

CONSTRUCTION

With a mixture of exposed slabs and raised floor areas throughout the building, the slabs are stepped in an intricate manner and therefore required considerable co-ordination of services. The use of cast-in light fittings in the exposed slab also required considerable attention to detailed co-ordination at design stage and an understanding of the strategies employed by all involved in the project.

CONCLUSIONS

Fingal County Hall is a leading example of an Irish low energy office building that minimises reliance on artificial / mechanical means of achieving the required levels of heating, cooling, ventilation and lighting.

Fig.1 Shows the quantity of energy that can be saved by adopting a natural ventilation strategy for an office building. In addition to this energy saving potential, it is accepted that providing occupants with local control over their environment gives a more pleasant working environment than a sealed, air-conditioned building.

The design of the structure, in particular the curved concrete ceiling, not only forms an integral part of the lighting and temperature control strategy, but also offers a unique and aesthetically pleasing working environment. It is the belief of the design team that building elements are capable of having a direct effect on the buildings internal environment and should be developed with this in mind.

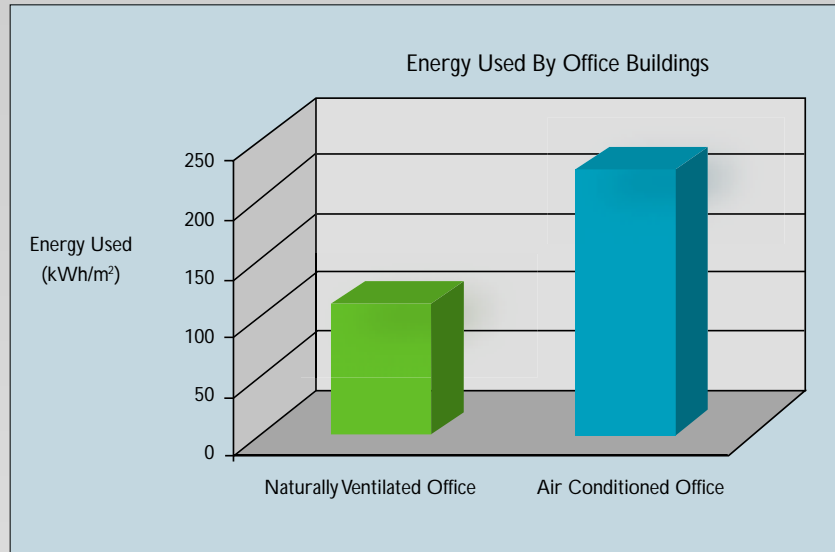


Fig 1 Typical Office Energy Usage as shown in guide DETR ECON 19

The client and design team's commitment to the production of a low energy and environmentally conscious building required considerable close working of all team members, and the client's involvement in the design. Good communication and understanding of intentions was required by all members of the team for the design concepts to be applied.

The construction of this building and the delight of its staff with their new low energy office environment, will hopefully convince the most sceptical of office developers that it is possible to design comfortable modern office buildings in Ireland without a reliance on energy consuming air conditioning.



View of facade at dusk indicating building's transparency

Source Text

Building Design Partnership, Dublin

Mechanical, Electrical, Lighting, and Energy Consultants

FINGAL COUNTY HALL – LOW ENERGY OFFICES



This case study aims to demonstrate how a modern Irish office building, containing a high density of computer equipment and large areas of glazing can be designed without the need for an energy intensive air conditioning system, while at the same time providing an improved internal environment.

In 1996 Fingal County Council set out to procure a new headquarters building in Swords and initiated a competition for the building's design. The Council's clear commitment to the environment was demonstrated in the competition condition that the building's design needed to demonstrate low energy usage and be responsive to the environment. The building was completed in May 2000 and the Council are pleased that the final building stands as a model of low energy design and a physical expression of their desire for 'open and transparent' local government.

The building has a gross area of 11,170 m² consisting mostly of open plan office areas, but also

supporting a small number of cellular offices, training rooms, storage facilities, a large council chamber, and a staff restaurant. The public interface consists of a five story high glazed atrium that welcomes the public to the building where they are directed to relevant information desks or interview rooms. While conducting business in the offices, the public may also relax in the coffee shop on the ground floor.

The building is used as a main administrative centre for the Council and provides a work place for 400 of their staff, in addition to providing a central location for the public to interact with the Council.

For further information on energy saving technologies and initiatives, contact:



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www.irish-energy.ie

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SUMMER DESIGN CONDITIONS

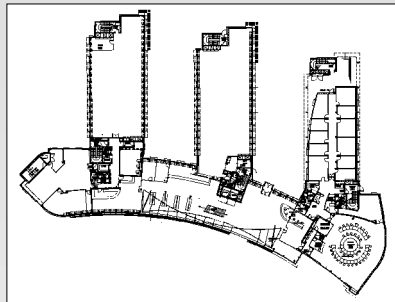
To ensure occupant comfort during the summer, the internal temperature in the office areas should not exceed 26°C for a period greater than 2.5% of the office working hours and should never rise above 27.5°C.

In order to achieve this goal, without mechanical assistance, the building structure must perform the role of internal climate moderator.

THE DESIGN OF THE BUILDING PLAN

The office areas consist of 3 office bars attached to a curved public circulation spine. This arrangement has allowed almost all areas of the building to utilise a narrow plan cross ventilation scheme, and to achieve impressive day lighting levels.

Toilet cores are located at the intersection of the spine and the office bars, to ensure that the deeper plan sections do not compromise the natural ventilation strategy.



Building plan layout which supports passive environmental control strategies

FAÇADE

The office facade contains a number of elements that work together to passively control solar gain, ventilation rates, glare and daylight levels.

These elements include an array of solar shading devices and light shelves each designed specifically to cater for the requirements of the particular glazing orientation, building self-shading and thermal loads.



Various solar shading devices to keep out the summer sun while admitting winter heat.

A typical section of office facade is made up of the following elements:

- External solar shading to reduce heat gain.
- External light shelf to reflect day light into the building.
- Upper windows above the light shelves which are motorised and open under the control of the BMS (Building Management System computer) to control peak summer ventilation and the night cooling strategy.
- Manually opening windows below the light shelf.
- In addition to the manually operated windows, two vertical vents are provided with openable doors for winter use. These vents are fitted with rain and insect screens to allow use without draughts or rain ingress.
- An internal light shelf is incorporated as part of a wall mounted uplighter to improve daylight penetration and to give an even distribution of light in the office.



Typical open plan office area showing the vertical ventilators that allow the occupants to control their local environment.

VENTILATION

In addition to the cross ventilation provided in the office areas, there is a stair well at the end of each office bar containing ventilation louvres at the upper section. With the stair well doors magnetically held open, the stairwell acts as a stack, supplementing the cross ventilation.



Subtle vertical vents in cellular offices attached to the atrium provide cross ventilation

THERMAL STORAGE

The ceiling slab offers exposed curved concrete to maximize the area of thermal absorption. In summer, this concrete mass is cooled by night ventilation and remains below room temperature throughout the day, absorbing heat from the room. During colder weather, the slab absorbs the peak afternoon casual gains (heat given out from people, lighting, and computers) and retains the heat, reducing the quantity of energy required during the following morning's pre-heat.

Night time pre-cooling of the building is provided in office areas by the operation of motorised office windows and the stairwell stack dampers. In the atrium the high level dampers are also programmed to open and allow cooling of this area.

LIGHTING

As electric lighting in a typical office accounts for up to 20% of the total building energy usage, the use of daylight must be carefully considered.

Early tests on the building suggest that a daylight factor in the order of 4% has been achieved even in the shaded north office bar. The even distribution of daylight provided by the internal and external light shelves, and the 4% daylight factor will result in a naturally lit office area for a large proportion of the working day. An even distribution of

daylight is as important as a good average daylight factor if a quality naturally lit environment is to be achieved.

There are no light switches within the office areas, the lighting above each desk group is controlled by an advanced lighting management system allowing the occupants to control their local lighting level by typing a code into their telephone. The building contains several external daylight sensors and the associated control strategy prevents energy wastage through unnecessary lighting.

The curved profile of the exposed ceiling slab rises from the centre of each office bar towards the windows and therefore allows a deeper, more even daylight penetration. The intrusion of edge beams was avoided by detailing up-stand beams concealed within the floor void above, maximising the area available at high level for daylight admission. The parabolic curve of the slab has been specifically designed in conjunction with the photometry of the up-lighters to ensure even light distribution across the working plane.



Curved, exposed concrete absorbs heat from the space, and distributes light evenly across the office.

Day lighting is also an important feature of the Council chamber where particular care had to be taken to avoid glare from daylight. A recessed roof light was used to reflect daylight on to the curved back wall of the chamber, flooding the wall and reflecting light across the chamber.



In the Council chamber, concealed roof lights reflect day light off the back wall to provide glare free daylight.

Dimmable tungsten halogen downlighting, controlled by a separate dimming system, is used in the Council chamber. This system incorporates adjustable 'scene setting' controls so that the lighting matches and enhances the use of the room at any particular time.

ATRIUM SERVICES

The atrium contains a large curved glass wall, supported by a system of cables.



The Atrium section with large areas of glass requires careful consideration to avoid energy wastage.

Due to the large area of glazing in this space there is a high potential for energy wastage if not handled appropriately.

As this area is only a circulation area, it does not have to be heated to the same temperature as the offices.

To minimise energy losses, an under floor radiant heating system has been installed. To prevent condensation on the large area of glazing, radiant panels have been mounted on the balcony faces at each floor, linked to glass surface temperature sensors.

Ventilation is provided via a trough system below the glazing incorporating a finned tube heater and a series of large ventilation louvres at high level.

These louvres are manufactured from polycarbonate to maximise daylight and allow a direct view from outside the building.

During the summer months, fresh air is drawn into the trough by stack effect through motorised dampers.

In wintertime, the dampers are fully closed and the finned tube heaters in the trough are used to counteract down draughts from the glazing.

HEATING SYSTEM

Heat is provided to the building by three high efficiency gas fired boilers, with a condensing boiler taking the lead load.

As occupant control is clearly an important feature, each radiator in the office areas is fitted with a thermostatic valve providing another element in an array of local controls available to the occupants.

Heating to the under floor system in the atrium is provided from a ground coupled heat pump. For its heat source, water is drawn from a borehole drilled to a depth of 160m below ground level. This water is passed through the heat pump evaporator and returned to the borehole at a lower temperature.

This ground water is also used directly within fan coil units to cool the computer room. This injects energy into the borehole and assists with maintaining the source temperature.

MECHANICAL VENTILATION SYSTEMS

While mechanical ventilation was eliminated from all office areas, it was deemed necessary for the toilet areas, the canteen and lower ground floor. The lower ground floor system includes a run-around heat recovery system to reduce energy input. The recovery of heat to the fresh air supply goes a long way towards compensating for the fan power used.

The Council chamber is the only area requiring an air-handling unit with mechanical cooling. To reduce the energy used for cooling this space, a displacement ventilation system has been installed to take advantage of free cooling when available.

COMPUTER SIMULATIONS

As part of the design development, BDP adopted the use of advanced computer models to predict the building's thermal performance, levels of ventilation airflow and natural daylight throughout the year.

It is essential to understand how a low energy building will react to changes in its external and internal environment and the model was continuously improved in an iterative process until the design requirements were met.