

THE ROLE OF CONSTRUCTION MATERIALS IN BREEAM

A GUIDE TO OUR SUSTAINABILITY CREDENTIALS

CONTENTS

Introduction	3
BREEAM in practice	4
Assessing Construction Materials in BREEAM	8
Tarmac Contributions	11
Summary	24
References	25

1 INTRODUCTION

1.1 WHAT IS BREEAM?

BREEAM is the acronym for the Building Research Establishment Environmental Assessment Method and is an international scheme for the benchmarking of the environmental performance of a building or scheme.

It extends to assess new construction, refurbishment, fit out, buildings in use and communities. This guide is focused on new construction detailing how Tarmac's products and solutions can help deliver a sustainable built asset.

Initially launched in 1990 the assessment scheme has seen a number of additions, expansions and revisions to reach its current version, BREEAM 2014 New Construction¹. It is a labelling system that measures a building's sustainability credentials allowing the direct comparison of building schemes.

1.2 AIMS OF BREEAM

BREEAM's overarching aim is to minimise the adverse effects that buildings have on the local and global environment, specifically considering a buildings the life cycle impacts with support to minimise and mitigate these. The scheme enables a building to be recognised for its environmental and sustainable credentials creating a consistent labelling scheme that stimulates a demand for sustainable buildings.

1.3 BENCHMARKING OF SCHEMES

Accreditation is driven through the attainment of credits linked to specific sustainability issues. The final sustainability rating is dictated by the percentage of available credits that have been awarded to the building scheme (Table 1).

1.4 ASSESSMENT PROCESS

A BREEAM Assessor trained and holding a current license from the BRE is required to undertake the assessment. The building is assessed at two stages, initially at the design stage, where a provisional rating and interim certificate is awarded, and secondly post-construction providing the final rating and certification of the building.

To fulfil the requirements for accreditation evidence needs to be collected and held by the project team. This evidence is then required to be reviewed and submitted by the projects BREEAM assessor to the BRE for approval and if successful the award of the corresponding BREEAM rating.

RATING	% SCORE
OUTSTANDNG	≥ 85
EXCELLENT	≥ 70
VERY GOOD	≥ 55
GOOD	≥ 45
PASS	≥ 30

TABLE 1

Percentage of credits required for each rating level¹

2 BREEAM IN PRACTICE

2.1 WHEN IS BREEAM REQUIRED?

The ability of BREEAM to enable the benchmarking of a building’s sustainability credentials has seen its widespread uptake within industry, resulting in the setting of minimum standards for government projects.

There is currently no requirement for commercial non domestic developments to achieve a BREEAM rating, however organisations do set specific targets. Table 2 highlights where BREEAM accreditation is required and the level of award to be achieved. When undertaking a project clarity should be sought from the client and project team as there may be a requirement to exceed the minimum standard.

TABLE 2

Minimum standards of BREEAM accreditation for Government projects²

SCHEME		NEW	REFURBISHMENT	
Non-Domestic Government	Central Government	Excellent	Very Good	
	Welsh Assembly ¹	Very Good	Very Good	
	Northern Ireland Executive	Very Good	Very Good	
Non - Domestic Public Sector	Healthcare	Excellent	Very Good	
	Education	Department for Education ²	Very Good	Very Good
		England - Skills Funding Agency	Excellent	Very Good
		Scottish Funding Council	Excellent	Excellent
		NI - Department of Education	Excellent	Very Good
		NI - Department of Education, Employment and Learning	Excellent	Excellent

1 Applies to developments with a floor space of 1,000m² plus or developments on sites of 1 hectare or more and achieve the mandatory credits for 'Excellent' under issue En1 - Reduction of CO₂ Emissions.

2 All major new build and refurbishment projects over £2 million and refurbishment affecting more than 10% of school floor area.

2.2 STRUCTURE OF BREEAM

The accreditation system is based upon the attainment of credits linked to specific sustainability categories. Each issue area has been assigned a weighting based upon its perceived importance which when combined within the assessment protocol provide an overall project rating (Table 3). Each issue relates to a specific aspect of a building project and within each category there are a number of sub issues which identify the exact aspects to be assessed and the criteria to be satisfied.

The scheme can be used for a number types of projects, not only fully purposed and bespoke designed projects but also for speculative projects:

- Fully fitted out refers to projects where all internal spaces have been completed to the point where they can be occupied.
- Shell only refers to a speculative build where services and systems are not installed but left to be installed at a later date.
- Shell and core refers to the completion of a building including base services but omitting the final finishing of occupied areas which are left free to be organised by the occupants.

TABLE 3

Weighting of issues per project type¹

ISSUE	WEIGHTING		
	FULLY FITTED OUT	SHELL ONLY	SHELL & CORE ONLY
Management	12	12.5	11
Health and Wellbeing	15	10	10.5
Energy	19	14.5	15
Transport	8	11.5	10
Water	6	4	7.5
Materials	12.5	17.5	14.5
Waste	7.5	11	9.5
Land Use and Ecology	10	13	11
Pollution	10	6	11
Innovation (additional)	10	10	10

MANAGEMENT

Focused on management policies and the procedures that need to be put in place to ensure the delivery of a sustainable project.

HEALTH AND WELLBEING

Concerned with indoor and external issues that can affect the health and wellbeing of the building occupants.

ENERGY

Describes the requirement for the measurement of the operational energy of the completed project. It includes steps taken to reduce its impact, such as the introduction of low or zero carbon technologies.

TRANSPORT

How well the development links into public transport networks and encourages the use of sustainable transport systems.

WATER

Encourages the responsible use of water resources with the implementation of water efficient equipment and monitoring to actively reduce water consumption.

MATERIALS

Primarily concentrated on the life cycle impacts of the materials used within construction and the assurance of responsible sourcing.

WASTE

Promotion of schemes to encourage the reduction of waste throughout the construction phase and the avoidance of waste to landfill during operational life.

LAND USE AND ECOLOGY

To encourage the selection and use of sites that minimise effects on existing ecology and avoids the use of virgin land.

POLLUTION

Concerned with the reduction and elimination of all forms of pollution, be it surface, atmospheric, light or noise.

INNOVATION

Opportunity for additional credits to be awarded as a result of sustainability benefits that are related to the project but are not rewarded as standard.

BREEAM offers a level of flexibility for assessing sustainability performance, with the ability to pick and choose certain issues that the building should be assessed on as long as certain minimum standards are attained.

Minimum standards are linked to each rating level (Table 4), however the attainment of these credits should not necessarily be considered as best practice for achieving each level.

TABLE 4

Minimum standards for BREEAM rating levels¹

BREEAM ISSUE	MINIMUM STANDARDS BY BREEAM RATING LEVEL ¹				
	PASS	GOOD	VERY GOOD	EXCELLENT	OUTSTANDING
Man 03: Responsible construction practices	None	None	None	1 credit (Considerate construction)	2 credits (Considerate construction)
Man 04: Commissioning and handover	None	None	None	Criterion 9 (Building User Guide)	Criterion 9 (Building User Guide)
Man 05: Aftercare	None	None	None	1 credit (Seasonal commissioning)	1 credit (Seasonal commissioning)
Ene 01: Reduction of energy use and carbon emissions	None	None	None	5 credits	5 credits
Ene 02: Energy monitoring	None	None	1 credit	1 credit	1 credit
Wat 01: Water consumption	None	1 credit	1 credit	1 credit	2 credits
Wat 02: Water monitoring	None	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Mat 03: Responsible sourcing of materials	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only	Criterion 1 only
Wst 01: Construction waste management	None	None	None	None	1 credit
Wst 03: Operational waste	None	None	None	1 credit	1 credit
Le03: Minimising impact on existing site ecology	None	None	1 credit	1 credit	1 credit

¹ To attain a specific rating level requires the minimum standards associated with that level and all preceding levels are achieved.

2.3 THE GREEN GUIDE

The Green Guide³ exists as a partner to the BREEAM assessment scheme and provides ratings on the environmental performance characteristics of a range of specific construction specifications. These specifications reflect how a material is used within a building and are arranged as systems across a range of distinct building elements:

- External walls
- Internal walls and partitions
- Roofs
- Ground floors
- Upper floors
- Windows
- Insulation
- Landscaping
- Floor finishes

The guide takes into account a number of key environmental factors to provide an overall measure of a specifications impact providing a rating from A+ to E. The environmental factors are as follows:

- Climate change
- Water extraction
- Mineral resource extraction
- Stratospheric ozone depletion
- Human toxicity
- Ecotoxicity to Freshwater
- Nuclear waste (higher level)
- Ecotoxicity to land
- Waste disposal
- Fossil fuel depletion
- Eutrophication
- Photochemical ozone creation
- Acidification

The ratings that our products achieve within the Green Guide is dependent on the element in which it used and its specification.

For example concrete used to create a precast in situ reinforced concrete floor slab, utilising 50% GGBS and 20% Recycled coarse aggregate (Green Guide number 807280059) achieves a C rating⁴. However when concrete is implemented as part of a system the rating it achieves can be significantly increased. Concrete as a structural topping in beam and expanded polystyrene suspending flooring system (820140015) it achieves an A+ rating⁵.

The complexity of the rating system and the wider positive impacts means that materials such as asphalt and concrete should not be discounted at an early stage based purely on their standalone ratings. Consideration should be given to systems that employ these materials and their complete performance rating. The effects of our products throughout the BREEAM assessment scheme should also be considered, as detailed in the remainder of this guide. Green Guide ratings should not be taken as exhaustive to detail sustainability performance of materials as it does not necessarily reflect product variability and whole life issues.

3 ASSESSING CONSTRUCTION MATERIALS IN BREEAM

The roles that Tarmac’s products and solutions can fulfil in BREEAM is less than clear. There are a number of categories and issues where a direct relationship is easily identifiable and can aid in the accruing of points, however in numerous area our products and solutions can play a supporting role.

3.1 RELATIONSHIP RATING OF CONSTRUCTION MATERIALS

A two tier system has been established to describe and explain how Tarmac can contribute to BREEAM assessments.

RELATIONSHIP RATINGS

DIRECT	Use of a product or solution that has a direct effect on the issue and criteria of assessment.
INDIRECT	Use of a product or solution that has an indirect effect on the issue (i.e. forms part of a system that contributes to a direct relationship or has a discreet effect on an issue).

EXAMPLES

DIRECT	Waste 02 – Recycled aggregates	<p>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.</p> <p>Recycled aggregates are readily available and can be easily incorporated into asphalts and concretes, with supporting evidence directly available from Tarmac.</p>
INDIRECT	Energy 01 – Reduction of CO ₂ emissions	<p>Aim: To recognise and encourage buildings designed to minimise operational energy demand, consumption and CO₂ emissions.</p> <p>Taking a passive solar design approach enables significant reductions in energy requirements for the heating and cooling of buildings. Concrete as a construction material with favorable thermal mass properties can play a significant role in the delivery of these savings, a subject on which Tarmac can advise.</p>

3.2 ROLE OF CONSTRUCTION MATERIALS

When the aforementioned tier system is taken into consideration it is possible to identify and elaborate on where and the level of influence that concrete can have in achieving and accruing credits.

TABLE 5

Relative influence of Tarmac products and solutions on assessment issues

ISSUE		DIRECT	INDIRECT
Management	Man 02 - Life cycle cost and service planning		✓
	Man 03 - Responsible construction practices	✓	
Health and Wellbeing	Hea 01 - Visual comfort		✓
	Hea 02 - Indoor air quality		✓
	Hea 03 - Thermal comfort		✓
	Hea 05 - Acoustic performance		✓
Energy	Ene 01 - Reduction of energy use and carbon emissions		✓
	Ene 04 - Low carbon design		✓
Water	Wat 01 - Water Consumption		✓
Materials	Mat 01 - Life cycle impacts	✓	
	Mat 02 - Hard landscaping and boundary protection		✓
	Mat 03 - Responsible sourcing of materials	✓	
	Mat 05 - Designing for durability and resilience		✓
	Mat 06 - Material Efficiency		✓
Waste	Wst 01 - Construction waste management		✓
	Wst 02 - Recycled aggregates	✓	
	Wst 06 - Functional Adaptability		✓
Pollution	Pol 01 - Impact of Refrigerants		✓
	Pol 02 - NOx Emissions		✓
	Pol 03 - Surface Water Run Off		✓
	Pol 05 - Noise Attenuation		✓

3.3 PASSIVE SOLAR DESIGN

Passive solar design is a strategic approach to sustainable construction that utilises the fabric of a building and natural solar effects to create a comfortable environment for occupants. This method reduces the reliance on mechanical methods to satisfy heating, cooling, ventilation and daylighting requirements, with the reduction of associated energy demands⁶. Heavyweight construction materials are ideal for these applications due to their inherent thermal mass. It is the attributes of a passive solar design approach utilising high thermal mass materials that allow a positive contribute to many BREEAM credits.

Passive solar design requires the environment in which the building is to be situated to be considered throughout the design process. Orientation, wind direction, neighbouring structures and natural sheltering, are starting points for passive design, demonstrating that it is about more than just the building itself. Passive solar design combines natural effects, such as prevailing winds and solar energy transfer mechanisms, with intelligent design to create significant benefits for maintaining a comfortable environment.

If considered at an early stage passive solar design can provide a valuable opportunity to improve a building's operation, however it is vital that this forms part of an integrated holistic approach.

As an approach to sustainable building passive solar design is built around a number of key principles and requirements that are too numerous and detailed to list and identify here. However, their role is important and more details can be found in our supporting Solution Guide on Passive Solar Design.



4 TARMAC CONTRIBUTIONS

This section sets outlines how Tarmac's products and solutions can have a positive effect on the awarding of credits. For Tier 1 issues detail is given on the contribution and evidence that can be provided. In the case of Tier 2 issues the approach to assist in the awarding of credits is has been reviewed.

4.1 MANAGEMENT

This category encourages the adoption of sustainable management practices throughout design, construction, commissioning, handover and operation. Its focus is to ensure that robust sustainability objectives are set and followed throughout the whole life of a building.

4.1.1 MAN 02 – LIFE CYCLE COST AND SERVICE PLANNING – INDIRECT

Complete satisfaction of assessment criteria within this issue will see the project awarded four credits; three credits are achieved through life cycle costing (LCC) and one through capital cost reporting.

The aim of this assessment criterion is 'to deliver whole life value from investment and promote economic sustainability by recognising and encouraging the use and sharing of life cycle costing (LCC) and service life planning to improve design, specification and through-life maintenance and operation'. LCC analyses are to be used to promote a holistic approach to design decisions encouraging design options to be considered for multiple scenarios and for fabric and servicing strategies to deliver the most suitable outcome.

Whilst we are unable to provide evidence to directly achieve credits, our products have the ability to positively influence the identification and use of solutions that are low in operation, maintenance and lifecycle costs. The majority of construction solutions that utilise our construction materials exceed the 60 year study term for LCC analysis and have low maintenance requirements due to their robust nature. These characteristics can have a positive effect when LCC analyses are performed helping to deliver sustainable buildings over their entire life cycle.

Our products can be readily utilised in a range of specific element and whole building solutions which can optimise and improve performance. Information and guidance on the type and how to implement these solutions can be found in our supporting Tarmac Solution Guides.

4.1.2 MAN 03 – RESPONSIBLE CONSTRUCTION PRACTICE – DIRECT

AIM	To recognise and encourage construction sites which are managed in an environmentally and socially considerate, responsible and accountable manner.
ASSESSMENT CRITERIA	Monitoring of construction site impacts – Transport of construction materials and waste Monitoring and recording of data on the transport movements resulting from delivery of construction materials to site and construction waste from site. Collected data must be used to report separately on materials and waste, collection is to span delivery, from factory gate to site, and waste, from site to waste centre, recording fuel consumption (litres), carbon dioxide emissions (kgCO ₂ eq) and total distance (km) travelled.
NO. OF CREDITS INFLUENCED	1 credit
CONTRIBUTION	Our carbon calculator can be used to determine all data relating to the transport CO ₂ arisings for the delivery of our products to site. This can be complemented with data on fuel consumption and distance travelled. All data is provided in line with BREEAM requirements with additional data available to cover cradle to site gate, rather than just factory gate to site. Our calculator has been created in accordance with PAS 2050:2011 'Specification for the assessment of the life cycle greenhouse gas emissions of goods and services' ⁷ . Where returned materials are concerned supporting data can also be provided.
EVIDENCE	Supporting evidence is required to detail the reporting that has been carried out and the protocols followed to collect and collate the data. Our footprinting tool allows us to document CO ₂ emissions at a number of stages, factory gate and site gate, presented in a report that clearly identifies emissions and details the scope and process followed.



4.2 HEALTH AND WELLBEING

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

4.2.1 HEA 01 - VISUAL COMFORT - INDIRECT

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	Daylighting Credits are awarded dependent on the level of daylighting achieved within a building. Compliance levels are dependent on the type of building and the area assessed within a building, with calculations to determine daylighting factors based upon illuminance, internal and external reflectance of surfaces, window size and room area.
NO. OF CREDITS INFLUENCED	Daylighting (1-2 credits) - dependent on building type
CONTRIBUTION	Daylight factor is a ratio between internal and external light, establishing the amount of light that can enter a space. It is measured as the amount of light which reaches a specific point within a space or room. Internal light is a factor of direct light entering the space and reflected light, which has been reflected off an internal or external surface prior to reaching designated point. In accordance with BS 8206-2: 2008 (Lighting for buildings. Code of practice for daylighting) ⁹ concrete can offer improved reflectance characteristics over other regularly utilised building materials without the need for additional finishes. The figure quoted is based upon typical "grey" concrete which can be misleading as it is possible through simple mix design adaptation to increase reflectivity and albedo. Incorporating white cement and substitute materials such as Ground Granulated Blast Furnace Slag (GGBS) can create a concrete with a higher albedo and therefore improved lighting effects.
EVIDENCE	Whilst no direct evidence can be provided to directly influence the awarding of credits, assistance can be provided at early project stages to help develop and implement solutions that make can optimise the availability of natural light especially when passive solar design principles are applied.

TABLE 6

Approximate values of the reflectance of light⁹

	MATERIAL					
	CONCRETE	BRICKWORK	WOOD	QUARRY TILES	CARPET	WHITE PAINT
REFLECTANCE	0.4	0.2-0.3	0.1-0.4	0.1	0.1-0.4	0.85

4.2.2 HEA 02 – INDOOR AIR QUALITY – INDIRECT

Low volatile organic compound (VOC) emissions and natural ventilation are two credits that can be achieved through implementing passive solar design principles at early project stages, in conjunction with the products and solutions that we offer.

Concrete is a material that is naturally low in VOC concentration and emission rate⁹, whilst not an assessed product its utilisation as a final finish means that additional plant can be reduced to create final finishes requiring assessment. This approach can reduce the risk of the use of non conforming supplementary products. Concrete's versatility does not hinder architectural freedom due to its ability to be readily pigmented and take on almost any form.

The second assessed credit, natural ventilation, can be supported by concrete through passive solar design. Passive solar design relies on the thermal mass of heavyweight materials to act as heat stores to attenuate unwanted heat gains in the summer and required heat gains in the winter, releasing it when required. The need for additional mechanical heating systems can be reduced or removed, facilitating the opportunity to utilise natural ventilation alone for maintaining air quality.

Further details on passive solar design can be found in Section 3.3 and our supporting Tarmac Solution Guide, Passive Solar Design.

4.2.3 HEA 03 – THERMAL COMFORT – INDIRECT

Thermal comfort is concerned with providing an internal environment which is acceptable to occupants. The focus of the issue is to ensure that thermal comfort levels can be achieved and maintained as a result of good design and the implementation of suitable controls. Credits are awarded for the undertaking of thermal modelling that demonstrates the building will satisfy criteria set out in CIBSE Guide A Environmental Design¹⁰. For full credits the modelling must also demonstrate that the building is adaptable for future climate change with suitable controls in place to manage the zoning of a building.

Our products and solutions provide the means to more efficiently manage the internal environment and deliver occupant thermal comfort. A passive solar design approach utilising inherent high thermal mass solutions as the buildings fabric can assist in delivering a comfortable and predictable thermal environment. Implementing an effective passive approach requires thermal modelling thus helping to achieve the first credit. Thermal mass assists in regulating internal temperatures during both summer and winter, by minimising the solar gain effects during summer and maximising them in winter.

The flexibility of concrete means that temperature control systems (such as active cooling systems) can be embedded within structural elements to increase a building's capability to react to temperature changes expected due to climate change.

Further details on how passive solar design can support this issue can be found in Section 3.3 or our supporting Tarmac Solution Guide.

4.2.3 HEA 05 – ACOUSTIC PERFORMANCE – INDIRECT

A building's acoustic performance is a function of the fabric from which it is constructed and the elements and materials used to provide its finishes. The assessment criteria for this issue relates to whether the design of the building enables the appropriate standard, dependent on building type, of acoustic performance to be achieved.

Our products have the capability, when considered and implemented at early design stages to achieve acoustic performance requirements. Utilising concrete in walls and floors enables a high level of sound insulation to be achieved by the fabric alone as a result of its inherent mass and damping qualities^{9,11,12}. When stiff walls and floors are constructed, low frequency sound transmission is reduced as a lack of flexibility prevents sound energy transfer into the air of adjoining rooms and cavities. Damping characteristics supported by the mass of concrete can attenuate sound and vibration by converting this energy into heat within the material itself, preventing its transfer to other structural elements or rooms. Concrete has the highest damping properties of any structural material^{9,11,12}.

4.3 ENERGY

This category encourages the specification and design of energy efficient building solutions, systems and equipment to support sustainable energy use effective management of the building's operation. Issues in this section are concerned with improvements to a building's energy, the reduction of carbon emissions and methods to support efficient management throughout the operational phase of a building's life.

4.3.1 ENE 01 - REDUCTION OF CO₂ EMISSIONS - INDIRECT

The objective of this issue is 'to recognise and encourage buildings designed to minimise operational energy demand, consumption and CO₂ emissions. Credits are awarded for building performance improvements over and above that required by national building regulations, with up to twelve credits available. Due to variances in building regulations across the UK it is possible for example for buildings in Scotland and England to achieve different ratings even if they were identical.

The metric for determining performance is defined as the overall Energy Performance Ratio (EPRNC). It is a measure of the improvement in a buildings performance in comparison to a benchmark based on a range of buildings, constructed in line with building regulations and it is defined by three metrics;

- The building's heating and cooling energy demand
- The building's primary energy consumption
- The total resulting CO₂ emissions

Data to support this is required to be sourced from National Calculation Method compliant energy modelling software, with its output used in the BREEAM Ene01 calculator to determine the EPRNC.

Reducing energy demand requires early and informed design decisions to be made to implement solutions that can be defined as 'energy efficient'. A significant holistic approach is passive solar design which looks to pair natural solar effects with a building's fabric and layout to reduce energy demand. During summer unwanted solar gain is minimised through shading and excess heat gain is absorbed by the building's inert thermal mass. During winter solar gain is maximised and stored within the building's fabric and released as temperatures drop, reducing energy demands for heating.

Further details on how passive solar design can support this issue can be found in Section 3.3 or our supporting Tarmac Solution Guide, Passive Solar Design.

4.3.2 ENE 04 - LOW CARBON DESIGN - INDIRECT

This issue is focused on reducing a building's energy consumption by considering two aspects for delivering low carbon design, passive design and the implementation of low or zero carbon technologies. Two credits are available for passive design one for analysis and the second for free cooling, it is through passive design strategies that our products and solutions can be most beneficial.

The passive solar design credit is interlinked with the provision of Thermal Comfort (Hea04), and is a prerequisite before any credits can be awarded. Obtaining the passive solar design credit requires decisions to be made during concept stages combined with analysis and modelling to ensure appropriate passive measures are employed. It is at this stage when high thermal mass materials should be considered due to their role in delivering reductions in energy demands for heating, cooling and mechanical ventilation.

Free cooling is defined as 'the ability of the building to provide cooling to the internal occupied areas without the need to rely on energy consuming mechanical cooling'. This can be achieved through a fabric first passive strategy integrating high thermal mass materials. In these circumstances very little active cooling is required and where it is required it can be satisfied by natural ventilation or the night time purging of stored heat energy from within the fabric of the building.

Credits awarded here also support Ene 01, making high thermal mass construction a useful tool in delivering high BREEAM scores. Further information on how high thermal mass design can contribute to a sustainable building can be found in Section 3.3 and our Solution Guide on Passive Solar Design.

4.4 WATER

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.

4.4.1 WAT 01 - WATER CONSUMPTION - INDIRECT

The issue is concerned with the reduction of potable water for sanitary applications in new buildings. Two distinct methods can be employed either improvements in efficiency or the use of greywater and rainwater. However for any contribution from greywater or rainwater to be included, minimum levels of water efficiency must be achieved. If these levels are obtained the contribution from greywater and rainwater can be offset against potable water use.

To award credits an assessment is required to be undertaken to determine the buildings level of potable water consumption and to ascertain its efficiency. This demand is compared against a baseline with the level of improvement dictating the number of credits that can be awarded. Once building consumption has been defined that the yield of any greywater or rainwater systems can be used to offset potable water demand for non potable applications.

Sustainable Drainage Systems (SuDS) offer an efficient way of harvesting rainwater whilst reducing the environmental impacts linked to increases in impermeable surfaces associated with new construction. Our innovative Ultisuds and Topmix Permeable solutions can be integrated into landscaping design to assist and provide feasible systems for the capture and utilisation of rainwater and aggregates to reduce potable water demand.

For more information on our solutions that support rainwater harvesting see our SuDS, Permeable Concrete and Permeable Asphalt Solution Guides.



4.5 MATERIALS

This category encourages steps taken to reduce the impact of construction materials through design, construction, maintenance and end of life. Its focus is on the procurement of materials which have been sourced in a responsible way and have a low embodied impact across their life including extraction, processing, manufacturing and recycling.

4.5.1 MAT 01 - LIFE CYCLE IMPACTS - DIRECT

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	<p>Credits are awarded based upon the quantified life cycle impacts of a building assessed on key elements; external walls, windows, roof, upper floor slab, internal walls and floor finishes/coverings. The number of credits available are dependent on building type.</p> <p>BRE's Green Guide (see Section 4.8) lists a range of design specifications that can be used make up a building's main elements. Points are awarded to the building scheme dependent on how many Green Guide elements are specified within the building. These points are then used in the BREEAM Mat 01 calculator to determine the number of credits that can be awarded.</p> <p>The Green Guide is an extensive catalogue of specifications for key building elements. Through the Green Guide it is possible obtain data on an element's environmental impact which allows informed decisions to be made and provide the basis for awarding credits. The Green Guide provides a rating on each specifications environmental performance from A+ down to E, through the balancing of environmental impact factors (see Section 2.3).</p>
NO. OF CREDITS INFLUENCED	Building type dependent but up to 6 credits and a maximum of 3 innovation credits
CONTRIBUTION	<p>We have a range of products and solutions which match or can be tailored to match and satisfy specifications linked in the Green Guide. For example a powerfloated insitu concrete slab for ground floor construction in a domestic application, using 30% PFA and 100% recycled aggregates achieves a B rating (Green Guide number 820100208)¹³. This specification provides one Ecopoint and can be used to build points to meet the requirements for the awarding of credits.</p> <p>It should be noted that the green guide and ecopoint system is not exhaustive for documenting the sustainable credentials of construction products. While we we satisfy all the specifications listed in the Green Guide which are related to our products, further information should be sought on sustainable performance. Assessments are based upon generic data which will not take into consideration inherent material variance that exists with heavyweight construction materials due to locality of supply, constituents and methods of manufacture and supply. More detailed performance on our products and their integration into projects can be provided by our sustainability team.</p> <p>In addition to the Green Guide rating based points, further points can be awarded through the use of products with an Environmental Product Declaration (EPD). EPD provide more indepth understanding of a product's environmental performance and a number of EPD are available for our key products.</p>
EVIDENCE	In order to obtain the associated credits it is necessary for the project specification to identify which elements have been assessed and its constituent material specification. Where our products have been specified product records can be provided detailing constituents along with EPD for selected products. It is also necessary for the Green Guide element number and rating to be recorded, copies of any EPD are to be included and the output from the BREEAM Mat 01 calculator.

4.5.2 MAT 02 – HARD LANDSCAPING AND BOUNDARY PROTECTION – INDIRECT

AIM	To recognise and encourage the specification of materials for boundary protection and external hard surfaces that have a low environmental impact, taking account of the full life cycle of materials used.
ASSESSMENT CRITERIA	The credit is awarded where 80% of the materials specified for the area encompassed by hard landscaping and boundaries achieve a Green Guide rating of A or A+. If a material does not appear in the Green Guide but has an EPD this can be used to calculate its rating, and if reaching the required standard used to demonstrate compliance.
NO. OF CREDITS INFLUENCED	1 credit
CONTRIBUTION	The contribution that our products can make to this credit follows a similar approach to that described within Mat 01, Life Cycle Impacts. Awarding of credits is based upon the gaining of Ecopoints which is directly linked to a specifications Green Guide rating. We are able to match all Green Guide specifications for aggregates, asphalt and concrete elements, a number of which are listed as A or A+.
EVIDENCE	For full compliance it is necessary for relevant clauses and design specifications to identify the constituents of construction elements and its related Green Guide specification. Post construction evidence is required in the form of as-built records and specifications which detail the constraints of materials that have been used to create the elements. At both these stages records can be provided to demonstrate conformance to Green Guide specifications.

4.5.3 MAT 03 – RESPONSIBLE SOURCING OF MATERIALS – DIRECT

AIM	To recognise and encourage the specification of responsibly sourced materials for key building elements.
ASSESSMENT CRITERIA	Credits are awarded through the development and implementation of a sustainable procurement plan and as a result of the responsible sourcing of materials (RSM). In undertaking the assessment a building is broken down into distinct major construction elements which are individually assessed. Each assessed element is assigned a responsible sourcing tier level, based upon the compliance of its constituent materials and awarded a number of points. The amount of credits attained is dependent on the number of points awarded. If 54% of the available points have been awarded full credits are obtained, with an additional exemplary credit if 70% or more points are awarded.
NO. OF CREDITS INFLUENCED	Maximum of 3 credits dependent on the design and material make up of building elements.
CONTRIBUTION	All of our products are certified under BES 6001, Responsible Sourcing of Construction Products. Certificates are available (on request or via the Tarmac website) that demonstrate our conformance to the standard at 'very good' level. Points for each element are based upon 8 tiers of conformance, our 'Very Good' standard contributes 3 points in the assessment of the element in which our product has been used. The percentage of available RSM points achieved is determined by using the BREEAM Mat03 calculator with credits awarded accordingly.
EVIDENCE	To comply with this issue it is necessary where responsibly sourced materials or products have been utilised that the relevant specifications and certificates submitted as evidence. Our BES 6001 Responsible Sourcing Certificate numbers are BES 557602 (Aggregates), BES 568430 (Asphalt), BES 573009 (Cement) BES 559207 (RMX) and BES 567267 (Building Products) and copies of the certificates are available on request. If further evidence is required regarding materials delivered to site the evidence can be provided.



4.5.4 MAT 05 – DESIGNING FOR DURABILITY AND RESILIENCE - INDIRECT

Longevity is fundamental to delivering a sustainable built environment. The available credit is awarded on delivering protection to exposed elements to reduce the frequency of repair and replacement, maximising material optimisation. Focus is placed on the protection of vulnerable parts of the building from damage, such as those exposed to pedestrian and vehicular traffic, or at risk of degradation due to environmental factors.

Applicable elements and effects that need to be protected against are defined within the BREEAM Technical Manual. For example applicable building elements include foundations and external walls, with effects to be protected against such as extreme weather conditions and corrosion. Two approaches to satisfying this credits criteria are identified either the addition of protective elements such as barriers and bollards, or the designing out of risk. Concrete is a material that offers both durability and resilience in its natural form and by its inclusion into elements at risk from degradation and damage go along way in satisfying the requirements of this credit.

4.5.5 MAT 06 - MATERIAL EFFICIENCY - INDIRECT

Material efficiency is concerned with 'enabling the most efficient use of materials over the life cycle of a building'¹. It can be achieved through design and construction approaches that use less materials, make use of waste materials, such as those arising from demolition, or procuring products with high recycled and secondary contents.

Aggregates, asphalt and concrete products inherently offer material efficiency. They are low waste generating due to their methods of production, the ability to specify precise volumes and ready acceptance of recycled and secondary materials. High performance concretes can be specified which offer increased structural performance characteristics to reduce material quantities along with its use as a final finish.

4.6 WASTE

This category encourages the sustainable management (and reuse where feasible) of waste generated during construction, operation and as a result of maintenance and repair. Through good design and construction practices, its aim is to reduce waste generation and encourage its diversion from landfill. Further to this it recognises efforts to reduce future waste which may be generated due to the need alter the building in response to climate change.

4.6.1 WST 01 – CONSTRUCTION WASTE MANAGEMENT – INDIRECT

This issue considers two main elements, resource efficiency through effective management and the reduction and diversion of waste from landfill. A precursor to the awarding of credits is the requirement to develop a resource management plan that takes into account the generation of non-hazardous waste from on and off site construction activities. The allocation of credits for the minimisation of waste (3 credits) and diversion from landfill are based upon performance against specified benchmarks.

The relatively inert nature of asphalt and concrete allows it to be easily sorted during decommissioning and deconstruction and in many cases it can be reused on site without the need for further processing or removal. Furthermore both asphalt planings and crushed concrete can be readily reused in the production of new concrete and asphalt¹⁵.

4.6.2 WST 02 – RECYCLED AGGREGATES – DIRECT

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 available credits are awarded based upon the meeting of a benchmark target for the replacement of high grade aggregates with recycled or secondary aggregates. The base credit benchmark is set at a replacement rate of 25%. An exemplary credit is also available where recycled and secondary content exceeds 35% and has travelled less than 30km by road. Only travel by road is considered even if the material has travelled longer distances by other forms. Recycled and secondary materials can only be considered if they meet or exceed application specific benchmarks (see Table 7). Where these benchmarks are not met recycled and secondary aggregates remain classified for assessment purposes as high grade.
NO. OF CREDITS INFLUENCED	2 credits
CONTRIBUTION	We provide products which can be used in all elements that are assessed as part of this issue listed in Table 7. Many of our asphalt and concrete already encompass recycled or secondary materials, those that do not can be easily adapted to include these materials. Recycled and secondary materials are also available for unbound applications.
EVIDENCE	Evidence can be provided to attain this credit at both the design and construction phases of a project. Detailed material specifications can be produced identifying the materials used, recycled and secondary aggregate contents and their sources. On delivery and post construction further documentation can be provided in terms of delivery tickets that prove what material has been used which can be linked to pour and quality assurance records.

4.6.3 WST 06 – FUNCTIONAL ADAPTABILITY – INDIRECT

The aim of this issue is to encourage long term planning and the implementation of features that will accommodate future changes to a building’s use over its lifespan. A credit is awarded where it can be demonstrated that a functional adaptation study has been undertaken and its findings implemented.

A building that has been designed with a concrete structure is an effective solution for future adaptation. It can be designed to provide large unobstructed spaces that can be readily reorganised and repurposed. The structure itself is long lasting and durable with a frame that can be stripped back without any compromising of its fire and structural integrity.

TABLE 7

Minimum levels of recycled and secondary aggregates required for consideration per application¹

APPLICATION		MIN. % BASE CREDIT	MIN. % EXEMPLARY CREDIT
BOUND	STRUCTURAL FRAME	15	30
	BITUMEN OR HYDRAULICALLY BOUND BASE, BINDER, AND SURFACE COURSES FOR PAVED AREAS AND ROADS	30	75
	BUILDING FOUNDATIONS	20	35
	CONCRETE ROAD SURFACES	15	45
UNBOUND	PIPE BEDDING	100	100
	GRANULAR FILL AND CAPPING (SEE RELEVANT DEFINITIONS SECTION)	100	100



4.7 POLLUTION

This category addresses the prevention and control of pollution and surface water run-off associated with buildings. Issues in this section aim to reduce a building's impact on surrounding environments and communities due to light-pollution, noise, flooding and emissions to air, land and water.

4.7.1 POL 01 - IMPACT OF REFRIGERANTS - INDIRECT

The objective of this issue is the reduction of greenhouse gas emissions associated with refrigerant leakage building plant systems. Two approaches are identified with up to 3 credits available; first implement a building design that requires no refrigerants and second take steps to minimise their potential impact.

A building design which requires no refrigerants can be enabled by employing the principles of passive solar design (see Section 3.3). Passive solar design utilises the fabric of a building and natural phenomena to meet the everyday demand for heating and cooling. A fundamental step is to use materials with high thermal mass characteristics (such as concrete) for the fabric of the building. The buildings fabric then acts as a daytime heat energy store that can be released or purged overnight using natural ventilation, reducing the need for specific plant systems. We are able to provide further guidance on the implementation of passive solar design through our Solution Guide.

4.7.2 POL 02 - NOX EMISSIONS - INDIRECT

Up to three credits are available (dependent on building type) in this issue for employing systems within a building that encourage the use of heat or coolth from systems that minimise NOx emissions. Credits awarded are based upon the meeting of listed specific benchmark emission levels.

As with Pol 01, impact of refrigerants, employing an approach that integrates passive solar design can significantly reduce or remove the need to rely on mechanical means for heating, cooling and ventilation. In these circumstances the role that the fabric of the building can play is fundamental along with their thermal mass characteristics.

More details on passive solar design and the role of a buildings fabric can be found in Section 3.3 and our Solution Guide on Passive Solar Design.



4.7.3 POL 03 - SURFACE WATER RUN OFF - INDIRECT

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	Initial credits are awarded based upon the risk and probability of the site being susceptible to flooding and the implementation of recommendations identified in the prerequisite initial flood risk assessment. The remaining credits are concerned with the development not increasing the risk of flooding or pollution of water courses. To meet this requirement the following items need to be satisfied; existing surface runoff rates do not exceed those from predevelopment and sufficient systems have been employed to treat any pollution.
NO. OF CREDITS INFLUENCED	Flood risk - 1 to 2 credits Surface water run off - 2 credits Minimising watercourse pollution - 1 credit
CONTRIBUTION	Sustainable drainage systems (SuDS) are the ideal solutions to address and achieve the credits linked to surface water runoff and pollution control. Paving systems constructed from permeable asphalt or concrete enable existing pre development runoff rates to be maintained and in the case of redevelopment of an existing site, improve them. Permeable paving allows water to infiltrate through the surface and where suitable underlying soil conditions exist directly into underlying strata, removing surface runoff completely. In areas where ground infiltration systems are not viable, attenuation layers can be incorporated that can delay surface runoff maintaining lower flow rates. Asphalt and concrete permeable paving systems are also extremely effective at treating water before discharge into water courses, stopping larger particles at the surface, with finer materials such as heavy metals and hydrocarbons trapped in lower layers.
EVIDENCE	Due to the nature of the issue it is not possible to provide direct evidence to demonstrate the achievement of this credit. However, through early engagement and extensive support on system design, material choice and installation methodologies, we can assist in the delivery of suitable and efficient systems.

4.7.4 POL 05 - NOISE ATTENUATION - INDIRECT

The objective of this issue is to reduce the likelihood of noise from any development having a detrimental effect on nearby noise-sensitive buildings. Noise-sensitive areas are defined within the issue criteria and where these are not present the single available credit is automatically awarded.

When noise sensitive areas do exist original background noise levels can not be exceeded by 5dB during the day and 3dB at night, in these circumstances methods to attenuate noise must be employed. Concrete is particularly well suited to noise attenuation due to its inherent mass and damping characteristics^{11,12}. Its mass provides attenuation of sound and vibration at all sound frequencies, whilst its damping properties attenuate and reduce sound and vibration energy by converting it into heat energy within the material. Its natural stiffness prevents flexing and the subsequent transmission of low frequency sounds to adjoining rooms.

Support can be provided by our specialists on the incorporation of the concrete into low and high rise structures.

5 SUMMARY

This guide to BREEAM has established that our products can play a significant role in developing a sustainable built environment and also contributing to metrics that are used to measure these credentials.

Due to the nature of the BREEAM measurement system the benefits of our products can not always be directly measured, however through intelligent design these benefits can be realised and influence the gaining of specific credits. Table 8 identifies the issues where our products have a role in the attainment of credits along with the total number of credits available. Where direct issues are identified the number of credits we can support with evidence are identified, indirect issues list the total number of credits available.

TABLE 8

Issues where Tarmac products and solutions assist in gaining credits

	ISSUE	CREDITS
DIRECT	Man 03 - Responsible Construction Practices	2
	Mat 01 - Life Cycle Impacts	6
	Mat 03 - Responsible Sourcing of Materials	3
	Wst 02 - Recycled Aggregates	2
INDIRECT	Man 02 - Life Cycle Cost and Service Planning	4
	Hea 01 - Visual Comfort	2
	Hea 02 - Indoor Air Quality	5
	Hea 04 - Thermal Comfort	3
	Hea 05 - Acoustic Performance	4
	Ene 01 - Reduction of Energy Use and Carbon Emissions	21
	Ene 04 - Low Carbon Design	4
	Wat 01 - Water Consumption	5
	Mat 02 - Hard Landscaping and Boundary Protection	1
	Mat 05 - Designing for Durability and Resilience	1
	Mat 06 - Material Efficiency	1
	Wst 01 - Construction Waste Management	4
	Wst 06 - Functional Adaptability	1
	Pol 01 - Impact of Refrigerants	3
	Pol 02 - NOx Emissions	3
	Pol 03 - Surface Water Run Off	5
	Pol 05 - Noise Attenuation	1

For more details on how our construction materials can aid in the creation of more sustainable building contact Tarmac's Sustainability Team at sustainability@tarmac.com

REFERENCES

1. **BREEAM UK New Construction Non-domestic Buildings Technical Manual 2014, SD 5076, Issue: 3.0, BRE Global Ltd, Jan 2015**
2. **BREEAM: Who specifies BREEAM**
BRE Global Ltd
www.breeam.com/podpage.jsp?id=273
[accessed 01/10/15]
3. **BRE Group: Green Guide to Specification**
BRE Global Ltd
www.bre.co.uk/greenguide/podpage.jsp?id=2126
[accessed 01/10/15]
4. **BRE: Green Guide: Green Guide 2008 Ratings, BRE Global Ltd**
www.bre.co.uk/greenguide/ggelementdetails.jsp?eid=17138
[accessed 01/10/15]
5. **BRE: Green Guide: Green Guide 2008 Ratings, BRE Global Ltd**
www.bre.co.uk/greenguide/ggelementdetails.jsp?eid=15725
[accessed 01/10/15]
6. **The Concrete Centre - Thermal Mass Explained (2012)**
7. **British Standards Institution and the Carbon Trust. (2011) PAS 2015:2011 'Specification for the assessment of life cycle greenhouse gas emissions of goods and services', London**
8. **British Standards Institution. (2008) Lighting for buildings: Code of practice for daylighting. London (BS 8206-2:2008)**
9. **The Concrete Centre - Concrete and BREEAM (2015)**
10. **CIBSE. CIBSE Guide A: Environmental Design (2015)**
11. **The Concrete Centre, How to achieve acoustic performance in masonry homes (2010)**
12. **The Concrete Centre, Concrete Silence (2010)**
www.concretecentre.com/news/2010_archive/concrete_silence.aspx
[accessed 01/10/15]
13. **BRE: Green Guide: Green Guide 2008 Ratings, BRE Global Ltd**
www.bre.co.uk/greenguide/ggelement2.jsp?buildingType=Housing&category=20&parent=0&elementType=10010&eid=15671
[accessed 01/10/15]
14. **The Concrete Centre, Performance and benefits**
www.concretecentre.com/technical_information/performance_and_benefits.aspx
[accessed 01/10/15]
15. **The Concrete Centre, End of life recycling**
www.concretecentre.com/sustainability/end_of_life_recycling.aspx
[accessed 01/10/15]



Tarmac Portland House Bickenhill Lane
Solihull Birmingham B37 7BQ
0800 1 218 218 enquiries@tarmac.com

TARMAC.COM

Version: December 2015

Tarmac and the *circle logo* are registered trademarks.
©2015 Tarmac Trading Limited.