

Client : Ellis Williams Architects
Project : Girls' Day School Trust (GDST)
Northwood College, Middlesex HA6 2YE
Date : 16th February 2014
Project No. 246 13

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flexible modular accommodation

Energy Statement

Please see below the energy statement for the above project.

I am of course more than happy to answer anything further.

Yours faithfully,

A handwritten signature in blue ink that reads "A. Livingstone". The signature is written over a horizontal line.

Andrew Livingstone MSc

MANUFACTURE & RENTAL OF RELOCATABLE ACCOMMODATION



Sibcas Limited
Easton Road
Bathgate
West Lothian
EH48 2SF
Tel 01506 633122
Fax 01506 634320
www.sibcas.co.uk
Registered Office: Bathgate, Scotland
Reg no. 52604 Scotland

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Project information

Design engineer: Andrew Livingstone MSc

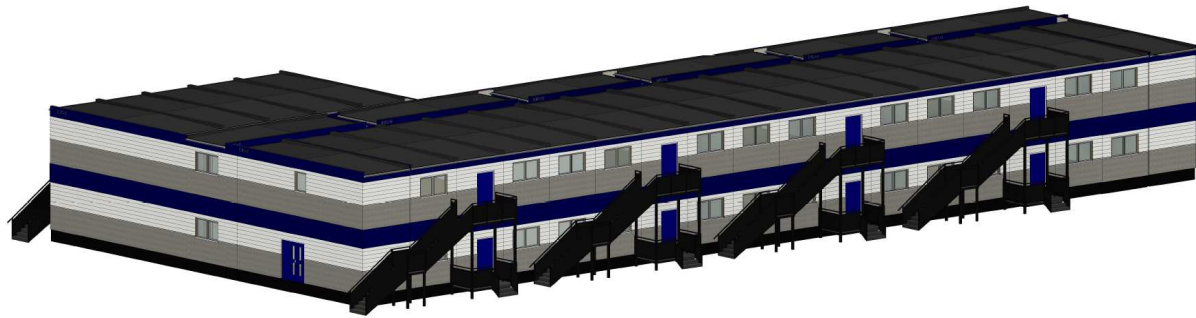


Figure 1 Isometric of proposed building

Client
Ellis Williams Architects

Site address
Northwood College
Maxwell Road
Northwood
Middlesex
HA6 2YE

This is a temporary two storey building being to be used as a decant facility for the school over the period of the hire.

The building will consist of fifty eight units that are from existing stock. The original manufacture date of at least 70% (40) of the units lies between January to July of 2010, taking full advantage of the embodied carbon within the existing stock units.

Minimum specifications for the units to be used within this project.

U-Values

Floor	0.19 W/m ² K	Appendix A
Walls	0.31 W/m ² K	Appendix B
Roof	0.25 W/m ² K	Appendix C
Door	1.80 W/m ² K	from manufacturers website
Window	2.00 W/m ² K	Appendix D

Table 1 U-Values

Please note that the buildings fabric has fully compliant U-values as indicated in Table 1.

The windows will be tilt and turn frames, with double glazed units consisting of soft coat and argon fill. External steel security doors manufactured by Kirncroft or equivalent. All internal lights will be high frequency T5 manufactured by Tamlite.

Web link for the external doors.

<http://kirnsecuredoors.com/products/personnel-doors/>

Web link for the light fittings.

<http://www.tamlite.co.uk/>

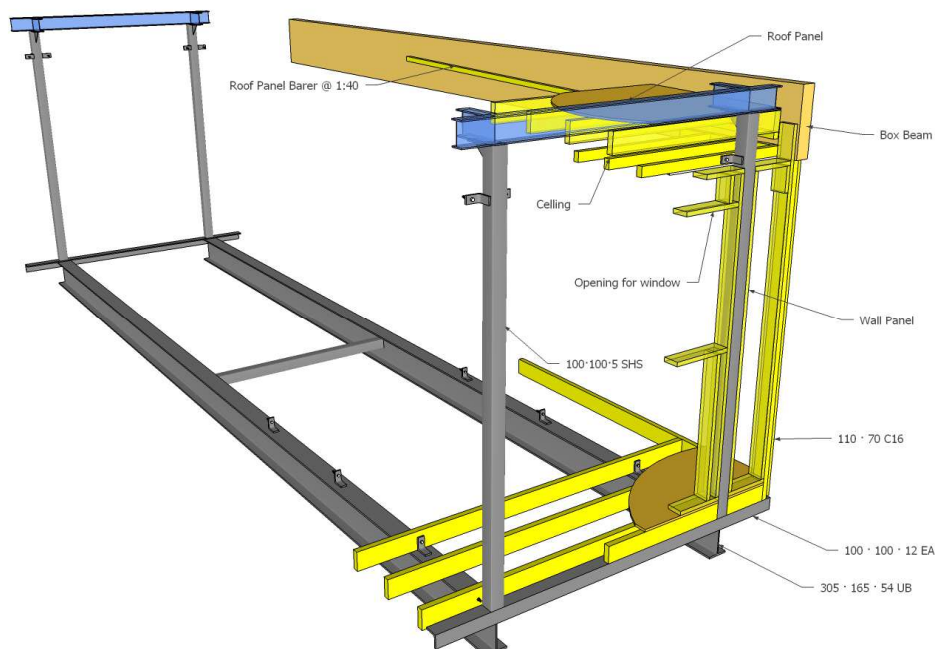


Figure 2 3D section of a standard unit

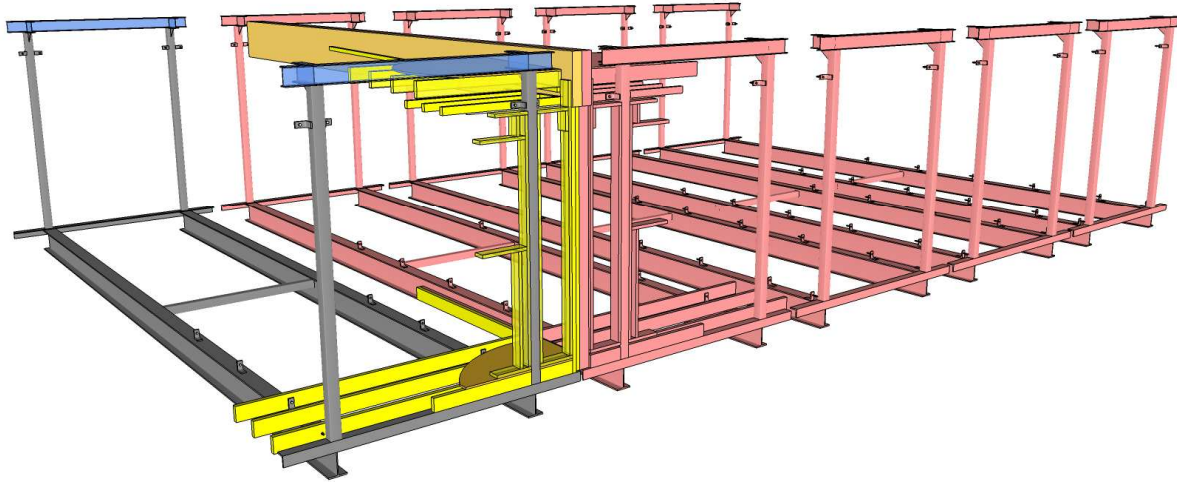


Figure 3 3D section of a standard building complex

The proposed building will rely on natural ventilation, with the addition of extractor fans in critical locations.

It is proposed that the space heating will be provided by electric convection, and the building will have natural ventilation by means of opening windows. There will be additional mechanical extractor fans providing 64 l/s extract each, with a specific fan power of 0.266 W/l/s.

For the purposes of this document we have assumed an air permeability of $5 \text{ m}^3/(\text{h.m}^2)$ @ 50 Pa
This is a conservative estimate based on historic records.

I have also made the assumption that the electric power factor will be greater than 0.95.

Calculation method.

The baseline and reduction energy consumption has been calculated by the use of SBEM – iSBEM v4.1.e

Emissions associated with space heating are calculated from an electrical baseline, as gas is not available to this project and the limited time that the building will be on the site.

The baseline carbon dioxide (CO₂) emissions have been calculated using standard conversion factors. Electricity: 0.422kgCO₂/kWh From Part L2a (2006) Table 2.

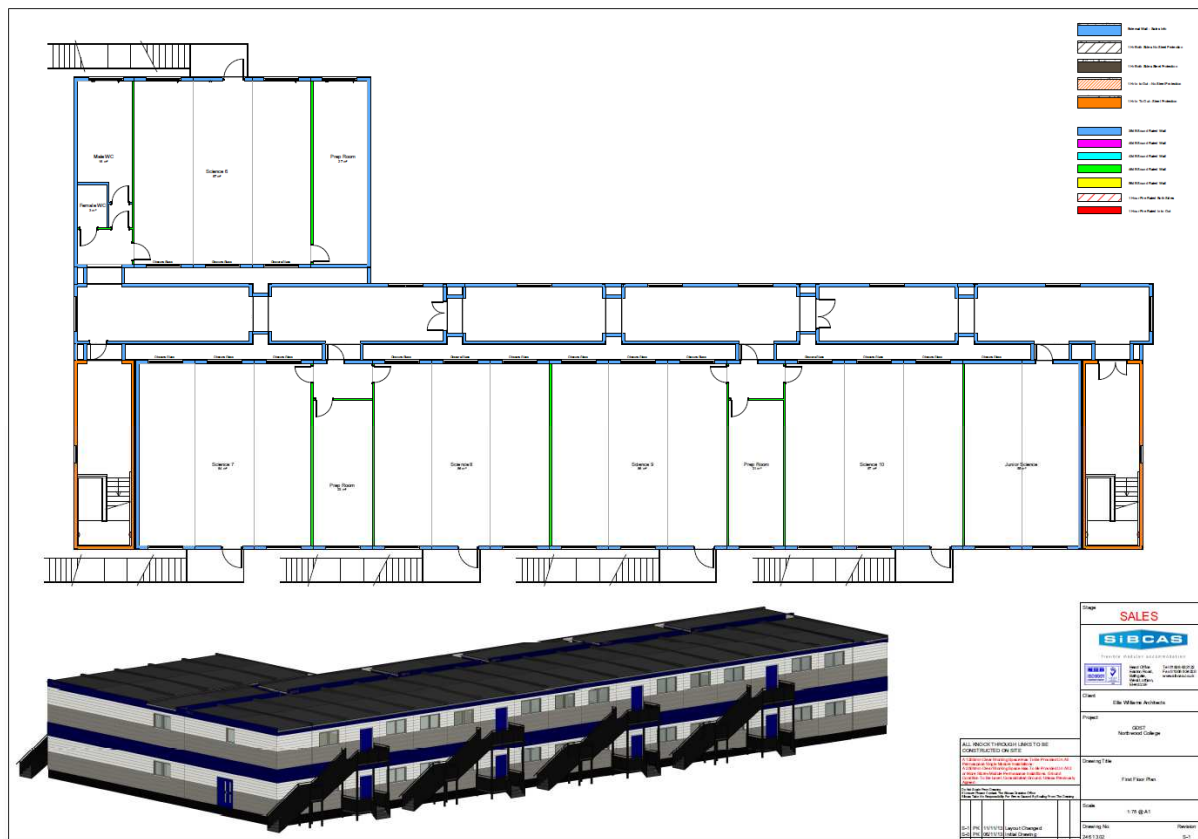


Figure 4 Plan and isometric

Baseline energy consumption and carbon dioxide emissions.

By calculation the Baseline energy consumption using iSBEM v4.1.e
We achieve the figures as in Table 2.

Annual energy consumption by end use			
Heating	29.56 kWh/m ²	23.44 MWh	
Cooling			
Lighting	9.50 kWh/m ²	7.53 MWh	
Hot water	8.70 kWh/m ²	6.90 MWh	
Equipment *	13.56 kWh/m ²	10.75 MWh	
TOTAL **	47.76 kWh/m ²	37.87 MWh	19,111 kgCO ₂ /yr
* Energy used by equipment does not count towards the total for calculating emissions.			

Table 2 Summary of baseline energy demand

Proposed energy demand reduction

Reduction in energy consumption and carbon dioxide emissions resulting from energy efficiency measures, as in Table 4.

Within this proposal the only measures that are different from the baseline calculations are as follows.

Replacing the space heating within all of the classrooms, prep-rooms and offices with air conditioning units, the units suggested are Daikin wall mounted 3.5kW, 5.0 kW and the 7.1 kW.

Passive infrared controls for the lighting within all toilet areas.

Annual energy consumption by end use			
Heating	16.42 kWh/m ²	13.02 MWh	
Cooling	3.06 kWh/m ²		
Lighting	9.44 kWh/m ²	7.49 MWh	
Hot water	8.70 kWh/m ²	6.90 MWh	
Equipment *	13.59 kWh/m ²	10.78 MWh	
TOTAL **	37.62 kWh/m²	27.41 MWh	15,043 kgCO₂/yr
* Energy used by equipment does not count towards the total for calculating emissions.			

Table 3 Summary of proposed building energy demand

Within this project no renewables have been allowed for.

Total CO ₂ emissions (kgCO ₂ /year)	
Baseline emissions	19,357.1 kgCO ₂ /yr
Improved emissions (after application of energy efficiency)	15,043 kgCO ₂ /yr
% CO ₂ displaced in total	22.1 %

Table 4 Summary of CO₂ emissions reductions

Possible further improvements

Possible further options for additional CO2 reductions include.

- Setting the air conditioning to only allow for room heating and not to provide room cooling. Room overheating is a concern and therefore we will not consider this.
- Allowing for more passive infrared controls for room lighting. Cost prohibitive compared to the potential savings.

Further reductions are possible but may not be beneficial or cost effective as a result of the proposed time that the building will be on this site.

Conclusions

By the installation of the proposed energy saving measures this building will provide a good standard of working environment to the end users and provide a 22.1% reduction of CO2. Which equates to a predicted saving of 10.46 MWh of mains grid supplied electricity.

Appendix A, U-Value for floor

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Documentation of the component
 Thermal transmittance (U-value)
 Source: **own catalogue - Ground floors**
 Component: **Permaspace Floor**

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INSIDE

This illustration of inhomogeneous layers is provided only to assist in visualising the arrangement.



OUTSIDE

Assignment: Ground floor

	Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
	Rsl					0.17
✓ 1	BS EN 12524	Chipboard [300 kg/m³]	0.019	0.100	D	0.19
✓ 2	BS EN 12524	Aluminium foil 0.05 mm	0.000	200.000	D	0.00
✓ 3	Inhomogeneous material	consisting of:	0.150	± 0.054		2.78
3a	Saint-Gobain Isover	Isowool Spacesaver Roll	87.50 %	0.043	D	-
3b	BS EN 12524	Softwood Timber [500 kg/m³]	12.50 %	0.130	D	-
✓ 4	BS EN ISO 6946	Slightly vent. air layer: 300 mm, downw. heat flow	0.300	2.609	D	0.11
	Rse					0.00
0.469						

U = 0.19 W/(m²K)

Explanation see next page

- Q** ... The physical values of the building materials has been graded by their level of quality. These 5 levels are the following
- A** ... Data is entered and validated by the manufacturer or supplier. Data is continuously tested by 3rd party.
- B** ... Data is entered and validated by the manufacturer or supplier. Data is certified by 3rd party
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- E** ... Information is entered by the user of the BuildDesk software without special agreement with the manufacturer, supplier or others.

U_{max} = **0.25 W/(m²K)** U = **0.19 W/(m²K)** R_T = **3.30 m²K/W**

Source of U_{max} value: England, Wales: Approved Document L1A (2006), Table 2 - New Build Dwellings
 Calculated with BuildDesk 3.3.1

Appendix B, U-Value for wall



BuildDesk version 3.4.2

Documentation of the component

Thermal transmittance (U-value) according to BS EN ISO 6946

Source: own catalogue - External walls

Component: Wall_Permaspace_120_APO

19. May 2010

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OUTSIDE

INSIDE



This illustration of inhomogeneous layers is provided only to assist in visualising the arrangement.

On the basis of the given information about the inhomogeneous layers, it is not possible to estimate how and where bearing elements intersect each other. It was assumed that the layers intersect crosswise. The size of the areas was calculated corresponding to their percentage of the whole area.

Assignment: External wall

	Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m²K/W]
	Rse					0.04
✓ 1	BS EN 12524	Render, lime and sand	0.014	0.800	D	0.02
✓ 2	BS EN 12524	Bituminous paper 0.1 mm	0.000	0.200	D	0.00
✓ 3	BS EN 12524	Plywood [300 kg/m³]	0.010	0.090	D	0.11
✓ 4	Inhomogeneous material layer	consisting of:	0.100	0.045		2.23
4a	Saint-Gobain Isover	Isowool Spacesaver Plus	94.67 %	0.040	D	-
	Air gaps	Level 0: $\alpha U^* = 0.00$ W/(m²K)				
4b	BS EN 12524	Softwood Timber [500 kg/m³]	05.33 %	0.130	D	-
✓ 5	Inhomogeneous material layer	consisting of:	0.000	189.347		0.00
5a	Apollo Insulation Ltd	Eco-Brite®	94.67 %	200.000	B	-
	Air gaps	Level 0: $\alpha U^* = 0.00$ W/(m²K)				
5b	BS EN 12524	Softwood Timber [500 kg/m³]	05.33 %	0.130	D	-
✓ 6	Inhomogeneous material layer	consisting of:	0.025	0.042		0.59
6a	Apollo Insulation Ltd	Unventilated air layer: 25 mm, horiz. heat flow	94.67 %	0.037	B	-
6b	BS EN 12524	Softwood Timber [500 kg/m³]	05.33 %	0.130	D	-
✓ 7	British Gypsum Limited	Gyproc Wallboard DUPLEX	0.015	0.160	D	0.09
	Rsi					0.13
			0.164			

$$R_T = (R_i' + R_i'')/2 = 3.25 \text{ m}^2\text{K/W}$$

Correction to U-value for	according to	delta U [W/(m²K)]
Air gaps	BS EN ISO 6946 Annex D	0.000
		0.000

$$U = 1/R_T + \sum \Delta U = 0.31 \text{ W/(m}^2\text{K)}$$

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$$U_{\max} = 0.35 \text{ W/(m}^2\text{K)}$$

$$U = 0.31 \text{ W/(m}^2\text{K)} \quad R_T = 3.25 \text{ m}^2\text{K/W}$$

Source of U_{max} value: England, Wales: Approved Document L1A (2006), Table 2 - New Build Dwellings

Calculated with BuildDesk 3.4.2

Appendix C, U-Value for roof

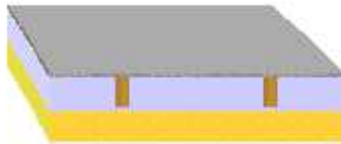
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 flexible modular accommodation

Documentation of the component
 Thermal transmittance (U-value) according to BS EN ISO 6946
 Source: **own catalogue - Flat roofs**
 Component: **Permaspace Roof**

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OUTSIDE

On the basis of the given information about the inhomogeneous layers, it is not possible to estimate how and where bearing elements intersect each other. It was assumed that the layers intersect crosswise. The size of the areas was calculated corresponding to their percentage of the whole area.



INSIDE

Assignment: Flat roof

	Manufacturer	Name	Thickness [m], number	Lambda [W/(mK)]	Q	R [m ² K/W]
		R _{se}				0.04
		Limitation because of weakly ventilated air layers				0.15
☐	1	BS EN 12524 Bitumen felt/sheet	0.004	0.230	D	0.02
☐	2	BS EN 12524 Bitumen felt/sheet	0.004	0.230	D	0.02
☐	3	BS EN 12524 Bitumen felt/sheet	0.004	0.230	D	0.02
☐	4	BS EN 12524 Plywood [300 kg/m ³]	0.013	0.090	D	0.14
☐	5	Inhomogeneous material layer consisting of:	0.050	0.577		0.09
	5a	BS EN ISO 6946 Slightly vent. air layer: 50 mm, upwards heat flow	90.36 %	0.625	D	-
	5b	BS EN 12524 Softwood Timber [500 kg/m ³]	09.64 %	0.130	D	-
☐	6	Inhomogeneous material layer consisting of:	0.100	1.142		0.09
	6a	BS EN ISO 6946 Slightly vent. air layer: 100 mm, upw. heat flow	90.36 %	1.250	D	-
	6b	BS EN 12524 Softwood Timber [500 kg/m ³]	09.64 %	0.130	D	-
☒	7	BS EN ISO 6946 Slightly vent. air layer: 25 mm, upwards heat flow	0.025	0.313	D	0.08
☒	8	Saint-Gobain Isover Isowool Spacesaver Plus Level 1: dU* = 0.01 W/(m ² K)	0.150	0.040	D	3.75
☒	9	British Gypsum Limited Gyproc Wallboard DUPLEX	0.013	0.160	D	0.08
		R _{si}				0.10
						0.362

☐ was not taken into consideration in the calculation

$$R_T = R_{se} + \sum R_i + R_{si} = 4.20 \text{ m}^2\text{K/W}$$

Correction to U-value for	according to	delta U [W/(m ² K)]
Air gaps	BS EN ISO 6946 Annex D	0.008
		0.008

$$U = 1/R_T + \sum \Delta U = 0.25 \text{ W/(m}^2\text{K)}$$

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U_{max} = **0.25 W/(m²K)** U = **0.25 W/(m²K)** R_T = **4.20 m²K/W**

Source of U_{max} value: England, Wales: Approved Document L1A (2006), Table 2 - New Build Dwellings
 Calculated with BuildDesk 3.3.1

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Date : 16th February 2014
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Appendix D, U-Value for window

Please note that this is the approved method of calculation the U-Value for a window system, CEN

U-Value Report

Person in Charge: Andy Roberts

Page: 1
Date: 11/12/2012
Time: 12:59 am
Job: **Sibcas U-value Reports**

Pos SPW300 Aluminium

1 Pcs. Window Element 1230 mm x 1480 mm, Consisting of a Fixed Field and a Tilt before Turn Window.



Scale 1:100
External View
System: Senior SPW 300

Area	Area/Length	U-Value	Heat Loss
Profiles (U_f)	0.491 m ²	3.7 W/m ² K	1.8 W/K
Glass (U_g)	1.329 m ²	1.1 W/m ² K	1.5 W/K
Interconnection Glass (Psi)	7.362 m	0.041 W/m K	0.30 W/K
Total (U_w)	1.820 m²	2.0 W/m² K	3.6 W/K