UK1

Refurbishment and recladding of 1970s classroom and laboratory block William Parker Community Secondary School in Daventry, UK

1 Photos

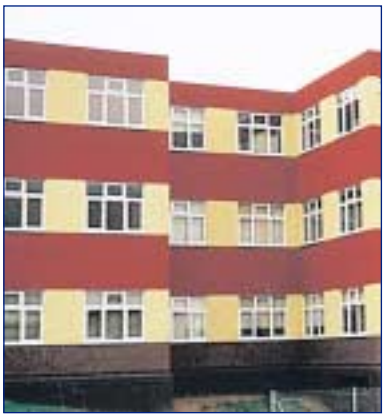


Figure 1: Left: Rear of block showing cladding half completed. Below: Rear of block after recladding

2 Project summary

The existing building had many problems. Very low thermal efficiency through the facade curtain walling with large areas of glazing lead to high heat losses and solar gains during summer. There was rainwater penetration through failed glazing gaskets causing £800 worth of damage to ceiling tiles every year, leading to a damp environment within the classrooms and degradation of the internal finishes. The building had high heating costs. The large glass areas posed a health and safety risk and were expensive to replace. During the contract asbestos was discovered in the suspended ceilings, which added greatly to the work.

The existing curtain walling was retained to minimise disruption to the school and to avoid cost of supporting/modifying services. “Structherm” structural insulated cladding was fixed externally to the existing aluminium curtain walling and directly to the main steel stanchions. Ceilings were replaced and new high efficiency electric lighting was provided.

The Structherm Structural insulated Render System comprises of a unique structural steel wire spaceframe module in the form of a series of Warren trusses interconnected by vertical and longitudinal wires. The panels have a 55mm thick core of phenolic insulation encapsulated within this spaceframe. (They are also made with polystyrene insulation depending on the fire rating and U-value required.)

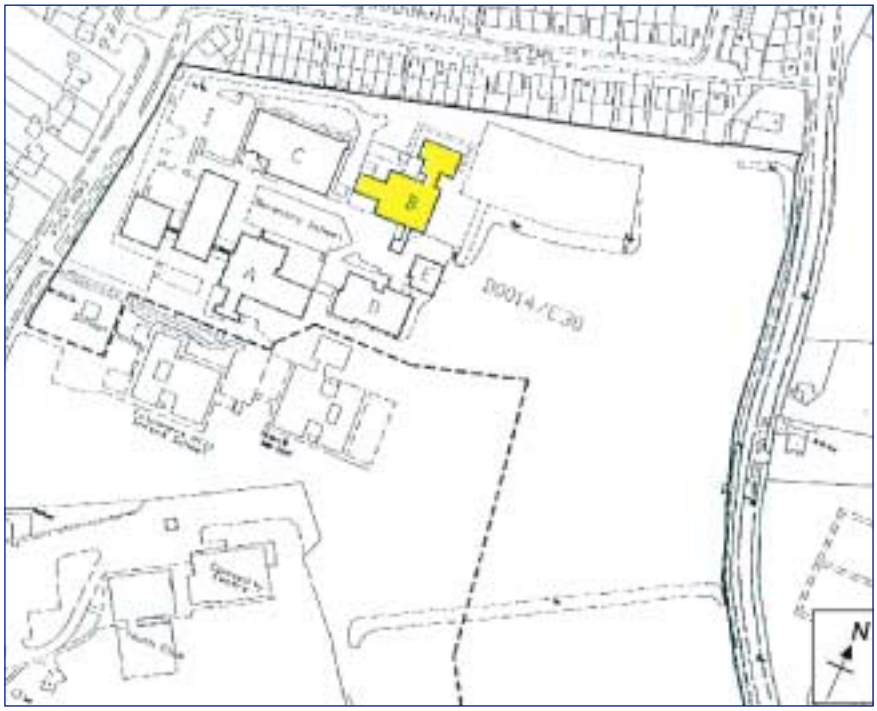
This gives the panels great impact resistance and resistance to buckling,

bending and racking shear. They are also lightweight (44 kg / m2 for single panel and 50 kg / m2 for double panel, with 24 mm render finishes) and have particularly good U-values. The low finished weight avoids the need for modifications to existing foundations or support structures.

3 Site

UK, latitude: 26.3°N., longitude; 45.7°E.

Figure 2: Site layout



4 Building description /typology

The existing block had 66% glazing causing severe comfort problems. This is now reduced to approximately 40% of exterior wall surface.
The building is typical of those that were constructed in the mid 1960's such as CLASP and SCOLA buildings and as such is easily overclad, insulated, sealed, and refenestrated using the Structherm systems. All these steel framed buildings tend to suffer from generic defects:

- Penetrating damp through failed joints
- Very poor U-values/high fabric heat losses
- Potential for excessive solar gain to some elevations
- Poor thermal response
- Interstitial and surface condensation
- Poor comfort levels

The above problems led to high maintenance and heating costs

The existing building was a 3-storey and single storey Oxford Method type construction with a steel framed structure, consisting of 152 x 152 x 37 Universal Column section stanchions on a 10'(3048mm) grid supporting a grillage of lattice girder, floor and roof beams. The second and third floors are concrete slabs supported on the steel lattice girders.
The existing roof is a steel metal deck with 1" of insulation and weathered with roofing felt. It was retained as it was in good condition.

The ground floor in the North Laboratory block had a suspended in-situ concrete floor slab and integral beams to form a large basement area, which was used as a boiler room.

Existing Cladding
Each of the 3048mm x 2700mm zones between the main columns were clad using a large aluminium curtain walling system. An opaque panel was installed between the floor slab and the window cill level. Columns were clad with 200mm white coated, steel cladding panels. A green cladding panel concealed the structural floor zone, that is 914mm deep.

4.1 Typology / Age
1970s 3-storey pavilion block.

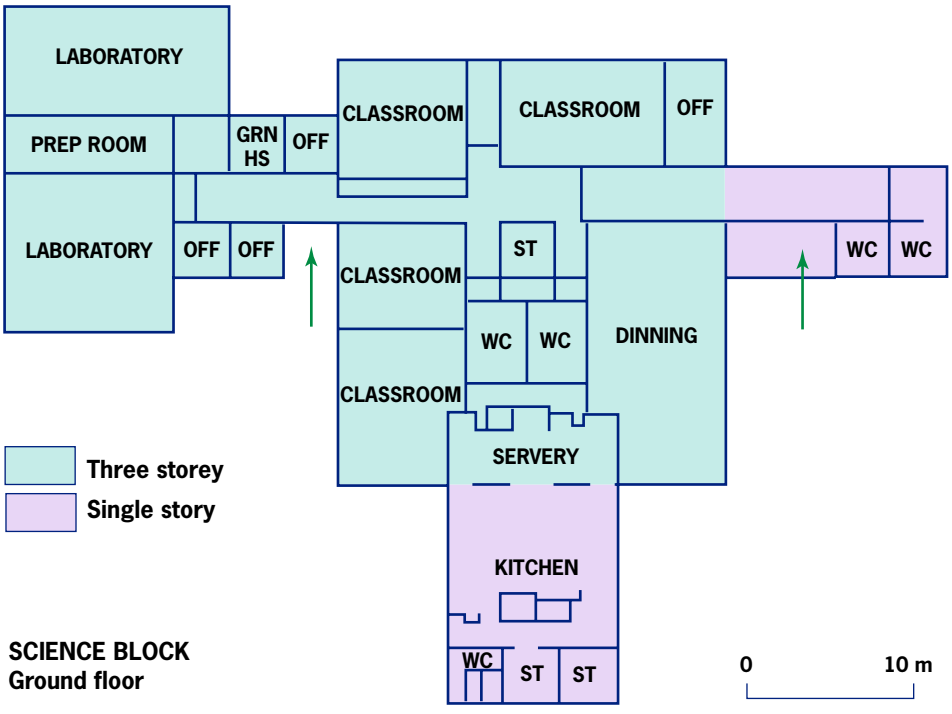
Typology/Age	Pre 1910	1910-1930	1930-1950	1950-1970	1970-
The multi-storey school The central corridor school The side corridor school					● ●
The pavilion school					●

4.2 General information
Number of pupils: approximately 600

Typical class room
size: 80 m^2
window/wall area: 66% was reduced to 40% of the external wall area by the refurbishment.
number of pupils: up to 30 in a class.

4.3 Architectural drawings

Figure 3: Plan of refurbished block



5 Previous heating, ventilation, cooling and lighting systems

Existing fan convectors were serviced and retained. New boilers were provided a few years ago. The existing boilers (which were retained) are two Beeston 293kW gas fired boilers and the heating system uses low pressure hot water radiators. There is no individual classroom control for the heating. Domestic hot water is provided by means of a separate 15kW gas fired Andrews model FF50 heater. The heating system remained unchanged by the retrofit.

6 Retrofit energy saving features

6.1 Energy saving concept

Use of Structherm structural overcladding, to improve the thermal insulation, achieving 0.4W/m^2/^{0}C.

- GPH 50 Phenolic foam panel was selected to overclad the structure providing a U-value of 0.29 W/m^2/^{0}C, and 0.19 in double panel areas.
- New window design has reduced glazing areas to 40% of the internal wall area, limiting solar gains & reducing heat loss, providing a U-value of 2.6 W/m^2/^{0}C compared with 5.8 W/m^2/^{0}C for the original single glazed units

6.2 Building

Existing windows de-glazed to allow installation of new PVCu (Polyvinyl Chloride (unplasticised)) double glazed units; incorporating window ventilators.
Asbestos ceilings were replaced and new energy efficient lighting provided.

6.3 Heating

No changes were made to the heating system.

6.4 Ventilation:

Strategy and systems:	natural
comfort cooling:	No
dehumidification:	No
Pre-heating of ventilation air:	No
Heat recovery:	No
Controls:	No

Weather stripping on all windows and doors, no draft lobbies.

It would be useful to analyse the resulting air quality in the naturally ventilated laboratories during the winter as part of a wider study on the adequacy of natural ventilation in specialist spaces such as technology and science laboratories.

7 Resulting Energy Savings

A typical Structherm refurbishment including new cladding and windows reduces fabric heat losses by up to 75%, with ensuing reductions in heating costs and carbon dioxide emissions.
Energy consumption for the whole school site (total building area 8992 m^2) is shown below.

Year	Pupils	Gas / kWh	Electricity /KWh	**Total delivered /kWh**	Degree-days
1999–2000	1074	917759	307734	**1225493**	1859
2000–2001	1124	945154	288688	**1233842**	2133
2001–2002	1156	1015399	265096	**1280495**	1845

The refurbishment and cladding replacement were completed in May 2000

	Before retrofit	After retrofit
Heating delivered fuel	194.1	69.2 kWh / m^2
Carbon dioxide equivalent	37.7	13.5 Kg CO_2 / m^2
Domestic hot water delivered fuel	5.4	5.4 kWh / m^2
Carbon dioxide equivalent	1.0	1.0 Kg CO_2 / m^2
Total electrical energy	26.5	27.8 kWh / m^2
Carbon dioxide equivalent	11.0	11.5 Kg CO_2 / m^2
Total Annual Carbon Dioxide Production Value (heating + hot water + electrical)	49.7	26.0 Kg CO_2 per m^2 of gross floor area
or equivalently	13.6	7.1 Kg C per m^2 of gross floor area

Table 1: Annual estimates (based on BB87, 2003) for the block that has been reclad

8 User evaluation

Quote from Teacher: It is not possible to appreciate the improvement without seeing how bad conditions were before, for example when the wind blew the ceiling tiles used to flap about.

Overheating issues have not been resolved. These occur both during the heating season, related to a lack of control of the heating system, and in other months.

Ventilation and airflow were raised as an issue of concern by the teaching staff, and dust in particular was noticeable. Many of the staff complained of frequent colds and coughs. However, once they had been trained in the correct use of trickle vents, levels of satisfaction generally increased. There was an improvement in perceived air quality, although this was not measured scientifically.

9 Renovation costs

Final account costs (1999/2000 prices)

Total cost of overcladding and associated work, excluding internal fit out:	£455,500.
Total cost of preliminary works:	£158,500.
Total cost of project excluding internal fit out:	£1.034m
Approximate increase in cost of project due to discovery of asbestos in ceilings:	£495,800
Approximate cost of cladding part of project:	£538,200
Total floor area: 2764 m^2	
Total area of walling: 745 m^2	
Unit cost of overcladding	£722/m^2 of walling.

Although the original plan was to complete the overcladding without decanting the pupils, rain damaged asbestos cement boarding had caused asbestos contamination of the ceiling voids. This meant that all pupils had to be decanted into mobiles while the building was cleaned of all asbestos.

10 Experiences/Lessons learned

The discovery of asbestos during the project led to large additional costs. This shows the importance of carrying out thorough pre-contract surveys.

11 General data

11.1 Address of project

William Parker School,
Ashby Road, Daventry, Northamptonshire NN11 5QE
Tel: 01327 705816, *Fax:* 01327 300156
Contact: Phil Parris, Assistant Headteacher responsible for premises

11.2 Project dates

Year of construction: 1970s
Refurbishment started on site in early 1999 and was completed in May 2000.

11.3 Date of this report/revision no.

5 August 2003 Revision 5

12 Acknowledgements

Client
Northamptonshire County Council
Contact: Peter Simmonds psimmonds@northamptonshire.gov.uk
Architect
Consultants: Jenk and Potter Consulting Engineers; *contact:* Derek Kent
12/15 Great Turnstile, London WC1V 7HN
Tel: 020 7242 8711, *Fax:* 020 7404 0742
e-mail: gendesk@jenpot.tcom.co.uk
Services engineer
Connaught Group Ltd: A Building Services company providing Refurbishment and Maintenance to building owners and occupiers
Connaught Property Services Limited
Connaught House, Alfred Court, Saxon Business park, Hanbury Road, Bromsgrove, West Midlands B60 4AD
Tel: 01527 877444, *Fax:* 01527 877900
e-mail: midlands@connaughtplc.co.uk
Others, eg, design advice consultant, building contractor, etc
Building Contractor: Connaught Group Ltd - Approved Installation Contractor for Structherm
System designer/Supplier of Overcladding: Structherm Building Systems, Meltham Mills, Bent Ley Road, Meltham, Huddersfield, West Yorkshire HD7 3AP. *Contact:* Julian Taylor, Technical Manager, *Mobile:* 0411 091304
email: julian@structherm.co.uk
Energy manager/premises manager
Assistant Headteacher responsible for premises, Phil Parris
Sources of funding:
eg, national or international support programmes
National Funds provided for first phase under the first year of the National *New Deal for Schools* (NDS) 5 year programme.
Funds for the second stage also being sought from NDS

13 References

BB87 (2003): www.teachernet.gov.uk/energy
Structherm: www.structherm.co.uk