warranty
LABC

TECHNICAL MANUAL

V4

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PART 1

INTRODUCTION AND STATUTORY REQUIREMENTS

GENERAL INTRODUCTION, LAYOUT AND USE OF THE MANUAL

This Technical Manual does not purport to be a construction text book and does not attempt to tell you how to design or build a Housing Unit. Instead, it sets out the Functional Requirements, Principal Performance Standards/Requirements as well as guidance information necessary for the design and construction of Housing Units, by contractors and others using LABC Warranty.

The guidance in the Manual is divided into nine parts which together cover the design and construction of the structure, the above and below ground foul and surface water drainage systems, the waterproof envelope and the chimneys and flues of the Housing Unit. The guidance in no way absolves the members of the design/construction team from the need to comply with all relevant legislation.

The first eight parts are sub-divided into sections and each section commences with a statement of the Principal Performance Standards, which should be met. Principal Performance Standards relate to the basic qualities of the Housing Unit, such as structural stability and fire resistance, and are in many cases covered by mandatory legislation (the Building Regulations 2000 in England and Wales.

The Functional Requirements are fundamental issues which must be complied with in all cases. The Principal Performance Standards are amplified by Performance Requirements which set out information aimed at guiding the designer or builder in how to achieve the necessary standard. In a minority of cases it may be possible to achieve the Principal Performance Standards without following the performance guidance, although it will be up to the designer or builder to put forward a case to the technical auditors and agree this before completing the relevant part of the construction.

The Performance Requirements are supported by references to a range of guidance documentation which may be used at the discretion of the designer or builder. In the majority of cases this information includes Approved Documents, Technical Standards and Technical Booklets. In certain circumstances specific guidance is also provided. It is not exhaustive, and designers and builders are free to use other suitable guidance, such as manufacturer's recommendations, provided that they agree this with the technical auditors before commencing with the work.

Part nine of this Manual contains guidance on certain specific constructional details which highlight areas where problems have occurred in the past. Designers and builders should follow this guidance unless they are prepared to put forward alternative solutions which are acceptable to the technical auditors.

The edition of the Manual which will be applicable to any Housing Unit will be that which was the latest published when the Initial Certificate was issued unless otherwise endorsed on the Certificate of Insurance.

FUNCTIONAL REQUIREMENTS

The following are the Functional Requirements of LABC Warranty in respect of any Housing Unit where an offer of insurance has been made:

A Statutory requirements – All work undertaken shall comply with all relevant Building Regulations and other statutory requirements relating to the Housing Unit.

B Design requirement – Design and specifications shall provide a satisfactory level of performance.

C Materials requirement – All materials, products and building systems shall be appropriate and suitable for their intended purpose. The structure of the home shall, unless specifically agreed otherwise with LABC Warranty, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability.

D Workmanship requirement – All works shall be carried out in a neat and workmanlike manner in accordance with relevant Standards and Codes of Practice

E Structural design requirement – Structural design shall be carried out by appropriately qualified persons in accordance with relevant Standards and Codes of Practice.

COMPLIANCE WITH BUILDING REGULATIONS

The Standards in the Technical Manual require compliance with the current Building Regulations for England, Wales and Northern Ireland as applicable, in force at the time the Initial Certificate was issued for the Housing Unit where applicable and require compliance with all other statutory requirements relating to the design and construction of dwellings. They also include some requirements which are not covered directly by Building Regulations, such as internal decorations and external works.

ENGLAND AND WALES: THE BUILDING REGULATIONS 2000 (AS AMENDED) AND APPROVED DOCUMENTS

Selected, relevant requirements contained in Schedule 1 to the Building Regulations 2000 (as amended) are summarised in each section below. The guidance documents referred to in each section of this Manual will always include references to the relevant Approved Documents approved by the Secretary of State under the powers contained in section 6 of the Building Act 1984. Compliance with a relevant Approved Document will normally satisfy the related Building Regulations requirements and will usually satisfy the corresponding Principal Performance Standards in this Manual. It should be noted that there is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way.

OTHER LEGISLATION

There is a general requirement that the design and construction of the Housing Unit comply with all relevant statutory requirements. It is the designer's **responsibility to be aware of current legislation applicable to the proposed works.**

PART 2

FITNESS OF MATERIALS AND STANDARDS OF WORKMANSHIP

PRINCIPAL PERFORMANCE STANDARDS

Materials and workmanship - All materials used in, or in conjunction with, the construction of the Housing Unit, shall be suitable and shall be used so as to fulfill their purpose.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, the building must be designed and constructed having regard to the following requirements of Regulation 7 of the Building Regulations 2000 (as amended):*

Materials and workmanship

7. (1) So much of any building work as is required to comply with any relevant requirement of Schedule 1 shall be carried out

(a) with proper materials which are appropriate for the circumstances in which they are used; and
(b) in a workmanlike manner.

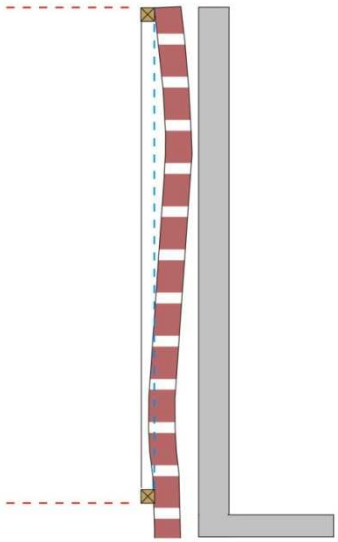
PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **the materials and components** used in the construction of the Housing Unit should be:

(a) of suitable nature and quality for their purpose;
(b) properly mixed and prepared, and correctly used, applied or fixed to achieve their design function;
(c) of sufficient durability to continue to meet the specific performance requirements of this Manual for the life of the Housing Unit, assuming normal maintenance practice.

The following guidance is not intended to deal with every situation that may arise and discretion should be exercised in its application in specific circumstances. The nature and extent of work necessary to remedy minor variances from the tolerances given should be appropriate to the circumstances.

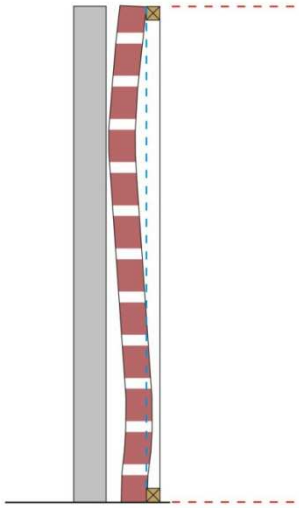
Fair faced Brickwork and Blockwork



Straightness on plan
10mm max deviation in any length of wall up to 5m. Using 25mm wide spacing blocks, the masonry line should be between 15mm and 35mm from the reference line.
Spacing block dimensions are a guide only. To suit individual site conditions, final dimensions should guarantee that the reference line is kept clear of the wall face.

Level of bed joints
10mm deviation for walls 5m long (a pro rata tolerance is applicable for walls less than 5m long).
15mm maximum deviation for walls over 5m long.
There should be no recurrent variations in the level of the bed joints line.

Thickness of bed joints
The thickness of an individual bed joint should not vary from the average of any 8 successive joints by more than 5mm.
Bricks and other building materials vary in size; therefore some variation in the thickness of bed joints is possible.

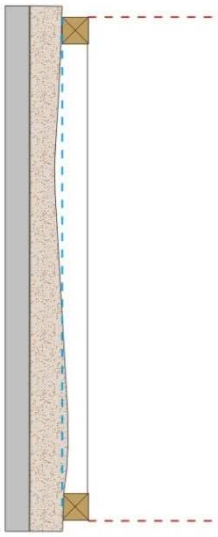


Perpendicular alignment in external walls
Vertical alignment of perpend joints should not deviate drastically from the perpendicular.
As a result of the manufacturing process, not all bricks are uniform in length. Therefore not all perpend joints will align. However, there should not be a collective displacement of the perpend joints in a wall.

Plumb of wall - overall height
Max deviation of 20mm in overall height of wall.

Plumb of wall - storey height
Max deviation of 10mm in a storey height, approx 2.5m. Using 50mm wide spacing block, the plumb

bob should be between 40mm and 60mm away from the wall.
Spacing block dimensions are a guide only. To suit individual site conditions, final dimensions should guarantee that the plumb line is kept clear of the wall face Plumb.

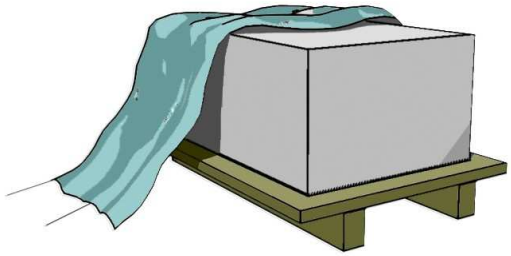


Straightness in section
Max deviation 10mm in any 2.5m height of wall.
Using 25mm wide spacing blocks, the masonry line should be anywhere between 15mm and 35mm from the reference line. Spacing block dimensions are a guide only. To suit individual site conditions, final dimensions should guarantee that the reference line is kept clear of the wall face.

Rendering (plain finish)
Vertical and horizontal flatness
10mm (excluding features).
Features such as bell casts, and the areas of render in close proximity to the feature, are excluded from the tolerance.
Flatness is measured in a similar way to straightness on plan and plumb of masonry.

COLD WEATHER WORKING

Wind Chill
The Meteorological Office is able to provide information on the wind chill factor. Strong winds can reduce the temperature of concrete and mortar significantly quicker than the temperature in still conditions. Work is more likely to be affected by frost in windy freezing conditions.



Overnight protection
During cold weather, the use of covers will protect materials from overnight snow, ice and frost. They will also reduce the effects of longer term frosts, and allow work to restart earlier. Frozen materials should never be used.
Appropriate covers should be provided for bricks, blocks, sand, aggregates and cement, to prevent them from becoming saturated, and or damaged by frost.

Protection for sustained cold periods
If it is necessary to continue site works during sustained periods of cold weather, the use of heaters will protect aggregates and other materials from becoming frozen, and prevent frost damage to newly laid masonry.

CONCRETING

Foundation and oversite concrete

Concrete should not be laid if the ground or oversite is frozen. Work built on frozen ground can be severely damaged by movement when thawing takes place.
If site work has to continue during sustained periods of cold weather, the whole site area should be covered, and heated if necessary, to keep the temperature above freezing.

Concreting other than in foundations or oversite

All surfaces that come into contact with fresh concrete, such as formwork, reinforcement, and or other concrete surfaces should be free of snow, ice and frost. Special care is needed when smaller quantities of fresh concrete are positioned against larger volumes of hardened concrete at a lower temperature.

Concreting in Cold weather conditions

The minimum temperature of concrete when delivered should be 5°C. This is a requirement of BS 8500.

If the air temperature drops further to 2°C, concrete work should NOT progress unless:

- The aggregate temperature is above 2°C, and the aggregate is free from snow and frost, and
- Water for mixing should be heated, but not in excess of 60°C, and
- The cement itself must not heated, and
- The cast concrete can be properly protected, taking account of the cross sectional area and the location, and
- The ground into which the concrete is to be placed is not frozen.

Covers will not stop severe frost penetrating the aggregate. If work is to continue, it may be necessary to steam heat aggregate or use hot air blowers below covers.

GUIDANCE DOCUMENTS

A satisfactory performance for the materials and workmanship may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document to support Regulation 7 - Materials and workmanship:

- a British Standard or other national technical specification of any EEC state which is equivalent in use to a British Standard;
- a material covered by a certificate issued by European Technical Approvals issuing bodies;
- a product bearing a CE marking in accordance with the Construction Products Directive;
- a product or method of workmanship which has been shown by previous experience to be adequate for the required performance standard;
- tests or calculations which show that a product, a method of construction, or a standard of workmanship is adequate for the required performance standard, provided that the tests are carried out by a NAMAS accredited testing station.

PART 3

SITE PREPARATION

PRINCIPAL PERFORMANCE STANDARDS

Site and ground investigation - an investigation shall be carried out of the site and ground in order to assist in the design of the Housing Unit and identify any geotechnical or contamination hazards which may be present on, or adjacent to the site, which might adversely affect the Housing Unit.

Contaminated sites - shall be suitably treated or otherwise remediated in order to remove any hazards or dangers found to be present and to ensure a satisfactory form of construction for the Housing Unit.

Geotechnical hazards - suitable design precautions and appropriate ground improvement measures shall be taken in order to remove or otherwise remediate any geotechnical hazards or dangers found to be present and to ensure a satisfactory form of construction for the Housing Unit.

BUILDING REGULATION REQUIREMENTS

For England and Wales, *the building must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000*:

Requirement A2 - Ground movement
Requirement C1 - Site preparation and resistance to contaminants site
Requirement C2 - Resistance to moisture

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory performance for the **site and ground investigation,** a site walkover survey, desk study and a trial pit investigation of the site (as defined in BS 5930: Code of practice for site investigation), should be carried out by a suitably experienced and qualified person. The need for further investigation will be determined by the extent and reliability of the information gathered concerning the site, at this stage.

Where, before or during the site works, **contamination or geotechnical hazards** are suspected or encountered, a suitably qualified and experienced person should be appointed to investigate the site. They should prepare proposals to treat or otherwise remediate the site and ensure that the proposals are put into effect in order to remove any hazards or dangers found to be present and to ensure a satisfactory form of construction for the Housing Unit.

GUIDANCE DOCUMENTS

A satisfactory performance for dealing with site investigation, contamination and geotechnical hazards may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document C - Site preparation and resistance to contaminants and moisture

PART 4

PRIMARY ELEMENTS

Section 4.1 EXCAVATIONS, FOUNDATIONS AND GROUND FLOOR

PRINCIPAL PERFORMANCE STANDARDS

Excavations - for foundations and below ground services shall be accurate in line, width and depth, and suitable for the type of foundation or service systems which form the basis of the design.

In order to provide safe working conditions on site, open excavations must be supported and protected in a manner which is suitable in the circumstances.

Foundations - shall be designed and constructed so that they are suitable for the size, form of construction and location of the Housing Unit in relation to the nature and load-bearing capacity of the ground and the site conditions.

Ground floors - shall be designed and constructed so that they:

a) provide a suitable surface for normal dwelling activities;
b) are structurally sound;
c) are durable and resistant to moisture;
d) have an adequate thermal performance;
e) prevent the entry of hazardous substances from the ground into the building.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, the foundations and ground floors must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement A2 - Ground Movement
Requirement C1 - Site preparation and resistance to contaminants
Requirement C2 - Resistance to moisture

Additionally, ground floors must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:

Requirement L1 - Conservation of fuel and power

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance **excavations** should be carried out so that:

a) they are suitable for the foundation or service being accommodated;
b) they provide a safe place to work, in relation to the activities being carried out and the nature of the surrounding environment and ground conditions;
c) adjacent buildings or other structures are not put at risk by the process of excavation.

Foundations should:

a) be able to sustain and transmit all normal loads from the Housing Unit to the ground without affecting the stability of the Housing Unit (and adjacent buildings) by excessive settlement, which would adversely affect the appearance, value and serviceability of the Housing Unit;
b) be designed and constructed to allow for possible movements in the ground caused by swelling, shrinkage or freezing of the subsoil, (or by landslip or subsidence), due to the weather, the presence of trees or some other cause.

Ground floors should be designed and constructed so that they:

a) provide a level and durable surface which is suitable for normal dwelling activities;
b) are not adversely affected by ground movements and are capable of carrying the design loads, either to the foundations or directly to the ground without causing excessive settlement, which would adversely affect the appearance, value and serviceability of the Housing Unit;
c) resist the passage of moisture to the inside of the Housing Unit and are not adversely affected by harmful or toxic materials in the fill or present in the ground;
d) prevent undue heat losses from the building and avoid the creation of thermal bridges which might give rise to the formation of condensation;
e) resist the passage of hazardous ground substances such as radon and landfill gases, into the building.

STRIP AND TRENCH FILL FOUNDATIONS

Setting out foundations
The accuracy of setting out foundations should be checked by a set controlled trench measurements, including their location relative to site borders and neighbouring buildings. Levels should be checked against bench marks, where appropriate.
In particular, for excavations check:

- Trench widths
- Trench lengths
- Length of diagonals between external corners.

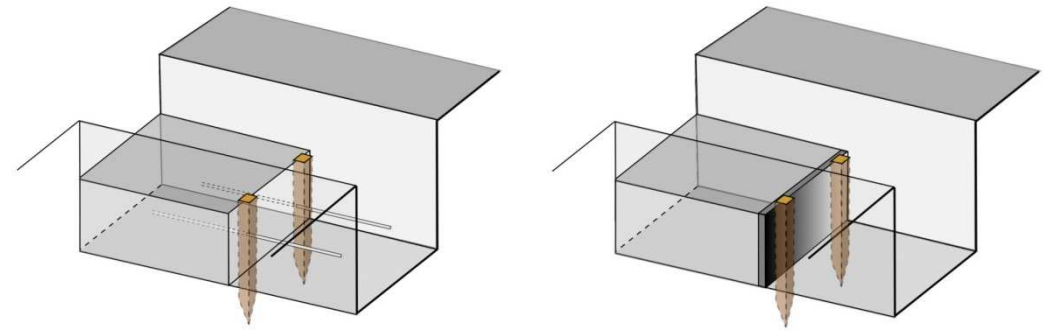
Walls should be located centrally upon the foundation, unless specifically designed otherwise.
Any discrepancy in dimensions should be reported promptly to the designer. Resulting variations should be distributed to all concerned with site works, including the LABC Warranty, where and when appropriate.

Excavations
Excavation should be to a depth that gives sufficient bearing and protection from frost damage. To avoid damage caused by frost, the depth of the foundation(s) in frost susceptible ground should be at a minimum 450mm below ground level. If the finished ground level will be above the existing ground level then, in cold conditions when freezing is expected, the foundation depth should be calculated from the existing, not finished, ground level.

Where trench fill foundations are in excess of 2.5m depth, they must be designed by an Engineer in accordance with Functional Requirement E. For trench fill, it is imperative to check that the finished foundation level is correct and horizontal. It will be difficult to adjust for discrepancies in the small number of brick courses between foundation and dpc level.

Strip and trench fill foundations should be reinforced, where necessary, to suit localised ground conditions. Reinforcement, if needed, ought to be clean and free from loose rust and should also be placed correctly. Bars, of an appropriate size, should be appropriately supported to guarantee that they are 75mm above the base of the foundation or as indicated in the design. They should be secured at laps and crossings. If in doubt about any soft spots, the engineer's advice should be taken prior to placing the concrete.

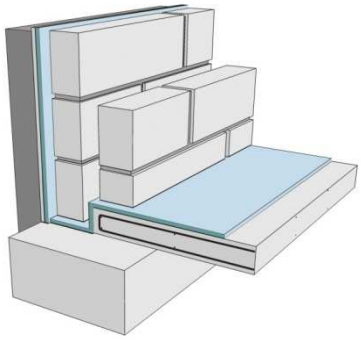
Strip Foundations
If construction joints are necessary, they should not be positioned near a return in the foundation. All shuttering should be removed before work progresses beyond the construction joint. For strip foundations, construction joints may be formed by one of the methods shown below.



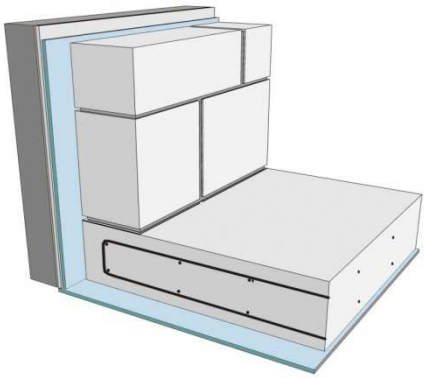
Details for basements

The following are generic details for basements. Because of the variations between different waterproofing systems, they should not be used as construction details. The manufacturer of the tanking system should be consulted.

Type A

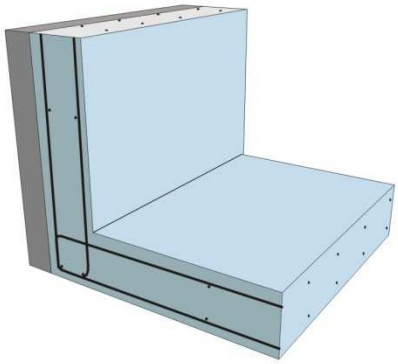


Tanked protection - Strip foundations without starter bars



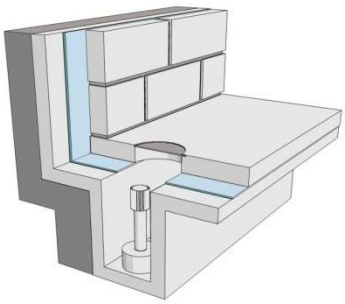
Tanked protection - External waterproofing with protection

Type B



Structurally integral protection – water resistant concrete
(reliant specifically on concrete construction however water resistance may be enhanced by use of additional tanking)

Type C



Drained cavity – water resistance reliant on collection and disposal of water through cavity drainage system

GUIDANCE DOCUMENTS

A satisfactory performance for the excavations, foundations and ground floors may be achieved by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

SECTION 4.2 EXTERNAL WALL

PRINCIPAL PERFORMANCE STANDARDS

External walls shall be designed and constructed so that they:

a) are structurally sound;
b) have adequate resistance to the effects of fire and will resist the spread of fire to adjacent buildings;
c) are durable and resistant to weather and ground moisture;
d) have an adequate thermal performance;
e) provide suitable surfaces to receive a range of finishes;
f) resist flanking sound transmission where adjacent to separating walls.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, the external walls must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement B2 - Internal fire spread (linings)
Requirement B3 - Internal fire spread (structure)
Requirement B4 - External fire spread
Requirement C2 - Resistance to moisture
Requirement E1 - Protection against sound from other parts of the building and adjoining buildings
Requirement L1 - Conservation of fuel and power

PERFORMANCE REQUIREMENTS

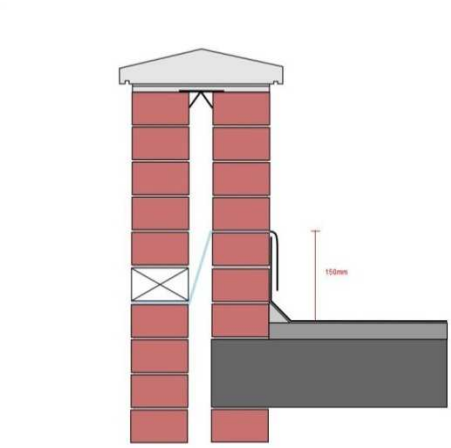
In order to achieve a satisfactory standard of performance, **external walls** should be designed and constructed so that:

a) in the event of fire in the Housing Unit, they are able to resist the spread of fire within the Housing Unit and to adjacent buildings;
b) in the event of fire in adjacent buildings, they resist fire spread to the Housing Unit;
c) they are able to resist the passage of moisture to the inside of the Housing Unit and are not adversely affected by harmful or toxic materials in the atmosphere or from the ground;
d) they prevent undue heat losses from the building and avoid the creation of thermal bridges which might give rise to the formation of condensation;
e) they provide an acceptable and durable external surface;
f) they provide a suitable internal surface for the application of wet or dry finishing systems;
g) flanking sound transmission is avoided at external/separating wall junction.

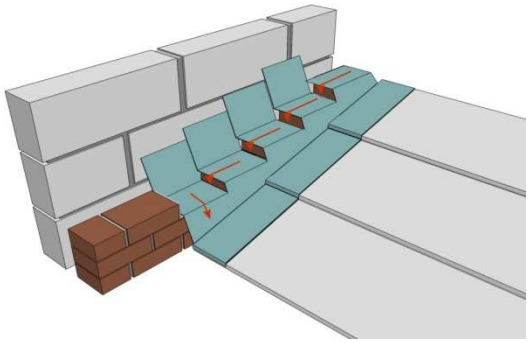
Additionally, **load bearing external walls** should be designed and constructed so that:

a) they are able to sustain and transmit all normal loads from the Housing Unit to the ground, without affecting the stability of the Housing Unit (and adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the Housing Unit;
b) they are able to continue to carry the normal loads for a reasonable time, in the event of fire in the Housing Unit.

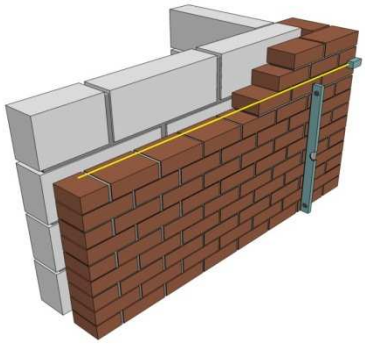
External Masonry Walls



Cavity trays should be provided at abutments of cavity walls and roofs. This will guarantee that any water penetrating the cavity does not enter the enclosed area. This only applies where the roof is over an enclosed area, including attached garages, but does not apply to open car ports and or open porches.



Where the roof abutments at an angle with the wall, preformed stepped cavity trays should be provided. DPC's below the coping should be supported above the cavity to prevent sagging. A specific dpc should be chosen in relation to each individual site and its needs in order to achieve a good key with the mortar.



Construction

Construction shall ensure a satisfactory standard of brickwork and blockwork

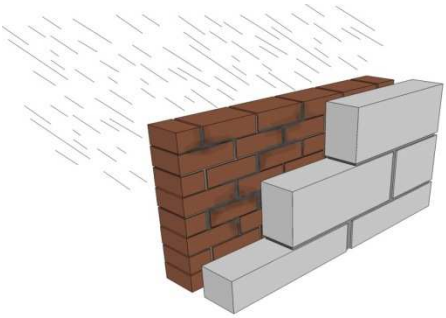
The appearance of masonry walls depend upon the materials used, the setting out and the workmanship.

When setting out masonry, avoid cutting bricks or blocks except when it is essential and avoid irregular or broken bonds, particularly at openings. Where a number of openings of similar width are being formed, use a rod cut to the required size to check the uniform width of openings, as work rises

To keep courses to uniform height, use a gauge rod. The rod should be marked with the height of windows, doors and floors. All work should be rationally level and true. Perpendicular joints should be kept in line and plumb. Courses should be kept level by using lines and spirit levels.

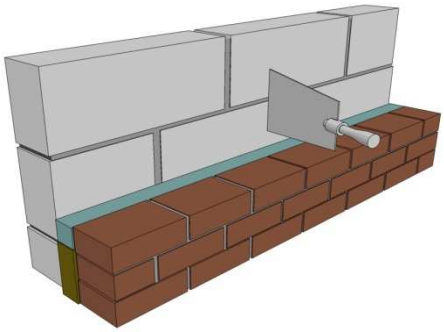
Mortar

Different types of bricks and blocks need a diverse range of varying strength mortar mixtures. Some parts of the building, such as below dpc, chimneys and copings, may need a different mix to the main walling. Make sure the mix is pertinent for the job. (Refer to BS 5628 – 3 : 2005)



Plant and banker boards should be kept clean when possible. Mixers should be kept clean in order to operate efficiently. The mortar colour should be consistent throughout the works. Mortar which has started to set should not be re-tempered. All bricks and blocks should be laid on a full bed of mortar and all perpends should be solidly filled. Joints should be filled to reduce the risk of rain saturation and dampness in the wall. Solid mortar bedding and fully filled perpends are particularly important in exposed areas and where the cavity is to be completely filled with insulation.

Unless the design states otherwise, only weathered joints or bucket handle joints should be used. Recessed joints should not be used where the cavity is to be completely filled with insulation. Where pigments are used they should not exceed 10% of the cement mass, 3% if carbon black is used.

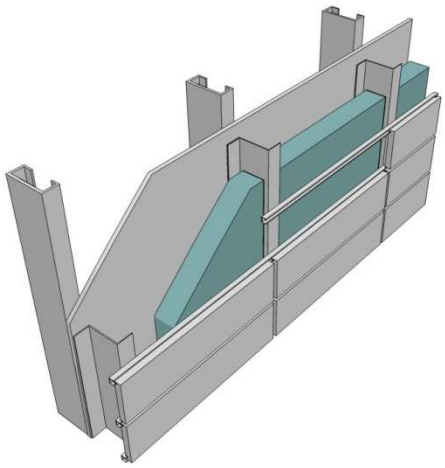


Clean cavities with the removal of all mortar droppings are particularly important in exposed areas and also where partial cavity fill is used. Additionally the width of the residual cavity should be not less than 50mm

Where full cavity insulation is used, mortar droppings should be cleaned off from the top edge of the cavity. Mortar residue on the top edge of the cavity may convey dampness to the inner leaf of the wall, by using a cavity batten, these risks will be reduced. Cavity battens should be wrapped with flexible material to allow easy withdrawal.

Where external render is to be applied surface to be rendered should be free from dust, loose particles, efflorescence and or organic growth. The number and thickness of coats should be in accordance with the architect / engineers design. Undercoats should be applied at least 3 days before applying the following coat. If coloured pigments are specified, batching should be undertaken with care to ensure colour consistency.

CLADDING



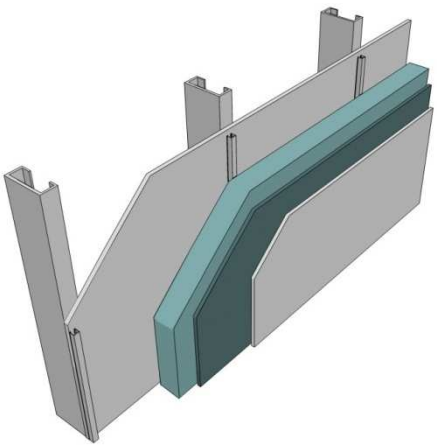
Rain screen Cladding
Rain screen cladding systems, including panels, should have current certification confirming satisfactory assessment by an appropriate independent technical approvals authority accepted by LABC Warranty, including: British Board of Agrément (BBA), Building Research Establishment (BRE) Certification or European Technical Approval (ETA)
Systems that are assessed and certificated by an appropriate independent technical approvals organisation in accordance with the CWCT Standard for Walls with Ventilated Rain screens will normally be acceptable to LABC Warranty. Other certification bodies or test documentation, may be acceptable if they are considered to be a suitable alternative. The certification, together with all test documentation should be made available to LABC Warranty before work on the rain screen begins on site. The use of the system should be within the scope of the certification and test documentation.

Rainscreen cladding systems should comprise:

- An outer skin of panels, which have open, baffled, or rebated joints. Joints should never be sealed
- A pressure equalised air gap of at least 38mm wide between the insulation and the panels
- An insulated airtight backing wall.

The air gap should be adequately ventilated. Dpc/dpm trays with stop ends should be provided above openings, at the base of the rainscreen and at interfaces where necessary, to ensure water is drained to the outside.

Particular attention should be given to the interface between the rainscreen cladding system and the walls, roof, doors, windows, other cladding systems, and curtain walling. External and internal air and water seals should be provided at all interfaces.
Open, baffled or labyrinth (rebated) joints should normally have a minimum opening of 10mm.



Insulated Render
This diagram depicts the insulated render systems that are fixed to all types of backing wall.
Insulated render systems should have current certification confirming satisfactory assessment by an appropriate independent technical approvals authority accepted by LABC Warranty, including: British Board of Agrément (BBA), Building Research Establishment (BRE) or European Technical Approval (ETA) Certification.

Items to be taken into account include:

Loads, movement and fixings
Dead and live loads should be transferred safely to the building's structure without undue permanent deformation or deflection of any component.
Imposed loads should be calculated in accordance with BS 6399 and take account of the location, shape and size of the building.

Thermal-induced loads due to differential stresses caused by temperature gradients within materials or components should be accommodated without any reduction in performance. The stresses in components and materials should not exceed the permissible values recommended by the manufacturer. Movement within the insulated render system should be accommodated without any reduction in performance.

Movement joints in the backing wall should be continued through the insulated render system and formed in accordance with the manufacturer's recommendations. Pull-out or destructive testing of anchors and fixings should be carried out in accordance with the design, BS 5080 and the Construction Fixings Association Guidance Note 'Procedure for Site Testing Construction Fixings'.

Weather resistance
Insulated render systems, together with the backing wall to which they are applied, should satisfactorily resist the passage of moisture to the inside of the building.
For timber and steel framed backing walls a cavity of at least 15mm should be provided between the wall and the insulation to allow any moisture to drain away.
The introduction of a cavity is likely to increase the risk of impact damage to vulnerable areas of the insulated render system, e.g. at low level, around balconies and where cradle systems, etc. can come into contact with the façade.
Dpc/dpm trays with stop ends should be provided above openings, above cavity barriers, at the base of the insulated render system and at interfaces where necessary to ensure water is drained to the outside. The insulated render support system should not obstruct the drainage paths.

Insulation
The insulation type should be suitable for the intended purpose and be appropriately keyed to receive the render finish.
The insulated render system should be securely fixed to the support frame or backing wall with appropriate fixings/adhesive in accordance with the manufacturer's recommendations.
The design should ensure the continuity of insulation around openings and other penetrations.

Condensation
The insulated render system should be designed to minimise the risk of thermal bridging and surface and interstitial condensation.
A condensation risk analysis in accordance with BS 5250 : 2002 should be carried out. Unless it shows otherwise, a vapour control layer should be provided. The vapour control layer should be fixed on the warm side of the wall insulation.

GUIDANCE DOCUMENTS

A satisfactory performance for the external walls may be achieve by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets, Deemed-to-satisfy provisions for other guidance documents, as appropriate.

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings
Approved Document E - Resistance to the passage of sound

SECTION 4.3 INTERNAL WALLS

PRINCIPAL PERFORMANCE STANDARDS

Internal walls - (including separating walls) shall be designed and constructed so that they:

a) are structurally sound;
b) have adequate resistance to the effects of fire and surface spread of flame;
c) are durable and resistant to moisture;
d) provide suitable surfaces to receive a range of finishes.

Separating walls - shall be designed and constructed so that they:

a) have adequate resistance to the spread of fire between Housing Units, and between Housing Units and other buildings;
b) have adequate resistance to the passage of sound between Housing Units, and between Housing Units and other buildings.

Separating walls between the dwelling area and **garage** –within a Housing Unit shall be designed and constructed so that they

a) have adequate resistance to the spread of fire between garage, and dwelling area;
b) have an adequate thermal performance

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, the internal walls must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement B2 - Internal fire spread (linings)
Requirement B3 - Internal fire spread (structure)
Requirement C2 - Resistance to moisture
Requirement E1 - Protection against sound from other parts of the building and adjoining buildings
Requirement L1 - Conservation of fuel and power

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **internal walls** should be designed and constructed so that:

a) they are structurally sound;
b) in the event of fire in the Housing Unit, they are able to resist the spread of fire within the Housing Unit;
c) they are able to resist the passage of moisture to the inside of the Housing Unit from the ground and are not adversely affected by harmful or toxic materials in the atmosphere or moisture from the ground;
d) they avoid the creation of thermal bridges which might give rise to the formation of condensation;
e) they provide an acceptable and durable surface;
f) they provide a suitable surface for the application of wet or dry finishing systems.

Additionally, **internal walls which separate** Housing Units from other Housing Units or from other buildings, should be designed and constructed so that they:

a) resist the spread of fire between the adjacent buildings for a reasonable period of time;
b) provide adequate resistance to the transmission of airborne sound between the adjacent buildings, both directly through the separating wall (direct transmission) and via the adjoining construction (flanking transmission).

Additionally, **internal walls which separate the dwelling area for a garage** –within a Housing Unit, should be designed and constructed so that they:

a) resist the spread of fire between the garage and the dwelling area for a reasonable period of time;
b) provide adequate resistance to the transmission of heat between dwelling area and unheated garage and avoid the creation of thermal bridges, which might give rise to the formation of condensation

Load bearing internal walls should be designed and constructed so that:

a) they are able to sustain and transmit all normal loads from the Housing Unit to the ground, without affecting the stability of the Housing Unit (and adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the Housing Unit;
b) they are able to continue to carry the normal loads for a reasonable time, in the event of fire in the Housing Unit.

GUIDANCE DOCUMENTS

A satisfactory performance for the internal walls may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document E - Resistance to the passage of sound
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

SECTION 4.4 UPPER FLOORS

PRINCIPAL PERFORMANCE STANDARDS

Upper floors - (including separating floors) shall be designed and constructed so that they:

a) provide suitable surfaces for normal dwelling activities;
b) are structurally sound;
c) are durable and resistant to moisture;
d) have adequate resistance to the effects of fire and surface spread of flame;

Separating floors - floors which separate Housing Units from other parts of the same building (such as in flats) shall be designed and constructed so that they:

a) have adequate resistance to the spread of fire between Housing Units, and between Housing Units and other buildings;
b) have adequate resistance to the passage of sound between Housing Units, and between Housing
Units and other buildings.

Separating floor between the dwelling area and **garage or outside** –within a Housing Unit shall be designed and constructed so that they:

a) have adequate resistance to the spread of fire between garage, and dwelling area;
b) prevent undue heat losses from the dwelling area to unheated garage or outside

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, the upper floors must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement B2 - Internal fire spread (linings)
Requirement B3 - Internal fire spread (structure)
Requirement E1 - Protection against sound from other parts of the building and adjoining buildings
Requirement E2 - Protection against sound within a dwelling-house etc
Requirement L1 – Conservation of fuel and power in dwellings

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **upper floors** should be designed and constructed so that:

a) in the event of fire in the Housing Unit, they are able to resist the spread of fire within the Housing Unit;
b) they provide acceptable and durable upper and lower surfaces;
c) they provide a suitable surface for the application of wet or dry finishing systems.
d) they are able to sustain and transmit all normal loads without affecting the stability of the Housing Unit (and adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the Housing Unit;
e) they are able to continue to carry the normal loads for a reasonable time, in the event of fire in the Housing Unit;
f) if necessary, they are able to accommodate normal domestic service installations without adversely affecting the structural stability of the floor.

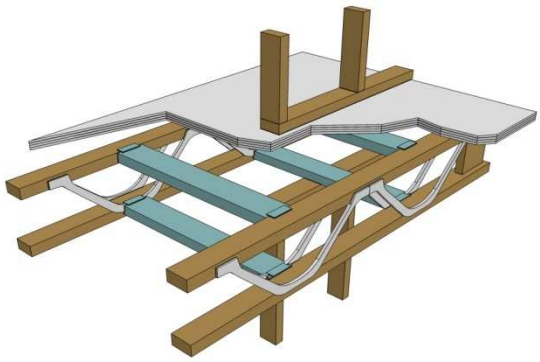
Additionally, **upper floors which separate** Housing Units from other Housing Units or from other parts of the same building (i.e. separating floors), should be designed and constructed so that they:

a) resist the spread of fire between the dwellings or between the dwellings and other parts of the same building, for a reasonable period of time;
b) provide adequate resistance to the transmission of airborne and impact sound between Housing Units or between Housing Units and other parts of the same building, both directly through the separating floor (direct transmission) and via the adjoining construction (flanking transmission).

Additionally, **upper floors which separate** a floor between the dwelling area and garage or outside air –within shall be designed and constructed so that they:

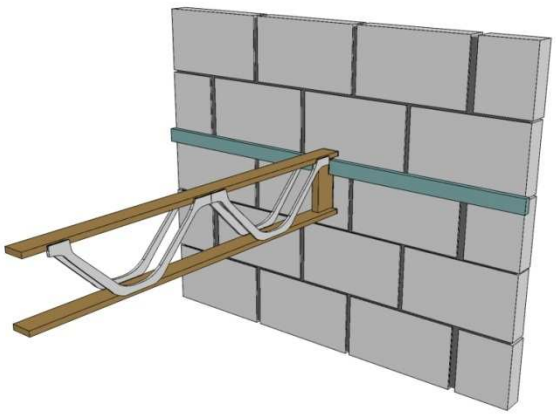
a) have adequate resistance to the spread of fire between garage, and dwelling area;
b) prevent undue heat losses from the dwelling area to unheated garage or to the outside of the of a Housing Unit;

Upper Floor design



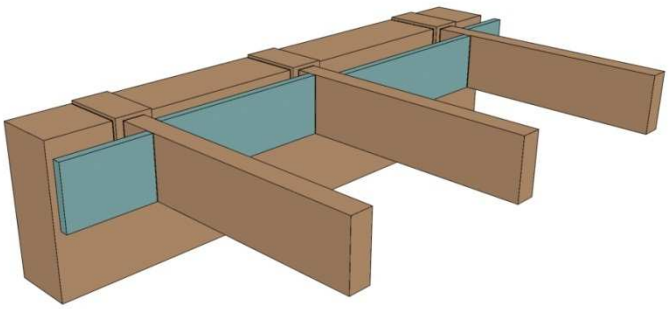
"I" and Metal Web Joist

The support reaction due to dead and imposed loads on the floor should not exceed the recommended value specified by the manufacturers of I-joists and metal web joists.
Where and when necessary, I-joists should have web stiffeners at the points of concentrated loads in accordance with the manufacturer's recommendations.



Metal web joists ought to have uprights at the supports between the flanges, held in place by punched metal plate fasteners. Other support options are either top or bottom chord (flange) support. I-joists and metal web joists should be specified in accordance with the manufacturer's instructions and the following deflection limits based on total dead and imposed loads for combined bending and shear; 0.003 times the span with a maximum deflection of 14mm if strutting is provided or 12mm if strutting is not provided.

I-joists and metal web joists should not be used at anytime where a part of the joist is exposed to external conditions.



Joists supported by hangers
Solid blocking should be used at all joist bearings of solid timber joists where they are not built into brickwork or blockwork. This includes some variations of timber frame construction. The blocking may be used for fixing plasterboard and or floor decking.

GUIDANCE DOCUMENTS

A satisfactory performance for the upper floors may be achieved by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document E - Resistance to the passage of sound
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

SECTION 4.5 ROOFS

PRINCIPAL PERFORMANCE STANDARDS

Roof structures and coverings - roofs shall be designed and constructed so that they:

a) are structurally sound;
b) satisfactorily resist the passage of moisture due to rain and snow to the inside of the building, and to materials which might be adversely affected by such moisture;
c) encourage the rapid discharge of moisture due to rain and snow from their external surfaces to a suitable discharge system;
d) have an adequate thermal performance;
e) are durable and resistant to moisture due to the weather, condensation or some other cause;
f) have adequate resistance to fire penetration and the spread of flame across their external surfaces;
g) do not allow fire spread across the tops of separating walls;
h) resist flanking sound transmission where adjacent to separating walls.

BUILDING REGULATION REQUIREMENTS

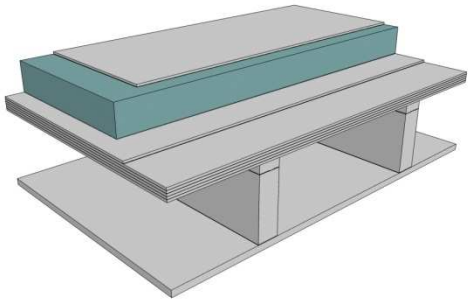
***For England and Wales**, roofs must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement B2 - Internal fire spread (linings)
Requirement B3 - Internal fire spread (structure)
Requirement B4 - External fire spread
Requirement C2 - Resistance to moisture
Requirement E1 - Protection against sound from other parts of the building and adjoining buildings
Requirement E2 - Protection against sound within a dwelling-house etc
Requirement H3 - Rainwater drainage
Requirement L1 - Conservation of fuel and power in dwellings

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **roofs** should be designed and constructed so that:

a) in the event of fire in the Housing Unit, they are able to resist the spread of fire within the Housing Unit and to adjacent buildings;
b) in the event of fire in adjacent buildings, they are able to resist fire spread to the Housing Unit;
c) they provide acceptable and durable internal and external surfaces;
d) they provide a suitable internal surface for the application of wet or dry finishing systems;
e) they are able to sustain and transmit all normal loads without affecting the stability of the Housing Unit (and adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the Housing Unit;
f) they are able to resist the passage of moisture from rain or snow to the inside of the Housing Unit, and are not adversely affected by harmful or toxic materials in the atmosphere;
g) they prevent undue heat losses from the Housing Unit and avoid the creation of thermal bridges which might give rise to the formation of condensation;
h) they encourage the rapid discharge of moisture due to rain or snow from their surfaces to suitable gutters and down pipes, or to some other form of collection and discharge, which prevents moisture from re-entering the building where it might have adverse effects;
i) flanking sound transmission is avoided at roof/separating wall junctions.



Warm Deck (Timber)

Reflective surface
Solar reflective treatment consisting of stone chippings or tiles of concrete or fibre cement.

Weatherproofing
Weatherproofing should entail one of the following treatments:

- Sheet metal roof complying with BS 6915 for lead or the relevant parts of CP 143 for other sheet materials
- Mastic asphalt (BS 6925), 20mm thick on the flat, laid on sheathing felt (Class 4 in BS 747)
- Bitumen roofing felt to BS 747 from the following table:

Type of Roofing Felt			Insulation Material	Method of fixing 1st layer
First Layer	Second Layer	Cap Sheet		
Type 3B	Type 5U	Type 3b or 3e	Glass Fibreboards Rock Fibreboards Corkboards	Full Bond
Type 5U	-	Type 5b or 5e		
Type 3G	Type 3B	Type 5b or 5e	Polyurethane and Polyisocyanurate boards	Partial Bond
Type 3G	Type 5U	Type 5b or 5e		

Cap sheeting with a 'b' suffix require a stone chipping finish. Normally, a separate stone chipping finish is required due to fire regulations.

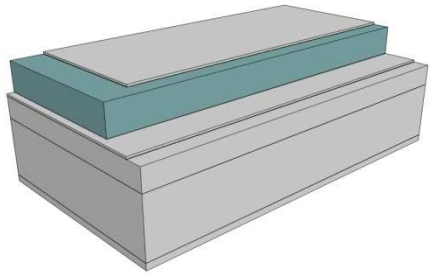
Insulation
The following rigid insulation boards are suitable:
- Glass fibreboards or rock fibreboards
- Corkboard.
- Polyurethane and Polyisocyanurate

Vapour control layer
Vapour control layers must consist of at least one layer of bitumen as roofing felt Type 3B partially bonded to the structural deck: all laps must also be sealed with bitumen.

Preservative treatment
All roof timbers, joists, wall plates, blocking, strutting, battens, firings and noggings to be treated by a preservative, unless naturally durable.

Deck
Timber or timber-based decks should be one of the following:

Material	**Minimum Board thickness for joist centres (mm)**		
	400mm	**450mm**	**600mm**
Pre-treated timber boarding(tongued & grooved)	16	16	19
Pre-treated plywood WBP grade	12	12	15
Marine plywood WBP grade	12	12	15
Wood chipboard, type P5	18	18	22
Woodwool slabs, type SB	51	51	51
Oriented strand board type OSB3	16	16	19



Warm Deck (concrete)
Reflective surface
Solar reflective treatment, consisting of stone chippings or tiles of concrete and / or fibre cement.

Weatherproofing
Weatherproofing should be one of the following:

- Sheet metal roof complying with BS 6915 for lead or the relevant parts of CP 143 for other sheet materials.
- Mastic asphalt (BS 6925), 20mm thick on the flat, laid on sheathing felt (Class 4 in BS 747)
- Bitumen roofing felt to BS 747 from the following table:

Type of Roofing Felt			**Insulation Material**	**Method of fixing 1st layer**
First Layer	**Second Layer**	**Cap Sheet**		
Type 3B	Type 5U	Type 3b or 3e	Glass Fibreboards Rock Fibreboards Corkboards	Full Bond
Type 5U	-	Type 5b or 5e		
Type 3G	Type 3B	Type 5b or 5e	Polyurethane and Polyisocyanurate boards	Partial Bond
Type 3G	Type 5U	Type 5b or 5e		

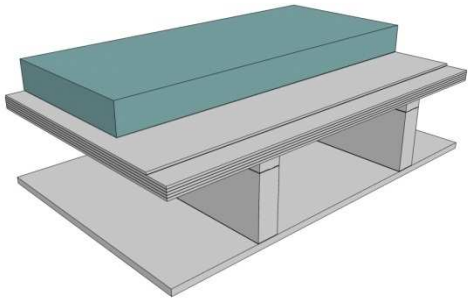
Cap sheeting with a 'b' suffix require a stone chipping finish. Normally, a separate stone chipping finish is required due to fire regulations.

Vapour control layer
Vapour control layers must consist of at least one layer of bitumen as roofing felt Type 3B partially bonded to the structural deck: all laps must also be sealed with bitumen.

Concrete deck and screeds
Concrete roof deck, with dense screed topping to achieve the falls. The screed should be a minimum of 40mm in thickness at all time.

Adequate time should be given for the drying out of the slab prior to any plastering/dry lining.

For in-situ site works, allowance should be made for draining away excess moisture that will be a by product of construction.



Inverted Roof (timber)

(NOT suitable for slopes greater than 10°)

Ballast

Ballast may consist of either paving slabs or a 50mm thickness of rounded pebbles with a minimum diameter of 19mm.

Insulation

Insulation must be a type unaffected by exposure to the weather. The following materials are suitable:

- Extruded polystyrene with ballast surface
- Extruded polystyrene
- Compressed boards of glass fibre/rock fibre

Weatherproofing

Weatherproofing should be one of the following:

- Bitumen roofing felt to BS 747: Pre-felting of the deck material cannot be counted as part of the weatherproofing.
- Mastic asphalt (BS 6925), 20mm thick on the flat, laid on sheathing of felt (Class 4 in BS 747)

Type of Roofing Felt			**Insulation Material**	**Method of fixing 1st layer**
First Layer	**Second Layer**	**Cap Sheet**		
Type 3B	Type 5U	Type 3b or 3e	Glass Fibreboards Rock Fibreboards Corkboards	Full Bond
Type 3B	Type 5U	Type 5b or 5e		
Type 3G	Type 3B	Type 5b or 5e	Polyurethane and Polyisocyanurate boards	Partial Bond
Type 3G	Type 5U	Type 5b or 5e		

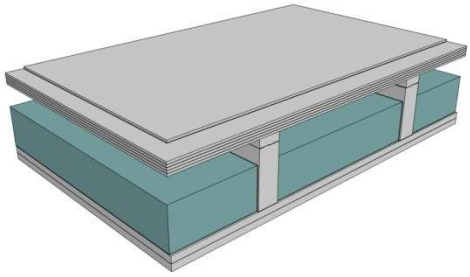
Preservative treatment

All roof timbers, joists, blocking, wall plates, strutting, firings, battens and noggings must be treated by preservative, unless they are naturally durable.

Deck
Timber or timber-based decks should be one of the following:

Material	**Minimum Board thickness for joist centres (mm)**		
	400mm	**450mm**	**600mm**
Pre-treated timber boarding(tongued & grooved)	16	16	19
Pre-treated plywood WBP grade	12	12	15
Marine plywood WBP grade	12	12	15
Wood chipboard, type P5	18	18	22
Woodwool slabs, type SB	51	51	51
Oriented strand board type OSB3	16	16	19

Joists and firings
The use of ballast may affect the timber size: for accurate sizes and spacing, reference should be made to tables prepared to recognised standards.
The weight of 50mm thick pebbles as ballast is approximately 80kg/m^2. The highest dead load figure (0.75kN/m^2 to 1.00kN/m^2) should be used to determine the joist sizing.



Cold Deck
Cold deck roofs can be used in the UK only where:
• The required level of ventilation can be achieved
• A ventilation space of 50mm can be maintained.
• Ventilation paths are not blocked by structural or other members

Reflective surface
Solar reflective treatment consisting of stone chippings, tiles of concrete and / or fibre cement.

Weatherproofing
Weatherproofing should be one of the following:
- Sheet metal roof complying with BS 6915 for lead or the relevant parts of CP 143 for other sheet materials.
- Mastic asphalt (BS 6925), 20mm thick on the flat, laid on sheathing felt (Class 4 in BS 747)
- Bitumen roofing felt to BS 747 from the following table:

Type of Roofing Felt			**Insulation Material**	**Method of fixing 1st layer**
First Layer	**Second Layer**	**Cap Sheet**		
Type 3B	Type 5U	Type 3b or 3e	Glass Fibreboards Rock Fibreboards Corkboards	Full Bond
Type 3B	Type 5U	Type 5b or 5e		
Type 3G	Type 3B	Type 5b or 5e	Polyurethane and Polyisocyanurate boards	Partial Bond
Type 3G	Type 5U	Type 5b or 5e		

Cap sheeting with a 'b' suffix require a stone chipping finish. Normally, a separate stone chipping finish is required due to fire regulations. In areas of high wind exposure, a first layer of Type 5U should be used instead of Type 3B. Pre-felting of the roof cannot be counted as part of the weatherproofing.

Preservative treatment
All roof timbers, joists, blocking, wall plates, strutting, firings, battens and noggings must be treated by preservative, unless they are naturally durable.

Deck
Timber or timber-based decks should be one of the following:

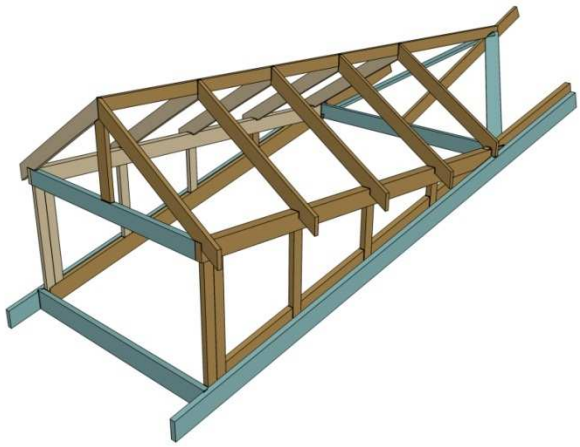
Material	Minimum Board thickness for joist centres (mm)		
	400mm	450mm	600mm
Pre-treated timber boarding(tongued & grooved)	16	16	19
Pre-treated plywood WBP grade	12	12	15
Marine plywood WBP grade	12	12	15
Wood chipboard, type P5	18	18	22
Woodwool slabs, type SB	51	51	51
Oriented strand board type OSB3	16	16	19

Joists and firings
The use of ballast may affect the timber size: for accurate sizes and spacing, reference should be made to tables prepared to recognised standards.
The weight of 50mm thick pebbles as ballast is approximately 80kg/m^2. The highest dead load figure (0.75kN/m^2 to 1.00kN/m^2) should be used to determine the joist sizing.

Ventilation
Every void should be ventilated with a totally unobstructed air flow to two opposite sides of the roof. The ventilation openings should be at a minimum, equal to continuous ventilation running the full length of the eaves and 25mm wide. A ventilation space of at least 50mm should be left between the decking and the insulation. Strutting must not obstruct ventilation. For roofs other than a single rectangle or roofs with a span greater than 10m, the eaves ventilation should be increased to 0.6% of the roof plan area. The actual width of ventilation openings will depend on the length of eaves and the shape of the roof.

Insulation
The thickness of the Insulation of rock fibre and / or glass fibre, directly above the ceiling, should correspond with the Building Regulations. Joist depths should allow for a minimum of 50mm air space above the insulation.

Vapour control layer
A vapour control layer of foil-backed or moisture-resistant plasterboard with the board joints fixed over joists; alternatively polyethylene sheeting can be used, with a minimum of 250g with 150mm laps.



Dormer construction
On most dormers, the dormer cheek studs ought to be supported either by a double rafter or by a double floor joist. Where cheek framing does not extend to floor level, a double rafter will give necessary support to the cheek. The two rafters must be securely fixed together. Trimmings around dormers should be large enough to take the extra load from the cut main roof members, dormer framing and cladding, as highlighted in the design. Dormers should be framed up so they are independent of the window frame by using a suitable lintel over the opening.

GUIDANCE DOCUMENTS

A satisfactory performance for roofs may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document E - Resistance to the passage of sound
Approved Document F - Ventilation
Approved Document H - Drainage and waste disposal
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

PART 5

SECONDARY ELEMENTS

SECTION 5.1 STAIRCASES, RAMPS AND GUARDS

PRINCIPAL PERFORMANCE STANDARDS

Staircases, ramps and guards - shall be designed and constructed so that they:

a) offer safe passage between levels in the Housing Unit;
b) provide a safe means of escape in case of fire;
c) where necessary, provide a safe means of access for ambulant disabled people;
d) are structurally sound;
e) adequately protect the user from the risk of falling;
f) are adequately lit.

Additionally, **common access staircases in flats** which form part of the separation between flats and between other parts of the same building shall:

a) have adequate resistance to the spread of fire;
b) have adequate resistance to the passage of sound.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, staircases, ramps and guards must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement B1 - Means of warning and escape
Requirement E1 - Protection against sound from other parts of the building and adjoining buildings
Requirement E2 - Protection against sound within a dwelling-house etc
Requirement K1 - Stairs, ladders and ramps
Requirement K2 - Protection from falling
Requirement M1 - Access and use

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance during normal use and in the event of fire, **staircases and ramps** should be designed and constructed so that:

a) they are structurally sound and offer a secure and slip resistant surface at a suitable pitch to allow users to move safely between levels in the Housing Unit;
b) they have sufficient headroom and width to ensure safe passage;
c) they provide safe and convenient access for ambulant disabled people as required by Building Regulations.

Staircases and ramps should be provided with:

a) suitable guarding, of sufficient strength to resist horizontal forces, where necessary to protect users (including young children) from the risk of falling or becoming trapped;
b) handrails on one or both sides as necessary, to provide support and assistance;
c) sufficient artificial lighting to ensure safe passage at all times.

Additionally, common access staircases in flats which form the separation between flats and other parts of the same building, should be designed and constructed so that they:

a) resist the spread of fire between the flats or between the flats and other parts of the same building, for a reasonable period of time;
b) provide adequate resistance to the transmission of airborne and impact sound between the flats or between the flats and other parts of the same building, both directly through the staircase (direct transmission) and via the adjoining construction (flanking transmission.

GUIDANCE DOCUMENTS

A satisfactory performance for staircases, ramps and guards may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document E - Resistance to the passage of sound
Approved Document K - Protection from falling, collision and impact
Approved Document M - Access to and use of buildings

SECTION 5.2 FUEL BURNING INSTALLATIONS

PRINCIPAL PERFORMANCE STANDARDS

Chimneys, flues, flue-pipes, fireplace recesses and hearths - shall be designed and constructed so that they:

a) ensure efficient operation of the fuel-burning appliance for which they have been designed;
b) are provided with sufficient air for proper combustion of the fuel;
c) are structurally sound and do not adversely affect the structural stability of the Housing Unit where they pass through floors, walls or roofs;
d) protect the structure and fabric of the building from the effects of fire;
e) do not adversely affect the ability of the Housing Unit to resist the effects of weather and ground moisture;
f) discharge the products of combustion safely to the outside air.

BUILDING REGULATION REQUIREMENTS

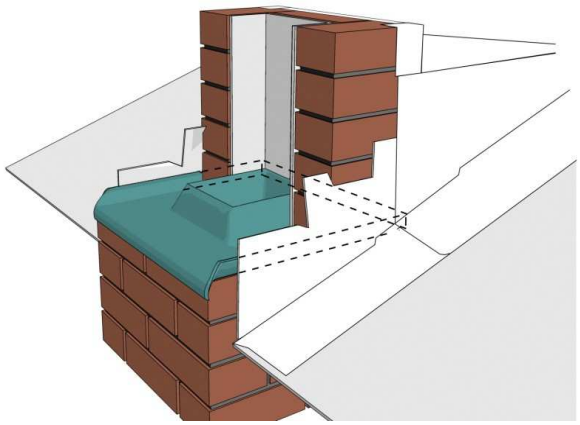
***For England and Wales**, chimneys, flues, flue-pipes, fireplace recesses and hearths must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000*:

Requirement A1 - Loading
Requirement B3 - Internal fire spread (structure)
Requirement C2 - Resistance to moisture
Requirement F1 - Means of ventilation
Requirement J1 - Air supply
Requirement J2 - Discharge of products of combustion
Requirement J3 - Protection of building

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **fuel-burning installations** should be designed and constructed so that:

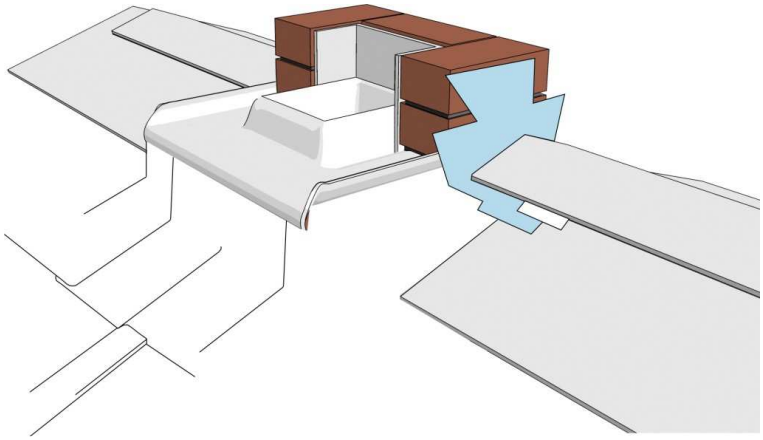
a) the system and components of the installation are appropriate for the fuel(s) for which they are designed;
b) all normal loads resulting from the installation are sustained and transmitted without affecting the stability of the Housing Unit (and adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the Housing Unit;
c) the structural integrity of the Housing Unit is not compromised where chimneys and flue-pipes pass through floors, walls or roofs;
d) the fuel-burning appliance operates efficiently under normal working conditions, is provided with sufficient air for proper and safe combustion of the fuel, and is installed and maintained in accordance with the manufacturers instructions;
e) the structure and fabric of the building is not put at risk from fire or high temperatures generated within the installation;
f) the ability of the Housing Unit to resist the effects of weather or moisture rising from the ground is not compromised where chimneys or flues pass through ground floors, external walls or roofs;
g) the products of combustion are conveyed by suitable flues, flue-pipes, or flue liners adequately supported in chimneys as appropriate, to the outside air where they are discharged safely and efficiently, having regard to the location of the outlet and the construction of the Housing Unit.



Flue block chimneys
Gas flue block chimneys are solely suitable for gas appliances, their suitability ought to be checked before connecting any appliance(s). Flue block chimneys should be constructed, jointed and weather proofed in accordance with the designers instructions. A high standard of workmanship should be maintained to guarantee that the flue is satisfactorily clean and sealed. Flue blocks should be correctly bonded with the flanking masonry. Where gas flue blocks are shown in the design they will be at least 140mm wide, this could be wider than the wall leaf itself.

Connection between flue block chimney and roof outlet
Connections between flue blocks and ridge terminals should be made as detailed as possible in the design, using the correct fittings and supports as specified by the manufacturers of the flue blocks, flue pipe and the ridge terminal.

Flue block, chimney and roof outlet weatherproofing details
Weatherproofing details recommended for use in Very Severe and Severe exposure zones
In other exposure zones the dpc tray can be dressed up the outside of the flue liner. All other details are the same.
Note: All flashings and trays in chimneys to be metal.



GUIDANCE DOCUMENTS

A satisfactory performance for fuel-burning installations may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document F - Ventilation
Approved Document J - Combustion appliances and fuel storage systems

SECTION 5.3 EXTERNAL FRAMES

PRINCIPAL PERFORMANCE STANDARDS

Windows, external doors and frames, and roof lights - shall be designed and constructed so that they:

a) are durable and resistant to weather;
b) provide adequate resistance to transmission of sound, where necessary;
c) have adequate thermal performance and air tightness;
d) have sufficient strength to withstand operational and wind loads;
e) offer reasonable resistance to unauthorized entry;
f) are suitable, where necessary, for means of escape in case of fire;
g) can be operated readily and safely by the user.

Windows and roof lights shall be designed and constructed so that they offer, where necessary, adequate natural ventilation.

External doors and frames shall be designed and constructed so that they:

a) resist to the spread of fire when situated between a dwelling and an attached or integral garage;
b) permit convenient access for disabled people.

Glazing in windows, doors and roof lights shall be designed and constructed so that it:
a) has sufficient strength;
b) can be readily cleaned.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, windows, external doors and frames, and roof lights must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement B1 - Means of escape
Requirement B3 - Internal fire spread (structure)
Requirement B4 - External fire spread
Requirement C2 - Resistance to moisture
Requirement F1 - Means of Ventilation
Requirement L1 - Conservation of fuel and power
Requirement M1 - Access and use
Requirement N1 - Protection against impact

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance**, windows, external doors and frames, and roof lights** should be designed and constructed so that:

a) they are able to resist the passage of moisture from rain or snow to the inside of the Housing Unit, and are not adversely affected by harmful or toxic materials in the atmosphere;
b) they prevent undue heat losses from the Housing Unit and avoid the creation of thermal bridges which might give rise to the formation of condensation;
c) outside noise is reduced to acceptable levels in the Housing Unit, where high outside noise levels are anticipated, such as near airports or motorways;
d) acceptable and durable internal and external surfaces are provided;
e) they offer sufficient strength, appropriate for the location of the Housing Unit, to withstand wind loads without suffering damage or loss of air tightness;
f) they are robust enough to withstand normal use and cleaning;
g) they resist unauthorised entry without jeopardising means of escape in case of fire;
h) means of escape in case of fire is facilitated where required by Building Regulations;
i) they can be opened, closed or adjusted safely by the user.

Additionally:

windows and roof lights should be designed and constructed so that where they are intended to provide natural ventilation by means of opening lights and/or trickle ventilators, this is provided without compromising security;

and **external doors and frames** should be designed and constructed so that:

a) they resist fire spread to the Housing Unit, for a reasonable period of time, when situated between the Housing Unit and an attached or integral garage;
b) they are wide enough, and so positioned as to permit convenient access for a person in a wheelchair.

Glazing in windows, doors and roof lights shall be designed and constructed so that:

a) it will withstand normal operational loads, and wind loads which are appropriate to the location of the Housing Unit;
b) the risk of injury from breakage is reduced to a minimum;
c) it will be accessible safely and conveniently for cleaning.

GUIDANCE DOCUMENTS

A satisfactory performance for windows, external doors and frames, and roof lights may be achieved by complying with relevant parts of the following Approved Documents, Building Standards or guidance documents, as appropriate:

England and Wales

Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document F - Ventilation
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings
Approved Document M - Access to and use of buildings
Approved Document N - Glazing - safety in relation to impact, opening and cleaning

PART 6

INTERNAL FINISHING

SECTION 6.1 INTERNAL JOINERY

PRINCIPAL PERFORMANCE STANDARDS

All internal joinery items including associated ironmongery - shall be designed and constructed so that they:

a) adequately perform their intended function;
b) are suitable for their intended use and location;
c) are durable and robust;
d) adequately resist the effects of moisture, if appropriate;
e) are protected against damage;
f) are installed and function correctly.

Glazing which is installed in fixed screens, internal doors and/or door side panels shall be designed and constructed so that it has sufficient strength.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, internal joinery items must be designed and constructed in accordance with the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement B1 - Means of escape in case of fire
Requirement M1 - Access and use
Requirement N1 - Protection against impact

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance **internal joinery items** should be designed and constructed so that:

a) adequate storage space is provided in the Housing Unit at each floor level for normal household items;
b) they are robust enough to withstand normal use and cleaning;
c) they are resistant to the effects of moisture, when situated in areas of high moisture production, such as kitchens, utility rooms and bathrooms;
d) they are protected against damage occurring during construction and installation;
e) they are installed in accordance with the manufacturer's instructions and continue to adequately perform their design function under normal working conditions.

Any **glazing** which is installed in fixed screens, internal doors and/or door side panels shall be designed and constructed so that in the event of an accident, it does not present a danger of injury to users of the Housing Unit.

GUIDANCE DOCUMENTS

A satisfactory performance for internal joinery may be achieved by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets or other guidance documents, as appropriate:

England and Wales

Approved Document B: Fire safety
Approved Document M: Access to and use of buildings
Approved Document N: Glazing - safety in relation to impact, opening and cleaning

SECTION 6.2 DECORATIVE FINISHES

PRINCIPAL PERFORMANCE STANDARDS

Internal and external decorative finishes - shall be carried out:

a) to properly prepared substrates;
b) under suitable environmental conditions;
c) to provide an acceptable and durable finish;
d) so that they are not adversely affected by the substrate;
e) so that they provide adequate protection, as necessary, to non-durable elements.

BUILDING REGULATION REQUIREMENTS

In general terms, the Building Regulations in England, Wales and Northern Ireland do not apply to painting and decorating. However, there may be specific instances where decorative finishes influence compliance.

Examples include intumescent paint systems designed to provide fire resistance to otherwise unprotected structural steelwork, protective treatments applied to exposed building elements (such as preservative wood stains on exposed window areas) and decorative wall and ceiling linings which affect the flame spread characteristics of the surface.

In each case it will be necessary to show that both the materials used and the method of application will satisfy the relevant Building Regulations.

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance**, internal and external decorative finishes** should be carried out so that:

a) the temperature and humidity conditions are suitable for the decorative finish being applied;
b) the materials are applied and used to properly prepared surfaces, strictly in accordance with the manufacturers recommendations, to achieve the required design finish;
c) they are compatible with the surface to be treated and will not be adversely affected by the surface or by materials within it
d) non-durable elements such as external surfaces of timber doors and windows, are properly prepared and have the correct treatment applied so that they adequately resist the effects of weathering;
e) where combinations of different materials are used in the finishing system, they are compatible with one another.

GUIDANCE DOCUMENTS

A satisfactory performance for internal and external decorative finishes may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards or guidance documents, as appropriate:

England and Wales

Approved Document to support Regulation 7 - *Materials and workmanship*
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses

PART 7

SERVICES

SECTION 7.1 INTERNAL SERVICES

PRINCIPAL PERFORMANCE STANDARDS

Internal services - shall be designed, constructed and installed so that they:

a) conform to all relevant statutory requirements;
b) do not adversely affect the structural stability of the Housing Unit;
c) prevent the entry of hazardous ground substances, external moisture or vermin;
d) are constructed using non-hazardous materials;
e) are durable and robust;
f) are safe and convenient in use.

Cold water service - an adequate cold water service shall be provided which is:

a) suitable for normal domestic purposes;
b) protected against frost.

Hot water service - an adequate and efficient hot water service shall be provided which is:

a) sufficient for normal domestic purposes;
b) insulated to prevent unintended heat losses.

Electrical service - an adequate electrical service shall be provided which is of a suitable scale for normal domestic purposes;

Gas service - where provided, the gas service shall be of a suitable scale for normal domestic purposes;

Liquid and gaseous fixed storage installations - where provided, shall be:

a) adequate for normal domestic purposes;
b) constructed and installed to minimize the risk of fire spreading to the storage facility;
c) constructed and installed to prevent contamination caused by leakage of the contents.

Central heating - where provided, the central heating system shall be:

a) efficient and suitable for normal domestic purposes;
b) insulated to prevent unintended heat losses;
c) capable of being adequately controlled;
d) capable of maintaining suitable room temperatures.

Above ground foul and surface water drainage systems - shall be designed and constructed so that:

a) liquid and solid waste may be discharged safely and efficiently;
b) they are accessible for inspection and cleaning;
c) foul air is prevented from entering the building;
d) the risk of blockages is reduced;
e) they are adequately vented;
f) noise transmission from pipes and appliances is reduced to a minimum.

Solid waste storage and removal - every Housing Unit shall have reasonable access to a designated solid waste storage facility which is designed and constructed so that:

a) it is reasonably accessible for emptying;
b) it is of adequate capacity;
c) it does not present a health risk.

BUILDING REGULATIONS REQUIREMENTS

For England and Wales*, internal services must be designed, constructed and installed in accordance with the relevant parts of the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement B1 - Means of warning and escape
Requirement C1 - Site preparation and resistance to contaminants
Requirement F1 - Means of ventilation
Requirement G1 - Sanitary conveniences and washing facilities
Requirement G2 - Bathrooms
Requirement G3 - Hot water storage
Requirement H1 - Foul water drainage
Requirement H3 - Rainwater drainage
Requirement H6 - Solid waste storage
Requirement L1 - Conservation of fuel and power
Requirement P1 – Design and installation
Requirement M1 - Access and use
Requirement M4 - Sanitary conveniences in dwellings

OTHER LEGISLATION

Internal services must be designed, constructed and installed in accordance with the relevant parts of the following additional legislation:

England and Wales

Gas Safety (Installation and use) Regulations 1998
Water Industry Act 1991 - Water supply (water fittings) Regulations 1999
Clean Air Acts 1993
Electricity Act 1989 (as amended) and BS 7671: *Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition*

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, all **internal services** should be designed, constructed and installed so that:

a) the users are protected against injury, danger to health or damage to the fabric arising from excess temperature, electric shock, or leakage;
b) the structural stability of the Housing Unit is not adversely affected by chasing of walls, drilling and notching of timber structural members or the passage of services through foundations, walls and floors;
c) hazardous ground substances such as radon and landfill gases, moisture from the ground or vermin, are prevented from entering the building where access is made for services;
d) water supplies, watercourses, drains and sewers are protected from contamination by leakage from liquid or gaseous storage facilities;
e) materials with known health and safety risks, such as lead and asbestos, are not used;
f) harmful effects arising from corrosion, furring, electrolytic action, deterioration of plastics materials or other chemical or physical causes are avoided;
g) controls for service installations are conveniently located for disabled people.

Hot and cold water services should be designed, constructed and installed so that:

a) drinking water is available off the incoming main in the kitchen and at other points as required, but sited away from hot water pipes;
b) they are sited within the warm envelope of the Housing Unit or suitably insulated to reduce the risk of freezing;
c) sufficient water is available according to the size and scale of the installation at adequate rates of flow;
d) adequate arrangements are made for expansion of hot water;
e) hot water storage cylinders, and hot water supply pipes passing through unheated spaces are suitably insulated.

Electrical services should be designed, constructed and installed:

a) by an installer registered with the National Council for Electrical Installation and Contracting (NCEIC) or the Electrical Contractors Association;
b) so that the meter is readily accessible;
c) with an adequate number of socket outlets available in each room (except the bathroom);
d) with an adequate number of lighting outlets available in each room including circulation areas, and two-way switching available on staircases;
e) so that provision is made for extractor fans, smoke detectors and television reception.

Gas services should be designed, constructed and installed:

a) so that the meter is readily accessible;
b) by British Gas or an installer registered with Gas Safe.

Liquid and gaseous fixed storage installations should be designed, constructed and installed to prevent:

a) fire from spreading to the storage facility, by the addition of suitable fire resisting construction if situated within a building, or by adequate separation if situated outside a building;
b) contamination caused by leakage of the contents, by the use of a catch pit capable of taking the contents of the tank plus 10%;

The central heating system should be designed, constructed and installed so that:

a) room temperatures may be adequately controlled (e.g. thermostatic control);
b) where hot water is provided as part of the system, it may be independently controlled;
c) it is time controlled allowing at least two heating/hot water periods per day;
d) it is efficient in use of fuel;
e) wet heating systems and ducted warm air systems are suitably insulated where they pass through unheated spaces.

Above ground foul and surface water drainage systems should be designed and constructed so that:

a) pipe and gutter sizes are adequate to take the expected rate of discharge and are laid at suitable gradients with the minimum of direction changes;
b) suitable sized traps are provided which will retain their seal under normal working conditions;
c) rodding access is provided at all direction changes;
d) sufficient ventilation is provided to prevent the build up of pressure in the system and to ensure the correct working of trap seals;
e) noise transmission from pipes and appliances is reduced to a minimum by good design, and sensitive siting of pipes and appliances relative to sleeping areas.

Solid waste storage facilities should be designed and constructed so that:

a) for Housing Units in buildings up to four storeys high, a separate movable container is provided for each Housing Unit, situated in a suitable enclosure;
b) for Housing Units in buildings over four storeys high, a shared container fed by a chute is provided, or other suitable management arrangements are made for taking the solid waste to the storage facility;
c) they are not more than 30 m from the Housing Unit or 25 m from any vehicle access;
d) they are of adequate capacity assuming weekly collection;
e) they can be readily cleaned and are adequately ventilated;
f) their siting is not prejudicial to health.

GUIDANCE DOCUMENTS

A satisfactory performance for internal services may be achieved by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document B - Fire Safety: Volume 1 - Dwelling Houses
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document F- Ventilation
Approved Document G - Hygiene
Approved Document H - Drainage and waste disposal
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings
Approved Document M - Access to and use of buildings
Approved Document P - Electrical safety - dwellings

SECTION 7.2 EXTERNAL SERVICES

PRINCIPAL PERFORMANCE STANDARDS

Below ground foul and surface water drainage - shall be designed and constructed so that it:

a) conforms to all relevant statutory requirements;
b) safely and effectively conveys the discharges to a suitable outfall;
c) does not adversely affect the structural stability of the Housing Unit;
d) prevents the entry into the Housing Unit of hazardous ground substances, external moisture or vermin;
e) is durable and robust;
f) is accessible for inspection and cleaning;
g) reduces to a minimum the risk of blockages;
h) is adequately vented.

BUILDING REGULATIONS REQUIREMENTS

***For England and Wales**, below ground foul and surface water drainage must be designed and constructed in accordance with the relevant parts of the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement A1 - Loading
Requirement C1 - Site preparation and resistance to contaminants
Requirement H1 - Foul water drainage
Requirement H2 - Waste water treatment systems and cesspools
Requirement H3 - Rainwater drainage

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **below ground foul and surface water drainage** should be designed and constructed so that:

a) it complies with the requirements of the local sewerage undertaker and local authority where necessary, and discharges to an approved outfall;
b) the structural stability of the Housing Unit is not adversely affected by the passage of drains through foundations, walls and floors, or by excavations for drainage adjacent to the Housing Unit;
c) the drains are adequately protected from ground loads;
d) hazardous ground substances such as radon and landfill gases, moisture from the ground or vermin, are prevented from entering the building where access is made for drains;
e) harmful effects arising from corrosion, furring, deterioration of plastics materials or other chemical or physical causes are avoided;
f) pipe sizes are adequate to take the expected rate of discharge and are laid at suitable gradients with the minimum of direction changes;
g) rodding access is provided in accordance with the manufacturer's recommendations for the chosen system of drainage and in accordance with normal practice;
h) sufficient ventilation is provided to prevent the build up of pressure in the system and to ensure the correct working of trap seals;
i) where necessary suitable sized traps are provided which will retain their seal under normal working conditions.

GUIDANCE DOCUMENTS

A satisfactory performance for the below ground foul and surface water drainage may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards or guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document H - Drainage and waste disposal

PART 8

EXTERNAL WORKS

SECTION 8.1 DETACHED GARAGES, CONSERVATORIES AND SMALL OUTBUILDINGS

PRINCIPAL PERFORMANCE STANDARDS

Garages, conservatories, small outbuildings and extensions with floor areas not exceeding 30m^2 shall be designed and constructed so that they:

a) are structurally sound and do not impair the stability of adjacent structures;
b) are durable and resistant to weather and ground moisture;
c) have adequate provision for drainage of roof water;
d) have resistance to the spread of fire to the Housing Unit or adjacent structures;
e) offer reasonable resistance to unauthorized entry;
f) comply with Part 7 of this manual where service installations are provided;
g) have glazing of sufficient strength, where provided.

BUILDING REGULATION REQUIREMENTS

Most of the buildings covered by this section are exempt from formal Building Regulation control. However, for the purposes of this Manual, the following parts of the Building Regulations should be met for the buildings covered by this section, to a degree which is appropriate in the circumstances:

England and Wales

Requirement A1 - Loading
Requirement B4 - External fire spread
Requirement C2 - Resistance to moisture
Requirement H3 - Rainwater drainage
Requirement N1 - Protection against impact

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **garages, conservatories, small outbuildings and extensions** should be designed and constructed so that:

a) they are able to sustain and transmit all normal loads to the ground, without affecting their own stability or that of the Housing Unit (or any adjacent buildings) by excessive deflection or deformation, which would adversely affect the appearance, value and serviceability of the building or the Housing Unit;
b) they provide an acceptable and durable external surface and are not adversely affected by harmful or toxic materials in the atmosphere or from the ground;
c) they are resistant to moisture and do not allow the passage of moisture to parts of the building which would be adversely affected by moisture;
d) they encourage the rapid discharge of moisture due to rain or snow from their surfaces to suitable gutters and down pipes, or to some other form of collection and discharge, which prevents moisture from re-entering the building where it might have adverse effects;
e) in the event of fire, they resist fire spread to the Housing Unit and to adjacent buildings;
f) they are provided with sufficient locks or other devices to resist unauthorized entry;
g) where additional services installations are provided (such as central heating boilers or electrical or plumbing installations) these comply with Part 7 of this manual;
h) the risk of injury from accidental breakage of the glazing (where fitted) is reduced to a minimum.

GUIDANCE DOCUMENTS

A satisfactory performance for the design and construction of garages, conservatories, small outbuildings and extensions may be achieved by complying with relevant parts of the following Approved Documents, Building Standards, Technical Booklets, or other guidance documents, as appropriate:

In most cases the guidance documents listed in the relevant sections above (e.g. external walls, roofs etc.) will be suitable for the buildings covered by this section, and reference should be made to those sections as appropriate.

SECTION 8.2 EXTERNAL ACCESS, LANDSCAPING AND ENCLOSURE

PRINCIPAL PERFORMANCE STANDARDS

External vehicular and pedestrian access routes - shall be designed and constructed so that they:

a) permit safe and convenient access from the highway;
b) are of sufficient width;
c) are durable and weather resistant.

Landscaping - within the immediate vicinity of the Housing Unit shall be designed and constructed to be:

a) reasonably level and consistent with adjacent features;
b) suitably drained to prevent water logging of the ground near the Housing Unit;
c) provided with suitable retaining walls or graded slopes if the plot is steeply sloping.

Additionally, account shall be taken of trees and shrubs (whether existing or provided) in the planting scheme and/or the design of the Housing Unit as necessary to preserve the structural integrity of the Housing Unit.

Plot enclosure - where provided, walls and fences shall be:

a) structurally sound;
b) durable and weather resistant.

BUILDING REGULATION REQUIREMENTS

***For England and Wales**, drives and paths must be designed and constructed in accordance with the relevant parts of the following paragraphs of Schedule 1 to the Building Regulations 2000:*

Requirement H6 - Solid waste storage
Requirement M1 - Access and use

PERFORMANCE REQUIREMENTS

External access - in order to achieve a satisfactory standard of performance, external drives and paths should be designed and constructed so that:

a) a safe and convenient access is provided from the highway to the Housing Unit, garage, carport, solid waste storage facility or vehicular hard standing, as appropriate;
b) the width of the vehicular access is suitable for an average family motor car plus any allowance required by Approved Document M for disabled access;
c) their surfaces provide safe passage for motor vehicles, pedestrians and people in wheelchairs;
d) they are sufficiently durable to withstand the expected weather conditions for their location;
e) where steps are needed on steeply sloping sites, adequate handrails and guards are provided as appropriate.

Landscaping - in order to achieve a satisfactory standard of performance, landscaping should be designed and constructed so that:

a) it is reasonably level within 3m of the Housing Unit, and consistent with the levels of adjacent features such as house dpc, covers of drainage and other service access points, and drives and paths;
b) water logging of the ground near the Housing Unit is avoided by land drainage or some other means;
c) unstable ground slopes are avoided by suitably designed retaining walls or grading of the ground to avoid future movement;
d) sufficient space is allowed for existing or new trees and shrubs so that they will be able to thrive, and precautions are taken where trees or shrubs are removed, so that the structural integrity of the Housing Unit is not compromised.

Plot enclosure - in order to achieve a satisfactory standard of performance, where provided, walls and fences should be designed and constructed so that:

a) they are resistant to overturning;
b) allowance is made for thermal and moisture movement;
c) they are sufficiently durable to withstand the expected weather conditions for their location.

GUIDANCE DOCUMENTS

A satisfactory performance for the design and construction of external access, landscaping and enclosure may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards or guidance documents, as appropriate:

England and Wales

Approved Document H - Drainage and waste disposal
Approved Document M - Access to and use of buildings

PART 9

SPECIFIED CONSTRUCTION METHODS

SECTION 9.1 GROUND SUPPORTED FLOORS

BUILDING ON DEEP FILL

In cases, such as on steeply sloping sites, it is usually necessary to provide deep infilling below the ground floor. In these cases, ground supported floor slabs are unlikely to be able to carry the design loads without excessive compression of the fill and subsequent failure or deflection of the slab.

Experience has shown that fill depths in excess of 600 mm are most likely to lead to slab failure and/or excessive deflection.

PRINCIPAL PERFORMANCE STANDARDS

Therefore, in order to meet the **Principal Performance Standards** for ground floors (see part 4 above) that they:

a) provide a suitable surface for normal dwelling activities; and
b) are structurally sound,

Where the depth of fill is likely to exceed 600 mm in any self-contained area, the ground floor should be designed and constructed in that area so that it is able to carry the design loads independently of the fill.

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance **ground floors** should be designed and constructed so that they:

a) provide a level and durable surface which is suitable for normal dwelling activities;
b) are not adversely affected by ground movements and are capable of carrying the design loads, either to the foundations or directly to the ground without causing excessive settlement, which would adversely affect the appearance, value and serviceability of the Housing Unit.

Where fill in excess of 600mm is provided under a ground floor slab a satisfactory performance may be achieved by providing a suspended ground floor construction over the areas in question.

GUIDANCE DOCUMENTS

A satisfactory performance for the suspended ground floor construction may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document A - Structure
Approved Document C - Site preparation and resistance to contaminants and moisture
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

SECTION 9.2 PLASTERING

WET PLASTERING ON LIGHTWEIGHT BACKGROUNDS

Modern lightweight and aerated block work backgrounds designed to give enhanced thermal properties to a wall can give rise to extremely high suction when wet plastered, leading to unacceptable drying shrinkage. Pre-wetting of the substrate is often carried out to counteract suction but wetting alone may be insufficient as the water is almost immediately absorbed. Additionally, the use of PVA bonding agents to reduce suction is not recommended in continuously damp or humid conditions or where the plaster thickness is likely to vary greatly from normal.

PRINCIPAL PERFORMANCE STANDARDS

Therefore, in order to meet the **Principal Performance Standards** for external and internal walls (see part 4 above) that they provide suitable surfaces to receive a range of finishes, the specified surfacing material must be compatible with the substrate and must provide a finish which is sound and free from excessive shrinkage cracking.

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **external and internal walls** should be designed and constructed so that:

a) they provide an acceptable and durable surface;
b) they provide a suitable surface for the application of wet or dry finishing systems.

Where the substrate consists of lightweight or aerated concrete block work or brickwork a satisfactory performance may be achieved by providing either:

a) a reinforcing layer of expanded metal lath over the entire face of the substrate to support the wet plaster; or
b) a suitable system of dry lining.

GUIDANCE DOCUMENTS

A satisfactory performance for the internal plastered or dry lined surfaces may be achieved by complying with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document B - Fire safety
Approved Document L1A - Conservation of fuel and power in dwellings
Approved Document L1B - Conservation of fuel and power in existing dwellings

SECTION 9.3 PLASTER FINISHES TO SEPARATING WALLS

PLASTER FINISHES AND RESISTANCE TO THE PASSAGE OF SOUND

Building regulations in all parts of the United Kingdom require that separating walls between dwellings, or between dwellings and other buildings, provide adequate resistance to the passage of airborne sound. The guidance documents (such as Approved Document E for England and Wales) give a range of examples of wall constructions which will satisfy the requirements and these include the use of both wet plaster and dry lining. Experience has shown that that dry-lined masonry separating walls often fail to reach the required standard due to substandard workmanship, which leads to the presence of air paths in the masonry core and inadequate sealing of the lining materials.

PRINCIPAL PERFORMANCE STANDARDS

Therefore, in order to meet the **Principal Performance Standards** for separating walls (see part 4 above) to have adequate resistance to the passage of sound between Housing Units, and between Housing Units and other buildings, an imperforate form of construction should be adopted.

PERFORMANCE REQUIREMENTS

In order to achieve a satisfactory standard of performance, **separating walls** should be designed and constructed so that they provide adequate resistance to the transmission of airborne sound between the adjacent buildings, both directly through the separating wall (direct transmission) and via the adjoining construction (flanking transmission).

Where it is proposed to dry line a solid or cavity masonry wall with plasterboard the following conditions should be met:

a) perforated or hollow bricks or blocks should not be used;
b) the mass of the wall (including the linings) should comply with the relevant statutory guidance;
c) bricks should be laid frog up and all joints should be properly filled with mortar;
d) solid brick walls should be laid in a bond which includes headers;
e) solid block walls should be constructed in blocks which extend the full thickness of the wall;
f) reductions in the thickness of the masonry core should be avoided, but where this is unavoidable, such as when accommodating electrical sockets or chases for services these should not be directly opposite each other;
g) in general, the dry-lining manufacturer's recommendations should be followed regarding staggering of joints and positioning of sealant, however all boards should be sealed at their bases with a continuous strip of jointing compound;
h) joists should be carried on joist hangers and not built into separating walls;
i) where it is apparent that small air paths exist within the masonry core, both surfaces should be wet plastered before the addition of dry lining.

GUIDANCE DOCUMENTS

A satisfactory performance for the separating wall may be achieved by complying with the above and with relevant parts of the following Approved Documents, Technical Standards, Technical Booklets, Deemed-to-satisfy provisions or other guidance documents, as appropriate:

England and Wales

Approved Document E - Resistance to the passage of sound

APPENDIX I

SPECIAL GROUND CONDITIONS

THE LABC NEW HOME WARRANTY POLICY

Liability arises under the LABC New Home Warranty policy when a Statutory Notice is served, or could reasonably be expected to be served, on the owner of the Housing Unit, and contamination already existed when the first owner purchased the Housing Unit from the builder.

The Insurers will:

a) pay for the remediation work to be done; or
b) arrange for the work to be carried out at their expense; or
c) purchase the dwelling from the owner at open market value.

The policy does not cover contamination, which occurs after the first sale, and does not cover damage from geotechnical hazards such as landslip and subsidence, since these will be covered by the householder's buildings insurance policy.

REQUIREMENTS OF THE LABC WARRANTY TECHNICAL MANUAL – ALL SITES

Part 3 of the Technical Manual sets out the Principal Performance Standards which must be met regarding Site Preparation on all sites.

Thus, in order to access the LABC New Home Warranty, a site and ground investigation must be carried out on every site. This requirement can be satisfied if a desk study, site walkover survey and trial pit investigation is carried out in accordance with BS 5930, by a suitably qualified person, such as an engineer or surveyor. Such a person must sign a declaration that the correct procedures have been followed. This also applies where radon gas is found to be the only contaminant.

During the site and ground investigation there will always be a need for trial pits at least 3 metres deep, and basic geophysical and contamination tests should also be carried out.

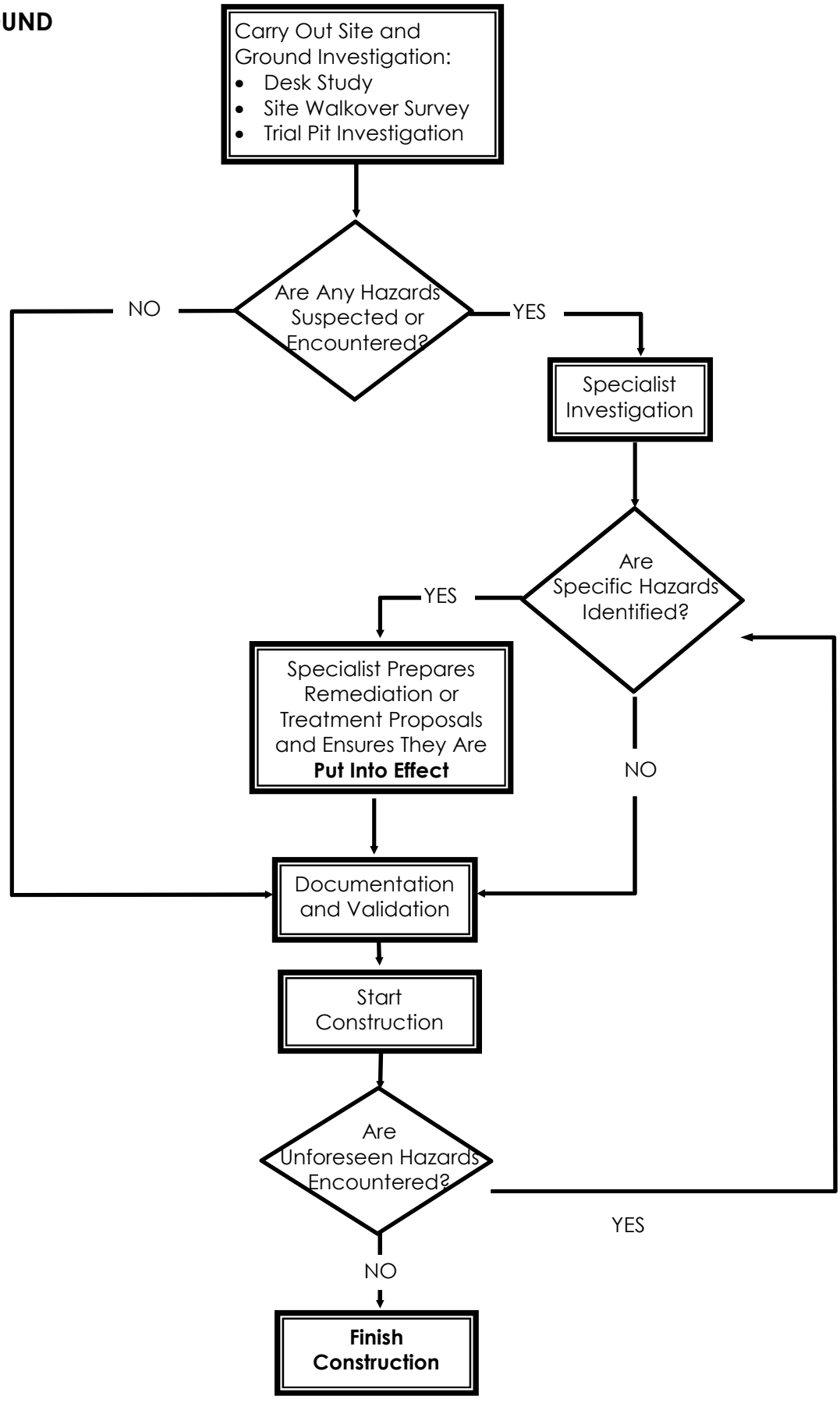
Requirements of the LABC Warranty Technical Manual – Contamination or Geotechnical Hazards Suspected or Encountered

Where, before or during the site works, contamination or geotechnical hazards are suspected or encountered, a suitably qualified and experienced person should be appointed to investigate the site. They should prepare proposals to treat or otherwise remediate the site and ensure that the proposals are put into effect, in order to remove any hazards or dangers found to be present and to ensure a satisfactory form of construction for the Housing Unit.

Undetected hazards discovered during the course of the works will result in the need to follow the standard procedures outlined above.

The above procedures are illustrated in Flowchart 1, Special *Ground Conditions,* on the following page.

FLOWCHART 1 – SPECIAL GROUND CONDITIONS



JAPANESE KNOTWEED

Japanese Knotweed is a vigorously growing and hardy plant, which will cause damage to buildings if left untreated. It was introduced in this country in the early part of the last century to stabilise railway embankments and as ornamental shrubs. The plant can spread rapidly from a clump to adjacent uninfested land by lateral growth of rhizomes. Knotweed can spread to non-adjacent uninfested areas by a number of means. These are principally through the transport of soil containing knotweed rhizomes during earthworks, by fly tipping, the dumping of cut knotweed on rubbish tips and by rhizomes being washed downstream after being eroded from riverbanks.

Control Strategy

Control of existing Knotweed will only be achieved by a planned programme which includes:

- A survey of the area of Knotweed to be controlled,
- Liaison with interested and affected parties,
- Informing land owners and users, including those adjacent to the control area, that the area is to be subject to Knotweed control,
- Implementation of control,
- Monitoring of the effectiveness of control and any modification of the control strategy which is appropriate,
- Logging of all control measures and their effectiveness to give a databank for future control efforts.

A control strategy shall consider the whole of the area infested and should not be restricted by site boundaries as knotweed can re infest an adjacent area in spite of the presence of a partitioning boundary.

A method statement should be provided on the chosen form of control. The control method selected may be chemical, mechanical, removal or a combination of some or all. Great care shall be taken adjacent or near to watercourses. In these areas the Environment Agency should be consulted prior to the use of herbicidal treatments to avoid contamination of the watercourse.

APPENDIX II

SITES SUSCEPTIBLE TO FLOODING

SITES SUSCEPTIBLE TO FLOODING

INTRODUCTION

This section of the guide has been prepared to provide supplementary guidance for use by developers, site audit surveyors and others involved with new development in areas of high flood risk, in support of the Government's new planning guidance on development and flood risk.

PLANNING GUIDANCE

Planning Policy Statement 25: Development and Flood Risk (DCLG, 2006) was published in 2006 by the Department for Communities and Local Government. The guidance, which applies only to England, explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and loss of life. It guides all parties involved in the planning and development process.

The above document requires a precautionary approach to ensure that any development is safe and not exposed unnecessarily to flooding. The guidance also requires that run-off from a development should not increase flood risk elsewhere in the catchment, and that development must not constrain the natural function of the flood plain, either by impeding flood flow or reducing storage capacity. New development should therefore be located in zones of little or no flood risk wherever possible.

The document states new building works within areas of flood risk are only permitted in exceptional cases where the risks are managed and adequate flood defence measures and/or flood resistant construction techniques are adopted. Developments should also incorporate **sustainable drainage systems** where practicable and other mitigation measures to avoid increasing the risk of flooding further downstream. The guidance within the document takes a sequential risk-based approach. New development in high flood risk zones should only be permitted where it can be reasonably demonstrated that lower risk alternatives are not available. The developer must demonstrate to LABC Warranty's site audit surveyor that the proposed development fulfils the above requirements.

In Wales, policy on development and flood risk is through Planning Policy Wales (PPW) and Technical Advice Note (TAN) 15 Development and Flood Risk (2004).

GENERAL PRINCIPLES OF FLOOD RESISTANCE DESIGN FOR NEW PROPERTIES

Where new development is proposed within areas of high flood risk, measures are required to reduce the impact of flooding. Such development can include new buildings and extensions to existing properties.

If a property is at very low risk of flooding then steps to improve flood resistance are clearly unnecessary. The following list of general questions, which will be raised during the technical audit process, can help to assess whether flood protection measures are worth considering for a particular property:

a) Has the property or surrounding land and gardens ever flooded in the past?
b) Have neighbouring properties ever flooded?
c) Is the property in a floodplain?
d) Has the property been issued with a flood warning?
e) Is the property close to a surface water drainage ditch or stream that could overflow?
f) Is the property in a hollow or low-lying area?
g) Is the property protected by river or coastal defences?

If "No" is the answer to all of these questions the risk of flooding affecting a property is small and flood resistance measures are unlikely to be necessary. Conversely if "Yes" is the answer to one or more of these questions then implementing will be a requirement for cover under the LABC Warranty to be provided.

THE TECHNICAL AUDIT

In order to ensure the above is achieved it will be necessary for the plan appraisal process to include an assessment of the potential risk of flooding (by consideration of the questions identified in 3.2 above). Should a flood risk be identified on any particular site it will be necessary to include the following information in the audit process:

a) A location plan at an appropriate scale that includes geographical features, street names and identifies all watercourses or other bodies of water in the vicinity.
b) A plan showing site levels related to ordinance datum, both current and following development.
c) An assessment of the cause of potential flooding – rivers, tidal, coastal, ground water, surface flow or any combination of these.
d) A more detailed indication, if appropriate, of flood alleviation measures already in place, of their state of maintenance and their performance.

CONCLUSION

All properties constructed in an identified flood zone must be built fully in accordance with Building Control and Environment Agency (EA) best practice guidelines. Site Audit Surveyors will be required to make (and document) specific enquiries on flood risks for all properties; to liaise with Building Control & EA and to monitor compliance with DCLG, 2006, SPPP7 and EA best practice advice.

This process must continue throughout the construction process, and any failure by developers to comply with all requirements/recommendations will be notified to LABC Warranty and the underwriters.

Site Audit Surveyors will monitor all issues regarding flood aspects and specifically identify those properties encountered which are susceptible to any of the factors identified in 3.2 above and record details of remedial measures taken and lessons to be learnt for the future.

APPENDIX III

ADDITIONAL GUIDANCE FOR CONVERSION AND REFURBISHMENT PROJECTS

INTRODUCTION

The following guidance has been formulated by LABC Warranty to assist both Site Audit Surveyors and Developers on projects involving either the conversion or refurbishment of existing buildings.

LABC Warranty includes cover for the **retained structural elements and waterproof envelope** of any existing building for the duration of the policy. LABC Warranty will always undertake an initial assessment of the existing fabric to ascertain in general terms if the proposal is capable of representing a standard risk to the Underwriter. If deemed acceptable the development is then subject to a Technical Audit process during construction and the following guidance is intended to assist all parties in ensuring the relevant requirements are met, as well as providing an element of consistency in approach.

Depending on the condition of the original building, an expert survey may be required for the elements below. If the Report concludes that any of these elements are unable to meet the life expectancy of 60 years for structure and 15 years for non-structural elements, they should be systematically replaced or repaired.

RETAINED ELEMENTS:

- **Foundations and load-bearing structures, including floors, walls and roof:** any areas of cracking or suspected movement are to be assessed and remedial measures provided. Any additional loads must be catered for.
- **Damp-proof courses and membranes:** All walls, floors and basements should include a DPC. Any remedial DPC treatments need to be appropriate to the type of construction, independently tested/approved and provided with a 10 year insurance backed guarantee. The construction of any existing ground floor will need to be assessed and details provided to the Site Audit Surveyor for consideration.
- **Timber treatment against insect and fungal attack:** All retained timbers will need to be assessed, logged and remedial treatment noted. Timbers which are embedded should be removed and replaced with masonry. Where this is not possible core samples should be taken to assess the moisture content and remedial works considered. Any treatment must be provided with a 10 year insurance backed guarantee and undertaken by a member of the Wood Protection Association or the Property Care Association.
- **Roof coverings:** Coverings and support systems should be replaced unless a specialist report compiled by an independent RICS surveyor concludes that the system can provide a life span of at least 15 years. This should include the covering, battens, felt, flat roof decking, fascias, soffits, flashings, nails and clips etc.
- **Weather resistance of walls including claddings, render, re-pointing etc:** The remedial works for the external walls must have regard for the exposure rating provided in BS5628. Any retained cladding system must be surveyed to determine a minimum 15 year life expectancy. Provision of additional thermal insulation must also be considered.
- **External doors and windows:** A condition survey should be provided by an independent RICS surveyor to confirm life expectancy of 15 years. Consideration to be given to improving the thermal characteristics.
- **External and internal services:** Any services to be retained should be suitably tested and reported by a specialist.
- **Drainage:** A CCTV survey should be undertaken to ensure the integrity and design of the retained system.

Where some of the elements are new and replaced as part of the conversion/refurbishment no report is necessary.

In addition to the installer guarantee, the Builder is required to provide a **10 year insurance backed guarantee** for**:**

(a) chemical damp-proof course and basement tanking,

(b) timber treatment against insect and fungal attack,

(c) specialist roofing systems,

(d) proprietary externally applied weather-proofing and/or insulation systems.

Please note that the requirements of the LABC Warranty Technical Audit are quite different from those undertaken for the purposes of compliance with Building Control and Planning Legislation. If any such bodies have imposed restrictions on the areas above we suggest that you contact LABC Warranty's Site Audit Surveyor before undertaking any works.

SUBSTRUCTURE

FOUNDATIONS

An appraisal of the existing building and its foundations should be carried out by a Structural Engineer. This appraisal should address:

- Settlement,
- Heave,
- Foundation depth and type,
- Soil type,
- Basement walls and floors,
- Trees adjacent to buildings.

When carrying out the appraisal the person should take into account any proposed increased loading on the structure and foundations, alterations to existing load paths and any alterations to the existing stability of the building.

Where the existing foundations are inadequate and the building has moved/cracked and/or the proposals are to increase the load on the foundations, a structural engineer should design a suitable solution, which should be discussed with LABC Warranty's Site Audit Surveyors prior to implementation.

When it is necessary to underpin any building an application should be made to the Building Control Authority and work inspected by them.

Proposals for underpinning should be prepared by an expert and be in accordance with BS 8004 or a proprietary underpinning system.

TANKING OF BASEMENTS

Where it is intended that any accommodation below ground level is to be habitable, then the design should be such that no moisture/damp can enter this area. Relevant matters include:

- Determine the position of water table,
- Assess the drainage characteristics of soil,
- Select an acceptable construction type,
- Products which are used should have independent third party certificates and be installed by an approved installer.

Existing basement floors may be suitable if it can be shown that the slab is in the region of l00mm thick and is bearing on to a suitable inert hardcore. The proposals to tank the basement should address both the walls and the floor, in order to ensure the integrity of the basement area.

It may also be necessary to provide land drainage to the external perimeter of the basement in order to reduce hydrostatic pressure to acceptable levels.

Internal walls will also require tanking if either they do not have an effective DPC located at the same level as the floor tanking membrane, or if they link with an external wall which is in contact with the adjacent ground.

Built-in structural timbers such as timber lintels shall be replaced (e.g. with concrete lintels) if they are sealed by tanking.

It should be ensured that continuity of tanking is maintained around chimney breasts. To simplify the problem, consideration should be given to the removal of the chimney breast in the basement and providing adequate support at ground level to the retained chimney.

Where the basement area is to be non-habitable, such as storage, it should be designed to ensure that the area is reasonably dry and well ventilated. This is of particular importance where timber is present in order to prevent the outbreak of wet/dry rot in the building. The measures to ensure that the storage areas are reasonably dry are not as onerous as when designing a habitable basement.

DAMP-PROOFING

An insurance backed guarantee shall be provided for all injected chemical damp proof courses. A suitable damp proof course should be provided to existing walls, and be placed at least 150mm above external ground level to ensure that ground moisture does not enter the inside of the building. An existing damp proof course may be acceptable if a specialist's survey report confirms it's adequacy.

Most types of wall are suitable for treatment by a remedial damp-proof course system. There are exceptions to this and these include:

- Walls of exceptional thickness, i.e. greater than 600mm
- Rubble filled walls
- Random flint/granite walls or other similar impermeable materials
- Mud walls (cob), wattle and daub
- Rat trap bond

Advice should be sought from the specialist installer as to the suitability of their products/system. Products used in chemically injected systems shall always hold current independent third party certificates.

TREATMENT OF TIMBERS – ROT/INSECTS

Any remedial treatment shall be carried out by registered members of the Wood Protection Association and Property Care Association, in accordance with their Code of Practice for Remedial Treatment and associated technical leaflets. **A 10-year insurance backed warranty shall also be provided.**

In order to obtain insurance it is necessary to undertake detailed investigation of all timber members to identify the presence of any insect or fungal decay and treat the affected areas as appropriate. It is essential that the type of fungal attack is correctly identified as treatment methods vary for dry rot and wet rot.

An alternative method of detecting and dry rot is by the use of

Hutton + Rostron: Tel No. 01483 203221, Fax No. 01483 202911, www.handr.co.uk, or

Ridout Associates: Tel No. 01562 885135, Fax No. 01562 885312, www.ridoutassociates.co.uk

Fungal attack covers wet rot and dry rot. Wood rotting fungi can be divided into two categories according to their effects on the wood:

- Brown Rot – causes the wood to become darker in colour and crack along and across the grain when dry. Badly decayed wood will crumble to dust, and the majority of wet rots and dry rot fall within this group
- White Rot – the wood becomes lighter in colour, the wood cracks along the grain. All white rots are wet rot

The root cause of fungal attack is dampness. For example, dampness may be caused by the following:

- Rain penetration
- Condensation
- Hygroscopic salts
- Defective rainwater goods and roofs
- Bridging of existing DPC's, or no DPC
- Defective renders
- Direct penetration of rainwater through solid walls, particularly those facing prevailing winds
- Leaking drains and internal plumbing
- Incorrect external levels

Fungal attack is controlled by two sets of measures, primary and secondary.

Areas which have not been inspected should be clearly identified to enable a subsequent inspection to be carried out when the structure has been fully exposed, this could include rafter feet and wall plates which are particularly prone to rot.

Primary measures consist of locating and eliminating sources of dampness and promoting the rapid drying out of the structure. Where the timber becomes wet and remains wet e.g. the moisture content exceeds 20%, then it is likely to decay, and by eliminating the source of dampness and drying of timbers below 20%, the fungus will normally stop growing and will eventually die.

Secondary measures consist of determining the full extent of the outbreak and a combination of:

- Removing all decayed timbers
- Treating of walls to contain fungi within the wall (only applicable to dry rot)
- Treating of sound timbers with preservative on a localised basis where required
- Using preservative-treated replacement timbers (pre-treated)
- Introducing support measures such as isolating timbers from walls and provision of ventilation between timbers and the walls.

Dry rot commonly occurs when timber is in contact with damp brickwork and where ventilation and heating are inadequate. Therefore, particular attention should be paid to cellars, basements and sub-floors and also behind panelling.

EXISTING CONCRETE FLOORS

Where there is an existing concrete ground floor and this is to remain, the following should be identified:

- The thickness and condition of the existing slab, a minimum 100mm concrete is normally expected. Slabs less than 100mm are more likely to be vulnerable to rising damp, especially if the concrete is of poor quality.
- If there are proposals to increase the load on the existing slab, such as building a masonry wall, then the new wall should be built on an adequate foundation or the existing slab proved for adequacy by calculation.
- Are there any gaps between the skirting and floor suggesting settlement of the slab, is the fill beneath the slab over 600mm?
- Are there any cracks in the floor slab due to settlement? If the slab has settled it may be practical to re-level the floor with a new screed or self-levelling compound. Before undertaking any works to a slab which has settled, it must be ascertained that the settlement has stopped.
- Has the slab heaved? Clay heave can be attributed to the swelling of the clay subsoil when there is a recovery of the desiccated zone following the removal of a tree. Where a slab has heaved, further investigation is necessary to determine the reason for this and appropriate measures taken to rectify the cause and damage.
- Where it can be shown that the existing ground floor is structurally adequate but does not incorporate a damp proof membrane, a damp proof membrane may be laid over the existing slab e.g. 2/3 coat bitumen paint or 1200 gauge polythene over which a minimum 50mm1:3 screed should be laid. The damp proof membrane should lap with the damp proof course.

EXISTING SUSPENDED TIMBER FLOORS

Where it is proposed to keep the existing ground floor, the existing floorboards/finish should be lifted to ascertain the condition of the timber joists/wall plates and a report carried out by a structural engineer as well as a specialist relating to insect infestation and fungal attack.

When deciding if an existing ground floor is adequate, there are a number of areas which should be addressed, these include:

- An adequate DPC to walls/sleeper walls.
- Are all timbers free from rot and insect infestation?
- Adequate ventilation to the sub-floor.
- Adequate foundations supporting sleeper walls.
- Joists are of sufficient size and span.
- Are any load-bearing internal walls built off floor joists.
- Have joists been weakened by excessive notching or drilling.
- Adequate trimming to hearth.
- Adequate strutting of joist.

DRAINAGE

Where it is intended to use the existing below ground foul drainage system a CCTV survey should be carried out to ascertain the condition of the drains and manholes. The survey should cover size, type of drain, falls and its adequacy to take the proposed discharge. An air or water test could also be carried out.

The use of existing surface water drainage may be acceptable providing that it can be shown to be carrying the water away from the building.

SUPERSTRUCTURE

STRUCTURAL REPAIRS

Prior to undertaking structural repairs it is essential that the root cause of the structural defect has been remedied; by underpinning, addition of adequate lateral restraint, buttressing, etc. Strengthening works to the structure may also be necessary to accommodate increased or modified loads.

MASONRY WALLS

To provide an acceptable level of protection against ingress of rain water any retained solid masonry external walls should either:

- Be fully lined internally with an independent timber or metal stud wall
- Be clad externally with a rain screen or other protective measure
- Comply with the requirements of BS 5628 (as outlined below)

When damage has occurred to walls, the cause needs to be investigated. Likely reasons for the damage include:

- Ground Movement – foundation failure, settlement, subsidence, chemical attack
- Thermal Movement – thermal expansion of wall due to temperature changes
- Roof Spread – pitched roofs not properly tied, spreading at eaves
- External and internal walls not bonded together
- Wall tie corrosion
- Lintels inadequate over openings
- Sulphate attack – water soluble sulphates attack cement based mortar, normally in a wet environment, i.e. below ground level and parapet walls
- Frost attack
- Bonding timbers present and subject to rot and shrinkage
- Ineffective or no lateral support at floor and roof level
- Moisture ingress

CRACKING IN MASONRY WALLS

Minor cracking can be defined as cracking which occurs in the mortar joints and which does not extend through the masonry components. Providing that the crack is no wider than 4mm and there has been no lateral displacement of the wall, the wall can be re-pointed.

Major cracking affects the structural integrity of the wall and investigation should be undertaken to find the cause of the problem.

WALLS OUT OF PLUMB/BULGING

Where walls are more than 25mm out of plumb or bulge more than 10mm within a storey height a structural engineer should comment on the stability. The wall may need to be rebuilt or strengthening works undertaken.

Where it is intended to provide buttressing walls to support out of plumb and/or bulging walls, they should be designed by an engineer.

In raised tie roofs (where no ceiling ties are provided at eaves level) lateral spread of the brickwork just below eaves level may have occurred because the roof has deflected. In such cases it is necessary to prop the roof and to rebuild the affected part of the wall.

BONDING TIMBERS

These are common in Georgian buildings and were laid in the internal skin of the wall to reinforce it and to provide fixings for panelling, etc. With the low compressive strength of lime mortar and general timber decay, the bond timber compresses under load. As the timber is on the inner skin, the compression causes bulging outwards. This may be apparent on the external face. Normally bond timbers should be exposed during the conversion and removed in short lengths and replaced with bonded masonry.

EXTERNAL AND INTERNAL WALLS NOT BONDED TOGETHER

A common defect in properties up to the 1920s is the lack of bonding/tie of party walls to the external wall.

Different bricks and bricklayers were often used, with the poorer quality materials and labour being used on the party walls. This junction should be exposed when undertaking a conversion and if the bond is inadequate a suitable stitching detail incorporated.

ARCHES AND LINTELS

Where existing timber lintels support structural walls and it can be shown that the lintel is adequate for its purpose, i.e. there is no sign of any structural movement, loads will not be increased and the timbers are free from rot and insect infestation, the lintel can be retained.

In order to ensure that a lintel is free from rot, a percentage of all lintels should be exposed at both ends and on the outer face for openings in external walls.

Where movement has occurred and the timber lintel is inadequate, the lintel should be replaced with either a concrete or steel lintel.

Where cracking has occurred in masonry arches it will be necessary to rebuild the arched construction. In cases where failure has occurred due to the low pitch of the arch, it may be necessary to incorporate a lintel.

WALL TIE CORROSION

Cavity walls have been constructed since 1850, but it was not until 1920 that this form of construction was widely adopted. It is important when undertaking a conversion to confirm the construction of the external wall. Care should be taken, where headers are incorporated into the bond of the external brickwork, the Site Audit Surveyor should investigate the wall construction, as many properties in the Victorian period were built with either a 215mm outer leaf and cavity behind, or a 215mm inner leaf, cavity and a half brick outer leaf with snapped headers.

Initial evidence of cavity wall failure can include cracking of bed joints in mortar, (typically every sixth course). This is due to the expansion of the wall tie as it corrodes.

Bulging of the external leaf could also indicate that the ties have failed.

Where there is wall tie corrosion or inadequate ties, a specialist company should be employed to provide a report which includes measures to overcome these defects.

Where wall ties have corroded to an extent that it is serious enough to threaten the stability of the wall or building, a structural engineer should be appointed to determine the necessary remedial works.

INTERNAL WALLS

1 EXISTING MASONRY

Where a wall is adequately founded or supported on a beam which shows no signs of distress, it can remain providing there is no increase in load onto the wall. Any increase in load should be justified by calculation. However, masonry supported on timber beams should be avoided.

In older properties it is possible that flitch beams and bessemer's may be supporting masonry walls and these should be examined by an appropriate expert to ascertain their capability to carry the load.

2 EXISTING STUDWORK

Many properties before 1880, have trussed internal partitions, usually located approximately halfway back in the depth of the property. Often these walls are load bearing and continue up through the building and carry floor and roof loads on to the foundations.

If a timber partition is load bearing, provided it is adequate and the loads are not being increased and the timber is free from rot and insect infestation, the partition can remain. Where there are defects i.e. the floor sags on the line of the partition and there is distortion of door heads then additional strengthening works should be undertaken.

New door openings cut into an existing trussed partition should be overseen by a qualified structural engineer, as it can adversely affect the triangulation of the truss.

TIMBER FLOORS ABOVE GROUND LEVEL

Existing timber floor joists can be retained within the building providing that they are adequate for their purpose. The following points should be considered:

- joists are of sufficient size for the span
- load on the floor is not being increased
- have joists been weakened by excessive notching and/or drilling
- ends of joists free from rot
- all timbers to be treated for insect infestation and wood rot
- no masonry walls are built off timber joists
- appropriate strutting is provided

ALTERATIONS TO EXISTING OPENINGS

Where existing openings are to be filled with masonry, the new work should be adequately bonded to the existing; the weather resistance of the wall maintained and, if a party wall, comply with the requirements for sound insulation.

WALLS OF SPECIAL CONSTRUCTION

If it is intended to retain walls of special construction such as wattle and daub, Tudor, mud walls (cob) etc., they should be altered so as to form a non-structural element e.g. by the incorporation of an additional load bearing wall or framing which provides lateral support to the wall and supports all structural loads previously supported by the wall. It will also be necessary to ensure that the wall provides an adequate barrier to the passage of rainwater into the fabric or the inside of the building.

CONCRETE/STEEL FRAMED STRUCTURES

Where the scheme involves converting a concrete or steel framed building into dwellings the following guidance is given.

An appraisal of the existing building should be carried out by a qualified Structural Engineer taking into account the proposals for the change of use, this will include:

- condition of the structural frame including joints;
- proposals to increase loadings on the structure and foundations;
- alterations to existing load paths;
- alterations to stability systems;
- changes in environmental exposure;
- recommendations to cover additional reports, testing by specialists.

The floor loads on the building may decrease as they will now be for domestic use only, where previously they were for example, offices. A statement from a qualified Structural Engineer confirming, where appropriate, that the existing foundation design is acceptable for the new loads subject to the building showing no signs of distress i.e. movement, cracking etc, will be acceptable in such circumstances.

Where the intention is to increase the load on the existing structure e.g. by the introduction of an additional floor, then structural calculations should be provided to prove the adequacy of the building and foundations.

CONCRETE FRAMED BUILDINGS

Where the building is of concrete construction additional reports are needed for:

- Carbonation
- Chlorination

The two major causes of corrosion in concrete are carbonation in association with inadequate depth of cover to reinforcement and chlorine penetration due to de-icing salts and admixtures used to accelerate the setting and hardening of concrete in temperatures at or below freezing point.

Carbonation involves a reaction of carbon dioxide in the air with the free lime present in the concrete. Over a period of time this reduces the pH level of the concrete.

With a reduction in the alkalinity, and the presence of both water and oxygen, corrosion of the embedded steel will occur.

Visual surveys on concrete structures are a starting point to gather information. However, care should be taken as the concrete structure may not show any obvious signs of corrosion and yet corrosion of the reinforcement may be occurring.

It is important that a second stage survey incorporates the following:

- Chemical tests on the concrete structure to ascertain if corrosion of the steelwork is or is likely to occur.
- Depth of carbonation can be assessed either on site or in the laboratory and the depth of the reinforcement measured. This allows those areas of risk to be identified.
- Chloride ion content can be taken by analysis of a drilled dust sample from the concrete.

Where concrete repairs are necessary they should be carried out by a specialist contractor.

1 HIGH ALUMINA CEMENT CONCRETE (HACC)

Where High Alumina Cement Concrete has been used in a building and the intentions are to keep the existing structure consideration should be given to:

• The structure being free from obvious signs of deterioration,

• The building being weather-tight,

• Structural calculations being provided to show that the floors and roof can solely carry the loads imposed on them.

2 ALKALI SILICA REACTION (ASR)

ASR occurs when the strongly alkaline cement begins to dissolve susceptible sand and aggregate within the concrete itself. The chemical reaction creates a gel material which absorbs water, expands and in turn creates tremendous pressures in the pores of the concrete surface and subsequent cracking. For a damaging reaction to occur the following need to be present in sufficient quantities:

- High alkali cement or a high cement content - may also arise from salt contamination during batching/mixing,
- Reactive aggregate - siliceous materials such as flint and quartz as well as recycled aggregates,
- Moisture – exposure to rain or condensation.

If any one of these factors is absent then the ASR cannot take place. Once cracking occurs the structure can deteriorate further as water entering the cracks generates reinforcement corrosion and this, in conjunction with the freeze/thaw cycle, can result in additional cracking and so on.

Affected concrete often exhibits surface cracking in the pattern of a star, heavily loaded sections may exhibit cracks along the line of the main reinforcement.

Defects in structures attributable to performance of concrete are relatively rare in the UK. Increased awareness of ASR and the publication of guidance on avoidance have reduced the risk of problems in new buildings to very small proportions.

Consequently, on any **refurbishment** project where the existing structure is concrete frame, the Site Audit Surveyor will request copies of the following to identify the presence or otherwise of ASR.

- Desk studies undertaken to identify materials used in original construction,
- Core sampling and detailed chemical testing.

If ASR is identified the following possible remedial works will need to be assessed by the project's design engineer and details put to Site Audit Surveyors for consideration:

- Critical examination of the robustness of the reinforcement.
- Measures to the amount of water available to the structure - any weatherproofing or cladding should not impair the ability of the structure to dry naturally,
- Limited strengthening of the structure,
- Partial of full demolition followed by re-building.

Furthermore any alterations to the weatherproof envelope will need to be considered to ensure that the concrete elements are not exposed to additional sources of moisture.

STEEL FRAMED BUILDINGS

In addition to any structural reports a visual inspection of the steel frame should be carried out to assess the extent of any corrosion of the framework.

Where corrosion is present accurate measurements can be made using an ultrasonic gauge. Data collected can then compare the thickness of steel sections against the original steelwork drawings, British Standards and Historical Structural Steelwork Handbook to ascertain if the structural frame is adequate for the proposed loads.

Exterior Steelwork should be inspected. Where corrosion is visible, the steel can be grit blasted cleaned and recoated.

Perimeter Steelwork in direct contact with the outer leaf of the building can be prone to corrosion particularly in older properties. A sign indicating that this has happened is the displacement of the external masonry due to the expansion of the steelwork caused by corrosion. During the conversion process the appropriate repairs/replacement should be carried out.

Interior Steelwork - normally corrosion of unprotected steelwork within the interior of a building is low with only superficial rusting.

Providing a visual inspection confirms this and the environment intends to remain dry no further treatment of the steel will be required.

Where the proposals involve the steelwork in a "wet" environment such as kitchens and bathrooms it should be adequately protected.

BIMETALLIC CORROSION

This should be considered in the existing and proposed structure. Bimetallic corrosion occurs where two different metals are in electrical contact and are also bridged by water or water containing other chemicals to form an electrolyte, a current passes through the solution from the base metal to the noble metal. As a consequence the noble metal remains protected and the base metal suffers increased corrosion.

Where there is a possibility of this occurring or if it has already occurred advice should be taken from a specialist on how to deal with it.

CAST IRON, WROUGHT IRON AND MILD STEEL STRUCTURES

Many older buildings which are converted into dwellings e.g. warehouses, cotton mills etc were built using cast iron, wrought iron or mild steel.

When the intention is to keep the existing structural elements, an appraisal of the existing building is necessary. In addition to this the engineer should comment on the following:

- determine age of the building and materials used,
- assess how its construction has faired,
- justify the loadings by calculation,
- identify areas where additional testing and/or opening up is necessary.

If the proposed loads remain unchanged or are reduced, as will probably be the case, and it can be shown that the existing structure has not suffered any deterioration due to corrosion, deflection of structural members etc, the building may only require localised structural alterations.

When the intention is to increase loads, carry out major structural alterations, or the existing building is under designed, a structural engineer should comment on this and provide calculations to justify the proposals.

FILLER JOIST FLOORS

Many buildings of late Victorian and Edwardian period were built with floors constructed of clinker concrete supported by embedded iron or steel joists. The concrete produced with clinker aggregate was porous and therefore provided poor corrosion protection to the metal.

The clinker also contains particles of un-burnt or partially burnt coke or coal which contain substantial proportions of sulphur. As the concrete is porous the sulphur oxidises to form Sulphur Dioxide (SO_2) and if moisture is present this then forms Sulphuric Acid (H_2SO_4). Where floors have been subject to the weather for any length of time severe corrosion of the embedded iron or steelwork is likely to have occurred.

When considering a conversion in a building which has filler joist floors it is important to firstly investigate to ascertain if the floors have been subject to damp conditions and whether any significant corrosion has taken place.

Particular attention should also be made during the conversion to ensure that the floor remains dry and this could include providing a temporary covering if removal of the existing roof is necessary.

TIMBER ROOFS

1 SURVEYING ROOF TIMBERS

All roof timbers should be surveyed by a specialist and any necessary treatment carried out. Particular attention should be given to rafter feet, wall plates and valley timbers as these often show signs of rot.

2 ROOF STRUCTURE

It is essential that the roof structure has adequate strength, stiffness and dimensional accuracy appropriate for the new roof covering. Common problems encountered include:

- Excessive spans of rafters, purlins, binder and ceiling joists,
- Inadequate ties between rafters and ceiling ties,
- Insufficient number of collar ties at purlin level,
- Decay of rafter feet and valley beams,
- Settlement of purlin supports,
- Lateral spread of raised-tie roofs.

All strengthening work should be designed by an engineer.

3 ROOF COVERINGS

Systematic replacement of all roof coverings, including associated support systems such as battens, felt, flat roof decking, fascias, soffits and flashings should be carried out, unless it can be shown that the existing roof covering is adequate.

Fixing of slates, tiles, the condition of existing fixings e.g. nails and clips should be examined if the intention is to keep the roof covering.

A specialist report will be required to confirm the adequacy of the existing roof covering and whether timber treatment is required. Adequate ventilation should be provided as appropriate.

Where it is intended to re-use existing roofing tiles or slates they should have a life span of at least 15 years.

In the case of replacement roof coverings where no extra load is incurred it may still be necessary to strengthen the roof structure if the roof has deflected.

CLADDINGS

WEATHER RESISTANCE OF WALLS AND CLADDING

Existing solid brick or stone walls may be acceptable as a weather resisting wall subject to the exposure category of the building and the porosity of the masonry. It is anticipated that all buildings located in severe or very severe locations will require at least one of the additional treatments noted below. However, all solid masonry wall situations will require a specialist's report to identify the extent of any necessary remedial treatment.

1 EXTERNAL TREATMENTS

Existing claddings can be retained if it can be shown that:

- the system is maintaining the integrity of the building,
- it is adequately fixed and the expected life span of the fixings where appropriate is in excess of 15 years,
- the cladding material is free from any defects,
- adequate provision for movement has been allowed.

If the above situations cannot be satisfied, then a new external cladding or render system will need to be installed.

2 INTERNAL TREATMENTS

An alternative to preventing moisture penetration by using externally applied claddings and renders is internally applied methods.

Systems are available that are installed on the inside of existing walls to prevent moisture penetration reaching the internal accommodation. These include:

- **Independent metal or timber framed systems -** these should not be fixed to the existing masonry walls, but fixed at the "head and base" to avoid direct contact. Ventilation should be provided to avoid build up of condensation between the masonry and the inner lining system.
- **Impervious sheet and drained sheet systems**: systems to prevent water penetration should be installed in accordance with the manufacturer's recommendations and shall possess third party accreditation.

CONTROL OF DAMP PENETRATION

Measures should be taken to ensure that thermal insulation in cavities does not encourage the passage of damp from the ground or from the exterior of the building to the inside of the building.

THERMAL INSULATION OF WALLS AND CLADDINGS

Various methods exist to upgrade the thermal insulation of existing walls and floors. Regardless of the methods adopted, it is essential that risks associated with increased thermal insulation are minimised, including:

- Surface condensation caused by improvements to draught proofing of the building.
- Interstitial condensation caused by moisture laden air passing from the dwelling to within the fabric of the structure and condensing on cooler surfaces.
- Increased risk of damp penetration caused by filling of cavities with insulation.
- Maintaining the robustness of the external and internal wall surfaces by the provision of adequate mechanical protection over insulation materials, e.g. externally applied insulation systems with render coat mechanical protection.
- Avoidance of cold bridges around openings and where structural elements extend through thickness of the building envelope.

RENDER APPLICATION FINISHES

PLASTER FOR CONVERSIONS/REFURBISHMENT

Where the condition and bond of the existing plaster can be shown to be adequate, it can remain with the exception of the following:

- Where rising damp is present,
- Where a chemical damp-proof course is installed,
- At the junction of external walls and party walls to see if they are properly bonded,
- Above openings to examine the make up and condition of lintels,
- Where there is a possibility of bond timbers which may have decayed.

Where a chemically injected damp-proof course is installed it is necessary to remove the plaster one metre above the DPC level or 600mm above any apparent salt line/dampness whichever is the higher.

Re-plastering work should be delayed as long as possible in order to encourage rapid evaporation of residual moisture and the building should be well ventilated during the drying period.

Plastering work must comply with independent third party and the chemical damp-proof course manufacturer's recommendations. Recommended plasters usually incorporate adhesives to increase resistance to the passage of hygroscopic salts from the wall into the plaster. They should not, however, act as a vapour barrier. Gypsum plaster should not be used in conjunction with chemically injected damp proof courses.

The plaster should not bridge the damp-proof course or be in contact with the ground floor slab.

Final redecoration should not be carried out until residual moisture has disappeared. Matt emulsion paint is recommended for use during this period.

Internally drilled holes which are concealed by skirting boards etc. should not be plugged. Other visible holes and external holes should be plugged.

RENDERING FOR CONVERSION/REFURBISHMENT

Where the condition and bond of the existing render can be shown to be adequate it can remain subject to the following exceptions:

- If the render bridges the DPC,
- Above door and window openings where it is necessary to examine the type and condition of the lintels,
- Where there are signs of structural movement in the building and further investigation is required.

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