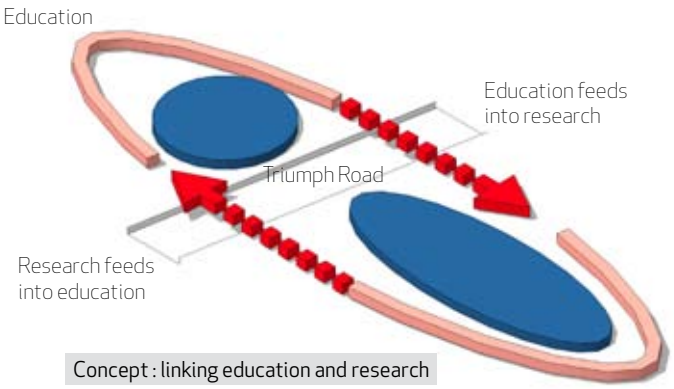
University of Nottingham, Jubilee Campus expansion: The Sir Colin Campbell Building

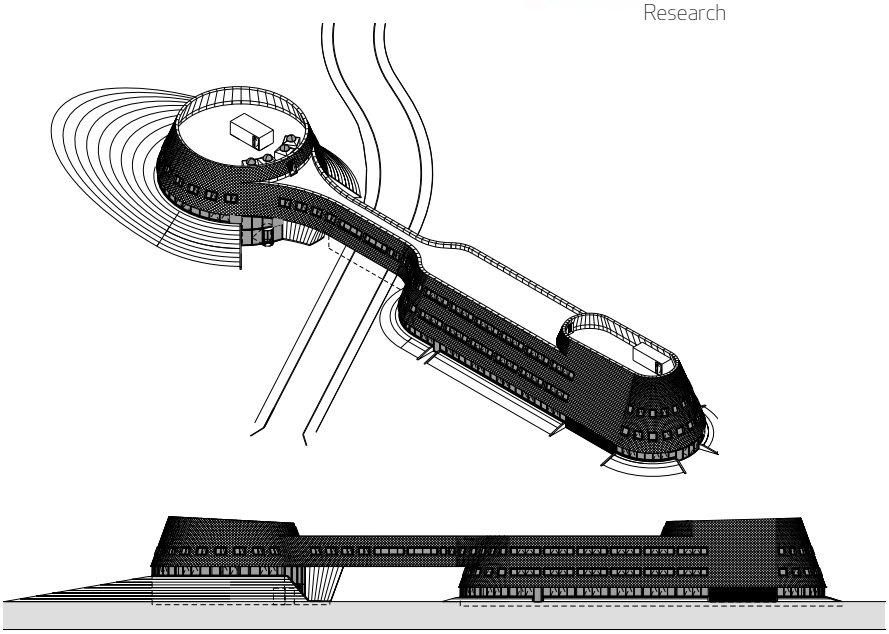
Named after the University's fifth Vice Chancellor, who played a key role in the commissioning of the Jubilee Campus expansion scheme, The Sirt Colin Campbell Building creates a new gateway to the campus. This curvaceous linear structure emerges from two landscaped mounds on either side of Triumph Road to bridge the primary route through the campus and forge a physical and symbolic link between the academic zone to the west and the planned Research and Innovation Park that will occupy the eastern zone of the campus. The three-storey building contains a range of facilities to support and extend the University's pioneering work to foster business and entrepreneurial skills, including office, event, exhibition and teaching spaces and incubator units for start-up businesses. The majority of these facilities are concentrated in the portion of the building to the west of Triumph Road, while the more elongated structure on the other side of the road to the east houses offices for the business incubator units.

Like International House and the Amenities Building, the form of The Sir Colin Campbell Building was inspired by the concept of a building that emerges from the ground plane. The surrounding landscape rises up into two mounds on either side of Triumph Road with the built form growing out of these features; in addition to anchoring the building, the earth banked up against the facade also provides additional insulation to the facades. Glazing contributes to approximately 40 per cent of the facade, with windows carefully positioned and set back to draw maximum amounts of natural light into the interior while providing additional shading from the high-angle summer sun. The gleaming zinc cladding was selected primarily to chime with the materials already used in existing Jubilee Campus buildings (notably the Business School) ; the silvery finish also emphasises the sinuous curves of the structure and establishes the building as a distinctive new focal point for the campus. The zinc is applied in the form of shingles which offer an efficient way of wrapping around the building while contributing an additional layer of articulation to the facade.

As with the other new campus buildings, adaptability of use was a key requirement of the brief and all internal spaces have been designed to offer the maximum flexibility. The Sir Colin Campbell Building's simple, efficient floor plates allow entire floors to be swiftly and easily reconfigured to a cellular or an open-plan layout and then back again, according to the University's particular needs. The bridge link provides breakout space for the building's occupants and this is supplemented by the triple height reception area, located in the western portion of the building and accessed directly from Triumph Road.



Concept : linking education and research



Artificial heating and cooling is provided by a closed loop system which extracts embodied energy from a vital natural resource already in existence on the campus: the nearby lake. Highly efficient heat exchangers submerged in the lake reject or absorb the embodied energy stored within this sizeable body of water; this energy is then routed to a series of reversible heat pumps which provide heating and cooling to air handling units within the building, thereby replacing the need for conventional gas-fired boilers and air-cooled chillers. Run-off water is collected and fed back into the lake, in order to preserve this valuable resource.

Exposed concrete columns and slab soffits provide the thermal mass to regulate internal temperatures and aid night-time cooling and air quality is maintained via a sophisticated displacement system which is quieter and more energy efficient than conventional systems. Pressurised floor plenums deliver fresh air, cooled or heated as required, to interior spaces; stale, warm air is then extracted via grilles located above doorways and ducted back to air handling units for heat recovery.
Within the triple height reception space additional ventilation is provided by four bespoke roof-mounted 'wind catchers'. These top down ventilation systems draw fresh air down into the building using a series of external louvres; an array of motorised dampers allow return air to be passed to the air handling units for heat recovery during the winter, or vent the air directly into the atmosphere during peak cooling periods. Both the primary displacement ventilation system and the wind catchers are controlled by a computerised building management system driven by temperature sensors located in the atrium. In addition to ventilating the space, the wind catcher elements incorporate centrally-mounted sun pipes. These highly reflective tubes measuring 1.5m in diameter draw natural light into the interior without adding to solar gain, and reduce the amount of artificial lighting required.

In keeping with the existing buildings on site the structural frame for the building is a reinforced concrete flat slab. This solution provides an economic frame with inherent thermal mass which contributes to the reduction of carbon dioxide production of the building in use by being effectively utilised within the services strategy. The key engineering challenge for the project came from the 40 tonne steel link bridge which spans between the two halves of The Sir Colin Campbell Building. The bridge is comprised of an array of fully welded steel beams acting compositely with the steel deck to enhance the stiffness and vibration performance, necessary as the overall depth of the structure was constrained by road clearance requirements. The bridge was fabricated off site and delivered in two sections of approximately 18m. The two sections were then assembled at low level on site before being lifted as a single unit into its final position. Remarkably the bridge was seated at the first attempt.

The three new buildings on Jubilee Campus have been designed such that they require optimum operational energy:

The envelope makeup (insulation) exceeds requirements of Part L 2006 whilst the percentage of glazing is below that allowed by the same regulation. Windows are provided with solar control glass and positioned within deep reveals that provide solar shading externally and act as light shelfs internally enhancing the natural daylight.

By combining insulation, solar protection and good daylight it was ensured that both winter and summer thermal loads remain low - within control capacity of an energy environmental control system such as low level variable volume air supply.

This system is sensitive to mobile loads such as occupancy and modulates quantity of air delivered to suit. As the air is delivered at low level it picks up impurities and heat as it naturally rises and discharges away from the spaces. This ensures excellent air quality and an additional 10-15% saving in energy that would have been necessary to "drive" the air from high level and up again.

Combination of low demand and an energy efficient environmental control system resulted in overall heating and cooling required capacity that was sufficiently low to be delivered in its entirety by a renewable energy system: lake coupled reversible heat pumps.

Instead of conventional, fossil fuel powered chillers and boilers, all heating and cooling is delivered via reversible heat that exchange energy with the on site lake.

High efficiencies of this type of heat exchange, coupled with demands much below average have resulted in predicted carbon footprint of the buildings to be on average 55% lower that of notional (conventional) buildings of the same type and make up.

Based on Part L 2006 calculation method, we expect the following carbon emissions:

International House: 53 kgCO_2/m², annually

Amenities Building: 87 kgCO_2/m², annually (higher as it takes into account Catering gas loads)

The Sir Colin Campbell Building: 47kgCO_2/m², annually

The above figures represent savings of 53-57% in comparison to Notional Building using Part L calculation.

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