Kellogg College Hub
Project Documentation

1. Abstract

1.1 Summary

Kellogg College Hub is a café and social space in central Oxford, UK, built for Kellogg College and Oxford University in 2017. The building consists of a common room and café and includes a commercial kitchen. The south-orientated building is constructed from concrete, is super-insulated with over 250mm PIR insulation on the walls and roof, and features demand-controlled ventilation to the main spaces and a commercial kitchen.

1.2 Building Data

Year of construction	2017	Space heating	**13** kWh/m²/yr
U-value external wall	0.083	**Primary Energy Renewable (PER)**	76.8 kWh/m²/yr
U-value ground floor	0.138	**Generation of renewable energy**	0 kWh/m²/yr
U-value roof	0.062	**Non-renewable Primary Energy**	106 kWh/m²/yr
U-value windows	0.883	**Pressure test n_{50}**	0.58
Heat recovery	82%		
Special features	The building features a commercial kitchen with demand-controlled heat recovery ventilation. The building has a brown roof.		
Passivhaus Database ID	6410		

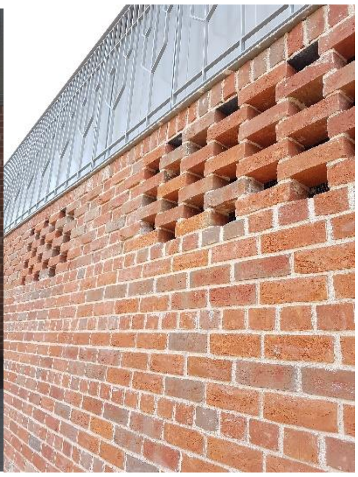
2. Project Team

Architect	Feilden Clegg Bradley Studios (Charlotte Walker)
	https://fcbstudios.com/
Building Services Engineer	CBG Consultants (Chris Swinburn/Chris Dicks)
Passivhaus Consultant	CBG Consultants (Chris Swinburn)
Passivhaus Certifier	WARM energy building practice
Structural Engineer	Price & Myers
Project Manager	Ridge & Partners (Tim Leigh)
Contractor	Speller Metcalfe (Adrian Metcalfe)

3. External Views of Kellogg College Hub Passivhaus

South-facing view- showing terrace and shading canopy:

View of north elevation- showing MVHR intakes and exhausts hidden within the brickwork:



West-facing view- showing main entrance:

East-facing view looking into the café:

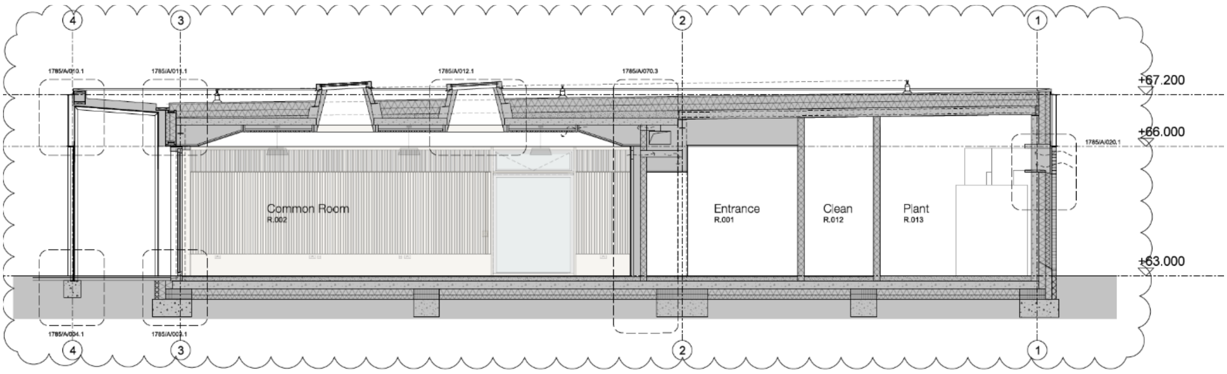
4. Internal Views of Kellogg College Hub Passivhaus

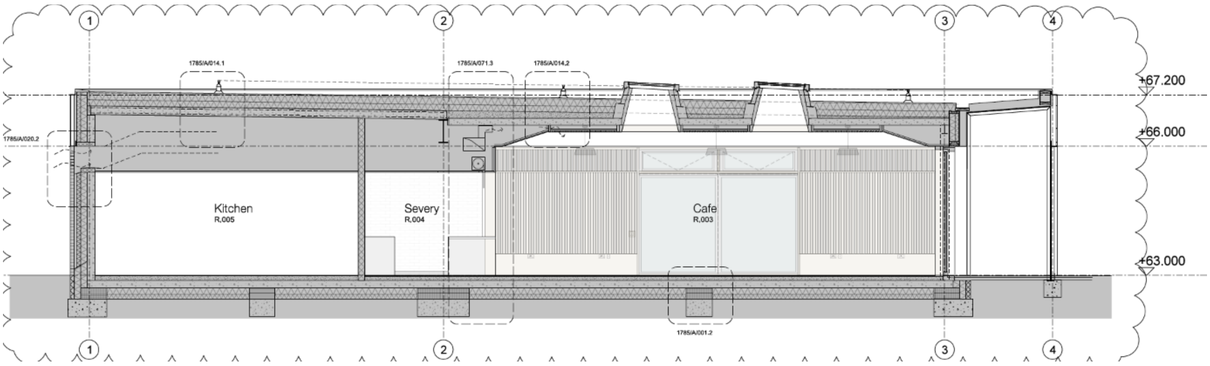
Interior views across the common room and cafe:

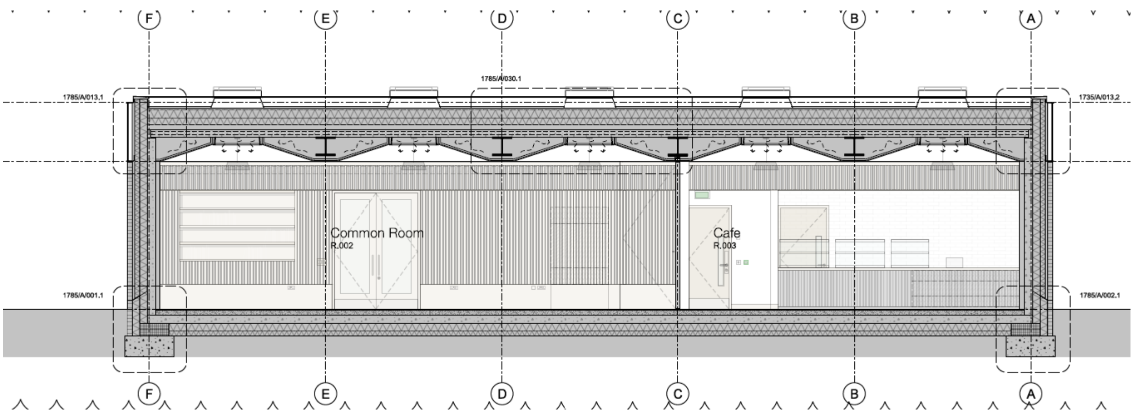
5. Sectional Drawing

Sectional drawings of the building are shown below. A few items to note:

- The external shading on the south façade creates a covered terrace, as well as protecting the building from the high summer sun, while permitting low level winter sun.
- The common room and café feature a ceiling plenum through which fresh air is supplied to the space.
- Rooflights in the common room and café bring light to the rear of the space

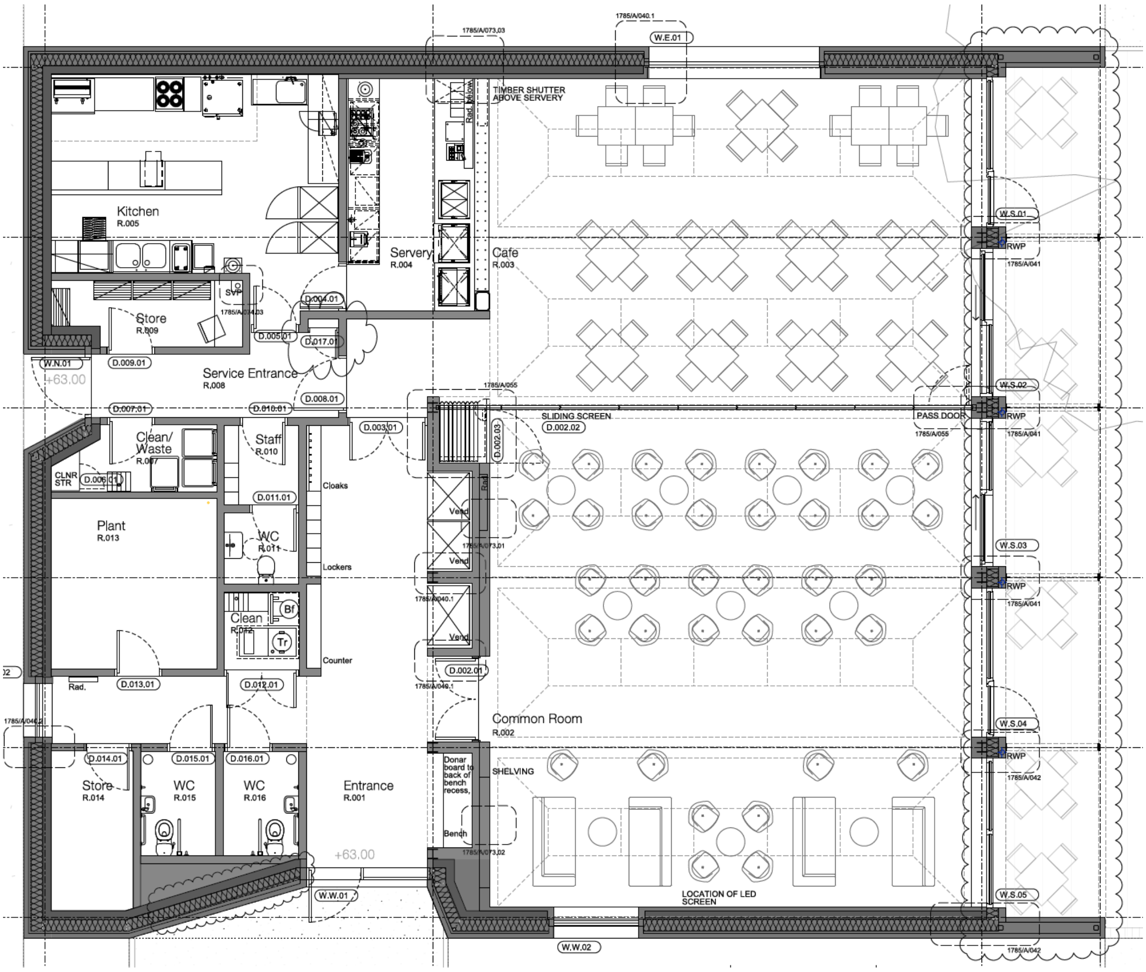






6. Floor Plans

The floor plan for the building is shown below. The two main spaces are the common room and café, separated by a sliding screen- which is normally left open to create one large space. A commercial kitchen and servery to the north-west of the plan is capable of servicing general café use, or larger scale catered events. The remainder of the floor plan is made up of circulation, WCs and storage, with the plant room housing the main MVHR unit, boiler and hot water storage.



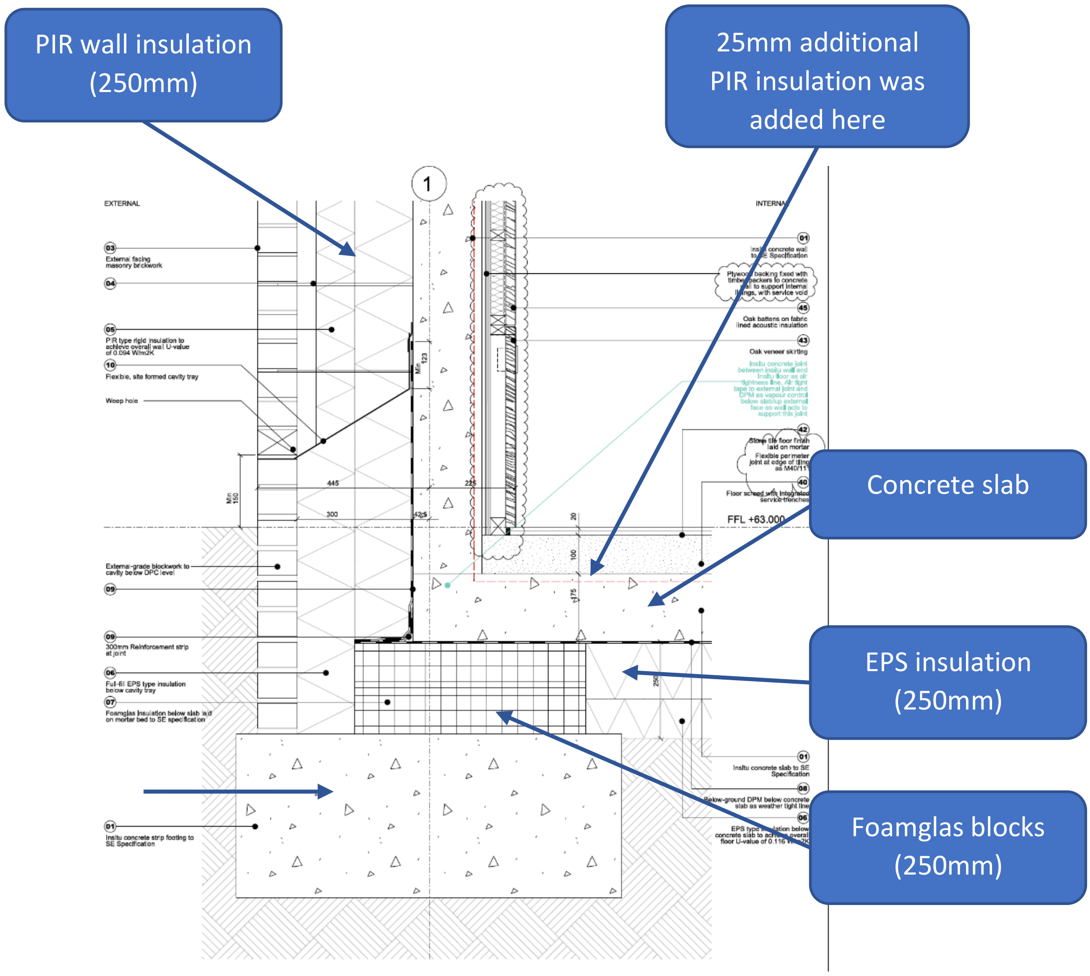
7. Construction of Floor Slab

The building is supported on a strip foundation which runs around the perimeter and below internal structural walls. The ground floor slab spans between the strip foundations, with thermal separation achieved using foamglas structural insulation blocks (250mm). The floor slab is insulated below using EPS insulation (200mm), and with 25mm of PIR insulation below the screed.

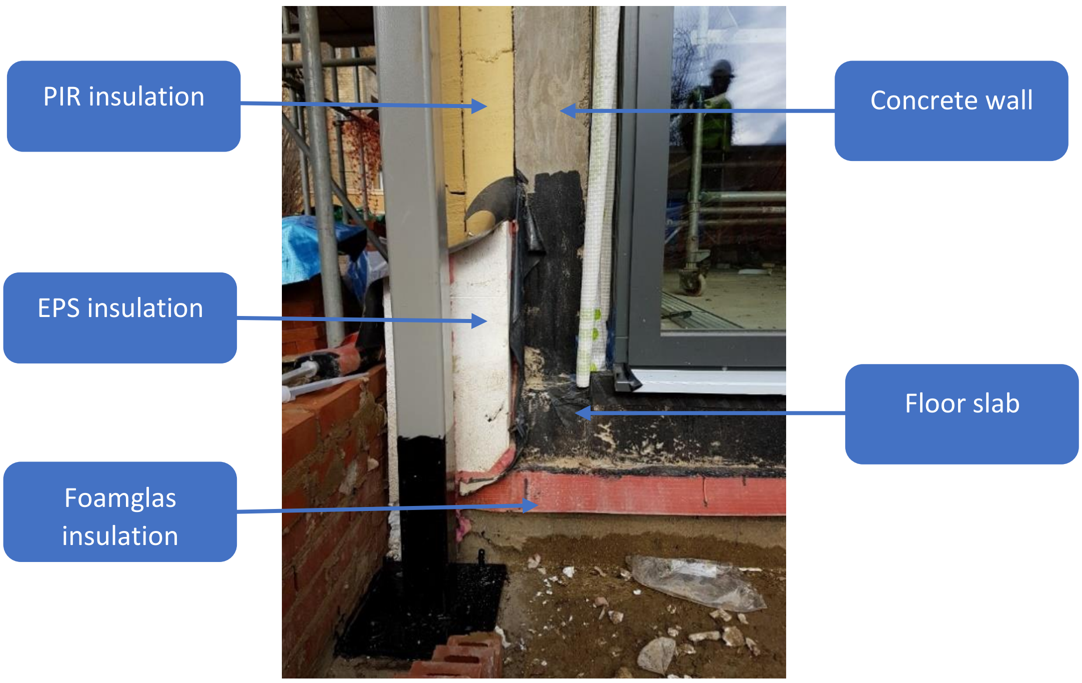
Insulation Type	Location	Product	Conductivity
Structural insulation	Between slab and strip foundations	Foamglas Floorboard F	0.05W/mK
EPS	Below slab	Cordek Filcor 140, 250mm	0.032 W/mK
PIR	Below screed	Xtratherm Thin-R 25mm	0.022 W/mK
PIR	External walls	Xtratherm Thin-R 250mm	0.022 W/mK

Ground Floor	Screed 25mm PIR insulation (0.022W/mK) Concrete slab 250mm EPS insulation	U-value: 0.138 W/m^2/K

Wall to ground detail:



Constructed wall to floor junction:



Laying of the floor insulation: white insulation is EPS, black insulation is foamglas:

8. Construction of External walls

The external walls are constructed from in-situ cast concrete, insulation with 250mm of PIR insulation, with a cavity and single skin brickwork exterior.

The concrete walls form a flat surface onto which the insulation boards can sit flat. The PIR insulation is fixed, in two layers, using the wall ties which support the brickwork. The boards have tongue and groove joints, with low expansion foam used to fill any gaps.

Insulation Type	Location	Product	Conductivity
PIR	External walls- above DPC	Xtratherm Thin-R 250mm	0.022 W/mK
EPS	External walls- below DPC	Cordek Filcor 140, 250mm	0.032 W/mK

External Walls	Cast in-situ concrete 250mm PIR insulation (0.022W/mK) 50mm cavity 100mm brickwork	U-value: 0.083 $W/m^2/K$

Left- PIR insulation (first later) fixed to cast concrete walls. Right- EPS insulation below damp-proof course:

PIR insulation – note wall ties:

Wall to wall junction- gaps between boards will filled with low-expansion foam:

9. Construction of Roof

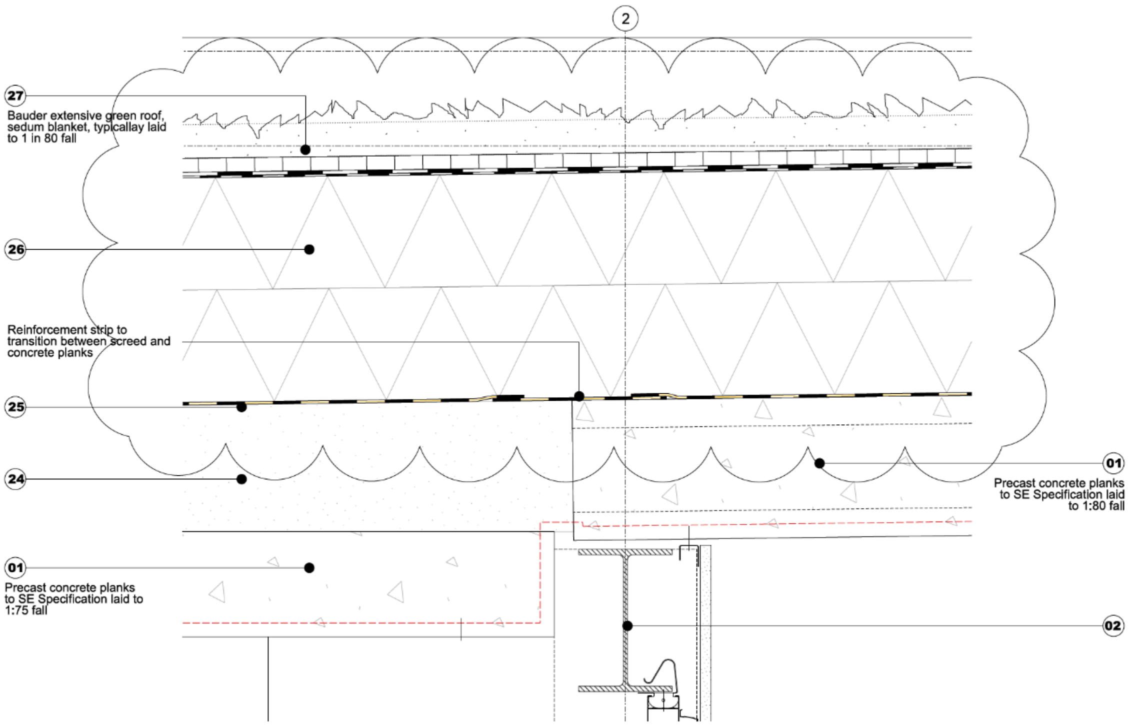
The roof is constructed from pre-cast concrete planks laid on top of steel beams, and grouted into the external concrete walls. 320mm of PIR insulation is laid on top of the planks, with a waterproof membrane above, and a brown roof above that.

To minimise thermal bridging, the decorative metal frieze around the perimeter of the roof is fixed into a timber cassette constructed of timber i-beams, which are fully insulated with PIR insulation.

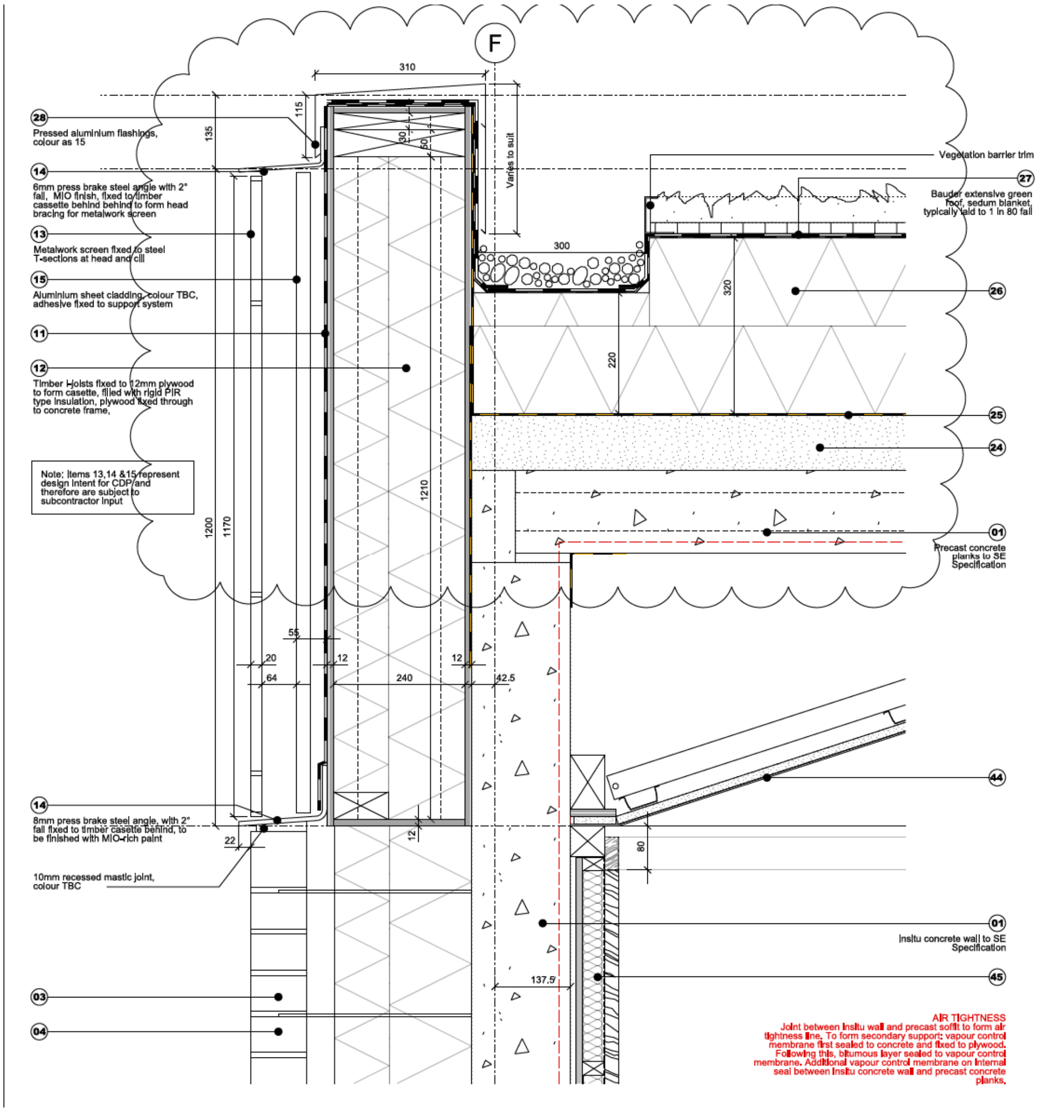
Insulation Type	Location	Product	Conductivity
PIR	Roof	BauderPIR FA 320mm	0.022 W/mK
PIR	Timber cassettes	Xtratherm Thin-R	0.022 W/mK

Roof	Pre-cast concrete planks 320mm PIR insulation (0.022W/mK) Roof membrane Brown roof	U-value: 0.062 W/m^2/K

Roof construction:



Roof to wall junction- showing timber cassette which supports the metal frieze:



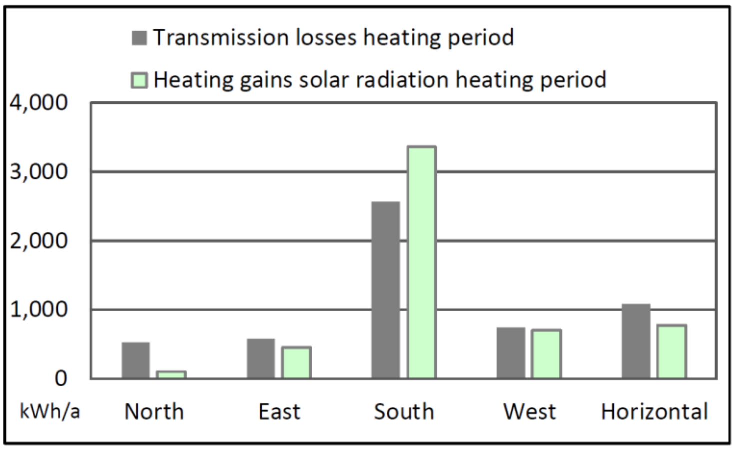
PIR Roof Insulation:

Insulated timber 'cassette' which supports decorative metal freeze:

10. Window and Installation of Windows

The windows used on the project were Ecowin and have an average U-value of 0.88 W/m^2/K. The performance of the glazing was maximised by keep glazing elements simple (to minimise frame area). The south-facing windows give a net energy benefit to the building by harvesting winter solar gain.

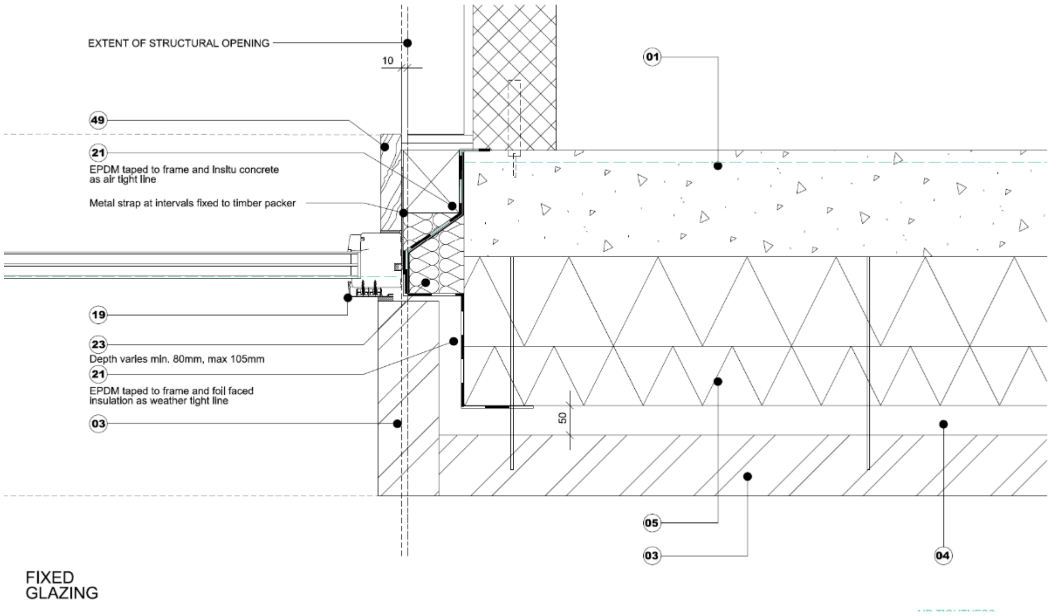
The windows are fixed using metal straps, which creates a gap between the window and surround structure. This is filled with fire-stopping cavity batts which also act as the insulation and provide a tight connection to the external wall insulation. Along the south façade, thermal bridging is minimised by the use of timber i-joists which create a suitable fixing structure for the window frames.



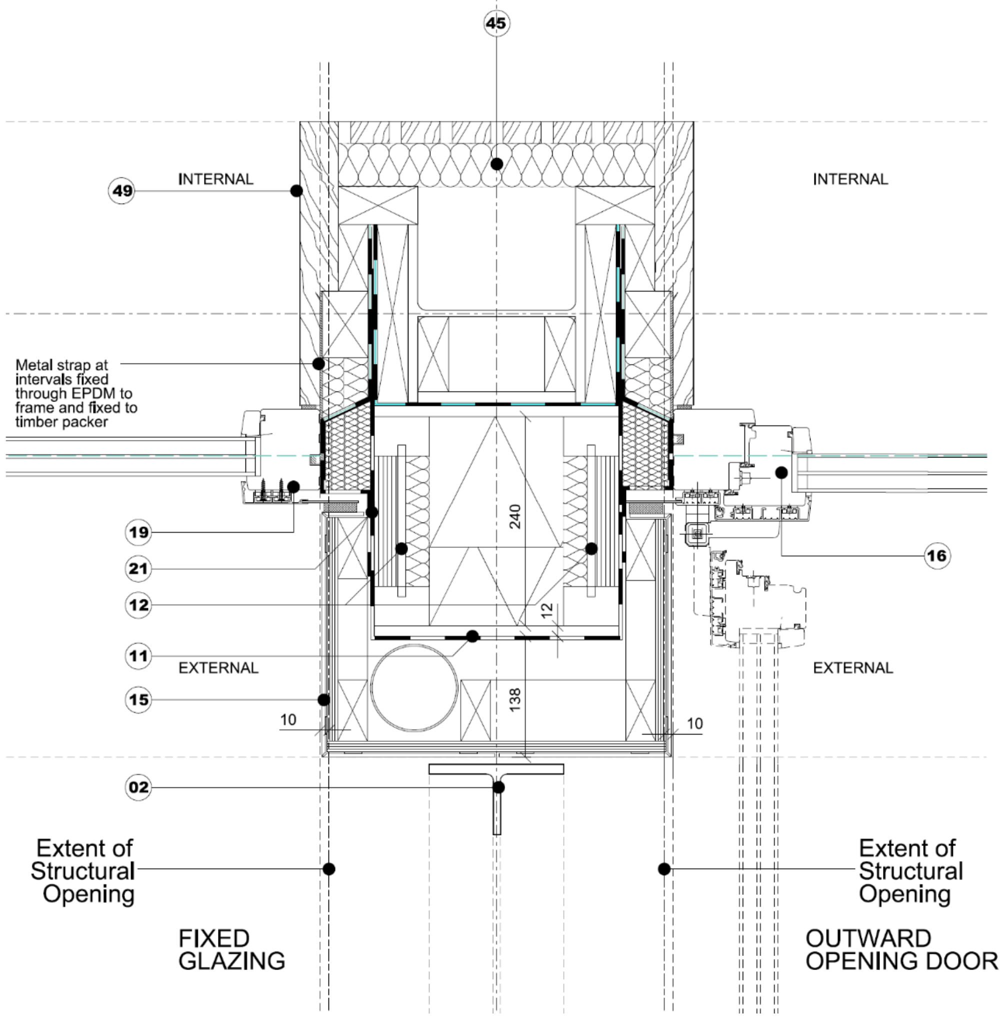
Window Properties	
Supplier/Manufacturer	Econwin/Gaulhofer
Product	Fusionline
Ug	0.54 W/m^2/K
Uf (typical)	1.0 W/m^2/K
g-value	0.53 W/m^2/K
Uw (average)	0.88 W/m^2/K

Windows	Triple glazing with low-e coatings, filled with krypton/argon. Composite window frames (timber/aluminium) with low conductivity spacers.	0.883

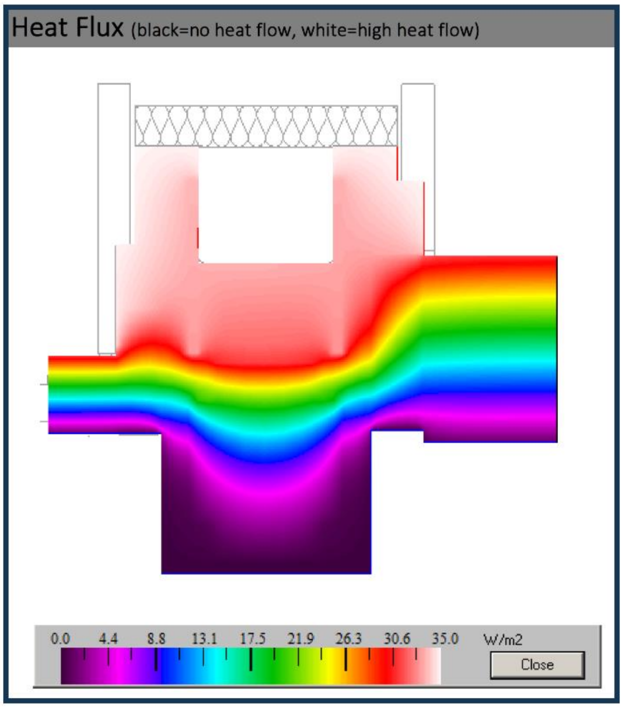
Typical Window Jamb Detail:



South façade window jamb detail:



Thermal analysis of south façade window jambs:



11. Airtight Building Envelope

Air tightness is primarily provided by the cast in-situ concrete walls, which link onto the screed, and onto the concrete planks which form the roof. Airtight tapes and membranes were used to connect the concrete to windows and at other interfaces between elements.

Fan blower door test:

Air barrier connections:

1. membrane around columns and onto windows

2. tapes between concrete roof planks

3. Tape from windows to concrete walls

4. Tape around steel beam

5. Tape from screed to windows.

TEST CONDITIONS & RESULTS			
HRS REF:	123404		
BUILDING:	The Kellogg College Hub University of Oxford 62 Banbury Road Oxford Oxfordshire OX2 6PN		
BUILDING TYPE:	Commercial		
YEAR OF CONSTRUCTION:	2017		
CLIENT:	Speller Metcalfe		
CLIENT CONTACT:	Dave Hull		
TEST DATE:	29/03/2017		
TIME OF TEST:	14:21		
BUILDING REGULATIONS:	Building Regulations 2013, Part L2A Conservation of Fuel and Power in New Buildings Other Than Dwellings		
NON RESIDENTIAL PASSIVHAUS BUILDINGS	The Criteria for Non-Residential Passivhaus Buildings denotes that the maximum acceptable leakage is <0.6 air changes per hour.		
PASSIVHAUS SPECIFICATION	0.6 ACH		
DESIGN AIR PERMEABILITY CRITERIA:	0.7 $m^3/(h.m^2)$ @ 50Pa		
TEST RESULT DEPRESSURISATION ($m^3/(h.m^2)$ @ 50Pa):	**0.57 $m^3/(h.m^2)$ @ 50Pa**		
TEST RESULT PRESSURISATION ($m^3/(h.m^2)$ @ 50Pa):	**0.54 $m^3/(h.m^2)$ @ 50Pa**		
AIR CHANGES PER HOUR	**0.58 ACH**		
ENVELOPE AREA (m^2):	1014	**FOOTPRINT (m^2):**	339
VOLUME (m3):	966.6		
The envelope area for air permeability is defined as the area of the external walls plus the area of the roof and the ground floor. The envelope area & volume was calculated by HRS Services Ltd in accordance with ATTMA Technical Standard 1. Please note that Passivhaus certification requires the volume to be calculated using the Euronorm methodology which excludes all internal partitions, stairs, floor void etc.			
ENVELOPE AREA CALCULATIONS UNDERTAKEN BY:	HRS	Sebastian Martinez	
AREA TESTED:	Entire		
AREA EXCLUDED:	None		
TEST TYPE:	Whole building		
VENTILATION TYPE:	System 5 - Other		
MASTIC SEALING STATUS:	Sanitary ware only		

TEMPORARY SEALING APPLIED TO INTENTIONAL OPENINGS FOR THE TEST:		
ELEMENT	**TEMPORARY SEAL?**	**COMMENT/EXTENT OF SEALING**
MECHANICAL VENTILATION	Yes	
TRICKLE VENTS	No	
AIR CONDITIONING	No	
PASSIVE VENTILATION	No	
CHIMNEY FLUES	No	
DRAINAGE TRAPS	Yes	
OTHER	No	
TEMPORARY SEALING TO MISSING OR BROKEN COMPONENTS APPLIED FOR THE TEST:		
NON-COMPLIANT TEMPORARY SEALING APPLIED FOR THE TEST:		
TEMPORARY SEALING NOTES:	It should be noted that any temporary seals applied to unintentional openings may, in practice, be more airtight than the element they replace. The complete elements should therefore be of an equal standard of air tightness for the quoted test result to remain unchanged.	
The agreed test state of the test area is with all external windows and doors closed, and all internal doors open, with any temporary seals employed to remain intact for the duration of the test.		

HRS Services Ltd, The Maltings, 81 Burton Road, Sheffield, S3 8BZ
Tel: 0114 272 3004 Email: altas@hrsservices.co.uk Web: www.hrsservices.co.uk

DETAILS OF RESULTS			
API ($m^3/(h.m^2)$ @ 50Pa):	0.57	(Q_{50}) AIR FLOW RATE AT 50PA (m^3/s):	0.1595
HRS REF:	123404	(n) AIR FLOW EXPONENT :	0.7656
BUILDING:	The Kellogg College Hub depressurised v3	(r^2) CORRELATION COEFFICIENT:	0.992
TEST ENGINEER:	Lee Kenton	(C_{env}) AIR FLOW COEFFICIENT ($m^3/(s.Pa^n)$)	7.950000E-003
TYPE OF TEST:	Depressurisation	(C_L) AIR LEAKAGE COEFFICIENT ($m^3/(s.Pa^n)$)	7.980000E-003

WEATHER:	Dry	Cloudy	No wind

ENVELOPE AREA (m^2):	1014

The envelope area for air permeability is defined as the area of the external walls plus the area of the ceiling/roof and the ground floor

ZERO FLOWS (Pa)							
$\Delta p_{0,1+}$	3.50	$\Delta p_{0,1-}$	0.00	$\Delta p_{0,2+}$	4.00	$\Delta p_{0,2-}$	4.00
$\Delta p_{0,1}$,	3.50			$\Delta p_{0,2}$,	4.00		

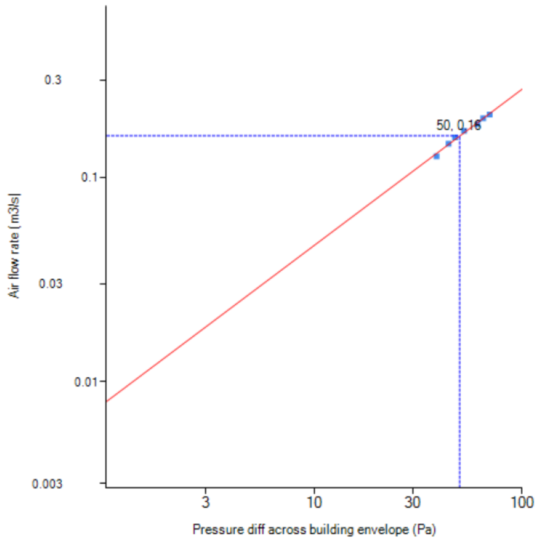
PARAMETERS	START OF TEST	END OF TEST
EXTERNAL TEMP (deg C)	13.4	13.8
INTERNAL TEMP (deg C)	14.4	16.6
BAROMETRIC PRESSURE (Pa)	101200	101200
FAN OFF PRESSURE DIFF. (Pa)	3.50	4.00

INDUCED PRESSURE DIFFERENCES & AIR FLOW RATES															
(Pa)	66	61	57	49	44	41	35								
(m^3/s):	0.20	0.19	0.18	0.17	0.16	0.15	0.13								

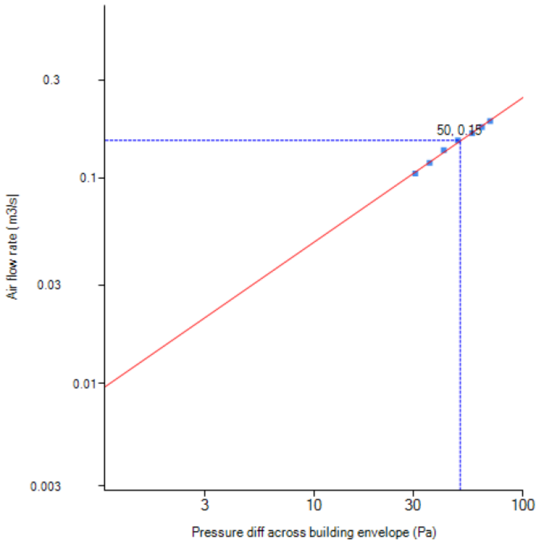
FOR THE FULL SET OF CALCULATIONS USED TO CALCULATE THE AIR PERMEABILITY RATE:
http://www.hrsservices.co.uk/wp-content/uploads/2015/11/air_permeability_calculations.pdf

AIR FLOW LOG GRAPHS

Despressurisation



Pressurisation



HRS Services Ltd, The Maltings, 81 Burton Road, Sheffield, S3 8BZ
Tel: 0114 272 3004 Email: altas@hrsservices.co.uk Web: www.hrsservices.co.uk

12. Ventilation System

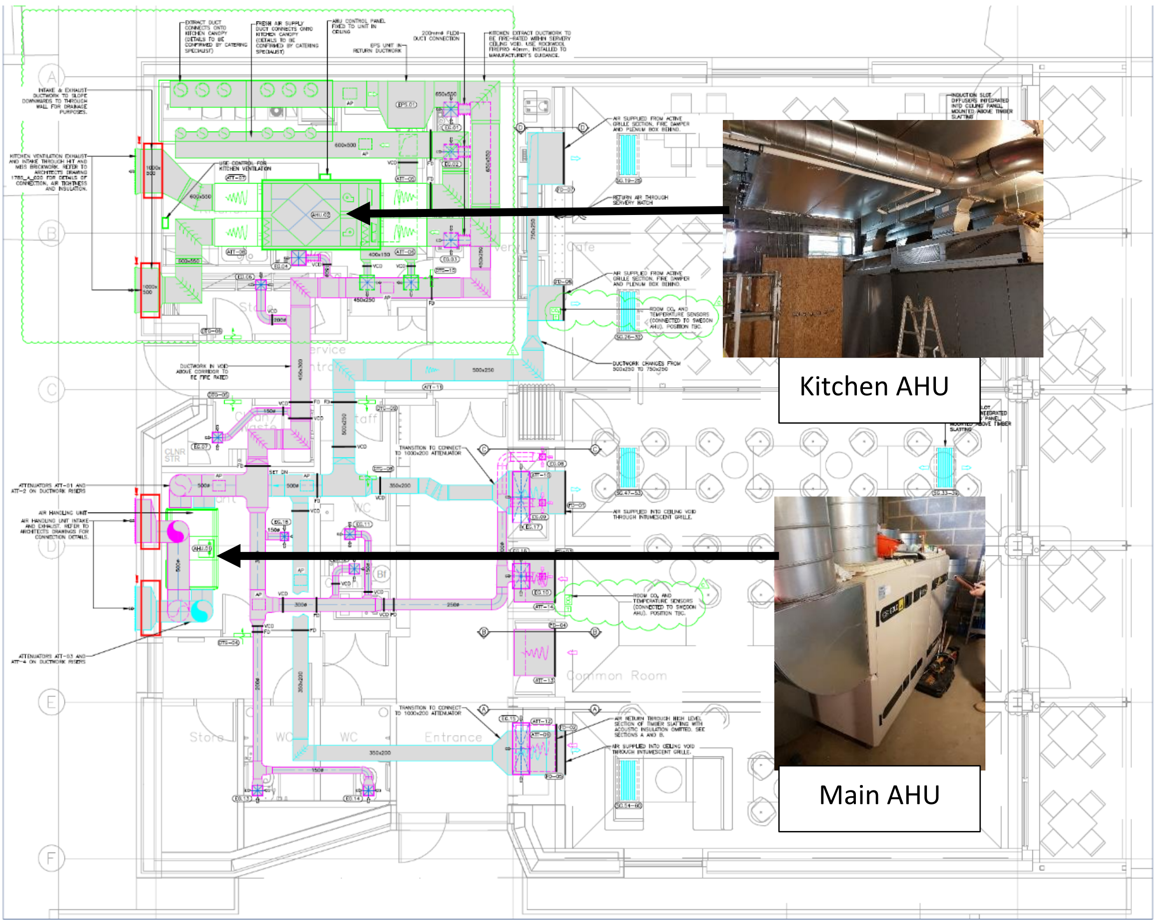
12.1 Ventilation Units

The building is served by two air handling units (AHUs):

- **Main AHU**- serves the common room and café. The unit features a thermal wheel heat exchanger. It operates on demand (according to air quality and temperature) to supply fresh air to these spaces, while extracting air from the WCs, café servery, vending machines and other back-of-house areas.
- **Kitchen AHU**- extracts from the cooking canopy and supplies fresh air back to the kitchen. The unit features a plate heat exchanger. An electrostatic precipitate filter removes grease from the airstream before it enters the unit. The unit operates according to demand by monitoring the return air temperature and increasing its speed when needed.

Air Handling Units		
Unit	Main AHU	Kitchen AHU
Supplier/Manufacturer	Swegon	VES
Product	Gold RX 11	Max 13 A/FP/S
Heat Recovery Type	Thermal Wheel	Plate
Heat Recovery	82%	76%
Specific Fan Power	0.45Wh/m^3	0.56 Wh/m^3

Ventilation drawing show location of AHUs:



12.2 Layout of the ventilation system ducting

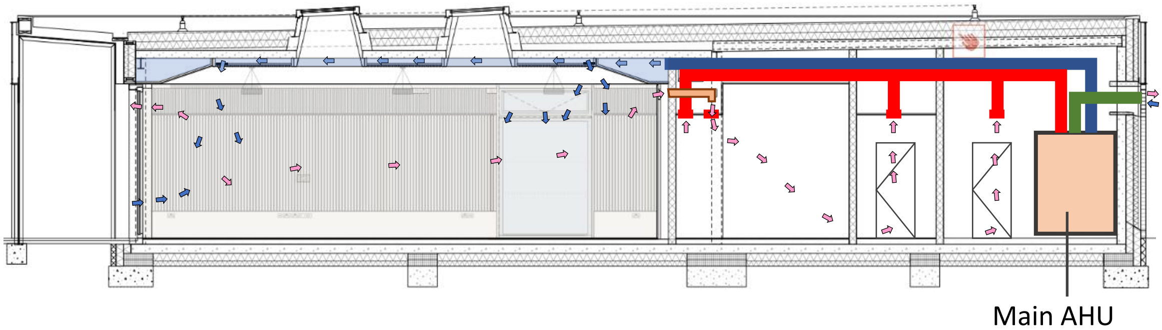
A ductwork system delivers fresh air and extraction around the building. The intake and exhaust to the air handling units are through 'hit n' miss' brickwork openings on the north façade.

Fresh air is supplied from the main AHU to the common room and café via a pressurised ceiling void, which reduces the amount of ductwork required, and creates a thermal connection between the fresh air and concrete planks. Fresh air is supplied into the ceiling and enters the spaces below through induction diffusers. The induction diffusers allow the air to be supplied colder without creating cold draughts.

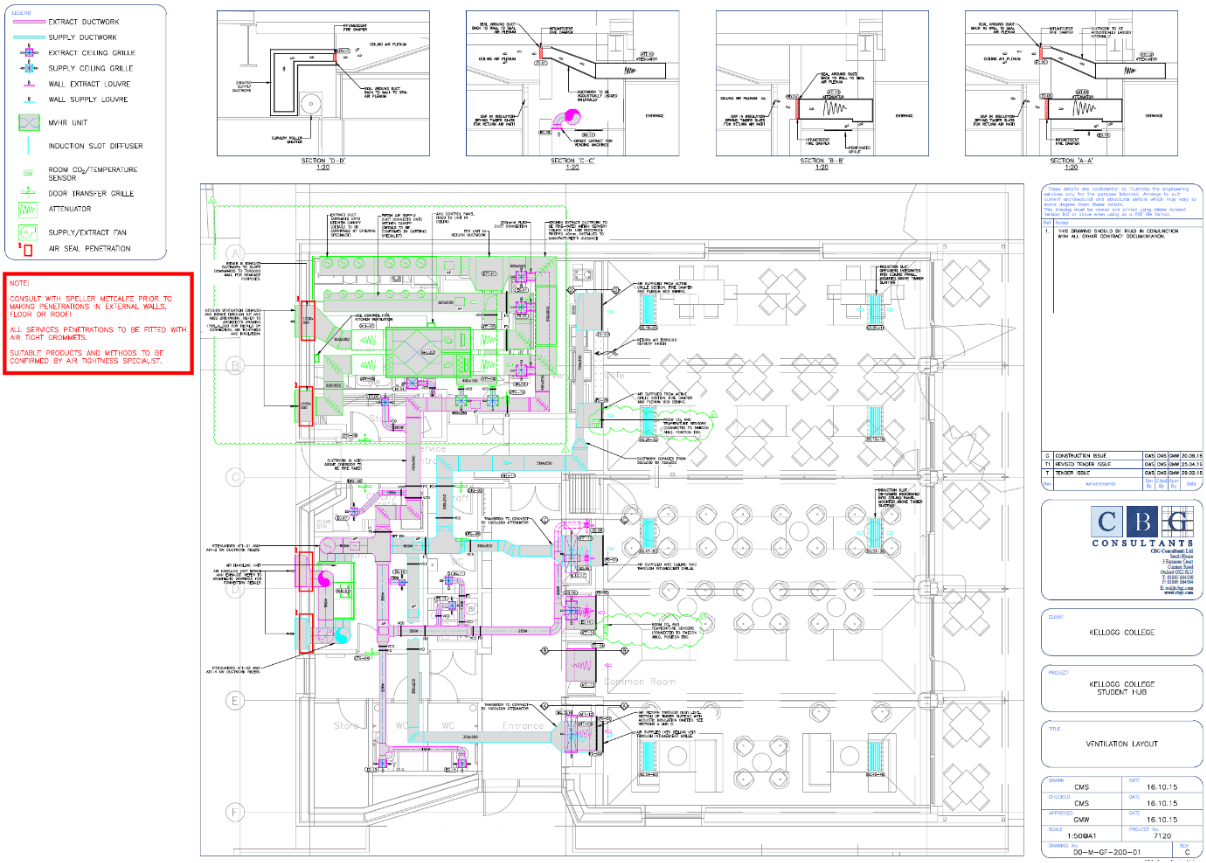
The corresponding extraction of air is from WCs, plant room, vending machines and store rooms. Acoustically treated air transfer ducts allow the passive transfer of air from the common room and café and into the corridor. From here it flows through transfer grilles into the WCs, plant room etc.

The kitchen AHU extracts from the cooking canopy, while supplying most of the fresh air into the kitchen. To keep the kitchen under negative pressure (to control odours and moisture), 15% of the fresh air is supplied into the adjacent corridor. This air makes its way back to the kitchen through door transfer grilles.

Air flow strategy:



Ductwork distribution drawing:

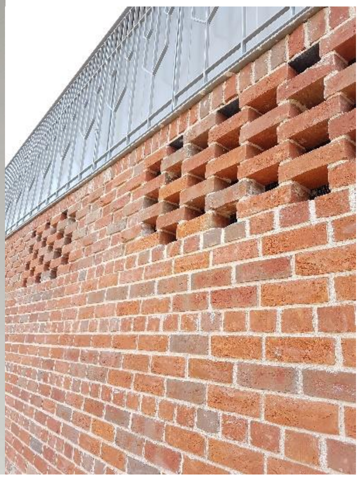


Ductwork Installation photos:

Air distribution features:

- Top left- induction diffuser prior to mounting.
- Top middle- ventilation supply through ceiling (with induction diffuser behind)
- Top right- intake and exhaust through ‘hit n’ miss’ brickwork
- Bottom left- air transfer into kitchen
- Bottom right- air transfer into plant room



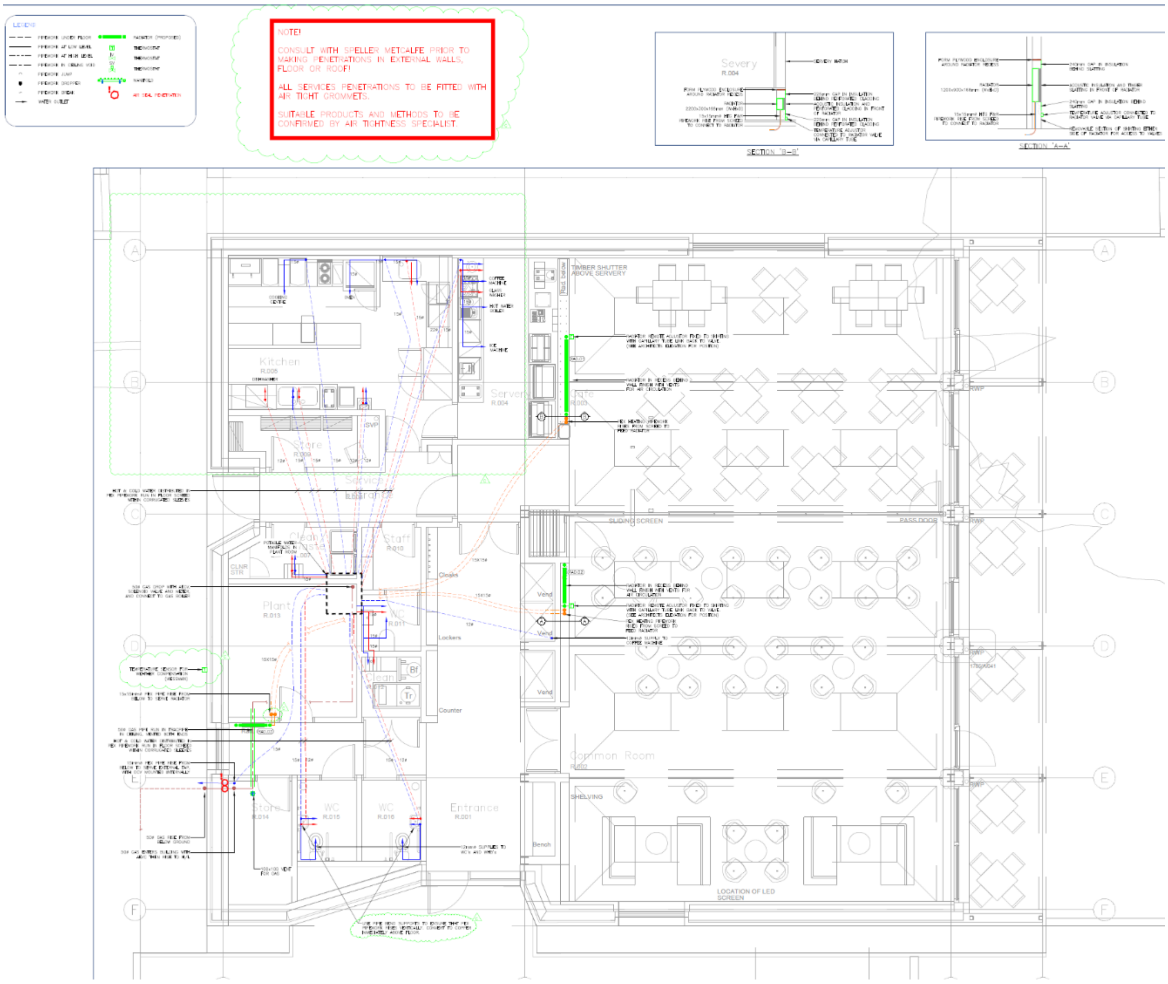


13. Space Heating System

Space heating is provided from a gas boiler which also serves the hot water system. The boiler heats a buffer vessel, which prevents short cycling. A pumped circuit from the buffer vessel connects to three radiators, which heat the entire building.

Left- radiator in café. Right- boiler and buffer vessel:

Space heating drawing:



14. PHPP Calculations

Passive House Verification

Building:	Kellogg College Hub		
Street:	Banbury Rd		
Postcode/City:	OX2 6PN	Oxford	
Province/Country:	Oxfordshire	GB-United Kingdom/ Britain	
Building type:	Social Hub & Café		
Climate data set:	GB0002a-Silsoe		
Climate zone:	3: Cool-temperate	Altitude of location:	66 m
Home owner / Client:	Kellogg College		
Street:	Banbury Rd		
Postcode/City:	OX2 6PN	Oxford	
Province/Country:	Oxfordshire	GB-United Kingdom/ Britain	

Architecture:	Feilden Clegg Bradley Studios		**Mechanical engineer:**	CBG Consultants	
Street:	Bath Brewery, Toll Bridge Rd		Street:	South House, 3 Farmoor Court, Cumnor Rd	
Postcode/City:	BA1 7DE	Bath	Postcode/City:	OX2 9LU	Oxford
Province/Country:		GB-United Kingdom/ Britain	Province/Country:	Oxfordshire	GB-United Kingdom/ Britain
Energy consultancy:	CBG Consultants		**Certification:**	WARM: Low Energy Building Practice	
Street:	South House, 3 Farmoor Court, Cumnor Rd		Street:	3 Admirals Hard	
Postcode/City:	OX2 9LU	Oxford	Postcode/City:	PL1 3RJ	PLYMOUTH
Province/Country:	Oxfordshire	GB-United Kingdom/ Britain	Province/Country:	Devon	GB-United Kingdom/ Britain

Year of construction:	2017	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.8	IHG cooling case [W/m²]:	2.8
No. of occupants:	80.0	Specific capacity [Wh/K per m² TFA]:	150	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	303.3				
Space heating	Heating demand kWh/(m²a)	13	≤	15	-	yes
	Heating load W/m²	11	≤	-	10	
	Frequency of overheating (> 25 °C) %	6	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	106	≤	135		yes

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:
2-Certifier	Michael	Roe	
Certificate ID	Issued on:	City:	
15797_WARM_PH_20170508_MR	09/05/17	Plymouth	

15. Construction Costs

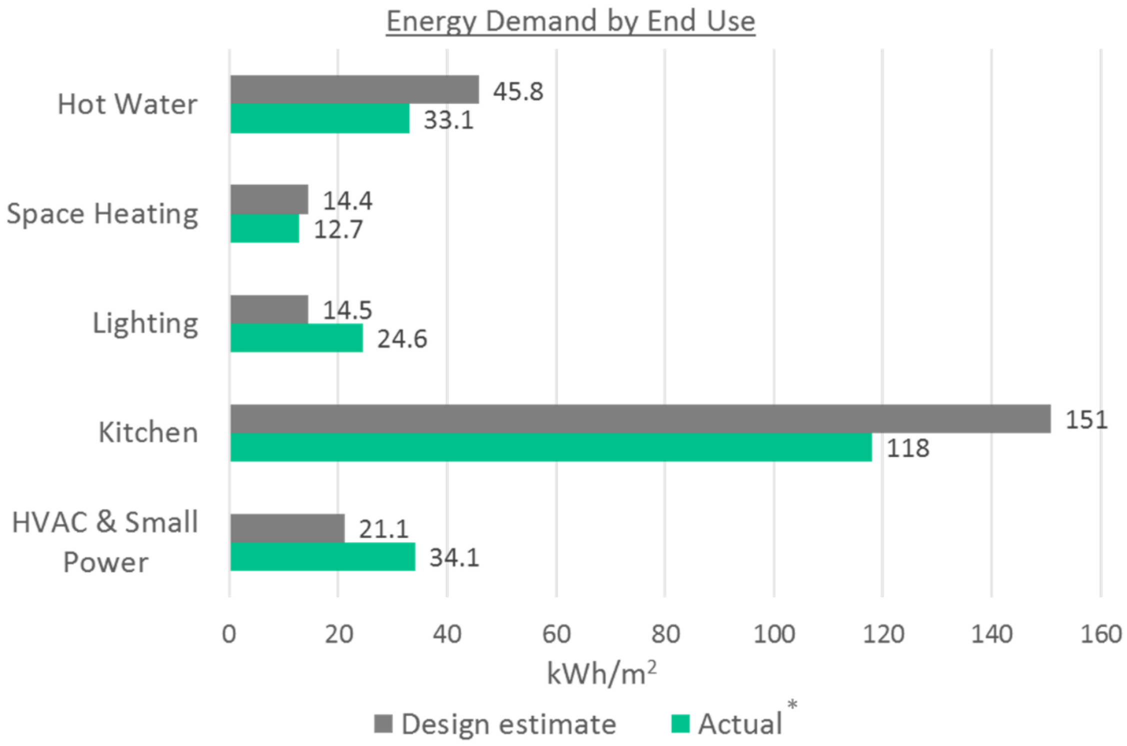
Cost data for this project is confidential and is therefore not available.

16. Measured Results

16.1 Energy Performance Data

Energy data collected in the first year of operation is summarised below. Note that this data was extrapolated from 6 months of data. Key points to note:

- Design estimates are generally close to actual energy consumption.
- Space heating and hot water demand are below that predicted
- Kitchen energy use is below that predicted.
- Lighting and small power energy consumption is higher than predicted.



16.2 Environmental Performance Data

Air temperature data for the café and common room has shown that during hot weather, the building performs extremely well. As the graph below shows, not only does the building suppress temperatures by 3-4degC compared to outside conditions, but the thermal mass of the building also creates a response lag.

Overheating Performance