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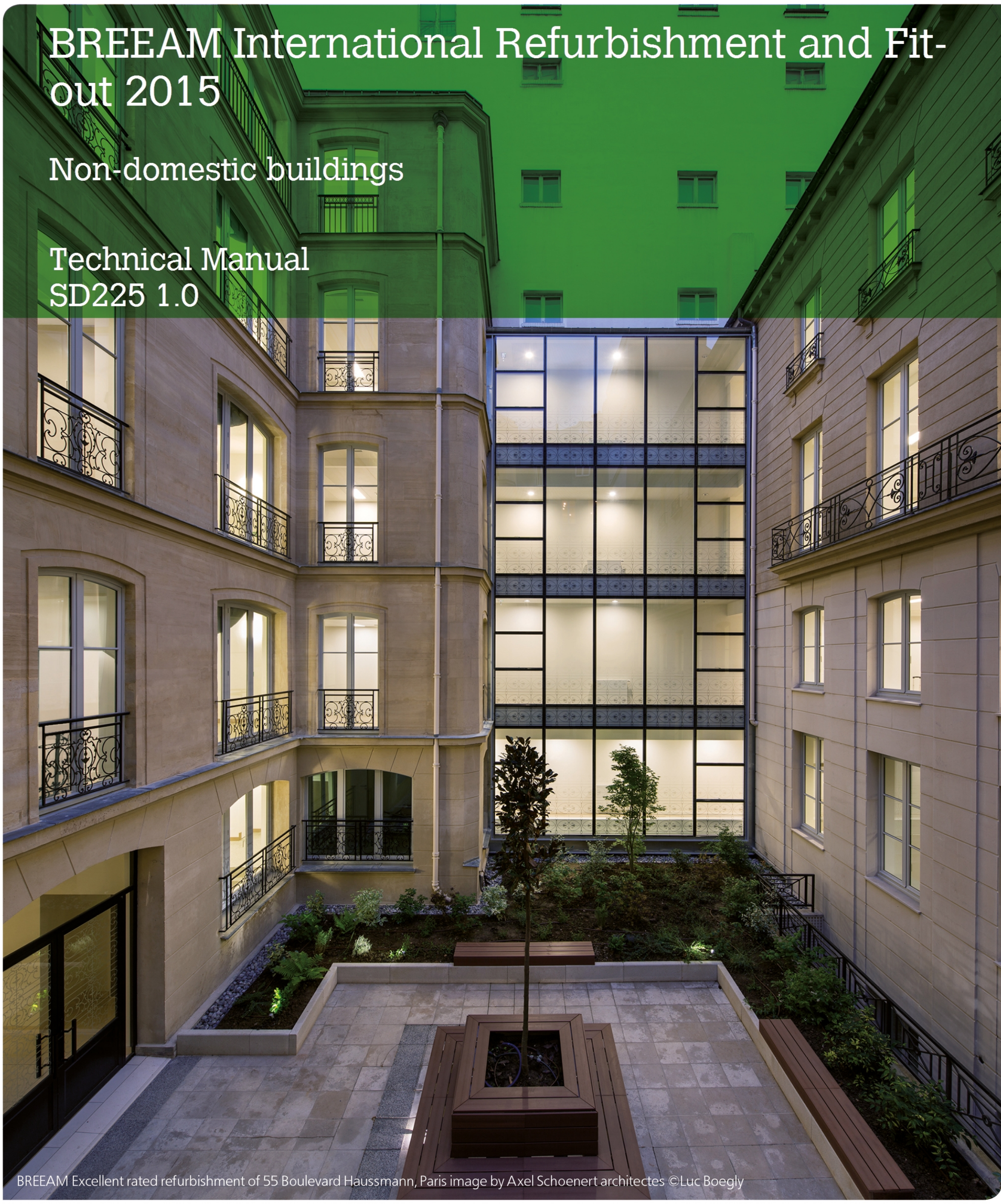
BREEAM International Refurbishment and Fit-out 2015

Non-domestic buildings

Technical Manual
SD225 1.0



BREEAM Excellent rated refurbishment of 55 Boulevard Haussmann, Paris image by Axel Schoenert architectes ©Luc Boegly

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Acknowledgements

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BRE Global Limited also extends its gratitude to those who support BREEAM by continuing to specify and apply the method and contribute towards a sustainable built environment.

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About BRE Global Limited

BRE Global Limited (part of the BRE (Building Research Establishment) Group) is an independent third party approvals body offering certification of fire, security and sustainability products and services to an international market.

BRE Global Limited's mission is to 'Protect People, Property and the Planet'.

We aim to achieve this by:

1. Researching and writing standards
2. Testing and certification in the areas of fire, electronics, security and sustainability
3. Developing world-leading sustainability assessment methods
4. Undertaking research and consultancy for clients and regulators
5. Promulgating standards and knowledge throughout the industry through publications and events
6. Developing and delivering training

BRE Global Limited's product testing and approvals are carried out by recognised experts in our world renowned testing laboratories.

BRE Global Limited is custodian of a number of world-leading brands including:

1. Building Research Establishment's Environmental Assessment Method (BREEAM) - the world's leading environmental assessment method for buildings
2. Loss Prevention Certification Board (LPCB) for approval of fire and security products and services.

BRE Global Limited is a trading subsidiary of the BRE Trust, the registered research and education charity which owns the BRE Group.

BRE Global Limited
Bucknalls Lane
Watford
Hertfordshire
WD25 9XX

T +44 (0)333 321 8811
F +44 (0)1923 664 910

E enquiries@breglobal.com

www.breglobal.com
www.greenbooklive.com

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The scheme document and the information detailed within is intended for use by trained, qualified and licensed BREEAM International Assessors in accordance with the procedural and operational requirements of BREEAM (as described in the BREEAM and CSH: Operational Guidance, SD5070) under the terms and conditions of a BREEAM International licence. This document should be used by non-BREEAM International Assessors for reference purposes only.

Changes to this BREEAM scheme document

This scheme document is subject to revision and can be reissued from time to time by BRE Global Limited. A schedule of the publication date for each issue of this document is provided below.

Any additions to this document that necessitates its reissue will be highlighted throughout the text (note: deletions are not identified in the updated issue). A detailed list of all additions and deletions made to each issue is available separately. BREEAM assessors can download this list of changes from the BREEAM projects website (http://www.breeam.org/projects/documenttoolshome.jsp)t. The list of changes is also available to other parties on request; please emailbreeam@bre.co.uk.

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1.0 Introduction

Introduction to BREEAM

BREEAM is an internationally recognised measure and mark of a building's sustainable qualities[1]. Since its launch in 1990, BREEAM has certified over a quarter of a million buildings and is now active in more than 50 countries around the world. Wherever they are, these buildings are immediately identifiable as having been planned, designed, constructed and operated in accordance with best practice sustainability principles.

BREEAM works to raise awareness amongst owners, occupants, designers and operators of the benefits of taking a life cycle approach to sustainability. It also helps them to successfully and cost-effectively adopt solutions, and facilitates market recognition of their achievements.

Using independent, licensed assessors, BREEAM examines scientifically based criteria covering a range of issues in sections that evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, land use, ecology and management processes. Buildings are rated and certified on a scale of 'Pass', 'Good', 'Very Good', 'Excellent' and 'Outstanding'. Refer to the scoring and rating section to see how a BREEAM rating is calculated.

Benefits of using BREEAM

BREEAM challenges the perception still held by many that good quality, sustainable buildings are significantly more costly to design and build than those that simply adhere to mandatory (regulatory) requirements.

A growing body of research evidence[2] demonstrates that sustainable options often add little or no capital cost to a development project. Where they do incur additional costs, these can frequently be paid back through lower running expenses, and ultimately lead to savings over the life of the building.

The greater efficiency and quality associated with sustainability are also helping to make such building more commercially successful. There is growing evidence[3], for example, that BREEAM-rated buildings provide increased rates of return for investors, and increased rental rates and sales premiums for developers and owners. Furthermore, BREEAM rated buildings can help investors in times of financial insecurity by providing properties with low risk, that provide safer long term investments.

Research studies have also highlighted the enhanced value and quality of sustainable buildings[4]. Achieving the standards required by BREEAM requires careful planning, design, specification and detailing, and a good working relationship between the client and project team. Using BREEAM as a tool throughout the project can also facilitate innovation, resulting in potential cost savings and adding value by producing better buildings and better conditions for building users.

Who is behind BREEAM?

BREEAM is managed and continually developed by BRE Global and supported in certain countries by a number of National Scheme Operators (NSOs)[5]. NSOs are independent organisations who develop and own country specific 'local' schemes that are affiliated to BREEAM. See Appendix A National Scheme Operators.

The founder and owner of the BREEAM brand, BRE Global, is the NSO for the UK. BRE Global also develops and manages the pan-country scheme, BREEAM International. BRE Global is an independent, third party approvals and certification organisation that is part of the BRE Group. The BRE Group is owned by the BRE Trust, a UK registered research and education charity that works to advance knowledge, innovation and communication in the built environment. The Trust uses all profits made by the Group to fund new research and education programmes.

The operation of BREEAM is overseen by an independent Governing Body and a Standing Panel for Peer & Market Review. The Governing Body represents stakeholders to ensure that BRE Global acts correctly and impartially, and treats customers fairly. The Standing Panel provides access to a range of experts that ensure scientific, technical and market robustness, and that BREEAM's development is open to external and independent scrutiny.

The United Kingdom Accreditation Service (UKAS) have accredited BRE Global Ltd against BS EN ISO/IEC 17024 Conformity assessment - General requirements for bodies operating certification of persons and BS EN 45011 General requirements for bodies operating product certification systems. For a list of the BREEAM schemes that are accredited please refer to the UKAS website http://www.ukas.com/CertificationBodiesSearch.asp.

BRE Global's BREEAM-related activities are also certified to ISO 9001 to assist in continually improving internal quality management.

The BREEAM family

BREEAM has expanded from a single scheme focusing on individual, UK buildings at the design stage, to a family of international schemes that encompass the whole life cycle of buildings from masterplanning of communities to new constructions, through to in-use and refurbishment of existing buildings.

All BREEAM schemes have affiliation to the 'BRE Global Code for a Sustainable Built Environment' in common. The Code is a set of strategic principles and requirements that define an integrated approach to designing, managing, evaluating and certifying the environmental, social and economic impacts of the built environment. It ensures that while BREEAM remains a highly flexible approach, all of the individual schemes share a robust scientific and performance basis (see Figure 1).

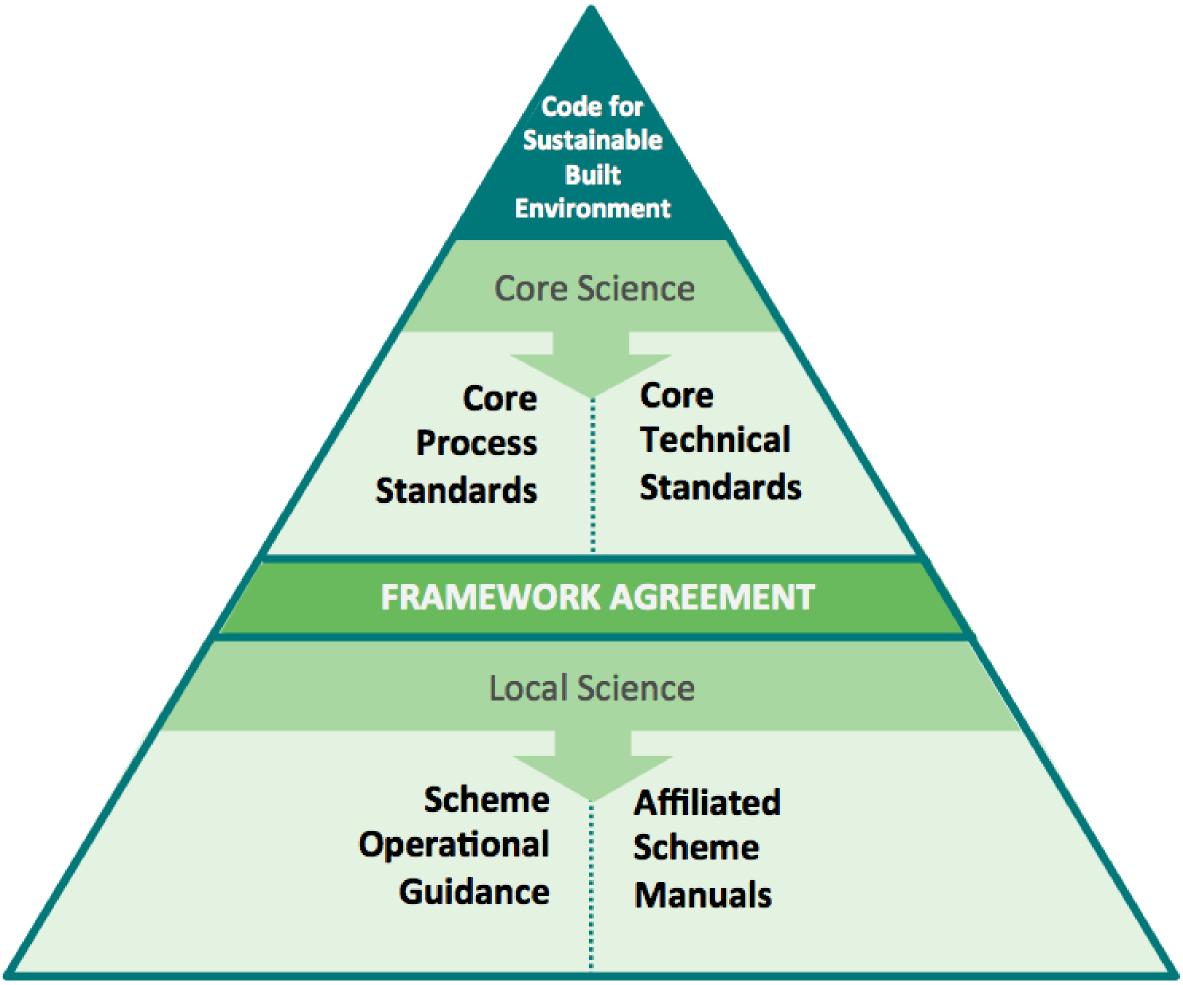

Figure 1: The BREEAM pyramid.

The BREEAM International Schemes

BRE Global Limited is the National Scheme Operator of BREEAM in the UK and owns and operates the pan-country scheme BREEAM International which can be used in countries where there is no BREEAM National Scheme Operator (NSO). For a full list of BREEAM National Scheme Operators and Schemes visit www.breeam.com.

BRE Global develop and operate a number of international BREEAM schemes, each designed to assess the environmental performance of buildings at various stages in the life cycle, and these include:

- **BREEAM Communities** for the master-planning of a larger community of buildings
- **BREEAM New Construction** for new build non-domestic buildings
- **BREEAM In-Use** for existing non-domestic buildings in-use
- **BREEAM Refurbishment and Fit-out** for non-domestic building fit-outs and refurbishments

Independent BREEAM assessors, trained, qualified and licensed by BRE Global Limited can undertake a BREEAM assessment using this scheme document and associated reporting and calculation tools.

Once an assessment is complete and quality assured BRE Global Limited will issue a BREEAM certificate. The BREEAM certificate provides formal verification that the Assessor has completed an assessment of a building in accordance with the requirements of the scheme and its quality standards and procedures.

A BREEAM certificate provides assurance to any interested party that a building's BREEAM rating, at the time of certification, accurately reflects its performance against the BREEAM standard.

Anyone wishing to verify the BREEAM rating of a building can do so by either checking its BREEAM certificate, which will contain the certification mark, (see below) or by searching the BREEAM buildings listings on www.breeam.com/projects/explore .

Figure 2: The BREEAM Certification mark

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[1] DLA Piper, Towards A Greener Future - March 2014,
[2] BRE Trust, 2014. Delivering sustainable buildings, savings and payback,http://www.breeam.org/page.jsp?id=224
[3] RICS Research 2012, A Maastricht University report published by RICS Research in March 2012 http://www.breeam.org/page.jsp?id=735
[4] Schneider electric report 'Value of green buildings', Schneider Electric. http://www.schneider-electric.co.uk/sites/uk/en/products-services/buildings/breeam/breeam-report.page
[5] A full list of current National Scheme Operators and country specific BREEAM schemes is available from www.breeam.com.

BREEAM International Refurbishment and Fit-out 2015

TheBREEAM International Refurbishment and Fit-out 2015 scheme is a performance based assessment method and certification scheme for existing non-domestic building refurbishment and fit-out projects (buildings other than dwellings or homes).

The primary aim of BREEAM International Refurbishment and Fit-out 2015 is to promote the delivery of sustainable refurbishment and fit-out, in order to mitigate the life cycle impacts of existing buildings on the environment in a robust and cost effective manner. This is achieved through integration and use of the scheme by clients and their project teams at key stages in the design and refurbishment or fit-out works process.

This enables the client, through the BREEAM assessor and the BRE Global certification process, to measure, evaluate and reflect the performance of their refurbishment or fit-out project against best practice in an independent and robust manner.

As illustrated in Figure 3, the scheme provides a modular framework split up into four separate parts, that are assessed according to the scope of work of the project, with each part defining a set of individual measures and associated criteria that each project is assessed against. This allows projects to be assessed against the parts that are within the scope of influence of the project, while also ensuring that similar project types are assessed against a comparable set of criteria.

This approach provides the scheme's users with a flexible means of measuring the environmental performance of their building and comparing it with other buildings across the property market, backed with the assurance that independent third party certification of the assessment process provides.

Figure 3: BREEAM International Non-Domestic Refurbishment and Fit-out scheme assessment Parts: 1 to 4

BREEAM Issues

The performance of an BREEAM-assessed project is quantified by a number of individual measures and associated criteria stretching across a range of environmental issues; see Table - 1, which highlights the full set of assessment issues that may be applied to a project. The performance of the project is then ultimately expressed as a single certified BREEAM rating, i.e. the label (section 3 describes how a BREEAM rating is calculated).

Table - 1: BREEAM International Refurbishment and Fit-out 2015 environmental sections and assessment issues

Sections and issues	
Management	Health and Wellbeing
— Project brief and design — Life cycle cost and service life planning — Responsible construction practices — Commissioning and handover — Aftercare	— Visual comfort — Indoor air quality — Safe containment in laboratories — Thermal comfort — Acoustic performance — Hazards
Energy	Transport
— Reduction of energy use and carbon emissions — Energy monitoring — External lighting — Low carbon design — Energy efficient cold storage — Energy efficient transportation systems — Energy efficient laboratory systems — Energy efficient equipment — Drying space	— Sustainable transport solutions — Proximity to amenities — Maximum car parking capacity — Travel plan
Water	Materials
— Water consumption — Water monitoring — Water leak detection — Water efficient equipment	— Environmental impact of materials — Responsible sourcing of materials — Designing for durability and resilience — Material efficiency
Waste	Land Use and Ecology
— Project waste management — Recycled aggregates — Operational waste — Speculative floor and ceiling finishes — Adaptation to climate change — Functional adaptability	— Protection of ecological features — Enhancing site ecology — Long term impact on biodiversity
Pollution	Innovation
— Impact of refrigerants — NO_x emissions — Flood risk management and reducing surface water run-off — Reduction of night time light pollution — Reduction of noise pollution	— Innovation

When and how to engage with the BREEAM International Refurbishment and Fit-out 2015 scheme

Engaging with BREEAM as early as possible in the project maximises the opportunity and ability to cost-effectively optimise a building's environmental performance and achieve the desired BREEAM rating. Starting early facilitates setting realistic targets, agreeing on responsibilities to ensure that they can be met. It also maximises the flexibility of low or no cost design solutions and the opportunities to apply them wherever possible to achieve the target rating.

BRE Global recommends that you bring your BREEAM Assessor and/or BREEAM Accredited Professional on board no later than the design brief work stage, prior to developing the concept design and ideally sooner where practical. The onus of orientating the brief towards sustainability needs to come first and foremost from the client.

Clients can view up to date listings of licensed BREEAM International Refurbishment and Fit-out Assessors and BREEAM Accredited Professionals at Green Book Live www.greenbooklive.com and www.breeam.com/projects/explore.

It is important to recognise that traditionally BREEAM primarily reflects the overall performance of the building rather than just the opportunities or limitations placed on specific stakeholders involved in the procurement process. The BREEAM International Refurbishment and Fit-out scheme allows the performance of the building to be broken down to different parts that stakeholders are able to influence in the scope of the project, such as splitting the scheme into criteria for local services that can be influenced by a tenant and core services that can be influenced by the landlord. This provides particular recognition for the challenges with existing building refurbishment. However, the measures assessed against each part are broadly standardised to provide comparability and to recognise the opportunity available to each project type. This means that the client, design team, principal contractor and BREEAM assessor, as well as other specialist disciplines, have an important role to play throughout the procurement process, if the desired performance level is to be achieved and reflected through the BREEAM rating.

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How to use the BREEAM International Refurbishment and Fit-out 2015 Scheme

This BREEAM scheme document is a technical document which has been created to:

1. Enable qualified and licensed BREEAM assessors to complete BREEAM assessments and determine a rating
2. Enable BRE Global Ltd to complete quality assurance reviews of a BREEAM assessor's assessment report, in accordance with the standards to which BRE Global Ltd is accredited
3. As an aid for BREEAM Accredited Professionals (AP) to undertake project team facilitation, in terms of defining, monitoring and successfully achieving the desired BREEAM rating
4. As a reference for clients and members of the project team whose proposed building is being BREEAM-assessed.

The scheme document is split into six parts:

1. Introduction
2. 2.0 Scope of BREEAM International Refurbishment and Fit-out 2015
3. Minimum standards
4. 4.0 The BREEAM evidential requirements
5. Assessment criteria
6. 15.0 Appendices (A - C).

The **Scope** section describes the types of buildings and stages of assessment that this version of the BREEAM International Refurbishment and Fit-out 2015 scheme can be applied to. It also defines the scope of BREEAM International Non-Domestic Refurbishment and Fit-out assessment Parts 1 - 4 and when they should be assessed. Appendices A to H provide additional scoping guidance for specific building and project types. The Scope section can be used by clients and BREEAM assessors to check whether this is the correct BREEAM scheme to use for their project.

The **Scoring and rating** section illustrates how a building's assessed performance is measured and rated. It outlines the BREEAM rating level benchmarks, the process of establishing national or regional environmental weightings and minimum BREEAM standards. It also includes a description of the BREEAM assessment issues and 'credits', including BREEAM 'Innovation credits', and how performance against these is calculated and expressed as a BREEAM rating.

Please note that, for the purpose of formal assessment and certification, actual building performance must be determined by the BREEAM assessor using the relevant BREEAM reporting and calculation tools.

The **BREEAM evidential requirements** section provides guidance to assessors and project teams on the various types and forms of evidence required by the BREEAM assessor to demonstrate compliance with BREEAM criteria. This includes a description of why BREEAM requires an auditable trail of evidence, a table of general types of building information produced during a building project, and therefore typically required and used as evidence of compliance. It also contains guidance on the differing forms of evidence that can be used and at what stages of the assessment, such as letters of commitment.

The **Assessment criteria** section includes the 47 BREEAM assessment issues, categorised in 10 environmental sections. Each issue defines a level of performance (the assessment criteria) against which the assessed building demonstrates compliance (using appropriate project information, i.e. evidence) in order to achieve a corresponding number of available BREEAM credits.

The majority of BREEAM issues and credits are tradable, meaning that a client and their project team can pick and choose which to target in order to build their BREEAM performance score and achieve the desired BREEAM rating. Several BREEAM issues have minimum standards, meaning that to achieve a particular BREEAM rating specific credits or criteria must be achieved (BREEAM's minimum standards are outlined in the section).

Each BREEAM issue is structured as follows:

1. **Issue information**: This contains the assessment issue reference, title, number of credits available[1], the issue applicability according to the parts being assessed and whether the issue forms part of BREEAM's minimum standards.
2. **Aim**: This outlines the broad objective of the issue and the impact it measures or mitigates.
3. **Assessment criteria**: This outlines the good/best practice performance level benchmark(s) and criteria. Where the building complies with the assessment criteria, as determined by the BREEAM assessor, the relevant number of BREEAM credits can be awarded. Some issues have Exemplary Level Criteria; where a building demonstrates that it meets Exemplary Level Criteria, a BREEAM Innovation credit can be awarded (refer to the Innovation section for more details). Up to a maximum of 10 Innovation credits are available.
4. **Checklists and tables**: This section contains any checklists and tables referenced in the assessment criteria section. This can include tables of benchmarks or building type specific performance criteria.

5. **Compliance notes**: These notes provide additional guidance that supports the application and interpretation of the main assessment criteria, including how to assess compliance in a particular location or for a particular building or project type, e.g. a Part 1 fabric only assessment.
6. **Methodology**: This section includes a description of any methodology used to determine the number of BREEAM credits achieved for a given level of building performance. It includes, for example, calculation procedures or guidance on how standards or qualifications referenced in the assessment criteria relate to those criteria.
7. **Evidence**: This section describes the type(s) of project information that must be provided by the design team/client and given to the BREEAM assessor to enable verification of the building's performance against the assessment criteria and so justify the award of the relevant number of BREEAM credits. Section 4, the BREEAM evidential requirements provides further guidance on evidential requirements.
8. **Additional information**: This section contains any further information relevant to the application of the assessment criteria, including any definition of terms used in the assessment issue or sources of additional information that may be of use in addressing the issue.
9. The **Appendices** provide supporting information relevant to either the scope of the BREEAM International Refurbishment and Fit-out scheme or its assessment criteria.

2.0 Scope of BREEAM International Refurbishment and Fit-out 2015

The BREEAM International Refurbishment and Fit-out 2015 scheme can be used to assess the environmental life cycle impacts of existing non-domestic buildings at the refurbishment and fit-out stages. The definition of 'refurbishment' encompasses a wide range of works to improve the performance, function and overall condition of an existing building. 'Fit-out' also encompasses a wide range of works, however it is more associated with internal works to the building including the first fit-out of a newly constructed building or refitting an existing building.

The BREEAM International Refurbishment and Fit-out 2015 scheme provides a modular set of criteria that are applied depending upon the scope of works for a particular project type including:

- Part 1: Fabric and Structure
- Part 2: Core Services
- Part 3: Local Services
- Part 4: Interior Design

The scheme is split into these assessment parts to allow the scheme to reflect the aspects of a building that are tenant or landlord responsibilities, as well as the varied life cycle stages that each component or element is upgraded. For example, interior finishes are typically replaced on a 5-10 year cycle compared to the fabric and structure of a building that may be upgraded after 60+ years. For commercial buildings, parts 1 and 2 typically reflect the aspects of a building that are landlord responsibilities, with parts 3 and 4 typically being aspects of the building that are tenant responsibilities although this will vary between specific projects.

Type of buildings that can be assessed using the BREEAM International Refurbishment and Fit-out 2015 scheme

The BREEAM International Refurbishment and Fit-out 2015 scheme is applicable to non-domestic buildings undergoing refurbishment and fit-out.

The non-domestic building types which can be assessed and rated using this scheme version are outlined in Table - 2. Additional guidance for some of the building types listed is also provided in the appendices (refer to the footnotes).

Table - 2: Non-domestic building types suitable for assessment

Sector	Building type	Description
Commercial	Offices	— General office buildings — Offices with research and development areas (i.e. category 1 laboratories only)
	Industrial	— Industrial unit - warehouse storage or distribution — Industrial unit - process or manufacturing or vehicle servicing
	Retail	— Shop or shopping centre — Retail park or warehouse — 'Over the counter' service provider e.g. financial, estate and employment agencies and betting offices — Showroom — Restaurant, café and drinking establishment — Hot food takeaway
Education[1]		— Preschool — Schools and sixth form colleges — Further education or vocational colleges — Higher education institutions
Residential accommodation[2]	Long term stay	— Residential care home — Sheltered accommodation — Residential college or school (halls of residence) — Local authority secure residential accommodation — Military barracks
Hotels and other residential accommodation	Short term stay	— Hotel, hostel, boarding and guest house — Secure training centre — Residential training centre

Applicable assessment parts

Table - 3 below indicates the typical BREEAM International Refurbishment and Fit-out 2015 scheme assessment parts that are applicable depending upon the type of refurbishment or fit-out project being undertaken. This table can be used to indicate which assessment parts are potentially applicable to the project; however ultimately it is down to the assessor and client to work together to identify which parts of the method they wish to gain certification against. Further guidance on this is provided later in the Scope section to help identify which assessment part may be appropriate for different project types.

Table - 3: Typical assessment parts applicable, depending on project type

Project Type	Assessment parts typically applied			
	Part 1 Fabric and Structure	Part 2 Core Services	Part 3 Local Services	Part 4 Internal Design
Major refurbishment	✓	✓	✓	✓
First fit-out		✓ *	✓	✓

Project Type	Assessment parts typically applied			
Secondary fit-out		✓ *	✓	✓
Shell only	✓			
Shell and core	✓	✓		
Upgrade of central M&E plant		✓		
Upgrade of local services			✓	
Change of use	✓	✓	✓ *	✓ *
Heritage building refurbishment	✓ *	✓	✓	✓
Internal refresh/remodelling				✓

* May be applicable depending on the scope of the project. For example a heritage building may not have the fabric within scope due to heritage restrictions or a major refurbishment or a change of use may not include part 3 and 4 where the project is speculative and the final fit-out will be undertaken by the future occupier.

Assessment Scope

The BREEAM International Refurbishment and Fit-out 2015 scheme has been developed to allow a flexible approach to assessments to fit the needs of a project. This approach allows the client or developer or assessor to select the parts of the assessment that are relevant to the scope of work being carried out. For example, where conducting work to interior finishes only, a Part 4 assessment would be appropriate.

The following assessment scope provides details of when it may be appropriate to conduct an assessment against each part, depending on the nature of the refurbishment or fit-out works that are being carried out.

It should be noted that, currently, a client can choose which parts they wish to gain certification against and this choice is not limited by the scope of a project. This is to provide flexibility recognising that a project may be doing work that is within the scope of an assessment part (e.g. upgrading part of the core services), but due to economic, technical or other factors may not be at a level that is compliant with BREEAM. In these situations, clients can choose to omit certain assessment parts, however the certificate will clearly highlight the parts that a project has been certificated against and clients and others must make the scope of the assessment clear in any published material or claims made which reference BREEAM e.g. a BREEAM International Refurbishment and Fit-out 2015 'Excellent' rating against Part 4.

Part 1: Fabric and Structure

A Part 1 assessment may be appropriate where a refurbishment project includes one or more of the following alterations to the building fabric and where the area to be renovated is greater than 50 per cent of the surface of the individual element or 25 per cent of the total building envelope:

- Building façade: where the external façade of the buildings is being thermally upgraded or refurbished such as new cladding, rendering, façade system, internal dry lining etc.
- Roof: where a new roof is being installed or where significant changes are being made to the roof structure or the replacement or refurbishment of roof coverings.
- Windows: where changes are being made to the windows such as replacement, upgrade or refurbishment of existing windows with new glazing or the specification of secondary glazing.

Note: A minor change to the building fabric (e.g. local upgrading of an external wall) below the above thresholds would not require a Part 1 assessment to be included, although it may be carried out in order to assess the overall performance of the building fabric.

Part 2: Core Services

A Part 2 assessment may be appropriate where at least two of the following are being installed or upgraded to a level that requires compliance with national regulations:

- Central air handling unit
- Heating boiler
- More than 50% of heat distribution
- Chiller plant
- More than 50% of chiller distribution
- Water services (sanitary fittings in core)
- Building management system
- Community heating system (e.g. CCHP)
- Low and zero carbon technologies.

Note: Where works comprise of 'like for like' component replacements (e.g. a fan motor of an air handling unit) a Part 2 assessment may not be appropriate although it may still be carried out in order to assess the performance of the core services.

Definition of core services

Core services are defined as services that supply multiple areas and/or tenants and will generally be centralised plant.

The services will be deemed core where the services supply multiple tenancy areas and are not focused on the needs of the individual tenants. In such instances these services will normally be owned, operated and maintained by the landlord or their agent. In single tenancy occupancy buildings, the systems services will be considered as core where they supply the whole of the building. The services will normally be owned, operated and maintained by the building owner or their agent.

Part 3: Local Services

A Part 3 assessment may be appropriate where at least two of the following fixed local building services are being installed or upgraded e.g. a replacement or new installation of local heating and cooling units.

- Replacement of more than 50% of light fittings, system and controls
- Upgrade of zone controls
- Local ventilation
- Local heating units (including sources not connected to core services)
- Local cooling units (including sources not connected to core services)
- Point of use water heaters.

Note: If there is a requirement to replace a component of a local service as part of the refurbishment or fit-out and that component is a direct replacement then a Part 3 assessment may not be appropriate, though may still be carried out in order to assess the performance of local services. Examples of component replacements include new lamps within existing fittings, circulation pumps or individual heat emitters and valves.

Definition of local services

Local services are defined as services that supply a specific area and may connect into the distribution systems from the core services within the tenanted area.

Part 4: Interior Design

A Part 4 assessment may be appropriate where the refurbishment or fit-out works involve changes to the layout and/or redecoration of the refurbishment or fit-out area. including:

- Remodelling or changes to interior spaces including two or more of the following:
  - Wall coverings (alterations to at least 50% by area) e.g. internal rendering
  - Floor coverings (alterations to at least 50% by area)
  - Ceiling covering or systems (alterations to at least 50% by area)
  - Partitions (alterations to at least 50% by area)
  - Raised floor system (alterations to at least 50% by area)
  - Furniture and fittings e.g. office furniture, retail display furniture and fittings etc. (alterations to at least 50% by area)
- AND at least one of the following:
  - Sanitary fittings e.g. tea or coffee points, kitchenette and washrooms (alterations to at least 50% of fittings)
  - Equipment e.g. Office equipment, display lighting, display chillers or freezers (alterations to at least 50% of equipment)
  - Local electrical installations e.g. sub-metering

Alignment with typical life cycle replacement of building components

To recognise the life cycle replacement of different building components, the scope of BREEAM International Refurbishment and Fit-out assessment parts group key aspects together that largely sit within a similar life cycle, which are often replaced or upgraded at different stages of a building's life including:

1. Fabric and Structure: typical 60+ year life cycle
2. Core Services: typically 20+ year life cycle
3. Local Services: typically 10+ Year life cycle
4. Interior Design: typically 5-10 year life cycle

Although the specific timing varies by building type (e.g. life cycles are often shorter in the retail sector and may be longer for other building types e.g. schools), this is fairly typical.

Mixed use sites or building types

Typically, sites which consist of a number of separate buildings of differing functional types, e.g. office, retail or education, will require an assessment and therefore BREEAM rating and certificate for each individual building.

A single building with a dominant use, but containing a number of different functional areas can have a single BREEAM assessment, rating and certificate. Examples of such buildings include:

- An office or industrial unit with some category 1 laboratories, workshop space, restaurant, canteen or staff gym
- A retail development with restaurants and /or cinema
- A University with a café, bookshop and/or offices

A single building that has a number of dominant functions, i.e. mixed use, will require separate assessments, ratings and certificates for each dominant function, as the scheme and/or assessment criteria for such building uses or users differs markedly. Examples of such buildings include:

- A building with one or more floors of offices space and retail units
- A building with one or more floors of retail and residential units

The above examples are not an exhaustive list. They are used to highlight the types of scenarios where a single BREEAM assessment or multiple assessments is required. Further guidance on how to define mixed use developments for the purpose of a BREEAM assessment can be found in Guidance Note GN10 - Mixed use developments and similar buildings (or units). Clients are advised to consult a licensed assessor for advice on applying BREEAM to mixed use developments. The BREEAM assessor will ensure that the building(s)/development is registered correctly, seeking advice from BRE Global on classification where needed.

Historic buildings

For the purpose of assessing historic buildings under the BREEAM Refurbishment and Fit-out scheme, historic buildings are defined as building's or monuments that are formally listed and protected under international, national or local laws or schedules and therefore subject to local planning and building regulations, including buildings that are in a conservation zone. Such buildings will normally require consent from the local, national or international historic buildings authority (e.g. UNESCO, Architectes des Batiments de France (ABF), the National Heritage Board of Poland etc.).

Within this scheme document, there are a number of Compliance notes that should be referred to where undertaking an assessment of a historic building.

Newly constructed buildings

Newly constructed buildings cannot be assessed under the BREEAM Refurbishment and Fit-out scheme and should be assessed under the BREEAM International New Construction scheme. The exception is the assessment of a fit-out being undertaken in an existing but newly constructed building.

Overall, a newly constructed building is defined as a building that has been constructed from scratch and in general does not incorporate any part of an existing building. Where a building is constructed on the site of a pre-existing building, it will be defined as a new build where it does not incorporate any part of the former building above ground level, with the exception of a retained cellar, basement and ground floor slab. There are however other situations where a building may be defined as a new build while incorporating existing building elements. This includes:

- Where there is no more than one façade (or two on a corner site) of a pre-existing building being retained as an explicit condition as part of Planning Permission, incorporated as part of the new shell
- Where there is more than one façade and/or party walls of a pre-existing building/s retained and a new shell is being constructed behind the retained façade
- A building is being extended to create additional floor area that is contained entirely within the extension with no internal access between the two buildings
- The structural elements of an existing building are stripped back to its frame, for example removal of the external walls, roof and all services, leaving the structural frame and floor and ceiling slab.

Where a building is defined as a newly constructed building then it should be assessed using the BREEAM International New Construction scheme.

Part new build, part-refurbishment projects

BREEAM can be used to assess new build extensions to existing buildings. The choice of scheme is dependent on the scope of new build and refurbishment works. There are several options for assessment and certification depending upon the scale of the new build extension as follows:

1. The new build extension can be included as part of a BREEAM Refurbishment and Fit-out assessment under the following circumstances:
   a. Where the original building area is less than 500m^2 and new extension is less than 40% of the original building area
   b. Where the original building area is greater than 500m^2 but less than 2500m^2 and the new extension is less than 30% of the original building area
   c. Where the original building is greater than 2500m^2 and the new extension is no greater than 20% of the original building area
2. Where the new extension is above these thresholds, there are two options as described below:

Option 1: Separate BREEAM International New Construction and BREEAM International Refurbishment and Fit-out assessments

Under option 1, two separate BREEAM assessments would be conducted with a BREEAM International New Construction assessment undertaken on the new extension and a BREEAM Refurbishment and Fit-out assessment undertaken on the existing building refurbishment or fit-out. Two separate certificates and ratings can be obtained to indicate the performance of both the new extension and existing building refurbishment or fit-out.

Option 2: BREEAM International Bespoke combined New Construction and Refurbishment and Fit-out assessment

Under option 2, one single assessment is conducted and certified under BREEAM International Bespoke. Under this option the new extension is assessed against the BREEAM International New Construction criteria and the refurbishment or fit-out aspects are assessed against the BREEAM International Refurbishment and Fit-out criteria. The category score for the refurbished area and extension are area weighted in order to provide a combined New Construction and Refurbishment rating and single BREEAM International Bespoke certificate issued for the project.

In determining the appropriate option for a part new build part-refurbishment project, the BREEAM assessor should review the scope of the proposed works and consider in particular the scope of the refurbished elements, i.e. is it major refurbishment, will there be a significant change of use and will the building's thermal and structural elements remain 'as existing'. Using this information the assessor should advise the client on the most suitable option in terms of which BREEAM version or scheme is most appropriate for maximising the building's environmental performance. Where the assessor is unsure of the classification for a mixed refurbishment and extension, details of the project with a copy of the plans highlighting the existing and proposed building should be sent to BRE Global for a scheme classification.

Comparability between assessments

BREEAM assessment schemes provide a highly visible and well recognised mark of best practice in the property industry that are designed to allow building owners and occupiers to compare how they perform against their peers. In order to provide this 'level playing field', there needs to be consistency in what each project is being assessed against.

BREEAM New Construction schemes are UKAS accredited certification schemes and the BREEAM International Refurbishment and Fit-out 2015 scheme follows the same principles, in order to allow the scheme to gain accreditation in the future. It is therefore important to ensure that the scope of the assessment and what is being certificated is highly visible and auditable.

Building life cycle stages covered by the BREEAM Refurbishment and Fit-out scheme

This BREEAM International Refurbishment and Fit-out 2015 scheme can be used to assess and rate the environmental impacts arising from refurbishment and fit-out projects, and the building's on going operation, at the following life cycle stages:

1. Refurbishment Design Stage (DS) - leading to an Interim BREEAM certified rating
2. Post Construction Stage (PCS) - leading to a Final BREEAM certified rating.

Design Stage

The DS assessment and Interim certified BREEAM rating confirms the project's performance at the design stage of the life cycle. Assessment and certification will ideally occur prior to the beginning of operations on site. The certified BREEAM rating at this stage is labelled as 'Interim' because it does not represent the project's final BREEAM performance.

To complete an assessment at this stage, the design must be advanced to a point where the relevant design information is available to enable the BREEAM assessor to evaluate and verify the project's performance against the criteria defined in this scheme document. The interim DS assessment will therefore be completed and certified at the scheme design or detailed design stages.

Post Construction Stage

The PCS assessment and BREEAM rating confirms the final post refurbishment or fit-out performance of the project at the refurbishment or fit-out final stage of the life cycle. A final PCS assessment is completed and certified after practical completion of the refurbishment or fit-out works.

There are two approaches to assessment at the post construction stage:

1. A post construction review of an interim design stage assessment
2. A full post construction assessment.

A post construction review serves to confirm that the project's 'as built' performance and rating is in accordance with that certified at the interim design stage. Where an interim DS assessment has not been carried out, i.e. certified, and a BREEAM assessment and rating is required, a full post construction stage assessment will need to be conducted.

Further information about BREEAM's evidential requirements for each of the above assessment stages can be found in 4.0 The BREEAM evidential requirements.

[1] For schools, further and higher educational building types, see also Appendix B - BREEAM International Refurbishment and

Fit-out 2015 scope and Education buildings.

[2]For multi-residential building types, see also for further detail of scope.

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[1]For some assessment issues the number of credits available will vary by building type and according to the Parts being assessed from Parts 1 - 4. Furthermore, some issues may not be applicable to certain building types or buildings which do not contain a particular function or area, e.g. a laboratory.

3.0 Scoring and rating BREEAM-assessed buildings

BREEAM rating benchmarks

There are a number of elements that determine the overall performance of a refurbishment or fit-out project assessed using BREEAM; these are as follows:

1. The scope of the assessment
2. The BREEAM rating level benchmarks
3. The minimum BREEAM standards
4. The environmental section weightings
5. The BREEAM assessment issues and credits

How these elements combine to produce a BREEAM rating for a refurbishment or fit-out project is summarised on the following pages. This is followed by a description and example describing the methodology for calculating a rating.

The BREEAM rating benchmarks for projects assessed using the BREEAM International Refurbishment and Fit-out 2015 scheme are as follows:

Table - 4: BREEAM rating benchmarks

BREEAM Rating	% score
OUTSTANDING	?85
EXCELLENT	?70
VERY GOOD	?55
GOOD	?45
PASS	?30
UNCLASSIFIED	<30

The BREEAM rating benchmarks enable a client and all other stakeholders to compare the performance of a refurbishment or fit-out project with other BREEAM rated buildings, and the typical sustainability performance of a stock of existing non-domestic buildings.

In this respect each BREEAM rating broadly represents performance equivalent to:

1. Outstanding: Less than top 1% of refurbishment or fit-out projects (innovator)
2. Excellent: Top 10% of refurbishment or fit-out projects (best practice)
3. Very Good: Top 25% of refurbishment or fit-out projects (advanced good practice)
4. Good: Top 50% of refurbishment or fit-out projects (intermediate good practice)
5. Pass: Top 75% of refurbishment or fit-out projects (standard good practice)

An unclassified BREEAM rating represents performance that is non-compliant with BREEAM, in terms of failing to meet either the BREEAM minimum standards of performance for key environmental issues or the overall threshold score required to achieve at least a Pass rating.

Minimum standards

To maintain a flexible system BREEAM adopts a 'balanced scorecard' approach to the assessment and rating of a refurbishment or fit-out project. This means that to achieve a particular level of performance the majority of BREEAM credits can be traded, i.e. non-compliance in one area can be offset through compliance in another to achieve the target BREEAM rating.

However, to ensure that performance against fundamental environmental issues is not overlooked in pursuit of a particular rating, BREEAM sets minimum standards of performance in key areas, e.g. energy, water, waste etc. It is important to bear in mind that these are minimum acceptable levels of performance and in that respect they should not necessarily be viewed as levels that are representative of best practice for a BREEAM rating level.

To achieve a particular BREEAM rating, the minimum overall percentage score must be achieved and the minimum standards, detailed in Table - 5 below, applicable to that rating level complied with. The required minimum standards also vary depending upon the applicable assessment parts, in order to reflect the potential influence a project may have over achievement of the minimum standards, given a project types scope of works.

Table - 5: Minimum BREEAM standards by rating level

	Minimum standards by BREEAM rating level				
BREEAM issue	Pass	Good	Very Good	Excellent	Outstanding
Man 03 Responsible construction practices				One credit (Considerate construction)	Two credits (Considerate construction)
Man 04 Commissioning and handover	None	None	None	Criterion 9 (Building User Guide)	Criterion 9 (Building User Guide)
Man 05 Aftercare	None	None	None	Parts 2 and 3 only: One credit (Seasonal commissioning)	Parts 2 and 3 only: One credit (Seasonal commissioning)
Ene 01 Reduction of energy use and carbon emissions	None	None	None	Parts 1, 2, 3 and 4 (full assessments): Six credits, varies for other assessment types	Parts 1, 2, 3 and 4 (full assessments): Ten credits, varies for other assessment types
Ene 02 Energy monitoring	None	None	Parts 2, 3 and 4: One credit (First sub-metering credit)	Parts 2, 3 and 4: One credit (First sub-metering credit)	Parts 2, 3 and 4: One credit (First sub-metering credit)
.Wat 01 Water consumption	None	One credit (where applicable)	One credit (where applicable)	One credit (where applicable)	Two credits (where applicable)

	Minimum standards by BREEAM rating level				
BREEAM issue	Pass	Good	Very Good	Excellent	Outstanding
Wat 02 Water monitoring	None	Part 2: Criterion 1 only	Part 2: Criterion 1 only	Part 2: Criterion 1 only	Part 2: Criterion 1 only
Mat 03 Responsible sourcing of materials	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Wst 01 Project waste management	None	None	None	None	One credit
Wst 03 Operational waste	None	None	None	One credit	One credit

Environmental section weightings

Environmental weightings are fundamental to any building environmental assessment method as they provide a means of defining, and therefore ranking, the relative impact of environmental issues. BREEAM uses an explicit weighting system derived from a combination of consensus based weightings, ranking by a panel of experts and where necessary an adaptation process to reflect local conditions in a country (or region if the country has a significant land mass with varied climates or environmental issues). These are then used to determine the relative value of the environmental sections used in BREEAM and their contribution to the overall BREEAM score.

The weightings for the BREEAM Refurbishment and Fit-out scheme are also tailored according to the applicable assessment parts and any 'scope dependent' issues such as where transportation systems or laboratories are not present. For example, where only undertaking a Part 4 assessment and where the ecology category is not within scope, the weighting for ecology would be zero, with the weighting for other categories adjusted to take account of this on a proportionate basis.

Adaptation of weightings for local conditions

In order to provide weightings that are adapted for local conditions, the weightings are reviewed for the first project that registers for assessment in a country or region. These weightings are then set as appropriate for that project and all other projects thereafter in that country or region for the life of the current BREEAM International Refurbishment and Fit-out version. The development of these weightings is based on robust and independent information forwarded from 'local experts' who have an understanding of local conditions. This may be a member of the design team if they can demonstrate sufficient knowledge of the environmental conditions of the region or country, or another individual or organisation with the relevant expertise.

The required information is compiled by the BREEAM Assessor using the 'BREEAM International Weightings' form (available from the BREEAM Assessor Extranet). It is the assessor's responsibility to correctly complete the 'Environmental Weightings' and submit the form to BRE Global, who use the information to develop appropriate weightings for that country or region.

The weightings are tailored based on the ten technical categories, with categories being considered 'Global' or 'Local'. Global categories are those defined as having a universal impact, independent of the local context. Local categories are those defined as being variable locally, due to social, environmental, political or economic factors. BRE Global will take account of these factors when determining the relative importance of the technical sections.

Influence of hazards

In the case of the Hea 07 Hazards and the Flood Risk criteria within Pol 03 Flood risk management and reducing surface water run-off, these issues are separately weighted from the remainder of their respective technical sections. BRE Global considers the Heath & Wellbeing and Pollution sections to be predominantly 'Global' categories; however, given the local importance of addressing natural hazards (including flood risk) these issues are 'Local'.

This weighting system is defined in greater detail within the BRE Global Core Process Standard (BES 5301) and its supporting procedural documents. These form part of the overarching BREEAM Standard and the Code for a Sustainable Built Environment. The same ranking of impacts used in BREEAM underpins the scoring mechanisms in the BRE Green Guide to Specification and the BRE Environmental Profiling Method for construction materials.

The influence of location

As well as having an impact on the weightings attributed to BREEAM sections and assessment issues (see section weightings above), the culture, economy, climate and work practices can also affect the development of criteria and the method of assessing certain BREEAM issues.

One example involves the opportunity for rainwater recycling in BREEAM issue .Wat 01 Water consumption. In this instance the higher performance benchmarks vary according to amount of precipitation available. The assessor can determine the climatic zone in which the building is located using the map in Figure 5 (and other information below) and consequently use this climatic zone to establish the appropriate water consumption benchmark for a building in that location.

The map below highlights the Earth's climates zones according to the Köppen-Geiger climate classification method. They are defined according to maximum and minimum temperature ranges, as well as the total and seasonal distribution of precipitation.

For the purposes of BREEAM, the climatic zones (refer to Figure 4) are defined as:

A. Equatorial - tropical climates where temperatures remain above 18°C
B. Arid - dry climates (semi-arid and desert climates)
C. Warm temperate - mid-latitude climates (warm, dry summers with cool, wet winters)
D. Snow - temperate, is generally between -3°C and 10°C (subarctic or temperate alpine areas and low precipitation)
E. Polar - permafrost or tundra climates

For the purposes of .Wat 01 Water consumption, the precipitation zones (refer to Figure 5) are defined as:

1. Precipitation zone 1: corresponds to Appender's precipitation regions f (fully humid) and m (monsoonal)
2. Precipitation zone 2: corresponds to Appender's precipitation regions s (summer dry) and w (winter dry)
3. Precipitation zone 3: corresponds to Appender's precipitation regions S (steppe) and W (desert)

Advice and guidance on how to carry out a classification can be found at:
http://www.physicalgeography.net/fundamentals/7v.html

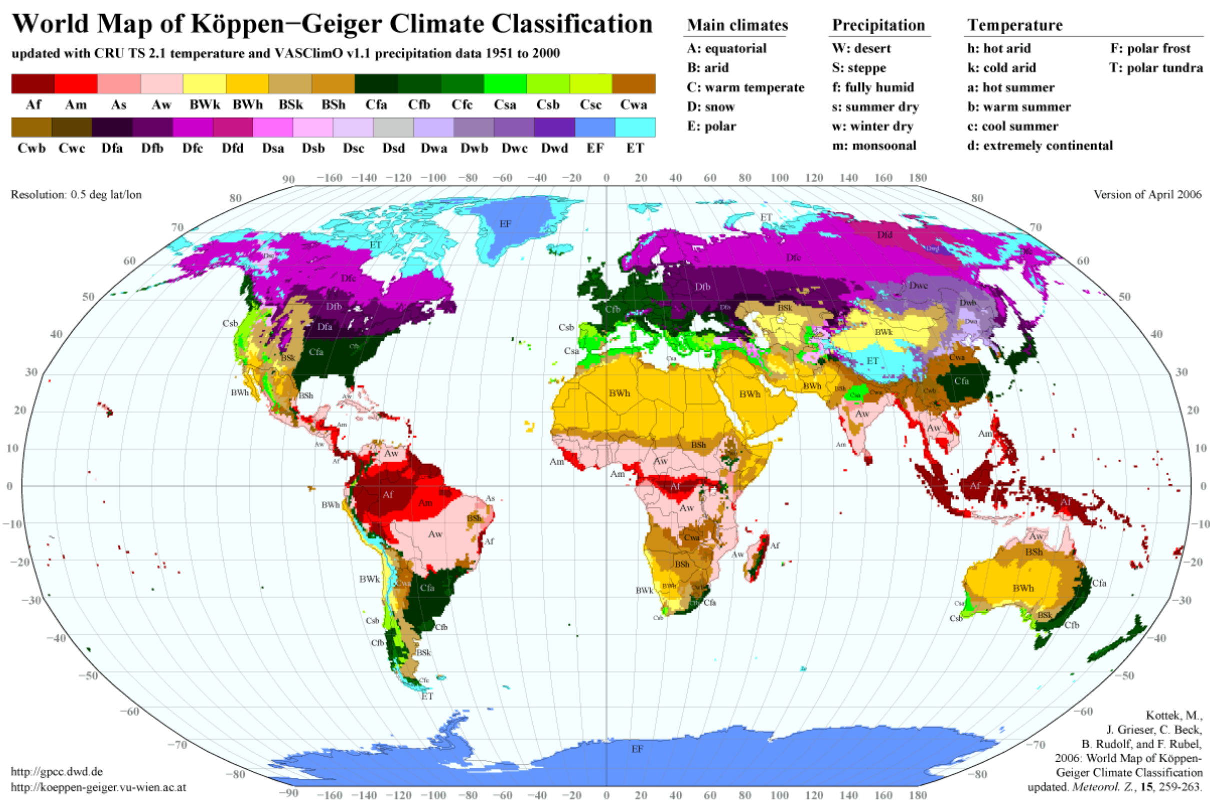

Figure 4: World map of Köppen-Geiger climate classification

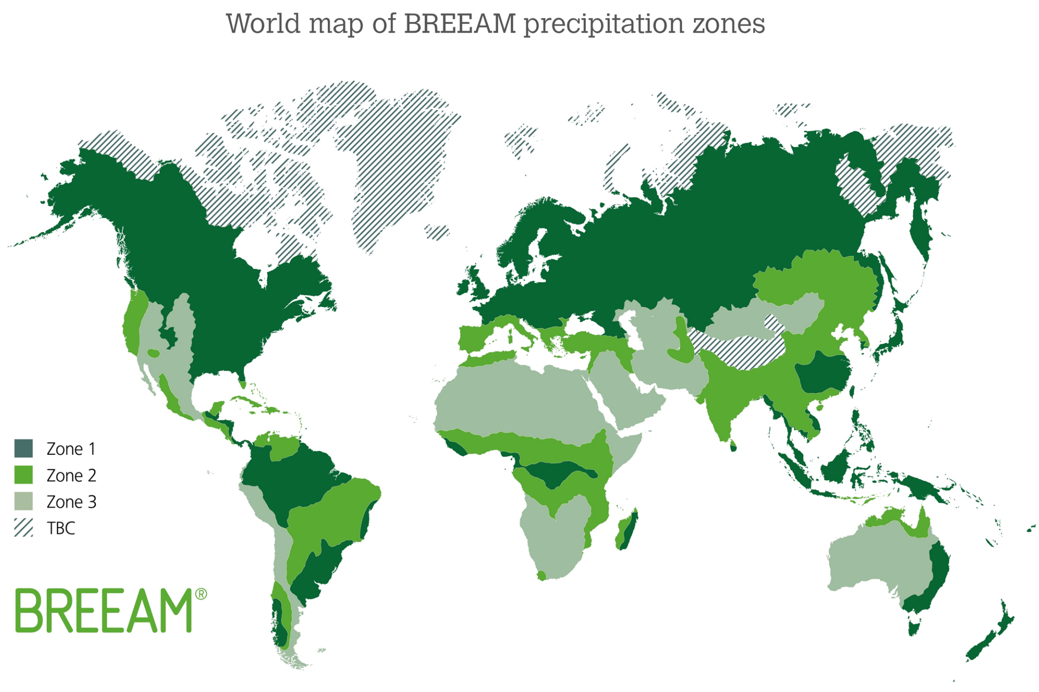

Figure 5: World map of BREEAM precipitation zones

Calculating a building's BREEAM rating

A BREEAM Assessor must determine the BREEAM rating using the appropriate assessment tools and calculators found on www.breeam.com/projects or other BREEAM Recognised software tools. An indication of performance against the BREEAM scheme can also be determined using a BREEAM Pre-Assessment Estimator. The Pre-Assessment Estimator is available from the BREEAM website www.breeam.com.

The process of determining a BREEAM rating is outlined below and an example calculation included in Table - 6

1. Firstly the BREEAM Refurbishment and Fit-out scheme parts assessed need to be selected according to the project type and scope of works. The BREEAM pre-assessment or reporting tool (found on www.breeam.com/projects) then adjusts the scoring and weightings to reflect the categories and individual credits assessed.
2. The BREEAM Assessor will then determine for each of BREEAM's ten environmental sections (as applicable) the number of 'credits' awarded. This must be determined by the BREEAM Assessor in accordance with the criteria of each assessment issue (as detailed in the technical sections of this document).
3. The percentage of credits achieved is then calculated for each section.
4. The percentage of credits achieved in each section is then multiplied by the corresponding section weighting. This gives the overall environmental section score.
5. The section scores are then added together to give the overall BREEAM score.
6. The overall score is then compared to the BREEAM rating benchmark levels and, provided all minimum standards have been met, the relevant BREEAM rating is achieved.
7. An additional 1% can be added to the final BREEAM score for each innovation credit achieved (up to a maximum of 10%).

Table - 6: Example BREEAM score and rating calculation for a fully fitted building assessed against Parts 1, 2, 3 and 4

BREEAM Section	Credits Achieved	Credits Available	% of Credits Achieved	Section Weighting (fully fitted)*	% Section Score
Management	10	20	50.00	0.12	6.00
Health and Wellbeing	17	22	77.27	0.15	11.59
Energy	16	34	47.05	0.15	7.05
Transport	5	11	45.45	0.09	4.09
Water	5	9	55.56	0.07	3.89
Materials	10	14	71.43	0.135	9.64
Waste	3	13	23.07	0.085	1.96
Land Use and Ecology	5	5	100.00	0.10	10.00
Pollution	5	13	38.46	0.10	3.85
Innovation	2	10	20.00	0.10	2.00
Final BREEAM score				60.07%	

BREEAM Section	Credits Achieved	Credits Available	% of Credits Achieved	Section Weighting (fully fitted)*	% Section Score
BREEAM Rating				VERY GOOD	
*This will vary by building type and location					

Table - 7: Minimum standards for a BREEAM Very Good rating

Minimum standards for BREEAM 'Very Good' rating	Achieved?
Man 03: Responsible construction practices	Y
Ene 02: Energy monitoring	Y
Wat 01: Water consumption	Y
Wat 02: Water monitoring	Y
Mat 03: Responsible sourcing of materials	Y

Use of local codes and standards

Certain criteria in BREEAM require compliance with specified standards and/or best practice documents. In some countries there may be local equivalents of these standards and in these cases BREEAM International allows BRE staff, with support from assessors and the project team, to review the local standards against BREEAM specified requirements and confirm their equivalence. The assessors need to send in the local standards to BRE Global for approval. Ideally the relevant sections of the standards will be translated into English, however, BRE Global can also provide this service for a fee.

If BRE Global approves the standard as equivalent, the local standard will form part of the approved named standards for that country, region or area.

Approved standards and weightings list

The individual requirements for a particular local standard and a list of approved standards are provided in the Approved standards and weightings list for the BREEAM International Refurbishment and Fit-out scheme.

Every BREEAM International assessment must include a completed (project specific) version of the Approved standards and weightings list to inform BRE Global which standards the project team have worked to and complied with. This may involve the use of a 'New country worksheet' or, where assessments have already been undertaken in that country, an 'Existing country-specific worksheet' that is amended to suit the specific project. Confirmation is required that previously approved standards remain valid and up to date.

For each BREEAM criterion requiring compliance with specified standards and/or best practice documents a combination of the following three situations is likely, as circumstances vary between issues:

1. No specific local standard is specified - in these cases the project team uses the Approved standards and weightings list to inform BRE Global that it will be working to the existing BREEAM approved standards detailed in the criteria.
2. Approved local standard is specified - the project team uses the Approved standards and weightings list to inform BRE Global that it will be using the approved local standards detailed in the 'Existing country-specific worksheet'. The team also need to confirm that the standards being used are current.

3. Unapproved local standard is proposed - the project team uses the Approved standards and weightings list to inform BRE Global that they will be working to (as yet unapproved) local standards. The team will need to send the relevant sections of the standard to BRE Global with evidence of its robustness. Note: The approvals process for local standards happens at the very early stages of a project assessment, i.e. well before a report is submitted for certification so that:
   a. Certification is not delayed, and
   b. The project team/client have certainty over which approved standards against which their building's performance is being assessed.

If BRE Global approves the local equivalent, it is added to the 'approved standards' for that country or region. If not, it is added to the 'unapproved standards' for that country - this is included for information and to prevent duplication of effort.

More details on this process can be found within the Assessor Operations manual (see BREEAM Assessor extranet).

Comparing BREEAM ratings and scores between different projects

Alongside the flexible structure provided by the BREEAM International Refurbishment and Fit-out 2015 scheme, the scheme also provides transparency regarding the scope of an assessment, in order to allow comparability between different projects across the property market.

Where comparing two projects assessed against the scheme, it is important to recognise the scope of the assessment and the BREEAM Refurbishment and Fit-out scheme parts assessed, to give a true reflection of what the project has achieved in terms of improving the overall existing building's performance. This scope will be clearly reflected in the assessment report and on the certificate.

Comparing building performance

Where seeking to compare sustainability of two projects in relation to their predicted overall impact on building sustainability, this comparison can only be made where each project has been assessed against the same assessment parts. For example, comparing two projects that have both been assessed against Part 2: Core Services is possible as both assessments will have a comparable scope. A comparison could not however be made between a project assessed under Part 2 and a project assessed against Part 4: Interior Design only as Part 4 mainly relates to the impact of interior finishes, fittings and equipment, whereas Part 2 relates to sustainability of core building services.

Comparing project team performance

The BREEAM rating allows the performance of project teams to be compared as it reflects the effort made to address the sustainability opportunities that are within the scope of influence of that project type. For example an 'Excellent' rated fit-out project assessed against Part 4 only, can be compared to an 'Excellent' rated major refurbishment project that has been assessed against all Parts 1, 2, 3 and 4, in terms of the performance of each project team and the effort made within the scope of works. This is because each project team would have met the minimum benchmark required for their respective project type, reflecting that they have achieved the sustainability requirements within the scope of their project type.

Benchmarking In-use performance

It should be noted that a BREEAM Refurbishment and Fit-out assessment is based on predicted performance. Actual performance can only be measured and compared at the in-use life cycle stage once the building is occupied which can be facilitated through the BREEAM In-Use scheme.

Where clients have gained certification against the BREEAM Refurbishment and Fit-out scheme, they are provided with a direct link to BREEAM In-Use through the BREEAM Refurbishment and Fit-out assessment and reporting tool. This is facilitated through the provision of a BREEAM In-Use Asset Rating as part of the BREEAM refurbishment certification process, allowing clients to then seek certification against the BREEAM In-Use scheme in order to monitor ongoing performance of the asset, the operation of the building and management of the activities in the building.

Further information on the BREEAM In-Use scheme can be found at www.breeam.com/inuse.

The BREEAM In-Use Standard has been produced to enable the assessment of an existing building, the operations of the building, how clients are managing their activities within the building; or a combination of the three. The rating and certification options are as follows:

- Part 1: Asset - the inherent performance characteristics of the building based on its built form, construction and services.
- Part 2: Building Management - the management quality and practices related to the operation of the building.
- Part 3: Occupier Management - the understanding and implementation of management policies; staff engagement and measuring performance against Corporate Social Responsibility (CSR) targets.

BREEAM In-Use also provides a set of ten Key Performance Indicators (KPIs) as highlighted by Table - 8

Table - 8: BREEAM In-Use KPIs

KPI	Description	Measurement
KPI 1	Building CO_2 ($kgCO_2eq$ pa per m^2GIA)	The mass of CO_2eq[1] 1 per square metre of the asset (GIA[2]) arising from direct fuel use at the asset (for electricity, heating and cooling) consumed during the reporting year.
KPI 2	Building CO_2 ($kgCO_2eq$ pa per FTE)	The mass of CO_2eq per Full-Time Equivalent[3] personnel employed at the asset arising from the fuel and electricity consumed by the asset during the reporting year.
KPI 3	Business Travel CO_2 ($kgCO_2eq$ pa per m^2GIA)	The mass of CO_2eq per square metre of the asset (GIA) arising from business travel by personnel (based at the asset) and from goods (despatched from the asset) during the reporting year.
	Staff Travel CO_2 ($kgCO_2eq$ pa per m^2GIA)	The mass of CO_2eq per square metre of the asset (GIA) arising from business travel by personnel (based at the asset) during the reporting year.
	Goods Transport CO_2 ($kgCO_2eq$ pa per m^2GIA)	The mass of CO_2eq per square metre of the asset (GIA) arising from business travel associated with goods (despatched from the asset) during the reporting year.
KPI 4	Staff Commute CO_2 ($kgCO_2eq$ pa per m^2GIA)	The mass of CO_2eq per square metre of the asset (GIA) arising from personnel travel to and from the asset during the reporting year.
KPI 5	Total CO_2 ($kgCO_2eq$ pa per m^2GIA)	Total mass of CO_2eq per square metre of the asset (GIA) arising from the fuel and electricity consumed by the asset, business travel of personnel based at the asset and transport of goods despatched from the asset, during the reporting year.
KPI 6	Building Primary Energy (kWh pa per m^2GIA)	The kilowatt hours per square metre of the asset (GIA) of fuel and electricity consumed by the asset, measured in terms of primary energy[4] equivalent, for the reporting year
KPI 7	Water Consumption (m^3 pa per m^2GIA)	The cubic meters of water consumed by the asset in the reporting year per square meter of the asset (GIA).

KPI	Description	Measurement
KPI 8	Total Waste (tonnes pa per m^2)	The tonnes of waste removed from the asset during the reporting year per square metre of the asset (GIA).
KPI 9	Proportion of Waste Recycled (%)	Percentage of total waste produced by the asset which is recycled.
KPI 10	Proportion of Waste to Landfill (%)	Percentage of total waste produced by the asset which is sent to landfill.

[1] CO_2 Eq. is the Carbon Dioxide (CO_2) equivalent: a measure of the global warming potential of different greenhouse gases in relation to that of carbon dioxide; it is defined as the amount of carbon dioxide that would give the same warming effect as that of the greenhouse gases being emitted.

[2] GIA (Gross Internal Area) is the whole enclosed area of a building within the external walls, taking each floor into account excluding the thickness of the external walls.

[3] Full-Time Equivalent is a unit which is used to measure the people employed, or studying in a comparable way, even if they work or study a different number of hours per week. A full-time employee or student is counted as 1 FTE, a part-time worker or student will be measured proportionately to the number of hours they work in comparison to a full-time person

[4] Energy which has not been subjected to any transformation or conversion process.

4.0 The BREEAM evidential requirements

This section provides guidance to assessors and project teams on the types of evidence required to demonstrate compliance with BREEAM issues.

Why does BREEAM require evidence?

BREEAM is a third party assessment and certification scheme operated in accordance with international standards. Operating to international standards ensures that certification schemes such as BREEAM are run in a consistent and reliable manner. The BREEAM Assessor's assessment report and the BRE Global Quality Assurance process are the fundamental tenets of BREEAM, ensuring consistency of, and confidence in, the BREEAM rating awarded by the assessor.

To maintain this consistency and credibility, all certification decisions must be based on verified and credible project information that is traceable, i.e. evidence based. This is not only important for ensuring compliance with the international standards to which BREEAM operates, but also in terms of managing risk to clients and BREEAM assessors in the event that a certification outcome is challenged.

The assessment report and the BREEAM Assessor role

It is the BREEAM Assessor who determines the BREEAM rating and the assessment report is the formal record of an assessor's audit against the criteria defined in the Technical Manual for a BREEAM scheme. The BREEAM certificate issued by BRE Global provides assurance that the service provided by the assessor (that is, the process of producing the assessment report) has been conducted in accordance with the requirements of the scheme. The purpose of the certificate is therefore to give confidence to the client in the assessor's performance and processes in determining a BREEAM rating.

It is the role of the assessor to gather project information and use it to assess performance against the BREEAM scheme in a competent and impartial manner. To award a BREEAM credit, the assessor must be satisfied beyond reasonable doubt that the evidence gathered demonstrates unambiguous compliance with all relevant criteria defined in the BREEAM scheme. All evidence must be appropriately referenced in the formal report produced by the assessor and made available on request from BRE Global Ltd for quality assurance checks.

Clear, ordered and well referenced evidence for each BREEAM issue and criterion facilitates efficient quality assurance and certification. BREEAM assessors can access further guidance on assessment report referencing in Assessor Guidance Note 01, and the 'Reporting process' webinar, both available from the BREEAM Assessor Guidance section of the BREEAM Assessor Extranet.

Evidence types

Evidence should not necessarily need to be prepared specifically for the purpose of the BREEAM assessment. In many instances, the assessor should be able to source readily available and prepared project information for the purpose of demonstrating compliance. For this reason, BREEAM aims to avoid being prescriptive on the type of evidence required, although some issues do require specific documents to be provided.

The assessor and project team will find that many assessment issues require more than one piece or type of information to demonstrate compliance with one criterion, or alternatively, one piece of information may be sufficient to demonstrate compliance with multiple criteria.

To assist project teams and the BREEAM Assessor in their collation of building information at each stage of assessment, the different types of documentation that can be used as evidence of compliance are listed below.

These evidence types fall broadly into three categories:

1. General evidence type
2. Specific evidence type
3. Other evidence type.

For some assessment issues, the assessor is likely to require a mixture of general and specific evidence types.

General evidence includes a broad list of defined building information commonly produced for a building project. One or a mix of these types of building information can be used to demonstrate compliance for one or more of the BREEAM issues and criteria, as deemed appropriate by the BREEAM Assessor for the stage of assessment.

General BREEAM evidence types are listed in Table - 10, and are not specifically listed in the ' Evidence' section found within each BREEAM issue. Note, not all general evidence types will be appropriate for all issues and it is the responsibility of the assessor to ensure that the evidence provided specifically demonstrates compliance and is fully referenced in the Assessment reporting tool.

Specific evidence is defined building information that must be provided to verify compliance with the relevant criteria for the BREEAM credit sought. In all cases it will be the only type of evidence that will be accepted by BRE Global Ltd for that particular issue/criteria. Where specific evidence is not provided and appropriately referenced in the assessment report, the Quality Assurance checks will identify non-conformity and certification will be delayed. An example of specific evidence would be a copy of the building regulations output document from the approved software for BREEAM issue Ene 01, and this is listed in the evidence table for this issue.

When required, specific evidence is defined and listed for each BREEAM issue in the 'Evidence' section for both final and interim stages of assessment. Although the 'Evidence' section lists the specific evidence required to demonstrate compliance with particular criteria, simply submitting this evidence may not be sufficient to demonstrate full compliance. Additional 'general evidence types' may also be required. For example Mat 01; to demonstrate compliance with criteria 1-5 at the design stage, a copy of the Mat 01 Calculator tool is listed in the 'Evidence' table. However, in addition to the Mat 01 tool, further evidence is required to demonstrate how the inputs for this tool have been determined, i.e. general evidence types such as building specifications or drawings etc., confirming the material specifications to be used. Note, not all BREEAM issues will have specific evidence requirements.

Other types of evidence can still be used to demonstrate compliance where an information type provided by a client/design team is not listed in Table - 10 or the 'Evidence' section for each issue. To avoid non-conformities and delays in certification, undefined alternative types of evidence must demonstrate credible, robust and traceable assurance to the same level as, or better than, specified or general evidence types. If in doubt, please contact BREEAM prior to accepting such evidence.

Written commitments at the interim stage of assessment – Design stage

At the interim design stage of assessment it is permissible to use letters or emails to demonstrate intent to comply with BREEAM criteria (provided they meet the requirements for the communication records above). Such evidence must also make clear the actions and evidence (or an understanding thereof) that will be undertaken and provided to ensure the project's ongoing compliance, particularly at the final stage of assessment, i.e. post construction. This is to ensure that the party who makes the commitment is clearly aware of the actions and evidence that needs to be supplied to demonstrate compliance with BREEAM at the final stage of assessment. For example, in many circumstances it would not be acceptable for the design team to copy and paste the BREEAM criteria into a formal commitment. The commitment should specifically detail how criteria are to be achieved in the context of the assessment, and often copying and pasting the BREEAM criteria will not provide this detail.

While letters of commitment can play a role in demonstrating compliance, they are not a replacement for more formal and established types of project information. The assessor must not award credits where they have a reason to doubt the validity or intent of written commitments, or where it is not unreasonable to expect formal design or specification information to be available to confirm compliance.

Written commitments at the final stage of assessment – post construction

As stated in the Scope section, there are two types of assessment that can be carried out at the post construction stage, a post construction review of a design stage assessment, or a post construction assessment (where no design stage assessment has been carried out). The 'Final post construction stage' column of the evidence table in each issue assumes that a design stage assessment has been completed. Where a design stage assessment has not been completed, the assessor will need to review both the 'Interim design stage' and 'Final post construction stage' evidence listed in the evidence table and ensure sufficient evidence is submitted with the assessment to demonstrate compliance with the criteria.

Evidence supplied at the post construction stage must be reflective of the completed building and must therefore demonstrate what has actually been implemented. For example, if sub-meters have been specified at the design stage, evidence at the post construction stage would need to demonstrate that these have actually been installed. Appropriate evidence may be a site inspection report with supporting photographs or as built drawings showing the location of the sub-meters.

Letters of commitment cannot be used to demonstrate compliance at the final, post construction stage of assessment. The only exception to this is where the criteria require an action to take place post construction, i.e. after handover and possibly during the building operation. An example could be a written commitment from the building owner/occupier making a commitment to conduct post occupancy evaluation. As with written commitments at the design stage, the BREEAM Assessor must not award BREEAM credits where they have a reason to doubt the validity or intent of written commitments or where it is not unreasonable to expect formal documentation, e.g. a schedule of services and/or professional services contract.

Evidence principles that BREEAM assessors and the BRE Global Ltd Quality Assurance work to

As described above, where specific evidence is stated in the 'evidence' table within each assessment issue, this must be sourced and verified by the BREEAM Assessor.

Where no specific evidence has been listed for an issue or specific criterion, this means that there are potentially a number of different types of 'general' project information, as per Table - 10 that can be sourced by the BREEAM Assessor and used to demonstrate compliance. It is the BREEAM Assessor's responsibility to source and verify the 'general evidence types' for each relevant criterion, where compliance and credits are being claimed by the project team.

In determining the appropriateness of 'general evidence types' for each issue, the principles outlined in Table - 9 must be considered by BREEAM assessors. Where the 'general evidence types' meet the principles outlined in Table - 9 and, where appropriate, the guidance provided in the 'robustness of evidence' section, such evidence is admissible for the purpose of the assessment and the BRE Global Quality Assurance checks.

These principles are not listed in a hierarchical order and are all equally important when considering which evidence type to submit to demonstrate compliance for each issue/criterion.

Table - 9: BREEAM Evidence principles

	Summary	Principle	Objective	A question to ask to check
1	Evidence provided for all criteria for all credits sought	Evidence must demonstrate that ALL relevant* criteria and sub-criteria for each credit sought are achieved and where relevant, is provided to support compliance notes, definitions etc.	Completeness	Are all criteria and sub-criteria covered? Have all relevant compliance notes and definitions been addressed?
2	Unambiguous assessment	The assessment must demonstrate unambiguous compliance and the evidence must support this assessment. Evidence (and supporting notes) must clearly demonstrate to a 3rd party reviewer that the criteria have been met.	Independent review compatibility	If a 3rd party (e.g. BRE Global Ltd) reviewed my report with the submitted evidence, would they be able to confirm compliance and award the same credits I have?

	Summary	Principle	Objective	A question to ask to check
3	Robust	a. When selecting the Evidence type, always ensure it is robust and is relevant to the stage of assessment. b. The selected Evidence contains all the relevant basic information, with the necessary constituent parts to be deemed robust. (see Robustness of Evidence section for further details on both of the above)	Proof that evidence is robust and from a reliable source	Is this the most robust form of evidence available to demonstrate compliance with this criterion? Does the evidence contain all the relevant basic information? Is it fully auditable?
4	Use existing evidence	Use existing project information to demonstrate compliance. In most cases evidence should not need to be 'created' for BREEAM compliance purposes.	Minimises evidence and reduces time and cost of compliance	Does robust evidence meeting the above principles already exist that I can use? If I need to ask for more evidence, is the project seeking credits where compliance is not adequately demonstrated?
* Where the assessor/design team deem specific criteria 'not relevant' to the assessment, a full justification should be collated and then submitted as a technical query for review by BRE Global Ltd.				

Robustness of Evidence

Robust evidence provides confirmation that the assessment has been carried out correctly and the building complies with the criteria for the BREEAM credits sought. The assessor should consider the following when gathering project information and evaluating whether the evidence provided is as 'robust' as possible:

- Is there more than one piece of evidence that could be used to demonstrate compliance?
- Is the chosen evidence the most robust and appropriate piece of evidence to demonstrate that a particular criterion has been achieved?

Any evidence submitted for a BREEAM assessment must be robust in terms of its source and its traceability. Below is a list of the minimum information the assessor must expect to see when certain types of evidence are submitted:

Communication records: Any communication records used as evidence must provide clear confirmation of the site name, author's identity and role, the date and recipient(s) identity.

Formal letters of correspondence: Must be on company/organisation headed note-paper with a signature (electronic signatures are acceptable). Ideally letters should be a secured document. (Please see sections relating to written commitment for further information.)

Meeting minutes: Must include date, location and attendee information (names, organisations and roles), along with a record of the meeting and agreed actions.

Drawings: All drawings must have the building/site name, phase (if applicable), title of drawing, date, revision number and a scale.

Specification: A specification must be clear that it relates to the project under assessment, and it must have a date and revision number. Where sections of a specification are provided the assessor should reference the extract and as a minimum submit the front page of the specification detailing the project name, revision number and date.

Site inspection report: A site inspection report must include the building/site name, date, author and summary text to detail what was witnessed, confirming compliance. Photographic evidence can be used to support the text in the report.

For other types of evidence not listed, the assessor should use the above as a guide for the sort of evidence that is suitable. As a minimum in most cases the evidence used to assess compliance should always contain key information such as the project name, the author, date, revision numbers etc.

Table - 10: Evidence types

Ref	Document/evidence type	Description/notes
E1	As constructed information	Information produced at the end of a project to represent what has been constructed. This will comprise a mixture of 'as built' information/drawings and surveys from specialist subcontractors and the 'final construction issue' from design team members.
E2	Building information model (BIM)	The BIM (or BIM files) used for the project containing relevant information/evidence of compliance.
E3	BRE Global correspondence reference number	For example the reference number for a BRE Global response to an assessor's technical query.
E4	BREEAM Assessor's site inspection report	A formal report based on the BREEAM Assessor's own survey of the site/building to confirm compliance with BREEAM criteria. An assessor's site inspection report will be distinct from their formal BREEAM assessment report, serving as a form of evidence of compliance in its own right, and it may include photographs taken by the assessor as part of the survey.
E5	Building contract(s)	The building contract (or excerpts/clauses from it) between the client and the contractor for the construction of the project. In some instances, the building contract may contain design duties for specialist subcontractors and/or design team members.
E6	Certificates of compliance (third party)	Examples include ISO 14001, BES 6001, FSC (Forest Stewardship Council), EPC (environmental profile certificate), EPD (environmental product declaration), Considerate Constructors etc.
E7	Communication records	Formal communication records between/from relevant project stakeholders and/or other third parties confirming an appointment, action or outcome. This may be in the form of a letter, meeting minutes, email correspondence, publication or another form of media (see also additional guidance on following pages).
E8	Communication strategy	The strategy that sets out when the project team will meet, how they will communicate effectively and the protocols for issuing information between the various parties, both informally and at information exchanges.
E9	Computer aided modelling results/outputs	Examples include thermal modelling, flooding, life cycle assessment, life cycle costing, ventilation modelling etc.

Ref	Document/evidence type	Description/notes
E10	Construction specification	The specification for the project/building.[1]
E11	Construction stage data/information	For example, purchase orders, metering data, log books, commissioning records/reports etc.
E12	Contractual tree	A diagram that clarifies the contractual relationship between the client and the parties undertaking the roles required on a project.
E13	Cost information	Project costs, including the cost estimate and life cycle costs.
E14	Design drawings[2]	Developed Design and Technical Design, including the coordinated architectural, structural and building services design. Site plans, drainage designs.
E15	Design programme	A programme setting out the strategic dates in relation to the design process. It is aligned with the Project Programme but is strategic in its nature, due to the iterative nature of the design process, particularly in the early stages.
E16	Design responsibility matrix	A matrix that sets out who is responsible for designing each aspect of the project and when. This document sets out the extent of any performance specified design.
E17	Feasibility study	Studies undertaken to test the feasibility of the Initial Project Brief for the site or in a specific context and to consider how site-wide issues will be addressed.
E18	Final project brief	The Initial Project Brief amended so that it is aligned with the Concept Design and any briefing decisions made during this stage.
E19	Other third party information	For example, maps, public transport timetables, product data/details, manufacturers' literature, government/EU standards or codes, EU labelling.
E20	Professional services contract	An agreement to provide professional or consulting services such as designing, feasibility studies, or legal or technical advice.
E21	Professional specialist reports	Professional reports resulting from specialist surveys/studies/test results, e.g. contaminated land, ecology, flood risk assessment, surface water run-off report, site investigation, acoustics, indoor air quality plan, low and zero carbon technologies study, transportation analysis, commissioning reports, passive design analysis report, free cooling analysis report, life cycle assessment, landscape and habitat management plan etc.
E22	Project Execution or Quality Plan	The Project Execution Plan is produced in collaboration with the project lead and lead designer, with contributions from other designers and members of the project team. The Project Execution Plan sets out the processes and protocols to be used to develop the design.

Ref	Document/evidence type	Description/notes
E23	Project programme	The overall period for the briefing, design, construction and post completion activities of a project.
E24	Project roles table	A table that sets out the roles required on a project as well as defining the stages during which those roles are required and the parties responsible for carrying out the roles.
E25	Project strategy	The strategies developed in parallel with the Concept Design to support the design and, in certain instances, to respond to the Final Project Brief as it is concluded. Examples include strategies for sustainability, acoustics, handover, maintenance and operational, fire engineering, building control, technology, health and safety, construction, travel plan, sustainable procurement plan.
E26	Risk assessment	The risk assessment considers the various design risks and other risks on a project and how each risk will be managed and the party responsible for managing each risk.
E27	Schedule of services	A list of specific services and tasks to be undertaken by a party involved in the project which is incorporated into their professional services contract.
E28	Strategic or initial project brief	The brief prepared following discussions with the client to ascertain the project objectives, the client's business case and, in certain instances, in response to site feasibility studies.

[1] For the purpose of BREEAM the specific clause of the specification must be referenced within the report.
[2] Evidence in the form of design drawings must be presented in a clear, professional working format with clearly identified legends indicating revision number, date, title, owner etc. (where appropriate).

5.0 Management

Summary

This category encourages the adoption of sustainable management practices in connection with design, refurbishment, fit-out, commissioning, handover and aftercare activities to ensure that robust sustainability objectives are set and followed through into the operation of the building. Issues in this section focus on embedding sustainability actions through the key stages of design, procurement and initial occupation from the initial project brief stage to the appropriate provision of aftercare.

Category summary table

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Man 01 Project brief and design	4	— Stakeholder consultation covering project delivery and relevant third parties. — Sustainability champion appointed to facilitate the setting, monitoring and achievement of BREEAM performance target(s) for the project.	Yes	Yes	Yes	Yes
Man 02 Life cycle cost and service life planning	4	— Recognising and encouraging the use of life cycle costing and service life planning and the sharing of data to raise awareness and understanding.	Yes	Yes	Yes	Yes
Man 03 Responsible construction practices	6	— The principal contractor demonstrates sound environmental management practices and consideration for neighbours across their activities on site. — Site related energy, water and transport impacts are monitored and reported to ensure ongoing compliance during the Refurbishment, Handover and Close Out stages and to improve awareness and understanding for future projects.	Yes	Yes	Yes	Yes

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Man 04 Commissioning and handover	4	— Schedule of commissioning including optimal timescales and appropriate testing and commissioning of all building services systems and building fabric in line with best practice. — Inspecting, testing, identifying and rectifying defects via an appropriate method. — Provision of a non-technical Building User Guide and user training and operator training timed appropriately around handover and proposed occupation.	Yes	Yes	Yes	Yes
Man 05 Aftercare	3	— Provision of the necessary infrastructure and resources to provide aftercare support to the building occupier(s). — Seasonal commissioning activities will be completed over a minimum 12 month period, once the building becomes substantially occupied. — The client or building occupier commit to carrying out a post occupancy evaluation (POE) exercise one year after initial building occupation and to disseminate the findings in terms of the building's post occupancy performance.	Yes	Yes	Yes	Yes

Man 01 Project brief and design

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
4	No	Yes	Yes	Yes	Yes

Aim

To recognise and encourage an integrated design process that optimises building performance.

Assessment criteria

This issue is split into two parts:

- Stakeholder consultation (2 credits)
- Sustainability Champion (2 credits).

The following is required to demonstrate compliance.

One credit - Stakeholder consultation (project delivery)

1 A clear sustainability brief is developed prior to completion of the concept design which sets out:
   - 1.a Client requirements e.g. internal environmental conditions required
   - 1.b Sustainability objectives and targets including target BREEAM rating, business objectives etc.
   - 1.c Timescales and budget
   - 1.d List of consultees and professional appointments that may be required e.g. Suitably Qualified Acoustician etc.
   - 1.e Constraints for the project e.g. technical, legal, physical, environmental.

2 Prior to completion of the concept design , the project delivery stakeholders (see Relevant definitions) have met to identify and define their roles, responsibilities and contributions for each of the key phases of project delivery.

3 In defining the roles and responsibilities for each key phase of the project, the following must be considered:
   - 3.a End user requirements
   - 3.b Aims of the design and design strategy
   - 3.c Particular installation and construction requirements and limitations
   - 3.d Design and construction risk assessments e.g. national health and safety regulations or best practice, legionella risk assessment
   - 3.e Legislative requirements e.g. local building regulations, heritage requirements
   - 3.f Procurement and supply chain
   - 3.g Identifying and measuring project success in line with project brief objectives
   - 3.h Occupiers' budget and technical expertise in maintaining any proposed systems
   - 3.i Maintainability and adaptability of the proposals
   - 3.j Requirements for the production of project and end user documentation
   - 3.k Requirements for commissioning, training and aftercare support.

4 The project team demonstrate how the project delivery stakeholder contributions and the outcomes of the consultation process have influenced or changed the initial project brief. This includes if appropriate, the project execution plan, communication strategy, and the concept design.

One credit - Stakeholder consultation (third party)

5 Prior to completion of the concept design work stage, all relevant third party stakeholders have been consulted by the design team and this covers the minimum consultation content (see compliance note CN2).

6 The project must demonstrate how the stakeholder contributions and outcomes of the consultation exercise have influenced or changed the initial project brief and concept design.

7 Prior to completion of the detailed design , consultation feedback has been given to, and received by, all relevant parties.

Additionally for Education only:

8 The consultation exercise used a method carried out by an independent party (see Relevant definitions).

One credit - Sustainability Champion (design)

9 A Sustainability Champion has been appointed to facilitate the setting and achievement of BREEAM performance targets for the project. The design stage Sustainability Champion is appointed to perform this role during the feasibility stage.

10 The defined BREEAM performance targets have been formally agreed (see Relevant definitions) between the client and design or project team no later than the concept design work stage.

11 To achieve this credit at the interim design stage assessment, the agreed BREEAM performance targets must be demonstrably achieved by the project design. This must be demonstrated via the BREEAM Assessor's design stage assessment report.

One credit - Sustainability Champion (monitoring progress)

12 The One credit - Sustainability Champion (design) criteria have been achieved.

13 A Sustainability Champion is appointed to monitor progress against the agreed BREEAM performance targets throughout the design process and formally report progress to the client and design team.

14 The Sustainability Champion must attend key project and design team meetings during the concept design, developed design and technical design work stages (see Relevant definitions). Reporting during and prior to completion of each stage, as a minimum.

Checklists and tables

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2, 3 and 4	All criteria in this issue are applicable
General		

Ref	Terms	Description
CN2	Minimum consultation content See criterion 4.	Minimum consultation content will be dependent on the building and scope of the project but would typically include the following: 1. Functionality, build quality and impact (including aesthetics). 2. Provision of appropriate internal and external facilities (for future building occupants and visitors and users). 3. Management and operational implications. 4. Maintenance resources implications. 5. Impacts on the local community, e.g. local traffic and transport impact. 6. Opportunities for shared use of facilities and infrastructure with the community and appropriate stakeholders, if relevant and appropriate to building type. 7. Compliance with statutory (national or local) consultation requirements. 8. Inclusive and accessible design. 9. Where services are taken from outside of the refurbishment area that affect the suitability of the service, e.g. domestic hot water services and legionella prevention. In the case of educational building types, minimum content also includes: 10. How the building and grounds could best be designed to facilitate learning. 11. Where the scope of works involves changes to the internal layout and function, the consultation considers how the design can best provide a range of social spaces appropriate to the needs of pupils, students and other users. In the case of building types containing technical areas or functions, e.g. laboratories, workshops etc., minimum content also includes: 12. The end users broad requirements for such facilities, including appropriate sizing, optimisation and integration of equipment and systems.
CN3	Assessing and awarding the available credits for a Sustainability Champion	There is an additional credit for appointing a Sustainability Champion during the construction and handover phase (see BREEAM issue Man 03 Responsible construction practices). The aim of the credit in Man 03 is to encourage and reward contractors and project teams that appoint a Sustainability Champion and therefore ensure continuation of the sustainability objectives during the construction phase and that the constructed building meets the client's target BREEAM rating.
CN4	BREEAM-related performance targets See criteria 9 to 13.	If the BREEAM-related performance targets set at the end of the Concept design stage have not been achieved at the post construction stage assessment. The credits awarded at the interim design stage assessment for appointing the Sustainability champion must be withheld in the final assessment. See Relevant definitions.
CN5	National health and safety regulations and best practice	Where there are no national health and safety regulations in the country of assessment, evidence is required to demonstrate that either: — the principal contractor has an occupational health and safety management system compliant with OHSAS 18001:2007 OR — refurbishment and fit-out works will be carried out in accordance with the International Labour Association's Safety and health in construction Code of Practice

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1-3	Consultation plan setting out the process and scope of the consultation.	As per interim design stage.

Additional information

Relevant definitions

BREEAM Accredited Professional (AP)

An individual trained and qualified by BRE as a specialist inbuilt environment sustainability, environmental design and assessment. The role of the BREEAM AP is to facilitate the project team's efforts to successfully schedule activities, set priorities and negotiate the trade-offs required to achieve a target BREEAM rating when the design is formally assessed. Only qualified individuals who are members of BRE's associated membership scheme comply with the BREEAM Requirements. This membership ensures an adequate level of competence is maintained through regular Continuing Professional Development(CPD) in key relevant areas. For a list and contact details of BREEAM Accredited Professionals, visit http://www.greenbooklive.com/.

BREEAM-related performance targets

BREEAM performance targets refer specifically to the BREEAM rating and minimum standards required. This does not necessarily include individual targeted BREEAM issues or credits, which may be traded over the course of the project as it evolves. In agreeing a BREEAM target, it is recommended that individual BREEAM issues, credits and criteria are targeted or prioritised. This is to ensure that the agreed target is achievable and achieved without potentially costly alterations to the design at a later stage.

Concept design

The concept design work stage includes the development of strategies and outline proposals for site planning, built form, structural design, building services systems, outline specifications and preliminary cost information.

Communication strategy

The Communication Strategy is defined as a strategy that sets out when the project team will meet, how they will communicate effectively and the protocols for issuing information between the various parties, both informally and at Information Exchanges.

Consultation feedback

This is feedback which focuses on the stakeholder suggestions, comments, recommendations and the consultation outcomes. This includes how the suggestions and outcomes influenced, or resulted in modifications to, the proposed design and building operation and use.

Developed design

The developed design work stage includes the coordination and updating of proposals for structural design, building services systems, outline specifications, cost information and project strategies.

Facilities management

EN 15221-1:2006 states that facilities management is the integration of processes within an organisation to maintain and develop the agreed services which support and improve the effectiveness of it primary activities. For the purposes of the assessment the term 'Agreed Services' is taken to mean those relating to the maintenance and management of the building, its services and surroundings including the interaction with related activities within and users of the building.

Formally agreed

The term 'formally agreed' relates to BREEAM performance targets. Examples of formal agreements include a contract or letters of appointment with the architect and with other relevant project team members.

Independent party

To comply with the criterion relating to the use of an independent party, the client/design team needs to demonstrate either of the following options:

1. They have used a party independent of the design process to conduct the necessary consultation exercise, using a compliant method. Examples of independent compliant methods include, but are not limited to, the Design Quality Indicator[1] (DQI).
   OR
2. If the consultation is to be carried out by an organisation involved with the design of the building, e.g. the project architect, then they must present the assessor with evidence that robustly demonstrates the independence of the consultation process. BREEAM has not attempted to define what form this evidence must take. The onus is on the design team or relevant individual to clearly demonstrate to the BREEAM Assessor a credible level of independence.

Key design team meetings

Key design team meetings can be defined as those where fundamental decisions that influence or affect the building's proposed design and its construction in accordance with the design (and therefore the building's sustainability impacts and BREEAM performance), are discussed and made. These meetings would typically include representatives from at least three of the parties listed below.

1. Representatives of the client or developer
2. The principal contractor
3. The architect
4. Structural engineers
5. Building services engineers
6. Cost consultants
7. Environmental consultants
8. Project management consultants.

Key phases

The definition of key phases of project delivery includes the following:

- Concept Design
- Developed Design
- Construction
- Commissioning and Handover
- In-Use occupation.

Project delivery stakeholders

The purpose of criterion 1 is to reflect the need to consider the input of all the major project stakeholders from the earliest practical stage. This is to ensure smooth and successful delivery of the project's sustainability objectives. Project delivery stakeholders therefore include the client, the building occupier (where known), the design team and the principal contractor. With regards to contractors' involvement, it ensures their input in terms of formulating sustainable design solutions, commenting on the practicality and build ability of (one or more) design solutions and their impact on programming, cost etc.

BREEAM recognises that traditionally for some projects, the contractor for the works might not be appointed at the early stages of the project. Therefore compliance with criterion 1 would not be possible. In these instances, criterion 1 will be met provided that a suitably experienced person with substantial construction or contracting experience in similar projects is involved prior to appointment of the contractor. A suitably experienced person could be a contractor appointed as a consultant for this stage or a construction project manager.

Project Execution Plan

The Project Execution Plan defined as a plan produced in collaboration between the project lead and lead designer, with contributions from other designers and members of the project team. The Project Execution Plan sets out the processes and protocols to be used to develop the design. It is sometimes referred to as a 'project quality plan'.

Relevant third parties (see criterion 4)

This includes the following, as relevant to the project type:

1. Actual or intended building users (if known) including facilities management (FM) staff or those responsible for the day-to-day operation of the building and grounds.
2. Existing partnerships and networks that have knowledge of, and experience working on, existing buildings of the same type.
3. Potential users of any shared facilities, e.g. operators of clubs and community groups.

AND the following where relevant:

4. For change of use projects and public buildings, a representative consultation group from the existing community.
5. In educational buildings, representatives of Local Education Authority, Board of Governors etc.
6. Local or national historic or heritage groups (over and above any requirements relating to statutory consultees).
7. Specialist service and maintenance contractors and representatives where the building function has particular technical requirements in complex environments, e.g. buildings containing laboratories.

Sustainability Champion (design and monitoring progress)

Members of formal schemes approved by BRE Global in connection with the provision of design advice. At present the following schemes are deemed to satisfy this requirement:

- BREEAM Accredited Professional (AP) Membership Scheme.

Sustainability Champions are trained and qualified to provide BREEAM-related advice to the design team. They are able to facilitate timely and successful target setting, scheduling, prioritisation and monitoring of BREEAM compliance relating to the design of the building.

They will be subject to ongoing training and competency requirements to ensure that their knowledge is maintained.

Providers of schemes or qualifications not listed, who feel their members meet this definition and who would like to be listed as approved membership schemes, should contact BRE Global.

Note: The aim of the Sustainability Champion credits is to encourage an integrated design and construction process that uses BREEAM as a framework for establishing, agreeing and achieving the desired level of sustainability performance for the project. The Sustainability Champion credits in this BREEAM issue focus on achieving this objective through the provision of appropriate expertise during the preparation, brief, and design stages of the project.

Technical design work stage

Is the stage at which all architectural, structural and building service design information, specialist subcontractor design and specifications are finalised.

Other information

None.

[1] The Design Quality Indicator (DQI) is a method to assess the design quality of buildings www.dqi.org.uk.

Man 02 Life cycle cost and service life planning

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
4	No	Yes	Yes	Yes	Yes

Aim

To deliver whole life value from investment and promote economic sustainability by recognising and encouraging the use and sharing of life cycle costing and service life planning. Thus improving design, specification and through-life maintenance and operation.

Assessment criteria

The following is required to demonstrate compliance:

Two credits - Elemental life cycle cost (LCC)

1 An elemental life cycle cost (LCC) analysis has been carried out at concept design stage together with any design option appraisals in line with 'Buildings and constructed assets -- Service life planning -- Part 5: Life cycle costing ISO 15686-5:2008[1].

2 The LCC analysis shows:
   - 2.a An outline LCC plan has been undertaken for the project based on the building's basic structure and envelope, appraising a range of options and based on the life expectancy of the refurbished building, e.g. 20, 30, 50+ years.
   - 2.b The servicing strategy for the project outlining services component over a 15-year period, in the form of an 'elemental LCC Plan'.
   - 2.c A fit-out strategy is developed outlining fit-out options over a 10-year period.

One credit - Component level LCC Plan

3 A component level LCC plan has been developed by the end of Process Stage 4 in line with ISO 15686-5:2008 and includes the following component types (where present):

Applicability	Building components
Part 1 assessments, including components within scope of works.	Envelope, e.g. cladding, windows and roofing
Part 2 & 3 assessments including newly specified local and core services.	Newly specified local or core service equipment, e.g. boiler, air-conditioning, air handling unit or controls etc.
Parts 1 - 4, where finishes are within scope of works.	Finishes, e.g. walls, partitions, floors or ceilings etc.
Where external spaces are within scope of works.	External spaces, e.g. alternative hard landscaping, boundary protection.

Where carrying out a major refurbishment covering all parts of the scheme, a component level LCC plan shall be developed as above.

4 Demonstrate, using appropriate examples provided by the design team, how the component level LCC plan has been used to influence building and systems design and specification to minimise life cycle costs and maximise critical value.

One credit - Capital cost reporting

5 Report the capital cost for the refurbishment or fit-out works in pounds per square metre (£k/m^2). This is reported on the BREEAM Assessment Scoring and Reporting tool.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Criterion 2.b and 2.c are not applicable. All other criteria in this issue are applicable.
CN2	Part 2: Core Services	Criterion 2.a and 2.c care not applicable. All other criteria in this issue are applicable.
CN3	Part 3: Local Services	Criterion 2.a and 2.c care not applicable. All other criteria in this issue are applicable.
CN4	Part 4: Interior Design	Criterion 2.a and 2.b are not applicable. All other criteria in this issue are applicable.
CN5	Parts: 1, 2, 3 and 4 e.g. major refurbishment	All assessment criteria in this issue are applicable.
General		
CN6	Heritage buildings	Where there are conservation requirements that set an explicit requirement from a relevant conservation or heritage authority (e.g. UNESCO, a national or local heritage body, local authority conservation or heritage officer) regarding the selection of components and materials. The Elemental life cycle cost and component level LCC plan should be based upon the range of materials and components that are allowable within the heritage restrictions in order to identify the option that provides the lowest life cycle cost. Where there are components or materials where only one product type is allowable as a result of heritage requirements, this can be excluded from the study.
CN7	Life Cycle Costing methodology ISO 15686-5:2008	The methodology used shall follow the requirements of ISO 15686-5:2008 and shall include the following cost elements applicable to the assessment parts: Construction, Maintenance, Operation, Occupancy and End of Life.
CN8	Appropriate examples See criterion 4.	The option(s) selected to demonstrate how life cycle costs have been minimised and critical value maximised must be appropriate in terms of its relative impact on project costs, future building maintenance burden and size (volume or area).

Ref	Terms	Description
CN9	Predefined specifications	Where the building is constructed to a predefined standard specification, the LCC plan for this specification may be used to help demonstrate compliance.
CN10	Capital cost reporting	At the design stage of assessment, where the final information is not available, the credit can be awarded where the client provides the predicted capital cost, including contingencies, and commits to providing this information for the final stage of assessment. At the final stage, if the final capital cost is not known, the client's/cost consultant's best estimate should be provided. This data will be used to inform future BREEAM performance benchmarking.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
1, 2	Elemental life cycle cost plan.	As per interim design stage.
3, 4	Component level life cycle cost plan.	As per interim design stage.

Additional information

Relevant definitions

Life cycle cost (LCC)

The cost of an asset, or its parts throughout its life cycle, while fulfilling the performance requirements; a methodology for systematic economic evaluation of life cycle costs over a period of analysis, as defined in the agreed scope.

Elemental LCC plan

This is commonly used for developing solutions at project level during option appraisals for the whole building or system. Information may be a mix of typical benchmark costs for key elements, comparative cost modelling or approximate estimates. It is expressed as cost per square metre of gross internal floor area (GIFA) and presented for elemental analysis, aligned to the level of capital cost plans.

Predicted capital cost

The capital cost for the building includes the expenses related to the initial construction of the building:

- Construction, including preparatory works, materials, equipment and labour
- Site management
- Construction financing
- Insurance and taxes during construction
- Inspection and testing

Costs relating to land procurement, clearance, design, statutory approvals and post occupancy aftercare should not be included.

Other information

Capital cost reporting

The lack of data relating to capital and life cycle costs and benefits arising from more sustainable building design presents a major barrier to take-up of more sustainable solutions. This issue seeks to encourage the sharing of data to break down these barriers and ensure that BREEAM continues to encourage cost effective and financially beneficial solutions. This information is collected to assist research into the cost and savings of developing sustainable or BREEAM-assessed buildings. This is used to inform the business case for sustainability and the ongoing development of BREEAM. All data submitted will be treated as confidential and will only be used anonymously.

Component level LCC plan

A component level LCC plan is commonly used for cost planning specification choices of systems, elements or component levels during design development.

Component level LCC appraisal for service life planning at the feasibility stage requires the environment of the building and other local conditions to be identified, and the fundamental requirements to be met in planning the service life of the building. Decisions should be made on:

- the likely design life of the building (rather than the contractual design life)
- minimum functional performance criteria for each component over the building's design life
- components that must be repairable, maintainable or replaceable within the design life of the building.

When to undertake life cycle costing

Life cycle costing is relevant throughout the building or constructed asset's life cycle. In particular during the project planning, design and construction and also during the in-use phases. (For further information please refer to ISO 15686-5.)

Standardised method for life cycle costing (SMLCC) for construction

ISO 15686-5:2008 describes the Standardised method for life cycle costing (SMLCC) for construction procurement. The objectives of this guide are to provide:

1. Life cycle costing practitioners with a standardised method of applying life cycle costing, applicable to the construction industry and to the key stages of the procurement process.
2. Process mapping the life cycle costing stages - to help structure how to plan, generate, and interpret and present the results for a variety of different purposes and levels of life cycle cost planning.
3. Instructions on how to define the client's specific requirements for life cycle costing and the required outputs and forms of reporting - and to decide on which method of economic evaluation to apply.
4. Simplification and demystification - by providing practical guidance, instructions and definitions, together with informative worked examples on how to undertake life cycle costing (for construction).
5. An industry accepted methodology, to facilitate a more accurate, consistent and robust application of life cycle costing estimation and option appraisals, thereby creating a more effective and robust basis for life cycle cost analysis and benchmarking.

   ISO 15686-5:2008, also seeks to help eliminate confusion over scoping and terminology and to address concerns over the uncertainty and risks that are undermining confidence in life cycle costs used for construction procurement.

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[1] ISO 15686-5:2008. Buildings and constructed assets. Service life planning - Part 5: Life cycle costing.

Man 03 Responsible construction practices

Number of credits available	Minimum standards	Applicability			
		Part 1	**Part 2**	**Part 3**	**Part 4**
6	Yes	Yes	Yes	Yes	Yes

Aim

To recognise and encourage construction sites which are managed in an environmentally and socially considerate, responsible and accountable manner.

Assessment criteria

This issue is split in to four parts:

- Environmental management (1 credit)
- Sustainability Champion (1 credit)
- Considerate construction (up to 2 credits)
- Monitoring of construction site impacts (2 credits).

The following is required to demonstrate compliance:

Prerequisite

1 All timber and timber-based products used on the project is 'Legally harvested and traded timber' (see Relevant definitions).

Note: For other materials there are no prerequisite requirements at this stage.

One credit - Environmental management

2 The principal contractor operates an environmental management system (EMS) covering their main operations. The EMS must be third party certified to ISO 14001/EMAS or equivalent standard

3 Implement best practice pollution prevention policies and procedures on site, demonstrated through the project team completing the checklist outlined in Table - 11. The project team are to complete this checklist. To demonstrate compliance, not all actions need to be achieved on site; however the assessor and project team must ensure that the intent of each section (i.e. Air Quality) is met through actions as appropriate to the site.

One credit - Sustainability Champion (construction)

4 A Sustainability Champion is appointed to monitor the project to ensure ongoing compliance with the relevant sustainability performance and process criteria, and therefore BREEAM targets, during the construction, handover and close out work stages.
To do this the Sustainability Champion will ideally be site based or will visit the site regularly to carry out spot checks, with the relevant authority to do so, and will require action to be taken to address shortcomings in compliance. The Sustainability Champion will monitor site activities with sufficient frequency (see compliance note CN6) to ensure that risks of non-compliance are minimised. They will report on progress at relevant project team meetings including identifying potential areas of non-compliance and any action needed to mitigate.

5 The defined BREEAM performance target forms a requirement of the principal contractor's contract (see Man 01 Project brief and design - CN4 and Man 01 Project brief and design - Relevant definitions).

6 To achieve this credit at the final post construction stage of assessment, the BREEAM-related performance target for the project must be demonstrably achieved by the project. This is demonstrated via the BREEAM Assessor's final post construction stage assessment report.

Up to two credits - Considerate construction

7 For small scale refurbishment or fit-out projects (see Relevant definitions):

7.a One credit can be awarded where an individual(s) is responsible for implementing and maintaining the following considerate construction practices throughout the works stage (see Relevant definitions):
- 7.a.i Keeping the site clean and tidy
- 7.a.ii Reducing impacts on the community through community and neighbour engagement
- 7.a.iii Continuous improvements in safety
- 7.a.iv Commitments to respect and fair treatment of all workers
- 7.a.v Suitable site facilities for operatives and visitors

7.b Two credits can be awarded where the contractor achieves six items in each of the four sections within Checklist A1

8 Where the refurbishment or fit-out project does not meet the definition of a small scale project (see Relevant definitions). The BREEAM credits can be awarded as follows:
- 8.a One credit where the principal contractor achieves six items in each of the four sections within Checklist A1
- 8.b Two credits where the principal contractor achieves all items in each of the four sections within Checklist A1 AND the contractor's performance has been confirmed by independent assessment and verification.

Up to two credits - Monitoring of refurbishment or fit-out site impacts

9 Responsibility has been assigned to an individual for monitoring, recording and reporting energy use, water consumption and transport data (where measured) resulting from all on-site refurbishment or fit-out processes (and dedicated off-site monitoring) throughout the refurbishment or fit-out programme.
To ensure the robust collection of information, this individual must have the appropriate authority and responsibility to request and access the data required. Where appointed, the Sustainability Champion could perform this role.

First monitoring credit - Utility consumption

Energy consumption

10 Criterion 9 is achieved.

11 Monitor and record data of the site energy consumption in kWh (and where relevant, litres of fuel used) as a result of the use of construction plant, equipment (mobile and fixed) and site accommodation (as relevant to the project type).

12 Report the total carbon dioxide emissions (total $kgCO_2$/project value) from the construction process via the BREEAM Assessment Scoring and Reporting tool (for the purposes of potential future BREEAM performance benchmarking).

Water consumption

13 Criterion 9 is achieved.

14 Monitor and record data on principal constructor's and subcontractors' potable water consumption (m^3) arising from the use of construction plant, equipment (mobile and fixed) and site accommodation (as relevant to the project type, see Compliance Note .

15 Using the collated data report the total net water consumption (m^3), i.e. consumption minus any recycled water use from the construction process via the BREEAM Assessment Scoring and Reporting tool (for the purposes of potential future BREEAM performance benchmarking).

Second monitoring credit - Transport of construction materials and waste

16 Criterion 9 is achieved.

17 Monitor and record data on transport movements and impacts resulting from delivery of the majority of refurbishment or fit-out materials to site and refurbishment, fit-out and demolition or strip-out waste from site. As a minimum this must cover:
- 17.a Transport of materials from the factory gate to the building site, including any transport, intermediate storage and distribution, see Relevant definitions.
- 17.b Scope of this monitoring must cover the following as a minimum:
  - 17.b.i Where Part 1 is being assessed, materials used in major building elements, including insulation materials
  - 17.b.ii Where Part 2 is being assessed, materials used for core services

17.b.iii Where undertaking a comprehensive refurbishment including fit-out with a combination of Parts 1 - 4, materials used for major building elements, services and interior fit-out

17.b.iv Where within scope, ground works and landscaping materials

17.b.v Where undertaking a Parts 3 & 4 only assessment, materials used in the fit-out are included with the exception of small scale and low value refurbishment of fit-out projects (see Relevant definitions) where this credit is not applicable.

17.c Transport of construction waste from the construction gate to waste disposal processing or recovery centre gate. Scope of this monitoring must cover the construction waste groups outlined in the project's waste management plan.

18 Using the collated data, report separately for materials and waste, the total transport-related carbon dioxide emissions ($kgCO_2$ eq) via the BREEAM Assessment Scoring and Reporting tool (for the purposes of potential future BREEAM performance benchmarking).

Exemplary level criteria

The following outlines the exemplary level criteria to achieve one innovation credit for this BREEAM issue:

19 Where the principal contractor has achieved compliance with a BREEAM 'compliant' organisational, local or national considerate construction scheme and their performance against the scheme has been confirmed by independent assessment and verification.

Checklists and tables

The project team are to complete this checklist. The assessor and project team must ensure that the intent of each section is met through actions appropriate to the site.

Table - 11: Checklist of actions to minimise air and water pollution during construction works

Section	Action	Completed (Y/N)
Noise and vibration	Intent: To minimise the impact of noise and vibration in the local community.	
A	Plan the noisiest activities for times that will result in least disturbance to the local community.	
B	Use noise control devices, e.g. temporary noise.	
C	Barriers, deflectors for impact and blasting activities.	
D	Avoid or minimise transport through community areas.	
Air quality	Intent: To prevent dust and other air pollution on site and in the local community.	
A	Minimise dust from materials by using covers, storage, control equipment, increase moisture content.	
B	Minimise dust from vehicle movements, using water sprays if appropriate.	
C	Avoid burning of materials on site.	

Section	Action	Completed (Y/N)
Water run-off management	Intent: To prevent water pollution from on site activities.	
A	Prepare a drainage plan and mark manholes or water entry points to highlight risk areas. Note: this plan may change as the works progress.	
B	Where possible and/or appropriate, schedule works to avoid heavy rainfall periods (i.e., during the dry season) and modify activities during extreme rainfall and high winds.	
C	Contour and minimise length and steepness of slopes.	
D	Mulch to stabilise exposed areas and/or line steep channels or slopes, e.g. using jute matting.	
E	Revegetate areas promptly.	
F	Reduce or prevent off-site sediment transport through use of settlement ponds, silt fences, and/or water treatment.	
G	Segregate or divert clean water run-off to prevent it mixing with water containing a high solids content (therefore minimising the amount of water requiring treatment).	
H	Provide adequate drainage systems to minimising and control infiltration.	
I	Carry out any activities that could cause pollution in a designated, bunded areas away from rivers, boreholes or other water courses.	
Hazardous materials	Intent: To prevent hazardous materials polluting local water courses.	
A	Provide adequate secondary containment for fuel storage tanks and for the temporary storage of other fluids such as lubricating oils and hydraulic fluids.	
B	Train workers on the correct transfer and handling of fuels and chemicals and the response to spills.	
C	Use impervious surfaces for refuelling areas and other fluid transfer areas.	
D	Provide portable spill containment and clean-up equipment on site and train staff to use it.	
E	Provide adequate sanitation facilities serving all workers.	

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2, 3 and 4 assessments	All criteria in this issue are applicable.
General		
CN2	BREEAM compliant organisational, local or national considerate construction schemes	Where a considerate construction or constructors scheme exists and is not listed as a BREEAM compliant scheme, the scheme administrator/operator can apply to BRE Global for recognition as a compliant scheme. Prior to any application the operator should first review their scheme against the requirements of . If they believe their scheme demonstrates equivalence with , they should contact BRE Global. BRE Global will review the scheme and, if appropriate, add to the list of compliant schemes and define appropriate benchmarks of performance for achieving BREEAM credits using the scheme.
CN3	Strip-out	The scope of this issue applies to the principal contractor and their scope of works. If the scope of their works includes strip-out then this stage of work falls within the scope of the assessment.
CN4	Site timber and reusable formwork See criterion 2.	Reusable timber formwork itself does not automatically comply. All timber used in the manufacture of the formwork must be either initially reclaimed, or 'legally harvested and traded' (see Mat 03 Responsible sourcing of materials - Relevant definitions).
CN5	Environmental management system (EMS)	The EMS can be developed following guidance in the WRAP publication 'Your Guide to Environmental Management Systems', which can be downloaded from the WRAP website. While a UK based document, this guide follows the requirements of ISO 14001 and EMAS, however certification against ISO 14001, EMAS or the equivalent standard will be required to demonstrate compliance with criterion 2.
CN6	Frequency of site monitoring See criterion 4.	In this context, visits should occur at key stages of the construction process, at times where: — works can be observed before they are covered up or new works or trades start; where significant risks of conflicts or errors could occur; — where timing is critical to demonstrating compliance; — where key evidence is required to be produced at specific times including, but not limited to photographic, delivery notes and other documentary evidence; — where different trades and systems come together and one could harm the integrity or compliance of another system's performance against BREEAM requirements.

Ref	Terms	Description
CN7	Independent assessment and verification	An assessment of the site activities against Checklist A1 which is carried out by an individual who can demonstrate their independence from the project delivery, i.e. someone not employed by (or working under a contract for) the contractors organisation. The individual must have at least five years experience working within the construction industry either as a contractor or as part of a design team. Where the assessor meets the criteria above, they can fulfil this role.
CN8	Compliance with Considerate Contractor Checklist	In instances where items in are not relevant due to the scope of works on site, the assessor should seek guidance from BRE Global on the appropriate number of items required.
CN9	Water Consumption	Where there is no water use associated with construction plant, equipment (mobile and fixed) and site accommodation, the requirements for monitoring water consumption is not required.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1	Refer to generic evidence requirement above	A copy of the principal contractors EMS/EMAS certificate
2	Refer to generic evidence requirement above	Where certified materials were used, copies of all relevant certificates or chain of custody evidence.
7	Refer to generic evidence requirement above	Scheme certificate or compliance report.

Additional information

Relevant definitions

Construction processes

The construction process includes the enabling works, assembly, installation and disassembly activities necessary for servicing the construction and completion of a new building.

Dedicated off-site manufacturing or fabrication

Production of a component or material carried out in an off-site manufacturing or processing facility specifically set up for a development project.

Factory gate

For the purposes of this issue, the factory gate is defined as being the product manufacturer gate (i.e. where manufacture and pre-assembly finishes and the material is in its final product form).

Examples might include:

1. Steel or concrete or glass manufacturers for cladding, windows and beams etc.
2. Quarry gate for aggregate and sand
3. Concrete plant for concrete
4. Saw mill and timber processing plant for timber.

Legally harvested and traded timber

Refer to Mat 03 Responsible sourcing of materials.

Principle contractor

The company that has overall responsibility for overseeing the construction stage of the project, whether that is a contractor or managing agent.

Small scale refurbishment or fit-out projects

For the purposes of this issue, small scale refurbishment or fit-out projects are defined as projects up to 500m^{2}gross internal floor area Additionally the assessor will need to confirm that the project does not have a significant impact on the local environment or community. This can be demonstrated where the project will have a minimal adverse impact on transport movements(e.g. number of deliveries, impacts on parking), noise, dust and pollution levels. This review of impacts should consider the existing local environment such as existing background noise, traffic conditions and proximity to communities/neighbours and other occupied buildings, demonstrating that the project is not likely to have an increased impact.

Sustainability Champion (Construction)

Members of formal schemes approved by BRE Global in connection with the provision of design advice. At present the following schemes are deemed to satisfy this requirement:

- BREEAM Accredited Professional (AP) Membership Scheme
- BRE Site Sustainability Manager Membership Scheme.

Sustainability Champions are trained and qualified to provide BREEAM-related advice to the design team to facilitate timely and successful target setting, scheduling, prioritisation and monitoring of BREEAM compliance relating to the design of the building. They will be subject to ongoing training and competency requirements to ensure that their knowledge is maintained. Providers of schemes or qualifications not listed, who feel their members meet this definition and who would like to be listed as approved membership schemes, should contact BRE Global.

Note: The aim of the Sustainability Champion credits is to encourage an integrated design and construction process that uses BREEAM as a framework for establishing, agreeing and achieving the desired level of sustainability performance for the project. The Sustainability Champion credits in this BREEAM issue focus on achieving this objective through the provision of appropriate expertise during the Construction, Handover and Close Out stages of the project.

BREEAM Accredited Professional (AP)

Refer to Man 01 Project brief and design.

Site Sustainability Manager

An individual qualified by BRE to help to ensure quality in project delivery and to minimise the environmental impacts of the construction process, as well as achieving the intentions of the building designers. They are based on-site and ensure that the construction site is managed in an environmentally efficient manner and that the site teams are confident in achieving the exacting regulations and requirements of environmental certification schemes, for example BREEAM. Only qualified individuals who are members of BRE's associated membership scheme and are registered to the scheme throughout the period of construction comply with the BREEAM requirements. This membership ensures an adequate level of competence is maintained through regular continuing professional development (CPD) in key relevant areas.

Other information

CO_2 reporting protocols

At time of publication, the following guidance is available for CO_2 measuring protocols.

1. Encord: http://www.encord.org. They have launched a CO_2 reporting protocol.
2. GHG Protocol - http://www.ghgprotocol.org.

Tools for monitoring and targeting construction site impacts

BRE's online environmental reporting tool, SMARTWaste, enables users to capture, monitor and target a project's on-site energy consumption and produce a CO_2 footprint, water consumption and responsible sourcing of timber. Transport and CCS data can also be collected. The system can be used as a tool to help meet the criteria of this issue and as a source of evidence for demonstrating compliance. It is available through the SMARTWaste Membership scheme by developing tailor-made versions of SMARTWaste. More details on the tool and membership are available at www.smartwaste.co.uk

The International Finance Corporation website provides information relating to this issue, i.e. the IFC World Bank Group - Environmental, Health and Safety (EHS) Guidelines.

Considerate construction practices

The following are examples of considerate construction practices that provide possible ways of meeting the criteria for small scale. Further examples can be found at the Considerate Contractors Scheme website under Examples of Good Practices.

1. Keeping the site clean and tidy
   a. Ensure no loose materials or debris lying around the site including the perimeter
   b. Vehicles are regularly checked for cleanliness
   c. Implement a 'Tidy Friday' initiative.
2. Reduce the impacts to the community
   a. The timing of deliveries to site to avoid disturbance to local residents
   b. Ensure that any noisy work is carried out at agreed times with adjoining neighbours
   c. Record car registration numbers of all operatives in the event that a complaint was made with regard to nuisance parking.
3. A drive for continuous improvements in safety
   a. Toolbox talks on safety matters
   b. Passport or helmet stickers for operatives who have successfully completed health and safety training
   c. Near miss reporting procedure.
4. A commitment to respect and provide fair treatment of all workers
   a. A 'Respect for people' wall chart displayed, recording satisfaction levels with welfare and other relevant topics
   b. Questionnaires issued to all operatives to establish what can be done to improve working conditions
   c. Information on dealing with abusive behaviour.
5. Provide suitable site facilities
   a. Provide suitable toilet facilities for male and female operatives
   b. Rest areas for operatives to have breaks away from work areas
   c. Suitable first aid facilities.

Man 04 Commissioning and handover

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
4	Yes	Yes	Yes	Yes	Yes

Aim

To encourage a properly planned handover and commissioning process that reflects the needs of the building occupants.

Assessment criteria

This issue is split into four parts:

- Commissioning and testing schedule and responsibilities (1 credit)
- Commissioning building services (1 credit)
- Testing and inspecting building fabric (1 credit)
- Handover (1 credit).

The following is required to demonstrate compliance:

One credit - Commissioning and testing schedule and responsibilities

1 There is a schedule of commissioning and testing that identifies appropriate commissioning required for the scope of works that includes a suitable timescale for commissioning and recommissioning of all relevant works carried out. Commissioning should be carried out where changes are being made to the following:
   1.a Building services (including both complex and non-complex systems)
   1.b Building services control systems (including Building Management Systems)
   1.c Changes to the building fabric that will affect thermal performance.

2 The schedule will identify the appropriate standards that all commissioning activities will be conducted in accordance with national best practice commissioning codes or other appropriate standards, where applicable. Where a building management system (BMS) is specified, refer to compliance note CN7 on BMS commissioning procedures.

3 An appropriate project team member(s) is appointed to monitor and programme pre-commissioning, commissioning and testing. Where necessary, including recommissioning activities on behalf of the client.

4 The principal contractor accounts for the commissioning and testing programme, responsibilities and criteria within their budget and main programme of works. The programme shall allow for the required time to complete all commissioning and testing activities prior to handover.

One credit - Commissioning building services

5 The commissioning and testing schedule and responsibilities credit is achieved.

6 For projects where work is being undertaken to upgrade, renovate or install new building services and systems.
   6.a For complex building services and systems, a specialist commissioning manager is appointed during the design stage (by either client or contractor) with responsibility for:
      6.a.i Undertaking design reviews and giving advice on suitability for ease of commissioning
      6.a.ii Providing commissioning management input to construction programming and during installation stages
      6.a.iii Management of commissioning, performance testing and handover or post handover stages.
   6.b For simple building services, this role can be carried out by an appropriate project team member (see criterion 3), provided they are not involved in the general installation works for the building services system(s).

One credit - Testing and inspecting building fabric

7 Projects where the fabric of the building is being upgraded, the integrity of the building fabric, including continuity of insulation, avoidance of thermal bridging and air leakage paths is quality assured through completion of post construction testing and inspection. Dependent on building type or construction, this can be demonstrated through the completion of a thermographic survey as well as airtightness testing and visual inspection at appropriate times during

the refurbishment. The survey or testing is undertaken by a Suitably Qualified Professional (see Relevant definitions) in accordance with the appropriate standard (refer to compliance note CN10). Visual inspections are conducted by a representative of the main contractor or by an independent inspector with appropriate and relevant qualifications and experience of construction.

8 Any defects identified in the site inspection, thermographic survey and the airtightness testing reports are rectified prior to building handover and close out. Any remedial work must meet the required performance characteristics for the building or element as defined at the design stage.

One credit - Handover

9 A Building User Guide is developed or (where present) an existing Building User Guide is updated, prior to handover for distribution to the building occupiers and premises managers (see Relevant definitions). A draft copy is developed and discussed with users first (where the building occupants are known) to ensure the guide is most appropriate and useful to potential users.

10 A training schedule is prepared for building occupiers or premises managers, timed appropriately around handover and proposed occupation plans, which includes the following content as a minimum:
- 10.a The design intent of refurbishment and fit-out works
- 10.b The available aftercare provision and aftercare team main contact(s), including any scheduled seasonal commissioning and post occupancy evaluation
- 10.c Introduction to, and demonstration of, installed systems and key features, particularly building management systems, controls and their interfaces, to ensure they are fully conversant with the detailed operation of the building
- 10.d Introduction to the Building User Guide and other relevant building documentation, e.g. design data, technical guides, maintenance strategy, operations and maintenance (O&M) manual, commissioning records, log book etc.
- 10.e Maintenance requirements, including any maintenance contracts and regimes in place.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and Structure	1. Criteria 1 to 4. 2. Criteria 7 and 8. 3. Criteria 9 and 10.
CN2	Part 2: Core services	1. Criteria 1 to 4. 2. Criteria 5 and 6.a. 3. Criteria 9 and 10.
CN3	Part 3: Local services	1. Criteria 1 to 4 2. Criteria 5 and 6.b 3. Criteria 9 and 10
CN4	Part 4: Interior design	1. Criteria 1 to 4. 2. Criteria 5 and 6.b., CN13 3. Criteria 9 and 10.

Ref	Terms	Description
General		
CN5	National best practice commissioning codes	Please refer to the country specific reference sheet to locate the appropriate national building regulations and best practice commissioning codes in the county of assessment. Alternatively, please demonstrate that the minimum requirements as set out in the Approved standards and weightings list are covered by the proposed documents. Where appropriate commissioning codes do not exist for a country, the design team should demonstrate compliance with the UK or European standards as listed in each relevant country reference sheet.
CN6	Process-related equipment See criterion 2.	Any process or manufacture-related equipment specified as part of the project may be excluded from the assessment of the commissioning credits, except where they form an integral part of the building HVAC services, such as some heat recovery systems.
CN7	BMS commissioning procedures See criterion 2.	Where a building management system (BMS) is specified, the following commissioning procedures must be carried out: 1. Commissioning of air and water systems is carried out when all control devices are installed, wired and functional 2. In addition to air and water flow results, commissioning results include physical measurements of room temperatures, off-coil temperatures and other key parameters as appropriate 3. The BMS or controls installation should be running in auto with satisfactory internal conditions prior to handover 4. All BMS schematics and graphics (if BMS is present) are fully installed and functional to user interface before handover 5. The occupier or facilities team is fully trained in the operation of the system.
CN8	Scope of the thermographic survey	The thermographic survey must cover 100% of the treated spaces, unless it is a large complex building (see CN9). Ensuring that all elements of the building fabric that enclose an internal heated or conditioned (treated) zone of the building will be tested. This includes internal walls separating treated and untreated zones.
CN9	Thermographic survey of large complex buildings	In the case of large and complex buildings, it may be impractical for the thermographic survey and air tightness testing to cover 100% of the building. Where a complete thermographic survey is deemed impractical by a Category II thermographic surveyor, the guidance in air tightness standard ISO 9972:2006/EN 13829:200[1] should be followed on the extent of the survey and testing. This could include airports, large hospitals and high-rise buildings.
CN10	Appropriate standards for thermal imaging and air leakage testing (where applicable)	ISO 18436-7:2014 Condition monitoring and diagnostics of machines - Requirements for qualification and assessment of personnel Part 7: Thermography[1] ISO 6781:1983 Thermal performance of buildings - Qualitative detection of thermal irregularities in building envelopes - Infrared method[2] ISO 9972:2006/EN 13829:2000 Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurisation method

Ref	Terms	Description
CN11	Remediation work	Any remediation work undertaken, resulting from a thermographic survey and air tightness test of the building, should be robust and durable, i.e. the remedial work must have the same performance characteristics and life expectancy of the surrounding elements. Where any defects are identified that relate to aspects that are outside of the scope of refurbishment works, these do not need to be remediated e.g. where testing highlights that glazing has defects but was not included in the scope of refurbishment works.
CN12	Thermographer qualification	The thermographic survey is normally undertaken by a Suitably Qualified Professional classified and qualified as a Category II in thermography (see Relevant definitions). Where a Category II thermographer is not available at the site, the survey may be undertaken by a Category I thermographer and then the images interpreted by a Category II thermographer.
CN13	Building Services in a Part 4 fit-out	Where the fit-out includes equipment such as display lighting and display chillers or freezers, these will need to be commissioned in accordance with the manufacturers requirements. For Part 4 assessments the commissioning mangers role can be carried out by a member of the project team - see criterion 6.b. Where there is no equipment within the scope of fit-out works, this issue is not applicable and filtered out from the assessment.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
7, 8	Refer to generic evidence requirement above.	Thermographic survey and Level 2 thermography certificate.
9, 10	Refer to generic evidence requirement above.	Building User Guide.

Additional information

Relevant definitions

Building User Guide (BUG)

Dedicated building/site specific guidance for the non-technical building user. The purpose of the guide is to help building users access, understand and operate the building efficiently and in a manner in keeping with the original design intent. A Building User Guide should be written so that it will provide easily accessible and understandable information relevant to the following stakeholders:

- The building's staff (or where relevant residents)
- The non-technical facilities management team or building manager
- Other building users, e.g. visitors, community users.

The content of the guide will be specific to the building type and end users, but broadly should include information on the following:

- Overview of the building and its environmental strategy, e.g. energy/water/waste efficiency policy/strategy and how users should engage with and deliver the policy or strategy.
- Building services overview and access to controls, e.g. where to find them, what they control, how to operate effectively and efficiently etc.
- Pre-arrival information for visitors, e.g. access and security procedures and provisions
- Provision of, and access to, shared facilities
- Safety and emergency information and instructions
- Building related operational procedures specific to building type or operation, e.g. laboratories
- Building related incident reporting and feedback arrangements
- Building related training information and links including information on legionella
- Provision of, and access to, transport facilities, e.g. public transport, cyclist facilities, pedestrian routes etc.
- Provision of, and access to, local amenities
- Provide details and copies of risk assessments carried out including a legionella risk assessment
- Re-fit, refurbishment and maintenance arrangements and considerations
- Links, references and relevant contact details

There is no requirement on the format the Building User Guide should take.

Complex systems

These include, but are not limited to, air-conditioning, comfort cooling, mechanical ventilation, displacement ventilation, complex passive ventilation, building management systems (BMS), renewable energy sources, microbiological safety cabinets and fume cupboards, cold storage enclosures and refrigeration plant.

Suitably Qualified Professionals - thermographic survey and airtightness testing

Thermography surveys and airtightness testing are to be undertaken by suitably qualified professionals in accordance with the appropriate standards as follows: Airtightness testing: by professionals with membership of ATTMA (Air Tightness Testing and Measurement Association) attained at organisational level maintaining UKAS accreditation (as air tightness testing laboratories to ISO 17025). Thermographic survey: by a professional holding a valid Category II in thermography, as defined by ISO 18436-7:2014 or Class II in infrared thermography as defined by ISO 6781:1983

Other information

Thermal bridging assessments

It is good practice to carry out thermal bridging assessments at the design stage. This is encouraged through building regulations for energy conservation by allowing the use of actual values in the energy calculation, which could make a significant improvement over using the default values in the National Calculation Methodology. This is reflected in the Ene 01 Energy Use and Carbon Emissions Reduction issue, so no additional credit is offered within this issue for thermal bridging assessments. However, good thermal bridging design and assessment will contribute to successful building fabric testing results and the associated credit.

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[1] ISO 9972:2006/EN 13829:2000 Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurisation method

[1] ISO 18434-7:2008 Condition monitoring and diagnostics of machines - Requirements for qualification and assessment of personnel Part 7: Thermography

[2] ISO 6781:1983 Thermal performance of buildings - Qualitative detection of thermal irregularities in building envelopes - Infrared method

Man 05 Aftercare

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
3	Yes	Yes	Yes	Yes	Yes

Aim

To provide post handover aftercare to the building owner or occupants following the refurbishment works to ensure the building operates and adapts, where relevant, in accordance with the design intent and operational demands.

Assessment criteria

This issue is split into three parts:

- Aftercare support (1 credit)
- Seasonal commissioning (1 credit)
- Post occupancy evaluation (1 credit).

The following is required to demonstrate compliance :

One credit - Aftercare support

1 There is (or will be) operational infrastructure and resources in place to provide aftercare support to the building occupier(s), which includes the following as a minimum:
- 1.a A meeting programmed to occur between the aftercare team or individual and the building occupier or management (prior to initial occupation, or as soon as possible thereafter) to:
  - 1.a.i Introduce the aftercare team or individual to the aftercare support available, including the Building User Guide (where existing) and training schedule and content.
  - 1.a.ii Present key information about features of the refurbished building including the design intent and how to use the building to ensure it operates as efficiently and effectively as possible (including the use of local services and controls and central services, as applicable).
- 1.b On-site facilities management training, to include a walkabout of the refurbished area of the building. This is to include an introduction to, and familiarisation with the building systems, their controls and how to operate them in accordance with the design intent and operational demands.
- 1.c Initial aftercare support provision for at least the first month of building occupation, e.g. on-site attendance on a weekly basis to support building users and management. Conduct a walk-around to examine how the refurbished area of the building is being used or operated to identify any issues that need to be communicated to building users and facilities managers (this could be more or less frequent depending on the complexity of the building and building operations).
- 1.d Longer term aftercare support provision for occupants for at least the first 12 months from occupation, e.g. a helpline, nominated individual or other appropriate system to support building users and management.

2 There is (or will be) operational infrastructure and resources in place to coordinate the collection and monitoring of energy and water consumption data for a minimum of 12 months (for Part 4, where local metering is available and accessible), once the building is occupied. Discrepancies between actual and predicted performance should be identified, with a commitment to identify actions required to address any discrepancies such as adjusting systems or to develop and review operational policies to influence user behaviours accordingly.

One credit - Seasonal commissioning

3 The following seasonal commissioning activities will be completed over a minimum 12-month period, once the building becomes substantially occupied:
- 3.a Complex systems - Specialist Commissioning Manager:
  - 3.a.i Testing of all building services under full load conditions, i.e. heating equipment in midwinter, cooling and ventilation equipment in midsummer, and under part load conditions (spring and autumn).
  - 3.a.ii Where applicable, testing should also be carried out during periods of extreme (high or low) occupancy.

3.a.iii Interviews with building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems.

3.a.iv Recommissioning of systems (following any work needed to serve revised loads), and incorporating any revisions in operating procedures into the operations and maintenance (O&M) manuals.

3.b Simple systems (naturally ventilated) - external consultant or aftercare team or facilities manager:

3.b.i Review thermal comfort, ventilation, and lighting, at three, six and nine month intervals after initial occupation, either by measurement or occupant feedback.

3.b.ii Take all reasonable steps to recommission systems following the review to take account of deficiencies identified and incorporate any relevant revisions in operating procedures into the O&M manuals.

One credit - Post occupancy evaluation

4 The client or building occupier makes a commitment to carry out a post occupancy evaluation (POE) exercise one year after initial building occupation. This is done to gain in-use performance feedback from building users to inform operational processes. This includes recommissioning activities, and to maintain or improve productivity, health, safety and comfort. The POE is carried out by an independent party (see Man 01 Project brief and design - Relevant definitions) and needs to cover:

4.a A review of the design intent and construction process (review of design, procurement, construction and handover processes).

4.b Feedback from a wide range of building users including facilities management on the design and environmental conditions of the building covering:

4.b.i Internal environmental conditions (light, noise, temperature, air quality)

4.b.ii Control, operation and maintenance

4.b.iii Facilities and amenities

4.b.iv Access and layout

4.b.v Other relevant issues.

4.c Sustainability performance (energy/water consumption, performance of any sustainable features or technologies, e.g. materials, renewable energy, rainwater harvesting etc.).

5 The client or building occupier makes a commitment to carry out the appropriate dissemination of information on the building's post occupancy performance. This is done to share good practice and lessons learned, inform changes in user behaviour, building operational processes and procedures, and system controls.
Refer to compliance notes CN6 and CN7 for a definition of appropriate dissemination. This also provides advice on appropriate dissemination where the building or building information is commercially or security sensitive.

Exemplary level criteria

The following outlines the exemplary level criteria to achieve one innovation credit for this BREEAM issue:

6 There are, or will be, operational infrastructure and resources in place to coordinate the following activities at quarterly intervals for the first three years of building occupation:

6.a Collection of occupant satisfaction, energy consumption and (where available) water consumption data.

6.b Analysis of the data to check the building is performing as expected, make any necessary adjustments to systems controls or to inform building user behaviours.

6.c Setting targets or appropriate actions for reducing water and energy consumption and monitor progress towards these.

6.d Feedback any 'lessons learned' to the design team and developer for use in future projects.

6.e Provision of the actual annual building energy, water consumption (where meters are available and accessible for Part 3 and 4 only assessments) and occupant satisfaction data to BRE for the purpose of future BREEAM performance benchmarking.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric & Structure assessment criteria	1. Criteria 1 and 2. 2. Criteria 4 to 6. 3. All other criteria are not applicable.
CN2	Part 2: Core services assessment criteria	1. Criteria 1 to 3.a. 2. Criteria 4 to 6. 3. All other criteria are not applicable. Note: where the project is speculative, criteria 3 to 5 are not applicable
CN3	Part 3: Local services assessment criteria	1. Criteria 1 to 3.b. 2. Criteria 4 to 6. 3. All other criteria are not applicable. Note: where the project is speculative, criteria 3 to 5 are not applicable.
CN4	Part 4: Interior design assessment criteria	1. Criterion 1. 2. Criteria 4 to 6. 3. All other criteria are not applicable.
General		
CN5	Collection and monitoring of energy and water consumption data See criteria 2 and 4.	This function can be coordinated or carried out by a dedicated aftercare team or, where the building occupier is known and able to confirm compliance based on their existing or proposed operations for the building, the building owner/occupier's estates or facilities management team.

Ref	Terms	Description
CN6	Appropriate dissemination of post occupancy evaluation information See criterion 5.	1. Appropriate dissemination includes communication to immediate stakeholders such as building occupants, managers and owners. In addition information should be communicated externally. 2. Appropriate dissemination in most cases will be the production and publication of a building case study through one of the following means: 1. The client's or building owner's own website, publicly available literature or press release 2. Industry or sector or government or local authority sponsored website or information portals. Where there is a demonstrably justifiable reason why public dissemination is not possible, for example the information is commercially or security sensitive, compliance can be demonstrated by a commitment to produce and disseminate the relevant information at an organisational level or to appropriate internal or external stakeholders. Alternatively, the sensitive parts of the relevant information for dissemination can be omitted from the publication.
CN7	Relevant information for dissemination See criterion 5.	This includes the following information about the building and its performance: 1. A basic description of the project and building 2. BREEAM rating and score 3. The key innovative and low-impact design features of the building 4. Project cost 5. Project size: floor area, site area 6. Facilities available for community use (where relevant) 7. Any steps taken during the construction process to reduce environmental impacts, i.e. innovative construction management techniques 8. Predicted and actual carbon dioxide emissions or Energy Performance Certificate rating (where this is available) 9. Outcomes of the post occupancy evaluation study, to share lessons learned from the project including: a. Occupant feedback b. Energy and water consumption including renewable energy generation, level of rainwater or grey water provision, as applicable.
CN8	Provision of annual energy and water consumption and occupant satisfaction data See criterion 4.	One way of demonstrating compliance with this criterion is for the client or end user to register and therefore commit the building for assessment under Part 2 Building Management of the BREEAM In-Use scheme.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1	Refer to generic evidence requirement above	Contract to provide compliant aftercare support and training
2	Refer to generic evidence requirement above	Seasonal commissioning records, reports and letter of appointment

Additional information

Relevant definitions

Complex systems

These include, but are not limited to, air-conditioning, mechanical ventilation, displacement ventilation, complex passive ventilation, building management systems (BMS), renewable energy sources, microbiological safety cabinets and fume cupboards, cold storage enclosures and refrigeration plant.

Specialist Commissioning Manager

The Specialist Commissioning Manager is a specialist contractor rather than a general subcontractor.

Independent third party

To comply with criterion 4 relating to the use of an independent third party, the client/design team needs to demonstrate either of the following options:

1. They have used a third party independent of the design process to conduct the necessary Post Occupancy Evaluation exercise using a compliant method. Or alternatively;
2. If the Post Occupancy Evaluation is to be carried out by an organisation involved with the design of the building e.g. the project architect. They must present the assessor with the evidence that demonstrates the independence of the Post Occupancy Evaluation process from the design process. BREEAM has not attempted to define what form this exercise must take, the onus is on the design team or relevant individual to clearly demonstrate to the BREEAM Assessor a credible level of independence.

Actual vs predicted performance

In most cases it is not feasible to accurately compare predicted vs actual performance due to variances in the assumptions used in the models. Figures reported via the UK's Carbon Buzz website show that on average, buildings consume between 1.5 and 2.5 times predicted values. When comparing predicted with actual, an analysis should be carried out to understand why there may be discrepancies in performance. These discrepancies can be for a number of reasons including:

- Predicted energy consumption is normally based upon building regulation compliance models which only focus on 'regulated' energy use. Additional unrelated energy use may not have been modelled in the design prediction model
- may be extended use due to extra occupancy and operating hours, not accounted for in predicted models
- Inefficiencies from poor control, bad commissioning or poor maintenance
- Additional special functions such as cafeteria, server rooms etc. not accounted for in the predicted model
- Variances in actual occupant behaviour that vary from predicted such as use of small power and lighting

CIBSE TM54, Evaluating Operational Energy Performance of Buildings at the Design Stage, CIBSE, 2013 provides guidance on how to improve the accuracy of the model for operational energy use of buildings at the design stage. The Carbon Trust guidance, 'Closing the gap: Lessons learned on realising the potential of low carbon building design', also provides additional guidance on this issue.

Absence of predicted performance data

Where building occupiers do not have predicted performance models, it may be more appropriate to benchmark actual building performance data with other sources of Building Performance Evaluation Data and benchmarks. The following sources of benchmarking information are from the UK that are internationally recognised:

Building performance benchmarks can be found in CIBSE Guidance including:

- Guide F: Energy Efficiency in Buildings
- CIBSE TM46: Energy Benchmarks
- CIBSE TM47: Operational Ratings and Display Energy Certificates

Additional information of building performance and benchmarking can be found at Buildings Performance Institute Europe (BPIE) - http://www.bpie.eu/ and ASHRAE - HTTPS://www.ashrae.org/

Post Occupancy Evaluation Methodologies

The BUS methodology was developed following a series of government funded 'PROBE' building performance evaluation studies in 1995. The BUS methodology is used by independent licensed partners following a four part process. Further information can be found at http://www.busmethodology.org.uk/

BRE's Design Quality Method (DQM) is a tried and tested, independent, post occupancy evaluation (POE) method used by all UK auditing authorities, and many funding bodies. Further information can be found at http://www.bre.co.uk/dqm

Further guidance on POE

- The BCO guide to Post Occupancy Evaluation (POE), British Council for Offices, 2007
- BRE Digest 478, Building performance feedback: getting started, Building Research Establishment, 2003
- Guide to Post Occupancy Evaluation Report and Toolkit, HEFCE, AUDE & University of Westminster, 2006

Other information

Soft Landings Framework[1]

A framework written and produced by Usable Buildings Trust (UBT) and Building Services Research and Information Association (BSRIA) that seeks to promote improved briefing, design, handover and building performance in-use. Embedding the principles of this framework within a project should ensure that the evidence is available to demonstrate compliance with particular aspects of the criteria under this BREEAM issue. Please also note that BSRIA has produced a BREEAM New Construction Soft landings interpretation note[2] for clients and design teams.

The Government Soft Landings (GSL) is a version of the Soft Landings concept tailored for use on public sector related projects to link in with the work of the government's Building Information Modelling Task Group. It is to be mandated in 2016 alongside Building Information Modelling (BIM) Level 2 and is to be implemented by central government departments. It should be noted that the GSL programme will become compulsory for local government developments after 2016. Further information is available from: http://www.bimtaskgroup.org/Government Soft Landings

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[1] The Soft Landings Framework, for better briefing, design, handover and building performance in-use, Usable Buildings Trust (UBT), BSRIA BG 4/2009.

[2] BREEAM 2011 and Soft Landings, an interpretation note for clients and designers, BSRIA BG 28/2011

6.0 Health and Wellbeing

Summary

This category encourages the increased comfort, health and safety of building occupants, visitors and others within the vicinity. Issues in this section aim to enhance the quality of life in buildings by recognising those that encourage a healthy and safe internal and external environment for occupants.

Category summary table

Issue	Credit summary	Applicability			
		Part 1	Part 2	Part 3	Part 4
Hea 01 Visual comfort	— Potential for disabling glare has been designed out of all relevant building areas. — Good practice daylighting levels have been met. — Floor space in relevant building areas has an adequate view out to reduce eye strain and provide a link to the outside. — Internal and external lighting systems are designed to avoid flicker and provide appropriate illuminance (lux) levels. — Internal lighting is zoned to allow for occupant control.	Yes	No	Yes	Yes
Hea 02 Indoor air quality	— Minimising sources of air pollution through careful design specification and planning. — Building ventilation strategy is designed to be flexible and adaptable to potential future building occupant needs and climatic scenarios.	Yes	Yes	Yes	Yes
Hea 03 Safe containment in laboratories	— Production of an objective risk assessment of the proposed laboratory facilities. — Containment devices such as fume cupboards meet best practice safety and performance requirements and objectives. — Containment level 2 and 3 laboratory facilities to meet best practice safety and performance criteria where specified.	No	Yes	Yes	Yes

Issue	Credit summary	Applicability			
		Part 1	Part 2	Part 3	Part 4
Hea 04 Thermal comfort	— Thermal modelling carried out to appropriate standards. — Projected climate change scenario(s) considered as part of the thermal model. — The thermal modelling analysis has informed the temperature control strategy for the building and its users.	Yes	Yes	Yes	Yes
Hea 05 Acoustic performance	— The building meets appropriate acoustic performance standards and testing requirements in terms of: — Sound insulation — Indoor ambient noise level — Reverberation times.	Yes	Yes	Yes	Yes
Hea 06 Safety and security	— This issue is not assessed in the BREEAM International Refurbishment and Fit-out scheme	No	No	No	No
Hea 07 Hazards	— To conduct a risk assessment for natural hazards that may affect the building and the implementation of measures to mitigate any risks	Yes	Yes	Yes	Yes

Hea 01 Visual comfort

Number of credits available	Minimum standards	Applicability			
Building type dependent (Up to 7 credits)	No	**Part 1**	**Part 2**	**Part 3**	**Part 4**
		Yes	No	Yes	Yes

Aim

To encourage and recognise projects that maximise opportunities for good daylighting, artificial lighting and occupant controls at the design stage to ensure best practice in visual performance and comfort for building occupants.

Assessment criteria

This issue is split into four parts:

- Glare control (1 credit)
- Daylighting (up to 3 credits)
- View out (up to 2 credits)
- Internal and external lighting (1 credit)

The following is required to demonstrate compliance:

One credit - Glare control

1 The potential for disabling glare has been designed out of all relevant building areas using a glare control strategy, either through building form and layout or building design measures (see compliance note CN7).

2 The glare control strategy avoids increasing lighting energy consumption, by ensuring that:
  2.a The glare control system is designed to maximise daylight levels under all conditions while avoiding disabling glare in the workplace or other sensitive areas. The system should not inhibit daylight from entering the space under cloudy conditions, or when sunlight is not on the façade: AND
  2.b The use or location of shading does not conflict with the operation of lighting control systems.

Up to three credits - Daylighting

3 One credit where daylighting provision, averaged over all relevant spaces, has improved after refurbishment or fit-out by 15% or more and there is a minimum glazing to floor area ratio of either:
  3.a 5% glass to floor area ratio for side windows; OR
  3.b 2.5% glass to floor area ratio for roof lights

4 Two credits where daylighting provision, averaged over all relevant spaces, has improved after refurbishment or fit-out by 30% or more and there is a minimum glazing to floor area ratio of either:
  4.a 5% glass to floor area ratio for side windows; OR
  4.b 2.5% glass to floor area ratio for roof lights;

5 Up to three credits are awarded on a sliding scale depending on the percentage of relevant building areas that comply with one of the following daylighting criteria:
  5.a The relevant building areas meet good practice daylight factor(s) and other criterion as outlined in Table - 12 and Table - 13: OR
  5.b The relevant building areas meet good practice average and minimum point daylight illuminance criteria as outlined in Table - 14.

Note: The improvement in daylighting provision is calculated using the BREEAM Hea 01 Calculator tool based upon either the increase in glazing area, transmittance, illuminance or percentage daylight factor. Please refer to the Methodology section for calculation procedures.

Table - 12: Minimum values of average daylight factor required

Building or area type	Average daylight factor required by Latitude (degrees)						Minimum area (m^2) to comply			Other requirements
	≤ 40	40-45	45-50	50-55	55-60	≥ 60	1 Credit	2 Credits	3 Credits	
Education buildings										
Preschools, schools, further education-occupied spaces	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	EITHER (a) OR {(b) and (c)} in Table - 13
Higher education-occupied spaces	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	30%	45%	60%	
Multi-residential buildings										
Kitchen	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	EITHER (a) OR (c) in Table - 13
Living rooms, dining rooms, studies (including home office)	1.2%	1.3%	1.4%	1.5%	1.6%	1.6%	40%	60%	80%	
Non-residential or communal occupied spaces	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	
Retail buildings										
Sales areas	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	17.5%	25%	35%	Point daylight factors of 2% or more
Other occupied areas	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	EITHER (a) OR {(b) and (c)} in Table - 13

Building or area type	Average daylight factor required by Latitude (degrees)						Minimum area (m^2) to comply			Other requirements
	≤ 40	40-45	45-50	50-55	55-60	≥ 60	1 Credit	2 Credits	3 Credits	
Industrial, Office, and all Other building types										
Teaching, lecture and seminar spaces	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	EITHER (a) OR {(b) and (c)} in Table - 13
All occupied spaces, unless indicated in Relevant definitions	1.5%	1.7%	1.8%	2.0%	2.1%	2.2%	40%	60%	80%	EITHER (a) OR {(b) and (c)} in Table - 13

Table - 13: Daylighting uniformity criteria

Ref	Criteria
(a)	A uniformity ratio of at least 0.3 or a minimum point daylight factor of at least 0.3 times the relevant average daylight factor value in Table - 12. Spaces with glazed roofs, such as atria, must achieve a uniformity ratio of at least 0.7 or a minimum point daylight factor of at least 0.7 times the relevant average daylight factor value in Table - 12.
(b)	At least 80% of the room has a view of sky from desk or table top height (0.85m in multi-residential buildings, 0.7m in other buildings).
(c)	The room depth criterion $d/w + d/HW < 2/(1-RB)$ is satisfied. Where: d = room depth w = room width HW = window head height from floor level RB = average reflectance of surfaces in the rear half of the room Note: Table - 18 gives maximum room depths in metres for different room widths and window head heights of side-lit rooms .

Table - 14: Space type and illuminance requirements - both criteria (average illuminance and minimum point illuminance) should be met.

Area type	Minimum area to comply			Average daylight illuminance (averaged over entire space)	Minimum daylight illuminance at worst lit point
	1 credit	2 credits	3 credits		
Education buildings					
Pre-schools, schools, further education - occupied spaces	40%	60%	80%	At least 300 lux for 2000 hours per year or more	At least 90 lux for 2000 hours per year or more
Higher education - occupied spaces	30%	45%	60%		
Multi-residential buildings					
Kitchens	50%	75%	100%	At least 100 lux for 3450 hours per year or more	At least 30 lux for 3450 hours per year or more
Living rooms, dining rooms, studies (including home office)				At least 100 lux for 3450 hours per year or more	At least 30 lux for 3450 hours per year or more
Non-residential or communal occupied spaces	40%	60%	80%	At least 200 lux for 2650 hours per year or more	At least 60 lux for 2650 hours per year or more
Retail buildings					
Sales areas	17.5%	25%	35%	At least 200 lux point daylight illuminances for 2650 hours per year or more	
Other occupied areas	40%	60%	80%	At least 200 lux for 2650 hours per year or more	At least 60 lux for 2650 hours per year or more
Industrial and Office, and all Other building types					
Internal association or atrium area	40%	60%	80%	At least 300 lux for 2650 hours per year or more	At least 210 lux for 2650 hours per year or more

Area type	Minimum area to comply			Average daylight illuminance (averaged over entire space)	Minimum daylight illuminance at worst lit point
	1 credit	2 credits	3 credits		
Teaching, lecture and seminar spaces	40%	60%	80%	At least 300 lux for 2000 hours per year or more	At least 90 lux for 2000 hours per year or more
All occupied spaces, unless indicated in Relevant definitions	40%	60%	80%	At least 300 lux for 2000 hours per year or more	At least 90 lux for 2000 hours per year or more

Up to two credits - View out

6 Two credits where all positions (or 95% of the net floor area) within relevant building areas are within X metres of a window or permanent opening that provides an adequate view out, as outlined in Table - 15

7 One credit where 80% of the floor area space within relevant building areas are within X metres of a window or permanent opening that provides an adequate view out, as outlined in Table - 15.

8 In addition, where the building type criteria in Table - 16 are met, as applicable.

Table - 15: Window or opening size required as a percentage of surrounding wall area depending on the distance of the desk or work space to the window or opening

Distance (in m) from window to work space/desk (X)	Window/opening size (as % of surrounding wall area)
7m or less	20%
8m-11m	25%
11m-14m	30%
14m or more	35%

Table - 16: View out building specific requirements

Building type	View out requirements
Multi-residential buildings	**Self-contained flats - living rooms** **Sheltered housing - communal lounges, individual bedrooms and bedsits** Positions within relevant areas are to be within 5m of a wall which has a window or permanent opening providing an adequate view out. The window or opening must be ≥ 20% of the surrounding wall area.

One credit - Internal and external lighting levels, zoning and control

Internal lighting

9 All fluorescent and compact fluorescent lamps are fitted with high frequency ballasts.

10 Internal lighting in all relevant areas of the building is designed to provide an illuminance (lux) level appropriate to the tasks undertaken, accounting for building user concentration and comfort levels. This can be demonstrated through a lighting design strategy that provides illuminance levels in accordance with national best practice lighting guides (see Compliance notes).

11 For areas where computer screens are regularly used, confirmation is required that the lighting has been designed to limit the potential for glare in accordance with a numerical glare limit specified within national best practice lighting guides (see CN17).). These should include:
- 11.a Limits to the luminance of the luminaires to avoid screen reflections. (Manufacturers' data for the luminaires should be sought to confirm this.)
- 11.b For uplighting, the recommendations refer to the luminance of the lit ceiling rather than the luminaire; a design team calculation is usually required to demonstrate this.
- 11.c Recommendations for direct lighting, ceiling illuminance, and average wall illuminance.

External lighting

12 All external lighting located within the refurbishment or fit-out zone is designed to provide illuminance levels that enable users to perform outdoor visual tasks efficiently and accurately, especially during the night. To demonstrate this, external lighting provided is specified in accordance with EN 13201 series Road Lighting and EN 12464-2:2007 Light and lighting - Lighting of work places - Part 2: Outdoor work places.

Zoning and occupant control

13 Internal lighting is zoned to allow for occupant control (see Relevant definitions) in accordance with the criteria below for relevant areas present within the building:
- 13.a In office areas, zones of no more than four workplaces
- 13.b Workstations adjacent to windows or atria and other building areas separately zoned and controlled
- 13.c Seminar and lecture rooms: zoned for presentation and audience areas
- 13.d Library spaces: separate zoning of stacks, reading and counter areas
- 13.e Teaching space or demonstration area
- 13.f Whiteboard or display screen
- 13.g Auditoria: zoning of seating areas, circulation space and lectern area
- 13.h Dining, restaurant, café areas: separate zoning of servery and seating or dining areas
- 13.i Retail: separate zoning of display and counter areas
- 13.j Bar areas: separate zoning of bar and seating areas
- 13.k Day rooms, waiting areas: zoning of seating and activity areas and circulation space with controls accessible to staff.

14 Areas used for teaching, seminar or lecture purposes have lighting controls specified in accordance with the size and use of the space but a typical auditorium or lecture theatre with stepped seating and a formal lectern/demonstration/performance area would typically be expected to have lighting controls as follows:
- 14.a Full normal lighting (to allow for entry/exit, cleaning etc.)
- 14.b Demonstration area lighting off and audience area lighting reduced to a low level (for the purpose of line slide projection, but allowing enough light for the audience to take notes),
- 14.c All lighting off (for the projection of tone slides, colour slides, and for the purposes of visual demonstrations/performances)
- 14.d Separate localised lectern lighting.

15 For zoning rooms/spaces not listed above, the assessor can exercise an element of judgement when determining whether what is specified is appropriate for the space, given its end use and the aim and criteria of this BREEAM issue.

16 In addition the building type criteria in Table - 17 (where relevant) are met.

Table - 17: Internal and external lighting building specific requirements

Building type	Internal and external lighting requirements
Education buildings	Manual lighting controls are easily accessible for the teacher while teaching and on entering or leaving the teaching space.

Checklists and tables

Reflectance for maximum room depths and window head heights

The table below gives maximum room depths in metres for different room widths and window head heights of side-lit rooms.

Table - 18: Reflectance for maximum room depths and window head heights

	Reflectance (RB)					
	0.4		0.5		0.6	
Room width (m)	3.0	10.0	3.0	10.0	3.0	10.0
Window head height (m)						
2.5	4.5	6.7	5.4	8.0	6.8	10.0
3.0	5.0	7.7	6.0	9.2	7.5	11.5
3.5	5.4	8.6	6.5	10.4	8.1	13.0

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and Structure	Criteria 1 to 8 are applicable
CN2	Part 2: Core Services	This issue is not applicable
CN3	Part 3: Local Services	Criteria 9 to 16 are applicable Note: where there is no external lighting specified, criterion 12 is not applicable and is filtered out from the assessment.
CN4	Part 4: Interior Design	Criteria 1 to 8 are applicable Note: It is recognised that fit-out projects will have limited influence over fabric measures that can increase daylighting. Criterion 1 to 3 are applicable in order to assess the impact of changes to internal layout on daylighting and view out (e.g. location of partitions, use of glare control film on glazing, reflectance of finishes etc.) to recognise fit-out projects that optimise the percentage of spaces that benefit from daylighting and views out.
General		

Ref	Terms	Description
CN5	Historic buildings; lighting zoning and controls	In some cases an explicit requirement from the relevant historic buildings conservation authority (e.g. local authority conservation officer) may require the retention of heritage features which prevents zoning of lighting in accordance with criterion 13. In such cases, evidence should be provided from the conservation officer and measures should be considered to ensure that adequate control is provided for existing retained lighting zones and measures adopted for the provision of task lighting as relevant for the function type and as is feasible within the constraints as applied by the conservation officer.
CN6	Building location (choosing the most appropriate daylight factors)	The average daylight factor and uniformity criteria Table - 12 and Table - 13 For hot or sunny locations with predominantly clear skies, especially those at latitudes much less than 40 degrees, it is better to use the daylight illuminance criteria in Table - 14 instead. The daylight illuminance calculation should include the additional light available from clear and partly cloudy skies and reflected sunlight. In these locations, using the criteria in Table - 12 and Table - 13 may result in excessive solar heat gain.
Glare control		
CN7	Compliant forms of glare control - curtains as glare control	Compliant shading measures for meeting glare control criteria include: — Building integrated measures (e.g. low eaves) — Occupant controlled devices such as blinds (where transmittance value is less than 0.1 (10%) — Bioclimatic design — External shading or brise soleil. Glare control must provide shading from both high level summer and low level winter sun where relevant to the country of assessment (for example, latitudes of 40 degrees or more). Where using fixed systems, design studies can be used to demonstrate that sunlight is prevented from reaching building occupants during occupied hours. Curtains (where used without other forms of shading) do not meet the criteria for the glare control criteria, as they do not provide sufficient control to optimise daylight into the space. Furthermore, the use of curtains to control glare is likely to cause occupants to rely more on artificial lighting.
Daylighting		
CN8	National daylighting best practice guides	Please refer to the country specific reference sheet to find the appropriate daylighting best practice guides in the country of assessment. Where daylighting best practice guides are not outlined in the country specific reference sheet or where the design team wishes to use an alternative reference document, please use the Approved standards and weightings list to determine its acceptability. Where no appropriate reference document exists for a country, the design team should demonstrate compliance using the criteria in EITHER Table - 12 and Table - 13 OR Table - 14.

Ref	Terms	Description
CN9	Percentage of assessed area See criterion 3.	Where the criteria specify that a percentage of floor area must be adequately illuminated by daylight, this refers to the percentage of the total floor area of all the rooms that must be assessed, i.e. the compliant area. If for example, a development has six rooms that must be assessed, each 150 m^2 (total area 900 m^2) and 80% of this floor area must meet the criterion, then 720 m^2 must comply with the criterion; this is equal to 4.8 rooms. The number of rooms that must comply must always be rounded up; therefore in this example, five rooms must have an average daylight factor of 2% or more (plus meet the other criteria) to achieve the credit.
CN10	External obstructions	In calculating minimum and average daylight factors and daylight illuminances, external obstructions should be taken into account. For illuminance calculations, the reflectance of external obstructions should be taken as 0.2 unless on-site measurements of external reflectance have been made.
CN11	Dirt factors when calculating daylight	Daylight calculations should include a maintenance factor for dirt on the windows, as given in British Standard Code of Practice for daylighting, BS 8206 Part 2, appendix A1.3.
CN12	Borrowed light	For areas where borrowed light is used to demonstrate compliance with daylighting criteria, calculations or results from appropriate lighting design software must be provided to demonstrate that such areas meet the BREEAM criteria (if the light from these sources is required in order for the room to comply). Examples of borrowed light include: light shelves, clerestory glazing, sun pipes or internal translucent or transparent partitions (such as those using frosted glass).
CN13	Room depth criterion - rooms lit from two opposite sides	For rooms lit by windows on two opposite sides, the maximum room depth that can be satisfactorily illuminated by daylight is twice the limiting room depth (d) (measured from window wall to window wall; CIBSE Lighting Guide LG10 [1]. The reflectance of the imaginary internal wall should be taken as 1.
CN14	Uniformity with rooflights	The room depth criteria cannot be used where the lighting strategy relies on rooflights. In such areas either appropriate software has to be used to calculate the uniformity ratio or, in the case of a regular array of rooflights across the whole of the space, figure 2.36 (page 37) within CIBSE Lighting Guide LG10 can be used to determine the uniformity ratio.
CN15	Daylighting - uniformity ratio calculation	The uniformity ratio calculation, minimum point daylight factor and minimum daylight illuminance can exclude areas within 0.5m of walls. Areas within 0.5m are not regarded as part of the working plane for this purpose, although they are included in the average daylight factor and average daylight illuminance calculations.

Ref	Terms	Description
CN16	View of sky requirement See criterion 3.	To comply with the view of sky criteria (ref (b)) in Table - 13, at least 80% of the room that complies with the average daylight factor requirement must receive direct light from the sky, i.e. it is permissible for up to 20% of the room not to meet the view of sky requirement and still achieve a compliant room.
Internal and external lighting levels or, zoning and control		
CN17	National best practice lighting guides	Please refer to the country specific reference sheet to locate the appropriate best practice lighting guidance in the country of assessment, alternatively the minimum requirements as set out in the Approved standards and weightings list are covered by the proposed documents. Where appropriate lighting guides do not exist for a country, the design team should demonstrate compliance with the European standards EN 12464-1 Light and lighting - Lighting of workspaces, 2011 and EN 12464-2 Lighting of work places - Part 2: Outdoor work places, 2007. .
CN18	Occupancy/ workstation layout unknown	Where occupancy or workstation layout is not known, lighting control can be zoned on the basis of 40 m^2 grids, i.e. an assumption of one person or workspace per 10 m^2.
CN19	Small spaces	Buildings consisting entirely of small rooms or spaces (less than 40 m^2) which do not require any subdivision of lighting zones or control will meet the zoning criteria by default.
CN20	Zones of four workspaces	The limit of four workspaces is indicative of the required standard but is not a fixed requirement. Where there is justification for this to be increased to fit with the adopted lighting strategy, this may be accepted provided that the assessor is satisfied that the aim of this criterion is upheld, i.e. that there is suitable zoning or control of lighting to enable a reasonable degree of occupant control over lighting in their personal work area. The relevant design team member, e.g. lighting consultant, should set out how this is to be achieved in such an instance.
CN21	Lighting zoning and control - auditoria spaces	The controls specified will depend on the size and use of the space, but a typical auditorium or lecture theatre with stepped seating and a formal lectern/demonstration/performance area would typically be expected to have lighting controls as follows: 1. Full normal lighting (to allow for entry, exit, cleaning etc.) 2. Demonstration area lighting off and audience area lighting reduced to a low level (for the purpose of line slide projection, but allowing enough light for the audience to take notes) 3. All lighting off (for the projection of tone slides, colour slides, and for the purposes of visual demonstrations or performances) 4. Separate localised lectern lighting.
Building type specific		

Ref	Terms	Description
CN22	Education (Preschools) and acute special educational needs controls for children	Where child care or acute special educational needs spaces are included within the scope of the assessment, controls should be provided for the teacher or member of staff, i.e. it is not a necessity for the controls to be accessible to the children. Where nursery spaces are included within the scope of the assessment, controls should be provided for the member of staff, not the nursery school children.

Methodology

Calculation procedures

In order to demonstrate compliance with criteria 4 and 5 for an improvement in existing daylighting, for each space, the percentage increase in daylight (Pi) is calculated in one of the following ways:

Where only the window area or glass transmission will increase:

a. If window area has increased but all other aspects remain the same, Pi = ((increase in glass area)/(original glass area)) x100%.
b. If glass transmission has increased but all other aspects remain the same, Pi = ((increase in glass transmission)/(original glass transmission)) x100%.

Where many aspects will change (e.g. room size, a combination of reflectance and window size etc):

a. Calculate the average daylight factor (ADF) in the space 'before' and 'after'. Pi =((ADF after - ADF before)/ ADF before) x100%.
b. Calculate the average illuminance in the space that is exceeded for 2000 hours per year. Pi =((Average illuminance after - Average illuminance before)/ Average illuminance before) x100%.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
3 - 6	Daylighting calculations	Refer to generic evidence requirement above

Additional information

Relevant definitions

Adequate view out

BREEAM defines an adequate view out as a view of a landscape or buildings (rather than just the sky) at seated eye level (1.2m - 1.3m) within the relevant building areas and should ideally be through an external window. A view into an internal courtyard or atrium will comply provided the distance from the opening to the back wall of the courtyard or atrium is at least 10m (therefore allowing enough distance for the eyes to refocus). The view cannot be an internal view across the room, as this is likely to become obstructed by partitions, filing cabinets etc.

Average daylight factor

The average daylight factor is the average indoor illuminance (from daylight) on the working plane within a room, expressed as a percentage of the simultaneous outdoor illuminance on a horizontal plane under an unobstructed CIE Standard Overcast Sky.

Computer simulation

Software tools that can be used to model more complex room geometries for daylighting.

Refurbishment or Fit-out zone

For the purpose of this BREEAM issue the Refurbishment or Fit-out zone is defined as the area of the building undergoing refurbishment or fit-out for the BREEAM-assessed building, and the external site areas that fall within the scope of the new works.

Illuminance

The amount of light falling on a surface per unit area, measured in lux.

Occupied space

A room or space within the assessed building that is likely to be occupied for 30 minutes or more by a building user. Please note there is a specific, unrelated, definition of 'unoccupied' with reference to acoustic testing and measurement and this should not be confused with the definition used here.

Point daylight factor

A point daylight factor is the ratio between the illuminance (from daylight) at a specific point on the working plane within a room, expressed as a percentage of the illuminance received on an outdoor unobstructed horizontal plane. This is based on an assumed overcast sky, approximated by the 'CIE (Commission Internationale de l'Eclairage) overcast sky'.

The minimum point daylight factor is the lowest value of the daylight factor on the working plane at a point that is not within 0.5m of a wall. Similarly the minimum illuminance is calculated at the worst lit point on the working plane that is not within 0.5m of a wall. These points will usually be close to a rear corner of the room. Computer simulations are the most appropriate tools to allow for point daylight factors and illuminances to be calculated.

Relevant building areas:

Daylighting

For the purpose of BREEAM this is defined as areas within the building where good daylighting is considered to be of benefit to the building users (typically those areas occupied continuously for 30 minutes or more). This includes the following (where occupied continuously for 30 minutes or more) specifically stated because they are often omitted;

1. Sports hall exercise spaces
2. Laboratory areas unless the type of research that will be carried out requires strictly controlled environmental conditions, such as the exclusion of natural light at all times.
3. Self-contained flats
4. Kitchen and catering areas
5. General communal areas
6. Small offices (including those within multi-residential buildings)
7. Meeting rooms (including those within multi-residential buildings)
8. Leisure areas
9. Any area that may involve close up work.

However, this excludes the following (where present):

1. Media, arts production, SEN sensory spaces and other areas requiring strictly controlled acoustic or lighting conditions

Glare control

For glare control include areas of the building where lighting and resultant glare could be problematic for users, e.g. those areas that have been designed to contain or use workstations, projector screens etc. and sports halls. Spaces in the categories described above, for which daylight and view out are excluded, should not be assessed against the glare control criteria.

View out

BREEAM defines relevant building areas requiring a view out to include areas of the building where:

1. There are or will be workstations or benches or desks for building users.
2. Close work will be undertaken or visual aids will be used.
3. A view out is deemed to be of benefit to the building occupants, e.g. in spaces where occupants are likely to spend a significant amount of time.

Excluded areas for each of these might include:

1. Conference rooms, lecture theatres, sports halls, acute SEN and also any spaces where the exclusion or limitation of natural light is a functional requirement e.g. laboratories, media spaces, etc.

Internal and external lighting

Where no external light fittings are specified (either separate from or mounted on the external building façade or roof), the criteria relating to external lighting do not apply and the credit can be awarded on the basis of compliance with the internal lighting criteria. The following internal areas are excluded from the lighting zone requirements:

1. Media and arts production spaces
2. Sports facilities (exercise spaces only, including hydrotherapy and physiotherapy areas).

Lighting zoning

For rooms or spaces not listed within criterion 14, the assessor can exercise an element of judgement when determining whether the specification is appropriate for the space given its end use, and the aim and criteria of this BREEAM issue.

Separate zoning control

Light switches or controls for a particular area or zone of the building that can be accessed and operated by the individual(s) occupying that area or zone. Such controls will be located within, or within the vicinity of, the zone or area they control.

Staff areas

Areas of the building used mainly by staff (e.g. offices, meeting rooms, staff rooms).

Surrounding wall area

Surrounding wall area refers to the area (in m^2) of the internal wall on which the window or opening is located, including the area of the window or opening itself.

Uniformity

The uniformity is the ratio between the minimum illuminance (from daylight) on the working plane within a room (or minimum daylight factor) and the average illuminance (from daylight) on the same working plane (or average daylight factor).

View of sky and no-sky line

Areas of the working plane have a view of sky when they receive direct light from the sky, i.e. when the sky can be seen from working plane height. The no-sky line divides those areas of the working plane, which can receive direct skylight, from those that cannot.

Working plane

The working plane is the horizontal, vertical or inclined plane in which a visual task lies. The working plane is normally taken as 0.7m above the floor for offices and 0.85m for industry.

Other information

The following references provide information relating to this issue:

1. CIBSE Lighting Guide 10 Daylighting and window design.
2. BS 8206 Part 2. Code of practice for daylighting.
3. BRE Report BR 209 Site Layout Guide 'Site layout planning for daylight and sunlight: a guide to good practice'.

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[1] CIBSE Lighting Guide LG10 Daylighting and window design, 1999.

Hea 02 Indoor air quality

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
Building type dependent	No	Yes	Yes	Yes	Yes

Aim

To recognise and encourage a healthy internal environment through the specification and installation of appropriate ventilation, equipment and finishes.

Assessment criteria

This issue is split into two parts:

- Prerequisite - avoidance of asbestos
- Minimising sources of air pollution (4 credits)
- Adaptability - potential for natural ventilation (1 credit)

The following is required to demonstrate compliance:

Prerequisite

1 Materials containing asbestos are prohibited from being specified and used within the building.

Minimising sources of air pollution

One credit - Indoor air quality (IAQ) plan

2 An indoor air quality plan has been produced and implemented, with the objective of facilitating a process that leads to design, specification and installation decisions and actions that minimise indoor air pollution during the design, construction and occupation of the building. The indoor air quality plan must consider the following:
- 2.a Removal of contaminant sources
- 2.b Dilution and control of contaminant sources
- 2.c Procedures for pre-occupancy flush out
- 2.d Protection of Heating Ventilation and Air-Conditioning (HVAC) systems from sources of pollution during refurbishment or fit-out works e.g. dust
- 2.e Procedures for protecting the indoor air quality of areas outside of the refurbishment or fit-out zone that may be affected by the refurbishment or fit-out works
- 2.f Procedures for identifying and implementing third party testing and analysis required to ascertain that the contaminant sources have been removed effectively before occupancy
- 2.g Procedures for maintaining indoor air quality in use to be handed over to the occupant, e.g. maintenance and cleaning of the HVAC system, ductwork and filters.

One credit- Ventilation

Refurbishment and fit-out works include measures to minimise the concentration and recirculation of pollutants in the building as follows:

3 Provide fresh air into the building in accordance with the criteria of the relevant standard for ventilation.

4 Design ventilation pathways to minimise the build-up of air pollutants in the building, as follows:
- 4.a In air-conditioned and mixed mode buildings or spaces:
  - 4.a.i The building's air intakes and exhausts are over 10m apart and intakes are over 20m from sources of external pollution; OR
  - 4.a.ii The location of the building's air intakes and exhausts, in relation to each other and external sources of pollution, is designed in accordance with EN 13779:2007[1] Annex A2.
- 4.b In naturally ventilated buildings or spaces: openable windows or ventilators are over 10m from sources of external pollution.

5 Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in EN 13779:2007 Annex A3.

6 Areas of the building subject to large and unpredictable or variable occupancy patterns have carbon dioxide (CO_2) or air quality sensors specified and:
   6.a In mechanical ventilated buildings or spaces: sensor(s) are linked to the mechanical ventilation system and provide demand-controlled ventilation to the space.
   6.b In naturally ventilated buildings or spaces: sensors either have the ability to alert the building owner or manager when CO_2 levels exceed the recommended set point, or are linked to controls with the ability to adjust the quantity of fresh air, i.e. automatic opening windows or roof vents.

7 In countries where smoking within buildings is not prohibited by law, one of the following is specified:
   7.a A smoking ban covering all public and staff areas of the building is implemented, and 'No Smoking' signs are located in appropriate areas clearly visible to all occupants (i.e. common areas, offices and building entrances) OR
   7.b Where smoking is permitted in dedicated smoking rooms only and smoking is banned in all other areas with 'No Smoking' signs located in appropriate areas clearly visible to all occupants and where:
      7.b.i Ventilation rates in the dedicated smoking room are in accordance with national best practice standard(s) for ventilation
      7.b.ii A separate ventilation system(s) prevents recirculation within the room and the smoking room is separated from all other occupied areas by a lobby
      7.b.iii Air intakes/exhausts and/or openable windows/ventilators are positioned to minimise recirculation of smoke (see Criteria 4 and 5).

One credit - Volatile organic compound (VOC) emission levels (products)

8 All decorative paints and varnishes specified meet the criteria in Table - 19

One credit - Volatile organic compound (VOC) emission levels (post construction)

9 The formaldehyde concentration level is measured post construction (but pre-occupancy) and is found to be less than or equal to 100μg/averaged over 30 minutes (WHO guidelines for indoor air quality: Selected pollutants, 2010[2]).

10 The total volatile organic compound (TVOC) concentration level is measured post construction (but pre-occupancy) and found to be less than 300μg/over 8 hours.

11 Where VOC and formaldehyde levels are found to exceed the limits defined in criteria 9 and 10, the project team confirms the measures that have, or will be taken, in accordance with the IAQ plan, to reduce the levels to within these limits, including remeasurement.

12 The testing and measurement of the above pollutants are in accordance with the following standards where relevant:
   12.a ISO 16000-4:2011 Diffusive sampling of formaldehyde in air[3]
   12.b ISO 16000-6:2011 VOCs in air by active sampling[4]
   12.c EN ISO 16017-2:2003 VOCs - Indoor, ambient and workplace air by diffusive sampling[5]
   12.d ISO 16000-3:2011[6] Formaldehyde and other carbonyls in air by active sampling.

13 The measured concentration levels of formaldehyde (μg/m^3) and TVOC (μg/m^3) are reported, via the BREEAM Assessment Scoring and Reporting Tool.

Adaptability - Potential for natural ventilation

One credit (credit not applicable to prison buildings)

14 The building ventilation strategy is designed to be flexible and adaptable to potential building occupant needs and climatic scenarios. This can be demonstrated as follows:
   14.a Occupied spaces of the building are designed to be capable of providing fresh air entirely via a natural ventilation strategy. The following are methods deemed to satisfy this criterion dependent upon the complexity of the proposed system:.
      14.a.i The openable window area in each occupied space is equivalent to 5% of the gross internal floor area of that room/floor plate. For room/floor plates between 7m-15m depth, the openable window area must be on opposite sides and evenly distributed across the area to promote adequate cross-ventilation; OR

14.a.ii The design demonstrates that the natural ventilation strategy provides adequate cross flow of air to maintain the required thermal comfort conditions and ventilation rates.

14.b For fit-out projects , local services (Part 3 assessments) are designed to provide fresh air via a natural ventilation strategy.

15 The natural ventilation strategy is capable of providing at least two levels of user control on the supply of fresh air to the occupied space (see compliance note CN9 for further details).

Note: Any opening mechanisms must be easily accessible and provide adequate user control over air flow rates to avoid draughts. Relevant industry standards for ventilation can be used to define 'adequate levels of fresh air' sufficient for occupancy and internal air pollution loads relevant to the building type.

Note: Multi-residential buildings with self-contained flats and individual bedrooms must have a degree of openable window function. This does not need to provide two levels of user control (as required above), but must be occupant controlled.

Exemplary level criteria

Minimising sources of air pollution - volatile organic compound (VOC) emission levels (products)

The following outlines the exemplary level criteria to achieve innovation credits for this BREEAM issue:

One credit

16 Criterion 8 has been achieved.

17 All seven remaining product categories listed in Table - 19 meet the testing requirements and emission levels criteria for Volatile Organic Compound (VOC) emissions (listed in the table).

18 For products B – F listed in Table - 19, the formaldehyde emission levels have been measured and found to be less than or equal to 0.06mg/m^3 air in accordance with the approved testing standards in Table - 19.

Two credits

19 Criterion 8 has been achieved.

20 All seven remaining products categories listed in Table - 19 meet the testing requirements and emission levels criteria for Volatile Organic Compound (VOC) emissions (listed in the table).

21 For products B to F listed in Table - 19, the formaldehyde emission levels have been measured and found to be less than or equal to 0.01mg/ m^3 air, in accordance with the approved testing standards in Table - 19.

Checklists and tables

Table - 19: VOC criteria by-product type

Ref	Product	Requirements
A	Paints and varnishes	
	Performance requirements	VOC content limit
	Compliant performance standard	EU Directive 2004/42/CE ('Paints Directive')
	Compliant testing standard	EN ISO 11890-2:2013 – Paints and varnishes – Determination of VOC content, Part 2 – Gas Chromatographic method
	Manufacturer also to confirm	Paint to be fungal and algal resistant in wet areas e.g. bathrooms, kitchens, utility rooms

Ref	Product	Requirements
B	**Wood panels (including particle board, fibreboard including MDF, OSB, cement bonded particle board, plywood, solid wood panel and acoustic board)**	
	Option 1	
	Performance requirements	Formaldehyde E1 class
	Compliant performance standard	EN 13986:2004 Wood-based panels for use in construction - Characteristics evaluation of conformity and marking
	Compliant testing standard(s)	EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method
	Manufacturer also to confirm	The absence of prohibited wood preservatives or biocides.
	Option 2	
	Performance requirements	Formaldehyde level of 0.1 mg/m^3
	Compliant testing standard(s)	1. EN ISO 16000-9:2006 Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method. OR 2. Standard method for the testing and evaluation of volatile organic chemical emissions from indoor sources using environmental chambers, version 1.1 - Emission testing method for California Specification 01350, Californian Department for Public Health, 2010. Note: For either method the resultant emission or surface area obtained from the chamber test method must be extrapolated to predict what the emissions would be in a theoretical model room (as detailed in the standard) and this extrapolated emission rate compared with the required formaldehyde level of 0.1 mg/m^3.
	Manufacturer also to confirm	The absence of prohibited wood preservatives or biocides.

Ref	Product	Requirements
C	Timber structures (e.g. glue laminated timber)	
	Option 1	
	Performance requirements	Formaldehyde E1 Class
	Compliant performance standards	EN 14080:2005 Timber structures - Glues laminated timber - Requirements
	Compliant testing standards	EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method
	Option 2	
	Performance requirements	As category B Option 2.
	Compliant testing standards	As category B Option 2.
D	Wood flooring (e.g. parquet)	
	Option 1	
	Performance requirements	Formaldehyde E1 Class
	Compliant performance standard	EN 14342:2005+A1:2008 Wood flooring - Characteristics, evaluation of conformity and marking
	Compliant testing standards	EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method
	Option 2	
	Performance requirements	As category B Option 2.
	Compliant testing standards	As category B Option 2.

Ref	Product	Requirements
E	Resilient textile and laminated floor coverings (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring)	
	Option 1	
	Performance requirements	Option 1 - Formaldehyde E1 Class
	Compliant performance standard	EN 14041:2006 Resilient, textile and laminate floor coverings - Essential characteristics
	Compliant testing standards	EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method
	Option 2	
	Performance requirements	As category B Option 2.
	Compliant testing standards	As category B Option 2.
F	Suspended ceiling tiles	
	Option 1	
	Performance requirements	Formaldehyde E1 Class
	Compliant performance standard	EN 13964:2004+A1:2006 Suspended ceilings - Requirements and test methods
	Compliant testing standards	EN 717-1:2004 Wood-based panels – Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method
	Option 2	
	Performance requirements	As category B Option 2.
	Compliant testing standards	As category B Option 2.

Ref	Product	Requirements
G	**Flooring adhesives**	
	Performance requirements	Carcinogenic or sensitising volatile substances are substantially absent
	Compliant performance standard	EN 13999-1:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 1: General procedure
	Compliant testing standard	1. EN 13999-1:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 1: General procedure 2. EN 13999-2:2013 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 2: Determination of volatile organic compounds 3. EN 13999-3:2007+A1:2009 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 3: Determination of volatile aldehydes 4. EN 13999-4:2007+A1:2009 Adhesives - Short term method for measuring the emission properties of low-solvent or solvent-free adhesives after application - Part 4: Determination of volatile diisocyanates
H	**Wall coverings**	
	Performance requirements	— Vinyl chloride monomer (VCM) content — Formaldehyde level — Migration of heavy metals
	Compliant performance standard	1. EN 233:1999 Wall coverings in roll form - Specification for finished wallpapers, wall vinyls and plastic wall coverings 2. EN 234:1997 Wall coverings in roll form - Specification for wall coverings for subsequent decoration 3. EN 259-1:2001 Wall coverings in roll form - Heavy duty wall coverings - Part 1: Specifications
	Compliant testing standard	EN 12149:1998 – Wall coverings in roll form. Determination of migration of heavy metals and certain other elements, of vinyl chloride monomer and of formaldehyde release

Ref	Product	Requirements

Relevant standards - VOCs

All standards outlined inTable - 19 are standards recognised across Europe and internationally for VOC content and testing. In instances where a product is not assessed against the listed European or International standard, it is acceptable to use an alternative, nationally recognised, standard provided the following is met as a minimum:

1. The performance level requirements required by the alternative standard are equivalent to or better than those specified in the standards in Table - 19. For example, if a material containing formaldehyde has been added to the floor covering product as part of the production process, then the E1 emission measured for formaldehyde must be less than 0.124mg/m^3 (as required by EN 14041:2004).
2. Where an alternative standard omits evaluation of a particular material, it is only acceptable to use the alternative standard in instances where the product does not contain that particular material.

BREEAM assessors should seek confirmation from BRE Global prior to awarding credits for compliance with standards not listed in Table - 19 or previously approved as alternative nationally recognised standards.

Products with no formaldehyde containing materials

For some floor coverings and wood-based panels, the requirement for formaldehyde testing (referred to in the above criteria) does not apply to 'floor coverings to which no formaldehyde containing materials were added during production or post-production processing', or in the case of EN 13986:2004, wood-based panels.

As such, if a product manufacturer confirms that they have made a declaration of formaldehyde class E1 without testing (in writing or via a company product fact sheet or literature) then the product in question meets the BREEAM requirement relevant to formaldehyde testing. A declaration of E1 without testing is effectively confirmation from the manufacturer that formaldehyde emissions comply with the emission level requirements of the relevant standard(s) and therefore, evidence confirming the actual emission levels via testing will not be required by the assessor to demonstrate compliance with that particular requirement.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and Structure	Criterion 2 is applicable. Criteria 3 to 6 are applicable. Criteria 14 and 15 are applicable.
CN2	Part 2: Core Services	Criteria 2 to 6 are applicable. Criteria 14.a and 15 are applicable.
CN3	Part 3: Local Services	Criteria 23 are applicable. Criteria 45 are applicable where there are newly specified or existing local ventilation systems within the refurbishment zone. Criteria 6are applicable. Criteria 14.b and 15 are applicable.
CN4	Part 4: Interior Design	Criterion 2 is applicable. Criteria 813 are applicable. Criteria 16 to 21 are applicable.
General		

Ref	Terms	Description
CN5	National best practice standards/relevant industry standards	Please refer to the country specific reference sheet to locate the appropriate national best practice standards in the country of assessment. Alternatively, the minimum requirements as set out in the Approved standards and weightings list are covered by the proposed documents. Where appropriate standards do not exist for a country, the design team should demonstrate compliance with the British or European standards as listed in each relevant country reference sheet.
CN6	Furnishings and fittings (Part 4 certification only)	The scope of the VOC credits include furnishings and fittings. In addition to focusing on the key internal finishes and fittings integral to the building it also includes such items as partitions, shelving, desks and chairs and other finishes and fittings that contain products listed in Table - 19. Please note that BRE Global are investigating additional items that may be added to the list of furniture and fittings for the final technical manual.
CN7	Mechanically ventilated or cooled buildings See criteria 14 and 17.	Buildings that employ a mechanically ventilated or cooled strategy are still able to achieve this credit provided it can be demonstrated that the features required by the criteria can be made easily available to the building user, e.g. windows fixed shut for an air-conditioned strategy can be modified to be opening windows. The aim of the potential for natural ventilation criteria is to ensure that a building is capable of providing fresh air using a natural ventilation strategy. Where the building is predominantly naturally ventilated, but mechanical ventilation is necessary to boost ventilation during peak conditions, (i.e. either maximum occupancy, peak temperature conditions or both) due to the function or specific usage patterns of the building, the potential for the natural ventilation credit can still be awarded provided calculations or modelling demonstrate that the mechanical ventilation system will be required for ≤ 5% of the annual occupied hours in the occupied space(s) for the adopted building design or layout.
CN8	VOCs - number of products required to comply See criterion .	Where five or fewer products are specified within the building, the number of products that need to be assessed for the VOC criteria reduces proportionally as follows: — Where five products are present, four must comply — Where four products are present, three must comply — Where three products are present, two must comply — Where two or fewer products are present, all must comply.
CN9	Levels of ventilation See criterion 15.	The two levels of ventilation must be able to achieve the following: — Higher level: higher rates of ventilation achievable to remove short term odours or prevent summertime overheating — Lower level: adequate levels of draught-free fresh air to meet the need for good indoor air quality throughout the year, sufficient for the occupancy load and the internal pollution loads of the space.
CN10	Industrial areas: air pollution or ventilation rate requirements	For industrial buildings, the minimising sources of air pollution and adaptability (potential for natural ventilation) criteria and credits apply only to office areas and not to operational areas. If the building does not contain any office areas, this issue is not applicable.

Ref	Terms	Description
CN11	Measuring the distance See criteria 4.a and 4.b.	The distance requirement for air intakes and extracts does not necessarily mean the plan distance, but the three-dimensional distance around and over objects, e.g. on plan the air intakes may be less than 20m from a source of external pollution, but the intake may be on the roof of a 10-storey building and therefore over 20m from the source of pollution.
Building type specific		
CN12	Paints and varnishes in historic buildings	An exemption is provided for historic buildings where there is an explicit requirement from the Local Authority conservation officer or the national conservation body to use specific paints and varnishes that may contain a high level of VOCs In all cases procedures should be in place to ensure the building is flushed out for a sufficient period prior to occupation and ventilated adequately in order to reduce risks with VOCs in accordance with criteria 1 and 2.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Areas with a large and unpredictable occupancy

The following are examples of these types of space:

- Auditoria
- Gyms
- Retail stores or malls
- Cinemas
- Waiting rooms.

Where the assessed building does not have any areas deemed to be large with an unpredictable pattern of occupancy, the criterion does not apply.

Habitable or occupied room (Hea 02 Indoor air quality)

A room used for dwelling purposes or a room in a non-dwelling occupied by people (e.g. office, hotel bedroom, classroom) but which is not used solely as a kitchen, bathroom, cellar, utility room or for storing plant/equipment.[7]

Occupied spaces

See relevant definition provided in issue Hea 01 Visual comfort. The following building areas, where relevant to the building type, can be excluded from the definition of occupied spaces for the potential for natural ventilation criteria:

1. Ancillary building areas, e.g. WCs, corridors, stairwells, store rooms, plant rooms
2. Swimming or hydrotherapy pools
3. Catering and small staff kitchens

5. Laboratory or other areas where strictly controlled environmental conditions are a functional

requirement of the space

5. Laboratory or other areas where strictly controlled environmental conditions are a functional requirement of the space
6. Operational, shop floors or ancillary areas in industrial buildings

Occupied spaces requiring local exhaust ventilation, e.g. laboratories, workshops and food technology rooms, must still demonstrate that they meet the criteria for potential for natural ventilation (unless listed as an exempted area in this definition).

Openable window area

The openable window area is defined as the geometric free ventilation area created when a ventilation opening, e.g. window, is open to its normal operational fully designed extent for ventilation purposes (i.e. this excludes open areas created when reversible windows are opened for cleaning etc). It is not the glazed area of a façade or the glazed area of the part of the window that is openable (unless it opens fully).

Sources of external pollution

This includes but is not limited to the following:

1. Highways and the main access roads on the assessed site
2. Car parks, delivery areas and vehicle waiting bays
3. Other building exhausts, including from building services plant industrial or agricultural processes

Service and access roads with restricted and infrequent access (for example roads used only for waste collection) are unlikely to represent a significant source of external pollution. These roads can therefore be excluded from the criteria of this issue. This does not include vehicle pick-up or drop-off or waiting bays.

Volatile organic compound (VOC)

Any organic liquid or solid that evaporates spontaneously at the prevailing temperature and pressure of the atmosphere with which it is in contact (Source: EN ISO 11890).

Other information

Indoor air quality and measurement

The testing and measurement of pollutants must be in accordance with the relevant standards (as listed in the Hea 02 Indoor air quality table). Sample measurements should normally be taken in representative habitable or occupiable rooms, so not every room in a building would need to be sampled (see below for examples of representative room types). For example, in an office, one sample in a cellular or single occupancy office should suffice to assess the VOC concentration of the air for that type of habitable space in the building (assuming the other cellular offices have the same specification). In larger rooms, such as open plan office areas, further sampling locations should be used to understand the homogeneity of the atmosphere. Depending upon the performance of the measurement method in terms of repeatability and the required level of confidence in the value obtained, replicate samples may be taken at one or more sampling locations.

Prior to measurements being taken, the ventilation and heating systems should be operating for a period of time to ensure the relevant spaces in the building reach equilibrium in terms of their internal environmental conditions. Typically this may take between 12 and 24 hours.

Examples of representative room types include: naturally ventilated carpeted office, mechanically ventilated vinyl floored meeting room, workshop, living room or bedroom. Rooms that are not habitable or occupiable may, for example, include toilets, store rooms, plant rooms, stairways or corridors.

In accordance with the criteria, where levels are found to exceed the defined limits, the credit can only be claimed where the project team confirms the measures that have, or will be undertaken in accordance with the IAQ plan, to reduce the TVOC and formaldehyde levels to within the required limits.

This information is provided to assist project teams and BREEAM assessors on the appropriate scope of IAQ testing; therefore it is guidance only and not a requirement of complying with BREEAM. The testing regime should be determined based on the advice of the appropriate person appointed to conduct the testing, in order to determine and report representative values of indoor air quality for the building.

There are a number of publications available on the issue of measuring and improving the indoor air quality in buildings including BR 450, A protocol for the assessment of indoor air quality in homes and office buildings, Crump, Raw, Upton, Scivyer, Hunter, Hartless. BRE (2002).

Volatile organic compounds

VOCs are emitted by a wide array of products numbering in the thousands. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings, glues and adhesives, urea-formaldehyde foam insulation (UFFI), pressed wood products (hardwood plywood wall panelling, particleboard, fibreboard) and furniture made with these pressed wood products.

'No' or 'low' VOC paints are available from most standard mainstream paint manufacturers. The emissions of VOCs from paints and varnishes are regulated by the Directive 2004/42/CE. Products containing high organic solvent content should also be avoided (EU VOC Solvent Directive 1999/13/EC).

Exposure risk assessment of any possible release of chemicals from manufactured products and their possible impact on health and the environment generally, is an important requirement of European regulations. The possible impact of a building product on indoor air quality is included in the European Construction Products Directive, 89/106/EEC. The amended Directive, 93/68/EEC provided the criteria for CE Marking of products.

Products to be fitted in buildings should not contain any substances regulated by the Dangerous Substances Directive 2004/42/CE, which could cause harm to people by inhalation or contact. Materials containing heavy metals (e.g. antimony, barium, cadmium, lead and mercury) and other toxic elements (e.g. arsenic, chromium and selenium) or regulated biocides (e.g. pentachlorophenol) should be avoided.

Various labelling schemes identify products that have been tested and shown to be low emitting and these have been summarised in various publications including:

BRE Digest 464 (the standards outlined in Table - 19 however, are the only standards recognised by BREEAM for the purposes of assessing this issue.)

ECA (European Collaborative Action, Urban Air, Indoor Environment and Human Exposure) (2005): Harmonisation of indoor material emissions labelling systems in the EU, Inventory of existing schemes[8].

ECA (European Collaborative Action, Urban Air, Indoor Environment and Human Exposure) (2012): Harmonisation framework for indoor material labelling schemes in the EU[9].

Dangerous substances are defined in the Dangerous Substances Directive (67/548/EEC)

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[1] EN 13779:2007 Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems
[2] WHO guidelines for indoor air quality:selected pollutants, World Health Organisation, 2010
[3] ISO 16000-4: 2011 Indoor air - Part 4: Determination of formaldehyde -- Diffusive sampling method
[4] ISO 16000-6: 2011 Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS/FID
[5] EN ISO 16017-2:2003, Indoor, ambient and workplace air. Sampling and analysis of volatile organic compounds by sorbent tube or thermal desorption or capillary gas chromatography. Diffusive sampling
[6] ISO 16000-3: 2011 Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds - Active sampling method
[7] Approved Document F, Means of Ventilation, HM Government, 2010
[8] ECA (European Collaborative Action, Urban Air, Indoor Environment and Human Exposure) (2005): Harmonisation of indoor material emissions labelling systems in the EU, Inventory of existing schemes., Luxembourg: Publications Office of the European Union. Report No. 24, EUR 21891 EN.
[9] ECA (European Collaborative Action, Urban Air, Indoor Environment and Human Exposure) (2012): Harmonisation framework for indoor material labelling schemes in the EU. Luxembourg: Publications Office of the European Union. Report No. 27, EUR 25276 EN

Hea 03 Safe containment in laboratories

Number of credits available	Minimum standards	Applicability			
Building type dependent	No	Part 1	Part 2	Part 3	Part 4
		No	Yes	Yes	Yes

Aim

To recognise and encourage a healthy internal environment through the safe containment and removal of pollutants.

Assessment criteria

The following is required to demonstrate compliance for:

One credit - Laboratory containment devices and containment areas

An objective risk assessment of the proposed or existing laboratory facilities has been carried out prior to completion of the design to ensure potential risks are considered in the design or refurbishment of the laboratory.

1 Where containment devices are specified, their manufacture and installation is carried out in accordance with national best practice standards for safety and performance requirements in laboratory containment devices or are manufactured and installed in accordance with the following standards: :
  - 1.a General purpose fume cupboards: EN 14175 Parts 1-7 (as appropriate)[1]
  - 1.b Recirculatory filtration fume cupboards:
  - 1.c Microbiological safety cabinets: EN 12469:2000[2] (for manufacture)
  - 1.d Clean air hoods, glove boxes, isolators and mini-environments:EN ISO 14644-7:2004[3]
  - 1.e Articulated extension arms: PD CEN/TR 16589[4]

2 Or, for Schools, Colleges, University and Further Education buildings with laboratories and fume cupboards
  - 2.a Where laboratory containment devices that are ducted to discharge externally are specified, the guidance in the National Annex of EN 14175-2 must be followed to ensure an appropriate discharge velocity is achieved.

3 Where laboratory containment devices that are ducted to discharge externally are specified, the guidance in the National Annex of EN 14175-2 must be followed to ensure an appropriate discharge velocity is achieved.

One credit - Buildings with containment level 2 and 3 laboratory facilities

4 Where containment level 2 and 3 laboratory facilities are specified or present they must meet best practice safety and performance criteria and objectives. This is demonstrated as follows:
  - a. Criterion has been achieved.
  - b. Ventilation systems comply with national best practice guidance. Where there are no national best practice guidance, it shall follow the best practice guidance set out in 'DRAFT HSE Biological Agents and Genetically Modified Organisms (Contained Use) Regulations 2010'[5] in relation to ventilation systems.
  - c. Filters for all areas designated as containment level 2 and 3 are located outside the main laboratory space for ease of cleaning or replacement and the filters are easily accessible by maintenance staff or technicians.

5 The design team demonstrate that the individual fume cupboard location and stack heights have been considered in accordance with national best practice guidance. Where national best practice guidelines do not exist then the stack height shall be calculated following the HMIP Technical Guidance Note (Dispersion) D1[6].

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Not applicable
CN2	Part 2: Core services	All criteria are applicable
CN3	Part 3: Local services	All criteria are applicable
CN4	Part 4: Interior design	All criteria are applicable
General		
CN5	National best practice standards / relevant industry standards	Please refer to the country specific reference sheet to locate the appropriate national best practice standards in the country of assessment. Alternatively, the minimum requirements as set out in the Approved standards and weightings list are covered by the proposed documents. Where appropriate standards do not exist for a country, the design team should demonstrate compliance with the British or European standards as listed in each relevant country reference sheet.
CN6	Building contains no laboratory containment devices	Please note that the laboratory and containment device criteria and credits only apply where laboratory space, fume cupboards or other containment devices are present within the assessed building.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Fume cupboard or safety cabinet

Scientific equipment designed to limit a person's exposure to hazardous fumes or biological material. Air is drawn through the enclosure of the cupboard conducting the contaminated air away from the experimental area and those using the equipment.

Risk assessment

For the purpose of the relevant laboratory criteria in this issue, a risk assessment is a systematic consideration of any activity in which there is a hazard, followed by decisions on the substances, equipment and procedures used and on the restrictions and precautions needed to make the risk acceptably low. Below is a list of useful resources:

1. ISO 15189:2012, Medical laboratories - requirements for quality and competence
2. CWA 15793:2008 (Management system for laboratory biosafety and biosecurity)

Other information

EN 14175 Fume cupboard discharge velocity: Part 2 states that the discharge velocity from fume cupboard extracts should be at least 7m/s but that a figure of 10m/s is preferable to ensure that the discharge will not be trapped in the aerodynamic wake of the stack. Higher discharge velocities may be required, especially in windy locations, but higher rates may cause noise problems.

Compliance in the EU would be demonstrated by meeting the following directives depending on the type of laboratory:

- EC directives 2000/54/EC
- Directive 98/81/EC and
- Directive 2005/83/EC

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[1]EN 14175-1:2003 Fume Cupboards, Vocabulary
EN 14175-2:2003 Fume Cupboards, Safety and performance requirements
EN 14175-3:2003 Fume Cupboards, Type test methods
EN 14175-4:2004 Fume Cupboards, on-site test methods
DD CEN/TS 14175-5:2006 Fume Cupboards, Recommendations for installation and maintenance
EN 14175-6:2006 Fume Cupboards, Variable air volume fume cupboards
EN 14175-7:2012 Fume Cupboards, Fume cupboards for high heat and acidic load

[2]EN 12469:2000 Biotechnology. Performance criteria for microbiological safety cabinets, BSi.
[3]EN ISO 14644-7:2004 Clean rooms and associated controlled environments. Separative devices (clean air hoods, gloveboxes, isolators and mini-environments)
[4]PD CEN/TR 16589 Laboratory installations - Capture devices with articulated extract arm
[5]The Biological Agents and Genetically Modified Organisms (Contained Use) Regulations 2010, HSE.
[6]Guidelines on Discharge Stack Heights for Polluting Emissions, HMIP Technical Guidance Note (Dispersion) D1, 1993.

Hea 04 Thermal comfort

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
3	No	Yes	Yes	Yes	Yes

Aim

To ensure that appropriate thermal comfort levels are achieved through design, and controls are selected to maintain a thermally comfortable environment for occupants within the building.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Thermal modelling

1 Thermal modelling (or an analytical measurement/evaluation of the thermal comfort levels of the building) has been carried out using the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices in accordance with ISO 7730:2005[1] taking full account of seasonal variations.

2 Local thermal comfort criteria have been used to determine the level of thermal comfort in the building, in particular internal winter and summer temperature ranges will be in line with the recommended comfort criteria within ISO 7730:2005, with no areas falling within the levels defined as representing local dissatisfaction.

3 Thermal comfort levels in occupied spaces meet the Category B requirements set out in Table A.1 of Annex A of ISO 7730:2005.

4 Where undertaking a Part 4 assessment a competent person (e.g. accredited building services engineer) must assess the suitability of existing building services and controls to identify any changes that may be required as a result of fit-out works (e.g. as a result of changes to internal layout, occupant density, additional equipment that may increase cooling loads etc.).

5 For air-conditioned buildings, the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool.

One credit - Adaptability - for a projected climate change scenario

6 Criteria 1 to 4 are achieved.

7 The thermal modelling demonstrates that the relevant requirements set out in criterion 3 are achieved for a projected climate change environment (see Relevant definitions).

8 Where thermal comfort criteria are not met for the projected climate change environment, the project team demonstrates how the building has been adapted, or designed to be easily adapted in the future using passive design solutions in order to subsequently meet the requirements under criterion 7.

9 For air-conditioned buildings, the PMV and PPD indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool.

One credit - Thermal zoning and controls

10 Criteria 1 to 4 are achieved.

11 The thermal modelling analysis (undertaken for compliance with criteria1 to 4) has informed the temperature control strategy for the building and its users.

12 The strategy for proposed heating or cooling systems demonstrates that it has addressed the following:
- 12.a Zones within the building and how the building services could efficiently and appropriately heat or cool these areas. For example consider the different requirements for the central core of a building compared with the external perimeter adjacent to the windows.

12.b Where specified, any new local cooling or heating services (or changes to existing services) are designed to ensure they do not conflict with core services (e.g. conflicts between two separate cooling systems, conflicts between core heating and locally provided cooling systems).

12.c The degree of occupant control required for these zones, based on discussions with the end user (or alternatively building type or use specific design guidance, case studies, feedback) considers:

- 12.c.i User knowledge of building services
- 12.c.ii Occupancy type, patterns and room functions (and therefore appropriate level of control required)
- 12.c.iii How the user is likely to operate or interact with the system(s), e.g. are they likely to open windows, access thermostatic radiator valves (TRV) on radiators, change air-conditioning settings etc.
- 12.c.iv The user expectations (this may differ in the summer and winter) and degree of individual control (i.e. obtaining the balance between occupant preferences, for example some occupants like fresh air and others dislike drafts).

12.d How the proposed systems will interact with each other (where there is more than one system) and how this may affect the thermal comfort of the building occupants.

12.e The need or otherwise for an accessible building user actuated manual override for any automatic systems.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Criteria 1 to 9 are applicable.
CN2	Part 2: Core services	All assessment criteria are applicable.
CN3	Part 3: Local services	Criteria 1 to 5 are applicable. Criteria 11 to 12 are applicable.
CN4	Part 4: Interior design	Criterion 4 only.
General		
CN5	Typical occupancy and use patterns	If it is not possible to confirm the number of building occupants using the building, e.g. speculative developments, then the default occupancy rates given in Tra 04 Maximum car parking capacity - Table - 38: can be used to determine a default number of users. Where the typical use patterns are also unknown, Tra 01 Sustainable transport solutions - Table - 36: can be used to determine the typical opening hours of different building types. The design team need to justify or validate the occupancy number and use patterns applied in the thermal model.

Ref	Terms	Description
CN6	Alternative to criterion 3.	In some cases it may be more straightforward to demonstrate compliance with the Category B design criteria in Table A.5 in Annex A of ISO 7730:2005. BREEAM considers this an appropriate equivalent to Table A.1, however, the example design criteria included in Table A.5 must be applicable to the building/space type and activity levels for the project. Criterion 4 still requires PMV and PPD to be reported and Annex D of ISO 7730:2005 includes the code of a BASIC programme that converts these design parameters into PMV and PPD. By using this programme it is possible to obtain the PMV and PPD figures and show direct compliance with Table A.1.
CN7	National/local alternative to ISO standard	It is possible to use a national/local equivalent to ISO 7730:2005, however this must be approved by BRE Global. The Approved standards and weightings list can be used to check for previously approved standards or to propose a new national/local standard.
CN8	Buildings with less complex heating or cooling systems See criterion 12.	For buildings with less complex heating or cooling systems the thermal comfort strategy need only comply with criteria 12.a and 12.b. Compliance can be demonstrated where zoning allows separate occupant control (within the occupied space) of each perimeter area (i.e. within 7m of each external wall) and the central zone (i.e. over 7m from the external walls). For example, adequate TRVs (thermostatic radiator valves) placed in zones around the building perimeter, and the provision of local occupant controls to internal areas, such as fan coil units. Note: The distance requirement for smaller buildings is approximate; however, the assessor must use sound judgement considering fully the aims of this issue, before accepting solutions that do not strictly meet the above criteria.
CN9	Meeting Criterion 3 in Historic Buildings	In historic buildings, the thermal comfort requirements must still be in accordance with criteria 1-5 in order to demonstrate compliance), except where alternative performance standards are required by a local or national conservation body or authority. Heating systems should be modelled for continuous heating rather than intermittent.
Building type specific		
CN10	Industrial Industrial unit with no office space	Where an industrial unit contains no office space and only an operational or storage area, this BREEAM issue does not apply.
CN11	Education: Occupant controls See criterion 12.	In this issue, occupant controls are intended to be for staff use only.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
10, 11, 12	Thermal comfort study	Refer to generic evidence requirement above

Relevant definitions

Clinical areas

Refer to BREEAM issue Hea 01 Visual comfort

Modifications to the internal layout

Internal layout modifications involve the placement and in some instances movement of floor to ceiling partitions

Occupied space

Refer to Hea 01 Visual comfort, however for the purpose of BREEAM issue Hea 04 the definition excludes the following;

1. Atria or concourses
2. Entrance halls or reception areas
3. Ancillary space e.g. circulation areas, storerooms and plant rooms.

Passive design

Passive design uses layout, fabric and form to reduce or remove mechanical cooling, heating, ventilation and lighting demand. Examples of passive design include optimising spatial planning and orientation to control solar gains and maximise daylighting, manipulating the building form and fabric to facilitate natural ventilation strategies and making effective use of thermal mass to help reduce peak internal temperatures.

Predicted mean vote (PMV)

The PMV is an index that predicts the mean votes of a large group of persons on the seven-point thermal sensation scale based on the heat balance of the human body. Thermal balance is obtained when the internal heat production in the body is equal to the loss of heat to the environment. See Other information for the seven-point thermal sensation scale.

Predicted percentage dissatisfied (PPD)

The PPD is an index that establishes a quantitative prediction of the percentage of thermally dissatisfied people who feel too cool or too warm. For the purposes of ISO 7730, thermally dissatisfied people are those who will feel hot, warm, cool or cold. See the seven-point thermal sensation scale in Other information.

Projected climate change environment

Dynamic thermal simulation software packages currently provide the facility for building designs to be assessed under external climatic conditions specific to geographic location. Industry standard weather data should be sought from an appropriate local or national best practice standard in the form of Test Reference Years (TRYs) and Design Summer Years (DSYs). Reference is provided in CIBSE guide A, which is internationally recognised.

This weather data typically used enables thermal analysis of building designs under current climatic conditions, yet no account is normally taken of the projected variations in weather data that will occur during the building's life cycle as a result of climate change.

To demonstrate compliance, weather data should be used based upon a projected climate change scenario. This should be sought from a recognised local or national best practice standard or organisation. Verification should be sought from BRE Global prior to using any such standards in an assessment.

Separate occupant control

Responsive heating or cooling controls for a particular area or zone of the building that can be accessed and operated by the individual(s) occupying that area or zone. Such controls will be located within, or within the vicinity of, the zone or area they control.

Thermal comfort

In EN ISO 7730:2005: Ergonomics of the thermal environment. Analytical determination and interpretation of thermal comfort, thermal comfort is defined using the calculation of PMV and PPD indices and local thermal comfort criteria and is 'that condition of mind which expresses satisfaction with the thermal environment.' The term 'thermal comfort' describes a person's psychological state of mind and is usually referred to in terms of whether someone is feeling too hot or too cold. Thermal comfort is difficult to define because it needs to account for a range of environmental and personal factors in order to establish what makes people feel comfortable. The purpose of this issue is to encourage appropriate and robust consideration of thermal comfort issues and specification of appropriate occupant controls to ensure both maximum flexibility of the space and thermal comfort for the majority of building occupants.

Thermal dynamic analysis

Thermal comfort analysis tools can be subdivided into a number of methods of increasing complexity. The most complex of these and the one that provides greatest confidence in results is the full dynamic model. This type of model enables annual heating or cooling loads, overheating risks and control strategies to be assessed.

Other information

Projected climate change weather data

A range of alternative probabilistic weather data produced based upon future climate change scenarios using data from the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report. This weather data should be used to evaluate the impact of varying climate change scenarios for the country to influence building design performance for the building throughout its life cycle. Projected climate change weather data should be should be sourced in TRYs and DSYs and according to three projected time periods; 2030s, 2050s and 2080s.

While not suitable for International, reference can be made to the UK PROMETHEUS project at Exeter University which produced a number of future weather files specific to different locations across the UK, created using the UKCP09 weather generator. Weather files produced under the PROMETHEUS project are available at the following location:

http://emps.exeter.ac.uk/research/energy-environment/cee/projects/prometheus/.

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[1] ISO 7730, Ergonomics of the thermal environment - analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

Hea 05 Acoustic performance

Number of credits available	Minimum standards	Applicability			
4 (building type dependent)	None	Part 1	Part 2	Part 3	Part 4
		Yes	Yes	Yes	Yes

Aim

To ensure the building's acoustic performance including sound insulation meet the appropriate standards for its purpose.

Assessment criteria

This issue is split into two parts:

- Prerequisite
- Acoustic performance standards (Up to 4 credits).

The following is required to demonstrate compliance for:

Prerequisite

1 A suitably qualified acoustician (see Relevant definitions) is appointed by the client at the appropriate stage in the procurement process (but no later than completion of outline design) to provide early design advice on:
   1.a External sources of noise impacting the chosen site
   1.b Site layout and zoning of the building for good acoustics
   1.c Acoustic requirements for users with special hearing and communication needs
   1.d Acoustic treatment of different zones and façades.

Acoustic performance standards for all building types except Multi-residential

One credit - indoor ambient noise and sound insulation

2 All unoccupied spaces comply with the indoor ambient noise level as detailed in the more rigorous of criteria 2.a or 2.b:
   2.a Indoor ambient noise level targets within national Building Regulations or other appropriate good practice standards
   2.b Where national Building Regulations or good practice standards do not exist for the building type or do not provide indoor ambient noise targets, the indoor ambient noise levels comply with 'good practice' criteria levels outlined in Table - 20

3 A suitably qualified acoustician carries out ambient noise measurements to ensure that the relevant spaces achieve the required levels. Where the measurements identify that spaces do not meet the standards, remedial works are carried out and the measurements repeated to confirm that the levels are achieved prior to handover and occupation.

4 The sound insulation between acoustically sensitive rooms and other occupied areas comply with the privacy index, as detailed in the more rigorous of criteria 4.a or 4.b:
   4.a Sound insulation between acoustically sensitive rooms and other occupied areas comply with targets within national regulations or other appropriate good practice standards
   4.b Where relevant national regulations or good practice standards do not exist for the building type or do not provide sound insulation performance targets, the sound insulation between acoustically sensitive rooms and other occupied areas complies with the following privacy index:
   $Dw + L_{AeqT} > 75$
   Where privacy is viewed to be critical by the client and/or design team (e.g. doctors consulting room, consulting room within a bank) or where the room is adjacent to noisy space such as a music room the area should comply with an enhanced privacy index:
   $Dw + L_{AeqT} > 85$
   - Dw is the weighted sound level difference between the two spaces
   - L_{AeqT} is the measured indoor ambient noise level in the acoustically sensitive room (for the purposes of awarding design stage credits, the design ambient noise level can be used).

   The source and receive room sound pressure levels from which Dw is measured in accordance with (EN) ISO 140-

4:1998 and rated in accordance with (EN) ISO 717-1:1996. Measurements must be based on finished but unfurnished rooms, accounting for, and to include the effect of, any carpets and acoustically absorbent ceilings specified.

One credit - reverberation times

5 Rooms/areas used for speech (including meeting rooms and rooms for public speaking) or rooms used for music performance and rehearsal, achieve reverberation times as detailed in the more rigorous of 6(a) or 6(b) & 6(c):
- 5.a Demonstrate that the reverberation time or equivalent absorption area for relevant spaces complies with targets within relevant national regulations or other appropriate good practice standards
- 5.b Where relevant national regulations or good practice standards do not require the control of reverberation time, achieve reverberation times compliant with Table - 21
- 5.c In addition, if relevant to assessed building, all areas used for teaching, training and educational purposes achieve reverberation times compliant with Table - 22

Up to four credits - Acoustic performance standards for Multi-residential

6 The building meets the acoustic performance standards and testing requirements as detailed in the more rigorous of EITHER
- 6.a Airborne and impact sound insulation values comply with the performance improvement standards, as compared to the relevant national regulations outlined in Table - 23
- 6.b Airborne and impact sound insulation levels comply with the performance standards outlined in Table - 24 unless otherwise stated within these criteria.

7 A programme of pre-completion testing is carried out by a compliant test body EITHER:
- 7.a Based on the normal programme of testing described in the relevant national regulations for every group or sub-group of rooms for residential purposes; this must demonstrate that the performance standards detailed within this issue are achieved OR
- 7.b Where there are no relevant national regulations in place, or they require laboratory measurements to demonstrate compliance, the programme of on-site pre-completion testing must be carried out based on the 'Frequency of testing required' guidance (see Calculation procedures) for every group or sub-group of rooms.

8 The number of credits awarded will depend on improvement to the national regulations determined according to Table - 23 or Table - 24. Where commercial space is below the residential space, only airborne sound insulation tests shall be required.

Checklists and tables

Table - 20: A selection of good practice indoor ambient noise level targets in unoccupied spaces

Function of area	Indoor ambient noise level*
General spaces (staffrooms, restrooms)	≤ 40 dB $L_{Aeq\,T}$
Single occupancy offices	≤ 40 dB $L_{Aeq\,T}$
Multiple occupancy offices	40-50 dB $L_{Aeq\,T}$
Meeting rooms	35-40 dB $L_{Aeq\,T}$
Receptions	40-50 dB $L_{Aeq\,T}$
Spaces designed for speech e.g. seminar/lecture rooms	≤ 35 dB $L_{Aeq\,T}$
Concert hall/theatre/auditoria	≤ 30 dB $L_{Aeq\,T}$

Function of area	Indoor ambient noise level*
Informal café/canteen areas	≤ 50 dB $L_{\mathrm{Aeq}\,T}$
Catering kitchens	≤ 50 dB $L_{\mathrm{Aeq}\,T}$
Restaurant areas	40-55 dB $L_{\mathrm{Aeq}\,T}$
Bars	40-45 dB $L_{\mathrm{Aeq}\,T}$
Retail areas	50-55 dB $L_{\mathrm{Aeq}\,T}$
Manual workshops	≤ 55 dB $L_{\mathrm{Aeq}\,T}$
Sound recording studios	≤ 30 dB $L_{\mathrm{Aeq}\,T}$
Laboratories	≤ 40 dB $L_{\mathrm{Aeq}\,T}$
Sports halls/swimming pools	≤ 55 dB $L_{\mathrm{Aeq}\,T}$
Library areas	40-50 dB $L_{\mathrm{Aeq}\,T}$
* Where ranges of noise levels are specified and privacy is not deemed by the final occupier to be an issue, it is acceptable to disregard the lower limit of the range and consider the noise level criteria to be lower than or equal to the upper limit of the range[1].	

Table - 21: Guide to reverberation time, T, at 500 Hz in unoccupied rooms for speech and music

Room volume m^3	Reverberation time T* s	
	Speech	Music
50	0.4	1.0
100	0.5	1.1
200	0.6	1.2
500	0.7	1.3
1000	0.9	1.5
2000	1.0	1.6
*Where the reverberation times stated above or in the referenced documents are not appropriate for the type of space/building assessed, the acoustician must confirm why this is the case. In addition the acoustician must set alternative appropriate reverberation times at the design stage and provide these to demonstrate compliance.		

Table - 22: Performance standards for reverberation in teaching and study spaces - mid-frequency reverberation time, Tmf, in finished but unoccupied and unfurnished rooms

Type of room (receiving room)	Tmf (seconds)*
Open plan Teaching areas Resource areas	 <0.8 <1.0
Lecture rooms Small (fewer than 50 people) Large (more than 50 people)	 <0.8 <1.0
Recording studio	0.6-1.2
Control room for recording	<0.5
Libraries	<1.0
Audio-visual, video conference rooms	<0.8
*Tmf is the arithmetic average of the reverberation times in the 500 Hz, 1 kHz and 2 kHz octave bands[2]	

Table - 23: Airborne and impact sound insulation performance improvement standards for national legislation or standard

Credits	Credits awarded according to improvement over national legislation, standard or other defined baseline	
	Airborne sound insulation dB	Impact sound insulation dB
Individual bedrooms & self-contained dwellings		
1	insulation values are at least 3dB higher	insulation values are at least 3dB lower*
3	insulation values are at least 5dB higher	insulation values are at least 5dB lower*
4	insulation values are at least 8dB higher	insulation values are at least 8dB lower*
*The index used to express impact sound insulation is usually based on the level of transmitted impact sound, such that a lower measured value indicates greater resistance to impact sound transmission. If the converse for the locally defined national index is true, the credit award will be based on the same performance increase as detailed for the airborne sound insulation and an accompanying statement from a SQA.		

Table - 24: Airborne and impact sound insulation performance standards

Credits	Credits awarded according to sound insulation performance standards	
	Airborne sound insulation DnT,w + Ctr dB (minimum values)	Impact sound insulation L'nT,w dB (maximum values)
Individual bedrooms & self-contained dwellings		
1	48	59
3	50	57
4	53	54

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All criteria relevant to the building type are applicable. Where a Part 1 only assessment is being undertaken and it is not possible to demonstrate full compliance with the criteria defined in the relevant tables, 1 credit is (as applicable to building type, note four credits are available for multi-residential) available where: A suitably qualified acoustician (SQA) carries out a quantifiable assessment of the specification of the built form and any external factors that are likely to affect the building acoustics criteria relevant to the building type and function. From the assessment, the SQA should demonstrate the capability of the building to be able to meet the required levels to demonstrate compliance with the BREEAM criteria and highlight any significant issues. Where the specific room functions and areas within the building are yet to be defined, the acoustician must base their assessment on the most sensitive room type likely to be present in the building (e.g. in a speculative office, meeting rooms may be the most sensitive space) as a worst case. This excludes defined specialist spaces (e.g. recording studios, laboratories), unless it is likely that this space will be present in the building. The assessment demonstrates that the works are considering future acoustic issues and criteria. Where deficiencies are highlighted that will make future compliance impracticable or incredibly costly, then the credits for the affected criteria should not be awarded.

Ref	Terms	Description
CN2	Part 2: Core services	All criteria relevant to the building type are applicable. Where a Part 2 only assessment is being undertaken and it is not possible to demonstrate full compliance with criteria 2 - 5, a maximum of one credit is available for indoor ambient noise only as relevant to the building type and function where the following is demonstrated. — An SQA confirms that the project has met the indoor ambient noise criteria as far as possible within the scope of works and has defined the highest achievable level of performance, based on the projects scope of works. — Measurements or quantitative assessment by an SQA demonstrates that the defined highest achievable level of performance has been met and the installed core services either: do not change the indoor ambient noise levels where local services or break-in noise dominate; or reduce the indoor ambient noise levels.
CN3	Part 3: Local services	All criteria relevant to the building type are applicable. Where a Part 3 only assessment is being undertaken and it is not possible to demonstrate fully compliance with criteria 2 - 5 a maximum of one credit is available for indoor ambient noise and sound insulation, as relevant to the building type and function where: — An SQA confirms that the project has met the indoor ambient noise and sound insulation criteria as far as possible within the scope of works and has defined the highest achievable level of performance, based on the projects scope of works — measurement and assessment by an SQA are required to demonstrate that the defined highest achievable level of performance has been met and that the local services either: do not change the indoor ambient noise levels where noise break-in through the building envelope is dominant and maintain sound insulation between noise-sensitive spaces; OR reduce the indoor ambient noise levels and maintain sound insulation between noise-sensitive spaces.
CN4	Part 4: Interior design	Two credits are available for the sound insulation and reverberation control criteria as relevant to building type and function, in accordance with the relevant tables.
Country specific		
CN5	Other appropriate good practice standards or regulations,	As detailed in the assessment criteria it is possible to use a national/local equivalent to the BREEAM requirements stated, however this must be approved by BRE Global. The Approved standards and weightings list can be used to check for previously approved standards or to propose a new national/local standard.
CN6	Building types without areas 'used for speech'	Where a building type does not have areas 'used for speech', it does not need to comply with the relevant 'reverberation times' criteria. In these instances, the credit available for reverberation can be awarded by default where the building complies with the indoor ambient noise level and sound insulation criteria.

Ref	Terms	Description
CN7	Acoustically sensitive rooms	Where the term 'acoustically sensitive rooms' is referenced in this BREEAM issue, it refers to any room/space the design team or client deems to be acoustically sensitive for the purposes of privacy, which may include the following types of space/rooms (where specified); 1. Single and multiple occupancy offices. 2. Meeting/interview/consulting/treatment rooms. 3. Rooms used for public speaking or seminars. 4. Any other room/space the design team or client deems to be acoustically sensitive for the purposes of privacy.
CN8	Remedial works	Where a programme of pre-completion testing identifies that spaces do not meet the standards, remedial works must be carried out prior to handover and occupation and the spaces retested to ensure compliance. Remedial works must be carried out to all affected and potentially affected areas, including rooms or spaces previously untested of a similar construction and performance requirement. The test report, or covering correspondence, should include a clear statement that the testing is in accordance with the required standard (where specified) or the BREEAM criteria (See Criteria 3 and Methodology section), and include the relevant pass/fail criteria.
CN9	Privacy index	To increase the ambient noise level, where privacy is required or the ambient targets include a minimum as well as maximum limit, an artificial sound source or sound masking system may be required. Any artificial sound source or sound masking system should be installed and in operation at the time of the acoustic testing to demonstrate compliance.
CN10	Reverberation times	Where the reverberation time required by the relevant standard is not appropriate for the type of space/building assessed, the suitably qualified acoustician must confirm why this is the case. In addition the suitably qualified acoustician must set alternative appropriate reverberation times at the design stage and provide these to demonstrate compliance.
CN11	Programme of testing	It is not acceptable to undertake a shorter test programme due to site readiness on the day of testing. If this issue arises additional testing should be scheduled. It may be that testing at less than the typical regime identified would be acceptable in some instances. Where this is the case, clear reasoning must be provided by the compliant test body prior to awarding the credit(s).
CN12	Historic buildings	For historic buildings, full credits available can still be achieved where full compliance has not been met where confirmation is provided from a SQA that the design has improved the acoustic performance as much as possible taking into account the restrictions as detailed in a report from a conservation officer.

Ref	Terms	Description
Building type specific		
CN13	Multi-residential or Other, Residential institutions Rooms not covered by residential criteria	Multi-residential and other residential institutions often contain a mixture of 'non-residential' areas such as offices, small retail outlets, meeting rooms etc. and residential areas, e.g. self-contained dwellings or rooms for residential purposes. Where less than 5% of the floor area of the assessed building includes 'non-residential' areas, these areas do not need to be assessed, hence only the residential spaces need to be assessed against the residential criteria to demonstrate compliance with criterion 6. Where more than 5% of the floor area of the assessed building includes areas other than self-contained dwellings or rooms for residential purposes: — If awarding 1 credit, only the self-contained dwellings or rooms for residential purposes need to be assessed to demonstrate compliance. — If awarding 3 or 4 credits the 'non-residential' areas must meet the relevant criteria for their function, and the self-contained dwellings or rooms for residential purposes need to be assessed to demonstrate compliance. The calculation for the percentage of floor area that is 'non- residential' should only include occupied spaces (as defined in BREEAM issue Hea 01 Visual comfort).

Methodology

Testing, measurement and calculation procedures

Where specific guidance on testing, measurement and calculation is not stated in the criteria tables above for the relevant building type, or within the relevant standard or guidance referenced, the following procedures can be followed by the acoustician when measuring or calculating the levels required to demonstrate compliance with this BREEAM issue.

Measurements of sound insulation (airborne and impact) should be made in accordance with the relevant part of (EN) ISO 140 series, or the successor to these standards. For measurements of reverberation time, the relevant principles of (EN) ISO 354:2003 should be used and the guidance provided in (EN) ISO 140-7:1998 should be followed in respect of the number of source and microphone positions, and decay measurements. For measurements of ambient noise, when no specific guidance is available, the following procedures should be used:

1. Noise from both internal sources (e.g. mechanical ventilation systems, plant noise, noise-making systems) and external sources (e.g. traffic noise transmitted via the building façade) should be included, and, where windows are openable as part of the ventilation strategy, these should be assumed to be open for the purposes of calculations and open for measurements. If openable windows are not part of the background or permanent ventilation strategy, then these should be assumed to be closed for the purposes of calculation and closed for measurements.
2. Noise from occupants and office equipment (e.g. computers) should not be included in the measurements.
3. Unless otherwise stated in the referenced document, a rate of testing of at least one in ten rooms or spaces of each performance level shall be subject to on-site performance testing.
4. Measurements should be made in at least four rooms in which noise levels can be expected to be greatest either because they are on the noisiest façade or because they are on a naturally ventilated façade.
5. Where different ventilation strategies are used, measurements should be conducted in rooms utilising each strategy. Otherwise, measurements should be made in rooms on the noisiest façade.
6. T in $L_{Aeq\,T}$ is taken as the duration of the normal working day (typically 8 hours between 09.00 and 17.00).
7. Measurements need not be made over a period of 8 hours if a shorter measurement period can be used. In this case, measurements should be made when external noise levels are representative of normal conditions throughout the day.
8. Measurement periods less than 30 minutes may give representative values for indoor ambient noise levels and may be utilised where this is the case. However measurement periods shorter than 5 minutes should not be used.
9. Measurements should be taken in a minimum of three locations in rooms at a height of 1.2m above the floor level and at least 1m away from any surface.

10. Where relevant, measurement of airborne sound insulation between teaching spaces should be conducted between one in four pairs of adjacent rooms (or teaching spaces) of each room type or performance requirement category and construction type.
11. Where relevant, measurement of impact sound pressure level should be conducted in one in four teaching spaces (separated from rooms above) of each room type or performance requirement category and construction type.
12. The measured level of ambient noise should be used to determine compliance with the criteria for acoustically sensitive rooms. If at the time of acoustic commissioning it is not possible to measure ambient noise levels in the absence of construction or other extraneous noise sources that will not be present when the building is complete, then, for mechanical services the lower level of 35 dB, L_{Aeq} or the lowest design limit for the acoustically sensitive space should be used.

The above is intended as guidance for undertaking acoustic testing or measurement to demonstrate compliance with the performance requirements in BREEAM. If the acoustician has felt it necessary to deviate from the above procedures, they should provide a reason for doing so and confirm that the alternative procedures are adequate for demonstrating that the building meets the acoustic performance requirements.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Acoustically sensitive rooms

Where the term 'acoustically sensitive rooms' is referenced in this BREEAM issue, it refers to any room or space the design team or client deems to be acoustically sensitive for the purposes of privacy which may include the following types of space or rooms (where specified);

1. Cellular offices
2. Meeting or interview or consulting or treatment rooms.

In addition:

1. Educational buildings or spaces: rooms for teaching and learning i.e. classrooms, lecture theatres
2. Rooms used for public speaking or seminars
3. Any other room or space the design team or client deems to be acoustically sensitive for the purposes of privacy.

Compliant test body

A Compliant Test Body is defined as :

1. Organisations who are accredited by a member of the International Accreditation Forum (IAF - www.iaf.nu) to the appropriate scope OR
2. Organisations who can provide evidence that they follow the relevant principles of ISO/IEC 17024 (Conformity assessment - General requirements for bodies operating certification of persons)[3] in relation to BREEAM requirements.

Groups

Grouping should be carried out according to the following criteria. Rooms for residential purposes should be considered as three separate groups. In addition, if significant differences in construction type occur within any of these groups, sub-groups should be established accordingly

Sub-groups

Rooms for residential purposes, sub-grouping should be by type of separating floor and type of separating wall. The construction of flanking elements (i.e. elements above, below and either side of the space for example walls, floors, cavities) and their junctions are also important. Where there are significant differences between flanking details, further sub-grouping will be necessary. Sub-grouping may not be necessary for rooms for residential

purposes that have the same separating wall and/or separating floor construction, with the same associated flanking construction(s), and where the room dimensions and layouts are broadly similar.
Some rooms for residential purposes may be considered to have unfavourable features; an example could be flats with large areas of flanking wall without a window at the gable end. It would be inappropriate for these to be included as part of a group and these should form their own sub-group(s).

Habitable rooms

For the purpose of this issue, habitable rooms include any room where individuals will sit or lie down and require a reasonably quiet environmental to concentrate or rest. Such rooms are bedrooms, living rooms, dining rooms, studies as well as kitchen-dining and kitchen-living rooms.

Material change of use

This is where there is a change in the purpose for which or the circumstance in which a building is used e.g. where a building has been converted from a non-dwelling (office, school, church etc.) to a dwelling.

Multiple occupancy offices

Office space that is not cellular in nature, i.e. it is open plan, and designed to accommodate more than two desk spaces or workstations.

Non-habitable rooms

For the purpose of this issue, non-habitable rooms include any room that is not considered a habitable room (as defined above), it includes rooms such as kitchens, bathrooms, toilets, hallways, garages and laundry rooms.

Occupied spaces

Refer to BREEAM issue Hea 01 and note that for BREEAM issue Hea 05 there is a specific, unrelated, definition of 'unoccupied' with reference to acoustic testing and measurement, see Compliance notes for details.

Room for residential purposes

A room, or a suite of rooms which is not a dwelling (house or a flat) and which is used by one or more persons to live and sleep. It includes a room in a hostel, hotel, a boarding house, a hall of residence or a residential home, whether or not the room is separated from or arranged in a cluster group with other rooms, but does not include a room in hospital, or other similar establishment, used for patient accommodation.

Suitably qualified acoustician (SQA)

An individual achieving all the following items can be considered to be 'suitably qualified' for the purposes of a BREEAM assessment:

1. Holds a University/Higher education qualification or equivalent qualification in acoustics or sound testing.
2. Has a minimum of three years relevant experience (within the last five years). Such experience must clearly demonstrate a practical understanding of factors affecting acoustics in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for suitable acoustic performance levels and mitigation measures.

Where a suitably qualified acoustician is verifying the acoustic measurements or calculations carried out by another acoustician who does not meet the SQA requirements, they must, as a minimum, have read and reviewed the report and confirm in writing that they have found it to:

1. Represent sound industry practice
2. Be appropriate given the building being assessed and scope of works proposed
3. Avoid invalid, biased and exaggerated recommendations.

Additionally, written confirmation from the third party verifier that they comply with the definition of a Suitably Qualified Acoustician is required.

Single occupancy offices

Cellular office space designed to accommodate one or two desk spaces or workstations (typically no greater than $10m^2$).

Unoccupied spaces

Where the term 'unoccupied space' is referenced in this BREEAM issue it refers to the nature of the space for the purpose of carrying acoustic calculations or measurements i.e. such measurements must be carried out when the space is unoccupied and therefore devoid of sources of noise.

Weighted standardised level differences ($D_{nT,w}$)

HTM 08-01 defines this as the 'unit for rating airborne sound insulation on-site'.

Weighted standardised impact sound pressure level ($L'_{nT,w}$)

HTM 08-01 defines this as the 'unit for rating impact airborne sound insulation on-site'.

Other information

Noise rating (NR) curves

Noise assessments based on NR curves are often used by building services consultants to predict internal noise levels due to mechanical ventilation systems. However, the BREEAM requirement uses the indoor ambient noise level, $L_{Aeq,T}$ which includes external noise transmitted via the façade as well as internal noise such as that from mechanical ventilation systems. In the absence of strong low frequency noise, $L_{Aeq,T}$ can be estimated from the NR value using the following formula: $L_{Aeq,T} \approx NR + 6$ dB. Therefore, if the NR value is known, but not the sound pressure levels in the individual frequency bands, an estimate for the indoor ambient noise level $L_{Aeq,T}$ can still be determined from the NR value for the building services noise. The $L_{Aeq,T}$ for the external noise transmitted via the façade must then be combined with the $L_{Aeq,T}$ for the building services.

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[1] BS 8233 Sound insulation and noise reduction for buildings - Code of practice, 2014
[2] Building Bulletin 93: Acoustic Design in Schools, A Design Guide, 2004, UK Department for Education & Employment
[3] ISO/IEC 17024:2003 Conformity assessment - General requirements for bodies operating certification of persons

Hea 06 Safety and security

This issue is not applicable to the BREEAM International Refurbishment and Fit-out 2015 scheme.

Hea 07 Hazards

(all buildings)

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes	Yes	Yes

Aim

To reduce or negate the impact of a natural hazard on the building.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. A risk assessment is carried out at the outline proposal or concept design stage by an appropriate person, or persons, to identify any potential natural hazards in the region of the building.
2. Where a potential hazard is identified, mitigation measures appropriate to the level of risk should be identified by an appropriate person(s) and implemented.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts 1 - 4	All assessment criteria are applicable. Note: where only doing a partial refurbishment or fit-out, there may be limited opportunities to mitigate risks from hazards however a risk assessment is still required with mitigation measures identified that can be implemented within the scope of refurbishment and fit-out works
CN2	Where no risk is identified or where flooding is identified as the only risk	Where no risks are identified, this issue will not be included in the assessment. Where flooding is the only risk identified, this issue will not be included in the assessment as flooding is addressed in BREEAM issue Pol 03 Flood risk management and reducing surface water run-off.

Schedule of evidence required

Ref	Design stage	Post construction stage
1 & 2	A copy of the Natural Hazards risk assessment. Letter from the appropriate person confirming their compliance with the definition of an appropriate person. Confirmation of the timing of the Natural Hazard Assessment within the plan of works.	As design stage.
2	Where applicable, a copy of the Natural Hazard risk assessment detailing the mitigation measures appropriate to level of risk for the site. AND EITHER A copy of the relevant section of the specification requiring the principal contractor to implement the mitigation measures identified OR A letter from the client or design team member confirming that the specification will require the principal contractor to implement the appropriate person's recommendations.	Assessor's building inspection or site inspection (or 'as built' drawings) and photographic evidence confirming that the mitigation measures have been implemented in line with the appropriate person's recommendations and specification.

Additional information

Relevant definitions

Natural hazard

Natural processes or phenomena occurring in the biosphere or crust that may constitute a damaging event. The list below is not intended to be exhaustive, but provides an indication of the type of hazards that should be considered to meet the definition. Other natural hazards may be relevant under this issue. Relevance will be dependent on local geography, geology, hydrology and climate factors and the assessor should be satisfied that appropriate local expertise has been sought by the client or design team to identify these fully:

1. Floods (addressed in Pol 03 Flood risk management and reducing surface water run-off)
2. Natural disasters of geological origin such as volcanic eruptions, earthquakes and landslides
3. Natural disasters of climatic or meteorological origin such as droughts, avalanches, wave surges including tsunamis and tidal waves, and wind storms including cyclones, hurricanes, tornadoes, tropical storms, and typhoons
4. Wildfires.

Natural disaster

A serious disruption of the functioning of a community or a society, causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Appropriate person(s)

An individual (or individuals) with relevant technical and professional experience suitable to:

- Determine the potential for natural hazards in the region of the development,
- Determine the likely impacts on the site, building and locality, and
- Subsequently identify appropriate mitigation measures.

This may be a member (or members) of the design team or a specialist, independent to the design and construction process. This (or these) individual(s) should practice to and abide by a professional code of conduct or similar.

Naturally occurring event

This is not necessarily a natural hazard. A large natural event will become a disaster only when it causes a natural disaster as defined above.

Other information

Please note that this issue is not attempting to define all possible risks and hazards that may be present, but instead encouraging the process of risk identification, assessment and mitigation.

Natural Hazard, Natural Disaster, and Risk Assessment: The definitions used within this issue are sourced from the International Strategy for Disaster Reduction http://www.unisdr.org/

7.0 Energy

Category overview

Summary

This category encourages the specification and design of energy efficient building solutions, systems and equipment that support the sustainable use of energy in the building and sustainable management in the building's operation. Issues in this section assess measures to improve the inherent energy efficiency of the building, encourage the reduction of carbon emissions and support efficient management throughout the operational phase of the building's life.

Category summary table

Issue	Credit summary	Applicability			
		Part 1	Part 2	Part 3	Part 4
Ene 01 Reduction of energy use and carbon emissions	— Recognise improvements in the energy performance of the refurbished building over existing building performance in relation to heating and cooling energy demand, primary energy consumption and carbon dioxide emissions. — Encouraging steps taken to reduce energy demand through building design and systems specification.	Yes	Yes	Yes	No
Ene 02 Energy monitoring	— Energy metering systems are installed to enable energy consumption to be assigned to end uses. — Sub-meters are provided for high energy load and tenancy areas.	No	Yes	Yes	Yes
Ene 03 External lighting	— Specification of energy efficient light fittings for external areas of the development and controls to prevent use during daylight hours or when not needed.	Yes	Yes	Yes	Yes
Ene 04 Low carbon design	— Analysis of the existing building is undertaken to identify opportunities for, and encourage the adoption of, passive design solutions, including free cooling. — A feasibility study has been carried out to establish the most appropriate on-site or near-site low or zero carbon (LZC) energy source(s) for the building or development and is specified.	Yes	Yes	Yes	No

Issue	Credit summary	Applicability			
		Part 1	Part 2	Part 3	Part 4
Ene 05 Energy efficient cold storage	— The refrigeration system, its controls and components have been designed, installed and commissioned in accordance with appropriate codes and standards and demonstrates a saving in indirect greenhouse gas emissions (CO_2 eq.) over the course of its operational life.	No	Yes	Yes	Yes
Ene 06 Energy efficient transportation systems	— An analysis of the transport demand and usage patterns is undertaken to determine the optimum number and size of lifts, escalators or moving walks. — Energy efficient installations are specified.	No	Yes	Yes	No
Ene 07 Energy efficient laboratory systems	— Client engagement to determine occupant requirements and define laboratory performance criteria to optimise energy demand of the laboratory facilities. — Specification of best practice energy efficient equipment and measures as appropriate.	No	Yes	Yes	Yes
Ene 08 Energy efficient equipment	— Identification of the building's unregulated energy consuming loads which have a major impact on the total unregulated energy demand. — Demonstrate a meaningful reduction in the total unregulated energy demand of the building.	No	No	Yes	Yes
Ene 09 Drying space	— Provision of adequate internal or external space and equipment.	Yes	No	Yes	Yes

Ene 01 Reduction of energy use and carbon emissions

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
12 (Building type and scope dependent)	Yes	Yes	Yes	Yes	No

Aim

To recognise and encourage refurbishment and fit-out projects that reduce operational energy demand, primary energy consumption and carbon emissions.

Assessment criteria

The following is required to demonstrate compliance:

Up to twelve credits - Elemental level energy model

1 Calculate the energy score using the BREEAM Refurbishment and Fit-out elemental level energy model for the applicable assessment parts to determine the number of credits awarded. The elemental level energy model also determines the number of credits available based upon the building type and applicable assessment parts with up to a maximum of 12 credits available (see Table - 27 for example credits available for common project types). Also, refer to Table - 25 to determine the minimum requirements for this issue.

2 The following should be assessed as applicable to the scope of works (see Table - 28 for further details):
- 2.a Part 1: Fabric and structure: thermal performance and air tightness of the building fabric
- 2.b Part 2: Core services: energy performance of core heating, hot water, cooling and ventilation systems and controls
- 2.c Part 3: Local services: energy performance of local heating, cooling, ventilation, lighting and controls as relevant
- 2.d Part 4: Interior design: not applicable.

Table - 25: Minimum requirements

Rating	Minimum requirements
Pass Good Very Good	Evidence that the project has complied with the minimum requirements of local building regulations.
Excellent	Requires a minimum of 36% of available credits to be achieved.
Outstanding	Requires a minimum of 60% of available credits to be achieved.

Two credits - Historic buildings only

Two additional credits are available for Historic buildings, up to a maximum twelve credits where:

3 A specialist study has been undertaken by a Suitably Qualified Heritage Conservation Specialist (see Relevant definitions) at the Concept Design stage, to investigate the implications of improving building fabric and services performance while minimising the potential negative impacts of both the historic character of the building, the condition of the building fabric and indoor air quality.

4 The study includes looking at the potential for improving ventilation, air tightness and moisture control within the building, ensuring that these are considered in balance with that of the welfare of the historic building fabric. This includes considering materials specified, impacts on breathability of the building, paying attention to additional ventilation that may be required e.g. roof, wall and floor voids.

5 The report makes recommendations for potential improvements to the building fabric in accordance with local building regulations and national best practice or where none existing in accordance with EN 16096:2012.

6 Each of the following (as a minimum) must be considered and recommendations for improvement made:
   6.a Roof
   6.b External and sheltered walls
   6.c Ground floor
   6.d Upper floors
   6.e Windows and external doors

7 Where improvement cannot be made to any of the above (e.g. due to conservation or building performance issues), justification should be provided including the alternative measures that have been considered and reasons these measures could not be adopted (e.g. glazing options considered etc.).

Exemplary level criteria

The following outlines the exemplary level criteria to achieve up to five innovation credits for this BREEAM issue:

(Note: the exemplary level credits are available for all assessment parts but are likely to be only achievable where undertaking a whole building assessment and where undertaking work to the fabric and services)

Two credits - zero net CO_2 emissions

8 The maximum available credits have been achieved under criteria 1 to 2

9 The energy performance of the building is calculated from design information using approved energy calculation (modelling) software

10 The calculated energy performance demonstrates that the building has zero net CO_2 emissions (see Relevant definitions) in terms of its building services energy consumption (see Relevant definitions).

Up to five credits - carbon neutral

11 Criterion 8 - 10 has been achieved.

12 The calculated energy performance demonstrates that an equivalent percentage of the building service energy consumption (see Relevant definitions), as stipulated in Table - 26, is generated by carbon neutral on-site, near-site or accredited external renewables and is used to meet equipment energy demand (see Relevant definitionsfrom building systems or processes.

Table - 26: Innovation credits for carbon neutral unregulated energy and carbon negative

Innovation credits	% operational energy consumption from carbon neutral sources
3	≥ 20
4	≥ 50
5	≥ 100

Checklists and tables

Table - 27 highlights examples of the credits typically available for each assessment part for common building types. Note that for Part 3 assessments, the credits available as indicated here are for where the only local service comprise of lighting only. Where there are a greater proportion of local services such as cooling, heating and ventilation compared to central services, there will be a greater number of credits available for Part 3 compared to Part 2. The credits available in this table should be used as a reference guide only. The actual number of credits available should be determined using the Elemental level energy model found on www.breeam.com/projects.

Table - 27: Example credits available for each assessment part for common building types

Building type	Credits available			
	Part 1	Part 2	Part 3	Part 4
Offices	3	8	1	N/A
Industrial	3	7	2	N/A
Retail	2	6	4	N/A
Student residences and key worker accommodation	3	8	1	N/A
Sheltered housing, care homes and supported living facilities	2	8	1	N/A
School	3	7	2	N/A
College	2	5	5	N/A
University or higher education	2	5	5	N/A

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2 and 3	All assessment criteria are applicable
CN2	Part 4: Interior Design	This issue is not applicable.
General		
CN3	Approved Building Energy Calculation Software	In countries with an existing National Calculation Methodology (NCM), the tool(s) approved for use under the NCM can be used as approved building energy calculation software. These will be confirmed by BRE as part of the Approved standards and weightings list process. Where the design team wishes to use an alternative modelling software package for the purposes of assessing this BREEAM issue, please refer to the Approved standards and weightings list to determine whether the modelling software package meets the minimum requirements in terms of: 1. Minimum capabilities 2. Design features 3. Testing. Where those minimum requirements are met, approval from BRE Global will be required (via the Approved standards and weightings list process) before the package can be used for the purposes of demonstrating compliance with Ene 01 criterion 9.

Ref	Terms	Description
CN4	Suitably qualified energy modelling engineer and/or accredited expert	Where a National Calculation Methodology (NCM) requires accredited experts to undertake the energy performance calculations, these accredited professionals are also required to demonstrate compliance with this BREEAM issue. If the NCM does not require accredited experts or alternative approved building energy calculation software is used, then a suitably qualified energy modelling engineer must carry out the modelling (see Relevant definitions).
CN5	Building Regulations compliance	Criteria 1 and 2 are based upon a relative improvement in energy performance over the existing building at an elemental level and do not assess compliance or performance beyond local Building Regulations. In all cases, the project should demonstrate that compliance with local Building Regulations has been met or exceeded through the relevant statutory body and this is the minimum requirement for a Pass rating.
CN6	Extensions to existing buildings and newly constructed thermal elements	Where the refurbishment project also includes a newly constructed extension with new thermal elements (see Scope section to see where this is allowable under the scope of the scheme), the performance of the baseline for new thermal elements should be based upon compliance with the appropriate local or national Building Regulations for new thermal elements Where the new extension uses existing building services, the baseline performance of the new extension and existing building should be based upon performance of the existing common building services plant. The baseline for any new building services plant servicing the extension only should be based upon compliance with the appropriate local or national Building Regulations.
CN7	Estimating energy demand from building systems/processes	To demonstrate compliance with the 'Exemplary level criteria', where the equipment system and process load (as relevant to project) for the existing building is similar to the energy demand for equipment and process load, post refurbishment or fit-out, the building's equipment energy demand should be based upon metered data from the existing building. Where metered data is not available or the equipment and process load is not comparable, the predicted equipment system and process load should be modelled using CIBSE TM54 or other equivalent national best practice standards for modelling operational energy demand.
CN8	Energy exported to the grid	Any electricity from an on-site LZC energy source that is exported to the grid may be included in the calculations as if it were used within the building.
CN9	Zero carbon sources of energy - double counting	In reference to the exemplary level requirements, the project team must avoid double counting the energy from zero carbon sources. This may be particularly relevant where that source of energy generation is being counted for in terms of the assessed building's services CO_2 emissions or it will contribute to offsetting other buildings' CO_2 emissions, which are not part of this assessment.
CN10	Buildings assessed as part of a larger site	Where the building or refurbishment and fit-out zone under assessment forms part of a larger building and either a new or existing LZC installation is provided for the whole site, the amount of LZC energy generation counted for in this issue, and subsequent CO_2 emissions saved, should be proportional to the building's energy demand compared to the total energy demand for the site.

Methodology

Methodology for calculating elemental energy score

The elemental energy score is calculated using the BREEAM Refurbishment and Fit-out elemental level energy model found on the BREEAM Projects website (www.breeam.com/projects). This can be found within the BREEAM RFO pre-assessment estimator and reporting tool under issue Ene01.

The elemental energy calculation methodology follows a simplified approach that does not require the use of building energy modelling software. Instead of considering whole building performance, the elemental energy calculation methodology considers the performance of individual energy end use subcomponents. This approach makes it possible to recognise improvements made to individual building components without penalising projects that are not undertaking a full building refurbishment addressing the building fabric, core services and local services in full. However it is possible to assess whole building energy performance where undertaking a parts 1, 2 and 3 combined assessment.

The elemental level energy model takes four calculation steps in order to determine performance:

Step 1: Evaluate existing building performance and the potential for improvement

Step 2: Assign end use subcomponent weightings which are a function of:

a. The outcomes of Step 1
b. The building type
c. The country and climate of the building undergoing assessment
d. The building servicing strategy
e. The level of certification being undertaken

Step 3: Calculate performance against relevant subcomponents for the refurbished building

Step 4: Calculate the energy score by multiplying the subcomponent scores by the relevant subcomponent weightings

The subcomponents that are applicable for assessment vary depending on the level of certification being sought, and the building servicing strategy. Table - 28 confirms the various subcomponents that are applicable for the different levels of assessment and certification.

Table - 28: Assessment parts and applicable performance components and subcomponents

Assessment part	Applicable components	Applicable subcomponents
Part 1: Fabric and Structure	Thermal conductance and infiltration	— Fabric (U-value) — Infiltration rate (against heating and cooling) — Glazing area

Assessment part	Applicable components	Applicable subcomponents
Part 2: Core Services	Heating	— % heat recovery — Efficiency of heat generation — Heating control factor — Efficiency of heating distribution — Heating pipework insulation
	Cooling	— Efficiency of cooling generation — Cooling control factor — Efficiency of cooling distribution — Cooling pipework insulation
	Ventilation	— Fan efficiency — Duct and AHU leakage — Ventilation control factor
	Hot water	— Efficiency of hot water generation — Hot water control factor
Part 3: Local Services	Lighting	— Lighting efficiency — Lighting control factor
	Local heating, cooling, ventilation and hot water	— As above for core services, depending on scope of local provision for local cooling, heating, ventilation and hot water

If, for example, the project is only undergoing a Part 1 assessment, it is only the subcomponents relating to the fabric and structure that will be assessed. Similarly, if the building does not have cooling or mechanical ventilation, then the applicable cooling and mechanical ventilation subcomponents would be excluded from a Part 2 assessment.

While the information entered by the user on the level of certification and servicing strategy is used by the tool to determine which subcomponents are applicable for a given assessment, it is the information entered on existing building performance and building type that determines the relative importance of the applicable subcomponents (and their respective weightings). The initial weightings are set by taking account of the typical split in energy consumption across the different energy end use components for the building type in question (based on a series of benchmarks built into the tool). This energy split is dependent upon the country and climate that the building undergoing assessment is located. The weightings are adjusted using degree day data in order to adjust the demand on heating and cooling as relevant e.g. for a building in a colder climate, the weighting for heating will be greater and vice versa for buildings in a warmer climate.

Once information has been entered on the existing building performance, this is then used to adjust the initial weightings to reflect the fact that subcomponents with relatively poor performance have greater potential for improvement. Where any subcomponent is not applicable for the project being assessed due to the level of certification being sought or the building servicing strategy, the subcomponent would receive a zero weighting and as such not contribute to the overall score. If undertaking a Part 3 assessment for example, the only applicable end use component may be 'Lighting' and as such the energy score would be calculated based entirely on the performance of the lighting in the refurbished building.

The applicable end use subcomponents, and their relative subcomponent weightings for any given project can be calculated by entering the relevant project details and the required information on existing building performance into the BREEAM Refurbishment and Fit-out elemental level energy model. Due to the nature of the calculator, it should be noted that the end use components weightings will vary for every project.

The performance of the refurbished building is determined based on the user responses to a second set of questions that mirror those used to ascertain the existing building performance, but should be answered based on the proposed refurbishment or fit-out specification.

Once the questions that describe the refurbished building performance have been answered, the BREEAM Refurbishment and Fit-out elemental level energy model will generate the overall energy score by combining the relevant subcomponent scores and respective weightings. Once the required questions have been answered, the tool will confirm the overall score, along with the relative performance in each of the applicable end use subcomponents.

Evidence

<table>
<tr><th>Criteria</th><th>Interim design stage</th><th>Final post construction stage</th></tr>
<tr><td>3-7</td><td colspan="2">One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.</td></tr>
<tr><td>1 - 2</td><td>One or more of the appropriate evidence types listed in The BREEAM evidential requirements to verify the data used to assess existing building and proposed building performance within the elemental level energy model</td><td>As per interim design stage, but this must account for any changes to the specification during refurbishment or fit-out and where applicable the measured air leakage rate, ductwork leakage and fan performances (where required by local or national Building Regulations).</td></tr>
<tr><td>8 -12</td><td>As above, plus evidence confirming:
1. A copy of the report produced by the approved calculation tool for the assessed building at the design stage illustrating the predicted actual building performance
2. Name of the approved software used to carry out the modelling for calculating the energy performance.
3. Confirmation of the expertise and experience of the individual carrying out the modelling in compliance with the requirements of the local building regulations.
4. The total carbon neutral energy generation (kWh/yr)
5. The source of the carbon neutral energy.
6. Calculated estimate of energy consumption from unregulated systems or process (kWh/yr) (only required if confirming zero regulated carbon or carbon negative exemplary credits).
7. Calculated estimate of exported energy surplus (only required if confirming carbon negative status).</td><td>As required above and as per interim design stage.</td></tr>
</table>

Additional information

Relevant definitions

Building Regulations

Building Regulations set standards for the design and construction of buildings to ensure the safety and health of people in or about those buildings. They also include requirements to ensure that fuel and power is conserved and facilities are provided for people, including those with disabilities, to access and move around inside buildings.

Carbon negative building

A building/site that generates, surplus to its own energy demand, an excess of renewable or carbon neutral energy and exports that surplus via the national grid to meet other, off-site energy demands, i.e. the building is a net exporter of zero carbon energy.

Surplus in this respect means the building/site generates more energy via renewable or carbon neutral sources than it needs to meet its own regulated and unregulated energy needs. Any surplus must be exported through the national grid as additional capacity to that required by the Renewables Obligation, i.e. Renewable Obligation Certificates are not claimed or sold for the renewable energy generation (see definition of Renewables Obligation Certificate).

This definition of carbon negative focuses only on energy and carbon dioxide emissions resulting from the operational stage of the building life cycle (as this is the stated aim of this assessment issue). It does not take into account the embodied carbon, in terms of carbon fixing or emissions resulting from the manufacture or disposal of building materials and components (these impacts and benefits are dealt with in Mat 01 Environmental impact of materials).

Carbon neutral

Carbon neutral means that, through a transparent process of calculating building operational emissions, reducing those emissions and offsetting residual emissions, net carbon emissions equal zero. This includes carbon emissions from both regulated and unregulated energy consuming plan and systems. See the 'Zero net regulated CO_2 emissions' definition also.

Energy demand

The sum of the calculated annual demands for heating and cooling of the building, based on the relevant design details and subject to the standard weather conditions for the country of assessment. This is expressed in MJ per m^2 of floor area and calculated in accordance with approved building energy calculation software.

Equipment energy

Building energy consumption resulting from systems or processes within the building, other than Service energy (see definition below). This may include energy consumption from systems integral to the building and its operation, e.g. lifts, escalators, refrigeration systems, ducted fume cupboards; or energy consumption from operational-related equipment, e.g. servers, printers, computers, mobile fume cupboards, cooking and other appliances.

Historic buildings

Historic buildings are defined as building's or monuments that are formally protected under international, national or local laws or schedules and therefore subject to local planning and building regulations, including buildings that are in a conservation zone. Such buildings will normally require consent from the local, national or international historic buildings authority (e.g. UNESCO, Architectes des Bâtiments de France (ABF), the National Heritage Board of Poland etc.).

Low or zero carbon (LZC) technologies

A low or zero carbon technology provides a source of energy generation from renewable energy sources or from a low carbon source such as combined heat and power (CHP) or ground source heat pumps (GSHP).

National Calculation Method (NCM)

The National Calculation Method (NCM) enables quantification of building operational energy consumption and CO_2 emissions resulting from regulated building services or systems and fabric performance. The NCM is the methodology used for demonstrating compliance with the European Union Energy Performance of Buildings

Directive (EPBD) 2012 (recast). Building energy modelling compliant with the NCM can be carried out using approved software .

Near-site LZC

A low or zero carbon source of energy generation located near to the site of the assessed building. The source is most likely to be providing energy for all or part of a local community of buildings, including the assessed building, e.g. decentralised energy generation linked to a community heat network or renewable electricity sources connected via private wire.

On-site LZC

A low or zero carbon source of energy generation which is located on the same site as the assessed building.

Primary energy consumption

This refers to the direct use at the source, or supply to users without transformation, of crude energy, that is, energy that has not been subjected to any conversion or transformation process.

Private wire arrangement

In the context of BREEAM for low or zero carbon technology installations, a private wire arrangement is where any electricity generated on or in the vicinity of the site is fed directly to the building being assessed, by dedicated power supplies. If electricity is generated which is surplus to the instantaneous demand of the building, this electricity may be fed back to a local or national distribution grid. The carbon benefit associated with any electricity fed into the grid in this manner can only be allocated against an individual installation or building. In cases where a building is supplied by a communal installation, no carbon benefit can be allocated to buildings which are not connected to the communal installation.

Building services energy consumption

Building energy consumption resulting from fixed internal lighting systems, fixed heating or cooling, hot water service or mechanical ventilation.

Suitably Qualified Heritage Conservation Specialist

A person with at least 3 year's relevant experience in heritage conservation within the last 5 years and a recognised qualification in building conservation with a nationally recognised accreditation body or institute. The individual should have a working knowledge of techniques for the restoration and conservation of heritage buildings. This includes knowledge of the materials and techniques that can be used to improve energy efficiency in historic buildings, while identifying and managing any risks that may damage the historic character and welfare of the building.

Suitably qualified energy modelling engineer

A person with at least 3 year's relevant experience in energy modelling within the last 5 years and a recognised qualification such as a building services engineer or building energy modelling engineer. Their expertise should be broad enough to cover all required technical aspects, guaranteeing that the data entered in the energy model is appropriate and that the results reflect the actual performance of the building. It can be someone operating as a sole trader or employed by public or private enterprise bodies.

Zero net regulated carbon (CO_2) emissions

The net annual building CO_2 emissions ($kgCO_2/m^2$/year) arising as a result of service energy consumption is equal to zero.

In aiming to achieve zero carbon status, the building energy modelling can take account of contributions of energy generated from on-site, near-site and accredited external renewables and low carbon installations. Energy generated and supplied from off-site renewables and low carbon installations that are not accredited cannot be used to meet this definition.

Other information

Ene 02 Energy monitoring

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
Building type dependent	Yes	No	Yes	Yes	Yes

Aim

To recognise and encourage the installation of energy sub-metering that facilitates the monitoring of operational energy consumption.

Assessment criteria

Please note:

- The first credit is applicable to all building types.
- The second credit is not applicable to Preschools, Primary schools, Law courts, Prisons, Multi-residential and Other buildings: Residential institutions.

The following is required to demonstrate compliance:

One credit - Sub-metering of major energy consuming systems

1 Energy metering systems are installed that enable at least 90% of the estimated annual energy consumption of each fuel to be assigned to the various end-use categories of energy consuming systems (see Methodology).

2 The energy consuming systems in buildings with a total useful floor area greater than 1,000m^2 are metered using an appropriate energy monitoring and management system.

3 The systems in smaller buildings are metered either with an energy monitoring and management system or with separate accessible energy sub-meters with pulsed or other open protocol communication outputs, to enable future connection to an energy monitoring and management system (see Relevant definitions).

4 The end energy consuming uses are identifiable to the building users, for example through labelling or data outputs.

One credit - Sub-metering of high energy load and tenancy areas

5 An accessible energy monitoring and management system or separate accessible energy sub-meters with pulsed or other open protocol communication outputs to enable future connection to an energy monitoring and management system are provided, covering a significant majority of the energy supply to tenanted areas or, in the case of single occupancy buildings, relevant function areas or departments within the building or unit.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1 : Fabric and structure	This issue is not applicable
CN2	Part 2 : Core services	All assessment criteria are applicable

Ref	Terms	Description
CN3	Part 3: Local services	All assessment criteria are applicable
CN4	Part 4: Interior design	Criteria 1 to 4 are applicable
General		
CN5	Extensions to existing buildings	Where the refurbishment project includes an extension, with building services plant and systems that will be common to both the new extension and existing building, the energy services supplying energy consuming systems in the existing building shall, as a minimum, be metered. Where the scope of the assessment includes the new build extension (see Scope section for guidance on assessment of new build extensions) energy metering must cover energy consuming systems for the entire building.
CN6	Refurbishment of part of an existing building	Where only part of an existing building is being refurbished and there are existing building services plant and systems that will be common to both the refurbished part and the unchanged part of the building, the criteria only apply to the refurbished part. In this case, energy services supplying energy consuming systems from the existing building services in the unchanged part shall, as a minimum, be metered at the entry points to the refurbished part, e.g. hot water, chilled water, gas and electricity. However, the best practice approach would usually be to ensure that the energy metering covers the entire building.
CN7	Modular boiler systems See criterion 1.	Modular boiler systems can be monitored as a whole. See Relevant definitions
CN8	Lighting and small power See criterion 5.	Due to traditional distribution methods, it can be difficult to separate lighting and small power cost effectively. It is acceptable, within a single floor, for lighting and small power to be combined for metering purposes, provided that sub-metering is provided for each floor plate.
CN9	Small function areas or departments See criterion 5.	For a building consisting of a number of small function areas or departments, sub-metering the heating, hot water and combined electricity energy uses is sufficient to achieve this credit. Individual electricity energy uses within each unit do not need to be sub-metered. For the purpose of this BREEAM issue, a small function area or department is defined as less than 250m^2.
CN10	Heating and hot water See criterion 5.	Space heating and domestic hot water may be combined with a single heat or gas meter per tenanted area or function area or department, where it is impractical to sub-meter these items separately.
CN11	Significant majority See criterion 5.	A significant majority of the energy supply to the tenanted areas or function areas or departments covers most of the energy uses but does not have to include very small ones. As a guide, energy uses that cumulatively make up less than 10% of the energy supply for that area may be excluded.

Ref	Terms	Description
Building type specific		
CN12	Buildings situated on campus developments See criterion 5.	The systems for buildings situated on campus developments must be monitored using either an appropriate energy monitoring and management system or another automated control system, e.g. outstations linked to a central computer, for monitoring energy consumption. The criteria only apply to the assessed building. Where energy services are supplied from an existing building on the campus, they shall be metered at the entry points to the assessed building, e.g. hot water, chilled water, gas and electricity. Provision of a pulsed or other open protocol communication output is not sufficient to award the credit for these building types.
CN13	Small tenanted office, industrial or retail units See criterion 5.	For a development consisting of a number of small tenanted units, a single meter per unit for electricity and another for heating is sufficient to achieve this credit. Individual areas within each unit do not need to be sub-metered. For the purpose of this BREEAM issue, a small unit is defined as less than 250m^2.
CN14	Large office, industrial or retail units See criterion 5.	For a development consisting of one or more larger units (i.e. greater than 250m^2), sufficient sub-metering to allow for monitoring of the relevant function areas or departments within the unit must be specified, in addition to metering of the unit as a whole.
CN15	Healthcare buildings: medical-based systems See criterion 5.	Large-scale medical equipment or systems can be excluded when assessing compliance with this issue (although it is recommended that sub-metering is considered in such instances).
CN16	Single occupant buildings: relevant function areas or departments See criterion 5.	The lists below summarise the commonly found functions by building types. These lists are not exhaustive and where other areas or departments exist, these should also be separately metered.
CN17	Office buildings	1. Office areas (metering by floor plate) 2. Catering
CN18	Retail buildings	1. Sales area 2. Storage and warehouse 3. Cold storage 4. Offices 5. Catering 6. Tenant units
CN19	Industrial units	1. Office areas 2. Operational area 3. Ancillary areas (e.g. canteens etc)

Ref	Terms	Description
CN20	Education buildings	1. Kitchens (excluding small staff kitchens and food technology rooms) 2. Computer suites 3. Workshops 4. Lecture halls 5. Conference rooms 6. Drama studios 7. Swimming pools 8. Sports halls 9. Process areas 10. Laboratories 11. High containment suites within laboratories 12. Controlled environment chambers 13. Animal accommodation areas 14. Data centres 15. IT work and study rooms, including IT-equipped library space and any space with provision of more than one computer terminal per 5m^2. Individual sub-metering of standard classrooms or seminar rooms is not required.
CN21	Hospitals and other healthcare facilities	1. Operating departments 2. Imaging departments 3. Radiotherapy departments 4. Pathology departments 5. Dialysis departments 6. Medical physics facilities 7. Mortuary and post mortem departments 8. Rehabilitation when including hydrotherapy pools 9. Central sterile supplies departments (or equivalent) 10. Process areas, e.g. commercial-scale kitchens and laundries 11. IT rooms 12. Pharmacy departments 13. Laboratories 14. Tenancy areas (e.g. catering, retail, laundry) In small healthcare buildings ($<999m^2$) with no high energy load areas (as defined above), a single meter per floor plate is sufficient to achieve this credit. Individual areas within each floor plate do not need to be sub-metered.
CN22	Other buildings See criterion 5.	Other types of single occupant buildings should use the above lists of function areas as a guide to the level of provision required to comply, bearing in mind the aim of the credit is to encourage the installation of energy sub-metering that facilitates the monitoring of in-use energy consumption (in this case by area).

Methodology

Metering strategy

Detailed guidance on how to develop an appropriate metering strategy for the energy criteria of a building is available in General Information Leaflet 65: Metering energy use in new non-domestic buildings and CIBSE TM39 Building energy metering[1].

Estimating the annual energy consumption of each end use

Where the total consumption of any single end use category (or a combination of end use categories added together) is estimated to account for less than 10% of the annual energy consumption for a given fuel type, it is not necessary for this end use to be sub-metered. In this instance, the design team should demonstrate that the respective end use(s) is expected to account for less than 10% of the annual energy consumption for the fuel type. Where a given end use will clearly account for less than 10% of the total annual energy consumption for the fuel type in question, a simple hand calculation or use of benchmark data to demonstrate this is acceptable.

Estimating the total annual energy consumption

Where it is unclear whether an end use would account for 10% of the annual energy consumption for a given fuel type or not, more detailed calculations should be provided. The total annual energy consumption should be estimated using a method that estimates actual energy consumption. The energy consumption for each end use may be estimated by using methods described in CIBSE TM54: Evaluating operational energy performance of buildings at the design stage[2], using actual operational inputs. The weather data used should be the average current weather data for the local area from a credible and verifiable source (e.g. a regional, national or international meteorological organisation, data source or equivalent). The data on water consumption from the .Wat 01 Water consumption issue may be used as inputs for evaluating the energy use of domestic hot water.

Alternatively, where present, energy metering data for the existing building may be used to estimate total annual energy consumption for the refurbished building, provided the metered data accounts for the total annual energy consumption from all energy consuming systems.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Accessible meters

Energy meters located in an area of the building that allows for easy access to facilitate regular monitoring and readings by the building occupant or facilities manager. Typically this will be the plant room, main distribution room or control room (where a building energy management system (BEMS) is installed).

Common areas

Developments that have several tenant units, particularly large retail developments, may also share common facilities and access that is not owned or controlled by any one individual tenant, but used by all. Common areas are typically managed and maintained by the development's owner, i.e. landlord or their managing agent. Examples of common areas include an atrium, stairwells, main entrance foyers or reception or external areas, e.g. parking.

Energy consuming systems

Systems that consume energy to perform the following functions (where present) within a building:

a. Space heating
b. Domestic hot water heating
c. Humidification
d. Cooling
e. Ventilation, i.e. fans (major)
f. Pumps
g. Lighting
h. Small power
i. Renewable or low carbon systems (separately)

j. Controls
k. Other major energy consuming systems or plant, where appropriate. Depending on the building type, this might include for example: plant used for swimming or hydrotherapy pools; other sports and leisure facilities; kitchen plant and catering equipment; cold storage plan; laboratory plant; sterile services equipment; transportation systems (e.g. lifts and escalators); drama studios and theatres with large lighting rigs; telecommunications; dedicated computer room or suite; dealing rooms; covered car parks; ovens or furnaces; and floodlighting. See also CIBSE TM39: Building energy metering and General Information Leaflet 65: Metering energy use in new non-domestic buildings for further information.

Energy monitoring and management system
Examples include automatic meter reading systems (AMR) and building energy management systems (BEMS). Automatic monitoring and targeting (aM&T) is an example of a management tool that includes automatic meter reading and data management.

Energy supply
All types of energy supplied to a building area (function area/department/tenancy/unit) within the boundary of the assessed development; including electricity, gas, heat or other forms of energy or fuel that are consumed as a result of the use of, and operations within, each relevant area.

Energy meters
Energy meters measure the amount of energy used on a circuit where energy is flowing. Primary meters measure the main incoming energy and are used for billing by the utility supplier. They include the principal smart and advanced utility meters to a site for electricity and gas.
Sub-meters are the second tier including heat and steam meters and secondary meters installed to measure consumption by specific items of plant or equipment, or to discrete physical areas, e.g. individual buildings, floors in a multistorey building, tenanted areas, function areas.

Major fans
Major fans typically include fans in air handling units (AHUs). Where multiple fans are within an air handling unit, they can be metered as one unit. Small fans such as individual extract fans for single rooms, such as kitchen, bathroom and toilet areas, are not required to be included where they only account for a small proportion of the total annual energy use.

Modular boiler systems
A modular boiler system consists of a series of boilers that are linked together to meet a variety of heating demands. They are generally composed of several identical boiler units, sometimes stacked, although a mix of condensing and conventional boilers could be used. They operate in increments of capacity, each at around their full capacity and their peak efficiency, so that the overall part load efficiency is greater than it would be for a single boiler.

Sub-meter outputs
Examples include pulsed outputs and other open protocol communication outputs, such as Modbus.

Other information

None.

[1] TM39 Building energy metering. CIBSE. 2009.
[2] TM54 Evaluating operational energy performance of buildings at the design stage. CIBSE. 2013.

Ene 03 External lighting

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	No	Yes	Yes	No

Aim

To recognise and encourage the specification of energy efficient light fittings for existing and new lighting within the scope of refurbishment works.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1 The building has been designed to operate without the need for external lighting (which includes on the building, signs and at entrances).

OR alternatively, where the building does have external lighting, one credit can be awarded as follows:

2 The average initial luminous efficacy of the external light fittings within the construction zone is not less than 60 luminaire lumens per circuit Watt.

3 All external light fittings are automatically controlled for prevention of operation during daylight hours and presence detection in areas of intermittent pedestrian traffic.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Not applicable.
CN2	Parts: 2 and 3	All assessment criteria are applicable.
CN3	Part 4: Interior design	Not applicable.
General		
CN4	Single building assessments on larger sites or campuses and partial refurbishments of existing buildings	Where the building being assessed forms part of a larger site (or is a partial refurbishment of an existing building) containing common areas and other buildings, the scope of the external lighting criteria applies only to external new and existing lighting within the construction zone of the assessed building.

Ref	Terms	Description
CN5	Temporary lighting, decorative lighting and floodlighting	Temporary lighting such as theatrical, stage or local display installations, where specified, can be excluded from assessment under this issue. Decorative lighting and floodlighting must however not be exempt from the assessment criteria.

Methodology

Average initial luminous efficacy of the external light fittings

The individual luminous fluxes of all luminaires within the refurbishment or fit-out zone are summed (in lumens), then divided by the total circuit Watts for all the luminaires.

For lamps other than LED lamps, the luminous flux of a luminaire using those lamps can be determined by multiplying the sum of the luminous fluxes produced by all the lamps in the luminaire by the light output ratio of the luminaire (as confirmed by the luminaire manufacturer).

> Note: LED lamps are typically integral to the luminaire (LED luminaires). As such, the manufacturers' literature will encompass both lamp and luminaire as a whole.

Evidence

Criteria	Interim design stage	Interim post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Automatic control

An automatic external lighting control system that prevents operation during daylight hours through either a time switch or a daylight sensor (a manually switched lighting circuit with daylight sensor or time switch override is also acceptable) in addition to providing presence detection in areas of intermittent traffic.
Note: for external lighting not fitted with presence detectors, time switches must provide automatic switch off of lighting after a specified curfew hour, except in cases where there is a specific requirement for lighting to be left on all night.

Daylight sensor

A type of sensor that detects daylight and switches lighting on at dusk and off at dawn.

Luminous efficacy in luminaire lumens per circuit Watt

The ratio between the luminous flux produced by an entire luminaire (light fitting) (in lumens) and the total power consumed by the lamps and the control gear contained within the luminaire (Watts).

Presence detector

A sensor that can turn lighting on when a presence is detected in the scanned area, and off after a preset time when no presence is detected. Presence detectors must be compatible with the lamp type used as very frequent switching can reduce the life of some lamp types.

Refurbishment or fit-out zone

For the purpose of this BREEAM issue the Refurbishment or Fit-out zone is defined as the area of the building undergoing refurbishment or fit-out for the BREEAM-assessed building, and the external site areas that fall within the scope of the new works.

Time switch

A switch with an inbuilt clock which will allow lighting to be switched on and off at programmed times.

Other information

None.

Ene 04 Low carbon design

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
6	No	Yes	Yes	Yes	No

Aim

To encourage the adoption of design measures, which reduce building energy consumption and associated carbon emissions and minimise reliance on active building services systems.

Assessment criteria

This issue is split into two parts:

- Passive design (2 credits)
- Low or zero carbon technologies (4 credits).

The following is required to demonstrate compliance:

Passive design

One credit - Passive design analysis

1 The first credit within issue Hea 04 Thermal comfort has been achieved to demonstrate the building design can deliver appropriate thermal comfort levels in occupied spaces.

2 The project team carries out an analysis of the existing building site during the Concept Design stage and identifies opportunities for the implementation of passive design solutions that reduce building energy demand (see compliance note CN5)

3 The building uses passive design measures to make a meaningful reduction in building energy demand in line with the findings of the passive design analysis (see compliance note CN17).

One credit - Free cooling

4 The passive design analysis credit is achieved.

5 The passive design analysis carried out under criterion 2 includes an analysis of free cooling and identifies opportunities for the implementation of free cooling solutions.

6 The building uses ANY of the free cooling strategies listed in compliance note CN6

Low and zero carbon technologies

One credit - Low zero carbon feasibility study

7 A feasibility study has been carried out by the completion of the Concept Design stage by an energy specialist (see Relevant definitions) to establish the most appropriate recognised local (on-site or near-site) low or zero carbon (LZC) energy sources for the building or development (see compliance note CN8).

8 A local LZC technology has been specified for the building or development in line with the recommendations of this feasibility study

Up to 3 credits - Low or zero carbon technology specification and installation

9 Criteria 7to 8 are achieved

10 A local LZC energy technology has been installed in line with the recommendations of the feasibility study and it can be demonstrated this method of supply results in a reduction in building CO_2 emissions (see Relevant definitionsas set out in Table - 29

11 The percentage reduction in building CO_2 emissions has been calculated using approved energy calculation (modelling) software by a Suitably qualified energy modelling engineer (see Relevant Definitions).

Table - 29: Percentage reduction in building CO_2 emissions

Number of credits	% reduction in building CO_2 emissions
1	10%
2	20%
3	30%

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Criteria 2 to 4 Criteria 5 to 7, options 1 to 3 listed in compliance note CN6 only
CN2	Part 2: Core services	Criteria 2 to 8 are applicable
CN3	Part 3: Local services	Criteria 2 to 4 are applicable to consider local services that utilise passive design
CN4	Part 4: Interior design	This issue is not applicable
General		
CN5	Passive design analysis See criterion 3.	As a minimum, the passive design analysis should cover: 1. Site location 2. Site weather 3. Microclimate 4. Building layout 5. Building orientation 6. Building form 7. Building fabric 8. Thermal mass or other fabric thermal storage 9. Building occupancy type 10. Daylighting strategy 11. Ventilation strategy 12. Adaptation to climate change.

Ref	Terms	Description
CN6	Free cooling analysis See criterion 7.	The free cooling analysis should demonstrate consideration of appropriate technologies from the following: 1. Night time cooling (which could include the use of a high exposed thermal mass) 2. Ground coupled air cooling 3. Displacement ventilation (not linked to any active cooling system) 4. Ground water cooling 5. Surface water cooling 6. Evaporative cooling, direct or indirect 7. Desiccant dehumidification and evaporative cooling, using waste heat 8. Absorption cooling, using waste heat 9. The building does not require any significant form of active cooling or mechanical ventilation (i.e. naturally ventilated).
CN7	Free cooling scope	The free cooling should apply to all occupied spaces in the building. Small IT rooms and lift motor rooms are excluded. Mechanical ventilation may only be used for small areas, e.g. for kitchenettes and toilets.
CN8	LZC feasibility study See criterion 8.	The LZC study should cover as a minimum: 1. Energy generated from LZC energy source per year 2. Carbon dioxide savings from LZC energy source per year 3. Life cycle cost of the potential specification, accounting for payback 4. Local planning criteria, including land use and noise 5. Feasibility of exporting heat or electricity or both from the system 6. Any available grants 7. All technologies appropriate to the site and energy demand of the development. 8. Reasons for excluding other technologies 9. Where appropriate to the building type, connecting the proposed building to an existing local community CHP system or source of waste heat or power OR specifying a building or site CHP system or source of waste heat or power with the potential to export excess heat or power via a local community energy scheme.
CN9	LZC feasibility study timing See criterion 8.	When undertaking a feasibility study at a stage later than Concept Design, an additional element would need to be included in the report to highlight the local LZC energy sources which had been discounted due to the constraints placed on the project by the late consideration, and the reason for their omission. If the feasibility study discounted all local LZC as infeasible due to the late stage in the project that the study was commissioned, then the credit for the feasibility study must be withheld. If the feasibility study were commissioned at the Concept Design stage or earlier, and in the unlikely event the study concluded that the specification of any local LZC technology were infeasible, the LZC credit could still be awarded.

Ref	Terms	Description
CN10	Recognised 'local' LZC technologies See criterion 8.	Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (www.eur-lex.europa.eu/en). The following requirements must also be met: 1. There must be a private wire arrangement for the supply of energy produced to the building under assessment. 2. Where the country of assessment has an independent national certification scheme for installers of small scale renewable energy or Combined Heat and Power systems, these technologies must be certified in accordance with the national scheme. 3. The accreditation scheme must align with the Directives listed above, or an equivalent country/regional directive or standard. 4. Air source heat pumps can only be considered as a renewable technology when used in heating mode. Refer to Annex VII of Directive 2009/28/EC for more detail on accounting of energy from heat pumps. Where independent accreditation schemes do not exist in the country the design team must demonstrate they have investigated the competence of the installer selected to install the LZC technology and that they are confident the installers have the skill and competence to install the technology appropriately.
CN11	Other technology not listed See criterion 8.	Other systems may be acceptable as part of a LZC strategy under this issue but are not inherently considered as LZC technologies. Acceptability will be dependent on the nature of the system proposed and the carbon benefits achieved. The BREEAM Assessor must confirm acceptability with BRE if in doubt.
CN12	Waste heat from a building- related operational process See criterion 8.	Waste heat from an operational process that takes place within the assessed building (or on the assessed site) can be considered as 'low carbon' for the purpose of this BREEAM issue. This is on the condition that the generation of the heat from the process is integral to the assessed building. Examples of operational processes and functions include manufacturing processes, high temperature oven or kiln, compressors serving process plant, microbrewery, crematorium, testing and commissioning boilers for training or manufacture, and data centres. It does not include waste heat from IT or server rooms, which could be used as part of conventional heat recovery measures.
CN13	Community and near-site schemes See criterion 8.	'Local' does not have to mean on-site; community schemes (near-site) can be used as a means of demonstrating compliance, as this BREEAM issue seeks to encourage the installation of on-site and near-site LZC technologies.

Ref	Terms	Description
CN14	Waste incineration See criterion 8.	Waste heat from an incineration plant can only be considered as low carbon for the purpose of this BREEAM issue under the following circumstances: 1. All other LZC technologies have been considered and discounted in the feasibility study and; EITHER 2. The local authority or region in which the incineration plant is located is demonstrably meeting its annual waste reuse and recycling targets and waste management policies; OR 3. There is a near or on-site facility connected to the building, via a private wire arrangement, which is demonstrably removing reusable and recyclable waste material prior to incineration.
CN15	First generation biofuels See criterion 8.	Given the current uncertainty over their impact on biodiversity, global food production and greenhouse gas savings, plus the ease of interchangeability between fossil fuels, BREEAM does not recognise or reward building systems fuelled by first generation biofuels manufactured from feedstocks, e.g. biofuels manufactured from sugars, seeds, grain, animal fats etc. where these are grown or farmed for the purposes of biofuel production. Subject to review against the criteria set out in compliance note CN16, BREEAM may recognise systems using second generation biofuels (see Relevant definitions) or biofuels manufactured from biodegradable waste materials e.g. biogas, waste vegetable oil or locally and sustainably sourced solid biofuels e.g. woodchip, wood pellets, where these are not interchangeable with fossil fuels or first generation biofuels.
CN16	Second generation biofuels and biofuels from waste streams See criterion 8.	BREEAM recognises that biofuels produced from biomass which is a by-product of other processes may provide a more sustainable alternative to fossil fuels. Typically, these use waste feedstock consisting of residual non-food parts of current food crops, industry waste such as woodchips, other waste vegetable matter and waste fish oil from sustainable fish stocks to produce biofuel. Such biofuels will, in principle be recognised by BREEAM for the purposes of defining low or zero carbon technologies. However due to the emerging nature of such technologies, full details would be required for review by BRE Global prior to confirmation of acceptability. Matters which would be required for consideration include the following: 1. Type, provenance and sustainability of the biomass feedstock 2. Avoidance or minimisation of fossil fuel use in extracting the biofuel 3. Minimising fossil fuel use in transporting the biomass or biofuel 4. Presence of a supply agreement and a robust supply chain 5. Compatibility of the biofuel with the specified boiler or plant and manufacturer's warranty issues The use of other recycled or waste-derived biofuels such as waste oil from catering may also be recognised by BREEAM subject to the above criteria. For smaller scale applications, the assessor will, in addition, be required to demonstrate that the biofuel is locally sourced. BREEAM does not qualify the term 'locally sourced' or specify a minimum supply contract. However the assessor must determine and demonstrate that these are reasonable for the particular application.
CN17	Meaningful reduction. See criterion 3.	The amount of energy reduction is not specified in the criteria in this issue. However, it should not be a trivial amount. As a guide, the passive design measures should contribute at least a 5% reduction in overall building energy demand.

Ref	Terms	Description
CN18	Approved Building Energy modelling Software	In countries with an existing National Calculation Methodology (NCM), the tool(s) approved for use under the NCM can be used as approved building energy calculation software. These will be confirmed by BRE as part of the Approved standards and weightings list process. Where the design team wishes to use an alternative modelling software package for the purposes of assessing this BREEAM issue, please refer to the Approved standards and weightings list to determine whether the modelling software package meets the minimum requirements in terms of: Minimum capabilities Design features Testing. Where those minimum requirements are met, approval from BRE Global will be required (via the Approved standards and weightings list process) before the package can be used for the purposes of demonstrating compliance with Ene 04.
CN19	Countries with national energy strategy heavily based on renewables	Four credits can be awarded by default where: The building is located in a country where the energy supply from the mains grid is highly decarbonised, due to this supply being generated from renewable sources AND The feasibility study considers the use of energy from the grid in addition to all other fuel types used within the building AND The feasibility study clearly confirms that the introduction of local LZC technologies on site would have an adverse effect on the overall related emissions.
CN20	LZC technology already available on site	For developments where there is an existing LZC energy source that can supply a compliant percentage of energy to the assessed building, a feasibility study will still have to be carried out to demonstrate that the existing technology is the most appropriate for the assessed building/development. The study should seek to identify any other options to supply a higher proportion of the building's energy demand in addition to that supplied by the existing source. In order to be compliant, the energy from any existing LZC energy source must be offsetting the carbon from the building in addition to any existing carbon offsetting that it was established for.
Building type specific		
CN21	Schools: information communication technology (ICT) classrooms	With respect to the free cooling credit, it is possible for ICT classrooms to be designed to avoid the use of active cooling. Hence, they are not exempt from the requirements of this issue, i.e. if active cooling were used to treat these spaces, it would not be possible to achieve the free cooling credit within this BREEAM issue.
CN22	Historic buildings	Under some circumstances an LZC feasibility study may be undertaken however due to heritage building consent or local planning regulations in a heritage conservation area, there may be no recommendations that can be implemented. In this situation, this may be compliant with criteria 7 and 8 provided it can be demonstrated that a wide range of options have been considered with consultation input from the local authority conservation/heritage officer, e.g. considering options for locating LZCs out of public view etc. and the report contains evidence to support these findings.

Methodology

Passive design analysis

The reduction in energy demand associated with the implementation of passive design measures should be demonstrated by comparing the energy demand for the refurbished building with the proposed / new passive design measures, to the energy demand for the existing building. Only the savings that are directly attributable to the proposed passive design measures should be accounted for when undertaking this comparison The energy demand for both scenarios should be calculated by a suitably qualified energy modelling engineer (see Relevant definitions) using approved building energy modelling software (see CN18).

Any design assumptions relating to building operation e.g. occupied hours, internal gains, set temperatures etc. should be consistent between the existing and refurbished building models.

Low and zero carbon feasibility study

The reduction in regulated carbon dioxide CO_2 emissions associated with the specification of low or zero carbon (LZC) technologies is demonstrated by comparing the carbon dioxide CO_2 emissions for the refurbished building including new/additional LZC technologies to the carbon dioxide CO_2 emissions for the existing building. Only the savings that are directly attributable to the proposed LZC technologies should be accounted for when undertaking the comparison.

The carbon dioxide CO_2 emissions for both scenarios should be calculated by a suitably qualified energy modelling engineer (see relevant definitions) using approved building energy modelling software (see CN18).

Any design assumptions relating to building operation e.g. occupied hours, internal gains, set temperatures etc. should be consistent between the existing and refurbished building models.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
4, 7	Results from a dynamic simulation model demonstrating the feasibility of the free cooling strategy and meeting the first credit for Hea 04 Thermal comfort.	As per interim design stage.

Additional information

Relevant definitions

Approved building energy modelling software
Refer to Ene 01 Reduction of energy use and carbon emissions.

Building CO_2 emissions
This is the building's CO_2 emissions associated with building services energy including fixed internal lighting systems, fixed heating or cooling, hot water service or mechanical ventilation. It is expressed as $kgCO_2/m^2$/year and calculated in accordance with approved building energy calculation software.

Energy specialist
An individual who has acquired substantial expertise or a recognised qualification for undertaking assessments, designs and installations of low or zero carbon solutions in the commercial buildings sector and is not professionally connected to a single low or zero carbon technology or manufacturer.

First and second generation biofuels

First generation biofuels are fuels made from sugar, starch, vegetable oil, or animal fats using conventional technology. Second generation biofuels are fuels from lignocellulosic biomass feedstock using advanced technical processes[1]. Common first generation biofuels include vegetable oil, biodiesel and bioalcohols.

Free cooling

The ability of the building to provide cooling to the internal occupied areas without the need to rely on energy consuming mechanical cooling. Free cooling is an enhanced passive design method that requires engineering design and modelling to demonstrate its effectiveness. Other similar methods include enhanced passive ventilation and enhanced daylighting.

Near-site LZC

Refer to Ene 01 Reduction of energy use and carbon emissions.

On-site LZC

Refer to Ene 01 Reduction of energy use and carbon emissions.

Payback period

The period of time needed for a financial return on an investment to equal the sum of the original investment.

Suitably qualified energy modelling engineer

Refer to Ene 01 Reduction of energy use and carbon emissions.

Other information

LZC feasibility study

The LZC feasibility study in BREEAM is intended to encourage the study to be done early in the project, not just before construction starts, so that the most appropriate solutions can be adopted. Also, this credit does not permit technologies that are not best practice or sustainable or cannot be modelled with a robust method.

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[1] Sustainable Bioenergy: a framework for decision makers, United Nations ? Energy, 2007.

Ene 05 Energy efficient cold storage

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
3	No	No	Yes	Yes	Yes

Aim

To recognise and encourage the installation of energy efficient refrigeration systems, therefore reducing operational greenhouse gas emissions resulting from the system's energy use.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Energy efficient design, installation and commissioning

1 With respect to the refrigeration system, its controls and components:
- 1.a A strategy for the design and installation has been produced and implemented by a Suitably qualified engineer from concept design stage onwards. The strategy is multidisciplinary and contains both an aim and method to achieve the lowest practicable environmental impact including energy use, carbon emissions and refrigerant impact.
- 1.b The design team has demonstrated the cold store and building has been designed to minimise heat loads through high levels of insulation, reduced air infiltration and minimisation of auxiliary heat loads, e.g. fans and pumps, lighting, people and machinery.
- 1.c At least 50% of the relevant energy efficient design features (refer to CN7) have been specified/installed.
- 1.d Control systems have been installed to minimise refrigerant temperature lifts by providing controls that optimise evaporator temperature levels and avoid head pressure control.
- 1.e Energy sub-metering has been installed to provide adequate central monitoring of operating parameters and collection of data on plant performance, temperature levels and energy consumption. This does not necessarily require the 'Energy monitoring' credits to have been awarded.
- 1.f The design has minimised the requirement for manual override of plant controls and equipment in normal operating conditions through the specification of central automatic controls, anti-tamper controls, automatic lighting controls, fixed set-point temperature and temperature dead bands.
- 1.g The design specification details appropriate commissioning and test procedures to be undertaken at completion.
- 1.h The installation adheres to the design specification and any necessary changes have been carried out with the approval of the Suitably qualified engineer and are formally documented.

2 The refrigeration system has been commissioned as follows:
- 2.a In compliance with criteria 5-6 for 'Commissioning' outlined in BREEAM issue Man 04 Commissioning and handover. This does not necessarily require the 'Commissioning' credits to have been awarded.
- 2.b Documentation has been provided showing due diligence and compliance with test and commissioning procedures relevant to the installation, such as pressure testing, leakage testing and validation to specification.

One credit - Energy efficiency criteria

3 The refrigeration system uses robust and tested components that meet published energy efficiency criteria (refer to CN8).

Three credits - Indirect greenhouse gas emissions

4 Criteria 1 and 2 are achieved.

5 The installed refrigeration system demonstrates a saving in Indirect operational greenhouse gas emissions (CO_2e) with respect to a 'baseline' building through specification of available technologies. The indirect emissions have been calculated using the Total Equivalent Warming Impact (TEWI) equation as defined in the Calculation procedures section.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable
CN2	Part 2: Core services	Criteria 1 to 5 are applicable
CN3	Part 3: Local services	Criteria 1 to 5 are applicable
CN4	Part 4: Interior design	Criteria 1 to 5 are applicable
Simple buildings		
CN5	Applicable assessment criteria	This issue is not applicable.
General		
CN6	Scope of this BREEAM issue	This issue is applicable only in instances where commercial or industrial sized refrigeration and storage systems are specified, for example: 1. Storage and refrigeration of food in supermarkets 2. Cold storage facilities in industrial, laboratory, healthcare and other buildings. The criteria do not apply to: 1. Domestic-scale refrigeration or 2. Refrigeration for kitchen and catering facilities. These types of installation are covered within BREEAM issue Ene 08 Energy efficient equipment. If the building does not contain commercial or industrial sized refrigeration systems, this issue is not applicable to the assessment.

Ref	Terms	Description
CN7	Energy efficient design features	Below are some design options that are intended to achieve best practice energy efficiency of the cold storage equipment: 1. Fit energy efficient lighting with suitable controls and high efficiency fans on evaporators. 2. Minimise loss of cold air through access doors by minimising frequency of door opening or fit of air curtains, self closing doors, door strips, etc. 3. Optimise evaporator temperature levels to keep suction/evaporation temperatures as high as possible. 4. Specify high efficiency compressors. 5. Provide controls on anti-sweat heaters on doors to minimise electrical consumption outside of operational hours. 6. Condensing temperatures that are as low as possible, including avoiding head pressure control. 7. Design evaporators and condensers for easy cleaning and safe access. 8. Optimise defrosting methods to minimise energy consumption and avoid electric heater defrost. 9. High evaporating temperature cabinets (large coils) with single evaporating temperatures across the refrigeration pack for supermarket display cases. 10. Provision of heat recovery in the design such as de-superheating to domestic hot water, condensing to hot water for heating. (If specified this must not lead to condensing conditions that are artificially inflated to deliver the heat recovery.) 11. Use of wet, condensing-based systems. 12. Use of re-manufactured items that are still of an energy efficient nature where they do not compromise the optimal energy efficiency of the cold storage equipment. 13. Not all of these energy efficient design features will be relevant to the cold storage being assessed. Where features are to be excluded the suitably qualified engineer must provide written justification for determining which are unachievable.

Ref	Terms	Description
CN8	Published energy efficiency criteria See criterion 3.	Please refer to the country specific reference sheet to locate the appropriate published energy efficiency criteria in the country of assessment. Alternatively, please demonstrate that the eligibility criteria are equal to or more onerous than those in the ECA Energy Technology Product List (ETPL): http://etl.decc.gov.uk. Where specified as part of the refrigeration system, products used for the following components must meet published energy efficiency criteria: 1. Air-cooled condensing units 2. Automatic air purgers 3. Cellar cooling equipment 4. Commercial service cabinets (cold food storage) 5. Curtains, blinds, sliding doors and covers for refrigerated display cabinets 6. Evaporative condensers 7. Forced air pre-coolers 8. Refrigerated display cabinets 9. Refrigeration compressors 10. Refrigeration system controls.
CN9	Refurbishing part of an existing building	Where only part of an existing building is being refurbished and there is cold storage that will serve both the refurbished part and the unchanged part of the building, then this plant must meet the criteria in order to achieve any available credits.

Methodology

Calculating indirect greenhouse gas emissions (CO_2eq.) using TEWI

When calculating the Total Equivalent Warming Impact (TEWI) factor, the following equation must be used where the various areas of impact are correspondingly separated:

$$TEWI = GWP \times L \times n + \left[GWP \times m \times \left(1 - \alpha_{recovery}\right)\right] + n \times E_{annual} \times \beta + \left[GWP \times m_i \times \left(1 - \alpha_i\right)\right]$$

As the criteria looks only to calculate the indirect emissions from the refrigeration system, only the impact of the energy consumption of the system needs to be calculated:

$$TEWI\left(Indirect\right) = n \times E_{annual} \times \beta$$

TEWI Equation Terms	
TEWI	Total equivalent warming impact ($kgCO_2$)
$GWP \times L \times n$	Impact of leakage losses
$GWP \times m \times \left(1 - \alpha_{recovery}\right)$	Impact of recovery losses

TEWI Equation Terms	
$n \times E_{annual} \times \beta$	Impact of energy consumption
$GWP \times m_i \times (1 - \alpha_i)$	Global warming potential of gas in the insulation (CO_2 related)
GWP[1]	Global warming potential (CO_2 related)
L	Leakage (kg/yr)
n	System operating time (yr)
m	Refrigerant charge (kg)
$\alpha_{recovery}$	Recovery/recycling factor between 0 and 1
E_{annual}	Energy consumption (kWh/yr)
β 2	CO_2 emission (kg/kWh)
m_i	Refrigerant charge in the insulation system (kg)
α_i	Rate of gas recovered from the insulation at the end of life between 0 and 1
1 The GWP is an index describing the radioactive characteristics of well-mixed greenhouse gases that represent the combined effects of the differing times these gases remain in the atmosphere and their relative effectiveness in adsorbing outgoing infrared radiation. This index approximates the time integrated warming effect of a given greenhouse gas in today's atmosphere, relative to CO_2. 2 The conversion factor β gives the quantity of CO_2 produced by the generation of 1 kWh. It can vary considerably geographically and in terms of time.	

The GWP is an index describing the radioactive characteristics of well-mixed greenhouse gases that represent the combined effects of the differing times these gases remain in the atmosphere and their relative effectiveness in adsorbing outgoing infrared radiation. This index approximates the time integrated warming effect of a given greenhouse gas in today's atmosphere, relative to CO_2.

Calculations must be carried out by an appropriately qualified professional (e.g. a building services engineer), including calculations to justify for assumptions and methodologies for savings in indirect greenhouse emissions.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
2	Refer to generic evidence requirement above.	Refrigeration plant commissioning record

Additional information

Relevant definitions

ECA Energy Technology Product List (ETPL)

The ETPL is part of the government's Enhanced Capital Allowance Scheme, a key part of the government's programme to manage climate change. The scheme provides a tax incentive to encourage investment in low carbon energy saving equipment that meets published energy efficiency criteria. The Energy Technology List (ETL) details the criteria for each type of technology, and lists those products in each category that meet them: https://etl.decc.gov.uk/etl/site.html.

Indirect operational greenhouse gas emissions

These are the indirect greenhouse gas emissions that result from the production of energy used to power the refrigeration system's, cooling plant. This includes the emissions from the production of grid electricity or an on-site source of energy generation, e.g. gas CHP. In the case of refrigeration systems, the term 'direct greenhouse gas emissions' is also used; this refers to the emissions that occur as a direct result of leakage of refrigerant from the system. The impacts of direct greenhouse gas emissions from refrigeration systems are dealt with in the BREEAM issue Pol 01 Impact of refrigerants. Therefore, only indirect emissions resulting from the energy consumption of the system are covered in this issue.

Other information

Code of Conduct for carbon reduction in the retail refrigeration sector

The Code of Conduct has been developed by the Carbon Trust, in partnership with the Institute of Refrigeration (IoR) and the British Refrigeration Association (BRA). The Code is intended to compliment the Carbon Trust Refrigeration Road Map.

Ene 06 Energy efficient transportation systems

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
3	No	No	Yes	Yes	No

Aim

To recognise and encourage the specification of energy efficient transportation systems.

Assessment criteria

The following is required to demonstrate compliance.

One credit - Energy consumption

1 Where new lifts, escalators or moving walks (transportation types) are specified within refurbishment works:
- 1.a An analysis of the transportation demand and usage patterns for the building has been carried out to determine the optimum number and size of lifts, escalators or moving walks.
- 1.b The energy consumption has been estimated in accordance with ISO/DIS 25745 Energy performance of lifts, escalators and moving walks, Part 2: Energy calculation and classification for lifts (elevators) or Part 3 - Energy calculation and classification for escalators and moving walks, for one of the following:
  - 1.b.i At least two types of system (for each transportation type required); OR
  - 1.b.ii An arrangement of systems (e.g. for lifts, hydraulic, traction, machine room-less lift (MRL)); OR
  - 1.b.iii A system strategy which is 'fit for purpose'.
- 1.c The use of regenerative drives should be considered, subject to the requirements in CN9
- 1.d The transportation system with the lowest energy consumption is specified.

Two credits - Energy efficient features

2 Criterion 1 is achieved for newly specified lifts.

Lifts

3 For each newly specified lift, the following three energy efficient features are specified and for existing lifts, at least two of the following energy efficient features are specified:
- 3.a The lifts operate in a standby condition during off-peak periods. For example the power side of the lift controller and other operating equipment such as lift car lighting, user displays and ventilation fans switch off when the lift has been idle for a prescribed length of time.
- 3.b The lift car lighting and display lighting provides an average lamp efficacy, (across all fittings in the car) of >55 lamp lumens/circuit Watt.
- 3.c The lift uses a drive controller capable of variable speed, variable-voltage, and variable-frequency (VVVF) control of the drive motor.

4 Where the use of regenerative drives is demonstrated to save energy, they are specified.

Escalators or moving walks

Each newly specified or existing escalator or moving walk complies with, or (in the case of existing) is retrofitted to comply with at least one of the following:

5 It is fitted with a load sensing device that synchronises motor output to passenger demand through a variable speed drive; OR

6 It is fitted with a passenger sensing device for automated operation (auto walk), so the escalator operates in standby mode when there is no passenger demand.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable
CN2	Part 2: Core services	Criteria 1 to 6
CN3	Part 3: Local services	Criteria 1 to 6 This is only applicable where there are transportation systems within the refurbishment or fit-out zone. This is not applicable where transportation systems are within landlord areas and not within the tenants fit-out zone.
CN4	Part 4: Interior design	This issue is not applicable
Simple buildings		
CN5	Applicable assessment criteria	**Energy consumption (1 credit)** 1. Criterion 1 **Energy efficient features (1 credit)** 2. Criteria 2 and 3 only; criteria 4 to 6 are not applicable.
General		
CN6	Scope of this issue	The criteria relating to lifts do not apply to lifting platforms, wheelchair platform stairlifts or other similar facilities to aid persons with impaired mobility. However, any lifting device with a rated speed greater than 0.15m/s must be assessed, inclusive of goods, vehicle and passenger lifts. An excluded transportation type that demonstrates compliance with the BREEAM criteria would be considered best practice for an energy efficient system (despite not being required for the purpose of awarding the available credits).
CN7	Transport analysis	The transport analysis can be in the form of a written statement justifying the lift selection for the following conditions: where a single lift is provided in a low rise building for the purpose of providing disabled access only; or where a goods lift is selected based on the size of the goods it is intended to carry.
CN8	Building has no lifts, escalators or moving walks	This issue will not be assessed where a building contains no lifts, escalators or moving walks.
CN9	Regenerative drives See criteria 1.c and 4.	A regenerative drive should only be considered where it produces an energy saving greater than the additional standby energy used to support the drives. Regenerative drives will typically be appropriate for lifts with high travel and high intensity use.

Ref	Terms	Description
CN10	Newly specified lifts, escalators or moving walks (transportation types)	A newly specified lift, escalator or moving walks includes the installation of transport systems where none existed before and also the replacement of an existing transportation system (for lifts this would include where undergoing major works to existing lifts such as moderations to the capacity of the lift). Where there are no newly specified lifts, criterion 1 is filtered out from the assessment.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Lift car lighting
The level of lift car lighting is determined by the relevant standards. For example, BS EN 81-1 and 2:1998+A3:2009 require 50 lux on the car floor and any control surfaces.

MRL: Machine room-less lift
All equipment is contained in the lift well, not in a separate machine room.

Standby condition - lifts
A condition when a lift is stationary at a floor and may have reduced the power consumption to a lower level set for that particular lift (from ISO 25745-1:2012). The period between when a lift was last used and when a standby condition is entered is defined in ISO 25745-1 as 5 minutes.

Standby condition - escalators and moving walks
A condition when the escalator or moving walk is stationary and powered on and it can be started by authorised personnel.

Idle condition
A condition when a lift is stationary at a floor following a run before the standby mode is entered (ISO 25745-1: 2012).

Other information

ISO/DIS 25745 - Energy performance of lifts, escalators and moving walks

ISO/DIS 25745 consist of three parts, under the general title Energy performance of lifts, escalators and moving walks:

- Part 1: Energy measurement and verification
- Part 2: Energy calculation and classification for lifts (elevators)
- Part 3: Energy calculation and classification for escalators and moving walks.

In Part 1, it has been estimated that approximately 5% of a building's total energy consumption can be attributed to the operation of lifts and a large proportion of this can be attributed to standby mode in many situations.

BS EN ISO 25745 Parts 2 and 3 have been prepared in response to the rapidly increasing need to ensure and to support the efficient and effective use of energy, providing:

1. A method to estimate energy consumption on a daily and an annual basis for lifts, escalators and moving walks.
2. A method for energy classification of new, existing or modernised lifts, escalators and moving walks.
3. Guidelines for reducing energy consumption that can be used to support building environmental and energy classification systems.

Ene 07 Energy efficient laboratory systems

Number of credits available	Minimum standards	Applicability			
Building type dependent (Up to 5 credits)	No	Part 1	Part 2	Part 3	Part 4
		No	Yes	Yes	Yes

Aim

To recognise and encourage laboratory areas that are designed to be energy efficient and minimise the CO_2 emissions associated with their operational energy consumption.

Assessment criteria

This issue is split into three parts:

- Prerequisite
- Design specification (1 credit)
- Best practice energy efficient measures (up to 4 credits) - building type dependent.

The following is required to demonstrate compliance:

Prerequisite

1 Criterion within issue Hea 03 Safe containment in laboratories has been achieved.

One credit - Design specification

2 Client engagement is sought through consultation during the preparation of the initial project brief to determine occupant requirements for new laboratory systems, or to review existing laboratory systems and define laboratory performance criteria to be met for any new systems or systems to be upgraded or refurbished. Performance criteria should include, but not be limited to the following aspects:
- 2.a Description of purpose
- 2.b Occupant or process activities
- 2.c Containment requirements and standards
- 2.d Air change requirements
- 2.e Ventilation system performance and efficiencies
- 2.f Heating and cooling requirements (including heat recovery)
- 2.g Interaction between systems
- 2.h Flexibility and adaptability of laboratory facilities

3 The design team demonstrates that the energy demand of the laboratory facilities has been minimised as a result of achieving the defined design performance criteria. This has informed the right-sizing (see Relevant definitions) of the services system equipment (including ventilation supply and extract).

Laboratory containment devices and containment areas (criteria only applicable to buildings containing these facilities)

4 New or existing fume cupboards and other containment devices have a specification that is compliant with criteria 1 and 3 of Hea 03 Safe containment in laboratories, as appropriate to the containment device specification.

5 Where ducted fume cupboards are newly specified or present:
- 5.a Compliance with item A in Table - 30.
- 5.b The measurement of volume flow rate should be taken in the exhaust duct (at the boundary of the laboratory) to take account of reductions in (inward) volume flow rate from fume cupboard leakage.
- 5.c A reduction in air flow does not compromise the defined performance criteria and therefore does not increase the health and safety risk to future building occupants.

Up to four credits - Best practice energy efficient measures

The following criteria are applicable where the laboratory area accounts for at least 10% of the total building floor area (see Relevant definitions).

6 Criteria 1 to 5 are achieved (or criteria1 to 4 where ducted fume cupboards are not specified).

7 New or existing plant and systems are designed, specified and installed to promote energy efficiency, demonstrated through compliance with items B to L in Table - 30 (see 7.a and 7.b for how credits are awarded)
   7.a Up to 2 credits: the laboratory area (see Relevant definitions) accounts for at least 10% (but less than 25%) of the total building floor area; OR
   7.b Up to 4 credits: the laboratory area accounts for 25% or more of the total building floor area.

8 To achieve credits for energy efficient measures, the chosen measure(s) must have a reasonably significant effect on the total energy consumption of the laboratory, i.e. 2% reduction or greater. This must be demonstrated by calculations or modelling.

9 The energy efficient measures specified do not compromise the defined performance criteria, and therefore do not increase the health and safety risk to future building occupants.

Checklists and tables

Table - 30: Best practice energy efficient measures in laboratories

Item	Category	Item description	Credits[1]
A	Fume cupboard reduced volume flow rates	An average design air flow rate in the fume cupboards specified no greater than 0.16m^3/s per linear metre (internal width) of fume cupboard workspace.	-
Additional items			
B	Fan power	Specification and achievement of best practice fan power figures (as shown below) for all air handling units, laboratory extract systems, local extract ventilation, containment area extracts (where applicable) and fume cupboard extracts (where applicable).	1
Laboratory system		Best practice specific fan power (W/(L/s))	
General laboratory supply air handling unit (AHU) with heating and cooling		1.5	
General laboratory extract systems		1.2	
Laboratory local extract ventilation - ducted		1.0	
Containment area extract, without high efficiency particulate absorption (HEPA) filtration		1.5	
Containment area extract, with HEPA filtration		2.5	

Item	Category	Item description	Credits[1]
Fume cupboard extract		1.5	
C	Fume cupboard volume flow rates (further reduction)	An average design air flow rate of $<0.12m^3/s$ per linear metre (internal width) of fume cupboard workspace	0.5
D	Grouping or isolation of high filtration or ventilation activities	Minimisation of room air change rates and overall facility ventilation flows by grouping together or isolating activities and equipment with high filtration or ventilation requirements.	0.5
E	Energy recovery - heat	Heat recovery from exhaust air (where there is no risk of cross-contamination) or via refrigerant or water cooling systems.	0.5
F	Energy recovery - cooling	Cooling recovery via exhaust air heat exchangers (where there is no risk of cross-contamination) or via refrigerant or water cooling systems.	0.5
G	Grouping of cooling loads	Grouping of cooling loads to enable supply efficiencies and thermal transfer.	0.5
H	Free cooling	Specification of free cooling coils in chillers or dry air coolers related to laboratory-specific activities.	0.5
I	Load responsiveness	Effective matching of supply with demand through modularity, variable speed drives and pumps, and other mechanisms.	0.5
J	Clean rooms	Specification of particle monitoring systems, linked to airflow controls.	0.5
K	Diversity	Achievement of high levels of diversity in central plant sizing and laboratory duct sizing, where compatible with safety.	0.5
L	Room air changes rates	Reducing air change rates by matching ventilation airflows to environmental needs and demands of containment devices.	0.5

Notes:
1. Only whole credits can be awarded in this issue. Therefore to achieve a credit for items C to L (above) the laboratory must comply with at least two of the items. In an instance where, for example, three and half credits are achieved this would need to be rounded down to three credits.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable
CN2	Parts: 2, 3 and 4	Criteria 1 to 9 (for buildings where these facilities are present or specified)
General		
CN3	Scope of this BREEAM issue	This issue is applicable only to Further education, University and Other buildings, Research and development facilities that contain laboratory space and containment devices or areas. This issue is not applicable for School buildings (primary and secondary level). The laboratory criteria within issue Hea 03 Safe containment in laboratories should be followed for assessing laboratories and containment devices in these building types. Where there are a large number of containment devices (such as fume cupboards) present in a School or College assessment, BRE should be contacted for further guidance.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Laboratory areas

Laboratory areas are defined as highly serviced (temperature or ventilation or humidity or containment controlled) spaces where physical or biological or chemical processing or testing is carried out. Such areas will have inherently high energy demands. In order to maintain controlled conditions to enable experiments and comply with health and safety standards, typically laboratories:

1. Contain various exhaust and containment devices (such as fume cupboards and microbiological safety cabinets)
2. Are heavily serviced to circulate air and to supply heating, cooling, humidity, and clean air
3. Often require 24-hour access and fail-safe redundant backup systems and uninterrupted power supply or emergency power to enable irreplaceable experiments.

Therefore, for the purpose of assessing this BREEAM issue, the definition of laboratory areas excludes any laboratory support areas such as:

1. Write up or offices
2. Meeting rooms
3. Storage
4. Ancillary and other support areas with lower servicing requirements.

Teaching and other laboratories workshops with a limited amount of fume cupboards or other containment devices or no energy intensive process equipment specified are excluded, unless the design team can provide evidence that their consumption is at least 50% higher than a typical office due to the laboratory process-related activities. Benchmarks for general offices can be found in Table - 30 in CIBSE TM46[1] Energy benchmarks. Typically, in buildings where 40% of the floor area is laboratory related, only 10% will actually constitute laboratory areas as per the BREEAM definition.

Different types of laboratories have different requirements for heating, ventilation and air-conditioning (HVAC), plug load / small power equipment and access. This can lead to enormous variations in energy and water requirements. The main types of laboratories include:

1. Wet laboratories - where chemicals, drugs or other material or biological matter are tested and analysed requiring water, direct ventilation and specialised piped utilities. They typically include chemical science laboratories. These laboratories require specially designed facilities.
2. Dry laboratories - contain dry stored materials, electronics, or large instruments with few piped services. They typically include engineering or analytical laboratories that may require accurate temperature and humidity control, dust control, and clean power.
3. Microbiological and clinical laboratories - often involve working with infectious agents. They typically require higher levels of primary containment and multiple secondary barriers including specialised ventilation systems to ensure directional air flow, air treatment systems to decontaminate or remove agents from exhaust air, controlled access zones, airlocks as laboratory entrances, or separate buildings or modules to isolate the laboratory.
4. In vivo laboratories - these require highly controlled environments for the care and maintenance of flora and fauna. The facilities are complex, and expensive to build and to operate. Tight environmental control over the facility is required to avoid the introduction of contaminants or pathogens, and prevent the possibility of infectious outbreaks, and avoid the transmission of odours.
5. Teaching laboratories - unique to academic institutes, they require space for teaching equipment, storage space for student belongings and less instrumentation than research labs.
6. Clean rooms - refers to a controlled environment (air quality, temperature and humidity) which prevent contamination and the regulating of environmental conditions, to facilitate accurate research and production needs. They are typically used in universities for nanotechnology, medical and pharmaceutical research or studies and microelectronics applications.

Right-sizing

Right-sizing principles encourage the use of better estimates in equipment loads from which services equipment is sized in comparison to traditional methods of estimates based on 'rated' data obtained from manufacturers' literature or design assumptions from previous projects. This can result in construction cost savings in addition to life cycle cost benefits, while taking account of the need for appropriate contingency.

Other information

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[1] TM46 Energy benchmarks. CIBSE, 2008

Ene 08 Energy efficient equipment

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
2	No	No	No	Yes	Yes

Aim

To recognise and encourage a reduction in the building's unregulated energy load through the use of energy efficient equipment to ensure optimum performance and energy savings in operation.

Assessment criteria

The following is required to demonstrate compliance:

Two credits

1 Identify the building's equipment energy consuming loads (see Relevant definitions) and estimate their contribution to the total annual equipment energy consumption of the building, assuming a typical or standard specification.

2 Identify the systems or processes that use a significant proportion of the total annual equipment energy consumption of the development and its operation.

3 Demonstrate a meaningful reduction in the total annual equipment energy consumption of the building. See Table - 31

Table - 31 contains solutions deemed to satisfy compliance for common examples of significant contributors to unregulated energy consumption, for a number of different building types or functions.

Checklists and tables

Table - 31: Examples of solutions deemed to comply with the criteria for the reduction of equipment energy load from significantly contributing systems

Ref	Function/equipment	Criteria
A	Small power, plug-in equipment	The following equipment meets the criteria for or has been awarded with a rating from a national or international energy efficient equipment scheme: : 1. Office equipment 2. Other small powered equipment 3. Supplementary electric heating. For domestic-scale white goods, the criteria in Ref F(Residential areas) apply.
B	Swimming pool	1. Where automatic or semi-automatic pool covers, or 'liquid' pool covers with an automatic dosing system, are fitted to ALL pools, including spa pools and Jacuzzis (if relevant). 2. The covers envelop the entire pool surface when fully extended. 3. Where the air temperature in the pool hall can be controlled so that it is 1°C above the water temperature.

Ref	Function/equipment	Criteria
C	Communal laundry facilities with commercial sized appliances	At least one of the following can be demonstrated for commercial sized appliances: 1. Specification of heat recovery from waste water 2. Use of greywater for part of the washing process. This may be recycled from the final rinse and used for the next pre-wash.
D	Data centres	1. Design is in accordance with national or international best practice standards for energy efficiency in data centres or where no national standards existing, are designed in accordance with the 'Best practices for the EU Code of Conduct on Data Centres'[1] principles with the data centre achieving at least the 'Expected minimum practice' level (as defined in the Code of Conduct). 2. Temperature set points are not less than 24 C, as measured at the inlet of the equipment in the rack.
E	IT-intensive operating areas	1. Uses a natural ventilation and cooling strategy as standard, with forced ventilation only to be used when the internal temperature exceeds 20°C and active cooling only when the internal temperature exceeds 22°C. 2. There is a mechanism to achieve automatic power down of equipment when not in-use, including overnight.

Ref	Function/equipment	Criteria
F	Residential areas with domestic-scale appliances (individual and communal facilities)	— Fridges, freezers and fridge-freezers have an energy rating under a national or international energy efficient white goods scheme equivalent to an A+ (or equivalent rating) under the EU Energy Labelling schemea national or international energy efficient white goods scheme. — Washing machines and dishwashers have an energy rating under a national or international energy efficient white goods scheme equivalent to an A rating under the EU Energy Labelling schemehave an A (or equivalent rating) under a national or international energy efficient white goods scheme. — Where provided, washer-dryers and tumble dryers have an energy rating under a national or international energy efficient white goods scheme equivalent to an B rating under the EU Energy Labelling scheme a B rating (or equivalent rating) under a national or international energy efficient white goods scheme. (If not provided criterion F4 must be achieved for tumble dryers.) OR — If appliances will be purchased during occupation by the tenant/owner, information on the appropriate energy efficient white goods scheme must be provided to all residential areas of the building. Note: 1. Any white goods available to purchase from the developer must be compliant with criteria F1 to F4 above. 2. If criterion F5 was chosen to demonstrate compliance, only one of the two available credits could be awarded.
H	Kitchen and catering facilities	The project has incorporated at least two thirds of the energy efficiency measures outlined in the section summaries of each of the following sections of CIBSE Guide TM50[2] (except as specified): 1. Section 8 (Drainage and kitchen waste removal) 2. Section 9 (Energy controls - specifically controls relevant to appliances) 3. Section 11 (Appliance specification - not fabrication or utensil specifications) 4. Section 12 (Refrigeration) 5. Section 13 (Warewashing: dishwashers and glasswashers) 6. Section 14 (Cooking appliance selection) 7. Section 15 (Water temperatures, taps, faucets and water saving controls). Refrigeration for kitchen and catering facilities should be assessed here, not in Ene 05 Energy efficient cold storage.
I	Display lighting	Display lighting shall have a minimum luminaire efficacy of ≥ 60 luminaire lumens per circuit Watt. Display lighting shall also be controlled by a time switch to prevent operation after midnight except where the area is open to the public.

Ref	Function/equipment	Criteria
J	Overhead warm air heaters (e.g. air curtains)	In all cases where overhead warm air heaters are used, they are to be controlled using automatic temperature control. Where the units supply multiple areas then these shall be controlled by zone temperature sensors.
Energy efficient white goods scheme and equivalent rating scheme (Category reference F) Energy rating certifications other than the EU labelling scheme will be accepted, providing the energy efficiency performance is equivalent to the EU labelling scheme. This can be any internationally recognised energy efficiency labelling scheme for white goods or a national scheme developed for use in the country of assessment, for example Energy Label (in the EU), Energy Star (in the USA), The Appliance Energy Rating Scheme (in Australia), etc. A statement confirming that the scheme is nationally recognised and can be regarded as equivalent to the EU labelling scheme is required for use.		

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable
CN2	Part 2: Core services	This issue is not applicable
CN3	Part 3: Local services	Criteria 1 to 3 are applicable
CN4	Part 4: Interior design	Criteria 1 to 3 are applicable
General		
CN5	Refrigeration equipment	The criteria in 'Ref A Small power, plug in equipment' in the Checklists and tables section apply to the following refrigeration equipment (where present): 1. Air-cooled condensing units 2. Cellar cooling 3. Commercial service cabinets 4. Curtains or blinds for refrigerated display cabinets 5. Refrigeration compressors 6. Refrigeration system controls 7. Refrigerated display cabinets.
CN6	A meaningful reduction in equipment energy demand	BREEAM does not specify a level or percentage that defines a meaningful reduction in equipment energy demand. The project team must justify how they have determined or judged a meaningful reduction from the equipment energy demand and the assessor must be satisfied that this is an appropriate justification.

Ref	Terms	Description
CN7	Cold storage	The criteria do apply to commercial kitchen refrigeration but not to other commercial or industrial sized refrigeration and storage systems. These systems are covered within the scope of Ene 05 Energy efficient cold storage and should be removed from the list of unregulated loads with respect to this issue.
CN8	Lifts, escalators and moving walks	This issue does not apply to lifts, escalators and moving walkways. These systems are covered within the scope of Ene 06 Energy efficient transportation systems and should be removed from the list of unregulated loads with respect to this issue.
CN9	Laboratory systems	This issue does not apply to laboratory ducted fume cupboards. These systems are covered within the scope of Ene 07 Energy efficient laboratory systems and should be removed from the list of unregulated loads with respect to this issue.
CN10	Reuse of equipment	Reuse of electrical equipment does not comply by default, as it may not be the most energy efficient option. However, the credit could be awarded if either of the following criteria are demonstrated: — Reusing the old equipment would, over the course of its life, be a more energy efficient option than specifying new equipment.
CN11	Speculative projects	Where the project is speculative and there are no unregulated energy demands including any of the equipment listed in Table - 31

Methodology

Estimating annual equipment energy consumption

A method should be used that estimates actual energy use, based on expected equipment loads and hours of operation. The energy uses may be estimated by using simple hand calculations, benchmark data or by the methods described in CIBSE TM54: Evaluating operational energy performance of buildings at the design stage[3].

Estimating a significant proportion of annual equipment energy consumption

This methodology is used to estimate which energy uses make-up a significant proportion of the equipment energy uses and so detailed calculations are not required. The approach should focus on identifying the larger energy uses that should be included and the small energy uses that can be excluded. As a guide, energy uses making up at least 90% of the estimated total annual energy consumption should typically be included.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Data centre

For the purpose of this BREEAM issue, the term 'data centres' includes all buildings, facilities and rooms which contain enterprise servers, server communication equipment, cooling equipment and power equipment, and may provide some form of data service (e.g. large-scale mission critical facilities all the way down to small server rooms located in office buildings).

IT-intensive areas

These include computer areas where more than one computer per 5m^2 is provided, e.g. training suites, design studios, libraries' IT areas and other areas with a high density of computing devices.

Office equipment

Computer monitors, desktop computers, scanners, photocopiers, printers, workstations etc.

Equipment energy

Building energy consumption resulting from systems or processes within the building, other than Service energy (see definition below). This may include energy consumption from systems integral to the building and its operation, e.g. lifts, escalators, refrigeration systems, ducted fume cupboards; or energy consumption from operational-related equipment, e.g. servers, printers, computers, mobile fume cupboards, cooking and other appliances.

White goods and small power equipment

Domestic appliances for example washing machines, fridges, freezers, fridges/freezers, tumble dryers, washer-dryers, air movement fans or heaters, etc.

Other information

None.

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[1] EU Code of Conduct on Data Centres: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/best_practices_v4_0_5-r1.pdf
[2] CIBSE TM50: Energy Efficiency in Commercial Kitchens, CIBSE
[3] TM54: Evaluating operational energy performance of buildings at the design stage. CIBSE. 2013

Ene 09 Drying space

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	No	Yes	Yes

Aim

To provide a reduced energy means of drying clothes.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1 For self-contained dwellings: an adequate internal or external space with posts and footings, or fixings capable of holding:
 1.a One to two bedrooms: 4m+ of drying line
 1.b Three or more bedrooms: 6m+ of drying line.

OR

2 Individual bedrooms: an adequate internal or external space with posts and footings, or fixings capable of holding:
 2.a Two metres or more of drying line per bedroom for developments with up to 30 individual bedrooms; plus
 2.b One metre of additional drying line for each bedroom over the 30 individual bedroom threshold.

AND

3 The space (internal or external) is secure.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part: 2	This issue is not applicable.
CN2	Parts: 1, 3 and 4	Criteria 1 to 3 are applicable
General		

Ref	Terms	Description
CN3	Adequate internal space See criteria 1 and 2.	This is either: — A heated space with adequate, controlled ventilation, complying with national building regulations (rooms that commonly meet these requirements are a bathroom or utility room); OR — An unheated outbuilding, where calculations by an appropriate building services engineer (or equivalent professional) demonstrate that ventilation in the space is adequate to allow drying in normal climatic conditions and to prevent condensation/mould growth.; AND — The fixing/fitting needs to be a permanent feature of the room. Internal drying spaces in the following rooms do not comply: — Living rooms. — Kitchens. — Dining rooms. — Main halls. — Bedrooms.
CN4	Building has no residential areas	Please note that where a building contains no residential function this issue is not applicable and will not require assessment.
CN5	Supported living facilities	This issue does not apply to multi-residential assessments of supported living facilities (for safety reasons, to minimise ligature risk to particular residents).

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Secure space

For self-contained dwellings this can be defined as an enclosed space only accessible to the residents of the dwelling. For buildings with a communal drying space it is an enclosed space with a secure entrance, accessible to the residents of the building only.

Other information

None.

8.0 Transport

Summary

This category encourages better access to sustainable means of transport for building users. Issues in this section focus on reviewing the accessibility of public transport and other alternative transport solutions (cyclist facilities, provision of amenities local to a building) that support reductions in car journeys and, therefore, congestion and CO_2 emissions over the life of the building.

Category summary table

				Applicability			
Issue ID	Issue name	Credits	Credit summary	Part 1	Part 2	Part 3	Part 4
Tra 01 Sustainable transport solutions	Public transport solutions	Up to 8 credits	– Recognition for projects where proximity to good public transport networks has been reviewed and where poor, alternative measures have been implemented, thereby helping to reduce transport-related pollution and congestion.	Yes	No	No	Yes
Tra 02 Proximity to amenities	Proximity to amenities	Up to 2 credits	– Recognition of projects where proximity of, and accessibility to, local amenities which are likely to be frequently required and used by building occupants has been reviewed.	Yes	No	No	Yes
Tra 03 Cyclist facilities	Cyclist facilities	0	– This issue is not assessed in the BREEAM International Refurbishment and Fit-out scheme	No	No	No	No

Issue ID	Issue name	Credits	Credit summary	Applicability Part 1	Part 2	Part 3	Part 4
Tra 04 Maximum car parking capacity	Maximum car parking capacity	Up to 2 credits	— To ensure change of use projects review provision of car parking spaces to optimise car parking capacity and encourage alternatives to car travel.	Change of use only	Change of use only	Change of use only	Change of use only
Tra05 Travelplan	Travel plan	1	— To promote sustainable reductions in transport burdens by undertaking a site specific travel assessment or statement and developing a travel plan based on the needs of the particular site.	Yes	No	No	Yes

Tra 01 Sustainable transport solutions

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
Up to 8 credits	No	Yes	No	No	Yes

Aim

To recognise projects where the proximity of good public transport networks has been reviewed, and encourage the implementation of alternative transport solutions where proximity to public transport networks is poor; thus helping to reduce transport-related pollution and congestion.

Assessment criteria

This issue is split into two parts:

- Accessibility Index (up to five credits - building type dependent)
- Alternative transport measures (up to three credits).

Note: up to a maximum of five credits are available from a combination of the following Accessibility Index and alternative transport measures criteria.

The following is required to demonstrate compliance:

Up to five credits - Accessibility Index

1 The public transport Accessibility Index (AI) for the assessed building is calculated and BREEAM credits awarded according to the building type. For Accessibility Index benchmarks see Table - 33.

2 The Accessibility Index is determined by entering the following information into the BREEAM Tra 01 calculator:
  - 2.a The distance (m) from the main building entrance to each compliant public transport node
  - 2.b The public transport type(s) serving the compliant node, e.g. bus or rail
  - 2.c The average number of services stopping per hour at each compliant node during the operating hours of the building for a typical day (see compliance notes and Table - 36).

Up to three credits - Alternative transport measures

3 Where alternative transport measures in Table - 34 are provided, credits can be awarded based upon the number of measures implemented as detailed in Table - 32.

Table - 32: Credits achieved for alternative transport measures

Credits	Number of measures required from Table - 34
One	Two
Two	Four
Three	Six

Checklists and tables

Table - 33: Credits available for each building type relating to the public transport Accessibility Index (AI) score.

Accessibility Index	≥ 2	≥ 4	≥ 8	≥ 10	≥ 12	≥ 18
Building type	BREEAM credits available					
Offices, Industrial, Multi-residential	1	2	3	-	-	-
Preschool, School, College	1	2	3	-	-	-
Retail,University and Further Education, Higher Education type 1 Hotels and other short stay accommodation	1	2	3	3	4	5
Higher Education type 2	1	2	3	4	5	-
Rural location sensitive buildings.	1	2	-	-	-	-

Table - 34: Alternative transport measures

Ref	Measure
A (worth two measures)	For buildings with a fixed shift pattern, i.e. where building users will predominantly arrive or depart at set times, this measure is achieved where the building occupier provides, or commits to providing, a dedicated bus service to and from the building at the beginning and end of each shift or day.
B	Where compliant cycle storage spaces that meet the minimum levels set out in Table - 35 (see Checklists and tables) are installed. Please check Methodologies and Additional Information for more information. Note: This measure is not applicable for sheltered housing, care homes and supported living facilities.
C	Where at least two of the following types of compliant cyclist facilities have been provided for all building users (including pupils where appropriate to the building type): a. Compliant showers b. Compliant changing facilities and lockers for clothes c. Compliant drying space for wet clothes. Please see Methodologies and Relevant definitions for the scope of each compliant cyclist facility. Note: This measure is not applicable to sheltered housing, care homes and supported living facilities, student residents and key worker accommodation.
D	For sheltered housing, care homes and supported living facilities, where the requirements of measures B and C have been met for cycle storage space and compliance cycle storage facilities, this is equivalent to the achievement of one measure.
E	Provision of electric recharging stations for at least 5% of the total car parking capacity for the building, with a minimum of at least 2 spaces. The design team can demonstrate electric vehicles emissions than petrol/diesel counterparts.

F	Provision of the following: — A car sharing group/facility to facilitate and encourage building users to sign up to a car sharing scheme. — Marketing material development to help raise awareness of the system and will be communicated to the tenants where applicable — Priority spaces for car sharers for at least 5% of the total car parking capacity for the building, with a minimum of at least 2 spaces. — Priority spaces are located in the nearest available spaces in the nearest available parking area to the main building entrance on site.
G	Where the building has digital information points providing details on alternative transport options; this could include bus times, car sharing and cycle routes. These information points must be well positioned and accessible to all building users.
H	Where on-site facilities have been provided that reduce the need to travel (taking into account the activities being undertaken in the building), for example the specification of video conferencing systems or where the appropriate amenities are available on site.
I	Where negotiations with local bus companies have resulted in an increase of the local service provision in the building's local area that results in improving the existing Accessibility Index (AI) for the building by at least one point.
L	Where another alternative measure has been implemented that is not listed above, which has been approved by BRE Global. Any additional approved measures will be listed on the assessor FAQs and added to this list over time as and when BRE Global reissue the technical manual.

Table - 35: Compliant cycle storage spaces

Building type	No. spaces per unit of measure	Unit of measure	Notes
Commercial			
Offices, Industrial	1	10 staff	None
Retail			
Large retail	1	10 staff	The number of staff should be the maximum number using the building at any time or shift. The staff spaces must be provided in addition to customer spaces. While they do not need to be separate from customer spaces, this is encouraged. This is subject to providing a minimum of 10 cycle customer spaces. Any retail development that provides at least 50 customer cycle storage spaces will comply regardless of the number of parking spaces.
	1	20 public car parking spaces	1

Small retail	10	Total	The spaces must be publicly accessible within the proximity of a main building entrance. Compliant cyclist facilities are intended for staff only, i.e. it is not a requirement of compliance to provide facilities for customers.
Education			
Preschool or crèche (i.e. up to age 6)	1	10 staff	None
Primary school (i.e. age 6 -11)	5	Per class in year group	For example: where a primary school has been designed to accommodate three classes per year, a total of 15 compliant cycle storage spaces are provided for the whole school. Where there are varying numbers of classes per year, the calculation must be based on the year with the greatest number of classes.
Secondary schools (11 years plus), college, University and Further Education	1	10 staff & pupils/students total	University and Further Education:
Multi-residential			
Student residences, key worker accommodation	1	10 staff	The requirement is subject to a minimum of one compliant space being provided.
	1	2 residents	
Sheltered housing, Care homes, Supported living facility	1	10 staff	* Or spaces specified in accordance with the number required as identified by the likely resident profile. Where the resident profile is not the elderly or physically disabled or impaired then, where appropriate, the requirement for wheelchair or electric buggy spaces should be changed to compliant cycle spaces.
	1 compliant wheelchair or electric buggy storage spaces	10 residents*	
Hotels and other short stay accommodation			
All	1	Staff	None
	1	Visitors/beds	
Note: Here the number of building users (based upon the unit of measure) exceeds 200 the sliding scale of compliance can be used to identify the appropriate number of cycle spaces required (see Methodology section).			

* See Tra 01 Sustainable transport solutions - Additional building type classifications

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and Structure	All assessment criteria are applicable.
CN2	Part 2: Core Services	Not applicable.
CN3	Part 3: Local Services	Not applicable.
CN4	Part 4: Interior Design	All assessment criteria are applicable.
General		
CN5	Campus style sites, see criterion 1.	Where 80% or more of the buildings on a campus style site, e.g. University or higher education sites, are within 1000m of the campus's main entrance, then the campus's main entrance can be used as the reference point for the assessment of distance to compliant public transport nodes for this issue. The campus's main entrance is that which is accessed by the majority of the assessed building's staff, students and visitors. A site may have more than one main entrance which between them account for the majority of staff, students and visitors that access the site. In such a case any of the entrances can be used as the basis for the calculation. Where less than 80% of the buildings on the campus are within 1000m of the campus's main entrance, the assessed building's main entrance must be used as the reference point for the assessment of distance to compliant public transport nodes for this issue. This rule implies for large campus sites, when distances are too great to be comfortably covered by walking, the needs of the building users would be served better by locating the public transport nodes inside or on the periphery of the campus. Where the building is not part of a centralised campus then its main entrance must be used as the reference point for the assessment of this issue.
CN6	Building locations with a high level of public transport accessibility	For sites where at least 50% of the available BREEAM credits for the Accessibility Index undercriteria 1 and 2 have been awarded (rounded to the nearest whole credit), the number of compliant cycle spaces required in Table - 35 for alternative transport measures reference B and C can be reduced by 50%. This reduction will also reduce the requirement for compliant showers or lockers by the same margin for most building types by default, since the calculation is based on the number of cycle storage spaces. Building types where the number of required showers/lockers is not based on cycle storage provision can reduce the actual requirement for compliant showers/lockers by 50%.

Ref	Terms	Description
CN7	Rural locations	For sites in rural locations the following can be applied; 1. Where the distance to the nearest urban location is greater than 10 miles, the number of compliant cycle spaces required for alternative transport measure reference B can be reduced by 50%. 2. Where the distance to the nearest urban location is greater than 20 miles, the number of compliant cycle spaces can be reduced by 70%. 3. Where the distance to the nearest urban location is greater than 30 miles, the number of compliant cycle spaces can be reduced by 90%. This reduction will also reduce the requirement for compliant shower/lockers by the same margin for most building types by default, since the calculation is based on the number of cycle storage spaces. Building types where the number of required showers/lockers is not based on cycle storage provision can reduce the actual requirement for compliant showers/lockers by 50%, 70% or 90% as appropriate. A percentage reduction in this context cannot be applied in addition to the 50% reduction due to the building's Public Transport Accessibility level (as described in the Compliance note above).
CN8	Existing facilities	Existing facilities such as cycle storage spaces, electric vehicle charging points etc. can be used to support the number of required but must be BREEAM compliant to be considered. For example, all existing cycle storage must be conveniently located and accessible to all appropriate building users.
CN9	Phased refurbishment/regeneration projects, see criterion 3	In the case of a large phased refurbishment or regeneration of a site where new transport facilities will be provided, but at a later stage than the building being assessed, the assessment can consider such facilities provided that: A commitment has been made to provide transport facilities within the shortest of the following periods, this is demonstrated either within the General Contract Specification or in the form of a Section 106 Agreement: 1. The transport facilities will be available for use by the time 25% of all phases have been completed and are ready for occupation; OR 2. The transport facilities will be available for use within 25% of the total build time for the phase in which the assessed building forms a part, measured from the completion date of that phase. The most appropriate rule for the site in question must be used, ensuring that the time building users have to wait before having use of the transport facilities is as short as possible. Where the transport facilities will not be available for use within a period of five years from occupation of the building, they cannot be considered for determining compliance with the BREEAM criteria.

Methodology

The methodology for calculating the AI is a calculation based on the number and distance of nearby public transport nodes and the frequency of the transport from these nodes. It uses the UK Transport for London's Public Transport Accessibility Level (PTAL) method. For a description of the PTAL methodology and how it works refer to appendix B of Transport Assessment Best Practice; Guidance Document (PDF link).

Calculating the average number of services

For the purpose of the calculation, the frequency of public transport is the average number of services per hour. This is calculated by determining the number of stopping services at the node during the peak arrival and departure times for the building or the building's typical day's operating hours (see Operating hours), divided by the number of hours within that period. For example: the average number of services for an assessment of a building that operates between 08:00 - 19:00 hrs (11 hours) and is within proximity of a bus stop with 35 stopping services during this period is 3.2 (equivalent to an average service frequency of approximately 20 minutes).

Multiple services

Services that operate from more than one node within proximity of the building, i.e. two separate bus stops served by the same bus, must be considered only once at the node in closest proximity to the building. Different services at the same node can be considered as separate.

Bidirectional routes

Routes will be bidirectional; however for the purpose of calculating the index, consider only the direction with the highest frequency (in accordance with the PTAL methodology).

Sliding scale of compliance for cycle facilities

To recognise the increased confidence in availability that occurs where there is larger scale provision of facilities, it is acceptable to reduce the provision requirement for building users by increasing the standard unit of measure (defined in Table - 35) and potentially the provision of cyclist facilities on a sliding scale as follows:

1. For buildings with more than 200 users but less than 300, the unit of measure can be increased by a ratio of 1.5.
2. For buildings with more than 300 users but less than 400, the unit of measure can be increased by a ratio of 2.
3. For buildings with more than 400 users, the unit of measure can be increased by a ratio of 2.5.

For example, an office building with 800 users would be required to provide the following number of cycle storage spaces:

- 1-200 users @ 1 space per 10 users = 20 spaces
- 201-300 users @ 1 space per 15 users (standard unit of measure x 1.5) = 7 spaces
- 301-400 users @ 1 space per 20 users (standard unit of measure x 2) = 5 spaces
- 401+ users @ 1 space per 25 users (standard unit of measure x 2.5) = 16 spaces
- Total compliant cycle storage spaces required = 48 spaces

The sliding scale of compliance does not apply to the following building types: small and large retail, primary schools, multi-residential buildings and Defence and national security residential buildings.

Sliding scale of compliance for electric vehicle charging points

To recognise the increased confidence in the availability that occurs where there is a larger scale of provision of facilities and also the current use of electric vehicles, it is acceptable to reduce the provision requirement for building users on a sliding scale as follows:

1. 1-200 car parking spaces: electric charging points for 5% of car parking capacity or a minimum of 2 spaces
2. 201 - 400 car parking spaces: electric charging points for 4% of car parking capacity
3. 401 + car parking spaces: electric charging points for 3% of car parking spaces

Minimum cycle storage provision

Where the calculated number of required cycle storage spaces is less than four, total provision should be based on the lower of the following:

a. A minimum of four compliant storage spaces must be provided OR
b. One space per user (staff and where appropriate other user groups).

Evidence

Criteria	Interim design stage	Final post construction stage
1-3	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1-2	A completed copy of the Tra01 calculator	As per interim design stage

Additional information

Relevant definitions

Accessibility Index

A measure that provides an indicator of the accessibility and density of the public transport network at a point of interest (in the case of BREEAM, a building). The index is influenced by the proximity and diversity of the public transport network and the level or frequency of service at the accessible node.

For example, a building that has a single public transport node 500m from its main building entrance with one service stopping every 15 minutes, i.e. four services per hour on average, will score an AI of approximately 1.90. Alternatively, the same node with one service every 15 minutes, but 300m from the building entrance will achieve an AI of 2.26. The same node with two services stopping every 15 minutes will score an AI of 2.85. The greater the number of compliant nodes, services and their proximity to the building, the higher the AI.

Additional building type classifications

Higher Education type 1: HE buildings located on a campus where less than 25% of students are resident on the campus or within 1km radius from the campus's main entrance.

Higher Education type 2: HE buildings located on a campus where 25% or more of the students are resident on the campus or within 1km radius from the campus's main entrance.

BREEAM Tra 01 Calculator tool

A spreadsheet-based calculator used to determine the Accessibility Index for the assessed building and the number of BREEAM credits achieved.

Compliant changing facilities

Compliant changing facilities are defined as those that meet the following:

1. Appropriately sized for the likely or required number of users. The assessor should use their judgement to determine whether the changing area is appropriately sized given the number of cycle storage spaces or showers provided.
2. Changing areas must include adequate space and facilities to hang or store clothing and equipment while changing or showering, e.g. bench seat or hooks.
3. Toilet cubicles and shower cubicles cannot be counted as changing facilities.

Compliant cycle storage space

Compliant cycle storage spaces are defined as those that meet the following:

1. Cycles can be secured within spaces in racks. They are covered overhead and the cycle racks are set in or fixed to a permanent structure (building or hardstanding). Alternatively the cycle storage may be located in a locked structure fixed to, or part of, a permanent structure with appropriate surveillance.
2. The distance between each cycle rack, and cycle racks and other obstructions, e.g. a wall, allows for appropriate access to the cycle storage space to enable bikes to be easily stored and accessed.
3. The storage facility or entrance to the facility is in a prominent site location that is viewable or overlooked from either an occupied building or a main access to a building.
4. The cycle storage facility has adequate lighting; this could be demonstrated with the lighting criteria defined in BREEAM issue Hea 01 Visual comfort. The lighting must be controlled to avoid out-of-hours use and operation during daylight hours, where there is sufficient daylight in or around the facility

Compliant drying space

A compliant drying space is defined as a space that is specifically designed and designated with adequate heating and ventilation for the drying of wet clothes. A plant room, for example, is not a compliant drying space.

Compliant lockers

Compliant lockers are defined as those that meet the following:

1. The number of lockers is at least equal to the number of cycle spaces required.
2. Lockers are either in, or adjacent to, compliant changing rooms.
3. The lockers are sized appropriately for the storage of a cyclist's equipment.

Compliant showers

Compliant showers are defined as those that meet the following:

1. Provision of one shower for every 10 cycle storage spaces, subject to a minimum provision of one shower.
2. Any building providing eight showers or more will comply regardless of the number of cycle storage spaces provided.
3. Both male and female users must be catered for, i.e. either separate showers within shared gender-specific facilities (required provision split 50-50) or single shower cubicles and changing space for mixed use.
4. The showers do not need to be dedicated to cyclists and can be those shared with other users or uses.

Compliant transport node

A compliant node includes any bus service with a stop within 650m and any railway station within 1000m of the assessed building's main entrance, measured via a safe pedestrian route (not measured directly as a straight line, unless access via pedestrian routes is in a straight line). The service stopping at each node must provide transport from, or onward travel to, either an urban centre, major transport node or a community focal point, e.g. doctor's surgery, library, school or village centre. Only local services should be assessed and any national public transport services should be excluded from the analysis, unless such a service can be said to provide a local commuter service.

Large retail type

Includes large retail developments, such as shopping centres, retail parks and supermarkets, which typically will have covered or uncovered parking, or external areas, and therefore scope to provide their own dedicated cyclist facilities.

Main building entrance

The main building entrance is the entrance to the assessed building which is directly connected to the main building reception, circulation routes, lifts or stairs and is available to the majority of the building's staff and visitors on arrival; it is not the site entrance (unless the site entrance is also the building entrance, e.g. a building with a boundary on a public highway).

Operating hours

BREEAM seeks to define the building's accessibility to the public transport network for the period during which the majority of building users will travel to and from the building. In most cases the normal operating hours of the building can be used. Where shift patterns see the majority of building users (over 80%) arriving or leaving during a certain period, for example an office building where the majority of office workers arrive between 8.00-10.00, then that period can be used as an alternative to the operating hours of the building. This accounts for some building types that operate a 24 hour day and on a shift work basis.

During what typically would be deemed unsociable hours, and therefore periods where there is little if any public transport operating, such periods are not required to be accounted for in the assessment of this issue. Where the assessed building operates on a 24 hour basis or the operating hours are unknown at the time of assessment, then refer to and use the table of default operating hours, which can be found in the Additional information section of this issue.

Rural location

A rural location is defined in this context as a site clearly not within or on the boundary of a small, medium or large urban cover. An urban cover will have a population of 3000 people or more, located within a tract of continuously built-up urban land extending 20 hectares or more. Therefore, the definition of rural includes village locations, green field sites or small urban centres with a population of less 3000 people within a tract of land no greater than 20 hectares. Such locations will most likely be on a local bus route to larger urban areas or other local towns and may have local shops and other facilities.

Rural location sensitive buildings

This definition includes any of the building types (listed below) where there is a demonstrable social or economic need from a rural population for the service or demand, which the building is intended to meet; and therefore locating the building at an alternative site which could have higher public transport accessibility levels, i.e. within an urbanised area, is unfeasible. The following building types are examples of those that may fall into this category:

1. Offices where providing services to the local community
2. Industrial where providing services to the local community
3. Retail where providing services to the local community
4. Preschool, primary and secondary school

Small retail type

Includes smaller retail units or shops that may form part of a wider retail or business district, city or town centre or mixed use sites, and typically do not have the scope to provide their own dedicated cyclist facilities.

Typical day

The typical day is that which represents the period when travel to and from the building by its users and visitors will be at its highest. For most buildings this should be taken as a midweek day. In choosing a typical day the assessor should check that timetabled information for that day is, within reason, representative of the public transport provision for the entire operating week (excluding Sundays).

Other information

Table - 36: Default hours of operation by building type for a typical day

Building type	Default hours
Commercial	08:00 - 19:00
Preschool, School, College	07:30 -22:00,15:00 - 17:30
University and Further Education	08:00 - 19:00
Retail: Shopping centre	09:00 - 19:00
Retail: Supermarket	08:00 - 22:00
Retail: Service provider	08:00 - 18:00
Retail: Convenience store	07:00 - 22:00
Retail: Retail park	08:00 - 20:00
Retail: Shop	08:30 - 17:30
Multi-residential accommodation, Hotels and other short stay accommodation	08:00 - 19:00
24 hour use building	07:00 - 20:00

Tra 02 Proximity to amenities

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
Up to 2 (Building type dependent)	No	Yes	No	No	Yes

Aim

To encourage and reward projects that review the building's access to local services and where necessary enhance existing services, reducing the environmental, social and economic impacts resulting from multiple or extended building user journeys, including transport-related emissions and traffic congestion.

Assessment criteria

The following is required to demonstrate compliance:

One credit (except for multi-residential buildings where two credits are available)

1 Where a building is located within close proximity of, and accessible to, local amenities which are likely to be frequently required and used by building occupants, as outlined in Table - 37.

Checklists and tables

Table - 37: Credits available for Tra02 for different building types

Criteria	Building types					
	Type 1	Type 2	Type 3	Type 4 (up to two credits available)		Type 5
No. of BREEAM Credits	1	1	1	1	2	1
No. of amenities	2	2	2	2	4	2
Proximity (metres)	500	500	500	500	1000	500
Appropriate food outlet	✓	✓	✓	✓	✓	✓
Access to cash	✓	✓	✓	✓	✓	✓
Access to an outdoor open space (public or private, provided suitably sized and accessible to building users)				✓	✓	✓
Access to a recreation/leisure facility for fitness/sports	✓	✓	✓	✓	✓	✓

Criteria	Building types Type 1	Type 2	Type 3	Type 4 (up to two credits available)	Type 5
Key: ✓ - Amenity relevant to building type **Building Types:** Type 1: Offices, Retail, Industrial Type 2: Preschools, Schools and Colleges Type 3: University and Further Education Type 4: Multi-residential Type 5: Hotels and other short stay accommodation This issue is not applicable to prison buildings or developments.					

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable.
CN2	Part 2: Core services	Not applicable.
CN3	Part 3: Local services	Not applicable.
CN4	Part 4: Interior design	All assessment criteria are applicable.
General		
	Collective amenities	One type of amenity may also exist within or as part of other types of amenities, e.g. a grocery store in a petrol station, cash point or pharmacy in a supermarket etc. It is not a requirement of this issue that each amenity is 'stand alone'.
CN5	Amenities within assessed building or on-site	An amenity within the building or on the same site as the refurbishment or fit-out project, e.g. where the assessed building is part of a campus, retail or business park or centre, complies with the assessment criteria.
CN6	Phased refurbishment projects	The guidance provided in BREEAM issue, concerning phased refurbishment projects, also applies to this issue.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
All	Where the amenities do not currently exist but are due to be developed, a letter from the client or developer confirming: 1. The location and type of amenities to be provided 2. The timescale for development of the amenities.	As per interim design stage

Additional information

Relevant definitions

Accessible amenities

Amenities (as listed) that are within the required proximity (distance in metres) of the building and accessible via safe pedestrian routes, e.g. pavements or paths and safe crossing points or, where provided, dedicated pedestrian crossing points. The distance should not be measured in a straight line, 'as the crow flies'.

Access to an outdoor open space (public or private, suitably sized and accessible to building users)

A space that enables building users to take an appropriate break from internal building activities, for example, an office building would benefit from a space to sit outside and have lunch. These spaces will need to be suitably sized to ensure that the space supports a reasonable number of building users associated with the project and should not form a part of the public highway.

Access to a recreation/leisure facility

A facility that will allow building users to exercise and maintain a healthy lifestyle. This could include a local leisure centre, tennis courts, an on-site gym or, for a school, a local playground.

Appropriate food outlet

A means of accessing a food supply that is affordable to the majority of the building's users, as well as being appropriate for their day-to-day needs. For example, a small office building would benefit from having a small shop selling sandwiches or snacks, a multi-residential building would benefit from having a restaurant in the local area.

Other information

None.

Tra 03 Cyclist facilities

This issue is not applicable toBREEAM International Refurbishment and Fit-out 2015.

Tra 04 Maximum car parking capacity

Number of credits available	Minimum standards	Applicability			
Building type dependent	None	Part 1	Part 2	Part 3	Part 4
		Change of use projects only	Change of use projects only	Change of use projects only	Change of use projects only

Aim

To encourage change of use projects to consider the provision of car parking in order to promote the use of alternative means of transport other than the private car to and from the building, thereby helping to reduce transport-related emissions and traffic congestion associated with the building's operation.

Assessment criteria

The following is required to demonstrate compliance:

Up to two credits - Car parking capacity

1 The building's car parking capacity is compared to the maximum car parking capacity benchmarks in Table - 38 and the relevant number of BREEAM credits awarded.
For most building types, except those where stated, the benchmarks vary according to the building's public transport Accessibility Index (AI determined in accordance with BREEAM issue). Therefore, for these building types the AI must be determined prior to assessing this issue. This is required to ensure that the building's car parking capacity is relative to the building's accessibility to the public transport network.

Checklists and tables

Table - 38: Credits available in Tra04 Maximum car parking capacity for different building types

	Criteria			Credits
Building's Accessibility Index	<4	≥ 4 - <8	≥ 8	
Building Type	Max. parking capacity 1 space per x building users, where x is:			
Office, industrial, student residences and key worker accommodation	3	4	5	1
	4	5	6	2
Sheltered housing, care homes and supported living facility	4	5	6	1
	5	6	7	2
University and Further Education	15	20	25	1
	20	25	30	2

Building's Accessibility Index	Criteria			Credits
	<4	≥ 4-<8	≥ 8	
Hotels and other short stay accommodation	3	4	5	1
	4	5	6	2
Preschool, schools, colleges and Retail,	Issue not assessed for these building types			

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2, 3 and 4	This issue is only applicable when the building is undergoing a change of use, as a result of the refurbishment works.
General		
CN2	Exclusions	Parking spaces set aside for the following building users can be excluded provided these spaces are dedicated for that use, i.e. sized accordingly with the appropriate signage or markings: 1. Disabled 2. Parent and baby 3. Motorbike 4. Car share In the case of excluding car share spaces, the future building occupier will need to confirm they have an enforceable car share policy.
CN3	Parking shared with other buildings	Where the assessed building forms part of a wider site, e.g. campus, business park, hospital, and parking is not designated to individual buildings, then the assessor has two options: 1. Assess compliance on the basis of parking capacity for the whole development, accounting for all existing and new users and parking spaces. 2. Assess compliance using a pro-rata of parking capacity to building users, e.g. if the assessed building is occupied by 20% of the development's total occupants, then attribute 20% of the total parking spaces to the assessed building for the purpose of the assessment.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
All	Where relevant, a completed copy of Tra 01 calculator confirming the building's Accessibility Index.	As per interim design stage.

Additional information

Relevant definitions

Accessibility Index

Refer to Tra 01 Sustainable transport solutions.

Building users

Where the term building users is referenced in this BREEAM issue it refers to the following, where relevant to the building type:

1. Staff (who will work within the building).
2. Students (who will access the building for work or study during a typical academic term time or semester day).
3. Residents (who will reside permanently or for a short period of time in the building).

If known, or can be reasonably estimated, project specific occupancy figures should be used. If this is not possible, for example where the building is a speculative project, use the default occupancy rates given in Table - 39 in the Other information section (below) to determine the number of users. Where the number of building users is variable, provision of parking spaces should be based on the maximum number of building users likely to be using the building at any time during a typical day.

Care homes

For the purpose of BREEAM, care homes are defined as building with residential accommodation and meals and have residents that require a level of personal care such as eating, cleaning and a level of medical care.

Change of use project

A change of use project is where there is a change in the purposes for which, or in the circumstances in which, a building is used. For example where the building becomes a hotel, where previously it was an office or where the building was previously a commercial building and is now a education building etc.

Sheltered housing

Sheltered housing can be defined as self-contained accommodation, usually with an emergency alarm system, communal facilities and a resident warden.

Other information

Table - 39: Default occupancy rates by building type

Building type and function area	Occupant density (person / m^2)	Building type and function area	Occupant density (person / m^2)
Business		University and Further Education	

Building type and function area	Occupant density (person / m²)	Building type and function area	Occupant density (person / m²)
Office area (including reception areas)	0.111	Residents bedroom	0.120
Food preparation area (staffed)	0.108	Classroom	0.203
Small workshop/category lab space	0.068	Food preparation area	0.096
Industrial		Hall, lecture theatre, assembly area	0.202
Food preparation area	0.213	Computer laboratory	0.231
Industrial process area	0.022	Laboratory	0.106
Laboratory	0.107	Laundry	0.105
Reception	0.110	Reception	0.112
Warehouse storage	0.009	Workshop - small-scale	0.068
Generic office area	0.108	Office and consulting areas	
Care homes		Hotels and other short stay accommodation	
Reception	0.152	Bedroom	0.094
Food preparation area	0.161	Food preparation area	0.108
Physiotherapy studio	0.200	Reception	0.105
Bedroom unit	0.105	Generic office area	0.106
Laundry	0.117	Other spaces or buildings	
Assembly areas and halls	1.000	Data centre / server room	0.096
Hydrotherapy pool hall	0.100		
Office and consulting areas	0.195		

Notes for Table - 39 of default occupancy rates:

1. The net floor area for each function must be multiplied by the equivalent occupant density to determine an overall occupancy for the function area.
2. Not all potential building areas are listed, only those required to reflect estimated building occupancy for the building type. For example, an office building may have a canteen but it will be the staff that predominantly uses the canteen. The office staff numbers will be estimated using the default occupancy rate for the office area; therefore to include the canteen would result in double counting of occupancy.
3. If a building type is not listed, occupancy rates for a similar building type or function area may be used.
4. The above occupancy rates have been sourced from the activity database of the UK Simplified Building Energy Model (SBEM).

Tra05 Travelplan

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	None	Yes	No	No	Yes

Aim

To recognise the consideration given to accommodating a range of travel options for building users, thereby encouraging the reduction of reliance on forms of travel that have the highest environmental impact.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1 A travel plan has been developed as part of the feasibility and design stages.

2 A site specific travel assessment or statement has been undertaken to ensure the travel plan is structured to meet the needs of the particular site and covers the following (as a minimum):
   - 2.a Where relevant, existing travel patterns and opinions of existing building or site users towards cycling and walking so that constraints and opportunities can be identified.
   - 2.b Travel patterns and transport impact of future building users.
   - 2.c Current local environment for walkers and cyclists (accounting for visitors who may be accompanied by young children).
   - 2.d Disabled access (accounting for varying levels of disability and visual impairment).
   - 2.e Public transport links serving the site.
   - 2.f Current facilities for cyclists.

3 The travel plan includes a package of measures to encourage the use of sustainable modes of transport and movement of people and goods during the building's operation and use.

4 If the occupier is known, they must be involved in the development of the travel plan and they must confirm that the travel plan will be implemented post refurbishment or fit-out and be supported by the building's management in operation.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and Structure	All assessment criteria are applicable.
CN2	Part 2: Core Services	This issue is not applicable.
CN3	Part 3: Local Services	This issue is not applicable.

Ref	Terms	Description
CN4	Part 4: Interior Design	All assessment criteria are applicable.
General		
CN5	Travel assessment or Statement see criterion 2	A travel assessment (also referred to as transport assessment) will be required where a proposed refurbishment project is likely to result in significant transport and related environmental impacts during building operation. For refurbishment or fit-out projects this is generally where there will be a change of use of e.g. from an office to a hotel. The study area for a transport assessment related to a project should be determined in discussion between the developer and appropriate authorities. A transport statement is required where the building is not likely to have a significant transport impact. A transport statement is suitable to demonstrate compliance with BREEAM when the building is expected to generate relatively low numbers of trips or traffic flows, with minor transport impacts.www.gov.uk/government/publications/guidance-on-transport-assessment
CN6	Travel plan measures See criterion 3	The following measures could be considered as part of the travel plan for the site: — Providing priority parking spaces for car sharers. — Providing dedicated and convenient cycle storage and changing facilities or improving existing facilities such as through improved security, lighting, provision and access. — Restricting or charging for car parking. — Financial incentives and benefits for walking, cycling or car sharing. — Providing information in lobby areas about public transport or car sharing made available. — Improved safe access for pedestrians and cyclists as feasible and within the scope for the existing site (for all types of user regardless of the level of mobility or visual impairment) via improved lighting, way-marking and signage for cyclist and pedestrian routes to adjoining routes, transport nodes and amenities, and provision of new or improved crossing points for pedestrians and cyclists. — Providing suitable taxi drop-off and waiting areas. — Improved lighting, landscaping and shelter to make pedestrian and public transport waiting areas pleasant. — Negotiating improved bus services, i.e. altering bus routes or offering discounts.
CN7	Where the end user or occupier is not known	A travel plan is still required even if the end user or occupier is not known, albeit that it may only be an interim travel plan or one that broadly addresses all the issues covered in the assessment criteria. The developer must confirm that they will hand over a copy of the travel plan to the building's future tenants or owner or occupiers, so that it may inform their own travel plan or strategy.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Travel plan

A travel plan is a strategy for managing all travel and transport within an organisation, principally to increase choice and reduce reliance on the car by seeking to improve access to a site by sustainable modes of transport. A travel plan contains both physical and behavioural measures to increase travel choices and reduce reliance on single occupancy car travel. BRE Global has no set format for this document, which can be as simple or complex as the building and its operation/use requires.

Building users

Where the term 'building users' is used, this refers to the following, as appropriate to building type:

1. Staff (commuter journeys and business travel)
2. Pupils and students
3. Visitors
4. Customers
5. Community users
6. People who make deliveries or collections to and from the development
7. Contractors and service providers, who regularly work at and access the building or development
8. Residents of multi-residential buildings.

Other information

Guidance on how to produce a travel plan can be found at the following locations:

1. ways2work.bitc.org.uk
2. www.lscp.or-g.uk

While these documents have been written for UK property development, the principles can be applied internationally.

9.0 Water

Summary

This category encourages sustainable water use in the operation of the building and its site. issues in this section focus on identifying means of reducing potable water consumption (internal and external) over the life time of the building and minimising losses through leakage.

Category summary table

Issue ID	Credits	Credit summary	Applicability Part 1	Part 2	Part 3	Part 4
.Wat 01 Water consumption	5	— Reducing the demand for potable water through the provision of efficient sanitary fitting, rainwater collection and water recycling systems	No	Yes	Yes	Yes
Wat 02 Water monitoring	1	— Specification of a water meter/s on the mains water supply to encourage water consumption management and monitoring to reduce the impacts of inefficiencies and leakage.	No	Yes	Yes	Yes
Wat 03 Water leak detection	2	— Recognition of leak detection systems capable of detecting a major water leak on the mains water supply — Flow control devices that regulate the supply of water to each WC area/facility to reduce water wastage.	No	Yes	Yes	Yes
Wat 04 Water efficient equipment	1	— Identifying a building's total unregulated water demand and mitigating or reducing consumption through systems and/or processes.	Yes	Yes	Yes	Yes

.Wat 01 Water consumption

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
5	Yes	No	Yes	Yes	Yes

Aim

To reduce the consumption of potable water for sanitary use in existing buildings from all sources through the use of water efficient components and water recycling systems.

Assessment criteria

The following is required to demonstrate compliance:

Up to five credits

1 An assessment of the efficiency of newly specified domestic water-consuming components and (where relevant) measures specified to retrofit existing devices is undertaken using the BREEAM Wat 01 calculator, including all fittings applicable to the project type as detailed in Table - 41. Where there are no fittings within the scope of refurbishment or fit-out works, or only minimal water-consuming fittings present or specified, refer to CN4, CN5 or CN6 to determine how this issue should be assessed.

2 The water consumption (litres/person/day) for the assessed building is compared against a baseline performance and BREEAM credits awarded based upon Table - 40.

3 The efficiency of the following domestic-scale water-consuming components must be included in the assessment (where specified or relevant to project type as defined by Table - 41):
- 3.a WCs
- 3.b Urinals
- 3.c Taps (wash hand basins and where specified kitchen taps and waste disposal unit)
- 3.d Showers
- 3.e Baths
- 3.f Dishwashers (domestic and commercial sized)
- 3.g Washing machine (domestic and commercial or industrial sized)

The BREEAM Wat 01 calculator defines the building types and activity areas for which the above components must be assessed.

4 Where a greywater or rainwater system is specified, its yield (litres/person/day) is used to offset non-potable water demand from components that would otherwise be supplied using potable water.

5 Any greywater or rainwater systems must be specified and installed in compliance with the national best practice standard.[1]

Checklists and tables

Table - 40: BREEAM Credits available for percentage improvement over baseline building water consumption.

No. of BREEAM credits	% Improvement		
	Precipitation zone 1	Precipitation zone 2	Precipitation zone 3
1	12.5	12.5	12.5
2	25%	25%	25%

No. of BREEAM credits	% Improvement		
	Precipitation zone 1	Precipitation zone 2	Precipitation zone 3
3	40%	35%	35%
4	50%	45%	40%
5	55%	55%	50%
Exemplary performance	65%	65%	60%

Note: please refer to compliance note CN8 and Figure 6 for information on BREEAM precipitation zone classifications. Also, please note that for some building types an alternative approach to compliance must be used to award credits (for further information please refer to the Methodology section and the BREEAM Wat 01 calculator).

Table - 41: Applicability of Wat01 according to building and project type

Building type	Project type	Applicable fittings to be assessed
Leasehold properties and speculative refurbishment or fit-out projects including retail, offices and industrial	Fabric and structure (Part 1)	Wat 01 is not applicable
	Core services only (Part 2)	Wat 01 is applicable to all water fittings in washrooms and changing facilities in common and core areas
	Fit-out of common areas and circulation spaces (Part 4)	Wat01 is applicable to all fittings provided in washrooms and changing facilities in common areas
	Tenant fit-out (Part 3/ 4)	Wat 01 is applicable to the assessment of all fittings within the tenant demise. Where WCs, washrooms or changing facilities are within core or common areas, outside of the scope of tenant fit-out works, these can be excluded from Wat 01. Where there are WCs, washrooms or changing facilities within tenanted areas (e.g. for staff or customers), these should be included in the assessment.

Building type	Project type	Applicable fittings to be assessed
Owner occupier properties including education, multi-residential, commercial and other building types covered by the scope of the scheme	Fabric and structure (Part 1)	Wat 01 is not applicable
	Upgrade of core building services only (Part 2)	Wat 01 is not applicable
	Fit-out of common areas and circulation spaces (Part 4)	Wat 01 is applicable to all fittings provided in washrooms and changing facilities in common areas
	Fit-out of general functional spaces (Part 3/4)	Wat 01 is applicable to the assessment of all water fittings provided in refurbishment/fit-out zone. Where no fittings are specified or present within the area undergoing refurbishment or fit-out, fittings within the nearest facilities likely to be used by the building occupant must be assessed, See compliance note .

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1 : Fabric and structure	This issue is not applicable
CN2	Parts 2, 3 and 4	All assessment criteria are applicable see Table - 41
Country specific		
CN3	National best practice standard for specifying and installing grey and rainwater systems	Please refer to the country reference sheet to locate the appropriate national best practice standards in the country of assessment. Alternatively, please demonstrate applicability as follows: - The minimum requirements as set out in the Approved standards and weightings list are covered by the proposed documents OR - Where appropriate standards do not exist for a country, the design team should demonstrate compliance with the UK or European standards as listed in each relevant country reference sheet.
General		

Ref	Terms	Description
CN4	No fittings present: owner occupied properties	In owner occupied properties, where a project under assessment contains none of the specified components, the performance specification for components provided in the nearest facilities likely to be used by occupants and visitors (where relevant) must be included in the assessment. Details of how this must be applied is provided in Compliance Note CN10
CN5	No fittings present: leasehold properties	In leasehold properties, where the scope of works and tenanted area includes none of the specified components and the water-consuming facilities to be used by future occupants are within common areas (i.e. landlord areas), Wat 01 can be excluded. Where there are water-consuming components within tenanted areas that are being excluded from the scope of works (e.g. customer toilets are present, but have been excluded from scope of works), these components must be included, to reflect the potential scope for reducing water consumption.
CN6	Minimal water-consuming fittings specified	Where undertaking a Part 3 or 4 assessment on a tenant fit-out project and the only fittings specified or present are kitchen taps or wash hand basin taps, Wat 01 can be excluded from the assessment to reflect the minimal potential for reducing water consumption as a result of the works. In all other cases, Wat01 must be assessed.
CN7	Benchmark and use data	The BREEAM Wat 01 calculator contains data for component use and building occupancy rates, which is used to calculate the water consumption for the building given the specified fittings. It is not expected that these rates would change appreciably between countries. However, if there is robust data available on component usage and building occupancy rates that relate to the country in which an assessed building is located, and the data is appreciably different to the figures currently used, please contact BRE Global with details of the information. Subject to peer review of the data, it may be possible to amend the Wat 01 calculator to include the relevant data for that country (and thus result in a more accurate reflection of modelled water consumption for the building).
CN8	Precipitation Zones (by Köppen)	Please refer to Figure 6 for information on BREEAM precipitation zone classification, note. Precipitation zone 1: corresponds to Appender's precipitation regions f (fully humid) and m (monsoonal). Precipitation zone 2: corresponds to Appender's precipitation regions s (summer dry) and w (winter dry). Precipitation zone 3: corresponds to Appender's precipitation regions S (steppe) and W (desert). For more information and guidance on Köppen climate classification refer to the Scope section of the manual.

Ref	Terms	Description
CN9	Greywater and rainwater system data	The following information is required where a greywater and/or rainwater system is specified: **Rainwater** Either: 1. Collection area (m^2). 2. Yield coefficient, a coefficient (%) to recognise that some rainwater is lost due to splashing, evaporation, leakage and overflow etc. This coefficient will vary depending on the surface from which the rainwater is collected. 3. Hydraulic filter efficiency, a coefficient (%) to recognise the efficiency of the hydraulic filter. Rainfall (average mm/year). Or 4. Daily rainfall collection (L) calculated in accordance with credible and verifiable national or local data, e.g. a regional, national or international meteorological organisation, data source or equivalent. Or 5. Daily rainfall collection (L) calculated in accordance with credible and verifiable national or local data, e.g. a regional, national or international petrological organisation, data source or equivalent. **Greywater** 1. Manufacturer or system designer details. 2. The percentage volume of waste water collected (and reused) from the following (where relevant); wash hand basins, showers, kitchen basins, dishwashers, baths, washing machines and sources of waste water from non-domestic components.
Building specific		
CN10	Nearest facilities	This includes facilities for staff, building occupants and visitors of the space undergoing refurbishment or fit-out. The required facilities that are needed should be determined based upon the function of the space and the needs of the occupants. As a minimum, toilet and wash room facilities are required for each applicable building user (e.g. facilities for male, female and disabled building users) and where applicable functions are present (e.g. leisure facilities) showers will need to be included in the scope where these will be required by building users. For multi-residential buildings (e.g. care homes), bathing facilities may be required by the users of the space undergoing refurbishment or fit-out and would therefore need to be included in the scope of the assessment. For other specific building types, a common sense approach should be applied regarding the facilities that will be used by building occupants.
CN11	Specification of retrofit measures for retained water using components	Where existing water-consuming components are to be retained, compliance can be achieved through retrofitting existing components with water saving devices. In all cases, advice from an engineer will be required to determine the suitability of the device for fitting being modified. Examples include: — Urinals: controls, timers or cistern displacement devices as applicable — Taps: aerated or spay tap inserts or flow regulators — Shower: low flow shower heads or flow regulators — WCs: dual flush mechanisms or cistern displacement devices.

Methodology

A non-domestic building's water efficient performance is determined using the BREEAM Wat 01 calculator in one of two ways, using either the standard approach (common building types) or the alternative (other building type) approach. Each approach is summarised below.

Standard Wat 01 method

The standard BREEAM method determines water efficiency (measured in L/person/day and m^3/person/year) for a building based on the building's actual component specification and default usage patterns for the building type and its activity areas. This modelled output is compared with the same output for a baseline component specification and the percentage improvement used to determine the number of BREEAM credits achieved.

The baseline component specification is equivalent to the water efficiency of industry standard components (seeTable - 42), steered by the minimum levels required by the Water Supply (Water Fittings) Regulations. The BREEAM percentage improvement benchmarks have then been determined based on progressively more efficient standards for water-consuming components and, for the higher levels of performance, the specification of greywater and rainwater systems.

The standard approach is the default method for calculating water efficiency of a BREEAM-assessed building and is that used for most of the common building types, where usage data are available. For building types where usage data are not available, and therefore the standard approach of determining performance cannot be used, an alternative approach to compliance must be used (described below). Refer to the BREEAM Wat 01 calculator for the current list of building types which can be assessed using the standard approach.

Alternative Wat 01 method

Where it is not possible to use the standard approach to determine the building's water consumption total (litres/person/day) the assessment can be completed on an elemental basis, as follows:

1. Using the list of applicable domestic-scale water-consuming components (see criterion 3), determine those that are specified or present in the assessed building.
2. Compare the actual specification for each component type with the table of water efficient consumption levels by component type (Table - 42) to determine the level of performance for each type. Note that the volumes quoted are maximums for that level and the percentage of WC or urinal flushing demand is a minimum for that level.
3. Define each component's level of performance in the 'Other building type calculator' worksheet of the BREEAM Wat 01 calculator.
   a. For the alternative approach, the calculator applies a building type specific weighting to each component level to reflect its 'in-use' consumption relative to the other components present. A component with high 'in-use' water consumption therefore has a larger weighting than one with lower 'in-use' consumption and contributes relatively more to the building's overall level of performance under this BREEAM issue.
   b. The weightings are derived from data on actual water consumption per day from non-domestic buildings, sourced from BNWAT22. They can be found in the BREEAM Wat 01 calculator.
4. Based upon the performance categorisation of each component type and the component weighting, the calculator will determine an overall, aggregate level of performance and award the relevant number of BREEAM credits as follows:

	greywater or rainwater levelachieved			
		Precipitation zones 1 and 2		Precipitation zone 3
Overall Component level	-	4	5	5
Baseline	0 credits	1 credit	2 credits	1 credit
Level 1	1 credit	2 credits	3 credits	2 credits

greywater or rainwater levelachieved				
		Precipitation zones 1 and 2		Precipitation zone 3
Level 2	2 credits	3 credits	4 credits	3 credits
Level 3 or 4	3 credits	4 credits	5 credits	4 credits
Level 5	4 credits		5 credits	

Note:

1. An innovation credit for exemplary level performance can be awarded where the component specification achieves level 5 and >95% of WC or urinal flushing demand is met using recycled non-potable water.
2. Due to the use of the weightings, the overall component level achieved will not necessarily be a whole number, e.g. component level 4. Where this is the case the methodology will always round down to the nearest component level and therefore BREEAM credit(s) level, e.g. if the component specification achieved is 3.6 credits, the actual number of credits awarded is 3 credits (the methodology will not round up to 4 credits because the performance specification for 4 credits has not been achieved).
3. Where the assessed building development has multiple specifications for the same water-consuming component type, the number of fittings and component level achieved for each specification can be entered in the 'Other building type calculator'. Using this information, the calculator will determine the building's aggregated performance level for that component type.

Please note: while attempts have been made to align the benchmarking of both methodologies described above, they do determine performance in different ways. The number of BREEAM credits awarded by each method could therefore differ for the same water component specification. This could lead to variation in the credits achieved when applying BREEAM Refurbishment and Fit-out to a number of different building types that form a part of the same overall site.

Component type

Table - 42 outlines the standards, by component type, used to define the performance levels set in BREEAM. These defined levels of efficiency have been steered by a range of published sources of information (see references[2]) and therefore reflect robust levels of typical, good, best and exemplary practice.

Table - 42: Water efficient consumption levels by component type

Component	Performance Levels (quoted numbers are minimum performance required to achieve the level)						
	Base	1	2	3	4	5	Unit
WC	6	5	4.5	4	3.75	3	Effective flush volume (litres)
Wash hand basin taps	12	9	7.50	4.50	3.75	3	litres/minute
Showers	14	10	8	6	4	3.50	litres/minute
Baths	200	180	160	140	120	100	litres

Component		Performance Levels (quoted numbers are minimum performance required to achieve the level)						
		Base	1	2	3	4	5	Unit
Urinal (2 or more urinals)		7.50	6	3	1.50	0.75	0	litres/bowl/hour
Urinal (1 urinal only)		10	8	4	2	1	0	litres/bowl/hour
greywater or rainwater system	Precipitation zone 1	0	0	0	25	50	75	% of WC and urinal flushing demand met using recycled non-potable water
	Precipitation zone 2	0	0	0	0	25	50	
	Precipitation zone 3	0	0	0	0	0	15	
Kitchen tap: kitchenette		12	10	7.50	5	5	5	litres/minute
Kitchen taps: restaurant (pre-rinse nozzles only)		10.30	9	8.30	7.30	6.30	6	litres/minute
Domestic sized dishwashers		17	13	13	12	11	10	litres/cycle
Domestic sized washing machines		90	60	50	40	35	30	litres/use
Waste disposal unit		17	17	0	0	0	0	litres/min
Commercial sized dishwashers		8	7	6	5	4	3	litres/rack
Commercial/ industrial sized washing machines		14	12	10	7.50	5	4.50	litres/kg

Please note that specifying components for a building in accordance with the above levels will result, in most cases, in the corresponding number of BREEAM credits being achieved. However, please bear in mind that the component specifications above are akin to thresholds between each level. Therefore caution should be taken when defining a component specification for a BREEAM-assessed building using exactly the same levels as the threshold levels. It is recommended that, where Wat 01 BREEAM credits are being targeted, the performance of a particular building's component specification is verified using the BREEAM Wat 01 calculator before committing to a particular specification and ordering or installing components. This will provide greater assurance that the component specification achieves the targeted number of BREEAM credits.

Existing retained water-consuming components

Where existing water-consuming components are being retained and no changes are being made to their performance (e.g. retrofit measures to reduce water consumption such as flow regulators), the following default figures can be used within the Wat 01 calculator, based upon the type or age of the component for assessing the performance of such fittings including showers, WCs, taps and baths. All other existing retained water-consuming components should use the baseline factors set out in Table - 43

Table - 43: Default performance factors for existing retained water-consuming components

Terminal fitting type	Average usage	Terminal fitting type
Showers	Mixer - traditional mixer	8 litres per minute
	Mixer - integrated power	10 litres per minute
	Mixer - separate pump	12 litres per minute
	Mixer - pressurised systems	12 litres per minute
	Mixer - bath/shower mixers	6 litres per minute
	Electric 7 - 7.9 kW	3.5 litres per minute
	Electric 8 - 8.9 kW	4 litres per minute
	Electric 9 - 9.9 kW	4.6 litres per minute
	Electric 10 kW+	5 litres per minute
WCs	Post 2001 installation	6 litres
	1993 - 2001 installation	7.5 litres
	Pre-1993 installation	10 litres
Taps	Low pressure system (as defined in EN 200:2008)	7.5 litres per minute per tap
	High pressure system (as defined in EN 200:2008)	12 litres per minute per tap
Baths	Undersized bath - 1600 mm length	165 litres - volume to overflow
	Corner bath	140 litres - volume to overflow
	Shower bath	250 litres - volume to overflow
	Standard bath	225 litres - volume to overflow
	Roll top bath	205 litres - volume to overflow
	Whirlpool spa baths	225 litres - volume to overflow

Water-consuming components - data requirements

Table - 44: Defines for each component type the appropriate data that will need to be collected from manufacturers' product information to complete the assessment

Domestic component	Data requirements
WCs	Actual maximum or, where dual flush, effective flush volume in litres/use.
Urinals	Flush volume in litres/use for single use flush urinals. For cistern fed systems, the flushing frequency/hour and cistern capacity in litres
Taps	Flow rate of each tap, at full flow rate in litres per minute measured at a dynamic pressure: For high pressure (Type 1) taps - 3 ± 0.2 bar (0.3 ± 0.02 MPa) OR For low pressure (Type 2) taps - 0.1 ± 0.02 bar (0.01 -± 0.002 MPa) (EN 200:2008, sanitary tapware, single taps and combination taps for supply systems of type 1 and 2. General technical specifications) This includes any reductions achieved with flow restrictions.
Showers	Flow rate of each shower at the outlet using cold water (≤ 30°C), in litres per minute measured at a dynamic pressure: 3 ± 0.2 bar (0.3 ± 0.02 MPa) for high pressure (Type 1) supply systems OR 0.1 ± 0.05 bar (0.01 ± 0.005 MPa) for low pressure (Type 2) supply systems (EN 1112:2008, Sanitary tapware. Shower outlets for sanitary tapware for water supply systems type 1 and 2. General technical specifications).
Kitchen taps	Maximum flow rate litres/minute.
Baths	Capacity to overflow in litres. Taps on baths should not be included in the calculation, as the water consumption from bath taps is taken account of in the use factor for baths. The calculation of water consumption for baths will assume 40% of the capacity to the overflow. This is to reflect that: — Users tend not to fill the bath to overflow; and — The displacement effect the user has on the actual volume of water required for a bath.
Dishwasher	Litres/cycle for domestic applications or appliances or litres/rack for commercial applications or appliances.
Washing machine	Litres/use for domestic applications (for a typical wash cycle) or appliances, or litres/kg for commercial applications or appliances, e.g. in hotels.
Waste disposal unit	Flow rate in litres/minute.

Unspecified water-consuming components

As the methodology and BREEAM credits for water efficiency compare the building's modelled water consumption performance against the performance of a baseline specification for the same component types, where a component type is not specified it is not accounted for in the methodology, i.e. the component is excluded from both the proposed and baseline building. Therefore no benefit is gained in terms of BREEAM performance, by deciding not to specify a particular component. However, the methodology will reflect the reduction in overall water consumption (litres/person/day) for the building, as a result of not specifying a particular component.

Buildings with a greywater and rainwater system(s)

The following information is required where a greywater and/or rainwater system is specified:

Rainwater

Either:

1. Collection area (m^2).
2. Yield coefficient (a coefficient (%) to recognise that some rainwater is lost due to splashing, evaporation, leakage and overflow etc. This coefficient will vary depending on the surface from which the rainwater is collected.)
3. Hydraulic filter efficiency (a coefficient (%) to recognise the efficiency of the hydraulic filter.
4. Rainfall (average mm/year).

Or

5. Daily rainfall collection (L) calculated in accordance with credible and verifiable national or local data, e.g. a regional, national or international meteorological organisation, data source or equivalent.

Or

6. Daily rainfall collection (L) calculated in accordance with credible and verifiable national or local data, e.g. a regional, national or international metrological organisation, data source or equivalent.

Greywater

1. Manufacturer or system designer details.
2. The percentage volume of waste water collected (and reused) from the following (where relevant); wash hand basins, showers, kitchen basins, dishwashers, baths, washing machines and sources of waste water from non-domestic components.

Where greywater or rainwater systems are specified there is a minimum level of component efficiency that must be achieved to award 4 or 5 BREEAM credits and the exemplary level credit. This is to avoid awarding a higher number of BREEAM credits where performance from less efficient fittings is offset by the specification of a greywater or rainwater collection system.

The intention being to ensure demand reduction is prioritised before offsetting consumption. Where a greywater or rainwater system is specified or installed, the component specification must achieve a percentage reduction in water consumption (over the baseline specification) equivalent to that required for 2 credits, i.e. a 25% improvement. Where this level is achieved, all of the total water demand met by greywater or rainwater sources can contribute to the overall percentage improvement required to achieve BREEAM credits. If it is not achieved, the percentage of greywater or rainwater allowable will be equivalent to the percentage improvement in water consumption achieved for the component specification, i.e. percentage improvement on baseline performance.

For example, if only a 20% improvement is achieved, and therefore the building is not meeting the 25% requirement, then only 20% of the water demand met via greywater or rainwater sources can be used to offset water consumption from the micro components. This minimum requirement does not apply where only 1, 2 or 3 credits are sought or where no greywater or rainwater system is specified, i.e. percentage improvement is based solely on the water efficiency of the micro-component specification.

BRE Global may allow some exemptions to this rule in instances where a particular fitting type requires a high flow rate due to specialised end user requirements, and its specification prevents compliance with 25% improvement.

Buildings with a mixture of different functional areas

For the majority of buildings using the standard Wat 01 method, the BREEAM Wat 01 calculator defines the building type and range of different water-consuming activity areas within that building; for example, a retail development with sales area and goods storage or an office that includes a canteen and gym. However, where carrying out a single assessment of a building or development which consists of a diverse mix of activity areas or building types, all of which can be assessed separately within the calculator, the following applies:

Determine the building's total water consumption performance by carrying out separate assessments for each relevant activity area or building type. On completion of each assessment, the assessor will need to determine the percentage improvement as follows:

$$I = 100 \times \left[1 - \frac{(T_{1Act} \times T_{1Occ}) + \ldots + (T_{nAct} \times T_{nOcc})}{(T_{1Base} \times T_{1Occ}) + \ldots + (T_{nBase} \times T_{nOcc})} \right]$$

Where:

I = Overall improvement (%)
Tn_{Act} = the modelled net water consumption (L/person/day) for each building type
Tn_{Base} = the modelled baseline water consumption for the corresponding building type
Tn_{Occ} = the total default occupancy rate for the corresponding building type.

Where greywater or rainwater systems are specified, the assessor should take care to avoid unintended double counting of the yield from such systems and using it to offset demand for each activity area or building type.

Fixed water use

The BREEAM water efficiency calculation includes an allowance for fixed water use. This includes water consumption for vessel filling (for building users' drinking water), cleaning in kitchens and food preparation in buildings with a catering facility. Fixed uses are included to provide greater accuracy in reporting of the building's overall estimated water consumption. As these uses are fixed for both actual and baseline building models, their totals do not influence the achievement of BREEAM credits.

Other permissible component demand for non-potable water

The focus of this BREEAM issue is the performance of the building's permanent domestic-scale water-consuming components. Where a greywater or rainwater system is specified, the yield from the system should be prioritised for such uses, i.e. WC or urinal flushing. However, where the building demonstrates that it has other consistent (i.e. daily) and equivalent levels of non-potable water demand, and such demands are intrinsic to the building's operation, then it is permissible for the demand from these non-domestic uses to be counted, i.e. the demand for rainwater or greywater yield from such systems or components can be used as well as, or instead of, non-potable water demand from the building's WC or urinal components. Examples of consistent and intrinsic demands could include laundry use in hotels or multi-residential developments or horticultural uses in garden centres, botanical gardens and golf courses. Demand for general landscaping and ornamental planting irrigation are not considered as equivalent or intrinsic by BREEAM.

Other permissible source of non-potable water

The methodology allows for the collection and recycling of non-potable water from the relevant components listed in the criteria i.e. taps, showers, baths and dishwashers or washing machines. In addition, where non-potable water is collected from a non-domestic component or source that is intrinsic to the building, then the amount collected can be accounted for in the methodology. This could include for example waste water from active hygiene flushing, i.e. a regular hygiene flushing programme to minimising poor water quality in a potable cold or hot water system. In order for the method to account for this total, the design team will need to confirm to the assessor the yield from the component or system (in litres) and the frequency of that yield (in days), i.e. if once a week then frequency would be seven days.

Evidence

Criteria	Interim design stage	Final post construction stage
1-	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1	A completed copy of the BREEAM Wat 01 calculator	As per interim design stage

Additional information

Relevant definitions

BREEAM Wat 01 calculator for New Non-Domestic Buildings

The BREEAM Wat 01 calculator is a method for the assessment of water efficiency in most common types of new non-domestic buildings based upon BS 8542:2011. The calculator assesses the contribution that each internal domestic-scale water-consuming component (as listed in the criteria) has on whole building water consumption). The calculator and accompanying guidance on its application is available separately from this scheme document. Please note; the calculator is a compliance tool and not a design tool for water demand and drainage systems. The tool uses default usage and occupancy rates to provide a benchmark of the typical consumption given the specified fittings (in litres/person/day and m^3/person/year) and their impact on the building's overall water efficiency. Due to the impacts and differences of actual user behaviour and occupancy rates, the results of the method will not reflect directly the actual water use during building operation. The results from the methodology should, therefore, not be used for the purpose of comparison with or prediction of actual water consumption from a non-domestic building.

Domestic-scale components

Domestic-scale components include water consumed (potable and non-potable) by internal building components including kitchen taps, wash hand basin taps, baths, showers and dishwashers, WCs, urinals, washing machines and waste disposal units.

Effective flush volume

Effective flush volume is the volume of water needed to clear the toilet pan and transport any contents far enough to avoid blocking the drain. The effective flush volume of a single flush WC is the volume of water used for one flush. The effective flush volume of a dual flush WC is the ratio of full flush to reduced flush. This is taken to be one full flush for every three reduced flushes for non-domestic buildings and one full flush for every two reduced flushes in domestic (residential) buildings/areas. The effective flush volume can therefore be calculated as follows, using a 6/4 litre dual flush volume WC as an example:

- Non-domestic: {(6 litre x 1) + (4 litre x 3)}/4 = 4.5 litre effective flushing volume (for a 6/4 dual flush WC)
- Domestic: {(6 litre x 1) + (4 litre x 2)}/3 = 4.67 litre effective flushing volume (for a 6/4 dual flush WC)

The differing ratio between non-domestic and domestic buildings reflects the different patterns of user behaviour between these building types.

Greywater recycling

The appropriate collection, treatment and storage of domestic wastewater (which is defined as that discharged from kitchens, baths or showers, laundry rooms and similar) to meet a non-potable water demand in the building e.g. WC flushing, or other permissible non-potable use on the site of the assessed building.

Potable water

Drinking quality water that is taken from a connection to the main water supply to the building, which may be from the public water supply or from a private supply such as from groundwater via a borehole.

Non-potable water

Any water other than potable water, also referred to as unwholesome water.

Rainwater recycling

The appropriate collection and storage of rainwater run-off from hard outdoor surfaces to meet a non-potable water demand in the building e.g. WC flushing, or other permissible non-potable use on the site of the assessed building.

Refurbishment or fit-out zone

For the purpose of this BREEAM issue, the Refurbishment or Fit-out zone is defined as the area of the building undergoing refurbishment or fit-out, and any external areas that fall within the scope of the new works. The refurbishment or fit-out zone may only include part of a building e.g. a floor or area of a building, or may encompass the whole building and external areas.

Clinical areas

Refer to BREEAM issue Hea 01 Visual comfort.

Other Information

BREEAM Precipitation zones - World map

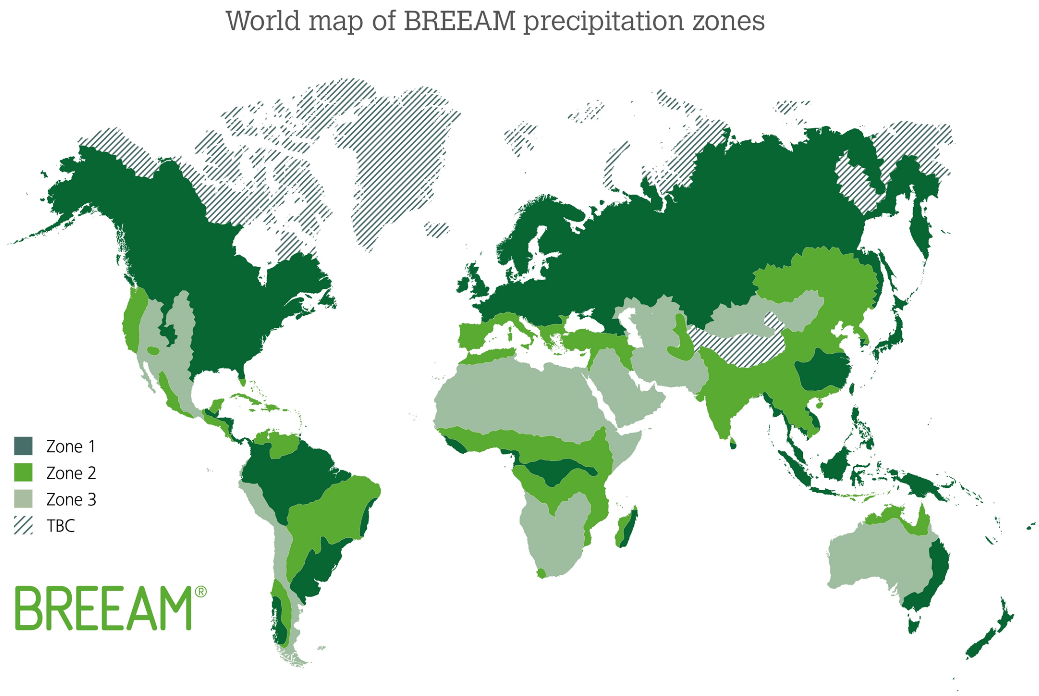

Figure 6: World map of BREEAM precipitation zones

1 Footnote to be added
2 Footnote to be added

Wat 02 Water monitoring

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	None	No	Yes	Yes	Yes

Aim

To ensure water consumption can be monitored and managed, and therefore encourage reductions.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1. The specification of a water meter on the mains water supply to each building; this includes instances where water is supplied via a borehole or other private source.
2. Water-consuming plant or building areas, consuming 10% or more of the building's total water demand, are either fitted with easily accessible sub-meters or have water monitoring equipment integral to the plant or area (see Compliance notes).
3. Each meter (main and sub) has a pulsed or other open protocol communication output to enable connection to an appropriate utility monitoring and management system, e.g. a building management system (BMS), for the monitoring of water consumption (see Relevant definitions).
4. If the refurbishment zone is within a site that has an existing BMS, managed by the same owner/occupier (as the space undergoing refurbishment or fit-out), the pulsed or digital water meter(s) for the refurbishment or fit-out zone must be connected to the existing BMS
5. If the refurbishment or fit-out zone is within a building that is leasehold, the pulsed or digital water meter(s) for the refurbishment or fit-out zone must be connected to the incoming water supply for water using equipment in tenanted areas (see compliance note CN8)

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicability		
CN1	Part 1: Fabric and structure	This issue is not applicable.
CN2	Parts 2: Core services	All assessment criteria are applicable.
CN3	Parts: 3 and 4	Criteria 2 - 5 are applicable.
Simple buildings		

Ref	Terms	Description
CN4	Applicable assessment criteria	All assessment criteria relevant to the building type and function apply.
General		
CN5	Water-consuming plant or building area See criterion 2.	As a minimum, this includes the following (where present): 1. Buildings with a swimming pool and its associated changing facilities (toilets, showers etc.). 2. On sites with multiple units or buildings, e.g. shopping centres, industrial units, retail parks etc. separate sub-meters are fitted on the water supply to the following areas (where present): — Each individual unit supplied with water — Common areas (covering the supply to toilet blocks) — Service areas (covering the supply to outlets within storage, delivery, waste disposal areas etc.) — Ancillary or separate buildings to the main development with water supply. 3. Laboratory: in any building with a laboratory or containing laboratories, a separate water meter is fitted on the water supply to any process or cooling loop for 'plumbed-in' laboratory process equipment.
CN6	10% of water demand See criterion 2.	The sub-meter requirement does not necessarily apply in the following cases, where the assessor confirms there will be no additional monitoring benefit resulting from their installation: 1. Where a building has only one or two small sources of water demand (e.g. an office with sanitary fittings and a small kitchen) 2. Where the building has two sources of water demand, one significantly larger than the other, and the water consumption for the larger demand is likely to mask the smaller demand.
CN7	Existing fittings and metering	Existing water meters can be recognised where they have a pulsed or digital or other open protocol communication output to enable connection to an appropriate utility monitoring and management system.
CN8	Water-consuming equipment	Water using equipment includes all equipment assessed under .Wat 01 Water consumption and unregulated water uses, included under Wat 04 Water efficient equipment. Where there is only one single water outlet such as a single basin or kitchen tap and no other water-consuming devices within the refurbishment or fit-out zone, this issue is not applicable.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Staff areas

Refer to BREEAM issue Hea 01 Visual comfort.

Meter outputs

Examples include pulsed outputs and other open protocol communication outputs, such as Modbus.

Utility monitoring and management system

Examples include automatic meter reading systems (AMR) and building energy management systems (BEMS). Automatic monitoring and targeting (aM&T) is an example of a management tool that includes automatic meter reading and data management.

Other information

None.

Wat 03 Water leak detection

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
2	No	No	Yes	Yes	Yes

Aim

To reduce the impact of water leaks that may otherwise go undetected.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Leak detection system

1 A leak detection system which is capable of detecting a major water leak on the mains water supply within the building and between the building and the utilities water meter is installed. The leak detection system must be:
   - 1.a A permanent automated water leak detection system that alerts the building occupants to the leak OR an inbuilt automated diagnostic procedure for detecting leaks is installed.
   - 1.b Activated when the flow of water passing through the water meter or data logger is at a flow rate above a preset maximum for a preset period of time.
   - 1.c Able to identify different flow and therefore leakage rates, e.g. continuous, high or low level, over set time periods.
   - 1.d Programmable to suit the owner/occupiers' water consumption criteria.
   - 1.e Where applicable, designed to avoid false alarms caused by normal operation of large water-consuming plant such as chillers.

One credit - Flow control devices

2 Flow control devices that regulate the supply of water to each WC area or facility according to demand are installed (and therefore minimise water leaks and wastage from sanitary fittings).

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable.
CN2	Parts 2: Core services	All assessment criteria are applicable
CN3	Part 3: Local services	Criterion 2 applicable only
CN4	Part 4: Interior Design	Criterion 2 applicable only

Ref	Terms	Description
General		
CN5	Leakage rates See criterion 1.	This issue does not specify what the high and low level leakage rates should be, however the leak detection equipment installed must have the flexibility to distinguish between different flow rates to enable it to be programmed to suit the building type and owner/occupier's usage patterns.
CN6	System criteria See criterion 1.	It is anticipated that the leak detection credit will usually be achieved by installing a system which detects higher than normal flow rates at meters or sub-meters. It does not necessarily require a system that directly detects water leakage along part or the whole length of the water supply system.
CN7	Water utilities meters See criterion 1.	Where there is a water utilities meter at the site/building boundary, it may be necessary to install a separate flow meter (or alternative measurement system) just after the utility meter to detect leaks; however, if the water utility company agrees to some form of leak detection being installed on their meter, this would also be acceptable.
CN8	Flow control devices See criterion 2.	The following could be considered as types of flow control devices: — A time controller, i.e. an automatic time switch device to switch off the water supply after a predetermined interval — A programmed time controller, i.e. an automatic time switch device to switch water on or off at predetermined times. — A volume controller, i.e. an automatic control device to turn off the water supply once the maximum preset volume is reached — A presence detector and controller, i.e. an automatic device detecting occupancy or movement in an area to switch water on and turn it off when the presence is removed — A central control unit, i.e. a dedicated computer-based control unit for an overall managed water control system, utilising some or all of the types of control elements listed above.
CN9	Flow control systems See criterion 2.	Flow control systems may control combined WC areas, such as male and female toilets within a core; they are not required for each individual sanitary appliance. The criteria are set to encourage the isolation of the water supply to each WC block when it is not being used.
CN10	Single WCs See criterion 2.	The flow control criteria for this issue do apply to facilities which have only a single WC (potentially within smaller or low occupancy buildings). In these instances shut-off could be provided via the same switch that controls the lighting (whether proximity detection or a manual switch).
CN11	No water supply to the building or unit	In freehold properties where the refurbishment or fit-out is being undertaken by the building owner, this credit is still assessed if there are no installed fittings within the refurbishment or fit-out zone. In these instances the facilities likely to be used by the future occupants of the building must meet the criteria e.g. washrooms and changing rooms to be used by the occupants in the nearest accessible part of the building. In the case of leasehold properties where the refurbishment or fit-out is being undertaken by the tenant and there are no installed fittings within the refurbishment or fit-out zone, this issue is not assessed.

Ref	Terms	Description
CN12	Existing fittings and metering	Where there is an existing leak detection device and flow control devices, the credits can be achieved where evidence demonstrates that they meet criteria 1 and 2 (as applicable).
Building type specific		
CN13	Multi-residential buildings and guest accommodation: flow control specification. See criterion 2.	The credit for the specification of flow control devices in WC areas or facilities does not apply to ensuite facilities in residential areas e.g. ensuite in individual private bedrooms and a single bathroom for a collection of individual private bedrooms in halls of residence, key worker accommodation or sheltered accommodation. The credit and criteria are however applicable to buildings with guest bedrooms with ensuite facilities, e.g. hotel rooms, and communal WC areas or facilities, e.g. communal WC facilities in hotels or hostels and care homes.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Other information

None.

Wat 04 Water efficient equipment

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes	Yes	Yes

Aim

To reduce unregulated water consumption by encouraging specification of water efficient equipment.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1 The design team has identified all unregulated water demands (see Relevant definitions) that could be realistically mitigated or reduced.

2 System(s) or processes have been identified to reduce the unregulated water demand, and demonstrate, through either good practice design or specification, a meaningful reduction in the total water demand of the building.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicability		
CN1	Parts: 1, 2, 3 and 4	All assessment criteria are applicable.
General		

Ref	Terms	Description
CN2	Reducing unregulated water consumption See criterion 2	BREEAM does not prescriptively define all potential means or solutions for reducing unregulated water consumption. The design team needs to demonstrate to the assessor that they have identified key areas of water consumption in the building and that a reduction in unregulated water consumption has been achieved using existing 'tried and tested' solutions or new innovative solutions relevant to the building and its functional requirements. The following are some examples of solutions deemed to satisfy compliance for a number of different building types or functions (where the unregulated water demand for that function is one of the significant contributor in the building): 1. Drip-fed subsurface irrigation incorporating soil moisture sensors. The irrigation control should be zoned to permit variable irrigation to different planting assemblages. 2. Reclaimed or recovered water from a rainwater collection or waste water recovery system, with appropriate storage, i.e. greywater collection from building functions or processes that use potable water, e.g. vehicle wash, sanitary facilities, irrigation etc. 3. External landscaping and planting that relies solely on precipitation, during all seasons of the year. 4. All planting specified is restricted to contextually appropriate species that thrive without irrigation and will continue to do so in those conditions likely as a result of climate change, i.e. typically warmer and drier conditions.
CN3	Only irrigation systems present See criterion 1.	Where the only unregulated water demand comes from an irrigation system specified or installed by the building owner, then this system must be used for the purpose of assessing compliance. Where the refurbishment is being undertaken by the tenant and the irrigation system is provided by the building owner, this issue can be excluded from the assessment. Where there are soft landscaped areas however no irrigation systems are specified, and therefore there are no unregulated water demands for the building, the credit available under this assessment issue can be awarded by default. Where there are no soft landscaped areas and no other unregulated water demands for the building, this credit is not assessed and is filtered out of the assessment.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Unregulated water

For the purposes of this BREEAM Issue, unregulated water is water not used for domestic purposes and is therefore not regulated by Building Regulations or other relevant legislation. This includes, but is not limited to, equipment used for irrigation and, for the relevant building types, vehicle wash plant and equipment.

Other information

None.

10.0 Materials

Summary

This category encourages steps taken to reduce the impact of construction materials through design, refurbishment, maintenance and repair. Issues in this section focus on the procurement of materials that are sourced in a responsible way and have a low embodied impact over their life including extraction, processing and manufacture and recycling.

Category summary table

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Mat 01 Environmental impact of materials	Up to 6	— Reductions in the building's environmental life cycle impacts through the reuse of materials and the use of tools to analyse the life cycle impact of any new materials using robust environmental information assessment of the main building elements.	Yes	Yes	Yes	Yes
Mat 02 Hard landscaping and boundaryprotection	0	— There is no standalone hard landscaping and boundary protection issue applicable to this scheme. Hard landscaping and boundary protection is assessed within Mat 01 Life cycle impacts.	No	No	No	No
Mat 03 Responsible sourcing of materials	4	— Materials sourced in accordance with a sustainable procurement plan. — Key building materials are responsibly sourced to reduce environmental and socio-economic impacts.	Yes	Yes	Yes	Yes
Mat 04 Insulation	0	— There is no standalone insulation issue applicable to this scheme. Insulation is assessed in the Mat 03 and Mat 01 issues.	No	No	No	No

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Mat 05 Designing for durability andresilience	1	— The building incorporates measures to reduce impacts associated with damage and wear and tear. — Relevant building elements incorporate appropriate design and specification measures to limit material degradation due to environmental factors.	Yes	No	No	Yes
Mat 06 Material efficiency	1	— Opportunities and measures have been identified and taken to optimise the use of materials.	Yes	Yes	Yes	Yes

Mat 01 Environmental impact of materials

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
6	None	Yes	Yes	Yes	Yes

Aim

To reward projects where materials have been selected to reduce their life cycle environmental impacts through the use of robust life cycle environmental assessment tools and robust environmental data.

Assessment criteria

This issue is broken down into:

- Option 1 : Project life cycle assessment study (6 credits)
  OR
- Option 2 : Elemental assessment of environmental performance information (4 credits)

The following is required to demonstrate compliance:

Up to six credits (option 1): Project life cycle assessment study

1. The project uses a life cycle assessment (LCA) tool or undertakes a building information model life cycle assessment (BIM LCA) to measure the life cycle environmental impact of the refurbishment or fit-out works.
2. The LCA covers new materials as relevant to the assessment parts listed in CN2.1 and indicated in the 'Materials assessment scope' section of the BREEAM International Refurbishment and Fit-out Mat 01 calculator (Part B of the tool).
3. The mandatory requirements identified in the 'Materials assessment tool, method and data' section of the BREEAM International Refurbishment and Fit-out Mat 01 calculator have been met.
4. A member of the project team completes the BREEAM International Refurbishment and Fit-out Mat 01 calculator using parts A and B and determines a score based on the robustness of the LCA tool used (Part A of the tool) and the scope of the assessment in terms of the materials specified that have been considered (Part B of the tool)
5. Where the design team can demonstrate how the LCA has benefited the building in terms of measuring and reducing its environmental impact. See CN2.8
6. Where the design team submit the LCA tool output (e.g. Building Information Model (BIM)) for assessing the building to BRE Global (via the project's appointed BREEAM Assessor) to inform future potential LCA benchmarking for BREEAM
7. Credits are awarded in accordance with Table - 45

Table - 45: Percentage of BREEAM Mat 01 calculator points achieved and credits awarded (Option 1)

Percentage of BREEAM Mat 01 calculator points achieved (%) (Option 1)	Credits	
	Industrial	All other buildings
10	1	1
30	1	2
50	1	3
65	2	4

Percentage of BREEAM Mat 01 calculator points achieved (%) (Option 1)	Credits	
	Industrial	All other buildings
75	2	5
80	2	6
85	2 + 1 exemplary	6 + 1 exemplary

OR

Up to four credits (option 2): Elemental assessment of environmental performance information

The following are required to demonstrate compliance:

8 Robust environmental performance information has been collected for newly specified materials or where materials are retained in situ, for elements listed in CN2.1

9 The total number of points achieved as set out in the Methodology section are calculated using Part B of the BREEAM Mat 01 calculator. The number of points scored is based on the percentage of each element that has been:
- 9.a reused in situ
- 9.b reused in situ with minor repairs
- 9.c specified with robust environmental performance information.

10 Credits are awarded based upon the percentage of available points achieved as set out in Table - 46

Table - 46: Percentage of BREEAM Mat 01 calculator points achieved and credits awarded (Option 2)

Percentage of BREEAM Mat 01 calculator points achieved (%) (Option 2)	Credits	
	Industrial	All other buildings
10	1	1
40	1	2
60	1	3
75	1	4
85	1 + 1 exemplary	4 + 1 exemplary

Checklists and tables

Five points are available for each element depending upon the percentage of each element that is reused in situ or has compliant environmental claims. See the Methodology section in order to calculate the point score per element. Details of compliant environmental claims are detailed below in Table - 47

Table - 47: Allocation of points awarded

Type of claim	Compliant environmental claim	Points:
Environmental product declaration	Where at least one product per element type has a third party certificated environmental product declaration that conforms to one of the following standards: ISO 15804 Type 3 EPD ISO 14025 Type 3 EPD ISO 14024 Type 1 EPD.	5
Self declared recycled content	Where newly specified materials have recycled content to ISO 14021 that meets good practice levels of recycled content set out in Choosing construction products, Guide to the recycled content of mainstream construction products, WRAP or an equivalent nationally recognised standard that defines the minimum recycled content of construction products	5
Reused in-situ	Where a whole element or part of an element has been reused in situ and confirmation has been provided that the element complies with current statutory requirements and is fit for purpose (i.e. a minimum design life of at least 5 years)	5
Reused in situ with minor repairs	Where the whole or part of an element has been reused in situ with minor repairs (see Relevant definitions).	5

Compliance notes

Ref	Terms	Description
CN1 Applicable assessment criteria		
CN1.1	Part 1: Fabric and structure	All assessment criteria are applicable
CN1.2	Part 2: Core services	All assessment criteria are applicable
CN1.3	Part 3: Local services	All assessment criteria are applicable
CN1.4	Part 4: Interior design	All assessment criteria are applicable
CN2 General		

Ref	Terms	Description
CN2.1	Relevant elements	1. Part 1 includes elements of the fabric and structure including: a. External walls (envelope, structure and finishes) b. External windows and roof lights c. Structural frame d. Basements or retaining walls (including excavations) e. Upper floors (including horizontal structure) f. Roof (including coverings) g. Stairs h. External solar shading devices, access structures etc. i. Ground or lowest floor 2. Part 2 and 3 includes elements used for core and local services including: a. Heat source, space heating, air-conditioning and ventilation b. Communication, security and control systems c. Electrical installations d. Fire and lightning protection e. Lift and conveyor installations or systems f. Water and waste installations g. Sanitary installations 3. Part 4 includes interior fit-out elements including: a. Internal floor finishes (including access floors) b. Internal ceiling finishes (including suspended or access ceilings) c. Internal walls and partitions d. Internal wall finishes e. Internal windows f. Internal doors g. Furniture (desks, chairs, display cabinets, shelving) h. Fittings (shop fittings, railings, screens, gutters, vents, air grilles) 4. Hard landscaping and boundary protection are included where within scope of works
CN2.2	Element not present	In most projects, not all elements listed in CN7 will be present. This does not affect the credits available as this issue is assessed based upon the percentage of available points that have been achieved. The percentage of available points is adjusted in the Mat 01 Calculator tool in order to reflect the number of elements present.
CN2.3	Partial reuse	Where part of an element has been reused in situ (e.g. the ceiling grid is retained in situ, but new ceiling tiles are specified) the points should be determined based upon the percentage of the element being reused in situ (see Methodology section).
CN2.4	Scoring of the materials assessment tool method and data section	All tools (and versions of tools) used for option 1 must: 1. Meet the mandatory requirements outlined in BREEAM Refurbishment and Fit-out Mat 01 LCA calculator. 2. Have the score generated by the BREEAM International Refurbishment and Fit-out Mat 01 calculator and verified by BRE Global. Please note that the verification process will require the involvement and issue of evidence by the tool producer or developer. Please see the list of previously submitted tools (by version) and their associated verified score on the BREEAM Extranet or complete the BREEAM International Refurbishment and Fit-out Mat01 calculator and issue to BRE for verification when required.

Ref	Terms	Description
CN2.5	Measuring performance	This issue is concerned with the use of LCA on the project and for the collection of robust environmental information from product manufacturers. At present, we do not seek to benchmark performance due to the limited availability of benchmarking data. This is likely to be included as LCA data matures and BRE Global have collected sufficient building performance data to establish robust benchmarks.
CN2.6	Scope of BREEAM Refurbishment and Fit-out Mat 01 LCA calculator	The Mat 01 LCA calculator scores points for option 1 based on the rigour of the life cycle assessment in terms of: 1. The quality of the assessment tool or method and data and 2. The scope (of specified materials) included in the assessment.
CN2.7	Previously approved LCA tools	All LCA tools must be verified by BRE Global to assess their robustness. This verification will result in a score that reflects this robustness and can be input into the Mat 01 calculator tool. All previously verified LCA tools are listed on the BREEAM Extranet along with the resultant score. Where appropriate, these verified results can be entered into the Mat 01 calculator for other projects and used as part of the assessment evidence; however the scope will need to reviewed to ensure this reflects the specific scope of the LCA for the project being assessed.
CN2.8	Demonstrating benefit	This should take the form of a short qualitative statement from the design team providing comments on the following: 1. How and at what stages of the design the tool was utilised. 2. How the tool helped (or did not help) steer the design process to optimise cost and mitigate environmental impacts, giving examples of specific changes to the building design or specification that resulted.
CN2.9	Repairs to existing in situ elements	Materials used to repair existing in situ elements may be excluded provided no more than 20% of the total area; or volume of the existing element is subject to minor alternations, repair or maintenance.
CN2.10	Material use cut-off for fixings, adhesives, membranes and other minor product uses	Any material type within a relevant element which clearly accounts for less than 0.33 m^3per 1000 m^2 of gross internal floor area, can be excluded from the assessment. Calculations will not normally be required to justify such exclusions.
CN2.11	Green Guide to Specification	The Green Guide to Specification can be used towards option 1 as a type of LCA tool for the assessment of new elements including external walls, external windows, internal floor finishes, upper floors, internal walls and partitions and roofs. Please refer to the Green Guide tab within the tool and select the elements that have been assessed using the Green Guide to Specification.

Methodology

Option 1: Assessing the points awarded for the project life cycle assessment study

Under option 1, points are awarded using the Mat 01 calculator according to the robustness and scope of the life cycle assessment study.

Step 1: Answering the materials assessment tool or method and data questions

The first step is to answer questions using the Mat01 calculator tool on the methodology and data that the life cycle assessment study is based upon. This includes the following aspects:

- Output Indicators available, e.g. embodied carbon, embodied water and other indicators
- The output Life stage(s) available (for all indicators selected), e.g. cradle-to-gate, cradle-to-grave etc.
- Assessment level(s) looking at the life cycle impact comparisons possible (and made) at either the whole building or elemental level
- The source of LCA data quality including the geographic applicability and age
- Source of LCA data quality - Methodologies e.g. have the data been assessed to ISO 14040 and ISO 14044
- Has the source LCA data quality been verified, e.g. verified or peer reviewed LCA data AND the majority of EPD used (manufacturer or trade association) are verified to ISO 14025, ISO 21930 or EN 15804.

Step 2: Assessing the materials assessment scope

The second step is to answer questions in the Mat 01 calculator tool on the scope of the assessment to look at the number of elements (as relevant to applicable assessment parts, see CN2.1).

Step 3: Calculating the number of points awarded

The Mat 01 calculator tool will assign points according to the information entered for steps 1 and 2 above regarding the robustness and scope of the LCA study. Up to 70 points are available based upon the robustness of the LCA assessment study. An additional 30 points are available based upon the scope of the LCA assessment study in terms of the number of applicable elements that have been included in the study. The calculator will then determine the percentage of available points awarded and assign the credits awarded in accordance with Table - 47

Option 2: Assessing the points awarded for an element

Under option 2, up to 5 points are available per element depending upon the % of that element that is reused in-situ and the percentage of newly specified materials that are covered by robust environmental claims recognised as detailed in Table - 47

Step 1: Elements present

Identify the relevant elements that are present in the project, as relevant to the BREEAM assessment parts that are being assessed in accordance with CN2.1

Step 2: Identify the percentage reused in situ

The next step is to estimate the percentage of each element that is new and the percentage that is reused in situ. This recognises elements where part of the element has been retained and part of the element is new. Examples of this would be where a proportion of internal walls have been retained with others as new, where an existing element has a significant amount of new materials added to adapt or reinforce it, or where an existing external wall is being refurbished with new internal dry lining or a cladding system. This percentage is an approximate figure to the nearest 25% and is to be provided by the design team. This does not need to be an accurate measurement and can be based on a common sense judgement. It can be based on measured data (for elements where this is relatively straight forward to do so such as the percentage area of new floor finishes or the percentage of new internal doors) or, where there is a more complex mixture of retained and newly specified materials within an element such as the percentage volume of new structural steel within a building, it can be based on an estimated percentage.

Step 3: Calculate the points awarded per element

The next step is to calculate the points awarded per element based upon the percentage of element that is reused in situ and the percentage of new materials that have robust environmental performance information available (see Table - 47 Points are allocated according to the matrix set out in Table - 48

Table - 48: Allocating points for elements

Percentage of element reused in situ	Percentage of newly specified materials with robust environmental performance information					
	0	≤ 25%	≤ 50%	≤ 75%	>75%	100%
	Unweighted Points					
≥95%	5	5	5	5	5	5
≥75%	4	4.2	4.4	4.6	4.8	5
≥50%	3	3.4	3.8	4.2	4.6	5
≥25%	2	2.6	3.2	3.8	4.4	5
<25%	1	1.8	2.6	3.4	4.2	5
0	0	1	2	3	4	5

Step 4: Calculating the percentage of available points achieved

Once the unweighted points awarded for each element present have been calculated, they then need to be multiplied by the weighting for that element type to reflect the relative significance of that element at a whole building level. This is then used to calculate the maximum Mat 01 points available for that element as detailed in Table - 49 .

Finally, once the points awarded and maximum available points for each element has been calculated, this is then used to determine the percentage of available points achieved using the MAT 01 calculation tool. This calculation is further detailed in the example in Table - 49.

Table - 49: Example calculation of the percentage available points achieved

Assessment part	Element description	Weighting (a)	Applicable elements (b) Enter 1 = Yes 0 = No	Maximum Mat 01 points available (c) = (a) x (b) x 5	Unweighted points achieved per element using Table - 48	Weighted Points (e) = (a) x (d)
Part 1: Fabric and structure	External walls (envelope, structure and finishes)	1	1	5	3	3
	External windows and roof lights	1	1	5	3	3
	Structural frame (vertical)	1	1	5	5	5
	Basements or retaining walls (including excavations)	0.5	1	2.5	5	2.5
	Upper floors (including horizontal structure)	1	1	5	5	5
	Roof (including coverings)	0.5	1	2.5	3	1.5
	Stairs	0.5	1	2.5	5	2.5
	External shading devices, access structures etc.	0.5	1	2.5	1	0.5
	Ground or lowest floor	0.5	1	2.5	5	2.5

Assessment part	Element description	Weighting (a)	Applicable elements (b) Enter 1 = Yes 0 = No	Maximum Mat 01 points available (c) = (a) x (b) x 5	Unweighted points achieved per element using Table - 48	Weighted Points (e) = (a) x (d)
Parts 2 and 3	Heat source, space heating, air-conditioning and ventilation	1	0	0	0	0
	Communication, security and control systems	0.5	0	0	0	0
	Electrical installations	0.5	0	0	0	0
	Fire and lightning protection	0.5	0	0	0	0
	Lift and conveyor installations or systems	0.5	0	0	0	0
	Water and waste installations	0.5	0	0	0	0
	Sanitary installations	0.25	0	0	0	0

Assessment part	Element description	Weighting (a)	Applicable elements (b) Enter 1 = Yes 0 = No	Maximum Mat 01 points available (c) = (a) x (b) x 5	Unweighted points achieved per element using Table - 48	Weighted Points (e) = (a) x (d)
Part 4: Interior design	Internal floor finishes (including access floors)	1	0	0	0	0
	Internal ceiling finishes (including. suspended or access ceilings)	0.5	0	0	0	0
	Internal walls and partitions	0.5	0	0	0	0
	Internal walls finishes	0.5	0	0	0	0
	Internal windows	0.5	0	0	0	0
	Internal doors	0.25	0	0	0	0
	Furniture (desks, chairs, display cabinets, shelving)	0.25	0	0	0	0
	Fittings (shop fittings, railings, screens, gutters, vents, air grilles).	0.25	0	0	0	0
Hard landscaping and boundary protection	Hard landscaping (roads, paths and pavings)	0.5	0	0	0	0
	Boundary protection (fencing, railings and walls)	0.25	0	0	0	0
Maximum available points (f) = Sum (c)			32.5			
Total points achieved (g) = Sum (d)			25.5			
Percentage of available points achieved (h) = (g) / (f) x 100			78%			

Evidence

Ref	Design stage	Post construction stage
1-10	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1-10	A copy of the Mat 01 calculator tool	As per interim design stage
6	A copy of the statement demonstrating benefit of the LCA assessment	As per interim design stage
7	LCA tool output	As per interim design stage

Additional information

Relevant definitions

Environmental Product Declaration

BS EN ISO 14025:2010[1] defines an environmental label or environmental declaration as a claim which indicates the environmental aspects of a product or service. BS EN ISO 14020:2001[2] goes on to state that environmental labels and declarations provide information about a product or service in terms of its overall environmental character, a specific environmental aspect, or any number of aspects. The BRE's Environmental Profile Methodology and the Green Guide to Specification are both examples of EPDs. Life Cycle Assessment (LCA) is the tool underpinning EPD and the LCA should conform to the requirements of the BS ISO 14040 series.

Green Guide to Specification

The Green Guide to Specification is an easy to use, comprehensive reference website and electronic tool, providing guidance for specifiers, designers and their clients on the relative environmental impacts for a range of different building elemental specifications. The generic elemental ratings within the online Guide are based on LCA data generated using the BRE Environmental Profiles Methodology. The Environmental Profiles Methodology has been peer reviewed to comply with BS ISO 14040 and represents the Product Category Rules for BRE Global's environmental labelling scheme (EPD - ISO 14025, Type III) for construction products and elements, see www.thegreenguide.org.uk.

Other information

IMPACT (Integrated Material Profile And Costing Tool)

IMPACT is a specification and database for software developers to incorporate into their tools to enable consistent Life Cycle Assessment (LCA) and Life Cycle Costing (LCC). IMPACT compliant tools work by allowing the user to attribute environmental and cost information to drawn or scheduled items in the BIM. IMPACT takes quantity information from the BIM and multiplies this by environmental impact and/or cost 'rates' to produce an overall impact and cost for the whole (or a selected part) of the design. The results generated by IMPACT allow the user to:

- analyse the design to optimise cost and environmental impacts.
- compare whole building results to a suitable benchmark to assess performance, which can be linked to building assessment schemes.

The benefit of BIM enabled whole building assessment is that the calculations are based on real design data and accurate quantities, rather than generic specifications for particular building elements. IMPACT compliant tools also allow users to accurately model the life cycle performance of primary structures and substructures, which are not covered by the Green Guide to Specification.

IMPACT was developed by an industry consortium led by BRE. The work was funded by the UK's Technology Strategy Board. Further information about IMPACT and IMPACT compliant software tools (identified by the IMPACT compliant logo) is available from www.impactwba.com.

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[1] BS EN ISO 14025:2010, Environmental labels and declarations - Type III environmental declarations, Principles and procedures. BSi, 2010

[2] BS EN ISO 14020:2001, Environmental labels and declarations - General principles. BSi, 2001

Mat 02 Hard landscaping and boundaryprotection

An issue dedicated to hard landscaping and boundary protection is not included in BREEAM International Refurbishment and Fit-out 2015. Hard landscaping and boundary protection are assessed in Mat 01 Environmental impact of materials.

Mat 03 Responsible sourcing of materials

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
4	Yes (criterion 1 only)	Yes	Yes	Yes	Yes

Aim

To recognise and encourage the specification and procurement of responsibly sourced materials for key materials used in refurbishment and fit-out.

Assessment criteria

The following is required to demonstrate compliance:

Prerequisite

1 All timber and timber-based products used on the project is Legal timber .

Note:

a. It is a minimum requirement for achieving a BREEAM rating (for any rating level) that compliance with criterion 1 is confirmed.

b. For other materials there are no prerequisite requirements at this stage.

One credit - Sustainable procurement plan

2 A sustainable procurement plan has been implemented:

2.a The design team have set aims, objectives and targets to guide sustainable procurement activities with engagement from the Principle contractor. This includes measurement criteria and performance indicators to assess progress and demonstrate success

2.b A strategic assessment of sustainably sourced materials available locally and nationally has been conducted with a policy to procure materials locally where possible

2.c The principle contractor will ensure that all materials for the project are sourced in accordance with the documented sustainable procurement plan and will have procedures in place to check and verify that the plan has been implemented/adhered to, including any materials sourced by subcontractors.

Up to 3 credits - Responsible sourcing of materials (RSM)

3 One credit can be awarded where at least three of the material types listed in Table - 52 'Material categories' has been responsibly sourced from one of the responsible sourcing schemes recognised by BREEAM as detailed in Guidance Note 18

4 Up to three of the available RSM credits (refer to Table - 50) can be awarded where the applicable building materials (refer to Table - 52) are responsibly sourced in accordance with the BREEAM methodology, as defined in steps 1 to 2 in the Methodology

Table - 50: The number of BREEAM credits achieved is determined as follows

RSM credits	% of available RSM points achieved
3	≥ 54%
2	≥ 36%
1	≥ 18%

Exemplary level criteria

The following outlines the exemplary level criteria to achieve one innovation credit for this BREEAM issue:

1. Where at least 70% of the available RSM points are achieved.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts 1, 2, 3 and 4	All criteria in this issue are applicable
General		
CN1.1	Sustainable procurement plan See criterion 2.	For design stage assessments where the principal contractor has not yet been appointed, a specification or a letter of intent from the party responsible for appointing the principal contractor must be provided confirming a requirement for the principal contractor to adhere to the documented sustainable procurement plan in accordance with criterion 2.c. Refer to 4.0 The BREEAM evidential requirements section for more guidance on providing letters of commitment.
CN1.2	BREEAM recognised responsible sourcing certification schemes and their point scores See criterion 3.	Guidance Note 18 available in the Resources section of the BREEAM website, provides a table of responsible sourcing certification schemes recognised under BREEAM, their scope and associated point scores. This table is reviewed on a regular basis and BREEAM assessors must ensure they use the current table.
CN1.3	Checking responsible sourcing claims See criterion 3.	Confirmation of manufacturers and suppliers claims should be sought from the relevant responsible sourcing scheme provider. Many of the organisations who administer RSM certification schemes will, via their website, list companies and products that have been certified against their standards, including the scope of any such certification. Some schemes, including BES 6001 via www.greenbooklive.com, will provide downloadable copies of the relevant certificate, which can in turn be used as evidence of compliance for this BREEAM issue.
CN1.4	Specified reused materials See criterion 3.	Where reused materials are specified for the project, these can be allocated ten points.
CN1.5	Specified recycled materials See criterion 3.	Where evidence can be provided that certified products used in the building contain a high proportion (≥ 90%) repurposed or recycled content , these can be allocated points as per Table -1 in Guidance Note 18.

Ref	Terms	Description
CN1.6	Route 1 Cut- off See step 1 in the Methodology section.	Any material type within a location/ use category, other than external walls (structure), roof (structure), floor (structure) and hard landscaping, which clearly accounts for less than 0.33 m^3per 1000 m^2 of gross internal floor area, can be excluded from the assessment. Material types within external walls (structure), roof (structure), floor (structure) and hard landscaping location/use categories, which clearly account for less than 0.33m^3per 1000 m^2 of gross internal floor area, can be excluded from the assessment. Calculations will not normally be required to justify such exclusions.

Methodology

There are two routes to demonstrating compliance with this issue. Either of the routes or a combination may be followed for any situation:

- Route 1 is intended for use in the majority of situations where detailed information on quantities of materials is not readily available.
- Route 2 is intended for situations where a more detailed analysis is possible due to the availability of sufficient detail on material quantities and associated supply chains.
- Route 3 (a combination of routes 1 and 2) is intended for situations where details on material quantities are only available for some of the materials.

Route 1: Lowest responsible sourcing certification scheme point score

The following steps outline the methodology to be followed for this route to determine the number of credits achieved for responsible sourcing. The calculations outlined below are undertaken using the BREEAM Mat 03 calculator and the relevant project information, collated by the project team.

Step 1: Confirm the presence of 'Location/use categories' and materials

Identify from 'Location/use categories' list under Table - 51

Note:
The most appropriate category for each particular material type must be selected. Where none of the categories are appropriate use 'other'.

Products made up of constituent materials (such as windows, doors, etc.) must be broken down into constituent materials and assessed separately following the category allocation process described above. As before, any material that falls below the cut-off threshold (see CN1.6 should be excluded from the assessment.

Table - 51: Location/use and material categories.

Location/use categories
1. External wall (e.g. bricks, blocks) 2. External wall finishes (plastering, cladding, render, internal dry lining, wall coverings etc.) 3. Insulation 4. Roof (structure) 5. Roof finishes (e.g. tiles, cladding systems, etc.) 6. Upper floors (mezzanines) 7. Floor (structure) 8. Flooring finishes (including coatings) 9. Internal partitions or internal walls (structure) 10. Internal partitions or internal walls (finishes, wall coverings) 11. Ceiling (structure) 12. Ceiling finishes (including coatings) 13. External or internal doors and windows 14. Staircases or ramps 15. Fittings (shop fittings, railings, screens, gutters, vents, air grilles) 16. Furniture (desks, chairs, display cabinets, shelving) 17. Building services (equipment, distribution systems) 18. Hard landscaping 19. Other
Material categories
1. Timber or timber-based products (TBP) 2. Concrete or cementitious (plaster, mortar, screed etc.) 3. Metal 4. Stone/aggregate 5. Clay-based (pavers, blocks, bricks) 6. Gypsum 7. Glass 8. Plastic, polymer, resin, paint, chemicals and bituminous 9. Animal fibre/skin, cellulose fibre 10. Other

Step 2: Confirm the responsible sourcing certification scheme point score achieved for each applicable material

For each material type identified as applicable in step 1, determine whether or not it is covered by a BREEAM recognised Responsible Sourcing Certification Scheme certificate (see Additional information section).

Refer to Guidance Note 18 available in the Resources section of the BREEAM website for the most up to date list of BREEAM recognised Responsible Sourcing Certification Schemes, their scope and corresponding point score.

Note:

1. The responsible sourcing certification scheme (RSCS) point score is determined based on the rigour of responsible sourcing demonstrated by the supplier(s) or manufacturer(s) of that material through the use of recognised responsible sourcing certification schemes.
2. At the time of writing this document no International RSCS has been listed in the guidance note GN18.
3. International RSCS that wish to be recognised under BREEAM can apply and will need to be evaluated against the BREEAM RSM evaluation criteria to allocate associated point score.

Step 3: Point allocation and award of credits

The data entered in steps 1 and 2 is used by the BREEAM Mat 03 tool to calculate the number of RSM points achieved and award credits accordingly. This award of credits is determined as follows:

For materials that have been given the same material category (Timber or timber-based product has been used to illustrate), the tool:

1. First finds the average responsible sourcing certification scheme (RSCS) point score for Timber or timber-based products that have the same 'location/use' category. This is repeated for every 'location/use' category present,
2. Then selects the location/use category with the lowest average RSM point score,

The above process is repeated for each material category. The results for all material categories are summed and the difference between the total and the maximum total possible expressed as a percentage. The percentage is then converted to a credit score according to the Table - 50

An example calculation for route 1 is provided in Table - 52 below.

Table - 52: Example calculation for route 1

Location/ use category	Material category	RSCS point score	Average point score*	RSM point score allocation**
Door/ window	Timber or TBP1	4	5	4
	Timber or TBPt 2	6		
Floor	Timber or TBP 1	3	4	
	Timber or TB 2	5		
External wall	Timber or TBP1	6	6.5	
	Timber or TBP2	7		
Door/ window	Metal product 1	5	5	2
Ceiling	Metal product 1	3	2.5	
	Metal product 2	2		

Location/ use category	Material category	RSCS point score	Average point score*	RSM point score allocation**
Structure primary and secondary	Concrete or cementitious product 1	3	2	2
	Concrete or cementitious product 2	2		
	Concrete or cementitious product 3	1		
Internal partition	Concrete or cementitious product 1	4	5.5	
	Concrete or cementitious product 2	7		
Structure primary and secondary	Clay-based product 1	3	4	4
	Clay-based product 2	5		
Roof	Clay-based product 1	8	8	

* Average point scores for a given material in that location or use category.

** The point score allocation is the lowest point score, rounded, in the previous column, for a given material category.

Table - 53: Example point allocation and award of credits

Material category	Point scores achieved	Maximum point score	% available points achieved	Credits achieved
Timber/ timber-based product	4	10	30%	1
Metal	2	10		
Concrete/ cementitious	2	10		
Clay-based	4	10		
Total score	12	40		

Route 2: Proportion of materials responsibly sourced

This route allows for a more detailed calculation of the responsibly sourced materials in a building where information on material quantities are available. It follows a similar methodology to that set out for route 1 above but allows for a detailed calculation, based on the relative quantity of each material to weight the point scores, thus influencing the final result. Following route 2 leads to a more accurate final result and typically leads to a higher score. The required calculations are

performed by the Mat 03 Calculator tool.
An example calculation for route 2 is provided in Table - 54 below. The example illustrates the calculation for a single material category (timber/ timber-based products (TBP)). This process is repeated for each material category present in the building to determine the final RSM score.

Table - 54: Example calculation for single material category

Material category	RSCS point score (A)	Quantity (m^3 , lKg) (B)	Point score weighted (C)	Max. point score (D)	% total score (G)
Door/ window					
Timber/ TBP 1	4	100	400	1000	
Timber/ TBP 2	6	50	300	500	
Total Scores			(E)700	(F)1500	46.7%
Floor					
Timber/ TBP 1	3	100	300	1000	
Timber/ TBP 2	5	200	1000	2000	
Total Scores			(E)1300	(F)3000	43.3%
External wall					
Timber/ TBP 1	6	300	1800	3000	
Timber/ TBP 2	7	200	1400	2000	
Total Scores			(E)3200	(F)5000	64%
Average % total score (H)					51.3%
RSM score (I)					5.13

Description of columns shown in the example

Responsible sourcing certification scheme (RSCS) point score achieved, **A**

Quantity (m^3 , Kg), **B**

Point score weighted by quantity, **C** = responsible sourcing certification scheme (RSCS) point score achieved x quantity

$$C = A \times B$$

Maximum point score weighted by quantity, **D** = 10 x quantity

$$D = 10 \times B$$

Total score achieved, **E** = sum of point scores weighted by quantity

$$E = \text{sum of C scores}$$

Total maximum score, **F** = sum of maximum scores weighted by quantity

$$F = \text{sum of D scores}$$

Total score achieved, **G** = sum of point scores weighted by quantity/ sum of maximum scores weighted by quantity

$$G = E/F$$

Average percentage, **H** = average of total scores achieved

$$H = \text{average of G scores}$$

RSM score achieved, **I** = 10 x average percentage

$$I = 10 \times H$$

Route 3: Combination of routes

Table - 55 illustrates the awarding of credits where a combination of routes is used.

In the example below route 2 has been used to calculate the points for timber/ timber-based products. For all other materials present, route 1 has been used to allocate points. The figures shown have been taken from the relevant tables under route 1 and 2 example calculations provided above.

Note: Only one route can be selected per material category.

Table - 55: Example credit calculation for where a combination of routes are used

Material category	RSCS point score	Maximum point score	Percentage of available points	Credits achieved
Timber or timber-based product (using route 2)	5.13	10	32.83%	1
Metal (using route 1)	2	10		
Concrete/ cementitious (using route 1)	2	10		
Clay-based (using route 1)	4	10		
Total score	13.13	40		

Evidence

Criteria	Interim design stage	Final post construction stage
All	See 4.0 The BREEAM evidential requirements section for a list of general evidence types that can be used to demonstrate compliance with the relevant criteria for this issue.	
All	Completed copy of the Mat 03 Calculator tool	As per interim design stage.

Criteria	Interim design stage	Final post construction stage
All	Documentary evidence detailing how the Calculator tool has been completed.	As per interim design stage.

Additional information

Relevant definitions

Applicable legislation

Applicable legislation in force in the country of harvest covering the following:

- Rights to harvest timber within legally gazetted boundaries
- Payments for harvest rights and timber including duties related to timber harvesting
- Timber harvesting, including environmental and forest legislation including forest management and biodiversity conservation, where directly related to timber harvesting
- Third parties legal rights concerning use and tenure that are affected by timber harvesting
- Trade and customs, in or far as the forest sector is concerned.

BREEAM Mat 03 calculator

A calculator tool used by the BREEAM Assessor to determine the number of BREEAM credits achieved for BREEAM issue Mat 03.

BREEAM recognised responsible sourcing certification schemes

These are third party schemes evaluated and approved by BRE Global for recognition under BREEAM. Refer to Guidance Note 18 available in the Resources section of the BREEAM website for information on the evaluation criteria and the process for the evaluation and acceptance of schemes, including application and appeals.

Chain of custody (CoC)

This is a process used to maintain and document the chronological history of the evidence/path for products from forests to consumers. Timber must be tracked from the certified forest to the finished product. All the steps, from the transportation of timber from the forest to a sawmill until it reaches the customer, must maintain adequate inventory control systems that allow for separation and identification of the certified product. Chain of custody certification ensures that a facility has procedures in place to track timber from certified forests and avoid confusion with non-certified timber. Chain of custody is established and audited according to the rules of relevant forest certification systems. See also definition of CITES below.

Convention on International Trade in Endangered Species (CITES)

The Convention on International Trade in Endangered Species of wild fauna and flora (CITES) works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorised through a licensing system. Each Party to the Convention must designate one or more Management Authorities in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

1. Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
2. Appendix II includes species not necessarily threatened with extinction but in which trade must be controlled in order to avoid utilisation incompatible with their survival.
3. Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

Appendices I and II of the CITES list illustrate species of timber that are protected outright. Appendix III of the CITES list illustrates species that are protected in at least one country. If a timber species used in the project is on Appendix III it can be included as part of the assessment as long as the timber is not obtained from the country/countries seeking to protect this species.

Composite material

Composite material can be defined as an engineered material made from two or more constituent materials with significantly different physical or chemical properties and which remain separate and distinct on a macroscopic level within the finished structure. Resin based composites such as glass reinforced plastic and polymeric render and timber composites such as chipboard or particleboard, MDF, OSB, plywood, hardboard, laminated veneered lumber, glulam and cement bonded particleboard are all required to be assessed for responsible sourcing.

Hard landscaping

This includes materials for the surfacing (including subbases) of external pedestrian areas and lightly and heavily trafficked areas within the construction zone.

Legal timber

Timber that was legally harvested AND Legally traded both within the country(ies) in question and in accordance with internationally law/conventions including CITES.

Legally harvested

Timber that has been harvested in accordance with the Applicable legislation in the country of harvest.

Legally traded

Legally traded means timber or products derived from Legally harvested timber were:

1. Exported in compliance with exporting country laws governing the export of timber and timber products, including payment of any export taxes, duties or levies.
2. Imported in compliance with importing country laws governing the import of timber and timber products, including payment of any import taxes, duties or levies or not in contravention of exporting country laws governing the export of timber and timber products, including payment of any export taxes, duties , or levies.
3. Traded in compliance with legislation related to the convention on international trade in endangered species (CITES), where applicable.

Pre-consumer waste stream

Waste material generated during manufacturing processes; this excludes reuse of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

Post-consumer waste stream

Waste material generated by households or by commercial, industrial and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

Responsible sourcing

The management and implementation of sustainable development principles in the provision, procurement and traceability of construction materials and components.
In BREEAM, this is demonstrated through auditable third party certification schemes.
Refer to Guidance Note 18 available in the Resources section of the BREEAM website for an up to date table of responsible sourcing certification schemes recognised by BRE Global Ltd for the purposes of a BREEAM assessment.

Reused materials

Materials that can be extracted from the waste stream and used again without further processing, or with only minor processing, that does not alter the nature of the material (e.g. cleaning, cutting, fixing to other materials).

Recycled material

Materials diverted from the pre-consumer and/or post-consumer waste streams that require significant processing before they can be used again. For further information please see Calculating and declaring recycled content in construction products, 'Rules of Thumb' Guide (WRAP, 2008) www.wrap.org.uk.

Sustainable procurement plan

A plan that sets out a clear framework for the responsible sourcing of materials to guide procurement throughout a project and by all involved in the specification and procurement of construction materials. The plan may be prepared and adopted at an organisational level or be site/project specific, and for the purposes of BREEAM compliance, will cover the following as a minimum:

1. Risks and opportunities are identified against a broad range of social, environmental and economic issues. BS 8902:2009 Responsible sourcing sector certification schemes for construction products- Specification can be used as a guide to identify these issues.
2. Aims, objectives and targets to guide sustainable procurement activities.
3. The strategic assessment of sustainably sourced materials available locally and nationally. There should be a policy to procure materials locally where possible.
4. Procedures are in place to check and verify that the sustainable procurement plan is being implemented/adhered to on individual projects. These could include setting out measurement criteria, methodology and performance indicators to assess progress and demonstrate success.

Responsible sourcing certification scheme point scores

A graded scale to reflect the rigour of the certification scheme used to demonstrate responsible sourcing, forming the basis for awarding credits in the BREEAM issue Mat 03. Refer to Guidance Note 18 available in the Resources section of the BREEAM website for an up to date table of responsible sourcing certification schemes recognised by BRE Global Ltd for the purposes of a BREEAM assessment.

Other information

BES 6001:2008 Framework Standard for Responsible Sourcing of Construction Products

This is a BRE Global standard that provides a framework for the assessment and certification of the responsible sourcing of construction products. The Standard has been structured so that compliance can be demonstrated through a combination of meeting the requirements of other recognised certification schemes, establishing written policies, setting objectives and targets and engaging with relevant stakeholders.

To comply with the standard a product must meet a number of mandatory criteria. Where a product demonstrates compliance beyond the mandatory levels, higher levels of performance can be achieved. The standard's performance ratings range from Pass to Good, Very Good and Excellent.

The development of this standard and subsequent certification schemes will, it is envisaged, provide construction products, not wholly covered under current recognised standards, a means for demonstrating their responsibly sourced credentials. In turn this will allow clients, developers and design teams to specify responsibly sourced construction products with greater assurance and provide a means of demonstrating compliance with the assessment criteria for this BREEAM issue.

To view a list of products approved to BES 6001 and additional information about the standard visit: www.greenbooklive.com.

Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC) validity

A CPET document may be helpful to assessors with respect to determining the validity of FSC and PEFC certificates.

http://www.pefc.org/index.php/certification-services/find-certified

Individual certification scheme holders search database:

http://info.fsc.org/

http://www.pefc.org/

Mat 04 Insulation

This issue is not applicable to BREEAM International Refurbishment and Fit-out 2015. Insulation is assessed within Mat 01 Environmental impact of materials and Mat 03 Responsible sourcing of materials.

Mat 05 Designing for durability andresilience

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	No	No	Yes

Aim

To recognise and encourage adequate protection of exposed elements of the building and landscape, therefore minimising the frequency of replacement and maximising materials optimisation.

Assessment criteria

The following is required to demonstrate compliance:

One credit

Protecting vulnerable parts of the building from damage

1 The building incorporates suitable durability and protection measures or designed features or solutions to prevent damage to vulnerable parts of the internal and external building and landscaping elements. This must include, but is not necessarily limited to:
- 1.a Protection from the effects of high pedestrian traffic in main entrances, public areas and thoroughfares (corridors, lifts, stairs, doors etc.).
- 1.b Protection against any internal vehicular or trolley movement within 1 m of the internal building fabric in storage, delivery, corridor and kitchen areas.
- 1.c Protection against, or prevention from, any potential vehicular collision where vehicular parking and manoeuvring occurs within 1 m of the external building façade for all car parking areas and within 2m for all delivery areas.

Protecting exposed parts of the building from material degradation

2 Existing and newly specified materials or newly constructed elements (e.g. a new external wall) within the scope of refurbishment or fit-out works incorporate appropriate design and specification measures to limit material degradation due to environmental factors. See Methodology

See Table - 56 in the Checklists and tables section for a list of applicable elements, environmental factors and material degradation effects to consider.

Checklists and tables

Table - 56: Applicable building elements, environmental factors and material degradation effects to consider

Applicable building elements, environmental factors and material degradation effects
Applicable building elements
1. Foundation, substructure, lowest floor, retaining walls 2. External walls 3. Roof or balconies 4. Glazing: windows, skylight 5. External doors 6. Railings or balusters (where exposed to external environment) 7. Cladding (where exposed to external environment) 8. Staircases or ramps (where exposed to external environment) 9. Hard landscaping

Applicable building elements, environmental factors and material degradation effects
Environmental factors
1. Environmental agents, including: a. Solar radiation b. Temperature variation c. Water or moisture d. Wind e. Precipitation, e.g. rain and snow f. Extreme weather conditions: high wind speeds, flooding, driving rain, snow 2. Biological agents, including: a. Vegetation b. Pests, insects c. Pollutants, including: d. Air contaminants e. Ground contaminants
Material degradation effects (includes, but not necessarily limited to the following)
1. Corrosion 2. Dimensional change, e.g. swelling or shrinkage 3. Fading or discolouration 4. Rotting 5. Leaching 6. Blistering 7. Melting 8. Salt crystallisation 9. Abrasion

Compliance notes

Ref	Terms	Description
CN0.1	Part 1: Fabric and structure	All assessment criteria in this issue are applicable
CN0.2	Part 2: Core services	This issue is not applicable
CN0.3	Part 3: Local services	This issue is not applicable
CN0.4	Part 4: Interior design	Criteria 1, 1.a and 1.b Criteria 1.c and 2 are not applicable
General		

Ref	Terms	Description
CN1	Historic buildings	For heritage buildings and buildings in a local/national conservation area, measures to protect vulnerable parts of the building from damage (criterion1) and to limit material degradation (criterion2) should be based on the measures that are feasible within the scope of any heritage requirements that may be explicitly required by the relevant conservation authority (e.g. the local authority heritage office). This should consider the range of options that may be feasible in order to demonstrate compliance with justification provided, including reference to documentary evidence to verify any restrictions that are in place that prevent compliance with any durability measures (including those specified in CN1.1
CN1.1	Suitable durability measures See criterion 1.	Suitable durability and protection measures to vulnerable parts of the building can include: 1. Bollards or barriers or raised kerbs to delivery and vehicle drop-off areas 2. Robust external wall construction, up to 2m high 3. Protection rails to walls of corridors 4. Kick plates or impact protection (from trolleys etc.) on doors 5. Hard-wearing and easily washable floor finishes in heavily used circulation areas (i.e. main entrance, corridors, public areas etc.) 6. Designing out the risk without the need for additional materials specification to protect vulnerable areas.
CN1.2	Vehicle impact protection See criterion 1.c.	Any vehicle impact protection measures specified must be positioned at an adequate distance from the building to protect the fabric from impact from any vehicle with a measurable overhang of the body from the wheel track, in particular for any goods delivery areas. In vehicle movement areas only; where the specification of external robust wall construction is specified to comply with the credit, additional protection must be provided to ensure against potential damage to the robust façade from vehicle movement, i.e. specifying bollards or protection rails.
CN1.3	Preventing excessive material use	The specification or design measures chosen should reflect the need to balance the additional specification of materials with the need to protect building elements to minimise their replacement, insuring against excessive material use and promoting materials optimisation.
CN1.4	Public or common areas	Consideration should be given to materials specification in public or common areas (especially public waiting areas and toilet areas) to provide protection against potential malicious or physical abuse, as far as possible.
CN1.5	Minor repair work	Where conducting minor repair work and the material use accounts for less than 1 m^3 per 1000m^2 of gross internal floor area, this can be excluded from the assessment.

Methodology

Protecting exposed parts of the building from material degradation

The following outlines the process to assess criterion 2for newly specified materials and constructed elements.

1. Identify from the list of 'applicable building elements' under Table - 56 the elements that are appropriate to the building being assessed.
2. Establish from the 'environmental factors' list those factors that are likely to cause material degradation effects in the identified newly specified applicable building elements.
3. Confirm the design and specification measures in place to limit these degradation effects.

4. The assessor should use their professional judgement in determining whether the design team have adequately demonstrated that they have designed and specified materials or measures which will be effective in preventing unnecessary deterioration, so reducing frequent replacements, repairs and maintenance through the life cycle of the building.
5. At post construction stage, where the design and specification measures installed differ from that proposed at design stage, the assessor must ensure that these measures still meet the aims of the criterion as detailed in point 6 above.

The following outlines the process to assess criterion 2 for existing elements

1. Identify from the list of 'applicable building elements' under Table - 56 the existing elements that are appropriate to the building being assessed.
2. Existing applicable building elements (see Table - 56) have been surveyed have been assessed to identify impacts of material degradation effects including an assessment to grade the severity of any degradation effects. Design and specification measures have been developed to repair and protect existing elements according to the severity of any degradation affects, to limit degradation. Where it is not feasible to implement measures to limit material degradation for existing elements, justification should be provided.
3. Where existing elements with signs of environmental degradation are outside of the scope of refurbishment works, check that confirmation has been provided from design team that the severity of any degradation is low or that justification has been provided by the design team regarding the feasibility of any measures.
4. Same as 3 above
5. Same as 4 above
6. Same as 5 above

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Materials efficiency

Refer to BREEAM issue Mat 06 Material efficiency

Other information

None.

Mat 06 Material efficiency

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes	Yes	Yes

Aim

To recognise and encourage measures to optimise material efficiency in order to minimise environmental impact of material use and waste.

Assessment criteria

The following is required to show compliance for:

One credit

1 Opportunities have been identified, and appropriate measures investigated and implemented within the scope of refurbishment or fit-out works, to optimise the use of materials through building design, procurement, refurbishment, maintenance and end of life (see examples in Table - 57 and Table - 58, in the Additional information section)

2 The above is carried out by the design or construction team in consultation with the relevant parties (see CN1.1) at each of the following project work stages:
- 2.a Preparation and Brief
- 2.b Concept Design
- 2.c Developed Design
- 2.d Technical Design
- 2.e Construction.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2, 3 and 4	All assessment criteria in this issue are applicable.
General		
CN1.1	Relevant parties	All parties (as relevant to the project stage) involved in the design, specification and/or construction of the building should be consulted. This includes but is not limited to, the following: 1. Client or developer 2. Cost consultant 3. Architect 4. Structural or civil engineers 5. Building services engineers - mechanical, electrical 6. Principal contractor 7. Demolition or strip-out contractor 8. Environmental consultant 9. Project management consultant 10. Materials or component manufacturers or suppliers.

Ref	Terms	Description
CN1.2	Evidence requirements	BRE has avoided being overly prescriptive with the evidence requirements for this issue, recognising that this is a complex environmental and design issue, where solutions and approaches are largely influenced by building specific factors. The evidence required to demonstrate compliance will vary according to the project work stage. A few examples have been provided below: — Reports (at Preparation and Brief stage) outlining the activity relating to material efficiency (ideas discussed, analysis and decisions taken) — Drawings or building information model (BIM), calculations showing reduction of material use through design (Concept Design or Developed Design stages) — Meeting notes, construction program, responsibilities schedule (indicating parties consulted). For further guidance, examples of material efficiency measures have been provided in Table - 57, along with an example of how material efficiency could be considered through the project work stages in Table - 58 The BREEAM Assessor should use their judgement in determining whether the aim and intent of the credit has been met using appropriate project information to back their judgement. BRE Global will endorse the BREEAM Assessor's judgement through the Quality Assurance audit where a reasonable justification to award the credit on the basis of project team actions and proposed design solutions is evident.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Material efficiency

The process of undertaking a building project to enable the most efficient use of materials over the life cycle of the building and its components. This includes using fewer materials, reusing existing demolition and strip-out materials and, where appropriate, procuring materials with higher levels of recycled content. It may also include the adoption of alternative means of design or construction that result in lower materials usage and lower wastage levels including off-site manufacture and use of pre-assembled service pods.

Other information

Table - 57: examples of material efficiency actions are as follows

BREEAM Refurbishment and Fit-out assessment parts	Example material efficiency considerations

All assessment parts	— Can existing elements be reused, preferably on site? — Can materials with a high recycled content be used? — Consider the waste hierarchy for waste materials removed as part of the refurbishment
Part 1: Fabric and structure	— Windows: can existing windows be repaired? If not, consider the materials for the replacement windows (see Mat 01 Environmental impact of materials) — Insulation: can existing insulation be 'topped up' without removal of material? If not consider use of materials that comply with Mat 04 Insulation) — Cladding: consider whether cladding can be repaired or reused.
Parts 2 and 3: Core and local services	— Pipework: use of materials with a high recycled content — Ventilation systems and ductwork: consider changes to design to minimise the need for ventilation systems, position of air handling units closer to ventilated spaces to minimise length in ductwork, consider use of fabric ductwork to replace galvanised steel.
Part 4: Interior design	— Floor coverings: can existing floor coverings be reused on or off site? — Partitions and ceilings: can existing ceilings and partitions be reused? If not, consider adjusting sizes of partitions to minimise offcuts of material or removable partitions that can be reused

Table - 58 provides examples of useful information to help the optimisation of materials use at different project work stages. In refurbishment and fit-out projects the following project work stages may not work in this sequence. For example, many fit-out projects are undertaken using a design and build project. Therefore some actions may occur at a different stage of the project, e.g. consultation with contractors as suggested for Stage 4 would need to occur at stage 1. The examples should be used for traditional construction programmes and for where this sequence is not being followed, these examples should be adapted to identify at what point in the project plan actions or outputs are most appropriate in order to optimise material use most effectively.

Table - 58: Examples of useful information to help in the optimisation of materials use at different project work stages

Work stages	Information and actions	Output
0. Strategic Definition		Strategic brief to include section on material efficiency which identifies client aspirations and objectives
1. Preparation and Brief	Include information from: — Pre-refurbishment audit to identify potential reuse opportunities on and off-site (Wst 01 Project waste management) — Waste forecasts — Assessment of site constraints that may influence material efficiency — Other project specific feasibility studies.	Project brief including — Initial resource management plan — Project targets (waste arisings, percentage reuse, percentage recycled content) — Roles and responsibilities.

2. Concept Design	— Designing out waste workshop or discussions output (follow WRAP 5 principles of designing out waste) — Development of improved forecasts of types and amounts of waste — Engagement with contractors to investigate waste reduction activities — Prioritisation of ideas.	Expanded project brief summarising activities relating to material efficiency.
3. Developed Design	— Incorporation of selected ideas into drawings and outline specifications — Assessment of savings in material quantities.	Resource management plan updated to include accurate waste forecasts, opportunities to design out waste and increase reclaimed content.
4. Technical Design	— Engagement with contractors, subcontractors and suppliers — Consultations with planning or building regulation authorities.	— Report with final options from previous statements and reasons for inclusion or exclusions — Updated resource management plan including waste forecasts, design decisions.
5. Construction		— Updated resource management plan to include actual waste arisings and performance against targets (linked to Wst 01 Project waste management).

Optimising material use

The global built environment is responsible for 30% of GHG emissions and consumes three billion tonnes of raw materials annually. The breakdown of global industrial carbon emissions shows that 55% comes from the manufacture and processing of five stock materials- steel (25%), cement (19%), paper (4%), plastic and aluminium(3%).

Optimising material use is one the key resource efficiency goals for any sustainability strategy. This involves various components to ensure efficient use of materials, waste prevention and reduction, minimal damage to the environment and depletion of natural resources. This new BREEAM issue aims to encourage and support efforts to reduce the amount of materials use in building design without compromising on the structural stability. BRE intends to further develop the assessment criteria for this issue in future updates of BREEAM and as such BRE would welcome any feedback on the application of this assessment issue to assist with the evolution of the criteria and inclusion of additional guidance on compliance in future BREEAM versions.

Tools to guide material efficiency strategies

The following provide frameworks for the consideration and review of resource efficiency in design and construction:

BS 8895

Designing for material efficiency in buildings projects - Part 1: Code of practice for Strategic Definition and Preparation and Brief[1] standard outlines specific material efficiency processes, key tasks, team members and their responsibilities and outputs specific to each RIBA work stage along with supporting guidance and tools. This serves as a useful tool to assist the design team in developing and implementing material efficiency strategies for their developments.

WRAP

Designing out Waste: A design team guide for Buildings[2]. This document outlines five principles of designing out waste and can be applied during design development, and serve as prompts for investigating opportunities for material efficiency in design.

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[1] BS 8895: Designing for material efficiency in building projects - Part 1: Code of practice for Strategic Definition and Preparation and Brief. BSI, 2013
[2] Designing out Waste: A design team guide for Buildings, WRAP.

11.0 Waste

Summary

This category encourages the sustainable management (and reuse where feasible) of construction and operational waste through future maintenance and repairs associated with the building structure and interiors. By encouraging good design and construction practices, issues in this section aim to optimise material reuse, reduce the waste arising from the refurbishment and fit-out as well as through operation of the building, encouraging its diversion from landfill. It includes recognition of measures to reduce future waste as a result of the need to alter the building in the light of future changes to climate.

Category summary table

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Wst 01 Project waste management	6	— Development of a pre-refurbishment audit to identify options for reuse and recycling. — Actions to reuse or directly recycle materials. — Development of a refurbishment resource management plan. — Reducing project waste related to on-site construction and off-site manufacture or fabrication. — Diverting non-hazardous construction (on-site and dedicated off-site manufacture or fabrication), demolition and excavation waste (where applicable) generated by the project from landfill.	Yes	Yes	Yes	Yes
Wst 02 Recycled aggregates	1	— Percentage levels of recycled or secondary aggregate specified against set targets.	Yes	No	No	No

Issue	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Wst 03 Operational waste	1	— Provision of suitable space and facilities to allow for segregation and storage of operational recyclable waste volumes generated by the assessed building or unit, its occupant(s) and activities.	Yes	No	No	Yes
Wst 04 Speculative finishes	1	— Specification of floor and ceiling finishes only where agreed with the occupant or for tenanted areas where the future occupant is not known, carpets, other floor finishes and ceiling finishes are installed in a show area only to reduce wastage.	No	Yes	Yes	No
Wst 05 Adaptation to climate change	1	— Encourage consideration and implementation of measures to mitigate the impact of more extreme weather conditions arising from climate change over the lifespan of the building.	Yes	Major refurbishment projects only (i.e. where Parts: 1-4 are assessed)		
Wst 06 Functional adaptability	1	— Encourage consideration and implementation of measures to accommodate future changes to the use of the building and its systems over its lifespan.	Yes	Yes	Yes	Yes

Wst 01 Project waste management

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
6	No	Yes	Yes	Yes	Yes

Aim

To promote resource efficiency via the effective management and reduction of refurbishment and fit-out waste and the reuse and direct recycling of materials.

Assessment criteria

The issue is split into four parts:

- Pre-refurbishment audit (1 credit)
- Reuse and direct recycling of materials (up to 2 credits)
- Resource efficiency (up to 2 credits)
- Diversion of resources from landfill (1 credit)

The following is required to demonstrate compliance:

One credit - Pre-refurbishment audit

1 The client shall ensure that a pre-refurbishment audit of all existing buildings, structures or hard surfaces within the scope of the refurbishment or fit-out zone is completed.
The requirements for carrying out an appropriate pre-refurbishment audit are

- 1.a The audit should be carried out at the Concept Design Stage or equivalent , prior to strip-out or demolition works in order to use the audit results to guide the design, consideration of materials that can be reused, and to set targets for waste management and ensure all contractors are engaged in the process of maximising high grade reuse and recycling opportunities.
- 1.b The audit should be carried out by a competent person who is independent of the project, has appropriate knowledge of buildings, waste and options for the reuse and recycling of different waste streams
- 1.c Actual waste arisings and waste management routes used should be compared with those forecast from the audit and barriers to achieving targets should be investigated.

The audit must be referenced in the resource management plan and cover:

- 1.d Identification and quantification of the key materials where present on the project (see Table - 62)
- 1.e Potential applications and any related issues for the reuse and recycling of the key materials in accordance with the waste hierarchy.
- 1.f Identification of local reprocessors or recyclers for recycling of materials
- 1.g Identification of overall recycling rate for all key materials
- 1.h Identification of reuse targets where appropriate.
- 1.i Identification of overall landfill diversion rate for all key materials.

Up to two credits - Reuse and direct recycling of materials

2 Where waste material types detailed in Table - 60 are either directly reused on site or off site or are sent back to the manufacturer for closed loop recycling

3 One credit is achieved where 50% of the total available points for the waste material types detailed in Table - 60, that are present on the project have been achieved (using the Was 01 calculator tool, see Table - 61 in the Methodology section).

4 Two credits are achieved where 75% of the total available points for the waste material types detailed in Table - 60, that are present on the project have been achieved (using the Was 01 calculator tool, see Table - 61 in the Methodology section)

Please note that in most instances any materials specified in Table - 60, that are sent to a Material Recovery Facility (MRF) for recovery do not qualify for this credit. See compliance note CN2, Resource management plan for further details.

Up to two credits - Resource efficiency

One credit

5 Develop and implement a resource management plan covering the waste arisings from the refurbishment or fit-out project with the aim of minimising waste (see Relevant definitions), recording and reporting accurate data on waste arisings.

6 Appropriate targets (see Relevant definitions for the amount of non-hazardous and hazardous waste produced on site are set in m^3 of waste per $100m^2$or tonnes of waste per $100m^2$. These should be based on the pre-refurbishment audit findings and be set prior to strip-out or demolition works.

7 Procedures are in place to minimise non-hazardous and hazardous waste in line with the targets.

8 The amount of site construction waste created is being monitored and targets regularly reviewed.

9 The design/site management team has nominated an individual responsible for implementing the above.

10 Recovery of material from strip-out or demolition for subsequent use, prioritising high grade/value applications, should be maximised.

11 Using the collated data, report the amount of waste generated per $100m^2$ (gross internal floor area) in m^3 (where volume is actual volume of waste, not bulk volume) and/or tonnes from the construction process via the BREEAM scoring and reporting tool.

One credit

12 Criteria 5 to 11 are achieved.

13 Procedures are in place for sorting, reusing and recycling non-hazardous construction waste into at least five defined waste groups (see Table - 62) either on site or off site through a licensed externalcontractor.

One credit - Diversion of resources from landfill

14 A significant quantity of non-hazardous construction and demolition waste (where applicable) generated by the project has been diverted from landfill according to the figures withinTable - 59:

Table - 59: BREEAM targets for diversion from landfill according to National construction and demolition (C&D) waste recovery rate

	One credit	Exemplary level
	BREEAM target rates for diversion from landfill	
Where the national construction and demolition (C&D) waste recovery rate is < 40% (by weight)	≥ 50% (by weight) or ≥ 40% (by volume)	≥ 75% (by weight) or ≥ 65% (by volume)
Where the national construction and demolition (C&D) waste recovery rate is ≥ 40% (by weight)	≥ 10% improvement over national rate (up to where 95% of total waste created is diverted to landfill)	≥ 35% improvement over national rate (up to where 95% of total waste created is diverted to landfill)

15 Using the collated data, report the following via the BREEAM scoring and reporting tool (this applies to construction and demolition waste, where applicable)

15.a Destination of the non-hazardous waste leaving the site (i.e. address and facility) and the

15.b Level of waste diverted from landfill as a percentage of overall arising OR m^3 of waste per $100m^2$ OR tonnes of waste per $100m^2$ (see Compliance notes).

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM issue:

16 Criteria 5 to 19, where applicable, are achieved.

17 The percentage of non-hazardous and hazardous construction waste meet the resource efficiency targets and demolition waste (if relevant) diverted from landfill meets or exceeds the exemplary level percentage benchmark (outlined in Table - 59.

Checklists and tables

Note: See Table - 61 for details of the points awarded for each option detailed below and the methodology for calculating the % of available points achieved as required for criteria 3 and 4.

Table - 60: Options for direct reuse and recycling

Material	Options for reuse or direct recycling
Inert materials (excluding soil)	— On-site reuse in original form e.g. bricks, roof tiles, paving slabs, kerbs, cills
	— Off-site reuse in original form e.g. bricks, roof tiles, paving slabs, kerbs, cills
New and used metal materials	— On-site reuse of metal material in original form
	— Off-site reuse of metal material in original form
Composite materials (materials which include more than one material type often bonded together)	— On-site reuse in original form
	— Off-site reuse in original form
New and used plasterboard (offcuts/unused/undamaged boards)	— On-site reuse in original form
	— Off-site reuse of unused or undamaged plasterboard on other construction or refurbishment projects
	— Off-site reuse options for unused or undamaged plasterboard - e.g. local community scheme, surplus construction material trading, charities
	— Plasterboard manufacturer take-back schemes e.g. collection of bagged offcuts or unused boards
Furniture	— On-site reuse in original form
	— Off-site reuse options - e.g. local community schemes, local charities, schools, etc

Material	Options for reuse or direct recycling
Timber products (All sawn soft wood or hard wood only; no board products e.g. MDF, chipboard etc)	— On-site reuse of timber on the project
	— Off-site reuse via another project, national or local community wood reuse scheme
New and used mineral fibre ceiling panels and tiles	— Off-site reuse in other construction or refurbishment projects, local community schemes, charities
	— Off-site recycling via manufacturer for closed loop recycling (see Relevant definitions
Vinyl floor coverings (uplifted vinyl flooring and post-installation offcuts)	— Off-site direct recycling via manufacturer for closed loop recycling
Used carpet tiles (good reusable condition)	— On-site reuse of carpet tiles in their original form
	— Off-site direct reuse on other construction or refurbishment projects, local community schemes, charities
	— Direct recycling via a manufacturer for closed loop recycling
Packaging materials (all timber, cardboard & plastic)	— Repatriation of wooden pallets from product suppliers for direct reuse
New and unused insulation board (foam board only e.g. EPS, XPS, ISO, COMP. not mineral fibre)	— Off-site reuse of new and unused insulation board on other construction or refurbishment projects, local community schemes, charities
	— Resale of insulation board via surplus construction material trading companies
	— Collection by manufacturer for closed loop recycling
Fixtures and fittings	— On-site reuse in original form e.g. sinks, doors, gates
	— Off-site reuse in original form, e.g. sinks, doors, gates

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Parts: 1, 2, 3 and 4	All assessment criteria are applicable.
General		

Ref	Terms	Description
CN2	Resource management plan	To achieve any of the refurbishment resource efficiency credits the assessed development, regardless of value or locality, must have a resource management plan (see Relevant definitions in the Additional information section).
CN2.1	Limited site space for segregation and storage	Where space on site is too limited to allow materials to be segregated, a waste contractor may be used to separate and process recyclable materials off site at a Material Recovery Facility (MRF). Similarly, manufacturers' take-back schemes could also be used. Where this is the case, sufficient documentary evidence must be produced which demonstrates that segregation of materials is carried out to the agreed levels and that materials are reused or recycled as appropriate.
CN2.2	Waste from temporary support structures	Any waste generated on site for the purposes of the project (excluding demolition and excavation waste) must be taken account of in the assessment of this issue. If temporary support structures, or any other materials or system brought on-site to facilitate refurbishment of a building, enter the waste stream (albeit for recycling), then they will need to be classified as construction waste and therefore contribute to the construction waste benchmark necessary to facilitate assessment with this issue. If the support structure is reused by the contractor (or by another contractor) on other sites and has not been discarded, it would not be included in the waste generated for this issue. The same would apply to timber formwork where reused.
CN2.3	Strip-out prior to design team appointment	Where the strip-out has already taken place under a separate contract prior to appointment of the contractor and design team, criterion 1 (pre-refurbishment audit) cannot be achieved.
CN2.4	National construction and demolition waste recovery rate	Please refer to the country specific reference sheet to find the information required in the country of assessment to assess criterion14. Where the national C&D waste recovery rate is unknown, the design team should assume that it is 40%. Achieving a 10% improvement over this national recovery rate will therefore require the design team or the contractor to divert 50% by weight of their non-hazardous construction waste from landfill.
CN2.5	Damaged materials not suitable for direct reuse in original form	It is recognised that it will not always be possible for 100% of a material type present on site listed in Table - 60

Methodology

Calculating the percentage of available points achieved (see criteria 2, 3 and 4)

The percentage of available points achieved for criteria 2, 3 and 4 is calculated using the Was 01 calculator tool. The methodology for calculating the points awarded is as follows:

1. Identify the waste material types that are present on site detailed in Table - 61
2. Based upon the material types that are present, calculate the available points per material using column (d)
3. Determine the points achieved based upon the option for reuse or direct recycling that is being implemented for the materials present on site and the corresponding points awarded for that option as shown in column (a) see compliance note , where 100% of a material type has not been reused or directly recycled.

4. Calculate the total maximum points (f) available using column (d)
5. Calculate the total points achieved (g) using column (e)
6. Calculate the percentage of available points achieved (h) by dividing the points achieved (g) by the maximum points available (f) multiplied by one hundred

Table - 61: Calculating the percentage of available points achieved

Options for reuse or direct recycling	(a) Points to be awarded	(b) Maximum points available per material	(c) Material present on site? 1 = Yes 0 = No	(d) Available points = (a) x (c)	(e) Points achieved (using column (a))
Inert materials (excluding soil)					
— On-site reuse in original form e.g. bricks, roof tiles, paving slabs, kerbs, cills	3	3			
— Off-site reuse in original form e.g. bricks, roof tiles, paving slabs, kerbs, cills	2	-			
New and used metal materials					
— On-site reuse of metal material in original form	3	3			
— Off-site reuse of metal material in original form	2	-			
Composite materials (materials which include more than one material type often bonded together)					
On-site reuse in original form	3	3			
Off-site reuse in original form	2	-			
New and used plasterboard (offcuts/unused/undamaged boards)					
— On-site reuse in original form	3	3			
— Off-site reuse of unused or undamaged plasterboard on other construction or refurbishment projects	2	-			

Options for reuse or direct recycling	(a) Points to be awarded	(b) Maximum points available per material	(c) Material present on site? 1 = Yes 0 = No	(d) Available points = (a) x (c)	(e) Points achieved (using column (a))
— Off-site reuse options for unused or undamaged plasterboard - e.g. local community scheme, surplus construction material trading, charities	2	-			
— Plasterboard manufacturer take-back schemes e.g. collection of bagged offcuts or unused boards	2	-			
Furniture					
— On-site reuse in original form	3	3			
— Off-site reuse options - e.g. local community schemes, local charities, schools, etc	2	-			
Timber products (All sawn soft wood or hard wood only - no board products e.g. MDF, chipboard etc)					
— On-site reuse of timber on the project	3	3			
— Off-site reuse via another project, national or local community wood reuse scheme	2	-			
New and used mineral fibre ceiling panels and tiles					
— Off-site reuse in other construction or refurbishment projects, local community schemes, charities	2	2			
— Off-site recycling via manufacturer for closed loop recycling (see Relevant definitions)	1	-			
Vinyl floor coverings (uplifted vinyl flooring and post-installation offcuts)					

Options for reuse or direct recycling	(a) Points to be awarded	(b) Maximum points available per material	(c) Material present on site? 1 = Yes 0 = No	(d) Available points = (a) x (c)	(e) Points achieved (using column (a))
— Off-site direct recycling via manufacturer for closed loop recycling	1	1			
— Used carpet tiles (good reusable condition) — On-site reuse of carpet tiles in their original form	3	3			
— Off-site direct reuse on other construction or refurbishment projects, local community schemes, charities	2	-			
— Direct recycling via a manufacturer for closed loop recycling	1	-			
Packaging materials (all timber, cardboard & plastic)					
— Repatriation of wooden pallets from product suppliers for direct reuse	2	2			
New and unused insulation board (foam board only e.g. EPS, XPS, ISO, COMP. not mineral fibre)					
— Off-site reuse of new and unused insulation board on other construction or refurbishment projects, local community schemes, charities	2	2			
— Resale of insulation board via surplus construction material trading companies	2	-			
— Collection by manufacturer for closed loop recycling	1	-			
Fixtures and fittings					
— On-site reuse in original form e.g. sinks, doors, gates	3	3			

Options for reuse or direct recycling	(a) Points to be awarded	(b) Maximum points available per material	(c) Material present on site? 1 = Yes 0 = No	(d) Available points = (a) x (c)	(e) Points achieved (using column (a))
– Off-site reuse in original form, e.g. sinks, doors, gates	2	-			
Maximum available points (f) = Sum of (d)					
Total points achieved (g) = Sum of (e)					
Percentage of available points achieved (h) = ((g) / (f)) * 100					

Evidence

Criteria	Interim design stage	Final refurbishment stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
All	A copy of the resource management plan and pre-refurbishment audit.	As per interim design stage.
Criteria 2 - 4	One or more of the appropriate evidence types listed in the BREEAM evidential requirements that highlights the relevant materials that are present on the project prior to strip-out or demolition.	As per interim design stage.

Additional information

Relevant definitions

Appropriate targets

These should be set according to national/local best practice (where available) and will depend on the type of waste and the opportunities for reuse on site. Where national/local best practice targets are not available, targets could be set by using data from similar past projects and making an improvement or by working towards a company target or based on improving on past contractor performance. The design team should justify why the targets are deemed appropriate. A target is NOT deemed to be an 'appropriate target' within this issue solely because it is achievable. Note: Targets and measurements should exclude demolition and excavation waste as this varies from project to project (and is addressed in the 'diversion from landfill' credit). Further information can be found on the SMARTWaste Plan website on how to set appropriate targets.

Closed loop recycling

Is the remanufacturing of a product back into the same product e.g. remanufacturing of ceiling tiles into new ceiling tiles

Dedicated off-site manufacturing or fabrication

Refer to Man 03 Responsible construction practices - Dedicated off-site manufacturing or fabrication.

Diversion from landfill

Actions to avoid waste being disposed of in landfill include:

- Reusing the material on site (in situ or for new applications)
- Reusing the material on other sites
- Community reuse and recycling
- Salvaging or reclaiming the material for reuse
- Returning material to the supplier via a 'take-back' scheme
- Direct recycling of materials via a specialist material reprocessor or recycler
- Recovery of the materials from site by an approved waste management contractor and recycled or sent for energy recovery
- Utilising waste in exempt or permitted applications (not landfill).

Pre-refurbishment and pre-demolition audits

These provide detailed information on materials that can be reclaimed and recycled, so reducing the cost and environmental impact of waste disposal, bringing savings from reusing existing materials and earnings from selling those that are not needed. They:

1. Identify volumes of wastes so that your company can plan 'reuse, recycling and recovery' activities prior to work starting.
2. Are tailor-made for each demolition project including:
   a. Identifying markets for recycled or recovered material
   b. Identifying reclamation and reuse potential both on site and off site
   c. Local and national material valuation
   d. Segregation recommendations
   e. Environmental quantification.
3. Increase material and labour efficiency, reduce waste and maximise profit.

Resources management plan (RMP)

The implementation of a Resources management plan can help manage the waste arising from a project with an aim to promote resource efficiency and to prevent illegal waste activities. Resource efficiency includes minimising waste at source and ensuring that clients, designers and principal contractors assess the use, reuse and recycling of materials and products on and off the site. A RMP consists of a combination of commitments to best practice is a combination of commitments to:

1. Design out waste (materials optimisation)
2. Reduce waste generated on site
3. Develop and implement procedures to sort and reuse or recycle construction and demolition waste on and off site (as applicable)

Waste minimisation

This term encompasses:

Waste reduction or prevention = using less material in design, manufacture and installation, keeping products for longer, using no hazardous materials.

Reuse = using products again for the same purpose for which they were conceived, which may require checking, cleaning or repairing (preparing for reuse).

Types of waste minimisation actions include:

1. Set and report against waste reduction targets
2. Design for standardisation of components
3. Return packaging for reuse
4. Consider community reuse of surplus or offcuts
5. Include waste minimisation initiatives and targets in tenders or contracts, and engage with the supply chain
6. Consider use of BIM (Building Information Modelling)
7. Design for off-site or modular build
8. Design for flexibility, adaptability and future deconstruction
9. Design to use fewer materials
10. Use of reusable temporary elements such as shuttering and protection.

This list is not exhaustive and other waste minimisation actions can be taken.

Table - 62: Construction waste groups

European Waste Catalogue	Key group	Examples
170102	Bricks	Bricks
170101	Concrete	Pipes, kerb stones, paving slabs, concrete rubble, precast and in situ
170604	Insulation	Glass fibre, mineral wool, foamed plastic
1501	Packaging	Paint pots, pallets, cardboard, cable drums, wrapping bands, polythene sheets
170201	Timber	Softwood, hardwood, board products such as plywood, chipboard, medium density fibreboard (MDF)
1602	Electrical and electronic equipment	Electrical and electronic TVs, fridges, air-conditioning units, lamps equipment
200301	Canteen or office	Office waste, canteen waste, vegetation
1301	Oils	Hydraulic oil, engine oil, lubricating oil
1703	Asphalt and tar	Bitumen, coal tars, asphalt
170103	Tiles and ceramics	Ceramic tiles, clay roof tiles, ceramic, sanitary ware
1701	Inert	Mixed rubble, excavation material, glass
1704	Metals	Radiators, cables, wires, bars, sheet
170802	Gypsum	Plasterboard, plaster, fibre cement sheets
170101	Binders	Render, cement, mortar
170203	Plastics	Pipes, cladding, frames, non-packaging sheet
200307	Furniture	Tables, chairs, desks, sofas
1705	Soils	Soils, clays, sand, gravel, natural stone
Most relevant EWC	Liquids	Non-hazardous paints, thinners, timber treatments
Most relevant EWC	Hazardous	Defined in the Hazardous Waste List (HWL) of the European Waste Catalogue (EWC)

European Waste Catalogue	Key group	Examples
Most relevant EWC	Floor coverings (soft)	Carpets, vinyl flooring
Most relevant EWC	Architectural features	Roof tiles, reclaimed bricks, fireplaces
170904 (Mixed)	Mixed/other	Efforts should be made to categorise waste into the above categories wherever possible

Other information

None.

Wst 02 Recycled aggregates

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	No	No	No

Aim

To recognise and encourage the use of recycled, secondary aggregates and reuse of aggregates in situ, thereby reducing the demand for virgin material and optimising material efficiency in major refurbishment works.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Recycled aggregates

1 At least 25% of the high grade aggregate uses (within the refurbishment) are provided by secondary or recycled aggregate. This percentage can be measured using either weight or volume.

2 The recycled or secondary aggregates are EITHER
   2.a Construction, demolition and excavation waste obtained on site or off site
   OR
   2.b Secondary aggregates obtained from a non-construction post-consumer industrial by-product source (see Relevant definitions section)

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM issue.

3 Where the total amount of recycled and/or secondary aggregate specified is greater than 50% (by weight or volume) of the total high grade aggregate specified for the project.

4 The contributing recycled or secondary aggregate must not be transported more than 30 km by road transport.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable
CN1.1	Part 2: Core services	This issue is not applicable.
CN1.2	Part 3: Local services	This issue is not applicable.
CN1.3	Part 4: Interior design	This issue is not applicable.

Ref	Terms	Description
General		
CN2	Recycled aggregates in concrete	Where national building regulations limit the use of recycled aggregates in concrete, (typically applicable to bound aggregate uses as listed below) the onus for achieving this credit is on the unbound uses (please note that the total aggregate figure must still include the bound uses).
CN2.1	National restrictions on the use of recycled aggregates	In countries where the use of recycled aggregates is restricted, this credit cannot be achieved by default. In countries where there is a maximum permitted regulatory level of less 50% recycled aggregate, the exemplary credit can be achieved where the percentage of recycled aggregates used is greater than or equal to 35%. . Where there is no maximum regulatory level, the 50% requirement must be achieved in order to award this credit.
CN2.2	National best practice guidance on defining granular fill and capping as a high grade use	To demonstrate these materials used are high grade aggregates please refer to the country specific reference sheet to locate the appropriate national best practice standard or code of practice in the country of assessment. Alternatively, please demonstrate applicability as follows: — The minimum requirements as set out in Checklist A6 and the Approved standards and weightings list. are covered by the proposed documents OR — Where appropriate standards do not exist for a country, the design team should demonstrate compliance with the UK or European standards as listed in each relevant country reference sheet.
CN2.3	Off-site recycled aggregates	Where off-site recycled aggregates from construction, demolition and excavation waste are used, they should be produced according to the relevant BS/EN standards for aggregates.
CN2.4	Aggregates in off-site manufactured applications	Where high grade aggregate uses have been incorporated into applications manufactured off-site, the aggregate present in these applications should be included in the assessment of this issue.
CN2.5	Aggregates in existing applications	Where high grade aggregate uses are already in situ, the aggregate present in these applications should be included in the assessment of this issue as recycled or secondary aggregates.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
All	Calculation confirming the amount of recycled or secondary aggregate to be used.	Calculation confirming the amount of recycled or secondary aggregate used.

Additional information

Relevant definitions

Air-cooled blast furnace slag

Air-cooled blast furnace slag is classified as a by-product (rather than a waste) and can therefore be used as an aggregate without the need for a quality protocol. The slag used must meet the requirements of the European and BS Aggregates Standards that apply to the end use application (e.g. bitumen bound, unbound etc.).

Granular fill and capping (as high grade aggregate)

For granular fill to be considered a 'high grade aggregate', it must conform to one of the following classes under the Specification for Highway Works (SHW) Series 600 Earthworks:

1. Class 6A, 6I and 6N - Selected well graded granular material
2. Class 6B - Selected coarse granular material
3. Class 6C, 6D, 6J and 6L - Selected uniformly graded granular material
4. Class 6E, 6G, 6H, 6K, 6M, 6P and 6R - Selected granular material
5. Class 6F (and the various subclasses) - Selected coarse and fine graded material
6. Class 6Q - Well graded, uniformly graded or coarse graded material.

If the application is capping, then granular materials should conform to one of the following classes under the Specification for Highway Works (SHW) Series 600 Earthworks:

1. Class 6F - Selected coarse and fine graded material
2. Class 6S - Selected well graded granular material.

If the application is capping, then stabilised materials should conform to one of the following classes under the Specification for Highway Works (SHW) Series 900 Earthworks:

1. Class 9A - Cement stabilised well graded granular material
2. Class 9B - Cement stabilised silty cohesive material
3. Class 9C - Cement stabilised conditioned pulverised fuel ash cohesive material
4. Class 9D - Lime stabilised cohesive material
5. Class 9E - Lime and cement stabilised cohesive material
6. Class 9F - Lime and cement stabilised well graded material.

Low grade aggregate uses

Crushed masonry used as fill material for general landscaping is not considered to be high grade. This practice is now common place on construction sites due to increased landfill costs.

Materials optimisation

Refer to Mat 04 Insulation

Post-consumer waste stream

Waste materials generated by households or by commercial, industrial and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

Waste materials generated during manufacturing processes are pre-consumer waste streams and are excluded. These streams include reutilisation of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

Recycled aggregates

Recycled aggregates are those derived from reprocessing materials previously used in construction, e.g. crushed concrete or masonry from construction and demolition waste material.

Secondary aggregates

By-products of industrial processes that can be processed to produce secondary aggregates. Secondary aggregates are subdivided into manufactured and natural, depending on their source.

Recognised non-construction post-consumer or post-industrial by-products include:

1. China clay waste
2. Slate overburden
3. Pulverised Fuel Ash (PFA)
4. Ground Granulated Blast Furnace Slag (GGBFS)

5. Air-cooled blast furnace slag
6. Steel slag
7. Furnace Bottom Ash (FBA)
8. Incinerator bottom ash
9. Foundry sands
10. Recycled glass
11. Recycled plastic
12. Spent oil shale
13. Colliery spoil
14. Municipal solid waste treatment residues.

Other information

Further guidance

Details on the European Standards for Aggregates (2004) are available at: http://aggregain.wrap.org.uk/quality/aggregates_standards/european.html.

Wst 03 Operational waste

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	Yes	Yes	No	No	Yes

Aim

To recognise and encourage the provision of dedicated storage facilities for a building's operational-related recyclable waste streams, so that this waste is diverted from landfill or incineration.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Operational waste

1 Dedicated spaces is provided for the segregation and storage of operational recyclable waste volumes generated by the assessed building or unit, its occupants and activities. This space must be:
- 1.a Clearly labelled, to assist with segregation, storage and collection of the recyclable waste streams
- 1.b Accessible to building occupants or facilities operators for the deposit of materials and collections by waste management contractors
- 1.c Of a capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that will arise from daily or weekly operational activities and occupancy rates.

2 Where the consistent generation in volume of the appropriate operational waste streams is likely to exist, e.g. large amounts of packaging or compostable waste generated by the building's use and operation, the following facilities are provided:
- 2.a Static waste compactors or balers; situated in a service area or dedicated waste management space.
- 2.b Vessels for composting suitable organic waste resulting from the building's daily operation and use; OR adequate space for storing segregated food waste and compostable organic material prior to collection and delivery to an alternative composting facility.
- 2.c Where organic waste is to be stored or composted on-site, a water outlet is provided adjacent to or within the facility for cleaning and hygiene purposes.

Additionally for multi-residential buildings with self-contained dwellings or bedsits only

3 Each dwelling or bedsit has a provision of three internal storage containers, as follows:
- 3.a A minimum total capacity of 30 litres
- 3.b No individual container smaller than 7 litres
- 3.c All containers in a dedicated non-obstructive position
- 3.d The storage containers for recycling are provided in addition to non-recyclable waste storage.

Additionally for multi-residential buildings with individual bedrooms and communal facilities only

4 The above storage requirements (criterion 3) for self-contained dwellings or bedsits are met for every six bedrooms.

5 The recyclable storage is located in a dedicated non-obstructive position in either:
- 5.a Communal kitchens; OR
- 5.b Where there are no communal kitchens present, in a communal space such as communal lounges or utility areas.

6 Home composting facilities and a home composting information leaflet is provided within the kitchen area or communal space for each self-contained dwelling, bedsit or communal kitchen.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable
CN1.1	Part 2: Core services	This issue is not applicable.
CN1.2	Part 3: Local services	This issue is not applicable.
CN1.3	Part 4: Interior design	All assessment criteria are applicable
CN1.4	End occupier not known	If the end occupier is not known but the function or areas of the assessed building suggest that large amounts of packaging or compostable waste is likely to be generated during the building's operation, e.g. it is a retail or industrial project or contains a large catering facility, then an appropriately sized space and services/infrastructure to accommodate the relevant facilities must be provided. The facilities themselves do not necessarily need to be provided or installed to demonstrate compliance for a Part 1 or 2 assessment.
General		
CN2	Determining if the dedicated space complies See criteria 1 and 2.	The design team demonstrates that the provision of waste management facilities for the assessed building is adequate given the building type, occupier (if known), operational function and likely waste streams and volumes to be generated. Where it is not possible to determine what provision should be made, the following guide for minimum storage space provision should be used: 1. At least $2m^2$ per $1000m^2$ of net floor area for buildings $< 5000m^2$ 2. A minimum of $10m^2$ for buildings $\geq 5000m^2$ 3. An additional $2m^2$ per $1000m^2$ of net floor area where catering is provided (with an additional minimum of $10m^2$ for buildings $\geq 5000m^2$). The net floor area should be rounded up to the nearest $1000m^2$.
CN2.1	Extensions to existing buildings	Where there are facilities within the existing building, these can be used to assess compliance. The scope of these facilities must be adequate to cater for the total volume of predicted recyclable waste arising from the new and existing buildings.
CN2.2	Multiple building assessments and buildings that form part of a wider estate See criterion 1.c.	Where the assessment applies to one or more buildings or units that are part of a wider estate or campus, the design team can choose to demonstrate compliance through the provision of dedicated centralised storage space and waste management facilities with the capacity to accommodate the recyclable waste material generated from all buildings and their activities.

Ref	Terms	Description
CN2.3	Limited space or vehicle access for a compactor/baler See criterion 2.	For sites that have limited space for static installations, compliance can be assessed on the basis of the provision of adequate space for a smaller portable compactor or baler.
CN2.4	Internal storage areas	Where the facilities are situated internally, vehicular gate heights and widths and manoeuvring and loading space must be sized to ensure ease of access for vehicles collecting recyclable materials.
CN2.5	General waste	The area for storage of recyclable materials must be provided in addition to areas and facilities provided for dealing with general waste and other waste management facilities, e.g. compactors, balers and composters.
CN2.6	Small industrial units See criterion 1.	For an industrial building or development or site consisting of a number of smaller units, each ≤ 200m^2 floor area, shared facilities that meet the above criteria for the building/site as a whole are sufficient to achieve this credit.
CN2.7	Shopping centres and retail parks See criterion 1.	For shopping centres and retail parks there must be adequate space to cater for each tenant and their potential recyclable waste volumes. Tenants that occupy a large proportion of the centre, i.e. 'flagship tenants', must have their own dedicated compliant facilities. For smaller non-flagship tenant units, compliant central or common facilities on-site or dedicated spaces for individual units will meet the assessment criteria for this BREEAM issue.
Building specific		
CN3	Home composting information leaflet (multi-residential buildings) See criteria 3, 4, 5 and 6.	The leaflet must provide information on: — How composting works and why it is important; — The materials that can be composted (e.g. raw vegetable peelings and fruit, shredded paper, tea bags, etc.); and — Details of the operation and management plan for the communal composting scheme. Where a green or kitchen waste collection scheme is in operation, the information leaflet provided by the Local Authority is sufficient to meet the information leaflet criteria.
CN3.1	Multi-residential: supported living facility	Where it is not possible to locate the recycling bins within a communal area, which is accessible to residents, for safety reasons (e.g. where the residents have mental health problems and free access to these facilities would pose significant risk of self-harm or harm to others) it is acceptable to locate them within a dedicated non-obtrusive position accessible to staff only, but in close proximity to the areas where recyclable waste material is generated.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Accessible space

Accessible space is typically within 20m of a building entrance. Depending on the size of the building, site restrictions or tenancy arrangements, it may not be possible for the facilities to be within 20m of a building entrance. In such circumstances, judgement on whether the space is 'accessible' to the building occupants and vehicle collection must be made.

Dedicated non-obstructive position

An easily accessible cupboard under the sink or any other cupboard in the kitchen, next to the storage or likely area for storing non-recyclable waste, where practical. Where a kitchen cupboard location is not possible the bins can be located near to the kitchen, in a utility room or connected garage, for example.

Flagship or anchor tenant

The largest and primary tenant within a retail development, typically department store type retailers.

Waste compactor or baler

A machine that is designed to compress waste streams in order to improve storage and transport efficiency.

Other information

Recyclable storage

The following footprint dimensions (informed by the Metric handbook, Planning and design data) can act as a guide when determining size and accessibility criteria for the recyclable storage space:

1. Compactor dimensions: about the size of one car parking bay; 4.8 x 2.4m
2. Skip: the footprint of an 8 and 12 cubic yard skip measures 3.4m x 1.8m, therefore allow a minimum of 2.0m width and 4.0m length or $8m^2$ area for the storage and access of such containers
3. Wheeled bins: 360 litre = 0.86m x 0.62/660 L= 1.2m x 0.7m/1100 L = 1.28m x 0.98m
4. Roll-on roll-off containers: allow a minimum of 6.1m x 2.4m
5. Vehicle access: the following are dimensions for lorry types that are typically used to collect waste. Therefore gate heights and widths should not be smaller than these measurements:
   a. Dustcart: medium capacity; length = 7.4m Height = 4m width 3.1m
   b. Skip lorry: length = 7m Height = 3.35m width 3.1m.

Consideration must also be given to any other types of vehicle requiring access to this area, e.g. lorries for roll on/off containers.

Recycling bins

Individual recycling bins located at convenient locations throughout the building are necessary to maximise recycling rates.

Wst 04 Speculative finishes

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	No	Yes	Yes	No

Aim

To encourage the specification and fitting of floor and ceiling finishes selected by the building occupant and therefore avoid unnecessary waste of materials.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Speculative floor and ceiling finishes

Speculative Office building types only

1. For tenanted areas (where the future occupant is not known), prior to full fit-out works, interior finishes (including carpets, other floor finishes, ceiling finishes and any other interior finishes) have been installed in a show area only.
2. In a building being refurbished or fitted out for a specific occupant, that occupant has selected (or agreed to) the specified interior finishes.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1 : Fabric and structure	This issue is not applicable
CN1.1	Part 2 : Core services	All assessment criteria are applicable
CN1.2	Part 3 : Local services	All assessment criteria are applicable
CN1.3	Part 4 : Interior design	This issue is not applicable.
General		
CN2	General	None.
Building specific		
CN3	Office: Show area See criterion 1.	A show area could be either a floor plate or an individual office. However, to award this credit it must be less than 25% of the net lettable floor area.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

None.

Other information

None.

Wst 05 Adaptation to climate change

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	None	Yes	Major refurbishment only (Parts: 1, 2, 3 and 4)		

Aim

To recognise and encourage measures taken to mitigate the impact of extreme weather conditions arising from climate change over the lifespan of the building.

Assessment criteria

A number of BREEAM issues within the Refurbishment and Fit-out scheme contain assessment criteria which aim to support mitigation of the impacts of extreme weather events arising from climate change. The main credit in this issue focuses on structural and fabric resilience not covered in other issues, where undertaking a Part 1 assessment. An Exemplary credit is awarded where a holistic approach on adaptation to climate change has been covered, demonstrated by achieving credits in other issues, where undertaking a comprehensive refurbishment and all parts are being assessed (i.e. assessed under all parts 1 - 4).

The following is required to demonstrate compliance:

One credit - Adaptation to climate change - structural and fabric resilience

1 Conduct a climate change adaptation strategy appraisal for structural and fabric resilience by the end of Concept Design (or equivalent), in accordance with the following approach:
   1.a Carry out a systematic (structural and fabric resilience specific) risk assessment to identify and evaluate the impact on the building over its projected life cycle from expected extreme weather conditions arising from climate change and, where feasible, mitigate against these impacts. The assessment should cover the following stages:
      1.a.i Hazard identification
      1.a.ii Hazard assessment
      1.a.iii Risk estimation
      1.a.iv Risk evaluation
      1.a.v Risk management.
      1.a.vi Exemplary credit – Responding to adaptation to climate change

Exemplary credit - Responding to adaptation to climate change

A holistic approach to the design and refurbishment or fit-out of the current building's life cycle, to mitigate against the impacts of climate change, is represented by the achievement of these criteria.

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM issue:

2 Achievement of criterion 1, the structural and fabric resilience criterion in this issue, and the following criteria points or credits:

Hea 04 Thermal comfort

(Link to Wst 05 issue:- to preventing increasing risks of overheating)

- Criterion 7 in the second credit of the Hea 04 Thermal comfort issue has been achieved.

Ene 01 Reduction of energy use and carbon emissions

(Link to Wst 05 issue: to maximise energy efficiency contributing to low carbon emissions resulting from increasing energy demands)

- At least eight credits in this issue have been achieved.

Ene 04 Low carbon design

(Link to Wst 05 issue: to maximise opportunities to avoid unnecessary carbon emissions)

- The Passive design analysis credit in this issue has been achieved.

Wat 01 Water consumption

(Link to Wst 05: to minimise water demands in periods of drought)

- A minimum of three credits in this issue have been achieved.

Mat 05 Designing for durability and resilience

(Link to Wst 05 issue: to avoid increased risks of deterioration and higher maintenance demands)

- Criterion 2 relating to material degradation in this issue has been achieved.

Pol 03 Flood risk management and reducing surface water run-off

(Link to Pol 03: to minimise the risks of increased flood risk and surface water run-off affecting the site or others)

- Flood risk – a minimum of one credit has been achieved.
- Surface water run-off – two credits have been achieved.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Criterion 1 is applicable. Criterion 2 is not applicable
	Parts: 2, 3 or 4	This issue is not applicable
	Parts: 1 - 4 inclusive: Major refurbishment	Where all parts 1 - 4 are applicable (e.g. major refurbishment projects), all assessment criteria are applicable
General		
CN2	Relevant bodies See hazard identification item 1 in Methodology.	This includes but is not limited to the following: — Local authorities — Statutory bodies — Technical bodies

Methodology

Hazard identification

1. Review the evidence and information from relevant bodies to identify and understand the expected impacts of increased extreme weather events for climate change on the building.
2. Identify likely hazards (see Relevant definitions).

Hazard assessment

1. Identify the scale of the hazards identified.

Risk estimation

1. Identify the risk presented by these hazards to the building and the likely impact of the hazards taking into account the following aspects as a minimum:
   a. Structural stability
   b. Structural robustness
   c. Weather proofing and detailing
   d. Material durability
   e. Health and safety of building occupants and others
   f. Impacts on building contents and business continuity.

Risk evaluation

1. Evaluate the potential impact of these risks on the building.
2. Determine the tolerable risk threshold.
3. Check the sensitivity of the risk assessment.
4. Identify areas where the risks are unacceptable in health and safety, life cycle assessment and financial terms.

Risk management

1. Identify risk reduction measures.
2. Mitigate the hazards as far as is practically feasible.
3. Adapt the design or specification to incorporate the measures identified by the risk assessment in the final design.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Durability

The ability to withstand wear, pressure, or damage.

Hazard

A hazard is a situation or event which has the potential to cause harm. It may be an accidental or a malicious action, insufficient strength or resistance, or excessive deviation from intended limits.

Resilience

The ability of a building or structural system or material to withstand an accidental or exceptional loading or other incident without experiencing an undue degree of damage or decrease in performance, such that progressive collapse, loss of performance or disproportionate degree of damage occurs.

Structural and fabric resilience

BREEAM defines this as the ability of a structure to withstand an increased burden of weather, increased pressure or hazards associated with climate change. Examples of increased pressures or hazards include:

1. Solar radiation
2. Temperature variation
3. Water or moisture
4. Wind
5. Precipitation e.g. rain and snow
6. Extreme weather conditions: high wind speeds, flooding, driving rain, snow, rainwater ponding
7. Subsidence/ground movement.

Systematic risk assessment

A structured approach to help professionals identify, evaluate and manage risk, where the reduction of the risks identified is integral to the process.

It includes:

- Identifying the hazards
- Eliminating the hazards, as far as reasonably practicable
- Reducing the risks from each hazard, as far as reasonably practicable
- Developing the building design to be robust.

Other information

This new BREEAM issue aims to encourage and support efforts to mitigate the future impacts of climate change on the building by considering a number of relevant factors during the design stages. BRE have avoided being overly prescriptive with the assessment criteria in order to allow a degree of flexibility in its application and demonstrating compliance, recognising that this is a complex environmental and design issue where solutions and approaches are largely influenced by site location and building specific factors. This places a greater emphasis on the BREEAM Assessor to use their judgement in determining whether the project team and the building design has met the aim and intent of the credit and its criteria, using appropriate project information to back their judgement. BRE will endorse the BREEAM Assessor's judgement through the Quality Assurance audit where a reasonable justification to award the credit on the basis of project team actions and proposed design solutions is evident. BRE would welcome any feedback on the application of this assessment issue to assist with the evolution of the criteria and inclusion of additional guidance on compliance in future BREEAM versions.

There are a number of UK reports and publications which also provide useful climate change adaptation principles for international projects including:

1. The National Adaptation Programme[1] report has been drawn up by the government, industry and other non-governmental organisations working together. It contains a mix of policies and actions to help the UK to adapt successfully to future weather conditions, by dealing with the risks and making the most of the opportunities.
2. The book "Design for climate change"[2] describes buildings and issues as part of the Design for Future Climate, Adapting Buildings programme, the largest programme focusing on the climate change adaptation of buildings in the UK. This programme from the Technology Strategy Board (TSB) aims to improve the climate resilience of building projects. The book has guidance on construction, including structural stability.
3. The BRE report[3], Potential implications of climate change in the built environment, discusses climate change adaptation strategies, including some for structural resilience.

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[1] National Adaptation Programme: Making the country resilient to a changing climate. Defra; 2013

[2] Gething B, Puckett K, Design for climate change. RIBA; 2013

[3] Graves HM, Phillipson MC, Potential implications of climate change in the built environment. BRE Centre for Environmental Engineering: BRE East Kilbride; 2000

Wst 06 Functional adaptability

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes	Yes	Yes

Aim

To recognise and encourage measures taken to accommodate future changes of use of the building over its lifespan.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Functional adaptability

1. A building specific functional adaptation strategy study has been undertaken by the client and design team by completion of the concept design which includes recommendations for measures to be incorporated to facilitate future adaptation.
2. Functional adaptation measures (see examples in Table - 63) have been adopted in the design by completion of the technical design (in accordance with the functional adaptation strategy recommendations, where practical and cost effective. Omissions have been justified in writing to the assessor.

Checklists and tables

None

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable.
CN1.1	Part 2: Core services	All assessment criteria are applicable.
CN1.2	Part 3: Local services	All assessment criteria are applicable.
CN1.3	Part 4: Interior design	All assessment criteria are applicable.
General		

Ref	Terms	Description
CN2	Functional adaptation strategy study	This should consider: 1. The potential for major refurbishment, including replacing the façade. 2. Design aspects that facilitate the replacement of all major plant within the life of the building, e.g. panels in floors/walls that can be removed without affecting the structure, providing lifting beams and hoists. 3. The degree of adaptability of the internal environment to accommodate changes in working practices. 4. The degree of adaptability of the internal physical space and external shell to accommodate change in-use. 5. The extent of accessibility to local services, such as local power, data infrastructure etc. For additional guidance, see Table - 63
CN2.1	Functional adaptation implementation	The implementation will be specific to the building and scope of the project, but information should be made available to the assessor covering: 1. The feasibility for multiple or alternative building uses and area functions, for example, related to structural design of the building. 2. Options for multiple building uses and area functions based on design details, e.g. modularity. 3. Routes and methods for major plant replacement, e.g. networks and connections have flexibility and capacity for expansion. 4. Accessibility for local plant and service distribution routes, e.g. detailed information on building conduits and connections infrastructure. 5. The potential for the building to be extended either horizontally, vertically or both.

Methodology

None.

Evidence

Ref	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
All	Functional adaptation strategy and implementation plan report.	As per interim design stage.

Additional information

Relevant definitions

Building functional adaptation

Work to an existing building that responds to a required change of use or requirements and goes beyond maintenance and repairs. These changes solve functional problems and could provide significant improvements. The functional adaptation works could include alterations, conversions or extensions.

Functional adaptability

The ability of a building to be adapted for a change in operational requirements within the same building type, or for use as a different building type.

Other information

Table - 63 provides examples of functional design measures that may be adopted for each assessment part when considering accessibility, spatial adaptability and expandability.

Table - 63: Design measures allowing future adaptation

	Accessibility	Spatial adaptability	Expandability
Part 1: Fabric and structure — External walls — Cladding — Ground and first floor — Roof	Use of products or systems which allow easy replacements	Location of structural components within the floor space	Provision to add extensions or alterations to increase building capacity
Parts 2 and 3: Core and local services — Mechanical and electrical — Plumbing — Stairs and lifts — Fire	Inclusion of facilities management requirements and construction design management feedback for future operational needs		Provision of capacity in infrastructure to enable future expansion and adaptation
Part 4: Interior design — Finishes — Floors — Interior walls — Connections	Use of products or systems which allow easy replacements	Layout in standardised grids Use of inherent finishes to allow replacement Use of standardised material sizes	Identifying or recognising potential future functional requirements Efficient use of space to allow for any increase in occupancy

12.0 Land Use and Ecology

Summary

This category encourages habitat protection and creation, and improvement of long term biodiversity for the building's site and surrounding land. Issues in this section relate to the protection of ecology during refurbishment, enhancement of ecology and long term biodiversity management.

Category summary table

Issue	Credits	Credit summary	Part 1	Part 2	Part 3	Part 4
LE 01 Site selection	0	— Not applicable to this scheme.	Not applicable			
LE 02 Protection of ecological features	1	— Recognition of where existing features have been protected prior to and during site operations.	Scope dependent			
LE 03 Minimising impact on existing site ecology	0	— Not applicable to this scheme.	Not applicable			
LE 04 Enhancing site ecology	1	— Recognition of steps taken to enhance site ecology through the advice of a suitably qualified ecologist.	Scope dependent			
LE 05 Long term impact on biodiversity	2	— The production of a long term landscape and habitat management plan to encourage measures that improve the site's long term biodiversity.	Scope dependent			

LE 01 Site selection

This issue is not applicable to BREEAM International Refurbishment and Fit-out 2015.

LE 02 Protection of ecological features

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes (scope dependent)	Yes (scope dependent)	Yes (scope dependent)

Aim

To encourage the protection of existing ecological features from substantial damage during refurbishment or fit-out works.

Assessment criteria

The following is required to demonstrate compliance:

One credit - Protection of ecological features

1 All existing features of ecological value (see Relevant definitions) within and surrounding the refurbishment or fit-out zone and site boundary area are adequately protected from damage during clearance, site preparation and refurbishment or fit-out activities (see CN3).

2 In all cases, the principal contractor is required to construct ecological protection recommended by the Suitably Qualified Ecologist (SQE), prior to any preliminary site construction or preparation works (e.g. erection of temporary site facilities).

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable.
CN2	Parts 2, 3 and 4	This issue is only applicable where there are existing landscaping areas within the scope of the refurbishment and fit-out zone. Where there is no landscaping, this issue is filtered out from the assessment criteria.
General		

Ref	Terms	Description
CN3	Protecting features of ecological value	Where the following features of ecological value exist on site and are being retained they should be protected as detailed below;: — Trees of over 100 mm trunk diameter, stands of trees, and trees of significant ecological value, are protected by barriers. Barriers must prohibit construction works in the area between itself and the tree trunk. Minimum distance between tree trunk and barriers must be either the distance of branch spread or half tree height, whichever is the greater. Trees are protected from direct impact and from severance or asphyxiation of the roots. — Coastal developments, watercourses, wetland areas, areas of freshwater and known groundwater wells should be protected by cut-off ditches and site drainage to prevent run-off to minimise risk of pollution, silting or erosion. — Fenced exclusion zones should be maintained around all mangrove stands (landward side) that are being retained to minimise the risk of workforce machinery damage of these sensitive habitats. Activity on the seaward side of mangroves should be avoided where possible and closely monitored and controlled. Confirmation is required that mangrove stands would not be exposed to prolonged drought or waterlogging from changes in water levels as a result of construction activities. — Other ecological features and natural areas requiring protection must either have barriers erected and be protected, or, when remote from site works or storage areas, be protected with a prohibition of construction activity in the vicinity.
CN4	No features of ecological value. See criterion 1.	Where there are no features of ecological value within landscaped areas (see Relevant definitions), the credit can be awarded by default.
CN5	Features of little or no ecological value See criterion 1.	If an SQE has confirmed that a feature present on the site has little or no ecological value (see Relevant definitions), or where a tree is deemed to create a significant danger to the public or occupants by a statutory body or qualified arboriculturalist, then that feature may be exempt from the 'protection of ecological features' requirement of this issue.
CN6	Prior removal of features of ecological value	If features of ecological value have been removed as part of the site clearance activities then the development cannot achieve the credits, even if they are to be replaced as part of a new soft landscape strategy.
CN7	Verification of a report written by an ecologist not meeting the BREEAM SQE criteria See criterion 1.	Where a Suitably Qualified Ecologist is verifying an Ecology Report produced by another ecologist who does not meet the SQE criteria, they must, as a minimum, review the report and confirm in writing that they have found it to: 1. Represent sound industry practice. 2. Report and recommend correctly, truthfully and objectively. 3. Be appropriate given the local site conditions and scope of works proposed. 4. Avoid invalid, biased and exaggerated statements. Additionally, written confirmation from the third party verifier that they comply with the definition of a Suitably Qualified Ecologist is required.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

This refers to the statutory or legal organisation, or entity, whose duty it is to carry out the planning approval function for the development area.

Ecology related subject
Depending on the ecological content (minimum 60%), the following degrees might be considered relevant: Ecology, Biological Sciences, Zoology, Botany, Countryside Management, Environmental Sciences, Marine and Freshwater Management, Earth Sciences, Agriculture, Forestry, Geography, Landscape Management.

Peer review
A peer review is defined as the process employed by a professional body to demonstrate that potential or current full members maintain a standard of knowledge and experience required to ensure compliance with a code of conduct and professional ethics.

Refurbishment and fit-out zone
For the purpose of this BREEAM issue the refurbishment and fit-out zone is defined as any land on the site where refurbishment or fit-out works are taking place (and therefore disturbed) for hardstanding, soft landscaping, site access, site storage plus a 3m wide zone measured outward from the boundary of these areas.

Suitably qualified ecologist (SQE)
An individual achieving all the following items can be considered to be 'suitably qualified' for the purposes of compliance with BREEAM:

1. Holds a degree or equivalent qualification in ecology or a related subject comprising a significant ecology component.
2. Is a practising ecologist, with a minimum of three years relevant experience (within the last five years). Such experience must clearly demonstrate a practical understanding of factors affecting ecology in relation to construction and the built environment; including, acting in an advisory capacity to provide recommendations for ecological protection, enhancement and mitigation measures. The relevant experience must relate to the country that the assessment is being carried out in.

Other information

Very often there is the potential for a site to increase its biodiversity value through appropriate design and management, regardless of whether enhancing biodiversity is required to gain planning consent. This BREEAM assessment issue provides the opportunity to reward those projects that contribute to protecting and enhancing biodiversity, improve living environments and meet environmental objectives.

The issue recognises that many refurbishment and fit-out projects will not have any outdoor spaces within the scope of the project; however there are many projects where the potential for impacts upon ecological features exists, such as trees that are adjacent to works.

The Suitably Qualified Ecologist's recommendations may impact on specifications worked up by other design team members, such as landscape architects or drainage engineers. BREEAM recommends that collaborative input between the ecologist and relevant professionals is sought from the concept stage of the development to highlight opportunities and constraints and allow effective integration of these aspects into the ecologist's recommendations.

The World Database on Protected Areas (WDPA) contains information from various organisations such as national governments, non-governmental organisations, academic institutions, international biodiversity convention secretariats, etc. The data and maps can be used for environmental impact analysis and private sector decision-making when areas of ecological value could be impacted.

Relating Ecology Reports to BREEAM

Guidance on relating ecology reports to BREEAM is available in a Guidance Note on the BREEAM website.

LE 03 Minimising impact on existing site ecology

This issue is not applicable to BREEAM International Refurbishment and Fit-out 2015.

LE 04 Enhancing site ecology

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes (scope dependent)	Yes (scope dependent)	Yes (scope dependent)

Aim

To encourage actions taken to enhance the ecological value of the site as a result of development.

Assessment criteria

The following is required to demonstrate compliance for:

One credit - Ecologist's report and recommendations

1. A Suitably Qualified Ecologist (SQE) has been appointed by the client or their project representative no later than the conclusion of the design brief i.e. the ecologist is appointed at the beginning of concept design stage.
2. The SQE has provided an Ecology Report with appropriate ecological recommendations (see Relevant definitions) for the enhancement of the site's ecology at Concept Design stage . The report is based on a site visit or survey by the SQE (see also CN4).
3. The early stage advice and recommendations of the Ecology Report for the enhancement of site ecology have been, or will be, implemented in the refurbishment or fit-out.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1 : Fabric and structure	All assessment criteria are applicable.
CN2	Parts 2, 3 and 4	This issue is only applicable where works to external soft landscaping are within the scope of the refurbishment or fit-out zone.
General		
CN3	Early stage involvement from the SQE See criterion 1.	The role of the SQE during the Preparation and Brief stage will be to advise on early stage site layout decisions so that opportunities to enhance site ecology are maximised. SQE involvement at the Concept Design stage will be necessary to provide more detailed ecological recommendations (see Relevant definitions) based on the outline design.
CN4	Timing of ecologist's survey and report See criterion 2.	The SQEmust carry out site surveys of existing site ecology, on which their report is based (or to provide verification where the report is prepared by others) at the Concept Design stage in order to facilitate and maximise potential ecological enhancement.

Ref	Terms	Description
CN5	Guidance for ecologists and assessors	Guidance on relating ecology reports to BREEAM is available in a Guidance Note on the BREEAM website.
CN6	No areas for ecological enhancement	Where undertaking a Part 1 assessment and where there are no areas where it would be feasible to make ecological enhancement, this issue is not applicable where evidence clearly demonstrates that it would not be feasible to implement ecological improvements. An examples where it may not be feasible to implement ecological enhancements is a retail building with glazed shop frontages where there are no other external elements or external spaces for enhancement. In order to demonstrate this advice should be sought from an SQE or a local wildlife group in order to identify potential ecological enhancements that should be considered.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1 -	Refer to generic evidence requirement above	For a large mixed use or multi-building site, where the refurbishment works are phased and the whole site has not been completed and ecological enhancements have not yet been added, or where features are being added at a later date in an appropriate planting season: evidence from the client or principal contractor confirming any planting will be completed within 18 months from completion of the site.

Additional information

Relevant definitions

Ecological recommendations

Ecological recommendations are defined as measures adopted to enhance the ecology of the site. These are measures that the ecologist reasonably expects can be implemented, considering their feasibility taking into account building/site constraints. Measures may include but are not limited to:

1. The planting of locally appropriate native species or non-native species with a known attraction or benefit to local wildlife.
2. The adoption of horticultural good practice (e.g. no, or low, use of residual pesticides).
3. The installation of bird, bat or insect boxes at appropriate locations on the site.
4. Development of a full Biodiversity Management Plan including avoiding clearance/works at key times of the year (e.g. breeding seasons).
5. The proper integration, design and maintenance of Sustainable Drainage systems (SuDS) (such as rain gardens), green roofs, green walls, community orchards, community allotments etc.

Suitably Qualified Ecologist (SQE)

Refer to BREEAM issue LE 02 Protection of ecological features.

Other information

None.

LE 05 Long term impact on biodiversity

Number of credits available	Minimum standards	Applicability			
2	No	Part 1	Part 2	Part 3	Part 4
		Yes (scope dependent)	Yes (scope dependent)	Yes (scope dependent)	Yes (scope dependent)

Aim

To encourage long term protection and enhancement of biodiversity on the site and surrounding area.

Assessment criteria

The following is required to demonstrate compliance:

Up to two credits

1 Where a Suitably Qualified Ecologist (SQE) is appointed prior to commencement of activities on-site and they confirm that all relevant EU, Local and national regulations/legislation relating to the protection and enhancement of ecology has been complied with during the refurbishment or fit-out process.

2 Where a landscape and habitat management plan, appropriate to the site (including impacts of the building both during construction and in operation), is produced covering at least the first five years after project completion. This is to be handed over to the building owner/occupants for use by the grounds maintenance staff and includes:

a. Management of any protected features on site
b. Management of any new, existing or enhanced habitats
c. A reference to any current or future legislation requirements (local, national or regional) that apply to the site regarding the protection of species and habitats (and where applicable refer to biodiversity action strategies/action plans)
d. Confirmation from the SQE that all relevant aspects of ecology are included within the plan.

3 Where additional measures to improve the assessed site's long term biodiversity are adopted, according to Table - 64.

Where criteria 1 to 3 are met credits can be awarded as follows:

No. of credits	No. of additional measures
1	2
2	4

Where the SQE confirms that some of the additional measures listed in Table - 64 are not applicable to the assessed development, the credits can be awarded as follows:

	Applicable additional measures				
	All	4	3	2	1
Credits	Number of additional measures to assess				
1	2	2	2	N/A	N/A
2	4	4	3	2	1

Checklists and tables

Table - 64: Additional measures for the improvement of long term biodiversity

Ref	Additional measure for the improvement of long term biodiversity
1	The principal contractor nominates a Biodiversity Champion with the authority to influence site activities and ensure that detrimental impacts on site biodiversity are minimised in line with the recommendations of a Suitably Qualified Ecologist.
2	The principal contractor trains the site workforce on how to protect site ecology during the project. Specific training must be carried out for the entire site workforce to ensure they are aware of how to avoid damaging site ecology during operations on site. Training should be based on the findings and recommendations for protection of ecological features highlighted within a report prepared by a SQE.
3	The principal contractor records actions taken to protect biodiversity and monitor their effectiveness throughout key stages of the refurbishment or fit-out process. The requirement commits the principal contractor to make such records available where publicly requested.
4	Where a new ecologically valuable habitat appropriate to the local area is created. This includes a habitat that supports nationally, regionally or locally important biodiversity, or which is nationally, regionally or locally important itself.[1] Local biodiversity expertise should be sought before the end of the Concept design stage to help identify species of local biodiversity importance on site and ensure that the proposals support local priorities.
5	Where flora and fauna habitats exist on-site, the contractor programmes site works to minimise disturbance to wildlife. For example, site preparation, ground works, and soft landscape works have been, or will be, scheduled at an appropriate time of year to minimise disturbance to wildlife. Timing of works may have a significant impact on, for example, breeding birds, flowering plants, seed germination, amphibians etc. Actions such as phased clearance of vegetation may help to mitigate ecological impacts. This additional requirement will be achieved where a clear plan has been produced detailing how activities will be timed to avoid any impact on site biodiversity in line with the recommendations of a SQE.
6	**Education buildings (preschools, schools and colleges only)** A partnership has been set up by the design team with a local group that has wildlife expertise and the group has: a. Provided advice early in the design process regarding protecting and providing habitat for species of local importance on the site. b. Provided advice to ensure the design is in keeping with the local environment. In particular this should draw on their local knowledge of any features or species of ecological interest on or near the site. c. Provided, or will continue to provide, ongoing support and advice to the educational establishment to help them manage, maintain and develop the outdoor space in the longer term.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		

Ref	Terms	Description
CN1	Parts: 1, 2, 3 and 4	This issue is only applicable where works to external soft landscaping are within the scope of the refurbishment or fit-out zone, or where the occupier of the refurbishment or fit-out zone will have responsibility for ongoing management of soft landscaped areas.
General		
CN2	Where additional measures are not applicable See criterion 3.	In all cases it is necessary to employ a SQE to achieve credits for this BREEAM issue. As a minimum the SQE must provide the following in writing: 1. Confirmation that criteria 1 and 2 have been achieved 2. Clarification of how many of the additional measures for criterion 3 are applicable and have been achieved 3. Guidance on how to achieve Additional measure 4 (where possible). Where the SQE confirms that none of the additional measures are applicable (due to the nature of the site and its surroundings) full credits can be awarded for demonstrating compliance with criteria 1 and 2.
Building specific		
CN3	Education (preschool, school and sixth form college buildings only) Additional measure 6: Ongoing support and advice	This could take the form of meetings several times a year with a staff or pupils or students working party to help them plan conservation and ecological enhancement work, or activities relating the ecology in or near the school or college grounds.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Biodiversity

Biodiversity is defined as the variety of life on earth. It includes all species, animal, plants, fungi, algae, bacteria and the habitats that they depend upon.

Biodiversity Action Plan

A plan which sets specific, measurable, achievable, realistic and time bound conservation targets for species and habitats.

Biodiversity Champion

An individual formally tasked by the principal contractor with the responsibility for monitoring and influencing site activities and minimising detrimental impact on biodiversity. The individual must have sufficient authority and time on site and knowledge of ecology and construction to carry out the role. The Biodiversity Champion need not be an ecologist or ecological expert. This may be the same person as the Sustainability Champion in Man 03 Responsible construction practices.

Local group with wildlife expertise

A local group with wildlife expertise could be the local Wildlife Trust or an alternative group that has been involved in local wildlife conservation or enhancement projects.

Refurbishment and fit-out zone

As defined for BREEAM issue LE 02 Protection of ecological features.

Suitably Qualified Ecologist (SQE)

Refer to LE 02 Protection of ecological features

Other information

Guidance on relating ecology reports to BREEAM is provided in a Guidance Note available on the BREEAM website.

The following are examples of what to include in long term management plans for habitats, species and biodiversity features:

a. Description and evaluation of features to be managed
b. Ecological trends and constraints on-site that could influence management
c. Aims and objectives of management
d. Appropriate management options for achieving aims and objectives
e. Prescriptions for management actions
f. Preparation of a work schedule (including an annual work plan capable of being rolled forward over a five year period)
g. Body or organisation personnel responsible for implementation of the plan
h. Monitoring and remedial measures
i. Funding resources and mechanisms to ensure sustainable long term delivery of the proposed management.

The level of detail required for any given site should be that which is necessary to ensure the effective management of the biodiversity features present.

1

13.0 Pollution

Summary

This category addresses the prevention and control of pollution and surface water run-off associated with the building's location and use. Issues in this section aim to reduce the buildings impact on surrounding communities and environments arising from light pollution, noise, flooding and emissions to air, land and water.

Category summary table

Issue ID	Credits	Credit summary	Applicability			
			Part 1	Part 2	Part 3	Part 4
Pol 01 Impact of refrigerants	4	— Avoidance or reduction of the impact of refrigerants through specification and leak prevention or detection.	No	Yes	Yes	Yes
Pol 02 NOx emissions	Up to 3	— Reduction in emissions of ni (NO_x) arising from the building's space and water heating systems.	No	Yes	Yes	No
Pol 03 Flood risk management and reducing surface water run-off	5	— Identifying the buildings flood risk and adopting flood resilience or resistance measures through refurbishment or fit-out works. — Surface water run-off is managed to be no worse as a result of refurbishment works. — Watercourse pollution prevention systems are in place.	Yes	Yes	Yes	Yes
Pol 04 Reduction of night time light pollution	1	— External light pollution is eliminated through effective design or the removal of the need for unnecessary external lighting.	No	Yes	Yes	No
Pol 05 Reduction of noise pollution	1	— Measures to reduce the likelihood of disturbance arising as a result of noise from fixed installations on the development.	Yes	Yes	Yes	No

Pol 01 Impact of refrigerants

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
4	No	No	Yes	Scope dependent	Scope dependent

Aim

To reduce the level of greenhouse gas emissions arising from the leakage of refrigerants from building systems.

Assessment criteria

This issue is split into two parts:

- Buildings that use no refrigerants (4 credits)

OR for buildings that use refrigerants

- Prerequisite
- Ozone depletion potential (1 credit)
- Impact of refrigerant (1 to 2 credits)
- Leak detection (1 credit).

The following is required to demonstrate compliance:

Four credits - No refrigerant use

1 Where the building does not require the use of refrigerants within its installed plant or systems.

OR alternatively, where the building does require the use of refrigerants, the four credits can be awarded as follows:

Prerequisite

2 All systems (with electric compressors) must comply with the requirements of EN 378:2008[1] (parts 2 and 3) or ISO 5149:2014[2] and where refrigeration systems containing ammonia are installed, the Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice[3].

One credit - Ozone Depleting Potential (ODP)

3 The refrigerants used within the building plant/services must have an Ozone Depleting Potential of zero

Two credits - Impact of refrigerant

4 Where the systems using refrigerants have Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_{2e}) of ≤ 100 $kgCO_{2e}$/kW cooling/heating capacity. To calculate the DELC CO_{2e} please refer to the Relevant definitions in the Additional information section and the Methodology section.
OR

5 Where air-conditioning or refrigeration systems are installed the refrigerants used have a Global Warming Potential (GWP) ≤ 10.

OR

One credit - Impact of refrigerant

6 Where the systems using refrigerants have Direct Effect Life Cycle CO_2 equivalent emissions (DELC CO_{2e}) of ≤ 1000 $kgCO_{2e}$/kW cooling/heating capacity.

One credit - Leak detection

7 Where systems using refrigerants have a permanent automated refrigerant leak detection system installed; OR where an inbuilt automated diagnostic procedure for detecting leakage is installed. In all instances a robust and tested refrigerant leak detection system must be installed and must be capable of continuously monitoring for leaks.

8 The system must be capable of automatically isolating and containing the remaining refrigerant(s) charge in response to a leak detection incident (see Other information).

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	This issue is not applicable.
CN2	Part 2: Core services	All assessment criteria are applicable.
CN3	Part 3: Local services	All assessment criteria are applicable (scope dependent), see CN11.
CN4	Part 4: Interior design	All assessment criteria are applicable (scope dependent), see CN8
General		
CN5	Scope of this issue	The criteria of this issue apply to air-conditioning and refrigeration systems installed in the building for the following uses, regardless of the systems refrigerant charge (kg), including: 1. Comfort cooling and/or space heating (including assessment of refrigerants in heat pumps). 2. Cold storage, including commercial food/drink display cabinets but excluding domestic white goods e.g. fridges and freezers 3. Process based cooling loads e.g. servers/IT equipment.
CN6	Industrial buildings without offices & with untreated operational areas	This issue will be filtered from the scope of assessment for industrial units designed without offices and where the operational area will be untreated, i.e. not designed to be air-conditioned or contain a cold storage facility with refrigeration plant.
CN7	Country regulations on the use of Ozone Depleting Substances (ODS)	Where legislation with the country of assessment prohibits the use of ozone depleting substances within new refrigeration systems, the credit for using substances with an ozone depletion potential of zero will be filtered out of the assessment. At the time of writing all European countries are known to fall into this category

Ref	Terms	Description
CN8	Display Chiller Cabinets and Display Freezers	Where display chiller cabinets or display freezers are installed then these are to be assessed under this issue for Parts 3 and 4, including where the refrigerant charge is of 6kg or less and CN9. However where the display chiller cabinets or display freezers are supplied by a centralised chiller plant then they are to be assessed where undertaking a Part 2 assessment. Where display chiller cabinets or display freezers are not installed, then this issue would not be applicable for Part 4 assessments.
CN9	Refrigerant charge of less than 6kg	With the exception of systems covered by CN8 above, for installations of small multiple hermetic systems only where the refrigerant charge in each unit is less than 6kg, the credit for leak detection and containment can be awarded by default. This is on the basis that the risk of a large refrigerant leak due to system failure is minimised, as individual leaks from each system will be small where leakage occurs, and therefore there is little life cycle benefit of requiring leak detection equipment on each small system. Note: solutions such as this may be less energy efficient and as such may impact on the achievement of credits under Ene 01 Reduction of energy use and carbon emissions.
CN10	Specification of multiple systems	Where more than one air-conditioning or refrigeration system is installed in the building, the assessor must source the relevant technical data for each system and enter it into the Pol 01 calculator. The calculator will then determine the weighted average DELC for the multiple installation and the BREEAM credits can be awarded or withheld accordingly.
CN11	Local Services (Part 3 assessments)	Where refrigerants are specified in local services, this issue is applicable. Local services are defined as services that supply a specific area, i.e. split cooling unit supplying a single area. Local services may connect into the distribution systems from the core services within the tenanted area, examples of this would be fan coil units. Where local services are provided from core distribution systems, the refrigerants would not be assessed under this issue and this issue would only be assessed where undertaking a Part 2 assessment. Where refrigeration or air-conditioning systems supply multiple areas outside of the tenanted area they are to be assessed under Part 2: Core services.
CN12	Leak detection See criteria 7 and 8.	The refrigerant leak detection criteria are still applicable in instances where any type of non-solid refrigerant is present, i.e. even if the refrigerant meets BREEAM's DELC CO_{2e} benchmark(s). Exceptions to this are systems that use natural and environmentally benign refrigerants, such as air and water (for example lithium bromide or water absorption chillers) and installations of small multiple hermetic systems, where CN9 above applies. These types of system and refrigerants will achieve the leak detection credit by default.
CN13	ODP data not available	Where ODP data for the specified refrigerant is not available, the credit cannot be awarded on a default basis.

Methodology

The number of Pol 01 BREEAM credits achieved is determined by the assessor using the BREEAM Pol 01 calculator.

The Direct Effect Life Cycle CO_{2e} emissions (DELC) per kW of cooling/heating capacity are calculated using the following equation:

$$\frac{\text{[Refrigerant loss operational + refrigerant loss system retirement] x } GWP}{\text{Cooling Capacity (kW)}}$$

Where:

Refrigerant loss operational: $(Ref_{charge} \times Sys_{op\text{-}life} \times (L1 + L2 + S1 + S2))/100$

Refrigerant loss system retirement $= Ref_{charge} \times (1 - Ref_{RecEff}/100)$

Where:

1. Ref_{charge}: Refrigerant charge (kg)
2. $Sys_{op\text{-}life}$: System operational lifetime (years)
3. Ref_{RecEff}: Refrigerant Recovery Efficiency factor (%)
4. L1: Annual Leakage Rate (units: % Refrigerant charge)
5. L2: Annual Purge Release factor (% Refrigerant charge)
6. S1: Annual Service Release (% Refrigerant charge)
7. S2: Probability factor for catastrophic failure (% Refrigerant charge loss/year)
8. GWP: Global Warming Potential of refrigerant
9. Cooling or heating capacity (kW).

The following default values must be used, where system specific data is not available:

$Sys_{op\text{-}life}$: System operational design life (years): see Table - 65

Ref_{RecEff}: Refrigerant recovery efficiency factor (%): **95%**

L1: Annual leakage rates (% refrigerant charge): see Table - 66.

L2: Annual purge release factor (% refrigerant charge): **0.5** (if the system does not require an annual purge, zero should be used).

S1: Annual service release (% refrigerant charge): **0.25** (this applies where the system requires opening up to carry out the annual service. For systems which do not require opening up, there will be no associated annual release of refrigerant, therefore a default of zero should be used).

S2: Probability factor for catastrophic failure (% refrigerant charge loss/year): **1%** (based on a failure rate of 1 in 100 systems).

The following information must be sourced from the design team's mechanical and electrical engineer or system manufacturer:

- System type
- Ref_{charge}: Refrigerant charge (kg)
- GWP: Global Warming Potential of refrigerant(s)
- Cooling or heating capacity (kW).

Table - 65: Default system operational design life values

System type	Default system operational design life values (years)
Small and medium capacity chillers	15
Large capacity chillers	20
Unitary split	15
Variable Refrigerant Flow (VRF) system	15

System type	Default system operational design life values (years)
All other systems	10
These figures are based on those reported in LOT 6 for air-conditioning units and the British Refrigeration Association's (BRA) Guideline Methods of Calculating TEWI (2006)[4]. Note: The following should be considered when determining whether the system specified is defined as small or medium or large: — Large capacity chiller: centrifugal compressor — Medium capacity chiller: scroll or screw compressor — Small capacity chiller: scroll compressor.	

Table - 66: Average annual leakage rates for the UK

System type	Annual leakage rate (% of charge per annum)
Cold storage and display systems	
Integral cabinets	3%
Split/condensing units	18%
Centralised	19%
Air-conditioning systems	
Unitary split	15%
Small-scale chillers	10%
Medium/large chillers	5%
Heat pumps	6%
These figures are based on those reported in LOT 6 for air-conditioning units and also Table 2 of the Market Transformation Programmes Briefing Note for Commercial Refrigeration no. 36, 'Direct Emission of Refrigerant Gases' (version 1.2). The figures are based on the average of the leakage rates from the four separate studies reported in Table 2 (where a range is reported, the higher value was used).	

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Criteria	Interim design stage	Final post construction stage
5, 6	Completed copy of the Pol 01 Calculator tool	As per interim design stage
5, 6	Documentary evidence supporting the data used to complete the Calculator tool.	As per interim design stage

Additional information

Relevant definitions

Direct effect life cycle (DELC) carbon dioxide equivalent

A measure of the effect on global warming arising from emissions of refrigerant (in the case of this BREEAM assessment issue) from the equipment to the atmosphere over its lifetime (units: $kgCO_2eq.$). The calculation involves estimating the total refrigerant release over the period of operation and subsequent conversion to an equivalent mass of carbon dioxide. Should the system use several different refrigerants, e.g. a primary refrigerant and a secondary coolant, or a cascade system, individual calculations are made for all refrigerants which contribute to the direct effect (see Methodology section for a description of how DELC is calculated).

Global Warming Potential

GWP is defined as the potential for global warming that a chemical has relative to 1 unit of carbon dioxide, the primary greenhouse gas. In determining the GWP of the refrigerant, the Intergovernmental Panel on Climate Change (IPCC) methodology using a 100-year Integrated Time Horizon (or ITH) should be applied.

Moderately airtight enclosure

This can be defined as an enclosure that does not produce a draught or significant fresh air ingress that would dilute any leaked refrigerant gas (dilution may prevent detection).

Ozone Depleting Potential

ODP is the ratio of the relative amount of degradation to the ozone layer caused by a particular substance relative to the calculated depletion for the reference gas CFC 11 (ODP = 1.0).

Ozone Depleting Substances (ODS)

"Substances known to deplete the stratospheric ozone layer. The ODSs controlled under the Montreal Protocol and its Amendments are chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, methyl bromide (CH_3Br), carbon tetrachloride (CCl_4), methyl chloroform (CH_3CCl_3), hydrobromofluorocarbons (HBFCs) and bromochloromethane (CH_2BrCl).", extracted from IPCC/TEAP report, Special Report on Safeguarding the Ozone Layer and the Global Climate System, Cambridge University, 2006.

Refrigerant leak detection

An automated permanently installed multi-point sensing system, designed to continuously monitor the atmosphere in the vicinity of refrigeration equipment and, in the event of detection, raise an alarm. The system may be aspirated or have multiple sensor heads linked to a central alarm unit or BMS. Various sensor types are available including infrared, semiconductor or electro-chemical.

Refrigerant recovery

The process of removing refrigerant from a system and storing it in an airtight container.

Refrigerant pump down

The specification of automatic refrigerant pump down can further limit potential losses and damage to the environment and have subsequent economic benefits to the building owner. Under the United Kingdom Environmental Protection Act 1990 unwanted refrigerant and refrigerating system oil are classified as either controlled or hazardous waste. Not only is it an offence to discharge them to the environment, but there are procedures regarding transport, storage, transfer of ownership and ultimate disposal. Article 16 of EC Regulation 2037/2000 specifies that used CFCs and HCFCs must be recovered for destruction or recycling or reclamation.

Robust and tested refrigerant leak detection system

This is normally defined as that included on the Enhanced Capital Allowance (ECA) Energy Technology Product List[5] (or an equivalent list). Where the system does not fall within the scope of the ECA energy technology product list or an equivalent list, the design team must demonstrate to the assessor that the system specified meets the principles of the scheme as far as is applicable.

Small-scale white goods

These should be defined as domestic-scale white goods and would also include small individual display cabinets, for example drinks cabinets in small retail shops.

Systems using refrigerants

The criteria of this issue apply to air-conditioning and refrigeration systems installed in the building for the following uses, regardless of the systems refrigerant charge (kg), including:

- Comfort cooling or space heating (including assessment of refrigerants in heat pumps)
- Cold storage, including commercial food and drink display cabinets but excluding small scale white goods (see definition above)
- Process-based cooling loads e.g. servers, IT equipment.

Global Warming Potential (GWP)

GWP is defined as the potential for global warming that a chemical has relative to 1 unit of carbon dioxide, the primary greenhouse gas. In determining the GWP of the refrigerant, the Intergovernmental Panel on Climate Change (IPCC) methodology using a 100-year Integrated Time Horizon (or ITH) should be applied.

Refrigerant

There are three main make-ups of refrigerants:

1. Hydrogenated Fluorocarbon Refrigerants (HFCs) are made up of hydrogen, fluorine, and carbon. Because they do not use a chlorine atom (which is used in most refrigerants) they are known to be one of the least damaging to the earth's ozone layer.
2. Hydrogenated Chlorofluorocarbon Refrigerants (HCFCs) are made up of hydrogen, chlorine, fluorine, and carbon. These refrigerants contain minimal amounts of chlorine; they are not as detrimental to the environment as some other refrigerants.
3. Chlorofluorocarbon Refrigerants (CFCs) contain chlorine, fluorine and carbon. These refrigerants carry high amounts of chlorine so they are known to be the most hazardous to the ozone layer.

The use of CFCs and HCFCs as refrigerants has been addressed under the Montreal protocol. Phaseout programmes have been agreed resulting in these substances no longer being used as refrigerants in all new installations and most existing situations. The industry's favoured replacements are currently HFCs which are often potent global warming contributors. Hydrocarbons and ammonia-based refrigerants have low or zero GWP and are therefore preferred long term options. These are now widely available and are valid alternatives to HFCs in all buildings, provided health and safety issues are fully addressed.

The United Nations Environment Programme (UNEP) hosts a HCFC Help Centre which contains information about the management and phase out of HCFCs and alternatives to HCFCs in the refrigeration and air-conditioning sector http://www.uneptie.org/ozonaction/topics/hcfc.asp.

Other information

Automatic isolation and containment of refrigerant

Any system that isolates and contains refrigerant within the system so as to minimising leakage to atmosphere in the event of a systems failure. An example of a system which could meet criterion 8would be one which initiates an automated shut down and pump down of the refrigerant into a separate storage tank.

Common refrigerants

Table - 67: List of some common refrigerant types with low GWP

R-Number	Chemical name	GWP 100-year
R-30	Dichloromethane	9
R-170	Ethane	3
R-290	Propane	3
R-600	Butane	3
R-600a	Isobutane	3
R-702	Hydrogen	5.8
R-717	Ammonia	0
R-718	Water	<1
R-729	Air (nitrogen, oxygen, argon)	0
R-744	Carbon dioxide	1
R1150	Ethylene	3
R-1234yf	2,3,3,3-Tetrafluoropropene	<1
R-1270	Propylene	3

Sources: The United Nations Environment Programme (UNEP) '2010 Report of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee' (pages 32-34): http://ozone.unep.org/teap/Reports/RTOC/index.shtml
EN 378-1:2008+A2:2012: Refrigerating systems and heat pumps - Safety and environmental requirements. Part 1: Basic requirements, definitions, classification and selection criteria - Annex E.
The Intergovernmental Panel on Climate Change 5th Assessment Report, Chapter 8, 'Anthropogenic and Natural Radiative Forcing', 2013
'Global environmental impacts of the hydrogen economy', Derwent *et al*, 2006

The formula used to calculate the Direct Effect Life Cycle CO_{2e} emissions in BREEAM is based on the Total Equivalent Warming Impact (TEWI) calculation method for new stationary refrigeration and air-conditioning systems. TEWI is a measure of the global warming impact of equipment that takes into account both direct emissions (as assessed in this BREEAM issue) and indirect emissions produced through the energy consumed in operating the equipment (which is assessed in the BREEAM energy section).

Refer to EN 378-1[6] and the British Refrigeration Association's (BRA) Guideline Methods of Calculating TEWI for further details. The BRA publication also includes sectorial release factors for new systems designed to best practice standards.

REAL Zero

REAL Zero was a UK led project to investigate the causes of and solutions to refrigerant leakage, against the background of the EU F Gas Regulation. It brought together expertise across sectors and provided practical guides and training booklets. It was subsequently updated and developed into a European e-learning programme known as REAL Skills.

For further information including guidance notes, calculators, tools and case study information visit: http://www.realskillseurope.eu/

Ozone Depleting Potential refrigerants

Both CFCs and HCFCs are now tightly controlled or due to be phased out in the foreseeable future in all signatory countries to the Montreal Protocol on Substances That Deplete the Ozone Layer, BREEAM only recognises refrigerants that have an ODP of zero.Table - 68 gives current ODP figures for a range of available substances that are capable of acting as refrigerants, assessors should use this to verify the ODP of the specified refrigerant. Substances not on this list should be referred to the BREEAM office so that an appropriate figure can be established.

Note: This table omits substances that are not typically used as refrigerants in buildings.

Table - 68: Ozone depleting potential of refrigerants

Refrigerant type	Ozone Depleting Potential
R11 (CFC-11)	1.00
R12 (CFC-12)	1.00
R113 (CFC-113)	0.80
R114 (CFC-114)	1.00
R115 (CFC-115)	0.60
R125 (CFC-125)	0.00
Halon-1211	7.90
Halon-1301	15.90
Halon-2402	6.00
Ammonia	0.00
R22 (HCFC-22)	0.05

Refrigerant type	Ozone Depleting Potential
R123 (HCFC-123)	0.02
R134a(HFC-134a)	0.00
R124 (HCFC-124)	0.02
R141b (HCFC-141b)	0.11
R142b (HCFC-142b)	0.07
R143a (HFC-143a)	0.00
R32 (HCFC-32)	0.00
R407C (HFC-407)	0.00
R152a (HFC-152a)	0.00
R404A (HFC blend)	0.00
R410A (HFC blend)	0.00
R413A (HFC blend)	0.00
R417A (HFC blend)	0.00
R500 (CFC/HFC)	0.74
R502 (HCFC/CFC)	0.33
R507A (HFC azeotrope)	0.00
R290 (HC290 propane)	0.00
R600 (HC600 butane)	0.00
R600a (HC600a isobutane)	0.00
R290/R170 (HC290/HC170)	0.00
R1270 (HC1270 propene)	0.00
Sources: The United Nations Environment Programme (UNEP) '2010 Report of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee' (pages 33-36): http://ozone.unep.org/teap/Reports/RTOC/index.shtml EN 378-1:2008+A2:2012: Refrigerating systems and heat pumps - Safety and environmental requirements. Part 1: Basic requirements, definitions, classification and selection criteria - Annex E.	

[1] EN 378 Refrigerating systems and heat pumps – Safety and environmental requirements, 2008
[2] ISO 5149 Refrigerating systems and heat pumps – Safety and environmental requirements, 2014
[3] Ammonia Refrigeration Systems Code of Practice, Institute of Refrigeration, 2009
[4] Guideline Methods of Calculating TEWI Issue 2, (2006), BRA Specification.
[5] www.etl.decc.gov.uk.
[6] EN 378-1 Refrigerating systems and heat pumps - Safety and environmental requirements Part 1: Basic requirements, definitions, classification and selection criteria. 2008 + A2:2012

Pol 02 NO_x emissions

Number of credits available	Minimum standards	Applicability			
Building type dependent	No	Part 1	Part 2	Part 3	Part 4
		No	Yes	Scope dependent	No

Aim

To contribute to a reduction in national NO_x emission levels through the use of low emission heat sources in the building.

Assessment criteria

The following is required to demonstrate compliance:

Up to three credits (all building types except Industrial)

1 Where the plant installed to meet the building's delivered heating and hot water demand has, under normal operating conditions, a NO_x emission level (measured on a dry basis at 0% excess O_2) as follows:

NO_x Emission levels for heating and hot water (mg/kWh)	Credits
≤ 100 mg/kWh	1 credit
≤ 70 mg/kWh	2 credits
≤ 40 mg/kWh	3 credits

Two credits (Industrial building types only)

NO_x Emission levels for heating and hot water (mg/kWh)	Credits
Office and associated areas ≤ 70 mg/kWh	1 credit
Operational areas ≤ 70 mg/kWh	1 credit

2 Report via the BREEAM scoring and reporting tool the direct and indirect NO_x emissions in mg/kWh and energy consumption in kWh/m^2/yr arising from systems installed to meet the building's space heating, cooling and hot water demands.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		

Ref	Terms	Description
CN1	Part 1: Fabric and structure	This issue is not applicable
CN2	Part 2: Core services	All assessment criteria are applicable.
CN3	Part 3: Local services	All assessment criteria are applicable (scope dependent), see CN6.
CN4	Part 4: Interior design	This issue is not applicable
General		
CN5	New build extensions to existing buildings	If the heating/hot water demand for the new extension is being met by an existing system, then the NO_x emission level for the existing system must be assessed against the criteria of this issue.
CN6	Local Services (Part 3 Pol 02 NOx emissions - CN6assessments)	Local services are defined as services that supply a specific area i.e. local heating or cooling unit supplying a single area or point of use water heater. Where the heating or hot water demand is supplied from central services, this issue is not applicable to Part 3 assessments.
CN7	NO_x data provided in different units	Where NO_x data is provided in different units or at a level of excess oxygen greater than zero, the manufacturer or supplier must be asked to convert this to comply with the BREEAM criteria. Alternatively, the assessor may adjust the figure using the relevant correction factors provided in the Methodology section. Note that the conversion factors provided do not apply where combined heat and power (CHP) systems are being assessed. Where CHP systems are used, the information must be obtained from the system manufacturer.
CN8	Grid electricity	Where grid electricity is used to supply a heating system, the NO_x emissions for grid electricity should be determined from actual data or using default NO_x values. Table - 70 can be used to identify appropriate default NO_x figures for a range of countries or refer to the country specific reference sheet in the approved standards and weightings list, where more specific values are available for a number of countries. Where a default is not provided for the country of assessment, the fuel mix for the country of assessment should be provided to BRE Global to determine the appropriate default figure. However, please note that default factors are likely to represent a worst case scenario and actual emissions should be used wherever possible, determined by using robust data from a local/national authority or agency. All such data should be provided to BRE Global for verification prior to use within an assessment.

Ref	Terms	Description
CN9	Low NO_x grid electricity	Where heating is provided by grid electricity and the project assessed is located in a country where the emissions level of the national grid electricity is less than the levels required by BREEAM, then the credits can be awarded accordingly. Where the NO_x emissions level is already less than 40mg/kWh, all three credits can be awarded by default.
CN10	Electricity from a renewable source	Where electricity used by the heating system is sourced from a zero emission renewable source such as PVs, wind etc, there are no resulting emissions. This source of heating can therefore be counted as having zero NO_x emissions.
CN11	Combined Heat & Power	Refer to the Additional information section for guidance on calculating NO_x emission levels from CHP.
CN12	Heat recovery	Heat recovery can be considered as having zero NO_x emissions for the purpose of this issue.
CN13	Open flues	No credits may be awarded for open flue heating or hot water systems.
CN14	Water heating benchmark and point of use heaters	Where the water heating can be demonstrated to be less than 10% of the building's total energy consumption, these credits can be awarded based solely on the NO_x emissions from space heating.
CN15	More than one heating system	Where more than one heating system is specified refer to the Additional information section for guidance on calculating emission levels.
CN16	Green Tariff	Commitments to use a Green tariff to supply electricity to heat the building or power heat pumps are not recognised in this issue due to the uncertainty that this electricity will be zero emission.
CN17	Assessment and reporting of a building's NO_x emissions from cooling	At present the Pol 02 issue does not benchmark and award credits for NO_x emission levels associated with a building's cooling demands. To facilitate possible future benchmarking of this kind and alignment with European Standards on the Sustainability of Construction Works, BREEAM does require, as a condition of achieving any credits for this issue, the reporting of both direct and indirect NO_x emissions resulting from meeting the building's heating, cooling and hot water demands. In the case of indirect emissions, this refers primarily to emissions associated with grid electricity, where grid electricity is a source of energy for the building's heating, cooling or hot water demands. Direct NO_x emissions are those resulting from the burning of fuel on site or in the assessed building to meet heating, cooling or hot water demands, for example via a gas, oil-fired or biomass boiler.
Building type specific		

Ref	Terms	Description
CN18	Industrial Office or operational areas not present	**First credit**: Where the assessed building is designed without an office area, the first credit does not apply. One credit is therefore available where compliance with the operational area benchmark is met. **Second credit**: Where the operational area of the assessed building is designed to be untreated, the second credit does not apply. One credit is therefore available where compliance with the office area benchmark is met. Where there is no office area and no heating in the operational area, this issue is not assessed.

Methodology

Conversion factors

Manufacturers should be asked to supply NO_x emissions data in mg/kWh, measured on a dry basis. Where this is not possible the assessor may use the following conversion factors to convert figures in parts per million (ppm), mg/MJ, mg/m^3 or wet NO_x.

It should be noted that these conversion factors assume worst case efficiencies and are likely to give conservative answers. This could have the effect of lowering the number of credits achieved. Note that these conversion factors are not applicable where combined heat and power (CHP) systems are being used. Please see the calculation procedures below for further details on assessing CHP systems for this issue.

1. Figures in mg/m^3 should be multiplied by 0.859 in order to convert emissions into mg/kWh[1]. A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).
2. Figures in ppm should be multiplied by 1.76 in order to convert emissions into mg/kWh. A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).
3. Figures in mg/MJ should be multiplied by 3.6 in order to convert emissions into mg/kWh (1 kWh = 3.6 MJ). A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).

Wet NO_x conversion factor

This issue's criteria are based on dry NO_x values – almost all manufacturers will quote emissions measured on a dry basis. However, if wet NO_x figures are supplied, these will need to be converted to dry. The following formula should be used to determine the wet NO_x conversion factor[2]:

Conversion factor c = 100/(100-y)

Where y is the % water vapour content measured in the gas. This figure should be obtained from the manufacturer.

Excess oxygen correction

If a NO_x emission rate is quoted by the manufacturer in mg/m^3 or ppm, then it should be established at what percentage excess oxygen this emission was measured. The greater the amount of excess oxygen in the flue gases at the time of measurement, the more 'diluted' the NO_x emissions. It is therefore important to convert any emission rate back to 0% excess oxygen. For the purpose of BREEAM, the following conversion factors can be used for the most frequently used rates supplied by manufacturers:

Table - 69: Excess oxygen conversion factors

% Excess O_2	Conversion (c)
3%	x 1.17
6%	x 1.40
15%	x 3.54

Conversion factor c = 20.9/(20.9 – x)

Where x = % excess O_2 (NOT excess air) and 20.9 is the percentage of O_2 in the air.

Calculating NO_x emission levels from combined heat and power (CHP) systems

Where CHP systems are specified, it is only necessary to consider the heat-related NO_x emissions for the assessment of this issue.

NO_x emissions are allocated to heat and electricity in line with the electrical output and the relationship between the heat input and the heat output. A NO_x emission rate equivalent to the current rate for grid electricity should be assumed for the electrical output (i.e. 617 mg/kWh supplied), and the remaining NO_x should be allocated to the heat input. Only the heat-related component is then compared with the benchmark scale. The following formula should be used to determine this:

X = (A - B)/(C/D)

Where:

Term	Description
X	NO_x emissions per unit of heat supplied (mg/kWh heat).
A	NO_x emissions per unit of electricity generated (mg/kWh^{elec}), i.e. the NO_x emitted by the CHP system per unit of electricity generated. It is essential that this figure is obtained from the installer or supplier of the system and should be based on the system when operating at full load.
B	NO_x emissions per unit of electricity supplied from the grid (mg/kWh^{elec})
C	Heat to Electricity Ratio of the CHP scheme.
D	Overall system efficiency (%). When carrying out the calculation, enter the figure as a decimal, e.g. if the efficiency is 80%, then enter 0.8 into the calculation.

The above methodology determines the net NO_x emissions from CHP-generated electricity compared with central generation of electricity and allocates this amount to the heat production. Where x is calculated to be negative, it should be assumed to be zero.

Calculating the average NO_x emission levels from multiple systems

Where the CHP or other heating system type operates in conjunction with another system, an average NO_x emission rate should be used based on the ratio of power output from each source, i.e. multiply the emissions of each system by the percentage of heat demand it supplies and total these values.

This is likely to be the case where a CHP system has been sized on the base power demand rather than the heat demand and therefore a secondary heating system is required.

The following formula can be used for such cases:

$$\text{Average } NO_X = \left(N_1 \times \left(H_1 / H_T\right) + N_2 \times \left(H_2 / H_T\right)\right) \ldots + \left(N_n \times \left(H_n / H_T\right)\right)$$

Where:

Term	Description
N_1	NO_x emissions rate for source 1
N_2	NO_x emissions rate for source 2
N_n	NO_x emissions rate for source n
H_T	Total heat output from all sources
H_1	Heat output from source 1
H_2	Heat output from source 2
H_n	Heat output from source n

Calculating NO_x emission levels from heat pumps

For the purpose of assessing this BREEAM issue, either of the formulas below can be used to determine the contributing NO_x emissions from a heat pump:

$$M_{Heat} = \frac{M_{Elec} \times W_{Elec}}{W_{Heat}} \quad OR \quad M_{Heat} = \frac{M_{Elec}}{EER}$$

Where:

Term	Description
M_{Heat}	NO_x emissions per unit of heat generated in mg/kWh_{Heat}
M_{Elec}	NO_x emissions from UK grid electricity mg/kWh, this should be assumed to be 617 mg/kWh_{Elec}
W_{Elect}	Total quantity of electricity consumed by heat pump kWh_{Elec}
W_{Heat}	Total quantity of heat produced by heat pump kWh_{Heat}
EER	Energy Efficiency Ratio (also referred to as Coefficient of Performance)

Table - 70: Default factors: NO_x Emissions from Grid Electricity

Country List	Default NO_x Emission
Austria, Belgium, Denmark, Finland, France, Iceland, Italy, Japan, Kazakhstan, Latvia, Monaco, Netherlands, Norway, Sweden	250 mg/kWh
Canada, Croatia, Germany, Hungary, Ireland, Liechtenstein, Lithuania, Portugal, Slovakia, Slovenia, Switzerland, USA	650 mg/kWh

Czech Republic, Estonia, New Zealand, Romania, Spain,	950 mg/kWh
Australia, Belarus, Bulgaria, Greece, Poland, Russian Federation, Turkey, Ukraine	2,500 mg/kWh

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1, 2	Calculations showing the average NO_x emissions for the building where multiple systems are present.	As per interim design stage

Additional information

Relevant definitions

Approved building energy calculation software

Refer to BREEAM issue Ene 01 Reduction of energy use and carbon emissions

NO_x emissions

NO_x emissions are pollutant gases produced by the combustion of fossil fuels. NO_x reacts with heat and sunlight to produce ozone that can cause serious respiratory problems. It also reacts with water to produce acid rain which has a detrimental effect on ecosystems. For the purposes of BREEAM, NO_x emission levels are required in units of mg/kWh, measured on a dry basis at 0% excess oxygen levels.

Other information

Some systems may find it difficult to achieve credits in this issue, including:

Heat pumps

For counties that have grid electricity with high NO_x emission rate (see Table - 70), heat pumps powered by grid electricity are likely to indirectly produce emission rates higher than those required by BREEAM and are therefore typically unable to achieve credits under this issue. However, there is a formula for determining NO_x emissions from heat pumps in the Methodology section. Please note, the energy saved by using certain types of heat pumps is recognised in the energy section of BREEAM.

District heating

District heating systems that incinerate waste usually have NO_x emission rates higher than the levels set to achieve any BREEAM credits.

Biomass

Biomass systems are recognised as reducing the impact of fossil fuel depletion by employing a renewable fuel source (provided it is sustainably sourced). However, biomass can produce a significant amount of NO_x and so may not achieve this credit. They may, however, gain recognition in the energy section of BREEAM.

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[1] EN 15502-1:2012 Gas-fired heating boilers Part 1: General requirements and tests.
[2] EN 14792:2005 Stationary Source emissions - Determination of mass concentration of nitrogen oxides (NO_x) - Reference method: Chemiluminescence.

Pol 03 Flood risk management and reducing surface water run-off

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
5	No	Yes	Yes	Yes	Yes

Aim

To recognise projects that have identified flood risks and put in place measures to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses, and minimise the risk and impact of localised flooding on and off-site, watercourse pollution and other environmental damage.

Assessment criteria

This issue is split into three parts:

- Flood risk management - (2 credits)
- Surface water run-off - (2 credits)
- Minimising water course pollution - (1 credit)

Two credits - Flood risk management

Low flood risk

1 Where relevant planning, policy and technical guidance documents from an appropriate statutory body (see Relevant definitions) confirm the refurbishment or fit-out is situated in a flood zone that is defined as having a low annual probability of flooding. Confirmation must be based on historical, geological and geomorphic data (e.g. altitude) and take all sources of flooding into account (see compliance notes); OR

2 The project meets the requirements for avoidance of flooding in accordance with Checklist 1, (see Checklists and tables), e.g. where the refurbishment or fit-out zone is of a floor level that is 0.3m higher than the obtained or estimated flood level and safe access and escape routes are available or present

Medium/high flood risk

3 Where criterion 4 and either criterion 5 or 6 have been met

4 Where relevant planning, policy and technical guidance documents from an appropriate statutory body (see Relevant definitions) confirm the site has a medium or high flood risk and a site specific Flood Risk Assessment (FRA) has been undertaken (as relevant to size of project in accordance with CN7). The FRA must take all current and future sources of flooding into consideration in accordance with compliance note.

5 Where the refurbishment or fit-out zone achieves avoidance from flooding through either:
  - 5.a the refurbishment and fit-out zone is located entirely on the first floor or above and a flood emergency plan has been developed (see Relevant Definitions).
  - 5.b As a result of the building's floor level or measures to keep water away, the building is defined as achieving avoidance from flooding by following Checklist 1, Checklists and tables.

OR

6 Where avoidance is not possible, two credits are achieved where a full flood resilience/resistance strategy is implemented for the building's scope of works in accordance with recommendations made by a Suitably Qualified Building Professional (see Relevant definitions. The following aspects of the design should be addressed for the relevant parts, in accordance with best practice guidance (see compliance note CN8):
  - 6.a Part 1: Fabric - using flood resilient materials and flood protection measures for the building fabric, e.g. waterproof materials, impermeable membranes, flood barriers, safe access or exit points in the event of a flood etc.

6.b Part 2: Core services - core services and associated infrastructure (including equipment and vulnerable pipes/ducts/cables etc.) should be located or specified so as to protect services from flooding damage, e.g. location/routing/height, protection of building apertures (such as intakes/extracts/ventilation), non-return valves etc.

6.c Part 3: Local services - the location or height of local services such as sockets, vents etc. and the location of the wiring/pipework/ductwork in relation to the flood level and other measures to protect local services.

6.d Part 4: Interior - the proposed function of spaces that are below the flood level (e.g. sacrificial spaces) should be limited to those which are not susceptible to flood damage, and the resilience of materials used for partitions, walls, floors, ceiling finishes, furniture and fittings and the location of equipment in relation to the flood level, e.g. avoid storing flood sensitive materials and functions in spaces that are below the flood level.

Two credits - Surface water run-off

One credit - neutral impact on surface water

7 There is no increase in the impermeable surfaces as a result of the refurbishment works; OR

8 If there is an increase in the impermeable surface as a result of the refurbishment works then the following must be met:

8.a Hard standing areas - where there is an extension or increase in the hardstanding areas and hence an increase in the total impermeable area as a result of the refurbishment works, the hardstanding area must be permeable or be provided with on-site SuDS to allow full infiltration of the additional volume, to achieve the same end result. The permeable hardstanding must include all pavements and public rights of way, car parks, driveways and any roads (excluding municipal roads or highways i.e. those which have been accepted as being maintained by the local/national authority or government), but exclude footpaths that cross soft landscaped areas which will drain onto a naturally permeable surface.

8.b Building extension - where there is an increase in building footprint, extending onto any previously permeable surfaces, the additional run-off caused by the area of the new extension must be managed on-site using an appropriate SuDS technique for rainfall depths up to 5mm.

Two credits - reducing run-off

9 An appropriate consultant (see Relevant definitions) has been used to design an appropriate drainage strategy for the site.

10 Either of the following criteria are met:

10.a There is a decrease in the impermeable area by 50% or more, from the pre-existing impermeable hard surfaces; OR

10.b Where run-off as a result of the refurbishment is managed on-site using source control achieving the following requirements:

10.b.i The peak rate of run-off as a result of the refurbishment for the 1 in 100 year event has been reduced by 50% from the existing site.

10.b.ii The total volume of run-off discharged into the watercourses and sewers as a result of the refurbishment, for a 1 in 100 year event of 6 hour duration has been reduced by 50%.

10.b.iii An allowance for climate change must be included for all of the above calculations; this should be made in accordance with current best practice planning guidance.

Minimising water course pollution

One credit

11 There is no discharge from the developed site (includes new and existing hard landscaping and buildings) for rainfall up to 5mm (confirmed by the appropriate consultant).

12 Where suitable pollution prevention measures are put in place (or already exist) for the different sources of pollution present on the assessed site, in accordance with compliance note CN22.

13 A comprehensive and up-to-date drainage plan of the site will be made available for the building and site occupiers.

14 Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.

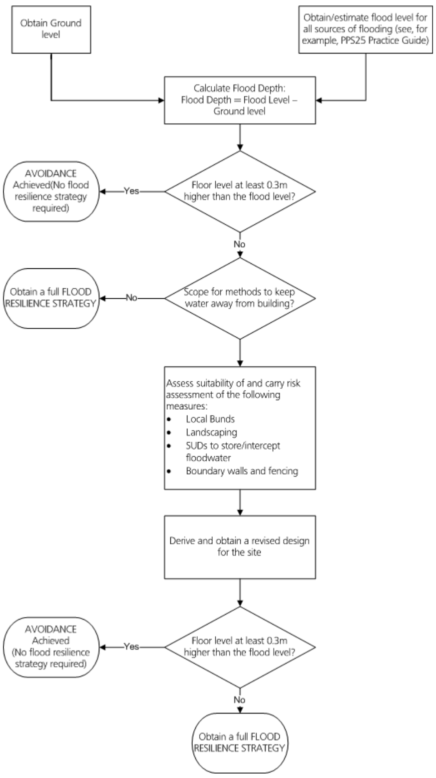
Exemplary level requirements

The following outlines the exemplary level requirements to achieve an innovation credit for surface water run-off:

15 Where all run-off from the developed site is managed on-site using source control, the following must be achieved to confirm compliance:
- 15.a The peak rate of run-off as a result of the refurbishment for the 1 in 1 year event is reduced to zero.
- 15.b The peak rate of run-off as a result of the refurbishment for the 1 in 100 year event is reduced to zero.
- 15.c There is no volume of run-off discharged into the watercourses and sewers as a result of the refurbishment, for a 1 in 100 year event of 6 hour duration.
- 15.d An allowance for climate change must be included for all of the above calculations, in accordance with current best practice national planning guidance.
- 15.e Where an appropriately qualified professional has been employed to provide the above calculations and design an appropriate drainage strategy for the site, ensuring all above criteria are achieved.

Checklists and tables

Checklist 1 Achieving avoidance from flooding



Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	All assessment criteria are applicable.

Ref	Terms	Description
CN2	Part 2: Core services	Criteria 1 - 6 are applicable. Criteria 7 - 15 are not applicable.
CN3	Part 3: Local services	Criteria 1 - 6 are applicable. Criteria 6 - 15 are not applicable.
CN4	Part 4: Interior design	Criteria 1 - 6 are applicable. Criteria 7 - 15 are not applicable.
General		
CN5	Contaminated sites	Drainage designs for sites must take into account legislation relating to contaminated sites; however in many circumstances even on contaminated sites there may be opportunities for the installation of some SuDS techniques. Please see the Other information for further details.
Flood risk management		
CN6	Sources of flooding	The FRA must detail the risk of flooding from the following sources: 1. Fluvial (rivers) 2. Tidal 3. Surface water: sheet run-off from adjacent land (urban or rural) 4. Groundwater: most common in low-lying areas underlain by permeable rock (aquifers) 5. Sewers: combined, foul or surface water sewers 6. Reservoirs, canals and other artificial sources. Please see the Other information which provides further details on sources of flooding. The content of the FRA should be based on historic trends, but should also account for predicted changes to the climate which may impact on the flood risk to the site in the future.

Ref	Terms	Description
CN7	Flood risk assessment (FRA)	For larger scale refurbishment or fit-out projects greater than or equal to 10,000 m^2, a study to assess the risk of site flooding and the impact that any changes (as applicable) on the site will have on flood risk on the site and elsewhere. A flood risk assessment (FRA) must be prepared according to current best practice national planning guidance for the relevant territory. For refurbishment or fit-out projects of less than 10,000 m^2, the level of detail required in an acceptable FRA will depend on the size of the refurbishment or fit-out and level of flood risk. This will range from a brief report for small developments, to a more detailed assessment for a larger development of 2,000–10,000 m^2. For example, for very small projects (2,000 m^2 and less), an acceptable FRA could be a brief report carried out by the contractor's engineer, including information obtained from: — The appropriate Statutory Body (see Relevant definitions) — Water company or sewerage undertaker — Other relevant statutory authorities — Site investigation (including basic surveys looking at the topography of the site) — Local knowledge (including speaking to people who have lived in the area for a long time). Details should be obtained from each of the above groups, regarding the history of flooding in the area. From this it should be established whether there is a likely risk of flooding from these areas.
CN8	Flood resilience strategy	This should be a full report carried out by a 'Suitably Qualified Building Professional' (see Relevant definitions) detailing appropriate solutions for the site and making clear recommendations on appropriate flood resilience actions or specifications. This should also include the preparation of a flood emergency plan(see Relevant definitions) All recommendations made by the consultant must be implemented in order for the refurbishment to comply. The report must have considered as a minimum: — Appropriate method of protection depending on flood level, i.e. water exclusion or water entry strategy — Structure — Floors — Walls — Electrics — Fixed furniture — Doors and windows — Removal of debris .

Ref	Terms	Description
CN9	Flood defences See criteria 1, 2 and 3.	**Third party defences** There are many landscape feature defences, owned by third parties, which due to their location act as a flood defence by default, e.g. motorway, railway embankments, walls etc. It can be assumed that such embankments will remain in place for the lifetime of the site, unless the assessor or project team have reason to believe otherwise. For walls, assurance must be sought that the wall is likely to remain for the design life of the building. **Pre-existing flood defences** In an area protected by existing flood defences (designed to withstand a certain magnitude of flooding) the appropriate number of flood risk credits can be awarded where the defences reduce the risk to 'low' or 'medium' and the following conditions are met: 1. The site is not located in an area where new flood defences have to be, or have been, constructed to minimise the risk of flooding to the site and its locality purely for the purpose of the site or its wider master plan. 2. The relevant agency confirms that, as a result of such defences, the risk of a flood event occurring is reduced to low or medium risk. If firm confirmation is not provided then the credit cannot be awarded. A statutory body's local or regional office may be able to provide more information on existing defences in the area in which the assessed site is located.
CN10	Flood maps	Where flood maps or equivalent are available in the area of assessment, the BREEAM International Assessor should get confirmation that: 1. The definition of risk is at least as onerous as the default definition in the BREEAM scheme document. 2. Flood maps have been developed based on historical, geological, hydrological and geomorphic data (e.g. altitude) and take all sources of flooding into consideration as per compliance note "Sources of flooding". Where this is not the case, the assessor needs to ensure the local authority (or other appropriate statutory body) confirms the flood risk at the location. Data on flooding events worldwide can be found in the Dartmouth Flood Observatory using the following links: http://floodobservatory.colorado.edu/ and http://www.dartmouth.edu/Archives
CN11	Best practice guidance	An example of best practice guidance that should be referred to when determining the flood risk management strategy includes SMARTeST: Six steps to flood resilience, guidance for local authorities and professionals, BRE, The University of Manchester and Manchester Metropolitan University

Ref	Terms	Description
CN12	Areas that historically have a low flood risk	Developments in areas that historically have a low risk of flooding (e.g. desert regions), may still experience a risk of infrequent flash flooding. In these instances a flood risk assessment is still necessary but the level of detail required will vary. Developments in Köppen climate zone B (arid) may only require a brief report where as a development in Köppen climate zone C (warm temperate) may require a more detailed assessment. For example, an acceptable FRA for a development in Köppen climate zone B or E, could be a brief report carried out by the design team confirming the risk of flooding from all sources of flooding, including information obtained from the local authority/statutory body, site investigation, and local knowledge.
CN13	Recommendations from an appropriate statutory body	None of the credits can be awarded where the proposed refurbishment or fit-out works have proceeded against the recommendation of the statutory body where these recommendations are made on the basis that the flooding implications are too great or insufficient protection has been incorporated into the design and construction.
CN14	Safe access or exit points	Where the refurbishment or fit-out is of a floor that is above the flood level, but the ground floor exit is below the flood level, the project can only be defined as low flood risk where safe access or exit points are provided above the flood level that allows occupants (including those with a disability) to safely exit the building, e.g. a means of escape at the first floor level, where the ground floor is below the flood level.
CN15	Rainfall	Local figures for rainfall should be used wherever possible and these must be credible and verifiable, e.g. from a meteorological organisation, data source or equivalent. Where local rainfall figures are not available, rainfall data for major cities in each country can be found from the World Meteorological Organisation (www.worldweather.org). Data for the closest city from the location of assessment should be used.
Surface water run-off		
CN16	National best practice guidance on the design of SuDS and rainwater harvesting systems	Please refer to the country specific reference sheet to locate the appropriate national best practice standards in the county of assessment. Alternatively, please demonstrate applicability as follows: — The minimum requirements as set out in Approved standards and weightings list are covered by the proposed documents OR — Where appropriate standards do not exist for a country, the design team should demonstrate compliance with the UK or European standards as listed in each relevant country reference sheet.
CN17	5mm event	The discharge from all rainfall events up to a depth of 5mm. See Additional information section for further details on the calculation. This calculation can be carried out by the assessor or the client. However, when designing solutions to deal with any additional discharge, an appropriately qualified professional must be employed.

Ref	Terms	Description
CN18	Climate change	When carrying out calculations an allowance for climate change must be made for all sites in accordance with current best practice national planning guidance (see Relevant definitions).
CN19	Limiting discharge rate to less than 5L/s	Where the above criteria would result in the peak rate of run-off from the site being reduced to less than 5 L/s, the limiting discharge rate may be increased up to a level of no more than 5 L/s at the point of discharge from the site to reduce the risk of blockage. Sites should not be subdivided to enable higher overall limiting discharge rates to be claimed. It is, however, recognised that some sites may require more than one discharge point as a result of the local topography or existing surrounding drainage infrastructure, and in such cases, the limiting discharge flow rate may be increased to a level no more than 5 L/s at each discharge point. The assessor should seek evidence that the number of discharge points is necessary due to either the topography or infrastructure limitations or both. Evidence may be in the form of a topographical map and an explanation from the Appropriate Consultant as to why multiple discharge points are required, stating that it is not feasible to have fewer discharge points.
CN20	Discharge directly to the sea or estuary	If all run-off is discharged directly from the site to either the sea, the foreshore, estuaries covered by a shoreline management plan or designated wildlife areas (as part of habitat management), then three credits can be awarded without the need to specify additional attenuation measures. The site must discharge run-off directly into the tidal estuary or the sea, if the credits are to be awarded. Typically, this would mean that drainage pipes would only carry run-off from the site and that they would not need to cross privately owned land outside the boundary of the site before reaching the sea.
CN21	Existing SuDS	Where existing SuDS techniques (on site prior to any refurbishment works began) are sufficiently sized to infiltrate the run-off from any new hard surfaces permeable paving is not required. Evidence must still be supplied to confirm that the existing SuDS technique is appropriately sized to cope with any additional run-off caused by the increase in the hardstanding and is properly maintained to provide the required capacity.
Minimising watercourse pollution		
CN22	Pollution prevention in different areas of risk	**Low risk source of watercourse pollution:** An appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques **High risk source of watercourse pollution:** Where there is risk of contamination or spillage of substances such as petrol and oil (see compliance note CN26 for a list of areas), separators (or an equivalent system) are installed in surface water drainage systems. **Chemical or liquid gas storage areas:** A means of containment is fitted to the site drainage system (i.e. shut-off valves) to prevent the escape of chemicals to natural watercourses (in the event of a spillage or bunding failure). **Vehicle washing areas:** Separators (or an equivalent system) are installed along with the use of appropriate SuDS techniques . All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS manual.

Ref	Terms	Description
CN23	5mm discharge for minimising watercourse pollution See criterion 11.	In a small number of sites, it may not be possible for the first 5mm of rainfall to be prevented from leaving site completely. Where this is the case, an appropriately qualified professional must design the system to ensure that the intent of this criterion has been met as far as possible, and provide justifications to explain why the criterion could not be fully achieved on the site. Where this can be justified, the awarding of the water quality credit would not be affected, provided all other relevant criteria have been achieved.
CN24	5mm requirement - end-of-pipe solutions See criterion 11.	End-of-pipe solutions, such as ponds and basins, will only be deemed to comply with the 5mm criteria where the principal run-off control to prevent discharge from the first 5mm of a rainfall event is achieved using source control and site control methods.
CN25	5mm requirement - green roofs See criterion 11.	Green roofs can be deemed to comply with this requirement for the rain that falls onto their surface. However, evidence is still required to demonstrate that the 5mm rainfall from all other hard surfaces on-site is being dealt with, to allow this credit to be awarded.
CN26	Areas that are a source of pollution See criterion 12.	For the purpose of assessing the watercourse pollution credit, an area that presents a risk of watercourse pollution includes vehicle manoeuvring areas, car parks, waste disposal facilities, delivery and storage facilities or plant areas.

Methodology

Calculating peak rate of run-off

The assessor is not required to perform any calculation. Calculations should be provided by the appropriate consultant to demonstrate that they have sized the drainage facilities appropriately. Further guidance on calculating peak rate run-off for different sites and situations include:

1. The SuDS Manual[1]
2. Preliminary rainfall run-off management for developments
3. Development and Flood Risk, Planning Policy Statement 25or where available, equivalent national planning policy guidance or statement) along with the latest version of the practice guide.
4. IH Report 124, Flood estimation for small catchments (Marshall and Bayliss, 1994)
5. Flood Estimation Handbook (Centre for Ecology & Hydrology, 1999)

Limiting discharge rate

The limiting discharge for each discharge point should be calculated as the flow rates from the pre-developed site. The calculation should include the total flow rate from the total area of site feeding into the discharge point (this should include both BREEAM-assessed and non-BREEAM-assessed parts of the development, if applicable). The discharge point is defined as the point of discharge into the watercourse/sewers (including rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, public sewers and passages through which water flows, see Relevant definitions). Where this calculation results in a peak flow rate of less than 5 L/s, the limiting discharge rate may be increased up to a level of no more than 5 L/s at the point of discharge from the site to reduce the risk of blockage.

For example, if the flow rate for the 1 year and 100 year events were 4 L/s and 7 L/s respectively, then the limiting discharges would be 5 L/s and 7 L/s. Similarly, if it was calculated to be 2 L/s and 4 L/s, then a maximum of 5 L/s limiting discharge rate could be applied to both discharge points.

[1] CIRIA, The SuDS manual, London, 2007.

Sites should not be subdivided to enable higher overall limiting discharge rates to be claimed. It is, however, recognised that some sites may require more than one discharge point as a result of the local topography or existing surrounding drainage infrastructure, and in such cases the limiting discharge flow rate may be increased to a level no more than 5 L/s at each discharge point. The assessor should seek evidence that the number of discharge points is necessary due to topography and/or infrastructure limitations. Evidence may be in the form of a topographical map and an explanation from the appropriate consultant as to why multiple discharge points are required, stating that it is not feasible to have fewer discharge points.

100-year peak rate event: Excess volume of run-off

The storage of excess flows from the 100-year event does not necessarily have to be contained within the drainage system or SuDS features (the features designed solely for the purpose of drainage). Where appropriate, storage of some or all of this volume can be achieved using temporary surface flooding of areas such as a playing field. Specific consideration should be given to overland flow routing. Overland flood flows and temporary storage of flood water on the surface must not be so frequent as to unreasonably inconvenience residents and other users.

Evidence

Ref	Design stage	Post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
7, 11	Calculation of the 5mm rainfall event from the relevant areas.	Refer to generic evidence requirement above.
10, 15	Calculation results for the pre-refurbishment and post refurbishment peak rate of run-off.	Refer to generic evidence requirement above.
10, 15	Calculation results for the pre-refurbishment and post refurbishment volume of run-off.	Refer to generic evidence requirement above.
14	No 'specific' evidence applies at Design Stage.	Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS.

Additional information

Relevant definitions

Appropriate consultant

A consultant with qualifications and experience relevant to designing SuDS and flood prevention measures and completing peak rate of run-off calculations. Where complex flooding calculations and prevention measures are required, this must be a specialist hydrological engineer.

Appropriate statutory body

This refers to the statutory/legal organisation/entity whose duty it is to carry out the planning approval function for the project.

Catchment

The area contributing surface water flow to a point on a drainage or water course. It can be divided into sub-catchments.

Design flood level

The maximum estimated water level during the design storm event. The design flood level for a site can be determined through either known historical data or modelled for the specific site.

Discharge point

The discharge point is the point at which the run-off from the site leaves the site boundary and enters a watercourse.

Flood risk

The combination of the flood probability and the magnitude of the potential consequences of the flood event.

Flood emergency plan

A flood emergency plan is a document that sets out actions that can be taken to ensure building occupants are safe in the event of a flood and to ensure that actions can be taken to minimise damage to the property and its contents to minimise repair and restoration costs. The plan should include as a minimum:

- A list of important contacts, including building services, suppliers and evacuation contacts for staff;
- A description or map showing locations of areas at risk, protective materials and service shut-off points;
- Basic strategies for protecting property, preventing business disruption and assisting recovery e.g. building materials for protecting the property such as sandbags, flood barriers etc.;
- A list of items that may require protection and preventative measures in place
- Details of those that may require assistance in the event of a flood
- Checklists of procedures that can be quickly accessed by staff during a flood

Hard surfaces

These include roofs, car parks, access roads, pavements, delivery/service yards and external hard landscaping. Footpaths less than 1.5m wide which have free drainage to soft landscaped areas on both sides may be excluded.

Low risk areas (with respect to watercourse pollution)

Low risk areas can be defined as areas where the risk of contamination or spillage of substances such as petrol and oil is reduced. For the purpose of this credit, roofs and small car parks may be considered as low risk areas.

SuDS management train

An approach to drainage design that combines a sequence of appropriate surface water drainage structures using SuDS systems for management of the run-off to treat the flow, reduce run-off volume and restrain the run-off rate in order to minimise man's impact on the environment. Additional benefits associated with operation and maintenance, ecology and amenity are aspects which are considered when designing a management system. The management train incorporates a hierarchy of techniques:

1. Source control. Examples of SuDS techniques include:
   - Soakaways
   - Porous or pervious paving
   - Roof water directed to garden (rather than piped drains)
   - Rainwater reuse or harvesting
   - Green roofs
   - Other surface infiltration, attenuation and conveyance techniques that deal with run-off at source.
2. Site/local control. Examples of SuDS techniques include:
   - Swales
   - Pond
   - Infiltration basins
   - Detention basin
   - Larger soakaways
   - Pervious (porous or permeable) paving
3. Regional control. Examples of techniques include:
   - Balancing ponds
   - Wetlands
   - Large detention basins

SuDS techniques

One or more components built to manage surface water run-off to prevent flooding and pollution, including for example: wet ponds, infiltration basins, detention basins, swales, reed beds, pervious (porous or permeable) paving, soakaways, rainwater harvesting, filter strips, filter drains and trenches with or without perforates pipes, green roofs and underground attenuation storage. For more information refer to The SuDS manual (CIRIA C697, 2007).

Suitably qualified building professional

This should be an individual who has the appropriate training and relevant experience to be able to implement a full flood resilience strategy for a building. This could be a building surveyor, architect or a specialist contractor who should confirm that they have the necessary knowledge and experience to complete the task.
The chosen professional should have good knowledge of flood resilience techniques and how these can be implemented for non-domestic buildings.

Surface water run-off

Water flow over the ground surface to a drainage system. This occurs if the ground is impermeable, saturated or if the rainfall is particularly intense.

Tidal estuary

A tidal estuary is defined as a semi-enclosed coastal body of water which has a free connection with the open sea at all times and within which seawater is measurably diluted with fresh water derived from land drainage. An estuary should be unconstrained tidal waters, i.e. there should be no barriers or constricted shorelines that would restrict the free flow of water into the open sea in any conditions. The impact on the total volume of run-off from the site (and other sites which may in future discharge into the estuary) should be insignificant in terms of the overall water levels in the estuary. Tidal rivers (i.e. where no or limited measurable seawater content is present during normal tidal movements) cannot be included as part of the estuary for the purposes of BREEAM.

Treatment

Improving the quality of water by physical, chemical or biological means.

Types of oil separator

Class 1 Separators:
These are designed to achieve a concentration of less than 5 mg/l oil under standard test conditions. They should be used when the separator is required to remove very small oil droplets, such as those arising from car park run-off.
Class 2 Separators:
These are designed to achieve a concentration of less than 100 mg/l oil under standard test conditions. They are suitable for dealing with discharges where a lower quality requirement applies or for trapping large spillages.
Both classes can be produced as 'full retention' or 'by pass' separators.
Full retention separators:
These treat the flow that can be delivered by the drainage system, which is normally equivalent to the flow generated by a rainfall intensity of 50mm/hr.
Bypass separators:
These fully treat all flows generated by rainfall rates of up to 5mm/hr. Flows above this rate are allowed to bypass the separator. These separators are used when it is an acceptable risk not to provide full treatment for high flows.

Volume of run-off

The volume of run-off that is generated by rainfall occurring on the site. This is typically measured in cubic metres. Additional predicted volume of run-off is the difference between the volumes of run-off pre- and post development.

Watercourses and sewers

A term that includes rivers, streams, ditches, drains, culverts, dykes, sluices, sewers and passages through which water flows.

Other information

Sources of flooding and flood risk

1. Streams and Rivers: Flooding that can take place from flows that are not contained within the channel due to high levels of rainfall in the catchment.
2. Coastal or Estuarine: Flooding that can occur from the sea due to a particularly high tide or surge, or a combination of both.
3. Groundwater: Where the water table rises to such a height where flooding occurs. Most common in low-lying areas underlain by permeable rock (aquifers), usually due to extended periods of wet weather.
4. Sewers and highway drains: Combined, foul or surface water sewers and highway drains that are temporarily overloaded due to excessive rainfall or due to blockage.
5. Surface water: The net rainfall falling on a surface (on or off the site) which acts as run-off which has not infiltrated into the ground or entered into a drainage system.
6. Infrastructure failure: Canals, reservoirs, industrial processes, burst water mains, blocked sewers or failed pumping stations.

Contaminated sites

Where the site risk assessment confirms that infiltration SuDS techniques are not appropriate, SuDS techniques that do not allow infiltration, such as swales lined with an impermeable membrane, can be used. It may be the case that only some areas of the site are contaminated and therefore infiltration SuDS techniques can be used elsewhere on the site. There may also be a requirement to remediate the contaminated soils, creating opportunities for the use of infiltration SuDS post-remediation.

Pol 04 Reduction of night time light pollution

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	No	Yes	Yes	No

Aim

To ensure that external lighting is concentrated in the appropriate areas and that upward lighting is minimised, reducing unnecessary light pollution, energy consumption and nuisance to neighbouring properties.

Assessment criteria

The following is required to demonstrate compliance:

One credit

1 Where external lighting pollution has been eliminated through effective design that removes the need for external lighting without adversely affecting the safety and security of the site and its users.

OR alternatively, where the building does have external lighting, one credit can be awarded as follows:

2 All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00.

3 Illuminated advertisements, where specified comply with:
- 3.a The uniformity of illuminance outlined in Table - 71
- 3.b The maximum luminance (CD/m^2) outlined in Table - 71 (please refer to Additional information for a definition of the different zones).

4 If safety or security lighting is provided and will be used between 23:00 and 07:00
- 4.a Illuminated advertisements, where specified, must comply with criterion 2 above except in Zone E1 (see Table - 72) where the maximum luminance value shall be zero post-curfew.
- 4.b Safety and security lighting complies with the lower levels of lighting recommended during these hours in accordance with CIE 150-2003 and CIE 126-1997, for example by using an automatic switch to reduce the lighting levels at 23:00hrs or earlier.

Checklists and tables

Table - 71: Recommendations for maximum luminance (CD/m^2)

Illuminated Area (m^2)	Zone E1	Zone E2	Zone E3	Zone E4
$<$ 10.00	100	600	800	1000
≥ 10.00	n/a	300	600	600

Table - 72: Environmental lighting zone

Zone	Surrounding	Lighting Environment	Examples
E1	Natural	Intrinsically dark	National parks or protected sites
E2	Rural	Low district brightness	Industrial or residential rural areas

Zone	Surrounding	Lighting Environment	Examples
E3	Suburban	Medium district brightness	Industrial or residential suburbs
E4	Urban	High district brightness	Town centres and commercial

Compliance notes

Ref	Terms	Description
Applicability		
CN1	Part 1: Fabric and structure	Not applicable.
CN2	Part 2: Core services	This issue is filtered out where there is no external lighting specified. Criteria 1 - 3 are applicable.
CN3	Part 3: Local services	This issue is filtered out where there is no external lighting specified. Criteria 1 - 3 are applicable.
CN4	Part 4: Interior design	Not applicable.
General		
CN5	General	None.

Methodology

The following provides guidance on when and how to apply the criteria to the external lighting associated with a building being assessed:

1. All external lighting within the refurbishment or fit-out zone needs to be assessed, i.e. the scope of refurbishment works. Where the assessment is of a building that forms part of a wider site (e.g. a campus, shopping centre, business park etc.) site-wide external lighting can be excluded where outside of the construction zone, unless the majority of buildings on the wider site are also undergoing refurbishment or are part of a new development
2. Flush stud lights used for safety purposes in vehicle manoeuvring areas may be excluded from the assessment.
3. Where light fittings are specified to comply with specific security standards and these conflict with the BREEAM criteria, they can be excluded from the assessment of this issue. In these circumstances the assessor must obtain evidence confirming the specific security standards and that they are applicable to the assessed development.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Advertisements

Any word, letter, model, sign, placard, board, notice, awning, blind, device or representation, in the nature of, and employed wholly or partly for the purposes of advertisement or announcement. This also includes any hoarding or similar structure used, or designed or adapted for use for the display of advertisements.

Refurbishment and fit-out zone

For the purpose of this issue the construction zone is defined as the area(s) of the building undergoing refurbishment and its directly associated external areas.

Illuminated advertisements

An advertisement which is designed or adapted to be illuminated by artificial lighting, directly or by reflection.

Illuminance uniformity

Ratio of the maximum luminance to the minimum luminance

Lighting zones

The contrast with the surrounding or background and therefore the lighting environment of the building change the perception of luminance. The maximum luminance of the advertisement needs therefore to be adapted depending on the lighting environment.

Other information

The design should be checked for compliance against the Commission Internationale d'Eclairage (CIE) guidance

This gives four sets of recommendations;

1. Limits to the average upward light ratio of the luminaires, to restrict sky glow.
2. Limiting illuminance at the windows of nearby properties for which light trespass might be an issue.
3. Limiting the intensity of each light source in potentially obtrusive directions beyond the site boundaries.
4. Limiting the average luminance of the building, if it is floodlit.

In each case the limiting values depend on the location of the site of the building (for example rural, urban or city centre). A calculation of illuminance (b) or intensity (c) is not required if all luminaires are cut-off types and angled so that light in potentially obtrusive directions is blocked.

Compliance with the International Dark Skies Association Model Ordinance Guidance http://www.darksky.org/assets/documents/MLO/MLO_FINAL_June2011.pdf may also ensure the requirements for this credit are met.

Pol 05 Reduction of noise pollution

Number of credits available	Minimum standards	Applicability			
		Part 1	Part 2	Part 3	Part 4
1	No	Yes	Yes	Yes	No

Aim

To reduce the likely impacts of noise arising from existing or newly specified fixed installations affecting nearby noise-sensitive buildings.

Assessment criteria

Applicability:

This issue is applicable to Parts 1, 2 and 3 assessments to assess the impact of existing or newly specified externally mounted plant and the impact of any fabric measures on reducing the impact of noise on any nearby noise-sensitive buildings.

The following is required to demonstrate compliance:

One credit

1 Where there are, or will be, no noise-sensitive areas or buildings within 800m radius of the assessed site.

OR

2 Alternatively, where the building does have noise-sensitive areas or buildings within 800m radius of the site, one credit can be awarded as follows:
   - 2.a Where a noise impact assessment been carried out and the following noise levels measured or determined in accordance with the ISO 1996 series:
      - 2.a.i Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar.
      - 2.a.ii The noise level resulting from the new noise source (see CN6).

3 The noise impact assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body (see Relevant definitions).

4 The noise level from the proposed site or building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 to 23:00) and +3dB at night (23:00 to 07:00) compared to the background noise level.

5 Where the noise source(s) from the proposed site or building is greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with criterion 4.

Checklists and tables

None.

Compliance notes

Ref	Terms	Description
Applicable assessment criteria		
CN1	Part 1: Fabric and structure	Criteria 1 - 5 are applicable. This issue is filtered out where there is no externally mounted plant.

Ref	Terms	Description
CN2	Part 2: Core services	Criteria 1 - 5 are applicable. This issue is filtered out where there are no externally mounted plant that are present or newly specified within core services.
CN3	Part 3: Local services	Criteria 1 - 5 are applicable. This issue is filtered out where there are no externally mounted plant present or newly specified within local services.
CN4	Part 4: Interior design	Not applicable.
General		
CN5	Standard not appropriate / not applicable	Where a suitably qualified acoustician confirms that ISO 1996:20071987 is not an appropriate standard of assessment for the proposed building/site, their assessment of the likelihood of complaint from noise impact can be accepted for the purpose of assessing this issue.
CN6	Compliance at the design stage See criterion 2.	At the design stage of assessment, where noise-sensitive areas or buildings are present, actual measurement is unlikely to be possible due to the planned but non-existent installation. In such situations compliance can be demonstrated through the use of acousticians' calculations or by scale model investigations. For such cases ISO 1996-2:2007 states that 'as universally agreed prediction models do not exist, the method adopted should be carefully described in the acoustician's report' and that 'when available, prediction models accepted by relevant authorities should be used'. Where prediction through these methods is not possible, measurement will be necessary using either a noise source similar to that proposed or, alternatively, measurement of the actual noise from the installation (once installed); compliance with the latter approach requires a written commitment to appoint a suitably qualified acoustician to carry out the required measurements post installation, and a further commitment to attenuate the noise source in compliance with criteria 4 and 5 of BREEAM (if proved necessary by the measurements).
CN7	Untreated buildings	This assessment issue does not apply to buildings designed to be untreated, i.e. where internal spaces will not be serviced by heating, ventilation or air-conditioning systems and therefore have no noise generating plant. Examples of such building types could include industrial warehouse storage.
CN8	National/local alternative to ISO standard	It is possible to use a national/local equivalent to the ISO 1996 series, however this must be approved by BRE Global. The Approved standards and weightings list can be used to check for previously approved standards or to propose a new national/local standard.

Methodology

None.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	

Additional information

Relevant definitions

Noise-sensitive area

Landscapes or buildings where the occupiers are likely to be sensitive to noise created by the new plant installed in the assessed building, including:

1. Residential areas
2. Hospitals, health centres, care homes, doctor's surgeries etc.
3. Schools, colleges and other teaching establishments
4. Libraries
5. Places of worship
6. Wildlife areas, historic landscapes, parks and gardens
7. Located in an area recognised as having outstanding natural beauty, scientific or ecological interest
8. Any other development that can be considered noise-sensitive.

Suitably qualified acoustician

An individual who holds a recognised acoustic qualification and membership of an appropriate professional body. Acousticians that meet the definition of a suitably qualified acoustician in Hea 05 Acoustic performance, will also meet the definition for the purposes of compliance with this issue.

Other information

None.

14.0 Innovation

Inn 01 Innovation

Number of credits available	Minimum standards
10	No

Aim

To support innovation within the construction industry through the recognition of sustainability related benefits which are not rewarded by standard BREEAM issues.

Assessment criteria

The following is required to demonstrate compliance;

Up to a maximum of 10 credits are available in aggregate from a combination of the following:

Exemplary level of performance in existing BREEAM issues

1 Where the building demonstrates exemplary performance by meeting defined exemplary level performance criteria in one or more of following BREEAM assessment issues:

1. Man 03 Responsible construction practices
2. Man 05 Aftercare
3. Hea 02 Indoor air quality
4. Ene 01 Reduction of energy use and carbon emissions
5. .Wat 01 Water consumption
6. Mat 01 Environmental impact of materials
7. Mat 03 Responsible sourcing of materials
8. Wst 01 Project waste management
9. Wst 02 Recycled aggregates
10. Wst 05 Adaptation to climate change
11. Pol 03 Flood risk management and reducing surface water run-off

Please refer to the relevant BREEAM issue within this scheme document for the exemplary level performance assessment criteria.

Approved innovations

2 One innovation credit can be awarded for each innovation application approved by BRE Global, where the building complies with the criteria defined within an Approved Innovation Application Form.

Checklists and tables

None

Compliance notes

Ref	Terms	Description
General		
CN1	Exemplary level of performance	Refer to the compliance notes within the individual assessment issues that contain exemplary performance levels.

Methodology

Exemplary level of performance in existing BREEAM issues

For information on the methodology for exemplary level credits refer to the 'Methodology' section of the relevant BREEAM issues.

Approved innovations

Innovation applications can be submitted to BRE Global by a licensed BREEAM Assessor using the formal Approved Innovation Application Form.

Evidence

Criteria	Interim design stage	Final post construction stage
All	One or more of the appropriate evidence types listed in 4.0 The BREEAM evidential requirements section can be used to demonstrate compliance with these criteria.	
1	As defined within existing BREEAM issues.	As defined within existing BREEAM issues.
2	A copy of the Approved Innovation Application Form AND A copy of the Innovation Application Report stating the application outcome as 'approved' AND Relevant documentary evidence demonstrating specification of the approved innovation.	As interim design stage AND Relevant documentary evidence confirming that the project has achieved/installed the approved innovation as described and quantified within the approved innovation application form.

Additional information

Relevant definitions

Approved innovation

Any new technology, design, construction, operation, maintenance or demolition method or process that can be shown to improve the sustainability performance of a building and is of demonstrable benefit to the wider industry in a manner that is not covered elsewhere in BREEAM. In addition the innovation has been approved by BRE Global in accordance with its published BREEAM Innovation credit procedures.

Other information

Applying for innovation credits

Refer to the BREEAM Innovation section documents available from the BREEAM Assessor Extranet for more information on BREEAM Innovation credit eligibility criteria, application process, application fees and, previously approved innovations.

15.0 Appendices

Appendix A National Scheme Operators

National Scheme Operators (NSOs)

A number of international organisations approach BRE Global Ltd to request advice and support with their own national/local environmental assessment method. BRE Global Ltd offer support and advice in the following ways;

- Assistance in developing a new scheme which will be affiliated to BREEAM
- Recognising the merits of an existing scheme by affiliating it to BREEAM

The organisations developing and operating BREEAM affiliated national schemes are known as National Scheme Operators (NSOs). BRE Global is the NSO for BREEAM in the UK and also for the pan-country BREEAM International schemes.

The schemes developed by National Scheme Operators can take any format as long as they comply with the requirements of the BREEAM Core Technical Standard and the BREEAM Core Process Standard both of which expand on the framework set out within the Code for a Sustainable Built Environment. To operate National Schemes as compliant and affiliated to BREEAM and the Code for a Sustainable Built Environment, a National Scheme Operator must also agree to the licensing conditions of the Framework Agreement (refer to the Introduction section).

The NSOs affiliated to BREEAM and their local schemes are listed on the BREEAM webpage. These local schemes must be used for international assessments where appropriate, in these instances contact your local NSO for further information. Where a building falls outside of the scope of these local schemes, the pan-country BRE Global Ltd BREEAM International scheme can be used.

For information on becoming a NSO please contact BRE Global Ltd on 00 44 (0) 333 321 88 11 or email breeam@bre.co.uk.

Appendix B - BREEAM International Refurbishment and Fit-out 2015 scope and Education buildings

BREEAM International Refurbishment and Fit-out 2015 has been tailored specifically for the assessment of the following educational establishments:

1. Preschool, including:
   a. Nursery and preschools[1] (typically age 3-5)
   b. Children's centres[2]
2. Schools, including:
   a. Primary schools (typically ages 4-11)
   b. Secondary schools, including those containing colleges (typically ages 11-16 or 11-18
   c. All age range schools (including education or teaching buildings at boarding schools)
   d. Non-acute special educational needs schools
3. Colleges (typically ages 16+)
4. University, further and higher education, colleges and institutions (typically ages 18 plus), including:
   a. Teaching facility
   b. Learning resource centre
   c. Laboratory, workshop, studio
   d. Student club (e.g. may include a bar, small retail and restaurant)
   e. Or a mixture of the above types.

All age range schools and academies

All age range schools can typically be assessed using the guidance or criteria applicable to secondary schools. In some cases, for these types of education establishments, it may be more appropriate to use the assessment criteria for further education colleges or primary schools. For example, where an all age range school or academy will contain functional or operational areas more akin to further or higher education buildings or where the needs of the accommodation and occupiers are similar to those of primary or early years pupils. Based on the information received about the proposed building, the BREEAM Assessor should determine the most appropriate BREEAM criteria to apply in the assessment of the building.

Acute special educational needs schools

Acute special educational needs (SEN) refers to children with severe disabilities or learning difficulties that prevent them from interpreting their surroundings without feeling anxious or distressed. These children can become easily distracted or overstimulated, or both. This group of pupils mainly include children with behavioural, emotional or social difficulties (BEDS) and children with a communication and interaction disability (autistic spectrum disorder (ASD)).

This BREEAM scheme has not been specifically tailored to assess acute SEN schools. However, assessment using the methodology is still possible, except where highly specialised accommodation is provided. Acute SEN schools are therefore defined as an 'Other' building type and BREEAM assessors carrying out assessments on schools for pupils with such needs will need to consider carefully all the BREEAM issues that might be affected by the need to provide special facilities for such building users, e.g. view out, cyclist facilities, etc. Where it is not explicit within this scheme document for this building type, the assessor will need to decide which, if any, building type assessment criteria are appropriate and apply accordingly, seeking confirmation from BRE Global Ltd on the application of alternative building criteria where appropriate to do so.

Student residential accommodation

BREEAM International Refurbishment and Fit-out 2015 can be used to assess boarding school residential and halls of residence accommodation buildings. These types of building are classified as a multi-residential accommodation building type for the purpose of a BREEAM assessment.

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[1] Nursery school or education means full-time or part-time education suitable for children who have not attained compulsory school age (whether provided at schools or elsewhere), i.e. facilities or buildings for the teaching of children who are between the ages of two or three to five years old.

[2] Children's centres are multi-agency service hubs where young children and their families can receive early education, full day childcare, parental support and child and family health services, such as access to health visitors and health screening. Children's centres will often be allied to a local primary school, on or adjacent to the school site.

16.0 Checklists

Checklist A1

Man 02 Responsible construction practices

1 Safe and adequate access

This section is intended to demonstrate that the constructor operates the site in a manner that guarantees a safe and appropriate access to, around and on the site. The following items demonstrate compliance with this section:

Table - 73: Checklist A1 - Safe and adequate access requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	Appropriate and safe access to the site is provided. This must include as a minimum: — Provision of parking on or near site OR a public transport node with an average frequency under 30 minutes within 500m OR a dedicated transport service to a major public transport node provided by the contractor. — Good lighting AND Adequate barriers AND uniform surfaces i.e. no trip hazards outside the site boundary — All accesses to be clean and mud free — Hoarding or scaffolding to be well lit at night AND scaffold netting is in place and well maintained		See copy of parking plan & check transport/dedicated service timetables and view other facilities are on site.	
b	Appropriate and safe access on site is provided. This must include as a minimum: — Footpaths marked with ramps and signs Pathways wide enough for wheelchairs — Accessibility of all areas by visually or hearing impaired visitors — All site hazards advertised at the site entrance		View on site and check that list of hazards is complete	
c	Site entrances and exits are clearly marked for visitors and delivery drivers to see.		View on site	
d	Site reception is clearly signposted OR all visitors are escorted to the reception		Check on arrival for the signs OR see a copy of the induction procedure.	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
e	The post box has been placed on the pavement to avoid the postman from entering the site.		View on site	
f	Where there are minority communities speaking a different language in the area or working onsite, notices are printed in the common local language		Check the area and the staffs register for a minority culture community. Where this is present on- or off-site, check for signs in the communities language.	
g	All road signs/names can be seen OR when a road sign/name is obstructed a replacement has been erected		View on site	
h	Where a site with severe congestion has a delivery point remote from a site, deliveries can then be made in smaller vehicles at times to cause the least inconvenience.		View procedures on site.	

2 Good Neighbour

This section is intended to demonstrate that the constructor operates the site in a manner that is considerate to the surrounding neighbours. The following items demonstrate compliance with this section:

Table - 74: Checklist A1 - Good neighbour requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	Introductory letters have been/will be sent to all neighbours AND there is a commitment to write and thank neighbours at the end of the contract for their patience AND provide feedback form		See copies of letters with list of addresses. A copy of this commitment should be provided or a copy of a standard letter that is always sent at the end of a project. A copy of the feedback form must be provided along a procedure to monitor the results and implement changes for future work.	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
b	Site hours and noisy work restrictions are appropriate to the area, in particular when the site is located near: — Houses — Schools — Hospitals — Industrial Units — Major public Transport Nodes — City centres — Shopping facilities		Copy of statement of intent, policy, agreement etc to be provided	
c	The site boundary (which includes all areas affected by the works) is clearly and safely marked and appropriate to the environment: — The colour of the hoarding has been considered in terms of the surrounding environment. — Pedestrians have a suitable, safe and protected passage around the site boundary — There are well lit warning signs for the benefit of the pedestrian and road user — The site's surroundings are seen by the public as tidy and clean		Ask site manager if any thought was given to the hoarding and the location of the site. Is the hoarding clearly/safely marked, clean, neat and well maintained? Ensure that there are no complaints about the site being untidy or that if there were this was quickly rectified and not repeated.	
d	There is a complaints book available AND evidence that complaints are being dealt with immediately		Inspect the complaints book and check responses for timeliness	
e	Local people are appropriately informed by the use of a notice board: — Of the site progress — Of the company contact details (telephone number/web site/email address)		View on site	
f	Light is shielded from the neighbours		Copy of the temporary works indicating light shielding or the site manager must demonstrate how the light shielding works or is not applicable.	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
g	Site personnel are discouraged from using local facilities in their site clothes. Examples of how this might be achieved include : — A canteen — Staggered breaks for different gangs. — Provision of showers/wash rooms. — Provision of lockers. — A request to leave PPE (Personal Protective Equipment) on site.		View on site. Check procedures with the Site Manager.	
h	There is a volume restriction on radio use or there is a radio ban		Check if restriction/ban is in place and how this is enforced	

3 Environmentally Aware

This section is intended to demonstrate that the constructor has considered the impact of the site on the environment and has implemented measures to mitigate this impact. The following items demonstrate compliance with this section:

Table - 75: Checklist A1 - Environmentally aware requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	There are restrictions on the effects of light pollution and all lights are directional and non-polluting. If there is a site specific environmental policy which sets restrictions on lighting, this point can be awarded.		View on site.	
b	Energy saving measures are implemented on site. Examples of this include: — Low energy lighting — Switching off equipment when not in use — Installing thermostats — Installing timers — Choosing energy efficient equipment If there is a site specific environmental policy which defines energy saving measures, this point can be awarded.		View on site.	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
c	An impact minimisation strategy review is in place for the site. The review should consider the impact of the site in environmental terms and how any adverse effects are being minimised e.g. protection of ecological features, pollution control.		View impact minimisation strategy.	
d	Water saving measures are implemented on site and monitored. If there is a site specific environmental policy which indicates how water saving measures are managed and monitored on site, this point can be awarded.		View procedures on site.	
e	Alternative energy sources have been considered.		View on site.	
f	Fuel oil spillage equipment is available.		View on site. Ensure the spillage equipment is located where spillages may occur to ensure a rapid response time.	
g	Sumps are provided in cases of heavy water run-off. If there is a site specific environmental policy which indicates how heavy water run-off will be minimised and dealt with on site, this point can be awarded.		View on site.	
h	Materials and equipment are tidily stacked and protected/covered where necessary AND there is adequate space for new materials to be stored in secured covered areas to avoid damage, theft and to protect from weather.		View on site. Ensure that where the space has been provided, it is being used correctly	

4 Safe and considerate working environment

This section is intended to demonstrate that the constructor is operating the site in a clean and safe manner in order to ensure the wellbeing of its workers and to minimise the risk to their health and safety. The following items demonstrate compliance with this section:

Table - 76: Checklist A1 - Safe and considerate working environment requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	Adequate facilities are provided on-site for workers and visitors. These must include as a minimum: — Separate male, female and disabled toilets — Working usable showers AND suitable changing areas — Lockers in the drying room — Dedicated smoking area — Suitable and safe accommodation (where provided)		View on site	
b	Site facilities are well maintained and clean. This must cover as a minimum: — Areas around the canteen, offices and skips — Site welfare facilities (including toilets and changing areas) — Dedicated smoking area		View on site.	
c	Private or visually-impacting areas are screened. These must include as a minimum: — Areas around the canteen, offices and skips where necessary. — Toilets — Dedicated smoking area		View on site.	
d	Clean Personal Protective Equipment (PPE) is available for use by visitors		Check company policy and procedure and if it is being implemented on site	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
e	Health and Safety procedures are in place for the following issues: — Appropriate training of all staff including non-native operatives to understand health and safety (H&S) best practices and information displayed on site — Operatives' exposure to the sun — Operatives' identification; all operatives to be provided with a photo identification clip card — Reporting of all incidents (minor and serious) and near misses — Ensuring that an appropriate number of first aiders and first aid equipment are available for the site.		Check company policy and procedures and how these are enforced Check first aid book in particular for minor accidents. Check the first aiders list and their qualifications (must be less than 3 years old). Check that each first aiders have a box with basic equipment and that they have access to more equipment if necessary and that they know where to find it.	
f	There is posted material indicating nearest police Station and Hospital (with Accident & Emergency facilities) in the following areas as a minimum: — Site reception — Site canteen — Main site office		Spot check managers, operatives, reception staff to check they know this information or at least where they would find it. Check induction talk.	
g	An inspection has been carried out by a Health and Safety inspector or equivalent.		View on site.	
h	Emergency escape routes well identified and clear emergency evacuation procedure AND drills carried out.		View on site. Written proof of fire drill procedure.	

Signed by:

Checklist A6

Wst 02 Recycled aggregate

To demonstrate that the local best practice guidance for defining "granular fill and capping as a high grade use" is appropriate, the local guidance/standard must cover the requirements set out in Table - 77 and Table - 78.
NOTE: The extent and scope of this local guidance/standards will be checked by BRE waste experts to ensure that the overall effect is equivalent to the BREEAM requirements.

Table - 77: Sampling/testing of processed/recovered product

Property description	Basic principals
General description	
Aggregate composition (including organics)	Visual sorting of the plus 8 mm fraction
Particle size/grading	Size distribution of particles in an aggregate sample determined using test sieves (sieves meeting a national or equivalent standard for test sieves)
Fines content	Percentage of aggregate by mass passing a 0.063 mm sieve
Particle shape	Determination of the proportion (by mass) of flat and/or elongated particles

Table - 78: Requirement for additional testing of processed/recovered aggregate products by end use (note that tests/properties given in brackets are only required where the test is relevant to the end application and/or the local climate or is considered otherwise essential)

Test/property	Basic principle
(Surface abrasion resistance)	Determination through testing of the ability of aggregate particles to retain their shape characteristics under construction conditions and traffic. (when relevant to the end use)
(Alkali silica reaction)	Aggregate reactivity in concrete (RILEM AAR3 or equivalent method) where there is concern about the possibility that the aggregate is alkali reactive.
(Resistance to freezing and thawing)	Resistance to fragmentation due to freezing and thawing action. Accelerated freeze-thaw test, magnesium sulfate soundness value or equivalent method.
(Polishing resistance)	Susceptibility of an aggregate to polishing (resistance to smoothing/loss of surface friction) when relevant to end use.
Bulk density	Determination of the loosely compacted bulk density of oven dry aggregate.
(Bearing capacity)	Determination of strength or bearing capacity of compacted aggregate or soil. Relevant to use of unbound aggregates in building or road foundations.

Test/property	Basic principle
(Chlorides)	Determination of water soluble chloride content (relevant to use in concrete or mortar)
Evidence that there is no release of dangerous substances	In particular emission of radioactivity, release of heavy metals, release of polyaromatic hydrocarbons. Evidence to be provided when required and in case of doubt.
Water solubility	Water solubility of aggregate (percentage by mass)
(Organic contamination)	Relevant to use in mortar or concrete. Determination of constituents affecting the setting and hardening of concrete; presence of lightweight organic contaminators.
Particle density	Specific gravity or relative density of aggregate
(Plasticity of fines)	A high proportion of plastic fines may be detrimental in asphalt or road construction. Testing may not be necessary where the total fines content of the aggregate does not exceed an agreed value which has been determined from local satisfactory use. Where amount of fines may be considered plastic or harmful, apply one of the following or other equivalent method: (a) sand equivalent value, (b) plasticity index, (c) methylene blue value
(Resistance to fragmentation or impact)	Test to assess resistance of aggregate particles to degradation under impact.
(Resistance to heat/thermal shock)	Relevant to application of aggregate in asphalt/bitumen. Change in physical properties of aggregates subjected to 700 °C environment
Sulfates and sulphides	When required, determination of acid soluble sulfate or total sulfur.
Water absorption	Increase in mass of a sample of oven dried aggregate due to the penetration of water into the water accessible voids.