January 2022
Updated October 2022

GD39 SUSTAINABILITY AND DURABILITY OF METAL ROOFING AND CLADDING SYSTEMS

SECTION 3: ENVIRONMENTAL ASSESSMENT METHODS

3.1 Environmental assessment methods

To reduce the environmental impacts that a building might have it is advantageous to measure and quantify its potential environmental performance and compare different options, e.g., building envelope materials and systems, lighting, heating and ventilation etc. This can be achieved using an environmental assessment methodology or rating system. These can be used to provide benchmarks that can, in turn, be used to set minimum standards and can encourage better levels of practice that go beyond those minimum standards.

The use of assessment methods and rating systems for new buildings can help encourage clients, developers and design teams to design and construct sustainable buildings which are more energy efficient, climatic responsive, material and resource efficient, have healthier indoor environments for occupants and limit waste emissions and pollution. Various environmental impact factors are assessed against given criteria and points/credits are awarded. The total number of points/credits obtained will provide an indication of the environmental friendliness of the building design and operation. Depending on the number of points/credits scored, the building will be certified to have met a specific rating or level.

Globally a number of these environmental assessment methods/rating systems have been developed over the years, usually by National Green Building Councils. The two most prominent ones are BREEAM (Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design) Green Building Rating System both of which are used internationally.

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3.2 BREEAM

BREEAM is a voluntary scheme which can be used to assess the environmental performance of most types of building (new and existing). It is the world's longest established environmental assessment system and is used internationally as well as in the UK.

The first version of BREEAM was developed in 1990 and has been frequently updated and refined over the years and different variations developed. For large non-domestic developments, the most commonly used variation is BREEAM New Construction**.**
The latest version is BREEAM 2018 although the previous version BREEAM 2014 is still in use for schemes registered prior to 23rd March 2018 and are within the five year expiry period.

BREEAM certifies buildings only, not individual products. BREEAM assessment is undertaken by independent licenced assessors and works by awarding credits to environmental issues in nine sections according to performance. Each of these sections will be weighted dependent upon the type of building and its degree of being fitted out and each will have a number of credits that can be achieved.

The environmental sections that are assessed are as follows:

- Management (Man)
- Health and wellbeing (Hea)
- Energy (Ene)
- Transport (Tra)
- Water (Wat)
- Materials (Mat)
- Waste (Wst)
- Land Use and ecology (LE)
- Pollution (Pol)

Each environment section will have a number of environment issues, each with its own unique identifier and available number of credits that can be achieved. For example, *Mat 03 – Environmental impacts from construction products – Building Life Cycle assessment (LCA)* in BREEAM 2018 has up to seven credits that are available.

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Additional credits for innovation can also be obtained, each worth one percent up to a maximum of 10 per building assessed. These can be achieved in one or two ways. The first is by meeting 'exemplary levels of performance' in a selection of existing BREEAM environmental issues; the second route is by application to BRE Global by the BREEAM assessor to have a particular building feature, system or process recognised as being 'innovative'.

The credits are added together for each section and the percentage achieved against those available is multiplied by the section weighting to achieve a section score (percentage)

The section scores are added together, including any innovation credits to produce a single overall score leading to a various level of BREEAM rating for the building. The total percentage score is capped at 100% after the innovation credits have been added.

As well as accumulating credits to achieve a BREEAM rating, there are also minimum BREEAM standards (e.g., minimum percentage scores) for a variety of BREEAM issues that must be achieved depending upon rating level.

The BREEAM ratings are shown in table 3.1

BREEAM Rating	% Score
Outstanding	≥ 85
Excellent	≥ 70
Very Good	≥ 55
Good	≥ 45
Pass	≥ 30
Unclassified	< 30

Table 3.1 – BREEAM Rating Benchmarks

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3.2.1. Metal cladding and roofing systems and BREEAM

Although not all inclusive and exhaustive the following table (table 3.2) gives a brief overview of where the specification and use of metal cladding and roofing systems and their associated components (e.g., insulation, rooflights etc.) can assist in the accumulation of BREEAM 2018 credits for several assessed environmental sections and issues.

More specific information is available from MCRMA members of how their products and systems can contribute towards BREEAM credits.

Several of the members publish their own product information sheets, an example is shown in figure 3.1.


BREEAM CREDITS USING KNAUF INSULATION GLASS MINERAL WOOL PRODUCTS

Figure 3.1 – Example of product information sheet for BREEAM

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BREEAM 2018 Credit	Credit aim	How metal roofing and cladding systems can contribute
Hea 01: Visual comfort	To encourage best practice in visual performance and comfort by ensuring daylighting, artificial lighting and occupant controls are considered.	The use of rooflights within metal roof systems helps make efficient use of natural light. Materials such as GRP acts as a diffuser giving a more even spread of light and reducing glare and localised heat build-up.
Hea 05: Acoustic performance	To ensure the building is capable of providing an appropriate acoustic environment to provide comfort for building users	The flexibility of built-up metal cladding and roofing systems in terms of acoustic performance can greatly assist the building designer/specifier in achieving and bettering the acoustic requirements for the building envelope in terms of air-borne sound, absorption, flanking and impact due to rain-noise. There are acoustic products that can be incorporated within the systems that will enhance the systems acoustic performance including perforated liner and decking profiles, various densities of Insulation, acoustic boards, acoustic membranes, anti-drumming membranes etc. The performance can be backed up by an extensive range of acoustic test data from MCRMA members and the use of the MCRMA SRI (sound Reduction Index) prediction software.
Pol 05: Reduction of noise pollution	To reduce the likelihood of noise arising from fixed installations on the new development affecting nearby noise-sensitive buildings	
Hea 04: Thermal comfort	To ensure the building is capable of providing an appropriate level of thermal comfort	The flexibility of built-up metal cladding and roofing systems in terms of thermal performance can greatly assist the building designer/specifier in achieving and bettering the U-value requirements for the building envelope can be designed and installed with a variety of U-values. The use of rooflights within metal roof systems helps make efficient use of natural light reducing the reliance on artificial lighting. Low U-values can be achieved with triple skin systems.
Ene 01: Reduction of energy use and carbon emissions	To minimise operational energy demand, primary energy consumption and CO_2 emissions	

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BREEAM 2018 Credit	Credit aim	How metal roofing and cladding systems can contribute
Ene 04: Low carbon design	Reducing the building's energy consumption through the adoption of passive design solutions, free cooling and low or zero carbon (LZC) energy sources.	MCRMA members offer several forms of flexible solar PV options that can assist in providing a renewable source of energy. These would include fully PV integrated roofing sheets, fabricated panels with flexible PV membrane for over-cladding roofing sheets and fastening systems for attaching PV modules to the roof sheets.
Mat 01: Environmental impacts from construction products - Building life cycle assessment (LCA)	To reduce the burden on the environment from construction products by recognising and encouraging measures to optimise construction product consumption efficiency and the selection of products with a low environmental impact (including embodied carbon), over the life cycle of the building.	MCRMA members can provide Life Cycle Assessments (LCAs) and EN 15804 compliant Environmental Product Declarations (EPDs) for their products and systems to enable data to be used in the whole building LCA.
Mat 02: Environmental impacts from construction products - Environmental Product Declarations (EPD)	To encourage availability of robust and comparable data on the impacts of construction products through the provision of EPD	MCRMA members can provide manufacturer specific EN 15804 compliant EPDs for their products and systems
Mat 03: Responsible sourcing of construction products	To facilitate the selection of products that involve lower levels of negative environmental, economic and social impact across their supply chain including extraction, processing and manufacture	All MCRMA members have an accredited Environmental Management System as per ISO 14001and some are certified to BES 6001 (BRE Framework Standard for Responsible Sourcing).
Mat 05: Designing for durability and resilience	To reduce the need to repair and replace materials resulting from damage to exposed elements of the building and landscape	Metal roofing and cladding systems are robust, durable and long-lasting. With ongoing cleaning and maintenance, they are capable of meeting the design life of the building. MCRMA members can provide information on the access categories as to where their materials/products/systems are suitable for without impact protection and where protection would be required.
Mat 06: Material efficiency	To avoid unnecessary materials use arising from over specification without compromising structural stability, durability or the service life of the building	Metal roofing and cladding sheets are manufactured from materials with a high recycled content from both post-consumer and pre-consumer scrap.

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BREEAM 2018 Credit	Credit aim	How metal roofing and cladding systems can contribute
		Aluminium is also available produced from 100% post-consumer scrap.
Wst 01: Construction waste management	To reduce construction waste by encouraging reuse, recovery and best practice waste management practices to minimise waste going to landfill.	Roll-formed metal roofing and cladding sheets are manufactured to order therefore minimising material wastage as there are no standard lengths that will produce waste offcuts. Long length sheets, in particular aluminium standing seam systems are often roll-formed on site to the required length, again minimising waste.
Wst 05: Adaptation to climate change	To minimise the future need of carrying out works to adapt the building to take account of more extreme weather changes resulting from climate change and changing weather patterns.	The flexibility of built-up metal cladding and roofing systems can greatly assist the building designer/specifier in developing long lasting building envelope solutions which can be future proofed for potential changes of use of the building and potential energy efficiency requirements. They are highly durable and long-lasting and manufactured from materials with a high recycled content. They can be widely and fully recycled without loss of quality for future use and there is also have a relatively high intrinsic scrap value. Aluminium is also available produced from 100% post-consumer scrap which fully embraces the principle of the circular economy.
Wst 06: Design for disassembly and adaptability	To avoid unnecessary materials use, cost and disruption arising from the need for future adaptation works as a result of changing functional demands and to maximise the ability to reclaim and reuse materials at final demolition in line with the principles of a circular economy	
LE 03: Managing impacts on ecology	To avoid, or limit as far as possible, negative ecological impacts associated with the site and surrounding areas resulting from the project.	Metal secret fix and standing seam roof systems can be designed as a ‘green’ or ‘brown’ roof to complement, support and provide habitat for a range of species. This could include plant, invertebrate and bird species.
LE 04: Ecological change and enhancement	To enhance ecological value of the area associated with the site in support of local, regional and national priorities	

Table 3.2 – How metal roofing and cladding systems and products can contribute towards BREEAM 2018 credits

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3.3 LEED

LEED (Leadership in Energy and Environmental Design) green building rating system is a voluntary, standard for developing high-performance, sustainable buildings developed by the Green Building Council (USGBC). Although developed in, and for the USA, it is used internationally, including the UK.

The LEED New Construction (LEED-NC) rating system was launched in 1998 and has been frequently updated and refined over the years. The current version is LEED v4 which has several variations for both new and existing buildings and other development schemes, including cities and communities. There is also a LEED v4.1 which has been released as a beta version and runs concurrently with LEED v4. LEED v4.1 is a more performance related version and sees a move from purely documentary evidence to data by tracking performance in energy, water, waste, transportation, indoor air quality, toxin-free environment and occupant satisfaction.

LEED for Building Design and Construction (LEED BD+C) is for new construction and major renovation and itself has several different variations dependent upon building type, e.g., schools, data centres etc. For large non-domestic developments which do not fall into a specific building category the variation LEED New Construction and Major Renovation is used.

LEED BD+C system certifies buildings only, not individual products. LEED works by building up points for credits under different environmental categories according to performance. The number of points available in each category is dependent upon building type and its degree of being fitted out. There are also several prerequisites some of which are building type specific which must be undertaken but do not add to the points total,

The environmental categories that are assessed, together with their achievable points (based on NEW Construction and Major Renovation variation) is as follows:

- Interactive process – 1 point
- Location and transportation (LT) – 16 points
- Sustainable sites (SS) – 10 points
- Water efficiency (WE) – 11 points
- Energy and atmosphere (EA) – 33 points
- Materials and resources (MR) – 13 points
- Indoor environmental quality (EQ) -16 points

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Each environment category will have prerequisites and credits, with its own unique name and available number of points that can be achieved. For example, *SS Credit: Heat Island Reduction* which has two points available (except for healthcare where one point is available).

The number of achievable points in the above categories is 100 and there are also up to 10 additional points for Innovation (IN) – six points and Regional Priority (RP) – four 4 points giving a total number of achievable points of 110.

Points are awarded for credits depending on the assessment of the performance to the various requirements and standards of the credit in the relevant LEED system documentation. The points are added together, and LEED certification is awarded based on the total points achieved as shown in table 3.3.

LEED rating level	Accumulated points
Platinum	80 - 110
Gold	60 - 79
Silver	50 - 59
Certified	40 - 49

Table 3.3 – LEED rating levels

3.3.1 Metal cladding and roofing systems and LEED

Although not all inclusive and exhaustive the following table (table 3.4) gives a brief overview of where the specification and use of metal cladding and roofing systems and their associated components (e.g., insulation, rooflights etc.) can assist in the accumulation of LEED v4/v4.1 credits for several assessed environmental sections and issues.

More specific information is available from MCRMA members of how their products and systems can contribute towards LEED credits. Several of the members publish their own product information sheets, an example of which is shown in figure 3.2.

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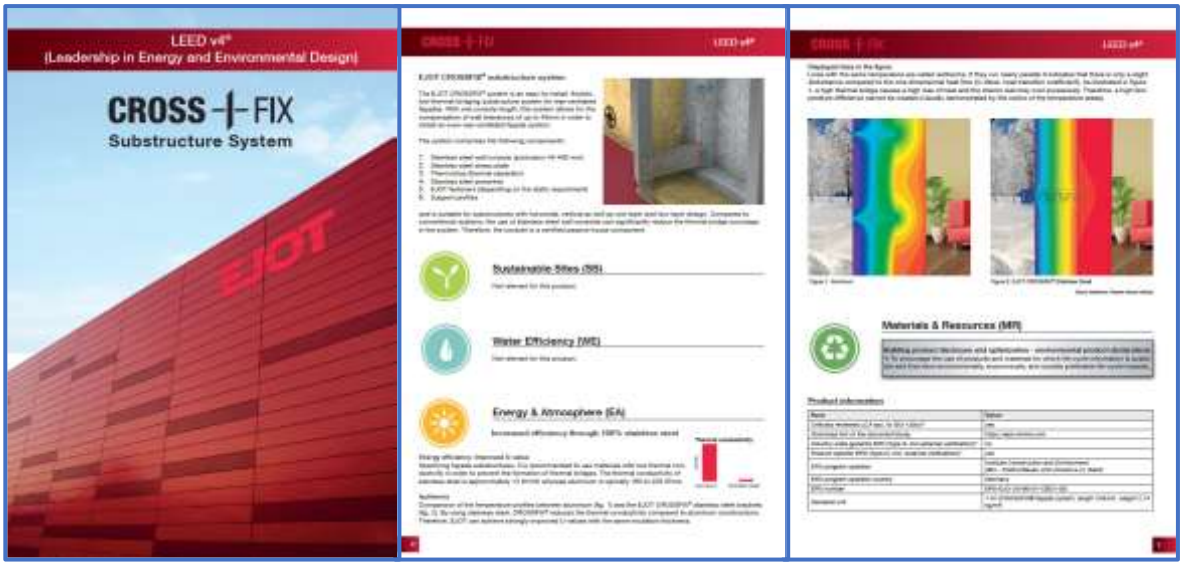

Figure 3.2 – Example of product information sheet for LEED v4

LEED v4/v4.1 credit	Credit intent	How metal roofing and cladding systems can contribute
SS credit: Site development – Protect or restore habitat	To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.	Metal secret fix and standing seam roof systems can be designed as a 'green' or 'brown' roof to complement, support and provide habitat for a range of species. This could include plant, invertebrate and bird species.
SS Credit: Rainwater management	To reduce run-off volume and improve water quality by replicating the natural hydrology and water balance of the site, based on historical conditions and undeveloped ecosystems in the region.	Green roofs can retain water and lower run-off which dramatically reduces the drainage infrastructure and water storage requirements on site.
SS Credit: Heat Island reduction	To minimise effects on microclimates and human and wildlife habitats by reducing heat islands.	Metal roof sheets can be supplied with highly reflectivity coatings with high SRI (Solar reflective Index) values which help keep the material cooler and reduce the heat island effect. A green roof system can also be used within this credit.
EA Credit: Optimise energy performance	To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic harms associated with excessive energy use.	The flexibility of built-up metal cladding and roofing systems in terms of thermal performance can greatly assist the building designer/specifier in achieving and bettering the U-value requirements for the building envelope can be designed and installed with a variety of U-values. The use of rooflights within metal roof systems helps make efficient use of natural light reducing the reliance on artificial lighting. Low U-values can be achieved with triple skin systems.
EQ Credit: Thermal comfort	To promote occupants' productivity, comfort, and well-being by providing quality thermal comfort.	
EA Credit: Renewable energy production	To reduce the environmental and economic harms associated with fossil fuel energy by increasing self-supply of renewable energy.	MCRMA members offer several forms of flexible solar PV options that can assist in providing a renewable source of energy. These would include fully PV integrated roofing sheets, fabricated panels with flexible PV membrane for over-cladding roofing sheets and fastening systems for attaching PV modules to the roof sheets.

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LEED v4/v4.1 credit	Credit intent	How metal roofing and cladding systems can contribute
MR Credit: Building life-cycle impact reduction	To encourage adaptive reuse and optimise the environmental performance of products and materials.	MCRMA members can provide Life Cycle Assessments (LCAs) and Environmental Product Declarations (EPDs) for their products and systems to enable data to be used in the whole building LCA.
MR Credit: Building product disclosure and optimisation – Environmental product declarations	To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products from manufacturers who have verified improved environmental life-cycle impacts.	MCRMA members can provide manufacturer-specific third-party verified EPDs for their products and systems. Metal roofing and cladding sheets are manufactured from materials with a high recycled content from both post-consumer and pre-consumer scrap. Aluminium is also available produced from 100% post-consumer scrap. Glass and rock insulation products can be supplied with recycled content from both post-consumer and pre-consumer scrap. MCRMA members can provide material information health and safety e.g., COSHH (Control of Substances Hazardous to Health) documentation.
MR Credit: Building product disclosure and optimisation – Sourcing of raw materials	To encourage the use of products and materials for which life cycle information is available and that have environmentally, economically, and socially preferable life cycle impacts. To reward project teams for selecting products verified to have been extracted or sourced in a responsible manner.	
MR Credit: Building product disclosure and optimisation – Material ingredients	To encourage the use of products and materials for which life-cycle information is available and that have environmentally, economically, and socially preferable life-cycle impacts. To reward project teams for selecting products for which the chemical ingredients in the product are inventoried using an accepted methodology and for selecting products verified to minimize the use and generation of harmful substances. To reward raw material manufacturers who produce products verified to have improved life-cycle impacts.	

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LEED v4/v4.1 credit	Credit intent	How metal roofing and cladding systems can contribute
EQ Credit: Acoustic performance	To provide workspaces and classrooms that promote occupants' well-being, productivity, and communications through effective acoustic design.	The flexibility of built-up metal cladding and roofing systems in terms of acoustic performance can greatly assist the building designer/specifier in achieving and bettering the acoustic requirements for the building envelope in terms of air-borne sound, absorption, flanking and impact due to rain-noise. There are acoustic products that can be incorporated within the systems that will enhance the systems acoustic performance including perforated liner and decking profiles, various densities of insulation, acoustic boards, acoustic membranes, anti-drumming membranes etc. The performance can be backed up by an extensive range of acoustic test data from MCRMA members and the use of the MCRMA SRI (Sound Reduction Index) prediction software to provide STC values.

Table 3.4 – How metal roofing and cladding systems and products can contribute towards LEED v4/v4.1 Credits

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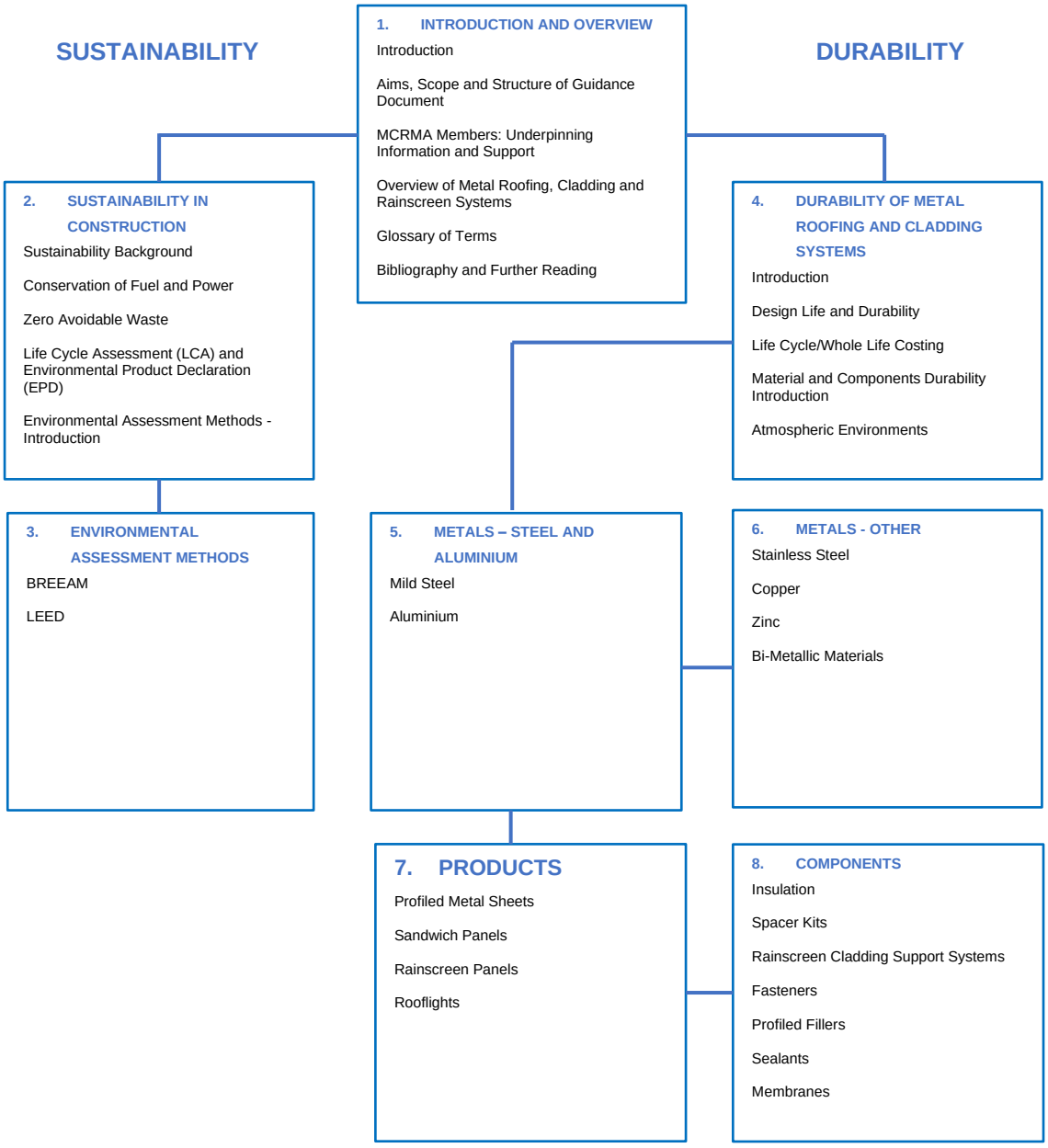
3.4 STRUCTURE OF GD 39



Pictorial overview of MCRMA guidance document GD39: Sustainability and durability of metal roofing and cladding systems

3.5 GLOSSARY OF TERMS

BRE Green Guide to Specification Generic product LCAs and EPDs form the basis of the BRE (Building Research Establishment) Green Guide to Specification (Green Guide). Initially published as a simple to use 'green guide' to the environmental impacts of common building materials and products. It has undergone regular updates and expansion as an online version which provides guidance for specifiers, designers and their clients on the relative environmental impacts of many elemental specifications for roofs, walls, floors etc.

BREEAM (Building Research Establishment Environmental Assessment Method) A voluntary scheme which can be used to assess the environmental performance of most types of building (new and existing). Developed by BRE (Building Research Establishment) it is the world's longest established environmental assessment system and is used internationally as well as in the UK.

COP (Conference of the Parties) 26 The 26th Meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). The COP26 conference was held in Glasgow in November 2021 hosted in partnership by UK and Italy. Previous notable COP conferences took place at Kyoto (COP3) in 1997 and Paris (COP21) in 2015. These and other conferences have led to commitments to climate change, reduction of greenhouse gases and keeping global temperature rise this century below 2°C (preferably 1.5°C) above pre-industrial levels have been agreed.

CSR (Corporate Social Responsibility) The self-regulated responsibility of companies to society in areas such as the environment, the economy, employee well-being etc. Most companies, especially larger ones, now report on their CSR, a major element of which is the carbon footprint of a company's activities and their efforts to reduce it.

Environmental assessment method/rating system A methodology and/or rating system where various environmental impact factors are assessed against given criteria and points/credits are awarded. The total number of points/credits obtained will provide an indication of the environmental friendliness of a building design and its operation. The use of environmental assessment methods and rating systems can help encourage clients, developers and design teams to design and construct more sustainable buildings which are more energy efficient, climatic responsive, material and resource efficient, have healthier indoor environments for occupants and limit waste emissions and pollution.

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EPD (Environment Profile Declaration) The results of an LCA are published in an EPD which is developed to a common format e.g., to the principles and procedures given in ISO 14025. The overall goal of an EPD is to communicate verifiable and accurate information on the environmental aspects of products that are not misleading. An EPD also provides the basis of a fair comparison of the environmental performance of products.

Greenhouse Gases Greenhouse gas emissions from human activities strengthen the greenhouse effect, causing climate change. Some of the gases occur naturally in the atmosphere, while others result from human activities. The seven greenhouse gases which contribute directly to climate change are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). The largest contributor to global warming is carbon dioxide (CO_2) which makes it the focus of many climate change initiatives.

LCA (Life Cycle Assessment) An assessment of the environment impacts of a product over its life cycle to a given methodology e.g., compliance with ISO 21930, considering several environmental issues. This life cycle of the product is often referred to as '*cradle to grave'*, where the *'cradle'* is the extraction of raw materials and the *'grave'* is the product's disposal and will consider the product's use over the building's life expectancy. A variation is a '*cradle to cradle'* life cycle where the disposal stage is replaced with a recycling process that produces material suitable for manufacturing a new product. LCAs are often broken down further into '*cradle to gate*' and '*gate to gate*' life cycles which can be useful for a manufacturer as a means of identifying internal processes for environmental improvements.

LCC (Life Cycle Costing) An LCC will consider all relevant costs over the defined life of a building covering construction costs, operation and occupancy costs, maintenance costs, renewal costs, and end of life costs as well as any environmental costs.

LEED (Leadership in Energy and Environmental Design) Green Building Rating System A voluntary, standard for developing high-performance, sustainable buildings developed by the US Green Building Council (USGBC). Although developed in and for the USA it is used internationally including the UK.

NDC – Nationally Determined Contributions National action plans on how countries will meet their commitments to climate change, reduction of greenhouse gases and rise in global temperature.

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Net Zero Carbon/Net Zero Total greenhouse gas emissions going into the atmosphere e.g., from a particular process are equal to (or less) than the removal of greenhouse gases out of the atmosphere.

WLC (Whole Life Costing) A WLC will cover all the costs in an LCC as well as non-construction costs and incomes.

ZAW (Zero Avoidable Waste) The prevention of waste being generated at every stage of a project's lifecycle, from the manufacture of materials and products, the design, specification, procurement and assembly of buildings and infrastructure through to deconstruction. At the end of life, products, components and materials should be recovered at the highest possible level of the waste hierarchy, whilst ensuring minimal environmental impact.

3.6 BIBLIOGRAPHY AND FURTHER READING

The following is a list of support documents and publications that were used in the development of this guidance document, and which will provide further reading on the subject.

Approved Document B Volume 2 – *Buildings other than dwellinghouses – Fire Safety (for use in England)*

Aurubis – *Copper Book for Architecture*

BES 6001 – *BRE Framework Standard for Responsible Sourcing*

BRE BR502 – *Sustainability in the built environment: An introduction to its definition and measurement*

BRE Digest 489 – *Wind loads on roof-based photovoltaic systems*

BRE Information Paper IP 13/10 – *Cool roofs and their application in the UK*

BREEAM – *BREEAM UK New Construction – Non-domestic Building (United Kingdom) – Technical Manual – 2014*

BREEAM – *BREEAM UK New Construction – Non-domestic Building (United Kingdom) – Technical Manual - 2018*

BS ISO 15686-5:2017 – *Buildings and constructed assets. Service life planning. Life-cycle costing*

BS 7543:2015: *Guide to durability of buildings and building elements, products and components*

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BS EN 1990: 2002+A1: 2005 (incorporating corrigenda December 2008 and April 2010) – *Eurocode – Basis of structural design*
NA to BS EN 1990: 2002+A1: 2005 (Incorporating National Amendments No.1) – *UK National Annex for Eurocode – Basis of structural design*
BS EN 15804: 2012+A2:2019 (incorporating corrigenda February 2014 and July 2020) – *Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products*
BS EN ISO 14001:2015 – *Environmental management systems. Requirements with guidance for use*
BS EN ISO 9001:2015 – *Quality management systems. Requirements*
BS EN 14782:2006 – *Self-supporting metal sheet for roofing, external cladding and internal lining. Product specification and requirements*
BS 5427:2016+A1:2017: *Code of practice for the use of profiled sheet for roof and wall cladding on buildings*
BS EN ISO 12944-2 *Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments*
BS 476-22:1987 – *Fire tests on building materials and structures. Part 22: Method for determination of the fire resistance of non-loadbearing elements of construction*
BS EN 506:2008 – *Roofing products of metal sheet. Specification for self-supporting products of copper or zinc sheet*
BS EN 1172:2011 – *Copper and copper alloys. Sheet and strip for building purposes*
BS EN 988:1997 – *Zinc and zinc alloys. Specification for rolled flat products for building*
BRE – *BRE Building Elements: Roofs and roofing: Performance, diagnosis, maintenance, repair and the avoidance of defects - Third Edition*
BSSA – *Stainless Steel and Sustainable Construction*
CAB – *Aluminium & sustainability: a 'cradle to cradle' approach*
CLC/GBC – *Zero Avoidable Waste in Construction*
CLC/GBC – *The Routemap for Zero Avoidable Waste in Construction*
Constructing Excellence – *Sustainable Construction: An Introduction*
Constructing Excellence – *Whole Life Costing*
CP 143-5:1964 – *Code of practice for sheet roof and wall coverings. Code of practice for sheet roof and wall coverings. Zinc*
CPA – *COP26 – An Introduction*
CPA – *Net Zero Carbon – What on Earth does it mean?*
CPA - *A guide to understanding the embodied impacts of construction products*

CWCT Technical Note 33 - *Breather membranes and vapour control layers in walls*
CWCT – *Guidance on built-up walls*
Euro-Inox – *Technical Guide to Stainless Steel Roofing*
Euro-Inox – *Cleaning Architectural Stainless Steel*
Hydro – *Circular economy – the design perspective. From theory to implementation*
International Molybdenum Association (IMOA) – Which *stainless steel should be specified for exterior applications?*
ISO 21930:2017 - *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*
ISO 14025:2006 - *Environmental labels and declarations — Type III environmental declarations — Principles and procedures*
MCRMA Article – The factors to consider when installing PV panels
MCRMA Membership Charter
MCRMA Guidance Document GD01 – *Built up systems and spacer stability*
MCRMA Guidance Document GD08 – *An introductory guide to rainscreen support systems*
MCRMA Guidance Document GD11 – *Fixings and fastenings for rainscreen systems*
MCRMA Guidance Document GD12 - *Composite flooring systems: Sustainable construction solutions*
MCRMA Guidance Document GD17 – *A guide to site installation of insulated roof panels*
MCRMA Guidance Document GD19 – *Effective sealing of end laps in metal roofing constructions*
MCRMA Guidance Document GD21- *Thermal performance of buildings: non-domestic construction*
MCRMA Guidance Document GD22 – *Installing renewables on metal roofs: A checklist*
MCRMA Guidance Document GD28 – *Mineral wool insulation installation: Best practice guide*
MCRMA Guidance Document GD 33 – *Fasteners for metal roofing and wall cladding: design, detailing and installation guide*
MCRMA Guidance Document GD 34 – *The definition of cladding within the construction sector*
NARM Technical Document NTD09 2014 - *Rooflights: glass, polycarbonate or GRP?*
NARM Technical Document NTD15 2018 - *A guide to rooflights for profiled sheeted roofs*
NFRC – *Profiled sheet roofing and cladding – The NFRC guide to design and best practice (Blue Book)*
NFRC Technical Bulletin 36 – *Performance standards of building strip sealants in metal clad buildings*

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RICS NMM3 - *New rules of measurement: Order of cost estimating and cost planning for building maintenance works*

RICS Guidance Note – *Life cycle costing*

UK Government – *COP26 Explained*

USGBC – *LEED v4 for Building Design and Construction*

USGBC – *LEED v4.1 for Building Design and Construction*

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Tel: 01633 895633 info@mcrma.co.uk www.mcrma.co.uk

This edition updated 26/10/22 to correct table 3.1

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