Sustainable Construction in Humanitarian Action

Criteria for humanitarian building sustainability

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Humanitarian organisations have an interest in improving the sustainability of buildings that support the assistance provided to people affected by conflict and disaster. Yet, usual means of assessing building sustainability - e.g., labels such as LEED and BREEAM - are not suited to the priorities and contexts of humanitarian action. This paper describes research seeking to identify building sustainability criteria that are relevant and feasible in relation to building in the context of humanitarian programs. A comprehensive master list of building sustainability criteria is developed and presented in a novel graphic format that supports comparison and analysis. Then, consultations with humanitarian construction practitioners support development of a ranked short list of criteria that are particularly relevant to the priorities and contexts of humanitarian assistance. The research is the first stage of a project developing an analytic framework and digital tool to support building sustainability assessment in the context of humanitarian action.
KEYWORDS: building; sustainability; assessment; criteria; humanitarian;

1. INTRODUCTION

Humanitarian assistance entails saving lives, alleviating suffering and protecting the dignity of people affected by conflict and disaster. The urgency of humanitarian response contrasts with the duration of construction and the durability of built work. Yet, construction – of health facilities, schools, etc. - is an important function of many humanitarian organisations.

The urgency and relatively short funding cycles of humanitarian assistance also contrasts with the long-term consideration of sustainability. Yet, sustainability is increasingly important for humanitarian organisations, due, *inter alia*, to donor concerns and recognition of links between sustainability, climate change and the incidence of humanitarian crises. Recently, numerous initiatives have aimed to improve the social, economic and environmental sustainability of humanitarian organisations and their operations (e.g., [1]). Improving the sustainability of humanitarian construction is one aspect of this broader emphasis on improved sustainability of humanitarian assistance.

Improved construction sustainability is typically supported by assessments of building and infrastructure designs and operation. Various methods and systems have been developed to support such assessments. Numerous sustainability labels (e.g., Leadership in Energy and Environmental Design, LEED) are available that define sustainability assessment methodologies and provide certification for buildings and infrastructure. Notwithstanding limitations, they are widely recognised and provide an accessible means of assessing and comparing sustainability, thereby promoting improvements in sustainability performance.

However, in general, sustainability labels are not readily applicable to the work of humanitarian actors. In particular, widely-used labels such as LEED and the Building Research Establishment Environmental Assessment Method (BREEAM) have been developed with regard to buildings and infrastructure in developed economies with relatively sophisticated building industries (and exported to socially and economically comparable markets). Notwithstanding international use of these labels, the criteria, priorities and benchmarking data they employ may be less relevant to less-developed and unstable contexts of humanitarian assistance [2]. Further, label assessment methodologies require expertise and data about buildings and contexts that may not be readily accessible for humanitarian organisations nor available for the countries in which they work.

This paper addresses the applicability of building sustainability labels and the criteria they use to construction work of humanitarian organisations. It reports research aimed at identifying criteria that are most relevant and feasible, or adaptable, in relation to assessment of building sustainability in the contexts of humanitarian assistance. This research is the initial stage of a collaboration between EPFL, ETH and the

International Committee of the Red Cross (ICRC), which aims to support improved sustainability of humanitarian construction. The subsequent stage involves development of an analytic framework and digital tool tailored for building sustainability assessments within the arena of humanitarian action.

2. METHODOLOGY

While the research has focussed on the work of the ICRC, it is intended to address a broader scope of humanitarian construction. The ICRC's mandate of assisting those affected by conflict encompasses various forms of assistance, including provision of protection, healthcare and basic services such as water and sanitation. While ICRC operations encompass a large proportion of humanitarian crises internationally, disaster-related situations not involving conflict are not explicitly addressed here.

A large range of building sustainability assessment labels are available (Bernardi et al. list 63 labels [3]). These labels are distinguished by different priorities, criteria, and scoring systems. Yet, many apparent differences are attributable to variations in terminology and structure rather than substantial differences in ways that sustainability is defined and assessed. Eight labels are addressed here:

1. LEED (New Construction, v.4.1)
2. BREEAM (International, New Construction)
3. EDGE (https://edgebuildings.com/)
4. SBTool (www.iisbe.org/sbmethod)
5. DGNB (New Buildings, International)
6. SNBS (v. 2.1) (www.snbs-batiment.ch)
7. HQE (International, Non-residential Buildings)
8. QSAND (www.qsand.org/)

In addition, criteria defined in standard ISO-21929-1:2011 – *Sustainability in Building Construction (Sustainability Indicators)* [4] are also taken into account.

The research comprised two components: 1) development of a weighted master list of building sustainability criteria, and 2) editing of the master list into a short list of criteria that are particularly relevant to buildings associated with humanitarian action.

The first component involved development of a weighted criteria master list through review of the group of nine labels. The review first involved comparison of criteria from each label. Given differences in structure, and terminology, a consistent hierarchy was adopted that distinguished between *criteria*, *indicators* and *categories*. Here, *criteria* refers to specific aspects of building sustainability (e.g., operational energy consumption). *Indicators* refers to measurements of performance in relation to each criterion (e.g., annual energy consumption). *Categories* refers general topics under which criteria are grouped (e.g., energy). Criterion weight was defined as the weighting of the criterion in relation to maximum score available in the label. For example, LEED (New Construction, v.4.1) has a maximum score of 110 points and allows a maximum of 4 points for *Renewable Energy*, resulting in a weight of 0.045. Definition of weight also highlighted non-scored prerequisite criteria.

The nine label-specific criteria lists were then combined into a single master list. This involved a process of comparison of criteria and indicators, taking into account differences in terminology and categorisation of criteria and indicators. For each criterion, aggregate weight was defined as the sum of label-specific weights. The definition of aggregate weight also highlighted criteria that are non-scored prerequisites in any of the labels.

The second research component involved practitioner consultations that informed editing of the master list into a short list. Building professionals (i.e., architects, engineers, and project managers) from ICRC and other humanitarian organisations were engaged in three phases of consultation. Consultations addressed the *relevance* and *feasibility* of building sustainability criteria in relation to humanitarian assistance. Here, *relevance* refers to the importance of criteria in relation to the functions of humanitarian buildings and the priorities of stakeholders. *Feasibility* relates the availability of project-specific and context-specific data, computational tools and expertise required to measure the criteria via associated indicators.

The first preliminary consultation sought to remove from the master list criteria that are clearly incompatible with contexts and functions of humanitarian assistance, to provide a group of criteria to be addressed effectively in more-detailed consultations. A focus group discussion involving two senior humanitarian construction practitioners informed this initial edit (which was later reviewed and adjusted in the larger focus groups during the third round of consultation).

The second consultation addressed in greater detail the feasibility of the remaining criteria. In an online survey, 48 humanitarian construction practitioners rated the feasibility of implementing 30 building sustainability criteria in the context of humanitarian assistance programs. Feasibility scores (from 0 to 5) were assigned by each respondent and then combined into aggregate feasibility scores (from 0 to 1) for each of the criteria.

In the third round, a consultation workshop addressed together the relevance and feasibility of the criteria from the master list. 11 participants were asked to position criteria in a field indicating relative relevance (vertical axis) and feasibility (horizontal axis). Assessments of relevance and feasibility addressed in the questionnaire survey (i.e., the second consultation) were first adjusted by participants. Then, additional relevant criteria from the master list were added and positioned in relation to relevance and feasibility determined by practitioner participants.

4. RESULTS

Review of each of the nine sustainability assessment labels identified criteria that are represented for each label in **Annex 1**. Combination of the criteria from each label identified 108 building sustainability criteria, which are listed with aggregate weights in **Annex 2**.

The 108 criteria are presented graphically in **Figure 1**, in which each node represents a sustainability criterion. Node sizes represent aggregate weight, with the width of grey circular bands representing weighting of the criteria in individual labels. Node colours represent dimensions of sustainability – green represents environmental conservation, orange represents social development, blue represents economic development. Nodes are positioned in segments representing generic categories that have been defined taking into account the various categories of the nine labels.

The results of consultations are presented in **Figure 2**, which highlights the 40 sustainability criteria deemed by informants to be particularly relevant to building in with regard to humanitarian assistance. Weights of these criteria – i.e., the size of the nodes – take into account workshop adjustments from the third round of consultation. **Annex 3** lists these criteria with adjusted weight/relevance and feasibility scores, which were modified from original aggregate weights and original feasibility ratings.

5. DISCUSSION

Figure 1 suggests a preponderance of environmental conservation in sustainability assessment labels. Of the 108 criteria, 72 (67%) are associated with environmental conservation, while 46 (42%) are associated with social development and 24 (22%) with economic development. Moreover, of nine of the ten highest aggregate weighted criteria are associated with environmental conservation. This reflects broader societal perspectives and priorities regarding sustainability as well as the evolution of assessment labels, with prominent labels (e.g., LEED and BREEAM) originally addressing environmental conservation only [3]. Despite the evolution of more holistic sustainability concepts, environmental conservation retains prominence compared to social and economic development.

In general, criteria are distributed evenly across the nine categories in **Figure 1**. One exception to this is the category of *Culture*, which comprised only two criteria addressed in SBTool, SNBS and ISO-21929.

Notwithstanding this distribution, the inordinate weighting of a small group of criteria highlights specific priorities. Among the range of 108 criteria, inordinately weighted criteria include:

1. Assessment and minimisation operational energy demand (C2),
2. Assessment and reduction of GHG emission from operation (F7),
3. LCA and optimisation of life-cycle impacts (operational and embodied energy) (C3, E5),
4. Design and provision for healthy air quality (G3),
5. Reduction of operational water demand (D4),
6. Selection of an appropriate site that has positive impacts on the land and surrounding area (B1),
7. Management of surface water, inc. collection and recycling (D1),
8. Adaptability to new uses and functions (H4),
9. Protection of site ecology, inc. flora & fauna (B5),
10. Design and provision of comfortable user-controlled heating and cooling (H1).

The consistently high weight allocated to these criteria across labels suggests a consensus that these criteria are particularly significant aspects of building sustainability.

Development of a short list of criteria that are particularly relevant and feasible in relation to humanitarian action entailed omission of many criteria from the master list. From 108 criteria in the master list, 40 criteria remained in the humanitarian-specific short list presented in **Annex 3**. The extent of omissions is in part attributable to the formats of consultations that restricted the depth of consideration of the wide range of criteria in the master list. Yet, the format of consultations also permitted informants to focus on criteria considered particularly relevant to their work.

The 68 omitted criteria may be characterised in several ways. 11 of the omitted criteria (16%) pertained to functions deemed irrelevant (or not significantly relevant) to humanitarian objectives, such as cold storage, laboratory and residential functions. 10 of the omitted criteria (15%) relate to features of sites and surrounding neighbourhoods. In excluding these criteria, practitioners cited the lack of control humanitarian organisations have over site selection. 7 of the omitted criteria (10%) relate to building systems that were deemed irrelevant to humanitarian action due to inordinate complexity and/or excessive cost; this included criteria relating to mechanical HVAC systems. Finally, criteria were omitted that were not deemed irrelevant, though were assessed as being of low significance in light of pressing needs characterising humanitarian assistance; this included criteria addressing, e.g., water temperature, light and noise pollution, as well as acoustic and olfactory conditions.

The resultant short list retains the preponderance of environmental conservation that characterised the master list. The short list also generally maintains the distribution of criteria across the nine categories, with the exception of the category of *Location and Site*, which is less represented in the short list, reflecting the limited control of humanitarian actors over site characteristics.

Adjustments to criteria relevance scores during workshops entailed changes to relative weight of these criteria in response to constraints and priorities of humanitarian action, compared to general building contexts addressed in assessment labels. These adjustments included increases in the relevance scores of 16 criteria, reductions in the relevance scores of six criteria, and the addition of 11 new criteria from the master list. No trend is apparent in these three groups of criteria regarding associated dimensions or categories.

Adjustments of feasibility scores during consultations entailed changes from the feasibility assessments derived from the questionnaire survey. The discursive character of the workshops enabled informants to consider in greater detail the factors affecting feasibility and to arrive at an improved assessment. Adjustments included increases to feasibility scores of seven criteria and reductions in feasibility scores of 13 criteria. As with changes to relevance scores, no trend is apparent in these two groups of criteria in relation to the associated dimensions or categories. Yet, the preponderance of reductions suggests that, in general, assessing building sustainability in humanitarian contexts is less feasible (i.e., more difficult) compared to usual contexts.

The manner in which these scores of relevance and feasibility are presented – specifically, the numerical precision – suggest a degree of accuracy that is not actually provided by the methods employed. The scores are determined from subjective assessments of a group of practitioners that occupy similar roles – architects, engineers and project managers working for humanitarian organisations. Rather than precise ratings, the scores allow relative positioning of the criteria from the perspective of expert practitioners.

Despite this limitation, this identification of criteria that are particularly relevant to building in relation to humanitarian assistance is a useful contribution to improving sustainability in this specific arena. The criteria identified in this study provide a foundation for the ongoing development of an analytic frame and digital tool that will enable the ICRC and other organisations to assess the sustainability of their building activities. Specifically, the findings of this study serve to focus attention on criteria that are the most relevant and feasible aspects on sustainability in relation to humanitarian construction.

6. CONCLUSIONS

A review of eight building sustainability assessment labels and one related standard informed development of a comprehensive range of 108 criteria and associated label-specific weights. These weights are taken to indicate the relative importance attributed to each criterion. Thus, aggregated weights across the group of labels are taken to indicate a consensus on the relative importance of each criterion as an aspect of building sustainability. The novel graphic format developed to present these criteria highlights the preponderance of the dimension of environmental conservation over those of social and economic development.

A consultation process engaging humanitarian construction professionals (i.e., architects, engineers and project managers) served to identify from this master list a short list of criteria that are particularly relevant and feasible in relation to construction in humanitarian action. *Relevance* here refers to relative importance in relation to the objectives and priorities of humanitarian assistance and the actors involved in its provision, while *feasibility* refers to the availability of project-specific and context-specific data, tools and requisite expertise to measure the criteria. 40 building sustainability criteria were highlighted as being particularly relevant/important in relation to buildings in the context of humanitarian assistance.

The process of consultation highlighted in the short list a smaller group of around ten criteria that were inordinately weighted – i.e., assessed by practitioners as being additionally important aspects of building sustainability in the context of humanitarian action.

The consultation process entailed subjective assessments of a relatively small group of practitioners. Nevertheless, the short list focusses attention on sustainability criteria that are particularly relevant to construction in the context of humanitarian action. This short list of criteria will inform ongoing research and development of a building sustainability assessment framework and digital tool tailored to the requirements of humanitarian organisations.

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Figure 1: *Graphic presentation sustainability criteria master-list including aggregate weight and categorisation*

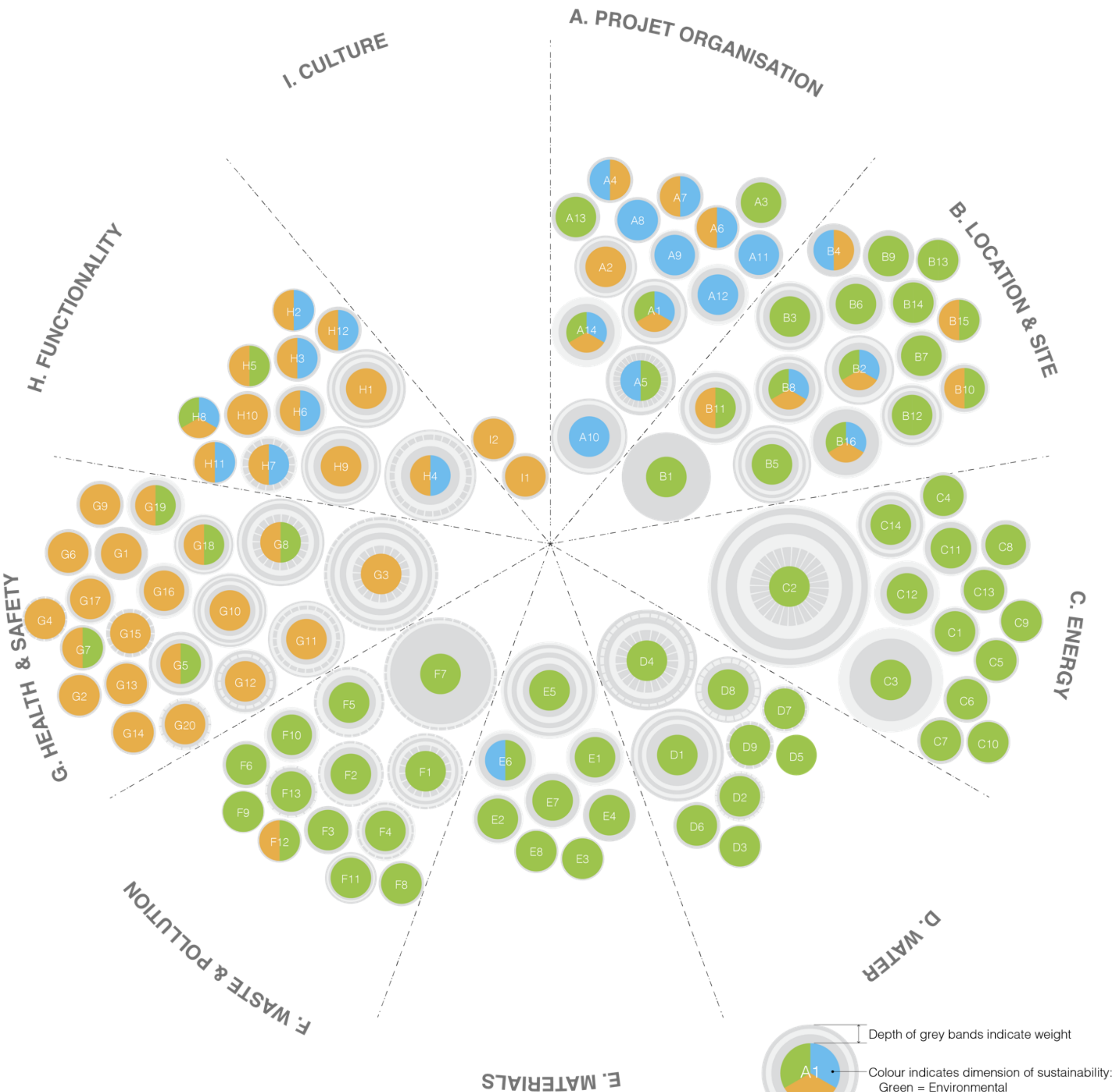
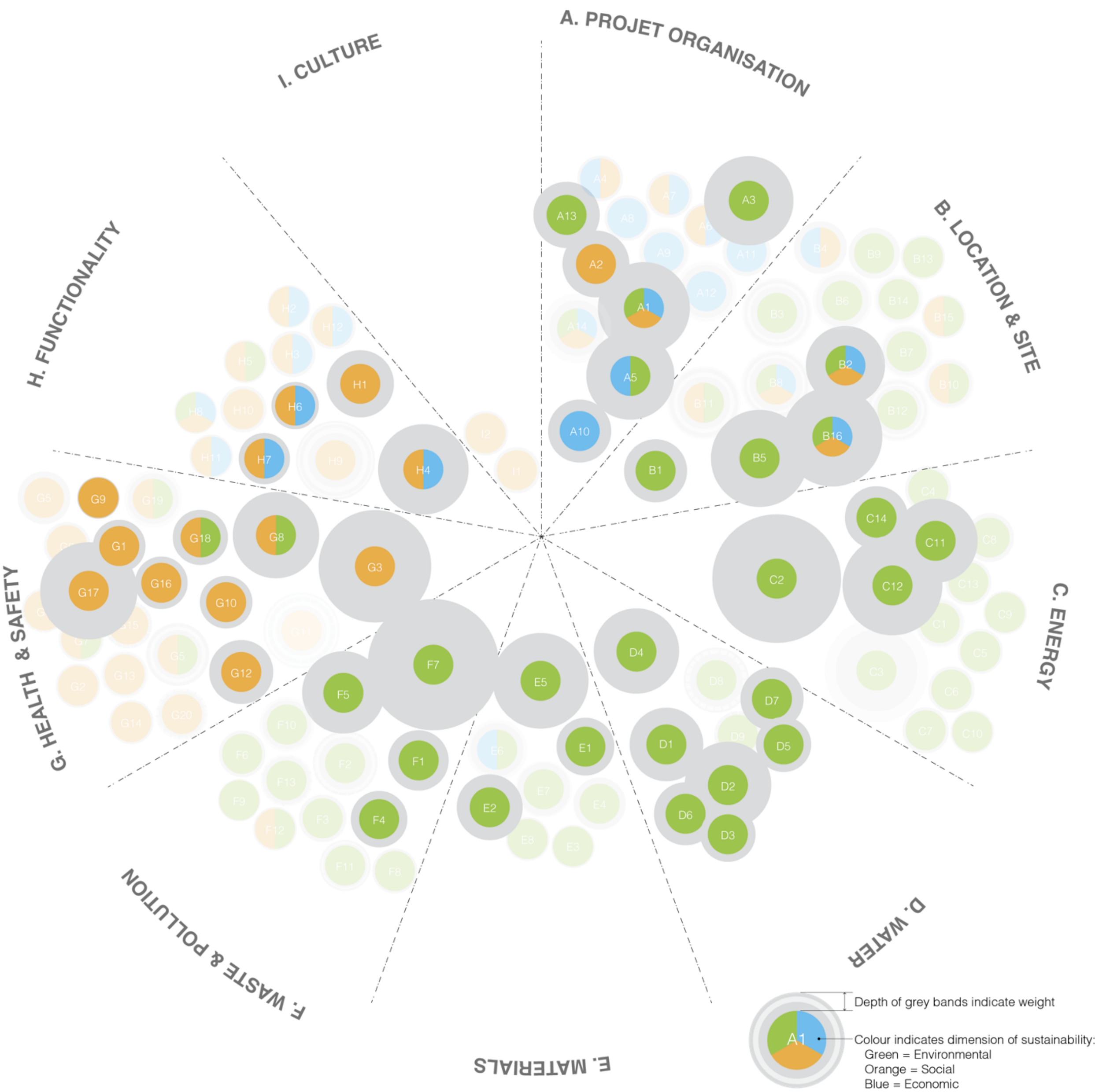


Figure 2: *Graphic presentation sustainability criteria short-list with adjusted weight reflecting relevance to humanitarian action*



A1	Comprehensive & consultative project brief	C2	Assessment and minimisation operational energy demand	D7	Installation of water metering with data collection and display	G8	Design and provision of comfortable user-controlled heating and cooling
A2	Participative design process (disciplines & users)	C11	Arch. design to reduce radiant and conductive heat gain/loss	E1	Assurance of resp. sourcing & efficient use of raw materials	G9	Architectural design to optimise thermal comfort
A3	Monitoring & reporting env. impacts during construction	C12	On-site renewable energy production	E2	Specification and use of recycled building material	G10	Design and provision of comfortable acoustic conditions
A5	Commissioning planned and undertaken	C14	Install. of energy metering w. data collection and display	E5	LCA and optimisation of life-cycle impacts (embodied energy)	G12	Design for comfortable natural lighting
A10	Life-cycle cost (LCC) calculation	D1	Management of surface water, inc. collection and recycling	F1	Assessment and reduction of construction waste	G16	Spec. of user control systems for ventilation, thermal & lighting
A13	Assessment of project impacts on local economy	D2	Assessment and reduction of landscaping water demand	F4	Provision for operational waste recycling	G17	Design & prov. for safety & security in relation to personal threat
B1	Selection of approp. site that has pos. impacts on surrounds	D3	Reduction in construction water demand	F5	Prov. of facilities for operational waste management & disposal	G18	Design & prov. for safety &security in relation to natural hazards
B2	Avoidance of negative impacts on local properties	D4	Reduction of operational water demand	F7	Assessment and reduction of GHG emission from operation	H1	Design & prov. for accessibility throughout the building and site
B5	Protection of site ecology, including flora and fauna	D5	Installation of operational water recycling	G1	Design and provision of sanitary health conditions	H4	Adaptability to new uses and functions
B16	Compliance with planning policies and regulations	D6	Installation of a leak detection system	G3	Design and provision for healthy air quality	H7	Design and provision for ease of maintenance & cleaning