

BREEAM-NOR 2016 New Construction

TECHNICAL MANUAL
SD5075NOR – Ver: 1.2.

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Acknowledgments

BREEAM- NOR for New Construction has been made possible through the continued efforts of many dedicated Grønn Byggallianse members, the strategic advisory Group, The Technical working groups, BREEAM Assessors and AP's, many dedicated BRE Group staff members, and those who have responded to our consultation calls and meetings or provided feedback in other ways. Over 100 persons, nation-wide and representative for the entire value chain in the construction and real- estate industry have contributed to develop this new manual. Grønn Byggallianse also reserve a special thank you to those who support BREEAM by continuing to specify and apply the method and contribute toward a sustainable built environment.

Cover image

Schweigaardsgate 21/23 were the two first buildings to obtain BREEAM-NOR certificates, both with an Excellent rating. They also won the Norwegian Award for Building Design in 2014. Photo: KLP Eiendom.
Architect: LUND+SLAATO Arkitekter

Grønn Byggallianse

Grønn Byggallianse is a non-profit membership organisation established in 2010 owned by members from the entire Norwegian construction and real estate industry. A list of members can be found at www.byggalliansen.no.

Grønn Byggallianse's mission is to improve the sustainability and quality of the built environment by encouraging the use of environmental assessments tools to transform the way buildings are planned, designed, constructed, maintained and operated. Grønn Byggallianse is designated by BRE Global Ltd. to operate BREEAM-NOR

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Introduction

About this Scheme Document

This document is the technical manual for the BREEAM-NOR New Construction 2016 Scheme. It describes an environmental performance standard against which new buildings in Norway can be assessed and achieve a BREEAM-NOR New Construction rating.

The scheme document and the information detailed within is intended for use by trained, qualified and licensed BREEAM-NOR Assessors in accordance with the procedural and operational requirements of BREEAM-NOR (as described in the BREEAM-NOR Operations Manual, SD5075NOR) under the terms and conditions of a BREEAM-NOR licence. This document should be used by non-BREEAM-NOR 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 Grønn Byggallianse. A schedule of the publication date for each issue of this document is provided below.

Any additions to this document that necessitate 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-NOR Assessors can download this list of changes from the Assessor webpage. The list of changes is also available to other parties on request; please email tech@byggalliansen.no.

Scheme document	Issue number	Date of issue
SD 5075NOR	1.0	31/08/2016
SD 5075NOR	1.1	02/05/2017
SD 5075NOR	1.2	05/06/2019

What is BREEAM?

BREEAM (Building Research Establishment's Environmental Assessment Method) is an internationally recognised measure and mark of a building's sustainable qualities. Since its launch in 1990, BREEAM has certified over 530,000 buildings and is now active in more than 70 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 research¹ evidence 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.

¹ Delivering sustainable buildings: Savings and payback (FB 63), Yetunde Abdul and Richard Quartermaine, Published IHS, August 2014

The greater efficiency and quality associated with sustainability are also helping to make such building more commercially successful. There is growing evidence, for example, that BREEAM-rated buildings provide increased rates of return for investors, and increased rental rates and sales premiums for developers and owners².

Research studies have also highlighted the enhanced value and quality of sustainable buildings. 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.

Aims of BREEAM

- To mitigate the life cycle impacts of buildings on the environment
- To enable buildings to be recognised according to their environmental benefits
- To provide a credible, environmental label for buildings
- To stimulate demand and create value for sustainable buildings, building products and supply chains.

Objectives of BREEAM

- To provide market recognition of buildings with a low environmental impact
- To ensure best environmental practice is incorporated in the planning, design, construction and operation of buildings and the wider built environment
- To define a robust, cost effective performance standard surpassing that required by regulations
- To challenge the market to provide innovative, cost effective solutions that minimise the environmental impact of buildings
- To raise awareness among owners, occupants, designers and operators of the benefits and value of buildings with a reduced life cycle impact on the environment
- To allow organisations to demonstrate progress towards corporate environmental objectives.

BREEAM is developed and operated to meet the following underlying principles:

- Ensure environmental quality through an accessible, holistic and balanced measure of environmental impacts.
- Use quantified measures for determining environmental quality.
- Adopt a flexible approach that encourages and rewards positive outcomes, avoiding prescribed solutions.
- Use robust science and best practice as the basis for quantifying and calibrating a cost effective and rigorous performance standard for defining environmental quality.
- Reflect the social and economic benefits of meeting the environmental objectives covered.
- Provide a common international framework of assessment that is tailored to meet the 'local' context including regulation, climate and sector.
- Integrate building professionals in the development and operational processes to ensure wide understanding and accessibility.
- Adopt third party certification to ensure independence, credibility and consistency of the label.
- Adopt existing industry tools, practices and other standards wherever possible to support developments in policy and technology, build on existing skills and understanding, and minimise costs.
- Align technically and operationally with relevant international standards, including the suite of standards on the 'Sustainability of Construction Works' prepared by the European Committee for Standardisation Technical Committee CEN/TC 350.
- Engage with a representative range of stakeholders to inform ongoing development in accordance with the underlying principles and the pace of change in performance standards (accounting for policy, regulation and market capability).

The aims, objectives and principles of BREEAM are embodied within a Core Technical Standard owned and managed by BRE Global Limited. This is applied through a suite of BREEAM schemes covering aspects of the built environment life cycle.

² Reports by Maastricht University and Schneider Electric - see <http://www.breeam.org/page.jsp?id=224>

Who is behind BREEAM and BREEAM NOR?

BREEAM is managed and continually developed by BRE Global and supported in certain countries by a number of National Scheme Operators (NSOs). NSO's (like Grønn Byggallianse) are independent organisations who develop and own country specific 'local' schemes that are affiliated to BREEAM.

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 ISO/IEC 17065 'Conformity assessment - Requirements for bodies certifying products, processes and services'. This can be verified on the UKAS website, and includes BREEAM Scheme SD123 'Environmental assessments of the built environment – certification of the process'.

BRE Global Ltd is also certified to ISO 9001 'Quality management systems – Requirements' for all its BREEAM related activities. BREEAM-NOR is developed by Grønn Byggallianse. Grønn Byggallianse is currently operating BREEAM-NOR under license from BRE Global Ltd. Grønn Byggallianse has developed its own management system to be in line with BRE requirements and in accordance with the framework agreement with BRE.

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).

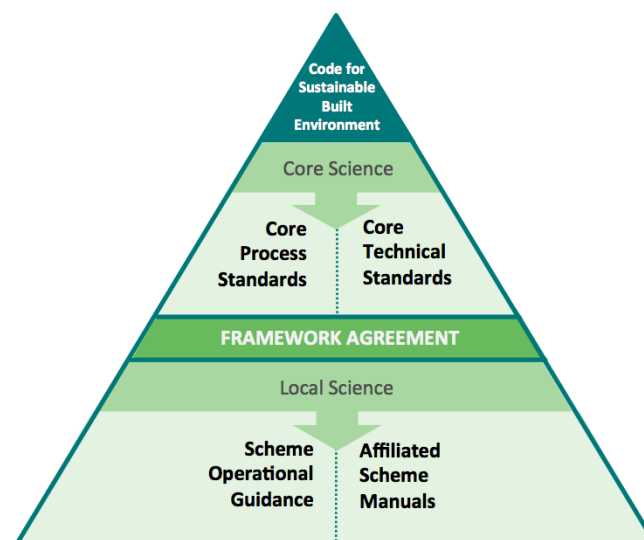


Figure 1: Diagram illustrating the relationship between the Code for a Sustainable Built Environment framework, the BREEAM Core Standards and the National Scheme Operator Scheme Documents.

BREEAM New Construction

The primary aim of the New Construction scheme is to mitigate the negative impacts of new buildings on the environment, and improve the positive social and economic impacts of the building over its lifetime. The BREEAM-NOR process allows this to be done in a cost effective, independent and scientifically authoritative manner.

How to apply the New Construction schemes

Careful timing of the use of BREEAM-NOR is key to cost effectively optimising the building's environmental performance and achieving the desired rating.

A BREEAM-NOR rating reflects the overall performance of the building. This means that the client, design team, principal contractor and BREEAM-NOR Assessor, as well as other specialist disciplines, all have an important role to play in achieving the desired performance level. However, orientating the brief towards sustainability needs to primarily come from the client. To facilitate this, clients and their project teams should preferably engage with a BREEAM Assessor (and/or BREEAM AP) no later than the BREEAM Pre-Assessment Stage (Step 2 in Figure 2) – and ideally sooner.

Appointing a BREEAM-NOR Assessor or Accredited Professional early in the project will make it much easier to gain the target rating, whilst retaining the flexibility of design decisions, budgets and potential solutions. Clients can find a list of assessors and Accredited Professionals on the www.byggalliansen.no and on the Green Book Live website www.greenbooklive.com³ Once an assessor is appointed they can register the project with Grønn Byggallianse at www.byggalliansen.no.

It is worth noting that some BREEAM-NOR credits cannot be achieved if they are not addressed in accordance with specified project work stages. The applicable Bygg 21/Fasenorm work stage requirement is specified within each of the relevant BREEAM-NOR issues.

Figure 2 serves to highlight the link between the BREEAM-NOR 2016 assessment and certification stages, the RIBA Outline Plan of Work 2013 and the phase norm from Bygg 21/NE Fasenorm⁴.

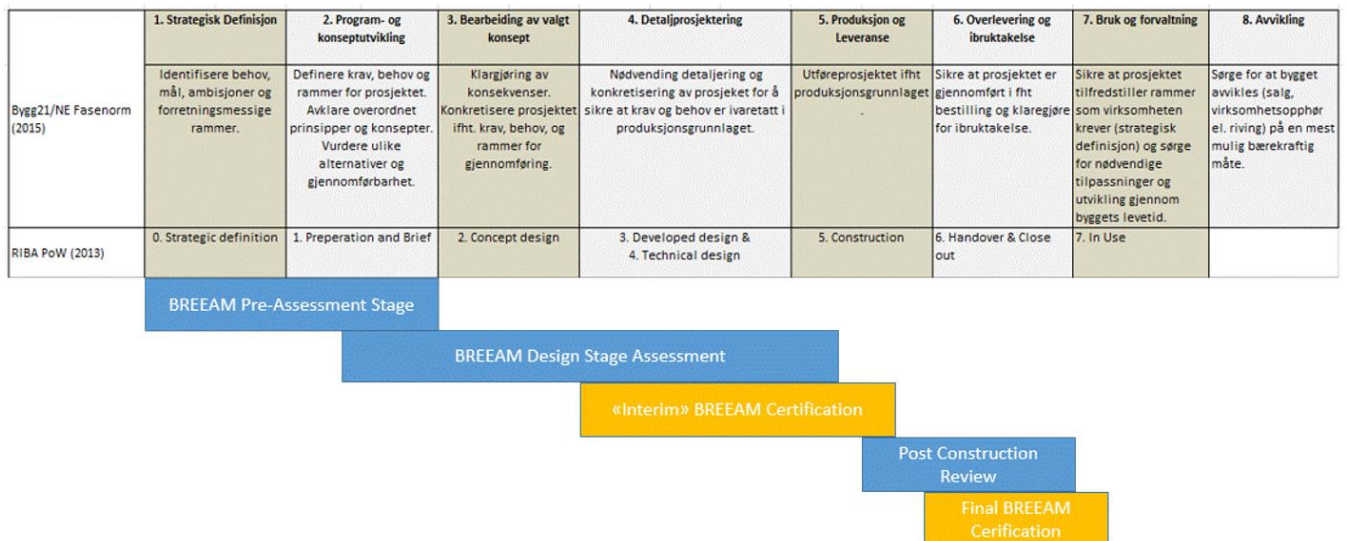


Figure 2: BREEAM-NOR assessment and certification stages in relation to the project work stages.

Verifying a building's certified BREEAM-NOR rating

The BREEAM-NOR certificate provides formal verification that the assessor has assessed a building in accordance with the scheme's requirements, and its quality standards and procedures. A BREEAM-NOR certificate therefore provides assurance to any interested party that a building's BREEAM-NOR rating, at the time of certification, accurately reflects its performance against the BREEAM-NOR standard.

³ Green Book Live is a free-to-use, publicly available online database designed to help specifiers and end users identify products and services that can help to reduce their impact on the environment.

⁴ Further detailed guidance and recommendations on the use and integration of BREEAM-NOR in the design and construction process and the use of Neste steg can be found on the following website:

<http://www.bygg21.no/contentassets/ac0c77e4ec904c7a955525528b474b6c/veileder-for-fasenormen-neste-steg.pdf> / (short version: http://www.bygg21.no/contentassets/974fd13545354595954fed799d1627b4/nestesteg_kortversjon.pdf). Also a more general description of integration BREEAM can be found in, 'Integrating BREEAM throughout the Design Process'. Cinquemani and Prior, BRE Press2010

All BREEAM-NOR certified buildings are listed on www.byggalliansen.no and Green Book Live at www.greenbooklive.com (along with a directory of licensed BREEAM-NOR Assessors/Accredited Professionals).

Anyone wishing to verify the BREEAM-NOR rating of a building can do so by either checking a building's BREEAM-NOR certificate, which will contain the certification mark (see Figure 3 below), or by searching Green Book Live for a specific listing.



Figure 3: BREEAM-NOR Certification mark

Maintaining a certified building's performance in use

To maintain the building's performance in use, and to help building managers and users reduce the running costs of their building, regular auditing against BREEAM In-Use Part 1 (Asset), Part 2 (Building Management) and Part 3 (Occupier Management) are recommended in the first three years of occupation (with regular reviews to maintain the 'In-Use' rating).

The certified performance of all BREEAM assessed buildings are listed by life cycle stage on the Green Book Live listing website. This is to provide evidence and assurance to the market of the business benefits of building, operating and maintaining buildings to high environmental standards and, it is envisaged, support the drivers for change in the way buildings are procured and operated. This in turn will help meet international obligations and targets on climate change.

Details of the BREEAM In-Use scheme can be found at www.breeam.org/inuse and a list of BREEAM In-Use Auditors is available from www.greenbooklive.com.

Using BREEAM NOR Scheme Documents

Scheme documents are produced to enable qualified and licensed BREEAM-NOR Assessors to complete assessments in a quality controlled, rigorous manner.

They will also help BREEAM-NOR Accredited Professionals (AP) to undertake project team facilitation, in terms of defining, monitoring and achieving the desired BREEAM-NOR rating. In addition, it is a reference guide for clients and members of the project team whose proposed building is being BREEAM-NOR assessed.

Note: BREEAM-NOR Scheme Documents are controlled documents and they are only valid on the day they are printed.

Scheme Documents are split in to six parts:

1. Introduction to BREEAM and BREEAM-NOR
2. Scope of the BREEAM-NOR Scheme Document
3. Scoring and rating
4. Assessment criteria
5. Checklists
6. Appendices (A-G)

Scope

The Scope section describes the types of building and stages of assessment that each version of the scheme can be applied to. The scope section can be used by clients and BREEAM-NOR Assessors to check whether it is the correct BREEAM-NOR Scheme Document to use for their project.

Scoring and rating

The Scoring and rating section outlines the BREEAM-NOR rating benchmarks, the process of establishing national environmental weightings and minimum BREEAM-NOR standards. It also describes how performance and BREEAM-NOR ratings are calculated from the individual BREEAM-NOR assessment issues and 'credits', including 'Innovation credits'.

Assessment criteria

The assessment criteria section includes the assessment issues categorised in ten environmental sections of sustainability (see Table 1). Each issue defines a level of performance (the assessment criteria) against which the assessed building demonstrates compliance (using appropriate evidence) in order to achieve the corresponding number of available BREEAM-NOR credits.

The majority of BREEAM-NOR issues are tradable, meaning that a client/design team can pick and choose which to target in order to build their BREEAM-NOR score and achieve the desired BREEAM-NOR rating. Several BREEAM-NOR issues have minimum standards meaning that to achieve a particular BREEAM-NOR rating certain credits or criteria must be achieved (BREEAM-NOR's minimum standards are outlined in section 3 'Scoring and rating').

Each BREEAM-NOR issue is structured as follows:

1. Issue information: contains the assessment issue reference, title, number of credits available for meeting the defined level of performance, whether the issue forms part of BREEAM-NOR's minimum standards.
2. Aim: outlines the objective of the issue and the impact it intends to mitigate.
3. Assessment criteria: outlines the good/best practice performance level benchmark(s) and criteria. Where the building complies with the assessment criteria, as determined by the BREEAM-NOR Assessor, the relevant number of BREEAM-NOR credits can be awarded. Some issues have Exemplary Level Criteria; where a building demonstrates that it meets Exemplary Level Criteria additional BREEAM-NOR credits can be awarded for innovation (refer to the 'Innovation' chapter for more detail).
4. Compliance notes: provide additional guidance that supports the application and interpretation of the main assessment criteria, including how to assess compliance in particular situations or for particular buildings or project types.
5. Evidence: outlines typical examples of the type of information that must be provided by the design team/client and given to the BREEAM-NOR assessor. This enables the assessor to verify in a robust and rigorous manner the building's performance against the assessment criteria and award the relevant number of BREEAM-NOR credits (refer to Appendix F for further information on BREEAM-NOR's evidence requirements).
6. Additional information: contains information that supports the application of the assessment criteria, including; definitions, calculation procedures, checklists and tables and any other relevant information.

Appendices

The Appendices provide supporting information relevant to either the scope of the scheme or its assessment criteria.

Checklists

The Checklists support the criteria within some of the BREEAM-NOR issues. They are separated from the criteria to allow assessors to use them with the project team as standalone documents.

Table 1: BREEAM-NOR New Construction 2016 sections and assessment issues

BREEAM-NOR 2016 sections and issues	
Management	Water
Man 01 Project brief and design Man 02 Life cycle cost and service life planning Man 03 Responsible construction practices Man 04 Commissioning and handover Man 05 Aftercare	Wat 01 Water consumption Wat 02 Water monitoring Wat 03 Water leak detection and prevention Wat 04 Water efficient equipment
Health and wellbeing	Materials
Hea 01 Visual comfort Hea 02 Indoor air quality Hea 03 Thermal comfort Hea 04 Microbial contamination Hea 05 Acoustic performance Hea 06 Safe access Hea 07 Natural hazards Hea 08 Private space Hea 09 Moisture protection	Mat 01 Life cycle impacts Mat 03 Responsible sourcing procurement of materials Mat 05 Designing for robustness

Energy	Waste
Ene 01 Energy efficiency Ene 02 Energy monitoring Ene 03 External lighting Ene 04 Low and zero carbon technologies Ene 05 Energy efficient cold storage Ene 06 Energy efficient transportation systems Ene 07 Energy Efficient Laboratory Systems Ene 08 Energy efficient equipment Ene 09 Drying space Ene 23 Energy performance of building structure	Wst 01 Construction waste management Wst 02 Recycled aggregates Wst 03 Operational waste Wst 04 Speculative floor and ceiling finishes
Transport	Land use and ecology
Tra 01 Public transport accessibility Tra 02 Proximity to amenities Tra 03 Alternative modes of transport Tra 04 Maximum car parking capacity Tra 05 Travel plan Tra 06 Home office	LE 01 Site selection LE 02 Ecological value of site and protection of ecological features LE 04 Enhancing site ecology LE 05 Long term impact on biodiversity LE 06 Building footprint
Innovation	Pollution
New technology, process and practices	Pol 01 Impact of refrigerants Pol 02 NOx emissions Pol 03 Surface water run-off Pol 04 Reduction of night time light pollution Pol 05 Noise attenuation

Scope of BREEAM NOR New Construction

The BREEAM-NOR New Construction schemes can be used to assess the sustainability of new buildings over their life cycle, at the design and construction stages of a project. 'New Construction' (NC) is defined as a development that results in a new standalone structure, or a new extension to an existing structure, which will come into use for the first time when the works are completed.

Prior to the launch of a refurbishment scheme for buildings, clients may continue to apply BREEAM-NOR and certify refurbishment and fit out projects using the method. For guidance please see appendix C.

BREEAM-NOR New Construction has been developed for use in Norway only.

Building types that can be assessed

Table 2: Building types that can be assessed by BREEAM NOR New Construction.

Sector	Building type	Description
Residential	Residential	<ul style="list-style-type: none"> - Individual dwelling and collection of individual dwellings/dwelling types - Apartment blocks
Non residential (Commercial)	Offices	<ul style="list-style-type: none"> - General office buildings - Offices with research and development areas (i.e. cat 1 labs only)
	Industrial	<ul style="list-style-type: none"> - Industrial unit – warehouse storage/distribution - Industrial unit – process/manufacturing/vehicle servicing

Sector	Building type	Description
	Retail	<ul style="list-style-type: none"> - Shop/shopping centre - Retail park/warehouse - 'Over the counter' service provider e.g. financial, estate and employment agencies and betting offices - Showroom - Restaurant, cafe & drinking - Establishment - Hot food takeaway
Public Buildings	Education	<ul style="list-style-type: none"> - Preschool - Child Education (Nursery school) - Schools and colleges - Primary Education - Secondary Education - Higher Education - Universities
Non standard (see guidance below)	Community	<ul style="list-style-type: none"> - Community/visitors centre - Town hall/civic centre - Conference facility - Theatre/concert hall - Sports/leisure facility (with/without a pool) - Library - Cinema - School/university - Hospital and other healthcare facilities
	Residential institutions (short term stay)	<ul style="list-style-type: none"> - Hotel, hostel, guest house - Residential care home - Sheltered accommodation - Residential college/school (halls of residence) - Military barrack
	Public	<ul style="list-style-type: none"> - Prison - Law court - Police station - Fire station - Transport hub (coach/bus/rail station) - Gallery, museum - Places of worship

Standard building types

Buildings are defined in BREEAM-NOR as either standard or non-standard types. Standard types include buildings listed in the Residential, Commercial and Education sections of Table 2. These are building types that the assessment criteria in BREEAM-NOR New Construction are specifically designed to assess without additional tailoring or development of the assessment criteria.

Non-standard building types (Bespoke)

Non-standard building types are listed in the non-standard building section of Table 2 and include a wide range of buildings – the list in Table 2 is not exhaustive.

Non-standard building types must undergo a scoping and tailoring exercise to facilitate a BREEAM assessment and rating. For an individual project this involves Grønn Byggallianse selecting appropriate BREEAM issues from the existing pool of assessment issues, to provide criteria against which the building can be assessed. This is known as a 'bespoke' assessment.

To ensure the consistency and robustness of the assessment, certain issues that are common to all BREEAM schemes form part of all 'bespoke' BREEAM criteria sets. These issues are applicable to any building type, e.g. Man 03 Responsible construction practices.

Issues that are applicable to the activities in a particular type of building will also form part of the criteria set. Where a criterion is not appropriate in a specific part of the building, it will be defined as not applicable for that area. For example, in issue Hea 01: Visual comfort, the Daylighting credit would not be applicable to cinema theatres.

Please note, the 'bespoke' process for non-standard buildings does not remove issues that the building may find difficult to achieve and cannot develop whole new sets of assessment issues, or extend or define new criteria for existing issues.

The assessment process, reporting, quality assurance and certification procedures for non-standard building types are the same as those for standard building types assessment. Further information on this process is available at www.byggalliansen.no.

Mixed use developments/building types

Typically, developments which consist of a number of separate buildings of differing functional types, e.g. office and retail, will require an assessment and therefore BREEAM-NOR rating and certificate for each individual building. Further information on mixed-use assessments can be found in Appendix B – Mixed-use developments and similar buildings (or units).

Similar buildings (or units) on the same site

It is possible to assess a number of separate but similar buildings, or individual units within a larger building development, within one BREEAM-NOR assessor's report. Further information on these assessments can be found in Appendix B.

Building life cycle stages that can be assessed

The BREEAM-NOR NC schemes can be used to assess and rate the environmental impacts of newly constructed building developments (including external site areas) at the following life cycle stages:

1. Design Stage – leading to an Interim BREEAM-NOR certified rating
2. Post-Construction Stage – leading to a Final BREEAM-NOR certified rating

Design Stage (DS)

The DS assessment and interim certified BREEAM-NOR rating confirms the building's performance at the design stage. This will ideally occur before operations on site begin. The certified BREEAM-NOR rating at this stage is labelled as 'interim' because it does not represent the building's final, new construction BREEAM-NOR performance.

The design must be advanced to a point where sufficient information is available to enable the BREEAM-NOR Assessor to evaluate and verify the building's performance against the criteria defined in this scheme document. The interim DS assessment will therefore be completed and certified (ideally) at the scheme design or detailed design stages.

Post-Construction Stage (PCS)

The PCS assessment and BREEAM-NOR rating confirms the final 'as-built' performance of the building at the new construction stage. A final PCS assessment is completed and certified after practical completion of the building works.

The assessment takes the form of either a post-construction review of an interim design-stage assessment, or a full, post-construction assessment.

A post-construction review serves to confirm that the building'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, a full post-construction stage assessment can be conducted.

Assessment of shell and core/speculative buildings

Non fitted-out 'speculative' new buildings, often referred to as shell and core buildings, can be assessed using BREEAM-NOR NC. Further details on the application of the scheme to these types of building can be found in Appendix D.

Outside the scope of BREEAM NOR New Construction Schemes

BREEAM-NOR NC is not designed to assess infrastructure projects, community level masterplanning projects, or the refurbishment, fit-out, operation and deconstruction of existing building.

Information on assessing refurbishment and/or fit out projects can be found in Appendix C.

Existing buildings (occupied/unoccupied) can be assessed and certified using the BREEAM In-Use scheme. See www.byggalliansen.no for more details.

Scoring and rating BREEAM NOR assessed buildings

The elements that determine the overall performance of a new construction project assessed using BREEAM-NOR are as follows:

1. BREEAM-NOR rating benchmarks
2. Minimum BREEAM-NOR standards
3. Section weightings
4. BREEAM-NOR assessment issues and credits

How these elements combine to produce a BREEAM-NOR rating is summarised in the following pages, followed by a description and example of the method of calculating a rating.

BREEAM rating benchmarks

The BREEAM rating benchmarks for new construction projects are as follows:

Table 3: BREEAM rating benchmarks

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

A BREEAM-rating enables clients and other stakeholder to compare a building's performance with other buildings BREEAM rated at the same life cycle stage of assessment. In this respect each BREEAM rating broadly represents performance equivalent to:

1. Outstanding: Less than top 1% of new buildings (innovator)
2. Excellent: Top 10% of new buildings (best practice)
3. Very Good: Top 25% of new buildings (advanced good practice)
4. Good: Top 50% of new buildings (intermediate good practice)
5. Pass: Top 75% of new buildings (standard good practice)

An unclassified BREEAM-rating represents performance that is non-compliant with BREEAM, failing to meet either the BREEAM minimum standards for key environmental issues or the overall threshold score required for formal BREEAM certification.

Minimum standards

To ensure flexibility, most BREEAM-NOR credits can be traded to achieve the target BREEAM-NOR rating i.e. non-compliance in one area can be off-set through compliance in another.

However, to ensure that performance against fundamental sustainability issues is not over-looked in pursuit of a particular rating, BREEAM-NOR sets minimum standards of performance in key areas, e.g. energy, water and waste. It is important to bear in mind that these are minimum acceptable levels of performance and should not necessarily be viewed as levels that represent best practice for a BREEAM –NOR rating level.

To achieve a particular BREEAM-NOR rating, the minimum overall percentage score (given in Table 3) must be achieved, and the minimum standards applicable to that rating level complied with – these are detailed in Table 4.

Table 4: Minimum BREEAM NOR standards by rating level

BREEAM issue	Comment	Pass	Good	Very Good	Excellent	Outstanding
Man 03: Responsible construction practices	*Crit 7/8				One credit*	Two credits*
Man 04: Commissioning and handover	*Crit 1-4 **Crit 1-4+7	1 credit*	1 credit*	2 credits**	2 credits**	3 credits**
Man 05: Aftercare	*Crit 3				1 credit*	1 credit*
Hea 01: Visual comfort		Criterion 1	Criterion 1	Criterion 1	Criterion 1	Criterion 1
Hea 02: Indoor air quality	*Crit 1+7 **Crit 1+9			2 credits*	3 credits**	3 credits**
Hea 08: Private space	Residential only					1 credit
Hea 09: Moisture protection				1 credit	1 credit	1 credit
Ene 01: Energy efficiency					6 credits	8 credits
Ene 02a: Energy monitoring	Non residential only			1 credit	1 credit	1 credit
Ene 04: Low or zero carbon technologies					1 credit	1 credit
Ene 23: Energy performance of building structure and installations						2 credits
Wat 01: Water consumption					1 credit	2 credits
Mat 01: Life cycle impacts		Criterion 1	Criterion 1	Criterion 1	Criterion 1	Criterion 1
Mat 03: Responsible Sourcing		Criterion 1	Criterion 1	Criterion 1	Criterion 1	Criterion 1
Wst 01: Construction waste management						1 credit
Wst 03a&b: Operational waste					1 credit	1 credit

Section weightings

Each of the technical sections within BREEAM-NOR has an associated weighting. Weightings provide a means of defining, and therefore ranking, the relative impact of the sustainability issues covered in BREEAM-NOR. BREEAM-NOR uses a weighting system derived from a combination of consensus based weightings, ranking by a panel of experts. These are used to determine the relative values of the sections used in BREEAM-NOR, and their contributions to an overall BREEAM-NOR score.

Table 5: Category weightings in BREEAM-NOR NC 2016

CATEGORY	Weighting (%)
MANAGEMENT	12
HEALTH AND WELLBEING	15
ENERGY	19
TRANSPORT	10
WATER	5
MATERIALS	13,5
WASTE	7,5
LAND USE AND ECOLOGY	10
POLLUTION	8
INNOVATION	10

BREEAM-NOR assessment issues and credits

BREEAM-NOR NC consists of a range of assessment issues spanning the ten technical sections.

Each issue addresses a specific building related environmental impact or occupant-related factor, and has a number of 'credits' assigned to it. BREEAM-NOR credits are awarded when a building meets the best practice performance levels defined for that issue i.e. it has mitigated an environmental impact or, in the case of the health and wellbeing section, addressed an occupant-related issue, such as thermal comfort, access to daylight or quality of acoustics.

The number of credits available for an individual assessment issue will vary. Generally, the higher the number of credits on offer, the more important that issue is to mitigating a building's impact. Where there are multiple credits available, the number awarded is usually based on a sliding scale, where progressively higher standards of building performance are rewarded with a higher number of credits.

It is worth noting that assessing a building's performance against the BREEAM-NOR issues also provides users with a credible set of key building performance indicators for a range of embodied, operational and construction impacts. They can be used to define performance levels in support of specific organisational policy objectives for individual environmental issues. However, care should be taken when setting design targets using individual issues, as it can limit design flexibility and have an impact on project costs.

Awarding credits for innovation

One of BREEAM-NOR's aims is to support innovation in the construction industry. The scheme does this by making additional credits available to recognise sustainability related benefits or performance levels that are currently not recognised by standard BREEAM-NOR assessment issues.

In this way BREEAM-NOR rewards buildings that go beyond best practice in terms of a particular aspect of sustainability, i.e. where the building or its procurement has demonstrated innovation.

Awarding credits for innovation enables clients and design teams to boost their buildings' BREEAM-NOR performance and, in addition, helps to support the market for new innovative technologies and design or construction practices.

There are two ways in which BREEAM-NOR awards innovation credits to recognise innovation in building design and procurement.

Exemplary level

The first is by meeting exemplary performance criteria defined in an existing BREEAM-NOR issue, i.e. going beyond the standard BREEAM-NOR assessment criteria and therefore best practice.

Note: not all assessment issues have exemplary performance criteria.

Innovative

The second route is where an application is made to Grønn Byggallianse by the BREEAM-NOR Assessor to have a particular building technology or feature, design or construction method or process recognised as 'innovative'. If the application is successful and building compliance is subsequently verified, an Innovation credit can be awarded.

An additional 1% can be added to a building's overall score for each innovation credit achieved. The maximum number of innovation credits that can be awarded for any one building is ten. Innovation credits can be awarded regardless of the building's final BREEAM-NOR rating, i.e. they are awardable at any BREEAM-NOR rating level.

Calculating a building's BREEAM NOR rating

A BREEAM-NOR Assessor must determine the BREEAM-NOR rating using the appropriate assessment tools and calculators. An indication of performance against the BREEAM-NOR scheme can also be determined using a BREEAM-NOR Pre-Assessment Estimator. The Pre-Assessment Estimator is available from the Grønn Byggallianse website www.byggalliansen.no.

The process of determining a BREEAM-NOR rating is outlined below and an example calculation included in Table 6:

1. For each environmental section the number of 'credits' awarded must be determined by the assessor in accordance with the criteria of each assessment issue (as detailed in the technical sections of this document).
2. The percentage of 'credits' achieved is then calculated for each section.
3. The percentage of 'credits' achieved in each section is then multiplied by the corresponding section weighting. This gives the overall environmental section score.
4. The section scores are then added together to give the overall BREEAM-NOR score. The overall score is then compared to the BREEAM-NOR rating benchmark levels and, provided all minimum standards have been met (refer to Table 6, the relevant BREEAM-NOR rating is achieved).
5. An additional 1% can be added to the final BREEAM-NOR score for each 'innovation credit' achieved (up to a maximum of 10%).

Table 6: Example BREEAM-NOR score and rating calculation

BREEAM-NOR Section	Credits Achieved	Credits Available*	% of Credits Achieved	Section Weighting*	Section score
Management	10	20	50%	0.12	6%
Health and wellbeing	11	22	50%	0.15	8%
Energy	15	32	47%	0.19	9%
Transport	6	9	67%	0.10	7%
Water	6	9	67%	0.05	3%
Materials	6	11	55%	0.135	7%
Waste	2	6	33%	0.075	3%
Land use & Ecology	1	10	10%	0.10	1%
Pollution	5	14	36%	0.08	3%
Innovation	0	0	0%	0.10	0%
Final BREEAM-NOR score					46,1 %
BREEAM-NOR rating					GOOD
*This will vary depending on building type and location.					

Table 7: Minimum standards for BREEAM NOR 'Good' rating achieved?

Minimum Standards for BREEAM NOR 'Very Good' rating Achieved?	Achieved?
Man 04 Commissioning and handover	Y
Hea 01: Visual comfort	Y
Mat 01 Life cycle impacts	Y
Mat 03 Responsibel Sourcing	Y

Producing case studies for BREEAM NOR 'Excellent and Outstanding' rated buildings

Projects certified to the BREEAM-NOR 'Excellent' and 'Outstanding' rating should act as exemplars for the industry. If they are to do this, case studies of these projects are needed so that other project teams and clients can refer to them.

Prior to Final Certification the design team and client for BREEAM-NOR 'Excellent' and 'Outstanding' rated projects are asked to provide either a case study of the building or information to allow Grønn Byggallianse to produce a case study. This information will be requested at the final post construction stage and should be provided with the BREEAM-NOR assessor's Final Certification Report.

Grønn Byggallianse will publish the case study on their websites, and share this with BRE Global to post on the Green Book Live website and in other BRE/BREEAM-related publications.

Management

Summary

This category encourages the adoption of sustainable management practices in connection with design, construction, 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
Man 01 Project brief and design	4	Stakeholder consultation covering project delivery and relevant third parties. BREEAM-NOR AP appointed to facilitate the setting, monitoring and achievement of BREEAM performance targets for the project.
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.
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 Construction, Handover and Close Out stages and to improve awareness and understanding for future projects.
Man 04 Commissioning and handover	3	Schedule of commissioning including optimal timescales and appropriate testing and commissioning of all building services systems 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 or operator training timed appropriately around handover and proposed occupation.
Man 05 Aftercare	3	Provision of the necessary infrastructure and resources to provide aftercare support to the building occupiers. Seasonal commissioning activities will be completed over a minimum 12 months 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.

Man 01 Project brief and design

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
4	-	-	-	-	-

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)
- BREEAM-NOR AP (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 (Step 3) 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 (SQA) etc.
 - 1.e Constraints for the project, e.g. technical, legal, physical, environmental.
- 2 Prior to completion of the concept design (Step 3), 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 (Step 3), all relevant third party stakeholders (see Relevant definitions) 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 (Step 4), 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 – BREEAM-NOR AP (design)

- 9 A BREEAM-NOR AP has been appointed to facilitate the setting and achievement of BREEAM performance targets for the project. The design stage BREEAM-NOR AP is appointed to perform this role during the feasibility (Preparation and Brief) stage (Step 2).
- 10 The defined BREEAM performance targets (see Relevant definitions) have been formally agreed between the client and design or project team no later than the concept design work stage (Step 3).
- 11 To achieve this credit at the interim design stage assessment (Step 4- 5), 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 – BREEAM-NOR AP (monitoring the design progress)

- 12 The credit for BREEAM-NOR AP (design) (criteria 9 to 11 has been achieved).
- 13 A BREEAM-NOR AP 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 BREEAM-NOR AP must attend key project and design team meetings during the concept design, developed design and technical design work stages (Step 3 and 4) (see Relevant definitions). Reporting must be carried out during and prior to completion of each stage, as a minimum.

Compliance notes

Ref	Terms	Description
Shell and core (non-residential and residential institutions only)		
CN1	Shell and core	All criteria relevant to the building type and function apply.

Ref	Terms	Description
General		
CN2	Minimum consultation content. See criterion 5 .	<p>Minimum consultation content will be dependent on the building and scope of the project, but would typically include the following:</p> <ol style="list-style-type: none"> 1. Functionality, build quality and impact (including aesthetics) 2. Provision of appropriate internal and external facilities (for future building occupants, visitors and users) 3. Management and operational implications 4. Maintenance resources implications 5. Impacts on the local community, e.g. local traffic and transport impacts 6. Opportunities for shared use of facilities and infrastructure with the community and appropriate stakeholders, if relevant and appropriate to the building type 7. Compliance with statutory (national or local) consultation requirements 8. Inclusive and accessible design <p>In the case of educational building types, minimum content also includes:</p> <ol style="list-style-type: none"> 9. How the building and grounds could best be designed to facilitate learning 10. 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. <p>In the case of building types containing technical areas or functions, e.g. laboratories, workshops etc., minimum content also includes:</p> <ol style="list-style-type: none"> 11. The end users' broad requirements for such facilities, including appropriate sizing, optimisation and integration of equipment and systems.
CN2.1	Assessing and awarding the available credits for a BREEAM-NOR AP	<p>There is an additional credit for appointing a BREEAM-NOR AP during the construction and handover phase (see BREEAM issue Man 03 Responsible construction practices). The aim of the credit in Man 03 Responsible construction practices is to encourage and reward contractors and project teams that appoint a BREEAM-NOR AP and therefore ensure continuation of the sustainability objectives during the construction phase, and that the constructed building meets the client's target BREEAM rating.</p>
CN2.2	BREEAM-related performance targets. See criteria 9 to 13.	<p>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 (Step 3), the credits awarded at the interim design stage assessment for appointing the BREEAM-NOR AP must be withheld in the final assessment (see Man 01 Project brief and design.)</p>

Evidence

Ref	Design stage	Post-construction stage
Stakeholder consultation		
1	The sustainability brief.	As design stage.
2-4	A list of the stakeholders consulted. A consultation plan setting out the process and the scope of the consultation. Agenda or minutes from consultation meetings.	As design stage.
5-7	A list of the stakeholders consulted. A consultation plan setting out the process and the scope of the consultation. Agenda or minutes from consultation meetings. Documentation demonstrating consultation feedback and subsequent actions.	As design stage.
8	Education only: Confirmation that the exercise was carried out by an independent party	As design stage.
BREEAM-NOR AP credits		
9	The BREEAM-NOR AP appointment letter. Project programme indicating the dates by which the key work stages. (Preparation and design; step 2-4) are to be completed.	As design stage.
10	Relevant section or clauses of the building specification or contract indicating the BREEAM performance targets	As design stage.
11	Design stage BREEAM assessment report.	The final post-construction assessment report.
12-14	The BREEAM-NOR AP appointment letter. Meeting notes or minutes, recorded correspondence or schedules that can demonstrate BREEAM issues are a regular agenda item and BREEAM-NOR AP attendance. The BREEAM-NOR AP progress reports (for each work stage).	As design stage.

Additional information

Relevant definitions

BREEAM-NOR Accredited Professional (AP)

An individual trained and qualified by Grønn Byggallianse as a specialist in built 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 licenced by Grønn Byggallianse as an AP comply with the BREEAM requirements. This membership ensures an adequate level of competence is maintained through regular continuing professional development in key relevant areas. For a list and contact details of BREEAM-NOR APs, visit: <https://byggalliansen.no/>

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 (Step 3)

The concept design work stage (Step 3) includes the development of strategies and outline proposals for site planning, built form, structural design, building services systems, outline specifications and preliminary cost information (see Bygg21 phasenorm for definition, http://www.bygg21.no/contentassets/974fd13545354595954fed799d1627b4/nestesteg_kortversjon.pdf or <http://www.bygg21.no/contentassets/ac0c77e4ec904c7a955525528b474b6c/veileder-for-fasenormen-neste-steg.pdf>).

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 (Step 1- 4)

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 its 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 other relevant project team members.

Independent party

To comply with assessment criterion 8 relating to the use of an independent party, the client or 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 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 (Step 3)
- Developed design (Step 4)
- Construction (Step 5)
- Commissioning and handover (Step 6)
- In-use occupation (Step 7)

Please refer to "Neste steg" from Bygg 21:

http://www.bygg21.no/contentassets/974fd13545354595954fed799d1627b4/nestesteg_kortversjon.pdf
or <http://www.bygg21.no/contentassets/ac0c77e4ec904c7a955525528b474b6c/veileder-for-fasenormen-neste-steg.pdf>

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 representatives from the following:

1. The client
2. The building occupier (where known)
3. The design team
4. The principal contractor.

With regards to contractors' involvement, it ensures their input in terms of formulating sustainable design solutions, commenting on the practicality and buildability of (one or more) design solutions and their impact on programming, costs etc. BREEAM recognises that traditionally for some projects, the contractor for the works might not be appointed at the early stages of the project and 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 is 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.

Relevant third parties (see criterion 5)

This includes, but is not limited to the following:

- 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 . A representative consultation group from the existing community (if the building is a new development in an existing community) or for a community still under construction
- 3 . Existing partnerships and networks that have knowledge of, and experience of working on, existing buildings of the same type
- 4 . Potential users of any shared facilities, e.g. operators of clubs and community groups
AND the following where relevant:
- 5 . In educational buildings, representatives from the local education authority, school board 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.

Technical design work stage

The technical design work is the stage at which all architectural, structural and building service design information, specialist subcontractor design and specifications are finalised (Step 4, http://www.bygg21.no/contentassets/974fd13545354595954fed799d1627b4/nestesteg_kortversjon.pdf).

Checklists and tables

None

Other information

None.

Man 02 Life cycle cost and service life planning

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
4	-	-	-	-	-

Aim

To deliver whole life value by encouraging the use of life cycle costing to improve design, specification, through-life maintenance and operation, and through the dissemination of capital cost reporting to promote economic sustainability.

Assessment criteria

This issue is split into three parts:

- Elemental life cycle cost (2 credits)
- Component level life cycle cost (1 credit)
- Capital cost reporting (1 credit)

The following is required to demonstrate compliance:

Two credits - Elemental life cycle cost (LCC)

- 1 An outline, entire asset elemental LCC plan has been carried out at the Concept Design stage (Step 3) 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 or NS 3454:2013 (see additional information for details).
- 2 The outline LCC plan:
 - 2.a Provides an indication of future replacement costs over a period of analysis as required by the client (e.g. 20, 30, 50 or 60 years)
 - 2.b Includes service life, maintenance and operation cost estimates.
- 3 Demonstrate, using appropriate examples provided by the design team, how the elemental LCC plan has been used to influence building and systems design, and specification to minimise life cycle costs and maximise critical value.

One credit - Component level LCC options appraisal

- 4 A component level LCC options appraisal has been developed by the end of Technical Design Stage (Step 4) in line with ISO 15686-5:2008 or NS 3454:2013 (see additional information for details), and includes the following component types (where present):
 - 4.a Envelope, e.g. cladding, windows, or roofing
 - 4.b Services, e.g. heat source, cooling source or controls
 - 4.c Finishes, e.g. walls, floors or ceilings
 - 4.d External spaces, e.g. alternative hard landscaping, boundary protection.
- 5 Demonstrate, using appropriate examples provided by the design team, how the component level LCC options appraisal 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

6 Report the capital cost for the building, via the BREEAM Assessment Scoring and Reporting tool.

Compliance notes

Ref	Terms	Description
General		
CN0	Shell and core	<p>Elemental life cycle cost, capital cost reporting and maintenance strategy, criteria 1 to 3 and 6 All assessment criteria relevant to the building type and function apply.</p> <p>Component level LCC plan, criteria 4 to 3 The plan must include all component types to be installed by the developer.</p>
CN1	Appropriate examples. See criterion 3 .	<p>The options selected to demonstrate how life cycle costs have been minimised and critical value maximised must be appropriate in terms of their relative impact on project costs, future building maintenance burden and size (volume or area) and the stage of the project.</p> <p>At step 3, when considering the outputs from the elemental LCC plan, examples could be in the form of elemental appraisals (where appropriate), evolutions in concept design (Step 3) to reduce maintenance or replacement costs or contracts for further elemental analysis.</p> <p>At stage 4, when considering the outputs from the component level options analysis, examples are likely to be in the form of component specifications coupled with justifications for their selection (i.e. how they reduce life cycle costs and maximise critical value).</p>
CN2.1	Predefined specifications	Where the building is constructed to a predefined standard specification, the LCC elemental plan for this specification may be used to help demonstrate compliance.
CN2.2	Capital cost reporting	<p>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 or cost consultant's best estimate should be provided.</p> <p>This data will be used to inform future BREEAM performance benchmarking and will be anonymised.</p>
CN2.3	Independent assessment of parts	<p>All <i>three parts</i> can be awarded independently from one another. For example, the project team can still target the one credit for the component level LCC option appraisal at Step 4 even if they have not been awarded the first two credits at stage 3 for developing an elemental life cycle cost plan. The capital cost reporting credit can also be awarded independently from the other two parts.</p>

Ref	Terms	Description
CN2.4	Component level LCC options appraisal – assessing types 4.a – 4.d	The component level LCC options appraisal should review all of the component types listed, 4.a – 4.d (where present). However not every single example cited under each component need be considered; only a selection of those most likely to draw valued comparisons. This is to ensure that a wide range of options are considered and help focus the analysis on components which would benefit the most from appraisal.
CN2.5	Elemental LCC plan study period	The study period should ideally be agreed by the client, in line with the design life expectancy of the building. However, where the life expectancy of the building has not yet been formally agreed (due to the early stages of the design process), the default design life of 60 years should be used for modelling purposes.

Evidence

Ref	Design stage	Post-construction stage
1 –3	Elemental LCC plan.	As per interim design stage.
4 – 5	Component level LCC options appraisal.	As per interim design stage.
6	Predicted capital costs via the BREEAM scoring and reporting tool.	Capital costs via the BREEAM scoring and reporting tool.

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. Costs are normally at building elemental level on the entire asset. 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.

Component level LCC options appraisal

A component level LCC plan is commonly used for cost planning specification choices of systems or component levels during design development. Component level LCC appraisal for service life planning 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.
- Only the key differentiators between components and systems need to be comparatively modelled.

Critical value

Critical value aims to create the highest increase in whole life value for the building, based on the needs of the client. This term encourages a more specific analysis of business needs beyond that of minimising life cycle cost. For instance:

- Where any disruption to business is costly, a specification with long periods between maintenance and minimum maintenance time may be desirable.
- Where maintaining aesthetics are important, a maintenance cycle may be based on aesthetic upkeep rather than functional lifespan.
- Where maximum recyclability and re-usability is important, an alternative specification may be required.
- Where capital costs are constrained, the specification with the lowest LCC may not be affordable, and instead the next best available option is chosen.

The above are examples of how critical value can be maximised, but are not exhaustive and will vary between projects.

Although some of these requirements are related to minimising LCC, a judgement based on critical value will help to maximise value to the client over the lifetime of the building.

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.

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 the following.

1. LCC 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 LCC stages - to help structure how to plan, generate, and interpret and present the results for a variety of different purposes and levels of LCC 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 LCC estimation and option appraisals, thereby creating a more effective and robust basis for LCC 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.

Use of NS 3454:2013

With the use of NS 3454 it is recommended, as described in ISO 15686-5, to carry out uncertainty and risk assessment.

Man 03 Responsible construction practices

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
6	-	-	-	1*	2*

*Crit 7/8

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 five parts:

- Prerequisite
- Environmental management (1 credit)
- BREEAM-NOR AP (1 credit)
- Considerate construction (up to 2 credits)
- Monitoring of construction site impacts (2 credits)

The following is required to demonstrate compliance:

Prerequisite - Legally harvested and traded timber

1. All timber and timber-based products used during the construction process of the project are '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 an equivalent standard.
3. Implement best practice pollution prevention policies and procedures on site, demonstrated through the project team completing the checklist outlined in Table 8. To demonstrate compliance, not all actions need to be achieved; however the assessor and project team must demonstrate that the intent of each section (i.e. air quality) has been met.

One credit – BREEAM-NOR AP (construction)

4. A BREEAM-NOR AP 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 (Step 5-6). To do this the BREEAM-NOR AP 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 BREEAM-NOR AP will monitor site activities with sufficient frequency (see compliance note CN1.3) 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: CN2.2 and Man 01 Project brief and design: Relevant definitions).
6. To achieve this credit at the final post-construction stage of assessment (end of Step 6), 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 single dwellings:
 - 7.a One credit can be awarded where an individual is responsible for implementing and maintaining the following considerate construction practices throughout the works stage (see "Other information"):
 - i Keeping the site clean and tidy
 - ii Reducing impacts on the community through community and neighbour engagement
 - iii Continuous improvements in safety
 - iv Commitments to respect and ensure fair treatment of all workers
 - 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 For all other building types, 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 (see CN 1.4).

Up to two credits - Monitoring of 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 processes (and dedicated off-site monitoring (see "relevant definitions")) throughout the 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 BREEAM-NOR AP 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 energy consumption (total kWh and kWh/10% of project value) and carbon dioxide emissions ((total kgCO₂ eq and kgCO₂eq/10% of 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 the principal constructor's and subcontractors' potable water consumption (m³) arising from the use of construction plant, equipment (mobile and fixed) and site accommodation (as relevant to the project type, see Compliance notes).
- 15 Using the collated data report the total net water consumption (m³), 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 the transport movements and impacts resulting from delivery of the majority construction materials to the site and construction waste from the 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 The scope of this monitoring must cover the following as a minimum:
- i Materials used for major building elements, (i.e. those defined as mandatory in the BREEAM International Mat 01 Calculator tool: walls, roof, floors, windows), including insulation materials
- 17.c Where within scope, ground works and landscaping materials.
- 17.d Transport of construction waste from the construction gate to waste disposal processing or the recovery centre gate. The scope of this monitoring must cover the construction waste groups outlined in the project's waste management plan (as defined in issue Wst 01 Construction waste management).
- 18 Using the collated data, report separately for materials and waste, the total transport-related carbon dioxide emissions (kgCO₂ eq) via the BREEAM Assessment Scoring and Reporting tool (for the purposes of potential future BREEAM performance benchmarking).

Compliance notes

Ref	Terms	Description
General		
CN1.0	Shell and core	All criteria relevant to the building type and function apply.
CN1.1	Site timber and reusable formwork. See criterion 1 .	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 construction products : Relevant definitions).
CN1.2	Environmental management system (EMS)	The EMS can be developed following guidance in the Waste Resources Action Programme (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. Eco-lighthouse/Miljøfyrtårn can be considered as an equivalent standard to ISO14001 and EMAS

Ref	Terms	Description
General		
CN1.3	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 Timing is critical to demonstrating compliance Key evidence is required to be produced at specific times including, but not limited to, photographic, delivery notes and other documentary evidence Different trades and systems come together and one could harm the integrity or compliance of another system's performance against BREEAM requirements.
CN1.4	Independent assessment and verification	An assessment of the site activities against Checklist A1 is to be assessed by a BREEAM-NOR Assessor along with the nominated individual on site, e.g site manager. This individual will confirm that the procedures outlined are in place and will therefore be responsible for demonstrating Checklist A1 compliance.
CN1.5	Compliance with Considerate Contractor Checklist	In instances where items in Checklist A1 are not relevant due to the scope of works on site, the assessor should seek guidance (through technical query if necessary) from Grønn Byggallianse on the appropriate number of items required.
CN2	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.

Evidence

Ref	Design stage	Post-construction stage
1	Relevant section or clauses of the building specification or contract. OR A signed and dated letter of commitment to meet the relevant criteria.	For certified and non-certified site timber, evidence as required for BREEAM issue Mat 03 Responsible sourcing of construction products
2-3	Relevant section or clauses of the building specification or contract. OR A signed and dated letter of commitment to meet the relevant criteria.	A copy of the principal contractors EMS/EMAS certificate. Copies of the documented procedures used on site for working to best practice pollution management guidelines. A letter from the principal contractor confirming: Procedures for pollution management and mitigation were implemented Name or job title of the individual responsible for monitoring and managing construction site impacts throughout the project.

4-6	Relevant section or clauses of the building specification or contract. OR A signed and dated letter of commitment to meet the relevant criteria.	Meeting notes or minutes, recorded correspondence or schedules that can demonstrate BREEAM issues are a regular agenda item and BREEAM-NOR AP attendance. The BREEAM-NOR AP progress reports. BREEAM Assessor's final post construction stage assessment report
7-8	Relevant section or clauses of the building specification or contract. OR A signed and dated letter of commitment to meet the relevant criteria.	Completed version of Checklist A1.
9-18	Relevant section or clauses of the building specification or contract. OR A signed and dated letter of commitment to meet the relevant criteria.	Name of the individuals responsible for monitoring, recording and reporting data resulting from all construction processes. Summary details of the monitoring and data gathering mechanism, protocols or system used to collate and process the relevant data. Collated construction phase data or information as follows: Total site energy consumption by fuel type and total carbon dioxide emissions Total site net water consumption (m ³) For both materials and waste, the total fuel consumption by type or total carbon dioxide emissions plus total distance travelled (km).

Additional information

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 8: 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 the least disturbance to the local community.	
B	Use noise control devices, e.g. temporary noise.	
C	Use barriers or 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, and increasing moisture content.	
B	Minimise dust from vehicle movements, using water sprays if appropriate.	
C	Avoid burning of materials on site.	
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 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 or line steep channels or slopes, e.g. using jute matting.	
E	Revegetate areas promptly.	
F	Reduce or prevent off-site sediment transport through the use of settlement ponds, silt fences, or water treatment.	

Section	Action	Completed (Y/N)
Water run-off management	Intent: To prevent water pollution from on site activities.	
G	Segregate or divert clean water run-off to prevent it mixing with water with a high solids content (therefore minimising the amount of water requiring treatment).	
H	Provide adequate drainage systems to minimise and control infiltration.	
I	Carry out any activities that could cause pollution in 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.	

Relevant definitions

BREEAM Accredited Professional (AP)

Refer to Man 01 Project brief and design.

Note: The aim of the BREEAM-NOR AP 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 BREEAM-NOR AP 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 (Step 5-6).

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, 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 construction products.

Principle contractor

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

Other information**CO₂ reporting protocols**

At the time of publication, the following guidance is available for CO₂ measuring protocols.

1. Encord: <http://www.encord.org>. They have launched a CO₂ reporting protocol.
2. Green House Gas (GHG) Protocol; <http://www.ghgprotocol.org>.

Tools for monitoring and targeting construction site impacts

[SMARTWaste](#) is an online environmental reporting tool for the construction industry. It enables organisations to efficiently capture, monitor and report on:

- Waste (including Site Waste Management Plans & Pre-Demolition Audits)
- Energy (including conversion to carbon dioxide emissions)
- Water
- Responsibly sourced materials (including timber)
- Transport
- Considerate Contractors Scheme.

Used to meet the criteria of this issue and as a source of evidence for demonstrating compliance, [SMARTWaste](#) helps organisations to reduce their environmental impacts, making substantial time and cost savings.

More information about SMARTWaste can be found 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 single dwellings. 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 there is 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. Schedule the timing of deliveries to the 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. 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

(all buildings)

Number of credits available	Minimum standards				
3	P	G	VG	E	O
	1*	1*	2**	2**	3**

*Crit 1-4

**Crit 1-4 + 7

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 three parts:

- Commissioning and testing schedule and responsibilities (1 credit)
- Commissioning building services (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 the appropriate commissioning required for the scope of works. The schedule includes a suitable timescale for commissioning and recommissioning of building services and control systems.
- 2 The schedule will identify the appropriate standards that all commissioning activities will be conducted in accordance with. This will include national best practice commissioning codes or other appropriate standards, where applicable. Where a building management system (BMS) is specified, refer to compliance note CN2.3 on BMS commissioning procedures.
- 3 An *appropriate project team member* is appointed to monitor and programme pre-commissioning, commissioning and testing. Where necessary, this will include 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 the 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 buildings with complex building services and systems, a specialist commissioning manager is appointed during the design stage (Step 4) (by either the client or the principal contractor) with responsibility for the following:
 - 6.a
 - i Undertaking design reviews and giving advice on suitability for ease of commissioning
 - ii Providing commissioning management input to construction programming and during installation stages
 - 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 systems.

One credit - Handover

- 7 A building or home user guide is developed, prior to handover for distribution to the building occupiers and premises managers. (see additional information for details). 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.
- 8 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:
- 8.a The design intent of the building
 - 8.b The available aftercare provision and aftercare team main contacts, including any scheduled seasonal commissioning and post occupancy evaluation (if relevant, cf. requirement 4 in Man 05)
 - 8.c Introduction to, and demonstration of, installed systems and key features, particularly BMSs, controls and their interfaces, to ensure they are fully conversant with the detailed operation of the building
 - 8.d Introduction to the building or home 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.
 - 8.e Maintenance requirements, including any maintenance contracts and regimes in place.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Commissioning and testing schedule and responsibilities, commissioning building services, criteria 1 to 6 With regard to the scope of services being specified or installed, all criteria relevant to the building type and function apply.</p> <p>Handover, criteria 7 and 8 Criterion 8 only is applicable. The guide includes, as far as possible, all relevant sections regarding the services and fabric installed. On completion of works the building owner, agent or user hands over to the fit-out contractor, who can then complete the relevant sections based on the fit-out strategy.</p>
General		
CN2	Appropriate project team member - Commissioning	<p>This appropriate project team member is responsible for overseeing that the installation and commissioning of the building services is undertaken to the standards required by the client. They can be a person from within the contractor or sub-contractor organisation provided they are not involved in the general installation works. The role must comply with the scope and intentions in national best practice guidelines; NS 3935:2011: Integrated technical building services (ITB) - Designing, implementation and commissioning</p> <p>Note: There will also be separate individuals who will install and commission the building services equipment, e.g. heating, lighting, ventilation.</p>

Ref	Terms	Description
General		
CN2.1	National best practice commissioning codes	<p>All facilities should develop commissioning program following at least the following standards, guidelines or regulations, where applicable:</p> <p>Overall: NS-EN 6450:2016: Commissioning and testing of technical building installations</p> <p>Heating: NS-EN 14336:2004: Heating systems in buildings - Installation and commissioning of water based heating systems</p> <p>Water distribution systems: NS-EN 806-1:2000: Specifications for installations inside buildings conveying water for human consumption - Part 1: General (Amendment A1:2001 incorporated)</p> <p>Lighting systems: CIBSE commissioning code L: lighting 2003 OR The commissioning aspects in: NS-EN 12464-1 Light and lighting – Lighting of workplaces – Part 1: Indoor work places NS-EN 12464-2: Light and lighting - Lighting of work places - Part 2: Outdoor work places</p> <p>Ventilation: NS-EN 12599:2012: Ventilation for buildings - Test procedures and measurement methods to hand over air conditioning and ventilation systems.</p> <p>Refrigeration (cooling): NS-EN 378-2:2016: Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation.</p> <p>Automatic control devices: NS-EN ISO 16484-3:2005: Building automation and control systems (BACS) - Part 3: Functions (ISO 16484-3:2005)</p> <p>Cold storage: Regulation on HVAC Installations in Buildings (RITE)</p> <p>The above list is not a definitive list, but includes the documentation is often seen as appropriate. If other document which comes to replace any of the above or any document that is not covered by the list, the Assessor should contact Grønn Byggallianse (Technical requirement) for approval.</p> <p>Consult guides recommendation commissioning of CIBSE and BSRIA in the <i>Other Information</i> section.</p>
CN2.2	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.

Ref	Terms	Description
CN2.3	BMS commissioning procedures. See criterion 2 .	Where a BMS is specified, the following commissioning procedures must be carried out: <ol style="list-style-type: none"> 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.
CN3	Distribution of Home user guide for residential buildings	The Home user guide must be supplied to all dwellings in a development. Where the development is divided into multiple dwellings and whenever there are communal systems and features in place, one central building user guide should be provided covering the scope of the building owner or manager controlled areas and responsibilities. A separate building user guide should be provided for each individual dwelling with content appropriate to the residents and their interaction with the building and its systems.

Evidence

Ref	Design stage	Post-construction stage
Commissioning and testing schedule and responsibilities, commissioning building services		
1-6	Project budget. Programme of works. Appointment letter or commissioning responsibilities schedule. Relevant section or clauses of the building specification or contract. Main contractor's programme. Commissioning schedule.	Commissioning records or reports. Main contractor's programme. Commissioning schedule.
Handover		
7-8	Relevant section or clauses of the building specification or contract. OR A letter of commitment from the client or developer.	If building occupants are known; evidence which proves that the user guide has been developed and discussed in consultation with the user. A copy of the building or home user guide. Written confirmation from the design team, contractor or client that the guide has been, or will be, distributed to the building's owner, tenants or fit-out contractor (for completion), as appropriate.

Ref	Design stage	Post-construction stage
7-8 (cont.)		Copy of the training schedule, with confirmation that it was (or will be) issued to the relevant people at the required time.

Additional information

Checklists and tables

None

Relevant definitions

Building user guide

Dedicated building or 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 or water or waste efficiency policy or 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 them 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 the building type or operation, e.g. laboratories
- Building related incident reporting and feedback arrangements
- Provision of, and access to, transport facilities, e.g. public transport, cyclist facilities, pedestrian routes etc.
- Provision of, and access to, local amenities
- 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.

Additionally, for the building occupiers' guide:

- Building services overview and access to building occupant 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 or provisions.

Additionally, for the facilities managers' guide:

- Building services overview and access to facilities management controls, e.g. where to find them, what they control, how to operate effectively and efficiently etc.
- Refit, refurbishment and maintenance arrangements or considerations
- Building related training information or links.

Complex systems

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

Home user guide

The aim of the Home user guide is to ensure the appropriate provision of guidance for the non-technical building user, so they can access, understand and operate the building efficiently and in a manner in keeping with the original design intent.

The guide should provide information relevant to the following stakeholders:

1. The building's residents
2. The non-technical facilities management team or building manager
3. Other building users, e.g. visitors or community users.
4. The section titles of the Home user guide are provided below. For further details on the scope or content of the guide, refer to Checklist A2.

Part 1 – Operational issues

1. Environmental strategy, design and features
2. Energy
3. Water use
4. Recycling and waste
5. Links, references and further information
6. Provision of information in alternative formats.

Part 2 – Site and surroundings

1. Recycling and waste
2. Sustainable (urban) drainage systems (if relevant)
3. Public transport
4. Local amenities
5. Responsible purchasing
6. Emergency information
7. Links, references and further information.

Specialist commissioning manager

The specialist commissioning manager is a specialist subcontractor rather than a general subcontractor. An appointed "ITB-ansvarlig" according to the national best practice standard NS 3935:2011: Integrated technical building installations (ITB) - Designing, implementation and commissioning may hold this role.

Checklists and tables

None

Man 05 Aftercare

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	1*	1*

*Crit 3

Aim

To provide post-handover aftercare to the building owner or occupants during the first year of occupation (Step 7) 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 occupiers, 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:
 - i Introduce the aftercare team or individual to the aftercare support available, including the building user guide (where existing) and training schedule and content
 - ii Present key information about the building, including the design intent and how to use the building to ensure it operates as efficiently and effectively as possible.
 - 1.b On site facilities management training, to include a walkabout of the building and 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 (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, once the building is occupied. This is done to facilitate analysis of discrepancies between actual and predicted performance, with a view to adjusting systems or user behaviours accordingly.

One credit - Seasonal commissioning

- 3 Seasonal commissioning shall, where applicable be performed in accordance with the national best practice standard NS6450:2015 Commissioning and testing of technical building installations. 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:
- 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)
 - ii Where applicable, testing should also be carried out during periods of extreme (high or low) occupancy
 - iii Interviews with building occupants to identify problems or concerns regarding the effectiveness of the systems
 - 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:
- i Review thermal comfort, ventilation, and lighting, at three, six and nine month intervals after initial occupation, either by measurement or occupant feedback
 - 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 (POE)

- 4 The client or building occupier makes a commitment to carry out a 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 third party (see 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:
- i Internal environmental conditions (light, noise, temperature, air quality)
 - ii Control, operation and maintenance
 - iii Facilities and amenities
 - iv Access and layout
 - v Other relevant issues.
- 4.c Sustainability performance (energy consumption, 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 CN3 and CN4 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 and occupant satisfaction data to Grønn Byggallianse.

Compliance notes

Ref	Terms	Description
Shell and core (non-residential and residential institutions only)		
CN1	Shell and core	This issue is not applicable
General		
CN2	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 or occupier's estates or facilities management team.
CN3	Appropriate dissemination of POE information See criterion 5 .	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> a. The client's or building owner's own website, publicly available literature or press release b. Industry, sector, government or local authority sponsored website or information portals. <p>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.</p>

Ref	Terms	Description
CN4	Relevant information for dissemination. See criterion 5 .	<p>This includes the following information about the building and its performance:</p> <ol style="list-style-type: none"> 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 9. Outcomes of the POE study to share lessons learned from the project including: <ol style="list-style-type: none"> a. Occupant feedback b. Energy and water consumption including renewable energy generation, level of rainwater or grey water provision <p>Appendix A can be used as guidance for producing this above information. Appropriate dissemination is described under CN3. Appendix A is also the information needed from Grønn Byggallianse/BRE to write a case study.</p>

Evidence

Ref	Design stage	Post-construction stage
Aftercare support		
1 2	Evidence of a commitment or contract to provide compliant aftercare support and training.	Evidence of a contract to provide compliant aftercare support and training.
Seasonal commissioning		
3	<p>Appointment letters or commissioning responsibilities schedule.</p> <p>Evidence of either existing procedures or a commitment or contract to put in place a mechanism to:</p> <ol style="list-style-type: none"> 1. Collect, compare and analyse relevant data 2. Undertake suitable adjustments if necessary. 	<p>Seasonal commissioning records, reports or a letter of appointment and commissioning responsibilities schedule.</p> <p>Records of occupant interviews.</p>

Ref	Design stage	Post-construction stage
Post-occupancy evaluation (POE)		
4 –5	A signed and dated commitment by the client or developer or future building occupier.	As design stage.
Exemplary level requirements		
6	Evidence as above (for the data collection and aftercare support credit), but from the end user.	Evidence as above (for the data collection and aftercare support credit), but from the end user.

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 subcontractor rather than a general subcontractor. An appointed "ITB-ansvarlig" according to the national best practice standard NS 3935:2011: Integrated technical building installations (ITB) - Designing, implementation and commissioning may hold this role.

Independent third party

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

1. They will use a third party independent of the design process to conduct the necessary POE exercise using a compliant method OR
2. If the POE 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 POE 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. For example, figures reported via the UK's Carbon Buzz website show that on average, buildings consume between 1.5 and 2.5 times the predicted values. When comparing predicted with actual values, 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
- They may be extended use due to extra occupancy and operating hours, not accounted for in the predicted models
- Inefficiencies from poor control, bad commissioning or poor maintenance
- Additional special functions such as a 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.

POE Methodologies

The most relevant POE methodology that fulfils the criteria should be used. For example, in the UK, the building use studies (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: www.busmethodology.org.uk/.

BRE's Design Quality Method (DQM) is a tried and tested, independent, POE method used by all UK auditing authorities, and many funding bodies. Further information can be found at: 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.

Checklists and tables

None

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	Credits	Credit summary
Hea 01 Visual comfort	Up to 4	The potential for disabling glare has been designed out of all relevant building areas. Good practice daylighting levels have been met. Floor space in the 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.
Hea 02 Indoor air quality	7	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. 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.
Hea 03 Thermal comfort	2	Thermal modelling carried out to appropriate standards. The thermal modelling analysis has informed the temperature control strategy for the building and its users.
Hea 04 Microbial contamination	1	Reduction of water contamination risk
Hea 05 Acoustic performance	Up to 4 credits	The building meets appropriate acoustic performance standards and testing requirements
Hea 06 Safe access	Up to 3 credits	Provision of effective measures which support safe access to and from the building. Security needs are understood and taken into account in the design and specification. The building is designed to be facilitated and accessible to all potential users (universal design).
Hea 07 Natural hazards	1	Risk assessment for natural hazards that may affect the building and the implementation of measures to mitigate any risks.

Issue	Credits	Credit summary
Hea 08 Private space	1	Provision of outdoor space which gives privacy and a sense of wellbeing.
Hea 09 Moisture protection	3	Minimizing sources of moisture issues through planning, monitoring and physical measures during the construction of the building.

Hea 01 Visual comfort

(all buildings)

Number of credits available	Minimum standards				
Up to 4 (Building type dependent)	P	G	VG	E	O
	-*	-*	-*	-*	-*

Criterion 1

Aim

To ensure daylighting, artificial lighting and occupant controls are considered at the design stage to ensure best practice visual performance and comfort for building occupants.

Assessment criteria

This issue is split into four parts:

- Pre-requisite (no credits)
- Daylighting (1-4 credits)
- Glare control and view out (1 credit)
- Internal and external lighting (1 credit).

The following is required to demonstrate compliance for:

Pre-requisite (no credits)

- 1 All discharge lamps, fluorescent tubes and compact fluorescent lamps are fitted with high frequency ballasts/transformers/drivers. If LED's are used in the building, drivers shall be fitted with AM (Amplitude Modulation) OR, if PWM (Pulse-Width Modulation) is used, it must be high frequent (see Additional information). The criteria is applicable for all internal lighting specified for the building.

Daylighting

Up to two credits (non residential buildings) and up to four credits (residential buildings)

- 2 EITHER
 - 2.a One credit for non residential buildings and two credits for residential buildings:
The provision of daylight has been designed in compliance with the following average daylight factors:

Table 9: Minimum values of average daylight factor required

	Latitude (°)	
	55-60	≥ 60
All area types	2.1%	2.2%

OR

- 2.b Two credits for non residential buildings and four credits for residential buildings:
The provision of daylight has been designed in compliance with the average daylight factor in as outlined in 2.a AND uniformity in Table 11.

OR

- 2.c Relevant building areas meet the climate-based daylight illuminance recommendations in Table 12

Average daylight factor, uniformity and illuminance (whichever is relevant) is required in at least 80 % (by area) of relevant areas in both non-domestic and residential developments. For retail developments at least 35 % (by area) of sales area shall comply.

Glare control and view out (for relevant areas in non residential buildings)

One credit

- 3 The potential for disabling glare has been designed out of all relevant building areas (see CN2) either through building layout (e.g. low eaves) and/or building design (e.g. blinds, brise soleil, bioclimatic design that provides shading from high level summer and low level winter sun).
- 4 The glare control strategy should be developed to ensure that daylight can enter the space under cloudy conditions, or when the sun is not on the façade, therefore avoiding higher than expected lighting energy consumption.
- 5 All positions (or 95% of the net floor area) within relevant building areas (see CN12) are within Xm of a window or permanent opening that provides an adequate view out, as outlined in Table 10.

Internal and external lighting levels and zoning (for relevant areas in non residential buildings)

One credit

- 6 Internal and external lighting illuminance (lux) levels are specified in accordance with national best practice lighting guides (see Compliance note 17). Where the lighting strategy of the building design is based on a localised or local lighting system, the task illuminance should be compliant with those levels and the average 'ambient' level at least one-third of this value or at the requirement of the non-task areas (whichever is greater).
- 7 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.
- 8 The uniformity of illuminance due to electric lighting is as per the recommendation in the approved national best practice lighting guides.
- 9 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:
 - a. In office areas, zones of no more than four workplaces (see also Compliance note). For workplaces the requirement of occupant control covers workplace lighting and not general lighting.
 - b. Workstations adjacent to windows/atria and other building areas separately zoned and controlled. This applies to workspace lighting and not general lighting.
 - c. Seminar and lecture rooms: zoned for presentation and audience areas
 - d. Library spaces: separate zoning of stacks, reading and counter areas
 - e. Teaching space/demonstration area
 - f. Whiteboard/display screen. This criterion is only applicable if there is a need for lighting in the display zone. If there is no such need, the criterion is achieved by default.
 - g. Auditoria: zoning of seating areas, circulation space and lectern area
 - h. Dining, restaurant, café areas: separate zoning of servery and seating/dining areas
 - i. Retail: separate zoning of display and counter areas
 - j. Bar areas: separate zoning of bar and seating areas.
- 10 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:
 - a. Full normal lighting (to allow for entry/exit, cleaning etc.)
 - 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)
 - c. All lighting off (for the projection of tone slides, colour slides, and for the purposes of visual demonstrations/performances)
 - d. Separate localised lectern lighting.
- 11 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.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Daylighting - No additional notes.</p> <p>View out - Where it is not possible to confirm which areas of the building will contain workstations/benches or desks, due to the speculative nature of the building, then all areas of the building designed for and/or likely to be occupied by workstations/benches or desks must comply with the relevant criteria (excluding ancillary areas).</p> <p>Glare control and artificial lighting - Compliance with these aspects of this BREEAM-issue can be demonstrated via one of the following means in shell and core buildings/areas:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer/landlord and tenant/s (full value of available credits). 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits). 3. Option 3 – Developer/Tenant collaboration (full value of available credits). <p>Refer to Appendix D for further description of the above options.</p> <p>Lighting controls - The lighting control system must have the capacity to be zoned, as required, once the final tenant is known and occupancy patterns/layout are agreed.</p>
CN2	Relevant building areas: Daylighting	<p>Generally, this refers to 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). Any exclusion will need to be fully justified by the Assessor in their certification report.</p> <p>This includes the following (where occupied continuously for 30 minutes or more) specifically stated because they are often omitted:</p> <ol style="list-style-type: none"> 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 6. Small offices. 7. Meeting rooms. 8. Leisure areas. 9. Any area that may involve close up work. <p>But excludes (where present);</p> <ol style="list-style-type: none"> 1. Media, arts production, x-ray rooms and other areas requiring strictly controlled acoustic or lighting conditions.

Ref	Terms	Description																																																																													
CN3	Daylighting: National daylighting best practice guides	<p>Make sure to take wall thickness and correct glazing transmittance into consideration.</p> <p>Recommended values of e.g. reflectance of surfaces and distance between calculation points in an illuminance grid are given in NS-EN 12464-1 Light and lighting - Lighting of work places - Part 1: Indoor work places.</p> <p>The recommendations can also be found in Lyskultur's publication 1B Luxtabell and planning criteria for indoor lighting systems.</p>																																																																													
CN4	Point daylight factors and daylight illuminances	<p>Computer simulation tools are required to calculate average daylight factor, point daylight factors and illuminances.</p> <p>The minimum point daylight factor is the lowest value of the daylight factor in the room at a point that is not within 0.5 metres of a wall. Similarly the minimum illuminance is calculated at the worst lit point in the room that is not within 0.5 metres of a wall. These points will usually be close to a rear corner of the room.</p>																																																																													
CN5	Daylighting: Uniformity ratio calculation	<p>Daylighting:</p> <p>The working plane to be calculated should exclude areas within 0.5 m from the walls.</p>																																																																													
CN6	Uniformity with rooflights	<p>The room depth criteria cannot be used where the lighting strategy relies on roof lights. In such areas either appropriate software should be used to calculate the uniformity ratio or, in the case of a regular array of roof lights across the whole of the space, Figure 2.36 within CIBSE Lighting Guide LG10 can be used to determine the uniformity ratio.</p> <table border="1"> <caption>Approximate data from Figure 2.36</caption> <thead> <tr> <th>Rooflight spacing/height</th> <th>Dome</th> <th>Flat</th> <th>Shed</th> <th>Monitor</th> <th>Northlight</th> <th>Sawtooth</th> </tr> </thead> <tbody> <tr> <td>5:1</td> <td>0.15</td> <td>0.25</td> <td>0.30</td> <td>0.35</td> <td>0.40</td> <td>0.45</td> </tr> <tr> <td>4.5:1</td> <td>0.20</td> <td>0.30</td> <td>0.35</td> <td>0.45</td> <td>0.55</td> <td>0.65</td> </tr> <tr> <td>4:1</td> <td>0.25</td> <td>0.35</td> <td>0.40</td> <td>0.55</td> <td>0.70</td> <td>0.80</td> </tr> <tr> <td>3.5:1</td> <td>0.30</td> <td>0.40</td> <td>0.45</td> <td>0.65</td> <td>0.85</td> <td>0.95</td> </tr> <tr> <td>3:1</td> <td>0.35</td> <td>0.45</td> <td>0.50</td> <td>0.80</td> <td>0.95</td> <td>1.00</td> </tr> <tr> <td>2.5:1</td> <td>0.40</td> <td>0.50</td> <td>0.55</td> <td>0.90</td> <td>1.00</td> <td>1.00</td> </tr> <tr> <td>2:1</td> <td>0.45</td> <td>0.55</td> <td>0.60</td> <td>1.00</td> <td>1.00</td> <td>1.00</td> </tr> <tr> <td>1.5:1</td> <td>0.50</td> <td>0.60</td> <td>0.65</td> <td>1.00</td> <td>1.00</td> <td>1.00</td> </tr> <tr> <td>1:1</td> <td>0.55</td> <td>0.65</td> <td>0.70</td> <td>1.00</td> <td>1.00</td> <td>1.00</td> </tr> <tr> <td>0.5:1</td> <td>0.60</td> <td>0.70</td> <td>0.75</td> <td>1.00</td> <td>1.00</td> <td>1.00</td> </tr> </tbody> </table>	Rooflight spacing/height	Dome	Flat	Shed	Monitor	Northlight	Sawtooth	5:1	0.15	0.25	0.30	0.35	0.40	0.45	4.5:1	0.20	0.30	0.35	0.45	0.55	0.65	4:1	0.25	0.35	0.40	0.55	0.70	0.80	3.5:1	0.30	0.40	0.45	0.65	0.85	0.95	3:1	0.35	0.45	0.50	0.80	0.95	1.00	2.5:1	0.40	0.50	0.55	0.90	1.00	1.00	2:1	0.45	0.55	0.60	1.00	1.00	1.00	1.5:1	0.50	0.60	0.65	1.00	1.00	1.00	1:1	0.55	0.65	0.70	1.00	1.00	1.00	0.5:1	0.60	0.70	0.75	1.00	1.00	1.00
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CN7	Rooms lit from two opposite sides	<p>For rooms lit by windows on two opposite sides, the maximum room depth that can be satisfactorily daylit is twice the limiting room depth (d) measured from window wall to window wall; CIBSE Lighting Guide LG1019. The reflectance of the imaginary internal wall should be taken as 1.</p>																																																																													
CN8	Borrowed light	<p>For areas where borrowed light is used to demonstrate compliance, 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).</p> <p>Examples of borrowed light include: light shelves, clerestory glazing, sun pipes or internal translucent/transparent partitions (such as those using frosted glass).</p>																																																																													

Ref	Terms	Description
CN9	Percentage of assessed area	Where the compliance requirement specifies that a percentage of floor area must be adequately daylit, it refers to the percentage of the total floor area of all the rooms in relevant building areas (cf. CN 2). If, for example, a development has 6 rooms that must be assessed, each 150m ² (total area 900m ²) and 80% of this floor area must meet the criteria, then 720m ² must comply with the criteria; 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 2.1%/2.2% (depending on the latitude) or more (plus meet the other criteria) to achieve the credit.
CN 10	Climate-based daylight illuminance	The climate data in NS3031 shall be used and work hours in compliance with Table 12 should be considered when conducting Climate-Based Daylight Modelling. The same solar shading control strategy and figures as applied in the energy and thermal assessment shall be used as input to the daylight analysis.
CN11	View of sky requirement	To comply with the view of sky criteria (ref (b) in Table 11) 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.
CN12	Relevant building areas: Glare control and view out	For a view out include areas of the building where: <ol style="list-style-type: none"> 1. There are or will be workstations/benches or desks for building users. 2. Close work will be undertaken or where 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: <ol style="list-style-type: none"> 1. Meeting rooms without workstations, conference rooms, lecture theatres, sports halls and also any spaces where the exclusion/limitation of natural light is a functional requirement, e.g. labs, media, etc. For glare control include areas of the building where lighting and resultant glare could be problematic for users, e.g. workstations, projector screens, sports halls.
CN13	Adequate view out	The view out is of a landscape or buildings (rather than just the sky) at seated eye level (1.2 – 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/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.
CN14	Surrounding wall area	Surrounding wall area refers to the area (in m ²) of the internal wall on which the window/opening is located, including the area of the window/opening itself.

Ref	Terms	Description
CN15	Curtains as glare control	<p>Compliant shading measures for meeting glare control criteria include:</p> <ul style="list-style-type: none"> 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. <p>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.</p> <p>Traditional curtains that are drawn from either side of a window and meet in the middle, or that are drawn across the whole window from one side to the other do not meet the criteria for the glare control requirement as the control/design needs to allow a degree of flexibility to still allow sunlight in.. Furthermore, the use of curtains to control glare is likely to cause occupants to rely more on artificial lighting.</p>
CN16	Relevant building areas: Internal and external lighting	<p>Where no external light fittings are specified (either separate from or mounted on the external building façade/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.</p> <p>The following internal areas are excluded from the lighting zone requirements:</p> <ol style="list-style-type: none"> 1. Media and arts production spaces. 2. Sports facilities (exercise spaces only, including hydrotherapy and physiotherapy areas).
CN17	Internal and external lighting: National best practice lighting guides	<p>Lyskultur's "1B lux table and planning criteria for indoor lighting systems" is a guide to "NS-EN 12464-1 Light and lighting - Lighting of workspaces - Part 1: Indoor work places".</p> <p>Lyskultur's "1C lux table and planning criteria for lighting of outdoor work places" is a guide to "NS-EN 12464-2 Light and lighting - Lighting of workspaces – Part 2: Outdoor work places".</p>
CN18	Zones of four workspaces	<p>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/control of lighting to enable a reasonable degree of occupant control over lighting in their personable work area. The lighting consultant/building services engineer should set out how this is to be achieved in such an instance.</p>
CN19	Occupancy/workstation layout unknown	<p>Where occupancy/workstation layout is not known, lighting control can be zoned on the basis of 30m² grids, i.e. an assumption of 1 person/workspace per 10m².</p>
CN20	Small spaces	<p>Buildings consisting entirely of small rooms/spaces (less than 30m²), which do not require any subdivision of lighting zones/control will meet the zoning criteria by default provided each space is switched separately.</p>
CN21	Self contained dwellings: Existing site features	<p>Where existing site features prevent all self contained dwellings from achieving the credit requirements. The credit can still be achieved if evidence provided demonstrates that 90% of the self contained dwellings are able to achieve the compliance requirement.</p>
CN22	Education buildings	<p>Manual lighting controls are easily accessible for the teacher while teaching and on entering or leaving the teaching space.</p>

Evidence

Ref	Design stage	Post-construction stage
Pre-requisite: High frequency lighting		
1	<p>A copy of the specification clause or room data sheets confirming:</p> <ul style="list-style-type: none"> A compliant lighting strategy. 	<p>Assessor's building/site inspection and photographic evidence confirming:</p> <ul style="list-style-type: none"> Installation of high frequency ballast/transformers/divers. <p>OR</p> <p>As-built drawings/specification conforming:</p> <ul style="list-style-type: none"> No changes have occurred since design stage assessment Where changes have occurred, a compliant lighting strategy is installed. <p>OR</p> <p>Formal confirmation of compliance from the supplier(s) or installer of lighting systems</p>
Daylighting		
All	Design drawings and daylight calculations OR relevant section/clauses of the building specification or contract confirming BREEAM requirements.	BREEAM Assessor's site inspection report and photographic evidence AND 'as built' drawings and calculations confirming compliance
View out and glare requirements		
All	Design drawings. Relevant section/clauses of the building specification or contract. Window schedule.	BREEAM Assessor's site inspection report and photographic evidence. 'As-built' drawings. Formal confirmation of compliance from the contractor or design team.
Internal and external lighting		
All	Design drawings and/or room data sheets/schedules. Relevant section/clauses of the building specification or contract OR a letter of formal confirmation of compliance from the relevant design team member.	BREEAM Assessor's site inspection report and photographic evidence. 'As-built' drawings. Formal confirmation of compliance from the contractor or design team.

Additional information

Relevant definitions

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 (Commission Internationale de l'Eclairage) Standard Overcast Sky.

Computer simulation

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

High frequency ballast

High frequency ballast: High frequency ballasts increase the frequency of the power coming from the grid (50Hz) to a frequency optimising the performance of fluorescent lamps, typically around 30kHz. There are several advantages to running fluorescent lamps at higher frequencies. At 30kHz, the frequency of re-ignition of a fluorescent lamp is too quick to be detected by the human eye, therefore reducing visible flicker that some fluorescent lamps running on mains frequency fail to do. Additionally, 30kHz being above the audible range of the human ear, the buzzing noise coming out of low quality main frequency ballasts is avoided. Finally, the luminous efficacy of fluorescent lamps increases with frequency; it can be optimised by up to 10% when they are running at 30kHz compared to those operating at 50Hz.

LED modules that are 230V will be able to flicker during dimming. When dimming LEDs, the most common method is PWM (Pulse Width Modulation), which causes the light to be rapidly switched on and off, i.e. the time the light is actually on is being regulated. If it is not checked that the frequency at which this is occurring is sufficiently high, it will be possible that flickering may be introduced. For further guidance see "Faktaark 07 - Led og flimmer" from Lyskultur.

Pulse-Width Modulation (PWM)

Pulse width modulation (PWM) involves driving LEDs with a modulated voltage. LEDs with PWM should be more than 450 Hz at dimming.

Amplitude Modulation (AM)

Power Reduction / Amplitude Modulation (AM) is another technology used in LED-drivers, and means that the power to the LEDs are reduced to dim down the light. This technique has no flicker at all.

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'.

Public areas

Areas of the building designed for public use (e.g. reception, retail unit, waiting areas).

Separate occupant control

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

Staff areas

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

Uniformity

For daylight in a space, 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).

For electric lighting in a task area, the uniformity is the ratio between the minimum illuminance (from electric light) on the working plane within a task area and the average illuminance (from electric light) on the same task area.

Unified Glare Rating

The Unified Glare Rating is a formula to measure adverse subjective discomfort response to a visual environment containing light sources.

View of sky/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 0.8 m above the floor for offices and for residential buildings.

Open plan office

For open plan offices the working plane calculation should be based on the designed workstation/desk layout. For area/room considerations corridors and communal areas may be excluded.

Checklists and tables

Table 10: Minimum window/opening size required as a percentage of surrounding wall area depending on the distance of the desk or work space to the window/opening

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

Table 11: Daylighting uniformity criteria

Area type	Applicable criteria
Non-residential buildings - Occupied spaces (unless indicated below)	EITHER (a) OR {(b) and (c)} below
Residential buildings - Kitchen	EITHER (a) OR (c) below
Residential buildings - Living rooms, dining rooms, studies (inc home office)	
Retail buildings - Sales areas	No additional criteria
<p>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 assessment criterion 2a. 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 assessment criterion 2a</p> <p>b. At least 80% of the room has a view of sky from desk or table top height (0.8m in occupied spaces and in residential buildings).</p> <p>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.</p> <p>Note: Table 13 gives maximum room depths in metres for different room widths and window head heights of sidelit rooms.</p>	

Table 12: Minimum values of climate-based daylight illuminance required - Both criteria (average illuminance and minimum point illuminance) should be met.

Space type	Area	Average daylight illuminance (averaged over entire space)	Minimum daylight illuminance at worst lit point
Non-residential buildings - Occupied spaces (unless indicated below)	≥ 80%	At least 300 lux during 50 % of the work hours throughout the year between 8:00 am and 4 pm	At least 60 lux during 80 % of the work hours throughout the year between 8:00 am and 4 pm
Residential buildings - Kitchen	100%	At least 100 lux for 50 % of the time throughout the year between 9:00 am and 9:00 pm	At least 30 lux for 80 % of the time throughout the year between 9:00 am and 9:00 pm.
Residential buildings - Living rooms, dining rooms, studies (inc home office)		At least 75 lux for 50 % of the time throughout the year between 9:00 am and 9:00 pm.	At least 22.5 lux for 80 % of the time throughout the year between 9:00 am and 9:00 pm.
Retail buildings - Sales areas	≥ 35%	At least 35% of space has a point daylight factor of at least 300 lux during 50 % of the work hours throughout the year between 8:00 am and 4 pm.	

Table 13: Reflectance for maximum room depths and window head heights - gives maximum room depths in metres for different room widths and window head heights of sidelit rooms.

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

Calculation procedures

None.

Other information

The following references provide information relating to this issue:

1. CIBSE Lighting Guide 10 Daylighting and window design.
2. Sintef Byggforsk 421.621 Metoder for distribusjon av dagslys I bygninger
3. Sintef Byggforsk 421.626 Beregning av gjennomsnittlig dagslysfaktor og glassareal
4. BRE Report BR 209 Site Layout Guide 'Site layout planning for daylight and sunlight: a guide to good practice'.
5. "Dagslys i rum og bygninger" SB i vejledning 219.
6. Lyskultur publikasjon 1B, Luxtabell og planleggingskriterier for innendørs belysningsanlegg
7. Lyskultur publikasjon 21/98 Dagslys i bygninger - Prosjekteringsveiledning

Hea 02 Indoor air quality

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
7 (Building type dependent)	-	-	2*	3**	3**

*Criteria 1+7

**Criteria 1+9

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 three parts:

- Minimising sources of air pollution (4 credits)
- Potential for natural ventilation (1 credit)
- Laboratory fume cupboard and containment areas (2).

The following is required to demonstrate compliance for:

Minimising sources of air pollution

One credit - Indoor air quality (IAQ) plan and ventilation (see appendix G for guidance)

1. 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 (Step 3-4), construction (Step 5) and occupation (Step 6) of the building. The indoor air quality plan must consider the following:
 - a. Removal of contaminant sources
 - b. Dilution and control of contaminant sources
 - c. Procedures for pre-occupancy flush out
 - d. Third party testing and analysis
 - e. Maintaining indoor air quality in-use

As a minimum, the indoor air quality plan shall cover and facilitate compliance with the following requirements:

- Procedures have been established for clean and tidy building process according to recommendations given in Sintef Building Research Design Guide 501.107
- The quality of cleaning upon the delivery of the building is documented and fulfills at least quality level 4 in Sintef Building Research Design Guide 501.108 and NS-EN-INSTA-800.
- Mineral fibre products and other products with small fibres, are sealed, shaped or built-in to eliminate and prevent emission of fibres to the indoor air. Polluting activities and processes are encapsuled, equipped with local exhaust or take place in premises with suitable separate ventilation.

One credit - Ventilation

The building has been designed to minimise the concentration and recirculation of pollutants in the building as follows:

2. Criterion 1 has been achieved.
3. The location of fresh air intakes are designed to minimise the entry of air pollutants into the building, as follows:
 - a. In air-conditioned and mixed-mode buildings or spaces:

3.a.i 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 Annex A2 (see CN3 for alternative methods of compliance).

OR

3.a.ii Where EN 13779:2007 Annex A2 is not followed, the building's air intakes and exhausts are over 10m of horizontal distance apart and intakes are over 10m of horizontal distance from sources of external pollution.

The positioning and design of air intakes and exhausts are according to recommendations given in Sintef Building Research Design Guide 552.360 in order to reduce the risk of moisture permeation and other pollution.

- b. In naturally ventilated buildings or spaces: openable windows or ventilators are at least 10m of horizontal distance from sources of external pollution (including the location of any building related air exhausts).
4. Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution entering the building, as defined in EN 13779:2007 Annex A3.
 5. Areas of the building subject to large and unpredictable or variable occupancy patterns have carbon dioxide (CO₂) or air quality sensors specified and:
 - a. In mechanically ventilated buildings or spaces: sensors are linked to the mechanical ventilation system and provide demand-controlled ventilation to the space.
 - b. In naturally ventilated buildings or spaces: sensors either have the ability to alert the building owner or manager when CO₂ 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.

Volatile organic compound (VOC) emission levels (products)

One credit

6. Criterion 1 is achieved.
7. The manufacturer(s) confirms that six of the product categories (A-J) in Table 14, including decorative paints and varnishes, have complied with the requirements also listed in Table 14.
Where five or less product categories are specified within the building all must meet the requirements in order to achieve this credit.

OR

Two credits

8. Criterion 1 is achieved.
9. The manufacturer(s) confirms that eight of the product categories (A-J) in Table 14, including decorative paints and varnishes, have complied with the requirements also listed in Table 14. Where seven or less product categories are specified within the building all must meet the requirements in order to achieve this credit.

Potential for natural ventilation

One credit

10. Occupied spaces of the building are designed to be capable of providing fresh air entirely via a natural ventilation strategy, demonstrated via either of the following:
 - a. 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
 - b. The design demonstrates (by calculation, using a ventilation design tool) that the natural ventilation strategy provides adequate cross flow of air to maintain required thermal comfort conditions and ventilation rates.
11. For a strategy which does not rely on openable windows, or which has occupied spaces with a plan depth greater than 15m, the design must demonstrate that the ventilation strategy can provide adequate cross flow of air to maintain the required thermal comfort conditions and ventilation rates.
12. 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, as follows:
 - a. Higher level: higher rates of ventilation achievable to remove short-term odours and/or prevent summertime overheating.
 - b. 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.
13. Any opening mechanisms must be easily accessible and provide adequate user-control over air flow rates to avoid draughts.
14. 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.

15. Residential buildings 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.

Laboratory Facilities - safe containment and removal of pollutants

One credit - Laboratory containment devices and containment areas

16. An objective risk assessment of the proposed laboratory facilities has been carried out during the preparation of the initial project brief (Step 3) to ensure potential risks are considered in the design of the laboratory.
17. Where containment devices are specified, their manufacture and installation is carried out in accordance with specified standards for safety and performance requirements in laboratory containment devices. These include:
 - a. General purpose fume cupboards in accordance with NS-EN 14175 1-7:2012 and with front speed as described in CN17.
 - b. Recirculatory filtration fume cupboards in accordance with best practice BS 7989:2001 or other best practice considered relevant.
 - c. Microbiological safety cabinets in accordance with NS-EN 12469:2000.
 - d. Clean air hoods, glove boxes, isolators and mini-environments in accordance with NS-EN ISO 14644-2:2000.
 - e. Articulated extraction arms in accordance with Ventøkblad 2.16 Punktav sug.
18. Where laboratory containment devices that are ducted to discharge externally are specified, national best practice guidance must be followed to ensure an appropriate discharge velocity is achieved.

One credit - Buildings with Containment Level 2 and 3 laboratory facilities

19. Criterion 16 is achieved.
20. Ventilation systems are designed in compliance with regulations concerning design and organization of workplaces and work premises.
21. Hepa filters for all areas designated as Containment Level 2 and 3 are located outside the main laboratory space for decontamination and replacement. The filters are easily accessible for maintenance staff/technicians. Pre filters may be placed within the containment zone.
22. The design team demonstrate that the individual laboratory containment device location and stack heights have been considered in accordance with NS-EN 12128:1998.

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM issue;

23. Criteria 6 and 7 are achieved.
24. Formaldehyde concentration level is measured post construction (but pre-occupancy) (End Step 5) and is found to be less than or equal to 100 µg/m³ averaged over 30 minutes (WHO guidelines for indoor air quality: selected pollutants, World Health Organization, 2010).
25. The total volatile organic compound (TVOC) concentration is measured post construction (but pre-occupancy) (End Step 5) and found to be less than 300 µg/m³ over 8 hours.
26. Where levels are found to exceed these limits, the project team confirms the measures that have, or will be undertaken to reduce the TVOC and formaldehyde levels to within the above limits.
27. The testing and measurement of the above pollutants are in accordance with the following standards where relevant:
 - a. ISO 16000-4:2011 Diffusive sampling of formaldehyde in air.
 - b. ISO 16000-6:2011 VOCs in air by active sampling.
 - c. EN ISO 16017-2:2003 VOCs – Indoor, ambient and workplace air by passive sampling.
 - d. ISO 16000-3:2011 formaldehyde and other carbonyls in air by pumped sampling.
28. The measured concentration levels of formaldehyde (µg/m³) and TVOC (µg/m³) are reported, via the BREEAM scoring and reporting tool, for the purpose of confirming criteria 25 to 27.

Compliance notes

Ref	Terms	Description
General		
CN1	Shell and core	<p>Minimising sources of air pollution: compliance for criterion 5 in shell and core buildings/areas can be demonstrated via one of the means below.</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – N/A 3. Option 3 – Developer/Tenant collaboration (full value of available credits) The use of shell and core options 1 or 3 are only allowable where: <ol style="list-style-type: none"> a. The shell and core build accommodates the scope for the specification of air quality sensors by future tenants, i.e. connections to mechanical ventilation systems, window/roof vent controls, etc. are present in the shell and core plans. b. It is practical and technically feasible for the tenant to specify and install the equipment in compliance with the BREEAM criteria. c. The compliant equipment will be installed and commissioned prior to occupation of the building. <p>VOC: compliance in shell and core buildings/areas can be demonstrated via one of the means below.</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN2	National best practice standards / relevant industry standards	<p>Building details 501.107 Clean, dry and tidy building processes. Building details 501.108 Cleaning during the building period. Building details 700.207 Monitoring of cleaning and cleaning quality. Building details 700.211 Planning for cleaning. NS-INSTA 800:2010 Cleaning quality – System for establishing and assessing cleaning quality</p> <p>Guidelines to building codes (VTEK). NS-EN 14175 1-7:2012 Fume cupboards. Part 1-7 NS-EN 12469:2000 Biotechnology - Performance criteria for microbiological safety cabinets. NS- EN ISO 14644-2:2000 Cleanrooms and associated controlled environments - Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1. Ventøkblad Protective ventilation 2.16 Punktavsug. Regulations concerning design and organization of workplaces and work premises. NS-EN 12128:1998 Biotechnology - Laboratories for research, development and analysis - Containment levels of microbiology laboratories, areas of risk, premises and physical safety requirements.</p>

Ref	Terms	Description
CN3	Alternative methods for demonstrating compliance with the air intake and exhaust criteria	<p>Compliance with the criteria can be demonstrated using alternative methods (e.g. wind tunnel studies, computational fluid dynamics (CFD) modelling), if such methods demonstrate that the proposed location of intakes and exhausts prevents significant recirculation of exhaust air under typical wind conditions.</p> <p>High velocity exhaust stack (jet cowl) with a diameter between 0.5 meter and 1 meter of exhaust opening, meeting the following criteria is pre-accepted (see Additional information):</p> <ol style="list-style-type: none"> 1. Direct exhaust flow upwards directed. 2. Average exhaust velocity of 5 m/s or more over the stack opening (minimum velocity for VAV systems). 3. A minimum of 0.4 meters vertical distance between the exhaust opening and upper part of the air intake. <p>OR</p> <p>Systems that according to a Computational Fluid Dynamics analysis has a yearly average recirculation rate of less than 1 % (according to Building Details 552.360). The wind statistics for the site must be applied in the calculation.</p>
CN4	Industrial areas or retail areas: air pollution/ventilation rate requirements	For industrial buildings (and retail) the “minimising sources of air pollution” and “potential for natural ventilation” requirements and credits apply only to office areas and not operational areas (as rates for operational areas are very dependent on the process housed in these areas). If the building does not contain any office areas, this issue is not applicable.
Minimising sources of air pollution - IAQ plan and ventilation		
CN5	Filters	It should be noted that filters fitted on the air supply are not considered by BREEAM to provide adequate protection from sources of external pollution. As such the distance criteria cannot be relaxed where filters are specified.
CN7	Areas with a large and unpredictable occupancy	<p>The following areas are examples of relevant spaces met by this definition:</p> <ol style="list-style-type: none"> 1. Auditoria 2. Gyms 3. Retail stores/malls 4. Waiting rooms 5. Canteens 6. Class rooms 7. Meeting rooms <p>Where the assessed building does not have any areas deemed to be large with an unpredictable pattern of occupancy, the criterion does not apply.</p>
Minimising sources of air pollution - Volatile organic compounds emission levels		
CN8	Furnishings	<p>The scope of the VOC credits does not extend to furnishings, e.g. desks/shelving, it focuses on the key internal finishes and fittings integrated to the building.</p> <p>Kitchen and bathroom fittings like cabinets and countertops need to be included in the assessment because they are typically specified by the client for installation during construction. They help define how the areas are used, so they are key fittings and are not considered furnishings.</p>
CN9	Where finishes are not provided	Where paints and varnishes are not being specified/provided, the criteria do not apply to these items.

Ref	Terms	Description
CN10	Products with no formaldehyde containing materials	<p>For some floor coverings and wood based panels, the requirement for formaldehyde testing (referred to in the above criteria) does not apply to products to which no formaldehyde-containing materials were added during production or post- production processing.</p> <p>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/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), therefore, evidence confirming the actual emission level(s) via testing will not be required by the Assessor to demonstrate compliance with that particular requirement.</p>
CN11	Documentation alternatives	<p>The required emissions levels from the different product groups are functional requirements, and can be documented in several ways. The following are approved as documentation where applicable:</p> <ul style="list-style-type: none"> - M1 - GEV Emicode EC1 and EC1 Plus - GUT - SINTEF Technical approval - Verified EPD (If the EPD includes information of indoor air emissions compliant with the required levels in BREEAM-NOR Hea 02) - Nordic Ecolabel "Svanen" (if the ecolabel criteria for the product groups are compliant with the required levels and test methods in BREEAM-NOR Hea 02 – such as e.g. for flooring products other than linoleum) - Green Ecoproduct - A self declaration from the manufacturer confirming that the product has been tested according to the relevant standards described in Checklists and tables
CN11.1	Scope of product assessment for VOCs	<p>For the purpose of this Issue, this covers any product installed or applied inside of the inner surface of the building's infiltration, vapour or waterproof membrane or, where not present, inside of the inner surface of the building envelope's interior facing thermal insulation layer.</p> <p>Only products that are installed or applied in parts of the building where their emissions are likely to affect indoor air quality need to be assessed.</p>
Potential for natural ventilation		
CN12	Openable window area	<p>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 (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).</p>

Ref	Terms	Description
CN13	Mechanically ventilated/cooled buildings	Buildings that employ a mechanically ventilated/cooled strategy are still able to achieve this credit, provided it can be demonstrated that compliance with all of the relevant 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. maximum occupancy and/or peak temperature conditions) due to the function/specific usage patterns of the building, the potential for natural ventilation credit can still be awarded provided design team calculations/modelling demonstrate that the mechanical ventilation system will be required for less than (or equal to) 5% of the annual occupied hours in the occupied space(s) for the adopted building design/layout.
CN14	Spaces requiring local exhaust ventilation	Occupied spaces requiring local exhaust ventilation, e.g. labs, workshops, food technology rooms, must still demonstrate that they meet the criteria for potential for natural ventilation (unless listed below).
CN15	Excluded occupied spaces for the potential for natural ventilation criteria	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: <ol style="list-style-type: none"> 1. Ancillary building areas, e.g. WCs corridors, stairwells, store rooms, plant rooms. 2. Swimming/hydrotherapy pools. 3. Catering and small staff and professional kitchens. 4. Washrooms/changing areas. 5. Laboratory or other area where strictly controlled environmental conditions are a functional requirement of the space. 6. Operational, shop floor or ancillary areas in industrial buildings.
Laboratory fume cupboards and containment areas		
CN16	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.
CN17	Front speed	The fume cupboard should have an average face velocity that is equal to 0,5 m/s. If a front speed lower than this is chosen, a risk assessment must be carried out with respect to operator safety.

Evidence

Ref	Design stage	Post-construction stage
Minimising indoor air pollution		
1-5	<p>Copy of the indoor air quality plan including a control plan with procedures for clean, dry building processes and cleaning quality. Relevant section/clauses of the building specification or contract Design drawings.</p> <p>Drawings or specifications that confirm that:</p> <ul style="list-style-type: none"> • Mineral fibre products and similar are designed or built-in to secure that emission of fibres to the air in the room is prevented. • Polluting activities and processes are encapsuled, equipped with local exhaust hoods or take place in premises with suitable separate ventilation. 	<p>Copy of the indoor air quality plan and a completely filled in control plan/checklist that documents fulfilment of criteria for clean, dry building processes and cleaning quality. BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As-built' drawings.</p> <p>Assessor's inspection report and as built drawings that confirm that:</p> <ul style="list-style-type: none"> • Mineral fibre products and similar are shaped or built-in to prevent emission of fibres to the room air. • Polluting activities and processes are encapsuled, equipped with local exhaust hoods or take place in premises with suitable separate ventilation. <p>For a naturally ventilated building, a letter from the design team or principal contractor confirming the building has been built in accordance with a design compliant with the BREEAM criteria. For a mechanically ventilated building, the commissioning manager's performance testing report confirming the required fresh air rates are achieved.</p> <p>Assessor's building/site inspection and as built drawings confirming:</p> <ul style="list-style-type: none"> • Installation of air quality sensors. • The sensors boost ventilation when set points are triggered
7-9	<p>Copy of the indoor air quality plan. Relevant section/clauses of the building specification or contract.</p>	<p>Copy of the indoor air quality plan. Letter from or copies of the manufacturer's literature confirming testing standards and emissions achieved.</p>

Ref	Design stage	Post-construction stage
Potential for natural ventilation		
10-15	Relevant section/clauses of the building specification or contract. Formal letter from the design team with details of the ventilation strategy and calculations/results from appropriate software modelling tool(s).	Manufacturers'/suppliers' literature. BREEAM Assessor's site inspection report and photographic evidence* AND/OR 'As-built' drawings, specification and calculations OR A formal letter from the design team or principal contractor confirming no changes have occurred since design stage. * A random spot check of a selection of occupied spaces is sufficient. The assessor is not required to check each opening in all spaces/rooms.
Laboratories and containment areas		
16-22	A copy of the proposed laboratory facilities risk assessment. Relevant section/clauses of the building specification or contract AND/OR a formal letter from the design team Design drawings	BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings. Correspondence from the design team confirming installation of a compliant system(s). A copy of the manufacturers' or suppliers' literature or a letter from these parties confirming their cupboards/cabinets are manufactured and installed in accordance with the relevant standards.
Formaldehyde concentration		
23-28	Copy of the indoor air quality plan. Commitment to carry out necessary testing post construction.	Copy of the indoor air quality plan. Confirmation from the project team that the recommendations are still relevant/have been implemented Testing results for formaldehyde, VOCs and TVOC.

Additional information

Relevant definitions

Containment levels

Containment Levels 2 and 3 are defined in NS-EN 12128

Cross flow

Cross-ventilation requires a continuous airflow path. Open-plan layouts are ideal, but where spaces are subdivided, rooms must be designed to allow airflow in and out, between rooms and through occupied areas.

Fume cupboard/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.

Habitable or occupied room (Hea 02 Indoor air quality)

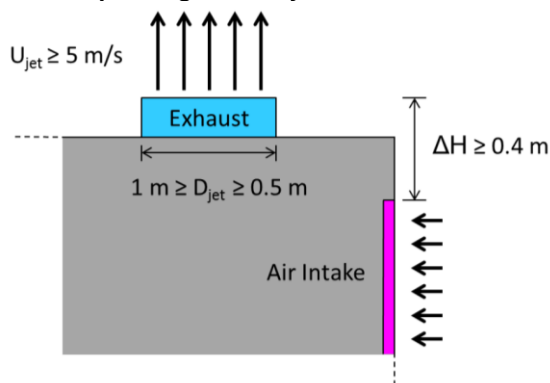
A room used for dwelling purposes or a room in a non dwelling occupied by people (e.g. office, hotel bedroom, classroom) but which is not used solely as a kitchen, bathroom, cellar, utility room or for storing plant/equipment.⁵

Mixed mode

This describes an integrated approach to providing ventilation using both natural and mechanical systems.

Occupied space

Refer to Relevant definitions

Pre accepted high velocity exhaust stack**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.

There is much guidance on producing risk assessments fit for the purpose of specific laboratory applications. There is no requirement within BREEAM to use specific guidance; however, it should be appropriate to the application of the laboratory facilities.

Ventilation design tools

Any of the following design tools can be used to demonstrate compliance, different tools being more suited to different stages in the development of the design. Envelope flow models are the simplest tool and are recommended for the initial sizing of openings at the chosen design conditions. The other tools provide more detailed information and are usually more suited to later stages in the design:

- | Envelope flow models
- | Computational fluid dynamics (CFD)
- | Combined thermal and ventilation models
- | Physical scale models.

Volatile Organic Compound (VOC)

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

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.

⁵ Approved Document F, Means of Ventilation, HM Government, 2010

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.

Checklists and tables

Table 14: VOC criteria by product type

Ref	Product	Requirements	Y/N
A	Paints and varnishes applied at site		
	Performance requirements	<p>1. VOC content limit value:</p> <p>Interior paints and varnishes applied on site, and defined as category a,b,d,e,g,h,i, j, k or l according to directive 2004/42/CE, Annex I, shall fulfill corresponding maximum VOC content limit values as defined in Annex II/A.</p> <p>2. VOC emission limits:</p> <p>Interior paints and varnishes for walls, floors and ceilings applied on site and defined as category a,b,i or j according to directive 2004/42/CE, Annex, shall comply with the emission limits for the relevant surface in table 15.</p> <p>Certifications like M1, EC 1, SINTEF Technical Approval with declaration of degassing are accepted as documentation</p>	
	Compliant performance standard	<p>1. EU Directive 2004/42/CE</p> <p>2. NS EN 15251:2007, Annex C</p>	
	Compliant testing standard	<p>1. ISO 11890-2:2013 – Paints and varnishes – Determination of VOC content, Part 2 – Gas Chromatographic method</p> <p>2. ISO 16000-9 (or ISO 16000-10) in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde)</p>	
	Manufacturer must also confirm with technical datasheet, maintenance documentation or by declaration.	Paint must be fungal and algal resistant in wet areas e.g. bathrooms, kitchens, utility rooms	
B	Wood panels (including particle board, fibreboard including MDF, OSB, cement bonded particle board, plywood, solid wood panel and acoustic board) according to EN 13986:2004 (Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking)		
	Performance requirements	<p>1. Formaldehyde E1 level or compliance with the emission limits in table 15 (wall)</p> <p>2. TVOC and Carcinogenic contents: table 15 (wall)</p>	

Ref	Product	Requirements	Y/N
	Compliant testing standard(s)	1. EN 717-1:2004 Wood based panels – Determination of formaldehyde release by chamber method. EN 717-2:1994 EN 120:1992 2. ISO 16000-9 in combination with ISO 16000-6 (VOC) Testing and calculation must be carried out according to EN 16516 Certifications like M1, Nordic Ecolabel (Svanen), SINTEF Technical Approval with declaration of degassing and ECOproduct level 2 (green) for indoor emissions are accepted as documentation.	
	Manufacturer also to confirm	The absence of regulated wood preservatives.	
C	Timber structures () according to EN 14080:2013 (Timber structures. Glued laminated timber and glued solid timber)		
	Performance requirements	As B above	
D	Wood flooring e.g. parquet according to EN 14342:2013 (Wood flooring. Characteristics, evaluation of conformity and marking)		
	Performance requirements	Emission limits for all products except untreated solid wood flooring: table 15 (floor). Certifications like M1 are accepted as documentation.	
	Compliant performance standard	NS EN 15251:2007, Annex C	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer also to confirm	The absence of regulated wood preservatives.	

Ref	Product	Requirements	Y/N
E	Resilient textile and laminated floor coverings (e.g. vinyl, linoleum, cork, rubber, carpet, laminated wood flooring) according to EN 14041:2004 (Resilient (semi hard), textile and laminate floor coverings. Essential characteristics)		
	Performance requirements	Emission limits: table 15 (floor). Certifications like M1, Gut, SINTEF Technical Approval with declaration of degassing are accepted as documentation. Nordic Ecolabel (Swan) are accepted, except for wood or linoleum flooring.	
	Compliant performance standard	NS EN 15251:2007, Annex C	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer also to confirm	None	
F	Suspended ceiling tiles according to EN 13964:2014 (Suspended ceilings. Requirements and test methods)		
	Performance requirements	Emission limits: table 15 (ceiling) Certifications like M1, SINTEF Technical Approval with declaration of degassing are accepted as documentation.	
	Compliant performance standard	NS EN 15251:2007, Annex C	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer also to confirm	None	
G	Flooring adhesives		
	Performance requirements	Emission limits: table 15 (floor) Certifications like M1, EC 1, Nordic Ecolabel (Swan) are accepted as documentation.	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer to confirm	Not relevant	

Ref	Product	Requirements	Y/N
H	Wall coverings according to EN 15102:2007 (Decorative wall coverings. Roll and panel form)		
	Performance requirements	<ol style="list-style-type: none"> 1. Emission limits: table 15 (wall) Certifications like M1, EC 1, SINTEF Technical Approval with declaration of degassing are accepted as documentation. 2. Migration of heavy metals, VCM and formaldehyde: " <ul style="list-style-type: none"> Vinyl chloride monomer (VCM): Pass (content < 0,2 mg/kg). Formaldehyde level < Pass (content < 120mg/kg) Migration of heavy metals < Table 2 (EN 15102:2007) Antimony – no upper limit Arsenic 25 mg/kg Barium 500 mg/kg Cadmium 25 mg/kg Chromium 60 mg/kg Lead 90 mg/kg Mercury 20 mg/kg Selenium 165 mg/kg 	
	Compliant performance standard	<ol style="list-style-type: none"> 1. NS-EN 15251: 2007, Annex C 2. <ul style="list-style-type: none"> - EN 233:1999, Section 5.7 - Finished wall papers - EN 233:1999, Section 5.7 - Wall vinyls and plastic wall covering - EN234:1997, Section 9.0 - Wall papers for subsequent decoration EN259-1:2001, Section 4.5 – 4.7- Heavy duty wall coverings	
	Compliant testing standard	<ol style="list-style-type: none"> 1. ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516 2. EN 12149:1998 – Wallcoverings in roll form. Determination of migration of heavy metals and certain other elements, of vinyl chloride monomer and of formaldehyde release - Test A Heavy metals, Test B Vinyl chloride monomer, Test C Formaldehyde. 	
	Manufacturer also to confirm	Not relevant	

Ref	Product	Requirements	Y/N
I	Sealants like elastic or plastic sealants bases on polyurethane, silicone, MS, acrylic or other		
	Performance requirements	Emission limits: table 15 (sealants) Certifications like M1, EC 1 Plus are accepted as documentation	
	Compliant performance standards	NS EN 15251:2007, Annex C GEV Emicode	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer to confirm	Not relevant.	
J	Flooring products according to EN 13813 (Screed material and floor screeds. Screed material. Properties and requirements)		
	Performance requirements	Emission limits: table 15 (floor) Certifications like M1, EC 1 and SINTEF Technical Approval with declaration of degassing are accepted as documentation.	
	Compliant performance standard	NS EN 15251:2007, Annex C	
	Compliant testing standard	ISO 16000-9 in combination with ISO 16000-6 (VOC) ISO 16000-3 (Formaldehyde) Testing and calculation shall be carried out according to EN 16516	
	Manufacturer also to confirm	Not relevant.	

Table 15: Emission limits for all product categories – Conversion table

Ref	Wall		Floor/ceiling		Sealants	
	$\mu\text{g}/\text{m}^2\text{h}$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^2\text{h}$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^2\text{h}$	$\mu\text{g}/\text{m}^3$
TVOC 28d	200	417	200	160	4260	60
Formaldehyde 3d*	24	50	62,5	50	3550	50
Formaldehyde 28d*	50	104	50	40	710	10
Carcinogenic	5	10	5	4	71	1

*The emission limits for 3 OR 28 days can be used for showing compliance.

Calculation procedures

None.

Other information

Post construction indoor air quality testing and measurement

The measurement of formaldehyde and TVOC must be made in accordance with the relevant standards (as listed in the criteria). ISO 16000-2 [III] and ISO 16000-5 [V] provide guidance on sampling strategies for formaldehyde and VOCs respectively. Sampling should be performed in rooms that will be occupied for long periods of time such as bedrooms, living rooms, classrooms, offices, etc. A representative number of rooms should be sampled, rather than every room in the building. For example, in an office building, sampling of one cellular or single occupancy office should suffice to assess the indoor air quality for that type of habitable space in the building (assuming the other cellular offices have the same materials specification and ventilation strategy). In larger rooms, such as open-plan office areas, additional sampling locations may be required in order to understand the homogeneity of the indoor environment. Uncertainties in sampling and analysis are inevitable and unavoidable, therefore it is recommended that replicate samples are taken at each sampling location (ideally a minimum of three samples for each measurement parameter). Before sampling, naturally ventilated rooms should be intensively ventilated for 15 minutes and then outer doors and windows closed for at least 8 hours (e.g. overnight) before sampling begins with the room still closed off. For mechanically ventilated rooms, the ventilation system should be running under standard operating conditions for at least for 3 hours before sampling begins. Sampling locations should be at least 1 m to 2 m from a wall and at a height of between 1 m to 1.5 m.

This information is provided to assist project teams and BREEAM Assessors on the appropriate scope of post-construction indoor air quality measurement, and, as such, is intended as guidance only and not a compliance requirement. The sampling strategy should be determined based on the advice of the appropriate person appointed to conduct the testing.

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. Inside Europe the emissions of VOCs from paints and varnishes are regulated by the Directive 2004/42/CE, implemented in the Norwegian Product Regulations § 2 – 24 and § 2 – 25 incl. Annex VII.

Hea 03 Thermal comfort

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

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 for:

First credit

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) or PPD (predicted percentage of dissatisfied) indices in accordance with NS-EN ISO 7730:2005 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 NS-EN ISO 7730:2005, with no areas falling within the levels defined as representing local dissatisfaction⁶.
3. Thermal comfort levels in occupied spaces meet the Category B requirements set out in Table A.1 of Annex A of NS-EN ISO 7730:2005.
4. The PMV or PPD indices are reported, via the BREEAM scoring and reporting tool, based on the modelling/measurement above.

Second credit

5. Criteria 1 to 4 are achieved.
6. A thermal modelling analysis has informed the temperature control strategy for the building and its users. The software used to carry out the simulation at the detailed design stage (Step 4) provides full dynamic thermal analysis.
7. The strategy for proposed heating/cooling system(s) demonstrates that it has addressed the following:
 - a. Zones within the building and how the building services could efficiently and appropriately heat or cool these areas, e.g. consider the different requirements for the central core of a building compared with the external perimeter adjacent to the windows
 - b. The amount of occupant control required for these zones, based on discussions with the end user (or alternatively building type/use specific design guidance, case studies, feedback) and considers:
 - i. User knowledge of building services
 - ii. Occupancy type, patterns and room functions (and therefore appropriate level of control required)
 - iii. How the user is likely to operate/interact with the system(s), e.g. are they likely to open windows, access thermographic radiator valves (TRV's) on radiators, change air conditioning settings etc.
 - iv. The user expectations (e.g. this may differ in the summer and winter; users tend to accept warmer internal conditions in the summer) and degree of individual control (i.e. obtaining the balance between occupant preferences, for example, some occupants like fresh air and others dislike drafts)

⁶ Thermal dissatisfaction: with reference to table A1 in NS-EN ISO 7730:2005 thermal dissatisfaction means both thermal state of the body as a whole and local discomfort.

- c. How the proposed systems will interact with each other (where there is more than one system) and how this may affect the building occupants thermal comfort
- d. The need or otherwise for an accessible building user actuated manual override for any automatic systems.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>For all credits within this issue, compliance with this BREEAM issue can be demonstrated via one of the following means in shell and core buildings/areas:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p> <p>Thermal modelling completed on the basis of a notional layout will also be acceptable.</p>
CN2	Buildings with less complex heating/cooling systems	<p>For buildings with less complex heating/cooling systems the thermal comfort strategy need only consider 7a and b above.</p> <p>Compliance can be demonstrated where zoning allows separate occupant control (within the occupied space) of each perimeter area (i.e. within 7 m of each external wall) and the central zone (i.e. over 7 m from the external walls), e.g. 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.</p> <p>Note: The distance requirement for smaller buildings is approximate; however, the assessor must use good judgement considering fully the aims of this issue, before accepting solutions that do not strictly meet the above criteria.</p> <p>Examples of potentially compliant heating control measures can be found in Technology Guide CTG002 Heating control.</p>
CN3	Industrial unit with no office space	Where an industrial unit contains no office space and only an operational/storage area, this BREEAM issue does not apply.
CN4	Alternative to criterion 3.	<p>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 NS-EN 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. PMV and PPD is still required 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.</p>
CN5	National standards and guidance	<p>NS-EN 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 (ISO 7730:2005)</p> <p>Guidance for thermal calculations: NS-EN 15251:2007+NA:2014 Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.</p>
CN 6	Education: Occupant controls.	In this issue, occupant controls are intended to be for staff use only.

Evidence

Ref	Design stage	Post-construction stage
1 – 5	Relevant section/clauses of the building specification or contract or correspondence (e.g. letter, email or meeting minutes) from the design team. Thermal modelling/measurement and evaluation results with confirmation these are within the required limits. PMV/PPD data from the design team.	Thermal modelling/measurement and evaluation results reflecting any changes to the design and resultant PMV/PPD data with confirmation these are within the required limits.
6 – 7	Thermal comfort strategy and software results highlighting the points that have been considered and decisions taken accordingly. Confirmation that the modelling software is BREEAM compliant. Relevant section/clauses of the building specification or contract. Design drawings.	As design stage. BREEAM Assessor's site inspection report and photographic evidence.* *For large buildings it would not be expected that the assessor checks every individual occupied space, but a random selection of spaces that confirm compliance.

Additional information

Relevant definitions

Occupied space

Refer to HEA 01 Visual comfort definitions however, for the purpose of BREEAM issue Hea 03 the definition excludes the following:

1. Atria/concourses
2. Entrance halls/reception areas
3. Ancillary space, e.g. circulation areas, storerooms, and plantrooms.

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 NS-EN 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'.

Separate occupant control

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

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/cooling loads, overheating risks and control strategies to be assessed.

Checklists and tables

None.

Calculation procedures

None.

Other information

Thermal comfort is defined in NS-EN ISO 7730 as '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 therefore 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.

Table 16: Seven point thermal sensation scale for PMV

Scale	Description
+3	Hot
+2	Warm
+1	Slightly warm
0	Neutral
-1	Slightly cool
-2	Cool
-3	Cold

Hea 04 Microbial contamination

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To minimise the risk of water contamination in building services and ensure the provision of clean, fresh sources of water for building users.

Assessment criteria

The following is required to demonstrate compliance for:

Building services water systems: minimising risk of contamination

One credit

1. All water systems in the building are designed in compliance with the measures outlined in the relevant national health and safety best practice guides/regulations to minimise the risk of microbial contamination, e.g. legionella.
2. Where humidification is required, a failsafe humidification system is provided.

Compliance notes

Ref	Terms	Description
CN1	National health and safety best practice guides	National guidelines for prevention of legionella are issued by the Norwegian Institute of Public Health: www.fhi.no . Vannrapport 123: Forebygging av legionellasmitte – en veiledning
CN2	Failsafe humidification system	A failsafe humidification system is one where failure of the system that sterilises the water vapour results in the entire humidification system initiating a shut down. This shut down, therefore, avoids any risk of building users being exposed to untreated and potentially contaminated water until the systems failure is corrected. Steam humidification is an example of a failsafe system.
CN3	New build extensions to existing buildings	If the new build extension and existing building will share the same services/water systems, then the existing systems must be assessed against the criteria regardless of whether the existing building forms a part of the assessment or not. If the extension is served by independent systems, only these need be assessed against the Assessment criteria. If it is the intention that building users of the new extension will use water systems in the existing building, then it must be confirmed that the existing systems comply with the criteria.

Ref	Terms	Description
CN4	Shell and core	Compliance with this BREEAM issue in shell and core buildings can be demonstrated via one of the following means in shell and core buildings/areas: <ol style="list-style-type: none"> Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) Option 3 – Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options.
CN5	Microbial contamination and the Assessor's reporting responsibility	The BREEAM Assessor is not required to confirm that the design is compliant with the relevant standard(s); this is the responsibility of the design team. The assessor is simply required to record, for the purposes of validation, whether or not the design team confirms it has complied.

Evidence

Req	Design stage	Post-construction stage
1-2	<p>Relevant section/clauses of the building specification or contract.</p> <p>OR</p> <p>Letter from the contractor(s) that confirms that the building's water systems will be compliant with the recommendations</p> <p>AND</p> <p>A description of the measures that will be taken.</p>	<p>A formal letter of declaration from the design team, relevant contractor(s) or installer of the relevant systems confirming compliance.</p> <p>AND</p> <p>A description of the measures taken</p> <p>BREEAM Assessor's site inspection report and photographic evidence AND/OR "As built" drawings.</p>

Additional information

Relevant definitions

Water systems

For the purpose of this issue, this refers to:

- Cooling towers
- Evaporative condenser
- Domestic hot and cold water systems
- Other plant and systems containing water which is likely to exceed 20°C and which may release a spray or aerosol during operation or when being maintained, for example:
 - humidifiers and air washers
 - spa baths and pools
 - car/bus washes
 - wet scrubbers
 - indoor fountains and water features.

Legionnaires' disease

A type of pneumonia caused by the bacterium *Legionella pneumophila*. People catch Legionnaires' disease by inhaling small droplets of water suspended in the air, which contain the bacteria.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Hea 05 Acoustic performance

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2/4 (non residential/residential)	-	-	-	-	-

Aim

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

Assessment criteria

This issue is split into two parts:

- Pre-requisite
- Acoustic performance standards (2-4 credits).

The following is required to demonstrate compliance for:

Pre-requisite

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) (Step 3) to provide early design advice on:
 - a. External sources of noise with influence on the site and the building
 - b. Site layout and zoning of the building for good acoustics
 - c. Acoustic requirements for users with special hearing and communication needs
 - d. Acoustic treatment and sound insulation of different zones and facades.

Acoustic performance standards

Up to two credits (non residential buildings) and up to four credits (residential):

Table 17: Noise class requirements

Noise class in NS8175:2012	Credits	
	C	B
Non residential buildings	1	2
Residential buildings	2	4

2. A suitably qualified acoustician carries out pre-completion testing of ambient noise measurements to ensure that the relevant spaces (as built) 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.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	Offices - Where it is not possible to define the type of office space due to the speculative nature of the development, i.e. open plan or cellular, it must be assumed that it will be open with an occupancy rate of 1 person per 10m ² . If the space is less than 50m ² it would most likely be cellular. Assessments of buildings that are not fully fitted do not need to assess the criteria associated with sound insulation of acoustically sensitive rooms.
CN2	Building types without areas 'used for speech'	Where a building type does not have areas 'used for any communication', it does not need to comply with the relevant reverberation criteria. In these instances, the two available credits can be awarded where the building complies with the indoor ambient noise level and, if relevant, sound insulation criteria.
CN3	Acoustically sensitive rooms	Defined in NS 8175.
CN4	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.
CN5	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.
CN6	Relevant standard	NS 8175:2012 Acoustic conditions in buildings. Sound classification of various types of buildings.
CN7	Factory noise	Factory noise Where there is a known source of noise within the operational area of the building e.g. installed machinery/plant, such noises must be factored in to any calculations or measurements of indoor ambient noise levels.

Evidence

Req	Design stage	Post-construction stage
All	<p>Professional report/study and calculations from the acoustician confirming:</p> <ul style="list-style-type: none"> - Indoor ambient noise levels in each relevant room/area. - If relevant, sound insulation levels between each acoustically sensitive room and adjacent occupied areas. - The standards to which calculations/measurements have complied, or are required to comply with. - Relevant requirements for the building - How the requirements are to be achieved - Requirements that will be passed through to technical purchasing packages <p>Letter of appointment or other confirmation demonstrating when the acoustician was appointed.</p> <p>Relevant section/clauses of the building specification or contract and/or formal letter from the project team regarding commitments.</p> <p>A copy of the specification clause or a formal letter from the project team confirming:</p> <ul style="list-style-type: none"> • A programme of pre-completion acoustic testing by a suitably qualified acoustician will be commissioned. • Where rooms/areas do not comply with the required levels, appropriate remedial works will be actioned and completed. <p>Either a resume (CV) or a written confirmation that the appointed acoustician meets BREEAM's definition for a suitable qualified acoustician (as described under additional information).</p>	<p>Copies of acoustic field test report/results confirming:</p> <ul style="list-style-type: none"> - The required performance levels have been achieved for each room/area of the completed building. - Where relevant, any remedial work/actions required to meet the performance standards. Evidence, such as a formal letter from the acoustician or their test report confirming that they meet BREEAM's definition of a suitably qualified acoustician. <p>Where remediation works have been carried out, professional field report/study and calculations from the acoustician post completion of the works demonstrating compliance with the credit requirements.</p> <p>A letter from the design team or main contractor confirming:</p> <p>Any and all required remedial works have been carried out in accordance with the acoustician's recommendations</p>

Additional information

Relevant definitions

Pre-completion sound testing

Tests should be carried out once the build is essentially complete, but may be carried out prior to or post decoration. The test set composition defined in Appendix B NS 8175:2012 shall be used.

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.
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/calculations carried out by another acoustician who does not meet the SQA requirements, they must first confirm they comply with the definition of SQA and, 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 assessed and scope of works proposed.

Calculation procedures

Testing, measurement and calculation procedures

The following procedures must be followed by the acoustician when measuring or calculating the levels required to demonstrate compliance with this BREEAM issue (see also compliance note above on measurement procedures):

- NS 8175:2012 "Noise conditions in buildings – Noise classes for different types of buildings" ,supplement B: "Guidelines for assessment of compliance"
- All requirements parameters must be measured with respect to the relevant standards for each parameter
- All deviations from the requirements levels must be commented and a plan must be presented for addressing the deviations
- If measured values are lower than the requirements levels in more than 20% of the measurements, the measurements must be increased (with respect to the scope specified in NS 8175)

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.

Where specific guidance on testing, measurement and calculation is not known for the relevant building type, or within the relevant standard/guidance referenced, the following procedures can be used 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 16283 series.

For measurements of reverberation time, the relevant principles of (NS-EN) ISO 3382-2:2008 should be used.

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 masking 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 background/permanent ventilation strategy, these should be assumed to be open (at their design opening distance) for the purposes of calculations and open for measurements.
2. If openable windows are not part of the background/permanent ventilation strategy, then these should be assumed to be closed for the purposes of calculation and closed for measurements.
3. Noise from occupants and office equipment (e.g. computers) should not be included in the measurements.
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 utilized 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 3 locations in rooms at a height of 1.2 m above the floor level and at least 1 m away from any surface.
10. The measured level of ambient noise should be used to determine compliance with the privacy index. 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, LAeq or the lowest design limit for the acoustically sensitive space should be used.

The above is intended as guidance for undertaking acoustic testing/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.

Other information

Noise rating (NR) curves

Noise assessments based on Noise Rating (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, 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:

$$L_{Aeq,T} \approx NR + 6 \text{ dB.}$$

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 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.

Hea 06 Safe access

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
Up to 3 (Building type dependent)	-	-	-	-	-

Aim

To recognise and encourage effective design measures that promote low risk, safe access to and from the building and make sure that the building is facilitated and accessible to all potential users (universal design).

Assessment criteria

This issue is split in two sections:

- Pedestrian and cyclist safety (1 credit)
- Inclusive and accessible design (up to 2 credit)

The following is required to demonstrate compliance for:

Pedestrian and cyclist safety (all buildings)

One credit

1. Dedicated cycleways are provided which meet the following minimum width dimensions:
 - a. Where pedestrian and cycle routes are shared the minimum total width of the combined path is 3.0m
 - b. Where the cycle lane is segregated from both the pedestrian route and carriageway the minimum width of the cycle path is 2.0m and the pedestrian path is 1.5m
 - c. Where the cycle route forms a part of the carriageway, the minimum width of the lane is 1.5m.
2. The cycle lanes provide direct access from the site entrance(s) to any cycle storage facilities provided, without the need to deviate from the cycle path and, if relevant, connects to off-site cycle paths where these run adjacent to the development's site boundary.
3. Footpaths on site provide direct access from the site entrance(s) to the building entrance(s) and connect to public footpaths off site (where existing), providing access to local transport nodes and other offsite amenities (where existing).
4. Where provided, drop-off areas are designed off/adjoining to the access road and provide direct access to pedestrian footpaths, therefore avoiding the need for the pedestrian to cross vehicle access routes.
5. Where a dedicated pedestrian crossing of a vehicle access route is provided, the crossing is designed to control traffic speeds and visibility; for example, by use of appropriate traffic signals, speed breakers, bollards, delineators and/or raising the road to pavement level.
6. For large developments with a high number of public users/visitors, pedestrian pathways must be signposted to other local amenities off site, including public transport nodes (where existing).
7. The lighting for access roads, pedestrian areas, footpaths and cycle lanes is compliant with the national best practise road lighting guide.

Where vehicle delivery access and drop-off areas form part of the assessed development the following apply:

8. Delivery areas are not directly accessed through general parking areas and do not cross or share pedestrian and cyclist routes and other outside amenity areas accessible to building users and general public.
9. There is a separate parking/waiting area for goods vehicles away from/adjacent to the manoeuvring area and staff/visitor car parking.

10. Parking and turning areas are designed for simple manoeuvring according to the type of delivery vehicle likely to access the site, thus avoiding the need for repeated shunting.
11. There is a dedicated space for the storage of refuse skips and pallets away from the delivery vehicle manoeuvring area and staff/visitor car parking (if appropriate given the building type/function).

Inclusive and accessible design (non-residential only)

One credit

12. The building is designed to be fit for purpose, appropriate and accessible by all potential users (universal design).
13. An access strategy is developed in accordance to TEK10. For buildings with public access the access strategy is in line with the column "Recommended qualities" in the checklist – Prosjekteringsverktøy Universell utforming av publikumsbygg. (see Additional information).
For non-public access buildings (such as Offices), the guide Prosjekteringsverktøy Universell utforming av publikumsbygg from DiBk (see Additional information), can be used as a tool to help develop the access strategy. If any area is not covered by the guide but relevant for office buildings, the design team must confirm that the design is compliant to the requirements in TEK 10 regarding universal design (as a minimum).
14. Facilities are provided for future building occupants and users (see Compliance notes) including, where relevant, facilities that can be shared and are accessible to members of the public/community without gaining uncontrolled access to other parts of the building (unless security processes and procedures prohibit this).

Inclusive and accessible design (residential only)

One credit

15. The building is designed to be appropriate and accessible by all potential users.
16. An access strategy is developed in line with the checklist – Prosjekteringsverktøy – tilgjengelig bolig – developed by DiBk (<https://dibk.no/no/Tema/Universell-Utforming/Verktoy/prosjekteringsverktoy-for-tilgjengelig-bolig/>).

Two credits

17. Criteria 15 and 16 are met
18. The design complies with the "Recommended qualities (Anbefalte tilleggsytelse) in the checklist– Prosjekteringsverktøy – tilgjengelig bolig

Compliance notes

Ref	Terms	Description
CN1	Development does not have any external site areas	The safe access criteria apply only to developments that have areas external to the assessed building and within the boundary of the assessed development (regardless or not of whether that external area is/will be the responsibility of the future building occupant). This includes external parking areas. If the assessed building does not have any external areas and access to the building is direct from the public highway/footpath i.e. there is no onsite vehicle access and parking areas, then the criteria concerning safe access are not applicable. In such instances the issue will be filtered out of the assessment scope.
CN2	Covered parking area	Where the assessed building has no external areas but does have a covered parking facility, and cyclists/pedestrians/delivery vehicles access the assessed building via this area, then the relevant Pedestrian and cyclist safety criteria apply and this area must be assessed against those criteria.

Ref	Terms	Description
CN3	National best practice road lighting guide	<p>NS-EN 12464-2 Light and lighting - Lighting of workspaces – Part 2: Outdoor work places</p> <p>The level for lighting strength is the same or stricter than those that have been established in the guidelines for roadway lighting in effect at any point in time.</p> <p>Norwegian Public Roads Administrations handbook V124 -Technical Planning of Road and Tunnel Lighting.</p>
CN4	Operational safety measures	Operational safety measures such as speed reduction are often recognised as an efficient measure to reduce risks to cyclists and pedestrians. However, these being dependent on the way they will be enforced, they cannot be recognised under BREEAM and only safety design measures will be assessed under this BREEAM issue.
CN5	Delivery access through parking areas (smaller sites and deliveries). See criteria 2 to 11 (apart from 8).	Criterion 8 (delivery access through general parking areas) can be relaxed for smaller sites if it can be confirmed that the building is of an operational type and size which is likely to mean that all deliveries to the building will be made by small vans and not heavy goods vehicles.
CN6	No vehicle delivery and manoeuvring areas. See criteria 2 to 7.	The criteria concerning vehicle delivery access are not applicable where dedicated delivery access and drop-off areas do not form part of the assessed development.
CN7	Dedicated footpaths from car parking spaces	Where it is not practical to provide dedicated footpaths from each parking space within a car park, it is expected that design teams take every practical measure to ensure the safety of pedestrians. In general terms, as a minimum, a safe pedestrian route should be provided from the pedestrian exit of the car park to the building entrance. For larger car parks it would be beneficial to provide footpaths at regular intervals across it, to aid safe access from the car to the building entrance, and the design team should demonstrate that they have achieved this as far as is practical.
CN8	Shared facilities	<p>No criteria have been set in this respect as the types of space or facilities will vary according to the building size, type, use and consultation feedback. Typical facilities that could be shared with others might include:</p> <ol style="list-style-type: none"> 1. Sports facilities 2. Meeting and conference rooms 3. Amenity space for staff or visitors (internal or external).
CN9	Existing facilities	Where existing facilities are present on site that comply with the shared facilities assessment criteria (including the involvement of users and the community in the consultation stage), the credits can be awarded. These facilities could be within an existing building that does not form part of the assessment, provided the building is accessible to all relevant building users.

Ref	Terms	Description
CN10	Potential users of shared facilities	<p>Potential users of shared facilities are identified as appropriate and can include all or any of the following (if relevant to the building type and use):</p> <ol style="list-style-type: none"> 1. Extra-curricular users and uses 2. Local authority or other provider of local community services 3. Local residents 4. Adult education 5. Volunteer groups 6. Local businesses 7. Operators or members of clubs and community groups.

Evidence

Req	Design stage	Post-construction stage
Safe access		
1-11	Design drawings (including a scaled site plan), AND/OR relevant sections of the specification highlighting all necessary compliant features and dimensions.	Assessor's building/site inspection and photographic evidence confirming compliance AND/OR 'As built' site plan and design details.
Inclusive and accessible design credit (non-residential only)		
12-14	<p>The access strategy. Design drawings AND/OR relevant section/clauses of the building specification or contract confirming the qualities implemented.</p> <p>For buildings with public access; A completed Checklist indicating commitment to comply with all applicable checkpoints (in column 1,2 and 3), signed by the developer or contractor.</p>	<p>As design stage.</p> <p>BREEAM Assessor's site inspection report and photographic evidence.</p>
Inclusive and accessible design (residential only)		
15-16	<p>The access strategy</p> <p>A completed Checklist indicating commitment to comply with all applicable checkpoints (in column 1 and 2), signed by the developer or contractor, as appropriate. Drawings or copy of specification confirming compliance with items in Checklist.</p>	<p>A completed As Built Checklist indicating compliance with all applicable checkpoints (in column 1 and 2).</p> <p>BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As-built' drawings.</p>
17-18	<p>A completed Checklist indicating commitment to comply with all applicable recommended qualities (in column 3), signed by the developer/contractor. Drawings or copy of specification confirming compliance with the recommended qualities in the Checklist</p>	<p>A completed As Built Checklist indicating compliance with all applicable recommended qualities (in column 3).</p> <p>BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As-built' drawings.</p>

Additional information

Relevant definitions

External site areas

Areas external to the assessed building, but within the development's site boundary, which contain vehicle and/or pedestrian access roads/pathways to the building, parking, unloading and drop-off areas.

Accessible

With respect to buildings or parts of buildings, the term 'accessible' means that people, regardless of disability, age or gender are able to gain access (approach, entry or exit).

In some environments it may not be appropriate to provide some types of facilities. A balance must be struck in terms of what is reasonable to provide to ensure access for all types of building user, with a particular focus on the types of user identified within the criteria.

Access strategy

The access strategy should show that the design team has considered how everyone (universal design). It should be written specifically for the building being assessed and need not be very long, but the amount of detail should reflect the complexity of the building and its use. The access strategy explains and confirms how the Planning and Building act (PBL) § 29-3 Universal Design requirements and TEK 10, § 12 have been met.

For buildings with public access, the guide "Prosjekteringsverktøy Universell utforming for publikumsbygg" from DiBK, can be used as a tool to help develop the access strategy.

For residential buildings the guide "Prosjekteringsverktøy for tilgjengelig bolig" from DiBK, can be used as a tool to help develop the access strategy.

For other buildings (such as Offices), the guide Prosjekteringsverktøy Universell utforming av publikumsbygg from DiBK can be used as a tool to help develop the access strategy. In addition, any area not covered by the guide but relevant for the building, the design team must confirm that the design is compliant to the requirements in TEK 10 regarding universal design.

The guides can be found on: <https://dibk.no/verktoy-og-vevisere/universell-utforming/>

Checklists and tables

Inclusive and accessible design

Refer to DiBks Checklist and guidance:

- "Prosjekteringsverktøy Universell utforming for publikumsbygg"
- "Prosjekteringsverktøy for tilgjengelig bolig"

<https://dibk.no/verktoy-og-vevisere/universell-utforming/>

Calculation procedures

None.

Other information

For design purpose/guidance (how to) the following can be used:

- The Norwegian Public Roads Administrations handbook N100 - Road and Street Design (criteria 1-3) and The Norwegian Public Roads Administrations handbook V127 -Criteria for Pedestrian Crossings (criterion 5) - «Prosjekteringsverktøy – tilgjengelig bolig» and «Prosjekteringsverktøy Universell utforming av publikumsbygg»

The tools, " Prosjekteringsverktøy – tilgjengelig bolig" and "Prosjekteringsverktøy Universell utforming av publikumsbygg" are based on the regulations on technical requirements for construction works (building technical regulation) TEK10 and excerpts from related guidance related to accessible dwelling unit and public buildings. The structure and checkpoints makes it easier for designers to use as a guide and reference tool. Changes in the guidelines for TEK10 April 1, 2016 are incorporated in the tool. The "Recommended qualities" (Anbefalte tilleggsytelser) goes beyond minimum requirements in TEK10. In all design and planning, it is necessary to use TEK10 as basic document. The Design Tools are supplements in the design work.

Hea 07 Natural hazards

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

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 outline proposal/concept design stage (Step 3) by an appropriate person(s) to identify any potential natural hazards in the region of the development.
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
CN1	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-NOR issue Pol 03.

Evidence

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.

Ref	Design stage	Post-construction stage
2	<p>Where applicable, a copy of the Natural Hazard risk assessment detailing the mitigation measures appropriate to level of risk for the site. AND EITHER</p> <p>A copy of the relevant section of the specification requiring the principal contractor to implement the mitigation measures identified OR</p> <p>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.</p>	<p>Assessor's building/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.</p>

Additional information

Relevant definitions

Natural hazard

Natural processes or phenomena occurring in the biosphere or crust that may constitute a damaging event.

DIBK's publication «Utbygging i fareområder» and TEK 10, chapter 7 gives 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/design team to identify these.

DIBK's publication can be found here:

<https://dibk.no/saksbehandling/kommunalt-tilsyn/temaveiledninger/>

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/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/) <http://www.unisdr.org/>

Hea 08 Private space (residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	1

Aim

To provide an external space which gives occupants privacy and a sense of wellbeing.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. The outdoor space (private or semi private) must comply with the following requirements:
 - a. Is of a size that allows all occupants to sit outside
 - b. Is accessible for all occupants, including wheelchair users
 - c. Is accessible only to occupants of designated dwellings.
2. The outdoor spaces need to be adjacent or in close proximity to the dwelling(s) and meet the minimum size requirements (see Compliance notes).

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	There are no additional or different requirements to those outlined above specific to extension projects.
CN2	Minimum space requirements	Subject to any higher requirements arising from national regulations or established national best practice, these are to be set at a level which is compliant with the following: <ol style="list-style-type: none"> 1. For private space: 1.5m²/bedroom. 2. For semi-private space, i.e. shared access by all dwelling occupants: 1.0m²/bedroom.

Ref	Terms	Description
CN3	Outdoor spaces	The following are representative examples of outdoor spaces: <ol style="list-style-type: none"> 1. A private garden 2. A communal garden or courtyard, providing a pleasant and secluded environment large enough for all occupants of designated dwellings to share and designed in a way that makes it clear that the space is only to be used by occupants of designated dwellings 3. Balconies 4. Terraces (roof or other) 5. Patios
CN4	Non-compliant outdoor space	'Juliet' balconies generally do not comply with the criteria as they are too small to provide an external space. Enclosed areas, such as conservatories, do not comply with the criteria.
CN5	Accessible only to occupants of designated dwellings	The design of the space, its boundaries and its relationship with the designated dwelling should make it clear that the space is only for the use of occupants.

Evidence

Ref	Design stage	Post-construction stage
All	Drawings or copy of specification confirming: <ol style="list-style-type: none"> 1. The number of bedrooms served by the outdoor space. 2. That the outdoor space meets the minimum size requirements and is located adjacent/close to the dwelling AND, where a shared outdoor space is provided, details of the security/control arrangements for access. 	BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As-built' drawings.

Additional information

Relevant definitions

None.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Hea 09 Moisture protection

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	1	1	1

Aim

To reduce the risk of incorporating moisture and prevent moisture and mould problems through appropriate design and construction measures.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

The following is required to demonstrate compliance:

1. Establish a control plan that describes how to secure the building from moisture damage in the construction phases as described in Building Detail 474.511 "Evaluation of moisture protection. Checks list", Building Detail 501.107 "Clean, dry and tidy building process" and Building Detail 474.533 "Drying and preventive measures". Control plans shall include material moisture content, storage of materials, protection against rain, control of moisture before capping / closing. The control plan shall be developed during the detailed planning phase (Step 4) and be linked to the construction programme.
2. Customised checklists for moisture protection must be prepared and used in the design and construction phases (Step 3-5) for all relevant moisture sensitive materials. A template for such a check list is included in Building Detail 474.511 'Evaluation of moisture protection. Control Points'

Two credits

3. First credit must be achieved
4. It must be documented that the drying of the building construction is carried out according to methods recommended in Building Detail 474.533 "Drying and preventive measures"
5. Concrete: It must be documented that there has been moisture measurements according to the methods specified in NS 3511 and Building Detail 474.531, "Measurement of moisture in buildings".
Timber structures: It must be documented that there has been moisture measurements according to the methods specified in NS 3512 and Building Detail 474.531, "Measurement of moisture in buildings". Also, It shall be demonstrated compliance with the moisture level requirements in the mentioned standards and NS 3420-T if applicable.

Three credits

6. The two first credits must be achieved
7. Construction under cover, e.g. with a tent-based cover system.

Compliance notes

Ref	Terms	Description
CN1	New build	There are no additional or different criteria to those outlined above specific to new-build projects.
CN2	Extensions to existing buildings	There are no additional or different criteria to those outlined above specific to the assessment of extensions to existing buildings.
CN3	Shell and core	There are no additional or different criteria to those outlined above specific to shell-only.
CN4	Relevant standards	NS 3511 Measurement of the relative humidity (RH) in concrete NS 3512 Measurement of moisture in timber structures NS 3420-T Specification texts for building, construction and installations Part T: Painting, papering and flooring Building Detail 501.107 Clean, dry and tidy building process. Building Detail 474.511 Evaluation of moisture protection – control points Building Detail 421.132 Moisture in buildings. Theoretical basis. Building Detail 474.533 Drying and preventive measures Building Detail 474.531 Measurement of moisture content in buildings
CN6	Relevant moisture sensitive materials	Examples of relevant moisture sensitive materials include, but are not limited to: insulation, plaster boards, wood panels and timber structures.
CN7	Construction under cover	For constructions with a coverage system stated to have similar properties as a tent based system it is required to provide evidence which proves that the system selected is at least as effective in terms of moisture protection measures. This means that moisture protection from rain and snow, both horizontally (through external walls) and vertically (through the roof) must be maintained throughout the construction process. Which measures that provides the same level of protection as tent based system needs to be assessed by the relevant responsible within the project team and accepted by the assessor.

Evidence

Ref	Design stage	Post-construction stage
1	The Project Manager, and / or the contractor, when appointed, submits a copy of the control plan, a copy of the specification, or a commitment letter.	Contractor's plan for quality assurance
2	The Project Manager, and / or the contractor, when appointed, submits checklists for moisture protection, a copy of the specification or a commitment letter.	A copy of the completed checklists used during the construction phase

Ref	Design stage	Post-construction stage
4	Project Manager and / or design team verification that requirements for drying procedures will be specified.	A copy of the documentation for how the drying of the building structures were conducted during the construction phase
5	Project Manager and / or design team verification that requirements for method statements and performance criteria for moisture measurement will be specified.	A copy of the documentation which describes how the moisture measurements have been carried out and the results from these
7	Project Team's report on the requirements for tent-coverage, and how this can be implemented cost effectively.	The assessor's report and photographic evidence. If the assessor was engaged later in the construction phase, the contractor's project report, documents and photographic evidence can document compliance.

Additional information

Relevant definitions

Control plan

A control plan, as described in the Building Regulations, should contain the following:

- A description of what is to be designed and constructed, and critical issues to be controlled and how the control should be carried out.
- The basis for the control, i.e. design and construction documents
- Who is responsible for the control during the construction phase

Checklists and tables

None.

Calculation procedures

None.

Other information

Background

High relative humidity can cause fungal growth, bacterial contamination, bad odours and adverse chemical reactions in building materials, as well as damages and reduced life times of structures and components. Emissions from the materials may also increase with increasing moisture content. Moisture is probably the single factor that contributes the most to poor indoor environment and can cause serious health problems like allergies, asthma and other issues related to hypersensitivity. In addition, exposure to moisture damage may cause general symptoms such as abnormal fatigue, headaches and concentration problems.

Building materials must be kept sufficiently clean and dry both during storage, transport and assembly at the construction site to prevent moisture problems. The materials must also be kept dry and clean after they are installed and while the building is in use.

Energy

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	Credits	Credit summary
Ene 01 Energy efficiency	12	Recognise improvements in the energy performance of the building above national building regulations/Byggtknisk forskrift. Encourage steps taken to reduce delivered energy demand through building design, energy supply and systems specification.
Ene 02a Energy monitoring (non residential)	3	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.
Ene 02b Energy monitoring (residential)	2	Specification of energy display devices.
Ene 03 External lighting	1	Specification of energy efficient light fittings for external areas of the development and controls to prevent use during daylight hours or when not needed.
Ene 04 Low and zero carbon technologies	2	A feasibility study has been carried out to establish the most appropriate on site or near site low or zero carbon (LZC) energy sources for the building or development, and is specified. ¹
Ene 05 Energy efficient cold storage	3	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 e.) over the course of its operational life.
Ene 06 Energy efficient transport systems	2	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.

Issue	Credits	Credit summary
Ene 07 Energy efficient laboratory systems	Up to 5	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.
Ene 08 Energy efficient equipment	2	Identification of the building's energy-consuming user equipment which have a major impact on the building's total energy demand. Demonstrate a reduction in the energy consumption of user equipment.
Ene 09 Drying space	1	Provision of adequate internal space and equipment.
Ene 23 Energy performance of building structure	2	Recognize and encourage buildings with low net energy demands. Inspecting, testing, identifying and rectifying climate screen defects via appropriate methods.

Ene 01 Energy efficiency

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
12	-	-	-	6	8

Aim

To recognise and encourage buildings that minimise their operational energy consumption through good design.

Assessment criteria

The following is required to demonstrate compliance for:

Up to 12 credits

Determination of the building's energy performance in the computation of energy delivered to the building

1. The number of credits obtained is based upon the percentage improvement in the building's calculated delivered energy, *Edeliv* (kWh/m²yr) in relation to the level required to achieve an energy label C within the the Norwegian Energy Performance Certificate scheme - *Eref*.
2. Delivered energy to the building is calculated according to the method in NS 3031:2014.
3. The percentage improvement is used to allocate the number of credits, as illustrated in the table below;

Table 18: Percentage improvement over the requirements of energy label C

BREEAM Credits	Non-residential	Residential
1	5%	4%
2	7%	6%
3	11%	8%
4	15%	10%
5	19%	13%
6	25%	16%
7	31%	19%
8	38%	23%
9	45%	30%
10	55%	42%
11	70%	60%
12	85%	85%

4. Modelling is carried out by a Suitably qualified energy modelling engineer and/or accredited expert who is responsible for verifying that the data entered in the energy model is appropriate.

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	<p>Where an existing building is being extended (and only the new extension is being assessed) and that extension uses existing building services plant, the energy modelling and percentage (%) improvement/reduction must be based on the building fabric of the new extension and any existing, common, building services plant and new building services plant installed that will service the new extension.</p> <p>The energy modelling does not have to consider the existing building fabric where this will not form part of the scope of the BREEAM assessment. Nor does it have to consider existing building services where they are not supplying services (heating, cooling and/or ventilation) to the new extension being BREEAM assessed.</p>
CN2	Shell and core	<p>When calculating the energy performance for a shell and core building, where heating, ventilation and air conditioning (HVAC) or lighting variables for the tenanted areas are not known, a developer is required to assume for the shell and core spaces not lower energy performance specifications than required the most energy intensive fit-out specification permissible under local building regulations (TEK 10).</p> <p>For the purposes of the BREEAM assessment it is permissible, when conducting the energy modelling, for the design team to use the performance specifications confirmed within a Green Lease Agreement to calculate the % improvement. This rule applies only to those areas of the building that the scope of the Green Lease covers. Tenanted areas not covered by the scope of the Green Lease must assume energy efficiency performance equivalent to minimum requirement in the technical building regulations. The use of a Green Building Guide for tenants fit out (as defined in Appendix D) cannot be used to substitute the maximum design fit out specification (TEK 10) for the purpose of assessing BREEAM issue Ene 01, because this type of Guide is not legally enforceable, i.e. it is not a contract or lease condition.</p>
CN3	Approved Building Energy Calculation Software	Approved Energy Software are software approved according to the specification in NS 3031:2014.
CN4	Suitably qualified energy modelling engineer	An individual with at least 3 years of relevant experience in energy modelling within the last 5 years and a recognised qualification such as an engineering degree in relevant fields, such as energy and environment, building physics or HVAC. 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.
CN5	Energy exported to the grid	Any electricity, heat and/or cooling 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.

Ref	Terms	Description
CN6	EPC for mixed use buildings,	<p>The Norwegian EPC (Energy Performance Certificate scheme) requires that calculations are carried out for each functional unit (e.g office and retail). For the purposes of determining the number of BREEAM credits, the reference and actual energy performance is calculated as the area-weighted average of the energy performance index of each individual unit. Where the development contains conditioned common and/or landlord spaces, the area of these spaces, unless otherwise accounted for, should be divided and attributed amongst the separate units. The proportion of common area attributed to each unit must be equivalent to the ratio of each unit's area as a proportion of the total area of all units.</p> <p>For residential buildings, the energy calculation of reference and actual energy performance can for the purpose of BREEAM-NOR be made on the whole building level, and not for each individual apartment (as required in the EPC scheme).</p>
CN7	Current point in time of EPC	The version of the EPC to be applied, is the version that was current at the launch date of this specific version of the BREEAM-NOR technical manual (BREEAM_NOR 2016 v 1.0)

Evidence

Ref	Design stage	Post-construction stage
All	<p>1. Confirmation of the expertise and experience of the individual carrying out the modeling.</p> <p>AND</p> <p>A copy of the report produced by the approved calculation tool for the assessed building at the design stage illustrating:</p> <p>2. Calculated delivered energy for the building (Edeliv) and applicable standard for energy label C (Eref)</p> <p>3. Name of the approved software used to carry out the modelling for calculating the energy performance. The output documents must be based on the 'As designed' stage of analysis.</p>	<p>As for the design stage. The final rating must account for any changes to the specification during construction including the measured air leakage rate, and documented calculation of thermal bridges, if "standard values for normalized thermal bridge value" from NS 3031:2014 is not used.</p> <p>AND</p> <p>Documentation of the as-built energy calculation input in a completed Appendix J in NS 3031:2014. Both the input and documentation column must be filled in according to guidelines stated in the standard. Printouts from approved software may be used, provided that the above requirement is met.</p> <p>Calculations associated with averaging of units, where it has occurred.</p>

Additional information

Relevant definitions

None.

Checklists and tables

None.

Ene 02a Energy monitoring (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	1	1	1

Aim

To recognise and encourage monitoring of operational energy consumption through sub-metering.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. The following major energy consuming systems (where present) are monitored using separate energy sub-meters connected to an Energy Monitoring System
 - a. Heating (space and ventilation heating)
 - b. Domestic hot water
 - c. Cooling (space and ventilation cooling)
 - d. Fans and pumps (major)
 - e. Lighting and small power
 - f. Other major energy-consuming items where appropriate (see Compliance notes).
2. As a minimum, for heat pumps and cooling equipment in hydronic heating/cooling systems, the electricity into the system must be measured.
3. The end energy consuming use is identifiable to the operating personnel through the data shown in the Energy Monitoring System.

OR

Two credits

4. The following major energy consuming systems (where present) are monitored using separate energy sub-meters connected to an Energy Monitoring System:
 - a. Space heating
 - b. Ventilation heating
 - c. Domestic hot water
 - d. Space cooling
 - e. Ventilation cooling
 - f. Fans (major)
 - g. Pumps (major)
 - h. Lighting (permanently installed)
 - i. Small power
 - j. Other major energy-consuming items where appropriate (see Compliance notes).
5. For cases with heat pump and / or cooling unit, in hydronic heating/cooling systems it is required both an electricity meter on input and an energy meter for thermal produced heat / cooling on output. This enables calculation and presentation of the efficiency of the heat pump and cooling machine in the Energy Monitoring System.
6. The end energy consumption is identifiable to the building user through the data shown in the Energy Monitoring System.
7. Compliance with Man 05, assessment criteria 2 is shown.

One credit

8. An accessible Energy Monitoring System or accessible sub-meters are provided covering the Energy supply to all tenanted areas or, in the case of single occupancy buildings, by floor or, if relevant, separable wing. Where the building has a diverse range of functions with different energy consuming profiles, the metering must cover energy supply by relevant function areas/departments (see CN 10-14)

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	Where the extension uses the building services plant and systems from the existing building, the criteria apply to the extension and existing building.
CN2	Shell and core	<p>Plant/equipment sub-metering</p> <p>Where present, core building services should be assessed in accordance with the assessment criteria. In shell and core areas/building, where final decisions concerning the specification of particular building services and systems will be made by a new owner/tenant, compliance with this BREEAM issue can be demonstrated via one of the following means:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options. Tenancy sub-metering.</p> <p>For speculative buildings, meters must be installed on the energy supply to each separate tenanted unit or floor plate within the assessed development.</p>
CN3	Lighting and small power	Due to traditional distribution methods, it can be difficult to cost-effectively separate lighting and small power. 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.
CN4	Other major energy-consuming systems	Other major energy-consuming systems, depending on the building type, might include, for example, plant used for swimming or hydrotherapy pools, kitchen plant, cold storage plant, laboratory plant, sterile services equipment, transportation systems (e.g. lifts and escalators), drama studios and theatres with large lighting rigs, humidification, snow melting system, underground parking, power and cooling to data center / server room (the list is not exhaustive). Advisor / project has the opportunity to assess / calculate what possibly is not necessary to sub-meter and which possibly other energy-consuming items / systems that should be sub-metered.
CN5	Modular boiler systems	Where a modular boiler system has individual boilers with a power input of 50kW but an overall power rated input of ≥ 50 kW, the lead boiler must be sub-metered regardless of its individual power rated input.
CN6	Accessible meters	All sub-meters must be available to be checked / read manually if necessary
CN7	Small commercial units	Where a development consists of a number of small units a single meter per unit is sufficient to achieve the third 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 ≤ 200 m ² .

Ref	Terms	Description
CN8	Large commercial units	A development consisting of one or more larger units (i.e. > 200m ²), sufficient sub- metering to allow for monitoring of the relevant function areas/departments within the unit must be specified, in addition to metering of the unit as a whole.
CN9	Central ventilation	In cases of central ventilation covering more than one tenanted area, it is sufficient to measure the central ventilation system and not split this on tenants / floors.
CN10	Relevant function areas/departments	The lists below summarise the commonly found function areas by building type. These lists are not exhaustive and where other areas/departments exist these should also be separately metered.
CN11	Office buildings	<ol style="list-style-type: none"> 1. Office areas (metering by floor plate, if relevant, building wing). See CN15 for details. 2. Catering
CN12	Retail buildings	<ol style="list-style-type: none"> 1. Sales area 2. Storage and warehouse 3. Cold storage 4. Office areas 5. Catering 6. Tenanted units
CN13	Industrial buildings	<ol style="list-style-type: none"> 1. Office areas 2. Operational areas 3. Ancillary areas (e.g. canteen, etc.)
CN14	Educational building	<ol style="list-style-type: none"> 1. Offices area 2. Kitchen (excluding small kitchen for staff) 3. Computer area 4. Workshop 5. Classroom Conference / Multipurpose Spaces 6. Theatre 7. Pools (with changing rooms) 8. Sport hall /fitness room (with changing rooms) 9. Laboratories 10. Data centre <p>Classrooms / classes need not have sub-meters.</p>
CN15	Single function and occupancy buildings	In cases of single occupancy buildings, the metering shall cover the Energy supply by floor or wing. Some buildings may be in only one or a few floors but have an elongated shape, and in such cases it can be more appropriate to divide the measurement by building wings instead of floors. The intention is that metering should be prepared for future occupants. If the building is not divided into relevant functional areas as specified in compliance notes above or tenanted areas (floors, wings etc.), the third credit is not applicable.

Evidence

Ref	Design stage	Post-construction stage
All	Relevant section/clauses of the building specification or contract. Design drawings. Specifications of the sub-metering and Energy Monitoring System	BREEAM Assessor's site inspection report and photographic evidence. Specifications of the sub-metering Specifications of the sub-metering and the Energy Monitoring System. Evidence confirming the Energy Monitoring System is operational. Must be able to demonstrate at least 2 weeks with complete registration, meaning that all meters have submitted data and that the system has generated graphical presentations of energy consumption etc.

Additional information

Relevant definitions

Energy Monitoring System

A system specially developed for oversight and monitoring of energy consumption in buildings, with features that enable analysis of energy use to uncover any errors and operational improvements. An Energy Monitoring System can be purchased as software for BEMS or as a web service from remote Energy Monitoring System provider. A suitable Energy Monitoring System will give transparent, reliable, updated information, alert for abnormal operating conditions, and indirectly contribute to a greater awareness of the energy consumption. An Energy Monitoring System, as defined in BREEAM NOR, shall at least contain the following features:

- Automatic data collection, storage and reporting of energy consumption on an hourly level
- Useful graphical presentations of energy consumption in optional time series down on an hourly level, as well as ET-diagram (Energy-Temperature diagram)
- Alarm management with energy consumption deviations

Energy supply

All types of energy supplied to a building area (department/tenancy/unit) within the boundary of the assessed development, i.e. electricity, district heating, district cooling or other form of energy/fuel, which is consumed as a result of the use of and operations within each relevant area.

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.

Checklists and tables

None.

Calculation procedures

None.

Other information

Further guidance on how to develop an appropriate metering strategy for the energy criteria of a new building is available in SINTEF FAG 6. Etterprøving av bygningers energiforbruk - Metodikk. (In English: Verification of building's energy consumption. Methodology)⁷.

⁷ Dokka, Tor Helge and Grini, Catherine, SINTEF FAG 6, Etterprøving av bygningers energibruk – Metodikk, ENOVA and SINTEF Akademisk Forlag, 2013

Ene 02b Energy monitoring (residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To recognise and encourage monitoring of energy consumption through use of energy display devices.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. Current electricity OR primary fuel consumption data is displayed to occupants through a compliant energy display device.

Two credits

2. Current electricity AND primary fuel consumption data is displayed to occupants through a compliant energy display device.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	For speculative dwellings, meters must be installed on the energy supply. Where multiple dwellings exist meters must be installed on the energy supply to each separate dwelling within the assessed development.
CN2	Electricity is the primary fuel	Where the heating and/or cooling system(s) are fuelled by electricity and current electricity consumption data are displayed to occupants through a compliant energy display device, two credits may be awarded.
CN3	Community heating, cooling or solid fuel systems	If it is not possible to measure the energy consumption based on the incoming mains supply using a compliant energy display device, a heat meter is required to be installed to measure the heat energy. The heat meter must calculate the energy consumption in kilowatt hours (kWh) which can then be transmitted to a compliant energy display device.

Ref	Terms	Description
CN4	Demonstrating compliance	As long as there is the required functionality a submeter located in each dwelling with a display for electricity and/or heating and cooling is accepted. An energy display device or homepage and/or an app on the smartphone from a metering company is also accepted.

Evidence

Ref	Design stage	Post-construction stage
All	Relevant section/clauses of the building specification or contract. Design drawings.	BREEAM Assessor's site inspection report and photographic evidence of installed and functioning meter.

Additional information

Relevant definitions

Compliant energy display device

This is a system comprising a self-charging sensor(s) fixed to the incoming mains supply/supplies, to measure and transmit energy consumption data to a visual display unit. As a minimum, the visual display unit must be capable of displaying the following information:

1. Local time
2. Current (real time) energy consumption (kiloWatts and kiloWatt hours)
3. Current (real time) estimated emissions (g/kg CO₂)
4. Current (real time) tariff
5. Current (real time) cost (per hour)
6. Visual presentation of data (i.e. non-numeric) to allow consumers to easily identify high and low level of usage
7. Historical consumption data so that consumers can compare their current and previous usage in a meaningful way. This should include cumulative consumption data in all of the following forms: day/week/month/billing period. The data must be stored internally for a minimum of two years or be connected to a separate device with automatic upload from the energy display device.

Primary fuel

The fuel used to provide the majority of heating or cooling to the dwelling under assessment.

Self charging sensor

A sensor and/or transmitter powered by the mains supply to the building that transmits energy consumption data to a visual display unit. Long life batteries, with a minimum life expectancy of 7 years, can be used in place of a self-charging sensor/transmitter where the functionality of the system is demonstrated to be maintained by the assessor.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Ene 03 External lighting

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To recognise and encourage energy efficient light fittings for external areas of the development.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. All external fittings, where provided, within the Construction zone meet or exceed the lighting requirements as given in Table 19.
2. External light fittings are controlled through a Time switch, or Daylight sensor, to prevent operation during daylight hours. Daylight sensor override on a manually switched lighting circuit is acceptable.

Table 19: Minimum external lighting requirements by location

External lighting location	Luminaires (luminaire lighting lumens/circuit Watt)	
	≥ 70	< 70
Building, access ways, pathways	70	90
Residential balconies, terraces	60	80
Car parking, associated roads, floodlighting	80	100

External lighting location	Luminaires (luminaire lighting lumens/circuit Watt)	
	≥ 25 W	< 25W
Signs, uplighting	70	60

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings/Small single building assessments on larger developments	Where the building being assessed forms part of larger development (or is an extension to an existing building) containing common areas and other buildings, the scope of the external lighting criteria apply to external new and existing lighting within the construction zone of the assessed building.
CN2	Shell and core	Typically, external lighting will be specified and installed by the developer and not the future tenant. If external lighting will be specified and installed by the tenant, then compliance can be demonstrated via one of the following available means: <ol style="list-style-type: none"> Option 1 - Inclusion of the relevant clause(s) in a tenancy lease agreement between the developer and tenant/s (full value of available credits) Option 2 - A Green Building Guide for tenant fit outs (half the value of the available credits) Option 3 - Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options. If responsibility for the external lighting specification and installation is shared by each party (developer and tenant), then compliance can be demonstrated via a combination of the base build design drawings/site inspection and one of the above options.
CN3	No external lighting specified	The credit can be awarded where the building is designed to operate without external lighting, including external lighting on the building, signs and at entrances.
CN4	Coloured light sources	Where a self coloured light source (such as a coloured LED or neon lamp) is being used, for example within signage, it would comply with the criterion if it used no more energy than an equivalent compliant white light source with a coloured filter, for example a fluorescent lamp with a sleeve of the same colour.
CN5	Decorative and floodlighting	Decorative lighting and floodlighting must not be exempt from the assessment criteria, although temporary lighting such as theatrical, stage or local display installations, where specified, may be excluded.
CN6	Lighting not managed by the site owner	External lighting not managed by the site owner or building users is exempt from the assessment, i.e. lighting managed by statutory or alternative public bodies.
CN7	Redeveloped and existing sites	Where a site is redeveloped and existing external lighting remains, the lighting that is retained has to comply with the requirements of the issue; replacement of the fittings may be necessary. Responsible disposal of any replaced fittings is recommended (but not required by BREEAM).

Ref	Terms	Description
CN8	Security lighting	The criteria are concerned only with general external lighting, e.g. way-finding, car parking, decorative, signage, landscape, storage areas, etc. Where the assessor can demonstrate that the BREEAM criteria cannot be met for lighting specified for security purposes, such lighting can be excluded from the assessment of this issue.

Evidence

Ref	Design stage	Post-construction stage
All	<p>Relevant section/clauses of the building specification or contract.</p> <p>OR</p> <p>Design drawings showing the location and purpose of all external light fittings.</p> <p>AND</p> <p>Lighting specification or lighting designer's calculations confirming:</p> <ul style="list-style-type: none"> • Luminaire lumens/circuit watt for each type of fitting as well as the colour rendering index Ra (where appropriate). • External lighting control strategy. 	<p>BREEAM Assessor's site inspection report and photographic evidence confirming external light controls.</p> <p>Relevant section/clauses of the building specification or contract. "As Built" drawings showing the location and purpose of all external light fittings.</p> <p>Manufacturers literature confirming the technical specifications for the installed external light fittings.</p>

Additional information

Relevant definitions

Colour rendering index (Ra)

A measure, between 0 and 100, of the ability of a lamp to reproduce the colour of objects in comparison to their aspect under a natural or reference source of light. An incandescent source has a Ra of 100 and a low pressure sodium source a Ra of 0 (see below for further information on colour rendering).

Construction zone

For the purpose of this BREEAM issue the construction zone is defined as the site that is being developed for the BREEAM-assessed building, and the external site areas that fall within the scope of the new works

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 a complete luminaire (in lumens) and the total power consumed by both the lamp and its associated control gear (in Watts).

Time switch

A switch with an inbuilt clock which will allow lighting to be switched on and off at programmed times.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Colour rendering

At night time, the sensitivity of the eye is shifted towards the blue region of the visual spectrum. As a result, lamps with poor colour rendering index, such as some sodium lamps that emit light between the yellow and red region of the visual spectrum, require more luminous output to light an object with the same level of brightness than a source with better colour rendering index. Sources with a poor colour rendering index also make the differentiation of coloured objects more difficult for individuals.

The colour rendering index requirement means compliance with this issue using sources of light with a poor colour rendering index is harder to achieve than those with an index greater than or equal to 70. Other benefits of using sources with an index greater than 70 include an increased feeling of safety for individuals, making recognition of spaces and other individuals easier. In areas where CCTV is used, the colour rendering index of lighting sources is critical; a Ra value of at least 80 is recommended (but not required by BREEAM).

Ene 04 Low and zero carbon technologies (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	1	1

Aim

To recognise and encourage the appropriate use of local energy generation from renewable sources.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. A feasibility study has been carried out by an Energy specialist (see relevant definitions) to establish the most appropriate local (on-site or near-site) low or zero carbon (LZC) energy source for the building/development. This study covers as a minimum:
 - a. Delivered energy from the LZC energy source per year.
 - b. A profitability calculation of the potential specification,
 - c. Any local planning criteria that may exist in the region including those relating to land use and noise.
 - d. Feasibility of exporting heat/electricity from the system.
 - e. Any available grants.
 - f. Any technologies appropriate to the site and energy demand of the development.
 - g. Reasons for excluding other technologies.
 - h. Where appropriate to the building type, the potential for connecting the proposed building to an existing local community CHP system or source of waste heat or power OR specifying a building/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.
2. A local LZC energy technology has been specified/installed for the building/development in line with the recommendations of the above feasibility study.
3. The feasibility study has been carried out at outline proposal/concept design (Step 3) or equivalent procurement stage.

OR

Two credits

4. Criteria 1 to 3 are achieved.
5. The feasibility study includes a Life Cycle Assessment (LCA) of the carbon impact of the chosen LZC system(s), accounting for its embodied carbon emissions and operational carbon savings and emissions. The LCA study must be completed in accordance with NS-EN ISO 14044:2006 Environmental Management Life Cycle Assessment – Requirements and Guidelines⁸
6. The LCA must consider a 60 year period (a typical assumption for the life of a building) and any necessary replacements/maintenance requirements within this period.

⁸ ISO 14044:2006 Environmental Management Life Cycle Analysis, Requirements and Guidelines, International Standards Organisation, Geneva

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>To award credits for speculative buildings the feasibility study must be completed as part of the shell and core design and build. Where appropriate, as determined by the recommendations of the feasibility study, responsibility for specifying/installing the relevant LZC technology can be passed to the future tenant in order to comply with the remaining criteria for this issue. In these circumstances compliance is demonstrated at the design and post construction stages of assessment via:</p> <ol style="list-style-type: none"> Option 1 - Inclusion of the relevant clause(s) in a tenancy lease agreement between the developer and tenant/s (full value of available credits) N/A Option 3 - Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options.
CN2	Feasibility study	<p>When the feasibility study is completed later than outline proposal/concept design stage (Step 3) the report must include details of the local LZC energy sources which have been discounted due to their late consideration, and the reason for their omission. If the feasibility study discounts all local LZC as unfeasible due to the late stage in the project that the study was commissioned, then the credit for the feasibility study must be withheld unless their omission is justified for technical reasons unaffected by late consideration.</p> <p>If the feasibility study was commissioned at or before the outline proposal/concept design stage (Step 3) and the study concludes that the specification of any local LZC technology is unfeasible, the first credit can still be awarded. The second credit will not be achievable.</p>
CN3	Recognised 'local' LZC technologies	<p>Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources 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. (www.eur-lex.europa.eu). All other ancillary requirements set out in the EU Directive also apply.</p> <p>The following requirements must also be met:</p> <ol style="list-style-type: none"> There must be a Private wire arrangement for the supply of energy produced to the building under assessment. 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. <p>The project 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.</p>
CN4	LZC technology not listed	<p>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 Grønn Byggallianse if in doubt.</p>
CN5	Waste heat from a building related operational process	<p>For the purpose of this BREEAM issue, waste heat from a process occurring within the assessed building (or on the assessed site) can be considered as 'low carbon'. This is on the condition that the generation of the heat from the process is integral to the assessed building.</p>

Ref	Terms	Description
CN6	Community and off-site schemes	'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 renewable and Near-site LZC technologies, accredited external renewables cannot be used to demonstrate compliance with the criteria of this BREEAM issue.
CN7	Waste incineration	Waste heat from an incineration plant can only be considered as low carbon for the purpose of this BREEAM issue if all other LZC technologies have been considered and discounted in the feasibility study and EITHER <ol style="list-style-type: none"> 1. The region in which the incineration plant is located is demonstrably meeting its annual waste reuse/recycling targets and waste management policies. Where waste targets and policies do not exist, then waste incineration cannot be considered as low carbon OR 2. A near or onsite facility connected to the building, via a private wire arrangement, is demonstrably removing re-usable and recyclable waste material prior to incineration.
CN8	Biofuels	Given the current uncertainty over their impact on biodiversity, global food production and greenhouse gas savings, plus the ease of inter-changeability between fossil fuels, BREEAM does not recognise or reward: <ol style="list-style-type: none"> 1. Building systems fuelled by First generation biofuels manufactured from feedstock's, i.e. 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 CN9 BREEAM may recognise: <ol style="list-style-type: none"> 1. Systems using Second generation biofuels (see Relevant definitions). 2. Biofuels manufactured from biodegradable waste materials e.g. biogas, waste vegetable oil, etc. 3. Locally or sustainably sourced solid biofuels, e.g. woodchip, wood pellets where these are not interchangeable with fossil fuels or first generation biofuels.
CN9	Second generation biofuels and biofuels from waste streams	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 and other waste vegetable matter to produce biofuel. <p>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 will be required for review by Grønn Byggallianse prior to confirmation of acceptability. Matters which will be required for consideration include the following:</p> <ol style="list-style-type: none"> 1. Type, provenance and sustainability of the biomass feedstock. 2. Avoidance/minimisation of fossil fuel use in extracting the biofuel. 3. Minimising fossil fuel use in transporting the biomass/biofuel. 4. Presence of a supply agreement and a robust supply chain. 5. Compatibility of the biofuel with the specified boiler/plant and manufacturer's warranty issues. <p>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 quantify 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.</p>

Ref	Terms	Description
CN10	Building assessed part of a larger development	Where the building under assessment forms part of a larger development and either a new or existing LZC installation is provided for the whole site, then the amount of LZC energy generation counted for in this issue, and subsequent emissions saved, should be proportional to the building's energy demand compared to the total energy demand for the site (see also note below on existing LZC technology).
CN11	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. See also CN 14, regarding allocating of emission reductions.
CN12	Export to the grid	Any electricity/ or excess heating/cooling from an onsite LZC energy source that is exported to the grid may be included in the calculations as if it were used within the building.
CN13	Emission factors	The specific emission factor feeded in to the LCA must be calculated based upon the average quantity of fuel / energy sources expended for the last 3 years, and the associated degrees of efficiency for the systems. Documentation must then be provided for such. If plans exist for the redesign of the energy supply or replacement of production equipment during the course of the first 3 years after the building has been constructed, the actual emission factor may be computed based upon the data for such, provided that satisfactory documentation is delivered. If satisfactory documentation is not delivered, specific emission factors defined by the National research centre Zero Emission Buildings (ZEB), (www.zeb.no) must be used: Electricity from the grid: 132 g/kWh delivered energy to the building Biofuel: 14 g/kWh delivered energy to the building Natural gas: 211 g/kWh delivered energy to the building Heating oil: 284 g/kWh delivered energy to the building District heating (ref.): 211 g/kWh delivered energy to the building
CN 14	Private wire arrangement	Where used in the context of BREEAM for low and zero carbon technology installations, a 'private wire arrangement' is defined as a system where any energy generated on or in the vicinity of the site is fed directly to the building being assessed, by dedicated distribution systems. If electricity is generated that is surplus to the instantaneous demand of the building, this electricity may be fed back to a national or local distribution grid. The carbon benefit associated with any electricity fed into the distribution network 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. Similar assumptions and compliance rules should be applied to heat distribution systems.

Evidence

Ref	Design stage	Post-construction stage
1-3	The feasibility study report. Design drawings or relevant section/clauses of the building specification or contract. A letter from the energy specialist confirming compliance with the definition of an energy specialist and the timing of the feasibility report.	As design stage AND BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings.
4-6	Evidence (as outlined above) confirming compliance with the first credit. A copy of the LCA study report/findings demonstrating the percentage carbon saving over the lifetime of the LZC system.	Up-to-date evidence (as outlined above) confirming compliance with the first credit. BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings.

Additional information

Relevant definitions

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 generation biofuels

First generation biofuels are biofuels made from sugar, starch, vegetable oil, or animal fats using conventional technology. Common first generation biofuels include vegetable oil, biodiesel and bioalcohols.

Profitability calculation:

The present value is used to assess the profitability of an investment. Present and future revenues and expenses will be converted to the present value. A positive present value means that the investment is profitable. It encompasses costs associated with planning, design, acquisition, operation, maintenance and disposal, less any possible residual value.

Life Cycle Assessment (LCA)

This is the requirement to look at the carbon balance of each technology over its whole life. Encouraging people to not just consider the savings or emissions over its operational life but also the savings or emissions over the whole life of the technology (from 'cradle to grave'), therefore reflecting the fact that different technologies have different life spans and impacts at each stage of the life cycle.

Near-site Low and Zero Carbon (LZC) Technologies

Renewable energy generated near to the site that is provided for all or part of the community, including the assessed building, e.g. decentralised energy generation linked to a community heat network or renewable connected via Private wire arrangement.

On-site Low and Zero Carbon (LZC) Technologies

Renewable energy generated on the assessed building or on the site of the assessed development.

Second generation biofuels

Second generation biofuels are biofuels from lignocellulosic biomass feedstock using advanced technical processes⁹.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

⁹ Sustainable Bioenergy: a framework for decision makers, United Nations – Energy, 2007.

Ene 05 Energy efficient cold storage (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	-

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 for:

One credit

1. With respect to the refrigeration system, its controls and components:
 - a. A strategy for the design and installation has been produced and implemented by a Suitably qualified engineer from concept design stage (Step 3) 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.
 - 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.
 - c. At least 50% of the relevant energy efficient design features (refer to CN4) have been specified/installed.
 - d. Control systems have been installed to minimise refrigerant temperature lifts by providing controls that optimise evaporator temperature levels and avoid head pressure control.
 - 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.
 - 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.
 - g. The design specification details appropriate commissioning and test procedures to be undertaken at completion.
 - 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.
 - i. Control of defrosting systems should make sure that there is no risk for cold liquids into the evaporator containing hot gas (i.e. liquid hammer should be avoided)
2. The refrigeration system has been commissioned as follows:
 - a. In compliance with criteria 1-6 for 'Commissioning' outlined in BREEAM issue Man 04 Commissioning and handover. This does not necessarily require the 'Commissioning' credits to have been awarded.
 - 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

3. The refrigeration system uses robust and tested components that meet published energy efficiency criteria (refer to CN5).

One credit

4. Criteria 1 and 2 are achieved.
5. The installed refrigeration system demonstrates a saving in Indirect operational greenhouse gas emissions (CO₂) 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.

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	If the assessed building is an extension to an existing building and there is cold storage plant in the existing building that will serve the new extension, then this plant must meet the criteria in order to achieve any available credits.
CN2	Shell and core	Where a cold storage system will be required and installed by a future tenant, compliance with this BREEAM issue can be demonstrated via one of the following means for shell and core/speculative buildings/areas: <ol style="list-style-type: none"> 1. Option 1 - Inclusion of the relevant clause(s) in a tenancy lease agreement between the developer and tenant(s) (full value of available credits) 2. Option 2 - A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 - Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options.
CN3	Scope of this BREEAM issue	This issue is applicable only in instances where commercial/industrial sized refrigeration and storage systems are specified, for example, <ol style="list-style-type: none"> 1. Storage and refrigeration of food in supermarkets and commercial or institutional kitchen 2. Cold storage facilities in industrial, laboratory, healthcare and other buildings. The issue applies to building integrated systems only, including e.g. supermarket chiller/freezer display units that are connected to the building's system. The criteria do not apply where only domestic-scale refrigeration is to be installed; this type of installation is covered within BREEAM issue Ene 08 Energy efficient equipment. If the building does not contain commercial/industrial sized refrigeration system(s), this issue is not applicable to the assessment.

Ref	Terms	Description
CN4	Energy efficient design features	<p>Below are some design options that are intended to achieve best practice energy efficiency of the cold storage equipment:</p> <ol style="list-style-type: none"> 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. <p>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.</p>
CN5	Published energy efficiency criteria	<p>Where specified as part of the refrigeration system, products used for the following components must meet published energy efficiency criteria listed in Norsk kulde- og varmepumpenorm (Eng: Norwegian refrigeration and heat pump norm):</p> <ol style="list-style-type: none"> 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. Liquid pressure amplification 9. Refrigerated display cabinets 10. Refrigeration compressors 11. Refrigeration system controls <p>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 or Eurovent Certification (http://www.eurovent-certification.com/)</p>
CN6	Modelling a 'baseline' building	<p>The Suitably qualified engineer must confirm details of the baseline system used and that it is based on a typical installation/technology for that building type. The systems being compared must have the same duty and service conditions and include the relevant consumption from the refrigeration systems ancillary equipment.</p>

Evidence

Ref	Design stage	Post-construction stage
1&4	Relevant section/clauses of the building specification or contract or other documentary evidence, such as a letter from the design team. Where not all energy efficient design features are relevant to the project, written justification of why they have been excluded from the suitably qualified engineer.	As design stage.
2&4	Evidence as outlined under BREEAM issue Man 04 Commissioning and handover for the relevant criteria.	As design stage.
3	A letter from the manufacturer/supplier or copies of their technical literature confirming the specific components meet published energy efficiency criteria AND/OR a print out of the ETPL or Eurovent –certification (or equivalent) listing the specific products. A confirmation (from the manufacturer/supplier or the Suitably qualified engineer that the test condition are relevant for the operating condition of the installation.	As design stage.
5	Documentary evidence confirming the type of technology specified and estimated savings in indirect greenhouse emissions, including a description of how this saving is achieved. Calculations should be carried out by the suitably qualified engineer including justifications for assumptions and methodologies for savings in indirect greenhouse	As design stage plus confirmation of installed technology.

Additional information

Relevant definitions

ECA Energy Technology Product List (ETPL)

The ETPL list is part of the UK Government's Enhanced Capital Allowance Scheme, a key part of the UK 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 ETPL details the criteria for each type of technology, and lists those products in each category that meet them: www.eca.gov.uk.

Eurovent Certification

Eurovent Certification certifies the performance ratings of air-conditioning and refrigeration products according to European and international standards. The objective is to build up customer confidence by levelling the competitive playing field for all manufacturers and by increasing the integrity and accuracy of the industrial performance ratings.

Indirect operational greenhouse gas emissions

These are the indirect greenhouse gas emissions that result from the production of energy used to power the refrigeration systems cooling plant. This includes the emissions from the production of grid electricity or an onsite 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.

Suitably qualified engineer

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

1. Holds a degree or equivalent qualification in refrigerating and heat pump technique or a relevant related subject.
2. Has a minimum of five years relevant design experience (within the last seven years). Such experience must clearly demonstrate a practical understanding of factors affecting the design of cold storage and include related continued professional development (CPD).
3. Has the authority to make decisions in regards to the final design.

Total Equivalent Warming Impact (TEWI)

TEWI is a measure of the overall global-warming impact of equipment based on the total related emissions of greenhouse gases during the operation of the equipment and the disposal of the operating fluids at the end-of-life.

TEWI takes into account both direct fugitive emissions, and indirect emissions produced through the energy consumed in operating the equipment. TEWI is measured in units of mass of CO₂ equivalent. It is important that TEWI is calculated relative to a particular refrigerating system and not only to the refrigerant itself. It varies from one system to another and depends on assumptions made relative to important factors like operating time, service life, conversion factor and efficiency.

Checklists and tables

None.

Calculation procedures

Calculating indirect Greenhouse Gas emissions (CO₂) using TEWI

When calculating the Total Equivalent Warming Impact (TEWI) factor, the following equation¹⁰ must be used where the various areas of impact are correspondingly separated:

$$TEWI = GWP * L * n + [GWP * m * (1 - \alpha_{recovery})] + n * E_{annual} * \beta + [GWP * m_i * (1 - \alpha_i)]$$

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:

$$TEWI (Indirect) = n * E_{annual} * \beta$$

¹⁰ NS EN 378-1 Refrigerating systems and heat pumps - Safety and environmental requirements Part 1: Basic requirements, definitions, classification and selection criteria.

TEWI Equation Terms	
TEWI	Total equivalent warming impact (kgCO ₂)
$GWP * L * n$	Impact of leakage losses
$GWP * m * (1 - \alpha_{recovery})$	Impact of recovery losses
$n * E_{annual} * \beta$	Impact of energy consumption
$GWP * m_i * (1 - \alpha_i)$	Global warming potential of gas in the insulation (CO ₂ related)
GWP1	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	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
<p>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 CO₂</p> <p>2. The conversion factor β gives the quantity of CO₂ produced by the generation of 1 kWh. It can vary considerably geographically and in terms of time.</p>	

In the above methodology many of the assumptions and factors are usually specific to an application in a particular location. Comparisons between different applications or different locations are therefore unlikely to have much validity.

Other information

The IPCC/TEAP Special Report 2005¹¹ refers to TEWI as a simplified method for assessing life-cycle greenhouse gas emissions of an application.

Further guidance on applying TEWI to a baseline building, please refer to the guidelines of methods for calculating TEWI listed below:

- Guideline Methods of Calculating TEWI. Issue 2. British Refrigeration Association, 2006.
- Methods of calculating total equivalent warning Impact (TEWI) 2012. The Australian Institute of Refrigeration, air conditioning and heating (AIRAH)

¹¹ IPCC/TEAP Special Report: Safeguarding the Ozone Layer and the Global Climate System, 2005

Ene 06 Energy efficient transportation systems

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To recognise and encourage the specification of energy efficient transportation systems.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. Where either lifts, elevators, escalators or moving walks (transportation types) are required:
 - a. The design team has carried out an analysis of the transportation demand and usage patterns for the building (traffic study of the building) and determined the optimum number and size of lifts, elevators (including Counterbalancing ratio, see CN2), escalators and/or moving walks.
 - b. The energy consumption has been estimated for one of the following:
 - i. At least two types of system (for each transportation type required)
 - ii. An arrangement of systems (e.g. for lifts, elevators, hydraulic, traction, MRL)
 - iii. A system strategy 'fit for purpose' (scheduling)
 - c. The lift/escalator/moving walk system/strategy with the lowest energy consumption is specified.

Two credits

2. Criterion 1 is achieved.
3. For lifts, of the following energy-efficient features, the three that offer the greatest potential energy saving are specified:
 - 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.
 - b. The lift car uses energy-efficient lighting and display lighting, i.e. an average lamp efficacy, across all fittings in the car, of > 55 lamp lumens/circuit watt and lighting switches off after the lift has been idle for a prescribed length of time.
 - c. The lift uses a drive controller capable of variable-speed, variable-voltage, variable-frequency (VVVF) control of the drive motor.
 - d. The lift has a regenerative drive unit so that any energy generated by a traction lift (due to running up loaded to less than the counterbalancing ratio or running down loaded to more than the counterbalancing ratio) or by an hydraulic lift (due to running down) is returned back to the electricity utility supplier or used elsewhere in the building.
4. For escalators and/or moving walks, each escalator and/or moving walk complies with EITHER of the following:
 - a. It is fitted with a load sensing device that synchronises motor output to passenger demand through a variable speed drive
 - b. It is fitted with a passenger sensing device for automated operation (auto walk), so the escalator operates in stand-by mode when there is no passenger demand.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Compliance with these issues can be demonstrated via one of the options below in shell and core buildings/areas:</p> <ol style="list-style-type: none"> Option 1 – Use of tenancy lease agreement between the developer and tenant/s (full value of available credits) Option 2 – N/A Option 3 – Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options. <p>The use of shell and core options 1 or 3 are only allowable provided that:</p> <ol style="list-style-type: none"> The shell and core build accommodates the scope for the specification of lifts by future tenants, i.e. lift shafts, motor rooms, etc. are present in the shell and core plans. It is practical and technically feasible for the tenant to specify and install the equipment in compliance with the BREEAM criteria. The compliant equipment will be installed and commissioned prior to occupation of the building.
CN2	Counter balancing ratio	<p>The requirement to analyse the counterbalancing ratio can be omitted if the project team can provide a statement confirming that it has been set by the manufacturer due to existing standards and to maximise efficiency. The remaining criteria must be met.</p> <p>Lifts have a specified rated load and, as such, the counterbalancing ratio will be set accordingly (generally the counterbalance ratio used is between 40% and 50%). Provided the type, number of lifts and the rated lift load specified, is based on an appropriate analysis of the transportation/lift passenger demand for the building, then the counterbalancing ratio can be considered optimised for the purposes of compliance with BREEAM.</p>
CN3	Exemptions	<p>The criteria relating to lifts within this issue do not apply to buildings that are installing lifting platforms, wheelchair stairlift/platforms or other similar facilities to aid persons with impaired mobility. However, any lift with a rated speed greater than 0.15m/s must be assessed inclusive of goods, vehicle and passenger lifts.</p>
CN4	Building has no lifts, escalators or moving walks	<p>Please note this issue will not be assessed where a building contains no lifts, escalators or moving walks.</p>
CN5	Lift car lighting	<p>The requirement for switching off the lift car lighting after the lift has been idle for a prescribed length of time shall not affect any lift emergency lighting requirements, which will switch on automatically in the event of any loss of power.</p>
CN6	Re-regenerative drive unit	<p>Where it can be demonstrated that the electrical distribution infrastructure locally/within the country of assessment does not allow for electricity generated on site to be returned to the network, and there is no demand for or feasible means of using this electricity elsewhere in the building or on the site, then the second credit can be assessed and awarded on the basis of meeting criteria 3 a. to c.</p>

Evidence

Ref	Design stage	Post-construction stage
1-2	Professional report/study of transportation analysis and/or calculations	As design stage.
3-4	<p>Formal letter of commitment from the system(s) manufacturer/supplier. OR</p> <p>Relevant section/clauses of the building specification or contract. AND Manufacturers product details.</p> <p>AND (in both cases) Where the regenerative drive unit is to be excluded as an energy efficient feature, written confirmation from electricity utility supplier and the design team giving reason's for its exclusion.</p>	Manufacturer's product details. BREEAM Assessor's site inspection report and photographic evidence and or 'as built' drawings

Additional information

Relevant definitions

Counterbalancing ratio

Traction lifts may use a counterweight to balance the weight of the car plus a proportion of the rated load; this reduces the size of the drive motor required for the lift. Lowering the counterbalancing ratio means a smaller motor and controlling drive unit are required, thus saving energy. Counterbalancing ratios are normally provided in the range of 40-50% for safety reasons. Any other values should be carefully considered. Hydraulic lifts may use a balance weight to balance out a proportion of the weight of the car; this reduces the size of the drive motor required for the lift.

Lift, elevator

Also known as an elevator, this is a platform or an enclosure raised and lowered in a vertical shaft to transport people or freight.

Lift car lighting

The level of lift car lighting is determined by the relevant standards. For example, NS-EN 12464 Light and lighting – Lighting of work places – Part 1: Indoor work places¹² has requirements for maintained illuminance (E_m) and several other lighting parameters for elevators, escalators and moving walks (travolators).

MRL

Machine Room Less lift, i.e. all equipment is contained in the lift well, not in a separate machine room.

¹² Norwegian adaptation of the standard and relevant requirements can be found as "Lyskultur - Luxtabell og planleggingskriterier for innendørs belsningsanlegg"

Standby condition

A condition when a lift is stationary at a floor and has reduced the power consumption to the minimum level set for that particular lift and terminates at the next traffic demand [from from NS-EN ISO 25745-1:2012]. The period between when the lift was last used and when standby condition is entered is not defined, but should be as short as possible without compromising any safety requirements.

Checklists and tables

None.

Calculation procedures

None.

Other information

CIBSE Guide D Transportation systems in buildings.4th Edition, 2010

Detailed design guidance on transportation systems is given in CIBSE Guide D: 2010 Transportation systems in buildings, Chapter 13: Energy consumption of lifts, escalators and moving walks.

Ene 07 Energy Efficient Laboratory Systems

(non residential only)

Number of credits available	Minimum standards				
Up to 5 credits (Building type dependent)	P	G	VG	E	O
	-	-	-	-	-

Aim

To recognise and encourage laboratory areas that are designed to be energy efficient and minimise the CO₂ emissions associated with their operational energy consumption.

Assessment criteria

The issue is split into three parts

- Pre-requisite
- Design specification
- Best practice energy efficient measures

The following is required to demonstrate compliance for:

Pre-Requisite

1. Criterion 16 within the issue Hea 02 (Risk assessment) has been achieved.

Design Specification

One credit

2. Client engagement is sought through consultation during the preparation of the initial project brief (Step 2) to determine occupant requirements and define laboratory performance criteria. Performance criteria should include, but not be limited to the following aspects:
 - a. Description of purpose
 - b. Occupant / process activities
 - c. Containment requirements and standards
 - d. Ventilation system performance and efficiencies
 - e. Heating and cooling requirements
 - f. Interaction between systems
 - g. Flexibility/ 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 definition) of the services system equipment (including ventilation supply and extract).

Laboratory containment devices and containment areas

4. Specification of fume cupboards and other containment devices has been carried out in compliance with criteria 17 and 18 of issue Hea 02 Indoor Air Quality the (laboratory containment devices and containment areas) as appropriate to the containment device specification.
5. Where ducted fume cupboards are specified:
 - a. Compliance with item a) in Best practice energy efficient measures in laboratories
 - 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.

- 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.

Best practice energy efficient measures

An additional two to four credits

6. Criteria 1-5 are achieved (or criteria 1-4 where ducted fume cupboards are not specified).
7. Laboratory plant and systems are designed, specified and installed in compliance with items B to L in Best practice energy efficient measures in laboratories (see (a) and (b) below for how credits are awarded)
 - a. Up to 2 credits: The laboratory area accounts for at least 10% (but less than 25%) of the total building floor area OR
 - b. Up to 4 credits: The laboratory area accounts for at least 25% 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.

Compliance notes

Ref	Terms	Description
CN1	Scope of this BREEAM issue	This issue is only applicable to buildings with laboratories.
CN2	Front speed	Where safe containment and removal of pollutants (according to HEA 02) requires an average face velocity of more than 0,5 m/s, this must be justified, and the lowest possible front speed must be calculated/specified.

Evidence

Ref	Design stage	Post-construction stage
1&4	Evidence as required for compliance with the relevant Hea 02 criteria.	Evidence as required for compliance with the relevant Hea 02 criteria.
2-3	Agenda/minutes from client consultation meetings. Suitable evidence demonstrating that the design team have considered consultation feedback and any subsequent actions. Relevant section/clauses of the building specification or contract showing defined laboratory facility performance criteria.	BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings. Supplier/manufacturers/design team documentation for 'as built' specification.
5-9	Evidence as required for compliance with the relevant Hea 02 criteria. Drawings, relevant section/clauses of the building specification or contract Modelling results / calculations / manufacturers information Formal correspondence from the design team	As design stage but for 'as built' information BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings. A commissioning report or similar demonstrating that the design containment performance and airflows have been achieved.

Additional information

Relevant definitions

Laboratory areas

Laboratory areas are defined as highly serviced (temperature/ventilation/humidity/containment controlled) spaces where physical/biological or chemical processing and/or testing is carried out. Such areas will have an 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. A 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/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 and/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. 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 HVAC, plug load equipment and access. This can lead to enormous variations in energy and water requirements. The main types of laboratories include:

- Wet laboratories - where chemicals, drugs or other material or biological matter are tested and analysed requiring water, direct ventilation and specialised piped utilities. Typically includes chemical science laboratories. These laboratories require specially designed facilities.
- Dry laboratories - contain dry stored materials, electronics, and/or large instruments with few piped services. Typically includes engineering or analytical laboratories that may require accurate temperature and humidity control, dust control, and clean power.
- Microbiological/clinical laboratories - often involve working with infectious agents. Typically require higher levels of primary containment and multiple secondary barriers including specialized 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.
- 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.
- Teaching laboratories - unique to academic institutes, they require space for teaching equipment, storage space for student belongings and less instrumentation than research labs.
- Cleanrooms - 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. Typically used in UK universities for Nanotechnology, medical and pharmaceutical research/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 lifecycle cost benefits, whilst taking account for the need for appropriate contingency.

Checklists and tables

Table 20: Best practice energy efficient measures in laboratories

Item	Category	Item description	Credits 1
A	Fume cupboard reduced front speed	An average design face velocity in the fume cupboards specified no greater than 0,5 m/s	1
Additional items			
B	Fan power	Specification and achievement of best practice fan power figures (as detailed 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		Specific fan power	
General laboratory supply air AHUs with heating and cooling		1.5	
General laboratory extract systems		1.2	
Laboratory local extract ventilation – ducted		1.0	
Containment area extract, without HEPA filtration		1.5	
Containment area extract, with HEPA filtration		2.5	
Fume cupboard extract		1.5	
C	Fume cupboard front speed(further reduction)	An average design face velocity in the fume cupboards specified no greater than 0.4 m/s	0.5
D	Grouping and/or isolation of high filtration/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 change rates	Reducing air change rates by matching ventilation airflows to environmental needs and demands of containment devices.	0.5
<p>1. Only whole credits can be awarded in BREEAM. 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.</p>			

Calculation procedures

None.

Other information

Synergy with BREEAM issue Ene 01 Energy efficiency

This BREEAM issue has been developed to recognise improvements made to laboratory areas/buildings, as part of the design and procurement of the building, that currently are not recognised fully through the National Calculation Methodology used to assess and award credits in Ene 01 Energy efficiency.

Ene 08 Energy efficient equipment

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To recognise and encourage procurement of energy-efficient equipment.

Assessment criteria

The following is required to demonstrate compliance for:

Up to two credits

- Identify from the list in the table below the functions/equipment that are or will be present within the assessed building. Of those functions, identify those responsible for the significant majority of Equipment energy consumption in the building. Two credit(s) are then awarded for compliance with the corresponding criteria. One credit can be awarded for compliance with criteria E4 for residential developments.

Table 21: Energy efficient equipment requirements

Ref	Function/equipment	Criteria.
A	Small power, plug in equipment	The following meets the criteria for or has been awarded with a rating from international energy efficient equipment scheme (Directive 2010/30/EU or EU Energy Star): <ol style="list-style-type: none"> Office equipment, if delivered with the building Domestic scale white goods and other small power equipment. Note: Where domestic scale white goods are present the rating levels given within E Residential areas must be met.
B	Swimming pool	<ol style="list-style-type: none"> 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 jacuzzi (if relevant). The cover(s) envelop the entire pool surface when fully extended. Where the air temperature in the pool hall can be controlled so that it is 1 °C above the water temperature.
C	Communal laundry facilities with commercial sized appliances	At least one of the following can be demonstrated for commercial sized appliances: <ol style="list-style-type: none"> Specification of heat recovery from waste water. Use of greywater for part of the washing process, i.e. either water from the final rinse used for the next pre-wash or water sourced from a rain water collection tank (s).

Ref	Function/equipment	Criteria.
D	Data centre	<ol style="list-style-type: none"> Design is in accordance with the 'Best practices for the EU Code of Conduct on Data Centres¹' principles with the data centre achieving at least the 'Expected minimum practice' level (as defined in the Code of Conduct). Note: the requirements set out in this code are not Europe specific. Temperature set points are not less than 24 °C, as measured at the inlet of the equipment in the rack.
E	Residential areas with domestic scale appliances (individual and communal facilities)	<ol style="list-style-type: none"> Fridges, freezers and fridge freezers have an A+ (or equivalent rating) under European Union energy label. Washing machines and dishwashers have an A (or equivalent rating) under European Union energy label.. Where provided, washer-dryers and tumble dryers have a B rating (or equivalent rating) under European Union energy label. (If not provided criterion E4 must be achieved for tumble dryers.) <p>OR</p> <ol style="list-style-type: none"> 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. <p>Note:</p> <ol style="list-style-type: none"> Any white goods available to purchase from the developer must be compliant with criteria E1 to E3 above. If criteria E4 is chosen to demonstrate compliance, only one of the two available credits can be awarded.
F	Kitchen and catering facilities	<p>Where the project team can demonstrate that the project has incorporated at least one energy efficiency measure for each of the following:</p> <ol style="list-style-type: none"> Drainage and kitchen waste removal (where these consume energy). Energy controls - specifically controls relevant to equipment. Appliance and fabrication specification -not utensil specification. Refrigeration. Dishwashers and glass washers. Cooking appliance selection. Water temperatures, taps, faucets and water saving controls. <p>Detailed guidance on measures to achieve energy efficiency in kitchens is given in CIBSE Guide TM50 Energy Efficiency in Commercial Kitchens² Sections 8 to 15 cover the 7 topics listed by BREEAM.</p>

EU Code of Conduct on Data Centres: http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative_data%20centers.htm

CIBSE TM50: Energy Efficiency in Commercial Kitchens, CIBSE, 2009. Can be purchased from: <http://www.cibse.org/knowledge/knowledge-items/detail?id=a0q2000000817f3AAC>

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Compliance with this BREEAM issue can be demonstrated via one of the following means for shell and core/speculative buildings/areas:</p> <ol style="list-style-type: none"> Option 1 - Inclusion of the relevant clause(s) in a tenancy lease agreement between the developer and tenant/s (full value of available credits) Option 2 - A Green Building Guide for tenant fit outs (half the value of the available credits) Option 3 - Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN2	Significant majority	<p>BREEAM does not specify how 'significant majority' is calculated as this may be complex. The project team must justify how they have determined or judged "significant majority" and the assessor must be satisfied that this is an appropriate justification.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>The following where appropriate:</p> <ul style="list-style-type: none"> Relevant section/clauses of the building specification or contract. Manufacturers product details. Documentation confirming compliance with the relevant scheme or standard outlined in the criteria Design drawings and/or calculations. 	<p>The following where appropriate:</p> <ul style="list-style-type: none"> BREEAM Assessor's site inspection report and photographic evidence. Manufacturers product details. Documentation confirming the installed equipment complies with the relevant scheme or standard outlined in the criteria.

Additional information

Relevant definitions

Data centre

For the purpose of this BREEAM issue, the term 'data centres' includes all buildings, facilities and rooms that 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).

Domestic scale white goods and other small power equipment

Domestic appliances; for example, washing machines, fridges and freezers, tumble dryers, air-movement fans/heaters, etc.

Equipment energy

Building energy consumption resulting from equipment and appliances that are or will be specified and used in the assessed building. This includes energy consumption from operational related equipment, e.g. servers, printers, computers, swimming pools, cooking and other appliances.

Office equipment

Computer monitors, computers, scanners, photocopiers, printers, workstations, etc.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Ene 09 Drying space

(residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To provide a low energy means of drying clothes.

Assessment criteria

The following demonstrates compliance for:

One credit

1. For dwellings, a compliant internal space with posts and footings, or fixings capable of holding:
 - a. 1-2 bedrooms: 4m+ of drying line
 - b. 3+ bedrooms: 6m+ of drying line.
2. For buildings with individual bedrooms, shared areas and communal facilities, a compliant internal space with posts and footings, or fixings capable of holding:
 - a. 2m+ of drying line per bedroom for developments with up to 30 individual bedrooms PLUS
 - b. 1m of additional drying line for each bedroom over the 30 individual bedroom threshold.
3. The space is secure.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>The provision of adequate drying space must be confirmed for any development seeking this credit. If the specification and installation of adequate posts and fittings, or fixtures for a drying line forms part of a subsequent fit-out of the building, and not a part of the base build, then compliance can be demonstrated via one of the following available means:</p> <ol style="list-style-type: none"> 1. Option 1 - Use of a green lease agreement between the building owner and landlord, if two separate parties (full value of available credits) 2. Option 2 - A Green Building Guide for fit outs (half the value of the available credits) 3. Option 3 - Confirmation of compliance is provided by the fit-out contractor or building landlord/owner (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>

Ref	Terms	Description
CN2	Compliant internal space	<p>This is EITHER;</p> <ol style="list-style-type: none"> 1. 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 2. 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. <p>AND</p> <ol style="list-style-type: none"> 3. The fixing/fitting needs to be a permanent feature of the room. <p>Internal drying spaces in the following rooms do not comply:</p> <ol style="list-style-type: none"> 1. Living rooms 2. Kitchens 3. Dining rooms 4. Main halls 5. Bedrooms
CN3	Secure space	For dwellings, this is an enclosed space only accessible to the residents of the dwelling. For buildings with a communal drying space, this is an enclosed space with a secure entrance, accessible to the residents of the building only.
CN4	Individual bedrooms with shared areas and communal facilities– criterion 2	Criterion 2 is only applicable to Bespoke assessments. Please refer to the Bespoke project criteria appendix for confirmation as to the applicability of the requirements of this issue.
CN5	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.

Evidence

Ref	Design stage	Post-construction stage
All	Design drawings AND/OR relevant section/clauses of the building specification or contract AND/OR a formal letter of instruction from the developer to a contractor/supplier.	BREEAM Assessor's site inspection report and photographic evidence AND/OR 'As built' drawings. Purchase orders/receipts.

Additional information

Relevant definitions

None.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Ene 23 Energy performance of building structure

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	2

Aim

To recognize and encourage minimization of the building's net energy demand

Assessment criteria

The following demonstrates compliance for:

Two credits:

Design Initiatives:

1. The building's net energy demand for heating and cooling shall be calculated according to NS 3701 for commercial buildings or NS 3700 for residential buildings by a suitably qualified energy modelling engineer.
2. The building is designed to reduce the extent of air leaks.
3. Energy requirements calculated in paragraph 1 is less or equal to the requirement for heating and cooling needs of passive house for the building category, as specified in NS 3701 for commercial buildings or in NS 3700 for residential buildings.

Performance Measures "as built".

4. It has been performed an air leakage testing combined with a thermographic survey of the building construction to confirm the following:
 - a. Insulation continuity in accordance with construction drawings
 - b. Avoidance of unnecessary thermal bridges
 - c. No paths of air leakage through construction (except through the openings that are made intentionally)
 - d. Air leakage number $\leq 0,6$ ACH measured at 50 Pa pressure difference.
5. Tightness Testing and Thermographic survey is conducted in accordance with the provisions of NS EN ISO 9972:2015 and NS-EN 13187.
6. Any errors that were discovered during the inspection and air leakage testing, has been repaired and the building is inspected again to verify that it matches the criteria in section 4.

Ref	Terms	Description
CN1	The extent of the thermal survey	The thermal survey must ensure that all exterior walls to the treated areas and all the walls separating treated from untreated areas, are tested.

Ref	Terms	Description
CN2	Relevant standards and references	NS 3031: 2014: Calculation of the energy performance of buildings - Method and data NS 3701: Criteria for passive houses and low energy buildings - Non-residential buildings NS 3700: Criteria for passive houses and low-energy buildings. Residential buildings NS EN ISO 9972:2015: Thermal performance of buildings - Determination of air permeability of buildings - Fan pressurization method NS-EN 13187 Thermal performance of buildings - Qualitative detection of thermal irregularities in building envelopes - Infrared method
CN3	No heated or air conditioned areas - industrial projects	If the building is designed to be not heated or air conditioned, one can omit the requirement for compliance with performance measures' as-built ". Design measures will still be applicable for future testing, ie, in the event that at some point there will be installed heating and / or air conditioning in the building.
CN4	The area's extent	The criteria basically encompass the entire building. The exception is any unheated areas in connection with the delivery of goods. For those areas that are relevant performance measures' as-built", ie the requirement for density testing and thermographic survey of the entire building.
CN5	Synergy with Ene1	One must be aware that the initiatives will also be recognized in the BREEAM-NOR area Ene 01, Energy Efficiency. This BREEAM-NOR area is thus in addition to Ene 01 to recognize and encourage specific actions to reduce net energy demand in the building.
CN6	Suitably qualified energy modelling engineer	An individual with at least 3 years of 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. (the same as for CN4 under Ene 01)

Evidence

Ref	Design stage	Post-construction stage
1-3	<p>1. Confirmation of the expertise and experience of the person who performed the modeling.</p> <p>2. A copy of the design stage report from a Suitably qualified energy modelling engineer demonstrating:</p> <ul style="list-style-type: none"> - Actual estimated net energy for heating and cooling. - The name of the approved software that was used to perform modeling for determining energy performance. <p>AND</p> <p>Where appropriate, a letter from the person who did the modeling, which confirms:</p> <p>The data was used to model the current standard building in accordance with the rules of NS 3701 / NS 3700</p>	<p>1. A report from a Suitably qualified energy modelling engineer OR printing from the calculation program, confirming that the building has achieved projected energy standard according to NS 3701/NS 3700</p> <p>2. 'As-built specifications of the input values to the calculations and a justification of any changes made to the design stage model.</p>
4, 5, 6	<p>A copy of the specification clause(s) confirming:</p> <ul style="list-style-type: none"> - A requirement to commission a thermographic study and air leakage measurement - The standards/method to which the survey will be carried out - A requirement to rectify any defects and re-inspect to confirm performance. 	<p>A copy of the survey report or certificate confirming either:</p> <ul style="list-style-type: none"> - The air leakage rate of the building - No consequential defects in construction details or continuity of air tightness layers and insulation. OR - All consequential defects remedied following re-inspection.

Additional information

Relevant definitions

Thermographic survey:

A method for creating images of a building by means of heat radiation. The images help identify areas in the building with a higher (or lower if it concerns the inner structure) surface temperatures than expected, which indicates the heat loss from, or air infiltration to, the building, which again highlights the failure of the building.

Transport

Summary

This category encourages better access to sustainable means of transport for building users. Issues in this section focus on 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 CO₂ emissions over the life of the building.

Category summary table

Issue	Credits	Credit summary
Tra 01 Public transport accessibility	Up to 5 credits	Recognition of developments in close proximity to good public transport networks, thereby helping to reduce transport-related pollution and congestion.
Tra 02 Proximity to amenities	Up to 2 credits	Recognition of developments in close proximity of, and accessible to, local amenities which are likely to be frequently required and used by building occupants.
Tra 03 Alternative modes of transport	Up to 2 credits	Provision of facilities to encourage travel using low carbon modes of transport and to minimise individual journeys.
Tra 04 Maximum car parking capacity	Up to 2 credits	Recognition of developments that limit car parking capacity.
Tra 05 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.
Tra 06 Home office	1	To provide necessary space and services to be able to work from home and reduce the need to commute to work.

Tra 01 Public transport accessibility (all buildings)

Number of credits available	Minimum standards				
Up to 5 (Building type dependent)	P	G	VG	E	O
	-	-	-	-	-

Aim

To recognise and encourage development in proximity of good public transport networks, thereby helping to reduce transport related pollution and congestion.

Assessment criteria

The following demonstrates compliance for:

Up to five credits

- The public transport Accessibility index (AI) for the assessed building is calculated and BREEAM-NOR credits awarded in accordance with the table of building types and AI benchmarks in Table 22:

Table 22: Accessibility index and BREEAM-NOR credits available

Accessibility index	≥ 0.5	≥ 1	≥ 2	≥ 4	≥ 8	≥ 10	≥ 12	≥ 18
Building Type	BREEAM credits available							
Type 1 and 2 (Offices and Industrial)	-	-	1	2	3	-	-	-
Type 3 (Retail and higher education)	-	-	1	2	3	3	4	5
Type 4 and 5 (Rural location)	-	-	1	2	-	-	-	-
Type 6 (Residential)	1	2	3	4	-	-	-	-
Type 7	-	-	1	2	3	3	3	4

- The Accessibility index is determined by entering the following information in to the BREEAM Tra01 Public Transport Accessibility Calculator:

- a. The distance (m) from the Main building entrance to each compliant public transport node
- b. The public transport type serving the compliant node, e.g. bus or rail
- c. The average number of services stopping per hour at each compliant node during the standard operating hours of the building for a typical day (see Compliance notes and Table 23 in Additional information).

One credit

Dedicated bus service

3. For buildings with a fixed shift pattern, i.e. where building users will predominantly arrive/depart at set times, one credit can be awarded where the building users will be provided with a dedicated bus service to and from the building at the beginning and end of each shift/day. The bus must provide transfer to the local population centre, public transport interchange or be a door-to-door service. This credit is available on the basis that the building is unable to achieve any of the available credits using the above methodology (i.e. it has a low AI), yet the building occupier is providing a suitable alternative transport option (alternative to the use of a private vehicle for commuting) for a majority of the building users (see Compliance notes).

Compliance notes

Ref	Terms	Description
CN1	Public transport	For the purposes of this BREEAM issue, the term 'public transport' includes 'publicly accessible' transport including services which are operated by private companies.
CN2	Operating hours	<p>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. Some building types will operate a 24 hour a day and on a shift work basis, in these instances part of the 24 hour period can be excluded from the assessment of this issue where:</p> <ol style="list-style-type: none"> 1. There is little if any public transport operating, and 2. The number of total building users travelling to the building during this time is in the minority. <p>Where the assessed building operates on a 24-hour basis, or the operating hours are unknown at the time of assessment, then the assessor can either refer to and use the table of default operating hours, which can be found in the Additional Information section of this issue OR justify alternative assumptions.</p> <p>For residences, 'operating hours' will need to reflect commuting travel and any other times of significant travel.</p>
CN3	Compliant public transport node	A compliant node includes any bus stop within 650m and any railway station, tram stop, cable car or ferry terminal within 1000m of the assessed building's main entrance, measured via a safe pedestrian route (not 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. There is no limit on the number of nodes that can be considered when calculating the AI, provided they all meet the above criteria.

Ref	Terms	Description
CN4	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 a typical day's operating hours, divided by the number of hours within the operating period. For example: the average number of services for an assessment of a building that operates between 08:00 hrs and 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).
CN5	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 mid-week day. In choosing a typical day the assessor should check that the timetabled information for that day is, within reason, representative of the public transport provision for the entire operating week (excluding Sundays or equivalent reduced service day).
CN6	No timetables available	Where public transport timetables are not available, the average number of services per hour should be determined by carrying out a survey for each mode of transport over a typical day's operating hours. Confirmation that the service runs all year (i.e. not seasonal) is also required.
CN7	Building type definitions	<p>Type 1: Staff building: user occupants only (occasional business related visitors e.g. office or industrial building).</p> <p>Type 2: Staff plus visitors, with a reasonably constant stream of visitors (Including pre-school and school)</p> <p>Type 3: Core staff plus large numbers of visitors (e.g. retail, higher education).</p> <p>Type 4: Rural buildings with predictable occupancy pattern, mostly staff occupants or staff plus residential visitors (e.g. remote/rural research centre).</p> <p>Type 5: Rural buildings with a few core staff plus large numbers of visitors.</p> <p>Type 6: Residential.</p> <p>Type 7: Transport hubs.</p> <p>Rural: 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 settlement with a center zone. Such locations will most likely be on a local bus route to larger urban areas or other local towns and may have localised shops and other facilities.</p> <p>Urban Settlement (according to Statistics Norway) An urban settlement has at least 200 people and the distance between buildings do not exceed 50 meters. A center zone consists of the centrum core and a surrounding zone of 100 meters. A centrum core is an area where the buildings are less than 50 meters apart, and where at least 3 main industrial groups are represented. In addition, it must be retail, and either public administration, health and social services or other social / personal services present.</p>

Ref	Terms	Description
CN8	Campus' development	<p>Where 80% or more of the buildings on a campus style development, e.g. university sites, are within 650m of the campus' main entrance, then the campus' main entrance can be used as the reference point for the assessment of distance to compliant public transport nodes for this issue.</p> <p>A site may have more than one main entrance, which between them account for the majority of staff, students, and visitors access the site. In such a case, either entrance can be used as the basis for the calculation.</p> <p>Where less than 80% of the buildings on the campus development are within 650m of the campus' main entrance, the assessed building's main entrance must be used as the reference point for the assessment of distance to compliant public transport node for this issue. This rule implies that for large campus developments, 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.</p>
CN9	Residential developments	<p>In a residential development, the following can be considered:</p> <ol style="list-style-type: none"> 1. Where 80% or more of the dwellings are within 650m of the development's main entrance, then the main entrance can be used as the reference point for measuring the distance to the nearest transport node. The development's main entrance is that which is accessed by the majority of the assessed development's residents/visitors. 2. <ol style="list-style-type: none"> a. Where there are less than 80% within 650m, or there are multiple main entrances, the reference point should be the mid-point of all entrances. b. Where the distance is not measured from a main entrance, the public transport node must be within the required distance for 80% of the assessed dwellings if it is to be used within the calculation.
CN10	Multiple services	<p>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.</p>
CN11	Bi-directional routes	<p>Routes will be bi-directional; however, for the purpose of calculating the index, consider only the direction with the highest frequency.</p>
CN12	Dedicated bus services	<p>The credit for the provision of a dedicated bus service is available for any building type with a fixed shift pattern; examples could include schools, offices, factories, prisons, etc. The available credit cannot be awarded where credits are already being achieved for this issue via a compliant Accessibility index. The credit is provided as an alternative, where the AI of the building is too low to achieve any BREEAM-NOR credits but where the building users will have the option of a dedicated bus service.</p> <p>A dedicated bus service can be included in the public transport Accessibility index calculation as a means of contributing towards achieving credits via this method (regardless of the shift pattern). Where this is the case, the distance from the Main building entrance to the drop-off/pick-up point (the transport node) of the service should be used.</p>

Ref	Terms	Description
CN13	Phased developments	<p>In the case of a large phased development 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:</p> <ul style="list-style-type: none"> • A commitment to provide transport facilities has been made in the General Contract Specification and the shortest of the following periods • Either the transport facilities will be available for use by the time 25% of all phases have been completed and are ready for occupation or • 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. <p>The most appropriate rule for the development 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 two years from occupation of the building, they cannot be considered for determining compliance with the BREEAM-NOR criteria.</p>

Evidence

Ref	Design stage	Post-construction stage
1&2	<p>Scaled map highlighting the location of the building and all public transport nodes in proximity of the building. Timetables for each service at each public transport node considered.</p> <p>The calculated Accessibility index for the building (Tra 01 calculator). Where appropriate; information about the dedicated bus service.</p>	<p>As design stage (where relying on a calculation carried out at the design stage to demonstrate compliance post construction).</p> <p>If the period between design and post construction stage reporting is greater than 12 months, then the AI must be re-calculated using up-to-date public transport timetable information.</p>
3	<p>A formal letter from the future building occupier confirming provision of and details for the dedicated bus service(s).</p>	<p>As design stage.</p>

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-NOR, 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. 4 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 (500m from its main building entrance) will score an AI of 2.86. The greater the number of compliant nodes, services and their proximity to the building, the higher the AI.

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. building with a boundary on a public highway).

Tra01 Public Transport Accessibility Calculator

A spreadsheet-based calculator used to determine the AI for the assessed building and the number of BREEAM-NOR credits achieved.

Checklists and tables

Table 23: Default hours of operation for a typical day

Building type	Times
Office	07:00 – 17:00
Industrial and commercial buildings	08:00 – 19:00
Preschool, school	07:30 – 10:00, 15:00 – 17:30
University, Higher Education	08:00 – 19:00
Retail: Shopping centre	09:00 - 20:00
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
Residential accommodation	08:00 - 19:00
24 hour use building	07:00 - 20:00
Note: These hours are provided as a guideline: differing hours can be used, where justified by the assessor, as a result of regional/national culture, customs or routine.	

Calculation procedures

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.

Other information

None.

Tra 02 Proximity to amenities (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2 (Building type dependent)	-	-	-	-	-

Aim

To encourage and reward a building that is located in close proximity to local amenities, thereby reducing the need for extended travel or multiple trips.

Assessment criteria

The following demonstrates compliance for:

Up to 2 credits

Table 24: List of applicable amenities for each building type and potential BREEAM-NOR credits available.

Criteria	Building types* (see CN 7 under Tra 01 for definition)					
	Types 1 – 3 & 7		Types 4 & 5	Type 6 - Residential buildings		
No. of BREEAM-NOR credits	1	1	1	1	1	2
No. of applicable amenities required	All	5**	All	2	5**	5**
Proximity of amenities (metres)	≤ 500	≤1000	≤500	≤500	≤1000	≤500
Applicable amenities						
Food shop/outlet	✓	✓	✓	✓	✓	✓
Postal facilities/ post box	✓	✓	✓	✓	✓	✓
Cash machine/ bank		✓	✓	✓	✓	✓
Pharmacy		✓		✓	✓	✓
Creche/ school				✓	✓	✓

Criteria	Building types* (see CN 7 under Tra 01 for definition)					
		Types 1 – 3 & 7	Types 4 & 5	Type 6 - Residential buildings		
Medical centre		✓		✓	✓	✓
Leisure/ sports centre		✓		✓	✓	✓
Outdoor open public access area		✓		✓	✓	✓
Community centre		✓		✓	✓	✓
Place of worship		✓		✓	✓	✓
<p>*For a definition of building types please see BREEAM issue Tra 01 Public transport accessibility</p> <p>** Where at least 5 amenities are required, it should include a food outlet as a minimum.</p> <p>For each assessment only one column must be achieved, i.e. for building types 1 - 3 & 7 column 1 OR 2 should be met to award 1 credit, not both columns.</p>						

Compliance notes

Ref	Terms	Description
CN1	Accessible amenities	The proximity distance must be measured via safe pedestrian routes, e.g. pavements and safe crossing points or, where provided, dedicated pedestrian crossing points, such as pelican or zebra crossings. A safe crossing point could also be a tactile crossing that drops to the level of the road, which could be used by wheelchair users. An element of assessor judgement is required and if in doubt, their justification of safe crossing points should be provided. The distance should not be measured in a straight line, (unless the safe pedestrian route is a straight line).
CN2	Collective amenities	One type of amenity may also exist within or a part of other types of amenities, e.g. food outlet 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'.
CN3	Amenities within assessed building or on site	The amenity can be located within the building or on the same site as the proposed development, e.g. a campus in the case of university buildings, as long as the accessibility requirements indicated within the criteria are met.
CN4	Food Outlet	This includes the following: <ul style="list-style-type: none"> - Grocery shop - Supermarket - Sandwich shop or café with lunch offerings or restaurant - On-site or off-site cafeteria or staff canteen.
CN5	Phased developments	Refer to BREEAM issue Tra 01 Public transport accessibility
CN6	No postal facilities	The building occupier can provide an alternative facility, such as a contract with the postal office or alternative mail/courier service. Alternatively, the building occupier can provide a facility to collect the mail within the building on a daily basis and arrange to have them delivered to the nearest postal facility. Daily collection of the mail will need to be guaranteed for the facility to be deemed compliant.

Evidence

Ref	Design stage	Post-construction stage
1	Marked-up site plan or map highlighting: Location of assessed building. Location and type of amenities. The route to the amenities. Plan/map scale.	Assessor's building/site inspection and photographic evidence confirming: The existence of the local amenities. The route and distance to the amenities.
	Where the amenities do not currently exist, but are due to be developed, a letter from the client/developer confirming: The location and type of amenities to be provided. The timescale for development of the amenities.	Evidence as outlined at the design stage of assessment. OR As above where amenities developed, or under development at the time of post construction review/assessment.

Additional information

Relevant definitions

None.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Tra 03a Alternative modes of transport (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To provide facilities which encourage building users to travel using low carbon modes of transport and to minimise individual journeys.

Assessment criteria

The following is required to demonstrate compliance for:

Up to two credits

One of the following options has been implemented:

Option	Criteria	Applicable building types (CN3)	Credits
1	<ol style="list-style-type: none"> During the preparation of the brief (Step 2) the design team has consulted with the local authority on the state of the local cycling network and how the development could contribute to improving it. One proposition has been chosen in agreement with the local authority and implemented. This proposition must be additional to what would have been done by the local authority without the support from the project and must have a significant impact on the local cycling network. 	All	2
2	<ol style="list-style-type: none"> Negotiations with public transport service companies have resulted in an increase of the local service provision in the development's local area. This increase in public transport service has improved the existing AI by at least 1.00 (see BREEAM issue Tra 01). 	All	2
3	<ol style="list-style-type: none"> Electric recharging stations have been provided for at least 10% of the total car parking capacity for the building. Electric recharging stations for electric bicycles have been provided for at least 10% of the total bicycle parking capacity for the building. 	All	2

Option	Criteria	Applicable building types (CN3)	Credits
4	<p>7. A car/lift sharing group/facility has been set up to facilitate and encourage building users to sign up to a car/lift sharing scheme</p> <p>8. Marketing material has been developed to help raise awareness of the system and will be communicated to the tenants where applicable.</p> <p>9. Priority spaces for car/lift sharers are provided for at least 5% of the total car parking capacity for the building.</p> <p>10. Priority spaces are located in the nearest available spaces in the nearest available parking area to the main building entrance on site.</p>	All	2
5	<p>Compliant cycle storage spaces</p> <p>11. The number of compliant cycle storage spaces provided is as follows:</p> <p>a. 10% of building users up to 500 PLUS</p> <p>b. 7% for building users in the range of 501 – 1000 PLUS</p> <p>c. 5% for building users over 1000</p>	1-5	1
	<p>PLUS</p> <p>d. 10% of building visitors up to 500 PLUS</p> <p>e. 7% of building visitors in the range of 501 - 1000 PLUS</p> <p>f. 5% for buildings visitors over 1000</p>	2, 3, 4 & 5 excluding Retail	
	<p>PLUS</p> <p>g. 5% of the total number of customer car parking spaces (excluding disabled spaces and mother-and-baby spaces where provided). This is subject to providing a minimum of 10 cycle racks. Any development that provides at least 50 customer cycle storage spaces will comply regardless of the number of parking spaces The staff spaces must be provided in addition to customer spaces and whilst they do not need to be separate from customer spaces, this is encouraged.</p>	Retail buildings only	
	<p>12. Criterion 11 is achieved.</p> <p>13. The following three compliant facilities must be provided for the building users:</p> <p>a. Compliant showers</p> <p>b. Compliant changing facilities and lockers for clothes</p> <p>c. Compliant drying space for wet clothes.</p>	1-5	1
	<p>14. Criterion 11 is achieved.</p> <p>15. Compliant cycle storage spaces are provided for members of the public using the transport provision as follows:</p> <p>a. 10% of public users up to 500 PLUS</p> <p>b. 7% for public users in the range of 501 – 1000 PLUS</p> <p>c. 5% for public users over 1000</p> <p>To a maximum required provision for 5000 daily public users.</p>	7	1

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM-NOR issue.

16. Two of the options above have been implemented, where option 5 (cyclist facilities) is one of the two.

Compliance notes

Ref	Terms	Description
CN1	Number of building occupants unknown	If it is not possible to confirm the number of building occupants commuting to the development, possibly due to the speculative nature of the building, then the default occupancy rates given in the table in the Additional information section of BREEAM issue Tra 04 Maximum car parking capacity can be used to help determine a default number of users. Alternatively, the number of building occupants in an existing development of similar type and size can be used (the assessor needs to justify/validate the number used in their certification report).
CN2	Building users	Where the term building users is referenced, this refers to the staff who will work within the building.
CN3	Building types	Please see BREEAM issue Tra 01 Public transport accessibility to determine the building type. If assessing a bespoke building, please see the Bespoke criteria appendix for confirmation.
CN4	More onerous requirements	Where local authorities require more onerous requirements than BREEAM-NOR (i.e. number of electric recharging stations or cycle racks), these must be met in order to award the credits.
CN5	Compliant cycle storage space	<p>Compliant cycle storage facilities are those that meet the following:</p> <ol style="list-style-type: none"> 1. Where the calculated number of required cycle storage spaces is less than 4, total provision should be based on the lower of the following: <ol style="list-style-type: none"> a. a minimum of four compliant storage spaces must be provided (unless otherwise stated) OR b. one space per user (staff and where appropriate other user groups). 2. The space is covered overhead to protect from the weather. 3. Cycles are secured within spaces in rack(s). The rack(s) consists of fixings for one or more spaces. The fixings should allow both the wheel and frame to be locked securely. 4. The covered area 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 closed circuit television (CCTV) surveillance. 5. 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. 6. The facilities are in a prominent site location that is viewable/overlooked from either an occupied building or a main access to a building. 7. Lighting of the cycle storage facility must be compliant with the external (or internal where relevant) lighting criteria defined in BREEAM-NOR 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/around the facility. 8. The majority of the cycle racks are either inside the building or within 100m of a building entrance. Or alternatively, in the case where the building forms part of a larger site, e.g. campus, business park, hospital or prison establishment where it is not feasible to meet the 100m requirement, the assessor justifiably deems the facilities to be in an easily accessible location (within the site boundary). 9. Arrangements for rinsing road salt, etc., off bicycles must be provided.

Ref	Terms	Description
CN6	Compliant showers	<p>One shower must be provided for every 10 cycle storage spaces (unless stated, see below), subject to a minimum of one shower. Any development providing eight showers or more will comply, regardless of the number of cycle storage spaces provided.</p> <p>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. The showers do not need to be dedicated to cyclists and can be those shared with other users/uses.</p> <p>Please note the BREEAM requirement for showers is based on accommodating good practice levels for commuting by bicycle. The maximum number of showers level is set to avoid unnecessary specification for typical buildings. Where a high ratio of cyclists is likely or expected for the building type, the provision of showers must reflect this and not be limited to the maximum without justification.</p>
CN7	Compliant changing facilities & lockers	<p>Changing facilities and locker criteria:</p> <ol style="list-style-type: none"> 1. The assessor should use their judgement to determine whether the changing area is appropriately sized given the number of cycle storage spaces/showers provided. 2. Changing areas must include adequate space and facilities to hang/store clothing and equipment whilst changing/showering, e.g. bench seats and/or hooks. 3. The number of lockers is at least equal to the number of cycle spaces provided. 4. Lockers are either in or adjacent to compliant changing rooms. 5. The lockers are sized appropriately for the storage of a cyclist's equipment, e.g. helmet, shoes, clothing, panniers/back-pack and cyclists equipment. 6. Both male and female users are catered for, i.e. either gender specific, shared facilities or individual changing cubicles in mixed use areas. 7. Toilet/shower cubicles cannot be counted as changing facilities.
CN8	Compliant drying space	The drying space (for wet clothes) must be a specially designed and designated space with adequate heating/ventilation. A plant room is not a compliant drying space.
CN9	Existing compliant facilities and extensions to existing buildings	For assessments of new buildings on an existing site, and extensions to existing buildings, where there are existing compliant facilities, such facilities can be assessed against the requirements of this issue. The number of existing compliant facilities must be large enough to cater for the building users of the assessed building, in addition to the users from any existing buildings.
CN10	Building locations with a high level of public transport accessibility	For sites where at least 50% of the available credits for BREEAM-NOR issue Tra 01 Public transport accessibility have been awarded (rounded to the nearest whole credit), the number of compliant cycle spaces can be reduced by 50%. This reduction will also reduce the requirement for compliant shower/lockers by the same margin.

Ref	Terms	Description
CN11	Public bicycle sharing systems	<p>Bicycle sharing systems are increasingly popular and diverse systems have appeared over the past few years in major cities whereby a number of bicycles are made available for shared use amongst people who do not own a bicycle. The central concept of many of the systems is free or affordable access to bicycles for city transport in order to reduce the use of automobiles for short trips inside the city thereby diminishing traffic congestion, noise and air-pollution.</p> <p>Up to 50% of the BREEAM cycle racks requirement may be provided by a public bicycle sharing system where it complies with the following:</p> <ol style="list-style-type: none"> 1. The program is implemented by the municipality or through a public-private partnership. 2. The system must be open to casual users who wish to use them for one-way rides to work, education or shopping centres. 3. Bicycles are available at unattended urban locations; and they operate in a manner that could be seen as 'bicycle transit' 4. Service terminals must be available throughout the city 5. The average distance between service terminals is 500m maximum in inner city areas. 6. A service terminal is available within 500m of the main building entrance. 7. The service terminals do not need to comply with the design requirements listed above. <p>The number of compliant facilities is calculated based on the total number of cycle racks required. For retail projects, public bicycle racks can also count towards the number of customer cycle racks required.</p>
CN12	Rural locations	<p>For sites in rural locations, where the average building user commuting distances are likely to be greater than 16 km, the number of compliant cycle spaces can be reduced by 50%. This reduction will also reduce the requirement for compliant shower/lockers by the same margin.</p> <p>A 50% 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 CN10)</p> <p>A rural location is defined in BREEAM-NOR issue Tra 01 Public transport accessibility.</p>
CN13	Minimum number of facilities	<p>Where more than the minimum number of compliant cycle spaces is provided, it is not necessary to also provide more than the minimum number of showers/lockers/changing facilities/bicycle charging stations.</p>
CN14	Cycle storage criteria for pre-schools and primary schools	<p>Pre-school: 1 cycle space per 10 staff.</p> <p>Primary school: 5 cycle spaces 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 forms or classes per year, the calculation must be based on the year with the greatest number of classes or forms.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Design drawings and/or relevant section/clauses of the building specification or contract.</p> <p>Plus, the following where relevant to option(s) selected:</p> <ul style="list-style-type: none"> - Assumptions and calculations used to determine number of public users. - Consultation documentation Responses/actions to consultation feedback. - Marketing material. 	<p>As design stage evidence.</p> <p>Assessor's building/site inspection and photographic evidence confirming the installation of the compliant facilities.</p> <p>Plus, timetables where relevant to option(s) selected.</p> <p>Where changes have occurred since the design stage that could affect the compliance, full details of the changes are required to demonstrate compliance.</p>

Additional information

Relevant definitions

None

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Tra 03b Alternative modes of transport (residential only)

Number of credits available	Minimum standards				
2	P	G	VG	E	O
	-	-	-	-	-

Aim

To provide facilities which encourage building users to travel using low carbon modes of transport and to minimise individual journeys.

Assessment criteria

The following is required to demonstrate compliance for:

Up to two credits

One of the following options has been implemented:

Option	Criteria	Credits
1	<ol style="list-style-type: none"> During the preparation of the brief (Step 2), the design team has consulted with the local authority on the provision/condition of the local cycling network and how the development could contribute to improving it. One proposition has been chosen in agreement with the local authority and implemented. This proposition must be additional to what would have been done by the local authority without the support from the project and must have a significant impact on the local cycling network. 	2
2	<ol style="list-style-type: none"> Negotiations with any local bus, tram or train companies have resulted in an increase of the local service provision in the development's local area. This improvement in public transport provision has increased the pre-development AI by at least 1.00 (see BREEAM issue Tra 01). 	2
3	<ol style="list-style-type: none"> Where car parking are a part of the development, electric recharging stations have been provided for at least 30 % of the parking lots. Table 26. Illustrates how credits are achieved. Electric recharging stations for electric bicycles have been provided for at least 10% of the total bicycle parking capacity for the building. 	Up to 2 (see Table 26)

Option	Criteria	Credits
4	7. A communal 'Car club' is created where the members share the use of a locally based fleet of vehicles. <ol style="list-style-type: none"> The use of the vehicles should be charged on a 'pay-as-you-drive' basis. The club should be introduced to residents in sales literature and during sales/open days. Details of the scheme including costs and how to join should be provided to each dwelling. 	2
5	8. Cycles are stored in a compliant individual or communal cycle storage space. This has to be safe, secure, convenient, weather-proof and with easy and direct access. 9. <i>Table 25</i> illustrates how credits are achieved.	Up to 2 (see <i>Table 25</i>)

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM-NOR issue.

- Two of the options above have been implemented, where option 5 (cyclist storage) is one of the two

Compliance notes

Ref	Terms	Description
CN1	Notional occupant numbers	For the purposes of BREEAM-NOR this would normally be assumed on the basis of bedrooms as follows: <ol style="list-style-type: none"> Studio/1 bedroom – up to two occupants. Each additional bedroom (regardless of size) – 1 additional person.
CN2	Existing compliant facilities and extensions to existing buildings	Please refer to issue Tra 03a Alternative modes of transport
CN3	Building types	Please refer to issue Tra 03a Alternative modes of transport

Ref	Terms	Description
CN4	Compliant cycle storage space	<p>Compliant cycle storage facilities are those that meet the following:</p> <ol style="list-style-type: none"> 1. The space is covered overhead to protect from the weather. 2. The covered area and the cycle racks are set in or fixed to a permanent structure (building or hardstanding). Cycles are secured within spaces in rack(s). The rack(s) consists of fixings for one or more spaces. The fixings should allow both the wheel and frame to be locked securely. 3. Alternatively the cycle storage may be located in an enclosed permanent structure with a permanent entrance lock (not a padlock) and closed circuit television (CCTV) surveillance. 4. 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. Where cycles are to be stored in an area with another use, (i.e. garage), adequate space should be provided so that it doesn't prevent the intended use of the facility and the cycle can be easily stored and accessed. 5. Lighting of the cycle storage facility must be compliant with the external (or internal where relevant) lighting criteria defined in BREEAM-NOR 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/around the facility.
CN5	Access to cycle store	<p>Access from the cycle store to the public right of way must not be through the residence, i.e. where cycles are stored in a shed in the back garden of a mid-terraced home and there is no back garden gate, this is non-compliant. In blocks of flats with communal areas, communal cycle store(s) has to be located within 100m from the front door or the main entrance.</p>
CN6	Storage space within apartments	<p>Where cycles are to be stored inside the apartment, the credit cannot be achieved (unless within a porch of adequate space as defined in minimum space requirements).</p>
CN7	Folding cycles	<p>The provision of space for folding cycles stored within the apartment, would not achieve the credit. Folding cycles would be a temporary provision whereas the provision of cycle storage is a permanent feature.</p>
CN8	More onerous requirements	<p>Where local authorities require more onerous requirements than BREEAM-NOR (i.e. number of electric recharging stations or cycle racks), these must be met in order to award the credits.</p>

Evidence

Ref	Design stage	Post-construction stage
All	Design drawings and/or relevant section/clauses of the building specification or contract Plus, the following where relevant to option(s) selected: <ul style="list-style-type: none"> - Assumptions and calculations used to determine number of users. - Consultation documentation - Responses/actions to consultation feedback. - Marketing material. 	As design stage evidence. Assessor's building/site inspection and photographic evidence. confirming the installation of the compliant facilities. Plus, timetables where relevant to option(s) selected. Where changes have occurred since the design stage that could affect the compliance, full details of the changes are required to demonstrate compliance.

Additional information

Relevant definitions

None.

Checklists and tables

Table 25: Number of cycle racks per apartment and number of credits available

Credits available	1 credit	2 credits
Notional occupant numbers per apartment	Min cycle rack per apartment	
1 bedroom (Up to 2 people)	1	2
2 and 3 bedroom (3-4 people)	1	2
4 + Bedroom (5 or more people)	2	4

Table 26: Number of electric recharging stations for cars per development and number of credits available

Number of electric recharging stations for the development	Number of credits available
Min 30 % of the car parking lots	1
Min 50 % of the car parking lots	2

Calculation procedures

None.

Other information

None.

Tra 04 Maximum car parking capacity (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2 (building type dependent)	-	-	-	-	-

Aim

To encourage the use of alternative means of transport to the building other than the private car, 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

- The building's car parking capacity is compared to the maximum car parking capacity benchmarks in *Table 27* and the relevant number of 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 Tra 01 Public transport accessibility). 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 development's accessibility to the public transport network.

Table 27: Maximum car parking capacity for number of BREEAM credits based on building's accessibility index.

Building type	Criteria: Building's Accessibility Index			No of credits
	< 4	≥ 4 - < 8	≥ 8	
Max. parking capacity 1 space per x building users, where x is:				
Building Types 1-5 (excluding Retail, and Higher Education)	3	4	5	1
	4	5	6	2
Building Type 3 - University and higher education	15	20	25	1
	20	25	30	2
Building Type 3 - Retail only Building Type 6 Building Type 7	Issue not assessed for these building types			

Compliance notes

Ref	Terms	Description
CN1	Building users	Where the term building users is referenced in this BREEAM-NOR issue it refers to the following, where relevant to the building type: <ol style="list-style-type: none"> 1. Staff (who will work within the building). 2. Students at higher education (who will access the building for work or study during a typical academic term time or semester day).
CN2	Determining the number of building users	If known, or can be reasonably estimated by the design team, client or end occupier, actual building occupancy figures should be used. If an actual figure cannot be confirmed, for example where the building is a speculative development, use either: <ol style="list-style-type: none"> 1. The default occupancy rates given in Table 28 "Table of default occupancy rates (persons/m²net floor area)" to determine the number of users or 2. Published data with more locally appropriate default rates.
CN3	Variable occupancy	Where the number of building users is variable, provision of parking spaces should be based on the likely maximum number of building users to be using the building at any time during a typical day.
CN4	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/markings. <ol style="list-style-type: none"> 1. Disabled 2. Parent and baby 3. Motorbike 4. Car/lift share In the case of excluding car/lift share spaces, the future building occupier will need to confirm they have an enforceable car/lift share policy.
CN5	Parking shared with other buildings	Where the assessed building forms part of a wider site development, e.g. campus, business park, and parking is not designated to individual buildings, then the assessor has two options: <ol style="list-style-type: none"> 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.
CN6	Local authority car parking requirements	As a general rule, where the local authority sets car parking requirements that are different from the BREEAM-NOR criteria, the most onerous of the requirements will need to be complied with: Where the local authority requires a minimum car parking capacity that is higher than the maximum limit set by BREEAM-NOR, the BREEAM-NOR criteria will need to be met for the credit to be awarded. Where the local authority requires a maximum car parking capacity that is lower than the one set by BREEAM-NOR, then the local authority criteria should be met for the credit to be awarded.
CN7	Building types	Type 1: Staff building: user occupants only (occasional business related visitors e.g. office or industrial building). Type 2: Staff plus visitors, with a reasonably constant stream of visitors (Including pre-school and school) Type 3: Core staff plus large numbers of visitors (e.g. higher education). Type 4: Rural buildings with predictable occupancy pattern, mostly staff occupants or staff plus residential visitors (e.g. remote/rural research centre). Type 5: Rural buildings with a few core staff plus large numbers of visitors.

Evidence

Ref	Design stage	Post-construction stage
All	A site plan or copy of the specification. Relevant documentation or correspondence from the design team, tenant(s) or client confirming the number of building users. Confirmation of the building's AI (as per Tra 01 Public transport accessibility).	As design stage. Assessor's building/site inspection and photographic evidence

Additional information

Relevant definitions

Accessibility Index (AI)

Refer to BREEAM issue Tra 01 Public transport accessibility

Checklists and tables

Table 28: Table of default occupancy rates (persons/m²net floor area)

Building type and function area	Occupant density	Building type and function area	Occupant density
Business		Other spaces/buildings	
Office area (including reception areas)	0.111	Data centre	0.096
Food preparation area (staffed)	0.108	Server room	0.096
Small workshop/category lab space	0.068	Heavy plant room	0.096
Industrial			
Food preparation area	0.213		
Industrial process area	0.022		
Laboratory	0.107		
Reception	0.110		
Warehouse storage	0.009		
Generic office area	0.108		

Notes for table 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 within *Table 28* have been sourced from the activity database of the UK's Simplified Building Energy Model (SBEM), valid at the time of this Scheme Document's authoring. Alternative figures from similar reference models in Norway can be used as basis for the calculation

Calculation procedures

None.

Other information

None.

Tra 05 Travel plan

(non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To recognise and encourage the provision of a range of travel options for building users to promote the reductions in the environmental impact of travel to and from the building.

Assessment criteria

The following demonstrates compliance for:

One credit

1. A travel plan/strategy has been developed as part of the feasibility and design stages (Step 1-3) which considers all types of travel relevant to the building type and users.
2. The travel plan/strategy is structured to meet the needs of the particular site and takes into consideration the findings of a site-specific transport survey and assessment that covers the following (as a minimum)
 - 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.
 - b. Travel patterns and transport impact of future building users.
 - c. Current local environment for walkers and cyclists (accounting for visitors who may be accompanied by young children), such as connection to the nearest public road, walkway and bicycle path, and public transport.
 - d. Disabled access (accounting for varying levels of disability and visual impairment).
 - e. Public transport links serving the site
 - f. Current facilities for cyclists.
3. The travel plan/strategy includes a package of measures that have been used to steer the design of the development in order to meet the travel plan objectives and minimise car-based travel patterns. This is demonstrated via specific examples such as:
 - a. Providing parking priority spaces for car/lift sharers
 - b. Providing dedicated and convenient cycle storage and changing facilities
 - c. Lighting, landscaping and shelter to make pedestrian and public transport waiting areas pleasant
 - d. Negotiating improved bus services, i.e. altering bus routes or offering discounts
 - e. Restricting and/or charging for car parking
 - f. Criteria for lobby areas where information about public transport or car/lift sharing can be made available
 - g. Pedestrian and cycle friendly (for all types of user regardless of the level of mobility or visual impairment) via the provision of cycle lanes, safe crossing points, direct routes, appropriate tactile surfaces, well lit and signposted to other amenities, public transport nodes and adjoining offsite pedestrian and cycle routes
 - h. Providing suitable taxi drop-off/waiting areas
 - i. Ensuring that rural buildings are located with appropriate transport access to ensure that they adequately serve the local community (where procured to do so e.g. community centre).
4. The travel plan/strategy includes measures tailored to minimise the impacts of operational-related transport, e.g. deliveries of supplies, equipment and support services to and from the site.
5. Where the building's final occupier is known, they confirm that the travel plan/strategy will be implemented post construction (After Step 6) and supported by the building's management during building operation.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	Where the end user/occupier is not known a travel plan is still required, albeit that it may only be an interim travel plan/strategy or one that broadly addresses all the above issues. The developer must confirm that they will provide a copy of the travel plan/strategy to the building's tenant(s), so that it may inform their own travel plan/strategy.
CN2	Building users	Where the term building users is referenced, this refers to the following, as appropriate to building type: <ol style="list-style-type: none"> 1. Staff (commuter journeys and business travel) 2. Pupils/students 3. Visitors 4. Patients 5. Customers 6. Community users 7. Personnel who make deliveries/collections to and from the development 8. Contractors/service providers, who regularly work at and access the building/development.
CN3	Existing travel plan	The credit can be awarded if the assessed building is part of a site that has an existing up-to-date organisational travel plan/strategy that is compliant with BREEAM, is applicable to all building users (in existing and assessed new buildings) and accounts for the additional travel resulting from users of the new building.

Evidence

Ref	Design stage	Post-construction stage
1-5	A copy of the Travel plan. A copy of the site-specific transport survey/assessment.	As design stage.
3	A marked-up copy of the site plan demonstrating examples of design measures, implemented in support the travel plan's findings. OR Where a detailed site plan is not available, a formal letter from the client confirming that measures will be implemented into the final design in support the travel plan's findings.	Assessor's building/site inspection and photographic evidence confirming the installation of measures that support the travel plan.
5	A letter of confirmation from either the building's occupier, or in the case of a speculative development, the developer.	As design stage.

Additional information

Relevant definitions

Travel plan/strategy

A travel plan/strategy 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 or development by sustainable modes of transport. A travel plan/strategy contains both physical and behavioural measures to increase travel choices and reduce reliance on single-occupancy car travel. BRE Global/Grønn Byggallianse has no set format for this document, which can be as simple or complex as the building and its operation/use requires.

Checklists and tables

None.

Calculation procedures

None.

Other information

Guidance on how to produce a travel plan can be found at the following location:

The Norwegian Public Road Administration (Statens Vegvesen):

http://www.vegvesen.no/attachment/454714/binary/751984?fast_title=Veileder+for+mobilitetsplanlegging.pdf

Tra 06 Home office (residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To reduce the need to commute to work by providing residents with the necessary space and services to be able to work from home.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. A home office has been provided within each dwelling with adequate space and services, as follows:
 - a. For dwellings with one or two bedrooms or studio homes, space is provided in the living room, one of the bedrooms or any other suitable area in the home such as a large hall or dining area.
 - b. For dwellings with three or more bedrooms, sufficient working space (as defined below) is provided within a room other than the kitchen, living room or master bedroom or bathroom.
 - c. In all cases, the room is large enough not to prevent the intended use of that room, i.e. a home office set up in the main bedroom does not compromise the ability for a double bed and other necessary furnishing to be contained within that room.
2. Sufficient services must include as a minimum:
 - a. Two double power sockets.
 - b. Connection to a cable or broadband service available at the address.
 - c. Adequate daylight, the room chosen to be the nominated home office must have a compliant average daylight factor as outlined in Hea 01, assessment criteria 2.a.
 - d. Adequate ventilation (see compliance notes).

Compliance notes

Ref	Terms	Description
CN1	Sufficient space	<p>This is defined as the minimum size (1.8m wall length) to:</p> <ol style="list-style-type: none"> 1. Allow a desk, chair and filing cabinet or bookshelf to be installed. 2. Allow space to move around the front and side of the desk. 3. Use the chair appropriately and operate the filing cabinet safely. <p>The 1.8m wall size requirement can, in some circumstances, be altered if drawings can prove that a desk can be fitted in any other type of arrangement, i.e. alcove or similar, fulfilling all the above criteria.</p>

Ref	Terms	Description
CN2	Adequate ventilation	Rooms intended to be used as a home office must have achieved either 1. Criteria 11 within BREEAM-NOR issue Hea 02 Indoor air quality (i.e. the potential for natural ventilation credit) OR 2. Criterion 3-4 within BREEAM-NOR issue Hea 02 Indoor air quality if the building employs a mechanical ventilation strategy and/or the windows are locked.

Evidence

Ref	Design stage	Post-construction stage
All	Scaled drawings or copy of the specification.	'As built' drawings/assessor's site inspection report confirming the details required at the design stage.

Additional information

Relevant definitions

None.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

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 lifetime of the building and minimising losses through leakage.

Category summary table

Issue	Credits	Credit summary
Wat 01 Water consumption	5	Reducing the demand for potable water through the provision of efficient sanitary fittings, rainwater and greywater collection and water recycling systems.
Wat 02 Water monitoring	1	Specification of water meters on the mains water supply to encourage water consumption management and monitoring to reduce the impacts of inefficiencies and leakage.
Wat 03 Water leak detection and prevention	2	<ul style="list-style-type: none"> - 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 or facility to reduce water wastage - Easily accessible leak isolation valves, to allow leaks to be stopped and then fixed quickly and with minimum water wastage.
Wat 04 Water efficient equipment	1	Recognition of water efficient systems for irrigation of external soft landscaping and vehicle washing.

Wat 01 Water consumption (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
5	-	-	-	1	2

Aim

To reduce the consumption of potable water for sanitary use in buildings from all sources through the use of water efficient components and water recycling systems.

Assessment criteria

The following is required to demonstrate compliance for:

Up to five credits

1. An assessment of the efficiency of the building's domestic water consuming components is undertaken using the BREEAM Wat 01 calculator.
2. The water consumption (L/person/day) for the assessed building is compared against a baseline performance and BREEAM credits awarded as follows:

Table 29: Number of credits awarded depending on the percentage improvement

No. of BREEAM credits	% Improvement
1	12.5%
2	25%
3	40%
4	50%
5	55%
Exemplary	65%

3. The efficiency of the following 'domestic scale' water consuming components must be included in the calculation (where specified). The BREEAM Wat 01 calculator defines the building types and activity areas for which the following components must be assessed:
 - a. WCs
 - b. Urinals
 - c. Taps (wash hand basins and, where specified, kitchen taps and waste disposal unit)
 - d. Showers
 - e. Baths
 - f. Dishwashers (domestic and commercial sized)
 - g. Washing machine (domestic and commercial/industrial sized)
4. Where a greywater and/or rainwater system is specified, its yield (L/person/day) can be used to off-set non potable water demand from components that would otherwise be supplied using potable water.
5. Any greywater and rainwater systems must be specified and installed in compliance with best practice standards.
6. Report the total net water consumption in litres/person/year via the BREEAM scoring and reporting tool.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>If a water supply is provided to tenanted areas of the building, but sanitary components will be specified and fitted by future building tenants, then the following options are available with respect to defining the efficiency of flow rates for components in the shell and core (tenanted) areas of the building:</p> <ol style="list-style-type: none"> Option 1 – use of a tenancy lease agreement between the developer and tenant(s) which specifies a minimum acceptable level of water efficiency for specified components. Option 2 – N/A Option 3 – whereby the tenant confirms (in writing or via their fit out specification) the efficiency of fittings that will be specified/installed. <p>Alternatively, fittings compliant with the BREEAM baseline level can be used for the purpose of determining the level of performance for the building (see Additional Information section for further detail on the baseline level).</p> <p>Refer to Appendix D for further description of the above options.</p>
CN2	Scope of the BREEAM Wat 01 Methodology for New Construction Buildings	<p>The BREEAM Wat 01 calculator determines a figure for whole building water consumption from domestic scale components and some non-domestic components, e.g. taps, washing machines and dishwashers in food preparation areas. This figure is derived using the actual component specification and default component usage factors for a range of building users/types.</p> <p>The methodology is applicable to all standard building types assessed using this Scheme Document. See calculation procedures below for details on the alternative approach, which is applicable to certain buildings assessed under Bespoke.</p> <p>Please also refer to Compliance note 11 where the building is a mixture of different building types covered by the Water Efficiency Methodology.</p>
CN3	Best practice standard for specifying and installing grey and rainwater systems	<p>The design team should demonstrate compliance with UK or European standards.</p>
CN4	Benchmark and usage data	<p>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 assessed buildings within the same building type. However, if there is robust data available on component usage and building occupancy rates that relate to the assessed building, and the data is appreciably different to the figures currently used, please contact NGBC 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 assessment (and thus result in a more accurate reflection of modelled water consumption for the building).</p>

Ref	Terms	Description
CN5	Water-consuming components - data requirements	<p>Water consumption figures will need to be collected from manufacturers' product information to complete the assessment</p> <ol style="list-style-type: none"> 1. WCs: actual maximum or, where dual flush, effective flush volume in L/use 2. Urinals: Flush volume in L/use for single use flush urinals. For cistern fed systems, the flushing frequency/hour and cistern capacity in litres. 3. Taps: Flow rate of each tap, at full flow rate in litres per minute measured at a dynamic pressure: <ul style="list-style-type: none"> 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). <p>(NS-EN 200:2008 sanitary tapware, single taps and combination taps for water supply systems of type 1 and type 2. General technical specifications) This includes any reductions achieved with flow restrictions.</p> 4. Showers: Flow rate of each shower at the outlet using cold water ($T \leq 30^{\circ}\text{C}$), in litres per minute measured at a dynamic pressure of $3 \pm 0.2\text{bar}$ ($0.3 \pm 0.02\text{MPa}$) for high pressure supply systems, or at a dynamic pressure of $0.1 \pm 0.05\text{bar}$ ($0.01 \pm 0.005\text{MPa}$) for low pressure supply systems <ul style="list-style-type: none"> (NS-EN 1112:2008 Sanitary tapware - Shower outlets for sanitary tapware for water supply systems of type 1 and type 2 - General technical specification). 5. Kitchen taps: Maximum flow rate L/min. 6. 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 a) users tend not to fill the bath to overflow and b) the displacement effect the user has on the actual volume of water required for a bath. 7. Dishwasher: L/cycle for domestic applications and/or appliances or L/rack for commercial applications and/or appliances. 8. Washing machine: L/use for domestic applications and/or appliances or L/kg for commercial applications and/or appliances e.g. in hotels. 9. Waste disposal unit: flow rate in L/minute.
CN6	Greywater and rainwater system data	<p>The following information is required where a greywater and/or rainwater system is specified:</p> <p>Rainwater Either:</p> <ol style="list-style-type: none"> 1. Collection area (m²). 2. Yield co-efficient, 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 metrological organisation, data source or equivalent. <p>Greywater</p> <ol style="list-style-type: none"> 1. Manufacturer or system designer details. 2. The percentage volume of waste water collected (and re-used) from the following (where relevant); wash hand basins, showers, kitchen basins, dishwashers, baths, washing machines and sources of waste water from non domestic components.

Ref	Terms	Description
CN7	Multiple specification of a sanitary component type	Where multiple fittings are specified with various flow rates, e.g. three makes of tap with differing flow rates, the flow rates for each type of fitting will need to be collected and the average flow rate for the sanitary component using the BREEAM Wat 01 calculator.
CN8	Using greywater and rainwater systems to off-set performance efficiency of components	<p>Where greywater and/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 off-set by the specification of a greywater and/or rainwater collection system. The intention being to ensure demand reduction is prioritised before off-setting consumption.</p> <p>The following is an example, as variation occurs depending on where the building is located.</p> <ul style="list-style-type: none"> - Where a greywater/rainwater system is specified/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/rainwater sources can contribute to the overall percentage improvement required to achieve BREEAM credits. If it is not achieved, the percentage of greywater/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/rainwater sources can be used to off-set water consumption from the 'domestic scale' water consuming components. - This minimum requirement does not apply where only 1, 2 or 3 credits are sought or where no greywater/rainwater system is specified, i.e. percentage improvement is based solely on the water efficiency of the 'domestic scale' water consuming components 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 the 25% improvement level.
CN9	Other permissible component demand for non potable water	<p>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/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/greywater yield from such systems/components can be used as well as, or instead of non potable water demand from the buildings WC/Urinal components</p> <p>Examples of consistent and intrinsic demands could include laundry use in care homes.</p> <p>Demand for general landscaping and ornamental planting irrigation are not considered as equivalent/intrinsic by BREEAM as BREEAM aims to incentivise the use of native species that do not rely on additional irrigation to thrive.</p>

Ref	Terms	Description
CN10	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/washing machines. In addition, where non potable water is collected from a non domestic component/source that is intrinsic to the building, then the amount collected can be accounted for in the methodology. This could include, for example, wastewater from active hygiene flushing, i.e. a regular hygiene flushing programme to minimize 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/system (in litres) and the frequency of that yield (in days), i.e. if once a week then frequency would be 7 days.
CN11	Building is a mixture of different functional areas	<p>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 a goods storage or an office that includes a canteen and gym. However, where a single assessment of a building/development consists of a diverse mix of activity areas/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/building type. On completion of each assessment, the percentage improvement is determined as follows:</p> $I = 100 \times \left[1 - \frac{(T_{1Act} \times T_{1Occ}) + \dots + (T_{nAct} \times T_{nOcc})}{(T_{1Base} \times T_{1Occ}) + \dots + (T_{nBase} \times T_{nOcc})} \right]$ <p>Where:</p> <p>I = Overall improvement (%)</p> <p>T_{n Act} = the modelled net water consumption (L/person/day) for each building type</p> <p>T_{n Base} = the modelled baseline water consumption for the corresponding building type</p> <p>T_{n Occ} = the total default occupancy rate for the corresponding building type.</p> <p>Where greywater/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/building type.</p>
CN12	Fixed water use	The BREEAM water efficiency calculation includes an allowance for fixed water use. This includes water consumption for vessel filling (for building user 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 the actual and baseline building models, their totals do not influence the achievement of BREEAM credits.
CN13	No fittings present	<p>Where a project under assessment contains none of the specified components, the performance specification for components provided in facilities in an adjacent and accessible building must be used in the calculation, i.e. those facilities most likely to be used by the occupants and visitors of the assessed building.</p> <p>This rule also applies where a project under assessment consists solely of an extension to an existing building, i.e. where the extended building contains no new sanitary facilities because there are facilities present within the existing building.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Completed copy of the BREEAM Wat 01 calculator.</p> <p>Relevant section/clauses of the building specification/ design drawings confirming technical details of:</p> <ol style="list-style-type: none"> 1. Sanitary components 2. Rainwater and greywater collection system. <p>OR where detailed documentary evidence is not available at this stage; A letter of instruction to a contractor/supplier or a formal letter from the developer giving a specific undertaking, providing sufficient information to allow the water calculations to be completed.</p>	<p>As design stage for post construction information OR written confirmation from the developer that the appliances/fittings have been installed as specified for the Design Stage OR assessor site inspection report and photographic evidence confirming installation of components in accordance with a compliant specification.</p>

Additional information

Relevant definitions

BREEAM Wat 01 calculator for New Construction Buildings

The BREEAM Wat 01 calculator is a method for the assessment of water efficiency in most common types of buildings. The calculator assesses the contribution that each internal domestic scale water consuming component (as listed in the criteria) has on whole building water consumption.

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 model and provide a benchmark of the typical consumption given the specified fittings (in L/person/day and m³/person/year) and their impact on the buildings 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 building.

Domestic scale components

Includes water consumed (potable and non potable) by internal building components including kitchen taps, wash hand basin taps, baths, shower and dishwasher, WCs, urinals, washing machines and waste disposal units. Note: This definition can be applied to residential and non residential building types.

Effective flush volume

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-residential buildings and one full flush for every two reduced flushes in residential buildings/areas. The effective flush volume can therefore be calculated as follows, using a 6/4L dual flush volume WC as an example:

Non-residential: $\{(6L \times 1) + (4L \times 3)\}/4 = 4.5L$ effective flushing volume

Residential: $\{(6L \times 1) + (4L \times 2)\}/3 = 4.67L$ effective flushing volume

The differing ratio between non-residential and residential 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/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 (Wat 01 Water consumption)

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

Also sometimes known as rainwater harvesting, can be defined as 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.

Checklists and tables

Table 30 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) and therefore reflect robust levels of typical, good, best and exemplary practice.

Table 30: Water efficient consumption levels by component type

Component	Baseline	Level 1	Level 2	Level 3	Level 4	Level 5	Unit
WC	6	5	4.5	4	3.75	3	Effective flush volume (L)
Wash hand basin taps	12	9	7.5	4.5	3.75	3	Volume (L/min)
Showers	14	10	8	6	4	3.5	Volume (L/min)
Baths	200	180	160	140	120	100	Volume (L)
Urinal (2 or more urinals)	7.5	6	3	1.5	0.75	0	Volume (L/bowl/hr)
Urinal (1 urinal only)	10	8	4	2	1	0	Volume (L/bowl/hr)
Greywater /rainwater	0	0	0	25	50	75	% of WC/flushing demand met using recycled non potable water
Kitchen tap:kitchenette	12	10	7.5	5	5	5	Volume (L/min)
Kitchen taps:restaurant (pre- rinse nozzles only)	10.3	9	8.3	7.3	6.3	6	Volume (L/min)
Domestic sized dishwashers	17	13	13	12	11	10	Volume (L/cycle)
Domestic sized washing machines	90	60	50	40	35	30	Volume (L/use)
Waste disposal unit	17	17	0	0	0	0	Volume (L/min)
Commercial sized dishwashers	8	7	6	5	4	3	Volume (L/rack)
Commercial/industrial sized washing machine	14	12	10	7.5	5	4.5	Volume (L/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 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/installing components. This will provide greater assurance that the component specification achieves the targeted number of BREEAM credits.

As the methodology and BREEAM credits for water efficiency compare the buildings 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, which is the % improvement over the baseline building, by deciding not to specify a particular component. However, the methodology will reflect the reduction in overall water consumption (L/person/day) for the building, as a result of not specifying a particular component.

Calculation procedures

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 an 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 m³/person/yr) for a building based on the buildings 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 (see Table 30). 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 is available. For buildings types where usage data is 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 that can be assessed using the standard approach.

Alternative Wat 01 method

Where it is not possible to use the standard approach to determine the buildings water consumption total (L/person/day) the assessment can be completed on an elemental basis (only applicable to certain buildings assessed under Bespoke), as follows:

1. Using the list of applicable domestic scale water consuming components (see criterion 3), determine those that are specified/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 30) to determine the level of performance for each type. Note that the volumes quoted are maximums for that level and the % WC/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 or less to the building's overall level of performance.
 - b. Based upon the performance categorisation of each component type and the component weighting, the calculator will determine an overall component level of performance and award the relevant number of BREEAM credits as follows (table):

Table 31: Using alternative Wat 01 method - credits available

Overall component level	Credits	Greywater and rainwater level achieved	
	-	4	5
Baseline	0 credits	1 credit	2 credits
Level 1	1 credit	2 credits	3 credits
Level 2	2 credits	3 credits	4 credits
Level 3 or 4	3 credits	4 credits	5 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/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 four. 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, 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.

Note: Whilst 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 may therefore differ for the same water component specification. It is important to be aware of this difference when applying BREEAM-NOR New Construction to a number of different building types that form a part of the same overall development.

Other information**Certification of water efficient products**

Product certification schemes provide specifiers and clients with greater assurance of manufacturers' claims regarding the water efficiency performance of their products and, therefore, the potential water savings of different products. Specifying water efficient fittings certified by accredited bodies are encouraged by BREEAM, but at present the scheme does not require components to meet an approved standard to gain BREEAM credits.

BRE Global currently operates a certification and listing scheme for low flush WCs, water-efficient baths and terminal fittings. Products certified to this standard will be listed on www.greenbooklive.com. Green Book Live is a free-to-view online database designed to assist specifiers and end users in the identification of environmentally beneficial products and services. If you would like to know more information about the Certification and Listing of Low Flush WCs Scheme please contact BRE Global at enquiries@breglobal.com.

Rainwater recycling (also known as rainwater harvesting):

"Rainwater harvesting can co-exist with and provide a good supplement to other water sources and utility systems, thus relieving pressure on other water sources. Rainwater harvesting can reduce storm drainage load and flooding in city streets.¹³" The system can be designed to maximise water collection during extreme events contributing to the reduction of runoff, which is recognised in BREEAM issue Pol 03 Surface water run-off.

¹³ UNEP, An Environmentally Sound Approach for Sustainable Urban Water Management: An Introductory Guide for Decision- Makers, <http://www.unep.or.jp>

Wat 02 Water monitoring (all buildings)

Number of credits available	Minimum standards				
1	P	G	VG	E	O
	-	-	-	-	-

Aim

To ensure water consumption can be monitored and managed and therefore encourage reductions in water consumption.

Assessment criteria

The following is required to demonstrate compliance for:

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 sub meters or have water monitoring equipment integral to the plant or area (see Compliance notes).
3. Each meter (main and sub) has the ability of giving an instantaneous reading (e.g. has a pulsed output) and enables connection to a BMS for the monitoring of water consumption.
4. If the site on which the building is located has an existing BMS, managed by the same occupier/owner (as the building), the pulsed water meter(s) for the building must be connected to the existing BMS.

Compliance notes

Ref	Terms	Description
CN1	Water consuming plant or building areas	<p>As a minimum this includes the following (where present):</p> <ol style="list-style-type: none"> 1. Buildings with a swimming/therapy 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): <ol style="list-style-type: none"> a. Each individual unit supplied with water (for residential institutions with self-contained dwellings, each dwelling/apartment) b. Common areas (covering the supply to toilet blocks). c. Service areas (covering the supply to outlets within storage, delivery, waste disposal areas etc.). d. Separate ancillary buildings to the main development with water supply. e. Supplementary supply of water from a cold water tank. <p>Other examples of where sub-meters will also be required include:</p> <ol style="list-style-type: none"> 1. Tenanted areas of large developments 2. Laundries 3. Main kitchens 4. The water supply to any process or cooling loop for 'plumbed-in' laboratory process equipment 5. Any other facility with a major water use.
CN2	Shell and core	<p>Where metering arrangements within tenanted units/areas will be the responsibility of the future tenant, compliance with the relevant criteria for this BREEAM issue can be demonstrated via one of the following means for such areas:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN3	10% of water demand	<p>The sub-meter requirement does not necessarily apply in the cases where the assessor confirms there will be no additional monitoring benefit resulting from their installation:</p> <ol style="list-style-type: none"> 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.
CN4	Extensions to existing buildings (and no water supply to the building/unit)	<p>If no new water supply is being installed because occupants of the (extended) building will use the facilities in, and therefore water supply to an existing building, then the following must be provided in the existing building:</p> <ol style="list-style-type: none"> 1. A water meter for the mains water supply, 2. Sub-meters for large water consuming plant or facilities, e.g. evaporative cooling, swimming pool etc. (where present). <p>The meters provided must have a pulsed output or connection to existing BMS in accordance with the assessment criteria.</p>
CN5	Method of deduction	<p>Where a simple deduction calculation (based on water meter readings) will determine the water use for a function or area, it is not necessary to specify/install a meter for this use.</p>

Evidence

Ref	Design stage	Post-construction stage
All	Relevant section/clauses of the building specification or contract. Design drawings.	BREEAM Assessor's site inspection report and photographic evidence OR 'As built' drawings.

Additional information

Relevant definitions

Ancillary buildings

Providing necessary support to the primary activities or operation of the main building.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Wat 03 Water leak detection and prevention

(non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To reduce the impact of water leaks that may otherwise go undetected.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. Provision of a leak detection system that is capable of detecting a major water leak on the mains water supply within the building and between the building and the water supply company meter
2. The leak detection system is:
 - a. Audible when activated (this can be in the form of a phone message or call as the aim is not for the alarm to sound in the whole building but to be audible to the person responsible for addressing leak issues)
 - b. Activated when the flow of water passing through the water meter/data logger is at a flow rate above a pre-set maximum for a pre-set period of time
 - c. Able to identify different flow and therefore leakage rates, e.g. continuous, high and/or low level, over set time periods
 - d. Programmable to suit the owner/occupiers' usage patterns
 - e. Where applicable, designed to avoid false alarms caused by normal operation of large water-consuming plant such as chillers.

One credit

3. One of the following types of flow control device is fitted to each WC area/facility to ensure water is supplied only when needed (and therefore prevent minor water leaks):
 - a. A time controller, i.e. an automatic time switch device to switch off the water supply after a predetermined interval
 - b. A programmed time controller, i.e. an automatic time switch device to switch water on and/or off at predetermined times
 - c. A volume controller i.e. an automatic control device to turn off the water supply once the maximum preset volume is reached.
 - d. 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
 - e. 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.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Where the installation of facilities within tenanted units/areas will be the responsibility of the future tenant, compliance with the flow control credit within this BREEAM issue can be demonstrated via one of the following means for shell and core buildings/areas:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenants (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN2	Mains supply shut-off	There is no requirement for the leak detection system to shut off the water supply when the alarm is triggered (constant water supply may still be required for certain systems/operations).
CN3	Leakage rates	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.
CN4	System criteria	It is anticipated that the leak detection credit will usually be achieved by installing a system that detects higher than normal flow rates at meters and/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.
CN5	Water supply company meter at site boundary	Where there is a water supply company meter at the site/building boundary, it may be necessary to install a separate flow meter (or alternative measurement system) just after the water supply company meter to detect leaks. However, if the water supply company agrees to some form of leak detection being installed on their meter, this would also be acceptable.
CN6	Flow control systems	Where flow control systems 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.
CN7	Single WCs	The flow control criteria for this issue applies to facilities that 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).
CN8	Ancillary or multiple buildings/units	The criteria apply to the water supply to all buildings falling within the scope of the assessment.

Ref	Terms	Description
CN9	No water supply to the building/unit	These credits are still assessed where there are no installed fittings and therefore no water supply to the building. In these instances the facilities likely to be used by the future occupants of the assessed building must meet the criteria, e.g. those facilities within the nearest accessible building.
CN10	Extensions to existing buildings	If the water supply to the new extension is via the existing building then the water supply to the existing building must be assessed against the criteria of this issue.
CN11	Residential buildings	This issue is not applicable to residential buildings.

Evidence

Ref	Design stage	Post-construction stage
All	Relevant section/clauses of the building specification or contract. Design drawings. Manufacturers product details.	BREEAM Assessor's site inspection report and photographic evidence. Manufacturers product details.

Additional information

Relevant definitions

Water supply company

A company, regulated by the government, who provides a water supply service.

Volume controller

An automatic control device to turn off the water supply once a maximum preset volume is reached.

Checklists and tables

None.

Calculation procedures

None.

Other information

Light fittings in toilets are often controlled by proximity detection, infra red (IR) movement detectors or sensors placed at entry doors (the latter can be less accurate as more than one person can enter or depart in the opening of one door). The sensors used to control the lighting can also be linked to a solenoid valve in the cold water supply. This will then act as a proximity detection shut-off system.

Small water leaks can result in significant losses over time, increasing costs as well as causing damage. There is a significant risk of leaks going undetected, particularly as toilet accommodation is often unoccupied for long periods. A proximity detection shut-off system prevents waste water from minor leaks by shutting off the water supply when toilet accommodation is not occupied.

Valves in cisterns supplying urinals and WCs are especially prone to failure, leading to wastage of water via the overflow. Whilst leakage from any valve is variable, a typical value for a leaking valve toilet might be 4 L/day.

Wat 04 Water efficient equipment (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To reduce water consumption by encouraging specification of water efficient equipment.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. Where an irrigation method is specified for external soft landscaping, it complies with ANY ONE of the following:
 - a. Drip feed subsurface irrigation that incorporates soil moisture sensors. The irrigation control should be zoned to permit variable irrigation to different planting assemblages
 - b. Reclaimed water from a rainwater or greywater system. The storage system must be appropriately sized, i.e. storage capacity is relative to the size of the soft landscaped area
 - c. External landscaping and planting that relies solely on precipitation, during all seasons of the year
 - d. All planting specified is restricted to species that thrive in local climatic conditions.
 - e. Where no dedicated, mains-supplied irrigation systems (including pop-up sprinklers and hoses) are specified and planting will rely solely on manual watering by building occupier or landlord.
2. Where a subsurface drip feed irrigation system is installed for external areas, a rainstat must also be installed to prevent automatic irrigation of the planting and the landscape during periods of rainfall.
3. Where a vehicle wash system is specified, it uses a full or partial reclaim unit, which contains one or more of the following: a hydro-cyclone, a sand or activated carbon filter, a sump tank(s), three chamber interceptors, a cartridge filter or bag filter.

Compliance notes

Ref	Terms	Description
CN1	No planting or vehicle washing facilities	Where there is no planting or vehicle wash facilities in the building this issue is not applicable and does not require assessment.

Ref	Terms	Description
CN2	Microbial contamination	Where vehicle wash systems are specified, the design team are to clarify that the installed system(s) is designed to minimise any legionella risk (refer to BREEAM issue Hea 04 Microbial contamination).
CN3	Residential - Rainwater harvesting	In individual houses with a garden, the provision of a water butt is sufficient to demonstrate compliance with criterion 1b. This is applicable only to the main (i.e. larger) garden. No requirements are set on the type of water butt or storage capacity required. The assessor should be satisfied that, within reason, the installation is adequate for the size of development and climatic conditions of the region.

Evidence

Ref	Design stage	Post-construction stage
All	Documentation detailing the planting and irrigation strategy. Relevant section/clauses of the building specification or contract AND/OR Design drawings (where necessary). Manufacturers product detail.	BREEAM Assessor's site inspection report and photographic evidence. Manufacturer's product details.

Additional information

Relevant definitions

Vehicle wash

A commercial scale automatic, semi-automatic or manual system for washing vehicles. This includes wheel and chassis wash, fixed gantry and screen wash systems using brushes, spray bars or handheld jet hoses.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Materials

Summary

This category encourages steps taken to reduce the impact of construction materials through design, construction, 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
Mat 01 Life cycle impacts	Up to 7	Reductions in the building's environmental life cycle impacts through the use of materials with low environmental impact.
Mat 03 Responsible sourcing of construction products	3	Recognition of legally harvested timber and responsibly sourced materials to reduce environmental and socio-economic impacts.
Mat 05 Designing for robustness	1	<p>Relevant building elements incorporate appropriate design and specification measures to limit material degradation due to environmental factors.</p> <p>The building incorporates measures to reduce impacts associated with damage and wear and tear.</p>

Mat 01 Life cycle impacts

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
7	-*	-*	-*	-*	-*

*Crit 1

Aim

To recognise and encourage the use of construction materials with a low environmental impact (including embodied carbon) over the full life cycle of the building.

Assessment criteria

This issue is split into five parts:

- Absence of environmental toxins – pre-requisite (no credits)
- Environmental Product Declarations (EPD) (1 credit)
- Performance requirement for building products (1-2 credits)
- Life cycle impacts of building (1-2 credits)
- Climate gas calculations (1-2 credits)

There are two exemplary level credits available; one for EPDs for building services and one for life cycle impacts of buildings.

The following is required to demonstrate compliance for:

Absence of environmental toxins – pre-requisite (no credits)

1. Evidence must be presented to document the absence of the specified toxins listed in Checklist A20. Compliance with this criterion is a minimum standard for all building types and all BREEAM-NOR ratings, i.e. a BREEAM-NOR certificate cannot be obtained without compliance.

For possible exceptions see compliance note 1.

Environmental Product Declarations (EPD)

One credit

2. Environmental Product Declarations (EPDs) developed and verified according to EN 15804, EN ISO 14025 or ISO 21930 have been collected for at least 15 different building products from product groups listed in Table 33. Each of the products documented must comprise at least 25% of the product group's (listed in Table 33) area, volume or weight in order to be included. (See CN 2 for example and additional information)

Note: This credit is not dependent upon other credits achieved.

Exemplary level – EPD building services

3. Assessment criterion 2 is achieved
4. One exemplary level credit is awarded where at least three EPDs are collected for products from level-three product groups in the NS 3451 Table of Building Elements (Byggningsdelstabellen), part 3 - 6 regarding building services. Each of the products documented must provide at least 25% of the service's function/output in order to be included.

Performance requirements for building products

One credit

5. At least 10 products from product groups listed in Table 33 satisfies the criteria to receive at least one 'green' and the remaining 'white' for the four environmental indicators in the ECO product method and/or satisfies the EU Ecolabel / Nordic Ecolabel (Swan) criteria for their product group.

Of the 10 product groups, minimum four out of the following five shall be included:

- 231/232 Insulation in external walls
- 234 Windows
- 235 External cladding
- 246 Internal cladding
- 251 Decks

OR

Two credits

6. At least 15 products from product groups listed Table 33 satisfies the criteria to receive marks 1-6 (at least one 'green' and the remaining 'white') for the four environmental indicators in the ECO product method and/or satisfies the EU Ecolabel / Nordic Ecolabel (Swan) criteria for their product group.

Of the 15 product groups, minimum four out of the following five shall be included:

- 231/232 Insulation in external walls
- 234 Windows
- 235 External cladding
- 246 Internal cladding
- 251 Decks

The 25% requirement for scope, as described under Criterion 2 Environmental Product Declarations (EPD), also applies here.

The evaluation of Indoor air quality (emissions) in ECOproduct is not relevant for all product groups, and for these product groups a satisfactory mark (at least one green and the rest white) is required only for the other three environmental areas.

Note: These credits are not dependent upon other credits achieved.

Life cycle impacts of building (LCA)

7. The project uses a preaccepted (see CN4) life cycle assessment (LCA) tool to measure the life cycle environmental impact of the building.
8. The LCA includes at least the mandatory building elements indicated in the 'Materials assessment scope' section of the BREEAM International Mat 01 calculator (where present in the building).
9. The mandatory requirements identified in the 'Materials assessment tool/method and data' section of the BREEAM International Mat 01 calculator have been met.
10. A member of the project team completes the BREEAM International Mat 01 calculator and determines a score based on the robustness of the LCA tool used and the scope of the assessment in terms of elements considered.

Credits are awarded as follows;

Table 32: Percentage of BREEAM International Mat01 calculator points achieved and credits awarded

Percentage of BREEAM Mat 01 calculator points achieved (%)	Credits (all building types)
10	1
75	2
85	2 + Exemplary

Exemplary level criteria

The requirements for exemplary level criteria are outlined in percentage of BREEAM International Mat 01 calculator points achieved and credits awarded.

Reduction of green house gas emissions

11. The project uses the LCA tool and the same Mat 01 scope as in assessment criteria 7-10 to calculate the green house gas emissions from new materials in the building in accordance to EN 15978 or NS 3720 (see CN 7).

12. The tool demonstrates the reduction of climate gas emissions compared to a reference building- see compliance notes

One credit

13. The green house gas emissions from new materials in the building are reduced by 20 % compared to the reference building (see compliance notes)

OR

Two credits

14. The green house gas emissions from new materials in the building is reduced by 40 % compared to the reference building

Compliance notes

Ref	Terms	Description
CN1	Environmental toxins	<p>The environmental toxin list, Checklist A20, has been prepared in co-operation with the Norwegian authorities in order to avoid the use of building materials with environmental toxins (ref Product Control Act, section 3a and TEK10 § 9.2), and is not endorsed by BRE Global.</p> <p>In accordance with section 3a of the Product Control Act, exceptions to this requirement may be accepted where it can be satisfactorily demonstrated that it is not possible to use alternative products without encountering unreasonable cost or inconvenience (substitution assessment). Any exceptions must be approved by the building owner.</p> <p>Absence of environmental toxins can be documented through, Safety Data sheets, EPD, Sintef Technical Approval, Nordic Ecolabel (the Swan), EU-Ecolabel, BASTA, Byggvarubedømmingen or self-declarations. In the event that SINTEF Technical Approval, EPD or other pre-dates an update of the A20 check list, these must be supplemented by a self-declaration confirming the absence of any newly added toxins.</p>
CN2	EPDs	<p>Examples of products comprising at least 25% of a product group's area, volume or weight:</p> <p>Documented internal doors must comprise at least 25% of the total internal doors (244 in table of building elements NS 3451), or documented indoor paint must comprise at least 25% of the total area of surface treatment on interior walls in order to be included among the 15 required EPDs.</p> <p>In cases where two or more EPDs together cover 25% of a product group, they may be counted as one of the 15 required products.</p> <p>An EPD which covers an entire building element will count for the number of product groups in Table 33 that are physically present in the element. The 25% scope requirement also applies here. For example, an EPD for a complete exterior wall element can count as several EPDs if the element is used in at least 25% of the total exterior wall area. Another example is pre-painted interior wallboards, which covers both Surface treatment and Internal wall coverings.</p> <p>If the same product is used in several building elements, e.g the same insulation product is used in both floor, internal and external wall, the EPD for the product should only be counted once. An EPD containing variations of the same product, e.g. insulation with different thickness or density, can only be counted once even though the product variations has been used in different building elements.</p>

Ref	Terms	Description
CN3	Element not specified (applicable elements)	In some buildings, not all elements listed within the BREEAM International Mat 01 calculator will be present/specified, e.g. upper floors in single storey buildings. In these instances the calculator will re-evaluate the standard and exemplary level benchmarks according to the applicable elements.
CN4	Scoring of the materials assessment tool method and data section	<p>All tools (and versions of tools) used must:</p> <ol style="list-style-type: none"> 1. Meet the mandatory requirements outlined in BREEAM International Mat 01 calculator. 2. Have the score generated by the BREEAM International Mat 01 Calculator and verified by BRE Global <p>Please note that the verification process will require the involvement and issue of evidence by the tool producer/developer. Please see the list of previously submitted tools (by version) and their associated verified score on the BREEAM Extranet. For tools that are not preaccepted, please complete the BREEAM International Mat 01 calculator and issue to BRE Global for verification when required.</p>
CN5	Scope of Mat 01 Calculator	<p>The Mat 01 Calculator scores points based on the rigour of the life cycle assessment in terms of:</p> <ol style="list-style-type: none"> 1. The quality of the assessment tool/method and data and 2. The scope (of building elements) included in the assessment.
CN6	Reference building	<p>The reference building is 'A functionally equivalent¹ building design that achieves the same functional requirements and technical requirements¹ as the actual building design. These requirements shall be defined by the client and national regulations but shall exclude aesthetic requirements. The reference building design shall be representative of similar buildings (with similar requirements) in terms of material selection, material consumption and cost. The functional requirements, technical requirements and an outline design specification for the reference building shall be included in the evidence submitted. The design team shall develop, agree and fix the reference building design based on the same scope in assessment criteria 7-10, then submit it to the Assessor before commencing the building LCA.</p> <p>¹See EN 15978 clauses 3.14, 3.16, 3.37.</p>
CN7	National best practice, assessment criterion 11 and 12	<p>NS 3720 complements and concretises Norwegian practice for calculating greenhouse gas emissions. NS 3720 is based on NS-EN 15978, but is limited to calculating greenhouse gases. NS 3720 defines and specifies the method for greenhouse gas calculations in relation to requirements set in NS-EN 15978. NS 3720 extends the system boundaries in relation to NS-EN 15978 by including energy and transport in the operating phase (B6 and B8). Energy and transport in the operating phase is not relevant for material calculations for Mat 01.</p> <p>The terms for using NS 3720 in Mat 01 is listed on the FAQ-pages of Grønn Byggallianse.</p>

Evidence

Ref	Design stage	Post-construction stage
Environmental toxins		
1	<p>A copy of the specification describing the requirement of compliance with Checklist A20.</p> <p>OR</p> <p>A letter from the client or turnkey contractor (totalentreprenør) acknowledging the compliance with the A20 checklist.</p>	<p>Completed version of Checklist A20, signed by the developer or turnkey contractor (totalentreprenør).</p> <p>In the case that there are no suitable product alternatives, the design team or contractor shall provide satisfactory documentation that a substitution assessment concludes that there are no alternative products that can be used without causing the project unreasonable additional cost or inconvenience.</p> <p>Non-compliances for the A20-checklist must be evaluated, signed and dated by a technically competent person. The developer must confirm the substitution assessment and the non-compliance by signing and dating the non-compliance notice.</p>
EPD		
2-4	<p>Design drawings and/or specification that confirms:</p> <ul style="list-style-type: none"> - Location of the specified elements and materials/products - Information about the specified materials/products <p>AND</p> <p>A letter from the design team confirming: That EPDs will be collected for the selected product groups</p> <p>OR</p> <p>If the material /products have been ordered, delivered or the supplier is known: Copies of EPDs for specified products.</p> <p>Alternatively a valid letter confirming that the development of EPDs is underway with a planned end date.</p>	<p>Design drawings and/or specification that confirms:</p> <ul style="list-style-type: none"> - Location of the specified elements and materials/products <p>AND</p> <ul style="list-style-type: none"> - Copies of the EPDs for the specified products.

Ref	Design stage	Post-construction stage
Performance requirements for building products		
5-6	<p>Design drawings and/or specification confirming:</p> <ul style="list-style-type: none"> - location and specification of the relevant elements and products <p>AND</p> <p>A letter from the project planning group confirming:</p> <ul style="list-style-type: none"> - that the performance requirements relating to these criteria are implemented in the specification 	<p>Design drawings and/or specification that confirms:</p> <ul style="list-style-type: none"> - location of the relevant elements and products <p>AND</p> <ul style="list-style-type: none"> - The EU Ecolabel / Nordic Ecolabel license number (where available) <p>OR</p> <ul style="list-style-type: none"> - Product documentation from the ECOproduct database <p>OR</p> <ul style="list-style-type: none"> - Test reports, EPDs or other recognized third party verified documentation confirming that the criteria for EcoProduct and/or Ecolabel are met.
Life cycle impacts of building		
7-10	<p>Specification confirming:</p> <ol style="list-style-type: none"> 1. The name of the LCA tool(s) used. 2. A copy of the LCA tool output and/or information from the tool provider to demonstrate answers given in the BREEAM International Mat 01 calculator. 3. Copy of the output from the BREEAM International Mat 01 calculator. <p>See also Additional information for detailed requirements.</p>	As design stage but with 'as built' data.
11-14	<p>Copy of the output of green house gas calculations for both reference and designed building.</p> <p>A report from the design team demonstrating the reduction of green house gas emissions, including justification of the input data to the calculation of reference building emissions.</p>	<p>As design stage but with 'as built' data</p> <p>Assessor's building/site inspection and photographic evidence confirming:</p> <ul style="list-style-type: none"> - Element in-situ (where possible)

Additional information

Relevant definitions

BREEAM International Mat 01 calculator

A spreadsheet-based calculator required to determine whether a project has used an appropriate life cycle assessment (LCA) tool, and to calculate the number of credits achieved for this BREEAM issue, based on the scope and rigour of life cycle assessment and elements considered within the LCA.

Ecolabeled building materials

Building materials that meets one or more of the criteria listed in assessment criteria 5 and 6

Material guidance

Can be downloaded from www.byggalliansen.no:

- **Materialveileder:**
This guide aims to increase the awareness of material impacts on the environment and throughout the value chain in context of the BREEAM-NOR requirements.
- **Grønn Materialguide:**
This is a practical and educational overview of environmental properties for various building materials. The guide makes it easier to make environmentally-friendly choices in the planning of a construction project.
- **Nordic Guide to Sustainable Materials:**
The guide includes functional and documentational requirements for building materials making the process of procuring environmentally friendly materials clearer.

Checklists and tables

Table 33: Applicable building elements and product groups

Building elements	NS 3451	Product groups
Foundation/substructure (21)	215 214	Construction foundation Supporting structures
Structural Frame (22)	222 223 225	Separate columns Separate beams Fire protection
External walls (23)	231 235 231/232 231/232 231/232 236 236 231/235 234 233/234	Supporting structures Exterior finishing Wind barrier Insulation Vapour barrier Internal wall coverings Internal surfaces Plaster etc. Doors Windows/curtain walls
Internal walls (24)	241/242 241/242 246 246 244 244	Bearing structures Insulation Internal wall coverings Surface treatment Doors Windows
Ground floor/Upper floors (including separating floors) (25)	251 253 255 255 252 256/257 256	Decks Screeds Req. pre-treatment for floorings Flooring Insulation Ceiling Surface treatment
Floors on the ground (25)	252 252 252 255 255	Radon barrier Floors / concrete Insulation Req. pre-treatment for flooring Flooring
Roofs (26)	261 261 261/262 261 266 266 262 263	Supporting structures Wind barrier Insulation Vapour barrier Ceiling Int. Surface treatment Roofing Glass roof/skylights
Stairs/balconies (28)	281 281 282 282 284	Int. stairs Coating / Surface treatment int. stairs Ext. Stairs Coating / Surface treatment ext. stairs Balconies/veranda
Processed terrain (76)	761/762	Paving of roads, paths and places (asphalt, paving stones etc)

Other relevant product groups not listed in the above table may be included if these comprise at least 25% of the building element area, volume or weight, for example sealant.

Calculation procedures

None

Other information

None

Evidence requirements

Note: The objective for the life cycle impact section of this BREEAM-NOR issue is, apart from the green house gas calculations, to gather LCA performance data in order to create benchmarks and inform future updates of the scheme. The evidence requirements below are generic but BRE Global understand that some tools are not be able to fulfil all of the criteria. Where this is the case, the tool operator should submit results as close as possible to that required for the tool:

Tools

An electronic data table or tables of results (suitably cross referenced) generated by the tool, submitted by the Assessor to Grønn Byggallianse/BREG must fulfil the following criteria:

1. Submit a total building environmental impact result for year 0 (installation only) and year 60 study periods, as follows:
 - a. To include individual results for all environmental issues/indicators that the tool/data permits, showing issue/indicator names and units used. Where issues/indicators according to NS EN 15978:2011 are available, these should be used.
 - b. Include individual results for each life stage/module, e.g. stages A, B and C (see NS EN 15978:2011). Where the tool further permits, or where complete measurement of aforementioned stages is not possible, more detail should be provided. For example, NS EN 15978:2011 modules should be used.
 - c. The reporting format should be to NS EN 15978:2011 (or equivalent).
2. Results for each element as follows:
 - a. Element impact per issue (as above), with unit(s).
 - b. Element kg CO2 eq. per life stage and/or module (as above).
 - c. Element quantity, with unit(s).
 - d. Element description.
 - e. For each material in the element:
 - i. Installed quantities, with unit(s).
 - ii. Site wastage quantities, with unit(s).
 - iii. Replace, repair, refurbish' quantities, with unit(s).
 - iv. Re-use, recycling or disposal (landfill, incineration) quantities, with unit(s).
3. Transmitted in IFC, MS Excel or CSV file format.

Data permissions

Submission of information to Grønn Byggallianse/ BREG for the purpose of assessing this issue will be deemed to grant permission for the BRE Group of companies to use the information to:

1. Fulfil BREEAM-NOR Quality Assurance requirements.
2. Conduct further research (using anonymised data), including for the establishment of robust building level life cycle performance benchmarks in BREEAM and BRE associated tools and methodologies.

Mat 03 Responsible sourcing of materials

(all buildings)

Number of credits available	Minimum standards				
3	P	G	VG	E	O
	_*	_*	_*	_*	_*

*Crit 1

Aim

To recognise and encourage the specification of responsibly sourced materials for key building elements.

Assessment criteria

This issue is split into two parts:

- Pre-requisite (no credits)
- Responsible sourcing

The following is required to demonstrate compliance for:

Pre-requisite (no credits)

1. Evidence that all timber used on the project is 'Legally harvested and Legally traded timber'

Responsible sourcing

Up to three credits:

2. Responsible sourcing of two or more of the following building elements:
 - a. Structural Frame
 - b. Ground floor
 - c. Upper floors (including separating floors)
 - d. Roof
 - e. External walls
 - f. Internal walls
 - g. Foundation/substructure
 - h. Staircase (stairs)

Applicable materials:

- Brick (including clay tiles and other ceramics)
- Resin-based composites and materials, including GRP and polymeric render
- Concrete (including in-situ and pre-cast concrete, blocks, tiles, mortars, cementitious renders etc.)
- Tiles
- Glass
- Plastics and rubbers (including EPDM, TPO, PVC and VET roofing membranes including polymeric renders)
- Metals (steel, aluminium etc.)
- Dressed or building stone including slate
- Timber, timber composite and wood panels (including glulam, plywood, OSB, MDF, chipboard and cement bonded particleboard)
- Plasterboard and plaster
- Insulation Materials
- Bituminous materials, such as roofing membranes and asphalt
- Other mineral-based materials, including fibre cement and calcium silicate
- Products with recycled content

Note: Fixings, adhesives and additives are excluded from the assessment. For any other materials that form a part of an applicable building element, but do not fit into the applicable materials list or the exclusions list, please refer to Grønn Byggallianse who will identify the relevant Key Process and Supply Chain Process or Processes.

3. Each applicable material is assigned to a responsible sourcing tier level based on the level and scope of certification achieved by the material supplier(s)/manufacturer(s) (see *Table 35: Tier Levels and Compliance* and *Table 36 EMS criteria* in the additional guidance section).
4. The number of BREEAM-NOR credits achieved is determined as follows:

Table 34: Percentage of available points achieved and BREEAM-NOR credits awarded

BREEAM-NOR credits	Points achieved
3	≥ 15
2	≥ 10
1	≥ 5

Note:

- a. The BREEAM Mat 03 calculator must be used to determine the points and credits achieved for this issue
- b. To achieve points for any given building element, at least 80% of the materials that make-up that element must be responsibly sourced i.e. classified in tier 1-4
- c. Refer to the Calculation procedures in the Additional information section for a description of how the number of points and credits are determined.

Exemplary level criteria

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

5. Where, in addition to the above criteria, 95% of the applicable materials, comprised within the applicable building elements, have been responsibly sourced.

Compliance notes

Ref	Terms	Description
CN1	Refurbishment	In the case of a major refurbishment assess, the newly specified applicable and reused materials (reused as defined below).
CN2	Building-element not present	Where an element is not present, e.g. the building has no upper floors because it is a single storey building, it will not require assessment. Only those elements present contribute towards achieving responsible sourcing points and BREEAM credits.
CN3	Reused in-situ materials	Materials reused in-situ can be excluded from the assessment. The aim of this issue is to focus on the responsible sourcing of new specified materials.
CN4	Specified reused materials	Reused materials specified for the development e.g. recycled aggregates are considered equivalent to materials covered by certification schemes that fall within tier 1 of Table 35

Ref	Terms	Description
CN5	Pre or post consumer waste	Where materials being assessed (including timber) are part of a pre- or post-consumer waste stream, the EMS sections of the credit can be applied for; however, using an EMS scheme (ISO, EMAS etc.) for new timber does not demonstrate timber certification and therefore does not qualify for any of these BREEAM credits.

Evidence

Ref	Design stage	Post-construction stage
1	Written confirmation from the principal contractor or client that all timber will be sourced in compliance with the definition of Legally harvested and Legally traded timber.	<p>Documentary evidence confirming all timber used in the building is legally harvested and trader timber.</p> <p>Copies of purchase orders or receipts including (as appropriate) Chain of Custody (CoC) number and/or relevant certification number for all applicable materials, including those recycled or reused</p>
2-5	<p>Design plan and/or specification confirming:</p> <ul style="list-style-type: none"> - The location of elements and materials specified - Details of the materials specified <p>AND</p> <p>A letter of intent from the design team confirming relevant products shall be sourced from suppliers capable of providing certification to the level required for the particular credit claimed</p> <p>OR</p> <p>If the material has been ordered, supplied or the supplier is known:</p> <p>Purchase order from the supplier including (as appropriate) Chain of Custody (CoC) number and/or relevant certification number</p>	<p>As built drawings or as built specifications confirming that the building has been constructed in accordance with the design stage drawings/specifications.</p> <p>Copies of purchase orders or receipts including (as appropriate) Chain of Custody (CoC) number and/or relevant certification number for all applicable materials, including those recycled or reused</p> <p>Output from the MAT 03 calculator</p>

Additional information

Table 35: Responsible Sourcing Tier Levels and Criteria

Tier level	Issue assessed	Points available per element	Evidence/measure assessed	Examples of compliant schemes
1	Legality & responsible sourcing	3	Certification scheme EMS (Environmental Management Scheme)	ISO 14001 certified for the Key Process and all Supply Chain processes. Wood: FSC, CSA, SFI with CoC, PEFC.
3	Legality & responsible sourcing	1.5	Certification scheme EMS (Environmental Management Scheme)	ISO 14001 or 3rd party certified EMS (e.g. EMAS or Miljøfyrtårn) for the Key Process and key Supply Chain process. Timber: MTCC, Verified**, SGS, TFT Recycled Materials with certified EMS for the Key Process
4	Legality & responsible sourcing	1	Certification scheme EMS (Environmental Management Scheme)	Certified EMS for the key process (e.g ISO 14001/EMAS or Miljøfyrtårn)

Table 36: EMS Criteria

Material	Key Process	Key supply chain processes
Brick (including clay tiles and other ceramics)	Product Manufacture	Clay Extraction
Resin-based composites and materials (including GRP and polymeric render but excluding timber based composites)	Composite product manufacture	Glass fibre production (or other principle matrix material) Polymer production
In situ Concrete (including ready mix and cement mortars and renders)	Ready mixed concrete plant	Cement production (The production of cement and the recovery of the aggregate and limestone used in the cement production) Aggregate extraction and production
Precast concrete and other concrete products (including blocks, cladding, precast flooring, concrete or cementitious roof tiles)	Concrete product manufacture	Cement production Aggregate extraction and production
Glass	Glass production	Sand extraction Soda Ash production or extraction
Plastics and rubbers (including polymeric renders, EPDM, TPO, PVC and VET roofing membranes)	Plastic/rubber product manufacture	Main polymer production
Metals (steel, aluminium etc)	Metal Product manufacture - e.g. cladding production, steel section production	Metal production: Steel: Electric arc furnace or Basic oxygen furnace process, Aluminium, ingot production, Copper: ingot or cathode production.
Dressed or building stone (including slate)	Stone product manufacture	Stone extraction
Plasterboard and plaster	Plasterboard or plaster manufacture	Gypsum extraction Synthetic gypsum (from flue gas desulphurisation) by default (recycled content)
Virgin timber	Timber from certified sources	Timber from certified sources
Cement Bonded Particle Board	Due to the significant cement content, in addition to requiring timber certification, the key supply chain process must also be considered to obtain the relevant tier. Timber from certified sources	Cement production Timber from certified sources

Material	Key Process	Key supply chain processes
Wood panel and wood based composite products such as Oriented Strand Board, plywood, HPL, chipboard/particle, glulam, LVL,etc.)	Wood products, including those with recycled content, can only use the Timber Certification route (e.g. FSC and PEFC)	
Bituminous materials, such as roofing membranes and asphalt	Product manufacture	Bitumen production Aggregate extraction and production
Other mineral-based materials, including fibre cement and calcium silicate	Product manufacture	Cement production lime production other mineral extraction and production
Products with 100% recycled content	Product manufacture	Recycled input by default
Products with lower % of recycled content	Product manufacture	Supply chain process/processes for any virgin material in the relevant product type above. Recycled input by default
Any other product	Key processes is likely to be product manufacture	1 or 2 main inputs with significant production or extraction impacts should be identified
Excluded products: , fixings, adhesives, additives	N/A	N/A

Calculation Procedure by using the Mat 03 calculator

For each element, select the number of different types of element you wish to enter in the relevant drop down box and press the select button. If the element is not present, select '0'.

For each element, select the 'data type' from the relevant drop down box. There are two options, 'Volume' or 'Percentage'. User Defined - Volume

- For all present elements, enter the names of the material types comprising each individual element in the relevant cell of the column *materials types*.
- Enter the volume of each individual material type in the relevant cell of the column titled *percentage/volume of relevant materials present*.
- Enter the total combined volume of the material types in the cell *total volume of element present*.
- Enter the volume of each material that complies with either tier 1, 3 or 4, as appropriate. At least 80% of the total volume must comply with one or more of the tiers to achieve any points for that element type.

User Defined - Percentage

- For all present elements, enter the names of the material types comprising each individual element in the relevant cell of the column *materials types*.
- Enter the percentage of each individual material type (as a percentage of the whole element type) in the relevant cell of the column titled *percentage/volume of relevant materials present*.
- Enter the percentage of each material (as a percentage of the whole element type) that complies with either tier 1, 3 or 4, as appropriate. At least 80% of the materials that make up an element type must comply with one or more of the tiers to achieve any points for that element type.

It is beneficial to include even small percentages of materials that are in the higher tiers to gain more points in the calculator

Timber and Environmental Management Schemes (EMS)

Where an Environmental management scheme is used to assess products made from recycled timber, 100% of the timber content must be recycled or sourced from one of the recognised timber certification schemes in *Table 35 Responsible Sourcing Tier Levels and Criteria*. A timber product with 50% recycled timber and 50% legally sourced timber will not comply with the criteria and will not be awarded any points.

Calculation of Timber Volumes:

Most of the information on areas, lengths and volumes of timber will be available from the component manufacturers or estimator, who should provide a detailed breakdown of quantities of materials

Key Processes:

The final major aspects of processing that are carried out. There may be a single process or multiple processes requiring assessment, depending on the end product. The criteria for each of the assessed materials are detailed in *Table 36 EMS Criteria*.

Key supply Chain process:

Covers all of the major aspects of processing and extraction involved in the supply chain for the end product. Note that recycled materials are not required to demonstrate a Supply Chain EMS. The criteria for each of the assessed materials are detailed in *Table 36 EMS Criteria*.

Tier levels

A graded scale to reflect the rigour of the certification scheme used to demonstrate responsible sourcing, forming the basis for awarding points (all as detailed in *Table 35 Responsible Sourcing Tier Levels and Criteria*).

Relevant documentation demonstrating the above must be provided or made available on request subject to the availability of such materials in the country concerned. Certification from any of the timber certification schemes identified in tiers 1, 2 and 4 for this credit demonstrate legally sourced timber.

Responsible Sourcing:

Demonstrated through auditable third party certification schemes.

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.

Material guidance:

Please see the additional information section of Mat 01.

Legally harvested and traded timber

Legally harvested timber and wood-derived products are those that originate from a forest where the following criteria are met:

1. The forest owner or manager holds legal use rights to the forest
2. There is compliance by both the forest management organisation and any contractors with local and national legal criteria including those relevant to:
 - a. Forest management
 - b. Environment
 - c. Labour and welfare
 - d. Health and safety
 - e. Other parties' tenure and use rights
 - f. All relevant royalties and taxes are paid.
3. There is full compliance with the criteria of CITES.

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
3. Traded in compliance with legislation related to the convention on international trade in endangered species (CITES), where applicable

Examples of compliance:

Legally harvested:

- FSC, PEFC or SFI certification
- Evidence of compliance with the EUTR (EU's Timber Regulation)
- Risk assessment/due diligence documentation demonstrating a low risk of non-compliance with the 'legally harvested' requirements given in the manual.

Legally traded:

- FSC, PEFC or SFI certification
- Risk assessment/due diligence documentation demonstrating a low risk of non-compliance with the 'legally traded' requirements given in the manual.

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 or countries seeking to protect this species.

Mat 05 Designing for robustness

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

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 for:

One credit

1. The design team has identified the components of the building that are vulnerable to moisture damage, and has specified suitable protection measures to prevent damage caused by moisture. This must include, but are not necessarily limited to:
 - a. protect structural components from rain and other types of moisture in the operation phase
 - b. conduct life-span assessment for vulnerable structural components - both exposed and built-in components
 - c. use of materials that resist moisture-uptake in the structural parts that are difficult to protect and where access restricts replacement
2. Areas of the building have been identified (both internal and external) where vehicular, trolley and pedestrian movement occur.
3. The design incorporates suitable durability and protection measures or design features/solutions to prevent damage to the vulnerable parts of the building. This must include, but is not necessarily limited to:
 - a. Protection from the effects of high pedestrian traffic in main entrances, Public areas and thoroughfares (corridors, lifts, stairs, doors etc.).
 - b. Where relevant, protection against any internal vehicular/trolley movement within 1m of the internal building fabric in storage, delivery, corridor and kitchen areas.
 - c. Protection against, or prevention from, any potential vehicular collision where vehicular parking and maneuvering occurs within 1m of the external building façade for all car parking areas and within 2m for all delivery areas.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Where the installation of suitable durability measures will form a part of the future tenants fit-out specification and installation, and not the base build, compliance can be demonstrated via one of the following available means:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN2	Suitable durability measures	<p>Suitable durability and protection measures to vulnerable parts of the building can include:</p> <ol style="list-style-type: none"> 1. Materials in façades and other surfaces exposed to rain, drips and other weather conditions should be moisture resistant. 2. Structural and built-in components should be protected from moisture during use (e.g. shower rooms) 3. Bollards/barriers/raised kerbs to delivery and vehicle drop-off areas. 4. Robust external wall construction, up to 2m high. 5. Protection to walls of corridors and partitions with high traffic volumes. 6. Kick plates/impact protection (from trolleys etc) on doors. 7. Hard-wearing and easily washable floor finishes in heavily used circulation areas (i.e. main entrance, corridors, Public areas etc). 8. Designing out the risk without the need for additional materials specification to protect vulnerable areas.
CN3	Vehicle impact protection	<p>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.</p> <p>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.</p>
CN4	Preventing excessive material use	<p>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.</p>
CN5	Public/common areas	<p>Consideration should be given to materials specification in public/common areas (especially public waiting areas and toilet areas) to provide protection against potential malicious or physical abuse in as far as it is possible.</p>
CN6	Sales areas	<p>In any sales areas, where customer goods trolleys will be used, protection must be provided to vulnerable parts of the building (such as glass curtain walling, etc.) which are within 1m of trolley movement.</p>

Evidence

Ref	Design stage	Post-construction stage
1	<p>Design drawings illustrating components of the building that are vulnerable to moisture damage - both exposed and built-in.</p> <p>Report or note from design team demonstrating the outcome of the Life-span assessment for the identified vulnerable components.</p> <p>Specification of moisture-resistant materials for the relevant components.</p>	Assessor's report and photographic evidence.
2&3	Design drawings illustrating vulnerable areas/parts of the building. Design drawings and/or specification confirming the durability measures specified.	Assessor's building/site inspection and/or photographic evidence confirming compliance.

Additional information

Relevant definitions

Life-span assessment

Life-span assessments should identify:

- building components vulnerable to moisture damage
- consequences of exposure (e-g- through a frequency-consequence risk-assessment)
- proposed measures or alternative materials.

Materials optimisation

Material optimisation means adopting a resource efficient approach to design, which results in less material being used in the design (i.e. lean design), and/or less waste produced in the construction process, without compromising the design concept. Whilst this assessment issue is focused on specifying suitable durability measures, the design team should consider solutions that optimise the use of materials and therefore minimise construction waste.

Public areas

Refer to BREEAM issue Hea 01 Visual comfort.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Waste

Summary

This category encourages the sustainable management (and reuse where feasible) of construction and operational waste. By encouraging good design and construction practices, issues in this section aim to reduce the waste arising from the construction and operation of the building, encouraging its diversion from landfill.

Category summary table

Issue	Credits	Credit summary
Wst 01 Construction waste management	3	Development of a construction resource management plan. Minimize the waste amounts and maximize the potential of sorting, reusing and recycling of construction waste.
Wst 02 Recycled aggregates	1	Percentage levels of recycled or secondary aggregate specified against set targets.
Wst 03a Operational waste Wst 03b Operational waste	1 2	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 occupants and activities.
Wst 04 Speculative floor and ceiling 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.

Wst 01 Construction waste management

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	1

Aim

To promote resource efficiency via the effective and appropriate management of construction waste.

Assessment criteria

This issue is split into two parts:

- Construction resource efficiency (1 credit)
- Maximizing recovery rate (2 credits)

The following is required to demonstrate compliance for:

Construction resource efficiency

One credit

1. Where appropriate targets for the amount of non-hazardous and hazardous waste produced on site are set in kg of waste per m².
2. Procedures are in place to minimize non-hazardous and hazardous waste in line with the targets.
3. The amount of site construction waste created is being monitored and targets regularly reviewed.
4. The design/site management team has nominated an individual responsible for implementing the above.
5. Using the collated data, report the amount of waste generated per m² (gross internal floor area) in tonnes from the construction process via the form 5178 (New Construction) or 5179 (Demolition or refurbishment) (made by the Norwegian Building Authority) and the BREEAM scoring and reporting tool (in tonnes/100m² or m³/100m²).
6. Procedures are in place for sorting, reusing and recycling construction waste into at least five defined waste groups on site.
7. Where buildings exist on the site, a pre-demolition audit of any existing buildings, structures or hard surfaces is completed to determine if refurbishment/reuse is feasible and, if not, to maximize the recovery of material from demolition for subsequent use, prioritizing high grade/value applications. The audit must cover:
 - a. Identification of the key refurbishment/demolition materials
 - b. Potential applications and any related issues for the reuse and recycling of the key refurbishment and demolition materials.

Maximizing recovery rate

One credit

8. At least 75% (by weight) of the construction waste will be sorted into separate key waste groups (according to the waste streams generated by the scope of the works) onsite. The collated data will be reported using the form 5178 or 5179 (where applicable) and the BREEAM scoring and reporting tool (in tonnes/100m² or m³/100m²).

OR

Two credits credit

9. At least 85% (by weight) of the construction waste will be sorted into separate key waste groups (according to the waste streams generated by the scope of the works) onsite. The collated data will be reported using the form 5178 or 5179 (where applicable) and the BREEAM scoring and reporting tool (in tonnes/100m² or m³/100m²).

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM-NOR issue:

10. At least 90% (by weight) of the construction waste will be sorted into separate key waste groups (according to the waste streams generated by the scope of the works) onsite. The collated data will be reported using the form 5178 or 5179 (where applicable) and the BREEAM scoring and reporting tool (in tonnes/100m² or m³/100m²).

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	For assessments of extensions to existing buildings, where only the extension is being assessed, it is only the extension that must comply.
CN2	Maximizing recovery rate	<p>Maximizing recovery rate includes in order of priority:</p> <ol style="list-style-type: none"> 1. Reusing the material on site (in-situ or for new applications). 2. Reusing the material on other sites. 3. Salvaging or reclaiming the material for reuse. 4. Returning material to the supplier via a 'take-back' scheme. 5. Recovery of the material from site by an approved waste management contractor for recycling 6. Energy recovery. <p>Based on the Directive 2008/98/EC - on waste and repealing certain Directives EU's rammedirektiv for avfall (Avfallsdirektivett). Norwegian Government link: https://www.regjeringen.no/no/sub/eos-notatbasen/notatene/2006/apr/rammedirektivet-for-avfall/id2432014/</p> <p>Guidance on this topic can be found in "Hvordan planlegge for mindre avfall", available for download from www.byggalliansen.no</p>
CN3	Optimizing waste treatment downstream	In order to optimize waste treatment downstream, gypsum and waste groups that are intended for energy recovery, must be placed in closable containers (alternatively containers covered by tarpaulin or equivalent) to prevent the waste from getting wet, and thus reduce the possibility of recycling (gypsum) or energy recovery.
CN4	Pre-demolition audit	<p>A pre-demolition audit should be carried out using an appropriate methodology. Minimum content is described under Other Information (Pre-demolition and refurbishment audits).</p> <p>A possible method is described in the guide "Hvordan planlegge for mindre avfall". This guidance is available for download from www.byggalliansen.no</p> <p>Where existing buildings have been demolished prior to the design stage, within the last two years, this credit can be obtained if compliance can be documented in accordance with criterion 7.</p>

Evidence

Ref	Design stage	Post-construction stage
1-6 + 8-10	<p>A copy of the specification or contract or other formal document confirming waste procedures, including targets for waste reduction and the arguments for them</p> <p>OR</p> <p>A letter from the client, their representative or the turnkey contractor confirming that such procedures will be in place in the building process, including targets for waste reduction and the arguments for them</p> <p>A copy of form 5178 or 5179 (where applicable). Column 1 "Plan" should be completed).</p>	<p>A copy of the waste procedures, including targets.</p> <p>If the targets are not met, the project should reflect on the reasons for exceeding the targets.</p> <p>A copy of a completed form 5178 or 5179 (where applicable).</p>
7	A copy of the pre-demolition/pre-refurbishment audit	<p>A copy of the pre-demolition/pre-refurbishment audit.</p> <p>Where relevant, evidences that building materials / elements have been reused / sent to a market for reused building materials.</p>

Additional information

Relevant definitions

Appropriate targets

These can be set according to best practice (where available) and will depend on the type of waste and the opportunities for reuse on site. Targets could also be set to improve on data from similar past projects or working towards a company target. 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

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 re-using existing materials and earnings from selling those that aren't needed. More details can be found under "Other information" below.

Checklists and tables

None

Calculation procedures

None.

Other information

Key waste groups

For determining key waste groups, consult the renovator in the project or the NS 9431:2011

Site waste management plan

The implementation of a Site Waste Management Plan (SWMP) can help manage the site construction waste produced. The aim of a SWMP is 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 SWMP consists of a combination of commitments to:

1. Design out waste.
2. Reduce waste generated on site.
3. Develop and implement procedures to sort and reuse/recycle construction waste on site

Data obtained from measuring and monitoring site construction waste can then be used to check performance against targets and benchmarks, analyse the effectiveness of any solutions implemented and strive for continual improvement.

Pre-demolition and refurbishment audits (CN 4)

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 re-using existing materials and earnings from selling those that aren't needed. They:

1. Identify volumes of wastes so that your company can plan 're-use, recycling and recovery' activities prior to work starting.
2. Are tailor-made for each demolition project. Available services include:
 - a. Identifying markets for recycled or recovered material
 - b. Identifying reclamation and re-use 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.

Norwegian Building code TEK 10 or 17 (§ 9-5 and § 9-6) focus on minimising the amount of materials used and to have a plan for how to manage the waste produced. The pre-demolition audit describes a framework for what to focus on to make sure that any re-usable materials can be used and thereby is one action to help achieve the TEK § 9-5 goal.

More details about pre-demolition audits and suitable methods that can be used for the audit can be found in the report "Hvordan planlegge for mindre avfall" from Grønn Byggallianse.

Limited space

When limited space, the project can seek solutions in cooperation with the project's renovator. Using alternative collecting equipment, containers etc, alternative collecting routines and frequencies. The guidance in national regulations (Veiledning til TEK 10 or 17 § 9.8) should be used and followed. It is important that construction waste is a natural part of the construction management planning and hence is also to happen on the site. Centralized solutions may be considered as exemption where there is practically impossible to organize sorting of construction waste on the site.

Wst 02 Recycled aggregates

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To recognise and encourage the use of recycled and secondary aggregates, thereby reducing the demand for virgin material and optimising material efficiency in construction.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. At least 25% of the high grade aggregate uses (within the development) are provided by secondary and/or recycled aggregate. This percentage can be measured using either weight or volume.
2. The aggregates are EITHER
 - a. Obtained on site OR
 - b. Obtained from waste processing site(s) within a 30km radius of the site; the source will be principally from construction, demolition and excavation waste (CD&E) – this includes road plannings OR
 - c. Secondary aggregates obtained from a non-construction post-consumer or post-industrial by-product source (see Compliance notes).

Exemplary level criteria

The following outlines the exemplary level criteria to achieve an innovation credit for this BREEAM-NOR 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.

Compliance notes

Ref	Terms	Description
CN1	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).

Ref	Terms	Description
CN 2	Secondary aggregates	<p>Recognised non-construction post-consumer or post-industrial by-products include:</p> <ol style="list-style-type: none"> 1. China clay waste 2. Slate overburden 3. Pulverised Fuel Ash (PFA) 4. Blast Furnace Slag 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. Tyres 13. Spent oil shale 14. Colliery spoil 15. Municipal Solid Waste Treatment Residues
CN3	National best practice guidance on defining granular fill and capping as a high grade use	<p>To demonstrate these materials used are high grade aggregates please demonstrate applicability as follows:</p> <p>The minimum requirements as set out in Checklist A6 are covered by the proposed documents OR</p> <p>Where appropriate standards/national best practice exist, the design team should demonstrate compliance with these standards. The standards must meet the minimum requirements in checklist A6.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Relevant section/clauses of the building specification or contract.</p> <p>Project team calculations.</p> <p>Documentation confirming the source of recycled/secondary aggregates and that the required amount can be provided.</p>	<p>Calculations detailing the weights (or volumes) and types of aggregate provided for each application.</p> <p>Delivery notes (or confirmation from supplier) of the types and quantities of aggregates provided on site.</p>

Additional information

Relevant definitions

High Grade aggregate uses:

High Grade aggregate uses are considered to be

Bound

1. Structural frame;
2. Floor slabs including ground floor slabs;
3. Bitumen or hydraulically bound base, binder, and surface courses for paved areas and roads.

Unbound

1. Asphalt-based or similar road surfaces
2. Granular fill and capping
3. Pipe bedding
4. Sub bases/building foundations
5. Gravel landscaping.

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 landfill costs.

Pre-consumer waste stream

Waste material generated during manufacturing processes. Excluded is 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.

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.

Recycled aggregates

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 sub-divided into manufactured and natural, depending on their source.

Checklists and tables

None.

Calculation procedures

None.

Other information

None

Wst 03a Operational waste (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	1	1

Aim

To recognise and encourage the provision of dedicated storage facilities for a building's operational-related recyclable waste streams and so help to avoid waste being sent to landfill or incineration.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. There is dedicated space(s) to cater for the segregation and storage of operational recyclable waste volumes generated by the assessed building/unit, its occupant(s) and activities.
2. The dedicated space(s) and equipment (where installed as part of the building) must be:
 - a. Clearly labelled, to assist with segregation, storage and collection of the recyclable waste streams
 - b. Accessible to building occupants/facilities operators for the deposit of materials and collections by waste management contractors
 - 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/weekly operational activities and occupancy rates
3. Where there is likely to be a consistent generation (in volume) of the appropriate operational waste streams e.g. large amounts of packaging and/or compostable waste generated by the building's use and operation, the following facilities are provided:
 - a. Static waste compactor(s) or baler(s); situated in a service area or dedicated waste management space
 - b. Vessel(s) for composting suitable organic waste resulting from the building's daily operation and use OR adequate space(s) for storing segregated food waste and compostable organic material prior to collection and delivery to an alternative composting (or biogas) facility
 - c. Where organic waste is to be stored/composted on site, a water outlet is provided adjacent to or within the facility for cleaning and hygiene purposes.

Compliance notes

Ref	Terms	Description
CN1	Determining if the dedicated space complies	<p>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, likely waste streams and volumes to be generated.</p> <ol style="list-style-type: none"> The following information can be used as a default guide for determining the validity of the provision, where it is unclear what is justifiable for the building type/use: At least 3,5m² per 1000 m² of net floor area An additional 2 m² per 1000 m² of net floor area where catering is provided <p>AND (if relevant)</p> <p>Net floor area above 5000 m²:</p> <ol style="list-style-type: none"> A minimum of 18m² An additional minimum of 10m² where catering is provided. <p>The additional waste storage area provided for catering shall be measured against the net floor area of the building and not just the net floor area of the catering.</p> <p>The area set aside must be used to sort and store at least 6 different types of recyclable materials in accordance with local requirements for the collection methods for waste:</p> <ol style="list-style-type: none"> Paper Cardboard Plastic Other packaging materials (not listed above) Glass Metal Batteries Wood Fluorescent lamps Plant oils Mineral oils Food waste Electronic and electrical waste Textiles Toner cartridges and ink cartridgesp. Other recyclable waste that can be treated. <p>If any two or more of these fractions are sorted in a common container, it can only be counted as one fraction. Example is if glass and metal are sorted in one container it is counted as one fraction.</p>
CN2	Shell and core	<p>There are no additional or different criteria to those outlined above specific to shell and core assessments, except for the compactor/baler and composting facility requirements, where the following applies:</p> <p>End user/occupier known</p> <ol style="list-style-type: none"> As common criteria OR The end user/occupier commits to providing a dedicated space for a compactor/baler and/or composting vessel installation (or storage space for compostable material) including: <ol style="list-style-type: none"> A suitable concrete standing for a future installation A three phase power supply Good access for vehicle collections and manoeuvring <p>End user/occupier not known</p> <ol style="list-style-type: none"> Criterion not applicable where the building design/type (and therefore end use) is unlikely to result in large packaging or compostable waste streams e.g. where there is no commercially sized catering area, retail and/or large commercial storage or production areas within the speculative building OR Facilities to be provided as detailed above for a "known end user" committing to provide the necessary facilities (see point 2 above). This would be in instances where a compactor/baler and/or compost facilities may be appropriate given the building design/type and therefore end use.

Ref	Terms	Description
CN3	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.
CN4	Multiple building assessments and buildings that form part of a wider estate	Where the assessment applies to one or more buildings/units that are part of a wider estate or campus, the design team can choose to demonstrate compliance through using dedicated centralised storage space and waste management facilities with the capacity to accommodate the recyclable waste material generated from all buildings and their activities.
CN5	Accessible	Typically 'accessible' is defined in BREEAM-NOR as either inside the building or within 20m of a building entrance. In some circumstances, 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. If, in the opinion of the BREEAM-NOR Assessor it is not feasible for the facilities to be within 20m of a building entrance, then Assessor's judgement should be exercised to determine if the facility is deemed to be 'accessible' to the building occupants and vehicle collection.
CN6	Limited space or vehicle access for a compactor/baler	For developments 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.
CN7	Individual recycling bins	Individual recycling bins located at convenient locations throughout the building are necessary to maximise recycling rates. On their own, however, these are not sufficient to obtain this credit.
CN8	Internal storage areas	Where the facilities are situated internally, vehicular gate heights/widths and manoeuvring and loading space and floor must be sized correctly to ensure ease of access for and withstand the use of vehicles collecting recyclable materials.
CN9	Residual 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.
CN10	Shopping centres & retail parks	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, must have their own dedicated compliant facilities. For smaller tenant units, compliant central or common facilities on site or dedicated spaces for individual units will meet the assessment criteria for this BREEAM-NOR issue.
CN11	Small industrial units	For an industrial building/development consisting of a number of smaller units, each $\leq 200\text{m}^2$ floor area, shared facilities that meet the above criteria for the building as a whole are sufficient to achieve this credit.

Evidence

Ref	Design stage	Post-construction stage
All	<p>Design drawings showing the location of the waste facilities described for the building</p> <p>OR</p> <p>relevant section/clauses of the building specification confirming provision and scope of dedicated facilities (on site and off site).</p> <p>Project team meeting minutes/letter confirming likely building waste streams and indicative volumes.</p>	<p>As design stage.</p> <p>BREEAM-NOR Assessor's site inspection report and photographic evidence confirming compliant installation.</p>

Additional information

Relevant definitions

Waste compactor or baler

A machine that is designed to compress waste streams in order to improve storage and transport efficiency

Dedicated storage space for recyclable waste

The dedicated storage space must cater for the separation and storage of recyclable materials in accordance with CN 1. If any local collection scheme requirements are stricter, these should be used to show compliance.

Checklists and tables

None.

Calculation procedures

None.

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 8m² area for the storage and access of such containers
3. Wheeled bins: 360L = 0.86m x 0.62/660L = 1.2m x 0.7m/1100L = 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 height/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.

Wst 03b Operational waste (residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	1	1

Aim

To recognise and encourage the provision of dedicated storage facilities for operational-related household waste streams and so help to avoid waste being sent to landfill or incineration.

Assessment criteria

The following is required to demonstrate compliance for:

One credit - Recycling

1. An adequate external space has been allocated to the storage of both recyclable and non-recyclable/non compostable household waste (see Compliance note). The space must be:
 - a. Able to hold containers with a volume of, either:
 - i. At least the minimum recommended by the appropriate local authority OR
 - ii. Where there are no recommendations from the local authority, 100L of volume for a single bedroom dwelling and a further 70L for each additional bedroom.
 - b. Located on level hard standing surface.
 - c. Accessible to the house/block of flats occupants.
2. Adequate internal space (inside the apartments), (including bins) has been allocated to the storage of recyclable household waste as follows :
 - a. At least five bins (each not smaller than 15L) have been provided for the storage of recyclable household waste. See compliance note 8.
 - b. The internal recycling bins should be located in a dedicated non obstructive position. Free-standing recycling bins placed directly on the floor or in a cupboard do not comply. The bins could be in the kitchen (close to the non- recyclable waste bin) or located adjacent to the kitchen (i.e. within 10m) e.g. in a utility room or connected storeroom/garage.

One credit – Compostable waste

3. Provision of adequate external facilities for the storage and/or composting of household compostable waste. The facilities must be:
 - a. Located in a dedicated position and accessible to the dwelling occupant(s).
 - b. Accompanied by an information leaflet, delivered to each dwelling and/or communal kitchen.
4. In addition to the five internal storage bins mentioned in criterion 2a there must be one bin allocated to the compostable organic material. The bin should be located as described in criteria 2. The bin size must be at least 7 L.
5. Where adequate external facilities have not been provided with a composting container for organic material, compliance can be demonstrated where one of the following is applicable to all dwellings under assessment:
 - a. An accessible local communal or community composting service, run by either a local authority or a private organisation.
 - b. An accessible local communal or community composting service for bio-gas production, run by either a local authority or a private organization.
6. For communal facilities at least one water outlet is provided for cleaning in and around the facility.

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	Where there are external 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 waste from the new and existing buildings.
CN2	Community /developer based adequate external space	Where the outdoor space supplied for storing non-recyclable and recyclable waste is provided by the local authority or by the developer as part of the requirements from the local authority for small communities of dwellings, this can still be used to demonstrate compliance.
CN3	Accessible-reasonable distance to the facilities	<p>Easy to access and within a reasonable distance to facilities. The distance will depend on the collection scheme prevalent in the country/locality and should permit easy transfer of recycled waste streams to the facility. As a baseline this should normally be taken as the recommended distance set out by local authority requirements OR</p> <p>50m from an external entrance for houses and blocks of flats where no other requirements are in place.</p>
CN4	Recyclable household waste	<p>For the purpose of this issue, the space needs to be compatible with the range of recyclable collection provided by the local authority, the following materials will therefore typically be considered:</p> <ol style="list-style-type: none"> 1. Paper 2. Cardboard 3. Plastics 4. Glass 5. Metals (tins and cans) 6. Textile (clothes and shoes) 7. Organic compostable materials (incl. Vegetable oils (from kitchen)) 8. WEEE (Norwegian EE-avfall, like batteries etc.)
CN5	Adequate external composting facilities	<p>These must consist of an external storage bin for compostable waste and/or a warm composting container for the compostable organic waste.</p> <p>The composting container must be specifically designed for composting/warm composting and sited according to the manufacturer's instructions. Such containers should not be sited in close proximity of windows, doors, or ventilation intakes for habitable areas within the dwelling or surrounding dwellings.</p> <p>No requirements are set on the type of container or storage capacity required as this will be determined by the end user and predicted volumes of organic compostable waste. The assessor should be satisfied that, within reason, the installation is adequate for the size of development, bearing in mind the likely quantity of organic waste that will be produced by the development.</p>

Ref	Terms	Description
CN6	Community composting schemes	<p>Existing and proposed community schemes are acceptable under this issue as long as they comply with all the specifications in the technical guide. The community scheme composting facility should be easily accessed from all dwellings served by the scheme, i.e. the householder would normally deliver the waste by foot.</p> <p>It is acceptable for the bin to be beside other recycling bins in a communal collection site as long as it is clearly identifiable as being connected to a licensed community scheme. The distance between the site entrance and the communal/community containers must not usually exceed 50m (if national regulations are in place and are more stringent, compliance with these is required).</p>
CN7	Composting information leaflet	<p>The leaflet must provide information on:</p> <ol style="list-style-type: none"> 1. How composting works and why it is important 2. The materials that can be composted (e.g. raw vegetable peelings and fruit, shredded paper, teabags, etc.) 3. Details of the operation and management plan for any communal composting scheme 4. Where adequate external composting facilities are provided - troubleshooting information, e.g. what to do if the compost gets too dry or too wet
CN8	Operational waste storage sizing	<p>The dedicated requirements given in the technical manual are default guidance, for situations where it is not possible to demonstrate the required size based on known waste streams.</p> <p>Compliance can, therefore, be achieved provided that it is clearly demonstrated and evidenced that there is adequate justification for the type of facilities & size of waste storage provided, and that the assessor is satisfied that the sizes and facilities meet the criteria based on the building type, occupancy and the likely waste volumes generated as a result of these.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Drawings and/or copy of specification.</p> <p>Calculations to justify the size of the space allocated for external waste storage.</p> <p>Letters/contract from local authority/private organisation where appropriate.</p> <p>Evidence for the existence of a community based adequate external space, set up and managed by the local authority, where applicable.</p>	<p>As design stage.</p> <p>As built drawings and/or specifications (where applicable)</p> <p>OR</p> <p>written confirmation that the development has been constructed in accordance with the design stage drawings/specifications.</p>

Additional information

Relevant definitions

Composting

Composting is a natural process which converts organic waste into an earth-like mass by means of bacteria and micro-organisms. The composting process is also supported by larvae, wood lice, beetles, worms and other such creatures.

Communal/Community composting

Communal or community composting is where a group of people share a composting system. The raw materials are provided by all who take part in the scheme, and the compost is then used in the community, either by individuals in their own gardens, or for use on larger projects within the local environment. The distance between the site entrance and the communal/community containers must not usually exceed 50m (or national regulations if these are more onerous).

The composting scheme must be compliant with all applicable legislation in the country of assessment.

Dedicated non-obstructive position

Ideally this would be in 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.

Checklists and tables

None

Calculation procedures

None

Other information

None

Wst 04 Speculative floor and ceiling finishes (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

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 for:

One credit

Office buildings only

1. For tenanted areas (where the future occupant is not known), prior to full fit-out works, carpets, other floor finishes and ceiling finishes have been installed in a show area only.
2. In a building developed for a specific occupant, that occupant has selected (or agreed to) the specified floor and ceiling finishes.

Compliance notes

Ref	Terms	Description
CN1	Show area	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.

Evidence

Ref	Design stage	Post-construction stage
All	<p>Floor plans and ceiling plans and/or relevant section/clauses of the building specification or contract AND/OR</p> <p>A letter from the client, project team or building user where the future occupant is known.</p>	As design stage and/or the BREEAM-NOR Assessor's site inspection report and photographic evidence

Additional information

Relevant definitions

None

Checklists and tables

None

Calculation procedures

None

Other information

None

Land use and ecology

Summary

This category encourages sustainable land use, 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 reuse of brownfield sites or those of low ecological value, mitigation and enhancement of ecology and long term biodiversity management.

Category summary table

Issue	Credits	Credit summary
LE 01 Site selection	3	To encourage the use of previously occupied and/or contaminated land and avoid land which has not been previously disturbed.
LE 02 Ecological value of site and protection of ecological features	2	To encourage development on land that already has limited value to wildlife and to protect existing ecological features from substantial damage during site preparation and completion of construction works.
LE 04 Enhancing site ecology	3	To recognise and encourage actions taken to maintain and enhance the ecological value of the site as a result of development.
LE 05 Long term impact on biodiversity	2	To minimise the long term impact of the development on the site and the surrounding area's biodiversity.
LE 06 Building footprint	2	Promote efficient use of a buildings footprint by ensuring that land and material use is optimized. A high ratio between the gross internal floor area and the gross internal ground floor area forms the basis of credit allocation.

LE 01 Site selection

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	-

Aim

To encourage the use of previously developed sites and/or contaminated land and avoid land which has not been previously disturbed.

Assessment criteria

This issue is split into two parts:

- Previously developed land (2 credits)
- Contaminated land (1 credit).

The following is required to demonstrate compliance for:

Previously developed land

Up to two credits

1. A percentage of the proposed development's footprint is on an area of land which has previously been developed for use by industrial, commercial or residential development purposes in the last 50 years.

Table 37: Percentage of proposed development's footprint on previously developed land

Percentage of the proposed development's footprint on previously developed land	Credits
75%	1
95%	2

Contaminated land

One credit

2. The site is deemed to be significantly contaminated, i.e. could not be developed/built to the proposed end use without remediation. This can either be confirmed by a contaminated land specialist or identified using Checklist A7.
3. The more onerous of criteria 3a or 3b below have been adopted:
 - a. Nationally recognised guidance for site investigation, risk assessment and appraisal of contaminated land as set out in regulation and/or nationally recognised code of practice OR
 - b. A robust site investigation, risk assessment and appraisal have been undertaken, in accordance with the requirements of Checklist A7 (as a minimum).
4. The client or principal contractor confirms that remediation of the site will be carried out in accordance with the recommended remediation strategy and its implementation plan (defined in Checklist A7) as set out by the Contaminated Land Specialist and any relevant national or other legislation.

Compliance notes

Ref	Terms	Description
CN1	Temporary works	Undeveloped areas of the site to be used for temporary works (e.g. temporary offices/parking, material/machinery storage) must be considered as development on undeveloped land and therefore included in the calculations unless they have been defined as 'land of low ecological value' in accordance with BREEAM issue LE 02 Ecological value of site and protection of ecological features.
CN2	Developed more than 50 years ago	Where a site has been previously developed (more than 50 years ago) but is now considered undeveloped, the credits for re-use of land may only be awarded if the site is deemed to be contaminated (as defined by the above criteria) and/or classified as 'land of low ecological value' in accordance with BREEAM issue LE 02 Ecological value of site and protection of ecological features.
CN3	Infill development	New buildings developed within the boundary of existing sites do not automatically comply with the re-use of land criteria. The land on which at least 75% or 95% of the new building will be sited must meet the definition of previously developed.
CN4	Prior decontamination	The credit for use of contaminated land can only be awarded where remediation has taken place to enable development of the site for the assessed building, or a larger phased development that includes the assessed building (see below). The credit is not achievable for instances where historical remediation and development of the site has occurred outside the scope of the current development proposals.
CN5	Large sites split into smaller plots	Where contamination of a large site has been remediated and has then been packaged up into smaller plots of land for individual buildings (possibly as part of a phased development strategy), the credit can be awarded regardless of the plot location of the assessed building within the wider development plan. This is on the condition that the whole site could not have been developed without remediation work taking place.
CN6	Health and safety related decontamination	Contaminated land that has been decontaminated solely for health and safety reasons (rather than for the specific purpose of re-development) does not comply.
CN7	Asbestos	Where the only remediation required is the removal of asbestos within an existing building fabric, the site cannot be classified as contaminated land. However, where asbestos is found to be present in the ground this will be classed as contamination for the purposes of assessing this issue.
CN8	Checklist A7	Checklist A7 indicates the likelihood of significant contamination problems on a site for the purposes of a BREEAM-NOR assessment. It also sets out the scope of any preliminary investigation, site investigation and remedial strategy. It does not seek to evaluate types, levels or risks of contamination present on the site.
CN9	Greenfield land	Land that has never been built on or used for industrial purposes. Such land may not be assumed to be non-contaminated. Reason is that ground air or water conditions and agricultural practices can lead to hazardous pollution in certain circumstances.

Evidence

Ref	Design stage	Post-construction stage
1	<p>Design drawings (including existing site plan), report or site photographs confirming</p> <ul style="list-style-type: none"> - Type and duration of previous land use. - Area (m2) of previous land use. - Where applicable, date the photograph was taken. <p>Proposed site plan showing;</p> <ul style="list-style-type: none"> - Location and footprint (m2) of proposed development and temporary works. 	<p>BREEAM-NOR Assessor's site inspection report and photographic evidence or 'as built' drawings. Where alteration has occurred, the percentage must be re-calculated using 'as built' plans.</p>
2-4	<p>A completed copy of the relevant sections of Checklist A7.</p> <p>Existing site plan(s) showing areas contaminated and to be remediated in relation to any proposed development.</p> <p>A copy of the specialist's land contamination report and confirmation of the contamination specialist.</p> <p>A letter from the principal contractor or remediation contractor confirming:</p> <ol style="list-style-type: none"> 1. The remediation strategy for the site. 2. Summary details of the implementation plan. <p>If a contractor has not yet been appointed, a letter from the client or their representative confirming that the appointed contractor will undertake necessary remediation works to mitigate the risks identified in the specialist report.</p>	<p>As design stage with information for the 'as built' situation.</p> <p>If remediation was considered necessary for the site: Final report (slutrapport) contaminated land written by specialist describing remedial works undertaken and how the contaminated soil has been processed.</p>

Additional information

Relevant definitions

Construction zone

For the purpose of this BREEAM issue the construction zone is defined as any land on the site that is being developed (and therefore disturbed) for buildings, hard standing, landscaping, site access, plus a 3m boundary around these areas. It also includes any areas used for temporary site storage and buildings. If it is not known exactly where buildings, hard standing, site access and temporary storage will be located it must be assumed that the construction zone is the entire site.

Contaminant

Defined as any solid, liquid or gaseous material in, or on the ground to be covered by the building, which is classed as a hazard and therefore presents an unacceptable risk to human health and the environment. The definition also includes land significantly infested by non-native invasive plant species.

Contaminated land/site

A contaminated land/site 'results from the presence of polluting substances produced by or used in human activities and that have characteristics likely to cause nuisance or represent a hazard for human beings, the environment or property' extracted from 'Identification and Management of Contaminated sites, A methodological guide' UNEP/ADEME, ADEME editions, Paris, 2005

ISO 10381-5 also states 'Contamination is defined as a result of human influences; however, the methods described for investigation are also applicable where there are naturally high concentrations of potentially harmful substances.'

Contaminated land specialist

A contaminated land specialist is an individual who holds a degree or equivalent qualification in chemistry, environmental science/management, earth sciences, civil engineering or a related subject, and has a minimum of three years relevant experience (within the last five years) in site investigation, risk assessment and appraisal. Such experience must clearly demonstrate a practical knowledge of site investigation methodologies and understanding of remediation techniques as well as national (and where relevant, regional) legislation on the subject; including, acting in an advisory capacity to provide recommendations for remediation.

Non-native invasive plant species

Non-indigenous species that adversely affect the habitats they invade economically, environmentally or ecologically.

In BREEAM-NOR, this includes all species in the Species Data Bank Blacklist (Artsdatabanken) and Norwegian species outside their natural range which exhibits the same negative powers (i.e such as maple tree and Norwegian spruce on the west coast). More information about the control and removal, and how this fits with the legislative framework related to such species, may be obtained from www.artsdatabanken.no and www.biodiversity.no.

Proposed development

Any development (building, hard landscaping, car park and access roads) that falls within the boundary of the assessed site.

Previously developed land

Land that is or was occupied by a permanent structure and any associated fixed surface infrastructure. This excludes:

1. Land that is or has been occupied by agricultural or forestry buildings
2. Land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures
3. Land in built-up areas such as private residential gardens, parks, recreation grounds and allotments
4. Land that was previously-developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape in the process of time.
5. Land with temporary gravel landfill for parking

For the purposes of BREEAM-NOR, previously developed land must have been in use within the last 50 years for industrial, commercial or residential purposes.

Remediation

Activity undertaken to prevent, minimise, remedy or mitigate the risk caused by contaminated land to human health or the environment.

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

LE 02 Ecological value of site and protection of ecological features

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To encourage development on land that already has limited value to wildlife and to protect existing ecological features from substantial damage during site preparation and completion of construction works.

Assessment criteria

The following is required to demonstrate compliance for:

One credit - Ecological value

1. Land within the construction zone is defined as 'land of low ecological value' using either:
 - a. The BREEAM-NOR checklist (*Table 38*) for defining land of low ecological value OR
 - b. A Suitably Qualified Ecologist who has identified the land as being of 'low ecological value' within an ecological assessment report, in accordance with relevant sections of Appendix E, and based on a site survey. The SQE must refer to the latest updated method for mapping and evaluation of biodiversity recommended by the Norwegian Environment Agency (Miljødirektoratet).

One credit - Ecological protection

2. All existing features of ecological value surrounding the construction zone and site boundary area (i.e. those likely to be affected by the works) are adequately protected from damage during clearance, site preparation and construction activities. In all cases, the principal contractor is required to construct ecological protection prior to any preliminary site construction or preparation works (e.g. clearing of the site or erection of temporary site facilities).

Compliance notes

Ref	Terms	Description
CN1	Protecting features of ecological value	<p>Where the following features of ecological value exist on site and are being retained they should be protected as detailed below;</p> <ol style="list-style-type: none"> 1. 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. Invasive tree species (appearing on the national black list) should generally be removed. Trees of ecological value are defined by one or more of the following: <ul style="list-style-type: none"> - Trees with a trunk diameter of at least 63 cm (circumference of at least 198 cm) measured at 1,3 m above ground. - Trees which are visibly hollow (the inner hollow room is larger than the opening, and the opening is larger than 5 cm) and with a trunk diameter of at least 30 cm (circumference of at least 95 cm) measured at 1,3 m above ground. - Trees which are habitat for species that are on the national red list for species - Trees with larger amounts of dead wood (standing or laying) - Trees with a long term function as a nesting place - Trees that for other reasons have regional or national value for biodiversity 2. 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. 3. 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 their vicinity.
CN2	No features of ecological value	Both credits can be awarded where the construction zone is defined as 'land of low ecological value' and where the surrounding site contains no features of ecological value.

Ref	Terms	Description
CN3	Use of a suitably qualified ecologist	<p>Where a Suitably Qualified Ecologist is employed and has, using their professional judgement, defined the site as land of low ecological value, this assessment/judgement overrides any assessment determined using the BREEAM checklist (<i>Table 38</i>) for defining land of low ecological value.</p> <p>The Suitably Qualified Ecologist must base their findings on data collected from a site visit conducted at appropriate time(s) of the year, when different plant and animal species are evident. The content of the Ecology Report is to be representative of the existing site's ecology prior to the commencement of initial site preparation works (i.e. before construction to practical completion). Where the ecologist has not visited the site at the appropriate times the credit cannot be awarded (except in the circumstances indicated below in CN6).</p> <p>See Additional information for the BREEAM-NOR definition of a Suitably Qualified Ecologist.</p> <p>If the BREEAM checklist (<i>Table 38</i>) is used, the person undertaking the task must demonstrate a knowledge of how to use the databases Artsdatabanken and Naturbase (www.naturbase.no, http://artskart.artsdatabanken.no/default.aspx) in order to identify valuable ecological features/objects as specified in <i>Table 38</i>.</p>
CN4	Features of little or no ecological value	If a Suitably Qualified Ecologist has confirmed that a feature has little or no ecological value, 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.
CN5	Removal of features of ecological value	If features of ecological value have been removed as part of the site clearance then the development cannot achieve this credit, even if they are to be replaced as part of a new landscaping strategy.
CN6	Site clearance prior to purchase of the site	<p>For sites cleared prior to purchase of the site and less than five years before assessment, a suitably qualified ecologist should estimate the site's ecological value immediately prior to clearance using available desktop information (including aerial photography) and the landscape type/area surrounding the site. Where it is not possible for the ecologists to determine that the site was of low ecological value prior to the site clearance then the credit must be withheld, i.e. where there is no evidence and therefore justification for awarding the credit.</p> <p>For sites cleared more than five years ago, the ecological value of the site is to be based on the current situation on the basis that within five years, ecological features would have started to re-establish themselves and therefore act as an indicator of the site's ecological value.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>EITHER</p> <p>A completed copy of <i>Table 38</i> signed and dated by the client or a design team member with appropriate confirmation of knowledge</p> <p>AND</p> <p>Plans, site photographs and specifications confirming presence, or otherwise, of ecological features and the protection measures specified</p> <p>OR</p> <p>Ecologist's report highlighting information required in accordance with Appendix E.</p>	<p>As design stage plus BREEAM-NOR Assessor's site inspection report and photographic evidence OR ecologist's report confirming:</p> <ol style="list-style-type: none"> 1. The boundary of the site and the construction zone has not been altered. 2. Where applicable, all existing ecological features still remain.

Additional information

Relevant definitions

Appendix E

A guidance document to help assessors relate the contents of a Suitably Qualified Ecologists report to the land use and ecology criteria of BREEAM-NOR. The document takes the form of a questionnaire which can be given to an SQE to complete, therefore giving the BREEAM-NOR Assessor the necessary information required to complete their assessment of the building.

Appropriate statutory body

This refers to the statutory/legal organisation/entity whose duty it is to carry out the planning approval function for the development area.

Construction zone

Refer to BREEAM issue LE 01 Site selection.

Designated site

Designating special areas for protection is an effective way of ensuring wildlife and natural landscapes retain their individual characteristics. Some areas are deemed of such importance that they are formally designated under various pieces of national and international legislation.

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.

Site clearance

The preparation of the site prior to construction works commencing including removal of walls, hedges, ditches, and trees, other vegetation and services from the site. It can also involve the clearance of fly-tipped materials.

Suitably qualified ecologist (SQE)

An individual achieving all the following items can be considered to be “suitably qualified” for the purposes of a BREEAM-NOR assessment:

1. Holds a degree or equivalent qualification in ecology or in a related subject comprising a significant ecology component.
2. Is a practising ecologist, with a minimum of three years of 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.

Checklists and tables

None

BREEAM checklist for defining land of low ecological value

If the answer to all questions in the checklist is ‘no’, the land can be defined as having a low ecological value and the credit awarded. Should any of the questions be answered ‘yes’, the credit can only be awarded on confirmation from a Suitably Qualified Ecologist that the site is of low ecological value.

The checklist should be completed by either the BREEAM-NOR Assessor, using appropriate evidence submitted by the design team or completed by the design team and submitted to the Assessor along with appropriate supporting evidence. The answers to the checklist must be based on an evaluation of the site prior to any site clearance or construction activities (refer to Compliance notes for further detail).

Table 38: BREEAM checklist for defining land of low ecological value

Ref	Question	Please tick as appropriate	
Q1	<p>Have any of the following local organisations <u>or databases</u> identified possible ecological value on the site, all relevant bodies must be contacted before responding to the question?</p> <ol style="list-style-type: none"> 1. The appropriate statutory body 2. Nature and/or conservation groups 3. www.naturbase.no 4. www.artskart <p>The following ecological valuable features/objects should be considered; Habitats (“naturtyper” and “viltområder”), rare and threatened (redlisted) species (“rødlistede arter”) and other species of national interest regarding management (“Arter av nasjonal forvaltningsinteresse”).</p>	Y	N
Q2	<p>Is the development within 2 km of a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services (e.g. Ramsar site)? The following sources of information are not exhaustive but can be used to check local land use.</p> <ol style="list-style-type: none"> 1. www.naturbase.no 2. Appropriate statutory body websites 3. Maps that show specific sites and provide information on local policies relating to that site 	Y	N

Ref	Question	Please tick as appropriate	
Q3	<p>Is the development within 500 m of a designated area? The following sources of information are not exhaustive but can be used to check local land use.</p> <ol style="list-style-type: none"> 1. www.naturbase.no 2. Appropriate statutory body websites 3. Maps that show specific sites and provide information on local policies relating to that site 	Y	N
Q4	<p>Are any of the following habitats present on, or within 100m of the construction zone? The following list is not exhaustive, but provides guidance on the type of habitat BREEAM defines as having ecological value.</p> <ol style="list-style-type: none"> 1. Woodland (e.g. high forest, scrub)* 2. Water courses (e.g. rivers, streams or canals)** 3. Wetlands (e.g. swamps, marshes, wet grasslands, peatlands, estuaries, deltas, tidal flats, near-shore marine areas, coral reefs, and human-made sites such as fish ponds and reservoirs) 4. Grassland (e.g. meadow, heathland, bogs, etc) 5. Arid/semi arid desert*** 6. Any other habitats considered to have ecological value (refer to the nationally approved DN-håndbok 13. <p>http://www.miljodirektoratet.no/old/dirnat/attachment/54/Håndbok%2013%20080408_LOW.pdf for guidance)</p>	Y	N
Q5	<p>Are any of the following features present within or on the boundary of the construction zone?</p> <ol style="list-style-type: none"> 1. Mature or semi-mature trees 2. Existing buildings (occupied or derelict) that may provide shelter for wildlife. 	Y	N
<p>Notes:</p> <p>* Woodland is defined as 'having over 25% canopy cover of trees and shrubs, over a metre high'.</p> <p>** Broad habitats of rivers and streams are defined as running watercourses ranging from small headwater streams to large rivers. This broad habitat, along with wetlands, includes the open water itself and the vegetation along the water's edge.</p> <p>***UNEP confirms deserts are unique, highly-adapted natural ecosystems, both providing life-supporting services on the planet and supporting human populations in much the same ways as in other ecosystems</p>			

Calculation procedures

None.

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/approval. BREEAM-NOR provides the opportunity to reward those projects that contribute to protecting and enhancing biodiversity, improve living environments and meet environmental objectives.

Whilst not mandatory, BREEAM-NOR recommends that a Suitably Qualified Ecologist is appointed to ensure that a project maximizes biodiversity gains.

The World Database on Protected Areas (WDPA) contains information from various organisations such as national governments, non-governmental organizations, 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. Norwegian resource pages are The Norwegian databases Naturbase (www.naturbase.no) and Artskart (www.artsdatabanken.no)

LE 04 Enhancing site ecology (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	-

Aim

To recognise and encourage actions taken to maintain and enhance the ecological value of the site as a result of development.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. A suitably qualified ecologist (SQE) has been appointed at the design brief stage (Step 2) to report independently and without bias on enhancing and protecting the ecology of the site and
 - a. The SQE provides an ecology report with appropriate recommendations for protection and enhancement of the site's ecology.
 - b. The report is based on a site visit/survey by the SQE (see also CN1 'Timing of ecologist's survey').
2. At least 50% of the recommendations within the ecology report for enhancement of site ecology have been, or will be, implemented.

Two credits

3. Criteria 1 and 2 are achieved.
4. At least 75% of the recommendations within the ecology report for enhancement of site ecology have been, or will be, implemented.

Three credits

5. Criteria 1 and 2 are achieved.
6. At least 95% of the recommendations within the ecology report for enhancement of site ecology have been, or will be, implemented.

Compliance notes

Ref	Terms	Description
CN1	Timing of ecologist's survey	<p>The SQE must be appointed at the design brief stage (Step 2) in order to:</p> <ol style="list-style-type: none"> 1. Carry out site surveys of existing site ecology, on which their report is based 2. Facilitate and maximise potential ecological enhancement. <p>If the ecologist is not engaged prior to step 3, then the ecologist's report must argue that the time of engagement had no significant impact for the ecologist's recommendations. This can be relevant, for instance, if the property does not contain any elements of ecological value.</p>

Ref	Terms	Description
CN2	Ecologist's recommendations	<ol style="list-style-type: none"> 1. The SQE's recommendations for enhancing and protecting the ecological value of the site are to include, and exceed, the most onerous of all relevant local, regional, national and (where relevant) international legislation relating to protected species and habitats. These recommendations may include ecological recommendations as detailed in Additional information. 2. The SQE must state the relevant importance/weighting of each recommendation in the report. Where the SQE confirms that one of the recommendations is twice as beneficial to the local ecology as another recommendation this can hold twice as much weight in the percentage assessment. This approach can be applied to more than one recommendation and where there is considered to be more than twice as much benefit as confirmed by the SQE.
CN3	Guidance for ecologists and assessors	Please refer to Appendix E.
CN4	Infill construction on existing sites with limited space for ecological enhancements or overriding security requirements	<p>Where it is not possible to implement ecological enhancements within the construction zone due to overriding security issues, or where space for ecological enhancements within the zone is severely limited, ecological enhancements made to other areas of the site can be taken into account and used to determine the number of BREEAM-NOR credits achieved.</p> <p>These enhancements must be made within the boundary of the wider existing development and be planned and commissioned on a similar timescale to the assessed development. Examples where this Compliance note may apply include: infill sites, campuses and retail/business parks.</p>
CN5	Site clearance prior to site purchase	Please refer to the compliance note in BREEAM-NOR issue LE 02 Ecological value of site and protection of ecological features.
CN6	Green roofs/walls	<p>Where the appointed SQE confirms a positive contribution of species from a green roof, these can be included within the assessment of this issue.</p> <p>Presently green walls cannot be considered compliant within this BREEAM-NOR issue as they have high maintenance requirements which are often not self supporting/sustainable, resulting in deterioration of these plants. If the assessor feels that the green wall specified meets the aims of this issue and will be self sustaining, details can be sent to Grønn Byggallianse for consideration. Ground planted plants trained up a framework supported by the building would be acceptable (confirmed by the SQE) as these are not so dependent on systems and maintenance.</p>

Evidence

Ref	Design stage	Post-construction stage
All	SQE's report highlighting information required in Appendix E or a copy of Appendix E completed by the ecologist. Design drawings including proposed and existing (pre-development) site plan/survey. Written confirmation from the client/design team confirming how the ecologist's recommendations will be implemented.	<p>As design stage requirements. BREEAM-NOR Assessor's site inspection report and photographic evidence confirming planting in accordance with design stage plan.</p> <p>Relevant section/clauses of the building specification or contract or a letter from the client or principal contractor confirming the planting will be completed within 18 months from completion of the development*.</p> <p>* This is for large mixed-use/multi-building developments, where 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.</p>

Additional information

Relevant definitions

Construction zone

Refer to BREEAM-NOR issue LE 01 Site selection.

Suitably qualified ecologist (SQE)

Refer to BREEAM-NOR issue LE 02 Ecological value of site and protection of ecological features.

Checklists and tables

None.

Calculation procedures

None.

Other information

Ecological recommendations are defined as measures adopted to enhance the ecology of the site, which may include:

1. The planting of native floral/plant species or those with a known attraction or benefit to localecology (specified by SQE).
2. The adoption of horticultural good practice (e.g. no, or low, use of residual pesticides).
3. The appropriate provision of habitats/homes for mammals, birds, reptiles, amphibians, insects etc at suitable locations on the site, with a preference for endangered species.
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 urban drainage systems (SUDS, see Pol 03 for details), green roofs, community orchards etc.

LE 05 Long term impact on biodiversity (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To minimise the long term impact of the development on the site and the surrounding area's biodiversity.

Assessment criteria

The following is required to demonstrate compliance:

Pre-requisite criteria

1. A suitably qualified ecologist (SQE) has been appointed prior to commencement of activities on site.
2. The suitably qualified ecologist confirms that all relevant national, regional and international legislation relating to protection and enhancement of ecology has been complied with during the design and construction process (Step 2-5).
3. A landscape and habitat management plan, appropriate to the site (including impacts of the building both during construction and in operation)(Through Step 7) is produced covering at least the first five years after project completion. This is to be handed over to the building owner and/or building occupants 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 legislative requirements (local, national or regional) that apply to the site regarding the protection of species and habitats (and where applicable refer also to biodiversity action strategies/action plans)
 - d. Confirmation from the SQE that all relevant aspects of ecology are included within the plan.

One credit

4. Two of the additional criteria are achieved.

Two credits

5. Four of the additional criteria are achieved.

Note: Where the Suitably Qualified Ecologist (SQE) confirms that some of the additional measures are not applicable the credits can be awarded according to table XX

Additional criteria

6. 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.
7. 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 suitably qualified ecologist.
8. The principal contractor records actions taken to protect biodiversity and monitor their effectiveness throughout key stages of the construction process. The requirement commits the principal contractor to make such records available where publicly requested.

9. Where a new ecologically valuable habitat, appropriate to the local area, is created. This includes habitat that:
- Supports nationally, regionally or locally important biodiversity, and/or which is nationally, regionally or locally important itself
OR
 - Is protected within statutory sites, or those within non-statutory sites identified in any local biodiversity strategy/action plans.
10. Where registered flora and/or fauna habitats exist on site, the contractor programmes site works to minimise disturbance to wildlife. For example, site preparation, ground works, and landscaping 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 suitably qualified ecologist.
11. A partnership has been set up by the design team with a local group that has wildlife expertise (e.g. local wildlife trust or similar local body) and the group has:
- Provided advice early in the design process regarding protecting and/or providing habitat for species of local importance on the site.
 - 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.
 - Provided or will continue to provide ongoing support and advice to the owner/occupier of the building to help them manage, maintain and develop the outdoor space in the longer term.

Compliance notes

Ref	Terms	Description
CN1	All relevant legislation	All relevant legislation includes all local, national, regional and international legislation that is relevant to the assessment issue.
CN2	Biodiversity Champion	A Biodiversity Champion does not have to be an ecologist or ecological expert but must have sufficient authority and time on site to influence activities and ensure that they have minimal detrimental impact on biodiversity.
CN3	Where additional criteria are not applicable	<p>In all cases it is necessary to employ a suitably qualified ecologist to achieve these credits. As a minimum the ecologist must provide the following in writing;</p> <ol style="list-style-type: none"> Confirmation that pre-requisite criteria 1 and 2 have been achieved Clarification on whether pre-requisite criterion 3 is applicable and if so that it has been achieved Clarification on how many of the additional criteria are applicable and have been achieved Guidance on how to achieve additional criterion 9 (where possible) <p>Where the suitably qualified ecologist confirms that pre-requisite criterion 3 and all additional criteria are not applicable (due to the nature of the site and its surroundings) full credits can be awarded for demonstrating compliance with pre-requisite criteria 1 and 2.</p>
CN4	Ground maintenance & management plan	The management plan should include guidelines for ground maintenance. Without this there may be a tendency for grounds maintenance staff to pursue a largely unchanging maintenance routine. This may not be favourable to biodiversity on site, and may reduce scope for involvement of building users (where appropriate) in the management of and engagement with site biodiversity.

Ref	Terms	Description
CN5	Ongoing support and advice	This could take the form of meetings several times a year with a working party (consisting of a representative group of the building owners and/or occupiers) to help owner/occupiers plan conservation/ecological enhancement work, or activities relating the ecology in or near the building grounds.
CN6	Ecologically valuable habitat	This will be defined by the SQE.

Evidence

Ref	Design stage	Post-construction stage
1-5	<p>Ecologist's report highlighting information required in Appendix E or a copy of Appendix E completed by the ecologist.</p> <p>AND EITHER</p> <p>A copy of the site's landscape and habitat management plan.</p> <p>OR</p> <p>Relevant section/clauses of the building specification or contract confirming its development and scope.</p> <p>OR</p> <p>A letter from the client confirming a commitment to produce the management plan and its scope.</p>	<p>A letter from the SQE confirming that all relevant legislation relating to protection and enhancement of ecology has been complied with.</p> <p>A copy of the site's landscape and habitat management plan.</p>
Additional criteria		
6	Relevant section/clauses of the building specification or contract or an appointment letter from the Contractor.	Assessor inspection of, or a copy of the relevant sections of the site log book confirming the details of any action/events taken by the biodiversity champion. If no actions required/taken, this should be confirmed in the log book.

Ref	Design stage	Post-construction stage
Additional criteria		
7	<p>Training schedule or letter of confirmation from the principal contractor committing to provide relevant training.</p> <p>OR</p> <p>A copy of the specification clause requiring the training of the site's workforce by the principal contractor.</p>	A record of training undertaken including the necessary details.
8	<p>A letter from the principal contractor confirming monitoring and reporting criteria for the development.</p> <p>OR</p> <p>A copy of the specification clause requiring the principal contractor to undertake monitoring and reporting.</p>	<p>Assessor inspection of, or a copy of the relevant sections of the site log book confirming:</p> <ol style="list-style-type: none"> 1. Records of monitoring and actions taken to protect biodiversity AND if relevant 2. Records and outcome of any requests to view such information.
9	<p>A copy of the proposed site plan highlighting the new ecologically valuable habitat.</p> <p>A SQE's report or letter confirming that the habitat supports the relevant biodiversity action plan(s).</p>	BREEAM-NOR Assessor's (or SQE's) site inspection report and photographic evidence confirming the existence of the proposed habitat.
10	<p>The SQE's report or letter confirming actions required with respect to programming site works to minimise disturbance. The principal contractor's programme of works.</p> <p>OR</p> <p>Relevant section/clauses of the building specification or contract confirming that the programme of site works will minimise disturbance to wildlife in accordance with the SQE's recommendations.</p>	A letter from the SQE, or a copy of their report confirming site works were executed in a manner that minimised disturbance to wildlife in accordance with their recommendations.
11	<p>Documentary evidence from the design team or wildlife group confirming:</p> <ol style="list-style-type: none"> 1. Scope of partnership 2. Details and remit of the wildlife group 3. A description of the process for ongoing support that the group commit to give to the partnership 4. Details of the meetings and actions to date 	Documentary evidence from the design team or wildlife group detailing as a minimum meetings, actions, advice given, framework for future support including a timetable for meetings and events.

Additional information

Relevant definitions

Suitably qualified ecologist (SQE)

Refer to BREEAM-NOR issue LE 02 Ecological value of site and protection of ecological features

Biodiversity

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 strategy/action plan

A plan which sets specific, measurable, achievable, realistic and time bound conservation targets for species and habitats.

Checklists and tables

Table 39: Additional measures not applicable

Where the Suitably Qualified Ecologist (SQE) confirms that some of the additional measures 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

Calculation procedures

None.

Other information

None.

LE 06 Building footprint (residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
2	-	-	-	-	-

Aim

To promote the most efficient use of a building's footprint by ensuring that land and material use is optimised across the development.

Assessment criteria

The following can be used to demonstrate compliance for:

Two credits

- For houses or flats - The ratio of the gross internal floor area of all dwellings on the site to their gross internal ground floor area, is as shown within Gross Internal Floor Area: Gross Internal Ground Floor Area ratio and credits awarded

Table 40: Gross Internal Floor Area: Gross Internal Ground Floor Area ratio and credits awarded

Number of credits awarded	Gross Internal Floor Area: Gross Internal Ground Floor Area ratio	
	Houses	Flats
1	≥ 2.5:1	≥ 3:1
2	≥ 3:1	≥ 4:1

- For a mixture of houses and flats the credit(s) is awarded where the site wide gross internal ground floor area to gross internal floor area ratio is calculated to be greater than the area weighted target ratio as detailed in Calculation procedures.

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	In order to award these credits for extensions to existing buildings, the whole building should be assessed and found to meet the criteria.
CN2	Local/national height limitations	Where local or national regulations set a maximum building height, the requirements must still be met to award the credits.

Evidence

Ref	Design stage	Post-construction stage
All	General layout drawings and elevations including dimensions for: <ol style="list-style-type: none"> Each type of dwelling All other buildings with permanent foundations, such as bin/cycle stores, garages The site plan Calculations	As design stage and 'as built' drawings or specifications

Additional information

Relevant definitions

Habitable space (BREEAM issue LE06)

The definition of a habitable space is a space, typically occupied for greater than 30 minutes throughout the day with safe access by a permanent stairway or other means of entrance which complies with the requirements of relevant national local building legislation AND where the space is 'finished' with floor, walls, lighting and electric sockets.

Gross Internal Floor Area (GIFA)

The area of all habitable spaces. This includes the area taken up by halls, stairwells, cupboards, internal partitions, habitable loft spaces and basements.

- For semi-detached or terraced dwellings, this excludes the area of the party walls.
- For flats, the floor area includes the party walls and separating walls to common areas.
- Where residential accommodation is constructed above other occupied space such as shops or offices (garages or car parking would not be included), the floor area of these spaces can be included within the gross internal floor area of the dwelling provided the areas are directly beneath the residential space.

Gross Internal Ground Floor Area (GIGFA)

This is the area of land that is taken up by the permanent foundations of the dwelling (including any other outbuildings with permanent foundations that are associated with the dwelling), within the external walls of the building. For this BREEAM issue, it is measured as the total gross internal floor area of the ground floor, excluding the area taken up by the external walls.

- In blocks of flats, this also includes the area taken up by party walls and separating walls to common areas, with the exception of party walls to adjoining buildings.
- For staggered dwellings, this area equals the gross internal floor area of the floor with the largest plate.
- Areas that normally count towards the gross internal ground floor area include conservatories, garages, permanent outhouses, fully enclosed permanent waste storage areas, communal garages or storage rooms and any other permanent buildings used by the occupants.
- Areas that will NOT normally count towards the gross internal ground floor area include hard landscaping, semi-enclosed external spaces, pergolas and carports.
- Lightweight outbuildings will not count unless they are built on a permanent solid foundation and are fitted out as habitable space with heating, lighting and power.
- If a dwelling is raised above ground level on columns or other structures, the gross internal ground floor area should be measured from the lowest floor of the dwelling.
- Where other occupied spaces (e.g. non residential spaces such as retail and offices etc.) form the ground floor or lower floors under a block of flats, the gross internal ground floor area should be measured as the gross internal floor area of the lowest floor of the block of flats.

Other occupied space

Other occupied spaces include retail, office spaces and other non residential spaces which are occupied for greater than 30 minutes throughout the day. Garages or car parking would not be included in this definition.

Staggered dwellings

These are dwellings on several levels which are of unequal floor area. For example, a dwelling that has a first floor area that is greater than the ground floor area, which may overhang the ground floor.

Houses (in accordance with NS 3457-3:2013)

Within LE 06, houses are defined as detached and attached residential buildings with up to three floors. Includes: detached house, two to four person house, townhouse, semi-detached houses and staggered dwellings up to three floors

Checklists and tables

None.

Calculation procedures

Calculations for Criterion 2:

$$\text{Site wide footprint to floor area} = \frac{(\text{Total GIFA of all dwellings})}{(\text{Total GIGFA of all buildings})}$$

For one credit

$$\text{Area weighted TARGET ratio} = \frac{(\text{Total GIFA Houses} \times 2.5) + (\text{Total GIFA Flats} \times 3.0)}{\text{Total GIGFA of all houses and flats}}$$

For two credits

$$\text{Area weighted TARGET ratio} = \frac{(\text{Total GIFA Houses} \times 3) + (\text{Total GIFA Flats} \times 4.0)}{\text{Total GIGFA of all houses and flats}}$$

Where:

GIFA = Gross Internal Floor Area

GIGFA = Gross Internal Ground Floor Area

Other information

None.

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 building's impact on surrounding communities and environments arising from light pollution, noise, flooding and emissions to air, land and water.

Category summary table

Issue	Credits	Credit summary
Pol 01 Impact of refrigerants	3	Avoidance or reduction of the impact of refrigerants through specification and leak prevention or detection.
Pol 02 NOx emissions	3	Reduction in emissions of NOx arising from the building's space, ventilation and water heating systems.
Pol 03 Surface water run-off	5	Development of sites with a low probability of flooding where the design minimises the impact of flooding through careful master-planning. Surface water run-off is managed to be no worse than the pre-development scenario. Watercourse pollution prevention systems are in place.
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.
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.

Pol 01 Impact of refrigerants (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	-

Aim

To reduce the level of greenhouse gas emissions arising from the leakage of refrigerants used to heat or cool the building.

Assessment criteria

The following is required to demonstrate compliance for:

Three credits – No refrigerant use

Where the building does not require the use of refrigerants within its installed plant or systems, or any off-site system it is connected to.

OR alternatively, where the building does require the use of refrigerants, the three credits can be awarded as follows:

Two credits – Impact of refrigerant

1. Where the systems using refrigerants have Direct Effect Life Cycle CO₂ equivalent emissions (DELCO₂e) of $\leq 100\text{kgCO}_2\text{e/kW}$ cooling capacity. To calculate the DELCO₂e the following information is sourced from the design team and entered into the BREEAM Pol 01 calculator:
 - a) Global Warming Potential (GWP) of the specified system refrigerant(s)
 - b) Total refrigerant charge (kg)
 - c) System(s) capacity (kW)
 - d) Sectoral release factors:
 - i. Annual refrigerant leakage rate (% of refrigerant charge)
 - ii. Annual purge release factor (% of refrigerant charge)
 - iii. Annual service release factor (% of refrigerant charge)
 - iv. Probability factor for catastrophic system failure (%)
 - v. Recovery efficiency (% of refrigerant charge)

For further detail refer to the Relevant definitions and Calculation procedures sections within Additional information.

OR

2. Where air-conditioning, heat pumps or refrigeration systems are installed the refrigerants used have a GWP ≤ 10 .

OR

One credit – Impact of refrigerant

3. Where the systems using refrigerants have Direct Effect Life Cycle CO₂ equivalent emissions of (DELCO₂e) of $\leq 1000\text{kgCO}_2\text{e/kW}$ cooling capacity.

One credit – Leak detection

4. Where systems using refrigerants are contained in a moderately air tight enclosure (or a mechanically ventilated plant room), and an automated permanent refrigerant leak detection system is installed covering high-risk parts of the plant

OR where a refrigerant leakage/charge loss detection system is specified, which is not based on the principle of detecting or measuring the concentration of refrigerant in air.

5. The automatic shutdown and pump down of refrigerant occurs on the detection of refrigerant leakage/charge loss.
6. Automatic pump-down to either a separate storage tank or into the heat exchanger is acceptable, but only where automatic isolation valves are fitted to contain the refrigerant once fully pumped down.

Compliance notes

Ref	Terms	Description
CN1	Scope of this issue	<p>The criteria of this issue apply to air conditioning, heat pumps and refrigeration systems serving the building by both external (off-site) systems or systems installed in the building for the following uses, regardless of the systems refrigerant charge (kg), including:</p> <ol style="list-style-type: none"> 1. Comfort cooling and/or space heating, heating supplied via air and/or tap water 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.
CN2	For installations of small multiple hermetic systems only	<p>Where the refrigerant charge in each unit is less than 5kg 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.</p>
CN3	Shell and core	<p>If the building (or part of it) is not designed to be naturally ventilated and the refrigerant type cannot be confirmed, because its specification is the responsibility of a future tenant as part of their fit out works, then compliance with this BREEAM issue can only be demonstrated via one of the following means in shell and core buildings/areas:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>

Ref	Terms	Description
CN4	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, heated by a heat pump or contain a cold storage facility with refrigeration plant.
CN5	Specification of multiple systems	Where a building is installing multiple air conditioning/refrigeration systems or heat pumps, relevant technical data for each system should be entered in to 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.
CN6	Solid refrigerant	Systems using solid refrigerants are likely to meet the above requirements by default as no or very little refrigerant will escape to the atmosphere in the event of system failure and leakage. Where this is confirmed by the project's mechanical and electrical engineer (or refrigeration system manufacturer) via the relevant sectoral release factors, the three available credits can be awarded without the need for a calculation.
CN7	Leak detection and pump down	The refrigerant leak detection and pump down 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 ₂ e benchmark(s). Exceptions to this are systems that use natural and environmentally benign refrigerants, such as air and water (for example lithium bromide/water absorption chillers) and installations of small multiple hermetic systems, where the refrigerant charge in each unit is less than 5kg (as outlined above).
CN8	CO ₂ / Ammonia as a refrigerant	The refrigerant recovery system credit/requirements can be awarded without the need for a recovery system (criteria 5 & 6) where CO ₂ or ammonia is used as a refrigerant and the design team confirm the system/installation complies with: <ul style="list-style-type: none"> - NS-EN 378-1:2016 (Refrigerating systems and heat pumps - Safety and environmental requirements - Part 1: Basic requirements, definitions, classification and evaluation criteria) and NS-EN 378-2:2016 (Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation). The following can also be used as guidance documents: - NS-EN 378-3:2016 (Refrigerating systems and heat pumps - Safety and environmental requirements - Part 3: Installation site and personal protection)

Ref	Terms	Description
CN09	High-risk parts	High-risk parts of refrigeration plant typically include the pipe work/pipe joints connected and close to the compressor. Evaporator or condenser coils can be omitted from the coverage of the system.
CN10	Manual refrigerant recovery system	The provision of any manual system, including manual storage cylinders on site, does not comply with the criteria.
CN 11	District heating or cooling	<p>Where a district heating or cooling facility is servicing the assessed building, the building will have an environmental impact in terms of refrigerants, albeit in this case indirectly. As such the district heating or cooling system must be considered against the BREEAM criteria for refrigerants.</p> <p>Where connection to an off-site district heating or cooling system, over which the developer has no control, is mandated by a local authority or other statutory body, the maximum number of credits can be awarded for Issue Pol 01.</p> <p>However, where this is not mandatory and the developer has the option whether to connect, regardless of encouragement or incentives by the local authority, the district cooling system must be considered against the BREEAM criteria for refrigerants to award the credits.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>The following as appropriate</p> <ol style="list-style-type: none"> 1. Confirmation of the absence of refrigerant in the development 2. A copy of the specification clause or letter from the M&E engineer / system manufacturer confirming relevant refrigeration type and system information. 3. A completed copy of the BREEAM Pol 01 Calculator. 	<p>As design stage. Assessor's building site inspection/As built drawings.</p> <p>Manufacturer's information where the relevant information is highlighted.</p>

Additional information

Relevant definitions

Direct Effect Life Cycle (DELIC) 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: kgCO₂ eq.). The calculation involves estimating the total refrigerant release over the period of operation and subsequent conversion to an equivalent mass of CO₂. Should the system use several different refrigerants, e.g. a primary refrigerant and a secondary coolant, or a cascade system, individual calculations will have to be made for all refrigerants which may contribute to the direct effect (see below for a description of how DELIC 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).

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 our ozone.
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 for being the most hazardous to the ozone layer.

The use of CFCs and HCFCs as refrigerants has been addressed under the Montreal protocol.

Phase out programmes have been agreed resulting in these substances no longer being used as refrigerants in all new build 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. These are now widely available and are valid alternatives to HFCs in all buildings, provided health and safety issues are fully addressed. 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>

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 infra-red, semi-conductor or electro-chemical.

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.

Refrigerant recovery

The process of removing refrigerant from a system and storing it in an airtight container

Checklists and tables

Table 41: List of some common refrigerant types with low GWP

R-Number	Chemical name	GWP 100-yr
R-30	Dichloromethane	8.7
R-170	Ethane	5.5
R-290	Propane	3.3
R-600	Butane	4
R-600a	Isobutane	3
R-702	Hydrogen	5.8
R-717	Ammonia	0
R-718	Water	0.2 ±0.2
R-729	Air (Nitrogen, oxygen, argon)	0
R-744	Carbon dioxide	1
R1216	Ethylene	3.7
R-1234yf	2,3,3,3-Tetrafluoropropene	4
R-1270	Propylene	1.8

Source: The United Nations Environment Programme (UNEP) '2006 Report of the Refrigeration, Air conditioning and Heat Pumps Technical Options Committee' (page 32-34), 2006:
<http://ozone.unep.org/>
 Department of Trade and Industry, 'Refrigerant and Air Conditioning CFC and HCFC Phase Out: Advice on Alternatives and Guidelines for Users, Appendix A, 2000

Calculation procedures

The Direct Effect Life Cycle CO₂ emissions (DELC) per kW of cooling capacity are calculated using the following equation:

$$\frac{(\text{Refrigerant loss operational} + \text{Refrigerant loss system retirement}) \times \text{GWP}}{(\text{Cooling capacity (kW)})}$$

Where:

Refrigerant loss operational:

$$\frac{(\text{Refcharge} \times \text{Sysop} - \text{life} \times (\text{L1} + \text{L2} + \text{S1} + \text{S2}))}{100}$$

Refrigerant loss system retirement:

$$\text{Refcharge} \times \left(1 - \frac{\text{RefrecEFF}}{100}\right)$$

Where:

1. Ref_{charg} : Refrigerant charge
2. Sys_{op-lif} : System operational lifetime (years) - use default value of 10 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/yr)
8. GWP: Global Warming Potential of refrigerant
9. Cooling capacity (kW)

With the exception of system operational life, which is a fixed default for the purpose of the BREEAM assessment, the information above should be sourced from the design team's mechanical and electrical engineer and/or system manufacturer. The following default values can be used, where system specific data is not available:

1. Annual service release: 0.25%
2. Probability factor for catastrophic failure: 1% (based on a failure rate of 1 in 100 systems)
3. Annual leakage rate: see Table 42

Table 42: Average annual leakage rates

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	16%
Chillers	10%
Heat Pumps	6%
These figures are based on those reported in 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).	

Other information

The formula used to calculate the Direct Effect Life Cycle CO₂ 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 IPCC/TEAP Special Report, 2005, EN 378-1:2008 and the British Refrigeration Association's (BRA) Guideline Methods of Calculating TEWI for further detail. The BRA publication also includes sectoral release factors for new systems designed to best practice standards. Additional information can be found in Ene 05 Energy efficient cold storage.

Montreal Protocol

The Montreal Protocol on Substances That Deplete the Ozone Layer is an international treaty for the phasing out of substances responsible for stratospheric ozone depletion.

REAL Skills-Europe

REALSkills-Europe started as a two-year project that has built on the achievements of a UK programme developed in 2009 to achieve reductions in refrigerant leakage through improved awareness, education and training. The project developed a range of guidance notes, carbon emissions and refrigerant management tools, which are available to anyone with a professional interest. The course is a pan European multi-lingual e-learning and assessment scheme and provides opportunities for accreditation for refrigerant leakage reduction specialists.

For further information including guidance notes, calculators/tools and case study information visit:

<http://www.realskillseurope.eu/>

Leak detection systems/devices

1. Handheld detectors (which include semi-conductor and corona discharge types) do not comply with BREEAM criteria.
2. Corona discharge detectors are not suitable where flammable refrigerants are used, or in potentially explosive atmospheres.
3. Indicator dyes: these consist of fluorescent or coloured dyes added to the refrigerant to show leakage sites. The use of the dye should be approved by the compressor manufacturer. Some compressor manufacturers do not approve the use of indicator dyes, in which case either an alternative type of equipment should be used, or an alternative type of leak detection specified.
4. Halide torch detectors: this type of detection is only appropriate for chlorine-based substances such as CFCs and HCFCs, and should not be used in areas where naked flames are prohibited. Compounds that do not contain chlorine, e.g. HFCs, cannot be detected by this method. When awarding this credit in instances where these detectors are in use, the assessor should confirm that the refrigerant is chlorine based.
5. Electronic leak detectors: these must be designed to detect a certain type of, or multiple types of, refrigerant, i.e. CFC, HFC, HCFC, etc.
6. Standing hold test: systems based on monitoring pressure drops within the pipe work are not necessarily compliant with the BREEAM criteria. There are natural fluctuations to the pressure of the refrigerant due to changes in volume and temperature of the system, and to the ambient temperature of the surroundings. Low pressure and high pressure switches, which are standard equipment on refrigerant plant, are therefore not sufficient to award the credit. Other methods exist, such as pressurising the system with a high pressure, dry nitrogen gas for a period of time and then identify whether or not the pressure drops during this time. However, this requires systems to be shut down for a period of time (usually overnight or longer).
7. Systems NOT based on the principle of detecting or measuring the concentration of refrigerant in air. Such systems (for example based on sensing the presence of refrigerant vapour in liquid-carrying pipes) are now commercially available.

Pol 02 NOx emissions

(all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
3	-	-	-	-	-

Aim

To encourage the supply of space heat, heating supplied via air and/or hot water from a system that minimises NOx emissions, and therefore reduces pollution of the local environment.

Assessment criteria

The following is required to demonstrate compliance for;

Up to three credits

1. The plant installed to meet the building's heating demand (space heating, ventilation heating and hot water) has, under normal operating conditions, a dry NO emission level (measured at 0% excess O₂) as follows:

Table 43: Dry NOx emissions level depending on nominal heat input

Credits	Nominal Heat Input ≤ 70kW		Nominal Heat Input > 70kW	
	Dry NOx level (mg/kWh)	Europe only Boiler class (EN 297:1994 & EN 483:1999)	Dry NOx level (mg/kWh)	Europe only Boiler class (EN 676:2003)
1	100	4	120	2
2	70	5	80	3
3	40	-	50	-

1 Note for residential developments – Each self contained dwelling must meet the requirements

2 The emissions should be estimated under normal operating conditions (not standby)

2. Report the direct and indirect NOx emissions in mg/kWh and energy consumption in kWh/m²/yr from meeting the demand for heating (space heating, ventilation heating and hot water) via the BREEM scoring and reporting tool

Compliance notes

Ref	Terms	Description
CN1	Extensions to existing buildings	If the heating demand for a new extension is being met by an existing system, then the NOx emission level for the existing system must be assessed against the criteria of this issue.
CN2	NOx data provided in different units	Where NOx data is provided in different units or at a level of excess oxygen greater than zero, the manufacturer/supplier will need to be asked to convert this to comply with the BREEAM-NOR criteria. Alternatively, the assessor may adjust the figure using the relevant correction factors provided in the Additional information section.
CN3	Shell and core	Where the specification and installation of heating systems within the tenanted units/areas will be the responsibility of the future tenant, compliance with this BREEAM-NOR issue can be demonstrated via one of the following means in shell and core buildings/areas: <ol style="list-style-type: none"> Option 1 – Use of a tenancy lease agreement between the developer and tenant(s) (full value of available credits) Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) Option 3 – Developer/Tenant collaboration (full value of available credits) Refer to Appendix D for further description of the above options.
CN4	Grid electricity	Where some of the building's space heating demand is fuelled by electricity from a national/regional grid supply, please use 15 (mg/kWh) as the Average NOx emissions from the Norwegian grid electricity. Source: Common Reporting Format for the provision of inventory information by Annex I Parties to the UNFCCC 2007, available at http://unfccc.int/ Eurostat - Energy yearly statistics 2007, available at http://epp.eurostat.ec.europa.eu/
CN5	Low NOx grid electricity	Where heating is provided by grid electricity all three credits can be awarded by default.
CN6	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 NOx emissions.
CN7	District heating	Where a district heating facility is servicing the assessed building, the building will have an environmental impact in terms of emissions, albeit in this case indirectly. As such the district heating system must be considered against the BREEAM criteria for NOx emissions. Where connection to an off-site district heating system, over which the developer has no control, is mandated by a local authority or other statutory body, the maximum number of credits available can be awarded for this issue. However, where this is not mandatory and the developer has the option whether to connect, regardless of encouragement or incentives, to award the credits the district heating system must be assessed against the BREEAM criteria. If relevant, the dry NOx rating figure in mg/kWh for the heating system should be used to assess the issue. In practice, this figure may be very high, therefore preventing achievement of the credit. However, it cannot be scaled down based on the number of apartments/buildings since the same amount of NOx will be produced in supplying 1 kWh whether or not the system services one apartment/building or 100 apartments/buildings.

Ref	Terms	Description
CN8	Combined Heat & Power	Refer to the Additional information section for guidance on calculating NOx emission levels from CHP.
CN9	Biomass	Whilst Biomass systems are recognised as low carbon systems, they can produce a significant amount of NOx and so may not achieve this issue; however they can score highly in the Energy section of BREEAM-NOR. Biomass systems are also recognised as reducing the impact of fossil fuel depletion by employing a renewable combustion fuel source.
CN10	Wood burning heating systems	Where wood burning heating systems are employed, please use the manufacturer's NOx figures. If these are not available please contact Grønn Byggallianse for further guidance.
CN11	Heat recovery	Heat recovery can be considered as having zero NOx emissions for the purpose of this issue.
CN12	Open flues	No credits may be awarded for open flue heating or hot water systems.
CN13	More than one heating system	Where more than one heating system is specified refer to the Additional information section for guidance on calculating NOx emission levels.
CN14	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.
CN15	Assessment and reporting of a buildings NOx emissions from cooling	At present this issue does not benchmark and award credits for NOx emission levels associated with a buildings cooling demands. To facilitate possible future benchmarking of this kind and alignment with European Standards on the Sustainability of Construction Works, BREEAM-NOR does require, as a condition of achieving any credits for this issue, the reporting of both direct and indirect NOx emissions resulting from meeting the buildings 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 the source of energy for the buildings heating, cooling and/or hot water demands. Direct NOx emissions are those resulting from the burning of fuel on site or in the assessed building to meet heating, cooling and/or hot water demands, for example via a gas/oil fired/biomass boiler.
CN16	Unheated industrial buildings	Where the industrial building does not contain an office area, and the operational area is designed to be unheated without significant hot water, this issue will be automatically filtered from the assessment by the preanalysis tool and the Assessment Scoring and Reporting Tool.

Ref	Terms	Description
Residential buildings		
CN17	Secondary water and/or space heating systems	If a secondary space and/or water heating system supplies less than 8% of the dwelling's combined space heating and hot water demand, it can be omitted from the assessment. However, including a low NOX heating system that supplies less than 8% of the combined demand can lower the average NOX figure. Where this is the case inclusion of the secondary system is at the discretion of the developer and assessor.
CN18	Post construction stage exceptions	Where communal heating systems intended to supply a dwelling under assessment are due to be commissioned within a reasonable period following completion of an individual dwelling, then they should be the heat energy source assessed under this issue for NOx rather than the interim heat energy supply measure (which should also be noted). The communal system (e.g. CHP, District Heating, etc) must be the intended primary heating energy source for the dwelling. Evidence to confirm that future commissioning of such plant will occur within a reasonable period must be provided in the form of developer commitments and other pertinent technical documentation such as local service strategies; this reasonable period might be up to 18 months from completion of the dwelling.

Evidence

Ref	Design stage	Post-construction stage
All	<p>Relevant section/clauses of the building specification or contract</p> <p>Manufacturer's product details</p> <p>Calculations</p>	<p>As design stage</p> <p>BREEAM-NOR Assessor's site inspection report and photographic evidence</p>

Additional information

Relevant definitions

Approved Energy Modelling Software for calculation the heating demand

Refer to Ene 01 Energy efficiency

Heating demand

For the assessment of this issue "heating demand" shall be considered as the energy used for heating purposes. Normally this would include the following three energy posts: space heating, ventilation heating and hot water.

NOx emissions

NOx emissions are pollutant gases produced by the combustion of fossil fuels. NOx 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.

Dry NOx Levels

The NOx emissions (mg/kWh) resulting from the combustion of a fuel at 0% excess oxygen levels.

Conversion factors

Manufacturers should be asked to supply dry NOx emissions data in mg/kWh. Where this is not possible the following conversion factors to convert figures in ppm, mg/MJ, mg/m³ or wet NOx. 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.

1. Figures in mg/m³ should be multiplied by 0.857 in order to gain emissions in mg/kWh. A conversion may also be necessary for data not calculated at 0% excess oxygen (see below).
2. Figures in parts per million (ppm) should be multiplied by 1.76 in order to obtain 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 show emissions in mg/kWh (1 kWh = 3.6 MJ). A conversion may also be necessary for data not calculated at 0% excess oxygen (below).
4. This Issue's criteria are based on dry NOx values – almost all manufacturers will quote emissions in dry NOx. However if wet NOx figures are supplied, these should be converted to dry NOx. This can be done by multiplying the wet NOx figure by 1.75.

Excess Oxygen Correction

If a NOx emission rate is quoted by the manufacturer in mg/m³ or ppm, then it should be established at what % 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 NOx. 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 44: Conversion factors for different %'s of excess O₂

% 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 $x = \% \text{ excess O}_2$ (NOT excess air) and 20.9 is the percentage of O₂ in the air.

Checklists and tables

Calculation procedures

Where relevant values used in the calculations must be based on the output from approved energy modeling software (see definition in Ene 01 Energy efficiency).

Calculating NOx emission levels from fossil energy fired boilers

For fossil fuel boilers, the NOx emission rate for heat production can either be directly obtained from manufacturers data or calculated from measurements. It is only possible to measure NOx emissions in mg/m³ combustion air. Please find conversion rates above.

Calculating NOx emission levels from Combined Heat & Power (CHP) systems

Where CHP systems are specified, it is only necessary to consider the heat related NO emissions for the assessment of this issue. NOx emissions are allocated to heat and electricity in line with the respective power outputs. A NOx emission rate equivalent to the current rate for grid electricity should be assumed for the electrical output (i.e. 15 mg/kWh supplied), and the remaining NOx should be allocated to the heat output. Only the heat-related component is then compared with the benchmark scale.

The following formula should be used to determine this:

$$X = (A - B)/C$$

Where:

Term	Description
X	NOx emissions per unit of heat supplied (mg/kWh heat)
A	NOx emissions per unit of electricity generated (mg/kWhelec) i.e. the NOx emitted by the CHP system per unit of electricity generated. This figure should be obtained from the installer/supplier of the system
B	NOx emissions per unit of electricity supplied from the grid (mg/kWhelec). See CN 4.
C	Heat to Electricity Ratio of the CHP scheme

The above methodology determines the net NOx 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 NOx emission levels from multiple systems

Where heat is provided by more than one system, an average NOx emission rate should be used based on the ratio of power outputs from each source, i.e. multiply the emissions of each boiler 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:

$$\text{Average NO emission Rate} = \{ N_1 \times \{H_1/H_T\} \} + \{ N_2 \times \{H_2/H_T\} \} + \dots + \{ N_n \times \{H_n/H_T\} \}$$

Where:

- N₁ – NO_x emissions rate for source 1
- N₂ - NO_x emissions rate for source 2
- N_n – NO_x emissions rate for source n
- H_T - Total heat output from all sources
- H₁- Heat output from source 1
- H₂- Heat output from source 2
- H_n- Heat output from source n

Where different boiler sizes have been specified, the assessment criteria levels should be averaged using the same formula. For instance, for one credit, N_n should be replaced by 100 mg/kWh for boilers with a nominal heat input ≤ 70 kW, and 120 mg/kWh for boilers with a nominal heat input > 70 kW. The average

NOX emission rate criteria should then be compared to the actual average NOX emission rate specified in the building to award the credits.

Calculating NOx emission levels from heat pumps

Heat pumps use electrical energy to produce heating energy. Therefore the reference emission of electricity should be multiplied by the used electricity and allocated to the heat output.

$$m_{\text{Heat}} = \frac{(m_{\text{el,ref}} \times W_{\text{el}})}{W_{\text{Heat}}}$$

Where:

m_{Heat} = NO_x emissions per unit of heat generated in mg/kWh_{heat}

W_{el} = total quantity of electricity produced in kWh_{el}

$m_{\text{el,ref}}$ = country specific electricity reference NO_x emissions in mg/kWh_{el} – please refer to CN4 to find the relevant information

W_{Heat} = total quantity of heat produced in kWh_{Heat}

The equation can easily be transformed using the Energy Efficiency Ratio (EER) or the Coefficient of Performance (COP) that can usually be found in manufacturers' data:

$$\text{EER} = \frac{W_{\text{Heat}}}{W_{\text{el}}}$$

$$m_{\text{Heat}} = m_{\text{el,ref}} \times \{W_{\text{el}}/W_{\text{Heat}}\} = m_{\text{el,ref}}/\text{EER}$$

Calculation example:

A heat pump has an EER of 3.8. It is located in Spain with a reference emission of 1205 mg/kWh:

$m_{\text{Heat}} = 1205/3.8 = 317$ mg/kWh (no credits are awarded). The same heat pump located in Norway with a reference emission of 15: $m_{\text{Heat}} = 15/3.8 = 3.9$ mg/kWh (3 credits can be awarded).

Other information

None.

Pol 03 Surface water run-off (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
5	-	-	-	-	-

Aim

To avoid, reduce and delay the discharge of rainfall to public sewers and watercourses, therefore minimising the risk of localised flooding on and off site, watercourse pollution and other environmental damage.

Assessment criteria

This issue is split into three parts:

- Flood risk - 2 credits
- Surface water run off - 2 credits
- Minimising water course pollution - 1 credit

Flood Risk

Two credits

1. The assessed development is situated in an area defined as having a low annual probability of flooding confirmed by a *hydrological consultant*. Confirmation must be based on historical, geological and geomorphic data (e.g. altitude) and take all sources of flooding in to consideration (see CN 3) in a site specific Flood Risk Assessment (FRA).

Where there are flood risk map assessed by the Norwegian Water Resources and Energy Directorate or the local municipality available, these can be used as background information for the hydrological consultant.

One credit

2. Where the assessed development is situated in a flood prone (exposed) area as having a medium or high annual probability of flooding confirmed by a *hydrological consultant* and is not within the Functional Floodplain (see compliance notes)
3. A site specific Flood Risk Assessment (FRA) conducted by a *hydrological consultant*, confirms that the development is appropriately flood resilient and resistant from all sources of flooding.

Where there are flood risk map assessed by the Norwegian Water Resources and Energy Directorate or the local municipality available, these can be used as background information for the hydrological consultant.

4. The ground level of the building, and access to both the building and the site, are designed (or zoned) so they are at least 600mm above the design flood level of the flood zone in which the assessed development is located (see compliance notes for further guidance).

Surface water run off

5. An appropriate consultant is appointed to carry out, demonstrate and/or confirm the following criteria:

One credit -Peak rate run-off

6. Where drainage measures are specified to ensure that the peak rate of run-off from the site to the watercourses (natural or municipal) is no greater for the developed site than it was for the pre-development site. The calculations should comply with current best practice planning guidance (see CN 14).
7. The calculations should include an allowance for climate change, this should be made in accordance with the Norwegian Meteorological Institute, corresponding organisations or municipality, to get the best possible updated estimate for future changes in IVF curves (Intensity Duration Frequency) for various parts of Norway.

One credit - Run-off volume

EITHER

8. The post development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development calculated in accordance with the current best practice planning guidance (see Compliance Notes).
9. Any additional predicted volume of run-off for the 100 year 6 hour event must be prevented from leaving the site by using infiltration or other Sustainable Urban Drainage (SuDS) techniques (see Norsk Vann Rapport kap. 2.4 for possible solutions).

OR (only where criterion no. 9 for this credit cannot be achieved)

10. Justification from the appropriate Consultant indicating why the above criteria cannot be achieved i.e. where infiltration or other SuDS techniques are not technically viable options.
11. The post development peak rate of run-off is reduced to a limiting discharge. The limiting discharge is defined as the following and the option with the highest flow rate must be achieved:
 - a) The pre development 1-year peak flow rate OR
 - b) The mean annual flow rate QM OR
 - c) 2 L/s/ha

Note: For the 1-year peak flow rate the 1 year return period event criterion applies (as described in the peak run off criteria above).

12. For either option above calculations must include an allowance for climate change; this should be made in accordance with the Norwegian Meteorological Institute or corresponding organisations, to get the best possible updated estimate for future changes in IVF curves (Intensity Duration Frequency) for various parts of Norway.
13. A comprehensive and up-to-date drainage plan of the site will be made available for the building/site occupiers.

Minimising water course pollution

One credit

14. Specification of Sustainable Drainage Systems (SUDs) or source control systems such as permeable surfaces or infiltration trenches where run-off drains are in areas with a relatively low risk source of watercourse pollution.
15. Specification of oil/petrol separators (or equivalent system) in surface water drainage systems, where there is a high risk of contamination or spillage of substances such as petrol and oil (see CN25 for a list of areas).
16. A comprehensive and up-to-date drainage plan of the site will be made available for the building/site occupiers.
17. Where the building has chemical/liquid gas storage areas, shut-off valves are fitted to the site drainage system to prevent the escape of chemicals to natural watercourses (in the event of a spillage or bunding failure).

Compliance Notes

Ref	Terms	Description
General		
CN1	Alternative standards and recommendations from an appropriate statutory body	None of the credits can be awarded where the assessed development has proceeded against the recommendation of the statutory body on the basis that the flooding implications are too great (this includes a recommendation given by the statutory body even where such a recommendation cannot or is not statutorily enforced). Where the local authority (or other statutory body) has set more rigorous criteria than those above, these must be met in order to achieve the credit.
Flood Risk		
CN2	Relevant planning policy and technical guidance. Definition of security classes for flooding	Norwegian Technical Regulations - Byggeteknisk forskrift med veiledning Norsk Vann - Rapport 162 2008 "Veiledning i klimatilpasset overvannshåndtering". Flood zone maps: http://www.nve.no/no/Flom-og-skred/Farekartlegging/Flomsonekart/
CN3	Sources of flooding	The Flood Risk Assessment (FRA) must demonstrate that there is a low risk of flooding from the following sources: <ul style="list-style-type: none"> - Fluvial (rivers) - Tidal (sea) - Surface water: sheet run-off from adjacent land (urban or rural), including situations where the ground is unable to infiltrate any water due to unusual amounts of water, saturated ground, dry and impermeable surface, ice cover, etc. - Groundwater: most common in low-lying areas underlain by permeable rock (aquifers) - Sewers: combined, foul or surface water sewers - Reservoirs, canals and other artificial sources - A nearby functional flood plain (see CN 4 for definition).
CN4	Functional flood plain	The BREEAM-NOR credit for locating in a flood zone of 'medium or high annual probability' cannot be awarded where the building is located in the functional flood plain. BREEAM-NOR defines the functional flood plain as a 'zone that comprises land where water has to flow or be stored in times of flood'.

Ref	Terms	Description
CN5	Flood zone maps	<p>Where flood zone maps or equivalent are available in the area of assessment, the BREEAM-NOR I Assessor should get confirmation that:</p> <p>The definition of risk is at least as onerous as the default definition in the BREEAM-NOR scheme document.</p> <p>Flood zone 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".</p> <p>Flood risk maps: http://www.nve.no/no/Flom-og-skred/Farekartlegging/Flomsonekart/</p>
CN6	Pre-existing flood defences	<p>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 makes the area comply with the assessment criteria 1 and the following conditions are met:</p> <ol style="list-style-type: none"> 1. The development 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 development and/or its wider master plan 2. The development is located on previously developed land (as defined by the criteria in BREEAM issue LE 01 Site selection) 3. The appropriate statutory body confirms that, as a result of such defences, the risk of a flood event occurring is reduced to comply with the assessment criteria 1. If firm confirmation is not provided then the credit cannot be awarded. <p>A statutory body's local/regional office may be able to provide more information on existing defences in the area in which the assessed development is located.</p>
CN7	Car park and site access in medium or high flood zones	<p>It is accepted that, for buildings located in a medium and high flood zone, areas of the car park and site access may be allowed to flood and therefore fall below the 600mm threshold. In such cases the credit is still achievable provided safe access to the site, and the ground floor of the building can be maintained (i.e. they are 600mm above the design flood level) to ensure the building/site does not become an 'island' in the event of a flood.</p> <p>Where the development has been permitted and the ground levels of the topography/infrastructure immediately adjacent to the site fall below the 600mm threshold, the credit can still be awarded, provided there are no other practical solutions for access to the site above this level and the assessed building, and access to it, meets the assessment criteria. As much of the external site area as possible (or as required by an appropriate statutory body) should be designed at or above the threshold.</p>
CN8	Buildings sensitive contents areas in medium or high flood zones	<p>For buildings located in medium or high flood risk zones, any areas used to store sensitive, historical, hazardous, valuable and perishable materials, e.g. radioactive materials, microbiological facilities, server rooms, libraries, etc., must be located above the 600mm threshold.</p>

Ref	Terms	Description
CN9	Third-party defences	There may be defences, owned by third parties, which due to their location act as a flood defence by default e.g. road/highway, railway embankments, walls etc. It can be assumed that such embankments will remain in place for the lifetime of the development, 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.
CN10	Level of detail required in the flood risk assessment (FRA) for smaller sites	<p>For smaller sites e.g. less than 1 ha (10,000m²), the level of detail required in an acceptable FRA will depend on the size of the site, the arrangement of buildings on that site and the site shape and proximity to water sources . For a small site with a relatively simple arrangement of buildings this might consist of a brief report. For larger sites with a higher density of buildings a more detailed assessment would be appropriate.</p> <p>For very small simple sites (2000 m² and less) and sites that historically have very low probability of flooding due to the proximity to water and the shape of the site an acceptable FRA could be a brief report carried out by the contractor's engineer (or other appropriate member of the project team) confirming the risk of flooding from all sources of flooding, including information obtained from the appropriate statutory body, site investigation and local knowledge.</p>
CN11	Rainfall	Local figures for rainfall should be used wherever possible and these must be credible and verifiable, e.g. from the Norwegian Meteorological Institute (www.eklima.no) or equivalent. Data for the closest city from the location of assessment should be used.
Surface Water run-off		
CN12	Discharge to the sea or estuaries	<p>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/SSSI areas (as part of habitat management) then the credit can be awarded without the need to specify additional attenuation measures.</p> <p>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 development before reaching the sea.</p>
CN13	Contaminated sites	Drainage designs for sites must take into account legislation relating to contaminated sites. Where the site risk assessment confirms that infiltration SUDS techniques are not appropriate, then 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.
CN14	National best practice guidance on the design of SUDS and rainwater harvesting systems	Best practice is; Norsk Vann Rapport 162:08 chapter 2.3 "Valg av dimensjonerende gjentakintervall for regn" Table 2.3.4. Norsk Vanns anbefalte minimums dimensjonerende hyppigheter for separat- og fellesavløpssystem.

Ref	Terms	Description
CN15	Sites with many buildings	<p>Where the assessed building is part of a larger development of buildings, there are a number of options for assessment of the surface water run-off credits:</p> <ol style="list-style-type: none"> 1. The individual building can be assessed independently where the run-off is being dealt with on a building by building basis (i.e. each building has its own dedicated sub-catchment that serves only that building). 2. Where assessing the run-off from a number of buildings the assessment must take into account the drainage from the local sub-catchment serving all those dwellings/buildings. Note that proportioning cannot be used to calculate the percentage of run-off discharging into the local sub-catchment resulting from just the assessed building. 3. Alternatively the whole development can be assessed for compliance. <p>Whichever approach is taken to demonstrate compliance, it must be consistent when completing both the rate of run-off and volume of run-off calculations.</p>
CN16	No change in impermeable area	<p>Where the impermeable area draining to the watercourse (natural or municipal) has decreased or remains unchanged post-development, the peak and volume rate of run-off requirements for the surface water run off credits (criteria 5-13) will be met by default. Flow rate calculations will not need to be provided. Instead, drawings clearly showing the impermeable areas of the site draining to the watercourse should be provided for the pre- and post-development scenarios. Figures must also be given (ideally on the drawings) to show a comparison between the areas of drained impermeable surfaces pre- and post-development. In this instance a Flood Risk Assessment must be carried out and any opportunities identified to reduce surface water run-off are implemented.</p>
CN17	Discharge point - blockages	<p>For the surface water run off credits (criteria 5-13), where the limiting discharge flow rate would require a flow rate of less than 5 L/s at a discharge point, a flow rate of up to 5 L/s may be used where required to reduce the risk of blockage. Discharge points are points of discharge into rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, sewers and passages through which water flows.</p>
CN18	Residual additional rainwater volume	<p>Where rainwater is being discharged to a public or communal sewer or surface water drain/system, and there is a specific minimum requirement defined by the organisation responsible for urban wastewater drainage that conflicts with the BREEAM requirement, then the BREEAM requirement can be discounted as long as supporting evidence has been provided to justify it.</p>

Ref	Terms	Description
CN19	Highways and impermeable areas	Where new roads/highways are built that will be privately managed (i.e. not owned/managed by a local authority), including those for developments with a mixture of buildings, all of the new impermeable surfaces must be included in calculations to demonstrate compliance with the peak rate of run-off and volume of run-off criteria. Where buildings are built beside existing roads/highways or where roads/highways are built that will be owned/managed by a local authority, the impermeable area of the highway does not need to be included in the calculations.
CN20	Derelict sites	If the site has been derelict for over five years, the appropriate Consultant must assess the previous drainage network and make reasonable assumptions to establish probable flow rates and volumes. To complete the calculations, a site visit prior to development will be required unless accurate data already exist from a previous survey. The resultant professional report can then be used to determine the pre-development volumes and rates of run-off.
CN21	Using computer software	Reputable computer drainage software can be used to demonstrate compliance. However, where hydrograph tables are provided as output, the relevant calculations should be highlighted.
CN22	Allowance for climate change	The allowance for climate change should only be included in the post development rainfall and/or run off calculations. Where it can be demonstrated that impacts of climate change are likely to result in less rather than more precipitation, it is not required to consider an allowance for climate change for the purpose of complying with the surface water run-off criteria.
Minimising Watercourse Pollution		
CN23	Extensions to existing buildings	For the minimising water course pollution credit (criteria 14-17) please refer to the compliance note below regarding 'infill building on an existing site' (CN 26).
CN24	Areas that are a source of pollution	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.
CN25	Areas where oil separators are required	The following site areas (where present) require oil separators in surface water drainage systems: <ul style="list-style-type: none"> - Car parks larger than 800m² or with 50 or more parking spaces - Smaller car parks discharging to a sensitive environment - Areas where cargo vehicles, e.g. vans, small trucks and large trucks, are parked or manoeuvred - Vehicle maintenance areas - Roads - Industrial sites where oil is stored or used
CN26	Infill building on existing site	Where the assessment is of an individual building on an existing site, i.e. infill development, the watercourse pollution criteria apply to areas within the construction zone that present a risk of pollution, as well as any areas external to the construction zone that are affected by the new works i.e. drainage onto or from the proposed development.

Ref	Terms	Description
CN27	Suitable level of treatment	In all cases the assessor should determine the operational use of the site in order to determine if the proposed strategy for minimising watercourse pollution is suitable.
CN28	Roof plant	Roof top plant space must be considered where there is a risk from substances such as petrol or oil. Refrigerants are not assessed under the pollution aspect of this issue, as the only risk of pollution is to air and not the watercourse.
CN29	Permeable paving system	Where it can be demonstrated that a permeable paving system designed to retain silts and degrade oils has been used, then this will meet the assessment criteria for minimising watercourse pollution for car parks and access roads.
CN30	Drainage plan	A comprehensive and up-to-date drainage plan of the site, which accurately identifies all drains, must be produced and handed over to the new occupier. If there is no in-house expertise to do this, a reputable drainage company should be used.
CN31	No areas at risk from pollution	Where it can be demonstrated that there are no external areas that present a pollution risk, e.g. parking, delivery, manoeuvring or servicing facilities (including individual parking spaces), external waste storage space or other hard standing areas AND there is no plant supported on the roof, then this credit can be awarded by default.
CN32	Workshop areas in retail buildings	Where workshop areas are specified, they should be assessed against the above requirements (minimising water course pollution). This is due to circumstances where there may be some form of vehicle servicing as part of a car showroom or other type of retail space.

Evidence

Req	Design stage	Post-construction stage
Flood Risk		
1-4	<p>Flood risk assessment (FRA)</p> <p>Statement from the <i>hydrological consultant</i> confirming that they are qualified in line with the BREEAM-NOR definition</p> <p>Design drawings</p> <p>Where appropriate, correspondence from the appropriate statutory body confirming reduced annual probability of flooding due to existing flood defences.</p>	<p>Flood risk assessment updated as necessary.</p> <p>Statement from the <i>hydrological consultant</i> confirming that they are qualified in line with the BREEAM-NOR definition</p> <p>'As built' drawings</p> <p>Confirmation that the basis of the Flood Risk Assessment has not changed where more than five years have passed since the Flood Risk Assessment was carried out.</p>

Req	Design stage	Post-construction stage
Surface Water Run-off		
5-13	<p>Statement from the appropriate consultant confirming that they are qualified in line with the BREEAM-NOR definition.</p> <p>Consultants report containing all information necessary to demonstrate compliance with the requirements.</p>	<p>Evidence to confirm that maintenance responsibilities have been defined for any SuDS solutions installed.</p> <p>AND EITHER</p> <p>Written confirmation from the developer or appropriate consultant that the solutions assessed at the design stage have been implemented.</p> <p>OR</p> <p>Where the design has changed the evidence identified for the design stage assessment is provided for post construction/'as built' details</p>
Minimising Watercourse Pollution		
14-17	<p>Design drawings and/or relevant section/clauses of the building specification or contract (or written confirmation from the contractor) indicating:</p> <ol style="list-style-type: none"> 1. High and low risk areas of the site 2. Specification of SUDS, source control systems, oil/petrol separators and shut-off valves as appropriate. 	<p>Assessor's building/site inspection and photographic evidence</p> <p>AND EITHER</p> <p>Written confirmation from the developer or appropriate consultant that the solutions assessed at the design stage have been implemented</p> <p>OR</p> <p>Where the design has changed the evidence identified for the design stage assessment is provided for post construction/'as built' details</p>

Additional information

Relevant definitions

Appropriate statutory body

Refer to the definition in LE 02, Additional information, Relevant definitions.

Appropriate consultant/hydrological consultant

A hydrological consultant or engineer with a minimum of 2 years experience in flood risk analysis, in surface water run-off calculations and design of flood prevention measures and completing peak rate of run-off calculations. Where complex flooding calculations and prevention measures are required, this must be carried out by a specialist hydrological engineer.

Catchment

The area contributing surface water flow to a point on a drainage or water course. It can be divided into sub-catchments.

Control systems

Any drainage structure or unit designed to control the runoff of stormwater. Examples of SUDS control devices are check dams within swales and basins, and combined weir/orifice controls for ponds. Examples of traditional control devices are throttles constructed with pipes and vortex controls. The control devices must be capable of regular inspection and maintenance, and the system should be fail-safe so that upstream flooding does not result from blockage or other malfunction.

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.

Design flood event

An historic or notional flood event of a given annual flood probability, against which the suitability of a proposed development is assessed and mitigation measures, if any are designed.

Design storm event

Historic or notional weather conditions of a given annual probability, against which the suitability of a proposed development is assessed and mitigation measures, if any are designed.

Drainage plan

A drainage plan is a plan/drawing indicating all the drainage on site including pipes, gravel drains, and any other drainage item that would need to be maintained on the site. The detail should be sufficient to allow the building/site occupiers to appropriately maintain and manage the site.

Flood probability

The estimated probability of a flood of given magnitude occurring or being exceeded in any specified time period. For example, a 100-year flood has a 1% chance of occurring in any given year.

Flood risk

The combination of the flood probability and the magnitude of the potential consequences of the flood event.

Flood risk assessment

A study to assess the risk of a site flooding and the impact that any changes or development on the site will have on flood risk on the site and elsewhere.

Flood storage

The temporary storage of excess run-off or river flow in ponds, basins, reservoirs or on the flood plain during a flood event.

Greenfield

A site which has either never been built on, or one which has remained undisturbed for five years or more.

Greenfield run-off rate

The rate of run-off that would occur from the site in its undeveloped and therefore undisturbed state.

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.

Infiltration

The passage of water into a permeable surface, such as soil, permeable paving, soakaways and so on.

Limiting discharge

The limiting discharge is based upon the calculated pre-development flow rate at a discharge point.

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.

Peak rate run-off (referred to as Q_p [m³/sec])

This is the highest rate of flow from a defined catchment area assuming that rainfall is uniformly distributed over the drainage area, considering the entire drainage area as a single unit and estimation of flow at the most downstream point only.

Pre-development

The state of the site under assessment immediately prior to purchase of the site by the client/developer (or, where the client has owned/occupied the site for a number of years, its current state).

QM

An estimation of the mean annual flood flow rate from a catchment

Rainwater discharge

Rainwater discharge is the rainwater that flows from the development site to watercourses and sewers. It is also referred to as run-off.

Run-off

This is usually rainwater, but can also be groundwater or overspill from sewers and other sources.

Soakaways

A sub-surface structure designed to promote the infiltration of surface water in to the ground. As a general point, soakaways may be shallow and broad – as in a blanket under permeable paving, or deeper structures. Deeper, point source soakaways should be avoided for road and car-park drainage, but shallow structures providing infiltration in an extensive way (infiltration trenches and permeable paving) do not need oil separators.

Surface Water Run-off

Water flow over the ground surface to a drainage system. This occurs if the ground is impermeable, is saturated or if the rainfall is particularly intense.

Treatment

Improving the quality of water by physical, chemical and/or biological means.

Types of Oil Separator

1. Class 1 Separators: These are designed to achieve a concentration of less than 5mg/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.
2. Class 2 Separators: These are designed to achieve a concentration of less than 100mg/L oil under standard test conditions. They are suitable for dealing with discharges where a lower quality requirement applies and/or for trapping large spillages. Both classes can be produced as 'full retention' or 'by pass' separators:
3. Full retention separators 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.
4. Bypass separators 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.

Run-off volume

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.

Checklists and tables

None.

Calculation procedures**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. "Hydrological projections for floods in Norway under a future climate", Norwegian Water Resources and Energy Directorate (NVE) 2011
2. "Veiledning i klimatilpasset overvannshåndtering", Norsk Vann - Rapport 162:2008

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.

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.

Other information

Flood event

A flooding incident characterised by its peak level or flow, or by its level or flow hydrograph.

Flood defences

Flood defences do not completely remove the risk of flooding, but they do reduce it. Building in areas where flood defences are present (and appropriately designed to withstand a certain magnitude of flooding) is therefore preferable to those built in medium/high risk areas without defences. However, for the purpose of this issue, it is still preferable to build in areas of low risk than encourage development of new flood defences in areas with a higher risk of flooding purely for the sake of new development.

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 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 over-loaded 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 runoff 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.
7. SUDS - sustainable drainage systems: a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques. Examples of SUDS devices include:
 - a) Holding ponds
 - b) Swales/rain gardens

- c) Reed beds
- d) Permeable paving - in areas where local geological and hydrological conditions allow this to function, e.g. block paved surface on permeable sub-base over gravel bed to store the water and allow it to seep into the soil. For less permeable soils, the gravel layer might be deeper and the water taken to a soakaway although this is not an option in some areas.
- e) Local or centralised soakaways either as full systems or as 'overflow' or 'holding' systems, in areas where local geological and hydrological conditions allow them to function.
- f) Run-off from roofs collected as a part of a rainwater harvesting system.
- g) Run-off from roofs directed to a local soakaway or other holding facility such as tanks, ponds, swales etc.
- h) Green roofs.

Pol 04 Reduction of night time light pollution (all buildings)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

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 for:

One credit

1. The external lighting strategy has been designed in compliance with the limits set for light technical parameters in table 2 in Lyskultur publication 1C.
2. Illuminated advertisements, where specified, comply with:
 - a) The maximum luminance (CD/m²) outlined in *Table 45* (please refer to Additional information for a definition of the different zones).
3. External lighting can be automatically switched off between 23:00hrs and 06:00hrs. This can be achieved by providing a timer for all external lighting set to the appropriate hours. See exceptions below.
4. Where safety, security and advertising lighting is to be used between 23:00hrs and 06:00hrs
 - a) Illuminated advertisements comply with criterion 2 above except in Zone E1 where the maximum luminance value shall be zero post-curfew.
 - b) Safety and security lighting complies with the lower levels of lighting recommended during these hours in *tabell 2* in Lyskultur publication 1C ("post curfew"), for example by using an automatic switch to reduce the lighting levels at 23:00hrs or earlier

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Typically external lighting will be specified and installed by the developer and not the future tenant. If external lighting and/or illuminated advertisements will be specified and installed by the tenant, then compliance can be demonstrated via one of the following available means:</p> <ol style="list-style-type: none"> Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options. If responsibility for the external lighting specification and installation is shared by each party (developer and tenant), then compliance can be demonstrated via a combination of the base build design drawings/site inspection and one of the above options. Note: where option two is used as a means of demonstrating compliance in this manner, only half the value of the credits available can be awarded.</p>
CN2	Extensions to existing buildings	If the scope of the assessment covers a new extension only, then it is only new lighting specified as part of that extended works that must be assessed against the criteria for this issue.
CN3	Scope of requirements	Where the assessment is of an individual building on an existing site then only those areas affected by the works i.e. within the construction zone, must be assessed. Where the assessment is of a building that forms part of an entire new development, the criteria apply site-wide.
CN4	No external lighting	If there is no external lighting on or around the assessed development the credit can be awarded by default.
CN5	Safety lights	Flush stud lights used for safety purposes in vehicle maneuvering areas may be excluded from the assessment.
CN6	Floodlighting, signage lighting	The post curfew values is defined as "Etter aftenklokke" in "Lyskultur publikasjon 1C" tabell 2. This will normally include floodlighting, signage and all lighting that is not required for safety or security. Illuminated advertisements may be excluded from this requirement, but will need to comply with different levels of maximum luminance depending on the surrounding and background environment (as per criterion 4.)
CN7	Non security lighting considered to be essential between 23:00 and 06:00	Where non security lighting is considered to be essential between 23:00hrs and 06:00hrs, i.e. for buildings which open/operate between these times, the lighting system is able to automatically switch to the lower levels of lighting recommended in the "Lyskultur publikasjon 1C" tabell 2 during these hours (or provide these lower levels at all times).

Ref	Terms	Description
CN8	Specific security criteria	Where light fittings are specified to comply with specific security standards and these conflict with these BREEAM-NOR criteria they can be excluded from the assessment of this issue. In these circumstances the assessor must obtain evidence confirming that the specific security standards are applicable to the assessed development.
CN9	Different curfew time	Where a different curfew time applies for other reasons (e.g. noise control), consideration should be given to the co-ordination of the curfews, e.g. allowing sufficient time of operation for the lighting after the conclusion of the activity to facilitate crowd dispersal, particularly where large numbers of spectators are involved.
CN10	Maximum luminance	When considering the zone in which an illuminated advertising sign is, or is intended to be, sited, the contrast with the surrounding or background should be taken into account (e.g. the surrounding could be unlit when viewed from the road or a residential window) and the zone adjusted accordingly. Where an illuminated sign lies on the boundary of two zones or can be observed from another zone, the illumination level used should be that applicable to the most rigorous zone.
CN11	Calculation of light pollution	<p>Checking compliance of the design should be carried out against the technical parameters in "Lyskultur publikasjon 1C" tabell 2. This gives four sets of recommendations;</p> <ol style="list-style-type: none"> 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. <p>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 (2) above or intensity (3) above is not required if all luminaires are cut-off types and angled so that light in potentially obtrusive directions is blocked.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Design drawings Relevant section/clauses of the building specification or contract or external lighting design data/calculations, or written confirmation from the contractor,</p> <p>In the case of the external lighting design, the M&E engineer or lighting designer must provide indicative examples of where and how the strategy complies with the assessment criteria.</p>	<p>BREEAM-NOR Assessor's site inspection report and photographic evidence</p> <p>AND EITHER</p> <p>Written confirmation from the project team that the solutions assessed at the design stage have been implemented</p> <p>OR</p> <p>Where the design has changed evidence is provided for post construction/'As built' details</p>

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.

Construction zone

Please refer to LE 02 Ecological value of site and protection of ecological features

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, see *Table 45* for requirements and the definition of lighting zones.

Checklists and tables

Table 45: Recommendations for maximum luminance (CD/m²) for illuminated advertisements

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

Note: Environmental lighting zone (E1-E4)

The four lighting zones referenced in table 2 of "Lyskultur publikasjon 1C" are defined in section 5.5 of the same publication

Calculation procedures

None.

Other information

None.

Pol 05 Noise attenuation (non residential only)

Number of credits available	Minimum standards				
	P	G	VG	E	O
1	-	-	-	-	-

Aim

To reduce the likelihood of noise, arising from fixed installations on the new development, affecting nearby noise-sensitive buildings.

Assessment criteria

The following is required to demonstrate compliance for:

One credit

1. The credit can be awarded by default where there are, or will be no existing noise-sensitive areas or buildings within 800m radius of the assessed development.
2. Where there are or will be noise-sensitive areas or buildings within a 800m radius of the assessed development a noise impact assessment has been carried out and the following noise levels measured/determined in accordance with the ISO 1996 series (see CN2 for guidelines where ISO 1996 is not appropriate standard)
 - a) Existing background noise levels (residual sound) at the nearest or most exposed noise-sensitive development to the proposed development; or at an equivalent location where background noise levels can be considered to be similar.
 - b) The noise level resulting from the proposed noise-source (see Compliance note).
3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification (see Relevant definitions in the Additional information section).
4. Where the level of the specific noise source(s) from the new development/site/building is less than +5dB during the day and +3dB at night compared to the background noise level, the credit can be awarded. Unless defined otherwise by local or national policy, the daytime period can be taken as is 07:00 hrs - 23:00 hrs and night-time period as 23:00 hrs - 07:00 hrs.
5. Where the level of the noise source(s) from the site/building is greater than the residual sound, measures have been installed to attenuate the noise at its source to a level where it will comply with criterion 4.

Compliance notes

Ref	Terms	Description
CN1	Shell and core	<p>Where the specification and installation of building services systems within the building/tenanted areas will be the responsibility of the future tenant, the acoustician will need to make an assumption for the worst case noise rating level. This can be based upon reference to servicing strategy/installations and sites similar to that of the assessed building or on a maximum design fit out specification.</p> <p>Alternatively, compliance with this BREEAM-NOR issue can be demonstrated via one of the following means:</p> <ol style="list-style-type: none"> 1. Option 1 – Use of a tenancy lease agreement between the developer and tenant/s (full value of available credits) 2. Option 2 – A Green Building Guide for tenant fit outs (half the value of the available credits) 3. Option 3 – Developer/Tenant collaboration (full value of available credits) <p>Refer to Appendix D for further description of the above options.</p>
CN2	Standard not appropriate/ not applicable	<p>Where a suitably qualified acoustician confirms that ISO 1996:2007 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.</p>
CN3	Compliance at the design stage	<p>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 acoustician's calculations or by scale model investigations.</p> <p>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."</p> <p>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 suitable 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)</p>
CN4	Compliance at the post construction stage	<p>Noise levels measurements do not need to be taken at the post construction stage if the acoustician has accurately modelled the noise level from the plant, using manufacturer's literature, and site measurements taken at the design stage. Any attenuation measures specified by the acoustician in their report must be confirmed as being present post construction.</p> <p>If the acoustician has been unable to model the noise level accurately, post construction measurements are needed to demonstrate compliance.</p>
CN5	Untreated buildings	<p>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 no noise generating plant. Examples of such building types could include industrial warehouse storage.</p>

Evidence

Ref	Design stage	Post-construction stage
All	<p>Design drawings or maps/aerial photographs highlighting:</p> <ol style="list-style-type: none"> 1. All existing and proposed noise-sensitive buildings local to, and within, the site boundary 2. Proposed sources of noise from the new development 3. Distance (m) from these buildings to the assessed development. 	<p>As design stage BREEAM Assessor's site inspection report and photographic evidence</p>
1-3	<p>The acoustician's report, acoustician's qualifications OR Relevant section/clauses of the building specification or contract requiring a noise assessment by a suitably qualified acoustician in compliance with ISO 1996:2007 OR A letter from the client, contractor or design team confirming that they will appoint an acoustician to carry out a noise assessment in compliance with ISO 1996</p>	<p>The acoustician's report with measurements based on installed and operating plant.</p>
4	<p>Acoustician's report with recommendations for noise attenuation measures AND EITHER</p> <ol style="list-style-type: none"> 1. A marked-up design plan highlighting the specification of the acoustician's attenuation measures OR 2. A formal letter from the client or design team confirming where relevant, that attenuation measures recommended by an appointed suitably qualified acoustician will be installed. 	<p>BREEAM Assessor's site inspection report and photographic evidence confirming the existence of the specified noise attenuation measures OR A letter from the acoustician confirming that all specified attenuation measures have been installed to the required standard.</p>

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 or areas of scientific or ecological interest.
8. Any other development that can be considered noise sensitive

Rating noise level

The specific noise level plus any adjustments for characteristics features of the noise (typically 5dB).

Residual noise

Total sound remaining at a given position in a given situation when the specific sounds under consideration are suppressed (source ISO 1996).

Specific noise level

The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval

Specific noise source

The noise source under investigation for assessing the likelihood of complaints.

Suitably qualified acoustician

Acousticians that meet the definition of a suitably qualified acoustician in Hea 05 Acoustic performance

Checklists and tables

None.

Calculation procedures

None.

Other information

None.

Innovation

Summary

The innovation category provides opportunities for exemplary performance and innovation to be recognised that are not included within, or go beyond the requirements of the credit criteria. This includes exemplary performance credits, for where the building meets the exemplary performance levels of a particular issue. It also includes innovative products and processes for which an innovation credit can be claimed, where they have been approved by Grønn Byggallianse. The cost-saving benefits of innovation are fostered and facilitated by helping encourage, drive and publicise accelerated uptake of innovative measures.

Innovation

Number of credits available	Minimum standards				
	P	G	VG	E	O
10	0	0	0	0	0

Aim

To support innovation within the construction industry through the recognition of sustainability related benefits which are not rewarded by standard BREEAM-NOR issues.

Assessment criteria

The following demonstrates compliance for:

Up to a maximum of 10 credits are available in aggregate from a combination of the following:

Exemplary level of performance in existing BREEAM-NOR issues

1. Where the building demonstrates exemplary performance by meeting defined exemplary level performance criteria in one or more of following BREEAM assessment issues:
 - a) Man 05 Aftercare (1 credit)
 - b) Hea 02 Indoorair quality (1 credit)
 - c) Tra 03a Alternative modes of transport (1 credit)
 - d) Tra 03b Alternative modes of transport (1 credit)
 - e) Wat 01 (1 credit)
 - f) Mat 01 Life cycle impacts (2 credits)
 - g) Mat 03 Responsible sourcing of materials (1 credit)
 - h) Wst 01 Construction site waste management (1 credit)
 - i) Wst 02 Recycled aggregates (1 credit)

Note: One or two innovation credit can be awarded for each individual BREEAM-NOR issue exemplary performance level complied with. Please refer to the relevant BREEAM-NOR issue within this Scheme Document manual for the exemplary level performance assessment criteria.

Approved Innovations

2. One innovation credit can be awarded for each innovation application approved by Grønn Byggallianse, where the building complies with the criteria defined within an Innovation application form (available at byggalliansen.no)

Compliance notes

Ref	Terms	Description
CN1	Exemplary level of performance	Refer to the compliance notes within the individual assessment issues that contain exemplary performance levels.

Ref	Terms	Description
CN2	Applying for Innovation credits	<p>Any new technology, design or construction method or process can potentially be recognised as 'innovative', provided it demonstrates it meets the BREEAM-NOR eligibility criteria for Innovation credits. Applications for innovations can be submitted to Grønn Byggallianse by Licensed BREEAM-NOR Assessors using the formal Innovation Application Form.</p> <p>BREEAM-NOR Assessors can obtain the application form from Grønn Byggallianse via the website (www.byggalliansen.no).</p> <p>Relevant details of the BREEAM-NOR Innovation application and approval process, application fees, innovation credit eligibility criteria and details of previously approved innovations are available separately from the websites of Grønn Byggallianse.</p>

Evidence

Ref	Design stage	Post-construction stage
	As defined within existing BREEAM-NOR Issues.	As defined within existing BREEAM-NOR Issues.
2-4	<p>A copy of the Innovation application form and innovation reference number.</p> <p>A copy of the Innovation application report demonstrating that the application has been approved by BRE Global.</p> <p>Relevant documentary evidence demonstrating specification of the approved innovation.</p>	<p>As Design stage</p> <p>Relevant documentary evidence confirming that the project has achieved/installed the approved innovation as described and quantified within the approved Innovation application form.</p>

Additional information

Relevant definitions

Approved Innovation

Any technology, method or process that can be shown to improve the sustainability performance of a building's design, construction, operation, maintenance or demolition, and which is approved as innovative by Grønn Byggallianse

Checklists and tables

None.

Calculation procedures

None.

Other information

For more information see the Grønn Byggallianse's website

Checklists

Checklist A1

Man 03 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 46: Checklist A1-1 - Safe and adequate access requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	<p>Appropriate and safe access to the site is provided. This must include as a minimum:</p> <ul style="list-style-type: none"> - 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 		<p>See copy of parking plan & check transport/dedicated service timetables and view other facilities are on site.</p> <p>Photographic evidence where appropriate</p>	
b	<p>Appropriate and safe access on site is provided. This must include as a minimum:</p> <ul style="list-style-type: none"> - Footpaths marked with ramps and signs - Walkways wide enough so that one can pass each other safely. - Wheelchair users, blind and hearing impaired should have access to and from the barracks/site offices. - All site hazards advertised at the site entrance 		<p>View on site and check that list of hazards is complete</p> <p>Photographic evidence where appropriate</p>	
c	<p>Site entrances and exits are clearly marked for visitors and delivery drivers to see.</p>		<p>View on site</p> <p>Photographic evidence where appropriate</p>	
d	<p>Site reception is clearly signposted OR all visitors are escorted to the reception</p>		<p>Check on arrival for the signs OR see a copy of the induction procedure.</p> <p>Photographic evidence where appropriate</p>	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
e	The post box (if relevant) has been placed on the pavement to avoid the postman from entering the site. If no post box available – clear information on site on how to get in contact with the constructor.		View on site Photographic evidence where appropriate	
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. Photographic evidence where appropriate	
g	All road signs/names can be seen OR when a road sign/name is obstructed a replacement has been erected		View on site Photographic evidence where appropriate	
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. Photographic evidence where appropriate	

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 47: Checklist A1-2 - 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. Photographic evidence where appropriate	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
b	<p>Site hours and noisy work restrictions are appropriate to the area, in particular when the site is located near:</p> <ul style="list-style-type: none"> - Houses - Schools - Hospitals - Industrial Units - Major public - Transport Nodes - City centres - Shopping facilities 		<p>Copy of statement of intent, policy, agreement etc to be provided</p> <p>Photographic evidence where appropriate</p>	
c	<p>The site boundary (which includes all areas affected by the works) is clearly and safely marked and appropriate to the environment:</p> <ul style="list-style-type: none"> - 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 		<p>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?</p> <p>Ensure that there are no complaints about the site being untidy or that if there were this was quickly rectified and not repeated.</p> <p>Photographic evidence where appropriate</p>	
d	<p>There is a complaints book available in hard copy or digital form AND evidence that complaints are being dealt with immediately.</p>		<p>Inspect the complaints book and check responses for timeliness</p> <p>Photographic evidence where appropriate</p>	
e	<p>Local people are appropriately informed by the use of a notice board:</p> <ul style="list-style-type: none"> - Of the site progress - Of the company contact details (telephone number/web site/email address) 		<p>View on site</p> <p>Photographic evidence where appropriate</p>	
f	<p>Light is shielded from the neighbours</p>		<p>Copy of the temporary works indicating light shielding or the site manager must demonstrate how the light shielding works or is not applicable.</p> <p>Photographic evidence where appropriate</p>	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
g	<p>Site personnel are encouraged to change from soiled work clothes and PPE (Personal Protective Equipment) before leaving the site and before using local facilities. Examples of how this can be achieved include:</p> <ul style="list-style-type: none"> - A canteen/designated eating area - Staggered breaks for different gangs. - Provision of showers/wash rooms. - Provision of lockers. - Provision of changing rooms - A request to leave PPE (Personal Protective Equipment) on site. 		<p>View on site. Check procedures with the Site Manager.</p> <p>Photographic evidence where appropriate</p>	
h	There is a volume restriction on radio use or there is a radio ban		<p>Check if restriction/ban is in place and how this is enforced</p> <p>Photographic evidence where appropriate</p>	

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 48: Checklist A1-3 - 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.		<p>View on site.</p> <p>Photographic evidence where appropriate</p>	
b	<p>Energy saving measures are implemented on site. Examples of this include:</p> <ul style="list-style-type: none"> - Low energy lighting - Switching off equipment when not in use - Installing thermostats - Installing timers - Choosing energy efficient equipment <p>If there is a site specific environmental policy which defines energy saving measures, this point can be awarded.</p>		<p>View on site.</p> <p>Photographic evidence where appropriate</p>	

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. Photographic evidence where appropriate	
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. Photographic evidence where appropriate	
e	Alternative energy sources have been considered.		View on site. Photographic evidence where appropriate	
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. Photographic evidence where appropriate	
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. Photographic evidence where appropriate	
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 Photographic evidence where appropriate	

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 49: Checklist A1-4 - Safe and considerate working environment requirements

REF	Criteria	Y	Evidence/reference required	Validation/Justification
a	<p>Adequate facilities are provided on-site for workers and visitors. These must include as a minimum:</p> <ul style="list-style-type: none"> - 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) 		<p>View on sit</p> <p>Photographic evidence where appropriate</p>	
b	<p>Site facilities are well maintained and clean. This must cover as a minimum:</p> <ul style="list-style-type: none"> - Areas around the canteen, offices and skips - Site welfare facilities (including toilets and changing areas) - Dedicated smoking area 		<p>View on site.</p> <p>Photographic evidence where appropriate</p>	
c	<p>Private or visually-impacting areas are screened. These must include as a minimum:</p> <ul style="list-style-type: none"> - Areas around the canteen, offices and skips where necessary. - Toilets - Dedicated smoking area 		<p>View on site.</p> <p>Photographic evidence where appropriate</p>	
d	<p>Clean Personal Protective Equipment (PPE) is available for use by visitors</p>		<p>Check company policy and procedure and if it is being implemented on site.</p> <p>Photographic evidence where appropriate</p>	

REF	Criteria	Y	Evidence/reference required	Validation/Justification
e	<p>Health and Safety procedures are in place for the following issues:</p> <ul style="list-style-type: none"> - 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. 		<p>Check company policy and procedures and how these are enforced</p> <p>Check first aid book in particular for minor accidents.</p> <p>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.</p> <p>Photographic evidence where appropriate</p>	
f	<p>There is posted material indicating nearest police Station and Hospital (with Accident & Emergency facilities) in the following areas as a minimum:</p> <ul style="list-style-type: none"> - Site reception - Site canteen - Main site office 		<p>Spot check managers, operatives, reception staff to check they know this information or at least where they would find it. Check induction talk.</p> <p>Photographic evidence where appropriate</p>	
g	<p>An inspection has been carried out by a Health and Safety inspector (HMS responsible) or equivalent.</p>		<p>View on site.</p> <p>Photographic evidence where appropriate</p>	
h	<p>Emergency escape routes well identified and clear emergency evacuation procedure AND drills carried out.</p>		<p>View on site. Written proof of Emergency escape routes AND clear emergency evacuation procedure AND safety drill carried out.</p> <p>Photographic evidence where appropriate</p>	

Signed by:

Representative on the construction site _____ date _____

BREEAM assessor _____ date _____

Checklist A2

Man 04 Commissioning and handover.

Table 50: Checklist A2 - Home User Guide requirements

Checklist A2 Home User Guide requirements		YES/NO
Part 1 – Operational issues		
a. Environmental strategy/design and features	<ol style="list-style-type: none"> 1. Details of any specific environmental/energy design strategy/features including an overview of the reasons for their use (e.g. environmental and economic savings and restrictions on making alterations) and how they should best be operated. Strategies/features could include passive solar design, super insulation, energy efficient timber windows, heat recovery systems, solar hot water systems, photovoltaics, passive vents or the use of certified timber or SUDS within the boundary of individual properties. 	
b. Energy	<ol style="list-style-type: none"> 1. Sufficient information about the building, the fixed building services and their maintenance requirements, for example; <ol style="list-style-type: none"> a. Provide a suitable set of operating and maintenance instructions aimed at achieving economy in the use of fuel and power in a way that occupiers can understand. The instructions should be directly related to the particular systems installed in the dwelling and account for the different demands likely to be placed on the system during the year b. Details of any renewable systems and how they operate c. Details of low energy light fittings, their use and their benefits, e.g. energy and cost savings compared to traditional light fittings d. Details of any energy labelling scheme for domestic equipment/appliances e. General information on energy efficiency f. Details on how to use and maintain an energy meter where one is installed/provided. 	
c. Water Use	<ol style="list-style-type: none"> 1. Details of water saving measures and tips 2. External water use and efficiency e.g. the use of water butts or other type of rainwater recycling systems 	
d. Recycling and waste	<ol style="list-style-type: none"> 1. Information about a local authority/government collection scheme (if applicable) 2. If the home is not covered by a local collection scheme, details and location of communal recycling bins/skips/facilities 3. Information on the location and use of any recycling and compost bins 4. Information on where residents can obtain information/guidance on recycling and sustainable waste disposal e.g. local authority/private organisation. 	

Checklist A2 Home User Guide requirements		YES/NO
e. Links, references and further information	<ol style="list-style-type: none"> 1. References/links to other information including websites, publications and organisations providing information on how to run the home efficiently and in the best environmentally sound way. As a minimum, this should include links to: <ol style="list-style-type: none"> a. Further good practice guidance on how to save energy b. The company responsible for the construction of the property c. The company responsible for the management of the home (where applicable) 2. In all instances both an address/telephone contact number and a weblink should be provided. 	
f. Provision of information in alternative formats	<ol style="list-style-type: none"> 1. Include details of the procedure for obtaining a copy of the guide in alternative formats, including alternative languages, Braille, large print or audio cassette/CD. This should include the contact details of the person/organisation responsible for producing the guide 	
Part 2 – Site and surroundings		
a. Recycling and waste	<ol style="list-style-type: none"> 1. Information on what to do with waste not covered by a standard weekly local authority collection scheme for example fridges/freezers, computer equipment, batteries and other potentially hazardous equipment. In some areas the local authority will collect these items. If this is the case, details and information of such a collection should be provided 2. Information and location of local recycling facilities and waste tips 	
b. Sustainable (urban) drainage systems (SUDS)	<ol style="list-style-type: none"> 1. Details of SUDS within the site boundary including an overview of the reasons and benefits behind their use (e.g. prevention of localised flooding) and advice on maintenance and operation 	
c. Public transport	<ol style="list-style-type: none"> 1. Details of local public transport facilities including maps and timetables and the location of nearby bus stops, trains, and/or subways/metro stations 2. Details of cycle storage and cycle paths in the area including, if available, cycle path network maps for the whole town/local area 3. Details of car parking and information on available park and ride, car sharing schemes and/or car pools/car hire in the area 4. Details on how to get to local amenities in the area by public transport or cycling 	
d. Local amenities	<ol style="list-style-type: none"> 1. Details of the location of food shops, post boxes, postal facilities, bank/cash points, pharmacies, schools, medical centres, leisure centres, community centres, places of worship, public houses, children's play areas, outdoor open access public areas 2. Other local amenities such as places of interest/cultural value, areas of beauty/wildlife/conservation/allotments etc. 	

Checklist A2 Home User Guide requirements		YES/NO
e. Responsible purchasing	1. Include information about the purchasing of: <ol style="list-style-type: none"> Energy and water efficient domestic equipment/appliances Electrical equipment, including light fittings and bulbs Timber products from sustainable sources Organic food procurement/food growing/local produce/local food provision e.g. farmers markets, organic box schemes etc. 	
f. Emergency information	1. Contact details for emergency services including: <ol style="list-style-type: none"> Location of local minor injuries clinics/hospitals or similar facilities. Location of nearest police and fire station 	
g. Links, references and further information	1. References/links to other information including websites, publications and organisations providing information on how to reduce the environmental impact in terms of transport, the use of local amenities, responsible purchasing etc. Such references/links may include links to: <ol style="list-style-type: none"> The local authority (including information about recycling and waste tips) Local transport providers (e.g. bus or train companies) Local amenities In all instances both an address/telephone contact number and a web link should be provided	
Developer Confirmation		
By entering a 'YES' against the criteria above, I confirm that all dwellings of this specification type on the ENTER SITE NAME site meet the stated criteria.		
Signatur Date: Print Name:		

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 51 and Table 52. 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-NOR requirements.

Table 51: Checklist A6 - 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 52: Checklist A6 - 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.

Test/property	Basic principle
(Bearing capacity)	Determination of strength or bearing capacity of compacted aggregate or soil. Relevant to use of unbound aggregates in building or road foundations.
(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 contaminants.
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.

Checklist A7

LE01 - Contaminated land

Table 53: Checklist A7-1- Likelihood of significant contamination on site

Item No	Questions	Response	
<p>Instruction: Items 1-5 below can be used to determine the likelihood of significant contamination to be present in or on the ground across the total site for the purposes of a rapid evaluation against the LE 01 Site selection criteria 3 requirements:</p> <ul style="list-style-type: none"> - If the construction zone records a YES against any of the questions then nationally recognised strategies for investigation of contamination should be followed, or where such strategies do not exist, a robust site investigation, risk assessment and appraisal should be carried out by a competent Contaminated Land Specialist covering the requirements of Checklist A7-2 as a minimum. - If NO is recorded against all questions for the construction zone, then the site may be defined as having no significant contamination and further investigation is not required, in such a case the credit cannot be awarded. This checklist is a simple review and in such instances the option remains for a site investigation, risk assessment and appraisal to be carried out as defined in Checklist A7-2 where the client wishes to do so. 			
1	Is the site registered by the local authority or any other appropriate organisation as contaminated?	Yes	No
2	Does the site have any historical/previous uses that may have caused the site to become contaminated (see Relevant definitions within BREEAM issue Relevant definitions and also Checklist A7-3 below)? Where this cannot be answered because of a lack of information please tick 'yes' i.e. assume the worst case scenario.	Yes	No
3	Is the site within 250m of landfill (e.g. active, not active, capped)?	Yes	No
4	Is the site known or suspected to be contaminated (e.g. have studies already been undertaken on the site)?	Yes	No
5	Does the local authority or other appropriate organisation possess any information on the site that may give suspicions of contamination? Where this cannot be answered because of a lack of information please tick 'yes' i.e. assume the worst case scenario.	Yes	No
6	Is the site known or suspected to have any non-native species that might cause the site be contaminated (e.g. have studies already been undertaken on the site)?	Yes	No

Table 54: Checklist A7-2- Scope of site investigation, risk assessment and appraisal report.

Item No	Content	Response	
Section 1: Preliminary investigation (desk study and site reconnaissance)			
<p>Instruction: Historical research and review of available information from sources such as archives, plans and records from regulatory authorities to discover the past and current activities at a site and in the surrounding area to determine the potential for the presence of contamination. If the preliminary investigation gives cause to believe there may be contamination (or no records can be found) then further more detailed investigations will be required (section 2 & 3). If not, then the site will not be considered contaminated for the purposes of this BREEAM issue and the credit cannot be awarded. The study must be carried out by a Contaminated Land Specialist as defined in the Relevant definitions, ISO 10381:5¹⁴ gives guidance on what the a preliminary investigation should cover and for the purposes of BREEAM it should cover the following as a minimum:</p>			
1.1	Purpose and aim of study	Yes	No
1.2	Site location and layout plans	Yes	No
1.3	Appraisal of site history	Yes	No
1.4	Assessment of environmental setting, covering: <ul style="list-style-type: none"> - Geology, hydrogeology, hydrology - Industrial activity - Location of controlled waters (canals, estuaries, lakes, ponds, rivers, springs, aquifers) - Pollution incidents, landfill sites within 250m etc. 	Yes	No
1.5	Assessment of current/proposed site use and surrounding land uses	Yes	No
1.6	Review of any previous site contamination studies (desk-based or intrusive) or remediation works	Yes	No
1.7	Preliminary (qualitative) assessment of risks: <ul style="list-style-type: none"> - Appraisal of potential contaminant sources, pathways and receptors - Conceptual site model - Identification of significant contamination (including non-native plants) 	Yes	No
1.8	Recommendations for intrusive contamination investigation if necessary	Yes	No
Section 2: Site investigation report			
<p>Instruction: The report must investigate each aspect highlighted by the desk study, this comprises exploratory holes constructed using the most appropriate method for the site to investigate the local subsurface strata (see ISO10381-5:2005 for further information). The report must cover the following as a minimum:</p>			

¹⁴ ISO 10381-5:2005, Soil quality - Sampling - Part 5: Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination

Item No	Content	Response	
		Yes	No
2.1	Site investigation methodology <ul style="list-style-type: none"> - Methods of investigation - Plan showing exploration locations - Justification of exploration locations - Sampling and analytical strategies 	Yes	No
2.2	Results and findings of investigation <ul style="list-style-type: none"> - Ground conditions (soil and groundwater) - Discussion of soil/groundwater/surface water contamination 	Yes	No
2.3	Risk assessment <ul style="list-style-type: none"> - As a minimum, based on contaminant pathway receptor model - Takes account of severity of consequences and likelihood of occurrence. 	Yes	No
2.4	Where applicable, recommendations for remediation based on: <ul style="list-style-type: none"> - Proposed site use - Risk assessment findings - Technical and financial appraisal. 	Yes	No
Section 3: Options for remediation			
Instruction: If remediation is deemed necessary following the site investigation, then a site specific remediation methodology must be produced and followed. Consultation with the regulatory authorities may be required to ensure satisfactory design and implementation of the remediation programme. The report must cover the following as a minimum:			
3.1	Detailed outline of the works to be carried out <ul style="list-style-type: none"> - Type, form and scale of contamination to be remediated - Remediation methodology - Site plans/drawings - Phasing of works and approximate timescales 	Yes	No
3.2	Consents, agreements and licences (discharge consents, waste management licence etc)	Yes	No
3.3	Site management procedures to protect site neighbours, environment and amenity during works: <ul style="list-style-type: none"> - Health and safety procedures - Dust, noise and odour controls - Control of surface run-off 	Yes	No
3.4	Details of how the works will be validated to ensure the remediation objectives have been met; <ul style="list-style-type: none"> - Sampling strategy - Use of on-site observations, visual/olfactory evidence - Chemical analysis - Proposed clean-up standards (i.e. contaminant concentrations) 	Yes	No

Table 55: Checklist A7-3 Previous site uses which can cause significant contamination

Polluting activity	Y/N	Polluting activity	Y/N	Polluting activity	Y/N
A list of the most common polluting activities and types of land contamination can be found in the list below or in Table 1 of the UNEP document: 'Identification and Management of Contaminated sites, A methodological guide' ¹⁵ , UNEP and ADEME, ADEME editions, Paris, 2005 (http://www.unep.fr/scp/waste/land.htm)					
Agricultural uses		Manufacturing of asbestos		Timber and timber products industry	
Chemical works		Metal processing		Use as a scrap metal store	
Energy Industry - Power stations		Paper, pulp and printing industries		Waste disposal	
Engineering and manufacturing processes		Petrol stations		Waste management facility	
Extractive industry & mineral processing		Premises for dry cleaning		Wood preserving yards	
Food processing industry		Production of metal		Works non-specified	
Gas works		Production of non-metals and their products		Demolition of buildings for any of the above uses	
Glass making and ceramics		Railway land		Mining	
Hospitals & cemeteries		Road vehicle maintenance		Waste management	
Infrastructure		Rubber industry		Mills	
Laboratories		Sewerage treatment		Oil refineries	
Landfill		Textile industry			

¹⁵ UNEP and ADEME, Identification and Management of Contaminated sites, A methodological guide, ADEME editions, Paris, 2005 (<http://www.unep.fr/scp/waste/land.htm>)

Checklist A20

Table 56: Checklist A20 - Environmental toxin list

PRODUCT GROUP	CHEMICALS TO AVOID For more information of the listed substances and other substances to be aware of, see www.erdetfarlig.no or www.miljodirektoratet.no/kjemikaliesok	DOCUMENTATION (to be completed for each project)
Building materials		
Building boards	Arsenic, Lead, Brominated flame retardants (HBCD, TBBPA), Phthalates (DEHP), Chromium, Octyl-/Nonylphenol	
Vinyl or PVC flooring	Phthalates (DEHP), Bisphenol A, Lead, Arsenic, Brominated flame retardants (HBCD, TBBPA), medium-chained chlorinated paraffins (short-chain chlorinated paraffins are prohibited)	
Wallpaper (vinyl-/wet room wallpaper and fibreglass wallpaper)	Brominated flame retardants (HBCD, TBBPA), Phthalates (DEHP) ,, Lead, Arsenic and medium-chained chlorinated paraffins	
Carpets	Lead, Brominated flame retardants (HBCD, TBBPA), Chlorinated paraffins, Chromium , Octyl-/Nonylphenol, PFOS/PFOA/PFCA,	
Preservative treated wood	Arsenic, Chromium, Creosote	
XPS (extruded polystyrene), EPS (expanded polystyrene) Cellular rubber insulation	Brominated flame retardants (HBCD, TBBPA) (flame retardants penta-, octa- og deca-BDE are prohibited)	
Polycarbonate sheets	All polycarbonate contains Bisphenol A	
Windows/ exterior doors	Bisphenol A, Lead, Brominated flame retardants (HBCD, TBBPA), Phthalates (DEHP), chlorinated paraffins, PFOS/PFOA, Octyl-/Nonylphenol	
Chemical products		
Glue	Bisphenol A, Lead, chlorinated paraffins, Chromium, Octyl-/Nonylphenol, TCEP	
Fillers, sealants and foam	Bisphenol A, Phthalates (DEHP), chlorinated paraffins, Chromium, Octyl-/Nonylphenol , siloxan (D4/D5)	
Paint, stains and varnishes	Bisphenol A, Lead, Phthalates (DEHP), cadmium, chlorinated paraffins, Chromium, Octyl-/Nonylphenol, PFOS/PFOA/PFCA, siloxan (D4/D5)	

Information regarding checklist A20

Background

The list is based on the Norwegian Environment Agency's (EA) list of the most environmentally hazardous chemicals, the "worst chemicals", and their list of what chemical products and building materials they can be found in. The EA has gathered this information on their website www.erdetfarlig.no.

The basis for BREEAM-NORs requirements on documenting the absence of the "worst chemicals" is in the law of product control § 3a The substitution duty, and TEK 10 § 9-2. Also, most products containing the "worst chemicals" are categorised as hazardous waste. The disposal of hazardous waste when replacing products means increased costs for the building owner.

Checklist A20 contains the most health- and environmentally hazardous chemicals based on the EA's assessment. There are more health- and environmentally hazardous chemicals in building materials. See www.erdetfarlig.no for further information. However, the minimum requirement of the content of these health- and environmental hazardous chemicals in BREEAM-NOR, is only related to Checklist A20.

How to use the checklist

For each building material given in the left column, the project must document the absence of the corresponding chemicals in the building material. If the project does not use the building material in the left column, the project manager must confirm this in writing. When several products are used within each product group, ex. different types of paint or glue, all products used in the project must be checked out and documented.

The project can produce a deviation statement if necessary, due to technicalities, to use a product which contains one of the "worst chemicals". The deviation statement must adhere to the substitution duty, be signed by the developer and approved by the assessor to be valid as an exception from BREEAM-NORs minimum requirements.

For building materials, approved documentation will be one of the following:

- EPD (Environmental Product Declaration) stating the chemical content
- Sintef Byggforsk Teknisk Godkjenning (TG) of 1.1.10, as a guarantee that the product does not contain the listed chemicals.
- Ecolabel or Nordic Ecolabel. For a listing of the labelled products see www.ecolabel.no
- BASTA
- The Swedish Building Product Declaration (Byggvarubedömningen) level Accepted or Recommended
- Safety Data Sheets
- A letter from the legally responsible at the producer in question stating that the given product does not contain one of the chemicals from the A20 checklist.

Regarding CAS-numbers

A list of CAS-numbers relevant to the substances listed on the Priority list can be found on Grønn Byggalliansen website www.byggalliansen.no. The list of CAS-numbers must be considered as a list of examples and is not exhaustive.

More information about how particular substances are regulated and listed on the priority list (or other lists) can be found on the Norwegian Environment Agency's website www.miljodirektoratet.no/kjemikaliesok.

NB: The content in "Kjemikaliesøk" is limited to the substance information available in the different lists or regulations. Some substances are listed as individual substances and others as groups of substances. When searching for a specific CAS-number in the database, it might therefore happen that no match is found if a substance group is listed without individual CAS-numbers. Some substances are also listed with no CAS- og EC-number, and the name of substances should therefore also be used for search. The list is not exhaustive and should be used as guidance only.

Appendices

Appendix A

BREEAM-NOR Case Study Template

The case study template can be found on Grønn Byggallianses website www.byggalliansen.no.

Appendix B

Mixed use developments and similar buildings (or units)

Mixed use developments

Typically, developments which consist of a number of separate buildings of differing functional types, e.g. office and retail will require an assessment and therefore BREEAM-NOR 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-NOR assessment, rating and certificate. Examples of such buildings include:

1. An office or industrial unit with some laboratory space, workshop space, restaurant/canteen and/or staff gym
2. A retail development with restaurants and /or cinema

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 and users differs markedly. Examples of such buildings include:

1. A building with one or more floors of offices space and retail units
2. 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-NOR assessment or multiple assessments is required. Clients are advised to consult a licensed assessor for advice on applying BREEAM-NOR to mixed-use developments. The BREEAM-NOR assessor will ensure that the building(s)/development is registered correctly, seeking advice from Grønn Byggallianse on classification where needed.

Similar buildings (or units) on the same site

It is possible to assess and therefore rate and certify a number of separate but similar buildings, or individual units within a larger building development, within one BREEAM-NOR assessor's report. This is subject to the following conditions:

1. The buildings/units must all be on the same site
2. The buildings/units must be of the same building type e.g. an office, with the same building functions/spaces and fitted out to a similar specification and therefore assessed using the same BREEAM-NOR issues
3. Each BREEAM-NOR issue must be assessed, and its credits awarded, based on the worst performing building/unit
4. The assessment and assessors report produce a single BREEAM-NOR rating covering all buildings/units assessed

For the above scenario, a single BREEAM-NOR certificate will be issued listing all the buildings/units covered by the single BREEAM-NOR assessor's report.

If one or more building/unit performs markedly better than another on the same site and the client wishes to recognise this, a separate BREEAM –NOR assessment and therefore rating and certificate is required.

Appendix C

Refurbishment and fit out projects

As the scope of the BREEAM-NOR New Construction scheme is the quantification and mitigation of environmental impacts of new building projects only, this version is not therefore specifically designed to cater for the assessment of refurbishment and fit-out projects

Prior to the launch of a refurbishment scheme for buildings, clients may continue to apply BREEAM-NOR and certify refurbishment and fit out projects using the method. There are two options available in terms of which BREEAM-NOR version to use for these types of project, as follows:

1. Major refurbishment projects only (see box for definition): assess and certify using the BREEAM-NOR NC 2016 version i.e. assess performance against the New Construction criteria if the criteria are deemed appropriate to the scale of the refurbishment works.
2. Refurbishment and fit out projects could be assessed and certified using the BREEAM International Refurbishment and Fit-out 2015 or BREEAM-NOR Bespoke 2016.

Major refurbishment is defined as construction that results in the fundamental remodeling or adaptation of existing elements of the building envelope, structure and renewal of key building services. And where, on completion of the works, such remodelling/renewal will materially impact on the performance of the building.

The term 'elements' includes:

1. Structural/building envelope elements including walls (including glazing), roofs (including rooflights) and floors.
2. Building services elements including lighting (artificial and daylighting), heating, mechanical ventilation/cooling plant and ductwork, water/drainage systems.

For the purposes of this definition, works to both 1 and 2 above must be taking place for the project to be classed as a major refurbishment. Where only individual elements of the structural/building envelope element (e.g. windows or doors), or individual services elements (e.g. a boiler, heating system or lighting installation) are being replaced, remodeled or upgraded, then, the project should not be classed a major refurbishment.

It should be noted that all major refurbishment projects will reuse the majority of the buildings existing supporting sub and superstructure and it is likely that in many cases the building façade will be retained, albeit with some remediation or renovation.

Part new-build, part refurbishment projects

BREEAM-NOR 2016 can be used to assess new build extensions to existing buildings. Where the existing building is also undergoing major refurbishment and requires assessment, the following options, in terms of this scheme's application, are available to the client:

1. Apply the New Construction scheme and its assessment criteria to the whole building development/project i.e. the new construction and major refurbished elements.
2. Apply the New Construction scheme and its assessment criteria to the new-build element only.
3. Where the project is predominantly a refurbishment, albeit with some new elements, follow the guidance and options above for existing building refurbishments projects.

In determining the appropriate option for a refurbishment or part new-build part-refurbishment project, the BREEAM-NOR 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 buildings thermal and structural elements remain 'as existing'? Using this information the assessor should advise the client on the most suitable option.

Definitions

Fit out

The design and completion of shell space (i.e. empty floor space bounded by walls but not specifically adapted to the requirements of its occupants) with the specific interior partitioning, floor, ceiling, mechanical, electrical, and environmental requirements of its occupants included¹⁶.

¹⁶ Definition from University of Colorado

Appendix D

Shell and core/speculative assessments

Non-fitted, speculative new buildings (often referred to as shell and core buildings) can be assessed using the BREEAM-NOR NC scheme.

The application of the BREEAM-NOR assessment criteria for a shell and core building, for the majority of BREEAM-NOR assessment issues, will be straightforward. However, several of the BREEAM-NOR issues and their criteria are tailored to assess a building that is being fitted out. These BREEAM-NOR issues will not be scoped out of the assessment of a shell and core new building. Ultimately the building will be used in a fitted-out state, the BREEAM-NOR assessment and rating must therefore reflect the environmental performance of the building based on its intended use.

It is recognised however, that it may not be possible for a shell and core design/specification to demonstrate compliance with some of the BREEAM-NOR criteria, as fit-out decisions relating to certain aspects of a new building will be made by the future tenant, who at the time of the interim or final assessment stage may not be known. Subsequently Grønn Byggallianse recognise that there is a need for a degree of flexibility in applying BREEAM-NOR to new shell and core building design and specification, to recognise the scope of limitations and opportunities open to the developer to influence the final fitted-out performance of the building.

There are three options available to clients who are using BREEAM-NOR to assess a new shell and core building. Each option provides a different level of robustness to assessing and demonstrating compliance with BREEAM-NOR issues from a shell and core perspective and therefore each has a different value in terms of its contribution towards the BREEAM percentage score and rating.

Option 1 – Use of a lease agreement between the developer and tenant/s

BREEAM-NOR aims to encourage a mutually beneficial relationship between the shell and core developer/owner of a building and its future tenant(s) so that the fully fitted operational building can demonstrate performance against the highest possible environmental standards. In order to achieve this, BREEAM-NOR encourages and rewards the use of formal legally binding Green Lease Agreements between a developer/owner and their tenant/s. As such, Green Lease Agreements (or 'green' clauses/sections in a standard lease agreement) can be used as evidence demonstrating compliance with the relevant BREEAM-NOR issue criteria at the interim and post construction stages of assessment.

Where a legally binding tenancy agreement is provided as evidence and it commits the tenant's fit-out to meet the criteria of a BREEAM-NOR issue, the full value of the available credits for that issue can be awarded.

In developments with multiple tenants, provided at least 75% of the net lettable floor area within the tenanted building/development is covered by a compliant lease agreement, this will be acceptable for the purposes of awarding BREEAM-NOR credits.

Option 2 – A Green Building Guide for tenant fit-outs

As an alternative to a Green Lease, developers may demonstrate part compliance with BREEAM issues where they produce a building specific Green Building Guide that is distributed to all future tenant/s of the assessed building. This formal, but non- legally binding document must provide development specific guidance to the tenant on carrying out their fit-out in a manner that upholds the BREEAM-NOR criteria of the credits sought, and encourages tenants to play their role in maintaining and improving the overall buildings environmental performance.

A Green Building Guide does not provide conclusive evidence that the tenant will implement the suggestions when compared to a Lease Agreement and this needs to be reflected in the relative score achieved by the building. Subsequently, where relying on a Green Building Guide to demonstrate compliance with a BREEAM-NOR issue or requirement, half of the value of the available credits can be achieved and contribute towards the overall BREEAM-NOR score and rating. It should also be noted that not all fit-out related BREEAM-NOR assessment issues permit the use of the Green Building Guide as a means of demonstrating compliance (refer to Table 57). For example, it is not permitted as an option for modelling energy consumption, issue (Ene01). The performance/modelling must be based on either the actual fit-out specification or the most energy intensive fit-out specification permissible under energy regulations.

The BREEAM-NOR assessor should note that Green Building Guides which simply copy BREEAM-NOR scheme criteria verbatim do not necessarily demonstrate compliance with this option. The Guide produced must be specific to the building, its layout and function. The BREEAM –NOR related requirements and advice included in the Guide

must reflect what a tenant's fit-out specification can realistically achieve given the opportunities and limitations of the core building and its services.

Option 3 – Developer/Tenant collaboration

Where the future tenant(s) of a building is/are known a collaborative assessment may be carried out. The performance of the building and compliance with the BREEAM-NOR criteria can be verified using both evidence provided by the shell and core project team/client and evidence provided by the future tenant(s) e.g. their fit-out design and specification. Where compliance is sought via this route, the full value of the available credits can be achieved and contribute towards the overall BREEAM-NOR score and rating.

Which issues provide specific information relating to shell and core assessments?

Table 57 lists the BREEAM-NOR New Construction assessment issues and highlights the following:

1. The assessment issues that are either specific to, or contain criteria that potentially rely on or influenced by building fit out design/specification issues.
2. The availability of options 1- 3, in terms of demonstrating compliance with the criteria for each issue.
3. Whether or not specific compliance notes are provided concerning the application of the assessment criteria to shell and core building design and construction. Where this is the case the compliance note can be found within the assessment criteria for that specific issue (in the main body of this scheme document).

Table 57: BREEAM-NOR NC issues relating to shell and core assessments.

Ref	Issue	Compliance influenced by fit-out spec	Option availability			Specific compliance notes
			1	2	3	
Management						
Man01	Project brief and design	Yes	-	-	-	Yes
Man02	Life cycle cost and service life planning	Yes	No	No	No	Yes
Man03	Responsible construction practices	No	-	-	-	No
Man04	Commissioning and handover	Yes	Yes	Yes	Yes	Yes
Man05	Aftercare	Yes	Yes	No	Yes	Yes
Health and wellbeing						
Hea01	Visual comfort	Yes	Yes	Yes	Yes	Yes
Hea02	Indoor air quality	Yes	Yes	Yes	Yes	Yes
Hea03	Thermal comfort	Yes	Yes	Yes	Yes	Yes
Hea04	Microbial contamination	Yes	Yes	Yes	Yes	Yes
Hea05a/b	Acoustic performance	Yes	No	No	No	Yes
Hea06	Safe access	No	-	-	-	-
Hea07	Natural hazards	No	-	-	-	-
Hea08	Private space	No	-	-	-	-
Hea09	Moisture protection	No	-	-	-	-

Ref	Issue	Compliance influenced by fit-out spec	Option availability			Specific compliance notes
			1	2	3	
Energy						
Ene01	Energy efficiency	Yes	Yes	No	Yes	Yes
Ene02a	Energy monitoring	Yes	Yes	Yes	Yes	Yes
Ene02b	Energy monitoring	Yes	No	No	No	Yes
Ene03	External lighting	Yes	Yes	Yes	Yes	Yes
Ene04	Low and zero carbon technologies	Yes	Yes	No	Yes	Yes
Ene05	Energy efficient cold storage systems	Yes	Yes	Yes	Yes	Yes
Ene06	Energy efficient transportation systems	Yes	Yes	No	Yes	Yes
Ene07	Energy efficient laboratory system	TBC	-	-	-	-
Ene08	Energy efficient equipment	Yes	Yes	Yes	Yes	Yes
Ene09	Drying space	Yes	Yes	Yes	Yes	Yes
Ene 23	Energy performance of building structure	Yes	Yes	No	Yes	Yes
Transport						
Tra01	Public transport accessibility	No	-	-	-	-
Tra02	Proximity to amenities	No	-	-	-	-
Tra03a/b	Alternative modes of transport	No	-	-	-	-
Tra04	Maximum car parking capacity	No	No	No	No	Yes
Tra05	Travel plan	No	-	-	-	-
Tra06	Home office	TBC				
Water						
Wat01	Water consumption	Yes	Yes	No	Yes	Yes
Wat02	Water monitoring	Yes	Yes	Yes	Yes	Yes
Wat03	Water leak detection and prevention	Yes	Yes	Yes	Yes	Yes
Wat04	Water efficient equipment	No	-	-	-	-
Materials						
Mat01	Life cycle impacts	No	-	-	-	-
Mat03	Responsible sourcing of materials	No	-	-	-	-
Mat05	Designing for robustness	Yes	Yes	Yes	Yes	Yes
Waste						
Wst 01	Construction waste management	No	-	-	-	-
Wst02	Recycled aggregates	No	-	-	-	-
Wst03a/b	Operational waste	Yes	No	No	No	Yes
Wst04	Speculative floor finishes	Yes	No	No	No	No

Ref	Issue	Compliance influenced by fit-out spec	Option availability			Specific compliance notes
			1	2	3	
Land use and ecology						
LE01	Site selection	No	-	-	-	-
LE02	Ecological value of site and	No	-	-	-	-
LE04	Enhancing site ecology	No	-	-	-	-
LE05	Long term impact on biodiversity	No	-	-	-	-
LE06	Building footprint	No	-	-	-	-
Pollution						
Pol01	Impact of refrigerants	Yes	Yes	Yes	Yes	Yes
Pol02	NOx emissions from heating source	Yes	Yes	Yes	Yes	Yes
Pol03	Surface water run-off	No	-	-	-	-
Pol04	Reduction of night time light pollution	Yes	Yes	Yes	Yes	Yes
Pol05	Noise attenuation	Yes	Yes	Yes	Yes	Yes

Shell and core building assessments and minimum BREEAM-NOR standards

Please note that all minimum BREEAM-NOR standards remain applicable for shell and core buildings. For issues with minimum standards, compliance can be demonstrated for the areas of the shell and core building that are directly under the influence of the developer. For issues reliant upon compliance of tenant areas/fit-out items, the minimum standards are still applied to those areas and compliance can be demonstrated via one of three permissible options i.e. the lease agreement, green building guide or tenant fit-out specification.

Definitions

Green Lease Agreements

A 'green lease' is a lease for a commercial or public building which incorporates an agreement between the landlord and tenant as to how the building is to be fitted out, managed and occupied in a sustainable way. Green leases include a schedule containing specific provisions for monitoring and improving energy performance, achieving efficiency targets (e.g. energy, water, waste) and minimising the environmental impacts of the building. The provisions represent an agreement between the landlord and the tenant to adopt procedures to ensure that a building operates at an agreed level through regular monitoring and addressing issues as they arise.

For the purpose of BREEAM-NOR a Green Lease Agreement must confirm to the BREEAM-NOR assessor that, in entering in to the agreement, the tenant will be required to meet the relevant BREEAM-NOR criteria (therefore providing adequate justification for awarding the BREEAM-NOR credits). The developer/landlord must confirm that such a lease will be a requirement of tenancy in the building.

Green Building Guide

A formal document that provides detailed advice to the proposed/actual tenant/s of the building on how to minimise the environmental impacts of the building. The Guide will have a particular focus on those impacts that can be influenced by the tenant(s) as a result of their building fit out. For the purposes of assessing this document within BREEAM-NOR an assessor will need to be provided with a copy of the guide clearly outlining the BREEAM-NOR issues covered within the guide. The assessor will need to determine which of the issue criteria within BREEAM-NOR will be achieved if the tenant puts the recommendations of the Guide into practice.

Shell and Core

Typically a Shell and Core building covers base building elements such as structure, envelope and fit out of common areas. A core HVAC system may be provided to allow for tenant connections.

Speculative development

Land development or construction with no formal commitment from the end users of the finished product. The developer anticipates demand exists or will be present once the building is put on the market.

Appendix E

Guidance for relating ecologist's report to BREEAM

Before using this guidance and completing the form please read the following:

1. This document is to be used for BREEAM-NOR 2016 assessments, where an ecologist has been appointed and produced an ecology report as part of a proposed development.
2. As an ecologist may have been appointed to carry out ecological site surveys and produced an ecology report without being aware that a BREEAM-NOR assessment has been, or is to be conducted, the purpose of this document is to help assist BREEAM-NOR assessors relate the contents of such a report to the land use and ecology criteria of BREEAM-NOR.
3. The assessor is to request that the appointed ecologist complete all sections of this guidance and return it to the BREEAM-NOR assessor along with all relevant documentation required to demonstrate compliance with the BREEAM-NOR criteria.
4. The assessor is to use this completed document in conjunction with the latest issue of the BREEAM-NOR 2016 New Construction Scheme Document and information provided by the developer/client to carry out the assessment of the land use and ecology BREEAM-NOR issues.

There are 6 sections (sections A - F) in this document.

1. Section A requires contact details for the ecologist and developer/client.
2. Section B1 determines whether the appointed ecologist is 'suitably qualified' (under BREEAM); and if not, section B2 determines whether the report has been verified by an ecologist who is 'suitably qualified'.
3. Section C determines whether the findings of the report have been based on data collected from site surveys conducted at appropriate times of the year to determine whether different species are evident.
4. If 'no' is recorded for either Section B or C then the contents of the ecology report cannot be used to determine compliance with the BREEAM criteria.
5. Section D provides the BREEAM assessor with the necessary information to complete the assessment of the ecology related BREEAM issues.
6. Section E provides details of the documentation/information required by BREEAM as evidence of compliance.
7. Section F requires the signature of the appointed ecologist who has completed this document.

Please note: it is only the appointed qualified and licensed BREEAM assessor who can award or withhold a credit.

Section A: Contact Details

Contact details
Ecologist's Details
Company name:
Company address:

Contact details

Ecological surveyor's name:

Membership of professional body (e.g. Norwegian
Biologist Association or other) where available:

Registration No:

Contact telephone number:

Ecology report reference:

Developer/Client Details

Company name:

Company address:

Contact name:

Contact telephone number:

Development details

Grønn Byggallianse reference number (if known):

Development name:

Development address:

Section B1: Ecologist's Qualifications

1. Do you hold a degree (or equivalent qualification,) in an ecology related subject?

Yes		No	
-----	--	----	--

If yes, please provide details e.g. degree/qualification title, university or other, year attained

Note: Depending on the ecological content (minimum 60%), the following degrees might be considered relevant: Ecology, Biological Sciences, Environmental Science, Agricultural Engineering and Agronomy, Forestry and Forestry Engineering or similar.

2. Are you a practising ecologist with a minimum of 3 years relevant experience within the last 5 years?

Yes		No	
-----	--	----	--

If yes, please provide details of your experience in the last three years

Note: Relevant 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. Examples of relevant experience are: ecological impact assessments; habitat surveys and habitat restoration.

Section B2: Report Verification

Details on verifying an ecology report for a BREEAM-NOR assessment:

1. The individual verifying the report must provide written confirmation that they comply with the definition of a 'suitably qualified ecologist' (as detailed in Section B1 above).
2. The SQE must as a minimum have reviewed the report and used reasonable endeavours to evaluate accuracy, truthfulness and objectivity. The SQE must confirm in writing that they have found the report to
 - a. Represent sound industry practice
 - b. Report and recommend objectively and (as far as possible given the SQE has not visited the site) that it is appropriate given the local site conditions and scope of work proposed.
 - c. Avoid invalid, biased and exaggerated statements
 - d. Demonstrate the competency of the ecologist writing the report
3. Whilst it may not be possible for the SQE to verify the accuracy of the survey details without a site visit, they should ensure that the local ecologist has used best practice procedures/appropriate standards or methodology in conducting the site survey and assessment and in all subsequent recommendations.
4. BRE advise that the local ecologist liaise with the SQE at the start of the site assessment process in order to ensure that best practice procedures/appropriate standards are followed. Whilst this is not mandatory, this will facilitate/speed up the verification process.

Written confirmation from the third party verifier on all the points detailed under 1-3 above (for section B2) must be included in an appendix to this guidance (see section E).

If the appointed ecologist does not meet the criteria of a 'suitably qualified ecologist' and the report has not been verified by an individual who does meet these criteria, then the report CANNOT be used as evidence of compliance with the ecology related BREEAM.

Section C: Site Survey

1. Have the findings of the ecology report been based on data collected from a site survey(s)?

Yes		No	
-----	--	----	--

If yes, please provide details to justify this (e.g. date(s) and scope of site survey(s))

Note: The site visit(s) and survey(s) must be conducted at appropriate times of the year when it is possible to determine the presence, or evidence of the presence, of different plant and animal species and other relevant organism groups .

Note: the contents of the ecology report must be representative of the site's existing ecology prior to the commencement of initial site preparation works, i.e. before Construction to Practical Completion, and after Design Brief.

If 'no' has been answered to question 1 of Section C then the ecology report CANNOT be used to determine compliance with the criteria of the relevant BREEAM-NOR ecology issues.

Section D: Site Survey Details

LE 02 Ecological value of land and protection of ecological features

1. Is the land within the 'construction zone' deemed by the SQE to be of low ecological value?

Yes		No	
-----	--	----	--

If yes, please provide a brief statement explaining how it has been deemed to be of low ecological value:

Note: The construction zone is defined as any land on the site which is being developed (and therefore disturbed) for buildings, hard standing, landscaping, site access, plus a 3m boundary in either direction around these areas. It also includes any areas used for temporary site storage and buildings.

2. Are there any features/areas of ecological value that fall within the site, but outside the construction zone?

Yes		No	
-----	--	----	--

Note: If you have deemed this area to be of low ecological value then there will be no features of ecological value to protect. However if there is a feature(s) or area(s) of low ecological value you wish to advise be retained and enhanced then full details of the protection and enhancement advice should be entered under LE04 Enhancing site ecology.

If yes please provide a brief statement outlining the advice/recommendations given for protecting all existing features and areas of ecological value:

LE 04 Enhancing site ecology

3. Has the client/developer required you to provide advice and make recommendations for enhancing site ecology?

Yes		No	
-----	--	----	--

If yes, please provide a brief statement below outlining the advice/recommendations given on enhancing and protecting the ecological value of the site. Please state the relevant importance/weighting of each recommendation (as a percentage of the whole e.g. recommendation 1 - 50%, recommendations 2-6 - 10% each) :

Note: Such advice is to include, and go beyond, compliance with all relevant legislation relating to protected species and habitats.

LE 05 Long term impact on biodiversity

4. Were you appointed prior to commencement of development work activities on site?

Yes		No		Don't know	
-----	--	----	--	------------	--

5. Has the client/developer given you the responsibility to confirm whether all relevant legislation relating to protection and enhancement of ecology has been (or will be) complied with during the design and construction process?

Yes		No	
-----	--	----	--

If yes, please provide details on all relevant legislation that relates to the site:

6. Has the developer/client appointed you to produce an appropriate landscape/site ecology management plan covering at least the first 5 years after project completion?

Yes		No	
-----	--	----	--

EITHER:

1. If yes, and the management plan has already been produced does it include the following:
 - a. Management of any protected features on site
 - b. Management of any new, existing, or enhanced habitats
 - c. A reference to the current or future site level Biodiversity Strategy/Action Plan?
2. If yes, but the management plan is still to be produced (due to it being too early in the design/construction phase), have you provided the following information to the developer/client;
 - a. Scope of management plan
 - b. Key responsibilities and with whom these responsibilities lie e.g. owner, landlord, occupier

Yes		No	
-----	--	----	--

If you have answered 'yes' to either question 6a or 6b please provide a brief explanation outlining the details. 6a and 6b refer to items 1 and 2, including all the items in the sub-list (a-b/c). If the ecologist replies 'yes' to either 1 or 2, then a brief explanation outlining the details needs to be provided.

7. Has the client/developer required you, as part of your responsibilities, to provide recommendations and advice to minimise detrimental impacts on site biodiversity?

Yes		No		N/A	
-----	--	----	--	-----	--

If yes, or not applicable, please briefly explain your reasoning:

8. Do your responsibilities to the client/developer include providing advice and recommendations for the protection of ecological features?

Yes		No		N/A	
-----	--	----	--	-----	--

If yes, or not applicable, please briefly explain your reasoning:

9. Do your responsibilities to the client/developer include providing advice on the creation of a new ecologically valuable habitat, which is appropriate to the local area and is either nationally, regionally, or locally important, or supports nationally, regionally, or locally important biodiversity?

Yes		No		N/A	
-----	--	----	--	-----	--

If yes, or not applicable, please briefly explain your reasoning:

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10. Do your responsibilities to the client/developer include providing advice and recommendations on when site works are to be avoided so as to minimise the disturbance to wildlife?

Yes		No		N/A	
-----	--	----	--	-----	--

If yes, or not applicable, please briefly explain your reasoning

Section E: Schedule of Evidence

Copies of the following documentation are required to support the above statements and act as evidence of compliance with the BREEAM-NOR Land Use and Ecology criteria:

1. The SQE's site/project specific report
2. Written confirmation from the verifier of the ecology report (where necessary)
3. Any supplementary documentation e.g. maps, plans, drawings, letters/emails of correspondence, etc.

Please include these details along with the appropriate reference to each document in the table below:

Document	Reference

Section F: Signature of Validation

I confirm the information provided in this document is truthful and accurate at the time of completion.

Name of ecologist:

Signature of ecologist:

Date:

Appendix F

The BREEAM-NOR evidential requirements

It is the BREEAM-NOR assessor's role to gather building information and use it to evaluate and verify the building's performance against the BREEAM-NOR standards. A range of building design and procurement information types, as well as the end product itself i.e. the building can be used by the client/project team to demonstrate compliance with the BREEAM-NOR assessment criteria.

To aid the assessor, client and project team members in the information gathering exercise, each assessment issue within the scheme document contains a 'schedule of evidence' table. The table and its content serve to outline the typical types of information that the assessor is obliged to ask for at each stage of assessment. Without this information the assessor has no means of verifying compliance with the relevant BREEAM-NOR criteria (where BREEAM-NOR credits are sought by the project team/client). In addition to the information listed in each issue's schedule, the assessor may ask for other additional information types where they feel that this is required in order to adequately demonstrate compliance, given the specific nature of the building or the contents of the document listed.

Documentation will vary from one new building project to another and as such BREEAM-NOR is not overly prescriptive about the form in which evidence should be provided. In general the following types of project information can serve as suitable evidence of compliance for most, if not all BREEAM-NOR assessment issues and criteria:

- Relevant section/clauses of the building specification or contract
- Design drawings (e.g. new and existing site plans, elevations, internal layouts)
- Certificates of compliance (e.g. ISO14001, BES6001, Environmental Profiles, FSC, EPC)
- Calculation/software modelling results/outputs (e.g. Energy, thermal modelling)
- Professional reports/studies (e.g. contaminated land, ecologist report, flood risk/security consultant report)
- Project/construction phase programme
- Construction phase data/information (e.g. purchase orders, metering data)
- Letters of appointment (e.g. Professional appointment)
- Letters of commitment (e.g. Client/contractor commitment which, unless otherwise stated in the schedule of evidence, are only acceptable at the interim Design Stage Assessment)
- Letters of action (e.g. Client/contractor confirming specific compliance with criteria)
- BREEAM-NOR Assessor's site inspection report and photographic evidence
- Meeting minutes
- Third party information (e.g. maps, public transport timetable, product manufacturers details)
- Tenant lease agreements or 'green' clauses from lease agreements (for shell and core buildings, refer to Appendix D for more guidance on types of evidence).

Grønn Byggallianse endeavours to ensure that BREEAM-NOR requests only types or categories of information which already exist as a result of the design and procurement process for a new building. This information should therefore be readily available and easily referenced if the building is justifiably claiming compliance with BREEAM-NOR criteria. Other types of formal information/evidence could be used to demonstrate compliance, provided it demonstrates robust assurance to the same level, or better than those types outlined above or in the schedule of evidence table.

It is the assessor's role to inform the project team as to what types of information are required and who should provide this material. If the information is not provided, the assessor will be unable to verify compliance and award the credit(s). As a result the building may not achieve the required BREEAM-NOR rating. All information referenced in an assessment which is submitted to Grønn Byggallianse for certification must be verifiable and must be produced by licensed BREEAM –NOR assessor organisations upon request by Grønn Byggallianse.

Final Post Construction stage assessment and certification

In some instances the client or project team may not need to, or may choose not to certify the building at the 'interim' design stage of assessment, instead choosing to certify at the final, post construction stage only. In such instances, verification of compliance with the BREEAM-NOR criteria will be based on actual 'as-built' information, relying less on design stage information and letters of commitment (unless relevant to the assessment issue).

The 'Post Construction Stage' column in the schedule of evidence table describes the typical information the assessor requires to validate 'as-built' performance and, for a number of issues and criteria, an assessor's site visit and subsequent report and photographs will be adequate.

Note: interim assessment and certification is strongly advised as it provides assurance of BREEAM –NOR performance prior to the start of construction works. This will give the project the best possible chance of achieving the desired rating, and maintaining performance at that rating level through to final certification, handover and building occupation.

Final Post Construction stage review and certification

A Post Construction Stage review (PCR) can be carried out where the building has been assessed and certified at the interim design stage of assessment. The post construction stage review differs from the post construction stage assessment in that a PCR serves to confirm the BREEAM-NOR rating achieved at the interim stage as the final 'as-built' rating (as opposed to a complete assessment at the post construction stage). For a post construction review, the BREEAM-NOR assessor is required to:

1. Review each assessment issue and confirm the criteria and the number of credits committed to at the interim stage of assessment are still valid.
2. Re-assess any issues where changes have occurred on the project since the interim assessment. This will be the case where such changes will or may have had an effect on compliance with a particular requirement and therefore the number of credits awarded/withheld and potentially the BREEAM–NOR rating achieved.

In the case of point 1 the assessor will require evidence confirming the validity of the review. For some assessment issues and criteria this will take the form of new information, for example where compliance at the interim stage was based on a formal letter from the client or design team confirming an intention to comply, at the post construction stage evidence confirming that this commitment was undertaken is required. This evidence is likely to be in one of the forms listed above e.g. assessor's site photographs, metered data, purchase orders etc. For other assessment issues and criteria it may be the case that information referenced as evidence at the interim design stage is a true reflection of 'as-built' performance, for example a map or site location plan highlighting proximity to public transport nodes or a bus timetable. In such instances the assessor may simply confirm the validity of the evidence referenced at the interim design stage assessment.

In the case of point 2, where changes have occurred that potentially affect the award of a BREEAM-NOR credit, the assessor has two options. Either, it is clear that compliance with a particular issue is no longer possible, in which case the credits awarded at the interim stage are withheld and the final score and BREEAM-NOR rating re-calculated. Or, additional, new information or altered versions of existing information are provided and the assessor re-evaluates and verifies compliance.

How to facilitate your report through the quality assurance process

1. Ensure that you have appropriate evidence, which means the documentation;
 - a. Demonstrates all the BREEAM-NOR requirements
 - b. Is robust e.g. legally binding or similar
 - c. Is clear and easy to read (electronic or hard copy)

Note: The scheme document gives examples of acceptable evidence

2. Record an audit trail
 - a. Grønn Byggallianse require there to be a clear route to evidence (no point having a trail that can't be followed)
 - b. This route should allow someone to undertake a swift third party review of assessment decisions.

Note: The audit trail is as important as the type of evidence

3. Be mindful that the most common reasons why Grønn Byggallianse rejects assessment reports are;
 - a. Missing evidence for a claimed credit criteria or compliance note "
 - b. Unclear justification of compliance via evidence and notes.
 - c. Imprecise evidence reference requiring unreasonable effort to locate the necessary information
 - d. Requirement / criteria misunderstood and credit awarded incorrectly

Appendix G

Hea02 Indoor Air Quality Plan

A guidance note for supporting the development and assessment of an IAQP can be found on Grønn Byggallianses website www.byggalliansen.no