Project:	*Howe Dell School, Hatfield*
Client:	*Hertfordshire County Council*
Design Team:	*Led by Capita Architecture*
Project/Construction Manager:	*Mace*
Structural Engineer:	*Adams Kara Taylor*
Steelwork Contractor:	*Britlands*
Building Services Consultants:	*Fulcrum Consulting*

The landmark Howe Dell School in Hatfield provides a sustainable template for the schools of the future. Commissioned by Hertfordshire County Council it was conceived as a test bed for eco-friendly technologies and the development, designed by a Capita Architecture led consultant team and project managed by Mace, has certainly provided this.

Photo: Courtesy of Peter Durant

The school has already earned plaudits from BREEAM (the world's most widely used environmental assessment method for buildings) and was selected as one of eight projects used during the development of the new BREEAM for Schools initiative. Preliminary appraisal by the pilot assessment panel for the school has showed that its innovative design achieves a level equivalent to the highest BREEAM rating, making it one of the highest achieving pilot schemes.

The building

This steel framed building is surrounded by a façade made up of mostly either block-work with infill and oak cladding, or full fill block and brick cavity wall with self coloured render finish.

The roof system consists of PC concrete plants with structural topping of ThermoDeck planks on a steel structural frame. On top of this are ‘Z’ purlins to falls set up on steel ‘stools’ supporting a secret fix profiled insulated metal deck roof finish.

These façade build-ups allow low u-values to be realised with 0.15 $Wm^{-2}K^{-1}$ achieved for both the wall and roof. High thermal performance windows were also specified with U-values down to 1.1 $Wm^{-2}K^{-1}$.

Why steel?
The architect Bob Edgar has confirmed that steel was chosen for the structural frame for both its sustainability features as well as practical and financial reasons. These included flexibility; quality control; effect on the programme and re-use and recycling opportunities.

Flexibility - At the RIBA Stage C, designing in steel allowed for flexibility since it was not clear until the last minute what size of school, one form entry (FE) or two FE was required. The modularity of steel meant that both designs could be accommodated in parallel until the decision was made.

Quality control – offsite fabrication gave the project team confidence in the accuracy of the manufactured structure

Programme – Steel allowed erection of the building in the minimal time, shortening the overall programme.

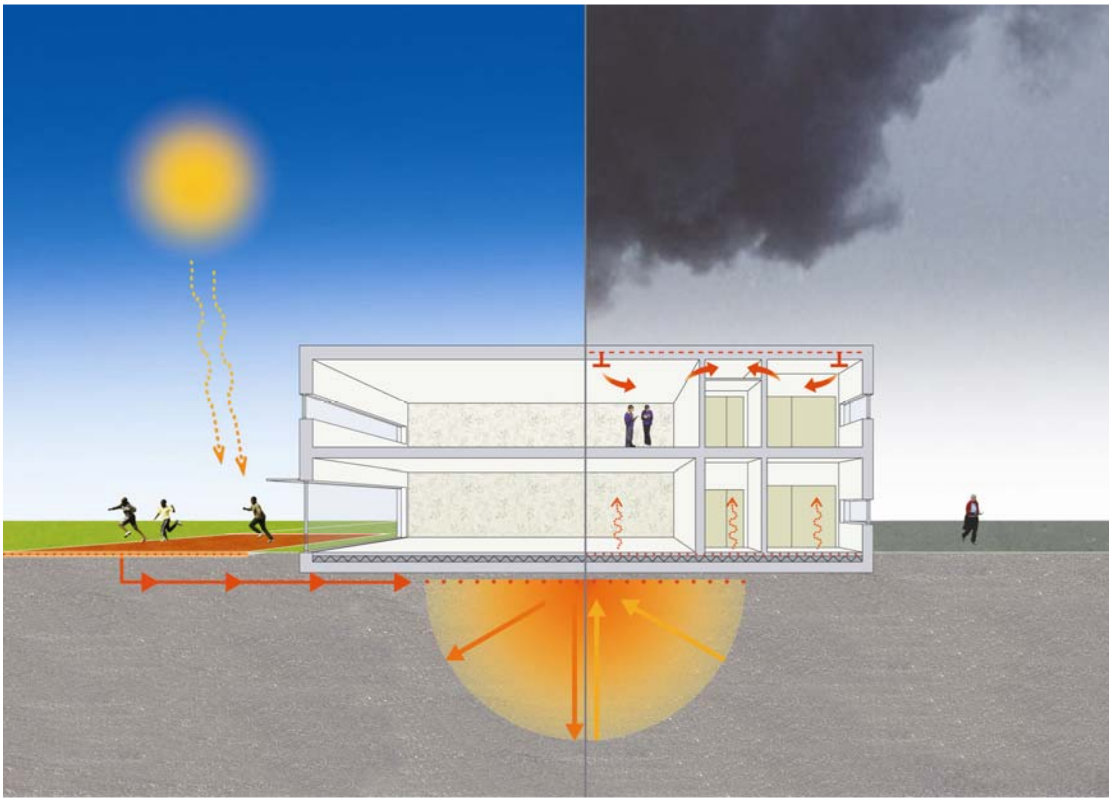
Recycling and re-use - High industry standard of re-cycled content by mass and potential for reuse following demolition as components within a new framed buildings added to the sustainability credentials for the BREEAM assessment.


Photo: Courtesy of Bob Edgar

Inter-seasonal Heat Transfer

Packed full of sustainable features, this steel framed building demonstrates not only how renewable technologies can be designed in, but how the building should be considered not in isolation to its surroundings but as inextricably linked to them. Recognising this, the design team has pioneered the use of a new low-carbon technique for heating and cooling called inter-seasonal heat transfer (IHT).

IHT makes use of the largest source of thermal mass in the school, the ground, as a storage facility for heat and coolth. As the sun beats down on the black tarmac of the playground, its heat is absorbed by a series of pipes buried beneath it, that contain a mixture of water and anit-freeze. This collector absorbs the sun’s heat and transfers it to the ground below the building where it is stored in the earth virtue of the resistance of heat transfer to the surrounding soil.


Diagrammatic representation of IHT

When needed this heat is then extracted through a series of underground pipes and "upgraded" to a useful temperature by heat pumps and transferred to the building through heat exchangers to the underfloor heating and ThermoDeck system.

Conversely in the summer when comfort cooling may be required, the system can be effectively reversed, heat being extracted from the building and stored in the thermal "battery".

The project was awarded a Carbon Trust Innovation grant to support the installation of the ICAX IHT system specified by building services consultants Fulcrum Consulting.

Solar Technologies

As well as making use of the sun's energy through this innovative system, Howe Dell also incorporates more established renewable technologies that harvest this freely available resource; solar thermal panels and photovoltaics (PV). The PV panels produce electricity which can be used on-site or exported to the grid in times of low demand, for example the school holidays or weekends.

These periods of low occupancy also highlight another benefit of the IHT in conjunction with the solar thermal panels. When demand is present, the hot water provided by the solar thermal panels is utilised in the kitchens and washing facilities. With most solar thermal systems when the demand for hot water is consistently low for a period of days or weeks, the energy captured would be wasted, or more seriously, very high temperatures may be experienced by the solar collectors because no heat energy is drawn off. The IHT solves both these problems as during periods of low occupancy, the hot water is directed to the underground storage, preventing high stagnation temperatures and storing the heat for when it is needed.

Photo: Courtesy of Peter Durant

In order to promote interest in these renewable technologies, and as an educational tool, an easily accessible, school-wide software interface has been installed that allows pupils to monitor the various environmental systems. This allows them to see how much energy has been generated by the various systems, how it is being stored, and how much has been exported to the National Grid. Visitors to the school can even see real time energy data displayed on an LCD screen within the main school entrance.

Other Sustainable features.

Natural daylight

In order to reduce electricity usage full use has been made of natural daylight where possible. Strategically placed roof lights allow natural daylight to flood into the centre of the building, minimizing the need for artificial lighting of deep plan spaces and carefully designed light wells bring daylight to the ground floors. Additionally the simple rectangular shape enables all teaching areas – which are all south facing – to have dedicated external classrooms, allowing pupils direct access to the extensive and bio-diverse grounds.

Highly specified glazing

These classrooms have a high percentage of glazing on their southern aspect. A worry with so many windows is heat loss in the winter and solar gain in the summer, particularly with south facing classrooms. This risk has been mitigated by inclusion of high performance windows that minimise heat loss, with U-values of $1.1Wm^{-2}K^{-1}$, and help control solar gain.

ThermoDeck system

Maximum use of the available thermal mass of the building has been made by integrating TermoDeck fan-assisted heating, cooling and ventilation system, to stabilize the temperature in the building. This uses the high thermal mass of structural, hollowcore slabs to warm or cool fresh air before it's distributed into the room spaces of the school.

Controlled by the building management system, supply of air passes through the hollow cores very slowly, giving plenty of time for passive heat exchange between the air and the concrete hollowcore slabs. The exposed concrete releases heat to, or absorbs heat from, the air passing through it. So by the time the air enters the room it is the ideal temperature for occupant satisfaction. In this way the thermal mass helps to both cool a building in the summer and keep it warm in winter

Green roofs and rainwater capture
The roof of the school has been transformed into a sustainability feature with 'living' sedum green roof areas helping to manage water runoff, insulate the building and promote bio diversity. Also Rainwater harvested from the main school roof is used for toilet flushing with any surplus being used either by the irrigation system or to top up for the wet-land biodiversity area located within the school grounds.

Sustainable materials
Use of eco-friendly materials has been extensively practised including a sustainably-sourced sprung timber floor in the main hall and a bamboo floor in the dining room. Classroom sink tops and splash backs have been made from recycled yogurt pots and play equipment is constructed from sustainably-sourced, timber.


Photo: Courtesy of Peter Durant