

Environmental Assessment of Industrial Buildings using BREEAM

The environmental assessment of buildings is a potentially powerful means of reducing environmental impacts including those arising from energy consumption, writes Josephine Prior, Alan Yates and Paul Bartlett, Building Research Establishment



Advance factory unit of Slough Estates plc which was assessed under BREEAM 5/93

In 1990 the Building Research Establishment (BRE) launched the first version of its environmental assessment method (BREEAM) for new Office designs¹. The scheme is voluntary and self financing. Currently around 25% of new office developments apply for a BREEAM assessment. Since then four additional versions have been launched, each covering different building types: New Homes, New Superstores and Supermarkets, Existing Offices and, most recently, New Industrial Buildings. In addition, the original version for new offices has been updated to keep abreast of emerging environmental issues.

BREEAM/New Industrial Units² was launched in November 1993 and applies to the design stage of new industrial, warehousing and non-food retail units. The level of building services provided, and the type of occupancy, varies considerably in this sector from the factory unit where only the office accommodation has been specified with services to fully fitted stores. The size and use should be no obstacle for assessment under the scheme as it concentrates on the building fabric and services. The process or activity undertaken in the building is not included in the assessment. The method is capable of assessing both speculative and bespoke projects, thereby giving developers two distinct options.

The response related to new office developments demonstrates that clients, designers and building users, who participate in BREEAM, are convinced that there are real benefits in addressing environmental concerns. It has been developed with support of private sector sponsors, listed in Fig 1. and the ECD Partnership.

Assessment approach and issues covered

BREEAM specifies criteria for a range of environmental issues. Its main objectives are:

- To stimulate the market for environmentally friendlier buildings and enable developers, designers and users to respond to this demand
- To reduce the long term impact of buildings on global, local and indoor environments
- To encourage designers and specifiers to become more environmentally sensitive
- To set targets and standards which are independently assessed, so helping to minimise false claims of environmental friendliness

The BREEAM assessment is divided into three sections, covering the global, local, and indoor environments. It gives credits for aspects of the design which meet specific targets within these sections. In devising the targets, the emphasis has been on action and changes which can be made now, using well

established techniques, often with little impact on either capital or life cycle costs. It deals with aspects for which there is a consensus of scientific opinion of the environmental problems they cause and which can readily be assessed at the design stage. However, the assessment method is not fixed and other issues will be added and amended as more information becomes available through regular reviews.

A summary of the issues assessed under BREEAM 5/93 (for New Industrial Units) is given in Fig 2. Some of the impacts assessed are discussed in more detail later in the article.

The assessment process

The BREEAM assessment method identifies, and credits, designs where specific targets are met. It is not expected that designs will meet all of the target requirements but BREEAM seeks to encourage a higher level of environmental performance whilst giving flexibility and choice to the design team and developer. The credits have been set at a level significantly above those required by legislation. The assessment aims to reduce undesirable effects on the environment by using the best available techniques. Thus, achieving one, or more, of the credits means that the building is likely to be environmentally better than a building where the issues have not been addressed.

BREEAM assessments are carried out by independent assessors licensed by BRE. A fundamental feature of BREEAM is that the process should be participative, and that the design which comes out of the scheme is 'greener' than the one that went in. For this reason the assessment is a two-stage process (see Fig 3.)

In order that an indication can be given of a building's overall relative performance across the broad spectrum of issues covered, BREEAM gives a single rating of FAIR, GOOD, VERY GOOD or EXCELLENT. This is calculated by summing the number of credits achieved in each of the three cate-

Fig. 1

Sponsors of BREEAM/New Industrial Units

Slough Estates
J Sainsbury Plc
Trafford Park Plc/AMEC
with the support of Stanhope Properties Plc

English Estates
Commission for the New Towns

gories. A minimum level of performance is required both overall and in each section to ensure a balanced approach.

Energy related issues

Global

The issue of energy efficiency is central to BREEAM and is assessed in terms of the resultant carbon dioxide emissions. This is done by reviewing specific energy efficiency features which have been included in the design. BREEAM uses a checklist approach to award points for specific measures relative to the resulting reductions in CO₂ emissions. Credits are awarded according to the number of points achieved.

There are three separate checklists. The first covers office accommodation for all units, the second covers all operational areas and the third covers only operational areas fitted with full lighting and space heating systems.

The EEO/BRE Design Manual for energy efficiency in factory units³, gives practical guidance in the planning, development, fit-out and use of advance factory units in order to achieve the efficient use of energy. Information is given on the options available for design and construction of the building fabric, and for the selection of the environmental services of heating, ventilation and lighting for both the office and operational areas. Although compiled specifically for advance factory units where the end use is generally not known, the information can also be used, where applicable, for bespoke factories with a defined activity, since the suitability of the services options for fitting out for different types of activities is covered. BREEAM credits the use of this design manual as good practice.

Oxides of nitrogen (NO_x) are produced during combustion and combine with water in the upper atmosphere to produce acidic compounds which are then deposited as acid rain. Acid rain is responsible for damage to plants, aquatic life and buildings. Perhaps even more seriously NO_x is a major contributor of local pollution by facilitating the production of ozone at ground level through photochemically induced reactions. A credit is awarded for specifying office accommoda-

tion space heating boilers which are fitted with reduced-NO_x emitting burners which emit NO_x at a rate no higher than 200 mg/kWh of delivered energy at full load output. A further credit may be awarded for specifying similar space heating burners in the operational area of a fully fitted-out building. Chlorofluorocarbons (CFCs), hydrochloro-

rofluorocarbons (HCFCs) and halons cause damage to the earth's stratospheric ozone layer and are substances controlled under the Montreal Protocol and European Community legislation. The ozone depletion potential for a given substance is a calculated measure of the contribution of that substance to ozone depletion relative to that of CFC11. A credit is awarded for specifying thermal insulants in the building fabric and services made only from materials with zero ozone depletion potential.

Local

The transport sector as a whole accounts for 25% of the CO₂ emitted in the UK and thus has a significant effect on global warming. A

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daily journey totalling as little as 6 miles by car can, over a year, emit as much CO₂ as that emitted to provide heat and power for a person in an office. To reduce pollution generated by cars and other vehicles, BREEAM promotes the use of cycling and public transport. Reductions in delivery vehicle exhaust emissions are encouraged by crediting well planned access to all the facilities on the site.

Indoor

Credit will be given for a design which maximises the effective use of daylight, which most people prefer to artificial light. This would also reduce electricity consumption for lighting. The Health and Safety Workplace (Health, Safety and Welfare) Regulations state that every workplace should have suitable and sufficient lighting, and that natural lighting should be used wherever reasonably practical. An additional credit is available for providing an adequate view to the outdoors from the operational area.

Headaches and eyestrain have successfully been reduced when high frequency ballasts are substituted for conventional ballasts used in fluorescent lights [4]. Energy consumption is also reduced when these are specified, albeit to a degree which is inadequate at present to cover the initial cost in a reasonable period. A credit is available under BREEAM for specifying that any fluorescent or other lamps with modulating (fluctuating) output should be fitted with high frequency ballasts in all areas used for office work and for ensuring that CIBSE guidelines on horizontal illuminance are followed and that luminaires appropriate

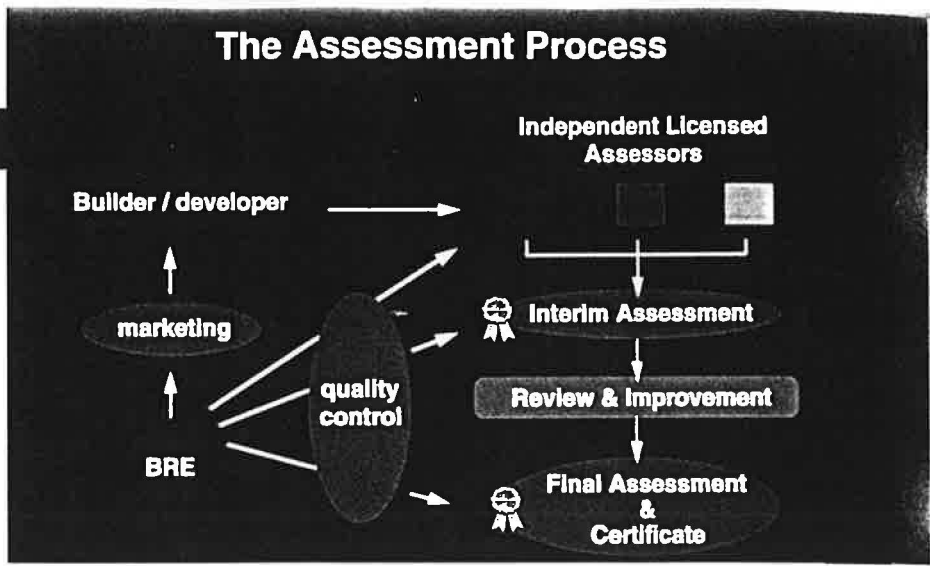


Fig. 3. The two-stage assessment process

to the tasks to be undertaken are used. An additional credit is available for a similar specification in operational areas.

ASHRAE defines thermal comfort as 'that condition of mind which expresses satisfaction with the thermal environment'. The general rule is that conditions of optimal thermal comfort result in the best conditions for performance and well-being of occupants. The avoidance of overheating is an important consideration in the design of a building. Information concerning design methods for avoiding overheating may be found in the CIBSE Guide, Volume A⁵, and the BRE Environmental Design Manual [6]. A credit is available for demonstrating that the office accommodation has been subject to an assessment consistent with the CIBSE Guidelines. The operational area is not assessed as overheating in these areas would be closely linked to the process or activity being undertaken.

Assessment experience

The first assessment undertaken by the lead sponsor for BREEAM 5/93, Slough Estates, was a newly completed development at Winnersh Triangle, Reading. The scheme was designed using their pre-BREEAM standard specification and achieved a GOOD rating at the second stage assessment when the design team incorporated high frequency ballasts in the lighting specification. A new design, currently under construction at Buckingham Avenue West, Slough, similar to that at Winnersh, has now been assessed. Its environmental performance has been dramatically improved, allowing the achievement of a VERY GOOD rating. The number of credits achieved under the CO₂ emission was increased primarily as a result of the use of the EEO/BRE Design Manual. Additional credits were achieved for minor changes to

the specification of materials and for taking steps to minimise damage to and enhance the ecological value of the site.

Conclusions

At the launch of BREEAM 5/93 for New Industrial Units, Dr Bernard Rimmer, General Manager - Construction, Slough Estates Plc, summed up the objectives of the development team by saying that "there is a growing need to allay public concern about the environment in and around buildings, and this initiative will make a significant contribution to pointing the way to more environmentally sensitive industrial developments."

References

- (1) BREEAM 1/93 - an environmental assessment for new office designs. Building Research Establishment Report No : BR, 234 1993.
- (2) BREEAM 5/93 - an environmental assessment for new industrial units designs. Building Research Establishment Report No : BR 252, 1993. BREEAM publications are available from BRE Bookshop, tel 0923 664444.
- (3) Energy Efficiency Office, Good Practice Guide 61. Design Manual. Energy efficiency in advance factory units. Available free from BRECSU, tel 0923 664258.
- (4) Fluorescent lighting, headaches and eyestrain. Lighting Research and Technology, 1989, 21(1) 11-18.
- (5) CIBSE Guide. Volume A: Design Data. Volume B: Installation and equipment data. The Chartered Institution of Building Services Engineers. London, CIBSE, 1986.
- (6) Environmental design manual: Summer conditions in naturally ventilated offices. BRE, Garston, BRE, 1988.

Further reading

For buildings related projects: Enquiries Bureau, BRECSU, Tel: 0923 664258.

For industrial projects: Energy Efficiency Enquiries Bureau, ETSU, Tel: 0235 436747.

Fig 2. Issues Assessed Under BREEAM 5/93

Global issues

- CO₂ emissions resulting from energy use
- Acid rain
- Ozone depletion due to CFCs (chlorofluorocarbons), HCFCs (hydrofluorochlorocarbons)
- Natural resources and recycled materials
- Storage of recyclable materials
- Designing for longevity

Local issues

- Transport and cyclists' facilities
- Water economy
- Noise
- Local wind effects
- Overshadowing of other buildings and land
- Contaminated land
- Ecological value of the site

Indoor issues

- Hazardous materials
- Ventilation
- Natural lighting
- Artificial lighting
- Thermal comfort and overheating

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