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The Lanchester Library — Building a Sustainable Library

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A powerpoint presentation with photographs of the library is available from http://www.zhbluzern.ch/LIBER-LAG/PP_LAG_08/Wednesday/Noon_Budapest_08_def.pdf.

Abstract

The award winning Lanchester Library is the largest deep plan naturally ventilated building in Europe and has consistently delivered significant energy savings compared to air conditioned buildings. The article provides some background to the design and explains the sustainable features of the building as well as describing how flexibility was built into the building to enable the library service to evolve in response to changing user needs.

Key Words: Academic library design; sustainable architecture; energy efficiency; flexible space design

Introduction

The Lanchester Library at Coventry University opened in September 2000 and cost £19m. The architects were Short and Associates led by Professor Alan Short whose main office is in London, UK, and the environmental engineers responsible for developing the sustainable aspects of the building

were Environmental Design Partnership. The floor area of the building is about 10,000m^2 and it is the largest deep plan naturally ventilated building in Europe and possibly the world.

More than just the Building

Although the building has attracted a great deal of attention for its sustainable energy features, we also wanted to incorporate into the building other aspects of sustainability. Therefore we have tried to make the power and network infrastructure and the configuration of library space as flexible as possible to ensure that the library service itself continues to evolve in response to changing customer needs — so that library service delivery is as sustainable as the building services.

The Architect's Brief

Short and Associates only design environmentally sustainable buildings but they had never designed a library before, so we developed a brief for them designed to get across the elements of a library service that would feature prominently in the new building. We wanted an integrated learning resource centre that brought together books, journals, media resources and electronic resources as well as extensive PC provision and a full range of help and support. We also wanted to include in the facility provision for other student facing services so that we created a new focal point for student activity around the new building. This included a café, a bookshop, a shop providing copying and binding as well as a full range of stationery products. We wanted to provide maximum flexibility for the future. We had seen plenty of examples where layouts and space use had changed significantly in comparatively short periods of time and wanted to be sure that we could accommodate such changes if they became necessary. Part of this dictated that we wanted a rectangular, preferably square building to make layouts and therefore legibility and navigation easy for customers. We did not want the building to rise above four floors for similar reasons, although

when we designed it, because of a sloping site we did have four and a half floors with a partial basement covering about half of the library footprint.

Environmental sustainability was a major feature of the brief, not a bolt-on extra, as the university had a national reputation for energy conservation and they were determined that this building would enhance that reputation.

Above all because we had seen buildings where the creative instincts of the architect in our opinion has compromised the library's functionality, we insisted in our brief that wherever these came into conflict it would be the learning needs of the students that would be paramount.

The New Library Vision

To reinforce the brief we also created a vision for the library that tried to capture some of our hopes and aspirations for the new building and to which we hoped the architect could respond in his designs. Amongst several other aspirations we wanted to

- provide an exciting and highly effective centre for information access, study and learning, which will affirm the university's commitment to the student learning experience;
- offer the highest quality information service delivery, in support of teaching, learning and research;
- develop an exciting focal point for students which will attract and delight users and in which staff and students will find it a pleasure to work.

In other words we wanted a building that turned on its head the conventional view of the library as a place associated with swotting and therefore visited reluctantly, by creating a building where students actually chose to go because they liked it.

Dialogues with Architects

This firm view of what we wanted led to an inevitable and lengthy dialogue with the architects and designers about how we could balance the often conflicting requirements of sustainability and the aspirations of the library service. For example, we wanted a simple building that was easy to use but the architect warned us that sustainable buildings were always complicated; to make layouts easy to follow we wanted a rectangular building but the architect assured us that sustainable buildings had to be long and thin to allow for the penetration of natural daylight; we only wanted four floors but the architect said if it couldn't be long and thin it has to be tall and thin; the architect had the idea that libraries were stores for books whilst we had to convince him that libraries were as much about customers as they were about books; we didn't want an atrium to avoid noise travelling through the building but the architect insisted that sustainable buildings had to have an atrium. In summary, whilst we insisted that the needs of the library customer were paramount, the architect insisted that in design matters he was always right. Of course out of this friendly and creative tension came a number of compromises on both sides but also the clever ideas that enabled the building to succeed in both environmental and service delivery terms.

Flexible Space Design

In response to our desire for the maximum flexibility across the library floor space, the architect had used structural steelwork to carry the weight of the building so there were no internal load bearing walls. All walls were partitions and could be removed as the changing needs of the building dictated. He also proposed to place the stair wells and the toilets — two of the most inflexible elements in any building — outside of the active library floor space in what he called 'pods' so that there were no obstructions to using all of the space flexibly. The cabling strategy added to this. Instead of expensive and space hungry raised floors, the engineers proposed to carry power and data cabling across the floors in channels cut into the floor screed fed from the four corners of the building. The channels were topped by a high tensile steel cap that could stand the weight of loaded book shelves. By this simple means it is possible to move book shelves anywhere in the building and to

exchange bookshelves for PCs space in any part of the building. Artificial lighting was provided by strips that ran diagonally across the ceiling enabling book-shelves to be placed almost any where on the floor and at almost any angle. In response to our desire for flexibility the architect and designers have delivered space that is almost infinitely flexible. I say almost because there is one very important limiting factor to this flexibility which is the means by which the building delivers most of its environmental sustainability.

Sustainable Energy Use

Our dialogue with the architect about atria was resolved by not having one large noisy atrium but replacing it with five lightwells spread across the floor plate. One of the key components of any sustainable building is maximising the use of natural daylight and reducing the reliance on artificially generated light. Light only penetrates into buildings a small distance between 5–6 metres, so in a deep plan building like ours a considerable floor area would rely on artificial light. The introduction of lightwells produces a huge increase in the penetration of natural daylight into the building. In conjunction with a dynamic lighting system that reduces output when daylight is strong and responds imperceptibly as daylight fades it is possible to generate very significant savings on energy use for lighting.

At 6.5 metres square the lightwells take up a significant amount of space but we agreed that the environmental benefits they brought to the building far outweighed any loss of active space. This is because they double up as the conduit by which the building is naturally ventilated. As I indicated earlier, throughout our discussions the architects and engineers were struggling to find a way to accommodate their preferences for natural ventilation with our desire for a deep plan building. It was our insistence on an enclosed atrium that led the architects and engineers to realize that an enclosed tube through the building could be used not just to draw light in but also to transport air throughout the building. As a result they have been able to design a building that is almost entirely naturally ventilated with only one very small area with a high density of PCs using conventional air conditioning.

Air is drawn into the building through vents on all elevations into a plenum beneath the ground floor. This feeds air into the light wells which is then fed onto the floors by vents at the foot of each light well that open and close in response to sensors around the building checking on temperature and air quality. Air exhausts out through vents in the perimeter walls to the towers that are such an eyecatching feature of the building and out into the atmosphere. Air also exhausts into the central light well, so there are four inlet light wells and one exhaust light well.

The elaborate metal constructions on the tops of the towers as well as being architecturally attractive in the words of the architect, also have a much more important and piratical function. Air rises through the building as long as it can exhaust out freely, but this is hampered and even prevented in high winds when the wind prevents the convection effect. The structures are designed to deflect even very strong winds to ensure that the building can continue to breathe.

All of this of course relies on a sophisticated building management system (BMS) that intelligently monitors the environment and prompts appropriate responses to maintain a comfortable working and study environment. One of the most important responses is night cooling. The temperature that occupants experience in a building is affected significantly by heat stored in the mass of the building and which gradually increases as temperatures rise. In the Lanchester Library after we close at midnight the building purges warm air by flooding the building with cool night air to bring down the temperature of the mass of the building so that temperatures start again the following morning at a lower temperature than would otherwise be the case. This plays an important part in delivering a building that is almost always at a comfortable temperature throughout the year without the need for an expensive air conditioning plant.

Does It Work?

Evidence that the technology is capable of delivering a comfortable environment is available from a research study performed by DeMontfort University's Institute of Energy and Sustainable Development (IESD) (Krausse, Cook and Lomas, 2007). They monitored the building for a whole year and discovered

that the building remained pretty constantly between 21ºC and 24ºC irrespective of the ambient temperature. Further support for the fact that the building could deliver acceptable levels of comfort was found in another piece of research conducted in the new building (Simons and Maloney, 2003), where satisfaction with the working environment was very high and in marked contrast to satisfaction levels in the old library, and from the staff survey conducted around the same time that found that 'The library has considerably higher levels of satisfaction for its environment than the university as a whole'. It is not always perfect of course. There are one-off occasions when the BMS blows up (a careless electrician), or rare occasions when settings are inadvertently set wrongly. Also, the natural ventilation was not designed to cope with those half dozen or so days which we occasionally get in the UK when the temperature soars to tropical levels. Despite these infrequent lapses the building has delivered pretty constant comfort with almost no serious complaints from staff or customers for the past eight years completely vindicating the faith of the engineers, the architects and those of us who helped plan the ground breaking building.

The other real test of success of course is how effective the building is at reducing energy costs. This was also monitored by IESD and showed quite conclusively that the Lanchester library operates at half the energy cost of a conventional air conditioned building and performs at least as well as the good practice guidelines for naturally ventilated open plan buildings (Krausse, Cook and Lomas, 2007).

Sustainable Library Service

Important and fascinating though the sustainable technology is, its main purpose is to serve the function of the library to enable it to deliver high quality services to its wide range of customers. This is why we wanted to build in the levels of flexibility that we talked about early in the article. We have been able to make effective use of that flexibility as we have gradually evolved our learning space to meet the changing needs of students in particular. Despite the inexorable growth of electronic information resources and the use of the internet to access information there is still a huge demand for the library as a space from students, and the uses to which students wish to put that space is

changing. The days of the silent monastic academic library are probably gone forever in many universities.

To respond to these changing demands we have already in the first seven years of our occupancy instituted a rolling programme of upgrades and refurbishments aimed at providing different learning environments to meet different needs. Our silent study areas have been refitted to make them more attractive to post-graduate students and PCs have been introduced in response to requests from students. Our entire ground floor space has been completely reshaped and refurnished to create a social learning space where students can work freely in groups on casual chairs with fixed PCs or with laptops using our wireless network. Our most radical change was to completely gut our basement study area, formerly home to around 120 PCs laid out in a highly functional but frankly dull and uninviting style, to create what we have called 'The Learning Lounge', an extension of our social learning space where we have also introduced catering to provide an even more relaxed study and social meeting space within the library.

All of these have benefited from the flexibility we built into the design of the building, but, more importantly, show that sustainable libraries are about more than just the environment and energy savings — proud though we are of this — but just as much about sustaining our relevance to the changing needs of customers.

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