
British Standard

Structural design of low-rise buildings

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

Elaboration des plans de construction des constructions de faible hauteur
Partie 1. Code de bonne pratique relatif à la stabilité des sols, à la reconnaissance
du terrain, aux fondations et aux dalles de rez-de-chaussée

Bauliche Durchbildung von Wohngebäuden mit geringer Geschoßzahl
Teil 1. Leitfaden für Standsicherheit, Baugrunduntersuchung, Fundamentierung
und Grobgeschoßplatten für den Wohnungsbau

Foreword

This Part of BS 8103 has been prepared under the direction of the Civil Engineering and Building Structures Standards Committee.

A large proportion of the national building programme is concerned with new housing and alterations in both the public and private sectors where traditional methods of construction are used for the majority of houses and it is to these that this code is applicable.

However, when such dwellings are certified by organizations such as The National House Building Council reference should in addition be made to the appropriate documents published by these bodies.

BS 8103 is being prepared in four Parts:

- Part 1. Code of practice for stability, site investigation, foundations and ground floor slabs for housing
- Part 2.* Code of practice for masonry walls
- Part 3.* Code of practice for timber floors and roofs
- Part 4.* Code of practice for concrete suspended floors

to allow detailed consultation with other BSI Technical Committees responsible for the structural use of materials. However, it is the intention to combine these Parts into a single document in due course.

It is assumed that this code will be used by those with expertise in building construction but not necessarily in structural engineering design. Houses constructed within the limitations stated in the relevant clauses will not require additional specialist advice. For any conditions outside the limitations of this code appropriate specialist advice has to be obtained.

A general list of these limitations is as follows:

- (a) roof: maximum clear span 9.0 m;
- (b) floor: maximum clear span 4.5 m;
- (c) design wind speed: not exceeding 44 m/s (see 4.3);
- (d) no part of wall or roof higher than 15 m above lowest adjacent ground level;
- (e) storey height: maximum 2.7 m;
- (f) maximum clear length of a loadbearing wall between vertical lateral supports of 9.0 m;
- (g) maximum length of any opening in loadbearing walls 3.0 m;
- (h) only strip footings or trench fill foundations in normal ground conditions (see 6.1).

Where foundations other than as in (h) have been designed by suitably qualified persons, the remainder of the building may be constructed in accordance with the relevant clauses of this code.

When using this code, it is important to ensure that the overall stability of the house is achieved, and that the work of any specialist engaged is properly coordinated. The situations included in this code which require the consultation of suitably qualified persons are identified in the clauses to which they relate.

All illustrations in this document only show structural details. Other details, e.g. d.p.cs, are not included.

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

* In preparation.

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Code of practice

1 Scope

This Part of BS 8103 gives recommendations for the structural design of low-rise housing and covers the stability of the house, site investigation and foundations and ground floor slabs used in the construction. Foundations comprising strip footings or trench fill founded in normal ground are the only type described.

Low-rise housing comprises detached, semi-detached and terraced houses of not more than three storeys above ground intended for single family occupancy and of traditional masonry construction with timber roofs and floors of timber or concrete. For the purposes of this code additional habitable accommodation in the roof space constitutes a storey of the house. This code does not include the design of basements, but providing the basement is of one level only and is designed to provide a firm platform at ground level the provisions of this code may apply to the superstructure.

Proprietary housing systems, and houses of timber, steel or concrete framed construction are not covered by this code. The structural design recommendations described in this code are not specifically intended to cover other considerations such as fire resistance, thermal and sound insulation, resistance to damp penetration and durability. Reference should be made to other codes and Statutory Regulations and their supporting technical documents (e.g. BS 5628 : Part 3 and the appropriate Approved Documents to the Building Regulations) for these and other matters.

In using this code the following limitations apply:

- (a) roof: maximum clear span 9.0 m;
- (b) floor: maximum clear span 4.5 m;
- (c) design wind speed: not exceeding 44 m/s (see 4.3);
- (d) no part of wall or roof higher than 15 m above lowest adjacent ground level;
- (e) storey height: maximum 2.7 m;
- (f) maximum clear length of a loadbearing wall between vertical lateral supports of 9.0 m;
- (g) maximum length of any opening in loadbearing walls 3.0 m;
- (h) only strip footings or trench fill foundations in normal ground conditions (see 6.1).

Where foundations other than as in (h) have been designed by suitably qualified persons, the remainder of the building may be constructed in accordance with the relevant clauses of this code.

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

2 Definitions

For the purposes of this Part of BS 8103, the following definitions apply.

2.1 buttress. A section of wall or pier bonded or securely tied to an adjacent wall providing support against lateral forces acting on the wall.

2.2 cavity. The space between two leaves of a cavity wall.

2.3 cavity wall. Two parallel single-leaf walls spaced usually at least 50 mm apart and effectively tied together with wall ties.

2.4 foundation. That part of a structure in direct contact with and transmitting loads to the ground.

2.5 foundation depth. The distance between the finished external ground level and the underside of the concrete in strip footings or trench fill construction.

2.6 ground-supported slab. A concrete slab constructed directly on and supported by the ground to receive material forming or supporting the wearing surface.

2.7 hoggin. An inert natural mixture usually consisting of gravel, sand and clay.

2.8 loadbearing wall. A wall that carries vertical and/or lateral loads in addition to its self weight.

2.9 masonry. An assemblage of structural units that are bonded or solidly put together with mortar.

2.10 nogging. A solid piece of timber between timber members to provide support for an attachment point.

2.11 party wall. A wall between two buildings that is common to both.

2.12 pier. An integral thickened section located in a wall.

2.13 storey height. The underside to underside distance between floors or between a floor and roof or in the case of a ground storey the distance between the top of the ground floor and the underside of the floor above.

2.14 strip footing. A bed of concrete laid in the bottom of a trench, its thickness being less than its width, that forms a strip foundation to carry a masonry wall.

2.15 trench fill. A deep bed of concrete filling a trench that forms a strip foundation to carry a masonry wall.

3 Symbols

For the purposes of this Part of BS 8103, the following symbols apply.

- w_1 width of wall to main building
- w_2 width of wall to wing or annexe
- d depth of fill material
- h_1 overall height of wall for the main building
- h_2 overall height of wall for the wing or annexe
- b length of wall to main building
- p_{sf} projection of strip footing beyond face of supported wall
- s step height in foundations
- t overall thickness of wall
- t_1 thickness of leaf 1 of cavity wall
- t_2 thickness of leaf 2 of cavity wall

t_{sf} thickness of strip footing
 t_{tf} thickness of trench fill
 w_{sf} width of strip foundation
 l length of wall to wing or annexe

4 Stability and connections between elements

4.1 Stability considerations

This Part of BS 8103 together with BS 8103 : Parts 2*, 3* and 4* (when published) gives guidance on the sizing of individual elements of a house: foundations, walls, floors and roof in relation to the forces acting on them due to dead and imposed loading. In order to provide overall stability of the structure in relation to any likely loading condition it is essential for these elements to be properly joined together. When considering the plan form of the building it is essential that the external walls interact to form the sides of a rigid box completed by the floors and roof as illustrated in figure 1 for the ground floor. In these forms of construction bracing in the planes of the roof is a necessary contribution to the overall stability.

Internal masonry walls should be connected so as to interact with external walls and brace the structure. Internal lightweight partitions should also be connected so that they contribute to the overall stability but they should be discounted in the design of the masonry. The connections between structural elements described in 4.4 should be used as required to ensure that the elements of the box interact fully so as to transfer and share loads placed on one element with other elements.

It is particularly important to ensure that wind loads are transferred to buttress walls, piers and chimneys.

In the situation illustrated in figure 2 with the force derived from wind action at right angles to the gable, the gable in isolation is extremely vulnerable. The front and rear walls in combination with the floor offer substantial lateral support provided that the wind forces from the top of the gable can be transferred to them. A braced roof, if adequately connected, will laterally restrain the top of the gable and transfer the loads to the front and rear walls.

Likewise the front and rear walls depend upon the lateral support provided by the floors and roof connected to the gable walls.

No house should be expected to be totally resistant to the excessive forces that may arise due to extreme causes such as earth tremors, explosion or impact by vehicles. Provided that the design procedures recommended in this code are correctly followed, particularly the recommendations for connections between elements, then the effects of the excessive forces should be minimized if they occur.

4.2 Dimensional limits to ensure stability

4.2.1 Ground levels either side of walls. Where a wall is subjected to a lateral load from retained material due to a difference in levels on opposite sides, the difference in level above fully compacted backfill should not exceed four times the wall thickness as shown in figure 3. Figure 3(b) does not apply to free-standing retaining walls.

4.2.2 Shape. For stability against wind forces, the ratio of building dimensions should not exceed the values shown in figure 4.

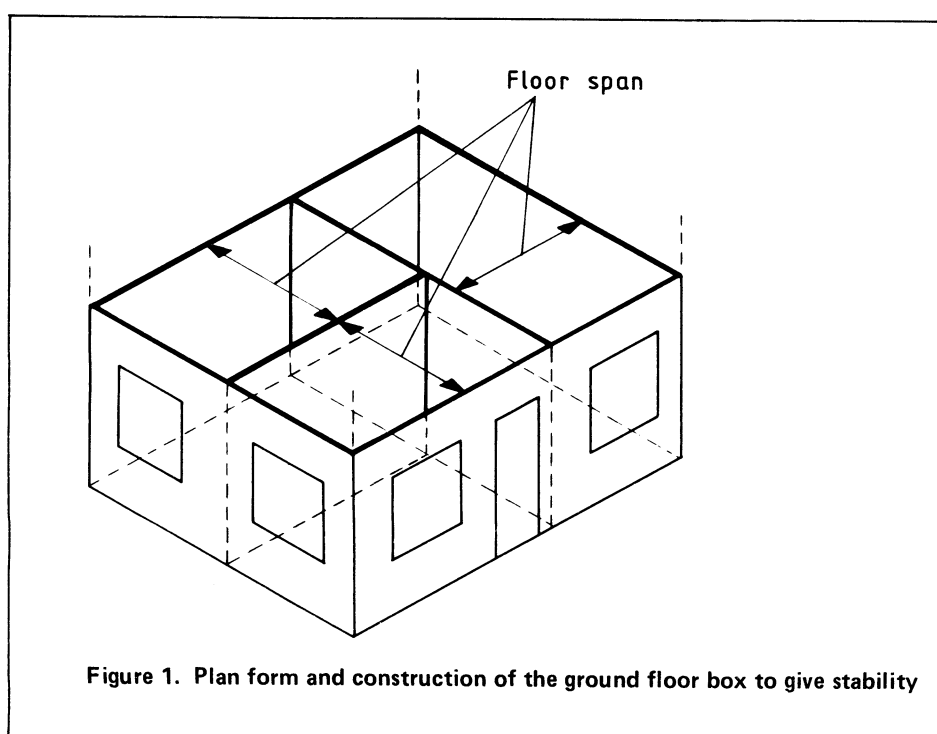
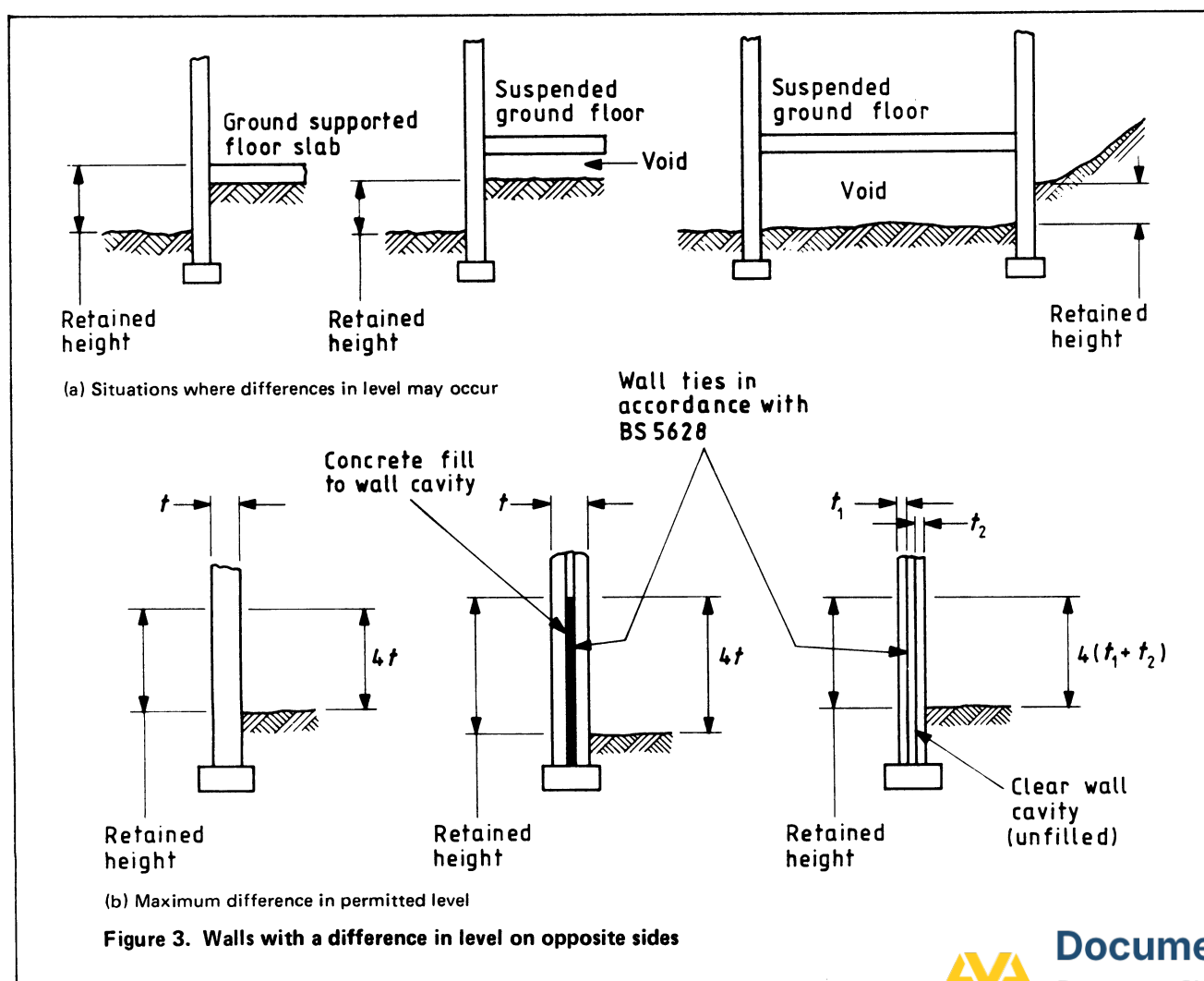
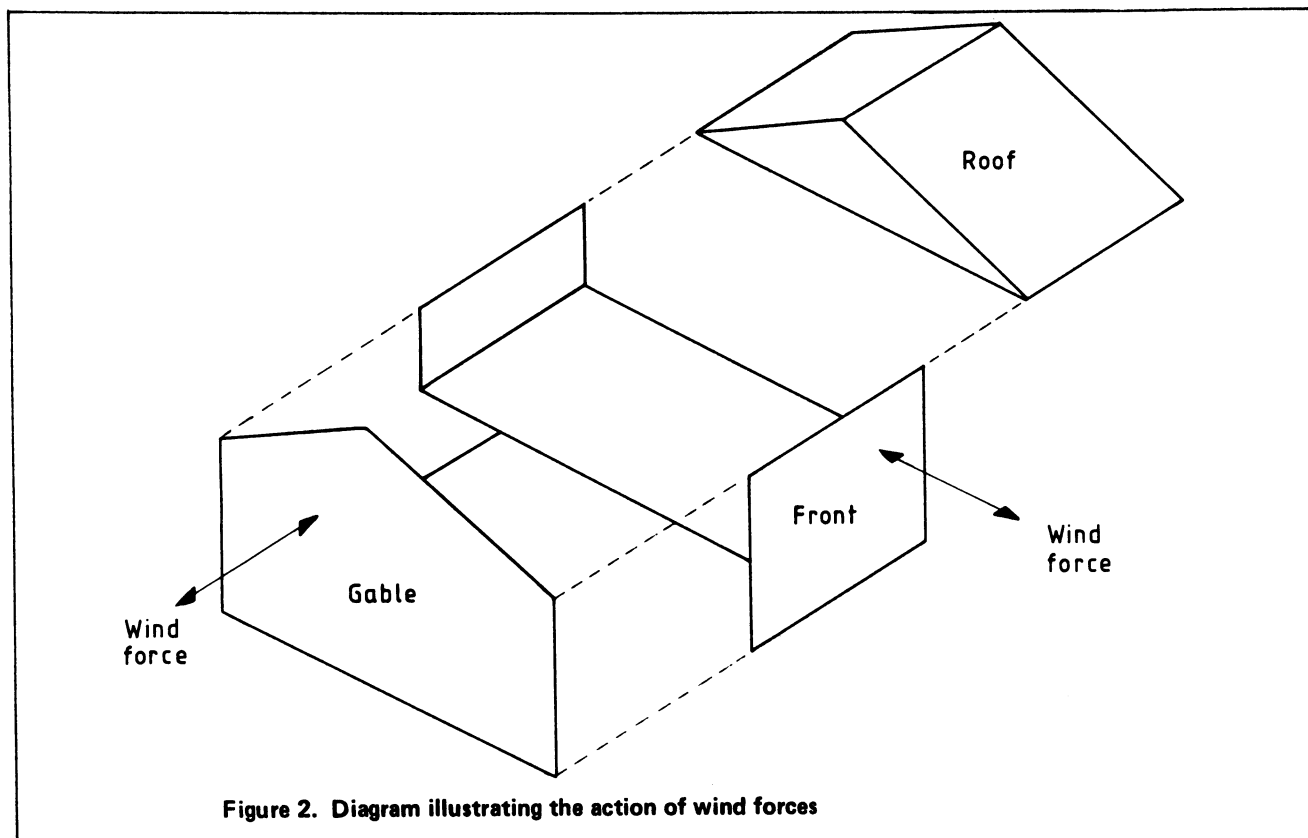
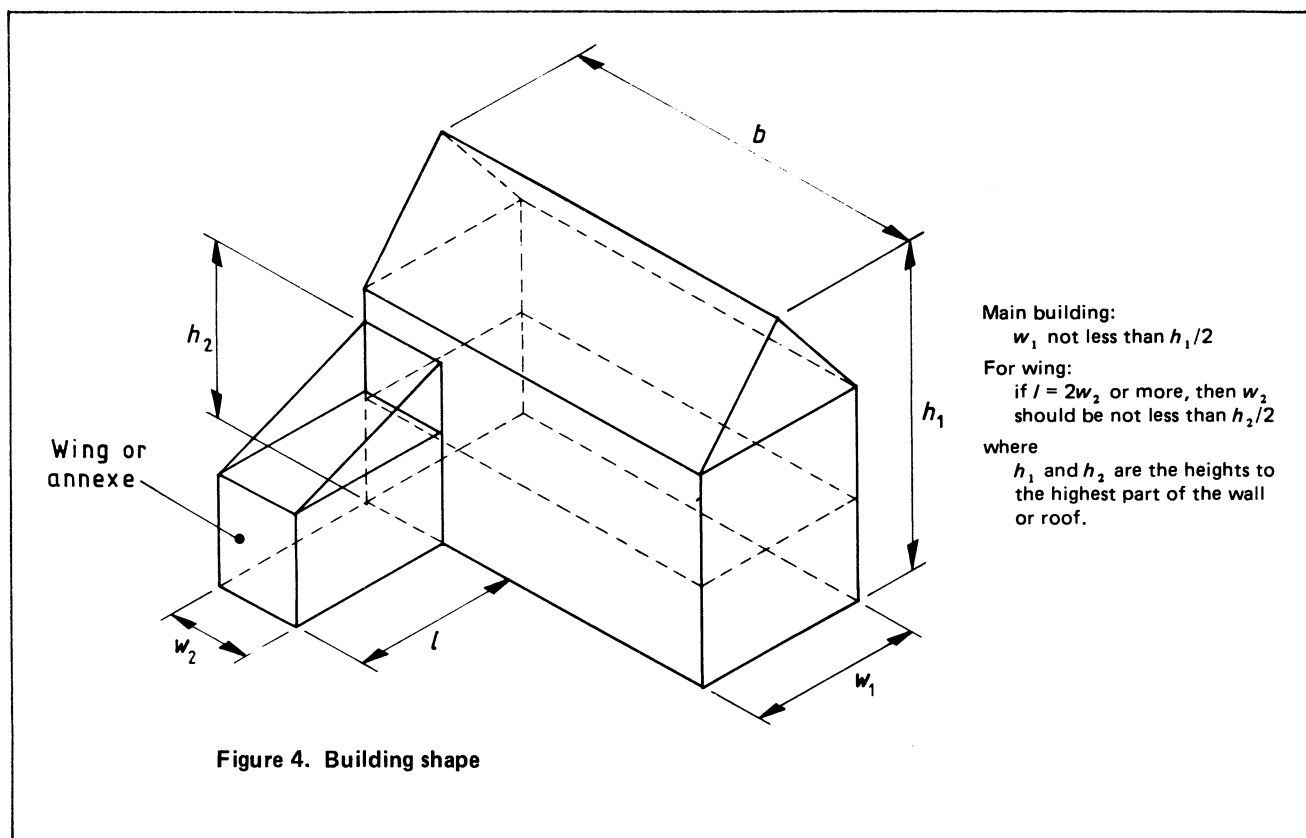


Figure 1. Plan form and construction of the ground floor box to give stability

* In preparation.





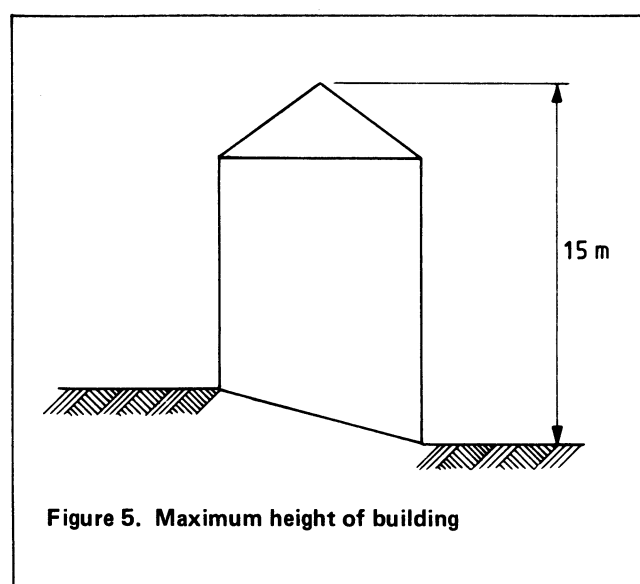
4.2.3 Height of building. The maximum height above the lowest finished ground level adjoining the building should not exceed 15 m as shown in figure 5.

4.2.4 Storey height. The maximum height of any storey should not exceed 2.7 m measured as shown in figure 6. The height of substructure walls measured between the top of the foundation and the top of the ground floor slabs should also not exceed 2.7 m.

4.3 Wind loading

The maximum wind forces to which a house is liable to be exposed will vary with its geographical location in the country, the degree of exposure, and the height of building. The scope of this code is based on a design wind speed not exceeding 44 m/s in accordance with CP 3 : Chapter V : Part 2 and a limited building shape as defined in figure 4, building height as defined in figure 5, and storey height as defined in figure 6.

It will normally be possible to establish the applicability of this code by reference to the exposure zones defined in figure 7 and listed in table 1. Where doubt exists, e.g. very exposed buildings on top of hills or in valleys where wind acceleration is known to occur, a separate design check in accordance with CP 3 : Chapter V : Part 2 should be carried out. Wind acceleration effects do not, however, need to be taken into account in the areas asterisked in table 1. If the design wind speed exceeds 44 m/s this code does not apply and the design should be carried out in accordance with an appropriate structural code, e.g. BS 5628.



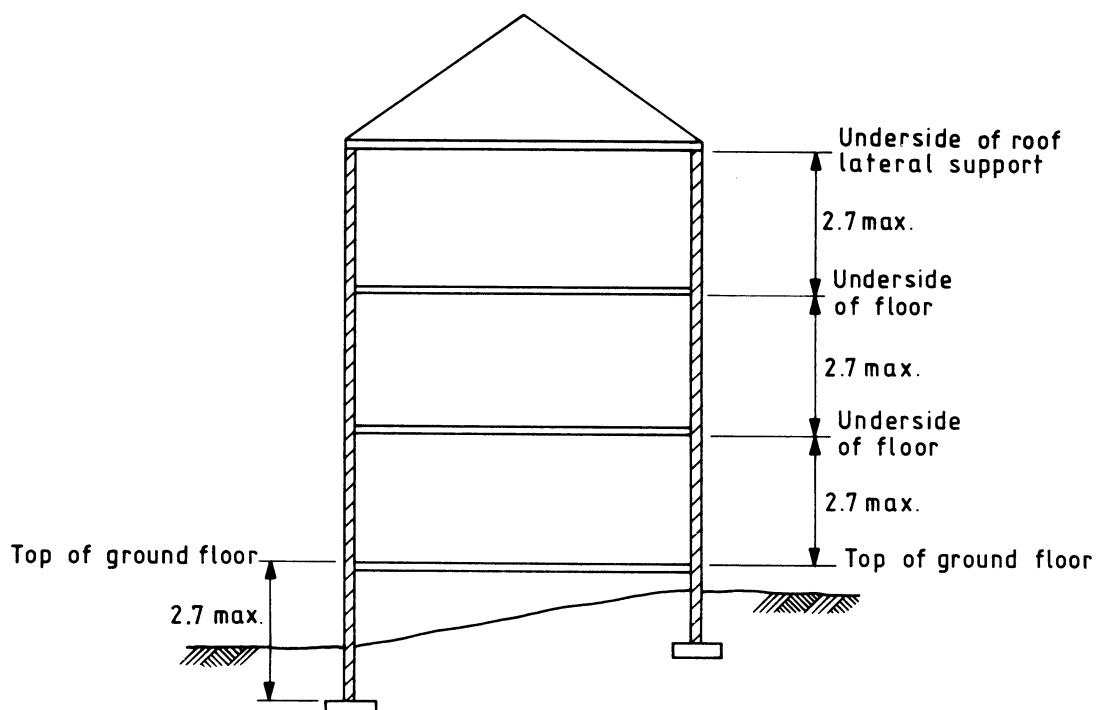


Figure 6. Measurement of storey height of walls

Table 1. Areas of the United Kingdom within the scope of this code

Height of building not greater than	Open countryside with no obstructions	Open countryside with scattered windbreaks	Country with many windbreaks, small towns, outskirts of large cities	Surface with large and frequent obstructions, city centres
m 5.0	Zones 1*, 2* and 3 only	Zones 1*, 2*, 3* and 4*		
10.0	Zones 1 and 2 only	Zones 1*, 2* and 3 only		
15.0	Zone 1 only	Zones 1 and 2 only	Zones 1*, 2* and 3 only	
* See 4.3.				

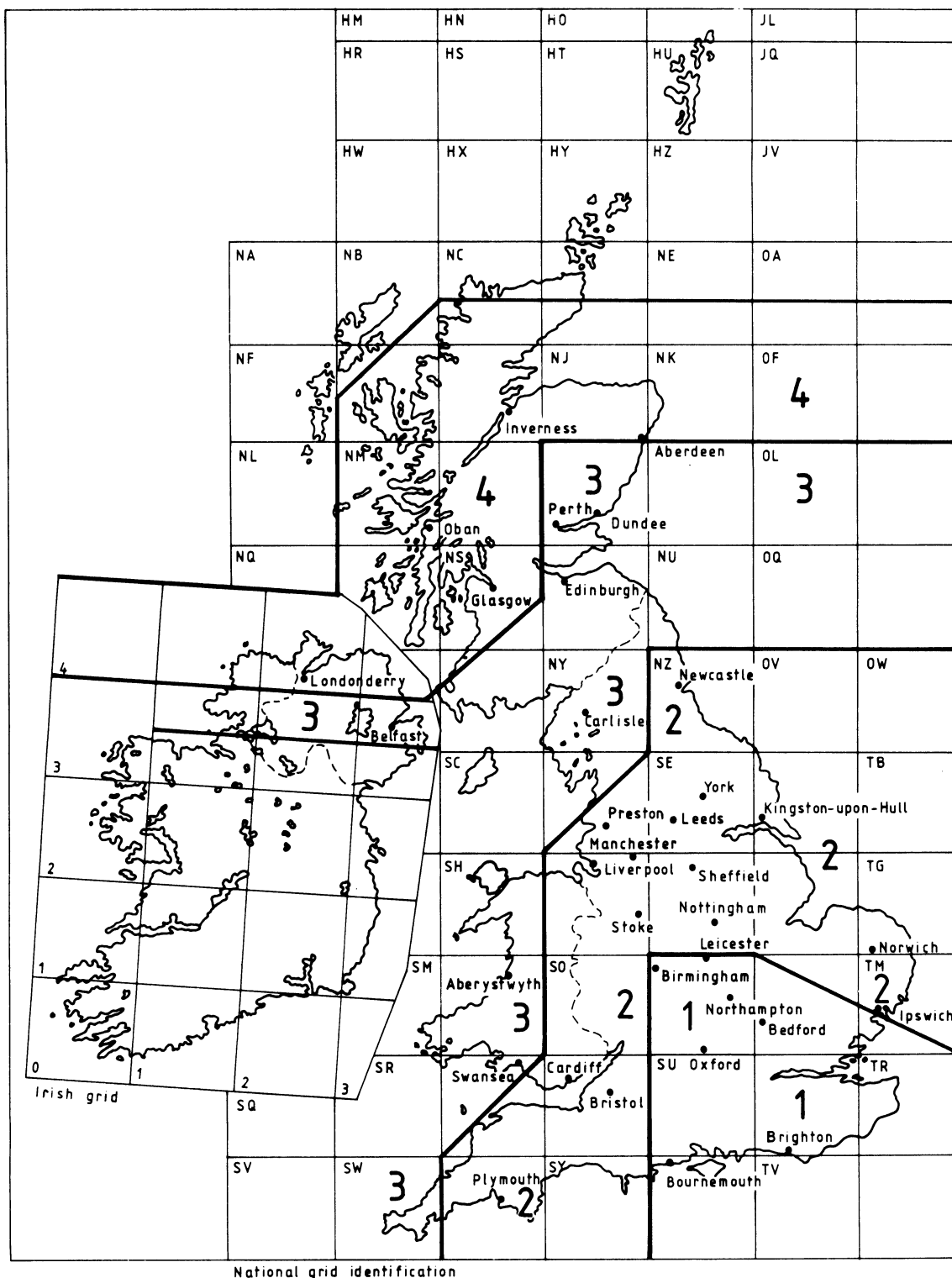


Figure 7. Wind exposure zones for the United Kingdom