

Code of practice for the use of masonry —

Part 3: Materials and components, design and workmanship

ICS 91.080.30

Committees responsible for this British Standard

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 - Brick Development Association
 - British Masonry Society
 - British Precast Concrete Federation
 - CERAM Research Ltd.
 - Concrete Block Association
 - Construction Federation
 - Institution of Civil Engineers
 - Institution of Structural Engineers
 - Mortar Industry Association Ltd.
 - National House Building Council
 - Office of the Deputy Prime Minister
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Foreword

This part of BS 5628 has been prepared under the direction of Subcommittee B/525/6, Use of masonry. It supersedes BS 5628-3:2001, which will be withdrawn on 31 March 2006.

The start and finish of text introduced or altered by Corrigendum No. 1 is indicated in the text by tags **[C1]** **<C1]**.

BS 5628 is published in the following parts:

- Part 1: Structural use of unreinforced masonry;
- Part 2: Structural use of reinforced and prestressed masonry;
- Part 3: Materials and components, design and workmanship.

Annex A is normative and Annexes B, C, D and E are informative.

Annex A to this standard repeats the content of BS 8000-3 (with certain modifications that are listed in **A.1**), in order to provide designers with the recommendations for basic workmanship necessary in order to achieve the design recommendations of this standard.

This edition of BS 5628-3 is a revision of the standard necessary to accommodate the publication of BS EN 771, BS EN 845 and BS EN 998 (see Clause 2), and the consequent withdrawal of the standards that they superseded.

Where materials, components and methods of design and construction are not covered by this or any other British Standard, this does not discourage their use. The designer may need to be satisfied by reference to the appropriate manufacturers' literature and test certificates, if any, issued by competent, independent authorities to ensure that the materials and methods to be employed provide a level of performance at least equal to that recommended in this standard.

As a code of practice, this part of BS 5628 takes the form of guidance and recommendations. It should not be quoted as though it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

This standard was drafted on the assumption that the execution of its recommendations is entrusted to appropriately qualified and competent people.

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

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 129 and a back cover.

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1 Scope

This part of BS 5628 gives general recommendations for the design, construction and workmanship of masonry, including materials and components and the main aspects of design, other than structural, which is covered by BS 5628-1 and -2.

The recommendations in this standard are based on experience of single-leaf and cavity walls with and without insulation within the cavity.

No specific recommendations for the use of random rubble walling are given, the methods of construction and appearance of which vary locally according to traditional practice and the type of stone available. However, general principles are laid down in this standard.

This standard does not cover the use of natural stone panels as cladding to structural masonry and steel and concrete frames.

NOTE Recommendations about the use of natural stone panels as cladding to structural masonry and steel and concrete frames are given in BS 8298.

This standard is not necessarily appropriate to the repair and restoration of old buildings. Guidance on cleaning and surface repair of masonry built of natural stone, cast stone and brick is given in BS 8221.

This standard does not necessarily cover the use of proprietary systems. The user is referred to the particular recommendations of any technical approval in this case.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

BS 493, *Specification for airbricks and gratings for wall ventilation.*

BS 743, *Specification for materials for damp-proof courses.*

BS 1186-2, *Timber for and workmanship in joinery — Specification for workmanship.*

BS 1186-3, *Timber for and workmanship in joinery — Specification for wood trim and its fixing.*

BS 1197-2, *Specification for concrete flooring tiles and fittings — Metric units.* (obsolescent)

BS 3837-1, *Expanded polystyrene boards — Boards and blocks manufactured from expandable beads — Requirements and test methods.*

BS 3892-1, *Pulverized-fuel ash.*

BS 4027, *Specification for sulfate-resisting Portland cement.*

BS 4729, *Specification for dimensions of bricks of special shapes and sizes.*

BS 4841-1, *Rigid polyurethane (PUR) and polyisocyanurate (PIR) foam for building applications — Specification for laminated board for general purposes.*

BS 5250, *Code of practice for control of condensation in buildings.*

BS 5262, *Code of practice for external renderings.*

BS 5268-2, *Structural use of timber — Code of practice for permissible stress design, materials and workmanship.*

BS 5268-5, *Structural use of timber — Code of practice for the preservative treatment of structural timber.*

BS 5440-1, *Installation of flues and ventilation for gas appliances of rated input not exceeding 70 kW (1st, 2nd and 3rd family gases) — Specification for installation of flues.*

BS 5606:1990, *Guide to accuracy in building.*

BS 5617, *Specification for urea-formaldehyde (UF) foam systems suitable for thermal insulation of cavity walls with masonry or concrete inner and outer leaves.*

BS 5618, *Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems.*

BS 5628, *Code of practice for the use of masonry.*

- BS 5628-1:2005, *Structural use of unreinforced masonry*.
- BS 5628-2:2005, *Structural use of reinforced and prestressed masonry*.
- BS 5642, *Sills and copings*.
- BS 5642-1, *Specification for window sills of precast concrete, cast stone, clayware, slate and natural stone*.
- BS 5642-2, *Specification for copings of precast concrete, cast stone, clayware, slate and natural stone*.
- BS 5977-1, *Lintels. Method of assessment of load*.
- BS 6150, *Code of practice for painting of buildings*.
- BS 6213, *Selection of construction sealants — Guide*.
- BS 6398:1983, *Specification for bitumen damp-proof courses for masonry*.
- BS 6431 (various parts), *Ceramic floor and wall tiles*.
- BS 6461-1, *Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) — Code of practice for masonry chimneys and flue pipes*
- BS 6510, *Specification for steel windows, sills, window boards and doors*.
- BS 6515, *Specification for polyethylene damp-proof courses for masonry*.
- BS 6699, *Specification for ground granulated blast furnace slag for use with Portland cement*.
- BS 6925, *Specification for mastic asphalt for building and civil engineering (limestone aggregate)*.
- BS 7456, *Code of practice for stabilization and thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with polyurethane (PUR) foam systems*.
- BS 7457, *Specification for polyurethane (PUR) foam systems suitable for stabilization and thermal insulation of cavity walls with masonry or concrete inner and outer leaves*.
- BS 7979, *Specification for limestone fines for use with Portland cement*.
- BS 8000, *Workmanship on building sites*
- BS 8000-2 (various sections), *Part 2: Code of practice for concrete work*.
- BS 8000-3, *Part 3: Code of practice for masonry*.
- (NB: Incorporated into this Standard as Annex A)
- BS 8000-16, *Part 16: Code of practice for sealing joints in buildings using sealants*.
- BS 8004, *Code of practice for foundations*.
- BS 8102, *Code of practice for protection of structures against water from the ground*.
- BS 8103 (various parts), *Structural design of low-rise buildings*.
- BS 8104:1992, *Code of practice for assessing exposure of walls to wind-driven rain*.
- BS 8215, *Code of practice for design and installation of damp-proof courses in masonry construction*.
- BS EN 197-1:2000, *Cement Composition, specifications and conformity criteria for common cements*.
- BS EN 413-1, *Masonry Cement — Composition, specifications and conformity criteria*.
- BS EN 450-1, *Fly ash for concrete — Definition, specifications and conformity criteria*.
- BS EN 459-1, *Building Lime — Definitions, specifications and conformity criteria*.
- BS EN 485, *Aluminium and aluminium alloys — Sheet, strip and plate*.
- BS EN 485-1, *Technical conditions for inspection and delivery*.
- BS EN 485-2, *Mechanical properties*.
- BS EN 490, *Concrete roofing tiles and fittings — Product specifications*.
- BS EN 515, *Aluminium and aluminium alloys — Wrought products — Temper designations*.
- BS EN 573, *Aluminium and aluminium alloys — Chemical composition and form of wrought products*.
- BS EN 573-3, *Chemical composition*.

- BS EN 573-4, *Forms of products*.
- BS EN 771, *Specification for masonry units*.
- BS EN 771-1, *Clay masonry units*.
- BS EN 771-2, *Calcium silicate masonry units*.
- BS EN 771-3, *Aggregate concrete masonry units (dense and light-weight aggregates)*.
- BS EN 771-4, *Autoclaved aerated concrete masonry units*.
- BS EN 771-5, *Manufactured stone masonry units*.
- BS EN 771-6, *Natural stone masonry units*.
- BS EN 845, *Specification for ancillary components for masonry*.
- BS EN 845-1, *Ties, tension straps, hangers and brackets*.
- BS EN 845-2, *Lintels*.
- BS EN 845-3, *Bed joint reinforcement of steel meshwork*.
- BS EN 934-3, *Admixtures for concrete, mortar and grout — Admixtures for masonry mortar — Definitions, requirements and conformity*.
- BS EN 942:1996, *Timber in joinery — General classification of timber quality*.
- BS EN 988, *Zinc and zinc alloys — Specification for rolled flat products for building*.
- BS EN 998-1, *Specification for mortar for masonry — Rendering and plastering mortar*.
- BS EN 998-2, *Specification for mortar for masonry — Masonry mortar*.
- BS EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water as mixing water for concrete*.
- BS EN 1015-11, *Methods of test for mortar for masonry — Determination of flexural and compressive strength of hardened mortar*.
- BS EN 1172:1997, *Copper and copper alloys — Sheet and strip for building purposes*.
- BS EN 1304, *Clay roofing tiles for discontinuous laying — Products definitions and specifications*.
- BS EN 1652, *Copper and copper alloys — Plate, sheet, strip and circles for general purposes*.
- BS EN 1806, *Chimneys — Clay/ceramic flue blocks for single wall chimneys — Requirements and test methods*.
- BS EN 1858, *Chimneys — Components — Concrete flue blocks*.
- BS EN ISO 11600, *Building construction. Sealants — Classification and requirements*.
- BS EN 12588:1999, *Lead and lead alloys — Rolled lead sheet for building purposes*.
- BS EN 12620, *Aggregates for concrete*.
- BS EN 12878, *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test*.
- BS EN 13055-1, *Lightweight aggregates for concrete, mortar and grout*.
- BS EN 13139, *Aggregates for mortar*.
- BS EN 13162, *Thermal insulation products for buildings — Factory made mineral wool (MW) products. Specification*.
- BS EN 13164, *Thermal insulation products for buildings — Factory made products of extruded polystyrene foam (XPS) — Specification*.

3 Terms and definitions

For the purposes of this part of BS 5628, the following terms and definitions apply.

NOTE Other associated definitions that may be of use to the user of this standard can be found in BS 6100-1 and -5.

3.1

ashlar

surface appearance of a vertical construction of plain blocks of stone, finely dressed and jointed to given dimensions and laid to courses
[BS 6100-5.2:1992, **520 3303**]

3.2

band course

plain contrasting course, that may be one of a number of courses, flush, projecting or recessed, carried horizontally along the face of a building or other structure
[BS 6100-5.1:1992, **510 2216**]

3.3

bed joint

horizontal joint in masonry
[BS 6100-5.1:1992, **510 1404**]

3.4

bond

<of materials> adhesion between materials
[BS 6100-1.5.2:1987, 152 1002]

3.5

bond

<of masonry units> arrangement of masonry units

NOTE 1 Generally this arrangement is such that the vertical joints of one course do not coincide with those of courses immediately above and below.

NOTE 2 Adapted from BS 6100-5.1:1992, **510 1401**.

3.6

capping

construction that protects the top of a wall, but does not shed rainwater clear of the surfaces of the wall beneath
[BS 6100-5.1:1992, **510 1204**]

3.7

cavity tray

damp-proof course that bridges a wall cavity to lead moisture to the external face of a wall
[BS 6100-5.3:1984, **530 4009**]

3.8

cavity wall

wall of two leaves effectively tied together and with a space between them

NOTE 1 The cavity is usually at least 50 mm wide.

NOTE 2 Adapted from BS 6100-1.3.1:1992, **131 2103**.

3.9

cavity wall insulation material

thermal insulation material positioned in a cavity
[BS 6100-1.3.1:1992, **131 2403**]

3.10

cavity wall tie

re-formed component built into the two leaves of a cavity wall to link them

NOTE Adapted from BS 6100-1.3.1:1992, **131 5219**.

3.11**cladding**

external vertical, or near-vertical non-loadbearing covering to a structure
[BS 6100-1.3.1:1992, **131 1004**]

NOTE 1 Cladding is generally subject to lateral loading.

NOTE 2 Cladding may be continuous or in panels.

3.12**closer**

portion of a masonry unit used to maintain bond
[BS 6100-5.3:1984, **530 1019**]

3.13**collar joint**

wall joint within a wall or vertical joint between walls built in parallel, continuous throughout height and length
[BS 6100-5.1:1992, **510 1409**]

3.14**collar-jointed wall**

wall of two leaves (not more than 25 mm apart and effectively tied together) that enable both exposed faces to be built fair faced

NOTE 1 The term “collar-jointed wall” is also known as “double-leaf wall”.

NOTE 2 Adapted from BS 6100-1.3.1:1992, **131 2104**.

3.15**coping**

construction that protects the top of a wall, balustrade or parapet and sheds rainwater clear of the surfaces beneath
[BS 6100-5.1:1992, **510 1205**]

3.16**course**

single layer of masonry units of uniform height, including the bed joint
[BS 6100-5.1:1992, **510 1303**]

3.17**cross joint**

joint, other than a bed joint, usually at right angles to the face of a wall
[BS 6100-5.1:1992, **510 1406**]

3.18**damp-proof course**

d.p.c.

device, usually comprising a layer or strip of material, placed within a wall, chimney or similar construction to prevent passage of moisture
[BS 6100-5.1:1992, **510 1503**]

3.19**damp-proof course brick**

clay brick that is used to resist rising damp
[BS 6100-5.3:1984, **530 2015**]

NOTE The properties of damp-proof course bricks are specified in BS 3921.

3.20**datum**

reference point for a series of measurements
[BS 6100-1.5.3:1988, **153 1015**]

3.21

diaphragm wall

wall of two leaves of masonry, separated by a wide cavity, but connected by vertical webs of masonry to improve structural performance

NOTE Adapted from BS 6100-1.3.1:1992, **131 2109**.

3.22

drip

projection below a horizontal surface that prevents water flowing back to a wall
[BS 6100-5.1:1992, **510 1504**]

3.23

efflorescence

crystalline deposit of salts on a surface as a result of the evaporation of water from a salt solution

NOTE Adapted from BS 6100-5.1:1992, **510 4001**.

3.24

face insulated block

block with thermal insulation material bonded to one face during manufacture

3.25

fair faced

surface built neatly and evenly without applied finish
[BS 6100-5.1:1992, **510 2202**]

3.26

fixed support

support to the edge of a wall that restrains the wall against lateral movement and also substantially against rotation

3.27

free-standing wall

wall or part of a wall, exposed on both faces, that stands above any horizontal lateral support
[BS 6100-1.3.1:1992, **131 2110**]

3.28

frog

depression formed in one or both of the largest surfaces of a brick
[BS 6100-5.3:1984, **530 2003**]

3.29

grouted reinforced cavity wall

cavity wall, designed to resist mainly lateral loading, in which reinforcement surrounded by concrete or mortar is located in the cavity

NOTE Adapted from BS 6100-1.3.1:1992, **131 2107**.

3.30

header

shorter face of a masonry unit showing on the face of a wall
[BS 6100-5.3:1984, **530 1017**]

3.31

insulation board

rigid rectangular unit of thermal insulation material of uniform thickness, typically of cellular plastic material

3.32**insulation slab**

resilient, semi-rigid, rectangular unit of thermal insulation material of uniform thickness, usually of mineral wool

[BS 6100-1.3.1:1992, **131 2411**]

NOTE The term “insulation slab” was previously sometimes referred to as “insulation batt”.

3.33**jamb**

vertical part of a wall at an opening

[BS 6100-1.0:1999, **100 3323**]

3.34**jointing**

forming and finishing mortar joints as work proceeds without pointing

NOTE Adapted from BS 6100-5.1:1992, **510 1410**.

3.35**lime bloom**

film of calcium carbonate formed by carbonation of calcium hydroxide leached to the surface of masonry

[BS 6100-5.1:1992, **510 4002**]

3.36**lintel**

beam supporting loads over an opening

[BS 6100-1.3.1:1992, **131 2306**]

3.37**masonry**

construction of bricks or blocks

NOTE Adapted from BS 6100-5.1:1992, **510 1101**.

3.38**masonry unit**

brick or block

3.39**mortar**

mix of one or more inorganic binders, aggregates, water, and sometimes additives and/or admixtures

3.39.1***factory made masonry mortar***

mortar that is batched and mixed in a factory

NOTE It may be “dry mortar”, which is ready mixed only requiring the addition of water, or “wet mortar” which is supplied ready to use and contains a cement set retarder.

3.39.2***semi-finished factory made masonry mortar***

premixed lime-sand mortar, batched and mixed in a factory requiring only the addition of cement and water on site, or prebatched masonry mortar supplied in a multi-compartment silo for gauging and water addition on site

3.40**mortar joint**

joint between masonry units filled with mortar

[BS 6100-5.1:1992, **510 1411**]

3.41**movement joint**

joint designed and located in masonry to accommodate movement

NOTE Movement may be due to, for example, changes in temperature and/or moisture content.

3.42

panel wall

wall that forms an in-filling between structural members
[BS 6100-1.3.1:1992, **131 2118**]

3.43

perforation

void which passes through a masonry unit

3.44

perpend joint

vertical cross joint that appears in the face of a wall between two masonry units

NOTE Adapted from BS 6100-5.1:1992, **510 1408**.

3.45

pistol unit

brick with accurately sized rebate, manufactured or sawn from a whole brick

NOTE Pistol units are often used to fit over and mask a support.

3.46

pointing

filling a partly raked back mortar joint to provide a finish
[BS 6100-5.1:1992, **510 1419**]

3.47

quoin

block of a special shape for the construction of a corner

NOTE Adapted from BS 6100-5.1:1992, **510 2208**.

3.48

reference panel

panel of masonry erected and retained on a building site, used to establish the visual acceptability of materials and workmanship to be maintained during construction work

3.49

retaining wall

wall designed to resist lateral pressure from a mass of material

NOTE Adapted from BS 6100-1.0:1999, **100 1205**.

3.50

rubble

stone of irregular shape and size
[BS 6100-5.2:1992, **520 1614**]

3.51

sample panel

panel of masonry erected on a building site as a means of comparing materials with an established reference panel

3.52

shell bedding

bedding consisting of two separate strips of mortar at the outer and inner faces of blocks in horizontal joints

3.53

simple support

support to the edge of a wall that may permit rotation but restrains the wall against lateral movement

3.54

single-leaf wall

solid wall of bricks or blocks laid to overlap in one or more directions
[BS 6100-1.3.1:1992, **131 2101**]

3.55**sleeper wall**

low loadbearing wall to provide intermediate support to a suspended ground floor

NOTE Adapted from BS 6100-1.3.1:1992, **131 2116**.

3.56**slip**

brick or block specially manufactured or cut to a thickness of between 20 mm and 50 mm

NOTE Adapted from BS 6100-5.3:1984, **530 2013**.

3.57**slip tie (general purpose)**

Wall tie fitted across a movement joint in masonry to transmit shear forces, but with one end debonded to allow the joint to close or open

NOTE Slip ties are usually a metal straight rod or metal fiat strip.

3.58**soldier course**

course of masonry units set on their ends with their stretcher faces visible
[BS 6100-5.1:1992, **510 4005**]

3.59**solid brick**

brick without frogs or with frogs up to 20 % of its volume, but with no through holes or perforations

3.60**special shaped brick**

brick with shape or size other than a standard parallel faced rectangular prism

3.61**stretcher**

longer face of a masonry unit showing on the face of a wall
[BS 6100-5.3:1984, **530 1018**]

3.62**string course**

moulded course, that may be one of a number of courses, that projects from a wall
[BS 6100-5.1:1992, **510 2217**]

3.63**veneered wall**

wall of which the facing and backing are joined, but not designed to result in common action under load
[BS 6100-1.3.1:1992, **131 2114**]

3.64**weathered**

having an upper surface sloped to throw off water
[BS 6100-5.1:1992, **510 1505**]

3.65**weathering**

sloped surface to throw off water

3.66**weep hole**

hole through a wall that drains water to its outer face
[BS 6100-5.1:1992, **510 1506**]

4 Materials and components

4.1 General

Recommendations concerning the durability of materials and components are given in 5.6.

NOTE A checklist for ordering clay and calcium silicate bricks is given in Annex E.

4.2 Masonry units

NOTE Consideration of safe handling techniques needs to be made if working with units of greater than 20 kg. Guidance on regulatory requirements and design options to avoid heavy units can be found in manufacturers' literature or in [1].

4.2.1 Clay

Clay masonry units should conform to BS EN 771-1.

Clay flue blocks should conform to BS EN 1806.

4.2.2 Calcium silicate

Calcium silicate masonry units should conform to BS EN 771-2.

4.2.3 Concrete

Concrete masonry units should conform to the following British Standards:

BS EN 771-3 for aggregate concrete units (dense and lightweight aggregates)

BS EN 771-4 for autoclaved aerated concrete units

BS EN 771-5 for manufactured stone units

Concrete flue blocks should conform to BS EN 1858.

4.2.4 Special shaped bricks

Special shaped bricks should conform to BS 4729.

4.2.5 Natural stone

For a particular application, stone should be selected with regard to availability in sufficient quantities in the desired colour and unit size.

NOTE Primary classification of building stones is ordered into the three major groups:

- igneous stone (principally granite, basalt, diorite and serpentine);
- sedimentary stone (principally limestone and sandstone); and
- metamorphic stone (principally slate and marble).

4.3 Materials for mortar

NOTE Epoxy and polymer resins can be used in various forms to joint masonry.

4.3.1 Cement

The following cements, or combination of cements, are suitable for use in mortars:

Cements:

Portland cement	BS EN 197-1 Notation CEM I
Limestone cement	BS EN 197-1 Notation CEM II/A-L and CEM II/A-LL
Sulfate-resisting Portland cement	BS 4027
Portland-slag cement	BS EN 197-1 Notation CEM or II/A-S or II/B-S
Portland-fly ash cement	BS EN 197-1 Notation CEM II/A-V or II/B-V
Masonry cement (inorganic filler, other than lime)	BS EN 413-1, Class MC
Masonry cement (lime)	BS EN 197-1 Notation CEM I (not less than 75% by mass) and lime

Combinations of cements:

- a) Combinations produced in the mortar mixer from Portland cement CEM I conforming to BS EN 197-1 and ground granulated blastfurnace slag conforming to BS 6699 where the proportions and properties conform to CEM II/A-S or CEM II/B-S of BS EN 197-1: 2000, except Clause 9 of that standard.
- b) Combinations produced in the mortar mixer from Portland cement CEM I conforming to BS EN 197-1 and limestone fines conforming to BS 7979 where the proportions and properties conform to CEM II/A-L or CEM II/A-LL of BS EN 197-1:2000, except Clause 9 of that standard.
- c) Combinations produced in the mortar mixer from Portland cement CEM I conforming to BS EN 197-1 and pulverized fuel ash conforming to BS 3892-1, or to BS EN 450-1, where the proportions and properties conform to CEM II/A-V or CEM II/B-V of BS EN 197-1:2000, except Clause 9 of that standard.

The use of high alumina cement is not permitted.

4.3.2 Lime

Limes should conform to BS EN 459-1.

4.3.3 Fine aggregates (sand) and other aggregates**4.3.3.1 Natural aggregates**

Aggregates from natural sources to be used for mortar should conform to BS EN 13139.

Aggregates from natural sources to be used for concrete should conform to BS EN 12620.

4.3.3.2 Lightweight aggregates

Lightweight aggregates should conform to BS EN 13055-1.

4.3.4 Admixtures and additions**4.3.4.1 Air entraining plasticizers**

Mortar plasticizers should conform to BS EN 934-3.

For guidance on their use see 5.7.1.3.

4.3.4.2 Colouring pigments

Pigments used for colouring mortars should conform to BS EN 12878.

4.3.5 Water

Water should be clean and should not contain any material, either in solution or in suspension, in a quantity sufficient to either have harmful effect on the mortar or on metals, or to impair the durability of the construction. In practice, mains water or other potable supplies are satisfactory. However, in cases where water supplies are of doubtful quality, the methods of water sampling and testing should conform to BS EN 1008.

4.4 Wall ties

Wall ties should conform to BS EN 845-1. For guidance on selection and use of wall ties see 5.3.5, Table 1 and Table 9.

4.5 Metal support and restraint components

Tension straps, joist hangers and brackets should conform to BS EN 845-1.

Joist hangers required for both vertical and lateral support as shown in BS 5628-1, Annex D should be purpose made. Support should conform to BS EN 845-1.

Materials for other types of support and restraint components such as support angles, dowels and fixings should conform to one or other of the specifications listed in BS EN 845-1, 2 or 3.

For guidance on the selection of materials see 5.6.7.1 and Table 1.

NOTE 1 A variety of metal components is available to tie and provide restraint for masonry cladding. Typical applications are illustrated in Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12 and Figure 13.

NOTE 2 A variety of metal components is available to support masonry cladding panels and corbelled forms of masonry. Typical applications are illustrated in Figure 16 and Figure 17.

Table 1 — Selection of ancillary components in relation to material/coating specification and situation

Material/ coating reference in accordance with BS EN 845-1	Material/ coating reference in accordance with BS EN 845-2	Material/ coating reference in accordance with BS EN 845-3	Material /coating specification (NOTE. See BS EN 845-1 to 3 for the full details of the specifications. The zinc coating weights are approximate values for one surface.)	Situation in buildings up to three storeys in a non-aggressive environment (For other buildings see Notes 1 and 2)											
				In contact with or embedded in an internal wall or an inner leaf of an external cavity wall						In contact with or embedded in an outer leaf of an external cavity wall or a single leaf external wall					
				T	S	L	L+	R	C	T	S	L	L+	R	C
1		R1	Austenitic stainless steel (molybdenum chrome nickel alloys)	Y	Y			Y	Y	Y	Y			Y	Y
2			Plastic used for the body of ties	Y ^a						Y ^a					
3	L3	R3	Austenitic stainless steel (chrome nickel alloys)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4			Ferritic stainless steel	X	X				X	X	X				X
5, 6, 7			Aluminium bronze, phosphor bronze, copper	Y	Y				Y	Y	Y				Y
8, 9			Zinc coated (940 g/m ²) steel wire or component	Y	Y				Y	Y	Y				Y
10	L10		Zinc coated (710 g/m ²) steel component	X	Y	Y	Y	Y	Y	X	X	Y	Y		X
11	L11		Zinc coated (460 g/m ²) steel component	X	Y	X	Y		Y	X	X	X	Y		X
	L11.1		Zinc coated (460 g/m ²) steel component with organic coating over all outer surfaces of finished component			Y	Y					Y	Y		
	L11.2					Y	Y					Y	Y		
12.1	L12.1		Zinc coated (300 g/m ²) steel strip or sheet with organic coating over all outer surfaces of finished component	X	Y	Y	Y		Y	X	X	Y	Y		X
12.2	L12.2			X	Y	Y	Y			Y	X	Y	Y		X
13		R13	Zinc coated (265 g/m ²) steel wire	X	Y			Y	Y	X	X			X	X
14	L14		Zinc coated (300 g/m ²) steel strip or sheet with all cut edges organic coated	X	Y	X	Y		Y	X	X	X	Y		X
15			Zinc pre-coated (300 g/m ²) steel strip or sheet	X	Y				Y	X	X				X
16.1	L16.1		Zinc coated (137 g/m ²) steel strip or sheet with organic coating over all outer surfaces of finished component	X	Y	X	Y		Y	X	X	X	Y		X
16.2	L16.2			X	Y	Y	Y		Y	X	X	X	Y		X
17			Zinc pre-coated (137 g/m ²) steel strip with zinc coated edges	X	Y				Y	X	X				X
18		R18	Zinc coated (60 g/m ²) steel wire with organic coating over all surfaces of finished component	X	X			X	X	X	X			X	X
19		R19	Zinc coated (105 g/m ²) steel wire	X	X				X	X	X				X
20		R20	Zinc coated (60 g/m ²) steel wire	X	X				X	X	X				X
21		R21	Zinc pre-coated (137 g/m ²) steel sheet	X	X			Y	X	X	X			X	X

Table 1 — Selection of ancillary components in relation to material/coating specification and situation (*concluded*)

Key to product types	
T	Ties and brackets conforming to BS EN 845-1 with this material/coating reference.
S	Tension straps and hangers conforming to BS EN 845-1 with this material/coating reference.
L	Lintels conforming to BS EN 845-2 with this material/coating reference have integral damp-proof systems and may be used without the need to provide a separate damp-proof course.
L+	Lintels conforming to BS EN 845-2 with this material/coating reference may be used in these locations with a separate damp-proof course.
R	Bed joint reinforcement conforming to BS EN 845-3 with this material/coating reference.
C	Components outside the scope of EN 845-1 to 3 but meeting the specification requirements of EN 845-1 for the material/coating reference.
Key to table	
Y	The use of components with this material/coating reference may be used in these locations.
(Blank)	Components with this material/coating reference are not specified
X	The use of components with this material/coating reference is not recommended in these locations.
^a Restricted to use for box-form residential buildings of up to two storeys (10 m max height). Note 1 In contact with or embedded in an outer leaf of an external cavity wall or a single leaf external wall, in buildings exceeding three storeys in a non aggressive environment, the material/coating specifications should be limited to austenitic stainless steels (references 1, R1, 3, L3 and R3) or aluminium bronze, phosphor bronze or copper (references 5, 6 or 7). The recommendations of the table may be used for the internal walls and inner leaves of all buildings in a non-aggressive environment. Note 2 For buildings located in an aggressive environment (e.g. coastal sites) the material coating specification for products in both leaves of an external wall should be austenitic stainless steel (molybdenum chrome nickel alloys — references 1 or R1).	

4.6 Reinforcement

Reinforcement and post-tensioning for structural use should follow the recommendations of BS 5628-2.

Reinforcement for non-structural use, e.g. crack control (see **5.4.5**), should be protected against corrosion (see **5.6.7**).

Bed joint reinforcement of steel meshwork should conform to BS EN 845-3.

4.7 Damp-proof courses (d.p.c.s), including cavity trays

Materials for d.p.c.s and cavity trays should conform to the following British Standards:

BS 6398 for bitumen sheet

BS EN 771-1 for clay d.p.c. bricks

BS 6515 for polyethylene sheet

BS 743 for other materials

Bituminous materials for d.p.c.s in masonry built of some natural stones should be carefully selected to avoid the risk of staining.

The suitability criteria for materials for d.p.c.s are set out in **5.5.5** and Table 2.

Table 2 — Physical properties and performance of materials for d.p.c.s

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other consideration
			Upward	Downward			
(A) Flexible							
Lead sheet	a	1.8	Lapped at least 100 mm	100 mm passing lap and interlocking upstand	Not under pressure met in normal construction	Corrodes in contact with mortars. Protect with bitumen or bitumen paint of heavy consistency applied to both surfaces of the lead	Easily worked to required shape but this is a slow process. Limit lengths to 1.5 m
Copper conforming approximately to BS EN 1172:1997, 2.28 grades C104 or C106 in the O condition	Approximately 2.28	0.25	Lapped at least 100 mm	Welded or welted	Not under pressure met in normal construction	Highly resistant to corrosion. If soluble salts are present, protected as for lead	Can stain masonry. Not easy to work on site, so not suitable for cavity trays. Avoid contact with aluminium
Bitumen hessian base (class A of BS 6398:1983)	3.8	—	Lapped at least 100 mm	Lapped at least 100 mm and sealed	Likely to extrude under heat and moderate pressure but this is unlikely to affect resistance to moisture penetration	The hessian or fibre can decay but this does not affect efficiency if the bitumen remains undisturbed. Classes D, E and F are most suitable for buildings that are intended to have a very long life or where there is risk of movement	Materials should be unrolled with care. In cold weather, warm before use. When used as a cavity tray, the d.p.c. should be fully supported. For further guidance see BS 6398:1983, Annex B.
Bitumen fibre base (class B of BS 6398:1983)	3.3	—					
Bitumen hessian base and lead (class A of BS 6398:1983)	4.4	—					
Bitumen fibre base and lead (class E of BS 6398:1983)	4.4	—					

Code number 4 in BS 743:1970

Table 2 — Physical properties and performance of materials for d.p.c.s (continued)

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other consideration
			Upward	Downward			
(A) Flexible (continued)							
Polyethylene, low density (0.915 g/cm ³ to 0.925 g/cm ³) conforming to BS 6515	Approximately 0.5	0.46	Seal with Welled double-sided adhesive tape	Welled	Not under pressure met in normal construction	No evidence of deterioration in contact with other building materials	Accommodates considerable lateral movement. When used as a cavity tray, can be difficult to hold in place and may need bedding in mastic for the full thickness of the outer leaf, to prevent rain penetration. Not suitable for use where compressive stress is low, e.g. under copings
Bitumen polymer and pitch polymer	Approximately 1.5	1.10	Lapped at least 100 mm	Lapped at least 100 mm and sealed	Not under pressure met in normal construction	Unlikely to be impaired by any construction movements normally occurring up to the point of failure of the wall	Accommodates considerable lateral movement. When used as a cavity tray, pre-formed cloaks should be used, e.g. at changes of level and junctions
(B) Semi-rigid							
Mastic asphalt conforming to BS 6925 of hardness appropriate to conditions	—	12	No joint problems	No joint problems	Liable to extrude under pressure above 0.65 N/mm ²	No deterioration	To provide a key for mortar below next course of brick masonry, up to 35 % grit should be beaten into asphalt immediately after application and left proud of surface. Alternatively, the surface should be scored whilst still warm

Table 2 — Physical properties and performance of materials for d.p.c.s (concluded)

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other consideration
			Upward	Downward			
<i>(C) Rigid</i>							
D.P.C. bricks of prescribed water absorption conforming to BS EN 771-1	—	Two courses, laid to break joint, bedded in 1:3 Portland cement: sand mortar	No joint problems	Not suitable	—	No deterioration	Particularly appropriate where is required to transmit tension, e.g. at base of a freestanding wall. D.P.C. Designation 1 bricks are required for buildings. D.P.C. Designation 1 or 2 may be used in external works (see BS EN 771-1:2003, Clause NA.3.10)
Slate conforming to BS 743 and most granites	—	Two courses laid to break joint, bedded in 1:3 Portland cement: sand mortar	No joint problems	Not suitable	—	No deterioration	—

4.8 Sealants

Sealants should conform to BS ISO 11600.

Sealant selection should be in accordance with the recommendations given in BS 6213.

Sealants should be installed in accordance with BS 8000-16.

NOTE Guidance on the application of sealants and on back-up materials in sealed joints is given in 5.4.4.

For the selection of a sealant for use with a particular type of natural stone, the sealant manufacturer should be consulted to avoid problems such as migration staining. Some silicone sealants liberate acidic by-products during curing and are therefore unsuitable for use with calcareous stones.

4.9 Airbricks, gratings and flues

Airbricks and gratings should conform to BS 493. Flues should follow the recommendations given in BS 5440-1 or BS 6461-1, as appropriate.

Unless satisfactory local experience exists, clay products should not be used in limestone masonry nor concrete products used in sandstone masonry. These restrictions avoid the risk of attack by run-off from limestone and concrete, respectively.

4.10 Sills

Sills can be purpose made components or can be constructed from suitably durable materials. Sill materials should conform to the British Standards given in Table 3.

NOTE For guidance on d.p.c.s below sills, see 5.5.7.6.

Table 3 — Sill materials

Component/Material	Standard to be complied with
Brick and block	BS EN 771-1, BS EN 771-2 or BSN 771-3
☐ Cost (manufactured) stone	BS EN 771-5 or BS 5642-1 ☐
Clay tile	BS EN 1304
Clayware	BS 5642-1
Concrete	BS 5642-1
Natural stone	BS 5642-1
Slate	BS 5642-1
Steel	BS 6510
Timber	BS 1186-2, BS 1186-3 and BS EN 942

4.11 Lintels

Lintels should conform to the appropriate British Standard listed in Table 4. Concrete and masonry lintels should be selected to have adequate concrete quality and cover to protect the reinforcement in their conditions of exposure.

NOTE At present, lintels of natural stone are not specified in any British Standard.

Table 4 — Lintels

Material	Appropriate standard
Autoclaved aerated concrete	BS EN 845-2
Cast concrete	
Reinforced concrete	
Pre-stressed concrete	
☐ Manufactured stone ☐	
Pressed steel	BS 5268-2
Rolled low carbon steel	
☐ Prefabricated reinforced masonry ☐	
Timber	BS 5268-2
Natural stone	None applicable

4.12 Copings

Copings can be purpose made components or can be constructed from suitably durable materials. Coping components and/or materials and the British Standard to which they should conform are listed in Table 5.

NOTE 1 For guidance on the design of, and the need for, d.p.c.s below copings, see 5.5.7.13.

NOTE 2 Table 13 provides information regarding the durability of masonry in finished construction.

Table 5 — Copings

Material	Appropriate standard	Recommended thickness mm
Aluminium	BS EN 515, BS EN 573-3, BS EN 573-4, BS EN 485-1 and BS EN 485-2	0.6 to 0.9
Brick and block	BS EN 771-1, BS EN 771-2 or BS EN 771-3	—
☐ Cast (manufactured) stone	BS EN 771-5 or BS 5642-2 ☐	—
Clay tile	BS EN 1304 or BS 6431	—
Concrete (cast)	BS 5642-2	—
Concrete tile	BS EN 490 or BS 1197-2	—
Copper	BS EN 1652:1998, material designation Cu-FRTP CW006A or Cu-DHP CW024A in the O condition	—
Lead	BS EN 12588	not less than 1.8 ^a
Natural stone	BS 5642-2	—
Zinc	BS EN 988	not less than 0.8
^a Code number 4 in BS EN 12588:1999		

4.13 Flashings and weatherings

Flashings and weatherings should conform to the relevant British Standards given in Table 7.

NOTE For guidance on the use of flashings and weatherings, see 5.5.7.12.

Table 6 — Flashings and weatherings

Material	Appropriate standard	Recommended thickness mm
Aluminium alloy	BS EN 485-1, BS EN 485-2, BS EN 573-3, BS EN 573-4, BS EN 515	0.6 to 0.9 (sheet or strip)
Copper	BS EN 1652:1998, material designation Cu-FRTP CW006A or Cu-DHP CW024A in the O condition	0.4 to 0.7
Lead	BS EN 12588	not less than 1.8 ^a
^a Code number 4 in BS EN 12588:1999.		

4.14 Insulation products

Insulation products should conform to the relevant British Standard listed in Table 7.

NOTE Insulation products may be installed in the cavity of a cavity wall partially or fully to fill it (see 5.5.4.2.7). Insulation products are produced in different forms to suit the various installation methods used (see Table 8 and A.5.4.4).

Table 7 — Insulation products

Insulation products	Product specification	Code of practice for installation
(A) For installation during construction of masonry to fill the cavity partially		
☐ Mineral wool boards (glass or rock fibre)	BS EN 13162 ☐	—
Expanded polystyrene bead boards	☐ BS EN 13163 ☐	—
Extruded expanded polystyrene boards	BS EN 13164	—
Polyurethane (PUR) boards	☐ BS EN 13165 ☐	—
Polyisocyanurate (PIR) boards	☐ BS EN 13166 ☐	—
☐ Cellular glass boards	BS EN 13167 ☐	—
(B) For installation during construction of masonry to fill the cavity fully		
Mineral wool insulation slabs (glass or rock fibre)	BS EN 13162	—
(C) For installation by blowing or injection into cavity walling to fill the cavity fully		
Loose mineral wool (glass or rock fibre)	—	—
Expanded polystyrene beads or granules	—	—
Urea-formaldehyde (UF) foam	BS 5617	BS 5618
Polyurethane (PUR) foam	BS 7457	BS 7456
Polyurethane (PUR) cavity stabilization foam	BS 7457	BS 7456

5 Design

5.1 General

5.1.1 Factors to be considered

When designing masonry, the following factors should be taken into account. For:

- choice of masonry unit materials, see 4.2;
- structural stability, see 5.2 and 5.3;
- accommodation for movement, see 5.4;
- resistance to rain penetration, see 5.5;
- durability, see 5.6;
- mortar for jointing, see 5.7;
- performance in fire, see 5.8;
- thermal properties, see 5.9;
- sound control, see 5.10;
- masonry bonds and other constructional details, see 5.11 and Annex C;
- the appearance of fair faced masonry see Annex D;
- workmanship, see Clause 6;
- health and safety issues, see also note to 4.2.

5.1.2 Foundations

The design of foundations should be in accordance with the recommendations of BS 8004.

5.2 Design for stability

5.2.1 Masonry in general

Masonry should be designed to have strength, stiffness and stability suitable for the intended purpose. Consideration should be given to the interaction of the whole structure, of which the masonry forms a part. Connections of other elements with the walls should be sufficient so as to transmit all vertical and lateral loads safely to the foundations. If necessary during construction, temporary support for masonry should be used, e.g. where composite action is required.

The structural design of masonry should be in accordance with the recommendations of BS 5628-1 and -2, and for low-rise buildings should be in accordance with the recommendations of BS 8103.

The stiffness and stability should be derived from one or more of the following, depending upon the type of masonry:

- a) thickness in relation to height and length;

NOTE The effective thickness of the wall is reduced by chases and/or recessed joints.

- b) self weight;

- c) presence of piers;

- d) interaction with other walls, columns, floors, roofs or structural elements.

The effect of introducing openings, movement joints or slip planes should be carefully considered.

The need for robust construction, including the effect of accidental loading, should always be taken into account in the design.

5.2.2 Walls subjected to concentrated loads

Where a concentrated load occurs in a wall, e.g. at a lintel or beam bearing, provision should be made for the local bearing stress in the design (see BS 5628-1). Where necessary, suitable bearing plates, spreader beams, padstones, piers or columns should be provided (for lintels or beam bearings see 5.3.4.)

Certain types of cellular, frogged or hollow unit which are otherwise suitable for the construction of the wall may not provide sufficient bearing strength at points of concentrated load and may need to be filled.

5.2.3 Walls subjected to imposed lateral load only

5.2.3.1 Free-standing walls

The design of free-standing walls should be in accordance with the recommendations of BS 5628-1 or -2.

NOTE Empirical guidance on maximum height and minimum foundation width of brick or block masonry free-standing walls is given in [2]. Similar guidance on reinforced, diaphragm and wide plan (e.g. chevron and staggered) free-standing walls, in addition to guidance on steel reinforcement size, is given in [3].

5.2.3.2 Walls with edge restraint

5.2.3.2.1 Maximum areas of walls

The design of walls with edge restraint which are subject to wind loads should be in accordance with the recommendations of BS 5628-1. However, certain rectangular walls and gables in buildings up to and including four storeys high may be proportioned as in Table 8, subject to the following conditions.

- a) The walls should be in buildings no higher than four storeys, situated in the wind zones shown in Figure 1.

NOTE The effective thickness of the wall will be reduced by chases and/or recessed joints.

- b) The walls should be free from any doors, windows or other openings, unless either:

- intermediate supports are provided, such as those shown in Figure 2a); or
- the total area of such openings is not greater than 10 % of the appropriate maximum area given in Table 8, or 25 % of the actual area of the wall, whichever is the less, and no opening is less than half its maximum dimension from the edge of the wall, other than its base, or from any other opening [see Figure 2b)].

- c) In a single-leaf, collar-jointed or grouted reinforced cavity wall, the distance between the supports should be not more than 40 times the total thickness of the wall.

- d) Interaction with other walls, columns, floors, roofs or structural elements.

- e) In a cavity wall:

- the distance between supports should be not more than 30 times the total thickness of the masonry in the wall;
- the thickness of each leaf should be not less than 100 mm, excluding plaster or render;
- the cavity width should be not more than 100 mm;
- wall ties should be spaced in accordance with **5.3.5** and **A.5.4.2**.

f) Pitched-gable ends which have support at the top (see **5.5.3**) should be regarded as equivalent to a rectangular area the height of which is measured to half way up the triangular portion [see Figure 2c)]. Three- or four-sided support should be assumed as appropriate.

g) Mortar should not be weaker than Strength Class M4 (see Table 13).

Table 8 — Maximum permitted areas of certain types of wall in square metres (m²)

Wind zone	Height m	Category and type of wall					
							
		A		B		C	
		Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall
1	5.4	11.0	13.5	17.5	19.0	26.5	28.5
	10.8	9.0	11.5	13.0	15.5	18.5	21.5
2	5.4	9.5	12.0	14.0	17.0	21.0	24.0
	10.8	8.0	9.5	11.5	14.0	13.5	17.5
3	5.4	8.5	10.5	12.5	15.0	15.5	20.0
	10.8	7.0	8.5	10.0	12.0	11.5	15.5
4	5.4	8.0	9.5	11.0	13.5	13.0	17.0
	10.8	6.5	7.5	9.0	11.0	10.5	13.5

Table 8 — Maximum permitted areas of certain types of wall in square metres (m²) (continued)

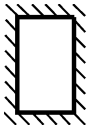
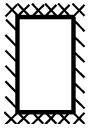
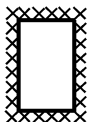
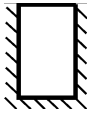
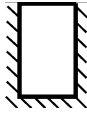
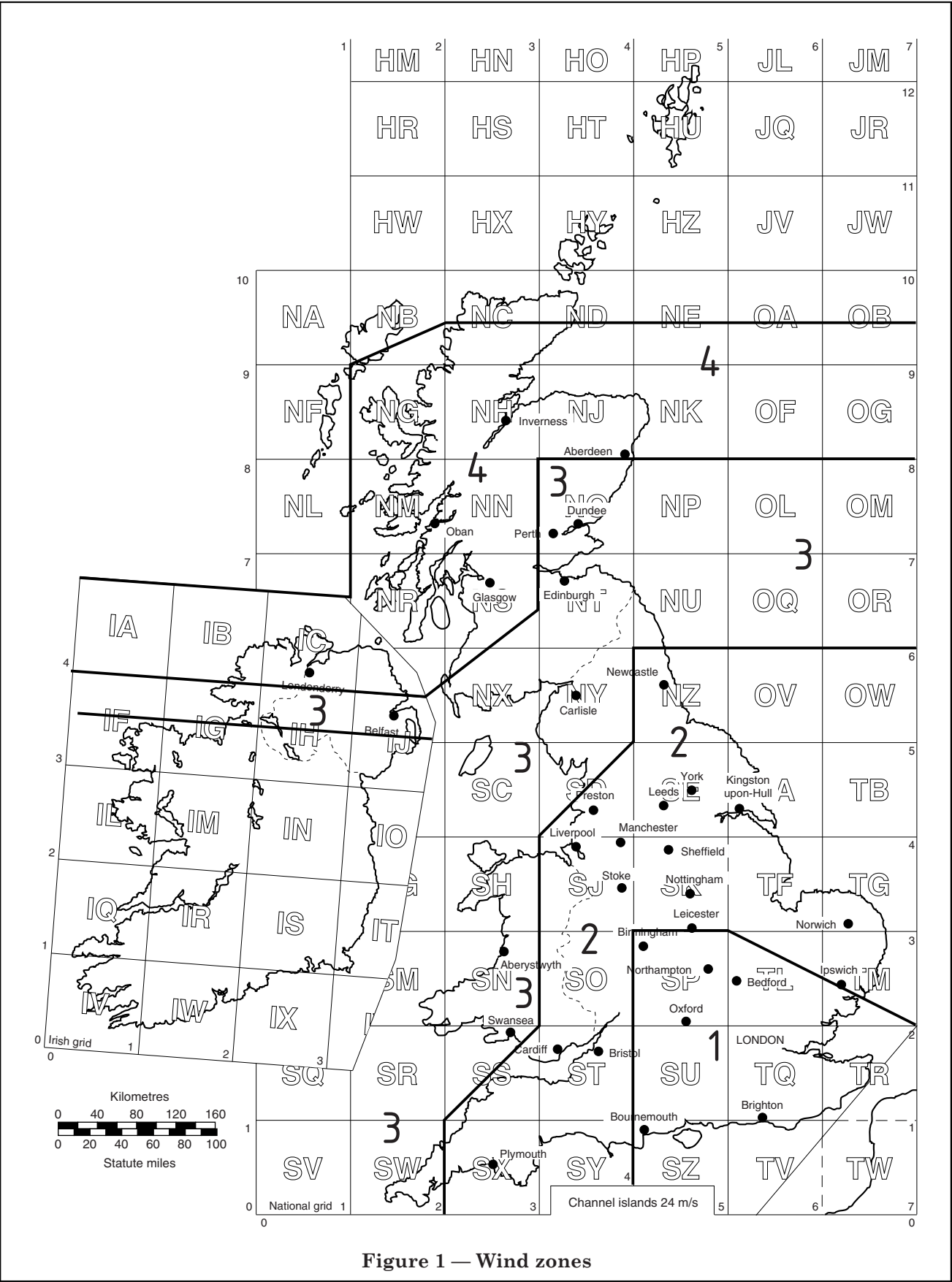
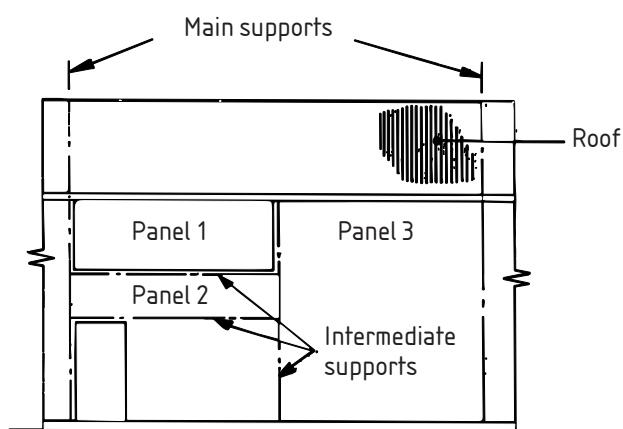
Wind zone		Height	Category and type of wall								
											
			D		E		F				
	m		Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall			
1	5.4	20.5		29.0	32.0	41.0	32.0	41.0			
	10.8	15.5		23.5	24.0	32.5	32.0	41.0			
2	5.4	17.5		25.5	27.0	35.5	32.0	41.0			
	10.8	13.0		20.5	19.0	28.5	28.0	36.5			
3	5.4	14.5		22.5	22.0	31.0	30.5	40.5			
	10.8	11.0		17.5	14.5	24.5	24.5	31.5			
4	5.4	12.5		19.5	18.0	27.5	27.0	35.0			
	10.8	9.5		14.5	12.5	21.0	21.5	27.5			

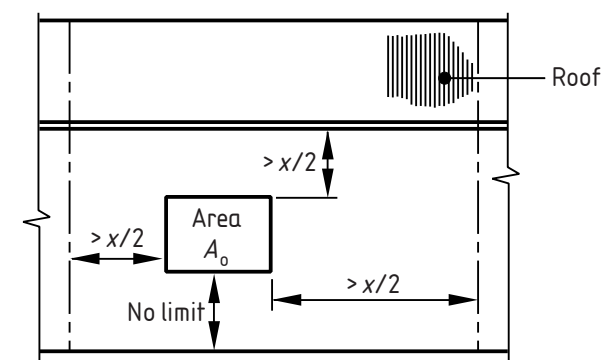
Table 8 — Maximum permitted areas of certain types of wall in square metres (m²) (continued)

Wind zone	Height	Category and type of wall					
							
		G		H		I	
	m	Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall
1	5.4	8.5	10.0	14.0	19.0	19.5	30.5
	10.8	7.0	8.0	10.0	14.5	15.5	21.5
2	5.4	7.5	8.5	10.5	16.5	17.0	24.5
	10.8	6.0	7.0	9.0	11.0	13.0	17.5
3	5.4	6.5	7.5	9.5	13.5	14.5	20.0
	10.8	5.0	6.05	7.5	9.0	11.5	15.0
4	5.4	6.0	6.5	8.5	10.5	12.5	17.0
	10.8	4.0	5.5	6.5	7.5	10.0	12.5
NOTE 1 Types of support are described in 5.2.3.2.2 and are represented as:							
		a) free edge: 					
		b) simple support: 					
		c) fixed support: 					
NOTE 2 The term “solid” is used in this table to denote single-leaf walls, collar-joined walls (see 3.14) or grouted reinforced. The 190 mm solid walls are of any brick, or blocks of compressive strength not less than 3.5 N/mm ² .							
NOTE 3 Cavity walls consist of:							
a) an outer leaf, 100 mm minimum in thickness, of any brick, or blocks of compressive strength not less than 15.0 N/mm ² ;							
b) an inner leaf, 100 mm minimum in thickness, of any brick, or blocks of compressive strength not less than 2.9 N/mm ² .							
If either leaf of a cavity wall is increased to 140 mm using blocks of the respective strength, the areas given in this table may be increased by 20 %.							



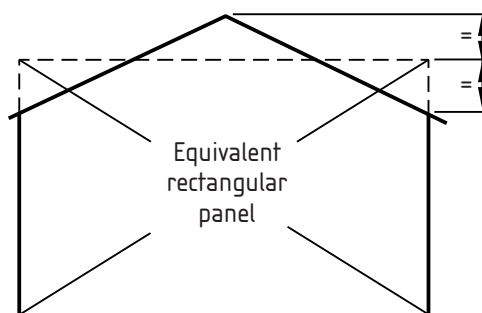


a) Example of division of a wall into panels with intermediate supports



x is the maximum dimension of opening (height or length);
 A_o is the permitted area of opening

b) Effect of opening in a wall where

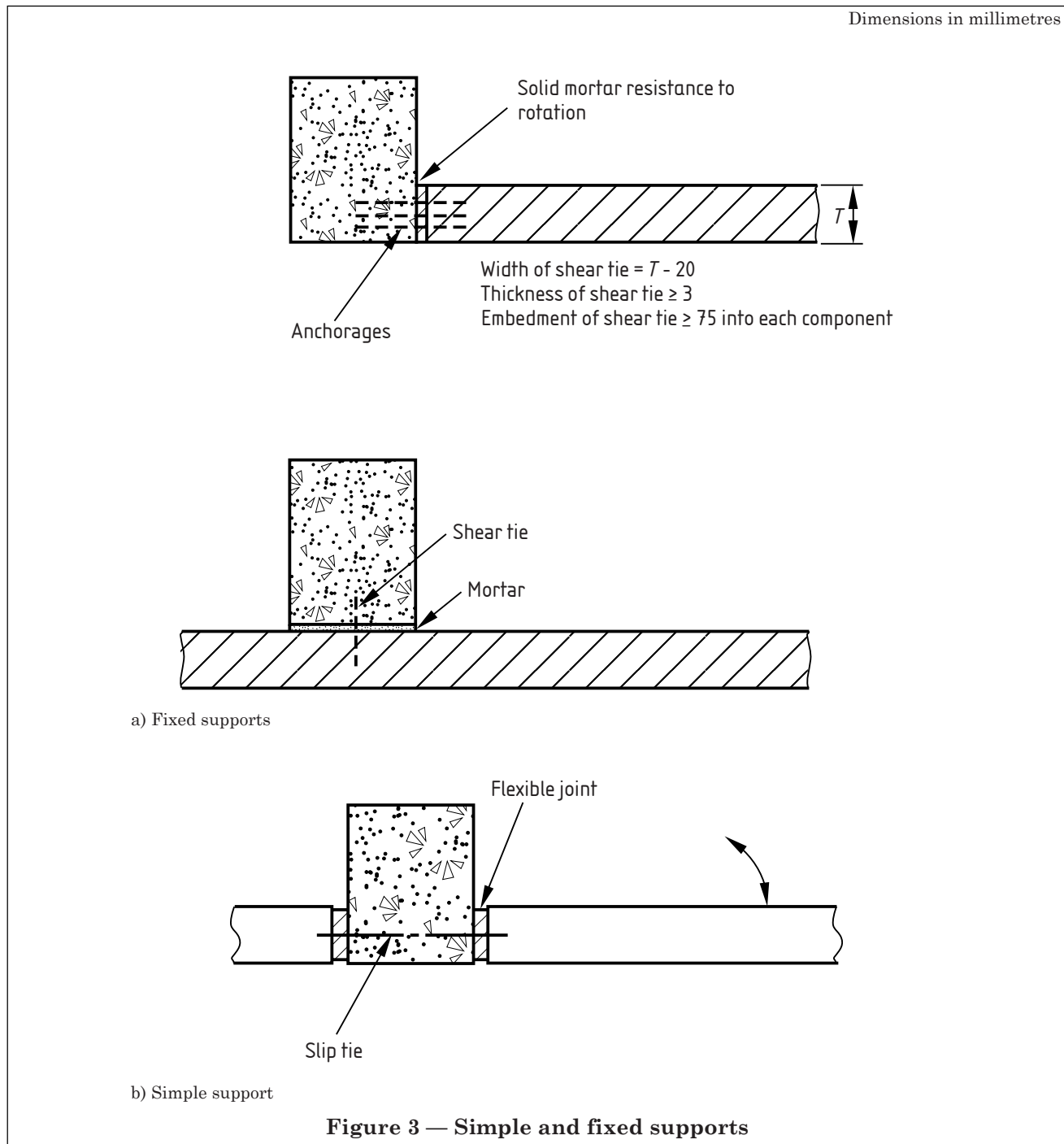


c) Gable walls

Figure 2 — Walls with edge restraint

5.2.3.2.2 Support conditions

The wall should be adequately connected to its support and all supports should be sufficiently strong and rigid to carry the transmitted loads (see Figure 3). A fixed support may be assumed in a single-leaf, collar joint or grouted-cavity wall in the cases shown in Figure 3a) and Figure 4 or where the wall abuts, and is adequately tied to, a column capable of resisting horizontal forces applied to it without excessive deflection.



Dimensions in millimetres

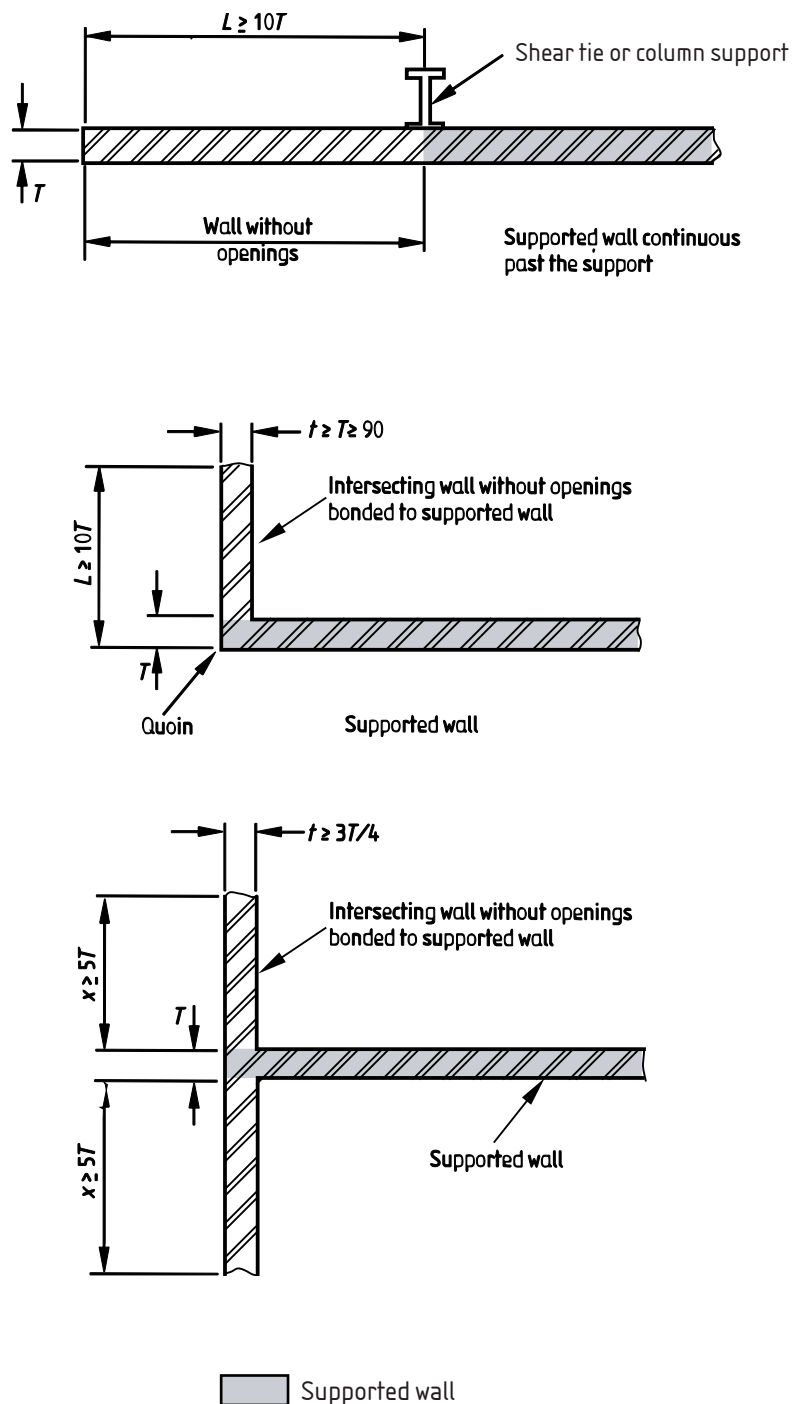


Figure 4 — Fixed support assumed in a single-leaf, collar joint or grouted-cavity wall

A fixed support may be assumed in a cavity wall in the cases shown in Figure 5.

A simple support may be assumed where the wall is permitted to rotate but is restrained against lateral movement.

The design should contain provisions for any chases cut in the wall (see 5.3.8).

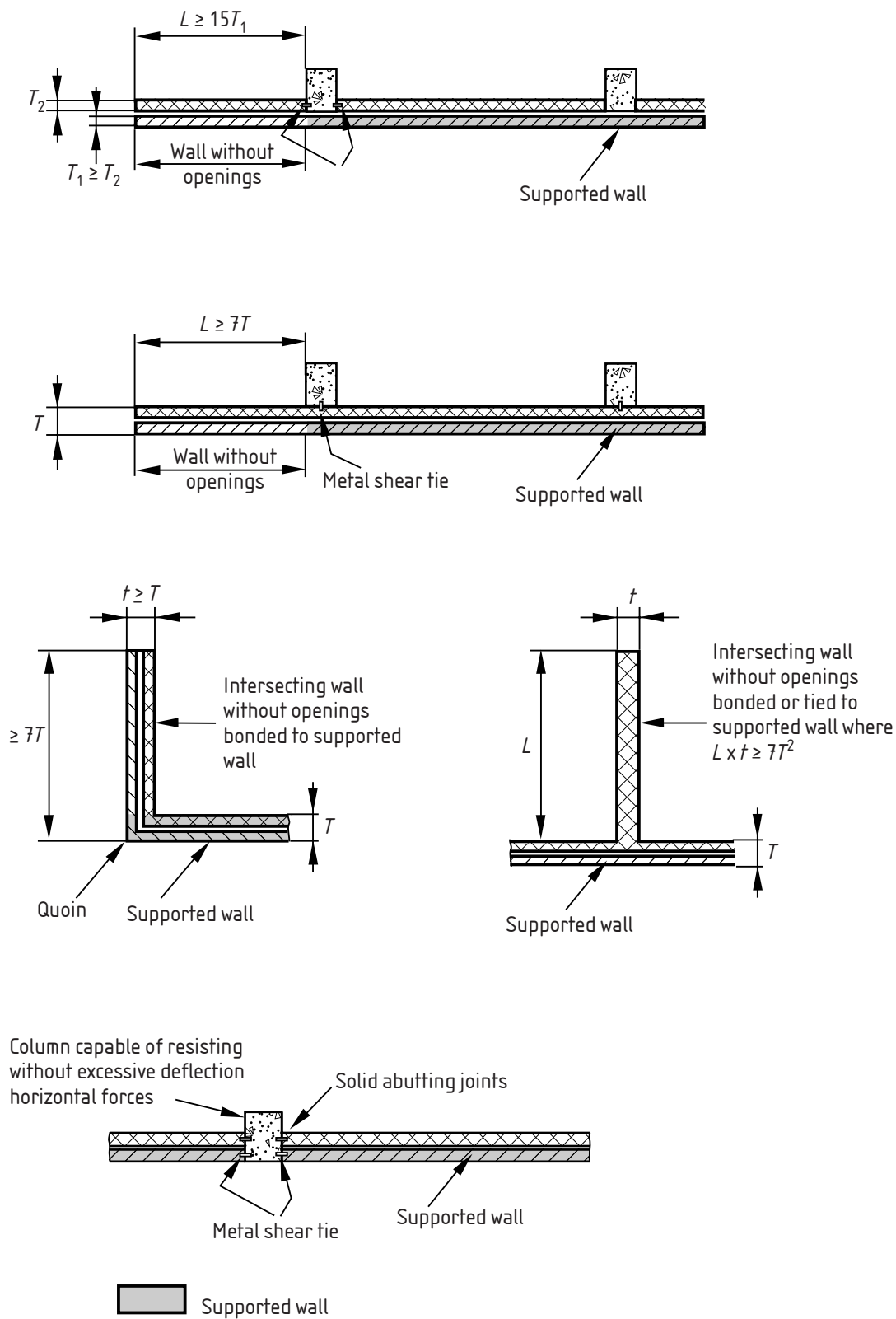


Figure 5 — Fixed support assumed in a cavity wall

5.2.4 Internal walls or partitions not designed for imposed loading

An internal wall or partition should be laterally restrained by horizontal or vertical continuous or intermittent supports (similar to those listed in Table 9), unless it is designed as a free-standing wall (see 5.2.3.1). The length or height of the wall in relation to its thickness should be within the limits given in Figure 6.

The following factors, which affect stability, should be provided for in the design:

- a) accommodation for movement (see 5.4);
- b) presence and position of openings;
- c) presence and position of abutting walls;
- d) chasing (see 5.3.6);
- e) the likelihood of exceptional lateral loading, arising from the nature of the use of the building;
- f) wind load;
- g) any necessary fire resistance.

When an internal wall or partition is to be plastered, a thickness of not more than 13 mm of plaster to one or both sides of the partition should be included when determining the thickness of the wall for design in accordance with Figure 6. Dry lining should not be considered as contributing to the thickness of the wall.

NOTE 1 Until the wall has been plastered it will not have its final strength.

NOTE 2 Figure 6 is derived from the following empirical formulae.

- a) If the wall is restrained at both ends but not at the top then:
 - $t > L/40$ and $t > H/90$ or $t > H/15$ with no restriction on the value of L ; or
 - $t < L/40$ and $t > L/59$ and $t > (H + 2L)/133$.
- b) If the wall is restrained at both ends and at the top then:
 - $t > L/40$ and $t > H/90$ or $t > H/30$ with no restriction on the value of L ; or
 - $t < L/40$ and $t > L/110$ and $t > (3H + L)/200$.
- c) If the wall is restrained at the top but not at the ends then $t > H/30$;

where

t	is the effective thickness, i.e. the thickness of a wall, pier or column assumed in calculating the slenderness ratio, in millimetres (mm);
H	is the height in millimetres (mm);
L	is the length in millimetres (mm).

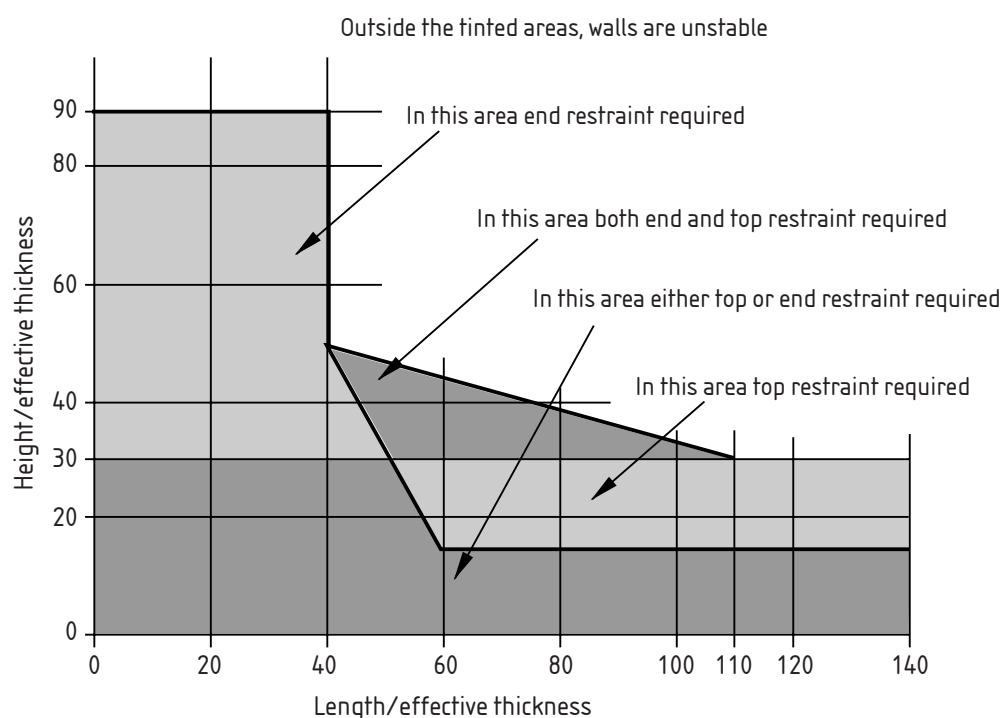


Figure 6 — Limiting dimensions of walls for stability

5.2.5 Adhesion of mortar

In any masonry construction, there should be adequate adhesion between the masonry units and the mortar.

Where the design relies on flexural strength and no guidance is given in BS 5628-1 on the adhesion characteristics of the particular masonry units and mortar strength class, the adhesion should pass the preliminary tests described in BS 5628-1:2005, A.1.

5.3 Structural detailing for stability

5.3.1 General

Structural interactions of walls, floors and roofs as discussed in 5.2.1 depend upon detailing of bearing, strapping and tying and any other connections of the various elements of the structure. (See Figure 7, Figure 8, Figure 9, Figure 10, Figure 11, Figure 12 and Figure 13 for typical connections and their locations.) In the particular case of low-rise buildings, reference should be made to BS 8103.

In Figure 7, the encircled numbers labelling a feature refer to the figure showing the feature in more detail. Where more than one type of restraint system is given at an element intersection, only one of the options should be used.

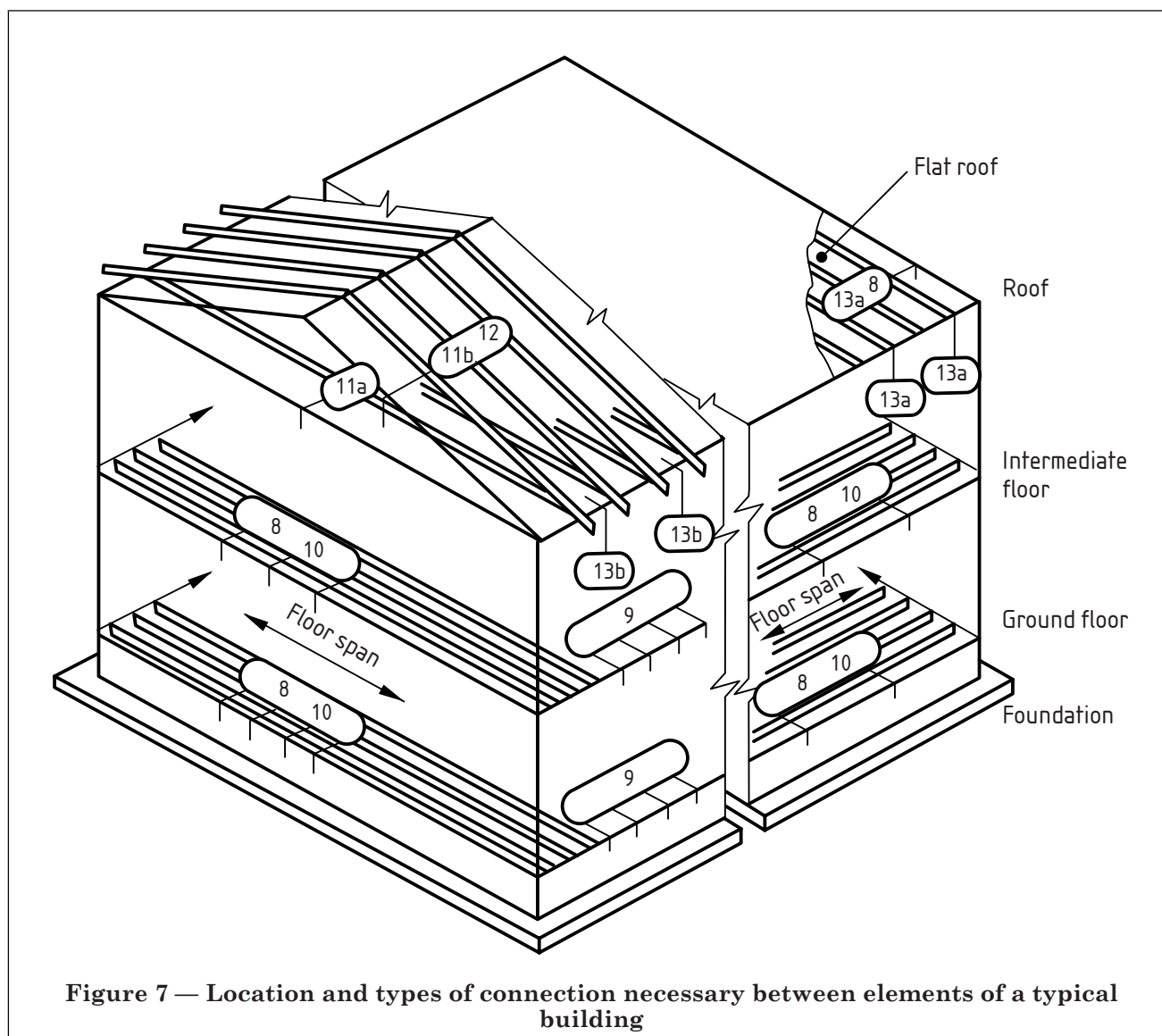


Figure 7 — Location and types of connection necessary between elements of a typical building

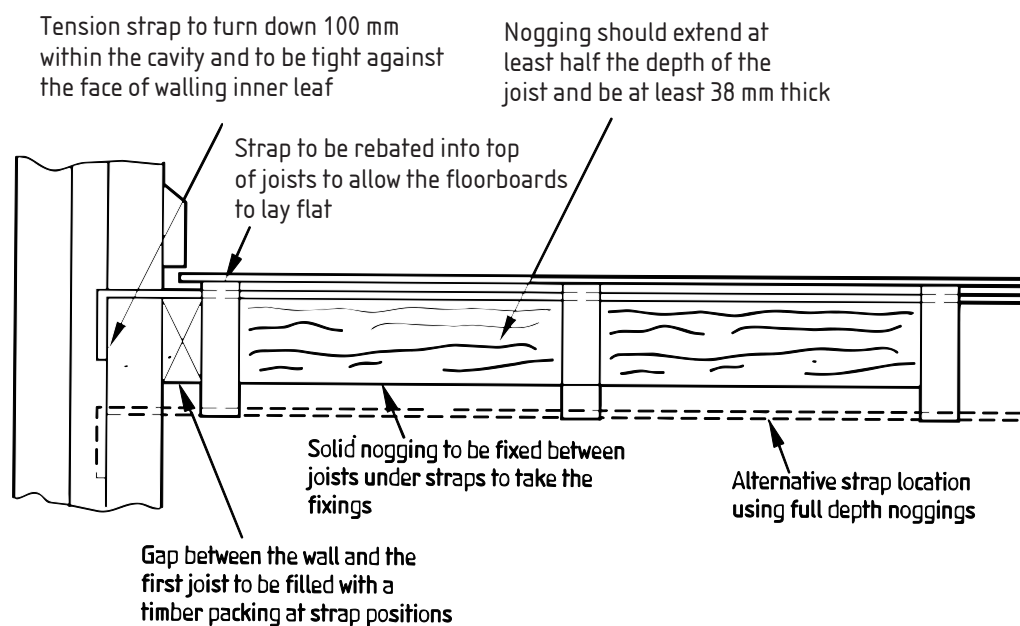
5.3.2 Floors

Typical ways of connecting floors with walls are shown in Figure 8, Figure 9 and Figure 10. Where floors are required to provide lateral restraint, the recommendations of BS 5628-1:2005, Annex D, or BS 8103 should be followed.

Where practicable, suspended timber floors near to the ground should be supported independently of the main structure by sleeper walls. Where this is not practicable, offsets or corbels from external walls may be used. Suspended timber floors at other levels should be built into the walls or supported by offsets, corbels or joist hangers. Timber wall plates should not be built into any wall.

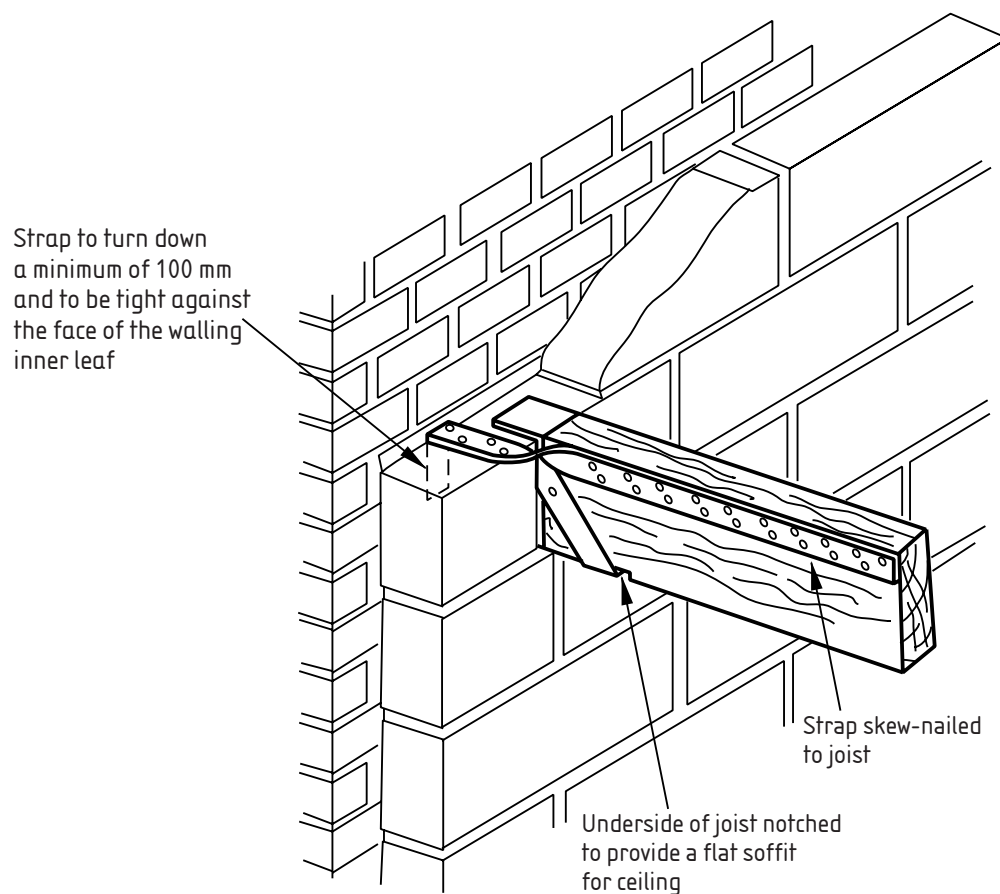
Unreinforced concrete floors laid on the ground, or on fill, should not also bear on walls as this can give rise to cracking as a result of differential movement.

The bearing of all types of floor and support fittings should be not less than 75 mm. Concrete floors should have a bearing of not less than 90 mm, however, this bearing may be reduced at the discretion of the designer provided relevant factors such as loading, span, tolerances, height of support and the provision of continuity reinforcement should be taken into account.



NOTE The tension strap should be carried over at least three joists and be secured with four fixings of which at least one should be in the third joist, or in a nogging beyond the third joint.

Figure 8 — Timber floor spanning parallel with a wall



a) Timber floor supported on standard joist hanger

Figure 9 — Alternative methods of supporting floor joists and providing restraint