LEADING CHANGES: the occupant as customer

Incoming CIBSE president Dr Geoffrey Brundrett explains how building occupants' increasing need for healthy, safe and comfortable workplaces will drive the pace of change in the building services industry.

The last 100 years of the CIBSE has witnessed a major shift in building design. From providing mere warmth and shelter, buildings have developed to become complex and comfortable environments in which to live and work.

Services engineers are now responsible for half the investment cost of a building. The heating, ventilation, lighting, acoustics, electrical services, controls and IT, air conditioning, lifts and fire protection all contribute to the wellbeing of building occupants.

Internationally, the CIBSE is the only professional body to possess such breadth, providing a good basis for future success. That success will be multi-disciplinary in nature, including architects, town planners, civil, mechanical and electrical engineers, chemical engineers (particularly for refrigerants), psychologists, physicians, meteorologists and even epidemiologists. All these professions are needed to provide healthy, comfortable and productive indoor climates and to enable complex services to function in harmony. That means going beyond the client to our true customer: the occupant.

Successful companies search out their customers, find out what they require, meet this need and keep a wary eye on opportunities and threats which may change the relationship. To the building services engineer, the customer requirements are a safe and comfortable environment, a healthy indoor climate and refreshing working conditions.

There are about ten key influences which will have a profound impact on the building services profession in the future. These are:

- ☐ customer expectations;
- ☐ productivity linked to the work climate;
- ☐ safety;
- ☐ security;
- ☐ health, infirmity and age;
- ☐ green issues;
- ☐ computerisation;
- ☐ finance;
- ☐ career profiles;
- ☐ globalisation.

These factors will have a powerful impact on the future of our technology and how we develop and use it. It will also affect our professional role and the future of our Institution, the expectation of our customers and the ways in which buildings serve them.

Building occupants expect that their working environment should contain no harmful or unpleasant distracting effects and should provide a positive and invigorating climate. With running costs of offices only 23% of the salary bill, it is clear that all efforts must be made to ensure safe operation and to maximise staff happiness, comfort and productivity.

It is already essential for occupants that services and business information systems are reliable. Residential expectation is also growing as affluence rises. Central heating is now taken for granted, while the benefits of planned ventilation are beginning to be recognised. The use of air conditioning, growing rapidly in cars, is expected to be the next development in house design.

Productivity and the work climate

The effect of indoor climate on productivity in manual work has been well researched. Cold conditions lead to insensitive and slow fumbling in manual tasks. Hot conditions can result in poor grip and occasional dropping of papers etc as moist skin minimises grip. Although machines are taking over manual tasks, the workforce is now making more mental judgments.

The effect of climate on such judgments is difficult to assess. The key factor which has emerged from research is that fatigue is minimised when people have the desired working conditions. Perceived control of ambient conditions is important, and fits into the general theory that personal strain is least in those circumstances in which people have control.

Safety and security

Buildings are also expected to be sufficiently disaster proof to allow safe escape of the occupants at times of emergency. The more complex the building, the more sophisticated the services needed to deal with fire detection, smoke control, directional escape route planning and emergency lighting.

Technological advance has produced computers which can monitor the signal patterns from fire and smoke detection sensors, virtually eliminating the false alarm problems of the old single-element isolated detector.

For the services engineer, security involves confidentiality of information, protection of data or goods and the reliable provision of communication and data storage systems.

The increasing need for secure IT systems is also leading to selective entry to spaces within a building, in addition to visitor screening and protection against out-of-hours theft or vandalism.

Such security systems can now be linked to safety escape procedures based on the knowledge of building occupancy. Security of information transmission is another speciality to prevent stray electromagnetic fields contaminating the transmission of signals.

Health, infirmity and age

Our increased longevity, rising at the rate of two years every decade, means that we no longer succumb to infectious diseases because medicine has solutions to combat them. The average life span of malesis now 74 years, and 80 years for females. However, we now experience more chronic problems, some of which can be linked to prolonged exposure to poor indoor environments, particularly during the early stages of our lives.

Inevitably, the healthiness of the indoor climate is expected to rise and this improvement is expected to be our responsibility. Increasingly, the building services engineer will be expected to provide heating and good indoor air quality systems for the handicapped, the infirm and the elderly. Greater attention will need to be made for the provision of work support, medical alarms, stair lifts and increased lighting levels.

Green issues

Two major problems face the international community: global warming, and the destruction of the ozone layer. While in both cases the facts are undisputed, the magnitude and nature of the changes are still speculative. Nevertheless a philosophy of prudent avoidance is essential because the time constant of the change is so slow and can be of the order of ten to 100 years.

Buildings are responsible for 50% of CO_2 emissions in Britain and for 20% of all cfc releases. Our customers expect "greenness", but at little or no cost. Fortunately we have practical solutions, but we must endeavour to publicise them.

Computerisation

The high processing capabilities of modern computers can now handle not only design calculations, but also model the building temperature and energy use over a wide range of weather conditions and occupancy levels for many different forms of construction. Com-

puters can also provide the specification, full tender documents and working drawings, show ductwork and cable runs, break down components into convenient transportable lengths and cost a given installation.

Increasing system sophistication will soon enable our customers to explore a design through virtual reality and change not only the lighting and colour features but the basis of the design as it develops. Perhaps this technology could provide the breakthrough for engineers and architects to communicate with each other from the start.

Finance

The cost of a building will gradually develop from initial capital cost to life-cycle costing. In the past, designers have had great difficulty in servicing speculative buildings where both the occupancy and use was unknown. Today, the trend is towards long-term serviced lease agreements and design, build and operate agreements – the very basis of the Private Finance Initiative.

In such schemes the financier provides both capital and running costs to an agreed performance criteria. Much more sensible trade-offs are then possible with higher capital investment to give more satisfactory running costs. Such an approach also allows more flexibility to be built- in to the design so that future changes in occupant use can be accommodated.

Career profiles

Careers will become more personal, not company-based. The trend is away from lifetime company careers towards personal development through short-term contracts, with retraining and new skills determined by the individual rather than the company.

Contract self-employment is likely through short-term project teams where staff are recruited for particular projects. The ability to work with others and understand the context of the work will increasingly place the emphasis on improved communication skills.

CPD schemes will become even more essential, although commercial pressures on companies will mean that staff are less likely to be allowed time off for Institutional purposes.

For the last 100 years the cost of running the CIBSE has been provided by volunteer effort, but this is unlikely to continue. We may need to reimburse companies in the future.

Globalisation

The traditional role of national institutions in defining good practice is being challenged by international legislation and by industry sector groups seeking to help their membership.

Governments, manufacturers and consultants now work internationally. Manufacturers are playing a key role here as they become larger, more international and fewer in number. Although harmonisation of European Standards and the setting of international standards (via the ISO) will give other countries easier access to our home market, it will also provide new opportunities for our leading companies.

Health and comfort criteria will become international, reducing the national role to one of local interpretation. However, such legislation will give authority to our work because it is based on the natural right of every employee to have proper light, heat and ventilation as well as reasonable noise conditions. It has important professional aspects as well in terms of a requirement for maintenance to be carried out and recorded with identification of who carried it out and when.

It is worth reflecting that the term "engineer" has no recognised meaning in Britain and that the word "service" is associated with maintenance. Building services engineers may well require a new description as they become more involved in customer health and satisfaction issues.

In their different ways all ten factors will have a powerful impact on the future of our technology and how we develop and use it, but how will they really affect technology, the profession and our customers?

Four changes are likely. The first is more elegant integration of the services within the structural elements of the building so that the building mass, for example, is used as part of the thermal tempering process.

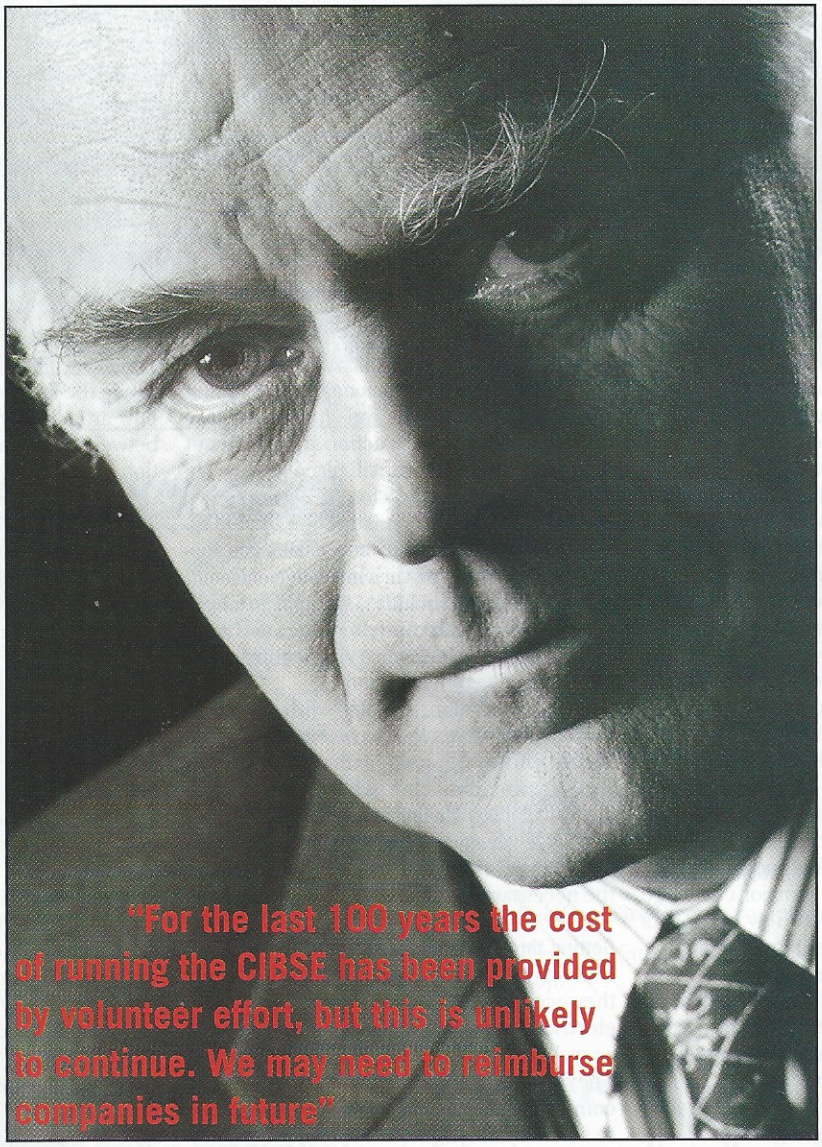
The second is movement of the design from drawing board to computer, with specialist component design services being provided by the specialist manufacturers.

Third is the new role of co-ordinating and linking all the growing and varied services to provide intelligent services management for both safety and comfort.

The fourth impact will be the market for buildings with low environmental impact. Architects are becoming used to engineers guiding them on how to modify the structure to provide natural ventilation. This close co-operation has to develop even further so that the building structure can play a greater role in internal thermal control.

In city centre buildings, where air filtration is needed and the pressure drop involved necessitates mechanical ventilation, many countries are adopting a novel use of the floor slab to provide some thermal storage from night-time cooling and hence minimise the cooling requirements – the Swedish hollowcore mechanical ventilation system Termodeck being a good example.

The design process is rapidly moving from the drawing board to the computer. The fundamental dimensions and location will, in future, lie in computer programs. Calculation procedures are purchased through the software. All involved in the design process will be linked through a hierarchical protocol.



PHOTOGRAPH: PAUL HARMER

The usual problems caused by interdisciplinary boundaries will be resolved on the computer, not on site, and well before construction starts.

As the prime data is already in a suitable form, this route lends itself to reliable prefabrication and robotic build. Translation errors from paper to computer are avoided. Aircraft and ships are already built in this way – buildings will be next on the agenda.

Manufacturers are tending to make sophisticated subsystems, complete with on-board computers and packaged controls. This minimises the scope for error, enables all functions to be certified in the factory and saves costly site labour.

Consultants are now requesting such subsystems, partly because the detailed performance of the units is so specialist and partly because the manufacturers do not always wish to share some of the commercially sensitive features of the designs.

That said, the controls of various building services subsystems – boilers, air handlers and smoke ventilation for example – will be designed increasingly to link to other systems. Enterprising manufacturers are offering consultants access to their powerful software programs. This enables the designers' computers to interface input data and subsequently receive the processed form in graphical or pictorial terms.

In the services field the designer is becoming an architectural technocrat, putting together the many technical disciplines without necessarily knowing the detailed functions of each component. This has worked well for the specialist areas of lifts and the growing complexity of the other services such as IT and fire engineering.

As each service becomes a highly specialist field, the next generation of services engineers will need to pull the specialisms together in a coherent way. A major challenge will be to learn more about how occupants respond to their physical surroundings.

Currently we cannot easily link vertical air temperature gradients with different heating and air conditioning systems. Our knowledge of the detailed factors which determine temperature gradients, thermal asymmetry, air movement and turbulence, and even relative humidity inside buildings lags behind our research data on human discomfort.

Development of the profession

Some 40% of the current CIBSE membership is made up of consultants, with the remainder in maintenance or contractor management and a sprinkling from the manufacturing world. The future may require a new four-way split – design, integration specialists in subsystems, contractors and maintenance specialists.

While a small number of our members work for large city-based international companies, the majority of members work in small practices scattered throughout the country. The occupation pattern will change as the manpower need for general services consultancy slows down and the trend goes towards service engineers in manufacturing, contracting and maintenance.

This has implications for professional training and accredited courses. The recent trend towards a third of our 18 year- olds entering higher education is already raising the entrance level for technician to that of a graduate. Higher level designers may therefore need to have a second and higher degree with a longer curriculum. Retraining options will be possible through developing cpd schemes.

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The increasing professionalism of building services will need to be reflected in the care taken during the construction and fitting-out of our buildings, which will place further obligations on our profession to pull together the engineering and construction functions. The Institution is already addressing the specialist interests by its thriving range of Group activities which includes thermal storage, daylight, electrical power, heritage, ASHRAE, lifts, information technology and controls and facilities management groups.

This stimulation, coupled with participation in the conference discussion and publication activities, will help maintain the Institution's momentum. Our publication activities are developing through Internet links, and CD-ROM versions of our Guides will eventually include interactive algorithms to perform the necessary calculations.

Getting through to the customer

Building occupants assume that the buildings they occupy are safe in the sense of stability, electrical integrity and purity of water supply, as well as freedom from fire and explosion. They would like the indoor climate to be comfortable and controllable, and expect not to suffer from long-term exposure to chemicals and materials present in the workplace.

The purchaser is protected by law on safe operation, and all buildings are checked to ensure compliance. As professional guidelines in Britain are rather coarse, our customers are not normally able to ask the right questions in order to specify a comfort level.

Hence the definition of what is meant by stimulating and refreshing conditions is currently the subject of research. Some countries, particularly in Scandinavia, have resolved the communication gap between purchaser and specifier by clarifying the responsibilities. The purchaser is asked to identify the level of occupier satisfaction sought: 90%+ is first class, up to 90% second class and up to 80% third class.

Services designers are responsible for selecting the equipment to achieve this level of satisfaction. Although thermal conditions are judged on the narrowness of the control band, such as 2°C, temperature asymmetry in terms of radiation, vertical air temperature gradients and floor temperatures are not often applied, despite a wealth of research.

In terms of air quality the higher satisfaction level goes with higher quantities of outdoor air. In practice there are far more sources of odour than cigarette smoke and the occupants themselves. Furnishings, adhesives, and fittings contribute to the ambient odour.

In these areas the customer perception of building services is strongly influenced by the architect, but success is unlikely if the architects and engineers fail to work together. While the link between overheating and window area and orientation is recognised, that between the building materials and ventilation requirements is less obvious.

Field studies show the importance of personal control. The tolerance band is large for any one individual, but it has to be much narrower for a group. Single-cell offices are highly rated by the occupants when controlled with a crude radiator valve for heating and an open window for cooling. Most car interiors are pleasantly controlled without the need for a finely tuned thermostat.

Open-plan offices would benefit from some degree of personal control, and this can now be achieved in, for example, lighting. Research is showing that occupants' own perceptions of productivity are closely linked to their perceptions of comfort and health. I therefore commend to the CIBSE membership the use of post-occupancy reviews during the first two years of building occupancy. Ultimately, working with our customers in this way must surely be beneficial for everyone.

To conclude, our Institution is unusual because our breadth of activities gives us more committee and more representational obligations than many other sister Institutions. We have always had a long-serving and outstanding team of dedicated volunteers to help us, and I want to reinforce these by positively encouraging the next generation to take an active role in the Institution's affairs. We are unusual in having 8% of our members on committees working for us. I would like even more members to participate.

Finally, may I declare these to be personal views. I may be wrong and you, the CIBSE members, may have different views which are perhaps better. During my presidential year I hope to listen to those views.