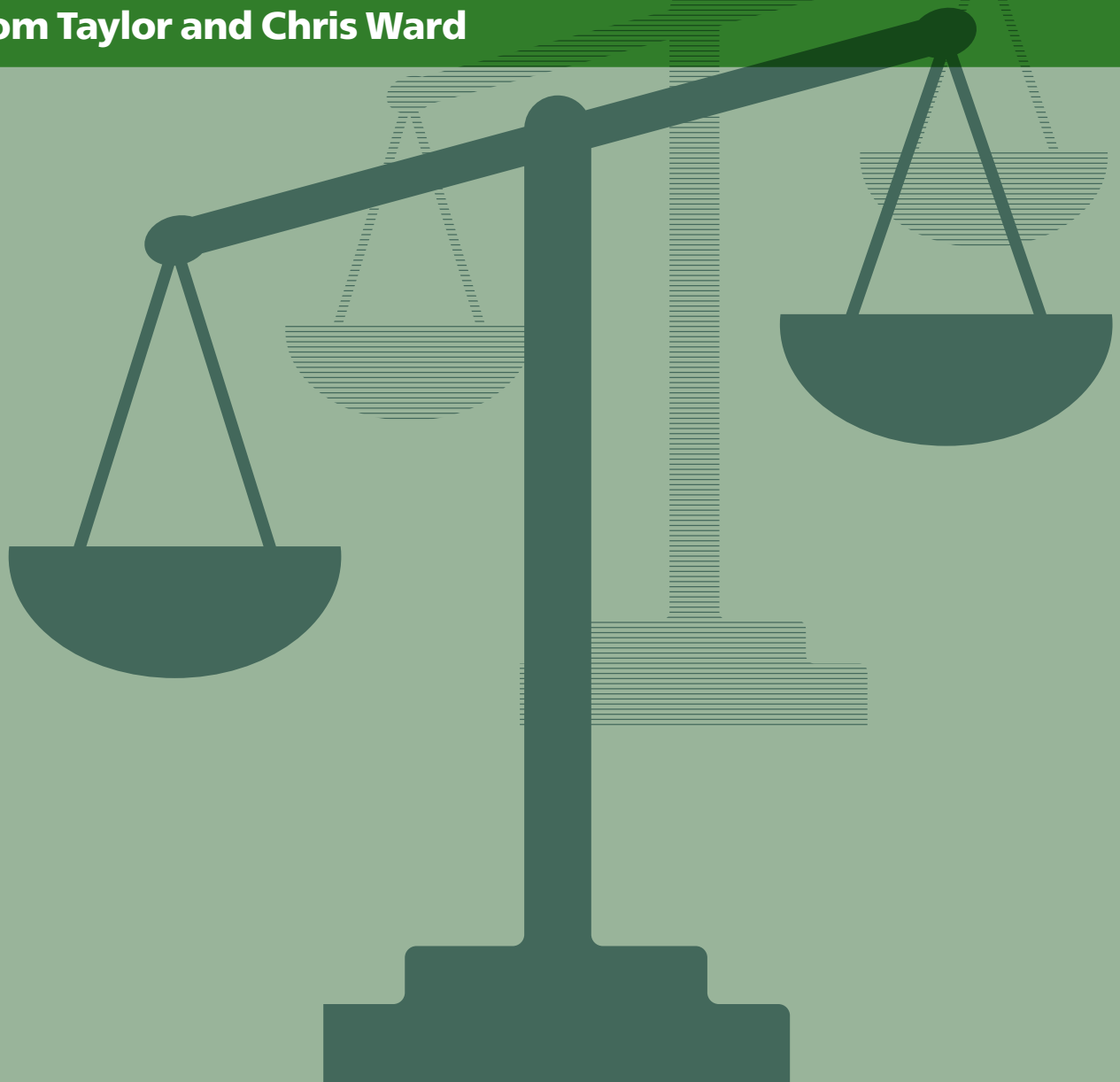


Briefing Paper

New Methodology for Generating BREEAM Category Weightings

Tom Taylor and Chris Ward



Overview

In order to reflect current circumstances, BRE has recently carried out a process of reviewing and updating the BREEAM scheme category weightings. This involved the development of a new, independently peer reviewed, weightings methodology that has subsequently been implemented to derive new consensus-based category weightings for use in recently updated BREEAM schemes operated by BRE Global. This briefing paper provides an overview of the new weightings methodology, which will be used to generate consensus-based category weightings for all BREEAM schemes moving forward. It provides a means of regularly reviewing weightings in a way that ensures a high level of transparency.

Background

Weightings lie at the heart of any holistic sustainability assessment scheme that provides a single score or rating for overall performance. They provide the basis for comparing the relative importance of issues included within the scope of the method and as such form a central element of a scoring system. In methods that do not have explicit weightings, they are present in the values ascribed to individual criteria. These are often based on limited evidence, subjective judgement, or implicit in that all indicators are given equal importance (i.e. each has a weighting of 1).

There is no single universally agreed method for developing environmental/sustainability category weightings and the process of doing so can be a challenging one. Developing category weightings for BREEAM schemes is particularly challenging because of the range of categories that are covered, with some addressing the environmental impacts of the built environment like global warming and resource depletion, and others addressing impacts that fall into the bracket of social or economic sustainability. Ideally weightings would be based on robust quantifiable evidence on the scale of impact, benefit and/or cost of all category issues. Whilst this may be possible for single issue tools/schemes, this is not currently achievable for schemes with multiple categories covering broad and wide ranging issues, as there are significant gaps in the scientific evidence base.

Category weightings are essentially a measure of importance, with a higher category weighting representing a higher level of importance. In order to assign a level of importance, it is first necessary to establish what is actually meant by 'importance' and in what context the 'importance' of a category should be considered. In particular, it is necessary to consider how it is possible to compare categories where:

- The impacts addressed by a given category may be felt on a global or local scale
- The significance/seriousness of addressing or failing to address the issues within a category will vary in terms of the associated social, environmental or economic impacts
- The relevance of some issues may vary according to location or context, but remain constant for others irrespective of location or context
- The potential to address the issues within a category will vary between different BREEAM schemes depending on the life cycle stage of assessment, the sector and the country of application

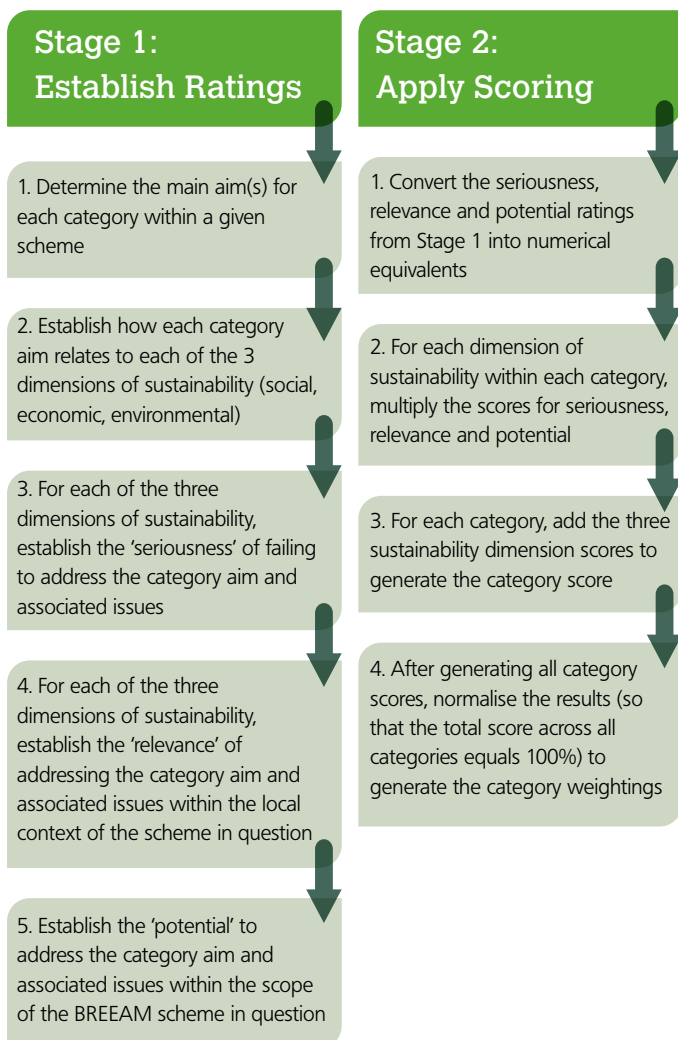
Since 1998, BREEAM has used an explicit category weighting system. The BREEAM category weightings were last updated in 2007 and these have been used as the basis for the weightings in BREEAM schemes launched or updated since then. Post 2007, the scope of BREEAM schemes has expanded to cover different life cycle stages of buildings (i.e. New Construction, In-Use, and Refurbishment) and other built environment sectors (e.g. Communities and Infrastructure). This expansion has created the need for BREEAM to develop a new weightings methodology that can be applied internationally to different life cycle stages and different built environment sectors in a consistent, transparent, robust and rigorous manner, whilst addressing the challenges highlighted above.

Weightings methodology summary

The new methodology has been subject to detailed independent peer review, including by two university professors active in the field of sustainability and the built environment. There are two stages to the new methodology:

- **Stage 1** – Establish ratings for the importance of each BREEAM scheme category
- **Stage 2** – Apply numerical scores to the category ratings to derive the category weightings

Each stage consists of a number of different steps as shown in Figure 1.



The first two steps of Stage 1 involve BREEAM setting the applicable assessment categories and category aims for a given scheme, and detailing how the category aims relate to the three dimensions of sustainability. The final three steps of Stage 1 involve rating the importance of the social, environmental and economic impacts for each BREEAM category in a given BREEAM scheme, in terms of the following:

- The 'seriousness' of failing to address the category aim and associated social/ environmental/ economic issues
- The 'relevance' of addressing the category aim and associated social/ environmental/ economic issues within the country that the BREEAM scheme will be operated
- The 'potential' for addressing the category aim and associated social/ environmental/ economic issues within the scope and asset life cycle stage of the BREEAM scheme in question

Steps 3-5 above allow the methodology to be used to generate consensus-based weightings, as ratings for these elements can be obtained from a wide range of interested parties through stakeholder engagement activities.

In Stage 2, the seriousness, relevance and potential ratings are converted into category scores, and ultimately, the category weightings.

Appendix 1 presents full details of how the methodology works for all steps across both stages.

Figure 1: BREEAM weightings methodology process flowchart

Application of the methodology to the BRE Global operated BREEAM schemes for Buildings and Infrastructure

In late 2014, BRE began the process of applying the new weightings methodology to the following built environment sectors and life cycle stages for the BREEAM UK schemes:

- Buildings
 - New Construction
 - In-Use
 - Refurbishment
- Infrastructure
 - New Construction

This involved two rounds of stakeholder consultation activities. The first round was a facilitated stakeholder consultation workshop held in October 2014 at BRE Watford, which was attended by various BREEAM stakeholders representing a wide range of interest groups covering both the buildings and infrastructure sectors. Following facilitated exercises and group discussions, workshop delegates were asked to individually rate each of the 'seriousness', 'relevance' and 'potential' aspects (i.e. Stage 1: Steps 3-5) for the various BREEAM categories for a UK context. The workshop delegates' ratings and comments were analysed to derive a general consensus for all category ratings (based on the most frequent rating, i.e. the mode average). The second round was a publicly available online survey that was open for four weeks in December 2014/January 2015, the purpose of which was to verify the general consensus category ratings obtained from the workshop. The survey asked respondents whether they agreed or disagreed with the ratings and gave them an opportunity to change the ratings and provide justification for their changes.

Analysis of the results from the stakeholder consultation workshop and the subsequent online verification survey allowed the derivation of robust consensus-based ratings for all categories covered by the above Buildings and Infrastructure sector life cycle stages. Using Stage 2 of the methodology, these ratings were then converted into the final category weightings, which are applicable for use in BREEAM UK schemes.

The consensus-based category weightings have been applied to the BREEAM UK New Construction Infrastructure (pilot) scheme (see technical manual <http://www.breeam.com/uk-new-construction>) and have been used as the basis for the BRE Home Quality Mark's (Beta) scoring system (see technical manual <http://www.homequalitymark.com/standard>). The new methodology has also been applied to the process of adaptation of weightings for local conditions used in the BREEAM International New Construction Infrastructure (pilot) scheme and the updated BREEAM International New Construction 2016 scheme for buildings (see technical manuals <http://www.breeam.com/new-construction>). Moving forward, the weightings derived from this process will be applied to all relevant BREEAM schemes during the next major scheme update or launch of a new scheme.

The weightings generated by this process will be thoroughly reviewed at least every five years (since the relevance and potential ratings could change over this period) and will be updated if necessary. Updated weightings for the BREEAM Communities scheme will be derived using this methodology as part of the next major update of this scheme.

Conclusion

The new BREEAM weightings methodology is intended to address the inherent difficulties with establishing category weightings for sustainability assessment schemes that were outlined earlier in this paper. Whilst it is acknowledged that the new methodology requires some simplifications and concessions to be made (as would be the case for any other weightings methodology), this methodology helps to simplify the process of assigning consensus-based category weightings and ensure that it is possible to follow a consistent, logical and robust approach.

Acknowledgement

The authors would like to thank the BRE Trust for funding the weightings methodology development project work and subsequent stakeholder consultation activities.

Appendix 1 – Weightings Methodology

Stage 1: Establish ratings

To perform the steps in Stage 1 it is necessary to define some terms and boundary conditions.

The scope of social, economic and environmental sustainability issues with respect to the sector of BREEAM assessment (i.e. Buildings, Communities or Infrastructure) has been defined by BREEAM based on the indicators listed in the CEN/TC 350 standards covering the sustainability of construction works¹. For example the scope for each of the three dimensions of sustainability in the context of the BREEAM for Buildings schemes has been defined as follows:

- Social sustainability covers health and comfort of building users (e.g. thermal comfort, acoustic comfort, visual comfort, indoor air quality) and of neighbours (e.g. noise, light, vibration), safety and security (including resilience), stakeholder engagement, accessibility, responsible sourcing of materials
- Environmental sustainability covers pollution (e.g. emissions to air, releases to land and water), climate change, biodiversity, land use change, resource use (e.g. raw materials, non-renewables, energy, freshwater), waste and by-products
- Economic sustainability covers economic performance in terms of cost and value over the life cycle of the building

It is also necessary to define the boundary conditions for how the impacts of each category will be considered, i.e. at an asset, local or global level, for each of the three dimensions of sustainability. For example, for a BREEAM for Buildings scheme:

- Social impacts will normally be considered at a building/asset and/or local level since the majority of impacts in a social context will be on the users of the building, or users of the surrounding area
- Environmental impacts will normally be felt at a local and/or global level
- Economic impacts will normally be considered at a building/asset and/or local level since it is the economic performance of the building itself that is being assessed rather than the economic impact the building has on the national or global economy

For Stage 1 Steps 3-5, it is necessary to rate the 'seriousness', 'relevance' and 'potential' of addressing the category aim. Rating for these three aspects is performed using the following predefined six-point scale:

- Not Applicable (N/A); Very Low; Low; Medium; High; Very High

The scale is kept relatively simple to allow easy differentiation between ratings with a reasonable degree of consistency, noting that a minimum number of classification levels is required to recognise the differences in seriousness, relevance and potential between the different category aims.

The following points outline how each of the five Steps in Stage 1 are applied.

Step 1 - Determine the main aim for each category within a given BREEAM scheme

For each built environment sector covered by BREEAM (i.e. Buildings, Communities, and Infrastructure), category aims have been established for all categories covered by each sector's schemes, which are applicable to all life cycle stages of the sector (e.g. New Construction, In-Use, Refurbishment). For example, the Water category aim in BREEAM for Buildings is "to encourage a reduction in the building's operational water consumption whilst maintaining a reliable supply to the building".

Step 2 - Establish how the main category aim relates to each of the three dimensions of sustainability (economic, environmental and social)

With respect to the subject of assessment (i.e. building, community or infrastructure asset), the relevant definitions for the scope of social, environmental and economic sustainability are used to establish how these relate to each category aim. Box 1 provides an example of this for the Water category in BREEAM for Buildings.

Box 1

The following points provide an example of how the BREEAM for Buildings Water category aim relates to each of the three dimensions of sustainability:

- The social impacts of the category aim are those associated with the basic provision of a reliable, clean water supply to the building.
- The environmental impacts of the category aim are those associated with excessive water consumption, which could include over abstraction and the collapse of fresh water ecosystems. Further environmental impacts are felt as a result of the energy consumption associated with water transport, treatment and abstraction, e.g. climate change and depletion of resources.
- The economic impacts of the category aim are those associated with general day to day operating costs, and the potential financial costs associated with any interruption to supply, which could, for example, force a building to close temporarily until the supply is restored.

¹ EN 15643-1:2010 Sustainability of construction works - Sustainability assessment of buildings - Part 1: General framework

EN 15643-2:2011 Sustainability of construction works - Assessment of buildings - Part 2: Framework for the assessment of environmental performance

EN 15643-3:2012 Sustainability of construction works - Assessment of buildings - Part 3: Framework for the assessment of social performance

EN 15643-4:2012 Sustainability of construction works - Assessment of buildings - Part 4: Framework for the assessment of economic performance

EN 15978:2011 Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method

EN 16309:2014+A1:2014 Sustainability of construction works - Assessment of social performance of buildings - Calculation method

EN 16627:2015 Sustainability of construction works - Assessment of economic performance of buildings - Calculation methods

Step 3 - For each of the three dimensions of sustainability, establish the 'seriousness' of failing to address the category aim and associated issues

This step requires an assessment of the potential consequences of failing to address the category aim. This needs to consider the applicability of the category aim for each of the three dimensions of sustainability (as determined in Step 2) and the relevant boundary conditions. The seriousness rating should be considered in terms of a worst case scenario. Based on these considerations, a 'seriousness' rating is then determined using the six-point scale. A very high seriousness rating, for example, might be appropriate where the consequences of failing to address an issue are death or serious injury/illness (social), significant pollution (environmental), or significant costs/loss of value (economic). Box 2 provides an example of some points that could be considered when determining a seriousness rating.

Note: The seriousness rating does not need to consider the likelihood of the worst case scenario, or the particular relevance to the country in which the BREEAM scheme will be operated. These factors are accounted for in the next steps of the rating process. In effect, the 'seriousness' of an issue would be consistent internationally.

Box 2

The following points may be considered when determining a seriousness rating for the BREEAM for Buildings Water category aim:

- Social sustainability: failure to address resilience could result in an increased risk of interruption to supply, which could in turn make it difficult to maintain an acceptable living/working environment
- Environmental sustainability: failure to reduce water consumption will result in an increased risk of loss of freshwater ecosystems, which could in turn impact upon flood attenuation, waste assimilation and food production; there are also environmental impacts from pumping and treating mains water
- Economic sustainability: failure to reduce water consumption would result in increased building operating costs; failure to address resilience could increase the risk of interruption to the building's water supply, which will in turn have associated economic impacts if the building cannot be used.

Step 4 - For each of the three dimensions of sustainability, establish the 'relevance' of addressing the category aim and associated issues within the local context of the scheme in question

This step requires an assessment of whether addressing the category aim is particularly relevant to the local context (i.e. country) in which the BREEAM scheme will be operated, i.e. does it address an issue that is a particular problem in the country (or expected to become a problem in the future over the lifetime of the asset). This means that the 'relevance' for a category aim may vary depending on the country in which the BREEAM scheme will be operated. Based on these considerations, a 'relevance' rating is then determined using the six-point scale. A very high relevance rating for a BREEAM UK scheme, for example, might be appropriate where an issue is causing significant social problems in the UK (e.g. serious health conditions); is causing serious damage to the UK's environment and/or is a significant global problem (e.g. climate change); or could potentially result in significant operational costs or economic benefit to a UK-based building. Box 3 provides an example of some questions that could be considered when determining a relevance rating.

Box 3

The following questions may be considered when determining a relevance rating for the BREEAM for Buildings Water category aim:

- Social sustainability: Is the reliability of water supply a particularly relevant social issue for buildings in the UK? How reliable, accessible and affordable is mains water in the UK? Is the reliability of water supply in the UK likely to become a significant issue in the future as a result of increasing population and/or more extreme weather patterns due to climate change?
- Environmental sustainability: Are the impacts associated with excessive water consumption a particularly relevant environmental issue in the UK? Is over abstraction and loss of associated wetlands etc. a significant issue in the UK? Are the environmental impacts from pumping and treatment of mains water a significant issue in the UK?
- Economic sustainability: Are the costs associated with water supply, and the risk of interruption to supply, a particularly relevant economic issue for buildings in the UK? How does the cost of water relate to the other operational costs associated with running a building?

Step 5 - Establish the 'potential' to address the category aim and associated issues within the scope of the BREEAM scheme in question

This step requires an assessment of what opportunities there are for the BREEAM scheme to address the category aim. This will require consideration of the following:

- The extent to which the issue can be influenced at different life cycle stages of the asset; in some instances, there may for example, be greater potential to address a category aim through the way in which an asset is managed (i.e. through the In-Use life cycle stage), than there is through influencing how the asset is designed (i.e. through the New Construction and/or Refurbishment life cycle stages), and vice versa
- The extent to which the issue is covered by existing legislation and/or regulation in the country of operation, as there may be limited potential to improve upon existing mandatory requirements
- The extent to which the issue is dependent on external factors that are outside the control of the design team or asset manager/owner

If many of the factors that influence the category aim are outside the influence of the project or management team(s), or there are already stringent regulatory requirements in place in the country of assessment, the potential for addressing a given category aim through a BREEAM scheme may be limited. Based on these considerations, a 'potential' rating is then determined using the six-point scale. A single rating for potential is awarded across the three dimensions of sustainability. Box 4 provides an example of some points that could be considered when determining a potential rating.

Note: The potential for addressing the category aim in an environmental context should be considered in terms of the relative contribution that an asset makes to the wider issue(s), i.e. it may be possible to have a significant impact on the energy and related carbon emissions of the asset through design and specification, even though this reduction may be small when compared to addressing the wider global issues of climate change and fossil fuel abstraction.

Box 4

The following points may be considered when determining a potential rating for the BREEAM for Buildings Water category aim for a BREEAM UK scheme:

- It is possible to incorporate measures as part of the building design and construction that will help to reduce water consumption, and reduce reliance on the mains water supply
- It is possible to impact water consumption through the way in which a building is managed, e.g. campaigns targeting user behaviour, implementation of effective maintenance procedures, etc.
- Local and national infrastructure may be considered to be a significant external factor with respect to the reliability of the water supply
- In England, Building Regulations Approved Document Part G addresses water consumption in the design of dwellings, but there is limited UK legislation in place that deals with water consumption for non-domestic buildings

Stage 2: Apply scoring

Step 1 - Convert the ratings for seriousness, relevance and potential from Stage 1 into numerical equivalents

The ratings from Stage 1 are converted to numerical equivalents using the following conversion factors:

- N/A = 0, Very Low = 1, Low = 1.5, Medium = 2, High = 2.5, Very High = 3

If a consensus-based approach is being employed (i.e. Step 1 has generated multiple ratings from a range of stakeholders), the ratings from each stakeholder need to be analysed to derive an overall consensus rating for each of the category's seriousness, relevance and potential elements. These overall consensus ratings would be based on the most frequent rating (i.e. the mode average rating) for each element.

Step 2 - For each of the three dimensions of sustainability for a given category, multiply the scores for seriousness, relevance and potential, to calculate individual social, economic and environmental sustainability scores

Figure 2 presents a visual representation of this calculation.

Note: The scores are multiplied because the overall 'importance' of the category is a function of the seriousness, relevance, and potential, and all should be considered in parallel. It is not appropriate to add the scores as this could, for example, result in a rating being given for a particular dimension of sustainability, even if it was not relevant, or there was no potential for addressing it.

Step 3 - For each category, add the individual social, economic and environmental scores to generate the overall category score

Figure 2 presents a visual representation of this calculation.

	Category 'Z'				
	Seriousness		Relevance		Potential
Social	A	×	D	×	G
			+		
Environmental	B	×	E	×	G
			+		
Economic	C	×	F	×	G
Category 'Z' Score = (A x D x G) + (B x E x G) + (C x F x G)					

Figure 2: Visual representation of the category scoring methodology

Step 4 - After the scores have been calculated for all categories, normalise the scores so that the sum of all category weightings is equal to 100%

In BREEAM schemes the category scores are expressed as percentages. Therefore the category scores from Step 3 are normalised using the following formula to generate the final category weightings as percentages:

$$\text{Category weighting} = \frac{100}{\sum \text{Category scores}} \times \text{Individual category score}$$

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BRE Global

Bucknalls Lane
Watford
United Kingdom
WD25 9XX

T +44 (0)333 321 8811
E breeam@bre.co.uk
www.breeam.com

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