

INNOVATE GREEN OFFICE

Thorpe Park, Leeds



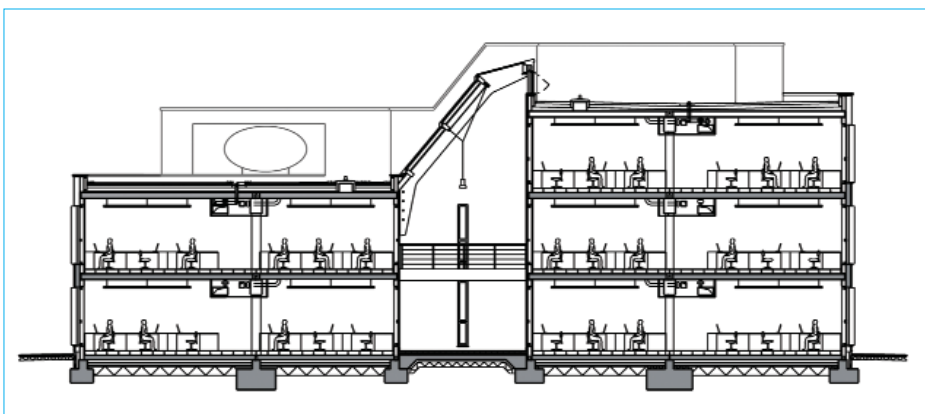
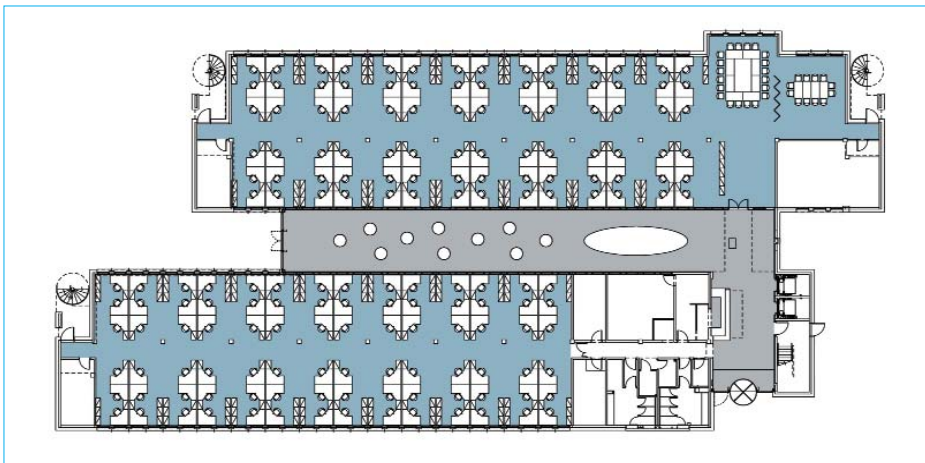
"Doing nothing is simply not an option"

The global environmental crisis, more stringent legislation and considerable fossil fuel cost rises are all beginning to affect the way in which buildings are designed and built.

The challenge for our team was to prototype a super-energy efficient building that would stand up the scrutiny of the institutional funding markets.

The form of the building has emerged from the first principles of sustainability tempered by an appreciation of how the environment affects architecture both spatially and aesthetically. Our design embraces orientation, thermal efficiency, natural ventilation, use of natural light, recyclability and modularisation.

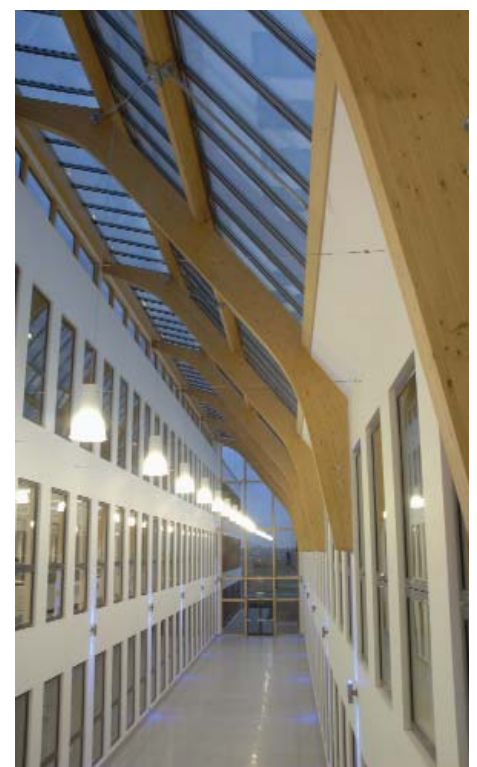
The resultant 46,000 ft² flexible office is the highest BREEAM rated building ever at 87.55%. It looks set to significantly reduce CO₂ emissions to one fifth of that of a similar sized institutional office and far exceeds current sustainability targets.



| | |
|---|---|
| a | |
| b | |
| c | |
| d | e |

LEGEND

- a East elevation
- b Plan
- c Section
- d Detail of service pod
- e 'The Street'



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THE BRIEF

In 2001, our client had a vision to produce a super-energy efficient building that would stand up the scrutiny of the institutional funding markets. They saw the huge gap in the market for providing efficient buildings coupled with the potential to dramatically reduce their substantial fuel bills. Over the next 3 years, the team embarked on a wide-ranging analysis of cutting edge sustainable thinking culminating in a detailed Stage D report that set the following goals: -

- To prototype the UK's first commercially developed sustainable office
- To "kick start" the commercial sector's awareness of global warming
- To achieve the highest BREEAM rating of any building type in the UK
- To create a pleasant working environment that meets standard investment criteria for institutional funding
- To significantly reduce life cycle/operating costs and waste and energy usage during construction
- Utilise recycled and recyclable products in the building construction where possible locally sourced

PROJECT SET UP

A Joint Venture was created between serviced office providers, Innovate Property and Yorkshire Forward to develop a 2.8 acre site at Thorpe Park, Leeds. Development on the site was governed by pre-determined rigorous Business park development guidelines.

THE DESIGN

The building consists of two 14 metre wide blocks either side of a 6 metre wide street containing flexible office space. The building is orientated along its N/S axis, minimising solar gain and thereby significantly reducing the need for cooling. The building is heavily



insulated with 250mm thick Sto render to the walls, 250mm Rockwool to the roof and 150mm EPS to the floors. The principle W/E elevations are predominately glazed and vertically shaded.

The building is configured to benefit from the heat of the morning sun. The precast concrete structure, incorporating 40% recycled content, acts as a giant heat store in the winter and a cool store in the summer. Supplementary cooling is generated by using waste heat from the central CHP. The spaces are mechanically ventilated using a Termodeck system which distributes and tempers the air supply to the floorplates through a labyrinth created from the hollow cores of the floor slabs. The building is divided into 4 environmental zones. Supply air is ducted to these areas within the spine return air plenum. Air intake is via 4 roof mounted AHU's which sit atop the sedum roof and are shrouded in fibre reinforced polymer elliptical enclosures. An in-depth material analysis was undertaken on all products during the construction process.

PROGRAMME

The project was conceived in 2001 and after 3 years of prototyping, construction commenced under a D and B contract in November 2005.

Practical completion was achieved on time and on budget in January 2007 with occupation in February 2007.

BUDGET CONSTRAINTS

The project was to be designed such that if the building were replicated it could be produced at institutional agreed commercial rates. The formula $G = T + P + O$ was created to obtain funding for this unusual development.

Where G = the sustainable office cost

T = typical institutional standard BI office cost

P = prototyping costs

O = overage costs (costs which can be proved to be recouped over the life time of the building)

OUTCOME

The resultant 46,000 sqft building has a carbon index of 22.6 Kg CO₂/m²/year (the equivalent of the yearly CO₂ produced by 16 houses) and has recently been certified by the BRE as the highest BREEAM rated building ever at 87.55%. The developers have continued the holistic sustainable nature of the building through the fit out phase and beyond and have commissioned Leeds University to monitor the performance of the building over the first 18 months of operation.



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SUSTAINABLE DESIGN APPROACH

The whole building is designed as a thermal store. The structure uses pre-cast panels of re-cycled concrete for the walls and roof, externally insulated, substantially exceeding the requirements of the Part L at $0.15\text{W/m}^2\text{°C}$ and exposed



internally giving high thermal mass. The floor and roof slabs are used as Termodeck to further increase the thermal mass. Heating, cooling and electricity tri-generation is provided by a 30kW baseload CHP and matched absorption chiller.

With the insulation levels achieved; heat loss is reduced to a point where the internal gains provide the majority of useful heat. Thermal wheels in the air handling units deliver excess heat onto the fresh air supply. Supply air is routed via the Termodeck where its temperature is regulated by giving up excess heat to the thermal mass or absorbing additional heat from it. In this way the casual heat gains in the building are recovered and stored for later beneficial re-use, rather than simply being rejected to atmosphere.

The building is cooled using similar principles: The ventilation runs overnight with outdoor air to draw out any excess heat stored in the thermal mass. During the day warm fresh air is cooled in the Termodeck lowering the supply temperature. In the peak summer condition a predictive control algorithm runs the chiller overnight to store additional cooling in the thermal mass to be drawn on during the day whilst the chiller continues to

operate for peak lopping. Thus the chiller runs continuously at full load for extended periods, the ideal scenario for utilising heat from the CHP. The offices achieve 4.5% average daylight factor so electric light is only required for 20% of the working year. This is a substantial reduction in electrical demand and air conditioning load. The building is orientated North - South so that summertime solar gains are minimised whilst in the winter the building can benefit from early morning passive solar heating. External vertical shades and internal blinds are provided to control excess gains and glare.

A dramatic reduction in water consumption is achieved by a vacuum drainage system utilising harvested rainwater. We expect to be able to meet the entire flush water demand from rainwater, eliminating the use of treated mains water to convey sewage, whilst the overall volume of sewage discharged from the building will be reduced by 75%.

CO₂ emissions from this comfort cooled building are substantially lower than typical offices and are on a par with naturally ventilated buildings. The annual emissions from the building services are predicted to be less than $22\text{kgCO}_2/\text{m}^2$, a reduction of over 80% compared to a typical office park building, saving over 350 tonnes of CO₂ per year.

Embodied CO₂ was addressed by careful selection of materials for their efficiency in the construction. Local supplies were sourced wherever possible for bulk materials whilst shipping issues were considered in the specification of the high performance elements. The building as a whole was specified for a high degree of recycled material content, simplicity of construction and low construction impact.

