



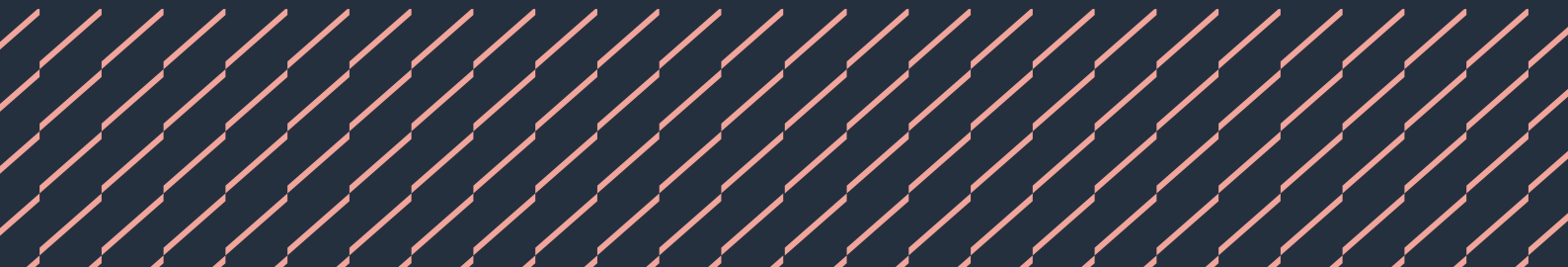
# Chapter 10.1



## Garages

This chapter gives guidance on meeting the Technical Requirements for integral, attached and detached garages.

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## 10.1.1 Compliance

Also see: Chapter 2.1

**Garages shall comply with the Technical Requirements.**

Garages which comply with the guidance in this chapter will generally be acceptable.

## 10.1.2 Provision of information

**Designs and specifications shall be produced in a clearly understandable format, include all relevant information and be distributed to the appropriate personnel.**

Designs and specifications should be issued to site supervisors, relevant specialist subcontractors and suppliers, and include the following information:

- location of garages
- relevant levels, in relation to an agreed reference point
- details of foundations
- waterproofing arrangements
- construction details of the roof structure and coverings
- construction details for walls
- external and internal finishes
- services, where applicable
- type of garage or structure.

## 10.1.3 Garage foundations

Also see: Chapter 4.3

**Garage foundations shall transmit all loads to the ground safely and without undue movement. Issues to be taken into account include:**

- 1) hazardous ground
- 2) type of foundation required for integral/attached garages
- 3) type of foundation required for detached garages and blocks of garages
- 4) adjacent structures
- 5) underground services
- 6) provision for movement.

Garage foundations should adequately support the imposed loads, taking account of ground conditions.

Further guidance is given in Chapter 4.3 Strip and trench fill foundations.

### 10.1.3.1 Hazardous ground

For foundations on hazardous ground, the following chapters are relevant:

- 4.1 Land quality — managing ground conditions
- 4.2 Building near trees
- 4.4 Raft, pile, pier and beam foundations
- 4.5 Vibratory ground improvement techniques.

Any existing fill on the site of the garage should be examined and identified. Where any potential health hazard or risk of damage is indicated, appropriate precautions should be taken, as described in the following chapters:

- 4.1 Land quality — managing ground conditions
- 5.1 Substructure and ground-bearing floors.

### 10.1.3.2 Type of foundation required for integral/attached garages

Foundations for integral or attached garages should be the same as those for the home, unless proper consideration is given to each foundation and the possibility of differential movement between them.

### 10.1.3.3 Type of foundation required for detached garages and blocks of garages

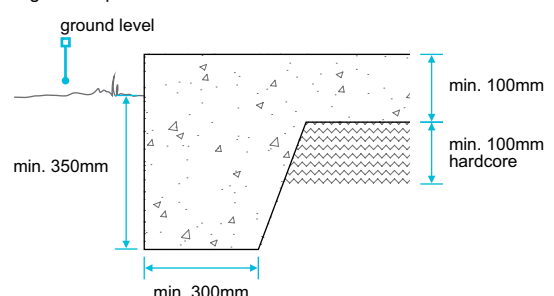
Foundations for detached individual garages or blocks of garages should avoid damage caused by differential loads and uneven settlement.

Where the ground is uniform and provides a satisfactory foundation bearing, an unreinforced edge thickened concrete slab may be used.

Unreinforced concrete slabs should:

- have a minimum thickness of 100mm
- have a minimum downstand thickening of 350mm below ground level around the whole perimeter of the slab
- have a minimum width of edge thickening of 300mm
- be constructed on 100mm minimum of properly compacted hardcore
- have dimensions not exceeding 6m in any direction; for dimensions greater than this, movement joints should be provided.

Figure 1: Specifications for unreinforced concrete slabs



#### 10.1.3.4 Adjacent structures

Foundations for garages should not impair the stability of the home or any other adjacent structure.

#### 10.1.3.5 Underground services

Garage foundations that are to be above or near services should be constructed so that no excessive settlement of foundations or damage to services occurs (see Chapter 5.3 Drainage below ground).

#### 10.1.3.6 Provision for movement

Movement joints in foundations should be provided:

- between homes and attached garages where there is a change of foundation type
- at 6m intervals where unreinforced concrete slab foundations are used.

### 10.1.4 Garage floors

*Also see: Chapters 5.1 and 5.2*

**Garage floors shall transmit all loads to either the foundations or the ground safely and without undue movement. Issues to be taken into account include:**

- 1) bearing capacity of the ground
- 2) resistance of the floor to moisture from the ground
- 3) resistance of the floor to hazardous gas
- 4) thickness of floor slabs
- 5) floor drainage
- 6) structural topping
- 7) construction joints.

Garage floors will be acceptable where they are in accordance with any of the following:

- Chapter 5.1 Substructure and ground-bearing floors
- Chapter 5.2 Suspended ground floors
- the guidance given in this chapter.

Unless ventilation is specifically required, the void beneath a garage floor which is suspended precast concrete may be unventilated where:

- the floor has adequate durability
- the ground beneath is well drained
- there is unlikely to be a build-up of soil gases.

#### 10.1.4.1 Bearing capacity of the ground

Where the depth of fill exceeds 600mm, concrete floors should be in accordance with Chapter 5.2 Suspended ground floors and BS 8103-1.

Supporting fill should comply with the requirements in Chapter 5.1 Substructure and ground-bearing floors.

Where protection is needed to prevent attack by sulfates in either the ground, groundwater or fill below the slab, an impervious isolating membrane should be provided between the concrete and the ground.

#### 10.1.4.2 Resistance of the floor to moisture from the ground

Generally, a DPM is unnecessary, except where:

- it is needed to prevent dampness entering the home, or
- the floor has to be protected against chemical attack from the ground.

Where no DPM is provided, the floor may show signs of dampness.

Where the floor is below ground level, precautions should be taken to prevent the entry of groundwater, and tanking may be required.

#### 10.1.4.3 Resistance of the floor to hazardous gas

Where hazardous gas precautions are required and a property includes either an integral or attached garage, notwithstanding the inclusion or omission of a connecting doorway or absence or presence of habitable accommodation above the garage, the hazardous gas precautions should be continuous to the garage(s) and extend to the perimeter of the property.

Membranes should not be exposed and be protected against physical damage.

Following a site-specific risk assessment and specialist advice, detached garages may also require hazardous gas precautions.

#### 10.1.4.4 Thickness of floor slabs

Ground-bearing floors, where provided, should not be less than 100mm thick, including a float finish.

### 10.1.4.5 Floor drainage

Where practicable, garage floors should be laid to falls to ensure that water or spillage is directed out of the garage via the vehicle doorway.

### 10.1.4.6 Structural topping

Where a garage floor is constructed using suspended beams and infill blocks of any type, the concrete topping should be reinforced with a minimum A142 mesh to resist a point load of 10kN minimum.

Alternatively where reinforced screeds are to be incorporated as a structural topping, they should be designed by an engineer in accordance with Technical Requirement R5.

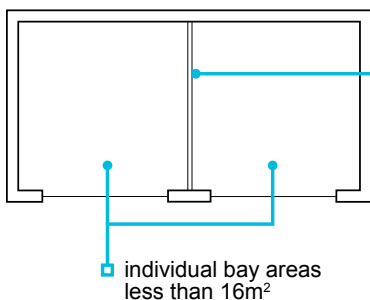
### 10.1.4.7 Construction joints

If the floor area of a garage exceeds 16m<sup>2</sup>:

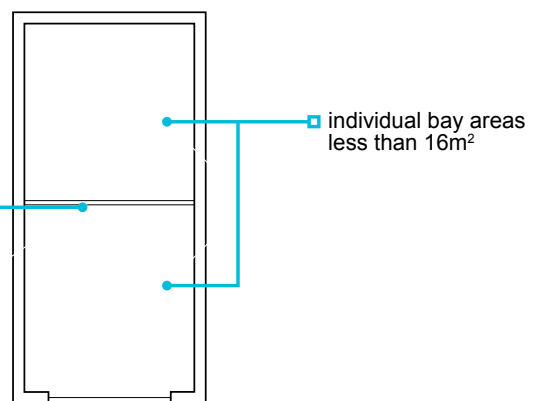
- either the floor slab should be reinforced, or
- construction joints should be provided which equally divide the floor area into bays less than 16m<sup>2</sup>.

Figure 2: Construction joints in unreinforced concrete floor slabs

Double garage (double width)



Double garage (double length)



Examples of unreinforced concrete floors in garages where the total floor area exceeds 16m<sup>2</sup>

## 10.1.5 Garage walls

**Walls for garages shall transmit all loads to foundations safely and without undue movement. Issues to be taken into account include:**

- 1) stability of walls above ground
- 2) stability of walls retaining ground
- 3) provision for movement
- 4) adequate resistance to rain and groundwater.

Garage walls will be acceptable where they are in accordance with any, or a combination, of the following:

- Chapter 5.1 Substructure and ground-bearing floors
- Chapter 6.1 External masonry walls
- the guidance given in this clause.

If integral garages are formed within a timber frame building, the construction of the garage walls should be in accordance with Chapter 6.2 External timber framed walls.

### 10.1.5.1 Stability of walls above ground

Walls for detached garages and external walls for attached garages should:

- be no less than 90mm thick
- have adequate lateral restraint against wind loading.

Piers should be located in single leaf walls:

- up to 200mm thick
- which are greater than 2.5m in length or height and which do not contain a major opening ie, garage door
- at corners, unless buttressed by a return of at least 390mm
- at intermediate centres not exceeding 3m
- either side of a major opening ie, garage door.

Piers should also:

- be built off the foundation
- extend the full height of the wall
- measure at least 390mm x 190mm or 327mm x 215mm depending upon masonry unit size
- be bonded or tied to walls with flat stainless steel wall ties, 20mm x 3mm in cross section, placed in pairs and not more than 300mm centres vertically.

### 10.1.5.2 Stability of walls retaining ground

Garage walls retaining ground should be:

- suitable for the ground conditions
- structurally adequate.

Where garage walls act as retaining walls, they should be designed in accordance with Chapter 5.1 Substructure and ground-bearing floors or by an engineer in accordance with Technical Requirement R5.

### 10.1.5.3 Provision for movement

Movement joints in garage walls, as described in BS EN 1996-2, should be provided:

- between homes and attached garages
- where there are movement joints in foundations.

### 10.1.5.4 Adequate resistance to rain and groundwater

To protect the wall from rising ground moisture, a DPC should be provided at a level at least 150mm above the level of adjacent ground.

Garage walls constructed from a single leaf of masonry, such as brickwork or blockwork approximately 100mm thick, will not be impervious to wind-driven rain and consequently could become damp.

Absorbent materials eg gypsum based lining boards should not be installed in direct contact with single leaf masonry. Alternatively the design should protect absorbent materials from coming into contact with moisture from rain penetration.

In areas of severe exposure or worse, single leaf walls may require a high standard of workmanship and possibly surface treatment to prevent an unacceptable level of rain penetration.

Where a cavity wall is to be used as an alternative to surface treatment of a single leaf wall, it would be acceptable to use a cavity of less than 50mm in this instance.

Where a garage is integral or attached, the design should ensure that dampness cannot enter the home.

Where a wall is below ground level, precautions should be taken to prevent the entry of groundwater by:

- tanking (see Chapter 5.4 Waterproofing of basements and other below ground structures)
- the use of DPCs and DPMS
- drainage of ground behind the wall.

## 10.1.6 Resistance to fire spread

**Garages shall be constructed so as to prevent fire spread to the home from the garage.**

Garages should be constructed to provide adequate fire separation between the garage and the home in accordance with the relevant Building Regulations.

## 10.1.7 Security

**Garages shall be constructed to provide reasonable security against unauthorised entry, in particular where garages are linked.**

Where garages of different ownership are linked, walls should prevent direct access from one garage to another.

The following should provide adequate security:

- walls — masonry construction, or timber frame with two layers of plasterboard on each side
- ceilings — two layers of plasterboard
- walls where fire resistance is not required — timber frame with one layer of 6mm plywood or 9mm OSB on each side.

## 10.1.8 Doors and windows

**Garage doors and windows shall be adequate for their purpose. Issues to be taken into account include:**

- 1) robustness
- 2) ease of operation.

Doors and windows will be acceptable where they are in accordance with Chapter 6.7 Doors, windows and glazing.

### 10.1.8.1 Robustness

Frames should be selected and fixed having taken into account the type and weight of the garage door.

### 10.1.8.2 Ease of operation

Proprietary doors and door gear should be installed in accordance with the manufacturer's recommendations.

Care should be taken to ensure that garage doors are in proper working order at handover.

## 10.1.9 Garage roofs

*Also see: Chapter 7.2*

**Garage roofs shall satisfactorily resist the passage of rain and snow to the inside of the building, support applied loads and self-weight, and transmit the loads to the walls safely and without undue movement. Issues to be taken into account include:**

- 1) holding down
- 2) bracing
- 3) restraint
- 4) detailing at abutments
- 5) movement
- 6) adequate disposal of rainwater.

Garage roofs will be acceptable where they are in accordance with:

- Chapter 7.1 Flat roofs, terraces and balconies, or
- Chapter 7.2 Pitched roofs.

### 10.1.9.1 Holding down

To prevent uplift, flat roofs and, where necessary, pitched roofs should be provided with holding-down straps at not more than 2m centres where the roof members bear on the supporting wall.

Holding-down straps should be:

- provided where the roof pitch is below 15° or the roof has a lightweight covering with a laid mass of less than 50kg/m<sup>2</sup>
- where local experience suggests there is a risk from wind gusts
- provided in accordance with the design
- a minimum cross-section of 30mm x 2.5mm (galvanized steel straps are generally acceptable) or proprietary straps and fixings
- at least 1m long and have three fixings to the wall, or turned into a bed joint.

### 10.1.9.2 Bracing

The building designer should specify all bracing. Trussed rafter roofs should be braced in accordance with Chapter 7.2 Pitched roofs, unless the roof is designed and braced in accordance with PD 6693-1.

All timber bracing to trussed rafters should be at least 100mm x 25mm in section and nailed twice to each trussed rafter. Nailing should be 3.35mm (10 gauge) x 65mm long galvanized round wire nails.

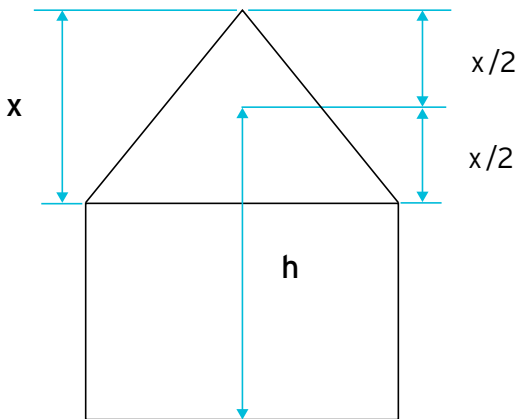
### 10.1.9.3 Restraint

For garages of masonry construction, the gable should be restrained at rafter level with restraint straps. Restraint should also be provided at ceiling level where the height ( $h$ ) exceeds:

- 16 x thickness of the wall for single leaf walls
- 16 x sum of thickness of leaves + 10mm for cavity walls.

Note: 'h' should be measured from the top of foundations or from the underside of the floor slab where this provides effective lateral restraint.

Figure 3: Calculating gable height



The restraint at rafter level may be provided by restraint straps or by a gable ladder.

Where straps are used, they should have a minimum cross-section of 30mm x 5mm or be proprietary straps that have been designed for lateral restraint purposes. Straps should be fixed to rafters with solid blocking (or be fixed to the longitudinal bracing), see Clause 7.2.8.

For cavity walls, the straps should be at 2m maximum centres, with the top strap near the apex of the gable. For solid walls, it will normally be necessary to fix the straps to the inside face with at least two 6mm x 30mm plug and screw fixings per strap.

Unless the design states otherwise, the restraint straps should be provided at:

- walls constructed of solid bricks — two restraint straps per roof slope at maximum 2m centres plus one extra strap near the apex of the gable
- walls constructed of perforated bricks/blocks or concrete/aerated concrete blocks — three restraint straps per roof slope at maximum 1.5m centres.

Note: for the purpose of lateral restraint, a 'perforated' brick/block is where the perforations (vertical holes) represent more than 25% of the volume of the brick/block.

### 10.1.9.4 Detailing at abutments

Precautions should be taken at abutments between a garage roof and the main building or between stepped garages, including:

- flashings and weatherproofing that allow for differential movement
- cover flashings formed from metal or other approved material
- cavity trays that divert water from inside the cavity to the external surface of the roof.

### 10.1.9.5 Movement

Movement joints in foundations and the structure should be continued through roof coverings and be provided with appropriate weather protection.

### 10.1.9.6 Adequate disposal of rainwater

The provision of rainwater should be in accordance with relevant Building Regulations.

Individual roofs, or combinations of roofs that drain from one to another, with a total area greater than 6m<sup>2</sup>, should have a rainwater drainage system.

Where rainwater from a large roof surface discharges onto a garage roof, precautions should be taken to prevent premature erosion of the lower surface.

Rainwater should not discharge from the roof directly to a drive or path.

For details on the design of rainwater disposal systems, reference should be made to the following chapters, as appropriate:

- 7.1 Flat roofs, terraces and balconies
- 7.2 Pitched roofs.

### 10.1.10 Permanent prefabricated garages and carports

**Permanent prefabricated garages and carports shall be suitable for their intended purpose.**

Permanent prefabricated garages and carports should:

- have appropriate foundations
- be structurally adequate
- provide appropriate weathertightness
- provide adequate separation between linked garages of different ownership.

Prefabricated garages should be erected in accordance with the manufacturer's recommendations.

Particular care should be taken to ensure adequate holding down of carports and other light structures against wind action.

### 10.1.11 Services

**The provision of any service or appliance within a garage shall be in accordance with relevant regulations. Issues to be taken into account include:**

- 1) protection of water services against frost
- 2) provision of electricity
- 3) risk of fire or explosion.

Where services or appliances are provided in garages, they should comply with the guidance below and with the following chapters, as appropriate:

- 5.3 Drainage below ground
- 8.1 Internal services.

#### 10.1.11.1 Protection of water services against frost

A rising main should not be located within a garage.

A water supply or outlet in a garage should have adequate provision for isolating and draining down.

Pipes should be insulated and located so as to minimise the risk of freezing.

#### 10.1.11.2 Provision of electricity

The provision of electric lighting and socket outlets in a garage is at the discretion of the builder.

All electrical installations should comply with BS 7671.

Where there is a risk of rain penetration through garage walls, electrical wiring and equipment should be appropriate for the location and take account of conditions likely to be expected. For further guidance, see Clause 8.1.6.

#### 10.1.11.3 Risk of fire or explosion

Installation in a garage of an oil or gas burning boiler or heating appliance should be in accordance with any relevant statutory regulations.

Where garages are to contain solar storage batteries, see Clause 8.2.1.

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