably be foreseen as possible during the life of the building. The structural form and concept and any protective measures should then be chosen and the detailed design of the structure and its elements undertaken in accordance with the recommendations given in the Codes and Standards given in paragraph 3.8.

Diagram 3.1 Area at risk of collapse in the event of damage

see para 3.6



Codes and Standards

- 3.8 Details of the effective horizontal and vertical ties, together with the design approaches for checking the integrity of the building following the notional removal of vertical members and the design of key elements, are available in [BS EN 1991-1-7:2006](#).

As an alternative to the above, the Standards referenced below which have been withdrawn by the British Standards Institution, may be used to satisfy the requirements of the building regulations. However, designers will be required to demonstrate appropriate use of withdrawn standards in the circumstances of the building work. Using withdrawn British Standards may continue to be acceptable where it can be demonstrated that design reliability can be achieved.

- (a) BS 5628: Part 1:2005;
- (b) BS 5950: Part 1:2000;
- (c) BS 8110: Part 1:1997; and
- (d) BS 8110: Part 2:1985.

Nominal length of load-bearing wall

- 3.9 The nominal length of load-bearing wall construction referred to in paragraph 3.6(b) **should** be taken as follows —
- (a) in the case of a reinforced concrete wall, the distance between lateral supports, subject to a maximum length not exceeding $2.25H$;
 - (b) in the case of an external masonry wall, or timber or steel stud wall, the length measured between vertical lateral supports; and
 - (c) in the case of an internal masonry wall, or timber or steel stud wall, a length not exceeding $2.25H$,
- where H is the storey height in metres.

Key elements

- 3.10 A “key element”, as referred to in paragraph 3.6, **should** be capable of sustaining an accidental design loading of 34 kN/m^2 applied in the horizontal and vertical directions (in one direction at a time), to the member and any attached components (e.g. cladding etc.), having regard to the ultimate strength of such components and their connections. Such accidental design loading **should** be assumed to act simultaneously with one third of all normal characteristic loading (i.e. wind and imposed loading).

Load-bearing wall construction

- 3.11 For the purposes of this Section the term “load-bearing wall construction” includes masonry cross-wall construction and walls comprising close centred timber or lightweight steel section studs.

Houses, annexes and small single storey buildings

Section 4 Single family houses, annexes and small single storey buildings

Application

- 4.1 This Section applies to a single family house of not more than 3 storeys in height, an annex and a small single storey building other than a dwelling.

General

- 4.2 This section is presented as follows:
- 4A Basic requirements for stability.
 - 4B Timber floor, ceiling and roof members in a house
 - 4C Masonry walls
 - 4D Proportions for masonry chimneys above the roof surface.
 - 4E Foundations of plain concrete.

4A Basic requirements for stability

General

- 4A.1 These basic requirements for stability must be used in conjunction with Sections 4B and 4C.

Roofs

Trussed rafter roofs **should** be braced to the recommendations of BS 5268: Part 3: 2006. Where a traditionally framed roof (i.e. using rafters, purlins and ceiling joists) does not have sufficient built-in resistance to instability, for instance from hipped returns, rigid sarking or the like, then bracing equivalent to that recommended in BS 5268: Part 3: 2006 **should** be provided.

Walls

If the roof structure is braced as described above and adequately anchored to the structure beneath, and the walls are designed and restrained in accordance with the requirements of Section 4, no further provision is required to take account of loads due to the effect of wind pressure or suction.

4B Timber floor, ceiling or roof members in a house

Determination of dimensions of timber members

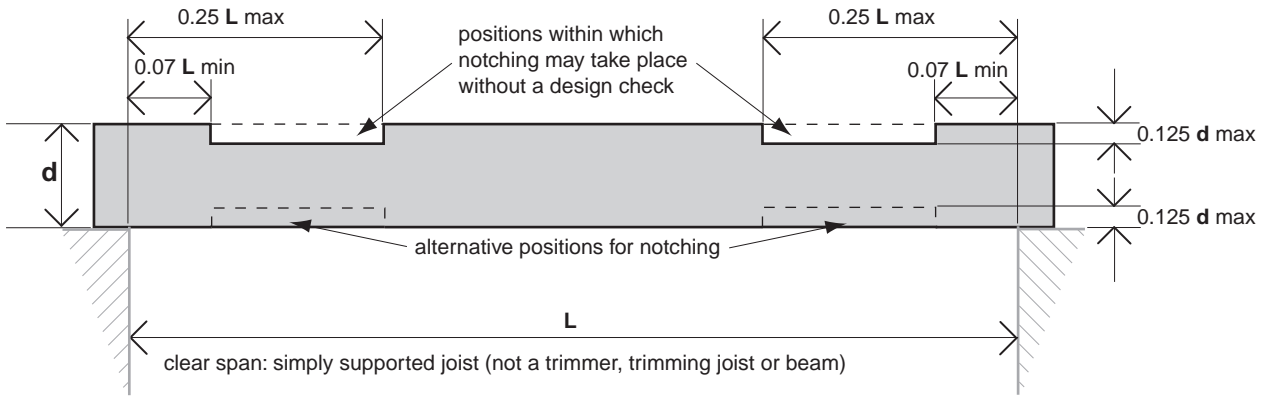
- 4B.1 The dimensions of a timber floor, ceiling or roof member may be determined by following either –
- (a) the guidance given in “Eurocode 5 span tables for solid timber members in floors, ceilings and roofs for dwellings” published by TRADA and available from Chiltern House, Stocking Lane, Hughenden Valley, High Wycombe, Bucks HP14 4ND; or
 - (b) the guidance given in paragraphs 4B.2 to 4B.15.

Generally

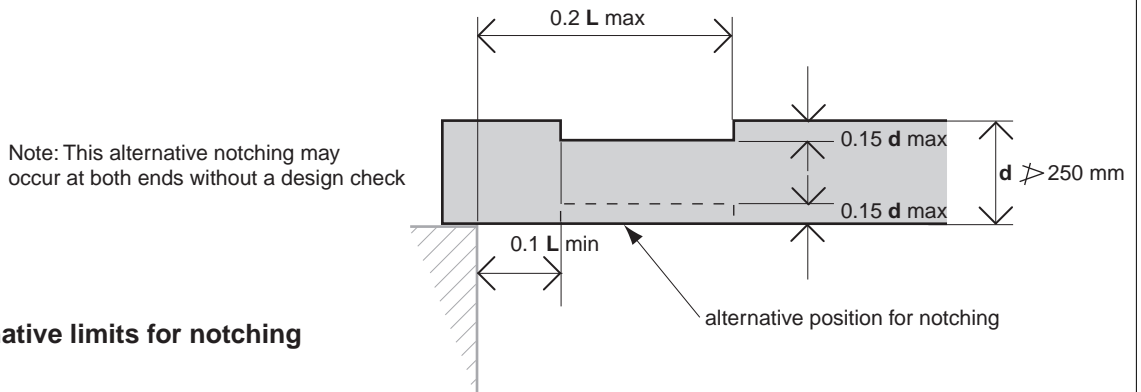
- 4B.2 The stability requirements in paragraph 4A.1 **should** be complied with when using this Section.
- 4B.3 The dimensions of a timber member may be determined by this Section where –
- (a) the dead and imposed loads to be sustained by the floor, ceiling or roof of which the member forms part, do not exceed the values given in the notes to the appropriate diagrams and tables;
 - (b) the species and grade of timber for the strength class to which the table relates is either –
 - (i) as given in Table 4B.1 for more common species; or
 - (ii) as given in the more comprehensive tables of BS 5268: Part 2: 2002;
 - (c) the timber is service class 1 or 2 and is clearly marked “Dry” or “KD” (kiln dried); and
 - (d) floorboarding complying with BS 1297: 1987 is used.
- 4B.4 Strength classes, species, grades and species combinations referred to in this Section are as defined in BS 5268: Part 2: 2002.
- 4B.5 Cross sectional dimensions given in the tables to this Section are applicable to either basic sawn or regularised sizes as defined in BS EN 1313 - 1: 2010. Reference **should** be made to the accompanying notes to the tables to determine whether sawn or regularised sizes apply. The tables do not apply where dimensions have been reduced by planing. For timber of North American origin the tables apply only as indicated to surface sizes unless the timber has been resawn to BS EN 1313 -1: 2010 requirements.
- 4.6 Notches and holes in simply supported floor and roof joists **should** be within the limits shown in Diagram 4B.1. No notches or holes **should** be cut in roof rafters, other than at supports where the rafter may be birdsmouthed to a depth not exceeding 0.33 times the rafter depth.
- 4.7 Bearing areas and workmanship **should** comply with the relevant requirements of BS 5268: Part 2: 2002 and to the lateral restraint provisions given in paragraphs 4B.21 to 4B.24.

Diagram 4B.1 Limitations for notches and holes in floor and roof joists

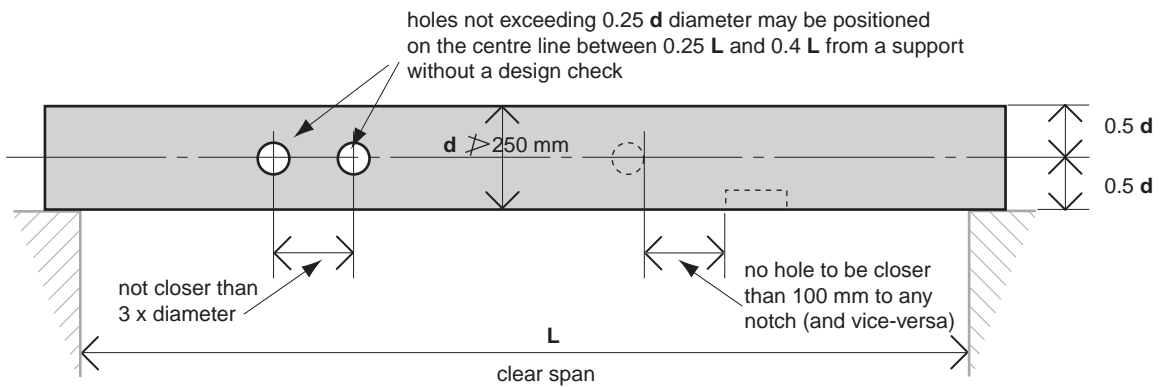
see para 4B.6



a) limits for notching



b) alternative limits for notching



c) limits for drilling

end of joists, trimmers etc. supported by a joist hanger shall be shaped to house the thickness and profile of the joist hanger chosen



d) end trimming

\geq means not greater than

Table 4B.1 Stress grade/species combinations which meet the strength classes C16 and C24

Species		Grade to meet strength class C16	Grade to meet strength class C24
All species listed in this table, machine graded to BS EN 14081-1 and marked accordingly		Machine graded to C16	Machine graded to C24
Imported redwood or whitewood visually graded to BS 4978		GS	SS
British - grown visually graded to BS 4978	Douglas fir	SS	--
	Larch	SS	--
	Pine	SS	--
	Spruce	SS	--
Canadian visually graded to BS 4978	Douglas fir-larch	GS	SS
	Hem-fir	GS	SS
	Spruce-pine-fir	GS	SS
	Sitka spruce	SS	--
Canadian graded to NLGA	Douglas fir-larch	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select Structural L.F.
	Hem-fir	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select Structural L.F.
	Spruce-pine-fir	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select
	Sitka spruce	Joist and Plank Select Structural L.F.	--
Canadian graded to MSR Standard	Douglas fir-larch	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
	Hem-fir	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
	Spruce-pine-fir	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
USA visually graded to BS 4978	Douglas fir-larch	GS	SS
	Hem-fir	GS	SS
	Southern pine	GS	SS
	Spruce-pine-fir	GS	SS
	Western white wood	SS	--
USA graded to NGRDL	Douglas fir-larch	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select Structural L.F. Select
	Hem-fir	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select Structural L.F. Select
	Spruce-pine-fir	Joist and Plank No. 1 and No. 2 Structural L.F. No. 1 and No. 2	Joist and Plank Select Structural L.F. Select
	Western white wood	Joist and Plank Select Structural L.F. Select	--
	Southern pine	Joist and Plank No. 3 Stud grade	Joist and Plank Select
USA graded to MSR Standard	Douglas fir-larch	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
	Hem-fir	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
	Southern pine	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
	Spruce-pine-fir	Machine stress-rated, 1 450f -1.3E	Machine stress-rated, 1 800f -1.6E
Notes:			
1 Where one stress grade is tabulated, any stronger stress grade of the same species also meets the strength class			
2 BS 5268-2 contains a larger selection of stress – grade/species combinations which meet C16 and C24 strength class			

Spans, sizes and spacings for timber members

4B.8 Table 4B.3 sets out a schedule of tables, which are preceded by notes and diagrams, that give spans, sizes and spacings for certain timber floor, ceiling and roof members.

4B.9 Tables 4B.11 to 4B.44 give the sizes of certain roof members for imposed loads of 0.75 kN/m^2 and 1.00 kN/m^2 . The loading applicable at a particular site depends on the elevation of that site above sea level and the zone in which it is situated. (See Table 4B.2 and Diagram 4B.2.)

The tables for the pitched roof timbers are only applicable to a building where no access is provided to the roof, other than that necessary for cleaning and maintenance, which has –

- (a) a roof area not greater than 200 m^2 in plan; or
- (b) a width not greater than 10 m and a pitched roof with no parapet,

provided that there are no other buildings within 1.5 m of its perimeter, and provided the roof configuration also meets one of the following conditions –

- (i) the roof has no abrupt changes of height greater than 1 m, at which a drift of snow could occur; or
- (ii) the area of a lower part of the roof, on which a drift of snow could form, is not greater than 35 m^2 .

Any building that does not fall within the criteria set out above is outside the scope of this Technical Booklet.

Table 4B.2 Simplified imposed roof loads

Altitude of site above sea level (m)	Zone A (kN/m^2)	Zone B (kN/m^2)
from 0 to 100	0.75	0.75
more than 100 but not more than 150	0.75	0.75
more than 150 but not more than 200	0.75	1.00
more than 200 but not more than 250	1.00	1.00
more than 250 but not more than 300	1.00	–

Diagram 4B.2 Simplified roof snow load map

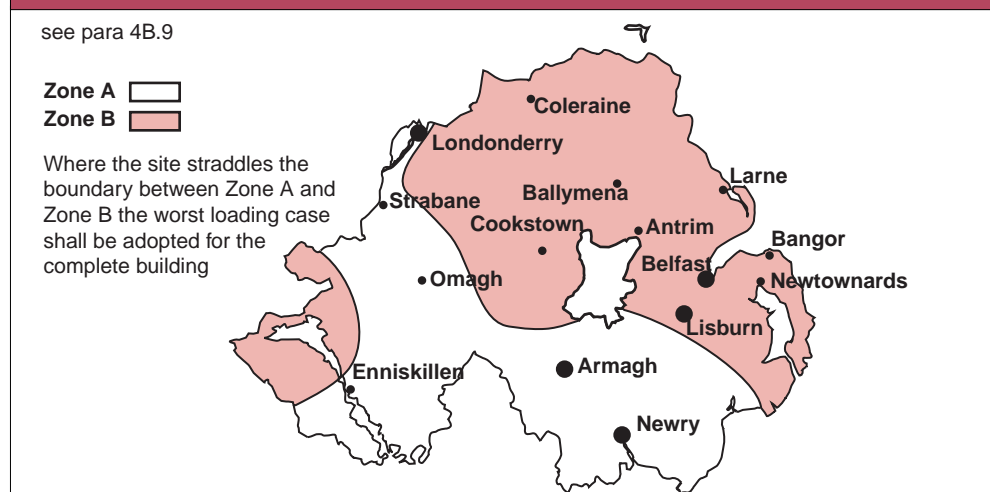


Table 4B.3 Schedule of tables relating to timber members

Construction	Timber members	Imposed loading kN/m ²	Table number	
			C16	C24
Floors	joists	1.50	4B.5	4B.6
Ceilings	joists	0.25	4B.7	4B.9
	binders	0.25	4B.8	4B.10
Pitched roofs more than 15° but not more than 22.5°	rafters	0.75	4B.11	4B.13
		1.00	4B.15	4B.17
	purlins	0.75	4B.12	4B.14
		1.00	4B.16	4B.18
Pitched roofs more than 22.5° but not more than 30°	rafters	0.75	4B.19	4B.21
		1.00	4B.23	4B.25
	purlins	0.75	4B.20	4B.22
		1.00	4B.24	4B.26
Pitched roofs more than 30° but not more than 45°	rafters	0.75	4B.27	4B.29
		1.00	4B.31	4B.33
	purlins	0.75	4B.28	4B.30
		1.00	4B.32	4B.34
Flat roofs access for cleaning and maintenance only	joists	0.75	4B.35	4B.36
		1.00	4B.37	4B.38
Flat roofs with access allowed	joists	1.50	4B.39	4B.40
Sheeted or decked roofs more than 10° but not more than 35°	purlins	0.75	4B.41	4B.42
		1.00	4B.43	4B.44

Notes:

- 1 The strength class given in this table assumes that the species and grades of timber to be used are those described in Table 4B.1
- 2 These tables do not apply to trussed rafter roofs

4B.10 Floor joists spanning in excess of 2.5 m **should** be strutted by one or more rows of solid or herringbone strutting in accordance with Table 4B.4. Solid strutting **should** be at least 38 mm timber thickness extending at least 0.75 times the depth of the joists. Herringbone strutting **should** be of at least 38 mm x 38 mm timber size but **should** not be used where the distance between joists is greater than 3 times the depth of the joists.

Table 4B.4 Strutting to joists

Joist span	No. of rows and position of strutting
Not greater than 2.5 m	None
Greater than 2.5 m but not greater than 4.5 m	1 at mid-span
Greater than 4.5 m	2 at one third span positions

Floor joists

- 4B.11 Tables 4B.5 and 4B.6 give the maximum clear span for floor joists using timber strength class C16 and C24 that will support the dead loads specified and a maximum imposed floor loading of 1.5 kN/m². Partition loads are not allowed for in Tables 4B.5 and 4B.6.

Softwood tongued and grooved floorboards 16 mm thick will safely support this floor loading if the spacing of the joists is not greater than 500 mm. Floorboarding 19 mm thick is required if the spacing of the floor joists is greater than 500 mm but not greater than 600 mm.

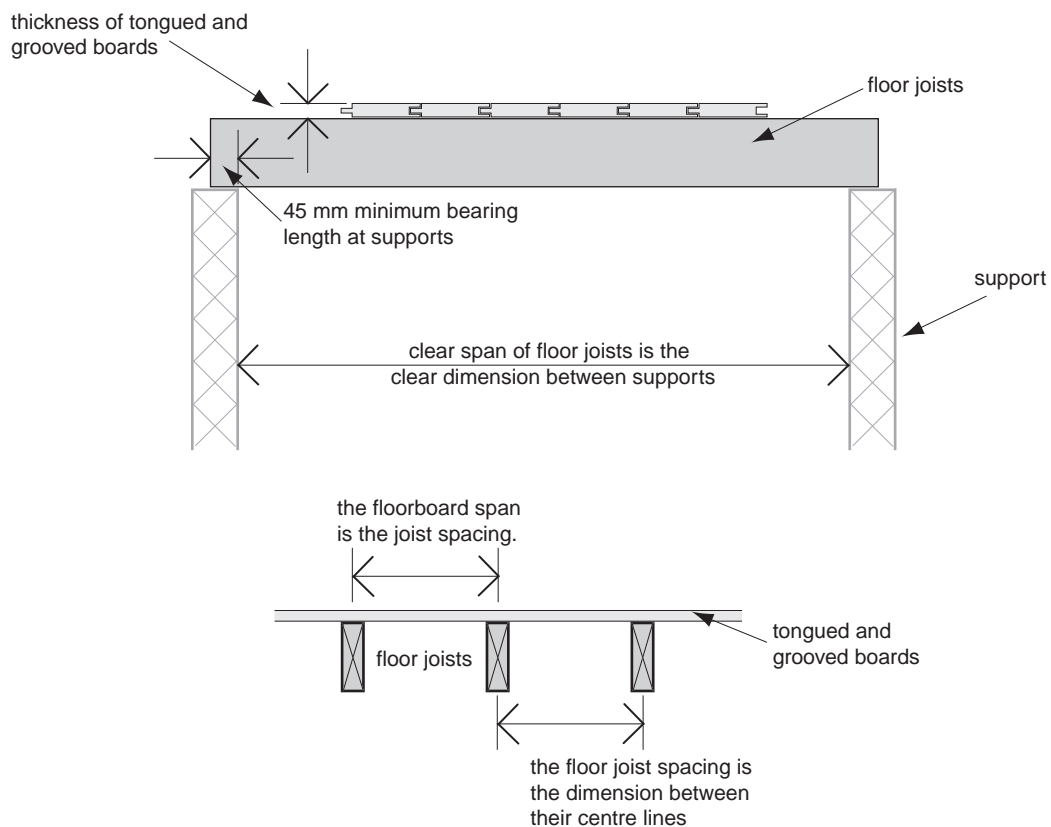
These tables can be used when a bath is to be installed provided the joists directly supporting the bath are doubled-up. There is no allowance made for the weight of partitions.

The section sizes are either sawn across the timber thickness in accordance with tolerance class 1 of BS EN 336: 2003 and processed in accordance with tolerance class 2 of BS EN 336: 2003 across the timber width (joist depth), or are Canadian Lumber Standards/ American Lumber Standards (CLS/ALS) processed sizes in accordance with tolerance class 2, to provide level surfaces for ease of ceiling lining and the fixing of structural decking.

If the end of a joist is supported on masonry, the end bearing **should** be increased from the 45 mm shown in Diagram 4B.3 to not less than 90 mm to provide restraint to the masonry wall.

Diagram 4B.3 Floor joists

see para 4B.11



**Table 4B.5 Maximum clear span of floor joists (m):
Timber strength class C16**

C16

Size of joist (mm x mm)	Dead Load [kN/m ²] excluding the self weight of the joist								
	Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
	Spacing of joists (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.83	1.69	1.30	1.72	1.56	1.21	1.42	1.30	1.04
38 x 120	2.48	2.39	1.93	2.37	2.22	1.76	1.95	1.79	1.45
38 x 145	2.98	2.87	2.51	2.85	2.71	2.33	2.45	2.29	1.87
38 x 170	3.44	3.31	2.87	3.28	3.10	2.69	2.81	2.65	2.27
38 x 195	3.94	3.75	3.26	3.72	3.52	3.06	3.19	3.01	2.61
38 x 220	4.43	4.19	3.65	4.16	3.93	3.42	3.57	3.37	2.92
47 x 97	2.02	1.91	1.58	1.92	1.82	1.46	1.67	1.53	1.23
47 x 120	2.66	2.56	2.30	2.55	2.45	2.09	2.26	2.08	1.70
47 x 145	3.20	3.08	2.79	3.06	2.95	2.61	2.72	2.57	2.17
47 x 170	3.69	3.55	3.19	3.53	3.40	2.99	3.12	2.94	2.55
47 x 195	4.22	4.06	3.62	4.04	3.89	3.39	3.54	3.34	2.90
47 x 220	4.72	4.57	4.04	4.55	4.35	3.79	3.95	3.74	3.24
50 x 97	2.08	1.97	1.67	1.98	1.87	1.54	1.74	1.60	1.29
50 x 120	2.72	2.62	2.37	2.60	2.50	2.19	2.33	2.17	1.77
50 x 145	3.27	3.14	2.86	3.13	3.01	2.69	2.81	2.65	2.27
50 x 170	3.77	3.62	3.29	3.61	3.47	3.08	3.21	3.03	2.63
50 x 195	4.31	4.15	3.73	4.13	3.97	3.50	3.65	3.44	2.99
50 x 220	4.79	4.66	4.17	4.64	4.47	3.91	4.07	3.85	3.35
63 x 97	2.32	2.20	1.92	2.19	2.08	1.82	1.93	1.84	1.53
63 x 120	2.93	2.82	2.57	2.81	2.70	2.45	2.53	2.43	2.09
63 x 145	3.52	3.39	3.08	3.37	3.24	2.95	3.04	2.92	2.58
63 x 170	4.06	3.91	3.56	3.89	3.74	3.40	3.50	3.37	2.95
63 x 195	4.63	4.47	4.07	4.44	4.28	3.90	4.01	3.85	3.35
63 x 220	5.06	4.92	4.58	4.91	4.77	4.37	4.51	4.30	3.75
75 x 120	3.10	2.99	2.72	2.97	2.86	2.60	2.68	2.58	2.33
75 x 145	3.72	3.58	3.27	3.56	3.43	3.13	3.22	3.09	2.81
75 x 170	4.28	4.13	3.77	4.11	3.96	3.61	3.71	3.57	3.21
75 x 195	4.83	4.70	4.31	4.68	4.52	4.13	4.24	4.08	3.65
75 x 220	5.27	5.13	4.79	5.11	4.97	4.64	4.74	4.60	4.07
CLS/ALS									
38 x 140	2.84	2.73	2.40	2.72	2.59	2.17	2.33	2.15	1.75
38 x 184	3.72	3.56	3.09	3.53	3.33	2.90	3.02	2.85	2.47
38 x 235	4.71	4.46	3.89	4.43	4.18	3.64	3.80	3.59	3.11

**Table 4B.6 Maximum clear span of floor joists (m):
Timber strength class C24**

C24

Size of joist (mm x mm)	Dead Load [kN/m ²] excluding the self weight of the joist								
	Not more than 0.25			More than 0.25 but not more than 0.50			More than 0.50 but not more than 1.25		
	Spacing of joists (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.94	1.83	1.59	1.84	1.74	1.51	1.64	1.55	1.36
38 x 120	2.58	2.48	2.20	2.47	2.37	2.08	2.18	2.07	1.83
38 x 145	3.10	2.98	2.71	2.97	2.85	2.59	2.67	2.56	2.31
38 x 170	3.58	3.44	3.13	3.43	3.29	2.99	3.08	2.96	2.68
38 x 195	4.10	3.94	3.58	3.92	3.77	3.42	3.53	3.39	3.07
38 x 220	4.61	4.44	4.03	4.41	4.25	3.86	3.97	3.82	3.46
47 x 97	2.14	2.03	1.76	2.03	1.92	1.68	1.80	1.71	1.50
47 x 120	2.77	2.66	2.42	2.65	2.55	2.29	2.38	2.27	2.01
47 x 145	3.33	3.20	2.91	3.19	3.06	2.78	2.87	2.75	2.50
47 x 170	3.84	3.69	3.36	3.67	3.54	3.21	3.31	3.18	2.88
47 x 195	4.39	4.22	3.85	4.20	4.05	3.68	3.79	3.64	3.30
47 x 220	4.86	4.73	4.33	4.71	4.55	4.14	4.26	4.10	3.72
50 x 97	2.20	2.09	1.82	2.08	1.98	1.73	1.84	1.75	1.54
50 x 120	2.83	2.72	2.47	2.71	2.60	2.36	2.43	2.33	2.06
50 x 145	3.39	3.27	2.97	3.25	3.13	2.84	2.93	2.81	2.55
50 x 170	3.91	3.77	3.43	3.75	3.61	3.28	3.38	3.25	2.94
50 x 195	4.47	4.31	3.92	4.29	4.13	3.75	3.86	3.72	3.37
50 x 220	4.93	4.80	4.42	4.78	4.64	4.23	4.35	4.18	3.80
63 x 97	2.43	2.32	2.03	2.31	2.19	1.93	2.03	1.93	1.71
63 x 120	3.05	2.93	2.67	2.92	2.81	2.55	2.63	2.53	2.27
63 x 145	3.67	3.52	3.21	3.50	3.37	3.07	3.16	3.04	2.76
63 x 170	4.21	4.06	3.70	4.04	3.89	3.54	3.64	3.51	3.19
63 x 195	4.77	4.64	4.23	4.61	4.45	4.05	4.17	4.01	3.65
63 x 220	5.20	5.06	4.73	5.05	4.91	4.56	4.68	4.51	4.11
75 x 120	3.22	3.10	2.83	3.09	2.97	2.71	2.78	2.68	2.43
75 x 145	3.86	3.72	3.39	3.70	3.57	3.25	3.34	3.22	2.93
75 x 170	4.45	4.29	3.91	4.27	4.11	3.75	3.86	3.71	3.38
75 x 195	4.97	4.83	4.47	4.82	4.69	4.29	4.41	4.25	3.86
75 x 220	5.42	5.27	4.93	5.25	5.11	4.78	4.88	4.74	4.35
CLS/ALS									
38 x 140	2.96	2.84	2.58	2.83	2.72	2.47	2.54	2.44	2.17
38 x 184	3.87	3.72	3.38	3.70	3.56	3.23	3.33	3.20	2.90
38 x 235	4.85	4.71	4.31	4.70	4.54	4.12	4.24	4.08	3.70

Ceiling joists and binders supporting ceiling joists

- 4B.12 Tables 4B.7 to 4B.10 give the maximum clear span of a ceiling joist and the timber binder that provides support to the ceiling joists using timber strength class C16 and C24. See also Diagram 4B.4.

The sizes, spacings and spans given will safely support the dead loads stated in the tables, together with a maximum imposed load of 0.25 kN/m² and a concentrated load of 0.9 kN acting together.

In calculating the ceiling joist sizes for these tables no account has been taken of trimming around items such as flues or the additional load of such things as water tanks.

Notching or drilling of a binder or ceiling joist **should** not be carried out unless justified by specialist calculation.

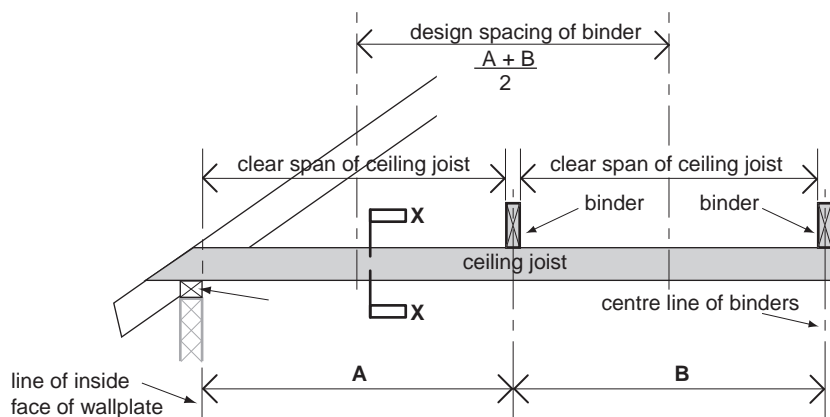
In the tables for ceiling joists the permissible clear spans are for ceiling joists simply supported between binders or a binder and the wallplate. However, in the tables for binders, the permissible clear spans are based on the assumption that the ceiling joists can be continuous.

The section sizes are either sawn across the timber thickness in accordance with tolerance class 1 of BS EN 336:2003 and processed in accordance with tolerance class 2 of BS EN 336:2003 across the timber width (joist depth), or are CLS/ALS processed sizes in accordance with tolerance class 2, to provide level surfaces for ease of ceiling lining and the fixing of structural decking.

The size of ceiling joists and binders are limited generally to those where the depth-to-thickness ratio is not greater than 4 unless lateral support is provided in accordance with BS 5268: Part 2:2002.

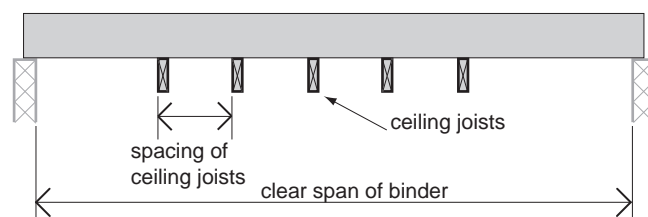
Diagram 4B.4 Ceiling joists and binders supporting ceiling joists

see para 4B.12



sectional elevation

section XX



**Table 4B.7 Maximum clear span of ceiling joists (m)
Timber strength class C16**

C16

Size of joist (mm)	Dead Load [kN/m ²] excluding the self weight of the joist					
	Not more than 0.25			More than 0.25 but not more than 0.50		
	Spacing of joists (mm)					
	400	450	600	400	450	600
38 x 72	1.15	1.14	1.11	1.11	1.10	1.06
38 x 97	1.74	1.72	1.67	1.67	1.64	1.58
38 x 120	2.37	2.34	2.25	2.25	2.21	2.11
38 x 145	3.02	2.97	2.85	2.85	2.80	2.66
38 x 170	3.63	3.57	3.41	3.41	3.34	3.16
38 x 195	4.30	4.23	4.02	4.02	3.94	3.72
38 x 220	4.98	4.88	4.64	4.64	4.54	4.27
47 x 72	1.27	1.26	1.23	1.23	1.21	1.17
47 x 97	1.92	1.90	1.84	1.84	1.81	1.73
47 x 120	2.60	2.57	2.47	2.47	2.42	2.31
47 x 145	3.30	3.25	3.11	3.11	3.05	2.90
47 x 170	3.96	3.89	3.72	3.72	3.64	3.44
47 x 195	4.68	4.59	4.37	4.37	4.28	4.04
47 x 220	5.39	5.29	5.03	5.03	4.91	4.63
50 x 72	1.31	1.30	1.27	1.27	1.25	1.21
50 x 97	1.97	1.95	1.89	1.89	1.86	1.78
50 x 120	2.67	2.63	2.53	2.53	2.49	2.37
50 x 145	3.39	3.34	3.19	3.19	3.13	2.97
50 x 170	4.06	3.99	3.81	3.81	3.73	3.53
50 x 195	4.79	4.70	4.48	4.48	4.38	4.13
50 x 220	5.52	5.41	5.14	5.14	5.03	4.73
CLS/ALS						
38 x 89	1.54	1.53	1.48	1.48	1.46	1.41
38 x 140	2.84	2.79	2.68	2.68	2.63	2.50
38 x 184	4.01	3.94	3.75	3.75	3.68	3.47

**Table 4B.8 Maximum clear span of binders (m):
Timber strength class C16**

C16

Size of binder (mm)	Dead Load [kN/m ²] excluding the self weight of the binder											
	Not more than 0.25						More than 0.25 but not more than 0.50					
	Design spacing of binders (mm)											
	1200	1500	1800	2100	2400	2700	1200	1500	1800	2100	2400	2700
47 x 150	2.17	2.05	1.96	1.88	1.81		1.99	1.87				
47 x 175	2.59	2.45	2.33	2.24	2.15	2.08	2.37	2.23	2.11	2.02	1.94	1.87
50 x 150	2.22	2.11	2.01	1.93	1.86		2.04	1.92	1.83			
50 x 175	2.65	2.51	2.39	2.29	2.21	2.13	2.42	2.28	2.16	2.07	1.99	1.91
50 x 200	3.08	2.91	2.77	2.65	2.55	2.47	2.81	2.64	2.50	2.39	2.29	2.21
63 x 125	1.97	1.87					1.82					
63 x 150	2.44	2.31	2.20	2.12	2.04	1.97	2.23	2.11	2.00	1.91	1.84	
63 x 175	2.90	2.74	2.61	2.51	2.41	2.33	2.65	2.49	2.37	2.26	2.17	2.10
63 x 200	3.37	3.18	3.03	2.90	2.79	2.69	3.07	2.88	2.74	2.61	2.51	2.42
63 x 225	3.83	3.61	3.44	3.29	3.16	3.05	3.49	3.27	3.10	2.96	2.84	2.74
75 x 125	2.12	2.01	1.92	1.85			1.95	1.84				
75 x 150	2.61	2.47	2.36	2.26	2.18	2.11	2.39	2.25	2.14	2.05	1.97	1.90
75 x 175	3.10	2.93	2.79	2.68	2.58	2.49	2.83	2.66	2.53	2.42	2.32	2.24
75 x 200	3.59	3.39	3.23	3.09	2.98	2.88	3.27	3.08	2.92	2.79	2.68	2.58
75 x 225	4.08	3.85	3.66	3.51	3.37	3.26	3.71	3.50	3.31	3.16	3.03	2.92

**Table 4B.9 Maximum clear span of ceiling joists (m):
Timber strength class C24**
C24

Dead Load [kN/m ²] excluding the self weight of the joist						
Size of joist (mm)	Not more than 0.25			More than 0.25 but not more than 0.50		
	Spacing of joists (mm)					
	400	450	600	400	450	600
38 x 72	1.21	1.20	1.17	1.17	1.16	1.12
38 x 97	1.84	1.82	1.76	1.76	1.73	1.66
38 x 120	2.50	2.46	2.37	2.37	2.33	2.22
38 x 145	3.18	3.13	3.00	3.00	2.94	2.79
38 x 170	3.81	3.75	3.58	3.58	3.51	3.32
38 x 195	4.51	4.43	4.22	4.22	4.13	3.89
38 x 220	5.21	5.11	4.86	4.86	4.75	4.47
47 x 72	1.35	1.33	1.30	1.30	1.28	1.24
47 x 97	2.03	2.00	1.93	1.93	1.90	1.83
47 x 120	2.74	2.70	2.60	2.60	2.55	2.43
47 x 145	3.47	3.42	3.27	3.27	3.21	3.04
47 x 170	4.15	4.08	3.89	3.89	3.81	3.61
47 x 195	4.90	4.81	4.57	4.57	4.47	4.22
47 x 220	5.64	5.53	5.25	5.25	5.14	4.84
50 x 72	1.39	1.37	1.34	1.34	1.32	1.28
50 x 97	2.08	2.06	1.99	1.99	1.96	1.88
50 x 120	2.81	2.77	2.66	2.66	2.62	2.49
50 x 145	3.56	3.50	3.35	3.35	3.29	3.12
50 x 170	4.25	4.18	3.99	3.99	3.91	3.69
50 x 195	5.01	4.92	4.68	4.68	4.58	4.32
50 x 220	5.77	5.66	5.37	5.37	5.25	4.95
CLS/ALS						
38 x 89	1.63	1.62	1.57	1.57	1.55	1.49
38 x 140	2.99	2.94	2.82	2.82	2.77	2.63
38 x 184	4.20	4.13	3.94	3.94	3.85	3.64

**Table 4B.10 Maximum clear span of binders (m):
Timber strength class C24**
C24

Dead Load [kN/m ²] excluding the self weight of the binder												
Size of binder (mm)	Not more than 0.25						More than 0.25 but not more than 0.50					
	Design spacing of binders (mm)											
	1200	1500	1800	2100	2400	2700	1200	1500	1800	2100	2400	2700
47 x 150	2.28	2.16	2.06	1.98	1.90	1.84	2.09	1.97	1.87			
47 x 175	2.72	2.57	2.45	2.34	2.26	2.18	2.48	2.34	2.22	2.12	2.03	1.96
50 x 150	2.33	2.21	2.11	2.02	1.95	1.89	2.14	2.02	1.92	1.83		
50 x 175	2.78	2.63	2.51	2.40	2.31	2.23	2.54	2.39	2.27	2.17	2.08	2.01
50 x 200	3.23	3.05	2.90	2.78	2.67	2.58	2.95	2.77	2.62	2.51	2.40	2.32
63 x 125	2.07	1.97	1.88	1.81			1.91	1.80				
63 x 150	2.56	2.42	2.31	2.22	2.14	2.07	2.34	2.21	2.10	2.01	1.93	1.86
63 x 175	3.04	2.87	2.74	2.62	2.53	2.44	2.78	2.61	2.48	2.37	2.28	2.20
63 x 200	3.52	3.32	3.16	3.03	2.92	2.82	3.21	3.02	2.86	2.73	2.63	2.53
63 x 225	4.00	3.77	3.59	3.44	3.31	3.19	3.65	3.42	3.24	3.10	2.97	2.86
75 x 125	2.22	2.11	2.01	1.94	1.87	1.81	2.04	1.93	1.84			
75 x 150	2.73	2.59	2.47	2.37	2.28	2.21	2.50	2.36	2.24	2.15	2.06	1.99
75 x 175	3.24	3.07	2.92	2.80	2.70	2.61	2.96	2.79	2.65	2.53	2.43	2.35
75 x 200	3.75	3.54	3.37	3.23	3.11	3.00	3.42	3.22	3.05	2.92	2.80	2.70
75 x 225	4.26	4.02	3.82	3.66	3.52	3.40	3.88	3.65	3.46	3.30	3.17	3.06

Rafters and purlins supporting rafters

4B.13 Tables 4B.11 to 4B.34 give the maximum clear span of common or jack rafters and the purlins that provide support to the common or jack rafters using timber strength class C16 and C24.

The sizes, spacings and spans given will safely support the dead loads stated in the tables, together with a maximum imposed load of 0.75 kN/m^2 or 1.00 kN/m^2 or a concentrated load of 0.9 kN .

The tables are presented in sets to cover a range of roof pitch from 15° to 45° for each load combination and strength class of timber.

In calculating the rafter sizes for these tables no account has been taken of permitted reduction to the imposed loads for a pitch greater than 30° , as recommended in BS 6399-3:1988. This is because the members have been sized assuming a pitch of 30° as being the most onerous for the pitch range 30° to 45° .

When the dimensions A and B in Diagram 4B.5 are not equal the rafter **should** be sized for the greater dimension. Where the purlin is continuous over an intermediate support and the spans are not equal the purlin **should** be sized for the longest span.

In the tables for rafters, the permissible clear spans are for rafters simply supported between a purlin and wallplate or between a purlin and the ridgeboard. However, in the tables for purlins, the permissible clear spans are based on the assumption that the rafters are to be continuous.

Notching or drilling of a rafter or purlin **should** not be carried out unless justified by a specialist calculation. This does not apply to the birdsmoothing of a rafter to a depth not greater than one third of the depth of the rafter.

The section sizes given in the tables are either sawn in accordance with tolerance class 1 of BS EN 336:2003, or are CLS/ALS processed sizes in accordance with tolerance class 2 of BS EN 336:2003.

Diagram 4B.5 Typical rafter and purlin arrangement

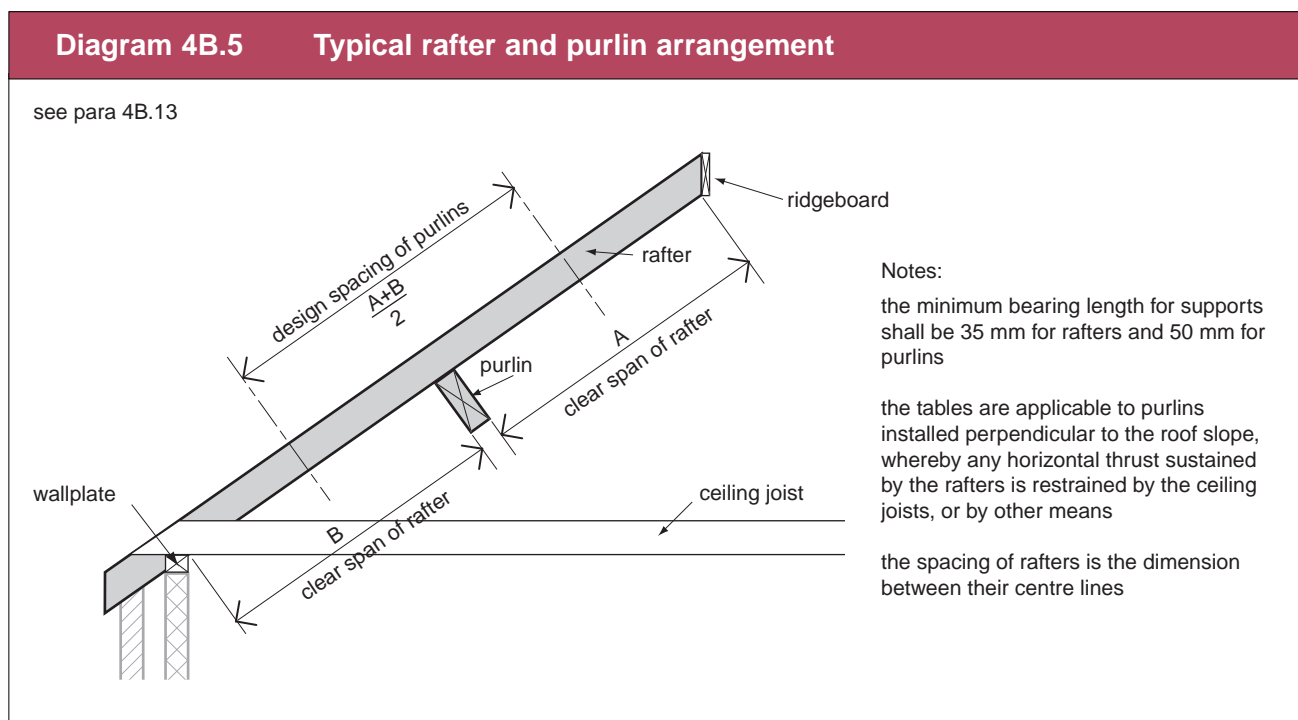


Table 4B.11 Maximum clear span of rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.10	2.05	1.93	1.93	1.88	1.75	1.80	1.75	1.61
38 x 125	2.89	2.79	2.53	2.63	2.55	2.34	2.44	2.35	2.15
38 x 150	3.47	3.34	3.03	3.26	3.14	2.78	3.08	2.96	2.57
47 x 100	2.46	2.40	2.18	2.25	2.19	2.03	2.10	2.03	1.87
47 x 125	3.10	2.99	2.72	2.92	2.81	2.56	2.78	2.67	2.41
47 x 150	3.71	3.57	3.25	3.50	3.36	3.06	3.32	3.20	2.86
50 x 100	2.54	2.45	2.23	2.35	2.29	2.09	2.19	2.12	1.95
50 x 125	3.17	3.05	2.78	2.98	2.87	2.61	2.83	2.73	2.48
50 x 150	3.78	3.64	3.32	3.57	3.43	3.12	3.39	3.26	2.94
CLS/ALS									
38 x 89	1.76	1.72	1.63	1.63	1.59	1.49	1.53	1.49	1.38
38 x 140	3.24	3.12	2.83	3.05	2.93	2.61	2.82	2.72	2.41

Table 4B.12 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.86																	
47 x 175	2.17	2.03	1.92	1.82			2.04	1.90					1.93					
47 x 200	2.48	2.32	2.19	2.08	1.96	1.86	2.32	2.17	2.04	1.90			2.20	2.05	1.89			
47 x 225	2.78	2.60	2.46	2.33	2.19	2.07	2.61	2.44	2.28	2.13	2.00	1.89	2.47	2.28	2.11	1.97	1.85	
63 x 150	2.06	1.94	1.83				1.94	1.82					1.84					
63 x 175	2.41	2.26	2.13	2.03	1.95	1.87	2.26	2.12	2.00	1.91	1.82		2.14	2.01	1.90	1.80		
63 x 200	2.75	2.58	2.44	2.32	2.22	2.14	2.58	2.42	2.29	2.18	2.08	1.97	2.45	2.29	2.16	2.05	1.93	1.83
63 x 225	3.09	2.89	2.74	2.61	2.50	2.40	2.90	2.72	2.57	2.45	2.33	2.20	2.75	2.58	2.43	2.29	2.16	2.04
75 x 125	1.83																	
75 x 150	2.19	2.06	1.95	1.86			2.06	1.94	1.83				1.96	1.83				
75 x 175	2.56	2.40	2.27	2.17	2.08	2.00	2.41	2.26	2.13	2.03	1.95	1.87	2.28	2.14	2.02	1.92	1.84	
75 x 200	2.92	2.74	2.59	2.47	2.37	2.28	2.75	2.58	2.44	2.32	2.22	2.14	2.61	2.44	2.31	2.20	2.10	2.00
75 x 225	3.28	3.08	2.91	2.78	2.66	2.56	3.09	2.89	2.74	2.61	2.50	2.40	2.93	2.74	2.60	2.47	2.36	2.23
2 x 47 x 200	3.30	3.10	2.94	2.81	2.69	2.60	3.11	2.92	2.77	2.64	2.53	2.44	2.96	2.77	2.63	2.50	2.40	2.31
2 x 47 x 225	3.71	3.49	3.31	3.16	3.03	2.92	3.49	3.28	3.11	2.97	2.85	2.74	3.32	3.12	2.95	2.82	2.70	2.60
2 x 47 x 250	4.11	3.87	3.67	3.50	3.36	3.24	3.88	3.64	3.45	3.29	3.16	3.04	3.69	3.46	3.28	3.13	3.00	2.88
2 x 47 x 275	4.52	4.25	4.03	3.85	3.69	3.56	4.26	4.00	3.79	3.62	3.47	3.34	4.05	3.80	3.60	3.44	3.29	3.17
2 x 47 x 300	4.92	4.63	4.39	4.19	4.03	3.88	4.64	4.36	4.14	3.95	3.79	3.65	4.41	4.14	3.93	3.74	3.59	3.45

Table 4B.13 Maximum clear span of rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.42	2.33	2.11	2.28	2.19	1.99	2.16	2.08	1.88
38 x 125	3.01	2.90	2.64	2.83	2.73	2.48	2.69	2.59	2.35
38 x 150	3.60	3.47	3.16	3.39	3.26	2.97	3.22	3.10	2.82
47 x 100	2.59	2.49	2.27	2.44	2.35	2.13	2.32	2.23	2.02
47 x 125	3.22	3.11	2.83	3.04	2.92	2.66	2.89	2.78	2.53
47 x 150	3.85	3.71	3.38	3.63	3.50	3.18	3.45	3.32	3.02
50 x 100	2.64	2.54	2.32	2.49	2.40	2.18	2.37	2.28	2.07
50 x 125	3.29	3.17	2.89	3.10	2.98	2.72	2.95	2.83	2.58
50 x 150	3.93	3.78	3.45	3.70	3.57	3.25	3.52	3.39	3.09
CLS/ALS									
38 x 89	2.16	2.07	1.88	2.03	1.95	1.77	1.92	1.85	1.68
38 x 140	3.37	3.24	2.95	3.17	3.05	2.77	3.01	2.90	2.63

Table 4B.14 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50					More than 0.50 but not more than 0.75					More than 0.75 but not more than 1.00							
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.94	1.82																
47 x 175	2.27	2.12	2.01	1.91	1.83		2.13	1.99	1.88				2.02	1.89				
47 x 200	2.59	2.42	2.29	2.18	2.09	2.00	2.43	2.27	2.15	2.04	1.95	1.87	2.30	2.15	2.03	1.93	1.81	
47 x 225	2.91	2.72	2.58	2.45	2.35	2.25	2.73	2.56	2.42	2.30	2.20	2.11	2.59	2.42	2.28	2.17	2.03	1.82
63 x 150	2.16	2.02	1.91	1.82			2.03	1.90					1.92	1.80				
63 x 175	2.51	2.36	2.23	2.13	2.04	1.96	2.36	2.22	2.10	2.00	1.91	1.84	2.24	2.10	1.99	1.89	1.81	
63 x 200	2.87	2.69	2.55	2.43	2.33	2.24	2.70	2.53	2.39	2.28	2.18	2.10	2.56	2.40	2.27	2.16	2.06	1.98
63 x 225	3.22	3.02	2.86	2.73	2.61	2.52	3.03	2.84	2.69	2.56	2.45	2.36	2.88	2.70	2.55	2.43	2.32	2.23
75 x 125	1.91																	
75 x 150	2.29	2.15	2.04	1.94	1.86		2.16	2.02	1.91	1.82			2.05	1.92	1.82			
75 x 175	2.67	2.51	2.37	2.26	2.17	2.09	2.51	2.36	2.23	2.13	2.04	1.96	2.39	2.24	2.12	2.02	1.93	1.85
75 x 200	3.05	2.86	2.71	2.58	2.48	2.39	2.87	2.69	2.55	2.43	2.33	2.24	2.72	2.55	2.42	2.30	2.20	2.12
75 x 225	3.42	3.21	3.04	2.90	2.78	2.68	3.22	3.02	2.86	2.73	2.62	2.52	3.06	2.87	2.72	2.59	2.48	2.38
2 x 47 x 200	3.44	3.24	3.07	2.93	2.81	2.71	3.25	3.05	2.89	2.76	2.65	2.55	3.09	2.90	2.75	2.62	2.51	2.42
2 x 47 x 225	3.86	3.64	3.45	3.29	3.16	3.05	3.65	3.43	3.25	3.10	2.98	2.87	3.47	3.26	3.09	2.94	2.82	2.72
2 x 47 x 250	4.29	4.03	3.83	3.66	3.51	3.38	4.05	3.80	3.61	3.44	3.30	3.18	3.85	3.61	3.43	3.27	3.13	3.02
2 x 47 x 275	4.71	4.43	4.20	4.02	3.86	3.72	4.44	4.18	3.96	3.78	3.63	3.50	4.23	3.97	3.76	3.59	3.44	3.32
2 x 47 x 300	5.12	4.82	4.58	4.38	4.20	4.05	4.84	4.55	4.32	4.12	3.96	3.81	4.60	4.33	4.10	3.91	3.75	3.62

Table 4B.15 Maximum clear span of rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.10	2.05	1.90	1.93	1.88	1.75	1.80	1.75	1.61
38 x 125	2.73	2.63	2.35	2.59	2.49	2.17	2.44	2.34	2.03
38 x 150	3.27	3.14	2.79	3.10	2.97	2.58	2.94	2.78	2.41
47 x 100	2.35	2.26	2.05	2.23	2.15	1.95	2.10	2.03	1.83
47 x 125	2.93	2.82	2.56	2.78	2.68	2.41	2.66	2.56	2.26
47 x 150	3.50	3.37	3.07	3.33	3.20	2.86	3.18	3.06	2.68
50 x 100	2.40	2.31	2.10	2.28	2.19	1.99	2.18	2.09	1.88
50 x 125	2.99	2.88	2.62	2.84	2.73	2.48	2.71	2.61	2.33
50 x 150	3.57	3.44	3.13	3.40	3.27	2.95	3.25	3.12	2.76
CLS/ALS									
38 x 89	1.76	1.72	1.63	1.63	1.59	1.49	1.53	1.49	1.38
38 x 140	3.05	2.94	2.61	2.90	2.78	2.42	2.76	2.61	2.26

Table 4B.16 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150																		
47 x 175	2.04	1.91					1.93	1.80					1.84					
47 x 200	2.33	2.18	2.05	1.91			2.20	2.05	1.89				2.10	1.92				
47 x 225	2.62	2.45	2.28	2.13	2.01	1.90	2.48	2.29	2.12	1.97	1.86		2.35	2.14	1.98	1.84		
63 x 150	1.94	1.82					1.84											
63 x 175	2.27	2.12	2.01	1.91	1.83		2.15	2.01	1.90	1.81			2.05	1.92	1.81			
63 x 200	2.59	2.42	2.29	2.18	2.09	1.98	2.45	2.30	2.17	2.06	1.94	1.83	2.30	2.19	2.06	1.92	1.81	
63 x 225	2.91	2.72	2.58	2.45	2.33	2.21	2.76	2.58	2.44	2.30	2.16	2.05	2.63	2.46	2.30	2.15	2.02	1.91
75 x 150	2.07	1.94	1.83				1.96	1.84					1.87					
75 x 175	2.41	2.26	2.14	2.04	1.95	1.88	2.29	2.14	2.03	1.93	1.85		2.18	2.04	1.93	1.84		
75 x 200	2.75	2.58	2.44	2.33	2.23	2.14	2.61	2.45	2.31	2.20	2.11	2.01	2.49	2.33	2.20	2.10	1.98	1.88
75 x 225	3.09	2.90	2.74	2.61	2.50	2.41	2.93	2.75	2.60	2.48	2.36	2.24	2.80	2.62	2.48	2.35	2.21	2.09
2 x 47 x 200	3.12	2.93	2.77	2.65	2.54	2.44	2.96	2.78	2.63	2.51	2.40	2.31	2.83	2.65	2.51	2.39	2.29	2.21
2 x 47 x 225	3.50	3.29	3.18	2.97	2.85	2.75	3.33	3.12	2.96	2.82	2.70	2.60	3.18	2.98	2.82	2.69	2.58	2.47
2 x 47 x 250	3.88	3.65	3.46	3.30	3.17	3.05	3.69	3.47	3.28	3.13	3.00	2.89	3.53	3.31	3.14	2.99	2.86	2.73
2 x 47 x 275	4.27	4.01	3.80	3.63	3.48	3.35	4.06	3.81	3.61	3.44	3.30	3.17	3.88	3.64	3.45	3.28	3.15	2.98
2 x 47 x 300	4.65	4.37	4.14	3.95	3.79	3.65	4.42	4.15	3.93	3.75	3.60	3.46	4.23	4.00	3.76	3.58	3.41	3.24

Table 4B.17 Maximum clear span of rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.28	2.19	1.99	2.16	2.08	1.89	2.07	1.99	1.80
38 x 125	2.84	2.73	2.48	2.70	2.59	2.35	2.58	2.48	2.25
38 x 150	3.40	3.27	2.97	3.23	3.10	2.82	3.09	2.97	2.69
47 x 100	2.44	2.35	2.14	2.32	2.23	2.03	2.22	2.13	1.94
47 x 125	3.04	2.93	2.67	2.89	2.78	2.53	2.77	2.66	2.42
47 x 150	3.64	3.50	3.19	3.46	3.33	3.03	3.31	3.18	2.89
50 x 100	2.49	2.40	2.18	2.37	2.28	2.07	2.27	2.18	1.98
50 x 125	3.10	2.99	2.72	2.95	2.84	2.58	2.82	2.72	2.47
50 x 150	3.71	3.57	3.26	3.46	3.40	3.09	3.38	3.25	2.95
CLS/ALS									
38 x 89	2.03	1.95	1.77	1.93	1.85	1.68	1.84	1.77	1.60
38 x 140	3.18	3.06	2.78	3.02	2.90	2.63	2.88	2.77	2.52

Table 4B.18 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 15° but not more than 22.5°; Imposed load of 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.83																	
47 x 175	2.13	2.00	1.88				2.02	1.89					1.93					
47 x 200	2.44	2.28	2.15	2.05	1.96	1.88	2.31	2.16	2.04	1.93	1.82		2.20	2.05	1.94			
47 x 225	2.74	2.56	2.42	2.30	2.20	2.11	2.59	2.43	2.29	2.17	2.04	1.83	2.47	2.31	2.18	2.02		
63 x 150	2.03	1.90	1.80				1.93	1.81					1.84					
63 x 175	2.37	2.22	2.10	2.00	1.91	1.84	2.25	2.10	1.99	1.89	1.81		2.14	2.01	1.90	1.80		
63 x 200	2.70	2.53	2.40	2.28	2.19	2.10	2.57	2.40	2.27	2.16	2.07	1.99	2.45	2.29	2.16	2.06	1.97	1.89
63 x 225	3.04	2.85	2.70	2.57	2.46	2.36	2.88	2.70	2.55	2.43	2.32	2.23	2.75	2.58	2.43	2.31	2.21	2.12
75 x 125	1.80																	
75 x 150	2.16	2.03	1.92	1.83			2.05	1.92	1.82				1.96	1.83				
75 x 175	2.52	2.36	2.24	2.13	2.04	1.96	2.39	2.24	2.12	2.02	1.93	1.86	2.28	2.14	2.02	1.92	1.84	
75 x 200	2.87	2.70	2.55	2.43	2.33	2.24	2.73	2.56	2.42	2.31	2.21	2.12	2.61	2.44	2.31	2.20	2.10	2.02
75 x 225	3.23	3.03	2.87	2.74	2.62	2.52	3.07	2.88	2.72	2.59	2.48	2.39	2.93	2.75	2.60	2.47	2.36	2.27
2 x 47 x 200	3.25	3.06	2.90	2.76	2.65	2.55	3.09	2.90	2.75	2.62	2.52	2.42	2.96	2.77	2.63	2.50	2.40	2.31
2 x 47 x 225	3.65	3.43	3.26	3.11	2.98	2.87	3.47	3.26	3.09	2.95	2.83	2.72	3.32	3.12	2.95	2.82	2.70	2.60
2 x 47 x 250	4.05	3.81	3.61	3.45	3.31	3.19	3.85	3.62	3.43	3.27	3.14	3.02	3.69	3.46	3.28	3.13	3.00	2.88
2 x 47 x 275	4.45	4.19	3.97	3.79	3.64	3.50	4.23	3.98	3.77	3.60	3.45	3.32	4.05	3.80	3.60	3.44	3.29	3.17
2 x 47 x 300	4.85	4.56	4.33	4.13	3.96	3.82	4.61	4.33	4.11	3.92	3.76	3.62	4.41	4.14	3.93	3.75	3.59	3.46

Table 4B.19 Maximum clear span of rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.18	2.13	2.01	2.01	1.96	1.82	1.88	1.82	1.68
38 x 125	2.97	2.86	2.60	2.74	2.66	2.44	2.54	2.46	2.25
38 x 150	3.55	3.42	3.11	3.34	3.21	2.92	3.17	3.04	2.72
47 x 100	2.55	2.46	2.23	2.35	2.28	2.10	2.18	2.12	1.95
47 x 125	3.18	3.06	2.79	2.99	2.88	2.62	2.84	2.73	2.48
47 x 150	3.80	3.66	3.33	3.57	3.44	3.13	3.39	3.27	2.97
50 x 100	2.60	2.51	2.28	2.45	2.36	2.14	2.28	2.21	2.03
50 x 125	3.24	3.12	2.84	3.05	2.93	2.67	2.89	2.79	2.53
50 x 150	3.87	3.73	3.40	3.65	3.51	3.20	3.46	3.33	3.03
CLS/ALS									
38 x 89	1.82	1.79	1.69	1.69	1.65	1.55	1.59	1.55	1.44
38 x 140	3.32	3.19	2.90	3.12	3.00	2.72	2.94	2.84	2.55

Table 4B.20 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load of 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.91																	
47 x 175	2.22	2.08	1.97	1.87			2.08	1.95	1.84				1.97	1.84				
47 x 200	2.54	2.38	2.25	2.14	2.03	1.92	2.38	2.23	2.10	1.97	1.85		2.25	2.10	1.95	1.82		
47 x 225	2.85	2.67	2.53	2.40	2.27	2.15	2.68	2.50	2.36	2.20	2.07	1.96	2.53	2.36	2.18	2.03	1.91	1.81
63 x 150	2.12	1.98	1.88				1.99	1.86					1.88					
63 x 175	2.47	2.31	2.19	2.09	2.00	1.92	2.32	2.17	2.05	1.95	1.87		2.19	2.05	1.94	1.85		
63 x 200	2.81	2.64	2.50	2.38	2.28	2.19	2.64	2.48	2.34	2.23	2.13	2.04	2.50	2.35	2.22	2.11	1.99	1.89
63 x 225	3.16	2.97	2.81	2.68	2.56	2.47	2.97	2.78	2.63	2.51	2.40	2.28	2.82	2.64	2.49	2.37	2.23	2.11
75 x 125	1.88																	
75 x 150	2.25	2.11	2.00	1.91	1.83		2.11	1.98	1.87				2.00	1.88				
75 x 175	2.62	2.46	2.33	2.22	2.13	2.05	2.46	2.31	2.19	2.08	1.99	1.92	2.33	2.19	2.07	1.97	1.89	1.81
75 x 200	2.99	2.81	2.66	2.54	2.43	2.34	2.81	2.64	2.50	2.38	2.28	2.19	2.67	2.50	2.36	2.25	2.15	2.07
75 x 225	3.36	3.15	2.99	2.85	2.73	2.63	3.16	2.96	2.80	2.67	2.56	2.46	3.00	2.81	2.66	2.53	2.42	2.31
2 x 47 x 200	3.38	3.18	3.01	2.88	2.76	2.66	3.18	2.99	2.83	2.70	2.59	2.50	3.02	2.84	2.69	2.56	2.46	2.36
2 x 47 x 225	3.80	3.57	3.39	3.23	3.10	2.99	3.57	3.36	3.18	3.04	2.91	2.81	3.39	3.19	3.02	2.88	2.76	2.66
2 x 47 x 250	4.21	3.96	3.76	3.59	3.44	3.32	3.97	3.73	3.53	3.37	3.24	3.12	3.77	3.54	3.35	3.20	3.06	2.95
2 x 47 x 275	4.62	4.35	4.13	3.94	3.79	3.65	4.36	4.09	3.88	3.71	3.56	3.42	4.14	3.89	3.68	3.51	3.37	3.24
2 x 47 x 300	5.04	4.74	4.50	4.30	4.13	3.98	4.75	4.46	4.23	4.04	3.88	3.73	4.51	4.24	4.01	3.83	3.67	3.54

Table 4B.21 Maximum clear span of rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.48	2.38	2.17	2.33	2.24	2.03	2.21	2.12	1.93
38 x 125	3.08	2.97	2.70	2.90	2.79	2.53	2.75	2.65	2.40
38 x 150	3.69	3.55	3.23	3.47	3.34	3.04	3.29	3.17	2.88
47 x 100	2.65	2.55	2.32	2.49	2.40	2.18	2.37	2.28	2.07
47 x 125	3.30	3.18	2.90	3.11	2.99	2.72	2.95	2.84	2.58
47 x 150	3.94	3.80	3.46	3.71	3.58	3.26	3.53	3.40	3.09
50 x 100	2.71	2.61	2.37	2.55	2.45	2.23	2.42	2.32	2.11
50 x 125	3.37	3.24	2.96	3.17	3.05	2.78	3.01	2.90	2.63
50 x 150	4.02	3.87	3.53	3.79	3.65	3.32	3.60	3.46	3.15
CLS/ALS									
38 x 89	2.21	2.12	1.93	2.07	1.99	1.81	1.97	1.89	1.72
38 x 140	3.45	3.32	3.02	3.24	3.12	2.84	3.08	2.96	2.69

Table 4B.22 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load of 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.99	1.87					1.87											
47 x 175	2.32	2.18	2.06	1.96	1.87	1.80	2.18	2.04	1.93	1.83			2.06	1.93	1.82			
47 x 200	2.65	2.48	2.35	2.24	2.14	2.06	2.49	2.33	2.20	2.09	1.92		2.36	2.20	2.08	1.98	1.89	
47 x 225	2.98	2.79	2.64	2.52	2.41	2.31	2.80	2.62	2.47	2.35	2.16		2.65	2.48	2.34	2.22	2.12	1.94
63 x 125	1.84																	
63 x 150	2.21	2.07	1.96	1.87			2.08	1.95	1.84				1.97	1.84				
63 x 175	2.57	2.42	2.29	2.18	2.09	2.01	2.42	2.27	2.15	2.04	1.96	1.88	2.29	2.15	2.03	1.93	1.85	
63 x 200	2.94	2.76	2.61	2.49	2.39	2.30	2.76	2.59	2.45	2.33	2.24	2.15	2.62	2.45	2.32	2.21	2.11	2.03
63 x 225	3.30	3.10	2.93	2.80	2.68	2.58	3.10	2.91	2.75	2.62	2.51	2.42	2.94	2.76	2.61	2.48	2.38	2.28
75 x 125	1.96	1.84					1.84											
75 x 150	2.35	2.20	2.09	1.99	1.91	1.84	2.21	2.07	1.96	1.87			2.09	1.96	1.86			
75 x 175	2.73	2.57	2.43	2.32	2.22	2.14	2.57	2.41	2.28	2.18	2.09	2.01	2.44	2.29	2.16	2.06	1.97	1.90
75 x 200	3.12	2.93	2.78	2.65	2.54	2.45	2.93	2.75	2.61	2.49	2.38	2.29	2.79	2.61	2.47	2.35	2.26	2.17
75 x 225	3.50	3.29	3.12	2.98	2.86	2.75	3.30	3.10	2.93	2.80	2.68	2.58	3.13	2.94	2.78	2.65	2.54	2.44
2 x 47 x 200	3.52	3.31	3.15	3.00	2.88	2.78	3.32	3.12	2.96	2.82	2.71	2.61	3.15	2.96	2.81	2.68	2.57	2.47
2 x 47 x 225	3.96	3.72	3.53	3.38	3.24	3.12	3.73	3.51	3.32	3.17	3.05	2.93	3.54	3.33	3.16	3.01	2.89	2.78
2 x 47 x 250	4.39	4.13	3.92	3.75	3.60	3.47	4.14	3.89	3.69	3.52	3.38	3.26	3.93	3.69	3.50	3.34	3.21	3.09
2 x 47 x 275	4.82	4.54	4.31	4.12	3.95	3.81	4.54	4.27	4.05	3.87	3.72	3.58	4.32	4.06	3.85	3.67	3.52	3.39
2 x 47 x 300	5.25	4.94	4.69	4.48	4.31	4.15	4.95	4.66	4.42	4.22	4.05	3.90	4.71	4.42	4.19	4.00	3.84	3.70

Table 4B.23 Maximum clear span of rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.18	2.13	1.96	2.01	1.96	1.82	1.88	1.82	1.68
38 x 125	2.80	2.69	2.45	2.65	2.55	2.30	2.53	2.44	2.15
38 x 150	3.35	3.22	2.93	3.18	3.06	2.73	3.03	2.92	2.55
47 x 100	2.41	2.32	2.11	2.28	2.20	2.00	2.18	2.10	1.90
47 x 125	3.00	2.89	2.63	2.85	2.74	2.49	2.72	2.62	2.37
47 x 150	3.59	3.46	3.14	3.41	3.28	2.98	3.25	3.13	2.83
50 x 100	2.46	2.37	2.15	2.33	2.24	2.04	2.23	2.14	1.94
50 x 125	3.06	2.95	2.68	2.91	2.80	2.54	2.78	2.67	2.43
50 x 150	3.66	3.52	3.21	3.48	3.34	3.04	3.32	3.20	2.90
CLS/ALS									
38 x 89	1.82	1.79	1.69	1.69	1.65	1.55	1.59	1.55	1.44
38 x 140	3.13	3.01	2.74	2.97	2.85	2.56	2.83	2.72	2.29

Table 4B.24 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load of 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150																		
47 x 175	2.09	1.96	1.85				1.98	1.85				1.88						
47 x 200	2.39	2.24	2.11	1.98	1.86		2.26	2.11	1.96	1.83		2.15	1.98	1.83				
47 x 225	2.69	2.51	2.37	2.21	2.08	1.97	2.54	2.37	2.19	2.05	1.92	1.82	2.42	2.22	2.05	1.91		
63 x 150	2.00	1.87					1.89					1.88						
63 x 175	2.33	2.18	2.06	1.96	1.88	1.80	2.20	2.06	1.95	1.85		2.10	1.96	1.85				
63 x 200	2.66	2.49	2.35	2.24	2.14	2.05	2.51	2.35	2.22	2.12	2.00	1.90	2.40	2.24	2.12	1.99	1.87	
63 x 225	2.98	2.80	2.65	2.52	2.41	2.29	2.83	2.65	2.50	2.38	2.24	2.12	2.69	2.52	2.38	2.22	2.09	1.98
75 x 150	2.12	1.99	1.88				2.01	1.88				1.92						
75 x 175	2.47	2.32	2.20	2.09	2.00	1.93	2.34	2.20	2.08	1.98	1.89	1.82	2.24	2.09	1.98	1.88	1.80	
75 x 200	2.82	2.65	2.51	2.39	2.29	2.20	2.68	2.51	2.37	2.26	2.16	2.08	2.55	2.39	2.26	2.15	2.05	1.94
75 x 225	3.17	2.98	2.82	2.68	2.57	2.47	3.01	2.82	2.67	2.54	2.43	2.32	2.87	2.69	2.54	2.42	2.29	2.17
2 x 47 x 200	3.20	3.00	2.85	2.72	2.60	2.51	3.03	2.85	2.70	2.57	2.47	2.37	2.90	2.72	2.57	2.45	2.35	2.26
2 x 47 x 225	3.59	3.37	3.20	3.05	2.93	2.82	3.41	3.20	3.03	2.89	2.77	2.67	3.25	3.05	2.89	2.76	2.64	2.54
2 x 47 x 250	3.98	3.74	3.55	3.39	3.25	3.13	3.78	3.55	3.36	3.21	3.08	2.96	3.61	3.39	3.21	3.06	2.93	2.82
2 x 47 x 275	4.37	4.11	3.90	3.72	3.57	3.44	4.15	3.90	3.70	3.53	3.38	3.26	3.97	3.73	3.53	3.36	3.22	3.08
2 x 47 x 300	4.77	4.48	4.25	4.06	3.89	3.75	4.53	4.25	4.03	3.84	3.69	3.55	4.32	4.06	3.85	3.67	3.51	3.35

Table 4B.25 Maximum clear span of rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.34	2.25	2.04	2.21	2.13	1.93	2.11	2.03	1.84
38 x 125	2.91	2.80	2.55	2.76	2.66	2.41	2.64	2.53	2.30
38 x 150	3.48	3.35	3.05	3.30	3.18	2.89	3.16	3.04	2.76
47 x 100	2.51	2.41	2.19	2.38	2.29	2.08	2.27	2.18	1.98
47 x 125	3.12	3.00	2.73	2.96	2.85	2.59	2.83	2.72	2.47
47 x 150	3.73	3.59	3.27	3.54	3.41	3.10	3.38	3.26	2.96
50 x 100	2.56	2.46	2.24	2.42	2.33	2.12	2.32	2.23	2.02
50 x 125	3.18	3.06	2.79	3.02	2.91	2.64	2.89	2.78	2.52
50 x 150	3.80	3.66	3.34	3.61	3.48	3.16	3.45	3.32	3.02
CLS/ALS									
38 x 89	2.08	2.00	1.82	1.97	1.90	1.72	1.88	1.81	1.64
38 x 140	3.25	3.13	2.85	3.09	2.97	2.70	2.95	2.84	2.57

Table 4B.26 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 22.5° but not more than 30°; Imposed load of 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.88																	
47 x 175	2.19	2.05	1.94	1.84			2.07	1.94	1.82				1.97	1.84				
47 x 200	2.50	2.34	2.21	2.10	2.01	1.93	2.37	2.21	2.09	1.99	1.90		2.25	2.11	1.99	1.89		
47 x 225	2.81	2.63	2.49	2.37	2.26	2.17	2.66	2.50	2.35	2.23	2.13	1.97	2.53	2.37	2.23	2.12	1.91	
63 x 150	2.09	1.95	1.85				1.98	1.85					1.88					
63 x 175	2.43	2.28	2.16	2.05	1.97	1.89	2.30	2.16	2.04	1.94	1.86		2.20	2.06	1.94	1.85		
63 x 200	2.77	2.60	2.46	2.35	2.25	2.16	2.63	2.46	2.33	2.22	2.12	2.04	2.51	2.35	2.22	2.11	2.02	1.94
63 x 225	3.12	2.92	2.77	2.64	2.52	2.43	2.95	2.77	2.62	2.49	2.39	2.29	2.82	2.64	2.49	2.37	2.27	2.18
75 x 125	1.85																	
75 x 150	2.22	2.08	1.97	1.88			2.10	1.97	1.86				2.01	1.88				
75 x 175	2.58	2.42	2.29	2.19	2.10	2.02	2.45	2.30	2.17	2.07	1.96	1.91	2.34	2.19	2.07	1.97	1.89	1.81
75 x 200	2.95	2.77	2.62	2.50	2.39	2.30	2.80	2.62	2.48	2.36	2.26	2.18	2.67	2.50	2.37	2.25	2.16	2.07
75 x 225	3.31	3.11	2.94	2.81	2.70	2.59	3.14	2.95	2.79	2.66	2.55	2.45	3.00	2.81	2.66	2.53	2.42	2.33
2 x 47 x 200	3.33	3.13	2.97	2.84	2.72	2.62	3.17	2.97	2.82	2.69	2.58	2.48	3.03	2.84	2.69	2.56	2.46	2.37
2 x 47 x 225	3.74	3.52	3.34	3.19	3.06	2.95	3.56	3.34	3.17	3.02	2.90	2.79	3.40	3.19	3.02	2.88	2.76	2.66
2 x 47 x 250	4.15	3.91	3.71	3.54	3.40	3.27	3.95	3.71	3.52	3.35	3.22	3.10	3.77	3.54	3.36	3.20	3.07	2.95
2 x 47 x 275	4.56	4.29	4.07	3.89	3.73	3.60	4.34	4.07	3.86	3.69	3.54	3.41	4.14	3.89	3.69	3.52	3.37	3.25
2 x 47 x 300	4.97	4.67	4.44	4.24	4.07	3.92	4.72	4.44	4.21	4.02	3.85	3.71	4.52	4.24	4.02	3.83	3.68	3.54

Table 4B.27 Maximum clear span of rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.28	2.23	2.10	2.10	2.05	1.91	1.96	1.91	1.76
38 x 125	3.07	2.95	2.69	2.87	2.77	1.52	2.65	2.56	2.35
38 x 150	3.67	3.53	3.22	3.44	3.31	3.01	3.26	3.14	2.85
47 x 100	2.64	2.54	2.31	2.45	2.38	2.17	2.28	2.21	2.04
47 x 125	3.29	3.17	2.88	3.09	2.97	2.70	2.92	2.81	2.56
47 x 150	3.93	3.78	3.45	3.69	3.55	3.23	3.50	3.37	3.06
50 x 100	2.69	2.59	2.36	2.53	2.43	2.21	2.38	2.30	2.09
50 x 125	3.35	3.23	2.94	3.15	3.03	2.76	2.98	2.87	2.61
50 x 150	4.00	3.86	3.52	3.76	3.62	3.30	3.57	3.44	3.13
CLS/ALS									
38 x 89	1.91	1.87	1.77	1.77	1.73	1.62	1.67	1.62	1.50
38 x 140	3.43	3.30	3.01	3.22	3.10	2.82	3.05	2.93	2.66

Table 4B.28 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load of 0.75 kN/m²; Timbers strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.98	1.85					1.85											
47 x 175	2.30	2.16	2.04	1.94	1.86		2.16	2.02	1.91	1.81			2.04	1.91				
47 x 200	2.63	2.46	2.33	2.22	2.12	2.03	2.46	2.30	2.18	2.07	1.95	1.84	2.33	2.18	2.04	1.91		
47 x 225	2.96	2.77	2.62	2.49	2.39	2.26	2.77	2.59	2.45	2.31	2.17	2.06	2.62	2.45	2.28	2.13	2.00	1.90
63 x 125	1.83																	
63 x 150	2.19	2.06	1.95	1.85			2.05	1.93	1.82				1.94	1.82				
63 x 175	2.55	2.40	2.27	2.16	2.07	1.99	2.39	2.24	2.12	2.02	1.94	1.86	2.27	2.12	2.01	1.91	1.83	
63 x 200	2.91	2.74	2.59	2.47	2.37	2.28	2.73	2.56	2.42	2.31	2.21	2.13	2.59	2.42	2.29	2.18	2.09	1.98
63 x 225	3.28	3.07	2.91	2.78	2.66	2.56	3.07	2.88	2.73	2.60	2.49	2.39	2.91	2.72	2.58	2.45	2.33	2.21
75 x 125	1.94	1.82					1.82											
75 x 150	2.33	2.19	2.07	1.97	1.89	1.82	2.18	2.05	1.94	1.85			2.07	1.94	1.83			
75 x 175	2.71	2.55	2.41	2.30	2.21	2.12	2.55	2.39	2.26	2.15	2.06	1.99	2.41	2.26	2.14	2.04	1.95	1.87
75 x 200	3.10	2.91	2.75	2.63	2.52	2.43	2.91	2.73	2.58	2.46	2.36	2.27	2.75	2.58	2.44	2.33	2.23	2.14
75 x 225	3.48	3.27	3.10	2.95	2.83	2.73	3.26	3.06	2.90	2.77	2.65	2.55	3.09	2.90	2.74	2.61	2.50	2.41
2 x 47 x 200	3.50	3.29	3.12	2.98	2.86	2.76	3.29	3.09	2.93	2.80	2.68	2.58	3.12	2.93	2.77	2.65	2.54	2.44
2 x 47 x 225	3.93	3.69	3.51	3.35	3.21	3.10	3.69	3.47	3.29	3.14	3.01	2.90	3.50	3.29	3.12	2.97	2.85	2.75
2 x 47 x 250	4.36	4.10	3.89	3.72	3.57	3.44	4.10	3.85	3.65	3.49	3.35	3.22	3.89	3.65	3.46	3.30	3.17	3.05
2 x 47 x 275	4.78	4.50	4.27	4.08	3.92	3.78	4.50	4.23	4.01	3.83	3.68	3.54	4.27	4.01	3.80	3.63	3.48	3.35
2 x 47 x 300	5.21	4.9	4.66	4.45	4.27	4.12	4.90	4.61	4.37	4.18	4.01	3.86	4.65	4.37	4.14	3.96	3.79	3.65

Table 4B.29 Maximum clear span of rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.56	2.47	2.24	2.40	2.31	2.10	2.28	2.19	1.99
38 x 125	3.19	3.07	2.80	2.99	2.88	2.62	2.84	2.73	2.48
38 x 150	3.81	3.67	3.35	3.58	3.45	3.14	3.39	3.27	2.97
47 x 100	2.74	2.64	2.41	2.58	2.48	2.25	2.44	2.35	2.13
47 x 125	3.41	3.29	3.00	3.21	3.09	2.81	3.04	2.93	2.66
47 x 150	4.08	3.93	3.59	3.83	3.69	3.36	3.64	3.50	3.19
50 x 100	2.80	2.70	2.45	2.63	2.53	2.30	2.49	2.40	2.18
50 x 125	3.48	3.35	3.06	3.27	3.15	2.87	3.10	2.99	2.72
50 x 150	4.16	4.01	3.66	3.91	3.77	3.43	3.71	3.57	3.25
CLS/ALS									
38 x 89	2.28	2.20	2.00	2.14	2.06	1.87	2.03	1.95	1.77
38 x 140	3.56	3.43	3.13	3.35	3.22	2.93	3.17	3.05	2.77

Table 4B.30 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load of 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	2.06	1.94	1.83				1.93	1.81				1.83						
47 x 175	2.41	2.26	2.13	2.03	1.95	1.87	2.26	2.11	2.00	1.90	1.82	2.13	2.00	1.88				
47 x 200	2.75	2.58	2.44	2.32	2.22	2.14	2.57	2.41	2.28	2.17	2.08	2.44	2.28	2.15	2.05	1.96	1.88	
47 x 225	3.09	2.89	2.74	2.61	2.50	2.40	2.89	2.71	2.56	2.44	2.33	2.24	2.74	2.56	2.42	2.30	2.20	2.11
63 x 125	1.91																	
63 x 150	2.29	2.15	2.03	1.94	1.86		2.15	2.01	1.90	1.81		2.03	1.90	1.80				
63 x 175	2.67	2.50	2.37	2.26	2.17	2.08	2.50	2.35	2.22	2.12	2.03	1.95	2.37	2.22	2.10	2.00	1.91	1.84
63 x 200	3.04	2.86	2.71	2.58	2.47	2.38	2.86	2.68	2.54	2.42	2.31	2.23	2.70	2.53	2.40	2.28	2.19	2.10
63 x 225	3.42	3.21	3.04	2.90	2.78	2.68	3.21	3.01	2.85	2.72	2.60	2.50	3.04	2.85	2.70	2.57	2.55	2.36
75 x 125	2.03	1.90	1.80				1.90					1.80						
75 x 150	2.43	2.28	2.16	2.06	1.98	1.91	2.28	2.14	2.03	1.93	1.85	2.16	2.03	1.92	1.83			
75 x 175	2.83	2.66	2.52	2.40	2.31	2.22	2.66	2.49	2.36	2.25	2.16	2.08	2.52	2.36	2.24	2.13	2.04	1.96
75 x 200	3.23	3.03	2.88	2.74	2.63	2.54	3.03	2.85	2.70	2.57	2.47	2.37	2.88	2.70	2.55	2.43	2.33	2.24
75 x 225	3.63	3.41	3.23	3.08	2.96	2.85	3.41	3.20	3.03	2.89	2.77	2.67	3.23	3.03	2.87	2.74	2.62	2.52
2 x 47 x 200	3.65	3.43	3.26	3.11	2.99	2.88	3.43	3.22	3.06	2.92	2.80	2.70	3.25	3.06	2.90	2.77	2.65	2.55
2 x 47 x 225	4.09	3.85	3.66	3.49	3.36	3.24	3.85	3.62	3.44	3.28	3.15	3.03	3.66	3.44	3.26	3.11	2.98	2.87
2 x 47 x 250	4.54	4.27	4.06	3.88	3.72	3.59	4.27	4.02	3.81	3.64	3.50	3.37	4.06	3.81	3.61	3.45	3.31	3.19
2 x 47 x 275	4.98	4.69	4.46	4.26	4.09	3.95	4.69	4.41	4.19	4.00	3.84	3.70	4.46	4.19	3.97	3.79	3.64	3.50
2 x 47 x 300	5.43	5.11	4.86	4.64	4.46	4.30	5.11	4.81	4.56	4.36	4.19	4.03	4.85	4.56	4.33	4.13	3.97	3.82

Table 4B.31 Maximum clear span of rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load 1.00 kN/m²; Timbers strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of rafter (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.28	2.23	2.03	2.10	2.05	1.91	1.96	1.91	1.76
38 x 125	2.90	2.79	2.54	2.75	2.64	2.40	2.62	2.52	2.26
38 x 150	3.47	3.34	3.04	3.29	3.16	2.87	3.13	3.01	2.69
47 x 100	2.50	2.40	2.18	2.36	2.27	2.06	2.25	2.17	1.97
47 x 125	3.11	2.99	2.72	2.94	2.83	2.58	2.81	2.70	2.45
47 x 150	3.72	3.58	3.26	3.52	3.39	3.08	3.36	3.23	2.94
50 x 100	2.55	2.45	2.23	2.41	2.32	2.11	2.30	2.21	2.01
50 x 125	3.17	3.05	2.78	3.00	2.89	2.63	2.87	2.76	2.51
50 x 150	3.79	3.65	3.33	3.59	3.46	3.15	3.43	3.30	3.00
CLS/ALS									
38 x 89	1.91	1.87	1.77	1.77	1.73	1.62	1.67	1.62	1.50
38 x 140	3.24	3.12	2.84	3.07	2.95	2.68	2.93	2.82	2.52

Table 4B.32 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load of 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.87																	
47 x 175	2.17	2.04	1.92	1.83			2.05	1.92	1.81			1.95	1.82					
47 x 200	2.48	2.32	2.20	2.09	1.97	1.86	2.34	2.19	2.06	1.93	1.81	2.23	2.08	1.92				
47 x 225	2.79	2.61	2.47	2.34	2.20	2.08	2.64	2.46	2.31	2.15	2.03	1.92	2.51	2.33	2.15	2.01	1.89	
63 x 150	2.07	1.94	1.84				1.96	1.83				1.86						
63 x 175	2.41	2.26	2.14	2.04	1.95	1.88	2.28	2.14	2.02	1.92	1.84	2.17	2.03	1.92	1.83			
63 x 200	2.76	2.58	2.44	2.33	2.23	2.14	2.61	2.44	2.31	2.20	2.10	2.00	2.48	2.32	2.19	2.09	1.97	1.86
63 x 225	3.10	2.90	2.75	2.62	2.51	2.41	2.93	2.74	2.59	2.47	2.36	2.23	2.79	2.61	2.47	2.33	2.20	2.08
75 x 125	1.84																	
75 x 150	2.20	2.07	1.96	1.86			2.08	1.95	1.85			1.98	1.86					
75 x 175	2.57	2.41	2.28	2.17	2.08	2.00	2.43	2.28	2.15	2.05	1.96	1.89	2.31	2.17	2.05	1.95	1.87	
75 x 200	2.93	2.75	2.60	2.48	2.38	2.29	2.77	2.60	2.46	2.34	2.24	2.16	2.64	2.47	2.34	2.23	2.13	2.04
75 x 225	3.29	3.09	2.92	2.79	2.67	2.57	3.12	2.92	2.76	2.63	2.52	2.43	2.97	2.78	2.63	2.50	2.40	2.28
2 x 47 x 200	3.31	3.11	2.95	2.82	2.70	2.60	3.14	2.95	2.79	2.66	2.55	2.46	2.99	2.81	2.66	2.54	2.43	2.34
2 x 47 x 225	3.72	3.50	3.32	3.17	3.04	2.93	3.53	3.31	3.14	2.99	2.87	2.76	3.36	3.16	2.99	2.85	2.73	2.63
2 x 47 x 250	4.13	3.88	3.68	3.51	3.37	3.25	3.91	3.68	3.48	3.32	3.19	3.07	3.73	3.51	3.32	3.17	3.04	2.92
2 x 47 x 275	4.53	4.26	4.05	3.86	3.71	3.57	4.30	4.04	3.83	3.65	3.50	3.37	4.10	3.85	3.65	3.48	3.34	3.21
2 x 47 x 300	4.94	4.65	4.41	4.21	4.04	3.89	4.68	4.40	4.17	3.98	3.82	3.68	4.47	4.20	3.98	3.79	3.64	3.50

Table 4B.33 Maximum clear span of rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of purlin (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.42	2.33	2.12	2.29	2.20	2.00	2.18	2.10	1.90
38 x 125	3.02	2.90	2.64	2.86	2.75	2.50	2.72	2.62	2.38
38 x 150	3.61	3.47	3.16	3.42	3.29	2.99	3.26	3.14	2.85
47 x 100	2.60	2.50	2.27	2.46	2.36	2.15	2.34	2.25	2.05
47 x 125	3.23	3.11	2.83	3.06	2.95	2.68	2.92	2.81	2.55
47 x 150	3.86	3.72	3.39	3.66	3.52	3.21	3.49	3.36	3.06
50 x 100	2.65	2.55	2.32	2.51	2.41	2.19	2.39	2.30	2.09
50 x 125	3.30	3.17	2.89	3.12	3.01	2.73	2.98	2.87	2.61
50 x 150	3.94	3.79	3.46	3.73	3.60	3.27	3.57	3.43	3.12
CLS/ALS									
38 x 89	2.16	2.08	1.89	2.04	1.96	1.78	1.95	1.87	1.70
38 x 140	3.37	3.25	2.95	3.19	3.07	2.79	3.05	2.93	2.66

Table 4B.34 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load of 1.00 kN/m²; Timbers strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.95	1.83					1.84											
47 x 175	2.27	2.13	2.01	1.92	1.83		2.15	2.01	1.90	1.80		2.04	1.91	1.80				
47 x 200	2.60	2.43	2.30	2.19	2.09	2.01	2.45	2.30	2.17	2.06	1.97	1.89	2.33	2.18	2.06	1.96	1.87	
47 x 225	2.92	2.73	2.58	2.46	2.35	2.26	2.76	2.58	2.44	2.32	2.22	2.13	2.62	2.45	2.32	2.20	2.10	1.89
63 x 125	1.81																	
63 x 150	2.16	2.03	1.92	1.83			2.05	1.92	1.81				1.95	1.83				
63 x 175	2.52	2.36	2.24	2.13	2.04	1.97	2.39	2.24	2.11	2.01	1.93	1.85	2.27	2.13	2.01	1.91	1.83	
63 x 200	2.88	2.70	2.56	2.44	2.33	2.24	2.72	2.55	2.41	2.30	2.20	2.12	2.59	2.43	2.30	2.19	2.09	2.01
63 x 225	3.23	3.03	2.87	2.74	2.62	2.52	3.06	2.87	2.71	2.59	2.48	2.38	2.92	2.73	2.58	2.46	2.35	2.26
75 x 125	1.92						1.82											
75 x 150	2.30	2.16	2.04	1.95	1.87		2.18	2.04	1.93	1.84			2.07	1.94	1.84			
75 x 175	2.68	2.51	2.38	2.27	2.18	2.10	2.54	2.38	2.25	2.15	2.06	1.98	2.42	2.27	2.14	2.04	1.96	1.88
75 x 200	3.06	2.87	2.72	2.59	2.49	2.39	2.89	2.72	2.57	2.45	2.35	2.26	2.76	2.59	2.45	2.33	2.23	2.15
75 x 225	3.43	3.22	3.06	2.91	2.79	2.69	3.25	3.05	2.89	2.75	2.64	2.54	3.10	2.91	2.75	2.62	2.51	2.41
2 x 47 x 200	3.46	3.25	3.08	2.94	2.82	2.72	3.28	3.08	2.92	2.78	2.67	2.57	3.13	2.94	2.78	2.65	2.54	2.45
2 x 47 x 225	3.88	3.65	3.46	3.31	3.17	3.06	3.68	3.46	3.28	3.13	3.00	2.89	3.51	3.30	3.13	2.98	2.86	2.75
2 x 47 x 250	4.30	4.05	3.84	3.76	3.52	3.40	4.08	3.84	3.64	3.47	3.33	3.21	3.90	3.66	3.47	3.31	3.18	3.06
2 x 47 x 275	4.73	4.45	4.22	4.03	3.87	3.73	4.48	4.22	4.00	3.82	3.66	3.53	4.28	4.02	3.81	3.64	3.49	3.36
2 x 47 x 300	5.15	4.85	4.60	4.39	4.22	4.07	4.89	4.59	4.36	4.16	3.99	3.85	4.67	4.38	4.16	3.97	3.80	3.66

Flat roof joists

4B.14 Tables 4B.35 to 4B.38 give the maximum clear span of joists for a flat roof using timber strength class C16 and C24.

The sizes, spacings and spans given will safely support the dead loads stated in the tables, together with a maximum imposed load of 0.75 kN/m^2 or 1.00 kN/m^2 or a concentrated load of 0.9 kN provided access is limited for the purpose of cleaning and maintenance only.

Tables 4B.39 and 4B.40 are also given for a flat roof where the access is not limited to the purposes of cleaning and maintenance only and in these tables the imposed load is 1.5 kN/m^2 or a concentrated point load of 1.8 kN .

The section sizes are either sawn across the timber thickness in accordance with tolerance class 1 of BS EN 336:2003 and processed in accordance with tolerance class 2 of BS EN 336:2003 across the timber width (joist depth), or are CLS/ALS processed sizes in accordance with tolerance class 2, to provide level surfaces for ease of ceiling lining and the fixing of structural decking.

See Diagram 4B.6.

Diagram 4B.6 Typical flat roof joist arrangement

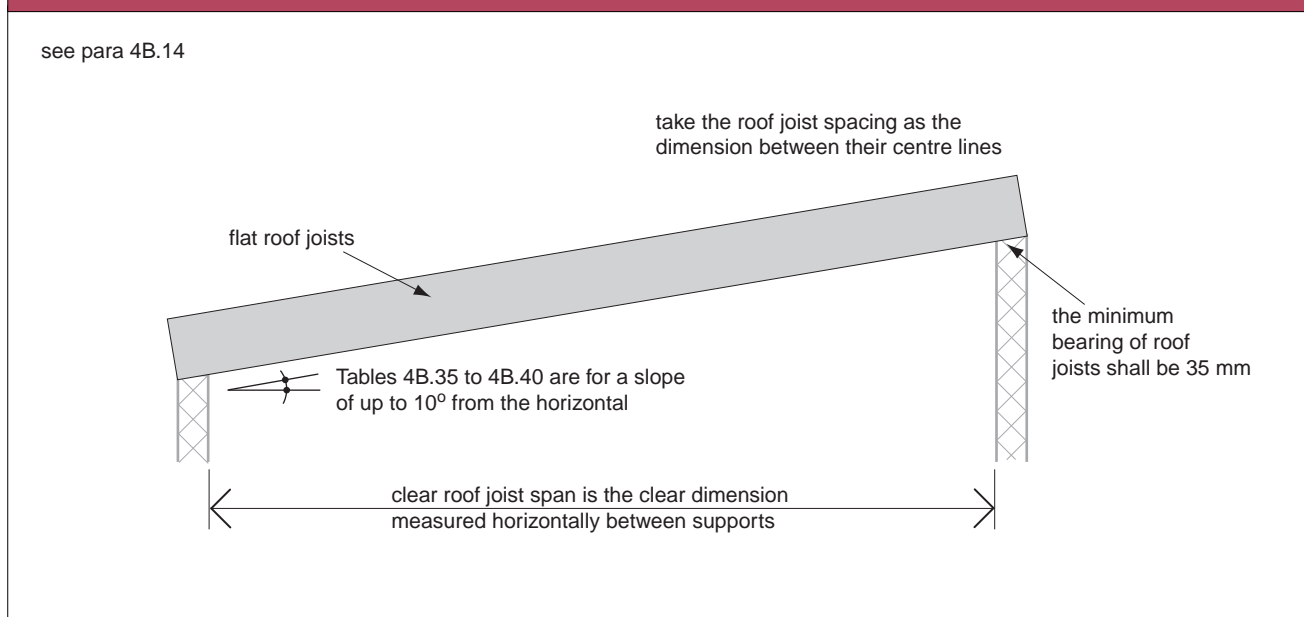


Table 4B.35 Maximum clear span of flat roof joists (m); Access only for cleaning and maintenance; Imposed load 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.74	1.72	1.67	1.67	1.64	1.58	1.61	1.58	1.51
38 x 122	2.37	2.34	2.25	2.25	2.21	2.11	2.16	2.11	2.01
38 x 147	3.02	2.97	2.85	2.85	2.80	2.66	2.72	2.66	2.51
38 x 170	3.63	3.57	3.37	3.41	3.34	3.17	3.24	3.17	2.98
38 x 195	4.30	4.23	3.86	4.03	3.94	3.63	3.81	3.72	3.45
38 x 220	4.94	4.76	4.34	4.64	4.49	4.09	4.38	4.27	3.88
47 x 97	1.92	1.90	1.84	1.84	1.81	1.74	1.77	1.74	1.65
47 x 120	2.60	2.57	2.47	2.47	2.43	2.31	2.36	2.31	2.19
47 x 145	3.30	3.25	3.12	3.12	3.06	2.90	2.96	2.90	2.74
47 x 170	3.96	3.89	3.61	3.72	3.64	3.40	3.53	3.44	3.23
47 x 195	4.68	4.53	4.31	4.37	4.28	3.89	4.14	4.04	3.70
47 x 220	5.28	5.09	4.65	4.99	4.81	4.38	4.75	4.58	4.17
50 x 97	1.97	1.95	1.89	1.89	1.86	1.78	1.81	1.78	1.70
50 x 120	2.67	2.64	2.53	2.53	2.49	2.37	2.42	2.37	2.25
50 x 145	3.39	3.34	3.19	3.19	3.13	2.97	3.04	2.97	2.80
50 x 170	4.06	3.99	3.69	3.81	3.73	3.47	3.61	3.53	3.30
50 x 195	4.79	4.62	4.22	4.48	4.36	3.97	4.23	4.13	3.78
50 x 220	5.38	5.19	4.74	5.09	4.90	4.47	4.85	4.67	4.25
63 x 97	2.19	2.16	2.09	2.09	2.06	1.97	2.01	1.97	1.87
63 x 120	2.95	2.91	2.79	2.79	2.74	2.61	2.66	2.61	2.47
63 x 145	3.72	3.66	3.44	3.50	3.43	3.25	3.33	3.26	3.07
63 x 170	4.44	4.35	3.97	4.16	4.07	3.74	3.95	3.85	3.56
63 x 195	5.14	4.96	4.54	4.86	4.69	4.28	4.61	4.47	4.07
63 x 220	5.77	5.57	5.10	5.46	5.27	4.82	5.21	5.02	4.59
75 x 120	3.17	3.12	3.00	3.00	2.94	2.80	2.86	2.80	2.65
75 x 145	3.98	3.92	3.64	3.75	3.67	3.44	3.56	3.48	3.27
75 x 170	4.74	4.58	4.19	4.44	4.33	3.96	4.21	4.11	3.77
75 x 195	5.42	5.23	4.79	5.13	4.95	4.53	4.89	4.72	4.31
75 x 220	6.07	5.87	5.38	5.76	5.56	5.09	5.50	5.30	4.85
CLS/ALS									
38 x 140	2.84	2.79	2.68	2.68	2.63	2.51	2.56	2.51	2.37
38 x 184	4.01	3.94	3.64	3.76	3.68	3.43	3.56	3.48	3.25

Table 4B.36 Maximum clear span of flat roof joists (m); Access only for cleaning and maintenance; Imposed load 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.84	1.82	1.76	1.76	1.73	1.66	1.69	1.66	1.59
38 x 120	2.50	2.46	2.37	2.37	2.33	2.22	2.27	2.22	2.11
38 x 145	3.18	3.13	3.00	3.00	2.94	2.79	2.85	2.79	2.64
38 x 170	3.81	3.75	3.50	3.58	3.51	3.30	3.40	3.32	3.12
38 x 195	4.51	4.40	4.01	4.22	4.13	3.78	3.99	3.90	3.59
38 x 220	5.13	4.95	4.51	4.85	4.67	4.25	4.59	4.44	4.04
47 x 97	2.03	2.00	1.94	1.94	1.91	1.83	1.86	1.83	1.74
47 x 120	2.74	2.70	2.60	2.60	2.55	2.43	2.48	2.43	2.30
47 x 145	3.47	3.42	3.26	3.27	3.21	3.04	3.11	3.04	2.87
47 x 170	4.15	4.08	3.76	3.89	3.81	3.54	3.69	3.61	3.36
47 x 195	4.88	4.70	4.29	4.58	4.44	4.05	4.33	4.22	3.85
47 x 220	5.48	5.29	4.83	5.18	5.00	4.56	4.94	4.76	4.33
50 x 97	2.08	2.06	1.99	1.99	1.96	1.88	1.91	1.88	1.79
50 x 120	2.81	2.77	2.66	2.66	2.62	2.49	2.54	2.49	2.36
50 x 145	3.56	3.50	3.32	3.35	3.29	3.12	3.19	3.12	2.94
50 x 170	4.26	4.18	3.83	3.99	3.91	3.61	3.78	3.69	3.43
50 x 195	4.97	4.80	4.38	4.68	4.53	4.13	4.43	4.31	3.93
50 x 220	5.59	5.39	4.93	5.28	5.09	4.65	5.04	4.85	4.42
63 x 97	2.31	2.28	2.20	2.20	2.16	2.07	2.11	2.07	1.97
63 x 120	3.10	3.05	2.93	2.93	2.88	2.74	2.80	2.74	2.59
63 x 145	3.90	3.84	3.58	3.67	3.60	3.38	3.49	3.41	3.21
63 x 170	4.65	4.51	4.12	4.35	4.26	3.89	4.13	4.03	3.70
63 x 195	5.33	5.15	4.71	5.05	4.87	4.45	4.82	4.64	4.24
63 x 220	5.98	5.78	5.30	5.67	5.47	5.00	5.41	5.22	4.76
75 x 120	3.33	3.27	3.14	3.14	3.08	2.93	2.99	2.93	2.77
75 x 145	4.17	4.10	3.78	3.92	3.84	3.57	3.73	3.64	3.40
75 x 170	4.92	4.75	4.35	4.64	4.50	4.11	4.40	4.29	3.92
75 x 195	5.61	5.42	4.97	5.32	5.14	4.70	5.08	4.90	4.48
75 x 220	6.29	6.08	5.59	5.97	5.77	5.28	5.70	5.50	5.04
CLS/ALS									
38 x 140	2.99	2.94	2.82	2.82	2.75	2.63	2.69	2.63	2.49
38 x 184	4.21	4.13	3.79	3.94	3.85	3.57	3.73	3.64	3.39

Table 4B.37 Maximum clear span of flat roof joists; Access only for cleaning and maintenance; Imposed load 1.00 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.74	1.72	1.67	1.67	1.64	1.58	1.61	1.58	1.51
38 x 120	2.37	2.34	2.25	2.25	2.21	2.11	2.16	2.11	2.01
38 x 145	3.02	2.97	2.75	2.85	2.80	2.61	2.72	2.66	2.49
38 x 170	3.62	3.49	3.17	3.41	3.31	3.01	3.24	3.17	2.88
38 x 195	4.15	3.99	3.63	3.94	3.79	3.45	3.77	3.63	3.29
38 x 220	4.67	4.49	4.09	4.44	4.27	3.88	4.25	4.09	3.71
47 x 97	1.92	1.90	1.84	1.84	1.81	1.74	1.77	1.74	1.65
47 x 120	2.60	2.57	2.45	2.47	2.43	2.31	2.36	2.31	2.19
47 x 145	3.30	3.24	2.95	3.12	3.06	2.80	2.96	2.90	2.68
47 x 170	3.88	3.74	3.40	3.69	3.56	3.23	3.53	3.40	3.09
47 x 195	4.44	4.27	3.89	4.23	4.07	3.70	4.05	3.89	3.54
47 x 220	4.99	4.81	4.38	4.75	4.58	4.17	4.55	4.38	3.99
50 x 97	1.97	1.95	1.89	1.89	1.86	1.78	1.81	1.78	1.70
50 x 120	2.67	2.64	2.50	2.53	2.49	2.37	2.42	2.37	2.25
50 x 145	3.39	3.31	3.01	3.19	3.13	2.86	3.04	2.97	2.73
50 x 170	3.96	3.81	3.47	3.77	3.63	3.30	3.61	3.47	3.16
50 x 195	4.53	4.36	3.97	4.31	4.15	3.78	4.13	3.97	3.61
50 x 220	5.09	4.90	4.47	4.85	4.67	4.25	4.65	4.47	4.07
63 x 97	2.19	2.16	2.09	2.09	2.06	1.97	2.01	1.97	1.87
63 x 120	2.95	2.91	2.70	2.79	2.74	2.57	2.66	2.61	2.46
63 x 145	3.70	3.56	3.25	3.50	3.39	3.09	3.33	3.25	2.95
63 x 170	4.26	4.10	3.74	4.06	3.91	3.56	3.89	3.74	3.41
63 x 195	4.86	4.69	4.28	4.64	4.47	4.07	4.45	4.28	3.90
63 x 220	5.46	5.27	4.82	5.21	5.02	4.59	5.00	4.82	4.39
75 x 120	3.17	3.12	2.86	3.00	2.94	2.72	2.86	2.80	2.60
75 x 145	3.90	3.76	3.44	3.72	3.59	3.27	3.56	3.44	3.13
75 x 170	4.49	4.33	3.96	4.29	4.13	3.77	4.11	3.96	3.61
75 x 195	5.13	4.95	4.53	4.89	4.72	4.31	4.70	4.53	4.13
75 x 220	5.76	5.56	5.09	5.50	5.30	4.85	5.28	5.09	4.65
CLS/ALS									
38 x 140	2.84	2.79	2.62	2.68	2.63	2.48	2.56	2.51	2.37
38 x 184	3.92	3.77	3.43	3.73	3.58	3.25	3.56	3.43	3.11

Table 4B.38 Maximum clear span of flat roof joists (m); Access only for cleaning and maintenance; Imposed load 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 97	1.84	1.82	1.76	1.76	1.73	1.66	1.69	1.66	1.59
38 x 120	2.50	2.46	2.37	2.37	2.33	2.22	2.27	2.22	2.11
38 x 145	3.18	3.13	2.86	3.00	2.94	2.71	2.85	2.79	2.59
38 x 170	3.77	3.63	3.30	3.58	3.45	3.13	3.40	3.30	2.99
38 x 195	4.31	4.15	3.78	4.10	3.95	3.59	3.93	3.78	3.43
38 x 220	4.85	4.67	4.25	4.61	4.44	4.04	4.42	4.25	3.86
47 x 97	2.03	2.00	1.94	1.94	1.91	1.83	1.86	1.83	1.74
47 x 120	2.74	2.70	2.55	2.60	2.55	2.42	2.48	2.43	2.30
47 x 145	3.47	3.37	3.07	3.27	3.21	2.91	3.11	3.04	2.79
47 x 170	4.03	3.88	3.54	3.84	3.70	3.36	3.68	3.54	3.22
47 x 195	4.61	4.44	4.05	4.39	4.23	3.85	4.21	4.05	3.68
47 x 220	5.18	5.00	4.56	4.94	4.76	4.33	4.73	4.56	4.15
50 x 97	2.08	2.06	1.99	1.99	1.96	1.88	1.91	1.88	1.79
50 x 120	2.81	2.77	2.60	2.66	2.62	2.47	2.54	2.49	2.36
50 x 145	3.56	3.44	3.13	3.35	3.27	2.97	3.19	3.12	2.85
50 x 170	4.11	3.96	3.61	3.92	3.77	3.43	3.75	3.61	3.28
50 x 195	4.70	4.53	4.13	4.48	4.31	3.93	4.29	4.13	3.76
50 x 220	5.28	5.09	4.65	5.04	4.85	4.42	4.83	4.65	4.23
63 x 97	2.31	2.28	2.20	2.20	2.16	2.07	2.11	2.07	1.97
63 x 120	3.10	3.05	2.81	2.93	2.88	2.67	2.80	2.74	2.56
63 x 145	3.84	3.70	3.38	3.66	3.52	3.21	3.49	3.38	3.07
63 x 170	4.42	4.26	3.89	4.21	4.06	3.70	4.04	3.89	3.54
63 x 195	5.05	4.87	4.45	4.81	4.64	4.24	4.62	4.45	4.06
63 x 220	5.67	5.47	5.00	5.41	5.22	4.76	5.19	5.00	4.56
75 x 120	3.33	3.26	2.97	3.14	3.08	2.83	2.99	2.93	2.71
75 x 145	4.05	3.91	3.57	3.86	3.72	3.40	3.71	3.57	3.25
75 x 170	4.66	4.50	4.11	4.45	4.29	3.92	4.27	4.11	3.75
75 x 195	5.32	5.14	4.70	5.08	4.90	4.48	4.88	4.70	4.29
75 x 220	5.97	5.77	5.28	5.70	5.50	5.04	5.48	5.28	4.83
CLS/ALS									
38 x 140	2.99	2.94	2.72	2.82	2.77	2.59	2.69	2.63	2.47
38 x 184	4.07	3.92	3.57	3.87	3.73	3.39	3.71	3.57	3.24

Table 4B.39 Maximum clear span of flat roof joists (m); Access not limited to the purposes of cleaning and maintenance; Imposed loading 1.50 kN/m²; Timber strength class C16

C16

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 120	1.80	1.79	1.74	1.74	1.71	1.65	1.68	1.65	1.57
38 x 145	2.35	2.33	2.27	2.27	2.25	2.18	2.21	2.18	2.09
38 x 170	2.88	2.85	2.77	2.77	2.74	2.64	2.68	2.64	2.53
38 x 195	3.47	3.43	3.29	3.33	3.28	3.16	3.21	3.16	3.02
38 x 220	4.08	4.03	3.71	3.90	3.84	3.56	3.75	3.68	3.43
47 x 120	2.00	1.99	1.94	1.94	1.93	1.87	1.89	1.87	1.81
47 x 145	2.60	2.58	2.51	2.51	2.48	2.40	2.44	2.40	2.31
47 x 170	3.18	3.14	3.06	3.06	3.02	2.91	2.95	2.91	2.78
47 x 195	3.82	3.78	3.54	3.66	3.61	3.40	3.52	3.46	3.28
47 x 220	4.48	4.38	3.99	4.27	4.20	3.83	4.10	4.03	3.70
50 x 120	2.06	2.05	2.00	2.00	1.98	1.93	1.95	1.93	1.86
50 x 145	2.68	2.65	2.59	2.59	2.56	2.47	2.51	2.47	2.38
50 x 170	3.27	3.23	3.14	3.14	3.10	2.99	3.04	2.99	2.86
50 x 195	3.93	3.88	3.61	3.76	3.70	3.47	3.62	3.56	3.35
50 x 220	4.60	4.47	4.07	4.38	4.30	3.91	4.21	4.13	3.78
63 x 97	1.67	1.66	1.63	1.63	1.61	1.57	1.59	1.57	1.53
63 x 120	2.31	2.29	2.24	2.24	2.21	2.15	2.17	2.15	2.07
63 x 145	2.98	2.95	2.87	2.87	2.84	2.74	2.78	2.74	2.63
63 x 170	3.62	3.59	3.41	3.48	3.43	3.28	3.36	3.30	3.16
63 x 195	4.34	4.29	3.90	4.15	4.08	3.75	3.99	3.92	3.62
63 x 220	5.00	4.82	4.39	4.82	4.64	4.22	4.62	4.48	4.08
75 x 120	2.50	2.48	2.42	2.42	2.40	2.32	2.35	2.32	2.24
75 x 145	3.23	3.19	3.11	3.11	3.07	2.96	3.00	2.96	2.84
75 x 170	3.91	3.87	3.61	3.75	3.69	3.47	3.61	3.55	3.35
75 x 195	4.66	4.53	4.13	4.45	4.36	3.97	4.28	4.20	3.84
75 x 220	5.28	5.09	4.65	5.09	4.90	4.47	4.92	4.74	4.32
CLS/ALS									
38 x 140	2.19	2.17	2.12	2.12	2.10	2.04	2.07	2.04	1.94
38 x 184	3.21	3.17	3.08	3.08	3.04	2.93	2.98	2.93	2.80

Table 4B.40 Maximum clear span of flat roof joists (m); Access not limited to the purposes of cleaning and maintenance; Imposed load 1.50 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the joist									
Size of joist (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of joist (mm)								
	400	450	600	400	450	600	400	450	600
38 x 120	1.91	1.90	1.86	1.86	1.84	1.79	1.81	1.79	1.73
38 x 145	2.49	2.46	2.40	2.40	2.38	2.30	2.33	2.30	2.21
38 x 170	3.04	3.01	2.93	2.93	2.89	2.79	2.83	2.79	2.67
38 x 195	3.66	3.62	3.43	3.51	3.46	3.29	3.38	3.33	3.18
38 x 220	4.30	4.25	3.86	4.10	4.04	3.71	3.94	3.87	3.58
47 x 120	2.12	2.10	2.06	2.06	2.04	1.98	2.00	1.98	1.91
47 x 145	2.75	2.73	2.66	2.66	2.62	2.54	2.57	2.54	2.44
47 x 170	3.35	3.32	3.22	3.22	3.18	3.06	3.11	3.06	2.93
47 x 195	4.03	3.98	3.68	3.85	3.80	3.54	3.71	3.64	3.42
47 x 220	4.71	4.56	4.15	4.49	4.39	3.99	4.31	4.23	3.85
50 x 120	2.19	2.17	2.12	2.12	2.10	2.04	2.06	2.04	1.97
50 x 145	2.83	2.81	2.73	2.73	2.70	2.61	2.65	2.61	2.51
50 x 170	3.45	3.41	3.28	3.31	3.27	3.15	3.20	3.15	3.01
50 x 195	4.14	4.09	3.76	3.96	3.90	3.61	3.81	3.74	3.49
50 x 220	4.83	4.65	4.23	4.61	4.47	4.07	4.42	4.32	3.93
63 x 97	1.77	1.75	1.72	1.72	1.71	1.66	1.68	1.66	1.61
63 x 120	2.44	2.42	2.36	2.36	2.34	2.27	2.30	2.27	2.18
63 x 145	3.15	3.12	3.03	3.03	2.99	2.89	2.93	2.89	2.77
63 x 170	3.82	3.78	3.54	3.66	3.61	3.41	3.53	3.47	3.29
63 x 195	4.56	4.45	4.06	4.36	4.29	3.90	4.19	4.11	3.77
63 x 220	5.19	5.00	4.56	5.00	4.82	4.39	4.84	4.66	4.24
75 x 120	2.64	2.62	2.56	2.56	2.53	2.45	2.48	2.45	2.36
75 x 145	3.40	3.36	3.25	3.27	3.23	3.11	3.16	3.11	2.98
75 x 170	4.11	4.07	3.75	3.94	3.88	3.61	3.79	3.73	3.49
75 x 195	4.79	4.70	4.29	4.67	4.53	4.13	4.49	4.38	3.99
75 x 220	5.48	5.28	4.83	5.28	5.09	4.65	5.11	4.93	4.49
CLS/ALS									
38 x 140	2.32	2.30	2.25	2.25	2.22	2.16	2.19	2.16	2.08
38 x 184	3.39	3.35	3.24	3.25	3.21	3.09	3.14	3.09	2.95

Purlins supporting decking or sheeting

4B.15 Tables 4B.41 to 4B.44 give the maximum clear span of purlins supporting decking or sheeting on roofs that have a pitch greater than 10° but not greater than 35°. The timber strength class used in the tables is C16 and C24.

The sizes, spacings and spans given will safely support the dead loads stated in the tables, together with a maximum imposed load of 0.75 kN/m² or 1.00 kN/m², measured on plan, or a concentrated load of 0.9 kN. It is assumed in the tables that access is limited for the purpose of cleaning and maintenance only.

BS 6399-3:1988, permits a reduction in imposed roof loading for a pitch over 30°. This reduction has not been used in the tables because the tabulated spans are based on a pitch of 10° as giving the most onerous case for the range of spans between 10° and 35°.

The section sizes given in the tables are either sawn in accordance with tolerance class 1 of BS EN 336:2003, or are CLS/ALS processed sizes in accordance with tolerance class 2 of BS EN 336:2003.

The tabulated purlin sizes are designed to resist only the load component perpendicular to the roof pitch with purlins installed normal to the roof pitch. Designers **should** ensure that the roof construction can satisfactorily accommodate the component of load parallel to the roof pitch.

Notching or drilling of the purlins **should** not be carried out unless justified by specialist calculation.

See Diagram 4B.7.

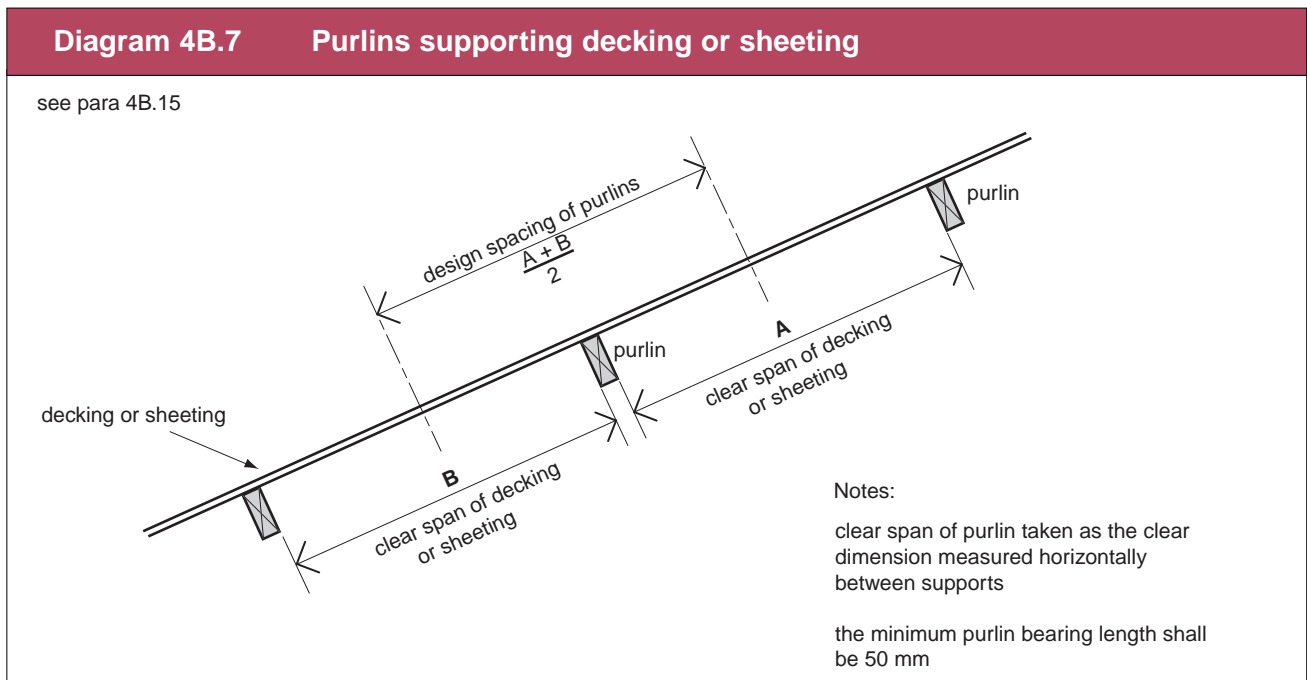


Table 4B.41 Maximum clear span of purlins supporting decking or sheeting (m); Roof pitch more than 10° but not more than 35°; Imposed load of 0.75 kN/m²; Timber strength class C16

C16

Dead Load [kN/m²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.25						More than 0.25 but not more than 0.50						More than 0.50 but not more than 0.75					
	Design spacing of purlins (mm)																	
	900	1200	1500	1800	2100	2400	900	1200	1500	1800	2100	2400	900	1200	1500	1800	2100	2400
50 x 100	1.68	1.63	1.51	1.42	1.34	1.28	1.55	1.48	1.40	1.31	1.24	1.18	1.45	1.37	1.31	1.22	1.16	1.10
50 x 125	2.24	2.03	1.88	1.77	1.67	1.60	2.06	1.88	1.74	1.63	1.54	1.47	1.91	1.77	1.63	1.53	1.44	1.37
50 x 150	2.68	2.44	2.26	2.12	2.01	1.91	2.49	2.26	2.09	1.96	1.85	1.76	2.34	2.12	1.96	1.83	1.73	1.65
50 x 175	3.12	2.84	2.63	2.47	2.34	2.23	2.90	2.63	2.43	2.28	2.16	2.06	2.72	2.47	2.28	2.13	2.02	1.92
50 x 200	3.56	3.24	3.00	2.82	2.67	2.55	3.31	3.00	2.78	2.60	2.46	2.35	3.11	2.81	2.60	2.44	2.30	2.19
50 x 225	4.00	3.63	3.37	3.17	3.00	2.86	3.71	3.37	3.12	2.93	2.77	2.64	3.49	3.16	2.92	2.74	2.59	2.47
63 x 100	1.87	1.77	1.64	1.54	1.46	1.39	1.72	1.64	1.51	1.42	1.34	1.28	1.60	1.52	1.42	1.33	1.26	1.20
63 x 125	2.42	2.20	2.04	1.92	1.82	1.73	2.25	2.04	1.89	1.77	1.68	1.60	2.10	1.91	1.77	1.66	1.57	1.50
63 x 150	2.90	2.63	2.44	2.30	2.18	2.08	2.69	2.44	2.26	2.12	2.01	1.92	2.53	2.29	2.12	2.00	1.88	1.79
63 x 175	3.37	3.07	2.85	2.67	2.54	2.42	3.13	2.84	2.63	2.47	2.34	2.23	2.94	2.67	2.47	2.32	2.19	2.09
63 x 200	3.84	3.50	3.25	3.05	2.89	2.76	3.57	3.24	3.01	2.82	2.67	2.55	3.36	3.05	2.82	2.65	2.51	2.39
63 x 225	4.31	3.92	3.64	3.43	3.25	3.10	4.01	3.64	3.38	3.17	3.01	2.87	3.77	3.42	3.17	2.97	2.82	2.68

Table 4B.42 Maximum clear span of purlins supporting decking or sheeting (m); Roof pitch more than 10° but not more than 35°; Imposed load of 0.75 kN/m²; Timber strength class C24

C24

Dead Load [kN/m²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.25						More than 0.25 but not more than 0.50						More than 0.50 but not more than 0.75					
	Design spacing of purlins (mm)																	
	900	1200	1500	1800	2100	2400	900	1200	1500	1800	2100	2400	900	1200	1500	1800	2100	2400
50 x 100	1.79	1.71	1.58	1.48	1.40	1.34	1.64	1.57	1.46	1.37	1.30	1.23	1.53	1.45	1.37	1.28	1.21	1.15
50 x 125	2.34	2.13	1.97	1.85	1.75	1.67	2.17	1.97	1.82	1.71	1.62	1.54	2.02	1.85	1.71	1.60	1.51	1.44
50 x 150	2.80	2.55	2.36	2.22	2.10	2.00	2.60	2.36	2.18	2.05	1.94	1.85	2.44	2.21	2.05	1.92	1.81	1.73
50 x 175	3.26	2.97	2.75	2.58	2.45	2.34	3.03	2.75	2.54	2.39	2.26	2.15	2.85	2.58	2.39	2.24	2.12	2.01
50 x 200	3.72	3.38	3.14	2.95	2.79	2.67	3.45	3.13	2.90	2.73	2.58	2.46	3.25	2.94	2.72	2.55	2.42	2.30
50 x 225	4.17	3.80	3.52	3.31	3.14	3.00	3.88	3.52	3.26	3.06	2.90	2.77	3.65	3.31	3.06	2.87	2.72	2.59
63 x 100	1.99	1.84	1.71	1.61	1.52	1.45	1.81	1.71	1.58	1.49	1.41	1.34	1.69	1.60	1.48	1.39	1.32	1.26
63 x 125	2.53	2.30	2.13	2.00	1.90	1.81	2.35	2.13	1.97	1.85	1.76	1.68	2.21	2.00	1.85	1.74	1.65	1.57
63 x 150	3.02	2.75	2.55	2.40	2.28	2.17	2.81	2.55	2.37	2.22	2.10	2.01	2.64	2.40	2.22	2.08	1.97	1.88
63 x 175	3.52	3.20	2.97	2.80	2.65	2.53	3.27	2.97	2.76	2.59	2.45	2.34	3.08	2.79	2.59	2.43	2.30	2.19
63 x 200	4.01	3.65	3.39	3.19	3.03	2.89	3.73	3.39	3.14	2.95	2.80	2.67	3.51	3.19	2.95	2.77	2.62	2.50
63 x 225	4.49	4.10	3.81	3.58	3.40	3.25	4.18	3.80	3.53	3.32	3.15	3.00	3.94	3.58	3.32	3.11	2.95	2.81

Table 4B.33 Maximum clear span of rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load 1.00 kN/m²; Timber strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the rafter									
Size of purlin (mm)	Not more than 0.50			More than 0.50 but not more than 0.75			More than 0.75 but not more than 1.00		
	Spacing of rafters (mm)								
	400	450	600	400	450	600	400	450	600
38 x 100	2.42	2.33	2.12	2.29	2.20	2.00	2.18	2.10	1.90
38 x 125	3.02	2.90	2.64	2.86	2.75	2.50	2.72	2.62	2.38
38 x 150	3.61	3.47	3.16	3.42	3.29	2.99	3.26	3.14	2.85
47 x 100	2.60	2.50	2.27	2.46	2.36	2.15	2.34	2.25	2.05
47 x 125	3.23	3.11	2.83	3.06	2.95	2.68	2.92	2.81	2.55
47 x 150	3.86	3.72	3.39	3.66	3.52	3.21	3.49	3.36	3.06
50 x 100	2.65	2.55	2.32	2.51	2.41	2.19	2.39	2.30	2.09
50 x 125	3.30	3.17	2.89	3.12	3.01	2.73	2.98	2.87	2.61
50 x 150	3.94	3.79	3.46	3.73	3.60	3.27	3.57	3.43	3.12
CLS/ALS									
38 x 89	2.16	2.08	1.89	2.04	1.96	1.78	1.95	1.87	1.70
38 x 140	3.37	3.25	2.95	3.19	3.07	2.79	3.05	2.93	2.66

Table 4B.34 Maximum clear span of purlins supporting rafters (m); Roof pitch more than 30° but not more than 45°; Imposed load of 1.00 kN/m²; Timbers strength class C24

C24

Dead Load [kN/m ²] excluding the self weight of the purlin																		
Size of purlin (mm)	Not more than 0.50						More than 0.50 but not more than 0.75						More than 0.75 but not more than 1.00					
	Design spacing of purlins (mm)																	
	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000	1500	1800	2100	2400	2700	3000
47 x 150	1.95	1.83					1.84											
47 x 175	2.27	2.13	2.01	1.92	1.83		2.15	2.01	1.90	1.80		2.04	1.91	1.80				
47 x 200	2.60	2.43	2.30	2.19	2.09	2.01	2.45	2.30	2.17	2.06	1.97	1.89	2.33	2.18	2.06	1.96	1.87	
47 x 225	2.92	2.73	2.58	2.46	2.35	2.26	2.76	2.58	2.44	2.32	2.22	2.13	2.62	2.45	2.32	2.20	2.10	1.89
63 x 125	1.81																	
63 x 150	2.16	2.03	1.92	1.83			2.05	1.92	1.81				1.95	1.83				
63 x 175	2.52	2.36	2.24	2.13	2.04	1.97	2.39	2.24	2.11	2.01	1.93	1.85	2.27	2.13	2.01	1.91	1.83	
63 x 200	2.88	2.70	2.56	2.44	2.33	2.24	2.72	2.55	2.41	2.30	2.20	2.12	2.59	2.43	2.30	2.19	2.09	2.01
63 x 225	3.23	3.03	2.87	2.74	2.62	2.52	3.06	2.87	2.71	2.59	2.48	2.38	2.92	2.73	2.58	2.46	2.35	2.26
75 x 125	1.92						1.82											
75 x 150	2.30	2.16	2.04	1.95	1.87		2.18	2.04	1.93	1.84			2.07	1.94	1.84			
75 x 175	2.68	2.51	2.38	2.27	2.18	2.10	2.54	2.38	2.25	2.15	2.06	1.98	2.42	2.27	2.14	2.04	1.96	1.88
75 x 200	3.06	2.87	2.72	2.59	2.49	2.39	2.89	2.72	2.57	2.45	2.35	2.26	2.76	2.59	2.45	2.33	2.23	2.15
75 x 225	3.43	3.22	3.06	2.91	2.79	2.69	3.25	3.05	2.89	2.75	2.64	2.54	3.10	2.91	2.75	2.62	2.51	2.41
2 x 47 x 200	3.46	3.25	3.08	2.94	2.82	2.72	3.28	3.08	2.92	2.78	2.67	2.57	3.13	2.94	2.78	2.65	2.54	2.45
2 x 47 x 225	3.88	3.65	3.46	3.31	3.17	3.06	3.68	3.46	3.28	3.13	3.00	2.89	3.51	3.30	3.13	2.98	2.86	2.75
2 x 47 x 250	4.30	4.05	3.84	3.76	3.52	3.40	4.08	3.84	3.64	3.47	3.33	3.21	3.90	3.66	3.47	3.31	3.18	3.06
2 x 47 x 275	4.73	4.45	4.22	4.03	3.87	3.73	4.48	4.22	4.00	3.82	3.66	3.53	4.28	4.02	3.81	3.64	3.49	3.36
2 x 47 x 300	5.15	4.85	4.60	4.39	4.22	4.07	4.89	4.59	4.36	4.16	3.99	3.85	4.67	4.38	4.16	3.97	3.80	3.66

4C Masonry walls

Part 1 - Masonry walls for houses

Application

4C.1 This Part of the Section applies to a single family house that is not more than 3 storeys in height. The walls considered are as follows –

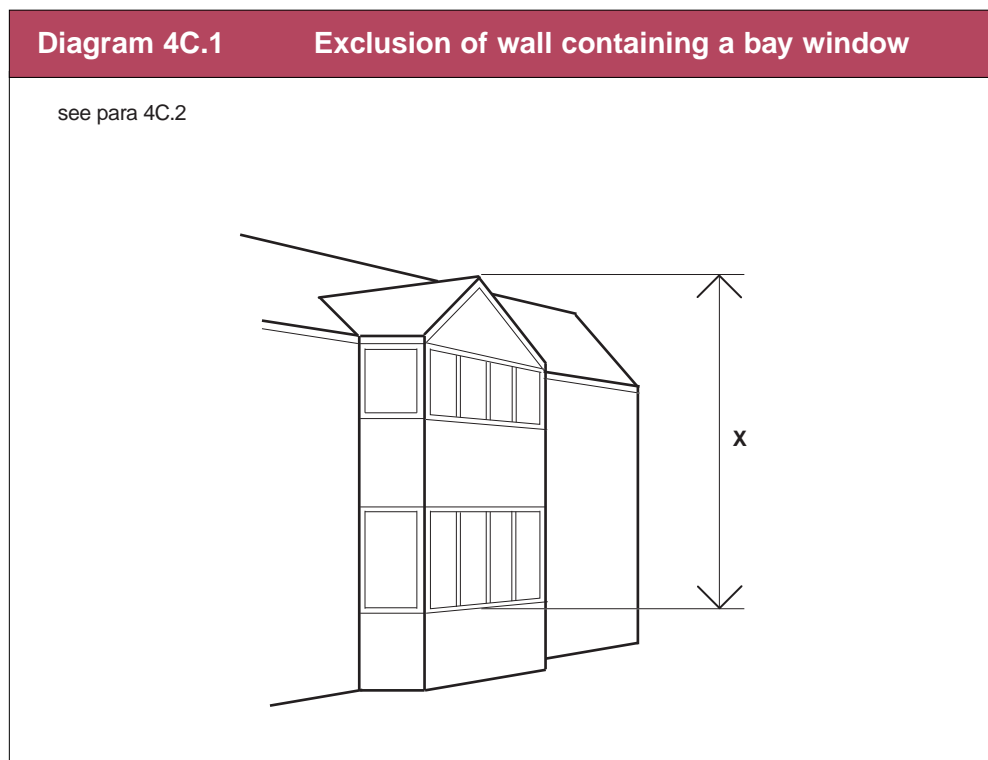
- (a) external walls;
- (b) internal loadbearing walls;
- (c) compartment walls; and
- (d) separating walls,

provided they extend to the full storey height.

Exceptions

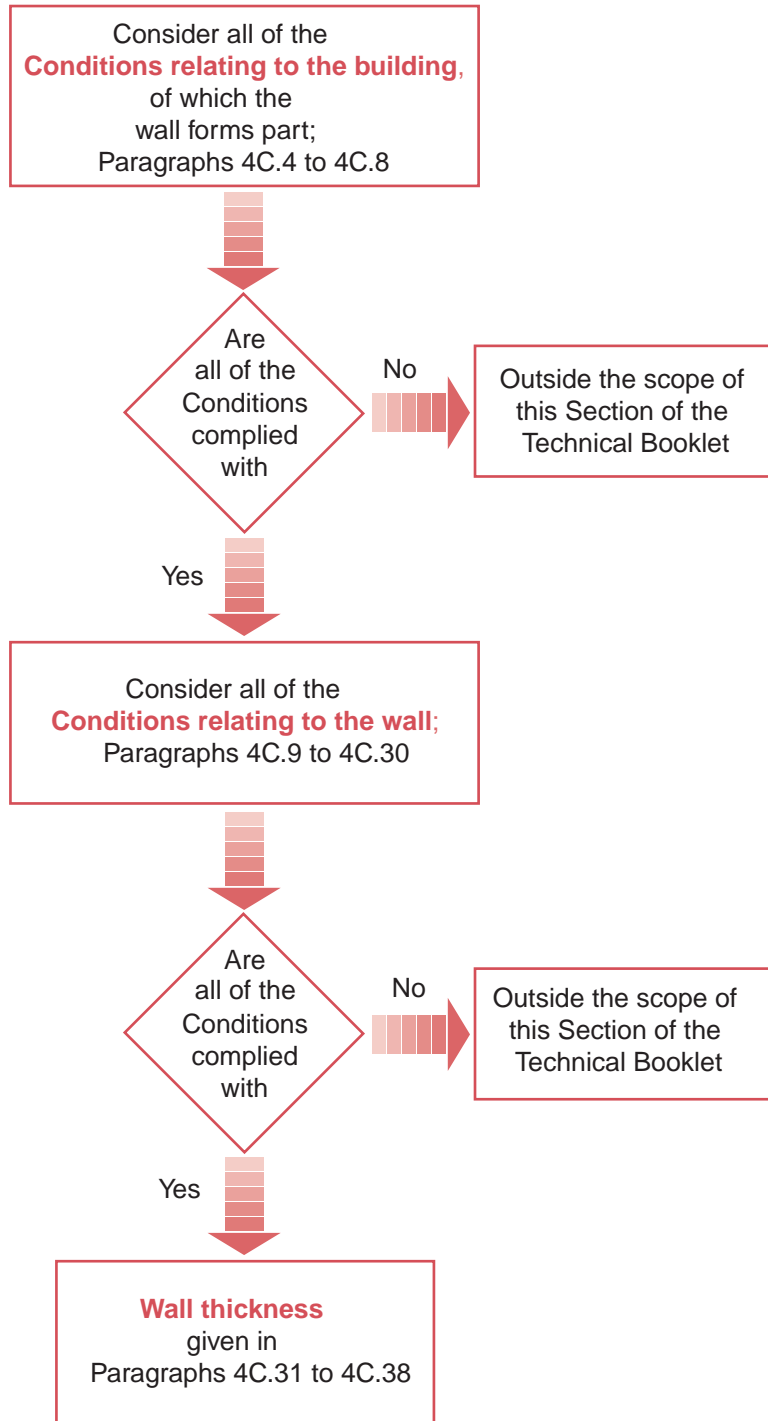
4C.2 External walls sized using this Section are not necessarily suitable for the support of building mounted wind turbines. Specialist advice from a suitably qualified person must be obtained to confirm the suitability of any wall subjected to such loading.

This Part does not apply to any portion of an external wall which is constructed as a bay for, or as a gable over, a bay window above ground floor cill level indicated as X in Diagram 4C.1.



The use of this Part

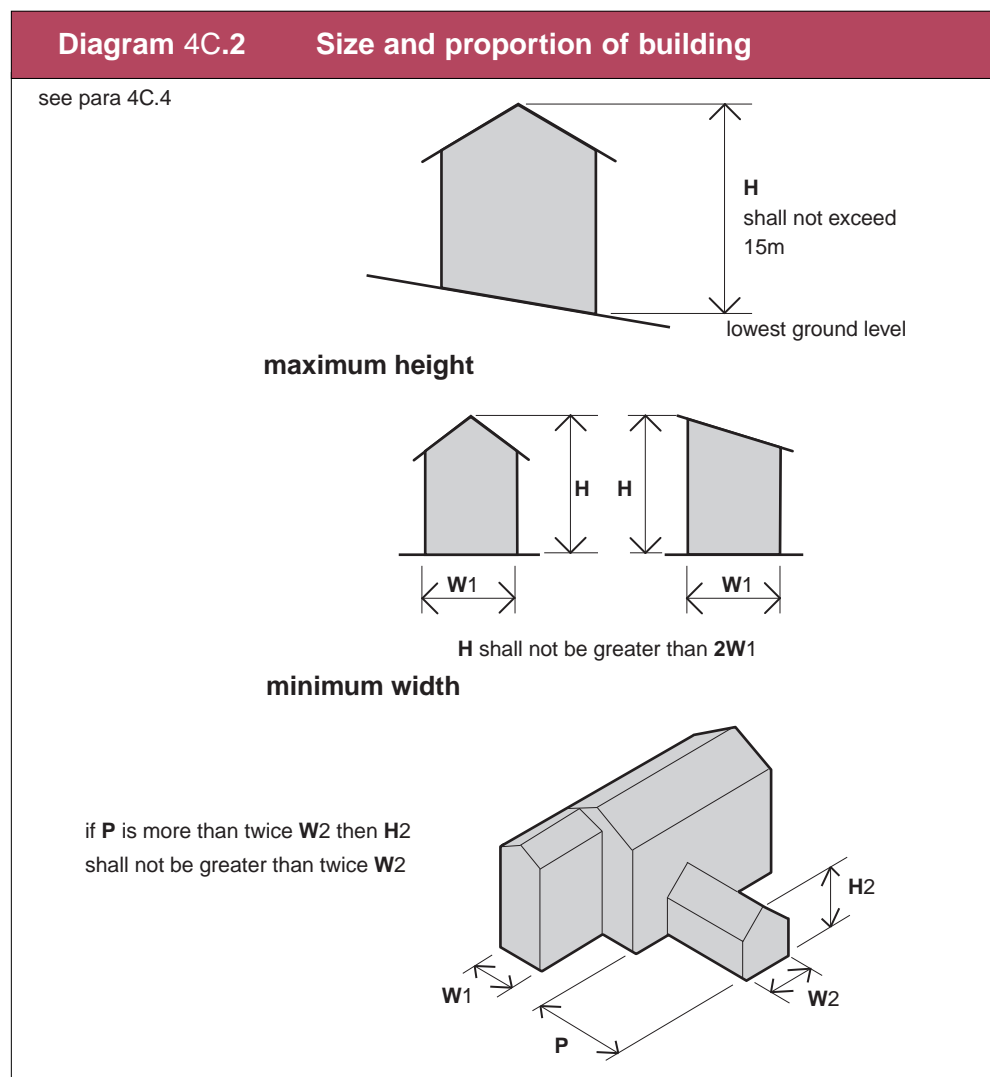
4C.3 When using this Part of the Section the stability requirements in paragraph 4B.1 **applies** and the following procedure **should** be followed –



Conditions relating to the building

Building proportions

- 4C.4 The building proportions **should** be within the following parameters –
- the maximum height of the building measured from the lowest finished ground level adjoining the building to the highest point of any wall or roof **should** not be greater than 15 m;
 - the height of the building H **should** not exceed twice the least width of the building $W1$; and
 - the height of a wing $H2$ **should** not exceed twice the least width of the wing $W2$ when the projection P exceeds twice the width $W2$ (see Diagram 4C.2).

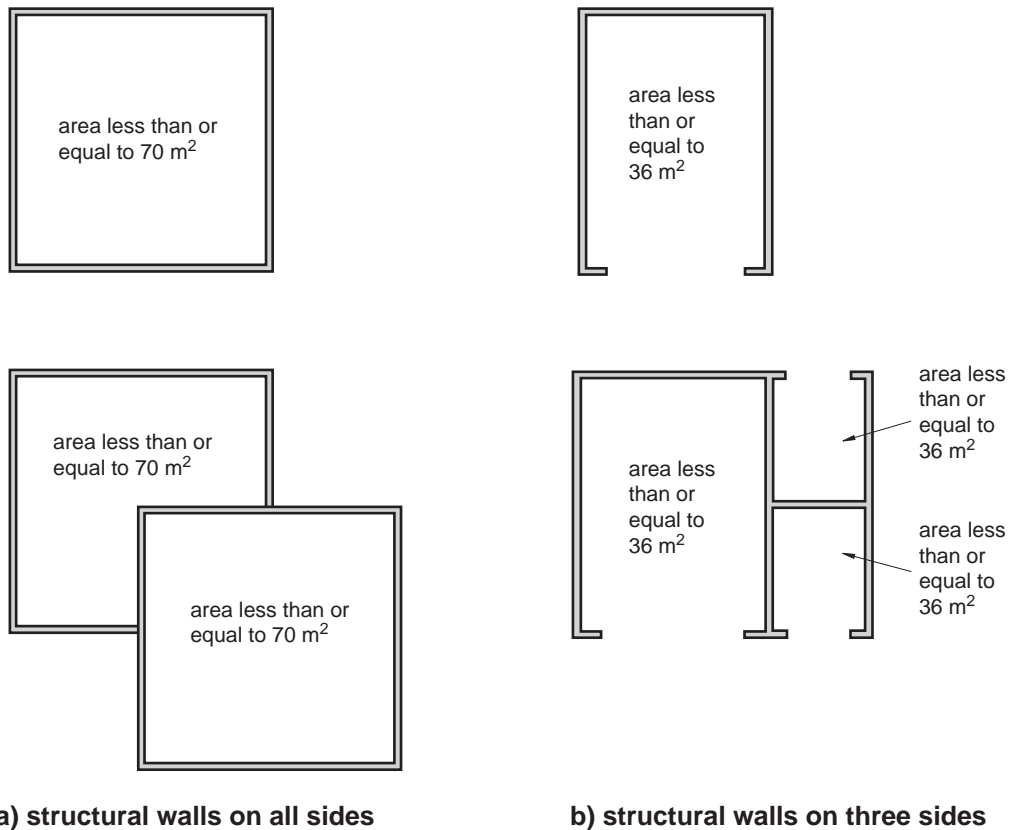


- 4C.5 For stability, the maximum floor area enclosed by structural walls complying with the provisions of paragraphs 4C.9 to 4C.30 **should** be –
- 70 m^2 where there are structural walls on all four sides; and
 - 36 m^2 where there are only structural walls on three sides.

See Diagram 4C.3.

Diagram 4C.3 Maximum floor area enclosed by structural walls

see para 4C.5

**Maximum imposed loads on roofs, floors and ceilings**

- 4C.6** The maximum imposed loads on each element of the building **should** not exceed those given in Table 4C.1.

Table 4C.1 Simplified maximum imposed loads

Element	Loading
roof	distributed load of 1.5 kN/m^2 for spans not greater than 6 m, and 1.00 kN/m^2 for spans greater than 6 m but not greater than 12 m.
floors	distributed load of 2.0 kN/m^2
ceilings	distributed load of 0.25 kN/m^2 together with a concentrated load of 0.9 kN

Maximum permitted height of buildings

- 4C.7** A simplified design methodology has been developed for the determination of the maximum height of building for which this Part can be used. The maximum height is dependant on a range of factors as follows –
- the wind speed as given in Diagram 4C.4;
 - the topography of the ground surrounding the building; and

(c) the type of terrain in which the building is located (e.g. in a town or out in the country)

4C.8 The procedure to determine the maximum height of a building that falls within the scope of this Part of the Section is as follows –

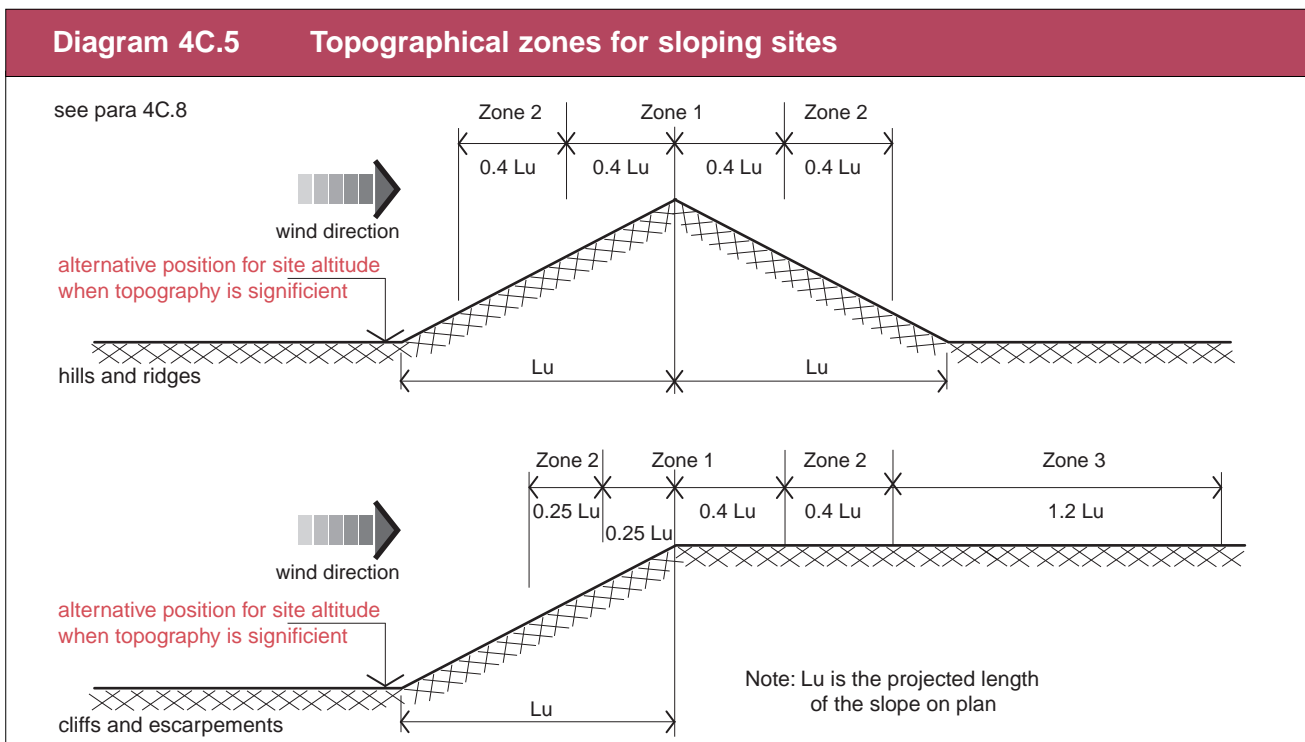
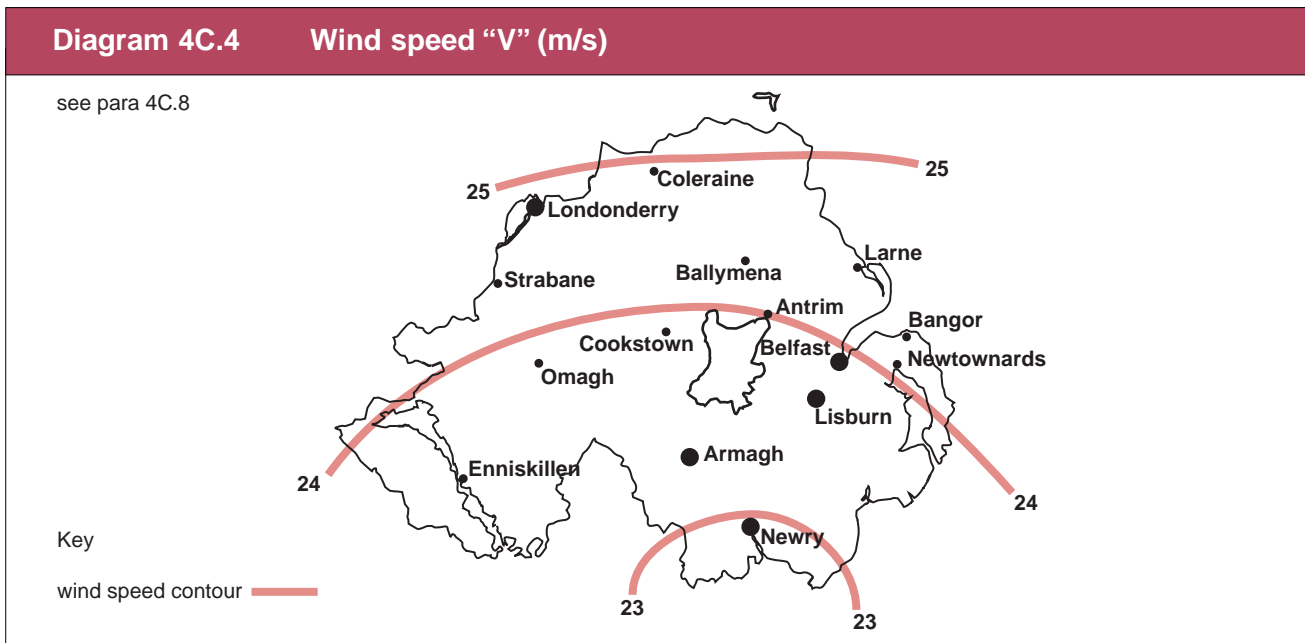
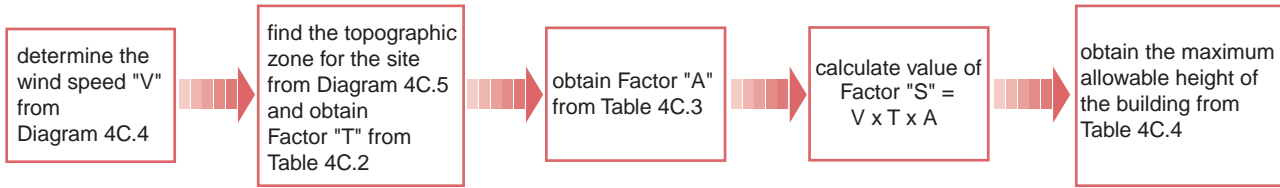


Table 4C.2 Factor “T” (determined in conjunction with Diagram 4C.5)

Topographical category and average slope of whole hillside, ridge, cliff or escarpment	Factor “T”		
	Zone 1	Zone 2	Zone 3
Category 1: Nominally flat terrain, average slope < 1/20	1.00	1.00	1.00
Category 2: Shallow terrain, average slope < 1/10	1.12	1.07	1.05
Category 3: Moderately steep terrain, average slope < 1/5	1.24	1.13	1.10
Category 4: Steep terrain, average slope > 1/5	1.36	1.20	1.15
Note: 1. Zones 1, 2 and 3 taken from Diagram 4C.5 2. Outside these zones Factor “T” should be taken as equal to 1.00			

Table 4C.3 Factor “A” (dependent upon the site altitude)

Site altitude (m)	Factor “A”
0	1.00
50	1.05
100	1.10
150	1.15
200	1.20
300	1.30
400	1.40
Note: For sites where topography is significant a more accurate assessment of Factor A can be obtained by using the altitude at the base of the topographic feature instead of the altitude at the site. See Diagram 4C.5	

Table 4C.4 Maximum allowable height of building (m)

Factor "S" (S = V x T x A)	Country sites			Town sites		
	Distance to the coast (Km)			Distance to the coast (Km)		
	less than 10	10 to 50	more than 50	less than 10	10 to 50	more than 50
24	15	15	15	15	15	15
25	11.5	14.5	15	15	15	15
26	8	10.5	13	15	15	15
27	6	8.5	10	15	15	15
28	4.5	6.5	8	13.5	15	15
29	3.5	5	6	11	13	14.5
30	3	4	5	9	11	12.5
31	–	3.5	4	8	9.5	10.5
32	–	3	3.5	7	8.5	9.5
33	–	–	3	6	7.5	8.5
34	–	–	–	5	7	8
35	–	–	–	4	6	7
36	–	–	–	3	5.5	6
37	–	–	–	–	4.5	5.5
38	–	–	–	–	4	5
39	–	–	–	–	3	4
40	–	–	–	–	–	3

Note:

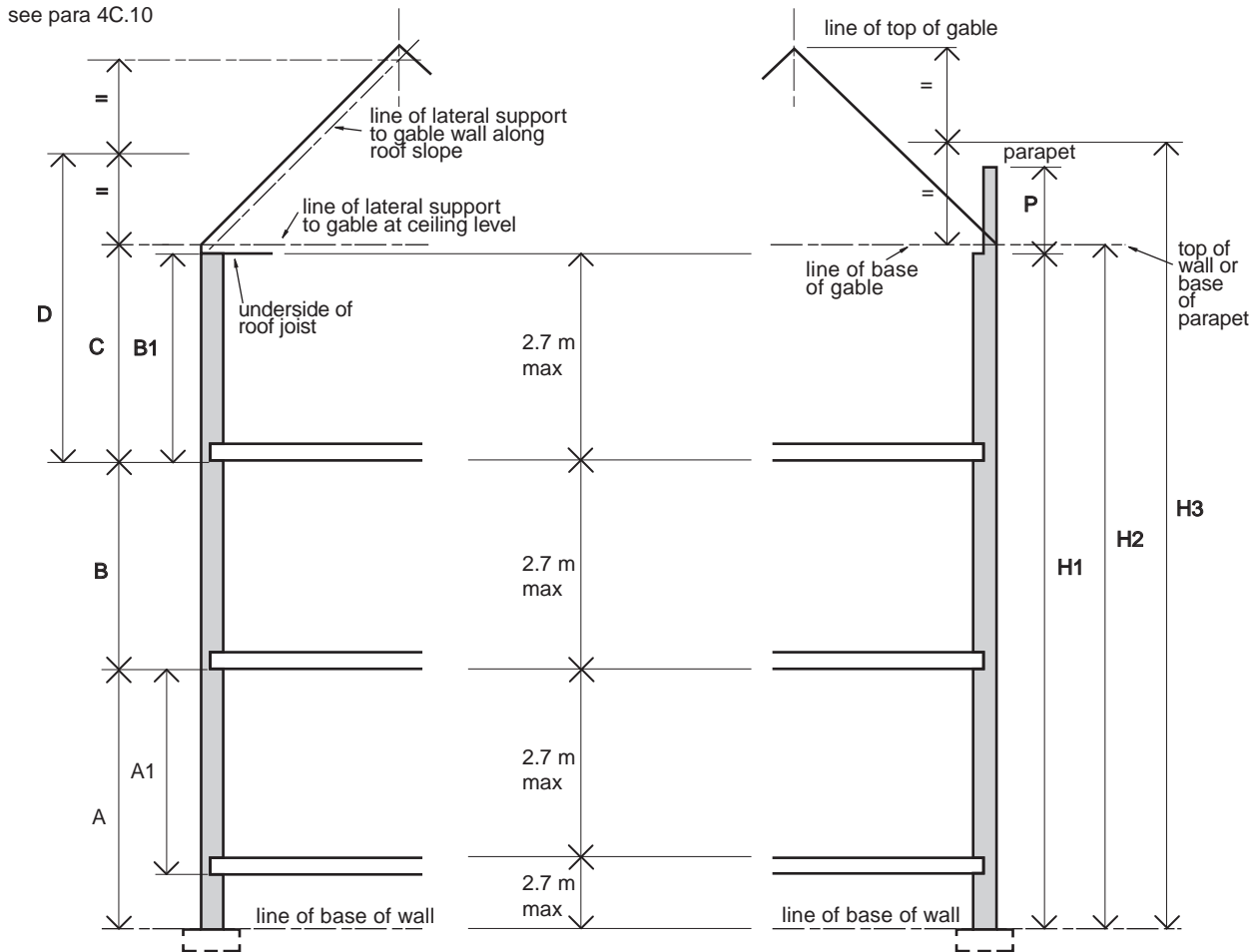
1. Sites in town less than 300 m from the edge of town should be assumed to be in country terrain
2. Interpolation may be used in Tables 4C.3 and 4C.4

Conditions relating to the wall

Length and height of wall

- 4C.9** The wall **should** not exceed 12 m in length, measured from centre to centre of buttressing walls, piers or chimneys providing restraint, and not exceed 12 m in height.
- 4C.10** The height of a wall or a storey **should** be measured in accordance with the rules in Diagram 4C.6.

Diagram 4C.6 Measuring storey and wall heights



Key:

(a) Measuring storey heights

- A is the ground storey height if the ground floor is a suspended timber floor or a structurally separate ground floor slab
- A1 is the ground storey height if the ground floor is a suspended concrete floor bearing on the external wall
- B is the intermediate storey height
- B1 is the top storey height for walls which do not include a gable
- C is the top storey height where lateral support is given to the gable at both ceiling level and along the roof slope
- D is the top storey height for walls which include a gable where lateral support is given to the gable only along the roof slope

(b) Measuring wall heights

- H1 is the height of a wall that does not include a gable (if the wall has a parapet see P)
- H2 is the height of a compartment or separating wall which includes a gable
- H3 is the height of a wall (except a compartment or separating wall) which includes a gable
- P if the parapet height is more than 1.2 m, add the height to H1

Construction materials and workmanship

Cavity wall ties

- 4C.11 The cavity wall ties **should** comply with BS EN 845 - 1: 2003 and DD 140 2: 1987 and **should** be material references 1 or 3 in BS EN 845 1:Table A. 1, austenitic stainless steel. Wall ties **should** be selected in accordance with Table 4C.5.

Table 4C.5 Cavity wall ties

Normal cavity width ⁽¹⁾ (mm)	Permissible types of tie		
	Tie length ⁽²⁾ (mm)	Tie shape in accordance with BS EN 845 – 1	Tie number in accordance with DD 140 - 2
50 to 75	200	Wire type or thick plate type	Types 1, 2, 3 or 4 selected on the basis of the design loading and design cavity width Prescriptive rules for selection, and a model calculation, are given in DD 140 - 2
76 to 90	225	Wire type or thick plate type	
91 to 100	225	Wire type or thick plate type	
101 to 125	250	Thick plate type	
126 to 150	275	Thick plate type	
151 to 175	300	Thick plate type	
176 to 300	(see Note (2))	Thick plate type	

Notes:

- (1) Where face insulated blocks are used the cavity width shall be measured from the face of the masonry unit
 (2) The embedment depth of the tie shall not be less than 50 mm in both leaves. For cavities wider than 180 mm calculate the length as the structural cavity width plus 125 mm and select the nearest stock length

- 4C.12 The cavity wall ties **should** have a horizontal spacing of 900 mm and a vertical spacing of 450 mm, which is equivalent to 2.5 ties per square metre. Wall ties **should** also be spaced not greater than 300 mm apart vertically, within a distance of 225 mm from the vertical edge of any opening, movement joint and roof verge.

Brick and block construction

- 4C.13 The wall **should** be properly bonded and solidly put together with mortar and constructed of –
- clay bricks conforming to BS EN 771-1:2003;
 - calcium silicate bricks conforming to BS EN 771-2:2003;
 - concrete bricks or blocks conforming to BS EN 771-3:2003;
 - autoclaved aerated concrete masonry units complying with BS EN 771-4:2003;
 - manufactured stone complying with BS EN 771-5:2003;or
 - square dressed natural stone conforming to the appropriate requirements described in BS EN 771-6:2005.

- 4C.14** The masonry units indicated for Conditions A, B and C in Diagram 4C.7 **should** have the declared compressive strengths as given in Table 4C.6 as designated in BS EN 771. The normalised compressive strengths for block sized clay and calcium silicate masonry units not complying with the brick dimensional format are given in Table 4C.7.

Table 4C.6 Declared compressive strength of masonry units complying with BS EN 771 - 1 to 5 (N/mm²)

Masonry unit	Clay masonry units to BS EN 771-1		Calcium silicate masonry units to BS EN 771-2		Aggregate concrete masonry units to BS EN 771-3	Autoclaved aerated conc. masonry units to BS EN 771-4	Manufactured stone masonry units to BS EN 771-5
Condition A							Any unit complying with BS EN 771-5 will be acceptable for conditions A, B and C
Brick	Group 1 6.0	Group 2 9.0	Group 1 6.0	Group 2 9.0	6.0	–	
Block	see Table 4C.7	see Table 4C.7	see Table 4C.7	see Table 4C.7	2.9*	2.9*	
Condition B							
Brick	Group 1 9.0	Group 2 13.0	Group 1 9.0	Group 2 13.0	9.0	–	
Block	see Table 4C.7	see Table 4C.7	see Table 4C.7	see Table 4C.7	7.3	7.3	
Condition C							
Brick	Group 1 18.0	Group 2 25.0	Group 1 18.0	Group 2 25.0	18.0	–	
Block	see Table 4C.7	see Table 4C.7	see Table 4C.7	see Table 4C.7	7.3	7.3	
Notes							
1 This table applies to Group 1 and Group 2 units							
2 For the BS EN 771 series of standards for masonry units the values of declared compressive strengths (N/mm ²) are mean values							
3 Brick is a masonry unit having work sizes not exceeding 337.5 mm in length or 112.5 mm in height							
4 Block is a masonry unit exceeding either of the limiting work sizes of a brick and with a minimum bed height of 190 mm. For blocks with smaller bed heights, excluding cuts or make up units, the strength requirements are as for brick except for solid external walls where the blocks should have a compressive strength at least equal to that shown for block for an inner leaf of a cavity wall in the same position							
5 Group 1 masonry units have not more than 25% formed voids (20% for frogged bricks). Group 2 masonry units have formed voids greater than 25%, but not more than 55%							
6 Values marked * are dry strengths to BS EN 772-1: 2000							

Table 4C.7 Normalised compressive strength of masonry units of clay and calcium silicate blocks complying with BS EN 771 - 1 and 2 (N/mm²)

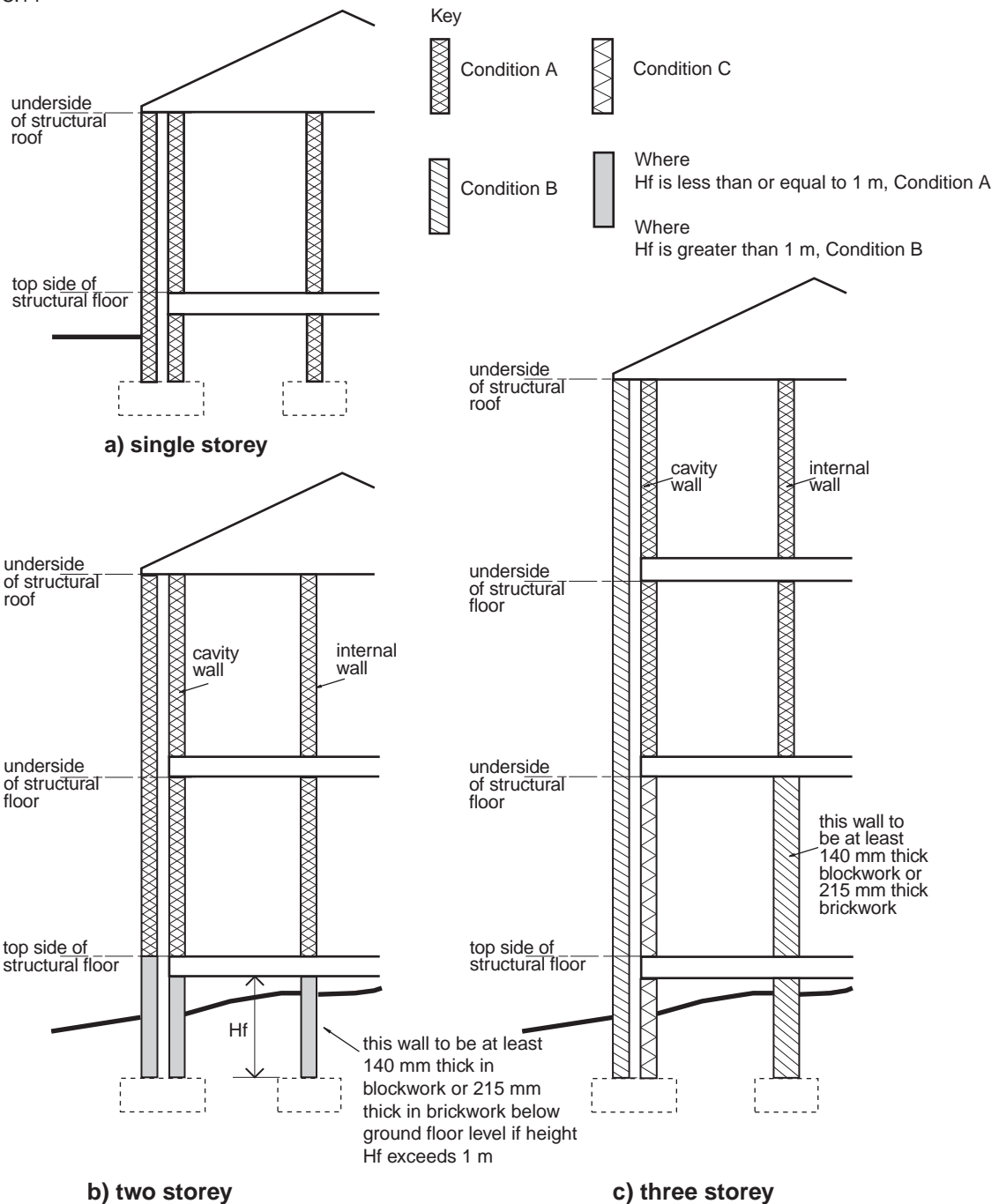
Standard	Condition	Group 1 masonry units	Group 2 masonry units
Clay masonry units to BS EN 771-1 and Calcium silicate masonry units to BS EN 771-2	A	5.0	8.0
	B	7.5	11.0
	C	15.0	21.0
Notes:			
1 Values in this Table are normalised compressive strengths (N/mm ²). Compressive strengths of masonry units should be derived according to BS EN 772-1			
2 The Table applies to clay and calcium silicate block masonry units where the work size exceeds 337.5 mm in length or 112.5 mm in height			
3 Group 1 masonry units have not more than 25% formed voids (20% for frogged bricks). Group 2 masonry units have formed voids greater than 25%, but not more than 55%			

4C.15 Mortar **should** be –

- of mortar designation (iii) as given in BS 5628: Part 1: 2005;
- strength class M4 as given in BS EN 998 - 2; or
- CEM1, lime and fine aggregate mixed in the ratio of 1:1:5 measured by volume of dry materials.

Diagram 4C.7 Declared compressive strength of masonry units

see para 4C.14



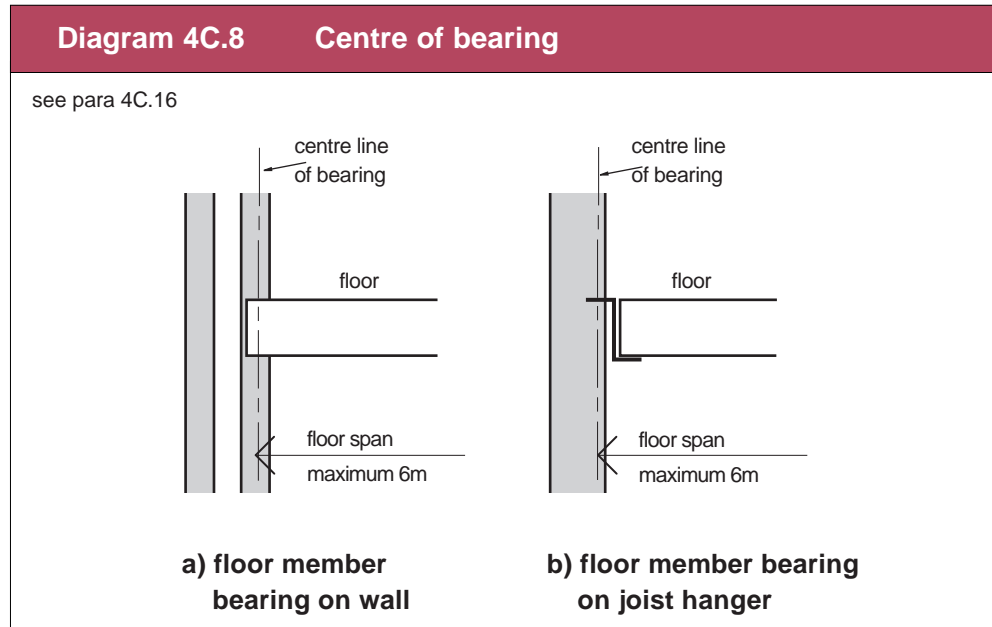
Notes

- If the external wall is solid construction the masonry units should have a compressive strength of at least that shown for the internal leaf of a cavity wall in the same position
- The guidance in the diagram for walls of two or three storey buildings should only be used to determine the compressive strength of the masonry units where the roof construction is of timber

Loading on walls

Maximum span of floors

- 4C.16 The maximum span for any floor supported by a wall **should** not exceed 6 m where the span is measured centre-to-centre of bearing (see Diagram 4C.8).

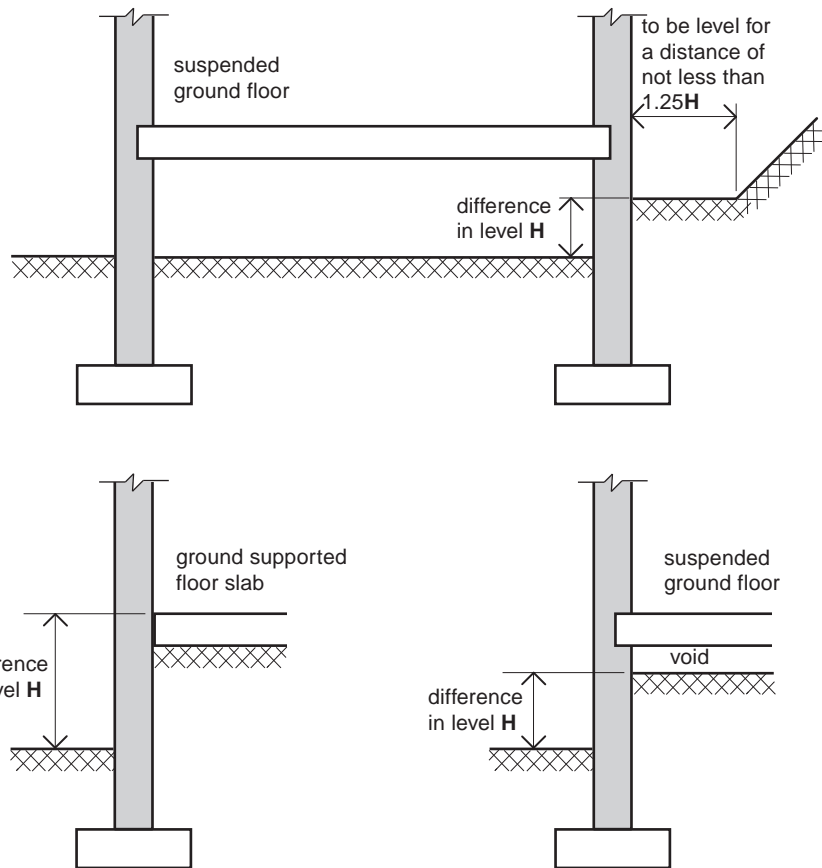


Other loading conditions

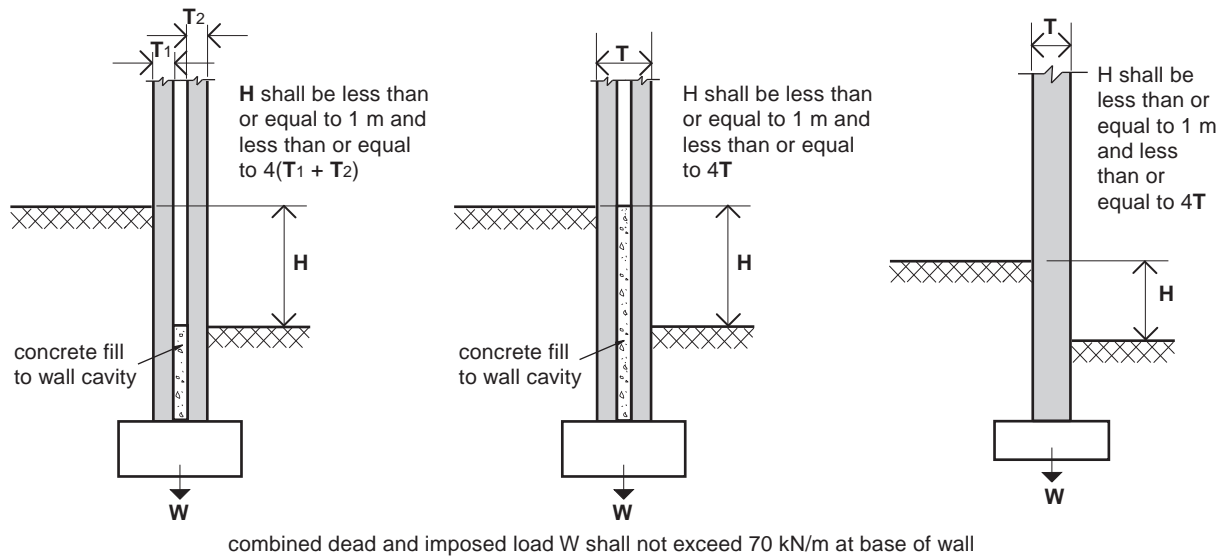
- 4C.17 Vertical and lateral loading **should** be limited to and assessed as follows –
- the combined dead and imposed load **should** not exceed 70 kN/m at base of wall (see Diagram 4C.9);
 - vertical loading on walls **should** be distributed. This may be assumed for concrete floor slabs, precast concrete floors, and timber floors designed in accordance with part B of this Section, and where the bearing length for lintels is 150 mm or greater. Where a lintel has a clear span of 1200 mm or less, the bearing length may be reduced to 100 mm. Where lintels carry a concrete floor the bearing length **should** not be less than 150 mm or $L/10$, whichever is the greater and where L is the clear span of the lintel;
 - walls must not be subject to lateral load other than from wind, and that covered by paragraph 4C.17(d); and
 - differences in level of ground or other solid construction between one side of the wall and the other **should** not exceed 4 times the thickness of the wall as shown in Diagram 4C.9.

Diagram 4C.9 Differences in ground level

see para 4C.17



a) examples of ground level differences



b) maximum permitted differences in ground level

Notes

- 1 Floor slabs in fig (b) have been omitted for clarity and may be on either side of the walls shown.
- 2 Cavity walls should be tied in accordance with Table 4C.5
- 3 These recommendations apply only to circumstances where there is a full storey height of masonry above the upper retained level

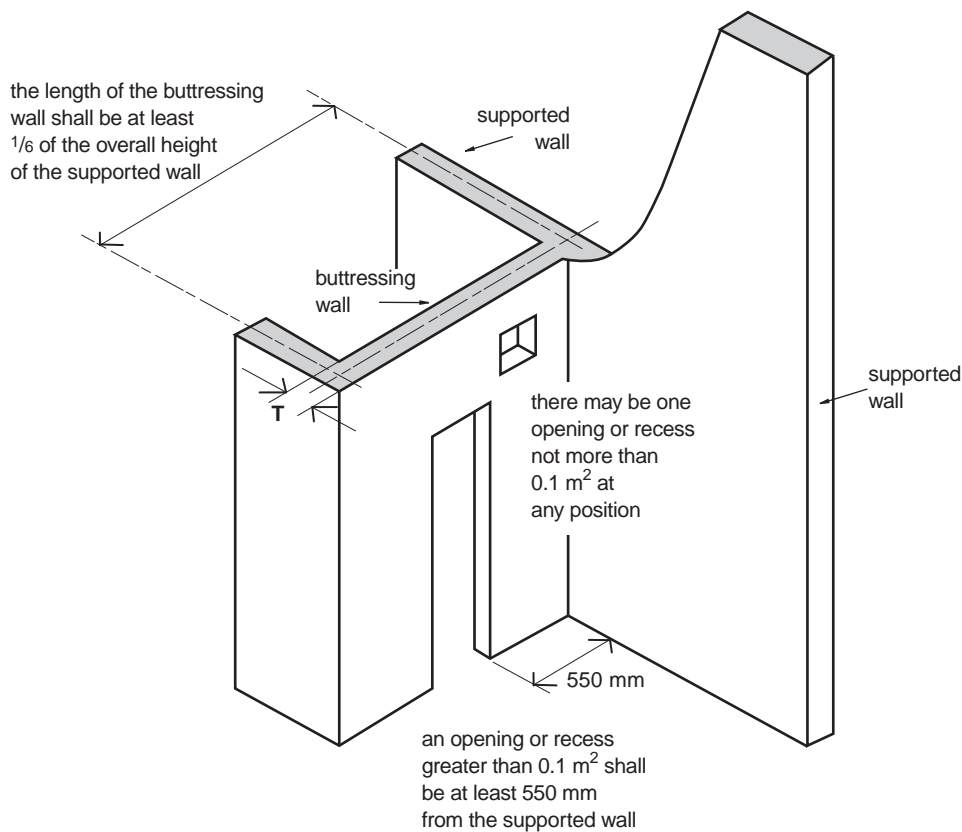
Wall restraints - Vertical restraint by buttressing walls, piers and chimneys

General

- 4C.18** The ends of every wall **should** be bonded or otherwise securely tied throughout their full height to a buttressing wall, pier or chimney. Long walls may be provided with intermediate buttressing walls, piers or chimneys dividing the wall into distinct lengths (L) within each storey; each distinct length is a supported wall for the purposes of this Section. The intermediate buttressing walls, piers or chimneys **should** provide lateral restraint to the full height of the supported wall, but they may be staggered at each storey.

Diagram 4C.10 Openings in a buttressing wall

see para 4C.19 and Table 4C.10



Notes

- 1 The buttressing wall shall be bonded or securely tied to the supported wall and at the other end to a buttressing wall, pier or chimney
- 2 Openings or recesses in the buttressing wall shall not exceed those shown – the position and shape of the openings shall not impair the lateral support to be given by the buttressing wall

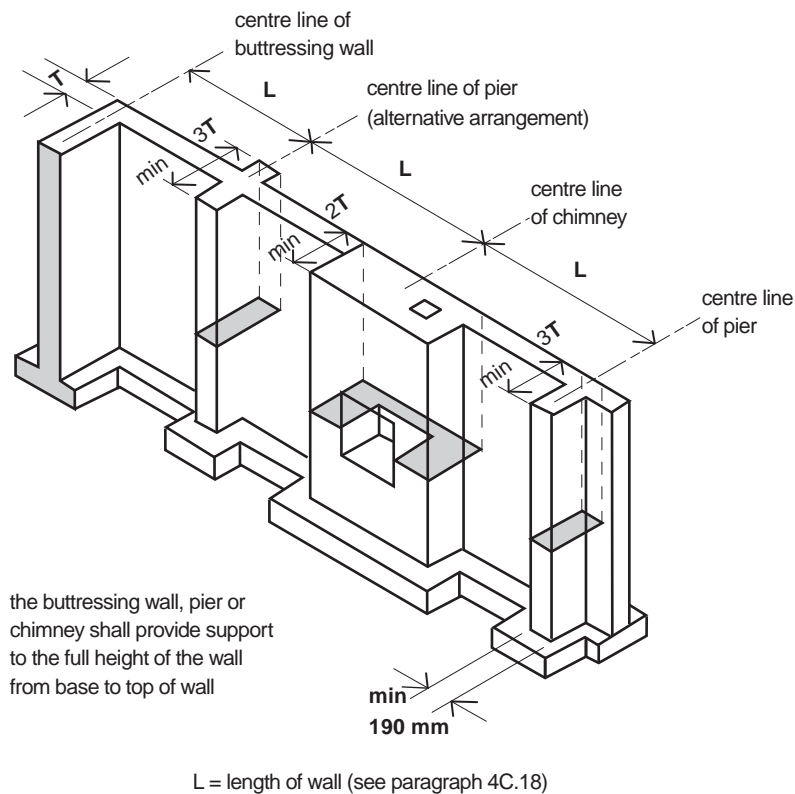
Design criteria for buttressing walls

- 4C.19** Diagram 4C.10 gives certain rules for masonry buttressing walls. Additionally if the buttressing wall is not itself a supported wall, its thickness T **should** not be less than –

- (a) half the thickness required by this Section for an external or separating wall of similar height and length, less 5 mm;
- (b) 75 mm if the wall forms part of a house and does not exceed 6 m in total height and 10 m in length; or
- (c) 90 mm in any other cases.

Diagram 4C.11 Buttrressing

see para 4C.20



Design criteria for piers and chimneys providing restraint

- 4C.20** Piers **should** measure at least 3 times the thickness of the supported wall and chimneys twice the thickness, measured at right angles to the wall. Piers **should** have a minimum width of 190 mm (see Diagram 4C.11).

The sectional area on plan of chimneys (excluding openings for fireplaces and flues) **should** be not less than the area required for a pier in the same wall, and the overall thickness not less than twice the required thickness of the supported wall (see Diagram 4C.11).

Wall restraints - Lateral restraint by floors and roofs

- 4C.21** Walls in each storey of a building **should** extend to the full height of that storey, and have horizontal lateral supports to restrict movement of the wall at right angles to its plane.
- 4C.22** Floors and roofs **should** –

- (a) act to transfer lateral forces from walls to buttressing walls, piers or chimneys; and
- (b) be secured to the supported wall by connections specified in paragraphs 4C.23 to 4C.25 and Table 4C.8.

4C.23 The wall **should** be strapped to the floors above ground level, at intervals not exceeding 2 m and as shown in Diagrams 4C.12(a), (b) and (c) by tension straps conforming to BS EN 845–1:2003. For corrosion resistance purposes, the tension straps **should** be material reference 14 or 16.1 or 16.2 (galvanised mild steel) or other more resistant specifications including material references 1 or 3 (austenitic stainless steel). The minimum cross-section of the strap **should** be 30 mm x 5 mm.

4C.24 Tension straps need not be provided –

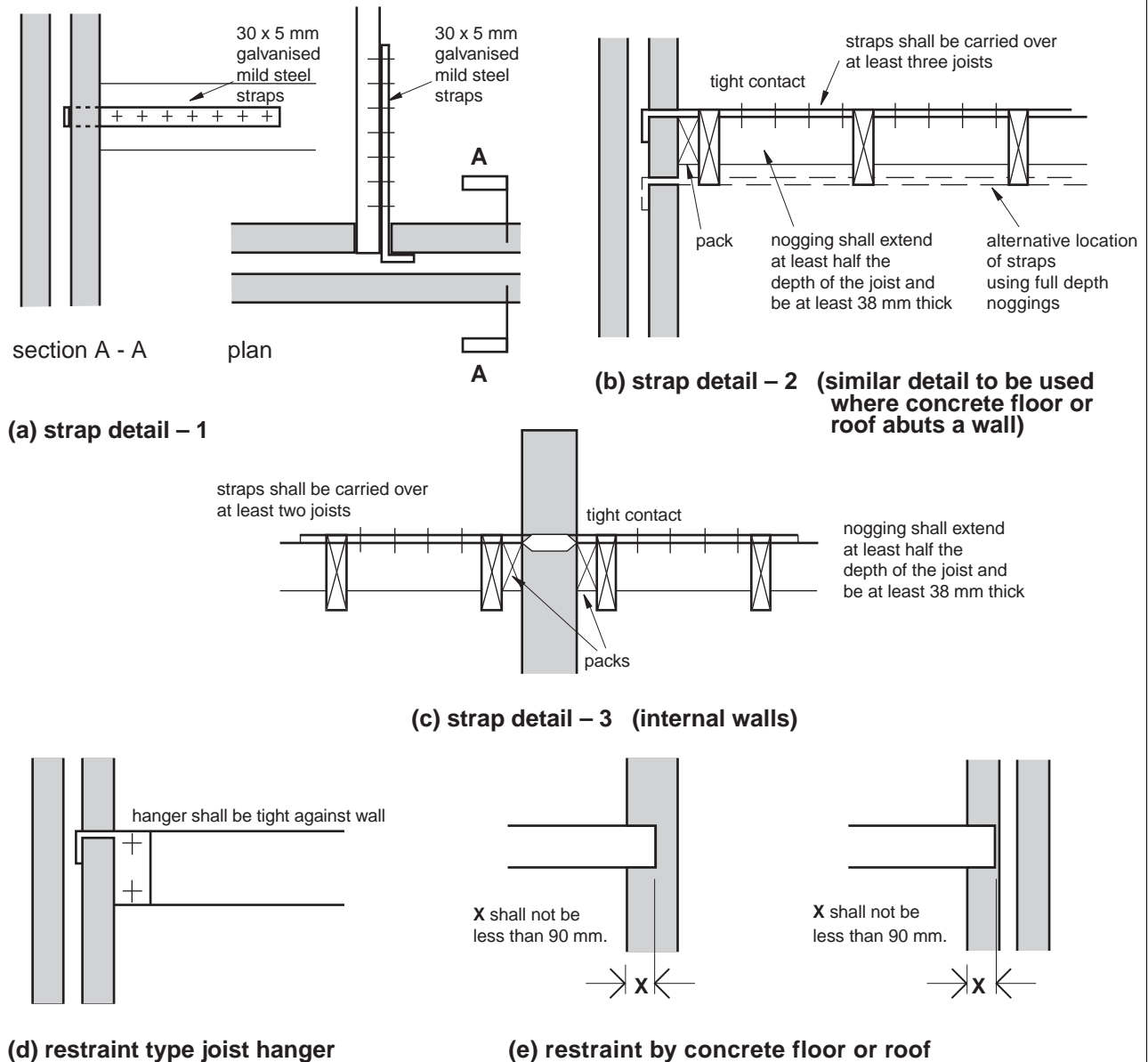
- (a) in the longitudinal direction of floor joists in houses of not more than 2 storeys, if the joists are at not more than 1.2 m centres and have at least 90 mm bearing on the supported walls or 75 mm bearing on a timber wall-plate at each end;
- (b) in the longitudinal direction of floor joists in houses of not more than 2 storeys, if the joists are carried on the supported wall by joist hangers in accordance with BS EN 845-1:2003 of the restraint type described in BS 5628: Part 1:2005 and shown in Diagram 4C.12(d), and are incorporated at not more than 2 m centres;
- (c) when a concrete floor has at least 90 mm bearing on the supported wall (see Diagram 4C.12(e)); and
- (d) where the floor is at, or about, the same level on each side of the wall, and contact between the floors and the wall is either continuous or at intervals not greater than 2 m. Where contact is intermittent, the points of contact **should** be in line, or nearly in line, on plan.

Table 4C.8 Lateral support for walls

Wall type	Supported wall length	Lateral support required
External, compartment or separating wall (solid or cavity)	Any length	Roof lateral support by every roof forming a junction with the supported wall
	Greater than 3 m	Floor lateral support by every floor forming a junction with the support wall
Internal load-bearing wall (not being a compartment or separating wall)	Any length	Roof or floor lateral support at the top of each storey

Diagram 4C.12 Lateral support for floors

see paras 4C.23 and 4C.24



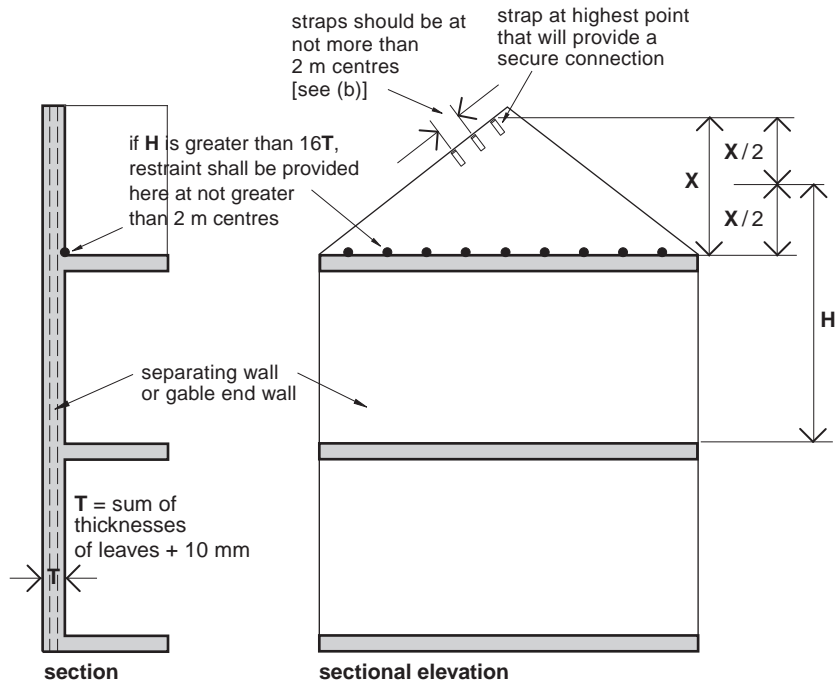
4C.25 The gable wall **should** be strapped to the roof as shown in Diagram 4.13(a) and (b) by tension straps as described in paragraph 4C.23. Vertical strapping at least 1 m long having a minimum cross-section of 30 mm x 5 mm **should** be provided at eaves level at intervals not exceeding 2 m (see Diagram 4C.13(c) and 4C.13(d)).

Vertical strapping is not required if the roof –

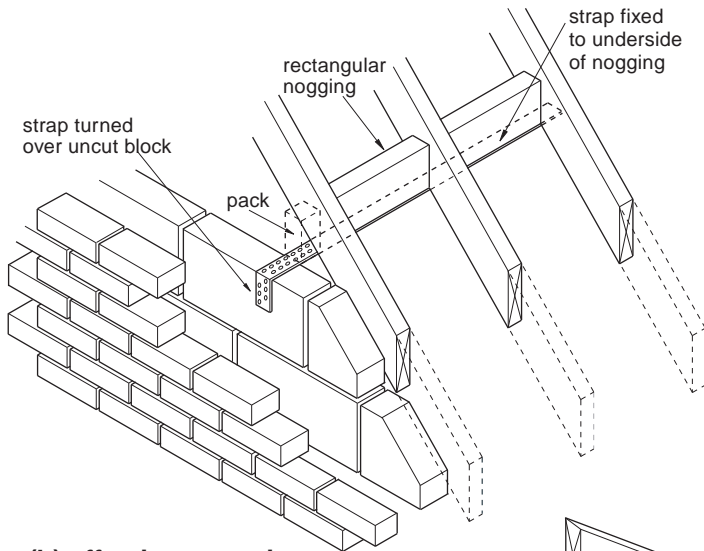
- has a pitch greater than 15°;
- is clad in tiles or slates with a laid mass per unit area greater than 50 kg/m²;
- is part of a building in a low wind exposure area; and
- has main timber members spanning onto the supported wall at not more than 1.2 m centres.

Diagram 4C.13 Lateral support at roof level

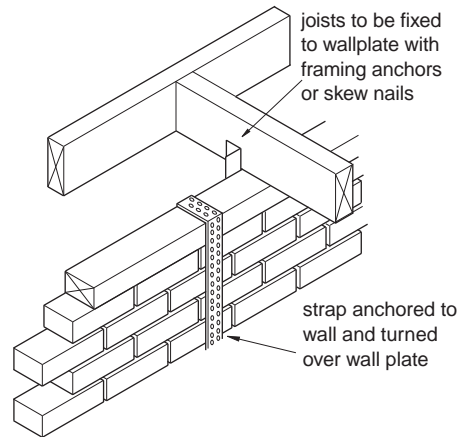
see para 4C.25



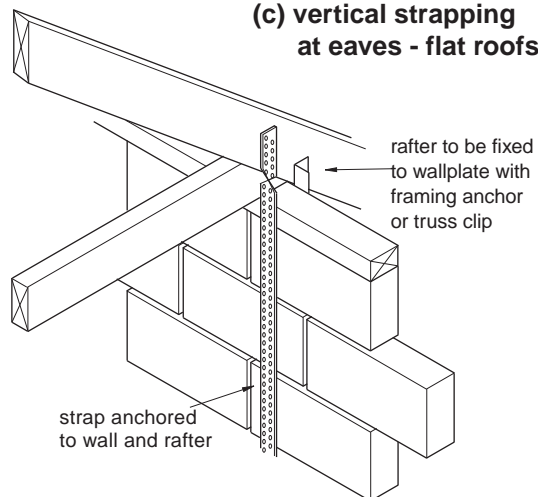
(a) strap location



(b) effective strapping



(c) vertical strapping at eaves - flat roofs



(d) vertical strapping at eaves - pitched roofs

Interruption of lateral support

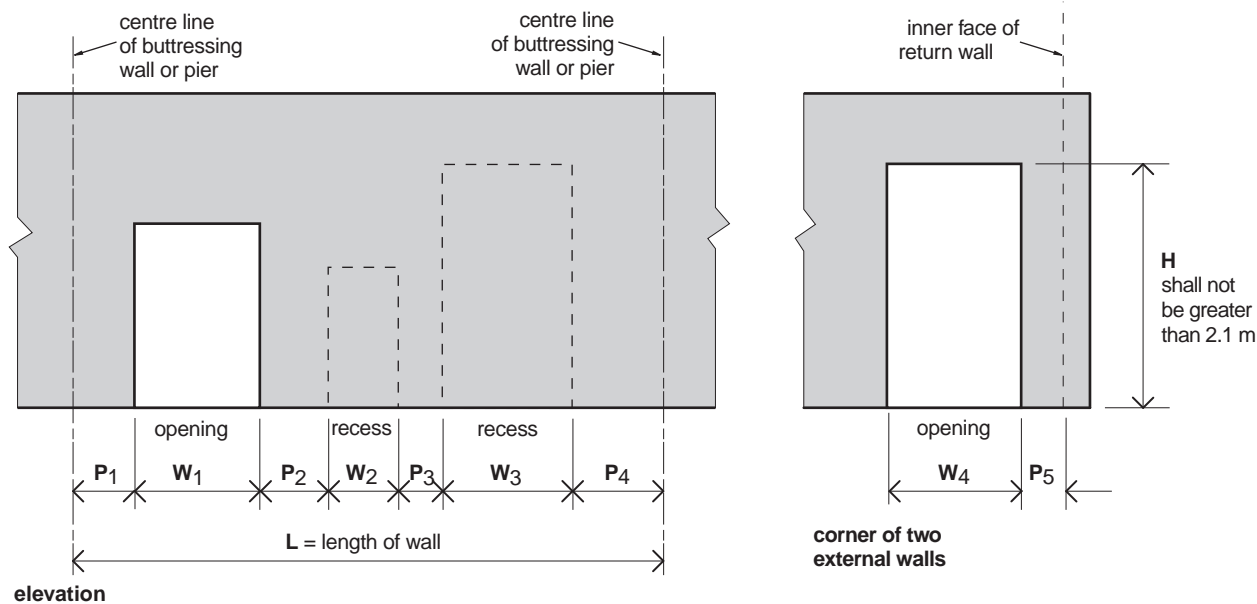
- 4C.26 Where an opening in a floor or roof for a stairway or the like adjoins a supported wall and interrupts the continuity of lateral support, the following provisions **should** be made –
- (a) the maximum permitted length of the opening **should** be 3 m, measured parallel to the supported wall;
 - (b) where a connection is provided by means other than by anchor, this must be provided throughout the length of each portion of the wall situated on each side of the opening;
 - (c) where connection is provided by tension straps, these must be spaced closer than 2 m on each side of the opening to provide the same number of straps as if there were no opening; and
 - (d) no other interruption of lateral support is permissible.

Openings, recesses, overhangs and chases

- 4C.27 The number, size and position of openings and recesses **should** not impair the stability of a wall or the lateral support afforded by a buttressing wall to a supported wall. Construction over openings and recesses **should** be adequately supported.
- 4C.28 The dimensional criteria for openings and recesses are given in Diagram 4C.14 and Table 4C.9.
- 4C.29 All chases **should** comply with the following –
- (a) vertical chases **should** not be deeper than one third of the wall thickness or, in cavity walls, one third of the thickness of the leaf;
 - (b) horizontal chases **should** not be deeper than one sixth of the thickness of the leaf or wall; and
 - (c) chases **should** be positioned so as not to impair the stability of the wall, particularly where hollow blocks are used.
- 4C.30 The projection of any overhang **should** not impair the stability of the wall.

Diagram 4C.14 Sizes of openings and recesses

see para 4C.28



Notes: Requirements (refer to Table 4C.9 for values of factor X)

- 1 $W_1 + W_2 + W_3$ shall not exceed $2L$ divided by 3
- 2 W_1, W_2, W_3 or W_4 shall not exceed 3 m
- 3 P_1 shall be greater than or equal to W_1 divided by X
- 4 P_2 shall be greater than or equal to $[W_1 + W_2]$ divided by X
- 5 P_3 shall be greater than or equal to $[W_2 + W_3]$ divided by X
- 6 P_4 shall be greater than or equal to W_3 divided by X
- 7 P_5 shall be greater than or equal to W_4 divided by X but shall be not less than 385 mm. In this case the height H of the opening shall not exceed 2.1 m
- 8 The value of the factor X shall be taken from Table 4.9 or it can be given the value 6, provided the compressive strength of the bricks or blocks (in the case of a cavity wall – in the loaded leaf) is not less than 7 N/mm^2

Table 4C.9 Value of “X” (see Diagram 4C.14)

Nature of roof span	Maximum roof span (m)	Minimum thickness of wall inner leaf (mm)	Span of floor is parallel to wall	Span of timber floor into wall (m)		Span of concrete floor into wall (m)	
				4.5	6.0	4.5	6.0
Value of x							
Roof spans parallel to wall	Not applicable	100	6	6	6	6	6
		90	6	6	6	6	5
Timber roof spans into wall	9	100	6	6	5	4	3
		90	6	4	4	3	3

Wall Thickness

General

- 4C.31 The wall thickness may be determined according to this Part provided that –
- (a) “Conditions relating to the building of which the wall forms a part” (see paragraphs 4C.4 to 4C.8) are met; and
 - (b) “Conditions relating to the wall” (see paragraphs 4C.9 to 4C.30) are met.

If any one of the conditions in these paragraphs is not met, the sizing of the wall is outside the scope of this Section and specialist advice should be obtained from a suitably qualified person.

Solid external, compartment and separating walls

- 4C.32 Solid external, compartment and separating walls in coursed brickwork or blockwork **should** be at least as thick as 1/16 of the storey height. Further requirements are given in Table 4C.10.

Uncoursed stone or flint

- 4C.33 The thickness of walls constructed in uncoursed stone, flints or other burnt or vitrified material **should** not be less than 1.33 times the thickness required by paragraph 4C.32.

Cavity walls

- 4C.34 All cavity walls **should** have leaves not less than 90 mm thick and cavities not less than 50 mm wide.

For external, compartment and separating walls in cavity construction, the combined thickness of the 2 leaves plus 10 mm **should** be not less than the thickness required by paragraph 4C.32 for a solid wall of the same height and length.

Table 4C.10 Minimum thickness of certain external walls, compartment walls and separating walls

Overall height of supported wall ⁽¹⁾	Length of supported wall ⁽²⁾	Minimum thickness of supported wall
not exceeding 3.5 m	not exceeding 12 m	190 mm for the whole of its height
exceeding 3.5 m but not exceeding 9 m	not exceeding 9 m	190 mm for the whole of its height
	exceeding 9 m but not exceeding 12 m	290 mm from the base for the height of one storey, and 190 mm for the rest of its height
exceeding 9 m but not exceeding 12 m	not exceeding 9 m	290 mm from the base for the height of one storey, and 190 mm for the rest of its height
	exceeding 9 m but not exceeding 12 m	290 mm from the base for the height of two storeys, and 190 mm for the rest of its height
Note (1) See Diagram 4C.6 (2) See Diagram 4C.10		

Walls providing vertical support to other walls

4C.35 Irrespective of the materials used in the construction, a wall that provides vertical support to another wall **should** be not less in thickness than any part of the wall to which it gives vertical support.

Internal loadbearing masonry walls

4C.36 Internal loadbearing masonry walls **should** have a thickness not less than –

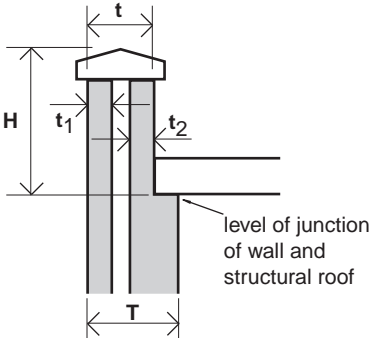
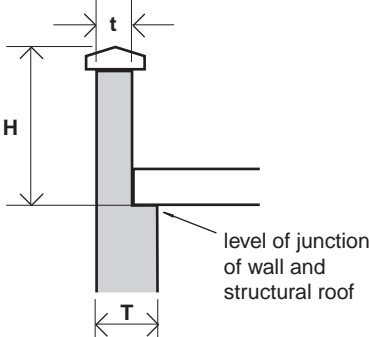
$$\frac{\text{(specified thickness from Table 4.10)}}{2} - 5 \text{ mm}$$

except for a wall in the lowest storey of a 3 storey building, carrying load from both upper storeys, which **should** have a thickness as determined by the above equation or 140 mm, whichever is the greater.

Parapet walls

4C.37 The minimum thickness and maximum height of parapet walls **should** be as given in Table 4C.11.

Table 4C.11 Maximum height of parapet walls

Wall type	Thickness of wall (mm)	Maximum height of parapet H (mm)
	where $t_1 + t_2$ is not greater than 200	600
	where $t_1 + t_2$ is greater than 200 but not greater than 250	860
	$t = 150$	600
	$t = 190$	760
	$t = 215$	860

Note: "t" shall not be greater than "T"

4C.38 Where a wall is constructed of bricks or blocks having modular dimensions derived from BS 6750: 1986, the wall thicknesses prescribed in this Part which derive from a dimension of a brick or block may be reduced by an amount not exceeding the deviation from work size permitted by a British Standard relating to equivalent sized bricks or blocks made of the same material.

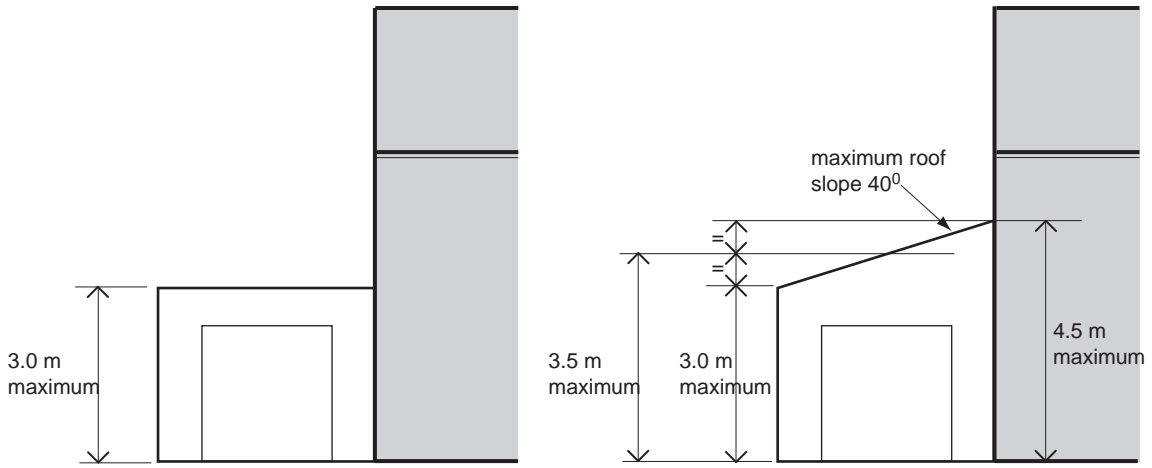
Part 2 - Masonry walls for annexes and small single storey buildings

Application of this Part of the Section

- 4C.39** This Part of the Section applies to –
- (a) an annex to a house; and
 - (b) a small single storey building other than a dwelling.
- 4C.40** The provisions contained in this Part apply only if the following criteria are met –
- (a) the floor area of the annex or building is not greater than 36 m²;
 - (b) the walls are solidly constructed in brickwork or blockwork using materials that comply with Tables 4C.6 and 4C.7;
 - (c) where the floor area of the annex or building is greater than 10 m², the walls have a surface mass of not less than 130 kg/m²; (Note: There is no surface mass limitation recommended for floor areas of 10 m² or less.);
 - (d) access to the roof is solely for the purposes of maintenance and repair;
 - (e) the only lateral loads are wind loads;
 - (f) the maximum length or width of the annex or building is not greater than 9 m;
 - (g) the height of the annex or building is not greater than the lower value derived from Diagram 4C.15 or paragraphs 4C.7 and 4C.8;
 - (h) the roof is braced at rafter level, horizontally at eaves level and at the base of any gable by roof decking, rigid sarking or diagonal timber bracing, as appropriate, in accordance with BS 8103-3:2009.
 - (i) the walls are tied to the roof structure vertically and horizontally in accordance with BS 8103-1:1995 and with horizontal lateral restraint at roof level in accordance with paragraph 4C.43; and
 - (j) the roof structure of an annex is secured to the structure of the main building at both rafter and eaves level.

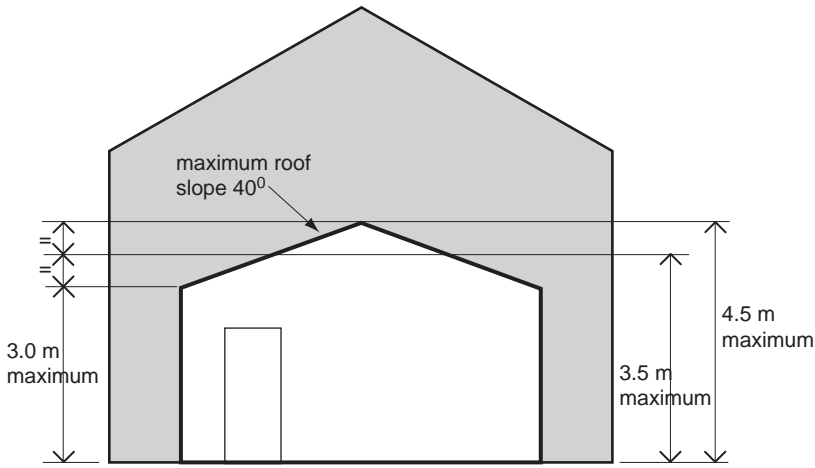
Diagram 4C.15 Maximum height of an annex or single storey building

see para 4C.40(g)



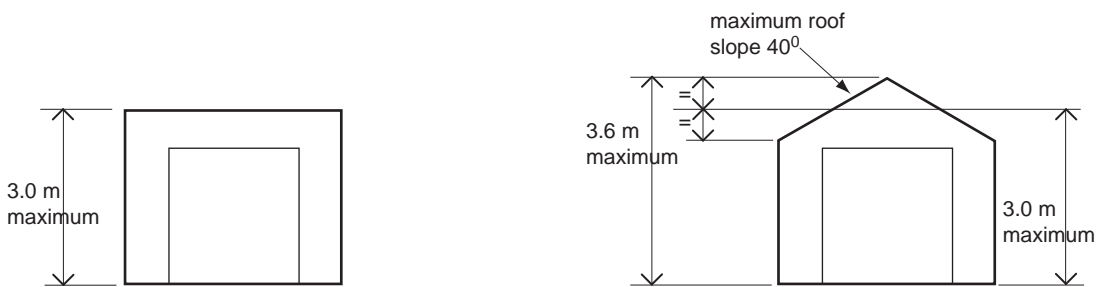
flat roof annexes

pitched roof annexes (type 1)



pitched roof annexes (type 2)

a) annexes



flat roof buildings

pitched roof buildings

b) buildings

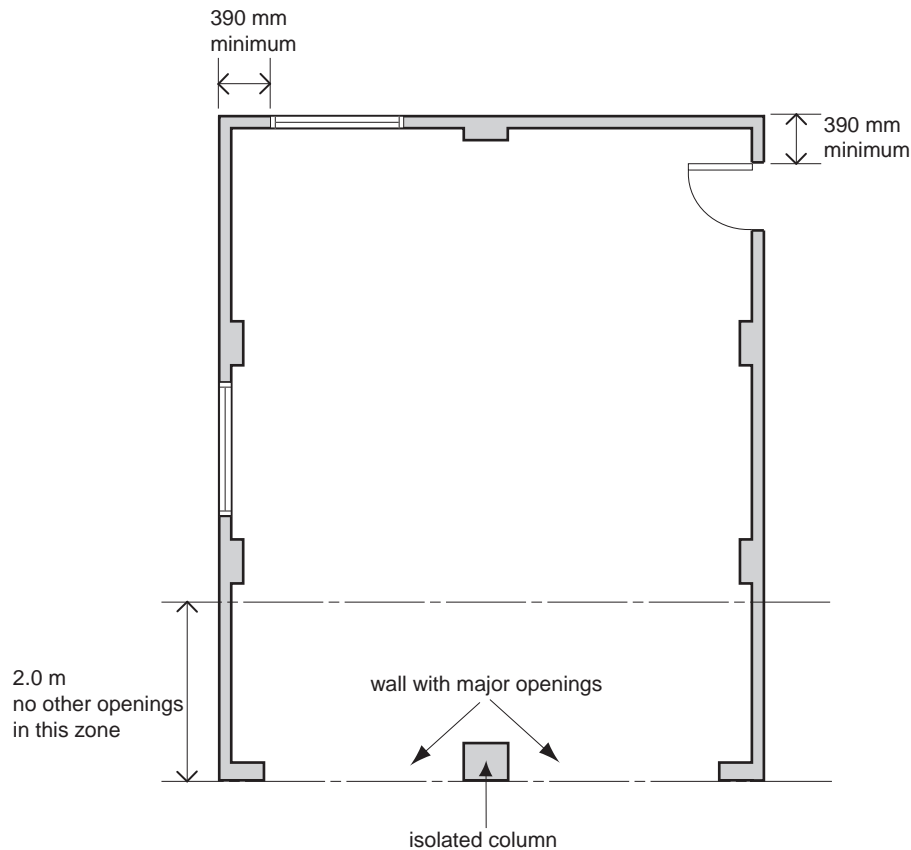
Note: Height should be measured from the top of the foundation or from the underside of the floor slab where this provides effective lateral restraint

Size and location of openings

- 4C.41** One or two major openings not more than 2.1 m in height are permitted in one wall of the building or annex only. The width of a single opening or the combined width of two openings **should** not exceed 5 m.
- 4C.42** The only other openings permitted in an annex or building are for windows and a single leaf door. The size and location of these openings **should** be in accordance with Diagram 4C.16.

Diagram 4C.16 Location of openings

see para 4C.42



Note:

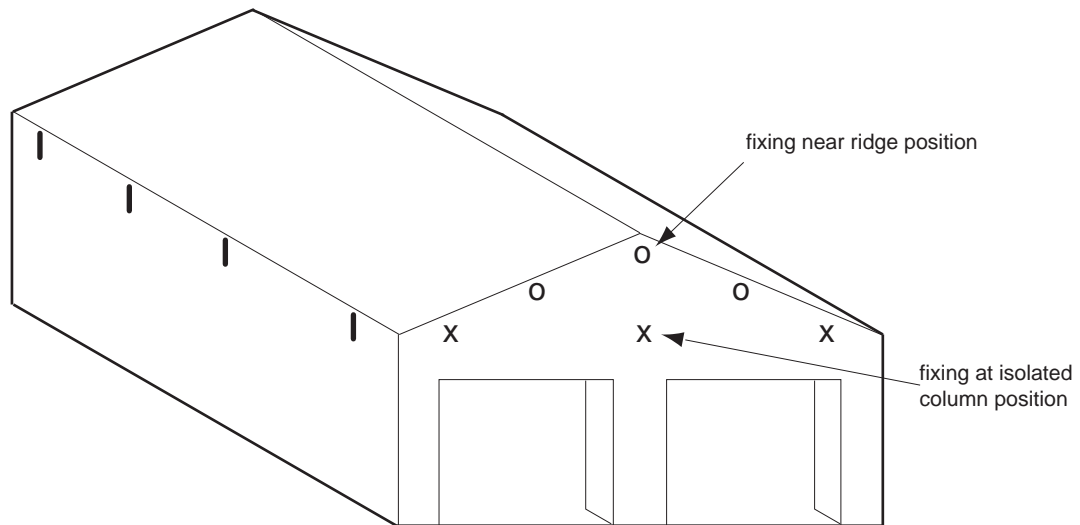
1. Major openings shall be restricted to one wall only. The aggregate width shall not be greater than 5.0 m and their height shall not be greater than 2.1 m
2. There shall be no other openings within 2.0 m of a wall containing a major opening
3. The aggregate size of openings in a wall not containing a major opening shall not be greater than 2.4 m²
4. Unless there is a corner pier the distance from a window or door opening to a corner shall not be less than 390 mm

Horizontal lateral restraint at roof level

- 4C.43** Walls **should** be tied horizontally at not more than 2 m centres to the roof structure at eaves level, base of gables and along roof slopes with straps fixed in accordance with Diagrams 4C.13 and 4C.17. Where straps cannot pass through a wall they **should** be adequately secured to the masonry using suitable fixings. Isolated columns **should** also be tied to the roof structure.

Diagram 4C.17 Horizontal lateral restraint at roof level

see para 4C.43



Key

I - denotes fixings at eaves level

X - denotes fixings at base of gable

O - denotes fixings along roof slope

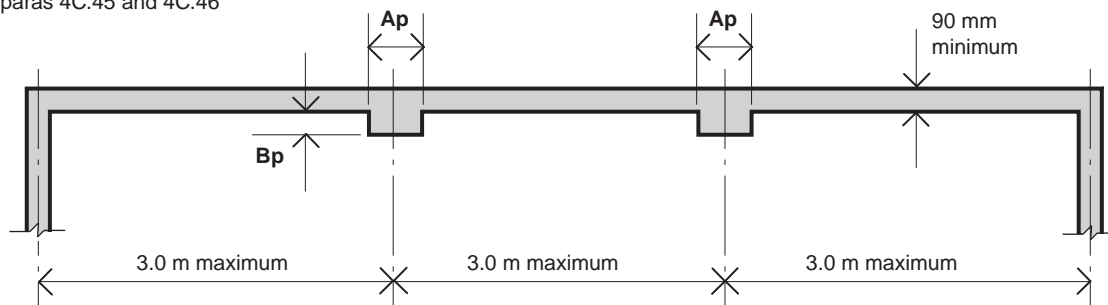
Note: fixings shall be in accordance with Diagram 4C.13

Wall thickness and recommendations for piers

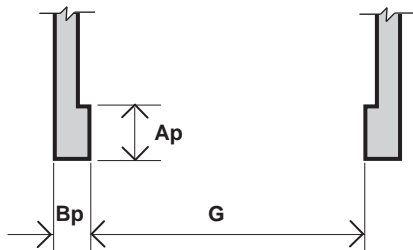
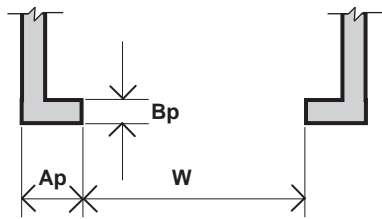
- 4C.44** The walls **should** have a minimum thickness of 90 mm.
- 4C.45** Walls which do not contain a major opening but exceed 2.5 m in length or height **should** be bonded or tied to piers for their full height at not greater than 3 m centres as shown in Diagram 4C.18.
- 4C.46** A wall, which contains one or two major openings, **should** in addition have piers as shown in Diagram 4C.18. Where ties are used to connect piers to walls they **should** be flat, 20 mm x 3 mm in cross section, be stainless steel, placed in pairs and spaced at not greater than 300 mm centres vertically.

Diagram 4C.18 Wall thicknesses

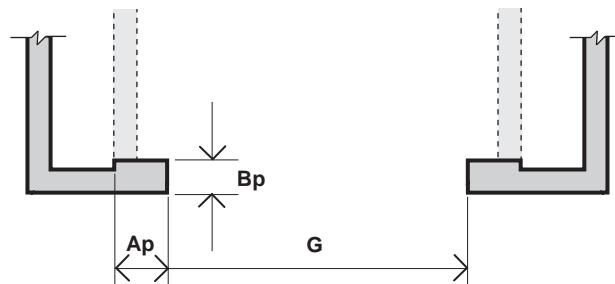
see paras 4C.45 and 4C.46



a) wall without a major opening

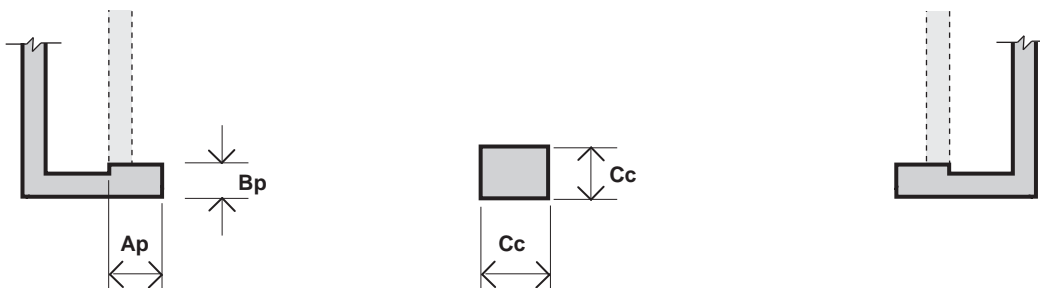


orientation of piers with opening width G not greater than 2.5 m



orientation of piers with opening width G greater than 2.5 m

b) walls with a single major opening



c) wall with two major openings

Notes:

1. In all cases the minimum pier size ($A_p \times B_p$) should be 390 mm x 190 mm or 327 mm x 215 mm depending on the size of the masonry units
2. Isolated columns (Case c) to be 325 mm x 325 mm minimum ($C_c \times C_c$)

4D Proportions for masonry chimneys above the roof surface

Application

This Section applies to a single family house of not more than 3 storeys in height, an annex and a small single storey building other than a dwelling.

Height to width relationship

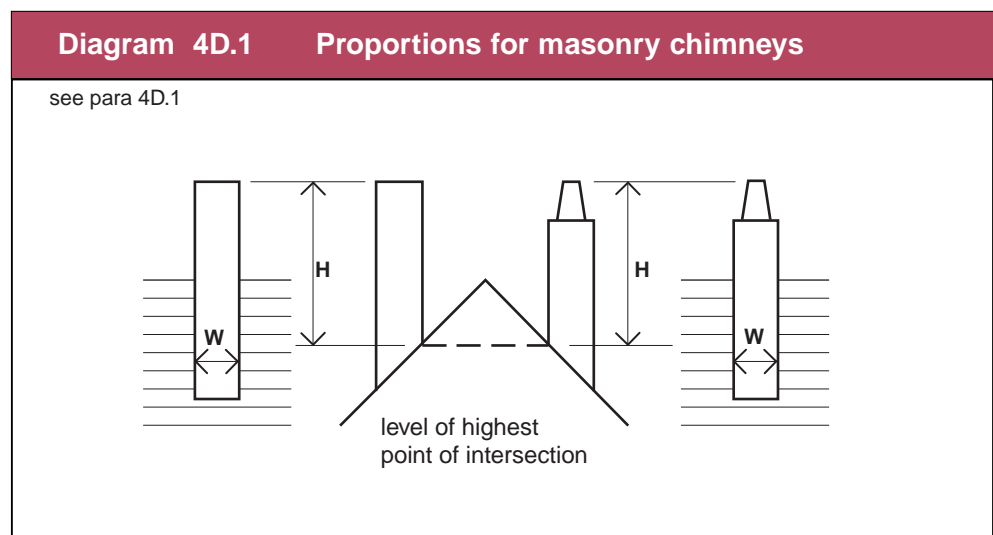
4D.1 Where a chimney is not adequately supported by ties or securely restrained in any way, its height, measured from the highest point of intersection with the roof surface, gutter, etc, **should** not exceed $4.5 W$, where –

W is the least horizontal dimension of the chimney measured at the same point of intersection; and

H is measured to the top of any chimney pot or other flue terminal.

Where the density of the masonry is less than 1500 kg/m^3 the 4.5 height factor **should** be reduced pro-rata.

(See Diagram 4D.1).



4E Strip foundations of plain concrete

Application

This Section applies to a single family house of not more than 3 storeys in height, an annex and a small single storey building other than a dwelling.

Conditions relating to the subsoil

- 4E.1 There **should** not be –
- (a) any made ground, peat or wide variation in the type of subsoil within the loaded area;
 - (b) a weaker type of soil at such a depth below the soil on which the foundation rests as could impair the stability of the structure; or
 - (c) soil movement within the loaded area resulting from seasonal weather changes.

Foundation concrete

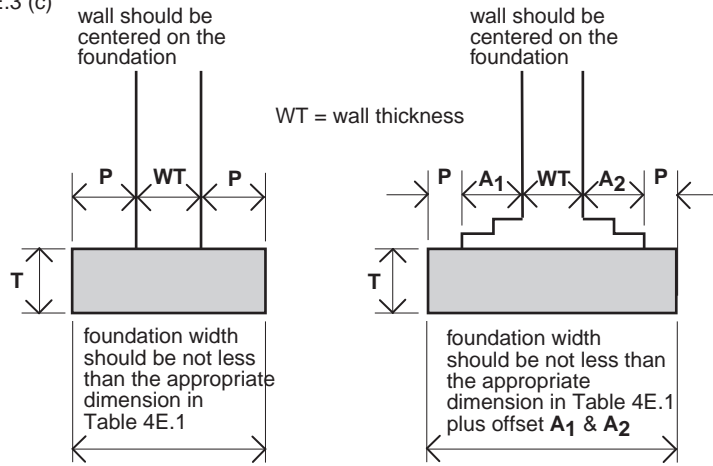
- 4E.2 The mass concrete used in the strip foundation **should** be –
- (a) in chemically aggressive soil conditions, an appropriate concrete mix as recommended in BS 8500-1:2006 and BRE Special Digest 1; and
 - (b) in chemically non-aggressive soils, composed of Portland Cement to BS EN 197-1 & 2:2000 and fine and coarse aggregate conforming to BS EN 12620:2002, the mix being –
 - (i) in the proportion of 50 kg of cement to not more than 155 kg (0.11 m³) of fine aggregate and 240 kg (0.16 m³) of coarse aggregate; or
 - (ii) Grade ST2 or Grade GEN 1 to BS 8500-2:2006.

Design provisions

- 4E.3 The following design provisions apply –
- (a) the foundation **should** be situated centrally under the wall;
 - (b) the foundation **should** have the minimum width given in Table 4E.1;
 - (c) the minimum thickness T of concrete foundations **should** be 150 mm or P, whichever is the greater, where P is derived using Table 4E.1 (see Diagram 4E.1(a) and (b));
 - (d) where the foundation is stepped on elevation, it **should** overlap by twice the height of the step, the thickness of the foundation, or 300 mm, whichever is greater (see Diagram 4E.2). **For trench filled foundations the overlap should be twice the height of the step or 1000 mm, whichever is greater;**
 - (e) the step in a foundation **should** not be of greater height than the thickness of the foundation (see Diagram 4E.2); and
 - (f) the foundation of a pier, buttress or chimney **should** project as indicated in Diagram 4E.3, the projection X **should** not be less than P.

Diagram 4E.1 Foundation dimensions

see para 4E.3 (c)



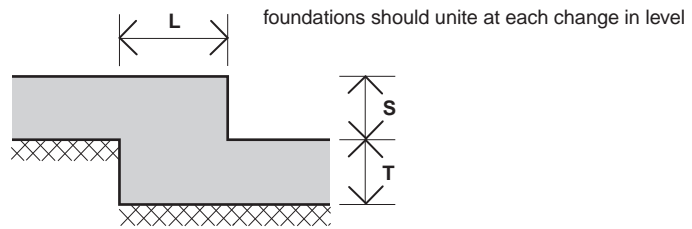
(a) strip foundation

(b) strip foundation with footing

in both the cases shown in this diagram, the thickness of the foundation should either be equal to P or 150mm, whichever is greater

Diagram 4E.2 Elevation of stepped foundation

see para 4E.3 (d) & (e)

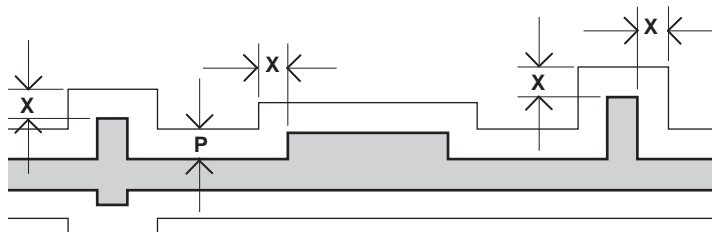


minimum overlap L = twice height of step, or thickness of foundation, or 300 mm, whichever is greater

S should not be greater than T

Diagram 4E.3 Piers and chimneys

see para 4E.3 (f)



Projection X should not be less than P

Minimum width of strip foundations

- 4E.4 Provided that the conditions relating to the subsoil (paragraph 4E.1) and design provisions relating to the foundations (paragraph 4E.3) are observed, the type and condition of subsoil are known and the loading at the base of the wall is within acceptable limits, the widths of foundations given in Table 4E.1 may be used.

Table 4E.1 Minimum width of strip foundations

Type No.	Type of subsoil	Condition of subsoil	Field test applicable	Total load of load bearing wall not greater than (kN/m)					
				20	30	40	50	60	70
				Minimum width of strip foundation (mm)					
1	Rock	Not inferior to sandstone, limestone or firm chalk	Requires at least a pneumatic or other mechanically operated pick for excavation	In each case not less than the width of the wall					
2	Gravel or sand	Medium dense	Requires pick for excavation. Wooden peg 50 mm square in cross section hard to drive beyond 150 mm	250	300	400	500	600	650
3	Clay or sandy clay	Stiff	Can be indented slightly by thumb	250	300	400	500	600	650
4	Clay or sandy clay	Firm	Thumb makes impression easily	300	350	450	600	750	850
5	Sand, silty sand or clayey sand	Loose	Can be excavated with a spade. Wooden peg 50 mm square in cross section can be easily driven	400	600	Note: Foundations on subsoil types 5 & 6 do not fall within the provisions of this Section if the total load exceeds 30 kN/m.			
6	Silt, clay or sandy clay & silt	Soft	Finger pushes in up to 10 mm	450	650				
7	Silt, clay or sandy clay & silt	Very soft	Finger easily pushes in up to 25 mm	Refer to specialist advice					

Minimum depth of strip foundations

- 4E.5 The minimum depth to the underside of a strip foundation **should** be the greater of –
- the depth to selected bearing stratum; or
 - a depth of 450 mm to the underside of foundations. This should avoid damage from frost action in normal soil conditions although this depth may have to be increased in areas which are subject to long periods of frost or in order to transfer the loading onto satisfactory ground.

The susceptibility of ground to movement, action of frost and changes in water table varies widely and the advice of a suitably qualified person should be sought if the conditions are outside the parameters set out above. More detailed guidance is provided in BRE Digests 240 and 241.

Appendix Publications referred to

BS EN 197 Cement.

- | | |
|--------------|---|
| Part 1: 2000 | Composition, specifications and conformity criteria for common element.
AMD 15209, AMD 17352 |
| Part 2: 2000 | Conformity evaluation. |

BS EN 336: 2003 Structural timber. Sizes, permitted deviations.

AMD 14533, AMD 16208

BS EN 771 Specification for Masonry Units.

- | | |
|--------------|---|
| Part 1: 2003 | Clay masonry units.
AMD 15998 |
| Part 2: 2003 | Calcium silicate masonry units.
AMD 15974 |
| Part 3: 2003 | Aggregate concrete masonry units.
AMD 16001 |
| Part 4: 2003 | Autoclaved aerated concrete masonry units.
AMD 16000 |
| Part 5: 2003 | Manufactured stone masonry units.
AMD 15999 |
| Part 6: 2005 | Natural stone masonry units. |

BS EN 845 Specification for ancillary components for masonry.

- | | |
|--------------|---|
| Part 1: 2003 | Ties, tension straps, hangers and brackets.
AMD 14736, AMD 15539 |
|--------------|---|

BS EN 998 Specification for mortar for masonry.

- | | |
|--------------|-----------------|
| Part 2: 2003 | Masonry mortar. |
|--------------|-----------------|

BS EN 1313 Round and sawn timber - Permitted deviations and preferred sizes.

- | | |
|-------------|------------------------------------|
| Part-1:2010 | Softwood sawn timber.
AMD 11020 |
|-------------|------------------------------------|

BS EN 1991: Action on structures

- | | |
|----------------|---|
| Part 1-1 2002 | Densities, self-weight and imposed loads. |
| Part 1-3 2003 | Snow loads. |
| Part 1-4 2005 | Wind actions. |
| Part 1-7: 2006 | Accidental actions |

BS EN 1992: Design of concrete structures.

- | | |
|----------------|---------------------------------------|
| Part-1-1: 2004 | General rules and rules for building. |
|----------------|---------------------------------------|

Part-1-2: 2004 General rules. Structural fire design.

BS EN 1993: Design of steel structures.

Part-1-1: 2005 General rules and rules for building.

Part-1-2: 2005 Structural fire design

Part 1-3: 2006 Supplementary rules for cold formed members and sheeting

Part-1-5: 2006 Plated structural elements.

Part-1-8: 2005 Design of joints.
AMD16291, AMD16571

Part-1-10: 2005 Material toughness and through-thickness properties.
AMD16293, AMD16569

BS EN 1994: Design of composite concrete and steel structures

Part 1-1: 2004 General rules and rules for building

Part 1-2: 2005 Structural fire design

BS EN 1995: Design of timber structures.

Part 1-1: 2004 General – Common rules and rules for building.

Part 1-2: 2004 Structural fire design.

BS EN 1996: Design of masonry structures.

Part-1-1:2005 General rules for reinforced and unreinforced masonry structures.

Part 1-2: 2005 Structural fire design

Part 3: 2006 Simplified calculations methods

BS EN 1997:Geotechnical Design

Part 1: 2004 General rules

BS EN 1999: Design of aluminium structures

Part 1-1: 2007 General structural rules

Part 1-2:2007 Structural fire design

Part 1-3: 2007 Structures susceptible to fatigue

BS EN 12620: 2002 Aggregates for concrete.

AMD 15333

BS EN 14081: Timber structures – Strength graded structural timber with rectangular cross section.

Part 1:2005 General requirements.

BS 1297: 1987 Specification for tongue and grooved softwood flooring.

BS 4978: 2007 Specification for visual strength grading of softwood.
AMD 9434

BS 5268: Structural use of timber.

Part 2: 2002 Code of practice for permissible stress design, materials and workmanship.

Part 3: 2006 Code of practice for trussed rafter roofs.
AMD 16541, AMD 16972

BS 5628: Code of practice for use of masonry.

Part 1: 2005 Structural use of unreinforced masonry.

Part 2: 2005 Structural use of reinforced and re-stressed masonry

Part 3: 2005 Materials and components, design and workmanship.

BS 5950: Structural use of steelwork in a building.

Part 1: 2000 Code of practice for design. Rolled and welded sections.
AMD 13199

Part 2: 2001 Specification for materials, fabrication and erection, hot rolled sections.

Part 3.1:1990 Design in composite construction. Code of practice for design of simple and continuous composite beams.

Part 4: 1994 Code of practice for design of composite slabs with profiled steel sheeting.

Part 5: 1998 Code of practice for design of cold formed thin gauge sections.

BS 6399: Loading for buildings.

Part 1: 1996 Code of practice for dead and imposed loads

Part 2: 1997 Code of practice for wind loads.
AMD 13392, AMD 14009

Part 3: 1988 Code of practice for imposed roof loads.
AMD 6033, AMD 9187, AMD 9452

BS 6750: 1986 Specification for modular coordination in building.

BS 8004:1986 Code of practice for foundations

BS 8103: Structural design of low-rise buildings.

Part 1: 1995 Code of practice for stability, site investigation, foundations and ground floor slabs for housing.
AMD 8980

Part 2: 2005 Code of practice for masonry walls for housing

Part 3: 2009 Code of practice for timber floors and roofs for housing.

Part 4: 1995 Code of practice for suspended concrete floors for housing

BS 8110: Structural use of concrete.

Part 1: 1997 Code of practice for design and construction.
AMD 9882, AMD 13468, AMD16016, AMD 17307

Part 2: 1985 Code of practice for special circumstances.
AMD 5914, AMD 12061, AMD 16017

Part 3: 1985 Design charts for singly reinforced beams, doubly reinforced beams and rectangular columns

BS 8118: Structural use of aluminium.

Part 1: 1991 Code of practice for design

Part 2: 1991 Specification for materials, workmanship and protection.

BS 8500: Concrete. Complementary British Standard to BS EN 206-1.

Part 1: 2006 Method of specifying and guidance for the specifier.

Part 2: 2006 Specification for constituent materials and concrete.

DD140-2: 1987 Wall ties. Recommendations for design of wall ties.
AMD 7971

BRE Special Digest 1 – Concrete in aggressive ground, 3rd Edition.

BRE Digest 240 – Low-rise buildings on shrinkable clay soils Part 1.

BRE Digest 241 – Low-rise buildings on shrinkable clay soils Part 2.