NWDC Offices Chippenham

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energy on the agenda

North Wiltshire District Council's new low-energy offices in Chippenham

With the deadline for the UK to achieve target reductions in CO_2 emissions set at Kyoto rapidly approaching, the government has for sometime been leading by example. In 1998 North Wiltshire District Council received treasury funding to procure new offices through the Private Finance Initiative (PFI) and not surprisingly, sustainability was high on the agenda. The District Council's existing offices were located in 6 separate buildings spread across the town of Chippenham. This was confusing for the public and a created a logistical and property management nightmare for the council.

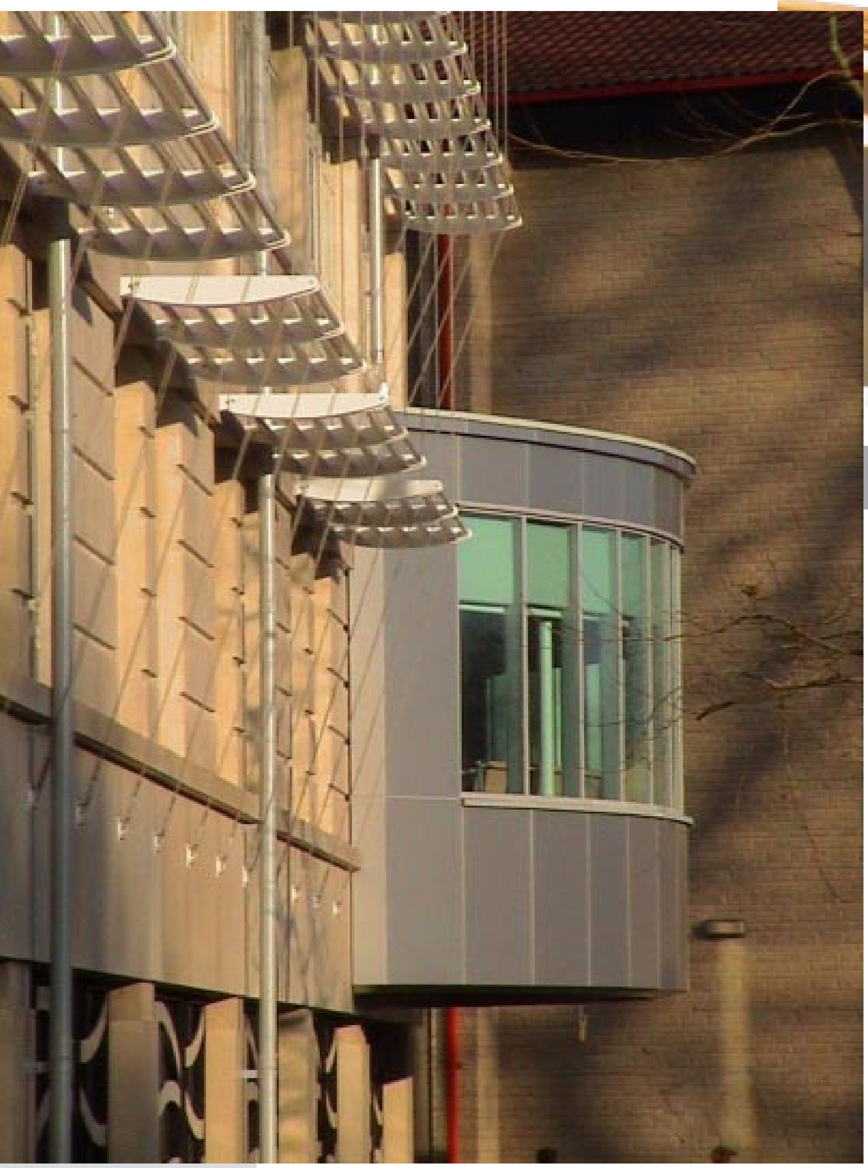
After the usual PFI bidding process, Jarvis Plc were appointed in April 2000 to construct and run for 25 years a **BREEAM excellent** rated office building conceived by their lead consultants DKArchitects, on a brown field site close to the town centre.

contents

DKArchitects

NWDC Offices Chippenham

team approach



Approach

The PFI process facilitated an 'integrated team' approach to the design. The contractor, facilities manager and key supply chain members worked with the consultants from a very early stage and provided a valuable contribution to design development. More importantly, they understood and' bought' into the low energy strategy for the building from its' inception.

The building design was driven by three fundamentals:

Value for money

Although the 25 year PFI contract allowed 'whole life costs' to take a greater role in the decision making process, energy costs were not included in the PFI providers unitary charge, so no cost benefits for the bid could be derived from this. It was essential if the PFI bid was to be competitive, that the capital cost of the low energy design was comparable with the conventional mechanically-ventilated speculative office building.

A low energy design

An 'excellent' BREEAM rating was established as the benchmark for the design. So a low energy strategy was an essential ingredient. This lead to a naturally ventilated atrium building, with exposed concrete structure to facilitate summer night time cooling, high levels of natural light and 'intelligent' electrical lighting.

The building as an expression of 'open' government.

The new building was an opportunity to improve communication. Firstly, between the various departments of the council through an open plan design with all floors grouped around a central atrium.
Secondly, between the council and the public, with the reception being one of the key spaces in the building. This is located to have strong visual links to the main office areas and the public are welcomed into the heart of building, rather than kept as far from officers as possible.
And finally, between councillors, the democratic process, and the public. The council chamber being accessible to all and glazed towards the town so that, conceptually at least, decision making doesn't go on 'behind closed doors'.

architectural

Site Selection

The choice of site had been left open to the bidding parties. Although the Monkton Park site chosen by the Jarvis team was not the easiest on which to build, it had four strong advantages: Firstly, it was in council ownership. Secondly, it was close to the town centre public transport connections and the railway station. Thirdly, the site contained one of the existing council offices, so was already identified with by staff and public alike, as the location of the council offices. Finally, that the site was a brown field site.

The site is long and thin with the axis running east/west and slopes steeply to the south, dropping 6 metres to the River Avon flood plain at a little less than an average of 45 degrees. The existing council office building on the site was a cellular reinforced concrete tower with low floor to ceiling heights and it was soon established that recycling (demolition, crushing and incorporation in foundations & road bases), rather than complete reuse, was the only viable option. The basement structure was retained however, to protect the roots of nearby mature trees.

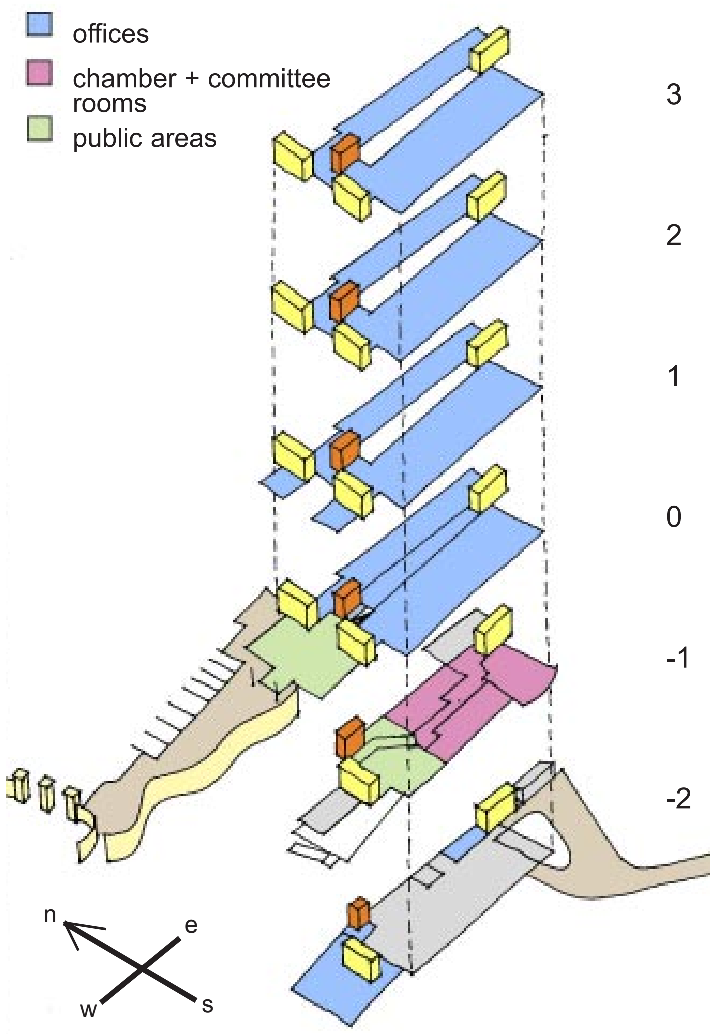
Layout

The main entrance to the new building is at the west end, facing the existing site entrance from Monkton Hill.

The entrance level: level 0, is two storeys above the flood plain. The wedge shaped atrium, aligned east/west starts at this level and rises up through three further floors of offices and associated accommodation (WC's, kitchenettes, meeting rooms etc). The atrium widens towards the west, gradually decreasing in height to form the reception area and main entrance. The floor plate to north of the atrium is 7m wide to accommodate cellular offices, whilst to the south it is 11m wide for open plan office accommodation. A clear glass screen with the council's coat of arms etched on it (one of several art works incorporated in the building), physically divides the public reception from the officers accommodation whilst maintaining a strong visual connection between the two.

On level -1 (a single aspect floor built into the slope) are all the mechanically ventilated spaces and the main mechanical plant rooms. Grouping all these on one floor, in close proximity to each other, minimises duct runs and thus plant size. The accommodation includes the council chamber and committee rooms, which overlook the river, some internal meeting rooms, the kitchen and the café. This is open to both staff and the public and has access to a south facing terrace overlooking the river, on top of the existing basement structure.

On level –2 (flood plain level) are cycle parking and changing facilities, electrical plant rooms, car parking and archive storage located in the reused basement structure.



Environmental Strategy

Lighting

With artificial lighting capable of consuming 40% of the total energy used by office buildings, lighting was an obvious place to start the development of the buildings low energy strategy. The first decision was to maximise available daylight by allowing generous floor to ceiling heights (2.9 metres to crown of coffer), optimising window sizes and introducing a central atrium to allow daylight into the heart of the building, which allowed a deep plan for the building. Solar gain on the south elevation and atrium roof are controlled by external shading whilst glare from winter sun is minimised by internal Venetian blinds. An 'intelligent' lighting installation which includes daylight sensing and PIR controls ensure that lamps dim/brighten to maintain pre-set illuminance levels on the working plane and dim to 20% maximum output when the desk spaces below are unoccupied to save energy without causing distraction to occupants of adjacent spaces.

Ventilation and Cooling

In addition to grouping most of the mechanically ventilated spaces on level –1, functions with a high heat output (graphics rooms, training rooms, I.T. server room, etc.) were also grouped together on the upper office floors, being located on the north side of the building (to offset greatest heat losses) in cellular spaces.

An exposed high thermal mass structure with a building management system (BMS) controlled summer night-time cooling was adopted to control internal heat gains. A number of precast concrete coffers were designed by DKArchitects with the close co-operation of C.V. Buchans. The coffers sit within the webs of steel beams positioned at 2.5m centres supported alternately by steel columns and steel hanger beams. This design was developed to avoid any downstands which might impede air flows along the underside of the coffers and thus lead to trapped pools of hot air. The air movement is driven by the 'stack effect' within the central atrium and wind pressures across the building as a whole. The amount of ventilation is controlled by the BMS, which operates opening windows on both sides of the mono pitch atrium roof and at high level along the perimeter of each floor plate.

The coffered form of the ceiling units increases the surface area through which heat can be absorbed by the concrete and controls the acoustics of the open plan offices below.

Acoustics

Without suspended ceilings to absorb noise in the office spaces another means of attenuating noise was needed. The 'waveform' of the coffers reduces reverberation time and focuses sound waves onto sound absorbing wings attached to the sides of the luminaries suspended centrally from each coffer. The coffers on the perimeter close to a level soffit to simplify detailing at the window interface.

Sound transfer between floors (across the atrium) is controlled by sound absorbing quilt built into the perforated timber balustrading.

Heating

With U-values exceeding those of the building regulations, fabric heat losses were kept to acceptable levels and it was decided to employ a traditional pumped LTHW perimeter heating system with panel radiators. The robust, reliable and easy to maintain system was favoured by the consultant team, the facility manager and the contractor.

building services + fm

Building Services Installation

Mechanical

Well-proven techniques were adopted to minimise the impact of summer time heat gains and maximise the use of natural ventilation to remove heat from the building.

High thermal mass was achieved with the use of exposed concrete soffits. The enhanced surface area increases heat transfer, thereby reducing the space temperature by 1 – 2 °C. The south elevation has been provided with external horizontal louvre shading. This limits summer time heat gains whilst allowing beneficial heat gain from low winter sun.

Local control of ventilation and temperature is provided by windows that have been designed with user-friendly side hung manual opening lights. These are complimented by automatically opening transom lights.

During the early stages of the design development, a 3D-computer model was created to simulate the thermal characteristics of the building throughout the year. The model sub-divided the building into over twenty zones. The analysis demonstrated that the building would perform significantly better than the threshold values set out within the client's brief.

As part of the ventilation strategy, night-time cooling of the space (and in particular the concrete soffit) was incorporated. The building management system (BMS) has been configured to progressively open the automated transom lights in response to external, internal and concrete slab temperatures (measured with embedded sensors). The air which enters the space via the transom lights, will pick up heat from the concrete soffit and carry it into the atrium from where it rises to be exhausted through the atrium automated vents. The BMS also uses, more so for daytime ventilation, wind speed and direction monitors to further adjust the amount of opening of the automated window and atrium vents to prevent nuisance draughts. A rain sensor will also reduce the amount of opening if rainfall is detected.

Natural ventilation is not only necessary to provide cooling of the space, but also fresh air for respiration and odour removal. During the summer months the manual and automated vents will admit fresh air into the space as a by-product of cooling ventilation. In the winter months a means of achieving trickle ventilation needed to be provided. This was solved by the use of air quality sensors signalling the BMS to 'crack' open the automated windows when the environmental conditions deteriorate.

In limited areas of the building natural ventilation was determined inappropriate and hence mechanical fresh air ventilation was employed. Even so, the benefits of night time cooling have been used. During the summer nights, the BMS opens high level windows and switches on the ventilation plant at night to pre-cool the space for the following day.

Electrical

The electrical services within the building were designed to be energy efficient, flexible and economic to install. All systems were developed so that each constituent part was easily installed on a 'plug in' basis which reduced final installation time on site to a minimum. This was particularly important as end user input was encouraged until quite late in the construction process.

This design strategy led to a prefabricated lighting installation being provided. The rafts which are suspended within each ceiling coffer consist of acoustic panels, luminaires with CIBSE LG3 Cat 3 controlled downward light and modern linear fluorescent T5 lamps (utilising high frequency control gear and a proportion 10 – 15% of upward light). The lighting installation was provided with a modern control system which enabled illumination levels throughout the open plan office areas to be adjusted to meet client requirements (350 Lux minimum) and react to occupancy and daylight, thus improving efficiency.

To assist the facility manager with running the electrical systems within the building, 'bus-wire' technology was employed. This enables the FM office to centrally control, monitor, test and fault-find the lighting control systems, emergency lighting systems, fire alarm installation, intruder alarm system, door access systems and closed circuit television.

Systems throughout the building were provided with flexibility in mind and are capable of modification or addition with little disruption to office area use. Small power systems run from a modular plug in busbar system located within the floor void alongside a structured 'state of the art' categorised (5e UTP) voice and data wiring network. Each workstation was provided with an easily re-locatable floor mounted technical service access station, providing four power (240v 13 amp) and four telecommunication (RJ 45) outlets to enable fast and efficient access to the "outside world".

Telecommunications

A state of the art 3Com VOIP (voice over internet protocol) telecommunications system was procured by NWDC and Jarvis in partnership. The system provides a versatile solution, which meets all the council's needs including the NWDC call centre. All the existing telephone numbers and internal extension numbers were transferred to the new system during the weekend of the move.

Facilities Management Implementation

The involvement of the facilities management provider in the design and construction phases of the project was seen as essential. Jarvis Workspace FM provided an implementation manager for the duration of these phases of the contract and the benefits are evident in the final product. Particular attention was paid to ensuring that the service level agreements in the PFI contract were achieved and that the budgets which were set within the sinking fund at contract signing remained adequate to meet all the anticipated future expenditure for the building.

FM's selection of service providers has ensured that the building maintenance, security (access control and CCTV), hard & soft landscaping maintenance, cleaning and catering are all in accordance with the client's expectations and the agreed service level agreements.

A Satisfied Client

Despite the political 'debate' which inevitably revolves around any PFI project, the overall response of councillors, council officers, local people and other visitors to the new building is overwhelmingly positive. Jarvis Workspace FM is now running the building (and will continue to do so for the next 25 years), allowing the council to focus on continuing to deliver and improve its service to the community.

construction management

Buildability

Construction works started only 3 months after the PFI contract was signed with the decanting of council staff to temporary accommodation and the demolition of the existing office building on the site.

An anticipated shortage of bricklayers and the team's concerns of controlling quality and consistency of 'facework' on such a large façade, led to an important decision at the first design team meeting. By changing the façade from masonry to pre-insulated, pre-cast pigmented concrete panels (manufactured less than a fifty miles away by the Marble Mosaic Company) it was possible to control the quality of the façade finish and save two months on the construction program. The local planning authority was agreeable to the change and the increased capital costs were offset by savings in the scaffolding package (as the façade could be erected from mobile cranes) and the prelims savings offered by the early completion and handover.

Logistics

The building was handed over to the council in early December 2001, two months ahead of programme. Months of pre-planning and considerable effort from the council, ensured that the PCs, files and personal effects of over 300 council staff were transferred into the new building in just one weekend, with many of the council staff on-hand to ensure all boxes went to the right locations. The council closed to the public on Friday afternoon and were open for business at 9.00am on the following Monday morning with an operational computer system, reception and call centre.

Key subcontractor involvement

A quasi two stage tendering process was used to select the key design-subcontractors involved with the project. Designs were developed working closely with the consultants, contractor and facilities manager as part of an overall project team. The steel frame, coffers, pre-cast façade, solar shading, curtain walling, windows and mechanical and electrical sub-contracts were all procured in this way. The quantity surveyors took an 'active' role in design team meetings. By employing an 'open book' style, the design team members were always kept informed of the overall and individual budgets for each package. The team could then 'overspend' on packages where it was justified and make savings on other packages to ensure that overall the project remained within budget.

The electrical subcontractor (who employed a mechanical subcontractor to create a combined services package), bought into the 'exposed structure/concealed services' aesthetic from the outset. Their close involvement with design development and their ingenuity during installation was an essential ingredient to the success of the project.

Project Dates

Contract Start Date	19 April 2000
Contract Completion Date	21 January 2002
Actual Completion Date	**03 December 2001**
Contract Duration	**91 Weeks**
Actual Duration	**84 Weeks**
Completion	**7 weeks early**

Floor Areas

Gross Internal	6500 m^2
Net Internal	4800 m^2 (excluding basement car parking)

Project Team

occupier	**North Wilts District Council**
pfi provider	**Jarvis Projects**
main contractor	**Jarvis Construction (UK) Ltd**
facilities provider	**Jarvis Workspace FM**
architect	**DKArchitects**
structural engineer	**Curtins Consulting Engineers**
services engineer	**Jones King Partnership**
environmental assessment	**ECD Energy & Environment**
acoustic consultant	**Acoustic Consultants Ltd**
building services	**Browns Electrical (Bristol) Ltd**
	Intoheat
coffers	**C.V. Buchans**
façade	**Marble Mosaic Company**
structural steelwork	**Hawk Engineering**
windows	**Velfac**
structural glazing	**Duplus Domes**
solar shading	**Levolux**

Further Information

Jarvis Projects

16 Queen Street
Bristol
BS1 4NT

Michael Stephens – Development Director
t 0117 927 6844
f 0117 927 2655
e michael.stephens@jarvis-uk.com
http www.jarvis-uk.com

DKArchitects

The Malthouse
Sydney Buildings
Bath
BA2 6BZ

Lee Inglis-Sharp - Director
t 01225 465701
f 01225 465714
e lee.inglissharp@dkarchitects.co.uk
http www.dkarchitects.co.uk

DKArchitects

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