TECHNICAL MANUAL

PART 11

CONVERSIONS
11.1 General

Part 11 – Conversions

11.1 General

WAYS OF ACHIEVING COMPLIANCE WITH THE REQUIREMENTS

The building should be designed and constructed in accordance with the guidance contained in the following appropriate documents:

**England & Wales**

- Approved Document A – Structure
- Approved Document B – Fire safety
- Approved Document D – Toxic substances
- Approved Document E – Resistance to passage of sound
- Approved Document F – Ventilation
- Approved Document G – Hygiene
- Approved Document H – Drainage
- Approved Document J – Combustion appliances and fuel storage systems
- Approved Document K – Protection from falling, collision & impact
- Approved Document L – Conservation of fuel and power
- Approved Document M – Access facilities for disabled people
- Approved Document N – Glazing
- Approved Document P – Electrical safety
- Approved Document 7 – Materials and workmanship

**Scotland**

- Section 0: General
- Section 1: Structure
- Section 2: Fire
- Section 3: Environment
- Section 4: Safety
- Section 5: Noise
- Section 6: Energy

**Northern Ireland**

- Part A: Interpretation and general
- Part B: Materials and workmanship
- Part D: Structure
- Part E: Fire safety
- Part F: Conservation of fuel and power
- Part G: Sound insulation of dwellings
- Part H: Stairs, ramps, guarding and protection from impact
- Part J: Solid waste in buildings
- Part K: Ventilation
- Part L: Combustion appliances and fuel storage systems
- Part N: Drainage
- Part P: Unvented hot water storage systems
- Part R: Access to and use of buildings
- Part V: Glazing
11.1 General

Ireland

Technical Guidance Document A – Structure
Technical Guidance Document B – Fire safety
Technical Guidance Document C – Site preparation and resistance to moisture
Technical Guidance Document D – Materials and workmanship
Technical Guidance Document E – Sound
Technical Guidance Document F – Ventilation
Technical Guidance Document H – Drainage
Technical Guidance Document J – Heat producing appliances
Technical Guidance Document K – Stairways, ladders, ramps and guards
Technical Guidance Document L – Conservation of fuel and energy
Technical Guidance Document M – Access and use

ADDITIONAL GUIDANCE ON BUILD-ZONE’S REQUIREMENTS

- The project must achieve compliance with Build-Zone’s technical requirements and the Building Regulations.
- All conversions must be registered with Build-Zone at least 15 working days prior to any works commencing on site.
- BZSS’s appointed Technical Auditor is unable to inspect the development until Build-Zone have received all of the reports, plans, specifications etc. and carried out a desktop appraisal.
- Testing of reclaimed materials such as bricks, timbers, tiles, slates etc. may be subject to a third party test to show suitability.
- All new structural timber must be stamped KD or DRY timber.

Retained Elements

Depending on the condition of the original building, an Expert’s survey is usually required for the elements below. If the Report concludes that any of these elements are unable to meet the life expectancy of 30 years for structure and 15 years for non-structural elements, they should be systematically replaced or repaired. The main report may be made up of several individual reports, such as an Engineer’s report on foundations and a specialist company report on rising damp and/or timber treatment.

- Foundations and load-bearing structures, including floors, walls and roof
- Damp-proof courses and membranes (see * below)
- Timber treatment against insect and fungal attack (see * below)
- Roof coverings (see * below)
- Weather resistance of walls including claddings, render, re-pointing etc.
- External doors and windows. Existing single glazed windows may need to be replaced with suitable double glazed units to comply with the Building Regulations. If restrictions such as covenants or planning restrictions reduce or remove the ability to comply with the Building Regulations, Build-Zone must be informed. It may be necessary to add an endorsement to the Warranty to exclude them from cover.
- External and internal services
- Drainage

RETAI KEI  TIMBER

- Retained timbers should be free from any rot, decay or insect infestation. If appropriate they should be treated and an Insurance Backed Guarantee be provided.
- All retained structural timbers must be stress graded by an Expert prior to them being reused.
- A Structural Engineer or other appropriately Insured Building Professional must provide calculations to justify their adequacy.

All treatment should:

- Be carried out by a specialist contractor and supervised by a CSRT or ASRT qualified Surveyor. All Property Care Association (PCA) contractors for example meet this specification.
- Have a suitable Insurance Backed Guarantee covering both workmanship and materials. The guarantee itself should:
  - cover failure of the work and consequent opening up and making good
  - remain valid for a period of a minimum of 10 years from the date of practical completion or ideally 20 years and be automatically transferred to subsequent purchasers/successors in title.
11.1 General

**New Elements**

In addition to the installer guarantee, the Builder is required to provide a 10 year insurance backed guarantee for any new works to the following:

- chemical damp-proof course and basement tanking
- timber treatment against insect and fungal attack
- specialist roofing systems
- proprietary externally applied weather-proofing and/or insulation systems.

**GREEN TIMBER/ UNGRADED TIMBERS**

- The use of green timber/ ungraded timbers is not permitted as structural members e.g. lintels, beams, joists, rafters, purlins etc, nor where they are aesthetic elements but are "fixed" to the structure, as the extent of their shrinkage is unknown and can lead to structural damage of the property.
- They can be used as lintels providing the detail on diagram 11.31 is followed and allowance is made for any possible shrinkage and / or swelling of the timber.
- Where some of the timber elements are new and replaced as part of the conversion/refurbishment no report is necessary.
11.2 Ensuring Build-Zone’s Quick Assessment

GENERAL

Any guarantee must provide cover against the specialist contractor’s insolvency (usually by insurance backing).

Any report provided should identify those parts of the building that have not been fully inspected at the time of the survey.

Suitable Experts, with relevant experience, normally include: Registered Architects, Chartered Civil or Structural Engineers, Chartered Building Surveyors, Members of the Chartered Institute of Building or Members of the Association of Building Engineers.

For conversion properties, Build-Zone will undertake a full Technical Assessment of your conversion project before offering a quotation. This assessment may on occasion include the requirement for a site visit.

We understand that you need to make quick progress on site and in order to help you do this, we set out below how we can help each other to streamline the assessment process.

The flow chart below shows you the stages, from notification of the project to our decision to accept, or, unfortunately, on some occasions to decline.

What We Are Looking For

In order to understand your project, we need to know as much as possible about it as soon as possible. In particular we need to see:

- Project specification – remedial proposals, plans (to Building Regulation standard) and specifications
- Structural Engineer’s report – to comment on structural adequacy of retained elements, defects noted and confirm life expectancy of at least 30 years
- Experts’ reports – these will be in addition to the structural engineer’s report and may include specialist reports on rising damp, timber infestation and fungal attack (see below for guidance on reports)
- Photographs of the existing structure prior to any works commencing
- Site investigation report including environmental reports

By providing us with the information when you notify us of the site we will be able to complete our desktop overview and if necessary arrange a site visit without delay.

Ideally the inspections for all of the expert/specialist reports should be carried out before any works start or if appropriate, when all the relevant parts of the building are opened up e.g. at the “SOFT STRIP” stage. This will enable us to confirm our initial acceptance of the project and any specific work or requirements. However, we appreciate that on larger projects it may be more practical for reports to be received by us on later stages of the building as work proceeds and these may be a condition of the Warranty offer. If this is the case please mention it when you first register the project. This will save unnecessary questions and delay later.

What Remedial Works We Expect

- Any roof covering that is not in sound condition should be replaced. If you propose to retain any roof coverings we will need safe access so we can inspect both above and below the covering. This safe access will also be needed by your expert for their report.
- All external walls must prevent moisture penetration to the inside and be insulated to building regulation requirements. This can be achieved where walls are “dried out” with a suitable independent system, which will both insulate the fabric and prevent moisture ingress, or by the provision of an externally applied render/insulation system.
- Any habitable areas either below or partially below ground level must be provided with a minimum grade 3 tanking system or equivalent.
- All repairs and treatments identified in the expert’s and engineer’s reports must be carried out.
- In addition to the contractor’s guarantee, minimum 10 year Insurance Backed Guarantees are required for chemical DPCs, timber treatments for insect and fungal attack, specialist roofing systems and proprietary externally applied weather proofing/insulation systems. Rising damp and timber treatments must be carried out by a PCA member.
- Windows, doors and internal services should be replaced to modern standards.
- Existing cavity walls may require a borescope inspection and the report passed to BZSS’s appointed Technical Auditor to determine the condition of the cavity wall including insulation and the adequacy of wall ties, cavity trays etc and report on any possible defects that exist.

In addition to the guarantees, certified copies of invoices, reports & plans indicating the areas treated must be supplied.
11.2 Ensuring Our Quick Assessment

**Guidance on Experts’ Reports for Retained Elements**

A full structural report of the existing building as described in BRE Digest 366 is required, including:

- Foundations
- Any basements
- Suspended timber floors, including joist ends, wall plates and ventilation
- Ground bearing slabs
- External and internal walls, including lintels and any built-in timber
- Intermediate floor including, for timber, the condition of any built-in joist ends, wall plates and floor coverings
- Any structural concrete (incl. carbonation) / steel frame
- Roof structures, including wall plates, joist ends, valley/parapet gutters
- Chimneys and parapets
- Report on investigations regarding rising damp, insect infestation and fungal decay. The report should be compiled by a suitably qualified expert (e.g. Certified Surveyor for Remedial Treatment).
- Weather resistance of walls including claddings, render, re-pointing, parapets and chimneys etc.
- Report on any retained roof coverings, including adequacy of fixings from above and below
- External doors and windows
- External and Internal services

If the elements are to be replaced no report is necessary.
Conversion Application Flowchart

1. Application received from Build-Zone Registered Developer/Builder
2. Application registered, details forwarded to Build-Zone. Any additional plans, reports etc. requested from Applicant
3. Any further details received
4. Technical Assessment undertaken - Site visit arranged if required
5. Building considered satisfactory for insurance under scheme
   - **YES**: Quotation sent to Developer (possibly with conditions)
   - **NO**: Application rejected, Applicant notified where scheme failed to meet requirements
6. Payment made by Developer
7. Technical Auditor contacts Developer, works commence and stage visits undertaken
11.3 Substructure

FOUNDATIONS

An appraisal of the existing building, its foundations and sub soil should be carried out by a Structural Engineer or similarly suitably qualified and fully insured Expert and the information presented to Build-Zone.

This appraisal should address such items as settlement, heave, foundation depth and type, soil type, radon and contamination, basement walls and floors and 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 it is proposed to use existing foundations, Build-Zone should be consulted at the design stage.

Providing the building shows no sign of movement and the proposals do not increase the loading on the foundations Build-Zone may accept the existing footings. Trial holes should be dug to ascertain the extent of the foundation and make up of the sub-soil.

Where either the existing foundations are inadequate and the building has moved/cracked and/or the proposals are to increase the load on the foundations, a qualified engineer should design a suitable solution, which should be discussed with Build-Zone prior to implementation. When it is necessary to underpin a building, this is covered under the Building Regulations and an application should be made to the Building Control Body 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.

Underpinning involves extending the foundations downwards in order that the building bears on to more stable ground. There are a number of ways of achieving this and these include:

- Traditional mass concrete
- Angle pile
- Pile and needle beam
- Pier and beam
- Other proprietary underpinning methods.

The decision as to which system should be used depends on a number of factors, including the type of existing foundation, depth of suitable strata and position of the water table. The decision rests solely with the Developer and their Professional Advisors and not Build-Zone.

Traditional Underpinning

The sequence of underpinning should be carried out in accordance with the approved plans (generally, alternate bay sequence) and under the direction of a Building Professional such as a Structural Engineer (see diagram 11.1).

Where a bay is located at a wall intersection or return, at least 600mm of the intersecting wall or return should be underpinned at the same time.

Maximum bay length must not exceed 1.0 metre. Reduce to 0.7m if the brickwork is of poor quality.

Excavations must be properly bottomed and dewatered prior to any concrete filling.

Size of new foundation must be appropriate for the safe bearing capacity of the supporting sub-soil (see diagram 11.2). Each base is to be connected via a mechanical fixing. Keys are preferable but metal reinforcement is acceptable.
11.3 Substructure

**Angle Pile**

Angle pile underpinning is the stabilisation of an existing wall foundation by the use of pairs of piles, normally augered, installed at an angle, through drilled holes in the existing foundation (See diagrams 11.3 and 11.4).

**Pile and Needle Beam**

Pile and needle beam underpinning is the stabilisation of an existing wall foundation by the installation of mini piles in pairs, one as a tension pile, one as a compression pile, connected by a reinforced concrete or concrete encased steel needle beam supporting the wall (see diagrams 11.5 and 11.6).

**Pier and Beam**

Pier and beam underpinning is the stabilisation of an existing wall foundation by the installation of a series of piers connected to the existing wall by a reinforced concrete tee beam, and connected together with a longitudinal ground beam to provide lateral restraint (see diagrams 11.7 and 11.8).
11.3 Substructure

Diagram 11.5: Plan of foundation – pile and needle beam

Diagram 11.6: Section through foundation – pile and needle beam

Diagram 11.7: Plan of pier and beam

Diagram 11.8: Section through pier and beam

**TANKING – BASEMENT SPACE**

If the building has an existing basement or it is proposed to build a new basement it is important that Build-Zone is consulted at the design stage to discuss and agree the proposals. The Designer should identify the intended use of the basement as this has a bearing on its design and construction. Insurance backed Guarantees will be required by Build-Zone for any tanking to be covered under the terms of the Warranty.

Where it is intended that any space below ground level is to be habitable, the design should be such that no moisture/damp should enter this area. There are a number of possible solutions to tanking existing basements and guidance is given in BRE Good Building Guide 3 – Damp Proofing Existing Basements.

Additional information is provided in the relevant Approved Documents, which although they cover design of new basements, identify a number of key points which are applicable to the design of all basements. These include:

- Determining the position of water table
- Assessing the drainage characteristics of soil
- Selecting an acceptable construction type, this will probably be one of the following:
  - Mastic asphalt
  - Cementitious render
  - Self adhesive membranes
  - Liquid applied membrane

Products which are used should have Independent Third Party certificates acceptable to Build-Zone and where required, should be installed by the Manufacturer’s Approved Installer.

The following are examples of different types of tanking systems. However the installations must be applied strictly in accordance with the manufacturer’s recommendations.
11.3 Substructure

**Mastic Asphalt**

Method: Build up a 2 coat asphalt angle fillet, 1. at wall/floor and wall/wall junctions. Apply 3 coats of asphalt to total of 30mm on floor slab and 20mm to walls, 2. Joints between successive coats should be staggered by at least 150mm (floors) and 75mm (walls). Add 50mm protective sand/cement screed, 3. and reinforced concrete loading, coat, 4. Build a vertical masonry lining wall (loading coat), 5. backfilling progressively against the asphalt with a 40mm cement/sand mix, 6. (see diagram 11.9).

![Diagram 11.9: Mastic asphalt](image)

**Cementitious Render or Cementitious Compound**

Method: Apply a cement corner fillet at wall/floor and wall/wall junctions. Render: apply three coats of the proprietary mix. Lap coats in accordance with the render manufacturer's instructions and cure. Skim-plaster walls if necessary. Compound: damp substrate, apply two coats to manufacturer’s recommendations, followed by a loading coat and floor screed (shown dotted, see diagram 11.10).

![Diagram 11.10: Cementitious render or cementitious compound](image)
11.3 Substructure

Self-Adhesive Membrane

Method: Add wall/floor and wall/wall fillets. Secure the membrane to the dry wall and floor surfaces following the manufacturer’s guidance allowing at least 150mm overlap at joints. Protect the floor membrane and build up blockwork lining wall, progressively backfilling with 18mm layer of cement/sand mortar. Add a new floor screed of at least 50mm thickness and re-plaster (see diagram 11.11).

![Diagram 11.11: Self-adhesive membrane](image)

Liquid-Applied Membrane

Method: The system used will normally be one of the following: Bitumen emulsions and solutions, rubber latex polyurethane compounds, epoxy resins. Usually one or more liquid coats are applied which require a period of cure before laying of a new floor screed and construction of a new inner leaf (normally backfilled with cement/sand mortar). Protect the floor membrane from damage during building operations (see diagram 11.12).

![Diagram 11.12: Liquid-applied membrane](image)

General

Existing basement floors may be suitable if it can be shown that the slab is of an adequate thickness, usually in the region of 100mm, 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 (consult the Building Control Authority who may have local knowledge of water table conditions).

Internal walls will also require tanking if they either 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 (see diagram 11.13).

Wall tanking should extend at least 150mm above adjacent ground levels. Where the adjacent ground is retained to the full height of the wall, the wall tanking should lap over the wall DPC located above ground level (see diagram 11.13).
11.3 Substructure

Diagram 11.13: Internal tanking of basement walls

Built-in structural timbers such as timber lintels are not acceptable to Build-Zone and must be replaced (e.g. with concrete lintels) if they are sealed by tanking.

Ensure 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.

Maintain continuity of the tanking system by continuing into the reveals of openings.

Ensure continuity of the tanking system is maintained where service pipes pass through the tanking.

Where the basement area is to be non-habitable, such as storage, it should be designed to ensure that the area is (Grade 2) 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. Guidance on ventilation of non-habitable areas is shown in table 11.14.

Prevent conditions of damp that may cause decay or failure of materials such as timber, insulation and reinforced concrete.

Remove excessive condensation trapped within the fabric of the building.

Prevent the build up of gases escaping from the ground or leaking gas pipes.

Table 11.15 gives the approximate ventilation areas for various types of ventilators and grilles. For exact net opening areas, consult manufacturer’s technical literature.

Detailed guidance on waterproofing basements is contained in the following:

- BRE Good Building Guide 3 – Damp Proofing existing basements
- The relevant Approved Document relating to basements for dwellings
- BS8102 Code of Practice for Protection of Structures against water from the ground
- British Cement Association Basement Waterproofing Design Guide
- British Cement Association Basement Waterproofing Site Guide
### DAMP PROOFING

An Insurance Backed Guarantee acceptable to Build-Zone must be provided for all injected chemical damp proof courses. Where a damp proof course is to be provided to existing walls, it should be placed at least 150mm above external ground level to ensure that ground moisture does not enter the inside of the building.

Where a damp proof course needs to be installed in an existing wall there are two options available:

- Injected chemical damp proof courses
- Physically cutting in a new damp-proof course.

Injected chemical damp proof courses should be installed where possible by a registered member of the British Wood Preserving & Damp-proofing Association. Registered members should provide a 10 year underwritten guarantee and be in accordance with BS 6576 Code of Practice for Installation of Chemical Damp-proof Courses.

Most types of wall are suitable for treatment by a remedial damp-proof course system. There are exceptions to this and these include but are not limited to:

- 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, Mundic Block,
- Pre cast concrete panels
- 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 must always hold current independent Third Party certificates acceptable to Build-Zone.

Provision can be made for physically cutting in a new damp-proof course. The drawback is that they have to be mechanically inserted into brickwork or coursed stonework. Random flint walls, rubble infilled or unusually thick walls may therefore require some rebuilding. When cutting into the walls to install the DPC it is essential to ensure that all pipes and wiring have been moved out of the way. The new DPC should be linked to any membrane beneath a solid concrete floor, or turned down the wall to protect timber and joist ends.

**Location of Damp Proof Courses and Membranes**

It is essential that any new damp-proof courses are continuous with other damp-proof courses and membranes so as to provide an effective barrier against rising damp.

Damp-proof courses should be located in a manner that damp susceptible materials such as suspended timber floors, joist ends and wall plates are located within a dry zone of the wall construction.

Continuity of injected damp proof courses should be maintained at changes in floor levels, around chimneys and fireplaces, within recesses, alcoves, party walls, garden walls, etc. (see diagram 11.16).

### Table 11.14: Ventilation of cellars and voids

<table>
<thead>
<tr>
<th>Type of Floor</th>
<th>Minimum Ventilation Per Metre Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber</td>
<td>3000m²</td>
</tr>
<tr>
<td>Concrete</td>
<td>600m²*</td>
</tr>
</tbody>
</table>

Note: * Building Control Authorities may require higher standards.

### Table 11.15 New areas of air bricks and ventilators

<table>
<thead>
<tr>
<th>Type</th>
<th>Size (mm)</th>
<th>Net area (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squared holed clay brick</td>
<td>225 x 75</td>
<td>1400</td>
</tr>
<tr>
<td></td>
<td>225 x 150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>225 x 225</td>
<td></td>
</tr>
<tr>
<td>Louvred clay brick</td>
<td>225 x 150</td>
<td></td>
</tr>
<tr>
<td></td>
<td>225 x 225</td>
<td>2000</td>
</tr>
<tr>
<td>PVC (typical values)</td>
<td>225 x 75</td>
<td>4645</td>
</tr>
</tbody>
</table>
11.3 Substructure

Diagram 11.16: Vertical injected DPC at abutments

Diagram 11.17: Continuity of damp-proofing system when not subject to hydrostatic pressure

Often in refurbishment work it is not possible to lower ground levels adjacent to walls as this will reduce the depth or cover to foundations and footings. In cases where the ground level is higher than the adjacent floor level special attention is required to maintain continuity of the damp proofing system (see diagram 11.17).

Further guidance on damp-proofing is available from:

- BRE Digest 245 Rising Damp in Walls
- BRE Good Repair Guide 5: Diagnosing the causes of damp
- British Wood Preserving and Damp Proofing Association

**Treatment of Timbers – Rot/Insects**

Any remedial treatment should be carried out by suitably qualified contractors. Suitable contractors would include registered Members of the British Wood Preserving and Damp-Proofing Association whose works are undertaken in accordance with their Code of Practice for Remedial Treatment and associated technical leaflets. A 10-year Insurance Backed Guarantee should be provided to Build-Zone.

It is necessary to undertake a 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.

Insects attack includes Common Furniture, Death Watch, House Longhorn and Powder Post Beetle. 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

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

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 then either:

- Removing all decayed timbers
- Treating of walls so 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

Alternatively the procedure under ‘Floors’ overleaf can be followed.

FLOORS

An alternative method of dealing with damp or fungal attack is to appoint a specialist company which is able to provide an automatic building monitoring system. Timber identified as being at risk of decay such as lintels, joist ends, flat roof timbers, rafter feet, etc., can be monitored and any changes in moisture content recorded by a central computer and the appropriate action taken before serious damage occurs. 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 (see table 11.14 for ventilation of cellars and voids).

Existing Concrete Floors

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

- The thickness and condition of the existing slab should be confirmed: 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.
- Check for any gaps between the skirting and floor or any cracks in the floor suggesting settlement of the slab. Is the fill beneath the slab over 600mm?
- 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.
- Check whether the slab has heaved due to either sulphate attack or clay swelling. Concrete ground floor slabs are vulnerable to attack by water soluble sulphates present in the hardcore, e.g. colliery shale. When the slab lifts it causes the walls containing the slab to be pushed out.
  - Where the slab has lifted and is no longer in contact with the hardcore, sulphate attack is the most probable cause.
  - Clay heave can also be attributed to the swelling of the clay subsoil when there is a recovery of the desiccated zone following the removal of a tree. The amount of heave can be as much as 150mm, this swelling of the clay, forces the ground floor slab upwards and can also push out the walls.
  - 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.
  - Guidance on this subject matter is available in BRE Good Building Guide 28 domestic floors.

Where it can be shown that the existing ground floor is structurally adequate but does not incorporate a damp proof membrane, remedial measures will be required. In such cases a damp proof membrane may be laid over the existing slab e.g. 2/3 coat bitumen paint or 1200 gauge (300μm) polythene over which a minimum 50mm 1:3 screed should be laid (65mm minimum thickness in the case of floating screeds and incorporating D49, chicken wire mesh reinforcement). 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 following guidance should be followed:

- The existing floorboards/finish should be lifted to ascertain the condition of the timber joists and wall plates and a report carried out by a specialist relating to insect infestation and fungal attack.

When deciding if an existing ground floor is adequate, the following areas should be considered:

- An adequate DPC is required to walls/sleeper walls.
- All timbers should be free from rot, insect infestation, particular attention should be given to the ends of the joists and wallplates.
- Check there is adequate ventilation to the sub-floor (1500mm² of free opening in air bricks per metre run of wall, in older properties where there is no oversite (sub floor) this figure should be doubled).
- Adequate foundations are required to support sleeper walls.
- Joists must be of sufficient size and span.
- Check whether any load-bearing internal walls are built off floor joists.
- Ensure joists have not been weakened by excessive notching or drilling.
- Ensure there is adequate trimming to hearth.
- Check strutting of joist with spans in excess of 2.5m.

The surface of the oversite covering should be above the highest level of adjoining ground or laid to a fall with a drainage outlet above the lowest level of the adjoining ground and the outlet screened against rodent entry.

All sub-floor voids should be cleared of all timber/builders rubble as this can provide a ready source of food for dry rots and insects.

Timber joists which are previously built into walls and the joist ends have decayed can be isolated from the damp walls by cutting back the joist and supporting on joist hangers. If the decay extends beyond the proposed cuts for the joist hangers, then the timber can be replaced in accordance with the diagram 11.18. This repair method should only be used where not more than three joists are affected per floor zone and the joist depth being not less than 140mm, unless designed by an Expert.

There are also proprietary methods of splicing new timbers to existing joists with galvanised plates, these systems are an acceptable method of repairing rotten or damaged joists.

![Diagram 11.18: Repairing joists ends](image-url)
11.3 Substructure

**Radon and Contamination**

The aim is to improve the resistance to contaminants and moisture as much as possible but it has been recognised that this is not always practical. In arriving at an appropriate balance between historic building conservation and improving resistance to contaminants and moisture the advice of the Local Planning Authority’s conservation officer should be sought at an early stage in the design process (see diagram 11.20).

Further information can be found within the following documents:


SPAB Information Sheet 4 1986 The need for old buildings to breathe.


**New Concrete Floors**

Replacement ground floor slabs should:

- Be minimum 100 mm thick and preferably located 150mm above the adjacent ground levels
- Incorporate a damp-proof membrane located immediately below the screed and lapped so as to form an integral barrier with the adjacent wall DPC (see diagram 11.21)
- Be laid on minimum 100mm consolidated and well graded non-organic hardcore. Hardcore which is used must be free from water soluble sulphates and other deleterious materials. Outbreaks of dry rot have been recorded and attributed to hardcore containing pieces of wood infected with dry rot.

![Diagram 11.19: Typical existing layout](image)

Part 11: Conversions
CONSTRUCTION DETAILS

Diagram 11.20: Radon protection construction detail (see notes below)

1. Existing concrete oversite should be broken out; excavate a sump approximately 400 x 400 x 400 mm.
2. Fill the excavation with crushed rock or crushed concrete.
3. Insert 110 mm UPVC pipe with minimum bends through hole broken through existing wall.
4. Reinstall existing wall around pipe and seal with a suitable gun-applied sealant.
5. Insert a vent cowl on a vertical riser cranked around the eaves.
6. Fibreboard permanent formwork installed under slab.
7. Grout check membrane.
8. Paint the exposed concrete with neat polymer or polymer-modified cement grout, then reinstate the concrete slab.
9. Seal small cracks in the existing slab with polyurethane roofing paint. Larger cracks should be cleaned and repaired with a suitable flexible filler. If the concrete is badly cracked over a large area and in poor condition, it may need to be replaced.
10. Before replacing skirting, force sealant into the gap and form a fillet with the sealant between the floor slab and the wall.
11. Dress gas-resistant membrane into a continuous chase cut in the existing wall then seal and protect immediately after installation.
12. Gas-resistant membrane laid to the underside of screed.
13. Apply screed and insulation.
14. Install proprietary cavity vents just above the damp-proof course and just below eaves at centres recommended by the manufacturer.
15. Seal cavity with polyurethane foam sealant.
In cases where the finished slab level is substantially higher than the damp-proof course level in the wall, special attention is needed to ensure that damp does not bridge the DPC (see diagram 11.22).

Diagram 11.21: Damp proof membranes
Diagram 11.22: Damp proofing between DPC and screed

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 should also be carried out. The use of existing surface water drainage may be used providing that it can be shown to be carrying the water away from the building i.e. to a soakaway located 5m away, Public Sewer etc or other outfall point.

Drainage and Ground Services

Excavations for new drains and below ground services should not extend below the spread load line of foundations unless special precautions are taken such as protecting the drains/service installations from damage by backfilling trenches with concrete whilst maintaining flexibility of the drainage system to accommodate movement (see diagram 11.23).

Often with refurbishment work it is necessary to extend the drainage system to connect to additional sanitary accommodation. Slab levels and drain inverts are fixed and consequently insufficient cover may be provided to the extended drain. The manufacturer’s recommendations for protection should be followed (see diagram 11.24).
11.4 Superstructure

GENERAL

Prior to undertaking structural repairs, it is essential that the root cause of the structural defect has been remedied e.g. 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

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 repointed. Minor cracking does not usually affect the structural integrity of the wall and may be remedied by raking out mortar joints to a minimum depth of 15mm and repoint with a mix 1:2:9 cement: lime: sand. If the existing mortar is very weak use a 1:3:12 mix.

Major cracking affects the structural integrity of the wall and investigation should be undertaken to find the cause of the problem. If it is necessary, cut out the brickwork either side of the crack (minimum 225mm) and replace, ensuring that adequate bonding is maintained between new and existing brickwork. It is recommended that brickwork reinforcement is used within the new mortar joints.

Avoid strong mortar mixes and use a well graded sand to minimise shrinkage. The use of gun-applied mortar pointing systems should be considered, as they are able to match strength and colour of the existing wall.

Where repointing a wall or building a new wall, jointing should be 'bucket handle' or 'weathered' in preference to flush jointing. Recessed pointing is not acceptable (see diagram 11.25). Additional guidance on mortar mixes can be found in table 6.06 in Part 6: Superstructure.
11.4 Superstructure

Part 11: Conversions

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 (see diagram 11.26).

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 (see diagram 11.27).

Lateral Support at Floor and Roof Level

Buildings may show signs of insufficient lateral support through bulging of walls. Many older houses are built with the floors spanning between the front and back walls with a load bearing spine wall and there is no lateral support to the flank walls at floor or roof level.

To overcome this, metal rods running through the building at floor and roof level, pulling together with end restraint nuts, can be fitted. This method is still acceptable, but due to the disruption involved as the tie will have to pass through every joist, it is more practical to apply the system shown in diagram 11.28.

Other methods of achieving the required lateral support are available and these include self-tapping tie bars. This system is suitable for tying the walls to floor joists only (see diagram 11.29).
Lateral Restraint at Roof Level

If lateral restraint is required, the solution is to use a retro-strap system, fitting solid noggins between the first three rafters and mechanically or resin bonding the strap to the wall and screwing it to the noggins. If this is not possible, then the removal and reinstatement of the roof structure should be considered.

Further guidance is available within the BRE Good Building Guide 29: Connecting walls to floors.

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 or internal partitions to the external walls.

Different bricks and bricklayers were often used, with the poorer quality materials and labour being used on the party walls and internal partitions. This junction should be exposed when undertaking a conversion and if the bond is inadequate a suitable stitching detail incorporated (see diagram 11.30).
Diagram 11.30: Bonding internal to external walls

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, it may be possible to retain the lintel. In order to ensure that a lintel is free from rot, a percentage of all lintels, under the direction of the Developer’s Design team, should be exposed at both ends on both faces.

Where it is intended to remove and re-use timber lintels, BZSS’s appointed Technical Auditor should be consulted to determine a suitable percentage of lintels to be exposed during works in order to ensure their suitability for re-use. Calculations may be required by a suitably qualified and insured Building Professional with regards to the re-use of any structural timber arches or lintels. However in normal circumstances, where existing timber lintels support structural walls, the lintel should be replaced with either a concrete or a steel lintel and have the appropriate bearing, rather than re-installing the existing timber lintels.

An option for Build-Zone to accept either new or re-used timber lintels over openings, is for additional structural support to be provided by a concealed steel angle so that the timber lintel acts as a non-structural element (see diagram 11.31).

Where cracking has occurred in masonry arches (openings not supported by a lintel), then it will be necessary to prop the wall and 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.
11.31: Timber lintels

Diagram 11.31: Timber lintels

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. Where headers are incorporated into the bond of the external brickwork, the wall construction should be investigated, 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.

Where the wall is of cavity form, a survey of the wall ties on a percentage of the development should be carried out.

An initial survey can involve cutting out bricks to inspect the condition and predict (remaining) life span of the ties.

During opening up works the ties can be inspected for their suitability and acceptance by BZSS’s appointed Technical Auditor. The report on the wall ties should cover:

- Age of property
- Condition of wall ties – evidence of rust or corrosion
- Whether there are enough wall ties – at least 2.5 ties/m²
- Whether ties have at least 50mm embedment into each leaf
- Whether ties slope towards the internal leaf
- Whether the cavity is bridged by mortar

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 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.
11.4 Superstructure

**Internal Walls**

**NEW MASONRY**

Masonry walls should be built off a suitable foundation, incorporate a DPC and be in accordance with table 6.07 (Part 6: Superstructure) and Approved Document A (England & Wales) and Regulation 11(Scotland) (up to three storeys). When a wall is outside the scope of these documents, a qualified Structural Engineer should design the element.

**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 Bressumers may be supporting masonry walls and these should be examined by an appropriate Expert to ascertain their capability to carry the load. An appraisal by a Qualified Engineer may not be necessary in all cases, it is suggested that BZSS’s appointed Technical Auditor be involved at the early stages to establish whether clarification by an engineer is actually necessary.

Existing solid brick or stone walls may be acceptable as weather resisting walls subject to the exposure category of the building (see exposure to wind driven rain map, diagram 6.77 (Part 6: Superstructure) 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 walls will require a specialist’s report to identify the extent of any necessary remedial treatment.

The specialist report including the proposed design and / or the manufacturer’s details must be forwarded to Build-Zone for approval along with other requested reports that form part of the conditions placed on the warranty.

If the existing wall is shown to be unsatisfactory, then a new external cladding or render system will need to be installed. The following options should be considered:

- 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 should possess third party accreditation acceptable to Build-Zone.
TIMBER WALLS

New Studwork

Studwork should be in accordance with guidelines given in Part 7: Internal Works.

Existing Studwork

Many properties constructed 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 e.g. the floor sags on the line of the partition and there is distortion of door heads, additional strengthening works should be undertaken.

New door openings cut into an existing trussed partition should be overseen by a qualified structural engineer, as these 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 must be of sufficient size for the span (see table 6.159 (Part 6: Superstructure)).
- Load on the floor must not be increased.
- Joists must not have been weakened by excessive notching and/or drilling.
- Ends of joists must be free from rot.
- All timbers should be treated for insect infestation and wood rot.
- No masonry walls should be built off timber joists.
- Adequate trimming to hearth is required.
- Solid strutting or herringbone should be used.

Where the existing joists do not comply with the span tables, but it can be shown that the joists are adequate, in that there has been no floor deflection, Build-Zone will consider these to be acceptable.

A common defect in floor joists is that the ends which are built into solid external walls have often rotted. A percentage of all existing joists should be examined to ascertain if there is any rot in these timbers. Build-Zone should be consulted to determine a suitable percentage of floor joists to be exposed. Where timber rot is identified in these joists, then further investigation should be undertaken on a further percentage of the joists.

A system of dealing with the rotten joists should then be implemented (See diagram 11.32).

Diagram 11.32: Repairing joist ends
Before carrying out this type of work, you should consult a qualified structural engineer to ensure the structural integrity of the building is not compromised.

Proprietary methods of splicing new timbers to existing joists with galvanised plates are also an acceptable method of repair.

Where joists have previously been excessively notched to accommodate services then they should be replaced or the joists strengthened, e.g. by the addition of steel plates securely connected to joists (see diagram 11.33).

**Diagram 11.33: Repairing excessively notched joists**

**DIFFERENTIAL MOVEMENT**

**Movement Joints Between New and Existing Construction**

In order to avoid the damage resulting from differential movement between new and existing work, it is necessary to isolate the new extension/construction from the existing construction whilst at the same time maintaining lateral support to the new construction and ensuring a weather-tight joint. The isolation joint should extend through to the foundations (See diagram 11.34 for a typical solution).

**Diagram 11.34: Abutment of new build to existing structure**
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.

Often it is necessary to make minor modifications to existing openings in order to accommodate new frames. In such cases the length of bearing of the supporting lintels should be verified and where less than 150mm the lintel may have to be replaced.

WALLS - 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 is also necessary to ensure that the wall provides an adequate barrier to the passage of rainwater into the fabric or the inside of the building. This may be achieved by e.g. the formation of cavity construction whereby the special wall forms the external leaf and the cavity construction provides the required resistance to rainwater penetration. It is recommended that Expert advice is obtained for these types of construction.

CHIMNEYS

Imperial Brickwork – Metric Blockwork

Where it is intended to use this construction particular attention should be paid to ensure that the wall ties do not slope inwards towards the inner leaf. Conventional coursing of 450mm centres vertically will not match as imperial bricks are bigger than metric. The use of proprietary walls ties should be considered.

Removal of Chimney or Chimney Breast

When removing chimney stacks, they should be taken down to below roof level and capped. Chimneys located on external walls should be ventilated to the external air at roof and base level.

Where it is intended to re-use existing flues they should be tested for airtightness.

Adequate support should be provided to chimneys after removal of chimney breasts (See diagram 11.35). Cantilever slabs built into existing walls or corbelling should not be used.

The design of any support should be justified by calculation.

Diagram 11.35: Support of chimneys

When intending to retain existing chimneys, the adequacy of the masonry, existing trays and flashings to resist moisture and retain structural stability should be confirmed by an Expert’s report.
11.4 Superstructure

SOUND INSULATION

Pre-Completion Sound Testing - Conversions

Sound testing is needed in accordance with Build-Zone’s requirements and Building Regulations Approved Document E (Resistance to the passage of Sound).

Build-Zone must be consulted in addition to the Building Control Body in order to agree the test regime.

Where pre-completion testing is carried out the construction needs to achieve the values shown in Tables 6.172 and 6.173 (Part 6: Superstructure). You must contact BZSS’s appointed Technical Auditor and the Building Control Officer to agree the number of tests required. In certain cases Build-Zone may require more or additional tests than the Building Control Body. Further guidance on the extent and number of tests is provided in Approved Document E.

We will require copies of the sound tests confirming the separating walls, floors and stairs have achieved the performance levels as set out in Approved Document E prior to BZSS’s appointed Surveyor or Al carrying out the completion inspection.

Note: in the event of a failed set of test results appropriate remedial treatment should be applied to the rooms that failed the test. A failed set of tests raises questions over the sound insulation between other rooms sharing the same separating elements. The developer should demonstrate that these rooms meet the performance standards. Normally this would be done by additional testing, and/or applying the appropriate remedial treatment to other rooms, and/or demonstrating that the cause of failure does not occur in other rooms.

The sound tests must be carried out by a practice registered either with the United Kingdom Accreditation Service (UKAS) or Association of Noise Consultants (ANC).

Historic Buildings

If the building is deemed “historical” it may not be practical or possible to improve the sound insulation to the standards set out in Tables 0.1a & 0.1b of Approved Document E.

The aim is to improve the sound insulation as much as possible but it has been recognised that this is not always practical. Where the performance standards cannot be met due to maintaining the character of the building it is acceptable to “test and declare” and provide a fixed notice in the building to show the sound insulation values achieved. For further information on testing see Part 6: Superstructure Section ‘Sound Insulation’.

Historic buildings include:

- Listed buildings
- Buildings situated within conservation areas
- Buildings which are of architectural and historic interest and which are referred to as a material consideration in a Local Authority’s development plan
- Buildings of architectural and historic interest within national parks, areas of outstanding natural beauty and world heritage sites
- Vernacular buildings of traditional form and construction.

Further guidance on the principles that should be applied when proposing work on Historic Buildings can be found in BS 7913 1998 – The Principles of the Conservation of Historic Buildings.

Party Walls and Floors

Where the conversion or refurbishment of the building does not constitute a “material change of use” there is no requirement under the Building Regulations to upgrade existing party floors and walls i.e. if the building is already sub-divided into flats and these are remaining, there is no need to upgrade sound resistance.

However where possible, Build-Zone will normally require any existing party floors and walls to be upgraded to achieve the decibel reduction given in Tables 6.172 and 6.173 (Part 6: Superstructure). However, in special circumstances, such as a listed building, this requirement may be waived.
11.4 Superstructure

AIR PRESSURE TESTING

Historic Buildings

- It is not an option to do nothing to existing windows unless keeping them intact is a specific condition of listed building consent.
- Historic buildings are not by right exempt from improving energy efficiency.
- Historic buildings are only exempt where change would unacceptably alter the character or increase the risk of long term deterioration of the fabric.

All Other Buildings

All buildings other than Historic are to be tested as described in Part 6: Superstructure.

CONCRETE/STEEL FRAMES

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 re additional reports, testing by specialists etc required

The floor loads on the building may decrease (e.g. if the use is being changed from commercial to domestic use). Build-Zone will accept 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 e.g. movement, cracking etc.

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
- 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 should be carried out on the concrete structure to ascertain if corrosion of the steelwork has occurred 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.
HIGH ALUMINA CEMENT CONCRETE (HACC)

Where High Alumina Cement Concrete has been used in a building and the intention is to keep the existing structure Build-Zone may consider the property for warranty subject 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.

Typically HACC precast concrete beams were cast as "X" or "I" shaped beams.

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.

When corrosion is apparent, what appears is a thick layer of rust may indicate a lower level of loss e.g. 10mm rust only actually indicates a loss of between 1.0mm and 1.6mm of steel. It is therefore important to take readings.

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. Corroded steelwork occupies between 6 and 10 times the original volume of the steel. Perimeter steelwork can normally be inspected during the conversion process and the appropriate repairs/replacement 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

Bimetallic corrosion should be considered in the existing and proposed structure. This issue 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. Typical beams are shown in diagram 11.36.

Cast and wrought iron were first introduced in 1800s followed by the use of steel around 1890. With the onset of steel the use of cast and wrought iron declined.

When the intention is to keep the existing structural elements, an appraisal of the existing building is necessary. As part of the appraisal the Structural Engineer should comment on the following:

- determine age of the building and materials used
- assess how its construction has fared
- 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.
\section*{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 (see diagram 11.37).

The clinker also contains particles of unburnt 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$_2$SO$_4$). 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 first to investigate to ascertain if the floors have been subject to damp conditions and whether any significant corrosion has taken place.

\section*{Prefabricated Reinforced Concrete (PRC) Repairs}

Particular attention should 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.

PRC houses covered under NTHAS (Non-Traditional Housing Appraisal Scheme) are suitable for warranty providing the category of repair is either 3, 4 or 5 (see table 11.38). Build-Zone will need to be made aware of such structures.

The NTHAS appraisal includes a visual inspection followed by testing of the structure. The testing covers:

- Depth of concrete cover to the reinforcing steel
- Degree of carbonation of the concrete
- Calcium chloride content
Table 11.37: Category ratings for PRC repairs

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<th>chloride limit</th>
<th>category</th>
<th>treatment</th>
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<td>4</td>
<td>replacement of external PRC components &amp; ventilation</td>
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<tr>
<td>external &amp; internal</td>
<td>No</td>
<td>no limit</td>
<td>unlimited</td>
<td>5</td>
<td>replacement of all PRC components &amp; ventilation</td>
</tr>
</tbody>
</table>

After the test results have been analysed the property is placed in the appropriate category, however works under Category 1 and 2 are not suitable for provision of a Build-Zone Warranty.

BZSS’s appointed Technical Auditor will need to inspect the property prior to work commencing to comment on those elements which are being retained:

- Ground floor slab – any signs of movement or damp
- First floor joists – deflection, rot
- Roof void – deflection of structural timbers, rot, adequate ventilation, insulation
- Drainage – external below ground drainage
- External – paths, drives, garden walls
- Services – gas, electricity, water etc.

Where any obvious defects are apparent in the retained structure they should be replaced or repaired.

**PRC DEMOLITION AND REBUILD**

Where the PRC property is demolished to slab level Build-Zone will consider the rebuild for warranty purposes subject to the following requirements:

- A Structural Engineer should comment on the adequacy of the existing foundations to take the proposed loads. Where it is necessary, the footing should be underpinned or a new foundation ‘stitched’ to the existing.
- The existing slab should be examined for any signs of settlement, heave or sulphate attack and where appropriate trial holes cut into the slab to ascertain the thickness of concrete and type of hardcore.
- Any new load-bearing walls are to be built on foundations unless it can be justified by calculation that the existing slab can carry the load.
- Where the existing below ground foul drainage system is retained a CCTV survey should be carried out.

**TIMBER ROOFS**

**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.

**Roof Structure**

It is essential that the roof structure has adequate strength, stiffness and dimensional accuracy appropriate for the new roof covering. In many existing buildings the roof structure is inadequate to support roof loads and has suffered from excessive deflection (see diagram 11.39).

Often, the necessary remedial works are relatively simple and inexpensive. 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.
There are a number of solutions for strengthening timber roofs (see diagram 11.40) which include:

- Provision of diagonal struts supported on loadbearing walls to reduce effective spans of purlins
- Provision of additional purlins
- Inclusion of new binders and collars
- Strengthening of rafters at ceiling level in raised tie ceilings
- Additional ties to connect rafter feet to ceiling joists
- Splicing new timber to rafter feet

All strengthening work should be designed by an Engineer.

Additional supports are often required for new water tanks in roof spaces. These should be located so that ceiling joists are not excessively loaded and the loads imposed are transmitted directly to supports (see diagram 11.41).

**Diagram 11.39: Existing pitched roof**

**Diagram 11.40: Strengthening of pitched roofs**

**Diagram 11.41: Supporting of water tank**

**Roof Coverings**

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

Consideration of reusing slates/tiles will be given depending upon their condition and Build-Zonemay request that these be tested by a Third Party specialist organisation.

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.
Where the existing construction is close boarded and there are no provisions to strip the roof to felt and batten, Build-Zone will consider close boarding to be acceptable if:

- Confirmed acceptable in a survey by an expert which must also consider the exposure level
- There are no signs of damp ingress into the roof void due to wind driven rain, snow or capillary action of moisture.

A specialist report will be required to confirm the adequacy of the existing roof covering and whether timber treatment is required. If the proposals are to replace the existing roof coverings, then it is good practice to erect a temporary roof to protect the building and prevent excessive water ingress into it. Failure to do so can lead to the building becoming saturated and the risk of wet/dry rot occurring. Build-Zone may refuse to provide policy cover for the project if inadequate protection is afforded to the structure.

Adequate ventilation of the roof should be provided in accordance with the guidance in Part 8: Roofs. Where it is intended to re-use existing roofing tiles or slates they should have a life span of at least 15 years. Adequate ventilation of valley gutters and parapets are often overlooked and may need additional ventilation to prevent stagnant air.

Where replacement coverings are heavier than the existing coverings, then the works are usually controlled under the Building Regulations and approval is required in respect of the strengthening works to the roof structure. 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.

The specialist report including the proposed design and/or the manufacturer’s details must be forwarded to Build-Zone for approval along with other requested reports that form part of the conditions placed on the warranty.

**External Treatments**

Existing cladding 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.

**Internal Treatments**

An alternative to using externally applied claddings and renders to prevent moisture penetration is to use an internally applied method.

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 should possess third party accreditation acceptable to Build-Zone.

**Interstitial Condensation**

Vapour control layers may need to be incorporated on the warm side of the thermal insulation. Voids and cavities may also need to be ventilated.

**Surface Condensation**

Measures should be taken to prevent surface condensation, this can be based on guidance contained in BS 5250.
11.4 Superstructure

**Summer Condensation**

Under certain conditions the warmth from sunlight falling onto a damp solid masonry wall can drive moisture inwards and form condensation on the outside of a vapour barrier. Diagrams 11.42 and 11.43 indicate two methods of upgrading the thermal properties of existing solid walls whilst attempting to limit the risk of summer condensation.

**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.

The following must be taken into account:

- 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.

Where planning restrictions prevent the thermal upgrade of the building then Build-Zone may deem it appropriate to add an endorsement to the policy regarding the risk of condensation.

Diagrams 11.42 and 11.43 provide guidance on increasing thermal values of existing walls.

It should be noted that these diagrams are for upgrading thermal values but are not ways to prevent moisture penetration.

Diagram 11.44 can be used when calculating the elemental method for conversions.
RENDER APPLICATION

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

See tables 6.139 and 6.142 (Part 6: Superstructure) for a suitable mix and design.

Guidance on this subject is available in BRE Good Building Guide 23 which gives advice on:

- Assessing external rendering for replacement or repair
- Repairing external rendering

Protection of Render

Renders are vulnerable to damage through exposure to extremes of temperature during the first few days. Therefore the following precautions should be arranged in advance:

- In hot weather, the wall should be shaded from the direct heat of the sun or the work programmed to be carried out in the shade.
- In cold weather, rendering should not be attempted when there is a risk of frost occurring during the day or the following night.
- Air temperature should be at least 5°C at the time of application.
- When rendering has been applied, it should be prevented from drying out for two or three days until the mortar has hardened. In drying winds it may need to be kept damp by gentle spraying.

PLASTER FINISH

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

- 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.
11.4 Superstructure

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 certificates acceptable to Build-Zone 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.

Additional advice on plaster is available in BRE Good Building Guide 7 – Replacing Failed Plasterwork.