

THE POTENTIAL FOR HIGH-PERFORMANCE DESIGN ADOPTION IN RETAIL PROPERTY PORTFOLIOS



Mark Preston¹ and Alison Bailey^{2*}

¹ Mapeley Ltd., UK

² Department of Agriculture, The University of Reading, UK

Growing legislative pressures and increasing stakeholder awareness of environmental issues are pushing the property market to consider high-performance, low-impact retail buildings. The office sector is relatively advanced in its apparent appreciation of such buildings; however, the retail sector is slow to recognize these benefits. In exploring the business case for high-performance design adoption in the retail sector, this paper examines the overlaps between office and retail sector benefits and considers the potential benefits peculiar to retailers. Barriers to high-performance design adoption are then addressed through case research, interviews with key representatives from the retail property market and a questionnaire survey of FTSE listed retail company property departments. The paper concludes that information gaps are a significant hindrance to high-

performance property development and that they can be reduced, to some extent, by the forthcoming introduction of the BREEAM Retail environmental assessment tool. Copyright © 2003 John Wiley & Sons, Ltd and ERP Environment.

Received 20 November 2002

Revised 14 January 2003

Accepted 27 February 2003

INTRODUCTION

European and domestic legislation flowing from international agreements on the protection of the global environment has begun to impact on the UK retail property sector. The climate change levy is estimated to have increased energy costs for retail property occupiers by 10–20% and encourages users to seek out renewable energy supplies. Furthermore, EC regulations implementing the Montreal Protocol's targets for phasing out ozone depleting gases oblige retailers to replace harmful refrigerants used in chilled food display units and air conditioning plant, and investigate the introduction of benign alternatives.

* Correspondence to: Dr A. Bailey, Department of Agriculture, The University of Reading, Earley Gate, P.O. Box 237, Reading, Berkshire, RG6 6AR, U.K. E-mail: a.p.bailey@reading.ac.uk



In addition, increasing environmental awareness amongst consumers, investors and pressure groups is encouraging some retailers to protect sales by improving the environmental credentials of their brands (ENDS, 2001). Whilst the majority of this focus inevitably falls on the products the retailer sells, there is the potential for environmental concerns to trickle down to the buildings in which the products are sold. This was the case in Australia, where Greenpeace's campaign against PVC started with children's toys and spread to encompass its use in building materials. The pressure group subsequently claimed credit for the Sydney 2000 Olympic Stadium being PVC free.

Using a comprehensive literature review, case study evidence from The Boots Company and Sainsbury's Property Company, interviews with key stakeholders in the property procurement process and a questionnaire survey of FTSE listed retailers' property departments, this paper examines the business case for high-performance design adoption in retail property portfolios. It then considers the barriers to adoption, which appear to have stymied progress in the field to date. The paper concludes with an examination of the future potential for high-performance design adoption.

DEFINING A 'HIGH-PERFORMANCE' RETAIL BUILDING

A consensus is yet to be reached on the definition of high-performance commercial buildings. McDonough and Braungart propose high-performance buildings that, 'like trees, are net energy exporters, produce more energy than they consume, accrue and store solar energy, and purify their own waste water and release it slowly in a purer form'.

However, Crosbie's (2001) less adventurous definition will no doubt be more meaningful to the commercial property industry. He states that 'a high-performance commercial building is energy efficient, has low short-term and

long-term life cycle costs, is healthy for its occupants, and has a relatively low impact on the environment'.

However, detailing the criteria required to interpret these definitions and assess a building's level of environmental performance is complicated by factors as divergent as location, longevity and embodied energy. Nevertheless, despite these inherent difficulties the Building Research Establishment's Environmental Assessment Method (BREEAM) has been widely adopted in the UK as an environmental performance measurement tool for buildings. Different versions of the tool have been developed (e.g. BREEAM for Offices, 1998) to reflect the peculiar characteristics of specific building types, and the office sector has become a particularly enthusiastic adopter: 40% of all new office space is now submitted for BREEAM assessment.

However, enthusiasm for high-performance design in the retail sector is much more muted, with only two buildings awarded the top BREEAM rating in the past 5 years: Sainsbury's Millennium store at North Greenwich and Chartwell Land's B&Q Warehouse unit at Imperial Park, Bristol. First, this is because the potential economic benefits of high-performance design do not appear to be fully appreciated and internalized by all parties in the retail property development process. Second, BREEAM currently only applies to new supermarket and retail warehouse type buildings: as such, it does not cover the vast majority of retail building stock. However, this void is to be filled in 2003 by the introduction of BREEAM Retail, a flexible version of the tool, which will be applicable to all types of new and existing retail property.

BENEFITS OF HIGH-PERFORMANCE DESIGN

The potential benefits of high-performance design can accrue as private internal capital and revenue savings and as wider societal ben-

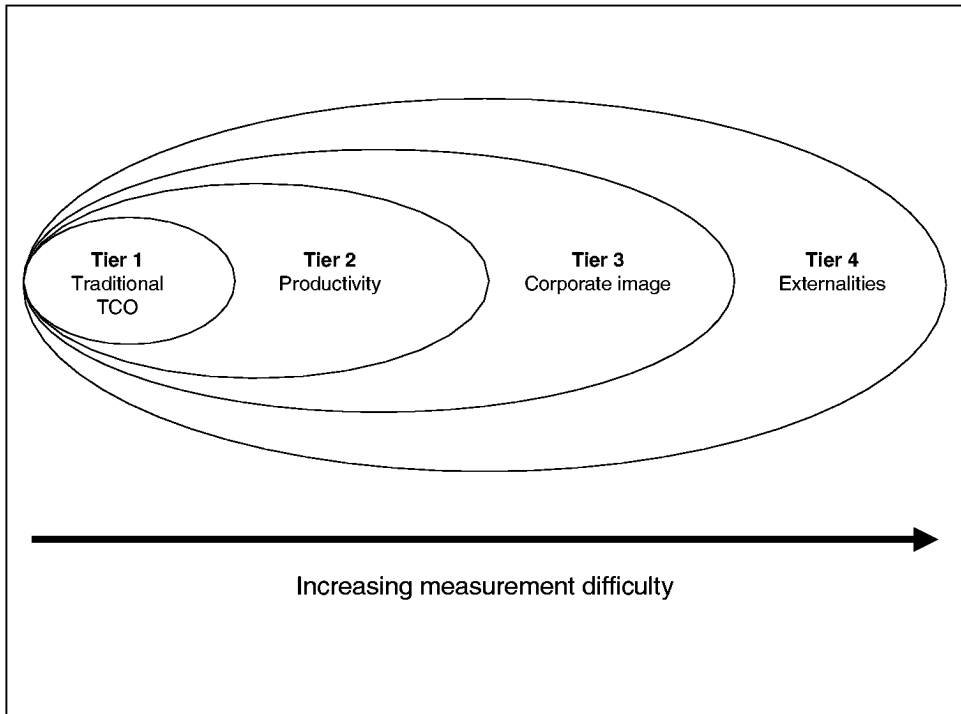


Figure 1. Tiers of potential economic benefits (Johnson, 2000, p. 352). Reproduced by permission of Netlogex, LLC

efits external to the retailer but influential in terms of corporate image. Johnson (2000) identifies four potential costs and benefits, which he divides into four tiers, each progressively more difficult to measure (see Figure 1).

Tier 1: Total cost of ownership

Tier 1 costs include the capital outlay required to design and build a property and the revenue costs of operating and maintaining it over its useful lifespan.

At its Greenwich store, Sainsbury’s employed a range of high-performance design features aimed at reducing the store’s environmental and revenue cost impact.

- (i) Passive not mechanical ventilation.
- (ii) Natural lighting to illuminate the sales area.
- (iii) Store heating by energy reclaimed from the refrigeration systems and combined heat and power plant, which increases

energy efficiency from approximately 33 to 90%.

- (iv) Landscaped earth mounds to provide insulation.
- (v) Reinforced concrete walls to provide thermal mass.
- (vi) Local underground water to supply refrigeration systems.
- (vii) Greywater re-use for landscape irrigation.
- (viii) Wind turbines and solar panels to provide energy to illuminate store signage.

Hawken *et al.* (1999) and Johnson (2000) note that reducing energy consumption through measures such as those outlined above can in turn reduce the overall load requirements for building systems such as heating, ventilation and air conditioning units. It may therefore be possible to either specify smaller, cheaper plant or eliminate it totally, thus reducing capital costs. At Greenwich, for example, the use of



passive ventilation technology negated the need for air conditioning plant in the sales area. However, both Sainsbury's Greenwich store and a second example, Wal-Mart's Eco-Mart concept store in the US (Browning and Romm, 1998), cost in the region of 20% more to develop. A review of the literature also failed to find evidence of overall construction costs for high-performance buildings competing with standard equivalent buildings.

Nevertheless, it should be noted that some of the high-performance features adopted at Greenwich are radical in design and cost terms and not necessarily transferable to the majority of existing building stock, nor to new developments in town centres. For example, solar cells mounted on the store's petrol filling station roof have a payback period of around 300 years and the use of earth mounds to provide insulation from wind chill are not practical on high-density sites.

In terms of operating costs, and specifically energy, Hawken *et al.* (1999) state that the use of high-performance design features can reduce energy use in non-retail properties by 70–90% against traditional building design. In the retail sector, Sainsbury's Greenwich store is 30–40% more energy efficient than a modern standard building and 50% more efficient than the average. However, these energy cost savings are negated somewhat by increased maintenance costs associated with some of the leading-edge high-performance design features.

External economic factors have also impacted on revenue costs at the Greenwich store. Over the past 18 months the price differential between wholesale gas and electricity has reduced to the extent that the energy efficient combined heat and power (CHP) plant is uneconomic to operate. This problem is also noted by Boots, which has been investigating the use of micro-CHP plants in its stores.

Tier 2: Productivity

In addition to savings in revenue costs, a growing body of case study research identifies

improvements in employee productivity resulting from high-performance design factors. Whilst the potential magnitude of these impacts is impressive, the research is based predominantly on office buildings. In the retail sector, employee performance is arguably of less significance as the number of employees per unit of floor area is much lower and their activities do not in themselves directly constitute the revenue-generating element of the business. However, the principle of high-performance design derived improvements in productivity does appear to be of significance when applied to retail sales performance.

A Californian study of a chain of 108 essentially identical single-storey retail stores (Heschong Mahone Group, 1999) found that natural lighting improved sales performance by 40%. However, these results are tempered by the fact that some operational variables were not screened out, demographic profiling was based on rudimentary zip code information and a large proportion of the non-naturally lit sample comprised re-branded former competitor units.

Natural lighting is used extensively in Sainsbury's Greenwich store. It trades extremely well and there is anecdotal evidence, supported by staff, that customers enjoy the in-store environment this use of natural lighting has created. Nevertheless it has not been possible to establish a link between the store's sales performance and any of its high-performance design features. It may be that a standard Sainsbury's store would have performed equally well in the same location.

However, whilst the Heschong Mahone Group study has flaws, the possibility that natural lighting might influence retail sales to anything like the levels reported merits further investigation and research in the UK.

Tier 3: Corporate image

Reinhardt (1999, p. 15) states that 'differentiation of products along environmental lines is



more likely to succeed ... if the environmental positioning is related to and supportive of other aspects of the firm's strategy'. Retailers such as Patagonia and The Body Shop have developed environmental sustainability as a key component of their product marketing and Johnson (2000) suggests that this marketing effort could be further enhanced by retailing their environmentally sensitive products from buildings that also aim to limit their environmental impacts.

Johnson also suggests that positive press coverage can be generated through a high-performance building project. However, whilst Sainsbury's Greenwich store has generated a large amount of positive coverage in the technical, professional, trade and consumer press, it has not been possible to evaluate the benefit of the coverage or the extent to which it permeates through to customer spending habits.

Finally, Johnson states that high-performance development projects are less likely to encounter resistance at the planning stage or during the building's operation. This view is supported by Francis (1998) and Lambert (cited in Minton, 2002): 'including environmental benefits in a project's design is a good way to smooth the planning process ... land owners such as the National Trust and English Partnerships are looking for this sort of [high-performance] approach'.

Tier 4: Externalities

Externality costs and benefits of high-performance design, despite being potentially valuable to society as a whole, at present, do not directly affect a company's bottom line. Although governmental bodies may include externalities in their decision making, for UK multiple retailers, many of whom are public companies, tier 4 issues are unlikely to be compelling motivators for the adoption of high-performance design until they can be internalized into company accounts.

Some UK corporations, such as HP Bulmer (ENDS, 2002) and Interface Europe (ENDS,

2000), are in fact experimenting with the explicit recognition of tier 4 externality costs through the production of environmental accounts. These aim to quantify the company's 'sustainability cost' – the notional sum it would need to spend to avoid or restore the environmental damage its activities cause – against which provision can be made in the conventional accounts to pay for damage avoidance and restorative measures.

Whilst environmental accounting methodologies are embryonic and not yet comprehensive, they do demonstrate that the production of basic environmental accounts is practical and that there is a willingness to build financial data into the ubiquitous corporate environmental report. Furthermore, the environmental accounting work carried out by Interface Europe forms part of a project sponsored by the Chartered Institute of Management Accountants and it is hoped it will eventually influence new accounting standards.

The widespread adoption of environmental accounting would have the effect of incorporating many tier 4 issues into tier 1; the externality would become quantifiable and internalized as a revenue cost.

BARRIERS TO ADOPTION OF HIGH-PERFORMANCE DESIGN

The fundamental element to consider when examining the barriers to adoption of high-performance design is the structure of the UK commercial property market and the relationships between its key players. In addition, significant obstacles include information barriers in the property profession, capital cost drivers, operational issues and retailers' pre-occupation with products not property.

Tenure and the adoption of high-performance design

The vast majority of UK retailers occupy their trading properties on a leasehold basis. Conse-



quently their scope to influence structural elements of building design is limited to pre-lettings of new and redeveloped buildings. Most often retailers will only have the scope to incorporate high-performance design into their internal non-structural shop-fit.

Thus, despite the terms of its lease generally obliging the tenant to meet all revenue costs associated with the building it occupies, it often has minimal, if any, input into building design decisions, which could affect running costs such as insulation and over-specification of ventilation plant.

In addition, the tendency for retail buildings to be developed on a speculative basis, prior to the identification of the end user, leads to property being designed sub-optimally on a one size fits all basis in order to appeal to a broad cross-section of potential occupiers. For example, a high-performance design specification for a property used by a clothing retailer may not deliver revenue savings if occupied by a food retailer with a large proportion of floor area dedicated to chilled and frozen food cabinets.

Occasionally, retail property is held freehold by the occupier (owner occupation). Here, the property may have been designed, funded, constructed, occupied and owned by the retailer. Sainsbury's developed its Greenwich store on a site it owned, a characteristic reflected in the office property sector, where most high-performance developments in the UK are also owner occupied (Partridge in Edwards, 1998). Owner occupation enables the building's end user to directly influence and benefit from the environmental performance characteristics of the property, and in the case of existing buildings owner occupation provides the occupier with increased flexibility to alter the premises to accommodate high-performance design features without the lengthy and often costly process of applying for the landlord's consent.

Finally, the retailer may have purchased an existing property from its original developer or a subsequent investor. Here the retailer may

not have had the opportunity to influence the design of the building but he does have a relatively free hand to carry out modifications to incorporate high-performance features.

Information barriers in the property profession

The dearth of literature on the economic performance of high-performance retail property, the current lack of a comprehensive environmental assessment system for retail buildings and the paucity of case study evidence mean that information on the costs, benefits and barriers of high-performance retail design is limited.

In the absence of a comprehensive tool to identify high-performance credentials across all retail property types, consultants assume all buildings attract similar revenue costs per unit area. However, if high-performance buildings could be identified their revenue benefits could be internalized through a rental premium, which could then be capitalized to produce a true reflection of the value added (Hawken *et al.*, 1999). Developing this hypothesis further, the investment yield used to calculate the capital value applied to conventional properties could be improved upon to reflect the greater potential attractiveness of high-performance retail buildings to retailer tenants and their potential to outperform standard buildings in terms of rental growth.

Such ability to value the benefit of high-performance design would be a significant development in illustrating to landlords, developers and tenants the business case for its adoption. Some elements of high-performance design may still not be economically viable (solar panels at Sainsbury's Greenwich store) but at least the decision making process will be more fully informed.

Capital cost drivers

A retailer's capital expenditure is typically written off over relatively short periods, usually three to five years. Therefore, revenue



savings from high-performance design are likely to be irrelevant to a retailer unless any increased capital cost associated with the design features can be recouped through revenue savings over a similar time frame.

In a perfect market, the revenue benefits of high-performance design adoption could be passed on to alternative retailers in return for a rental premium, if and when a property is vacated and the lease assigned or the property sub-let. Such a mechanism would allow revenue savings over a much longer accounting period to be taken into account when considering the adoption of high-performance design initiatives.

However, at present and as discussed in relation to information barriers, there is no means of demonstrating a building's potential revenue savings to prospective tenants, nor for them to be compared with the revenue costs at alternative premises. Furthermore, the nature of the retailer's offer usually requires an extensive re-fit of the premises prior to taking occupation. Such a re-fit may well involve the removal of some of the high-performance design initiatives installed by the original tenant if they compromise the in-going retailer's standard shop-fit requirements or introduce non-standard maintenance issues.

Operational issues

In addition to the capital cost issues, there are three operational prerogatives that have the potential to hinder the adoption of some elements of high-performance design in existing retail buildings.

First is poor linkage between the shop-fit specifier, who seeks to fulfil the merchandiser's ideas of in-store 'theatre', and the energy manager, who is tasked with reducing in-store energy consumption. As a result energy efficiency is often sacrificed in order to achieve higher in-store lighting levels or simply through the selection of inefficient but aesthetically pleasing lamps. However, the twin goals of appropriate lighting levels and

energy efficiency are not necessarily mutually exclusive as Sainsbury's demonstrates in its Greenwich store. Here lighting levels are approximately 30% lower than in a conventional store but in-store 'theatre' and product display lighting are not inhibited through the extensive use of natural lighting and super-efficient shelf mounted spot lamps.

Second, prescriptive specifications, in which the retailer client stipulates the specific materials and plant to be used in a shop-fit, may prevent supplier companies using their greater product knowledge to develop more innovative and potentially environmentally sound means of achieving the desired outcome.

Third, a general policy amongst retailers to continue trading during store re-fits limits opportunities to introduce elements of high-performance design as these may involve structural alteration impacting on trading performance during the refurbishment process.

Retailers' preoccupation with products not property

A general consensus amongst retailers is that consumers express their environmental concerns by reference to the products they purchase and not the building in which they are bought. They therefore aim to address these concerns by working to improve the environmental aspects of product sourcing, packaging and chemical content.

Their stance is supported to some extent by life cycle assessment work carried out on behalf of Marks & Spencer (ERM, 2002). In considering two items of clothing, it found that on average 77.8% of energy use was attributed to consumer use, 18.2% to product manufacturing and 4.0% to retail operations. Consequently, it is argued that most environmental benefit is to be derived from concentrating resources on reducing energy consumption during product use, e.g. by developing fabrics with lower wash temperatures and detergent loads.



A comparatively low level of resources is therefore allocated to improving the environmental credentials of operational aspects of the business and only 29% of FTSE listed retailers consider property issues in their environmental reporting. Of those that do, the majority are food retailers, who appear to be driven by three main influences: first, legislative compliance, particularly with regard to ozone depleting refrigerant gas phase-out, and the increasing prominence of the socially responsible investment sector. Second, FTSE4Good considers large food retailers to be high-impact industries and so they are required to produce an environmental report as a prerequisite for listing. Finally, food retail units are generally larger than other types of retail property and larger buildings have greater potential to realize revenue cost savings from more energy efficient plant and machinery.

DISCUSSION

The comprehensive use of high-performance design in retail property is very new and it is difficult to determine whether it will develop beyond the flagship/concept store stage to become an established practice in the UK. However, the potential benefits of high-performance design are significant, albeit difficult to quantify, and the barriers to adoption do not appear to be insurmountable in the medium term.

First, leasehold tenure in the retail sector has become more flexible in recent years with turnover rents and reduced lease lengths being introduced into the market as landlords seek to engage with tenants to improve property performance. All-inclusive rents, where the landlord pays the tenant's revenue costs of occupation, are the next step. They provide an incentive for landlords to develop, refurbish and maintain environmentally efficient buildings, as any revenue savings accruing from such measures will flow directly to them. A similar occupational structure can be provided

through corporate PFI projects in which major property occupiers such as Abbey National and various government agencies pass the ownership and management of their property portfolios to an outsourcing service provider and pay a fixed charge/all inclusive rent to occupy fully serviced floor space on a flexible basis.

Second, information barriers on the capital and revenue cost implications of high-performance buildings will be broken down once more case study evidence emerges.

The relatively poor capital cost performance of the Greenwich store is perhaps best exemplified by the fact that the only high-performance feature subsequently to be adopted as standard for all new Sainsbury's developments are the energy efficient T8 fluorescent lamps used in the store lighting system.

Taking a more tangential view, the store may also be considered to perform poorly in terms of flexibility for future expansion. As a result of strong trading performance outline investigations were carried out to consider how the store could be extended. However, the extension proposals were considered uneconomical due to the substantial areas of earth embankments surrounding most of the building and the structural elements of the underfloor heating and natural ventilation system. A conventional steel-framed unit would have been relatively easy to extend, allowing the retailer to benefit from increased sales.

However, it must be noted that the Sainsbury's Greenwich store could reasonably be described as a one-off, radical, cutting-edge, flagship store. Its development stemmed from a requirement of the then site owner, English Partnerships, for a statement building and from the retailer's tendency to periodically produce radically new architecture. It was not developed as a seedbed for high-performance technologies to be introduced throughout the Sainsbury's property portfolio; indeed, most of the design could not physically be replicated in the majority of stores.



Given these considerations, the selection of the Greenwich store as a case study is not ideal. It is an example of radical high-performance design whereas most industry commentators see adoption developing in a much more evolutionary manner, as at Imperial Park in Bristol. Here, the developer, Chartwell Land, states that it intends to replicate many elements of the retail park's design in future developments.

Third, and in addition to case study evidence, the introduction of BREEAM Retail in 2003 will be of great additional assistance in raising awareness of high-performance design across all types of retail property. Developers will have a standard to design to and retailers will be able to target buildings with improved environmental performance and fit them out to a recognized environmental standard. The rating system will also facilitate the benchmarking of property portfolios. Owners and occupiers will be able to prioritize poorly performing properties for improvement and to compare the revenue cost performance of buildings with different BREEAM ratings.

Finally, another valuable tool in reducing information gaps is the European Commission's proposal to introduce the mandatory display of energy certificates, based on minimum energy performance requirements, for new buildings and existing properties as and when they undergo refurbishment.

Two key elements differentiate this proposal for energy certification from current environmental rating schemes such as BREEAM. First, the energy certification proposal is mandatory and as such would allow energy performance comparisons to be made between all buildings. Second, the requirement for certificates to be prominently displayed to allow public inspection may raise the profile of tier 3 (corporate image) issues in the high-performance design decision making process.

Retail brands positioned towards customer well-being or concern for the wider environment may become somewhat tarnished if this stance cannot be supported by action

to improve energy performance on its store portfolio. Whereas individual consumers are unlikely to alter shopping patterns as a direct result, the energy label may have a cumulative impact as environmental concerns develop over time. Interestingly, Sainsbury's Greenwich store outperforms other equivalent stores in the sale of organic produce and customers often ask store staff about the building's environmental credentials.

CONCLUSION

This paper has highlighted potential benefits in adopting high-performance design in retail property portfolios. The most tangible of these benefits are possible reductions in capital and revenue costs, although the case study evidence is inconclusive. The assessment of indirect benefits such as retail sales performance and corporate image enhancement is necessarily subjective but of significant and growing relevance to retailers, and it presents interesting issues for future research.

However, significant barriers to high-performance building design are unlikely to be overcome in the short term. The established leasehold tenure system, with its inherent dislocation between building design and environmentally efficient occupation, is likely to pervade the retail property market for the foreseeable future in all but new shopping centre and retail park developments where all inclusive rent regimes may develop.

Information gaps help propagate the assumption amongst retailers, developers and consultants that high-performance buildings are more capital intensive than conventional units to design and build. Similarly, a key economic incentive to develop high-performance retail buildings is lost when consultants do not acknowledge revenue savings from energy efficient units. As a result they are not captured in rental and capital valuations and landlords investing in high-performance design go unrewarded.



In the current climate, the development of this sector of the retail property market is in the hands of a few pioneering property companies backed up by successful, high-profile retailers. Its growth in the medium term will only be assured once a clear tier 1 business case can be demonstrated for all types of high-performance retail building. Until the market becomes extremely well developed, retailers are unlikely to view other potential benefits as anything other than window dressing.

However, the comprehensive and widely recognized environmental rating system to be introduced as BREEAM Retail, coupled with the potential for compulsory energy certification, will add transparency to the retail property market and over time, with developing environmental awareness, may result in retailers seeking out high-performance properties to enhance their portfolios. Such positive selection may be driven not only by the retailer's property surveyors but also by the merchandising, brand and investor relations departments.

REFERENCES

- Browning DW, Romm JJ. 1998. *Greening the Building and the Bottom Line*. Rocky Mountain Institute: Snowmass.
- Crosbie MJ. 2001. Commercial high-performance buildings. *Architecture Week* 30 August 2000. http://www.architectureweek.com/2000/0830/building_1-1.html [28 November 2001].
- Edwards B (ed.). 1998. *Green Buildings Pay*. Spon: London.
- ENDS. 2000. Interface Europe: leading the way with environmental accounts. *ENDS Report* 504. <http://www.endsreport.com/issue/print.cfm?ArticleID=6607> [18 February 2002].
- ENDS. 2001. Toxics in consumer products: the next GM? *ENDS Report* 320: 20–23.
- ENDS. 2002. HP Bulmer: a ferment of sustainability ideas'. *ENDS Report* 324. <http://www.endsreport.com/issue/img/singlet.gif> [18 February 2002].
- Environmental Resources Management (ERM). 2002. *Streamlined Life Cycle Assessment of Two Marks & Spencer Apparel Products*, draft final report. Marks & Spencer. http://www2.marksandspencer.com/thecompany/ourcommitmenttosociety/environment/pdfs/Final_LCA_report.pdf [17 June 2002].
- Francis G. 1998. The relevance of green buildings to the procurement and marketing of offices. In *Green Buildings Pay*, Edwards B (ed.). Spon: London; 32–41.
- Hawken P, Lovins A, Lovins LH. 1999. *Natural Capitalism: the Next Industrial Revolution*. Earthscan: London.
- Heschong Mahone Group. 1999. *Skylighting and Retail Sales: an Investigation into the Relationship Between Daylighting and Human Performance*, report submitted to Pacific Gas and Electric Company. <http://www.h-m-g.com> [17 June 2002].
- Johnson SD. 2000. The economic case for 'high performance buildings'. *Corporate Environmental Strategy* 7 (4): 350–361.
- Minton A. 2002. Eco experiments. *Estates Gazette* 0206/9: 62–63.
- Partridge D. 1998. Achieving institutional levels of office design through sustainable approaches. In *Green Buildings Pay*, Edwards B (ed.). Spon: London; 42–47.
- Reinhardt FL. 1999. Market failure and the environmental policies of firms. *Journal of Industrial Ecology* 3 (1): 9–21.

BIOGRAPHY

Mark Preston BLE MSc graduated from the University of Aberdeen in 1994 (Bachelor of Land Economy). He is a chartered surveyor with extensive commercial property consultancy and investment management experience gained at Weatherall Green & Smith in Edinburgh, and Boots Properties plc in Nottingham. He recently completed an MSc by Research in Environmental Management for Business at Cranfield University at Silsoe.

Alison Bailey BSc PhD (corresponding author) lectures in Business Management at the University of Reading. She is an environmental economist whose areas of interest focus on environmental economic valuation, cost-benefit analysis and environmental accounting. Until recently she was lecturing at Cranfield University at Silsoe in Environmental Management for Business. She can be contacted at the Department of Agriculture, University of Reading, Earley Gate, PO Box 237, Reading, Berkshire, RG6 6AR, UK.

Tel.: +44 (0)118 378 6270.

Fax: +44 (0)118 935 2421.

E-mail: a.p.bailey@reading.ac.uk