

Is BREEAM suitable for small and medium refurbishment / maintenance projects?

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The introduction of sustainability assessment tools such as BREEAM has changed the way buildings are designed and constructed. If implemented properly, these tools can help to reduce the CO_2 emissions during and after the construction of the projects, bringing enormous benefits to the clients and end users as well as the society at large. However, these tools have found little application in most of the small and medium sized refurbishment / maintenance construction projects. Based on literature and practitioners' opinions and experiences sought through semi-structured interviews, the sustainability assessment tool BREEAM has been critically evaluated. This research found that the BREEAM is mainly designed for large new build projects encompassing whole buildings, and it is expensive and time consuming to undertake so it is not suitable for small / medium sized refurbishment / maintenance construction projects. To exacerbate the problem, practitioners for such projects have very limited knowledge and training into using the tool. An alternative sustainability assessment tool in a simpler format and more affordable for assessing such projects is urgently needed. More and better training is also needed for the practitioners to raise their awareness of sustainable development and improve their capability of applying the sustainability assessment tools in their projects.

Key Words: Sustainability assessment tool, Refurbishment / maintenance projects, Small and medium sized construction

Sustainable development

To meet the needs of the increasing population and their desire for better living, the construction industry needs to provide more houses and other infrastructures such as schools, offices, hospitals, roads and bridges, and airports (Burinskien, 2009). As a result, the construction industry has been and still is one of the major contributors to environmental problems, using vast amounts of energy during and after the construction of the buildings, and generating wastes through construction and demolition (Ding, 2006). For example, buildings in the UK count for 39% and 68% energy and electricity usage retrospectively (Retzlaff, 2008). It is estimated that the UK construction industry is responsible for some 120 million tonnes of construction waste every year, around one third of all waste arising from the UK (WRAP, 2010). It is therefore paramount that the industry considers sustainable solutions to ensure that growth can be managed.

One of the fundamental breakthroughs in sustainability is the Bruntland Report, *Our Common Future*, which defined sustainability as development which meets the needs of the present without compromising the ability of future generations to meet their own needs. It pointed out that the earth's resources cannot last forever and that sustainable development was needed to prevent the environmental and social downfall globally (WCED, 1987). Although there still exist some doubts in climate change and its impacts on our world, there are many significant drivers of sustainability, including corporate social responsibility, green credential, client needs, and business needs such as reduction in cost and competitive advantage (Dixon *et al*., 2007).

Sustainability assessment tools

The construction industry has been gradually adapting to these sustainability concepts to reduce its environmental impact and increase economic and social opportunities. As one of the measures for sustainable construction, building sustainability assessment tools have been developed to guide the design and construction of building projects to be more environmentally friendly and ultimately sustainable (Pope *et al.*, 2004). This will increase the value of the buildings and reduce the costs in both construction and operation through reduced waste and increased energy efficiency. The assessment results enable the clients, the end users and the society to make knowledgeable decisions regarding to their building products. The sustainability assessment tools score a building project against a set of parameters to establish indicators of how it performs sustainably. The parameters include building technology, construction design, and community and neighbourhood issues within the assessment scoring criteria (Rezlaff, 2008). There are a number of sustainability assessment tools available such as BREEAM (UK), CASBEE (Japan), Green Star (Australia) and LEED (USA) which have established history and are recognised within the construction market and are making an impact within the construction industry.

BREEAM (British Research Establishment Environmental Assessment Method) is developed by the British Research Establishment (BRE) for environmental assessment to rate general building projects. The latest revision of BREEAM released in 2011 takes a life cycle assessment approach and comprehensively assesses ten individual elements, i.e. management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution and innovation, with different weighting ranging from 6% for water to 19% for energy. It uses a six tier scoring system for the overall sustainability performance of a building as unclassified (<30%), pass (30%), good (45%), very good (55%), excellent (70%), and outstanding (85%) (BRE, 2011). Compared to the previous 2008 version, this latest version awards additional credits to innovation in building design and procurement to recognise any sustainability related benefits or performance levels which are not currently recognised by the standard BREEAM assessment issues and criteria. The assessment is initially undertaken at early design stage to ascertain that sufficient and proper sustainability measures have been considered and incorporated into the project, and then again at construction completion to validate that all the sustainability elements from the design stage are actually implemented in the final product (BRE, 2011). BREEAM maintains a flexible 'balanced-score card' system to allow the majority of the BREEAM credits to be traded to achieve the target rating, i.e. non-compliance in one area can be off-set through compliance in another, but the minimum standards of performance in the main areas including energy, water and waste have to be met. The assessment has to be undertaken by an independent assessor specifically trained and qualified by BRE (BRE, 2011).

New build vs. refurbishment / maintenance

The focus on sustainable development and its assessment has mainly been on new build construction because new build can provide full sustainable design without being compromised by existing features, such as thermal properties, acoustic properties, natural lighting levels and layout (Baker, 2009). However, new buildings count only a very small portion of building replacement annually, around 1-2% in the UK. It is also argued that new build projects are not the answer to sustainable development because they use more resources and energy and produces more waste than a refurbishment / maintenance project through construction and demolition, and there may also be some planning problems (Ding 2008; Baker, 2009; Mansfield, 2009). In fact, a large proportion of building projects are refurbishment / maintenance of the existing property stock, especially in developed countries like the UK. Refurbishment means replacing any element of a building other than its structure, including repair, acquisition and rehabilitation, conversion and re-improvement (Douglas, 2006). This type of development is popular to developers due to the availability of dilapidated building stock, and being faster and cheaper (Mansfield, 2009). Refurbishment / maintenance also prolongs the life of a building and reduces the overall environmental impact of the building (Hertzsch *et al*., 2011), therefore adds market value to a building (Chau *et al*., 2003). However, due to the restraints of the structure of the existing buildings, refurbishment / maintenance projects may not be able to achieve a concise sustainable design, and the fabric of older buildings can also be energy and resource inefficient, therefore affecting its ability to compete sustainably with new build development (Mansfield, 2009).

Problems with the existing sustainability assessment tools

With all the benefits they bring to sustainable construction, these sustainability assessment tools are criticised for being too expensive and time consuming and therefore have not been widely used in refurbishment projects (Jayne and Mackay, 1999; Baker, 2009). A BREEAM assessment costs between £2,000 and £10,000, which is comparable to Green Star, but cheaper than LEED at around £37,000 (Saunders, 2008). With a usually smaller and tighter budget and shorter time scale, it is not totally surprising that many of the refurbishment / maintenance projects opt not to undertake the sustainability assessment. Public funded refurbishment projects using BREEAM in the UK are as little as 18% (Mansfield, 2009). This has been exacerbated by the global financial crisis and economic recession in the past few years because the environmental and social factors may not be pursued or their consideration is substantially reduced due to less finance availability.

Although they assess the projects' environmental performance, the existing sustainability assessment tools such as BREEAM largely ignore the social and economic dimensions of the sustainable development. They are also mainly designed to assess the whole buildings only, which could be problematic for refurbishment / maintenance projects because a refurbishment / maintenance can be both the whole building and only part of a building (Happio and Viitaniemi, 2008). This certainly could affect achieving sustainable assessment within multiple occupied buildings such as office blocks and industrial units, where part refurbishment by different occupiers is undertaken. These sustainability assessment tools are also criticised for affecting design and innovation due to their emphasis on standardised design (Cole, 2005). In addition, the higher scores within elements can off-set lower scores within the assessment, providing an incorrect rating of the overall project (Sawyer *et al.*, 2008).

Research methodology and research design

Although appearing two decades ago, the sustainable development and its assessment tools are rapidly developing yet their use is still low in refurbishment / maintenance projects. This research aims to critically evaluate the application of BREEAM in small and medium sized refurbishment / maintenance projects and identify ways to effectively conduct sustainability assessment in such projects.

There are various causes for the low level of application of BREEAM in small and medium sized refurbishment / maintenance projects and the stakeholders have different opinions in how these sustainability assessment tools should be designed, funded and applied to refurbishment / maintenance projects, which tends to be more subjective than objective. Therefore, a qualitative approach is appropriate to explore the multiple layers of the problems and capture practitioners' experience and opinions on this subject. It is decided that an interview approach is suitable for this research, because it can gain an in-depth understanding or knowledge through verbal communication. In this research, face-to-face interview is preferred as it can capture the complex information such as opinions and experience through well designed questions and have the full attention of the interviewees to ensure that the questions are answered effectively (McBurney and White, 2007). With a set of open-ended questions, the interview is semi-structured to explore practitioners' various experiences and opinions on how the BREEAM works in practice and what needs to change so that they can be applied to refurbishment / maintenance projects more effectively. The answers to the same set of questions can also be compared and contrasted to explore the complexity of the research subject, from which a robust conclusion can be made. Whenever possible, the interviewees were encouraged to use their project cases to elaborate their points.

In order that different stakeholders' opinions are presented, considered and cross checked, two interviewees were selected from each of the main stakeholder categories within refurbishment / maintenance projects, i.e. two client project managers (A and B), one architect (C) and one M&E engineer (D), and two construction project managers (E and F). All the interviewees have worked in the construction industry for many years (ranging from 6 (D) to 23 years (B)) and they all have used BREEAM in their previous projects so they could provide valuable opinions. All the interviewees selected are based in the West Midlands area in the UK for logistics convenience. The interviews were undertaken in a meeting room at the interviewees' work place, and with the interviewees' permission recorded through a Dictaphone so the interviews could be thoroughly analysed later.

Although the number of interviews conducted in this research is limited and the interviewees are hardly representative enough in terms of location and project experience to depict a complete picture of the application of BREEAM in refurbishment / maintenance projects, it does provide a valuable snapshot of the current practice, which will help to identify the problems existed and point out the ways forward.

Data analysis and discussion

In this section, the findings from the interviews will be presented and analysed in conjunction with the existing literature so that the research aim can be achieved.

Benefits of BREEAM

Although considered in practice as a tick box exercise for delivering sustainable construction by some of them, most of the interviewees agreed that implementing BREEAM does bring some benefits, especially the environmental ones. They agreed that the energy saving measures required by BREEAM were of a great benefit to the end users to reduce operational costs, and the energy saving within the assessment rating can provide useful benchmarking against other buildings, which could increase their market value and saleability. They also stated that waste treatment and re-use of materials measures could reduce the waste sent to landfill and help to curb the escalating waste costs and alleviate the environmental impact. BREEAM also encourages sustainable energy source, local sustainable materials and water saving and reuse. C particularly pointed out that the sustainability measures such as SUDS drainage systems can improve wildlife habitats. Overall, BREEAM does have a very positive impact on the construction industry to make people rethink their projects and direct them to a more sustainable construction.

Cost of BREEAM assessment

Although all the interviewees have extensive industry working experience and BREEAM assessments have been around since the early nineties and it is one of the most established tools internationally (Howard, 2005), they have used it in their projects (ranging from 1 to 5 projects) for only 2 – 3 years, which appears to be low in comparison with their work experience in the industry. They also stated that they only used BREEAM in new build projects with value over £1 million. When asked the reasons for the low level of application of BREEAM in refurbishment / maintenance projects, C's answer is typical:

'*BREEAM is rarely considered for construction refurbishment projects, as it is too complex and expensive to use'.*

BREEAM assessment is costly and time consuming to develop a finished design due to its life cycle design analysis and the finished BREEAM design is also more expensive to construct. The increase in mechanical and electrical equipment required by BREEAM also significantly raises the long-term maintenance costs. F cited an example of rainwater harvesting system. Although its installation is awarded more credits and achieved a higher BREEAM rating, such a system is costly to install, unreliable, and uses energy to pump water into the systems and needs excessive amounts of water to fill a tank from mains water when breakdown.

The interviewees also identified there is a lack of such demand from clients. While they are keen to apply BREEAM in new build and larger projects in order to gain the green credential and therefore improve the marketability of their projects, the clients do not have many incentives to do so in the refurbishment / maintenance projects, especially when the clients are not the actual end user. C further pointed out that the clients are still very much cost driven and do not think in longer term. They just want the cheapest functional building for their business needs but not fully sustainable building with a higher cost. F concurred with C's opinion and questioned:

'*How can a client justify the additional work and cost of undertaking a BREEAM assessment?'*

The interviewees agreed that buildings with a BREEAM rating should mean cheaper operating costs and should have better marketability, leading to economic benefits such as higher rate charges for the landlords. However, this seems not have been materialised so far due to a weak property market, and therefore discounted by clients because of the higher overall development and construction costs.

Additionally, a trained assessor is required for the assessment. The estimated BREEAM assessment cost between £2,000 and £10,000 (Saunders, 2008) may be only a very small fraction to new build projects, but it would be quite substantial to refurbishment / maintenance projects. Therefore, all the interviewees stated that sustainability assessment will not be conducted if not mandatory. Just as D commented:

'The sustainability assessment tools will never be fully used, if not made mandatory through legislation '

They suggested that making it mandatory for planning application would be the way to encourage sustainable assessments. However, they do realise that this may not apply to refurbishment / maintenance projects because those projects are more just a replacement and upgrade of the existing building fabric rather than a change in use or design and therefore may not need planning permission in the first place.

The demand for sustainability assessment has first to come from the clients who dictate the whole development process and ultimately pay for the project. The change has also to be driven through legislation such as Building Regulations, which apply to all types of projects including refurbishment / maintenance projects (Howard, 2005). At the same time, a simpler and more cost effective and affordable tool for assessing sustainability elements needs to be developed to encourage its use. In its current form, BREEAM only undertakes a review of the environmental element (Swayer *et al*., 2008), and does not assess the economic impact, which could affect the client's decision making in the sustainable development. Therefore, a more comprehensive approach to include not only the environmental element but also the economic and social elements into the sustainable assessment needs to develop.

Implementation of BREEAM

Except that B implemented BREEAM in a project at detailed design stage, all the other interviewees implemented BREEAM at the feasibility study stage. They believe at the early stage of a project, various options can be considered and the sustainable elements can be better incorporated into the design brief. To support this, B reported that they lost some valuable points in a previous refurbishment project when BREEAM was only implemented at detailed design stage and it was too difficult and too costly to incorporate the right sustainable elements. E also pointed out that early agreement of BREEAM design standard could reduce a client's tendency to change the design throughout the project, and could also provide stability to the project programme.

When asked why to implement BREEAM, E exemplified that in an industrial construction project he involved, the planning permission required a BREEAM assessment as a planning condition. In practice, planning permission is usually granted at completion of either outline or detailed design. To achieve the best score, the assessment tool needs to be implemented at the earliest opportunity in the building design stage (BRE 2008). This is mainly due to the time and cost of changing the design, reapplying planning permission, and requesting construction resources (Low *et al*., 2010). The late implementation was identified as one of the main reasons for a high number of lower assessment scores (Mansfield, 2009).

The life cycle assessment method used in BREEAM is time consuming (Trusty and Horst, 2002). This could add unnecessary time within a project to implement BREEAM. With the shorter time in a refurbishment / maintenance projects, there may not be enough time to consider alternatives to provide a more sustainable and lower cost design. The CASBEE system uses a different approach of impact assessment from cradle to grave (CASBEE, 2006), which is a much faster route to assess environmental risks. This could be a more efficient route than life cycle assessment. A faster and more efficient system could increase the number of sustainable assessments used.

Post occupancy evaluation can be very beneficial to all the participants, such as validating the effectiveness and efficiency of the sustainability solutions installed and feeding back the lessons learned to the architect and engineers to improve their future projects (Eley, 2001). Post occupancy evaluation is undertaken within three years of the project completion and is only required on BREEAM rating of 'outstanding', which is, according to D, '*is almost impossible to achieve within refurbishment projects, as there are elements of an existing building that cannot be rated, reducing the overall score'*. Therefore, post occupancy evaluation is very rare in refurbishment / maintenance projects, thus a complete life-cycle assessment is not achieved. Changes in the assessment are needed to encourage post occupancy evaluation in not only new build projects but also refurbishment / maintenance projects.

BREEAM in refurbishment / maintenance projects

The interviewees are not convinced that BREEAM is appropriate for refurbishment / maintenance projects, and its use is nowhere near to the amount within new build projects. Unlike the new build projects on greenfield sites which provide the best opportunity to undertake design on blank canvass, interviewee C and F pointed out that credits were lost when applying BREEAM to refurbishment / maintenance projects mainly down to lost points from not being able to provide a sustainable structure. D added that existing buildings restrained what you can do because the existing structure and the embedded fabric cannot be replaced so it is difficult to achieve better insulating properties within an existing building.

Another main problem is that BREEAM assessing and rating applies to the whole building only while the refurbishment / maintenance may be undertaken just in part of the building within multiple occupation buildings. Obviously, the assessment of a whole building would be more costly and time consuming, which could potentially deter clients from investing in sustainable assessment in refurbishment / maintenance projects, because a higher rating cannot be achieved and they cannot afford to pursue the assessment of a whole building when only part of the building is under refurbishment / maintenance. Thus, a rating system that can be applied to part of the buildings needs to be considered to ensure that sustainable refurbishment / maintenance can be encouraged and recognised.

BREEAM's impact on design and innovation

The interviewees expressed their concerns on the impact of BREEAM on the design process. One of the key features of BREEAM marketed by BRE is to provide innovative design. But the interviewees thought BREEAM emphasises the standardisation of design so that the architect's role in the design process and innovation has been weakened because the architect has more restraints on using new products in the design. BRE has realised this problem and the latest version of BREEAM now awards extra credits to any innovative designs and practices which can enhance the sustainability performance of the project (BRE, 2011). Whether this will work or not is yet to be tested in practice.

As BREEAM assessment requires that any design variations be reported to and approved by the assessor appointed by BRE, the whole process could be very bureaucratic and very time consuming and costly due to the delay caused, especially when the assessor only has limited knowledge of the individual projects and the clients' needs. This is highlighted by D's comment:

'Variations are time consuming to implement because designs have to be forwarded to the BRE, approved and then returned. This adds unnecessary time to a project, especially when you are under pressure from a client to deliver the project that has no knowledge of sustainability tools.'

Jayne and Mackey (1999) and Cooper *et al.* (2009) argue that a sustainability assessment could be included into existing roles, such as Building Surveyor and Mechanical and Electrical Engineer. This appears to make sense, as those practitioners already have sufficient knowledge of construction, and they can undertake additional training in sustainability and assessment tools to take the assessor's role. This will also speed up the design variation and make the project more efficient.

Training, knowledge and awareness

It is mandatory that assessors trained and qualified by BRE be appointed to undertake BREEAM assessment and establish a BREEAM rating within a project (Jayne and Mackay, 1999). Among all the interviewees, only one had undertaken this training and the others had only a half day awareness training, which only includes what BREEAM can be useful within construction and provides an overview of the tool. This awareness training is very basic and does not teach them how to use the tool to assess a project.

While the certification of the trained assessors helps to maintain the standard of the sustainability assessment, it is argued that the appointment of a trained assessor is too expensive and time consuming (Jayne and Mackay, 1999), and adds unnecessary cost to a project. In house training of practitioners could be a cheaper alternative as it will increase the practitioners' awareness of the sustainability assessment so they will be more likely to incorporate

sustainability into their daily job. Or a similar route as the CASBEE sustainability assessment tool could be considered where project managers assess their own design through Excel spread sheets to produce the assessment, which is then audited at project post construction by CASBEE (Fowler and Rauch, 2006). This could remove the need to use a separate assessor. However, CASBEE takes 3-7 days to input (CASBEE, 2006), which would add unnecessary time to a practitioner's workload.

Conclusions

With the increasing awareness of the sustainability and demand from legislation and regulations, sustainable development is becoming more and more important. Sustainability assessment tools like BREEAM play a very important role in promoting sustainable development and bring huge benefits to all the parties involved as well as the society at large. However, based on literature review and practitioners' experience, this research found out that the sustainability assessment tools like BREEAM have not been widely used in small and medium sized refurbishment / maintenance projects. The main problem is the assessment is thought too expensive and time consuming for such projects, considering their relatively tighter budget and schedule. That a fully trained and certificated BREEAM assessor is required exacerbates the problem. The existing assessment tools are mainly designed for new build projects or large refurbishment projects, and do not suit the small and medium sized refurbishment / maintenance projects, especially when they are only partly refurbished. Due to the restraints of the existing structures, it is very difficult for refurbishment / maintenance projects to achieve higher score in the assessment, which cannot significantly enhance the marketability of the properties assessed, and therefore discouraging the clients to embrace the assessment. The assessment also makes the design process more onerous. The practitioners only have very limited knowledge of this assessment tool. And post occupancy evaluation is very rare in refurbishment / maintenance projects.

To promote sustainability in small and medium sized refurbishment / maintenance projects, changes are needed to the existing BREEAM assessment. Legislation for refurbishment / maintenance projects in areas such as planning permission and building regulations needs to adjust to make the sustainability assessment mandatory. The sustainability assessment should be implemented as early as possible and post occupancy evaluation should be an integrated part of the assessment for the maximum benefits. A simpler tool needs to develop to consider how an assessment of part building refurbishment / maintenance can be incorporated into a whole building score to maintain property recognition. The assessor's role can be incorporated to the existing roles such as Building Surveyor or Mechanical and Electrical engineer to reduce the cost. More training should be provided to the practitioners to improve their awareness and knowledge of the sustainability assessment.

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