

Code of practice for 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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- Autoclaved Aerated Concrete Products Association
- Brick Development Association
- British Ceramic Research Ltd.
- British Masonry Society
- British Precast Concrete Federation
- Construction Confederation
- Concrete Block Association
- Department of the Environment, Transport and the Regions represented by the Building Research Establishment
- Department of the Environment, Transport and the Regions Construction Services Directorate
- Institution of Civil Engineers
- Institution of Structural Engineers
- National House Building Council
- Royal Institution of British Architects

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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 It supersedes BS 5628-3:1985 and BS 5390, which are withdrawn.

This edition of BS 5628-3 is a full revision of the standard.

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 Annex B, Annex C, Annex D and Annex E are informative.

Annex A to this standard repeats the content of BS 8000-3 in order to provide designers with the recommendations for basic workmanship necessary in order to achieve the design recommendations of this standard.

At the time of publication of BS 5628-3:2001, “ordinary” European Standard specifications (ENs) for masonry products have not yet been published as British Standards. (Some have, however, been ratified by CEN.) In addition the ENs do not contain the necessary content for them to be considered as harmonized European Standards. The conversion process from ENs to harmonized ENs is already underway via revision. Because of this incomplete situation this standard makes reference to neither ENs nor harmonized ENs for masonry products. However, it is expected that:

- BS EN 771, the specification for masonry units, will supersede BS 187, BS 3921, BS 6073, BS 6457 and BS 6649;
- BS EN 845, the specification for ancillary components, will supersede BS 1243, BS 5977-2, BS 6178 and DD 140-2;
- BS EN 998, the specification for mortar, will supersede BS 4721 and BS 5838-2.

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, pages i to vi, pages 1 to 123 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 will vary locally according to the type of stone available and traditional practice. 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 normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 12:1996, *Specification for Portland cement*.

BS 146:1996, *Specification for Portland blastfurnace cements*.

BS 187:1978, *Specification for calcium silicate (sandlime and flintlime) bricks*.

BS 476-20, *Fire tests on building materials and structures — Part 20: Method for determination of the fire resistance of elements of construction (general principles)*.

BS 476-21, *Fire tests on building materials and structures — Part 21: Methods for determination of the fire resistance of loadbearing elements of construction*.

BS 476-22, *Fire tests on building materials and structures — Part 22: Methods for determination of the fire resistance of non-loadbearing elements of construction*.

BS 476-23, *Fire tests on building materials and structures — Part 23: Methods for determination of the contribution of components to the fire resistance of a structure*.

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

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

BS 882:1992, *Specification for aggregates from natural sources for concrete*.

BS 890, *Specification for building limes*.

BS 1047, *Specification for air-cooled blastfurnace slag aggregate for use in construction*.

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

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

BS 1197-2, *Specification for concrete flooring tiles and fittings — Part 2: Metric units*.

NOTE BS 1197-2 is obsolescent.

BS 1199 and 1200:1976, *Specifications for building sands from natural sources*.

BS 1243:1978, *Specification for metal ties for cavity wall construction*.

BS 1289-1, *Flue blocks and masonry terminals for gas appliances — Part 1: Specification for precast concrete flue blocks and terminals*.

BS 3148, *Methods of test for water for making concrete (including notes on the suitability of the water)*.

BS 3416:1991, *Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water.*

BS 3797, *Specification for lightweight aggregates for masonry units and structural concrete.*

BS 3837-1, *Expanded polystyrene boards — Part 1: Specification for boards manufactured from expandable beads.*

BS 3837-2, *Expanded polystyrene boards — Part 2: Specification for extruded boards.*

BS 3892, *Pulverized-fuel ash.*

BS 3921:1985, *Specification for clay bricks.*

BS 4027:1996, *Specification for sulfate-resisting Portland cement.*

BS 4721, *Specification for ready-mixed building mortars.*

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 — Part 1: Specification for laminated board for general purposes.*

BS 4887-1, *Mortar admixtures — Part 1: Specification for air-entraining (plasticizing) admixtures.*

BS 5224, *Specification for masonry cement.*

BS 5268-5:1989, *Structural use of timber — Part 5: Code of practice for the preservative treatment of structural timber.*

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

BS 5440-1, *Installation of flues and ventilation for gas appliances of rated input not exceeding 60 kW (1st, 2nd and 3rd family gases) — Part 1: Specification for installation of flues.*

BS 5493:1977, *Code of practice for protective coating of iron and steel structures against corrosion.*

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 5628-1:1992, *Code of practice for use of masonry — Part 1: Structural use of unreinforced masonry.*

BS 5628-2, *Code of practice for use of masonry — Part 2: Structural use of reinforced and prestressed masonry.*

BS 5642-1, *Sills and copings — Part 1: Specification for window sills of precast concrete, cast stone, clayware, slate and natural stone.*

BS 5642-2, *Sills and copings — Part 2: Specification for copings of precast concrete, cast stone, clayware, slate and natural stone.*

BS 5838-2, *Specification for dry packaged cementitious mixes — Part 2: Prepacked mortar mixes.*

BS 5977-2, *Lintels — Part 2: Specification for prefabricated lintels.*

BS 6073-1, *Precast concrete masonry units — Part 1: Specification for precast concrete masonry units.*

BS 6178-1, *Joist hangers — Part 1: Specification for joist hangers for building into masonry walls of domestic dwellings.*

BS 6213, *Selection of construction sealants — Guide.*

BS 6398:1983, *Specification for bitumen damp-proof courses for masonry.*

BS 6399-1, *Loading for buildings — Part 1: Code of practice for dead and imposed loads.*

BS 6399-2, *Loading for buildings — Part 2: Code of practice for wind loads.*

BS 6399-3, *Loading for buildings — Part 3: Code of practice for imposed roof loads.*

BS 6431, *Ceramic floor and wall tiles.*

BS 6457, *Specification for reconstructed stone masonry units.*

- BS 6461-1, *Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) — Part 1: 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 6561, *Specification for zinc alloy sheet and strip for building.*
- BS 6588:1996, *Specification for Portland pulverized-fuel ash cements.*
- BS 6649, *Specification for clay and calcium silicate modular bricks.*
- BS 6676-1, *Thermal insulation of cavity walls using man-made mineral fibre batts (slabs) — Part 1: Specification for man-made mineral fibre batts (slabs).*
- BS 6676-2, *Thermal insulation of cavity walls using man-made mineral fibre batts (slabs) — Part 2: Code of practice for installation of batts (slabs) filling the cavity.*
- BS 6699, *Specification for ground granulated blastfurnace slag for use with Portland cement.*
- 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 7583:1996, *Specification for Portland limestone cement.*
- BS 8000-2, *Workmanship on building sites — Part 2: Code of practice for concrete work.*
- BS 8000-3, *Workmanship on building sites — Part 3: Code of practice for masonry.*
- NOTE For the convenience of users of this standard the text of BS 8000-3 is reproduced here, in Annex A.
- BS 8000-16, *Workmanship on building sites — Part 16: Code of practice for sealing joints in buildings using sealants.*
- BS 8004:1986, *Code of practice for foundations.*
- BS 8103, *Structural design of low-rise buildings.*
- BS 8233:1999, *Sound insulation and noise reduction for buildings — Code of practice.*
- BS EN 485-1, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 1: Technical conditions for inspection and delivery.*
- BS EN 485-2, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 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 573-3, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition.*
- BS EN 573-4, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 4: Forms of products.*
- BS EN 942, *Timber in joinery — General classification of timber quality.*
- BS EN 1304, *Clay roofing tiles for discontinuous laying — Products definitions and specifications.*
- BS EN 1652:1998, *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 10025:1993, *Hot rolled products of non-alloy structural steels — Technical delivery conditions.*
- BS EN 10088-1, *Stainless steels — Part 1: List of stainless steels.*
- BS EN 10111, *Continuously hot-rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions.*
- BS EN 10143:1993, *Continuously hot-dip metal coated steel sheet and strip — Tolerances on dimensions and shape.*

BS EN 12167, *Copper and copper alloys — Profiles and rectangular bar for general purposes.*

BS EN 12588:1999, *Lead and lead alloys — Rolled lead sheet for building purposes.*

BS EN 12878, *Pigments for the colouring of building materials based on cement and/or lime — Specifications and methods of test.*

BS ISO 11600, *Building construction — Sealants — Classification and requirements.*

BS EN ISO 12944, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems.*

BS EN ISO 14713:1999, *Protection against corrosion of iron and steel in structures — Zinc and aluminium coatings — Guidelines.*

DD 140-1, *Wall ties — Part 1: Methods of test for mortar joint and timber frame connections.*

DD 140-2:1987, *Wall ties — Part 2: Recommendations for design of wall ties.*

3 Terms and definitions

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

NOTE Other associated definitions which 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

DPC 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

DPC

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

3.40**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**

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 flat 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**weephole**

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 needs to be taken 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 3921 or BS 6649 for clay bricks;
- BS EN 1806 for clay flue blocks.

4.2.2 Calcium silicate

Calcium silicate masonry units should conform to BS 187 or BS 6649.

4.2.3 Concrete

Concrete masonry units should conform to:

- BS 1289-1 for concrete flue blocks;
- BS 6073-1 for precast concrete masonry units;
- BS 6457 for reconstructed stone masonry units.

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

Cement should conform to:

- BS 12:1996, Class 42.5/32.5 for Portland cement;
- BS 4027:1996, Class 42.5 for sulfate-resisting Portland cement;
- BS 146:1996, Class 42.5/32.5 for Portland blastfurnace cements;

NOTE 1 Only Portland blastfurnace cements in which the ground granulated blastfurnace slag is limited to a maximum of 35 % may be taken as equivalent to Portland cement for use in mortar.

- BS 6588:1996, Class 42.5/32.5 for Portland pulverized-fuel ash cements;

NOTE 2 Only Portland pulverized-fuel ash cements in which the pulverized-fuel ash (fly ash) content is limited to 35 % may be taken as equivalent to Portland cement for use in mortar.

NOTE 3 Both Portland blastfurnace cements and Portland pulverized-fuel ash cements may be produced by weigh batching and blending at a mixer, using cement conforming to BS 12, blastfurnace slag to BS 6699 or pulverized fuel ash to BS 3892.

- BS 7583:1996, Class 42.5/32.5 for Portland limestone cement;
- BS 5224 for masonry cement.

4.3.2 *Limes*

Limes should conform to BS 890.

4.3.3 *Sand and aggregates*

4.3.3.1 *Natural aggregates*

Aggregates from natural sources should conform to:

- BS 1199 and 1200 for aggregates for mortar;
- BS 882 for aggregates for concrete.

4.3.3.2 *Lightweight aggregates*

Lightweight aggregates should conform to BS 3797.

4.3.4 *Pre-mixed mortars*

4.3.4.1 *Ready-mixed lime:sand for mortar*

Ready-mixed lime:sand for gauging with cement should conform to BS 4721.

4.3.4.2 *Retarded ready-to-use mortars*

Ready-to-use retarded cement:lime:sand and cement:sand mortars should conform to BS 4721.

NOTE 1 As used here, “sand” includes all recommended aggregates.

NOTE 2 Ready-to-use building mortars are factory made mortars which contain cement set-retarding admixtures. No further treatment is necessary before use.

4.3.4.3 *Dry pre-packed cementitious mortar mixes*

Dry pre-packed cementitious mortar mixes should conform to BS 5838-2.

4.3.5 *Admixtures and additions*

4.3.5.1 *Mortar plasticizers*

Mortar plasticizers should conform to BS 4887-1.

NOTE For guidance on use see 5.7.1.3 and BS 8000-2.

4.3.5.2 *Colouring pigments*

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

4.3.6 *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 3148.

4.4 *Cavity wall ties*

Cavity wall ties should conform to BS 1243 or DD 140-1. For guidance on the selection and use of cavity wall ties see Table 1 for corrosion resistance and 5.3.5.

4.5 Metal support and restraint components

4.5.1 General

Materials that should be used for support and restraint components (such as angles, brackets, anchorages, dowels and fixings, including bonding ties, joist hangers and lateral restraint straps) are given in Table 1.

In selecting metal support and restraint component materials, Table 1, 5.6.7.1 and Table 2 should be considered together.

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 — Materials for metal support and restraint components and recommended protection levels

Durability category	Base material	Form	Grade and standard that should be conformed to	Protective measures to be carried out after fabrication
A	Hot-dip galvanized low carbon steel	Sheet	BS EN 10143:1993, Z1 or Z2, coating type G 600. Minimum mass of coating 600 g/m ² including both sides	All external cut edges to be protected using a one-pack chemical resistant paint conforming to HF1A to HF2F in part 4 of Table 4H of BS 5493:1977 and modified to give adequate adhesion to the fixing. ^a
			BS EN 10143:1993, Z1 or Z2, coating type G 275. Minimum mass of coating 275 g/m ² including both sides	Coating to be applied after fabrication to the external surfaces and consisting of either: a) solution conforming to types 1 or 2 of BS 3416:1991 and of minimum thickness 25 µm; or b) a one-pack chemical resistant paint conforming to HF1A to HF2F in part 4 of Table 4H of BS 5493:1977 and modified to give adequate adhesion to the fixing. ^a Where the zinc is removed on internal surfaces during fabrication, e.g. by welding, further protection should be applied to these areas.
B	Low carbon steel	Strip	BS EN 10111	Post-galvanizing conforming to BS EN ISO 1461. Minimum mass of coating of 920 g/m ² including both sides, i.e. 460 g/m ² on any surface.
			BS EN 10025:1993 grade S275J0	
C	Low carbon steel	Strip	BS EN 10111	Post-galvanizing conforming to BS EN ISO 1461. Minimum mass of coating of 1 880 g/m ² including both sides, i.e. 940 g/m ² on any surface.
			BS EN 10025:1993 grade S275J0	

^a BS 5493:1977 has been proposed for obsolescence and has been partially replaced by BS EN ISO 12944 and BS EN ISO 14713.

Table 1 — Materials for metal support and restraint components and recommended protection levels (*concluded*)

Durability category	Base material	Form	Grade and standard that should be conformed to	Protective measures to be carried out after fabrication
D	Copper alloys	—	BS EN 1172 BS EN 12167	Material other than phosphor bronze to be formed either: a) by bending at dull red heat and allowing to cool in still air; or b) by cold forming and subsequently stress relief annealing at 250 °C to 300 °C for 30 min to 1 h. Effectiveness of stress relieving of cold formed components to be tested by the supplier using the mercurous nitrate test described in BS EN ISO 196.
	Austenitic stainless steel minimum 18/8 composition and excluding free machining specifications	Strip, bar, rod, tube or wire	BS EN 10088-1	—
E	Austenitic stainless steel minimum 18/8 composition and excluding free machining specifications (molybdenum chrome nickel alloys only)	Strip, bar, rod, tube, wire	BS EN 10088-1	—

Table 2 — Protection of metal support and restraint components (including wall ties) built into masonry

Type of component	Situation	Durability category of exposure given in Table 1 (materials and recommended protection)		
		For buildings not exceeding three storeys	For buildings exceeding three storeys	For buildings located in an aggressive environment (e.g. coastal sites)
Sliding anchors, anchorages, bonding ties, shear ties, brick slip ties, continuous support angles, support brackets and cavity wall ties	In contact with, or embedded in, an internal wall only	All categories		
	In contact with, or embedded in, an inner leaf of an external cavity wall	C, D or E	D or E	E
	In contact with, or embedded in, an outer leaf of an external cavity wall or a single-leaf external wall			
Dowels and restraint straps, joist hangers and reinforcement for non-structural use	In contact with, or embedded in, an internal wall only	All categories		
	In contact with, or embedded in, an inner leaf of an external cavity wall	A, B, C, D or E	A, B, C, D or E	E
	In contact with, or embedded in, an outer leaf of an external cavity wall or a single-leaf external wall	C, D or E	D or E	E
Lintels installed with or without a DPC tray	All situations	As specified in BS 5977-2 for the appropriate type of lintel (i.e. installed with or without a DPC tray)	Not normally applicable. If used special conditions may be necessary	

4.5.2 Joist hangers

Joist hangers for vertical support only should conform to BS 6178-1.

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**).

4.7 Damp-proof courses (DPCs), including cavity trays

Materials for DPCs and cavity trays should conform to:

- BS 6398 for bitumen;
- BS 3921 and BS 743 for damp-proof course bricks;
- BS 6515 for polyethylene;
- BS 743 for all others.

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

NOTE The suitability criteria for materials for DPCs are set out in **5.5.5** and Table 3.

Table 3 — Physical properties and performance of materials for DPCs

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other considerations
			Upward	Downward			
(A) Flexible (continued)							
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 to BS EN 1172:1997, 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 DPC 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	—					
^a Code number 4 in BS 743:1970.							

Table 3 — Physical properties and performance of materials for DPCs *(continued)*

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other considerations
			Upward	Downward			
(A) Flexible (concluded)							
Polyethylene, low density (0.915 g/cm ³ to 0.925 g/cm ³) complying with BS 6515	Approximately 0.5	0.46	Seal with double-sided adhesive tape	Welted	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 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 3 — Physical properties and performance of materials for DPCs (*concluded*)

Material	Minimum mass kg/m ²	Minimum thickness mm	Joint treatment to prevent water moving		Liability to extrusion	Durability	Other considerations
			Upward	Downward			
(C) Rigid							
DPC bricks of Designation 1 or 2 conforming to BS 3921:1985	—	Two courses, laid to break joint, bedded in 1:3 Portland cement: sand	No joint problems	Not suitable	—	No deterioration	Particularly appropriate where DPC is required to transmit tension, e.g. in freestanding walls. DPC Designation 1 bricks are required for buildings. DPC Designation 1 or 2 may be used in external works
Slate conforming to BS 743 and most granites	—	Two courses, laid to break joint, bedded in 1:3 Portland cement: sand	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 or 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 4.

NOTE For guidance on DPCs below sills, see 5.5.7.6.

Table 4 — Sill materials

Material	Standard that should be complied with
Brick and block	BS 187, BS 3921 or BS 6073-1 and BS 4729
Cast stone	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, BS EN 942 and BS 5642-1

4.11 Lintels

Lintels should conform to the appropriate British Standard given in Table 5.

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

Table 5 — Lintels

Material	Standard that should be complied with
Autoclaved aerated concrete	BS 5977-2
Cast concrete	
Reinforced concrete	
Prestressed concrete	
Pressed steel	BS 5977-2
Rolled low carbon steel	
Reinforced masonry	BS 5628-2
Timber	BS 5977-2

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 given in Table 6.

NOTE 1 For guidance on the design of and the need for DPCs below copings, see 5.5.7.13.

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

Table 6 — Copings

Material	Standard that should be complied with	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 187, BS 3921 or BS 6073-1 and BS 4729	—
Cast stone	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 6561	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 7 — Flashings and weatherings

Material	Standard that should be complied with	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 materials

Insulation materials should conform to the relevant British Standard given in Table 8.

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

Table 8 — Insulation materials

Insulation material	British Standard	Code of practice for installation
(A) For installation during construction of masonry to fill the cavity partially		
Mineral wool slabs (glass or rock fibre)	—	—
Expanded polystyrene bead boards	BS 3837-1	—
Extruded expanded polystyrene boards	BS 3837-2	—
Polyurethane (PUR) boards	BS 4841-1	—
Polyisocyanurate (PIR) boards	BS 4841-1	—
Foamed glass slabs	—	—
(B) For installation during construction of masonry to fill the cavity fully		
Mineral wool insulation slabs (glass or rock fibre)	BS 6676-1	BS 6676-2
(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 Loading

The dead, imposed and wind loads to be allowed for during the structural design of masonry should be in accordance with BS 6399-1, -2 and -3.

5.1.3 Foundations

The design of foundations should be in accordance with the recommendations of BS 8004:1986.

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 9, 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 9, 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 5.3.3) 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 Designation (iii) (see Table 14).

Table 9 — Maximum permitted areas of certain types of wall in square metres (m²)

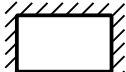
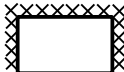
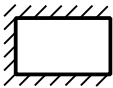
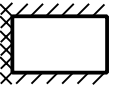
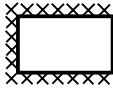
Wind zone	Height m	Category and type of wall					
							
		A		B		C	
		Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall	Cavity wall	190 mm solid wall
1	5.4	11.0	13.5	17.5	19.0	26.5	28.5
	10.8	9.0	11.5	13.0	15.5	17.5	21.5
2	5.4	9.5	12.0	14.0	17.0	21.0	24.0
	10.8	8.0	9.5	11.5	14.0	13.5	17.5
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
Wind zone	Height m	Category and type of wall					
							
		D		E		F	
		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 9 — Maximum permitted areas of certain types of wall in square metres (m²) (concluded)

Wind zone	Height m	Category and type of wall					
							
		G		H		I	
		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	6.0	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.



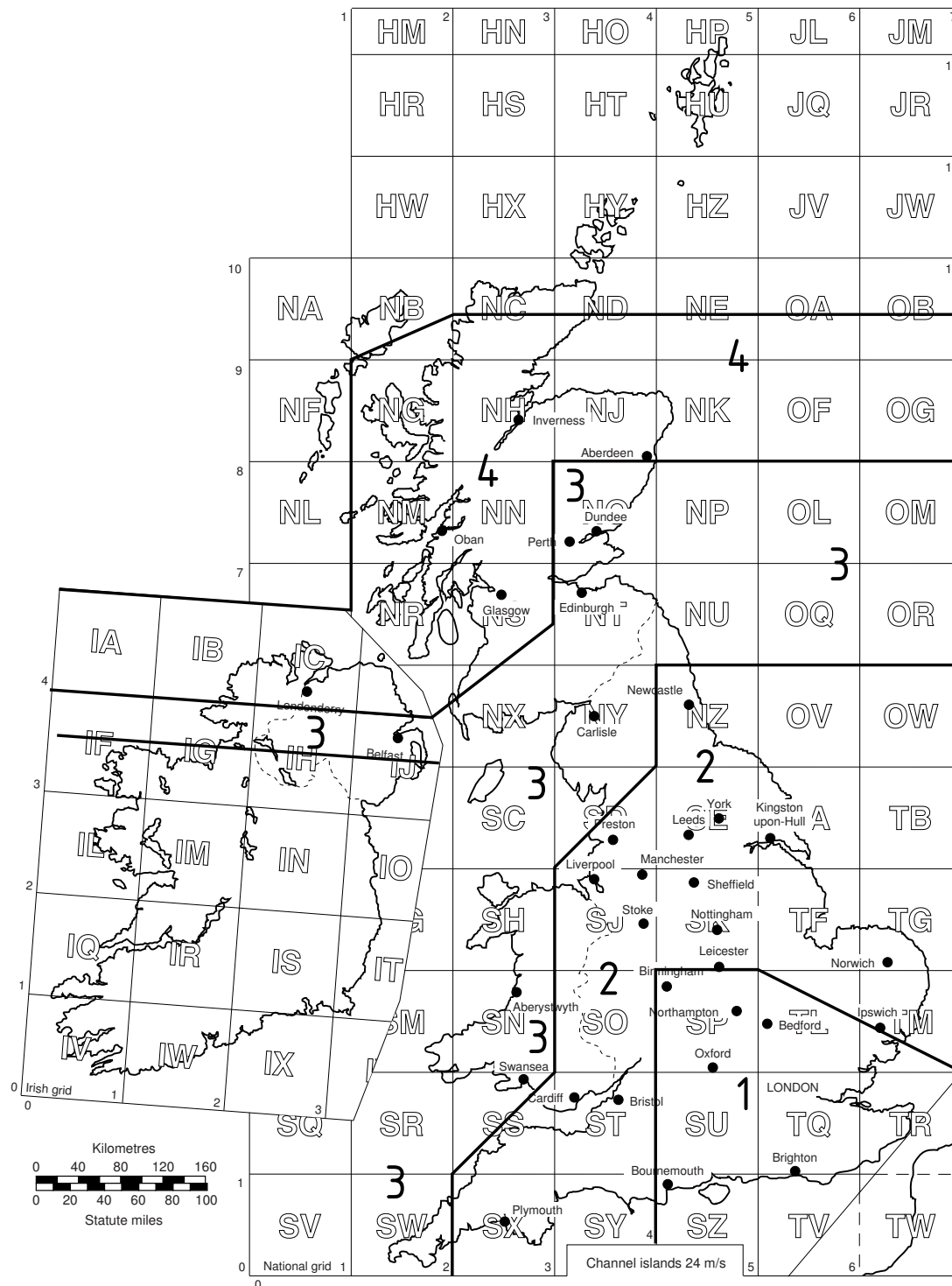
NOTE 2 The term “solid” is used in this table to denote single-leaf walls, collar-jointed walls (see 3.14) or grouted reinforced cavity walls. The 190 mm solid walls are of any brick, or blocks of compressive strength not less than 3.5 N/mm².

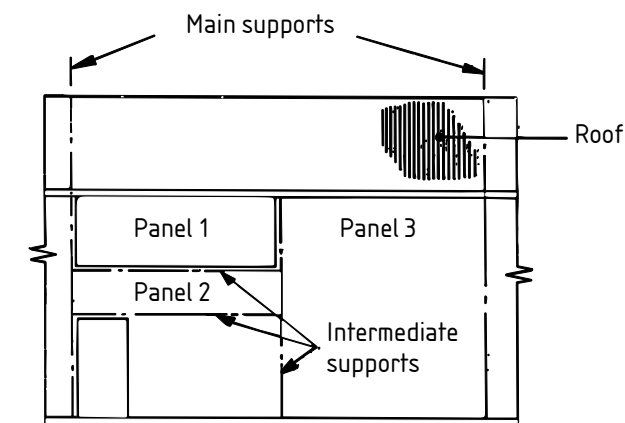
NOTE 3 Cavity walls consist of:

a) an outer leaf, 100 mm minimum in thickness, of any brick, or blocks of compressive strength not less than 14.0 N/mm²;

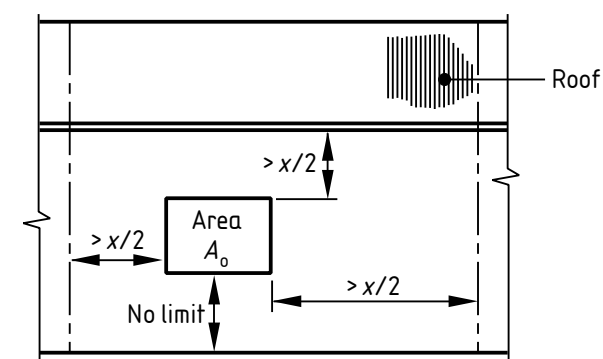
b) an inner leaf, 100 mm minimum in thickness, of any brick, or blocks of compressive strength not less than 3.5 N/mm².

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 %.





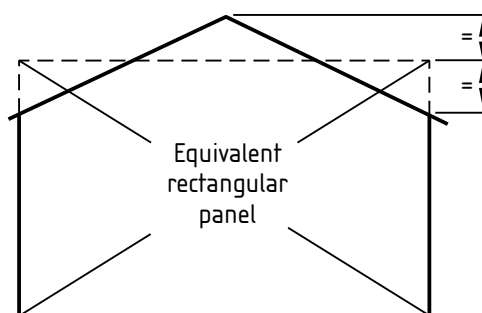
a) Example of division of a wall into panels with intermediate supports



b) Effect of opening in a wall where

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

A_0 is the permitted area of opening

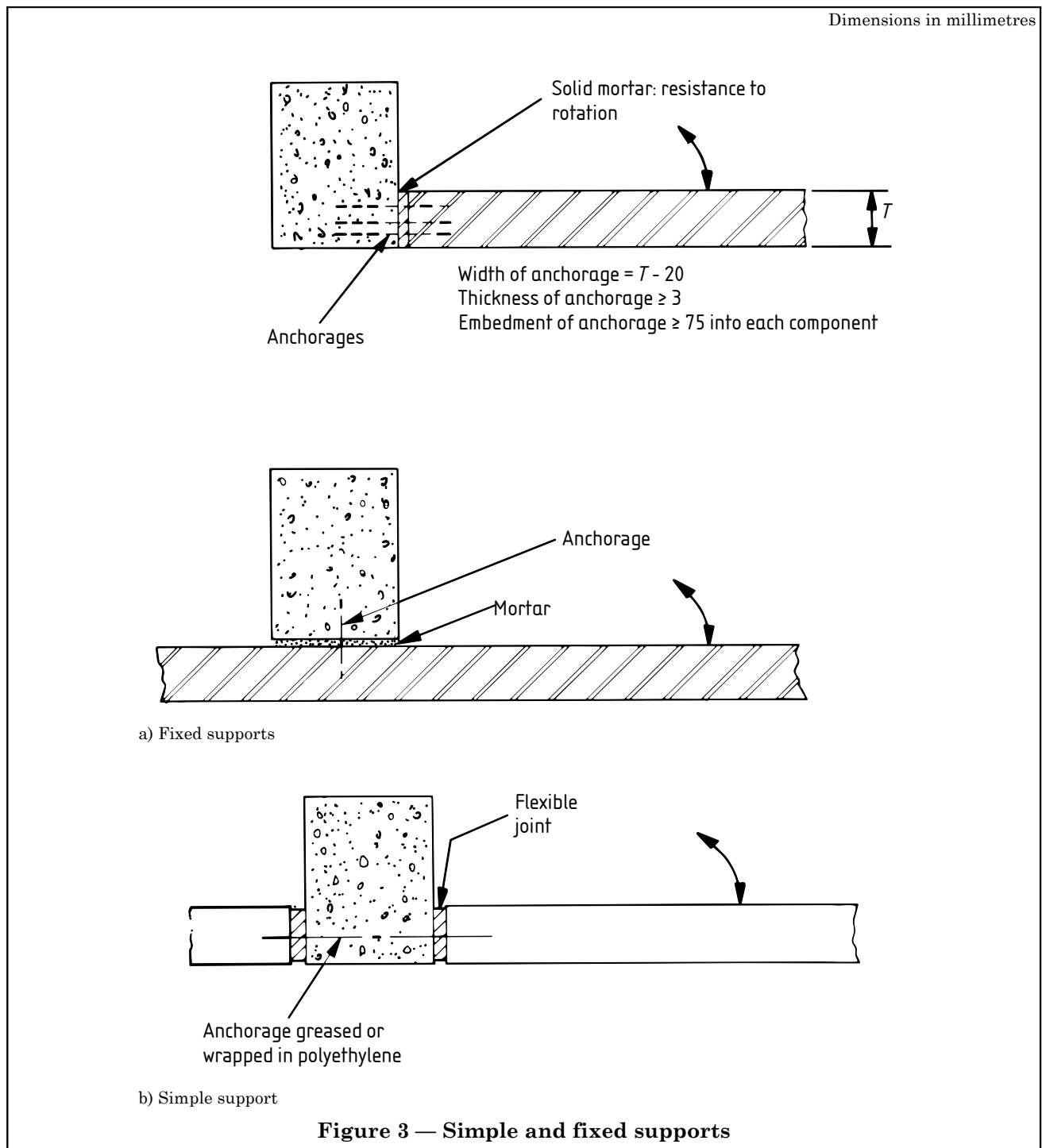


c) Gable walls

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.



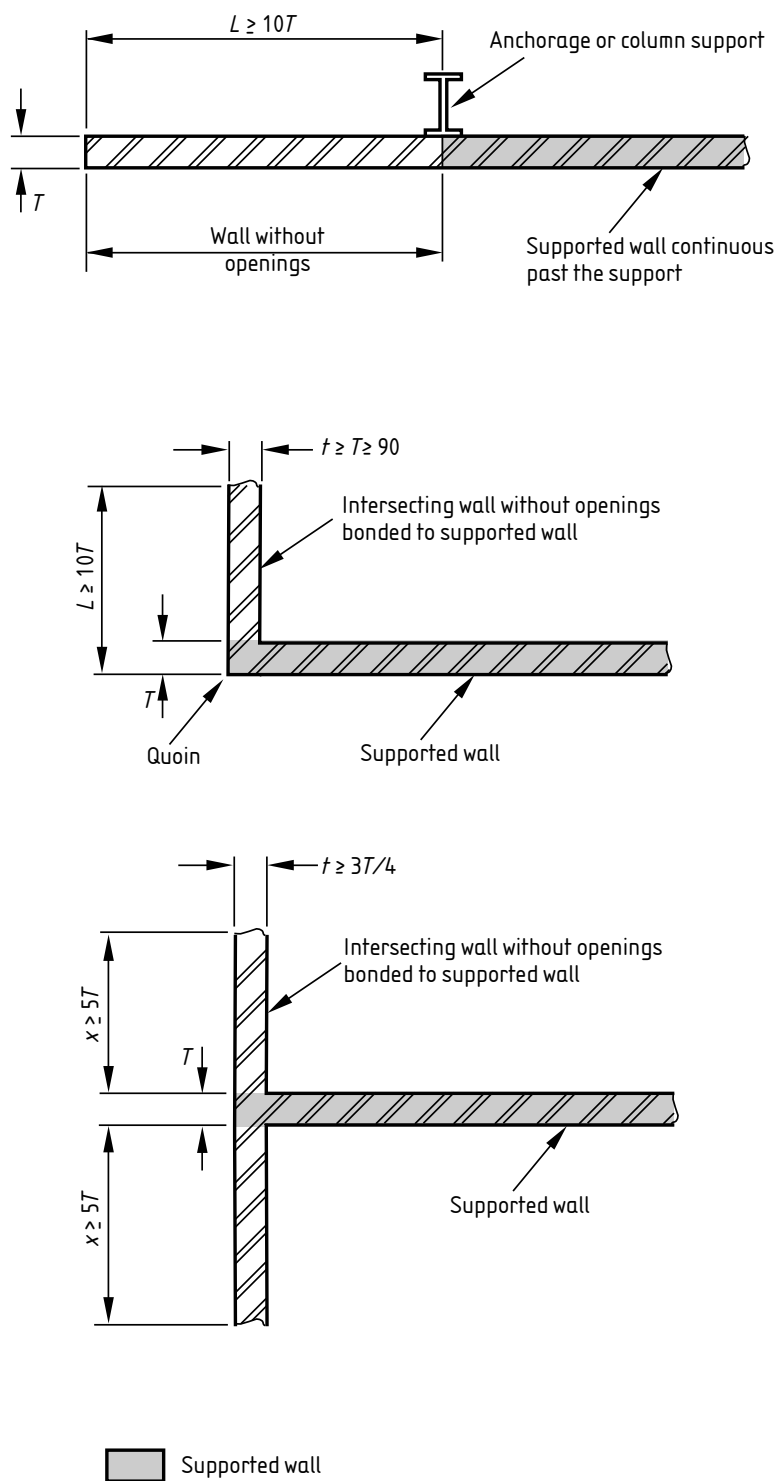


Figure 4 — Fixed support assumed in a single-leaf, collar joint or grouted-cavity wall

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).

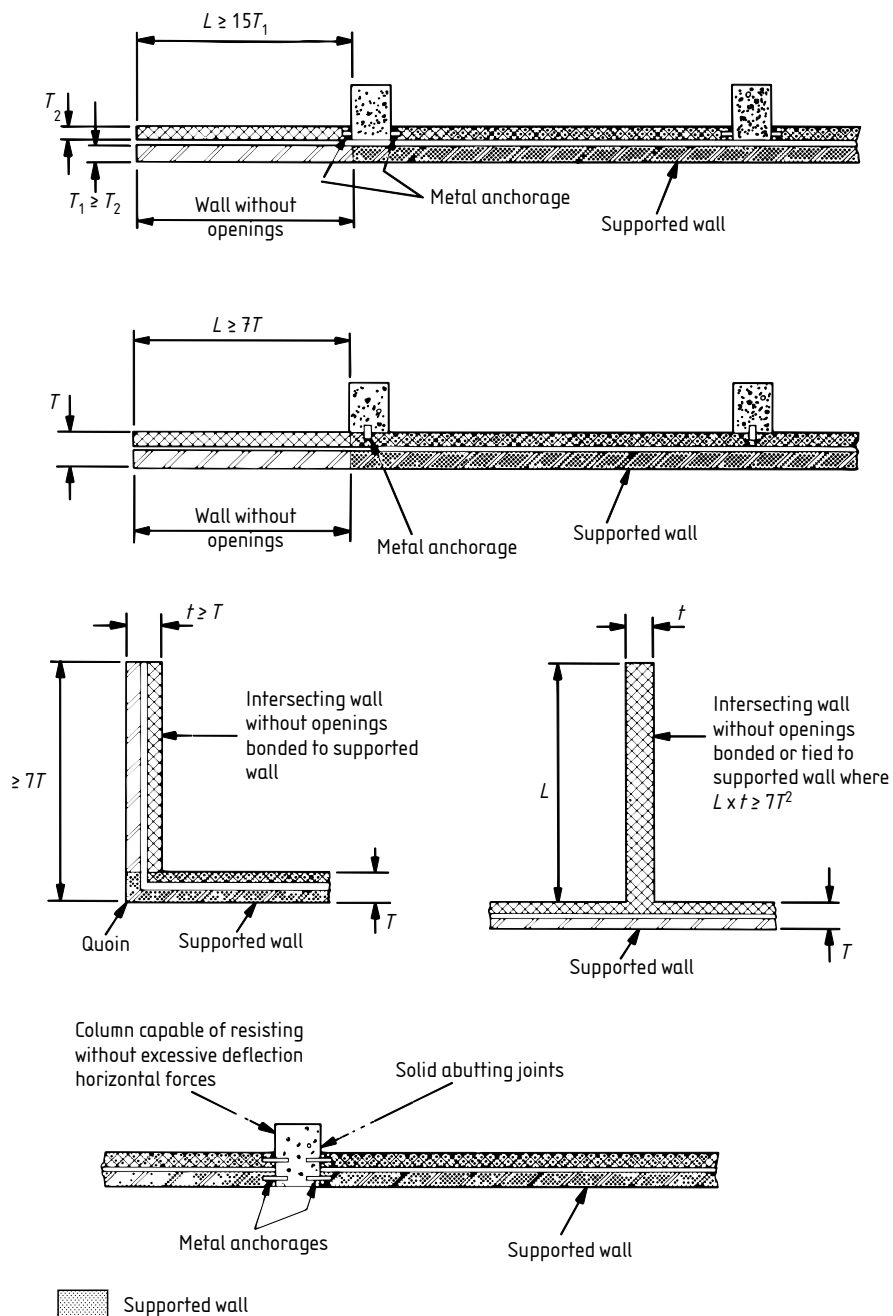


Figure 5 — Fixed support assumed in a cavity wall

5.2.3.3 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 given 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).

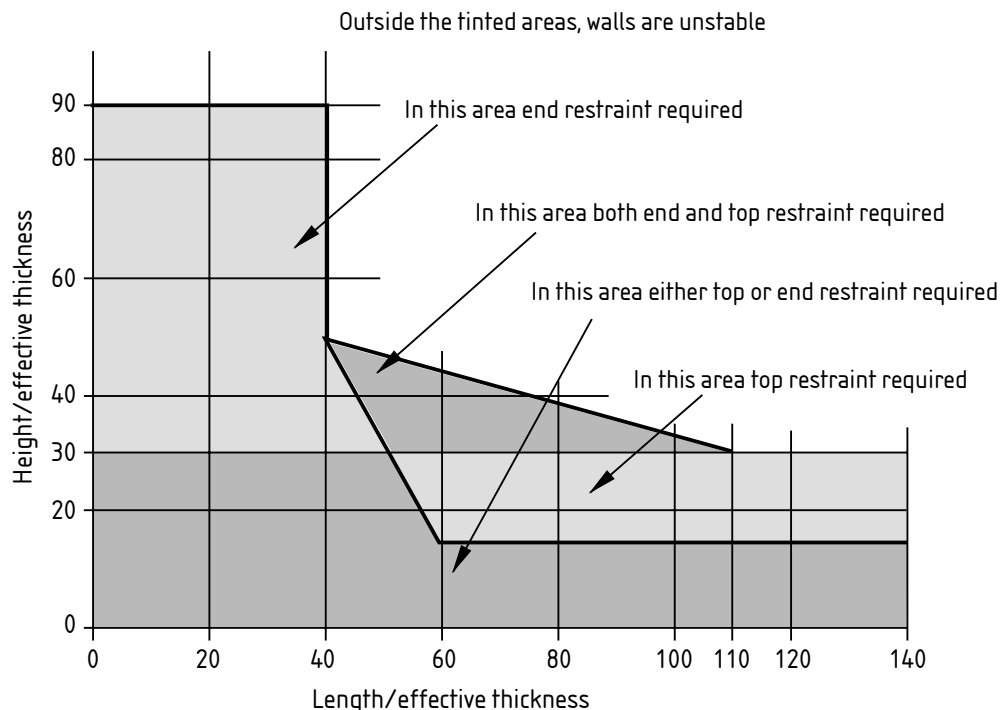


Figure 6 — Limiting dimensions of walls for stability

5.2.4 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 Designations, the adhesion should pass the preliminary tests as described in BS 5628-1.

5.3 Structural detailing for stability

5.3.1 General

Structural interactions of walls, floors and roofs as described 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 BS 8103 should be referred to.

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.