
Introduction to Probe

The BSRIA's *Environmental code of practice* launched in May 1994 broke new ground for the building services industry by adding to the stages of the design process *Part N: Feedback*.

Few people would question the educational value of structured feedback from occupied buildings. This kind of information is vital if the new generation of buildings are to meet client and user expectations, particularly given the heightened interest in health and welfare of building occupants. Recent reader research carried out by the *CIBSE Journal* has revealed that the services industry is crying out for such information.

Thanks to the generous support of the DoE's Construction Sponsorship Directorate, which has provided funds under the Partners in Technology programme, the *CIBSE Journal* is embarking on a two-year research project to bring readers up to date on how buildings featured previously in the magazine have actually performed in practice.

A £45 000 injection by the Construction Sponsorship Directorate, evenly matched by the publishing resources and expertise of the *CIBSE Journal*, will fund the necessary data collection, survey and analysis work.

Partners in Technology

- The DoE's Construction Sponsorship Directorate's collaborative Partners in Technology programme is designed to develop technical information for application across the construction industry.
- The principle of joint funding, where government meets up to 50% of the research costs, helps companies and research organisations to develop and exploit technology for industrial application.
- 80% of DoE's research budget is allocated to the technical infrastructure programme, which is specifically geared to develop and promote current best practice, particularly that based on ideas emerging from industry itself. PROBE, which received £45 000 from the DoE, is just one of 192 research projects which received the go-ahead for 1995/96.

Halcrow Gilbert Associates (HGA) and William Bordass Associates (WBA) will undertake the main investigations and co-ordinate inputs from other investigators, particularly on occupant surveys.

The two investigators, both of whom have considerable experience of building surveys, will undertake ten PROBE studies in all, which will appear at two-month intervals starting with the September 1995 issue. As PROBE will use the database of buildings analysed by the *CIBSE Journal* at time of completion, readers will be able to compare performance-in-use with the original design objectives.

An additional PROBE project 'Greenbuildings: evaluating the benefits and barriers' will be carried out by John Doggart of architect and energy specialist ECD Partnership. A separate, parallel module to PROBE, this study will examine particular buildings identified in PROBE which sport green credentials. Those credentials will be measured to identify the actual (rather than perceived) benefits that accrue from being green.

PROBE will encompass a spread of building types, ranging from air conditioned and non-air conditioned offices to schools, factories and leisure centres. All buildings studied will have been in use for at least two years but for no more than five years. This allows a

sufficient period for the youngest buildings to have settled down and for most of the major defects to have been ironed out, while the upper limit rules out those buildings where performance is beginning to suffer through poor maintenance, or which have been subject to major change of use or refurbishment of services.

At the end of the series a concluding review article will attempt to draw out general messages from the buildings featured, and any others from which information has also been obtained. There may also be an industry seminar at which issues raised by the investigators are discussed with the managers of the reviewed buildings.

• ***Scope of each investigation***

Figure 1 shows how each PROBE investigation will be carried out. Each assessment will cover a full range of post-occupancy issues:

- design and construction, in particular any innovative features, not only technical, but also in terms of client requirement;
- design integration;
- the effectiveness of the procurement;
- methods of construction, installation, and setting to work;
- initial occupation of the building and, in particular, testing, commissioning, handover, fit-out and move-in, and also any unexpected requirements, changes and teething problems.

PROBE will also try to unravel how the buildings and their services are being operated, controlled and maintained. The investigators will also aim to find out if the design intent has caused any management problems or affected running costs and system reliability, and if so whether they have been resolved.

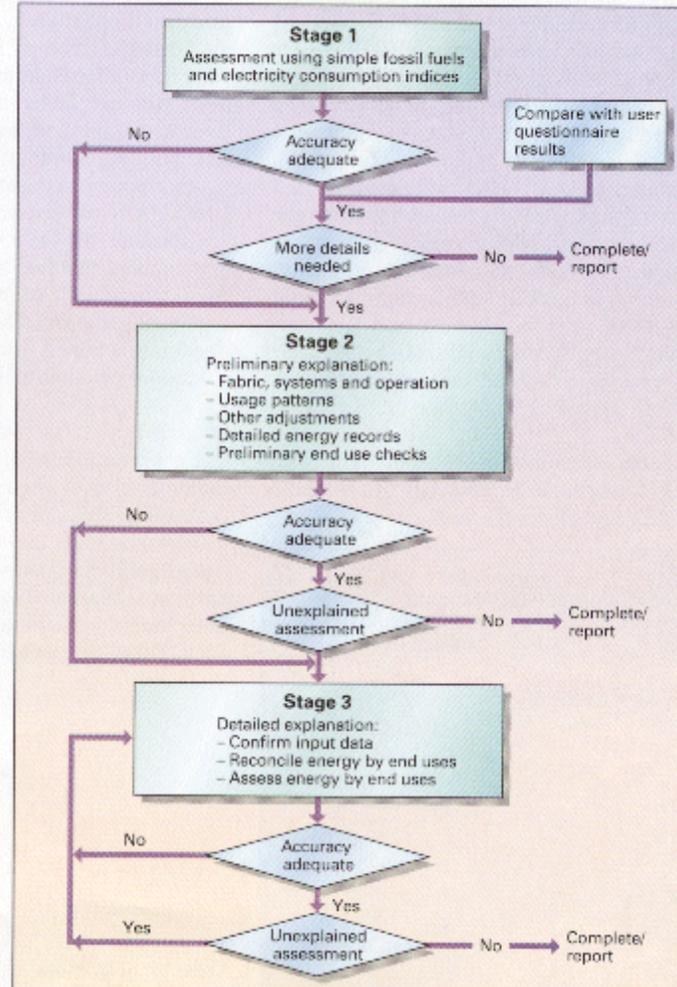
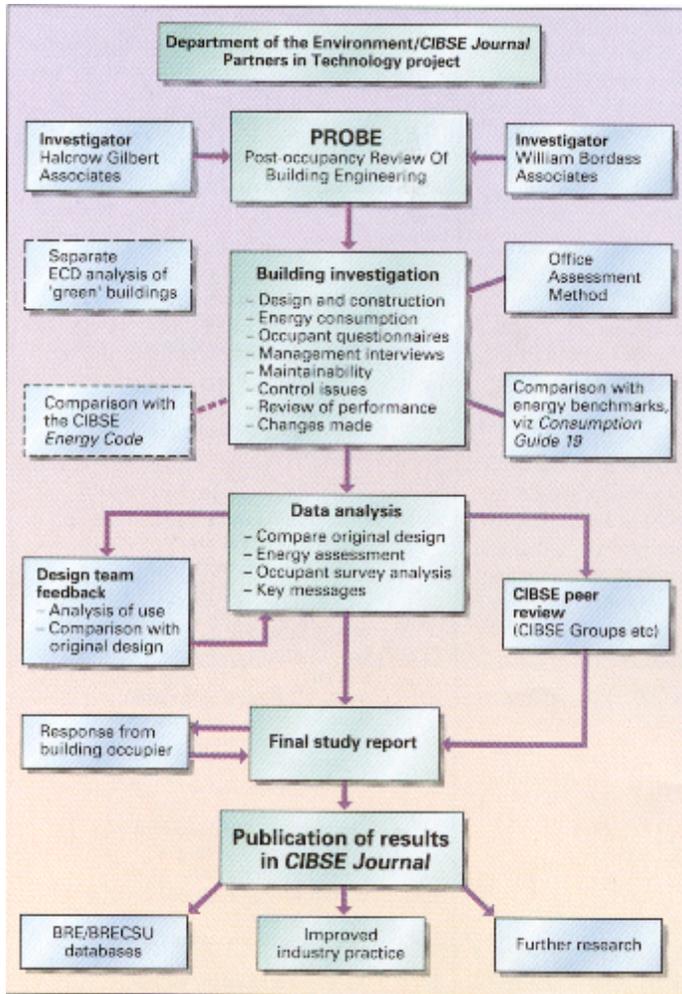


Figure 1 (Left) The investigative methods which will be used by the PROBE team

Figure 2 (Right) The basis of BRECSU's Office Assessment Method

User issues will receive particular attention, specifically how occupants and management perceive the building as a whole, its engineering systems, and levels of occupant comfort, productivity and well-being.

Measurement of energy performance will form a major part of the work, as will the control and management, system response, durability and maintenance requirements of the building services. Where possible this will be compared with occupant expectations, design intentions and good practice benchmarks.

Changes to the building, its services and occupancy levels will also be assessed, as will the effect of any alterations, extensions, replacements, and internal reorganisation. Obviously it will be important to find out the reasons for any changes and the degree to which they were foreseen or foreseeable in the brief or the design.

Once each study has been concluded, the investigators will identify the key messages and compare each buildings performance with similar buildings and current best practice. It is hoped that these will assist engineers, architects and their clients to build upon the good features identified, to avoid those that have proved unhelpful, and to

improve upon those which show potential for further development.

• **Study procedure**

When a suitable building has been identified and approval obtained from the occupier, the investigators will study the building's original design intent, particularly any background material used in preparing the first building analysis article. The building manager will then be requested to supply any missing information and identify any changes to the building, its use and equipment that may have occurred since completion.

Facilities managers will also be asked to annotate the earlier Journal article with any comments based upon today's perspective, and to identify what they regard as major strengths and weaknesses of the building and its services.

Once this preliminary material has been received and reviewed, the investigators will visit the building and apply a range of proven energy reporting and office assessment procedures and carry out structured interviews with those responsible for managing the building and maintaining its services. This will take two people one or two days, depending on the size and complexity of the building.

• **Survey methods**

Survey forms and procedures will be standardised as far as possible, but as PROBE will be covering buildings of different types and in different sectors, it has been necessary to develop a specific research method and to identify suitable research tools.

Under the DoE's Energy-Related Environmental Issues (EnREI) research programme, BRE has recently been developing a prototype procedure for collecting, assessing and reporting energy use in occupied non-domestic buildings, the Energy Assessment and Reporting Methodology (EARM). The EARM originated as a reporting procedure for consultants working on energy case studies of offices for BRECSU.

Table 1 demonstrates the modular basis of EARM, which can be tailored to fit a particular building and the level and extent of an energy survey. Essentially the research principles enable:

- a rapid assessment of energy use;
- a level of accuracy to be established;
- apportionment between end uses;
- indices for comparison with sector norms.

A prototype application of EARM has already been developed called the Office Assessment Method (OAM). Described in figure 2, OAM differs from most methods as it is iterative and contains in-built quality checks. Users are directed towards collecting only the information they really need for the purpose in hand. This helps to improve accuracy, consistency, and productivity.

The development, testing and dissemination of EARM and OAM is now being handled by BRECSU. The PROBE project intends to pilot the Office Assessment Method, particularly on air conditioned offices and may also adapt it for greater ease of use and for other building types.

Whether or not the OAM is used on a PROBE building, the investigators will determine

the level of user dissatisfaction through the use of occupant questionnaires. As it is vital that data gathered under PROBE are comparative with other research, either concurrent or planned for the future by other research bodies, considerable effort has been made to devise a standard questionnaire.

Several occupant questionnaires are already well established, notably those devised by Adrian Leaman of Building Use Studies, Gary Raw of the Building Research Establishment (for use under new Health & Safety Executive guidelines for the determination of sick building syndrome) and a more wide-ranging occupant questionnaire drawn up by UMIST's Geoff Levermore.

Considerable volunteer effort has resulted in an agreed standard and modular questionnaire which will be tested on PROBE and continually improved where necessary. If successful, it is hoped it will become an acceptable add-on module to the OAM for wider use.

• **Applying the results**

The overall purpose of PROBE is to provide building services engineers with an insight to the true performance of buildings so the design of new buildings can be improved. On that basis the PROBE datasets will be as transparent as possible, and freely available to enhance other industry databases, notably those run by BRE, BRECSU, and BSRIA.

It is vital that the building owners and facilities managers contributing to PROBE benefit from the project. Initially, this will be in the form of energy and operational advice given anecdotally by the investigators, but the results of the occupant questionnaires and energy analysis will also be made available. If time and resource permits, a further revisit will be made to find out whether performance improvements have been achieved.

It is also the intention to bring in other expertise to calibrate the survey results. Where possible the original designers will be asked to comment on the data analysis, particularly by comparing the actual use of the building with the performance specification. Where applicable the expert views of the relevant CIBSE Groups will be solicited to comment on findings, for example in naturally ventilated buildings or those which use ice storage.

It is also the *CIBSE Journal's* intention to carry out a reader questionnaire after the first five PROBE investigations so that reader requirements can be taken into account.



Tanfield House in Edinburgh, the first PROBE building.

The first PROBE study is scheduled for the September issue of the *CIBSE Journal* — we look forward to receiving your comments.

Dr Paul Ruyssevelt is manager of HGa’s Energy & Environment Division. Dr Bill Bordass is principal of William Bordass Associates which undertakes studies into the energy and environmental performance of buildings.

PROBE is a collaborative research project sponsored by the Construction Sponsorship Directorate of the DoE.

If any reader wants a particular building from the *CIBSE Journal* archives to be featured in PROBE, the editor would be interested to hear from you.

Table 1: Investigation stages, modules and quality criteria of the EARM		
Stage		Tick box if required
1	Building performance analysis using simple energy consumption indices	<input type="checkbox"/>
1A	Assess accuracy of data and analysis	<input type="checkbox"/>
1B	Assess the need for further investigation	<input type="checkbox"/>
2	Preliminary explanation of performance	<input type="checkbox"/>
2A	Develop normalised performance indices	<input type="checkbox"/>
2B	Analysis of building fabric systems and operation	<input type="checkbox"/>
2C	Analysis of detailed energy consumption records	<input type="checkbox"/>
2D	Preliminary assessment of energy by end-use	<input type="checkbox"/>
2E	Assess accuracy of data and analysis	<input type="checkbox"/>
2F	Assess the need for further explanation	<input type="checkbox"/>
3	Detailed analysis and explanation	<input type="checkbox"/>
3A	Confirm critical building data	<input type="checkbox"/>
3B	Calculate energy consumption by end-use and reconcile against metered data	<input type="checkbox"/>
3C	Explain energy end-use consumptions	<input type="checkbox"/>
3D	Assess accuracy of data and analysis	<input type="checkbox"/>
3E	Assess the need for further investigation	<input type="checkbox"/>

Table 1: Investigation stages, modules and quality criteria of the EARM