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Introduction

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BS 40104:2024

Retrofit assessment for domestic dwellings – Code of practice

DRAFT

Contents

Foreword 3

Introduction 5

1 Scope 4

2 Normative references 5

3 Terms and definitions 5

4 Assessment process 6

5 Context assessment 9

6 On-site assessment 16

7 Reporting and lodgement 25

8 Competencies 25

Annex A (informative) Condition 26

Annex B (informative) Data collection 42

Annex C (normative) Competence framework 119

Annex D (informative) Learning, skills development, and qualifications 127

Bibliography 129

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on XX Month 202X. It was prepared by Technical Committee CB/401, *Retrofitting energy efficiency measures*. A list of organizations represented on these committees can be obtained on request to the committee manager.

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The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

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Introduction

A retrofit assessment is the essential first step towards a successful risk-based retrofit project. An assessment aims to provide the evidence, and the intellectual and practical foundations, for decision making about the most appropriate solutions for each dwelling in terms of energy efficiency, health and the public interest.

The retrofit assessment process is based on the whole-dwelling approach. This considers the building's construction, significance, condition, ventilation, location, energy performance and occupancy issues. This, when combined with owners' objectives and budget, determines the most suitable energy efficiency measures to install.

A whole-dwelling approach is used to prevent retrofit works from being considered in isolation which can unintentionally damage the building's overall performance; minimal to zero assumptions are allowed in the assessment process. This risk-based approach is embedded in the principles outlined in *Each Home Counts* [1] and PAS 2035; however, this British Standard is to be seen as good practice in all retrofit assessments.

Assessment relies on an assessor's professional competence and requires a focus on the quality of information and data provided from both a desktop and on-site assessment. A quality assessment is determined not only by the assessor's ability to gather data on the dwelling, but also by "following the trail" of issues to identify their cause and to provide this information in a clear and concise manner that facilitates the next step in the retrofit process.

This British Standard provides the processes and recommendations for retrofit assessments based on a whole-dwelling approach, which forms the foundation for all the subsequent design and installation stages of any domestic retrofit.

1 Scope

This British Standard provides recommendations and guidance for the retrofit assessment of domestic dwellings in the UK.

This British Standard covers:

- a) context assessment;
- b) condition assessment;

- c) ventilation assessment;
- d) occupancy assessment;
- e) energy performance assessment;
- f) site specific context assessment;
- g) significance assessment;
- h) reporting and lodgement; and
- i) competencies.

This British Standard is intended for use by assessors, building surveyors, designers, coordinators of retrofit programmes and other professionals to assess dwellings prior to retrofit.

This British Standard might be of interest to small and medium-sized enterprises (SMEs) in the construction field and to landlords.

This British Standard does not cover fire, electrical and gas safety, and the structural elements of dwellings.

NOTE While fire, electrical and gas safety is out of scope in terms of inspection and installation, the assessor is expected to be aware of issues to flag as part of basic identification and information gathering.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 5250, *Management of moisture in buildings – Code of practice*

BS 7913, *Guide to the conservation of historic buildings*

BS 8104, *Code of practice for assessing exposure of walls to wind-driven rain*

BS 40101, *Building performance evaluation of occupied and operational buildings (using data gathered from tests, measurements, observation and user experience) – Specification*

Other publications

[N1] BUILDING SERVICES RESEARCH AND INFORMATION ASSOCIATION. *BG46/2022 – Domestic Ventilation Systems: A guide to measuring airflow rates*. Berkshire: BSRIA, 2022.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

3.1 competent person

individual who possesses the necessary skills, knowledge, experience and appropriate behaviours to effectively fulfil defined roles, functions and activities while performing specified tasks

3.2 energy efficiency measure (EEM)

specific improvements or upgrades made to a building to enhance its energy performance

NOTE These measures are designed to reduce energy consumption, alleviate fuel poverty and subsequently decrease the carbon footprint of the building. EEMs encompass a wide range of upgrades.

3.3 National Calculation Methodology (NCM)

methodology for assessing the energy performance of buildings for the purposes of compliance with building regulations and energy certification for non-domestic buildings

3.4 non-intrusive inspection

approach whereby no parts of the structure are opened up

3.5 Passive House

recognized international standard for designing and constructing buildings to high energy efficiency, comfort and affordability standards

3.6 Reduced Data Standard Assessment Procedure (RdSAP)

approved methodology developed by government for assessing the energy performance of homes

3.7 retrofit assessment

process of surveying, inspecting, assessing and recording the relevant characteristics of an existing dwelling, including its local context, built form and construction, services, ventilation, condition, significance, energy efficiency and occupancy, in order to provide sufficient information for the preparation of a retrofit design

3.8 Simplified Building Energy Model (SBEM)

computer programme which provides an analysis of a non-domestic building's energy consumption, under standardized operating conditions

NOTE SBEM estimates the monthly energy use and carbon emissions of a building when given a description of the building's geometry, construction, and its building services equipment.

3.9 Standard Assessment Procedure (SAP)

UK methodology for calculating the energy performance of dwellings

3.10 traditional building

construction consisting of solid brick or stone external walls, or pre-1919 timber-framed external walls with any infill

[SOURCE: PAS 2035:2023, **3.39**, modified]

4 Assessment process

COMMENTARY ON CLAUSE 4

The assessment process to be followed chronologically is split into three categories and detailed below. Annex A sets out an introduction to the contextual information that relates to each building element that may be assessed as part of the retrofit assessment process. A data collection template, with suggested data collection points, data types and responses, is included in Annex B.

4.1 Stage 1: Context assessment

The context assessment is a preliminary desktop assessment that informs all subsequent assessments and should be used to determine the level of competence required for the on-site assessment process (see Clause 5).

4.2 Stage 2: On-site assessment

The onsite assessment should include the:

- 1) condition assessment (6.1);
- 2) ventilation assessment (6.2);
- 3) occupancy assessment (6.3);
- 4) energy performance assessment (6.4);
- 5) site specific context assessment (6.5);
- 6) significance assessment (6.6); and
- 7) relevant retrofit assessment drawings.

NOTE 1 See Annex B for example drawings to be included in a retrofit assessment.

Assessments 1 to 4 should be undertaken in all dwellings.

Assessment 5 should be undertaken to confirm the details from the context assessment and identify additional information that is required from an on-site assessment.

NOTE 2 For example, if an air source heat pump (ASHP) has been identified as a potential EEM for the dwelling but a suitable internal location for associated equipment is required to facilitate this.

Assessment 6 should be undertaken in any dwelling that has any part that is of traditional construction so that any heritage values are taken into consideration in the design of retrofit measures.

NOTE 3 As part of the assessment, the assessor identifies issues that might affect the selection/design of retrofit measures. These might not be specific defects as such but can be seen as obstacles to a specific measure; for example, vegetation growing on a wall or external cabling. A non-exhaustive list of obstacles is included in Annex B.

The assessor should undertake a full and detailed internal and external non-intrusive inspection of the dwelling, including an inspection of each room of the property. If safe and accessible, a head and shoulders inspection of the loft should be carried out. Cellars and basements, external stores and garages, if present and safe to access, should also be inspected.

As part of the non-intrusive inspection, the assessor should not open up the fabric of the dwelling, including lifting carpets, floor coverings or floorboards and removing secured panels/hatches. No heavy furniture should be moved or items in storage areas. When accessing the roof space and loft, the assessor should not move loft insulation, wiring, or other materials.

A roof space head and shoulders inspection should be carried out, when the access is less than 3 m high and is safe to access with a ladder. If a floor void is accessible, then an inverted head and shoulders inspection should be carried out where it is deemed appropriate and safe to do so.

NOTE 4 It is not the purpose of the retrofit assessment to inspect the following areas:

- service voids;
- under fitted flooring such as carpets or vinyl;
- non-accessible sub-floor voids (where a fully accessible cellar is not present);
- cavities within the walls of the building; and

- underneath furniture, either fitted or loose.

There is no time limit or guidance for inspection times, other than to allow for a suitable amount of time to inspect the complete dwelling, to reflect on defects and issues and complete a full report.

The inside of cupboards or wardrobes should be inspected with permission of the occupant as there might be concealed signs of damp or mould.

The assessor should bring all equipment necessary to carry out a retrofit assessment, including, as a minimum:

- i) electronic moisture meter;
- ii) camera;
- iii) torch;
- iv) measuring devices, for example tape measure or laser measure;
- v) ladders to provide loft access;
- vi) meter cupboard key in order to view meters/main fuse;
- vii) compass;
- viii) binoculars;
- ix) hygrometer;
- x) vane anemometer with hood; and
- xi) crack gauge or ruler.

NOTE 5 Health and safety while working on site is of paramount importance to assessors. Guidance is available from RICS' Surveying safely: Health and safety principles for property professionals [2].

Where the assessor identifies areas of concern, a "trail of suspicion" should be determined; for example, damaged down pipes causing dampness to external elevation to identify the potential cause. The assessor should identify defects and flag any areas requiring further investigation by a recognized professional competent person.

4.3 Stage 3: Reporting and lodgement

Once all assessments are completed, then a report should be created that identifies all the relevant information from each assessment section with supporting photographic evidence (see Clause 7).

All photographs should:

- a) be of significant quality to be useful for other stakeholders in the process;
- b) show the context of the item/issue;
- c) be referenced and preferably marked on plans/elevations;
- d) be annotated to identify context and content; and
- e) be geotagged and date stamped.

The assessor should not perform actions outside of their competence and should inform the project manager of any concerns that require specialist assessment from a competent professional or where an area of assessment has not been possible and why.

All assessment sections should be amalgamated into a single assessment report and presented to the project manager.

5 Context assessment

COMMENTARY ON CLAUSE 5

In the built environment, context refers to how a particular site or project interacts with its surroundings. Buildings do not sit in isolation and are designed and constructed to respond to, support and enhance their surroundings. This clause outlines those elements that are determined as part of a preliminary desktop assessment, prior to an on-site survey.

5.1 Process

5.1.1 Overview

A preliminary desktop assessment should be undertaken to:

- provide an initial understanding of the building and its setting, including background information about site-specific historical, geological and environmental characteristics that can impact on the building and any future changes to it;
- identify any relevant information from the homeowner on the building's construction, alteration, or material choices;
- identify any potential health and safety concerns to be aware of during a site visit and potential constraints that might impact retrofit design choices; and
- predict, where data is available, future climate change related hazards, e.g. overheating, flooding, subsidence.

The preliminary desktop assessment should be broken down into the following elements to determine:

- planning and statutory considerations that might impact on design decisions, e.g. whether the property is designated (**5.1.2**);
- any historical constraints that might impact on design decisions, e.g. past planning or building control permissions, historic uses of the land (**5.1.3**);
- the ground conditions and topography of the site that might impact on design decisions, e.g. access, subsidence, foundation depths (if available on historic drawings) (**5.1.4**);
- local factors, exposure or shelter that might impact on design decisions, e.g. wind-driven rain exposure zone, elevation, shelter (**5.1.5**); and
- any environmental constraints that might impact on design decisions, e.g. flood risk, groundwater risk, radon, smoke-controlled area, lead and asbestos (**5.1.6**).

NOTE This is the first step of a whole-dwelling assessment to validate for retrofit suitability.

5.1.2 Planning and statutory considerations

Any planning and statutory considerations that might affect the potential retrofit of a dwelling should be identified via the preliminary desktop assessment. Any additional considerations identified during the site survey should be added to the report.

The assessor should identify and record whether the dwelling:

- is designated (nationally listed) or in a conservation area;

NOTE 1 A designated building is protected under the Planning (Listed Buildings and Conservation Areas) Act 1990 [3] in England and Wales and requires permission for any change to material or use via a listed building consent application.

NOTE 2 Information on listing status is available from:

- Historic England²⁾;

²⁾ Available at <https://historicengland.org.uk/listing/the-list/>.

- *Historic Environment Scotland*³⁾;
- *Cadw*⁴⁾; and
- *Department for Communities (Northern Ireland)*⁵⁾.

b) is non-designated (locally listed);

NOTE 3 Locally listed buildings are not protected to the same level as nationally listed buildings, but the interest of the building is at least considered during the planning process.

NOTE 4 Information is available from the relevant local authority's website or staff, for example a conservation officer.

c) has any restrictive covenants and easements;

NOTE 5 Attention is drawn to the Ancient Monuments and Archaeological Areas Act 1979 [4]. If any work is proposed within a scheduled monument, then Scheduled Monument Consent is applied for and applications are made to home nation heritage bodies directly. In Northern Ireland, the equivalent is the Historic Monuments and Archaeological Objects (Northern Ireland) Order 1995 [5]. Information is also available from GOV.UK.⁶⁾

NOTE 6 Buildings within the curtilage of a Scheduled Monument still need to apply for consent whether they are designated or not.

d) has any restrictions where work might impact historic parks and gardens recognized as sites of special scientific interest (SSSI); and

NOTE 7 More information is available from the MAGIC website⁷⁾, managed by Natural England.

e) is impacted by a tree preservation order (TPO).

NOTE 8 This can be determined via the Planning Portal⁸⁾ (which directs to the correct local authority) for England and Wales and e-Planning⁹⁾ for Scotland.

NOTE 9 Tree preservation orders curtail the cutting down, topping, lopping, uprooting, wilful damage or wilful destruction of trees without the local planning authority's written consent. Cutting roots is also a prohibited activity and requires the authority's consent. The presence of a TPO can therefore affect some choices of work.

5.1.3 Historical insight

The preliminary desktop assessment should determine any historical considerations that might impact on design decisions, including identifying any past historic uses of the site or property (e.g. whether it has always been a domestic dwelling or whether anything in its past use might require decontamination).

The assessor should identify and record:

a) if any previous planning or building control permissions (historical data) have been submitted and where material information is available via the relevant local authority;

NOTE 1 Information on local land charges is available from GOV.UK.¹⁰⁾

³⁾ Available at <https://www.historicenvironment.scot/advice-and-support/listing-scheduling-and-designations/listed-buildings/search-for-a-listed-building/>.

⁴⁾ Available at <https://cadw.gov.wales/advice-support/cof-cymru/search-cadw-records>.

⁵⁾ Available at <https://www.communities-ni.gov.uk/services/buildings-database>.

⁶⁾ Available at <https://search-property-information.service.gov.uk/>.

⁷⁾ Available at <https://magic.defra.gov.uk/home.htm>.

⁸⁾ Available at <https://www.gov.uk/find-local-council>.

⁹⁾ Available at <https://www.eplanning.scot/ePlanningClient/>.

¹⁰⁾ Available at <https://www.gov.uk/search-local-land-charges>.

- b) if an air tightness test certificate has already been produced; and

NOTE 2 This can be used in considering the existing ventilation provision and, in combination with potential changes to the building fabric, necessitate improvements to ventilation levels, or suggest to the designer possible changes to ventilation approaches.

- c) if an existing EPC certificate has been undertaken.

NOTE 3 EPC certificates can be found on GOV.UK.¹¹ and the Scottish Energy Performance Certificate Register.¹²

NOTE 4 Data can serve as a potentially useful source of information for the retrofit designer when considering possible changes.

NOTE 5 Some newer properties might have supporting information regarding specifications of materials and systems used that might not be obvious post construction.

NOTE 6 Properties built or refurbished within the last ten years are required to have a SAP certificate, not a RdSAP certificate, as their first assessment. The SAP method can provide a broader scope of historical information in line with building regulations at the time. This information can include, but is not limited to, lighting calculations, thermal bridges, u-values calculations, condensation risks, specific materials, and efficiencies relating to renewable technologies.

5.1.4 Ground conditions and topography

The preliminary desktop assessment should determine any topographical or ground condition constraints that might impact on design decisions, e.g. access, subsidence, landslide risk, heave, foundation depths (if available on technical drawings and planning applications) and predicted water infiltration of the site.

The assessor should identify and record whether:

- a) access to the site is sufficient for deliveries, equipment and heavy machinery;
- b) there is adequate space to erect scaffolding or scissor lift for high-level works;
- c) the existing access to the building or site is suitable for people; and
- d) ground levels are high or raised.

NOTE 1 Attention is drawn to accessibility requirements under the Equalities Act 2010 [6].

The assessor should also identify:

- 1) the risk of landslide; and

NOTE 2 This risk can be assessed via the BGS National Landslide Database¹³. This information might be important when considering any groundworks, or interventions involving changes or additions to foundations or involving increased loads on existing foundations.

- 2) known foundation depths.

NOTE 3 Where a building has had an extension and the extension has a greater or shallower foundation depth than the existing building, then it is at risk of differential movement. This might affect external wall and internal wall installation.

5.1.5 Local factors, exposure and shelter

The preliminary desktop assessment should determine any local factors, for example exposure or shelter, that might impact on design decisions.

The assessor should:

¹¹) Available at <https://www.gov.uk/find-energy-certificate>.

¹²) Available at <https://www.scottishepcregister.org.uk/CustomerFacingPortal/TermsAndConditions>.

¹³) Available at <https://www.bgs.ac.uk/datasets/national-landslide-database/>.

- a) identify the proximity to other structures and building services and procure or produce a site plan to inform exposure, shelter, orientation and external space in accordance with BS 8104;

NOTE 1 This can be established via Ordnance Survey maps or other online tools.

NOTE 2 Shelter will limit the effects of solar gain and summer overheating risk as well as the exposure level to wind-driven rain. Where there is little shelter, solar gain has the potential to increase summertime overheating risks.

NOTE 3 Buildings on the edge of neighbouring buildings or facing the open country tend to have a much greater risk of rain penetration than those further in, even those only one row in. Buildings are also at greater risk of rain penetration if they are elevated above the surroundings, for example by a knoll or gradual slope, or if there is a clear view down an open road.

- b) record the impact of neighbouring properties that shelter, over shade or have implications for potential future works, such as access, constraints, development and alteration to the site or its surrounding streetscape from historic versions;

NOTE 4 Historic maps can also identify past land uses that might have caused land contamination, potentially impacting on future interventions.

NOTE 5 Shelter from neighbouring or opposite buildings, or from surroundings (even tree cover where evergreen), can reduce or increase the level of wind-driven rain affecting an elevation or can impact upon solar gains, or on efficiency of solar panels or solar thermal systems due to shading.

- c) record whether the building is attached (noting that a party wall extending the whole width of the dwelling is counted as sheltered) and, if so, identify any relevant improvement measures on party walls that might affect detailing of the building being assessed;

NOTE 6 This can be undertaken by reviewing neighbouring EPC data and historic records from housing associations, and, where possible, by also contacting the neighbour to enquire about external wall and internal wall installation, room-in-roof, heated basements and any damp-proof measures or flood resistance measures on traditional buildings.

NOTE 7 Where one building has been improved, this can also affect potential surface condensation risk for a neighbouring property if considering internal wall insulation.

- d) determine whether windows or doors are likely to contribute to high levels of solar gain, increasing internal room temperatures, and highlight on a plan where retrofitting external shading is required;

NOTE 8 Historical research or an architectural survey might identify where external shading was originally present on buildings of traditional construction.

- e) determine the exposure level of the external façade in accordance with BS 8104 and subsequently review in accordance with BS 5250;

NOTE 9 Further information on exposure levels is contained in BEIS Research Paper 2021/017, Appendix A [7].

NOTE 10 Depending on a building's location and orientation, walls are subject to driving rain, wind, frost attack (freeze-thaw) and solar gain. These factors can result in the external wall absorbing the moisture and moving it to the internal walls, causing early deterioration of the material.

NOTE 11 A site can be located on the driving rain map in REP BR 262 Thermal insulation: Avoiding risks [8], although this publication is now withdrawn, or in Approved Document C [9] in order to determine the overall exposure.

- f) identify where the site or building is at increased risk of exposure due to its elevation; and

NOTE 12 A map of areas of the UK at risk of severe exposure to frost attack is available via NHBC Standards 2023, Section 6.16 [10].

NOTE 13 A map of wind driven rain exposure zones is available via :

- REP BR 262 Thermal insulation: Avoiding risks (withdrawn) [8]; and
- Approved Document C [9].

NOTE 14 BS EN ISO 15927-3 and BS 8104 provide a range of methodologies for the assessment of wind driven rain on the walls of a building as follows.

- *The methodology in BS EN ISO 15927-3, which is based closely on BS 8104, uses two procedures to analyse hourly wind and rain data, collected for any location over a minimum 10-year period, to calculate a driving rain index.*
- *The methodology in BS 8104 determines the degree of exposure of a wall by using historical wind and rain data mapped at specific locations across the country.*

NOTE 15 An alternative simplified approach is provided within REP BR 262 Thermal insulation: Avoiding risks (withdrawn) [8]. This document is based on BS 8104 and provides a map that indicates exposure zones.

NOTE 16 Orientation of the building's roof and degree of over shading can also provide pertinent information on the benefit and predicted yield of installation of solar PV where not already existing.

- g) assess the orientation, inclination and amount of over shading by external obstacles to inform potential future solar installation.

5.1.6 Environmental factors

The preliminary desktop assessment should determine any environmental considerations that might impact on design decisions.

The following environmental factors should be determined, so that proposed retrofit measures do not deteriorate prior to their life expectancy or cause unintended consequences to the building or its surrounding setting.

The assessor should identify and record:

- a) flood risk;

NOTE 1 Flood risk can be checked via:

- *GOV.UK (England);¹⁴⁾*
- *Cyfoeth Naturiol (Wales);¹⁵⁾*
- *SEPA (Scotland);¹⁶⁾ and*
- *Nidirect (Northern Ireland).¹⁷⁾*

These resources consider fluvial (river), coastal and surface water flooding.

NOTE 2 Flood risk mitigation and remediation measures at a dwelling level can help prevent flood water ingress into a building or aid rapid recovery and allow householders to simply wash out and disinfect after flooding, rather than requiring wholesale replacement of the fabric or the property. Assessing the likelihood of flooding can therefore aid a retrofit designer to develop an appropriate plan to aid that resilience. In combination with an assessment of existing drainage provision, an improvement plan can identify where improvements or changes to the existing strategy, or in combination with other improvements, might be necessary.

- b) groundwater risk to inform potential for subsidence or heave, including appropriateness of existing surface water drainage and potential for increased deterioration to the building's fabric;

NOTE 3 Information can be obtained from the lead local flood authority.

NOTE 4 Flooding from groundwater is most common in areas where the underlying bed rock is chalk.

- c) whether a building is in a designated "smoke control area";

¹⁴⁾ Available at <https://www.gov.uk/check-long-term-flood-risk>.

¹⁵⁾ Available at <https://naturalresourceswales.gov.uk/flooding/check-your-flood-risk-on-a-map-flood-risk-assessment-wales-map/?lang=en>.

¹⁶⁾ Available at <https://map.sepa.org.uk/floodmaps>.

¹⁷⁾ Available at <https://www.nidirect.gov.uk/articles/check-risk-flooding-your-area>.

NOTE 5 Smoke control areas are not strictly smoke-free but are specifically restricted in the types of fuel that can be burnt and the type of appliance that can be used. This could have a potential impact on the installation of biomass and secondary heating options.

NOTE 6 Smoke control areas are designated by the local authority.

d) radon risk, including:

- 1) existing radon control measures; and
- 2) whether there is an active radon sump already in situ with a fitted fan;

NOTE 7 This can be established via the UK Health Security Agency's UK maps of radon.¹⁸⁾

NOTE 8 Radon is a radioactive gas found in different areas across Britain. Where a property is in a radon area, more consideration needs to be given to the building's ventilation and the protection of the occupant.

NOTE 9 When extensions are added to existing buildings in high radon areas or new buildings are constructed in these areas, the Building Regulations [11], [12], [13] require that protective measures are taken against radon entering the building. Where existing buildings have already incorporated such protective measures, this is accounted for when considering future interventions.

- e) if any existing asbestos survey or register is present for the site; and
- f) whether any ecological surveys have been undertaken in the past.

5.2 Output

The information collected and recorded in **5.1** should be used to inform the assessor (prior to a site survey) of any potential issues, constraints or health and safety concerns.

The obtained information should be written up into a report and submitted to the project manager to help in developing an options appraisal.

6 On-site assessment

6.1 Condition assessment

COMMENTARY ON 6.1

The condition assessment is required as the condition of the existing building has an impact on:

- *what enabling works are required for a retrofit project to succeed;*
- *the costs of these enabling works;*
- *the timeframes on which retrofit work can be undertaken;*
- *the order in which work needs to proceed;*
- *the risk profile of any retrofit works and associated EEM;*
- *the appropriateness of different materials, services and techniques for the retrofit; and*
- *the skills/competence levels required of the retrofit team, including the designer, installer etc.*

6.1.1 Condition rating

Condition ratings should be based on factual and/or a deduced amount of risk of the issue becoming a contribution to a non-successful retrofit. Notes should be provided to evidence defects and damage.

The trail of a defect should be followed, from the damage caused to the defect that is causing it.

NOTE 1 Damage to a building is generally the consequence of a defect, which might have occurred in a different area of the property.

The condition assessment should include a risk assessment classification as follows:

¹⁸⁾ Available at <https://www.ukradon.org/information/ukmaps>.

- a) the defect does not require addressing prior to an EEM being installed;
- b) the defect does require addressing prior to a related EEM being installed; and
- c) further investigation is needed to this element before a related EEM is installed.

This classification should identify whether a dwelling is:

- 1) free from significant defects; or
- 2) requires repairs; or
- 3) exhibits serious defects and/or requires further investigation.

Any areas that are inaccessible for the assessor to access/assess adequately should be deemed as “3”.

Use of this classification should be used as a method of “headline” assessment between stakeholders involved in the retrofit of the dwelling in order to easily identify risks.

NOTE 2 Using this classification for other assessments is encouraged to facilitate the clear assessment of risk for the design process.

NOTE 3 If an assessor is unsure of an assessment topic, then it may be classified as “2)” to raise this issue to other professionals. For example, if significance is unclear for a property, then this can be recorded and responsibility for further advice and assessment passed to a more competent person.

Issues raised as “2)” or “3)” should be acknowledged, addressed and resolved by others involved with design and project management/co-ordination of the retrofit of the dwelling. Where required, defects that are likely to significantly affect the retrofit of the dwelling should be shown on the retrofit assessment drawings.

NOTE 4 See Annex B for example drawings in a retrofit assessment.

The condition rating should take into account:

- i) actual condition of the element and not aesthetics, taste, or other cosmetic issues;
- ii) the effect of the defect on other parts of the dwelling; and
- iii) the performance of the element and whether it is carrying out its intended task as designed.

The condition at the time of assessment should be recorded.

The option of further investigation should only be used when needed, and where the issue is directly relevant to a likely EEM.

NOTE 5 Further investigations are required when a defect or damage has an unknown cause or is very serious in its nature. Examples of further investigations are as follows:

- structural survey, where significant movement is present in the structure; and
- damp/moisture further investigation.

6.1.2 Process

The retrofit assessment should record the physical condition of the dwelling, focusing on the following concerns in terms of a dwelling’s potential for retrofit:

- a) defects;
- b) damage;
- c) moisture related issues (damp, rot and mould);
- d) poor design;
- e) inappropriate materials;
- f) poor construction details and obstacles to retrofit; and

g) any other areas of concern.

NOTE 1 For example, evidence of past flooding or ecological impacts such as bat roosts/nesting birds.

The main elements of the property that should be assessed are:

1) external:

- i) chimney (if present);
- ii) roofs;
- iii) rainwater goods and the visible drainage system (gullies etc);
- iv) external walls, including damp proof course, floor ventilation and ground levels;
- v) windows and external doors;
- vi) the junctions and seals between all external elements; and

2) internal:

- i) internal roof structure;
- ii) external walls;
- iii) ceilings;
- iv) windows;
- v) fixtures;
- vi) chimney hearth and flues;
- vii) floors; and
- viii) services, including heating and electrical systems and where services penetrate the external envelope.

NOTE 2 This list is not exhaustive as there might be site specific information that the project manager requests from the on-site assessment process that has been noted in the context assessment process, e.g. evidence of subsidence due to past mining activity or the condition of fire doors.

6.1.3 Output

All issues related to the condition of the dwelling should be referenced and documented in a retrofit assessment report, including:

- a) type of concern;
- b) level of concern;
- c) photographic evidence;
- d) associated “trail of suspicion”;
- e) defined location;
- f) contextual information; and
- g) details of any further specialist investigation required.

6.2 Ventilation assessment

COMMENTARY ON 6.2

Any retrofit project that encompasses work to the building’s envelope, whether designed to or not, is likely to impact the infiltration rate, and as such a ventilation assessment is carried out as part of the retrofit assessment. If a ventilation assessment is not carried out, justification for this is included in the retrofit assessment report.

The ventilation assessment provides:

- information on the current fixed ventilation provisions, both passive and mechanical; and

- *information for consideration of replacement ventilation systems and/or passive measures.*

6.2.1 Process

COMMENTARY ON 6.2.1

The ventilation assessment requires careful observation and assessment of the existing provision for passive and active ventilation within the dwelling.

The assessor should observe, measure and record the airflows through any openings served by mechanical fans and the termination of input or extract ducting in accordance with BG46/2022 [N1]. The required information should be recorded on plans and elevation drawings, where applicable, and comprise the following:

- a) room information;
- b) background ventilation assessment; and
- c) presence of mechanical ventilation system.

NOTE 1 An example of the required information to be observed, measured and recorded is set out in Annex B. Examples of drawings in a retrofit assessment are also provided in Annex B.

NOTE 2 Templates might be useful to ensure all the necessary observations are made and recorded in a logical and methodical way. Adopting a standardized recording and reporting template might help to ensure that all the required observations are made and assist those who later draw value from the observations made at the time of the assessment.

6.2.2 Output

A detailed account of the existing provision for ventilation for each room should include information on the provision of both mechanical and passive ventilators and associated ducting. All internal openings and door undercuts that allow air movement between rooms or adjoining areas of the dwelling should also be recorded, along with confirmation that there is adequate provision for purge ventilation of each habitable room.

NOTE 1 Appendix D in Approved Document F provides a useful checklist to aid confirmation that the minimum standards are complied with. This is included in both the Approved Document F for England [14] and Wales [15]. Although the checklist is not included in the Building Standards Technical Handbook for Scotland [16], the ventilation requirements in Section 3.14 are similar.

Observations should be illustrated and supported by photographs taken at the time of the assessment.

Elevation drawings and floor plans should be created by the assessor to show the dimensions of the occupied space as well as the type and location of the existing ventilation provision.

NOTE 2 An example of such drawings is provided in Annex B.

6.3 Occupancy assessment

COMMENTARY ON 6.3

This assessment is required as the occupancy of the building has a significant impact on the actual energy consumption and therefore the potential energy cost and emissions savings. The occupants are present all the year round, so they are best placed to provide information on the comfort conditions in the dwelling and how any evidence of dampness varies according to the time of year or different weather conditions. They might also have particular needs to be taken into account in the design of retrofit measures.

6.3.1 Process

An occupancy assessment should be carried out as part of the retrofit assessment of any dwelling that is occupied by the same household that is expected to be remaining in the property post-retrofit. If an occupancy assessment is not carried out, justification for this should be included in the retrofit assessment report.

NOTE 1 See also Annex B for example methods of recording data for an occupancy assessment.

The assessor should:

- a) provide the information needed so that the project manager can adjust the predicted energy savings from retrofit measures to take account of the current energy use, energy tariffs and any occupancy patterns/lifestyle factors that are significantly different from the “standard occupancy” assumptions used for energy modelling;
- b) identify any relevant special considerations regarding the occupancy, such as the presence of vulnerable persons;

NOTE 2 For example, children, elderly people or those with disabilities.

- c) record the baseline information that is needed for the project evaluation post retrofit; and
- d) obtain information regarding the conditions in the building or previous work carried out that can be most easily provided by the occupant.

The occupancy assessment should be carried out through an interview with one of the householders who is permanently resident at the dwelling that is being assessed.

Advance notice of the requirement for annual fuel consumption information should be provided so that this is available. In the case of a tenancy, this might not be possible but a request to the tenant should be made.

NOTE 3 “Buy in” from the tenant is probably needed in order to get energy use data from them, but effective engagement with the tenant is essential anyway unless retrofits are programmed to be carried out when properties are void.

6.3.2 Output

COMMENTARY ON 6.3.2

See Annex B for data collection templates with suggested data collection points, data types and responses for each output in this clause.

6.3.2.1 Current energy use

Information relating to the use of energy in the dwelling should be recorded for the following:

- a) annual energy use and current tariffs;
- b) renewable energy generated;
- c) renewable energy exported;
- d) fuel used for cooking;
- e) exceptional energy use items;
- f) metering;
- g) heating controls;
- h) heating hours; and
- i) use of room heaters.

6.3.2.2 Occupants

The following information regarding the full-time occupants of the dwelling should be recorded:

- a) number of adults;
- b) number of children;
- c) elderly or those with disabilities;

NOTE Or health issues leading to additional heating requirements.

- d) any other reasons why any of the occupants are considered as vulnerable or having special needs; and

e) any other factors that might affect energy use and/or humidity.

6.3.2.3 Occupant comfort, satisfaction, wellbeing, needs and usability

Baseline information regarding the occupants' comfort, satisfaction, wellbeing and needs, and the usability of the building services, should be recorded so that it is available for evaluation post-retrofit (in addition to the energy use information from **6.3.2.1**).

NOTE This information allows a "preliminary evaluation" as defined in BS 40101:2022, Table 11, to be carried out.

Responses to questions in the following areas should be recorded along with any other relevant comments made:

- a) overall satisfaction with the home;
- b) whether the home meets the needs of the occupants;
- c) perception of health and wellbeing;
- d) thermal comfort, which could include questions such as:
 - 1) can the home be adequately heated during the cold winter weather?
 - 2) can the occupant normally keep comfortably warm in their living room? If no, is this because:
 - i) it costs too much to keep the heating on; or
 - ii) because it is not possible to heat the room to a comfortable standard?
 - 3) in the summer, is the occupant able to keep cool opening windows?
- e) indoor air quality, which could include questions such as:
 - 1) can the occupant ventilate their home effectively?
 - 2) are there any particular rooms that feel especially cold or stuffy?
- f) sound;
- g) lighting;
- h) perceived control; and
- i) utility costs.

6.3.2.4 Other information

The assessor should seek the views of the occupants on the following areas and record all responses:

- a) the conditions in the building throughout the year;
- b) details of previous energy efficiency improvements carried out;
- c) age of extensions or rooms in the roof, and details of insulation incorporated if known (useful even if evidence is not adequate for an EPC);
- d) details of any planned home improvements;
- e) details of the landlord (if the property is rented and the landlord is not the client); and
- f) any other information pertinent to the retrofit assessment.

NOTE If the occupants have been living in the property for some time, they are likely to be a useful source of information regarding the building that would be difficult to obtain from any other source. This information might alternatively be provided by the landlord in the case of rented properties or obtained by the project manager in their initial discussions with the property owner.

6.4 Energy performance assessment

COMMENTARY ON 6.4

In the built environment, energy performance refers to the amount of energy consumed each year by a building, via its construction, use and fixed energy equipment.

6.4.1 Process

6.4.1.1 Overview

The following overarching principles should be determined as part of a retrofit assessment.

- a) The assessor should always undertake a physical site visit.
- b) The assessor should gather good quality data for the accurate modelling of the building. The energy performance assessment should be completed in line with the standards set within the methodology used, encompassing all applicable conventions and quality assurance requirements.

NOTE Good quality data supports the project manager and retrofit designer in making appropriate design decisions for the building.

- c) The assessor should be competent in accordance with Clause 8.

6.4.1.2 Suitable methodologies

Assessment should be completed using the most up-to-date methodology and engine available. The most accurate methodology should be used where documentary or photographic evidence exists.

NOTE 1 The approved methodologies available to use during a retrofit assessment include:

- *Standard Assessment Procedure (SAP) and Reduced Data Standard Assessment Procedure (RdSAP);*
- *Passive House Planning Package (PHPP)¹;*
- *Dynamic Simulation Modelling (DSM), i.e. where a complex mixed-use building/site is being assessed (a highly glazed tower block); and*
- *other approved methodologies (e.g. SBEM), i.e. when a mixed-use site is being assessed (a block of flats with commercial units on the lower storeys).*

Where a methodology changes in between assessment and calculation, then the assessor should undertake a new site visit where the data set is expanded.

In all cases the assessor should overwrite defaults or use the enhanced data entry methods available to them, where more accurate information is available via their chosen methodology.

NOTE 2 In RdSAP, examples of this include:

- *width and height measured and details of glazing type and orientation for each window and external door;*
- *areas of all external elements of the roof and rooms, plus the presence of any insulation and/or the u-value of each element;*
- *calculated u-values in accordance with BR 443 [17] for doors, windows, floors, walls and roofs;*
- *performance values for installed renewable and HVAC systems;*
- *air pressure test results that take into account the measured air permeability of the dwelling; and*
- *database values for heating controls.*

6.4.1.3 Site evidence

The assessor should refer to the relevant methodology guidance when identifying what is deemed to be suitable and required evidence to support a site assessment and resulting calculation.

Each data point used within the calculation should be supported by documentary and/or photographic evidence.

6.4.1.4 Software

The assessor should use an approved and up-to-date engine for any software employed to calculate the energy performance of a building.

NOTE See 6.4.1.2, Note 1, for more information on software.

6.4.2 Output

The energy performance outputs as a minimum should include:

- a) a report containing all input data;
- b) a software file that contains all the input data; and
- c) site evidence that relates to the energy data collected.

NOTE These may be supplied together or as separate documents/files. It is acceptable that data and evidence are derived from other aspects of the retrofit assessment.

Data and evidence derived from other aspects of the retrofit assessment should be specific to the retrofit assessment and not from another type of assessment (i.e. an EPC).

6.5 Site specific context assessment

COMMENTARY ON 6.5

The on-site assessment of the dwelling is affected by a number of factors as outlined below.

- *The context assessment (Clause 5) might identify information that is out of date (e.g. old imagery from web resources).*
- *The initial consultation between the client and the project manager might have resulted in a need to gather information from site to ascertain the opportunities for certain specific measures within a design (e.g. installation of an ASHP) that require specific on-site information to be collated.*
- *The assessor might notice inaccurate information from the context assessment whilst on site.*
- *Any factors that might affect the feasibility and/or cost of improvement measures, e.g. the extent of loft boarding, services in the loft space, overhangs at eaves, verges and window cills, diameter of heating pipework, etc.*

It is important, therefore, that certain key aspects of the context assessment and/or measure specific data are collected on-site to ensure that the most up-to-date or accurate information is provided to the project manager and retrofit designer.

The type of information to be corroborated/confirmed on site includes:

- *over-shading (e.g. by trees, neighbouring extensions etc);*
- *shelter/exposure;*
- *any obvious hazards and health and safety risks;*
- *distance to large buildings that might overshadow potential renewable technologies;*
- *access that will be sufficiently wide after any EEM has been applied; see Approved Document M [18] and the Building Standards Technical Handbook for Scotland, Sections 4.1 and 4.2 [16]; and*
- *installation requirements for specific individual measures.*

6.5.1 Process

The assessor should:

- a) review the context assessment prior to the on-site assessment and report any concerns about the accuracy of the initial desktop data to the project manager;
- b) collect, assess and report on any specific data sets on site as requested by the project manager; and

NOTE The project manager identifies this request in writing to the assessor.

- c) report to the project manager if the requested data cannot be collected, along with supporting reasons.

6.5.2 Output

All issues related to the requested information from site should be referenced and documented in the retrofit assessment report, including:

- a) the requested site-specific context information;
- b) evidence relating to this information, including a minimum of its location and supporting photographic evidence;
- c) additional information, as requested by the project manager, to be presented appropriately (e.g. dimensions, “trails of suspicion”); and
- d) an update to the original context assessment to more accurately reflect the on-site situation (if appropriate).

If the assessor is unable to gather the requested information, then this should be reported directly to the project manager.

NOTE In these circumstances, the project manager would commission a competent or specialist assessor.

6.6 Significance assessment

COMMENTARY ON 6.6

A significance assessment is undertaken to ensure that retrofit measures do not diminish or impact the heritage values (e.g. architectural details or cultural value) of the dwelling or increase the risk of long-term deterioration of its fabric or fittings.

Dwellings that have any form of statutory protection, e.g. those designated (nationally listed) or in a conservation area, are assessed in accordance with BS 7913. Unprotected dwellings (those not statutorily protected) follow the process below.

6.6.1 Process

A significance assessment should be completed which identifies features, elements and aspects that make a positive contribution to the building and its local area.

In completing the simplified significance assessment, the following should be taken into account to aid consistency.

a) Building materials

Materials which are identified as being original provide information on the history and development of the area contributing to a sense of place.

b) Windows and doors

The development of window and door styles, construction and materials provide evidence on the age and development of the building and its setting. Where original, they not only provide a positive contribution to the building overall but also contain large amounts of embodied carbon. Where properly maintained, they can be as effective as modern equivalents with a longer life expectancy.

c) Interior detail

The internal layout or the presence of original detail tell a story about the house's history. It can provide a positive impact on character and be integral to a building's natural method of ventilation.

NOTE Examples include chimney breasts and fireplaces, joinery of all kinds and in all areas, plasterwork, plaster cornices and floor surfaces.

6.6.2 Output

The information should be detailed in such a way as to be unambiguous and provide detail on each element/aspect sufficiently to enable a heritage impact assessment to be undertaken at a later date using the resultant information.

The retrofit assessment report should be supported by annotated photographic evidence.

7 Reporting and lodgement

A retrofit assessment should include the outputs identified within Clause 4 to Clause 6 and be submitted to the client within 6 months by a competent assessor who meets the recommendations set out in Clause 8.

The retrofit assessment report should be presented as a single document and include:

- a) the assessor's name and details of their qualifications and accreditation;
- b) the outputs identified within Clause 4 to Clause 6;
- c) photographic evidence as described in 4.3;
- d) retrofit assessment drawings showing the dimensions of all rooms and the location of key details, such as heat emitters, controls and the location of defects, plus section drawings of each main heat loss element to allow for U-value and hygrothermal calculations to be carried out by others;

NOTE See Annex B for example drawings used in a retrofit assessment.

- e) details of any assumptions made and areas that could not be accessed; and
- f) a summary highlighting key issues that should be brought to the attention of the client or the designer of any improvement measures.

8 Competencies

The assessor should have the necessary skills, knowledge, experience and appropriate behaviours described in Annex C to effectively fulfil defined roles, functions and activities while performing specified tasks.

NOTE Annex D provides examples of learning, skills development and suitable qualifications.

Annex A (informative)

Condition

COMMENTARY ON ANNEX A

This annex sets out an introduction to the contextual information that relates to each building element that may be assessed as part of the retrofit assessment process. Typical elements of a “normal inspection” are outlined with a summary of common defects associated with that building element.

Inspection of condition is often linked to issues around structural movement, moisture, repairs and maintenance. BRE have written several series of guides relating to repair and these are referenced in this annex.

For assessing moisture and structural movement see also:

- BRE Good Repair Guide 33 – Assessing moisture in building materials [19].
- Investigation of moisture and its effects on traditional buildings. Principles and competencies. Joint position statement (RICS, PCA, Historic England) [20].
- BRE Digest 251 – Assessment of damage in low-rise buildings, with particular reference to progressive foundation movement. Revised 1995 [21].

A.1 Chimney stacks

A.1.1 General

The chimney and stack can be the most exposed part of a home. In addition, the flue gases might have had a long-term detrimental effect from inside. It is also a common route for moisture ingress to the loft area and ceilings, both of which can present challenges to EEM.

A.1.2 Normal inspection

Inspection comprises the following elements:

- inspection from ground level using binoculars;
- inspection of all sides provided there are sufficient reasonably practical vantage points;
- inspection for moisture paths in structure within roof void (e.g. visual staining);
- note of the construction method and material;
- note of any previous restraints that have been installed;
- note of the quantity and location of chimney stacks;
- note of whether the chimney pots are capped/cowled;
- note of any chimney pots removed and stack capped; and
- note of condition, including pointing, render, flashing, vegetative growth, leaning, significant cracks etc.

A.1.3 Common defects

Defects can include:

- leaning stacks (caused by sulphate attack);
- unsafe pots;
- flaunching crumbling;
- spalling brickwork or stone;
- cracked render;
- poor pointing, or jacking from ferrous metal rusting in horizontal joints;
- failed flashing;

- h) heavy attachments, such as large aerials, satellite dishes, large antennae, chimney caps or crowns, lighting rods, wind direction indicators, decorative elements, and flue liner extensions; and
- i) moisture ingress around chimney/roof covering juncture.

NOTE For more information see BRE Good Repair Guide 15 – Repairing chimneys and parapets [22].

A.2 Roof coverings, soffits and fascias

A.2.1 General

The roof covering delivers protection to the home from the elements, consequently defects are likely to affect other building elements, in particular the roof space/loft. These are issues that are likely to affect retrofit choices to the building and are likely to involve repairs to be made before measures are introduced. The soffits and fascias are also common routes for ventilation to a roof.

A.2.2 Normal inspection

Inspection comprises the following elements:

- a) inspection from ground level or an upper window using binoculars;
- b) inspection from all sides (where possible);
- c) view of surrounding properties for comparison, e.g. different coverings might indicate age of original roof, possible overloading (if different);
- d) note of the construction method and material of all roofs at the property;
- e) note of ventilation paths into roof structure, tile vents, ridge vent, soffits and fascias and judgement of their suitability;
- f) note of condition of roof covering (ridge, hips and valleys) including any areas where it is cracked, missing, loose rotting, moss covered, blistered, past repairs, etc;
- g) note of condition of roof structure, including dishing/bows in roof, holding water, poor fall;
NOTE Thatch roofs can have various defects, including pests, decay, overloading and poor detailing.
- h) note of condition of soffits and fascias, including any areas where the structure is cracked, misaligned, rotting, etc; and
- i) note if roofing membrane extends into the gutter (if visible).

It is often possible to view flat roofs from higher level windows, but no attempt is to be made to access.

A.2.3 Common defects

Defects can include:

- a) lack of slope on flat roofs causing pooling;
- b) failed materials due to age or lack of maintenance;
- c) inappropriate repairs of those of a temporary nature;
- d) heavier replacement covering than original;
- e) water penetration causing failure of internal roof structure; and
- f) inadequate ventilation paths (lack of tile/ridge/soffit vents).

NOTE For more information see BRE Good Repair Guide 16 Part 1 – Flat roofs: assessing bitumen felt and mastic asphalt roofs for repair [23].

A.3 Rainwater pipes and gutters

A.3.1 General

The functionality of the gutters and other rainwater fittings is best assessed during rainy periods; however, this is not always possible. Additionally, the drainage provisions are often not visible, consequently assessors often rely on their knowledge and experience and use visual signs of defects, both past and present. The occupier might be able to advise if any leaks or other problems are present or have been experienced. Issues with rainwater goods have the capacity to cause significant moisture issues, which can affect retrofit choices.

A.3.2 Normal inspection

Inspection comprises the following elements:

- a) inspection from ground level using binoculars or a pocket mirror behind cast iron downpipes if rusting/cracks are suspected;
- b) inspection from an upper window if possible to check inside of guttering;
- c) inspection from underneath, as close to wall as possible, for evidence of gap between roof eaves and gutter;
- d) note of the construction material;
- e) note of any evidence of leaks, drips and obviously defective components including brackets and seals;
- f) note of any visible blockages; and
- g) note of any discolouration, deposited salts, algae, moss etc., to walls and fascias, as they might indicate current or historic moisture issues.

A.3.3 Common defects

Defects can include:

- a) missing/damaged components;
- b) misaligned/disconnected components;
- c) lack or inappropriate of fall, bends, etc;
- d) insufficient brackets/supports;
- e) leaf clutter and other blockage;
- f) insufficiently sized or configured systems for the anticipated flow rate of rainwater runoff from catchment areas – now and in future downpipes;
- g) outlets not appropriate for drainage connection (e.g. location, size, type of drainage);
- h) misalignment between roof edge and gutter; and
- i) areas of confluence causing overflow/splashing.

NOTE For more information see BRE Good Repair Guide 9 – Repairing and replacing rainwater goods [24].

A.4 External main walls

A.4.1 General

Walls form the fundamental structure of a dwelling and require accurate assessment as many EEMs relate to insulating walls. It is vital that accurate information of their structure, materials and condition is provided for the Retrofit Designer.

The main walls generally provide the structural support for the roof and floors, but they are also an important barrier against weather and noise. Party walls, including those shared with other flat owners, might have an additional support function.

Walls might be covered with “sacrificial layers” to protect the underlying supporting structure. These are commonly renders and these in turn might be protected by paints/cladding/boarding/tiles etc.

Walls (both external and internal) might be “clad” or covered to “hide” defects; this can be common practice so care is required when assessing them.

Traditionally built solid walls (stone, brick, timber frame, cob etc) are regarded as “permeable structures” that are “moisture open” and require specialist design considerations in retrofit. Identification of base structures, therefore, is important as is the nature of any subsequent covering that might have been applied. Managing moisture movement is an essential element of any retrofit design, hence the importance of the initial assessment.

A.4.2 Normal inspection

Inspection comprises the following elements:

- a) inspection of all elevations from ground level, using binoculars where necessary;
- b) identification of the main wall(s) archetype(s) and materials.

NOTE Measuring wall thicknesses and inspecting wall in roof void can help confirm construction methods. If unsure, further investigation might be necessary to accurately determine archetype.

- c) identification of any pointing / render material if possible, such as lime mortar, sand and cement etc;
- d) identification of any damp course and its condition;
- e) identification of any signs of retrospective repairs (e.g. wall tie replacement, crack repairs);
- f) identification of any installation holes from cavity wall insulation installs;
- g) identification of any underfloor ventilation vents and noting that they are appropriately sized and clear of blockages;
- h) note of height of external ground level compared to internal floor level;
- i) note of any potential cold bridge connections (e.g. gate posts, garden walls);
- j) note of any constraints such as creepers and close growing vegetation/trees;
- k) note of and cracking, leans or bulges;
- l) note of any structural movement (cracks);
- m) note of any material failures (e.g. crazed render from poor application/poor mix);
- n) note of any re-pointing requirements or inappropriate pointing (e.g. cement pointing in solid wall);
- o) note of any rendering over the line of DPC;
- p) note of any features such as high-level corbelling or external features that might influence the opportunities for EEMs;
- q) note of any movement joints;
- r) note of position and condition of weep holes (especially around extensions);
- s) note of signs of moisture staining;
- t) note of service penetrations (e.g. flues, vents, gas meters) and their location;
- u) note of any wall attachments (e.g. satellite dish); and
- v) note of any adjacent infrastructure (e.g. hydrants, street signs).

A.4.3 Common defects

Defects can include:

- a) structural movement (e.g. caused by past mining activities, heave in clay soils, impact damage, unsupported loading);
- b) inappropriate repair / maintenance materials used over time;
- c) natural degradation of sacrificial layers;
- d) cavity wall tie failure;
- e) failed CWI;
- f) rot to timber frames;
- g) moisture/frost damage including spalling brickwork, blown render;
- h) thermal expansion/contraction;
- i) render failure/surface cracking; and
- j) bridged or failing DPC.

NOTE 1 Some historic buildings do not have, or require, a DPC.

NOTE 2 For more information see:

- *BRE Digest 251: Assessment of damage in low-rise buildings, with particular reference to progressive foundation movement [21];*
- *BSI's Moisture in buildings: An integrated approach to risk assessment and guidance [25];*
- *BS 5250;*
- *BRE Good Repair Guide 1 – Cracks caused by foundation movement [26];*
- *BRE Good Repair Guide 2 – Damage to buildings caused by trees [27];*
- *BRE Good Repair Guide 3 – Repairing damage to brick and block walls [28];*
- *BRE Good Repair Guide 4 – Replacing masonry wall ties [29];*
- *BRE Good Repair Guide 24 – Repointing external brickwork walls [30];*
- *BRE Good Repair Guide 35 – Earth, clay and chalk walls: inspection and repair methods [31];*
- *BRE Good Building Guide 11 – Supplementary guidance for assessment of timber-framed houses: Part 1 Examination [32]; and*
- *BRE Good Building Guide 12 – Supplementary guidance for assessment of timber-framed houses: Part 2 Interpretation [33].*

A.5 Windows

A.5.1 General

Windows provide several purposes for a dwelling, including allowing in natural light, providing ventilation, and creating visual contact with the outside world, whilst still insulating and protecting the occupant from the weather. Internal windows might also be present for safety reasons or to increase natural lighting. Windows are often also used to increase the attractiveness and appearance of the building.

Windows require accurate assessment as there are several options for EEMs that do not require wholesale replacement, or in the case of heritage buildings the loss of an element that has a heritage value. It is vital that accurate information of their materials and condition is provided for the retrofit designer.

Windows can be constructed of various materials, with different openings, and of different thickness of glazing. The choice of material for the frame can also impact the u-value and efficiency of the window. In situations where a timber window is present, they might be

covered with “sacrificial layers” to protect the timber from weathering and decay. Sacrificial layers can be covering hidden defects, so care is required when assessing them.

Window improvement and replacement are frequently considered EEM; however, the condition of the original glazing, frames and the surrounding supporting structure are a key observation that can affect the choice of EEM in this area, as well the assessed energy performance of the property.

A.5.2 Normal inspection

Inspection comprises the following elements:

- a) identification of the type of windows in terms of frame material and glazing type (e.g. double glazed units);
- b) identification of any damp in window reveals and sill;
- c) inspection of window frame for defects (e.g. rot, failed hinges);
- d) inspection of glazing for defects (e.g. blown glazing, cracked glass);
- e) note of any trickle vents that are operational (if applicable);
- f) note of any failed seals between frame and wall;
- g) note of cracks in sills;
- h) note of any sill that has drip;
- i) note of functionality of window opening;
- j) note of draught proofing and its integrity; and
- k) measure of the distance between opening casements and frame.

A.5.3 Common defects

Defects can include:

- a) defective lintels;
- b) rot to timber frames and cills;
- c) “misting” (condensation) on double glazing;
- d) defective seals to double glazing;
- e) defective putty around single glazing units;
- f) cracked masonry sills, lack of drip groove;
- g) defective seals around frames;
- h) defective opening and closing mechanisms; and
- i) presence of over-cills.

NOTE For more information see:

- *BRE Good Repair Guide 10 – Repairing timber windows: investigating defects and dealing with water leakage Part 1 & Part 2 dealing with draughty windows, condensation in sealed units, operating problems, and deterioration of frames [34]*
- *BRE Good Repair Guide 31 – Hot air repair of PVC-U window and door frames [35]*

A.6 External doors (including patio doors)

A.6.1 General

Doors provide both access and security to the building. They also exclude external weather and can include visual access and lighting from the outside world.

Doors are often also used to increase the attractiveness and appearance of the building to give a sense of place. Doors require accurate assessment as there are several options for EEMs that do not require wholesale replacement, or in the case of heritage buildings the loss of an element that has a heritage value. It is vital that accurate information of their materials and condition is provided for the retrofit designer.

Doors can be constructed of various and sometimes multiple materials, with different openings and thicknesses. The choice of material for the frame and door also impacts its u-value and efficiency. In situations where a timber door is present, it might be covered with “sacrificial layers” to protect the timber from weathering and decay. Sacrificial layers can be covering hidden defects so care is required when assessing them.

Door improvement and replacement are frequently considered EEM; however, the condition of the original glazing, frames, the surrounding supporting structure and any draught proofing are a key observation that can affect the choice of EEM in this area, as well the assessed energy performance of the property.

A.6.2 Normal inspection

Inspection comprises the following elements:

- a) identification of the type of doors in terms of frame material and glazing type (e.g. double-glazed units);
- b) identification of any damp in door reveals and at base/threshold;
- c) inspection of door frame for defects (e.g. rot, failed hinges);
- d) inspection of glazing (if applicable) for defects (e.g. blown glazing, cracked glass);
- e) note of any failed seals between door frame and wall;
- f) note of any damage to threshold;
- g) note of functionality of door opening;
- h) note of draught proofing and its integrity;
- i) note of whether it is a flood door, or if a flood barrier system is in place; and
- j) measure of the distance between the frame and the reveal.

A.6.3 Common defects

Defects can include:

- a) rot to timber doors/frames;
- b) warping to timber doors;
- c) defective or deflecting lintels;
- d) water ingress at threshold;
- e) lack of weatherboard; and
- f) defective door furniture (e.g. handles, hinges, runners for sliding doors).

NOTE For more information see:

- *BRE Good Building Guide 47 – Level external thresholds: reducing moisture penetration and thermal bridging [36];*
- *BRE Good Building Guide (Rehabilitation) 1 – Repairing or replacing lintels [37].*

A.7 External woodwork

A.7.1 General

External timberwork can include timber cladding or details such as timber shutters. It is important that these elements are assessed and marked on the elevation drawings, as this can significantly affect EEM choices.

A.7.2 Normal inspection

Inspection comprises the following elements:

- a) inspection from ground level with binoculars if necessary or from inside through windows where practical;
- b) note of the construction method and type of wood (hard/soft); and
- c) note of any defects/damage (e.g. rot, warping, loose fixings, poor decoration).

A.7.3 Common defects

Defects can include:

- a) lack of maintenance/repair;
- b) high exposure to wind driven rain;
- c) rot to the timber;
- d) warping of the timber; and
- e) defective fixings to the building.

A.8 External finishes

A.8.1 General

External finishes (such as windows, doors, conservatories, gutters) are generally decorated with protective coatings (such as paint or oils) to extend their life expectancy, which often need renewing on a regular basis. They can be functional, e.g. to prevent rain penetration, or some might only be for cosmetic reasons.

A.8.2 Normal inspection

Inspection comprises the following elements:

- a) identification of any defect to finishes (e.g. peeling, blistering, flaking or bubbling paint);
- b) using “follow the trail” from defect to help identify any related issues (e.g. rot, moisture issues); and
- c) note of location, materials and defect if appropriate.

A.8.3 Common defects

Defects include moisture related issues.

A.9 Other external features

External defects that are not covered in other sections of the retrofit assessment report can include roof terraces, balconies, external stairways, metalwork fire escapes and railings.

Inspection comprises the following elements:

- a) identification of any defect to other external features (e.g. rust, cracked structure);
- b) using “follow the trail” from defect to help identify any related issues (e.g. rot, moisture issues); and
- c) note of location, materials and defect if appropriate.

A.10 Internal roof structure

A.10.1 General

A head and shoulders inspection of the roof space allows for the minimum amount of data to be collected via a visual assessment. If safe, a physical assessment of any roof structure is preferred, as this facilitates more detailed data to be collected on any structural, moisture and ventilation issues and the condition of installed insulation and roof coverings/membranes.

A.10.2 Normal inspection

Inspection comprises the following elements:

- a) report of restrictions that prevent an inspection, and consideration given to a re-inspection;
- b) a view with and without light/torch to detect holes/daylight;
- c) note of issues around chimney breasts;
- d) note of any usage of loft for storage where this might affect selection or installation of EEM; and
- e) note of any evidence of habitation by birds/wasps/bats and other wildlife.

NOTE In the course of inspection it is advisable to:

- *not force or open hatches which are screwed down or paint-sealed;*
- *not move stored items; and*
- *not roll back or otherwise disturb insulation.*

A.10.3 Common defects

Defects can include:

- a) inappropriate alterations to roof structure;
- b) structure overloaded of ceiling/joists with storage;
- c) structure bowing due to heavier replacement covering;
- d) loss of structural strength/integrity due to rot/rust caused by moisture;
- e) poorly laid insulation, or insulation that is covering electrical cables;
- f) inadequate ventilation as detailed in BS 5250;
- g) torn/defective sarking felt/building paper; and
- h) habitation by birds/wasps/bats, etc.

A.11 Ceilings

A.11.1 General

Ceilings can be inspected from floor level with a focus on issues that might directly affect EEM selection, including signs of structural movement, moisture and mould growth. These issues might be related to condensation, water penetration or thermal bridges and might be found at the junction of external walls and ceilings.

A.11.2 Normal inspection

Inspection comprises the following elements:

- a) inspection of ceilings visually looking for structural defects (e.g. bowing, cracks, textured coatings);
- b) inspection of ceilings for moisture related defects (e.g. mould, staining);

- c) testing for damp where appropriate; and
- d) using “follow the trail”, for example plumbing leaks, thermal bridging and poor seals around bathroom fixtures.

A.11.3 Common defects

Defects can include:

- a) structural movement due to weight above or movement in walls;
- b) sagging due to loss of key to lath and plaster ceilings;
- c) cracks, shakes or deflection in visual timber beams;
- d) shrinkage cracks at junctions with walls; and
- e) mould and staining indication penetrating damp, leaks and condensation.

A.12 Internal walls and partitions

A.12.1 General

Moisture meter readings can help indicate underpinning issues and “following the trail” of suspicion is recommended. Recent decoration or use of “dry-lining” might disguise a range of defects and damage. Raised sockets, renovated plaster and tidemarks might indicate past flooding events.

A.12.2 Normal inspection

Inspection comprises the following elements:

- a) note of the materials used and location;
- b) inspection of the wall visually for defects (e.g. damp, mould, cracks, textured coatings);
- c) inspection of wall service penetrations to assess they are sleeved appropriately;
- d) assessment of solid walls by random tapping to identify any lined construction and loose plaster;
- e) test of walls for moisture, especially at low levels, around windows, chimney breasts and other areas where damp is suspected, and record location and level; and
- f) note of high levels around chimney breasts for falling damp.

A.12.3 Common defects

Defects can include:

- a) damp via penetration, condensation or leaks;
- b) altered layout/removed partitions without adequate support structure;
- c) structural movement; and
- d) replacement solid floors damp proof membrane (DPM) not tied into wall (DPC).

A.13 Floors

A.13.1 General

Floors are a source of many areas of risk in a home and an item that might be the subject of deep retrofit. Many defects can appear within a floor that might go unnoticed in a purely visual inspection. For this reason, it is important that the risks to floors are studied as well as their visual condition, such as blocked vents (in suspended floors). High moisture meter readings at floor to wall junctions can also be used to inform the assessor of the risks to the floor. Noting floor coverings plays a vital part in EEM selection and can influence the thermal performance of the floor.

A.13.2 Normal inspection

Inspection comprises the following elements:

- a) note of the material and construction of all floors and coverings in all rooms;
- b) inspection of the floors for defects (e.g. rot, insect infestation, damp, cracks) and follow the trail where defects are noted;
- c) test of the structural condition of suspended timber floors with a “drop heel test”;
- d) note of the presence of efflorescent salts and damp; and
- e) note of the presence of any ventilation in suspended floors.

A.13.3 Common defects

Defects can include:

- a) damp, mould, fungi, and insect infestations due to damp, condensation, or leaks;
- b) lack of or inadequate sub-floor ventilation;
- c) DPM not tied into DPC;
- d) over spanning/lack of sub-floor support; and
- e) joists damaged/holed by service pipes/cabling.

A.14 Fireplaces and chimney breasts

A.14.1 General

Chimney breasts are often a point of weakness in a building in terms of moisture and protrude through the roof, which can often lead to damp penetration. They can also provide a ventilation route through the chimney for solid fuel/gas appliances, which are often removed and the openings sealed. This can lead to a build-up of moisture and/or condensation where not adequately ventilated. Chimney linings and the internal structures (including the internal area of the chimney) are not inspected.

A.14.2 Normal inspection

Inspection comprises the following elements:

- a) inspection of the chimney breasts for defects (e.g. damp);
- b) note of any chimney breasts that have been sealed or blocked; and
- c) note of any structural movement in the chimney.

A.14.3 Common defects

Defects can include:

- a) rainwater penetration from uncapped pots or poor external condition; and
- b) condensation in flues and penetrating to chimney walls due to poor level of ventilation to redundant chimneys.

A.15 Built in fittings

A.15.1 General

Built-in fittings can include wardrobes, kitchens and storage units. These items might contain high levels of moisture, condensation and mould growth, especially if not correctly ventilated. They might also be required to be relocated or removed completely for certain retrofit measures to be put in place. If these units are in poor condition, then this movement might be difficult.

A.15.2 Normal inspection

Inspection comprises the following elements:

- a) inspection of the fittings visually;
- b) inspection for damp and follow the trail where appropriate; and
- c) note of where fittings might interfere with the installation of EEM (e.g. kitchen units, stairwell).

A.15.3 Common defects

Defects can include:

- a) lack of ventilation causing condensation; and
- b) rot of perishable structures adjacent to damp walls.

A.16 Internal woodwork

A.16.1 General

Internal joinery includes the doors, skirtings, architraves, dado and picture rails and timber wall panelling etc. Cosmetic issues are not to be reported, only defects that might affect the likely selection of EEM to the property.

A.16.2 Normal inspection

This element includes inspection of internal joinery for defects (e.g. damp, rot) and following the trail where appropriate.

A.16.3 Common defects

Defects are often moisture related (e.g. rot, damp, warping, fungi, insect infestation).

A.17 Bathroom fittings

A.17.1 General

The retrofit assessment report only considers the actual condition of bathroom fittings (WC, baths, showers, cubicles and sinks). Cosmetic issues are not reported, only defects that might affect the likely selection of EEM to the property.

A.17.2 Normal inspection

Inspection comprises the following elements:

- a) inspection of all bathroom fixtures and fittings for visual signs of defects (e.g. missing seals, staining, mould); and
- b) note of any defects and “follow the trail” where appropriate.

A.17.3 Common defects

Defects can include:

- a) defective seals around baths, showers, etc;
- b) damp associated with condensation forming on cisterns; and
- c) loose WC pans.

A.18 Conservatories

Conservatories can be an important part of the property but are reported on as per external and internal walls, windows, doors and floors. Where conservatories and porches are part of an extension to the existing property, in most situations they are exempt from the energy efficiency requirements in Approved Document L [37], unless the floor area of the extension

exceeds 30m², the space is thermally broken from the existing building, or is heated by the main dwelling.

A.19 Electrical services

A.19.1 General

The electrical systems of a property can affect the choice of retrofit measures. Defective systems need to be repaired before some retrofit works. The capacity and age of the system can also limit the retrofit choices without an upgrade taking place. No electrical testing is required for any element of the electrical circuits beyond switching items on if this is deemed safe (e.g. lights, extraction fans); however, visible defects can be assessed.

A.19.2 Normal inspection

Inspection comprises the following elements:

- a) visual inspection of electrical elements, including switches, sockets, visible wiring, consumer units, electricity meter and main incoming fuse box;
- b) note of any defects, e.g. broken or loose fittings, burnt fittings, old fittings, cables with vulcanised Indian rubber (VIR) sheathing;
- c) note location of meters, consumer units;
- d) note where electrical wiring or systems are in direct contact with existing insulation, e.g. internal/external wall, floor or loft;
- e) note where external lighting, power sockets, security systems, cables (to include telecommunications) or ventilation and extraction fans are attached to the building;
- f) where evidence is available, note age of the electrical wiring and associated equipment; and
- g) provide appropriate photographic evidence (see Table A.1).

Table A.1 – Photographic evidence

Item	Photo(s) number (if applicable)	Location (examples given)	Obvious damage	Notes (examples given)
Consumer unit (with lid open)	1	Under stairs cupboard		Addition of isolation switch
Main fuse cut out (where possible showing size of fuse)	2	Under stairs cupboard		Supplies EVCP
Additional connection unit (1)	4	Under stairs cupboard		
Main earthing terminal (MET)	5	Under stairs cupboard		
Electrical meter	3	Under stairs cupboard		
Recessed lighting		X9 in front, north bedroom		
External lighting	6,7	North wall of kitchen		
External power sockets	9	West wall of garage		Alarm box on front of house, no visible signs of

Table A.1 – Photographic evidence

Item	Photo(s) number (if applicable)	Location (examples given)	Obvious damage	Notes (examples given)
				electrical connection-suspect battery powered
External security systems (cameras/alarms)				Very close to door frame, might need re-siting for door replacement and for better connectivity of devices
Telecommunications access point(s)		RHS below front door		
Ventilation/ extraction fans				Unknown electrical connection box
Other	8	North wall of kitchen		Might need re-siting for increased loft insulation
Loft		Wiring clipped to joists		

A.19.3 Common defects

Defects can include:

- a) broken/missing switch and socket covers; and
- b) damaged or outdated consumer units/or housed in non-appropriate areas.

NOTE It is important that electrical wiring and equipment are factored into all design considerations of EEMs. This is to mitigate the potential need to disrupt EEMs after retrofit to upgrade electrical systems, whilst also ensuring that there is sufficient supply for additional technology during the retrofit or later.

A.20 Space heating and domestic hot water

A.20.1 General

The space heating and domestic hot water (DHW) systems of a property can affect the choice of retrofit measures. Defective systems need to be repaired before some retrofit works. The capacity and age of the system can also limit the retrofit choices without an upgrade taking place. No testing is required for any element of the systems beyond a visual inspection; however, visible defects can be recorded.

A.20.2 Normal inspection

Inspection comprises the following elements:

- a) visual inspection of the main elements of the heating and DHW system (e.g. heat generation, DHW tank, heat pump, distribution system – radiators, heat emitters etc);
- b) note of all visual defects and damage to these components; and
- c) note of locations of main components.

A.20.3 Common defects

Defects can include:

- a) damage to system elements (e.g. boiler, pipes, radiators);
- b) no insulation around pipes or tanks; and
- c) leakage from broken seals, pipes, overflows etc.

A.21 Fuel supplies and meters (gas/oil/LPG/solid fuel/biomass)

A.21.1 General

The condition of the main components of any gas/oil/LPG/solid fuel/biomass can be visually assessed to give an indication of repairs and maintenance of the wider system. No invasive works or testing are to be carried out.

A.21.2 Normal Inspection

Inspection comprises the following elements:

- a) visual inspection of the main elements of the fuel supply (e.g. meters, fuel stores, fuel pipes and feed equipment);
- b) note of all visual defects and damage to these components; and
- c) note of locations of main components.

A.21.3 Common defects

Defects can include:

- a) damage to components (e.g. fuel pipes, meters); and
- b) leaking/dripping fuel lines.

A.22 Water services

A.22.1 General

Water is a charged for resource whether metered or not. Water leaks can cause a multitude of damage to a property and so condition is important.

A.22.2 Normal inspection

Inspection comprises the following elements:

- a) visual inspection of exposed pipework, tanks, stopcock, etc;
- b) note of any defects to the infrastructure; and
- c) note of the position of tanks and stopcock.

A.22.3 Common defects

Defects can include:

- a) inadequate lagging of pipework; and
- b) leaking/dripping from joints, overflows, DHW tanks, toilets and taps.

A.23 Other Issues

A.23.1 General

The site might have a range of other structures that can impact or benefit EEM. These can include garages, conservatories and other outbuilding and services.

A.23.2 Normal inspection

Inspection can include a description of the type, construction, age and any obvious defects which impair the functionality or use of any EEMs.

Annex B (informative)

Data collection

B.1 Data templates

COMMENTARY ON B.1

This annex provides example templates of minimum data to be collected during the retrofit assessment process; suggested data points, types and options for responses are given in most cases. The aim of this annex is to serve as an aid for not only those collecting the data, but also those involved in the development of systems to collect the data. The templates are not exhaustive.

Table B.1 – Data collection (onsite internal assessment)								
Clause	Data point	Data type	Answer options	Notes	Photo(s) required	Documentary (or link to) evidence required	Annotation on plan required	Notes required
A.10.1	Report any restrictions that prevent inspection	Free text	Free text	Y	Y		Y	
	Percentage of loft used for storage	Number	0-100	Y	Y			
	Note of any evidence of habitation by birds/wasps/ bats and other wildlife	Free text	Free text	Y	Y			