



The completed school

Red Hill School, Worcester

Contractor:	Frank Galliers Ltd.
Client:	Worcestershire County Council
Case Study Ref:	311
Project Number:	2847
Publication Date:	November 2007
Region:	West Midlands
Sector:	Local Authority, Education
Contract value:	£3.4m
Start date:	June 2004 to April 2007
Themes:	Sustainability

The Red Hill School project involved the replacement of a single form entry primary school on the site of an existing school in Worcester which was demolished in autumn 2005.

The original school building was constructed in 1965 and consisted mainly of brick panelling and timber frame with additional plywood filling. The building had low insulation levels and suffered from overheating during the summer months, with the additional inconvenience of a large central hall which was used to travel between classrooms. The earlier building had proved very difficult to maintain and was unsuitable for refurbishment. The space available within the grounds could not be utilised in a way to benefit everyone, and so Worcestershire County Council decided to build a new school with a 60 year design life.

Construction at the school was completed in April 2007, with pupils and staff moving into the building just after the Easter break. The school was officially opened by Climate Change and Environment Minister, Ian Pearson, on June 18 2007.

The school was recruited as a Demonstration Project mainly due to the involvement of WRAP (Waste and Resources Action Programme) which aims to stimulate the market for recycled products and reduce the amount of energy used in the manufacturing process. With this in mind, Red Hill School became an example of how, with careful specification, materials with a much greater recycled content can be chosen for the building without an increase in cost or loss in performance. WRAP commissioned two pieces of work in regards to Red Hill, these being:

- A report by DCS Consultants which identified simple substitutions of alternative mainstream products and manufacturers, mostly at no extra cost or providing a cost saving. The report included advice on performance specification which was then developed to tender, making use of this advice.
- A report by Davis Langdon LLP on the 'Potential for specifying recycled content in schools procurement', which would assist Worcestershire County Council in relation to its future schools programme.

Worcestershire schools' fuel consumption is already around 15% lower than the UK average which stands the council in good stead for meeting sustainability targets over the coming years. Projects such as Red Hill are used as pathfinder projects for organisations such as WRAP to effectively illustrate modern methods of construction which take into consideration environmental impacts.



The central curved corridor

Design

The new school is shaped in plan to follow the curve of an existing avenue of mature trees, so that all classrooms have shady outdoor terraces. In this way, the classrooms also face away from the noise of the adjacent busy London Road and the main line railway. A tall top-lit central corridor forms the spine of the school. The classrooms have been arranged in pairs, each pair sharing a group room and a practical area, as well as the covered outdoor terrace, to encourage collaborative teaching and learning. The front of the building houses facilities like the school hall and music and dance studio that are used by the local community, and these facilities have a separate entrance. The new school includes a planted internal courtyard that brings light into the heart of the building and contains a sculptural water feature donated by the local church.

The building design took a holistic approach to sustainability issues and this is evident in the features of the school. From the early stages of the design, climate change and its associated issues were considered when choosing methods of heating, drainage and lighting. This has had a huge impact on the way that the school has been designed and constructed with issues such as increases in temperatures and less frequent, but heavier, rainfalls that are likely to occur in the future considered from the outset.

An important factor in the design of the new school was the use of the UKCIP (UK Climate Impacts Programme) Adaptation Wizard Version 1.0. The County Council's architect took part in a pilot of the Wizard to identify potential impacts of climate change on a new school. The process helped provide an adaptation strategy for both the design and construction phases of the building, which extends beyond the final handover to the lifetime of the school.

Robert Lewin-Jones, Principal Architect, said that the UKCIP Adaptation Wizard had "a positive impact in shaping the design in many ways, for instance in terms of shading, roof overhangs and rainwater management."

Sustainability

Red Hill Primary is the first school in the County Council to have ground source heating. Water is drawn through 33 vertical heat exchangers in the form of continuous pipes in boreholes which go 100 meters deep under the car park. These use the earth's constant temperature, via heat pumps, to provide hot water to the school's underfloor heating system and hot water systems. The pumps run on a 'green tariff' (electricity sourced from renewable sources) and so provides a heating system with low carbon emissions.

Ventilation in the school is by means of vent stacks on the roof which draw hot air out of the classrooms by natural convection. Small photovoltaic panels drive the extract fans for the toilets in the school.

With the risk of heavy rain increasing with climate change, both the gutters and overhangs on the roof have been widened to cope with sudden downpours whilst providing shelter on level thresholds. A sustainable urban drainage system has been implemented which utilises swales, ponds and underground storage, and in addition, rainwater is used for flushing toilets by collecting water from approximately half of the roof area. Remaining roof areas have a sedum finish to reduce runoff and assist with insulation.

In summer, the wide overhangs provide shade and the underfloor heating system can be operated in reverse to help relieve the heat load from rooms with a high heat output, i.e. the ICT suite. Additional windows and patio doors were also added which can be fully opened to provide extra ventilation on very warm days.

The primary framing material for the building is steel, and internal and external walls are mainly timber framed, being insulated using materials of a high recycled content. For added thermal mass, a double layer of plasterboard has been used on both sides of all internal walls. The internal walls also have the advantage of being non-load bearing, which means that future changes to the inside layout of the school are much easier and less costly. In the construction of the school hall and kitchen where concrete was used, efforts were made to ensure it had a high recycled content.

The roof of the school is made from low-maintenance zinc standing seam roofing. This is fully ventilated beneath the timber boarded substrate, which supports the zinc, allowing air to circulate and thus reduce heat transfer. In addition, an underlayer of bitumen impregnated fibreboard provides insulation between external and internal conditions which helps to reduce energy consumption in winter.

The project also brought in expertise from the Waste and Resources Action Programme (WRAP), who identified that the project could increase the recycled content of materials in the building to be up to 26% by value by simple substitution. This policy was adhered to in the selection of insulation made from recycled paper, and the use of blockwork, plasterboard and carpets with a high recycled content. The use of stained timber for internal joinery added to the calm, natural feel of the internal environment.

Some decisions could not be driven by concerns on future climate change due to site constraints. For instance, the new school building was located on the lowest part of the site in an area that could potentially be prone to flooding. This was because, on this long, narrow site, only this part of the grounds was wide enough to accommodate the school building and provide suitable access. However, raising the floor level by 150mm compared to the previous building on the site, and implementing the sustainable urban drainage scheme mitigated the risk.



Red Hill School seen from the school sports field

Stakeholder engagement

Pupils and staff were engaged in the project from the start; particularly through the headteacher who ensured that ideas and layouts were tested as the project progressed. Throughout the construction phase the children were accommodated in mobiles on the adjacent school field so that they were able to view progress through viewing holes in the hoardings. Especially notable on this project was the pupil's engagement with the environmental features of the project. Through project work and meetings with the architect and the SUDS designer they came to understand the use of materials, the working of the groundsource heating and the rainwater harvesting and SUDS systems on the site. Sixth year pupils were able to provide detailed guided tours of the school and site for the guests at the official opening who were very impressed by the depth of their knowledge.

"The school is a terrific building to work in and was made such by cooperation between staff at the school, members of the local council and the architect working on the project. Everyone was able to share ideas and therefore a school was built that meets the needs of its inhabitants, encompasses modern eco-friendly features, and is greatly appreciated by all the staff and children."

Jane Long, Headteacher at Red Hill

The school was awarded the gold award trophy at the Green Apple Awards for the Built Environment ceremony held on June 11 2007. The awards are run by The Green Organisation, an independent environment group dedicated to recognising, rewarding and promoting environmental best practice around the world.

"The school has been really well received by pupils and staff and the Climate Change Minister, who told us it the best school of its kind he has seen so far."

**Robert Lewin-Jones, Principal Architect,
Worcestershire County Council**



Rainwater collection downpipe and a lift-up seat incorporating an in-line filter

Lessons Learned

- New school construction provides an excellent opportunity to develop the building and site as a learning tool including energy display monitoring (groundsource, rain harvesting, heating, ventilation); use of SUDS to create swale maze and habitat; viewable rain harvesting filter.
- Review the opportunities to increase the use of materials of higher recycled content. WRAP supported the Red Hill project and identified 'quick wins' to specify alternative products, at less or no greater cost.
- Use the online UKCIP online climate change wizard to analyse the possible effects of climate change during the life of the building and identify possible adaptation strategies.
- Choose KPIs which are most relevant to the project's drivers. Some of the key aspects of measurement on Red Hill were the analysis of environmental considerations such as the percentage of recycled content in materials by value.



The interior of the new school hall



Practical area shared between two classrooms



Constructing Excellence
in the Built Environment
Warwick House,
25 Buckingham Palace Road,
London SW1W 0PP

T 0845 605 5556 E helpdesk@constructingexcellence.org.uk
W www.constructingexcellence.org.uk



worcestershire
county council



Robert Lewin-Jones, Principal Architect, Property Services, Worcestershire County Council,
T 01905-766416 E rlewinjones@worcestershire.gov.uk