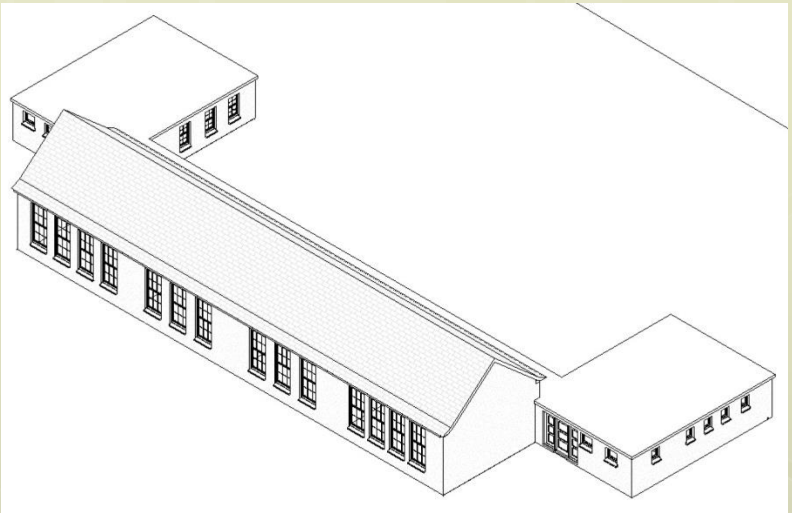


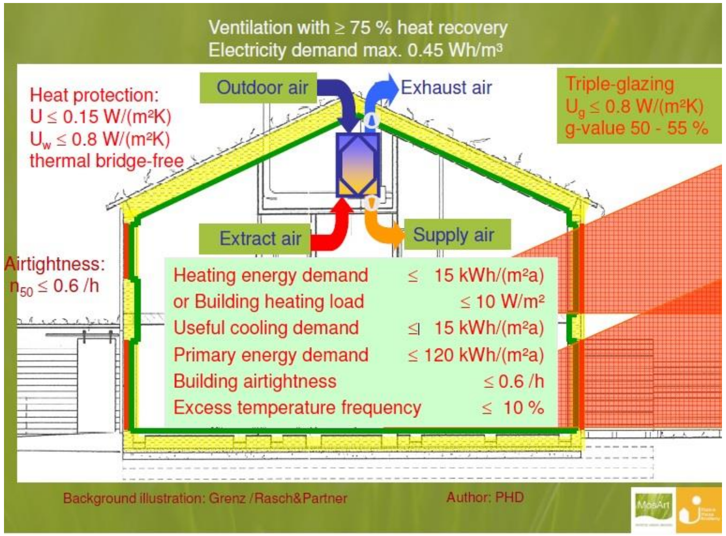
Primary School Retrofit Project

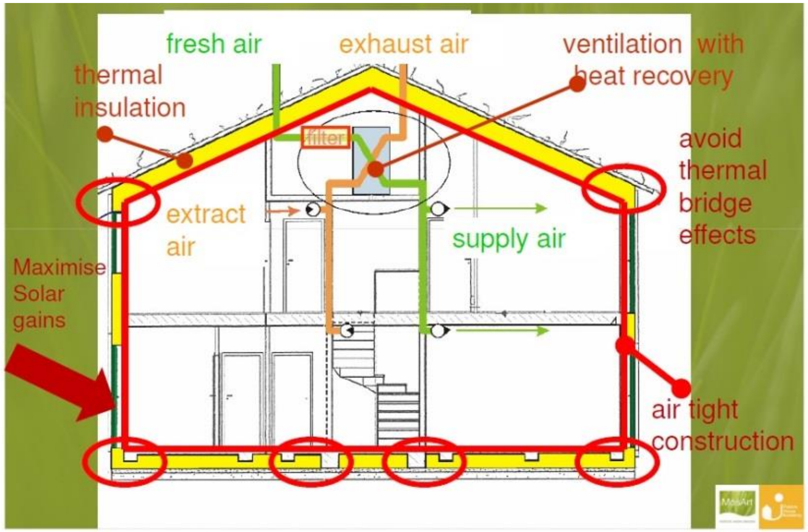
Final Design Proposal

Ian Black

DIT – D12124703

Passiv Haus Design Criteria





PHI ENERPHIT CRITERIA

EnerPHit Certification based on the requirement for heating demand
Heating demand: QH ≤ 25 kWh/(m2a) (calculated using the PHPP)

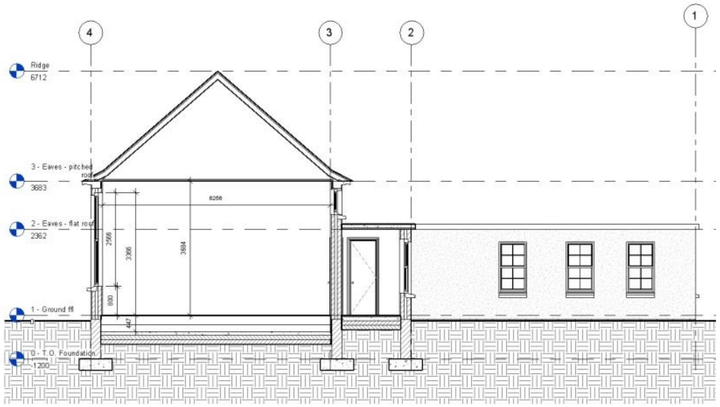
Primary energy demand
QP ≤ 132 kWh/m2a + ((QH - 15 kWh/(m2a)) . 1.2)

The primary energy demand includes all necessary energy applications for heating, cooling,domestic hot water, auxiliary electricity, lighting, and other electricity uses

Frequency of Overheating
Of 25 deg C or more < 10% of year

EnerPHit
Certified Retrofit
Passive House Institute

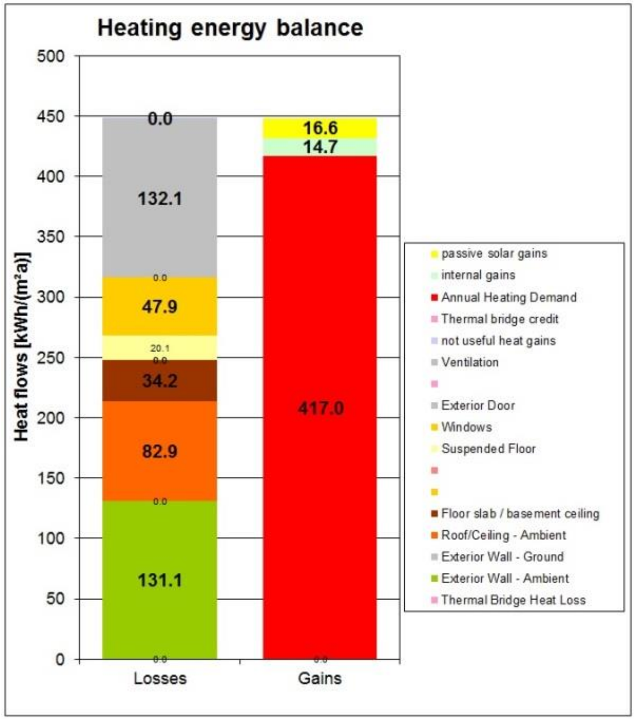
Existing Situation

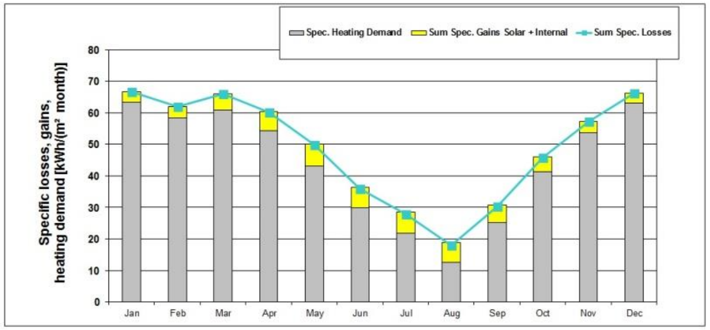


Specific building demands with reference to the treated floor area				use: Monthly method	
	Treated floor area	314.0	m²	Requirements	Fulfilled?*
Space heating	Annual heating demand	**528**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**161**	**W/m²**	-	-
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	0.0	%	-	-
Primary Energy	Space heating and cooling, dehumidification, household electricity.	**731**	**kWh/(m²a)**	735 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	667	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**10.6**	**1/h**	1 1/h	**no**

* empty field: data missing; '-': no requirement

EnerPHit building retrofit (acc. to heating demand)?	**no**

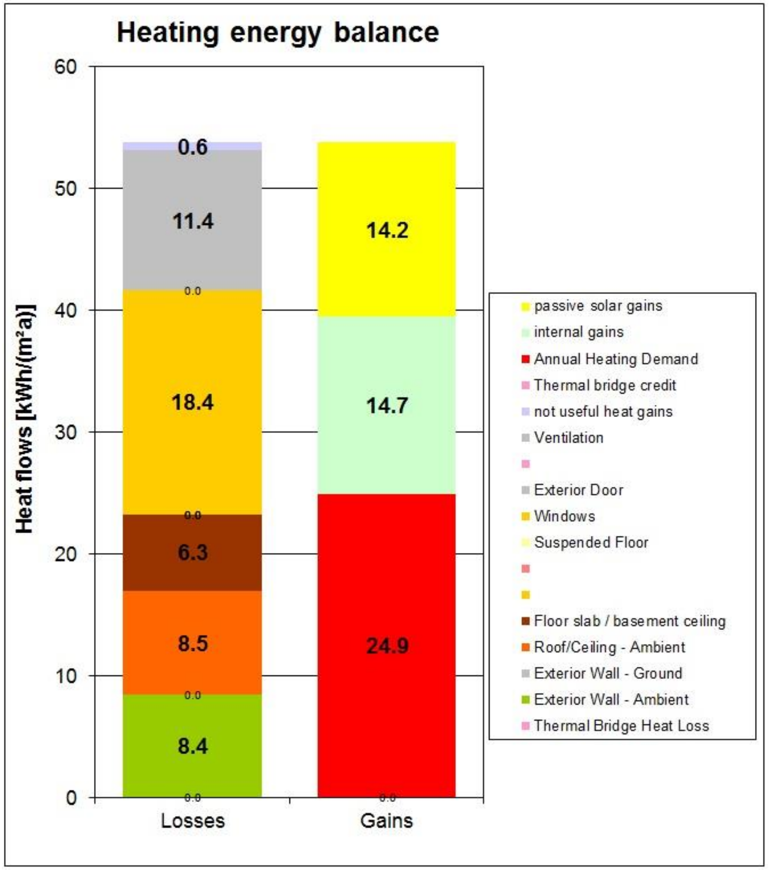




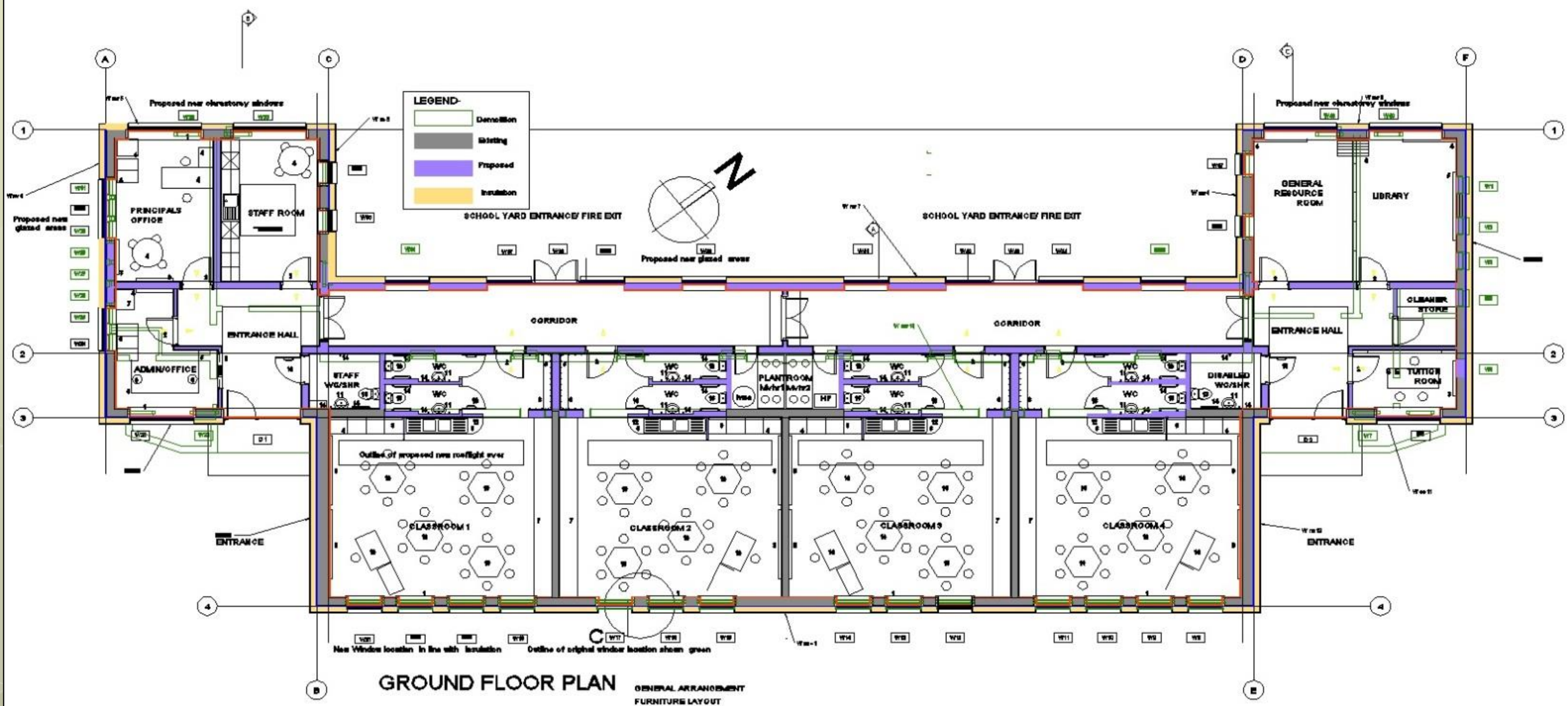
SUMMARY;-
Existing building is poorly insulated , with poor level of airtightness, naturally ventilated ,therefore the Space Heating demand (SHD)is very high, with heat loss through all fabric elements, and through ventilation. Conceptual Analysis will Indicate a 5 step strategy using PHPP to achieve a better heat energy balance , and reach the target EnerPHit Space Heating & Primary Energy Demand (PED)

Summary Concept PHPP

CONCEPTUAL DESIGN	PHPP CALCULATIONS			
STEP DESCRIPTION	Space Heat Requirement	Primary Energy (DHW Heating, Cooling ,Auxilliary electricity)	Heat Load	Frequencyof Overheating
Units of Measurement	kWh/(m2a)	kWh/(m2a)	W/m2	%
EnerPhit Threshold	25	132	10	10
Current Performance Base Model	528	731	161	0
1- FABRIC UPGRADE Improve elemental u values;- Walls 1.74- 0.12W/m2K Ceiling-0.63-0.09W/m2K Floors (Solid)-1.96-0.10 (Suspended) 4.0-0.10 FlatRoof- 1.27-0.10W/m2K	212	357	92	0
2- AIRTIGHTNESS Improved from 10.6-1.0 ach@50 pa	119	247	39	2.2
3- VENTILATION-MVHR Balanced whole building ventilation system , with heat recovery unit, efficiency min 84%- Selected unit 93%	57	174	24	2.2
4 - EX-GLAZING UPGRADE From DG- TG with improved U Values;- Uw instal -0.83W/m2K Windows – 2.70 -0.85W/m2K Doors- 3.0-0.80 W/m2K	25	156	16	0



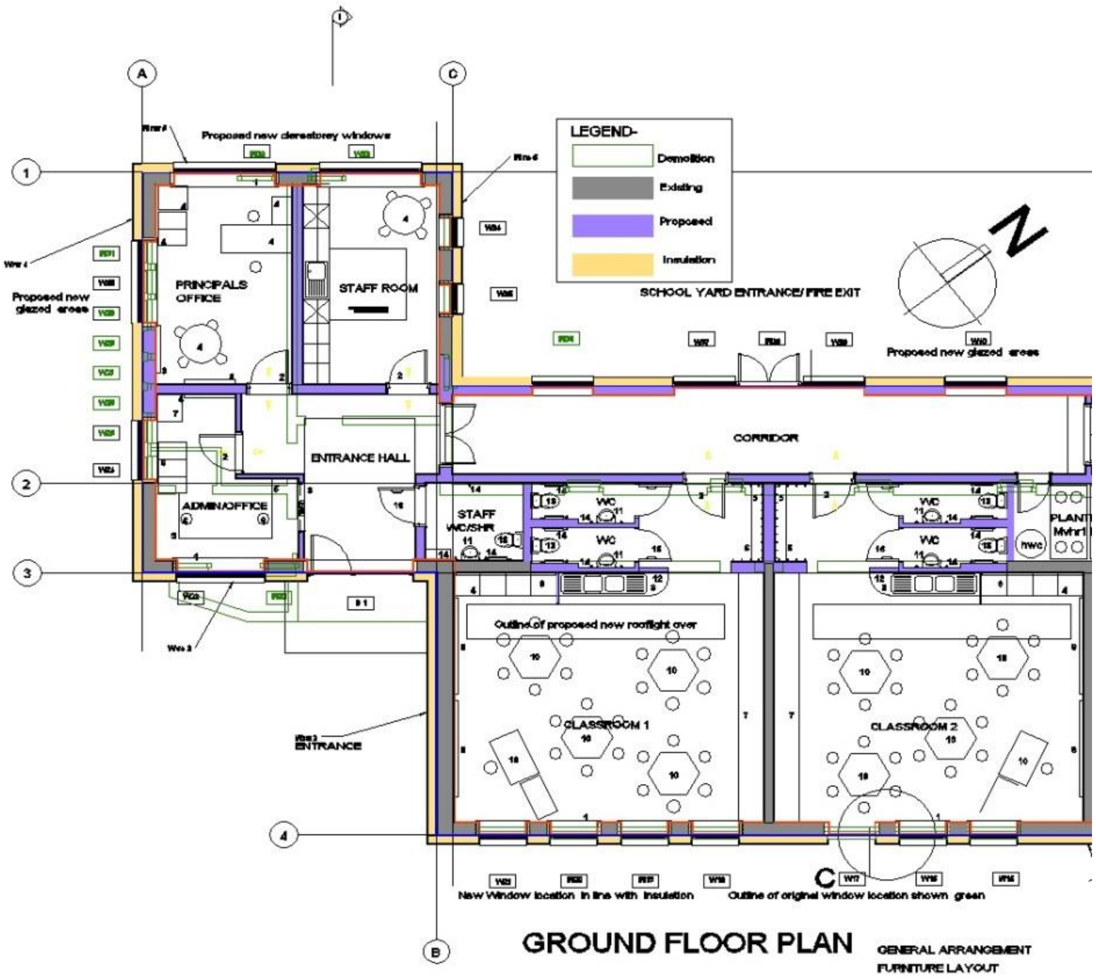
Final Design Proposal



STRATEGY

Internal Layout re-designed to aim at meeting DoE requirements. Ex Corridor converted into 'Wet Zone' containing classroom, staff & disabled WCs, and Plantroom, with efficient services distribution zone overhead. New corridor pushed in NW direction into school yard ,and as all EnerPHit certification data relates to FA ratio , this increases the ratio of FA:ESA Which in turn reduces specific energy and space heat demand which is the key energy issue. The layout is symmetrical with the ancilary wings now largely service free zones (except ventilation distribution) containing entrance halls ,offices , staff room , general purpose room, library & special education tuition room. More efficient access to school yard from each classroom.

Proposed GA Plan

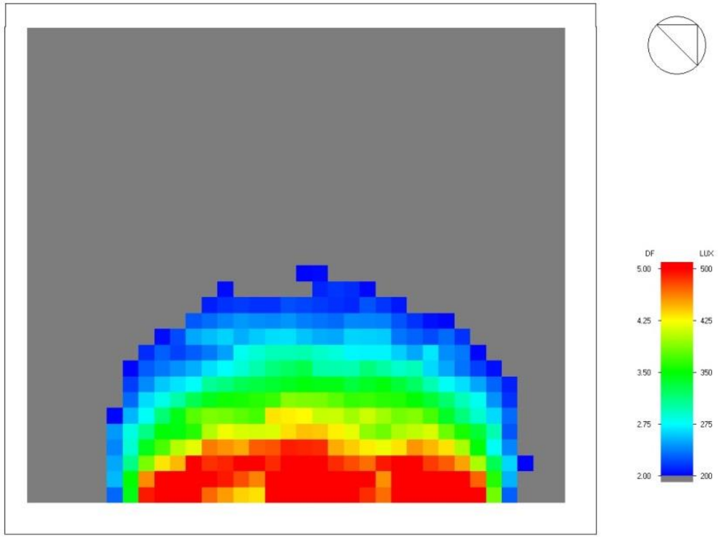


Key

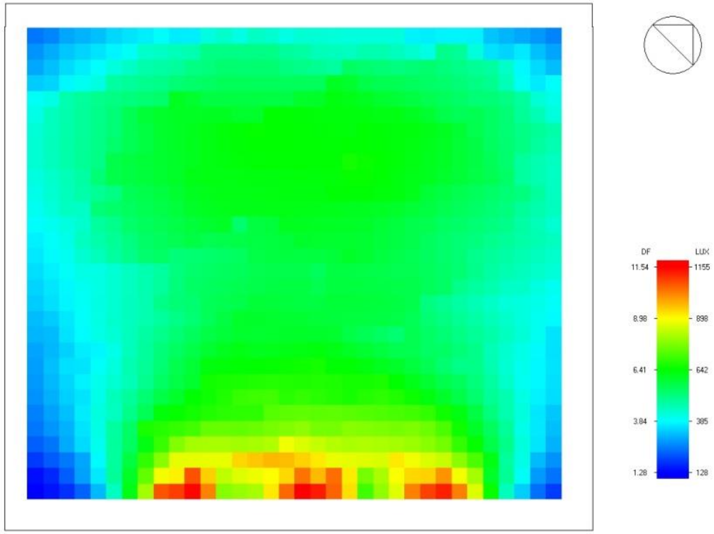
Classroom Daylight

Target DF- 4.5-5.5% (Dept of Education)

Existing



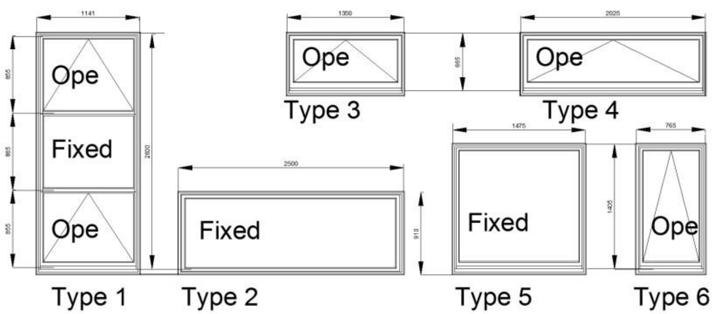
After Addition of Rooflight



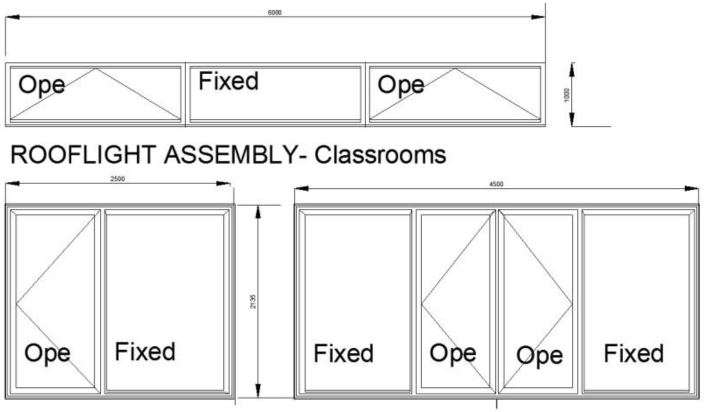
The existing clerestorey windows were not contributing to the DF of the Classrooms which prevented them from meeting DoE target DF, by eliminating the clerestorey windows and replacing with new strip rooflight the target DF was easily achieved. This in turn was the critical design decision which in turn influenced all the other decisions ie removal of rear wall & flat roof to corridor block, in addition to glazing percentage & shading, and surface finishes strategy.

Glazing Percentage

-Addition of roof light to each classroom to improve Daylight Factor to meet DoE requirements
--Increase Glazing areas to corridor , Entrance Halls, office /staff room /library /GR Room to maximise solar gain
-Reduce Glazing areas to north facing facades.
-Introduce Summer Ventilation strategy with opening vents in primary classroom windows , and vents in rooflights to create passive stack /night time purge ventilation /cooling to prevent overheating



WINDOW TYPES



Type 1- Entrance   Type 2 - Yard Exit

GLAZED DOOR & SCREENS

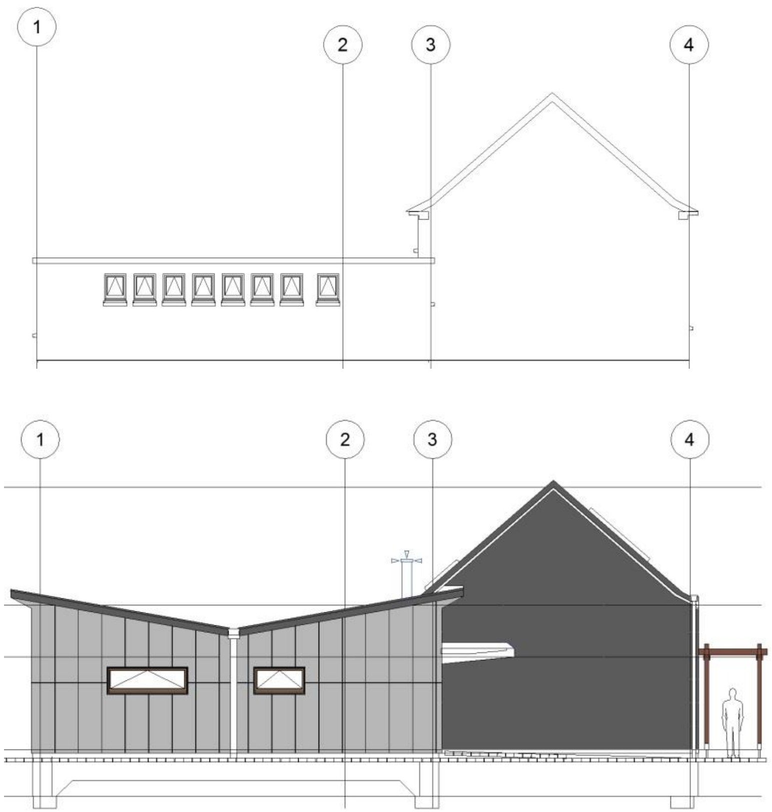
STRATEGY;-
Design intention was to retain as many existing opes as possible (ie Primary Classroom windows) but to optimise solar gain as far as possible By combining existing small opes with high frame to glass ratios into larger opes with lower frame to glass ratio. The classroom windows had to have three sections to comply with DoE requirements and summer night ventilation strategy. All new opes to new rear wall maximize Solar gains without overheating. Fixed windows are combined with opening sections in all spaces.

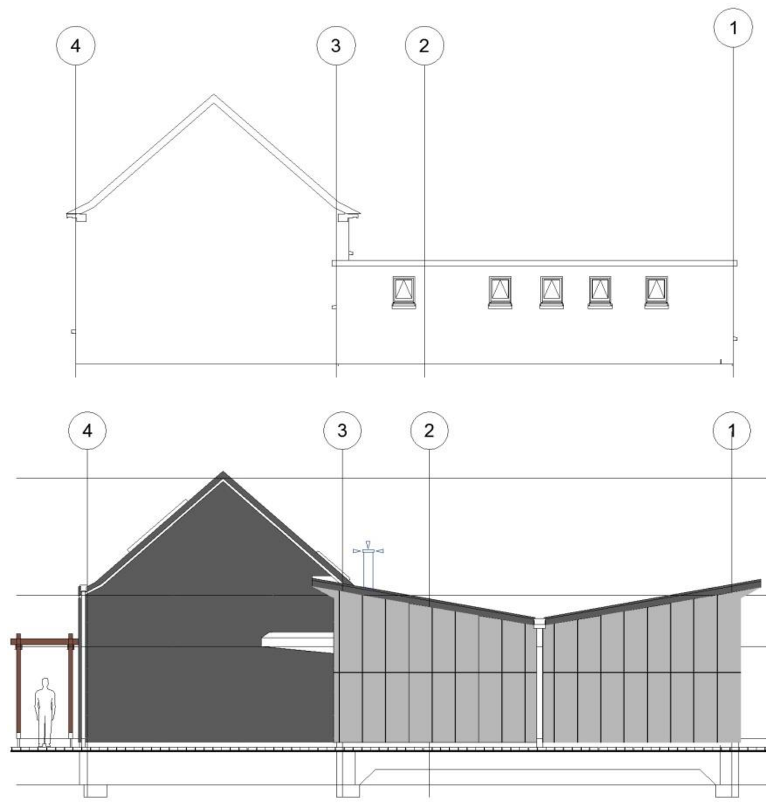
Before V After Elevations

STRATEGY;-

Its is intended to keep the 'iconic ' rural National school image , but give it a contemporary facelift. New rear lean –to & butterfly roof to ancilary wings are too shallow for slates or tiles, therefore it is proposed to use zinc roof finish, and replace existing pitch roof finish with zinc to match. Solar PV panels fixed within roof finish. Fibre Cement cladding colour matched to zinc on classroom block with spandrel panels between windows colour matched to windows which retain the original window proportions. Lighter colour FC to ancilary blocks , it is intended to keep the palette of materials to min , with zinc, fibre cement cladding , combined with aluclad triple glazed windows and hardwood pergola shading device to classroom windows.

Elevations Contd





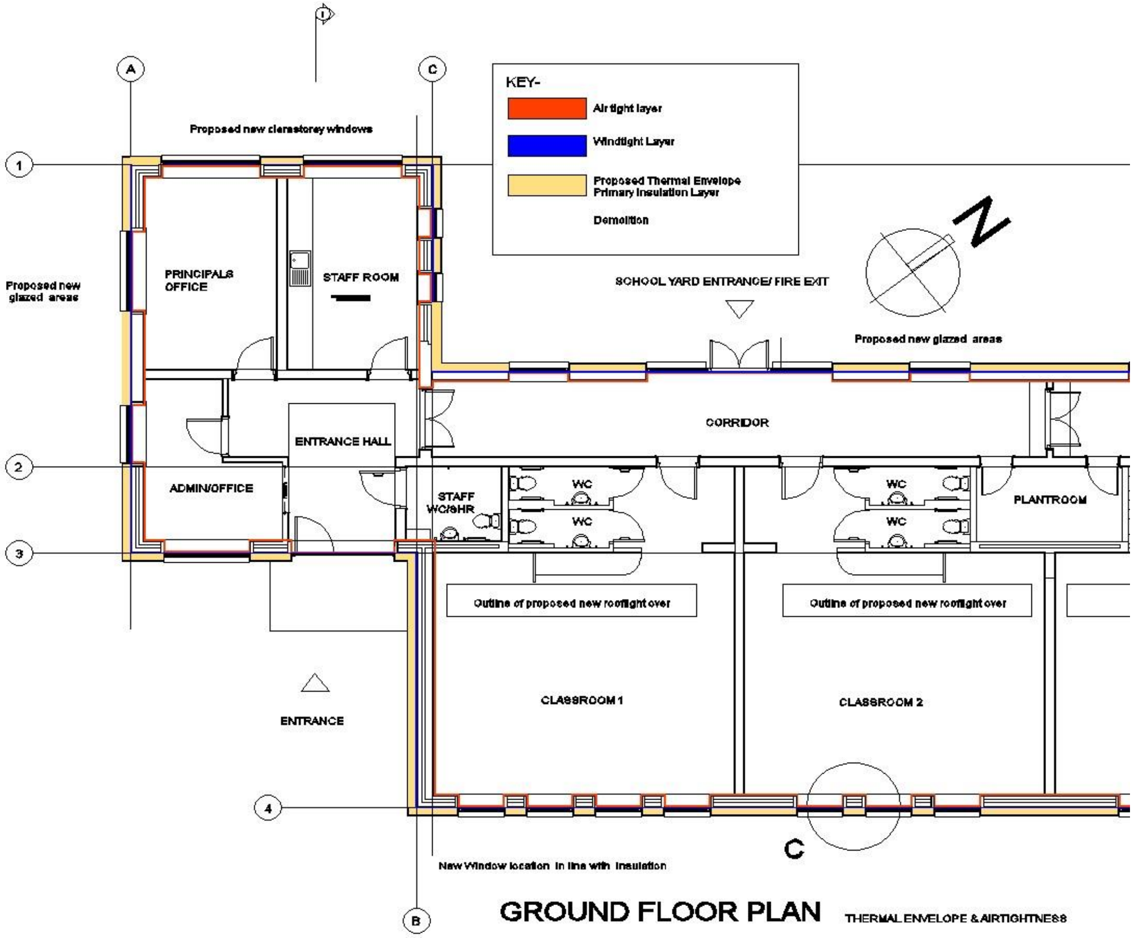
SIDE - SOUTH WEST ELEVATION

SIDE -NORTH EAST ELEVATION

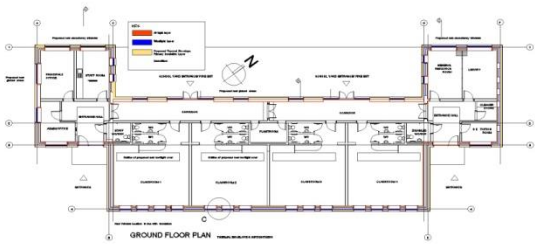
STRATEGY CONTD;-

. FC cladding is proposed as it is on DoE list of approved materials, but also a personal belief that large areas of external insulation with rendered finish are not suitable for our wet climate, and will not retain its appearance especially on north facing or shaded areas, with unsightly staining or lichen growth. FC cladding is more durable , easier to maintain & can be replaced easily. It is also available in a range of colours that can animate any façade, in this case differentiating between classroom & ancilary blocks.

Thermal / AT Layer -Plan



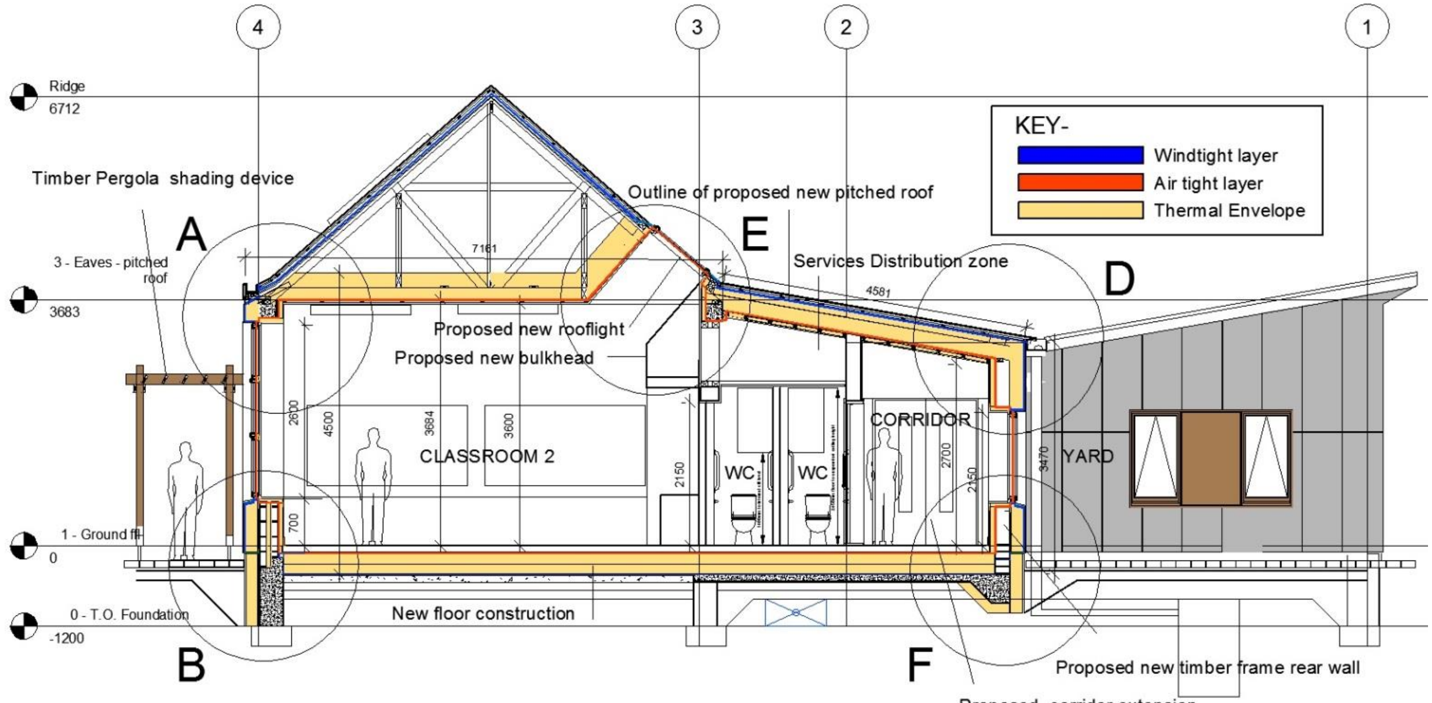
Definition of Airtightness layer & Thermal Envelope



Existing internal plaster is adequate as Airtightness layer , with proprietary AT tape used at all junctions with floor , ceiling, windows. Parge coat used to level ex pebble dashed surface prior to fixing ETICS can also function as windtight layer. External insulation acts as an ‘overcoat’ to the building and used in conjunction with AT layer is extremely effective in reducing fabric heat losses.

Thermal A/T Layer- Section

Definition of Airtightness layer & Thermal Envelope



TYPICAL SECTION A-A

THERMAL ENVELOPE & AIRTIGHTNESS

STRATEGY

Rear wall pushed out into school yard to facilitate creation of ' Wet Zone' containing classroom , staff & disabled WCs, with services distribution zone overhead accessed via demountable ceiling . Higher glazing percentage to new rear wall optimises solar gains , in addition to providing more efficient Access / escape to school yard directly across corridor from classroom door, rather than via entrance hall. New roof outline visually links classroom blocks to ancilary wings

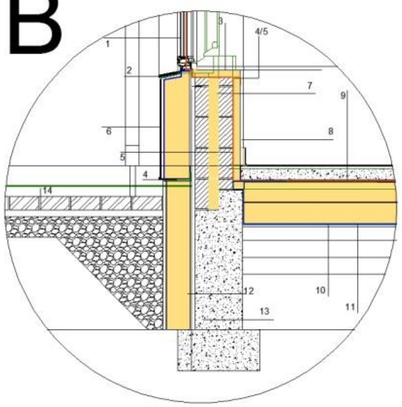
Ground Floor Details

TARGET -Opaque building envelope
For exterior insulation:
ft . U ≤ 0.15 W/(m2K)

GROUND JUNCTION

Critical Detail as it is the most difficult to resolve in terms of thermal bridging .

B



REF WALL TYPE 1- CAVITY WALL -EW1   (U VALUE -0.12 W/m2K)

1.-Selected triple glazed Passiv certified Aluclad window system fixed using galvanised MS brackets to existing wall face prior to fixing external insulation. (Location of existing windows shown dotted green)

2.-Powder coated pressed metal cill to match window finish

3.-PIR insulation (0.038 W/mK) to internal cilll with jute scrim / mesh as key for wet plaster & skim finish with timber windowboard

4.-DPC (green) to window cill fitted behind PIR insulation

5.-Airtightness layer (Red) consisting of 25mm wet plaster used in conjunction with proprietary airtightness tape (orange) with taped joints at all floor/ ceiling junctions , taped to window frames .

6.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex racking board (0.037 W/mK) fixed to timber frame wall structure

7.-Existing 300mm concrete block cavity wall with 75mm cavity filled with selected full fill insulation (0.035W/m2K) & Insulated services cavity to window sill level

8.-Aura natural based diffusion friendly paint finish on new skim finish to existing internal plaster made good at openings and floor / ceiling junctions

REF FLOOR TYPE 3- CLASSROOM FLOOR (U VALUE -0.108 W/m2K)

9.-Selected marmoleum floor finish on 80mm self levelling easi screed on vapour barrier /airtight membrane (red) lapped 150mm up wall to top of skirting and sealed with airtight tape.(orange)

10.-350mm selected rigid insulation (0.039W/mK) laid in two layers of 175mm

11.-Proprietary radon barrier /dpm (blue) laid on existing concrete slab / hardcore bed . Radon barrier to be turned up rising wall to dpc level and taped to concrete block wall , also taped to airtight membrane at junction between wall & floor .

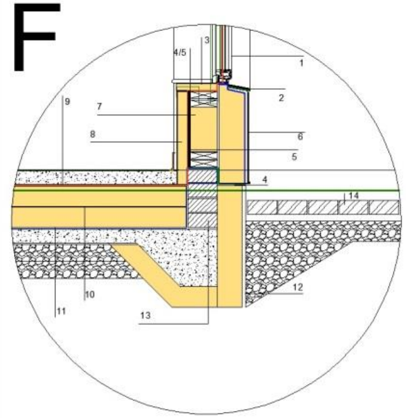
12.-150mm PIR insulation (0.024W/mK) ,carried from DPC level to top of ex foundation with silicate render finish below dpc level

13.-Existing dense concrete block rising wall painted with bitumen paint for protection from moisture penetration on existing foundation

14.-Selected paving system on sand on hardcore bed

DETAIL B- TYPICAL GF / WALL JUNCTION

F



WALL REF 8- TIMBER FRAME- NEW REAR WALL   (U VALUE -0.09 W/m2K)

1.-Selected triple glazed Passiv certified Aluclad window system fixed using galvanised MS brackets to existing wall face prior to fixing external insulation. (Location of existing windows shown dotted green)

2.-Powder coated pressed metal cill to match window finish

3.-PIR insulation (0.038 W/mK) to internal cilll with jute scrim / mesh as key for wet plaster & skim finish with timber windowboard

4.-DPC (green) to window cill fitted behind PIR insulation

5.-Airtightness layer (Red) consisting of 18mm OSB/intello AT membrane used in conjunction with proprietary airtightness tape (orange) with taped joints at all floor/ ceiling junctions , taped to window frames .

6.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex racking board (0.037 W/mK) fixed to timber frame wall structure

7.-220mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between 220x40mm timber frame structure

8.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining to soffit

FLOOR REF 6- CORRIDOR FLOOR (U VALUE -0.108 W/m2K)

9.-Selected marmoleum floor finish on 80mm self levelling easi screed on vapour barrier /airtight membrane (red) lapped 150mm up wall to top of skirting and sealed with airtight tape.(orange)

10.-350mm selected rigid insulation (0.039W/mK) laid in two layers of 175mm

11.-Proprietary radon barrier /dpm (blue) laid on existing concrete slab / hardcore bed . Radon barrier to be turned up rising wall to dpc level and taped to concrete block rising wall , also taped to airtight membrane at junction between wall & floor .

12.-150mm PIR insulation (0.024W/mK) ,carried from DPC level to top of ex foundation with silicate render finish below dpc level

13.-New dense concrete block rising wall painted with bitumen paint for protection from moisture penetration on new RC foundation

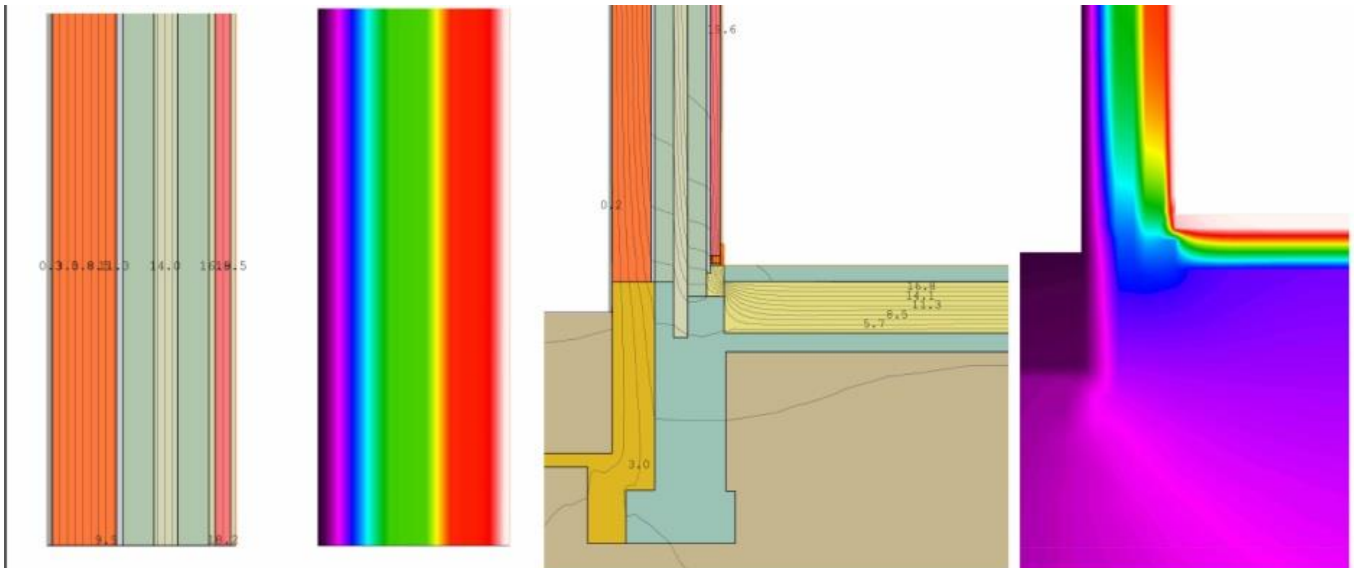
14.-Selected paving system on sand on hardcore bed

DETAIL F- NEW GF / TF WALL JUNCTION

LTB Analysis-

TARGET -Minimise Thermal Bridges
(Psi ext ≤ +0.01 W/(mK)

Ground Junction



WALL DETAIL ISOTHERMS AND INFRARED

FULL JUNCTION DETAIL - ISOTHERMS AND

INFRARED DETAILS

PASSIVATE
PASSIVE HOUSE CONSULTING

www.passivate.ie
info@passivate.ie
(+353) 86 8843399

SOLID FLOOR U-VALUE CALCULATOR (ISO 13370)				
		Floor U value according to ISO 6946 (W/m²K)		0.108
Floor area (m²)	4.599	Floor perimeter (m)	1	
Wall thickness (m)	0	Ground thermal conductivity (W/mK)	2.0	
Ground equivalent thickness d_t (m)	18.60	B' (m)	9.198	
		Floor U value (W/m²K)		0.088

Linear Thermal Bridge Calculations for School Ian Black 6 Jan 2014

Ground – Foundation – Wall Junction

Ψ = L2D – LW x UW - 0.5B x U F

= 0.0963 x 5.779 - 0.352 x 0.182 - 4 x 0.088

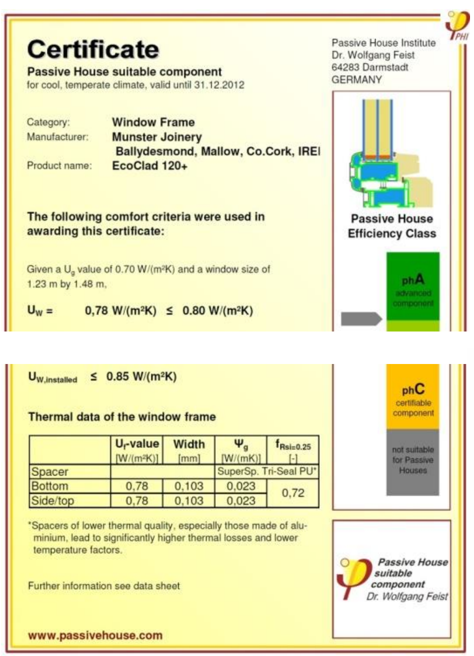
= 0.556 (values for junction) - 0.1816 (value for wall) - 0.352 (value for floor)

= 0.0227 W/m2K

Glazing Upgrade

TARGET-Window W (window)For the window as a whole (EN 10077): UW,installed ≤ 0.85 W/(m2K)
for g and Ug-value of glazing: g . 1.6 W/(m2K) ≥ U3

TARGET-External doors D (door) ft . UD,installed ≤ 0.80 W/(m2K)



Certificate

Passive House suitable component
for cool, temperate climate, valid until 31.12.2012

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Category: **Window Frame**
Manufacturer: **Munster Joinery**
Ballydesmond, Mallow, Co.Cork, IREI
Product name: **EcoClad 120+**

The following comfort criteria were used in awarding this certificate:

Given a U_g value of 0.70 W/(m²K) and a window size of 1.23 m by 1.48 m,

U_W = 0,78 W/(m²K) ≤ 0.80 W/(m²K)

$U_{W,installed}$ ≤ 0.85 W/(m²K)

Passive House Efficiency Class

phA advanced component

phC certifiable component

not suitable for Passive Houses

Thermal data of the window frame

	U_f-value [W/(m²K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			SuperSp. Tri-Seal PU*	
Bottom	0,78	0,103	0,023	0,72
Side/top	0,78	0,103	0,023	

*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

Further information see data sheet

Passive House suitable component
Dr. Wolfgang Feist

www.passivehouse.com

PROPOSAL ;-

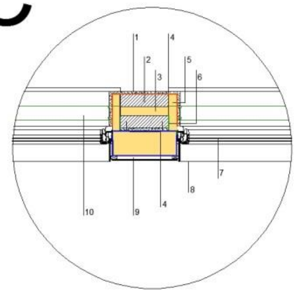
Replacement of all existing Double glazed windows with PHI Certified Triple Glazed windows , ie Munster ECOCLAD 120+ used in conjunction with External Insulation has a Installed U Value of 0.83W/m2K to satisfy EnerPHit criteria.

Position		EIFS
Bottom	[W/(mK)]	0,037
Side/top	[W/(mK)]	0,011
$U_{W,instal.}$	[W/(m²K)]	0,83

Window Details

NEW WINDOW LOCATION;-
Moved out to external insulation zone to prevent thermal bridging , fixed on brackets to ex wall Prior to fixing ETICS

C

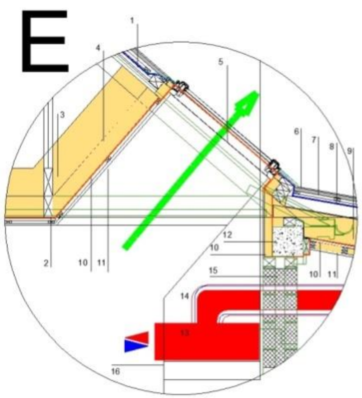


WALL REF 1- CAVITY WALL WITH EWI (U VALUE -0.12W/m2K)

1.-Aura natural based diffusion friendly paint finish on skim finsh
2.-Existing 300mm concrete block cavity wall
3.-Existing 75mm cavity filled with selected fill insulation (0.035W/m2K)
4.-Airtightness layer (Red) consisting of 25mm wet plaster used in conjunction with proprietary airtightness tape with taped joints at all junctions make sure taped to window frames .
5.-PIR insulation (0.038 W/mK) to internal reveal with jute scrim / mesh as key for wet plaster & skim finish
6.-Vertical DPC (green) to window jamb fitted behind PIR insulation
7.-Selected triple glazed Passiv certified Aluclad window system fixed using galvanised MS brackets to existing wall face prior to fixing external insulation.
8.-Powder coated pressed metal cill to match window finish
9.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex vapour permeable external insulation board (0.037 W/mK) fixed to existing wall structure
10.-Location of existing windows shown dotted

DETAIL C- TYPICAL WINDOW JAMB

E



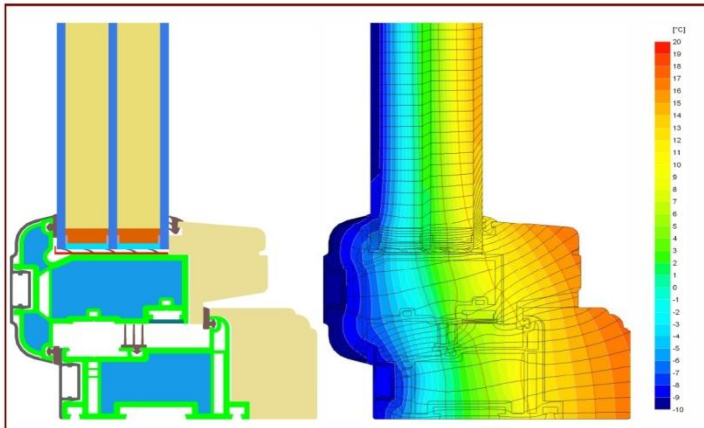
REF TYPE2 -NEW ROOFLIGHT EX CEILING / (U VALUE -0.08 W/m2K)

1-Proprietary Zinc Standing Seam sheeting on seperating membrane on 25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity on Solitex breather membrane (blue) on 25mm Plywood racking board fixed to strengthen existing roof structure.
2.- New timber truss/ beam spanning width of classroom to support ex ceiling joists , trim new rooflight well
3.- 225mm quilt insulation (0.037 W/mK) laid over existing roof structure
4.-175mm blown fill insulation (0.037 W/mK) between existing timber roof joists & new rooflight well structure
5.-Selected triple glazed Passiv certified Aluclad rooflight system

REF TYPE 7 -NEW ROOFLIGHT NEW ROOF / EXISTING ROOF JUNCTION (U VALUE -0.10 W/m2K)

6.-Proprietary standing seam zinc roofing on seperating membrane
7.-25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity
8.-Solitex breather membrane(blue) on 90mm Gutex (0.037 W/mK) vapour permeable sarking board over new roof structure
9.-200mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between timber roof structure
10.-18mm OSB/ intello airtightness membrane (red) with taped joints at all junctions , (orange) ensure to provide continuity with ceiling /wall .
11.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining to soffit
12.-Existing concrete ring beam with cornice removed to facilitate fixing of new pitched roof to services distribution zone .
13.- 250 Dia Supply air duct (RED)
14.-250 Dia Extract air duct (BLUE)
15.-Existing clerestorey windows removed and new stud partition with rockwool acoustic insulation to services distribution zone
16.-Aura natural based diffusion friendly paint finish on skim plaster finish to new plasterboard lightshelf / bulkhead

DETAIL E- TYPICAL ROOFLIGHT DETAIL



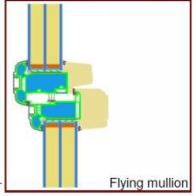
Bottom section Isothermal

Description

Timber window frame, rain protected by exterieor aluminium cladding. Insulated by polyurethane foam (0,030 W/(mK)) in the frames center. Glazing: 4/20/4/20/4

Thermal data for the window frame

	U_f-value [W/(m²K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer			SuperSp. Tri-Seal PU*	
Bottom	0,78	0,10	0,02	0,72
Side/top	0,78	0,10	0,02	
Flying Mullion	0,79	0,12	0,02	0,72
-				



Flying mullion

* Spacers of lower thermal quality leading to higher thermal losses and lower temperatures.

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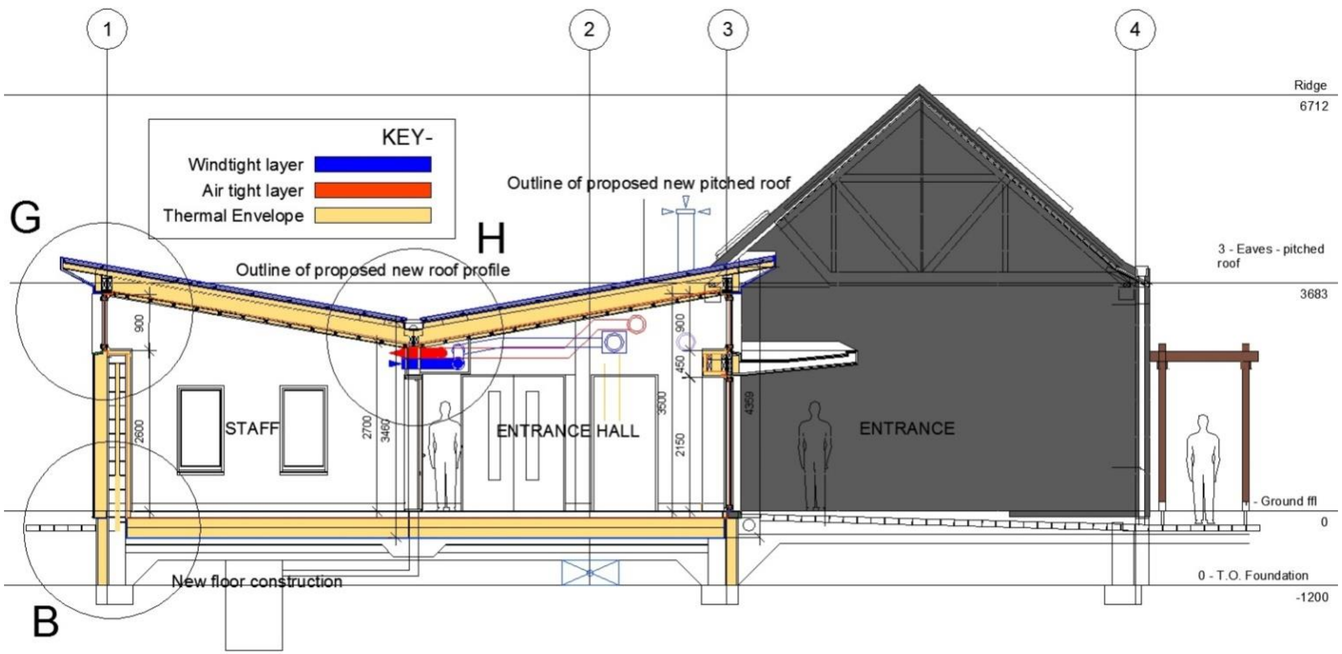
Thermal A/T Layer Section

Definition of Airtightness Layer & Thermal Envelope



TYPICAL SECTION B-B

THERMAL ENVELOPE & AIRTIGHTNESS

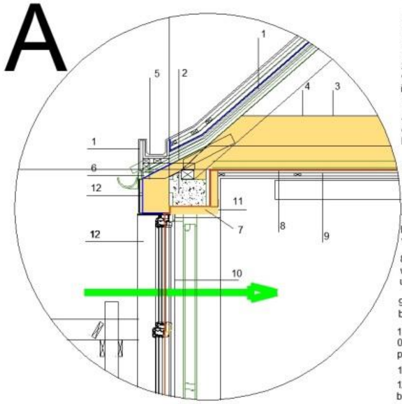
STRATEGY;-

Existing concrete flat roof replaced with new 'warm' butterfly roof , to optimise solar gain through new clerestorey windows , wihout compromising usable wall surface area for equipment layout to comply with DoE requirements. New roof profile also provides space for services distribution in entrance hall , in addition to creation of more attractive light filled entrance hall. Projecting canopy acts as a shading device and defines entrance. New roof profile is shallow pitched to tie in visually with new lean to pitched roof extension on classroom block, and also satisfies DoE requirements in terms of limiting area of flat roofs.

Roof Details

TARGET -Opaque building envelope
For exterior insulation:
ft . U ≤ 0.15 W/(m2K)

A



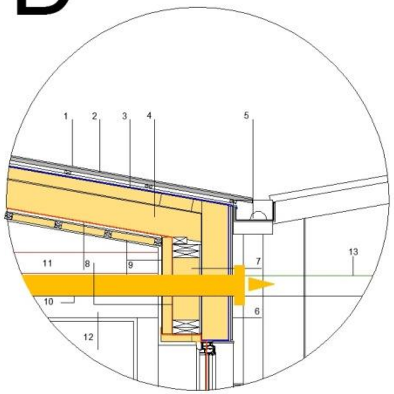
CLASSROOM CEILING (U VALUE -0.083 W/m2K)

1-Proprietary Zinc Standing Seam sheeting on seperating membrane on 25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity on Solitex breather membrane (blue) on 25mm Plywood racking board fixed to strengthen existing roof structure.
2.-Existing concrete ring beam with cornice removed and external face made good with 25mm wet plaster parge coat (A/T layer -Red) to form level surface for insulation fixings
3.- 225mm quilt insulation (0.037 W/mK) laid over existing roof structure
4.-175mm blown fill insulation (0.037 W/mK) between existing timber roof joists ensure to fill all gaps at eaves between existing insulation board and top of ring beam.
5.- New proprietary Zinc box gutter fixed with brackets to top of sprocket rafters , rainwater outlet to have special leaf guard for rainwater harvesting .
6.-Insect mesh fixed to vertical timber battens @ 600 cts to 50mm ventilated cavity
7.- PIR insulation (0.035W/m2K) to inside face & soffit of ring beam with vapour barrier EML & wet plaster /skim finish and airtightness tape to each corner and window junction
8.-18mm OSB/ intello airtightness membrane (red) fixed to U/S of existing joists with taped joints at all junctions , (orange). Ensure continuity with wall AT layer using well lapped & taped joints.
9.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining/ acoustic ceiling to soffit
10.-Selected triple glazed Passiv certified Aluclad window system (Min U value 0.8W/m2K) fixed using galvanised MS brackets (sides & cill) to existing wall face prior to fixing external insulation.with profiled aluminium cill on dpc.
11.-DPC (green) to window head fitted behind PIR insulation
12.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex vapour permeable external insulation board (0.037 W/mK) fixed to existing wall structure

All Demolition Shown Green

DETAIL A- TYPICAL EXISTING EAVES

D



REF TYPE 7 NEW PITCHED ROOF (U VALUE -0.10 W/m2K)

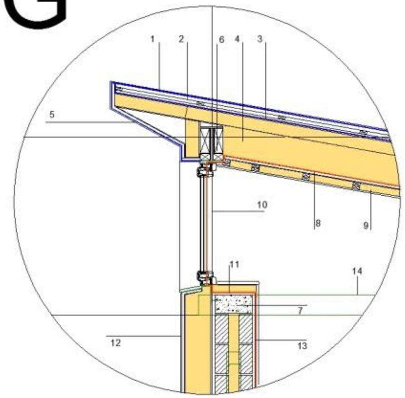
1.-Proprietary standing seam zinc roofing on seperating membrane
2.-25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity
3.-Solitex breather membrane(blue) on 90mm Gutex (0.037 W/mK) vapour permeable sarking board over new roof structure
4.-200mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between timber roof structure
5.- Zinc clad galvanised steel gutter fixed with brackets to top of rafters with internal lining , rainwater outlet to have special leaf guard for rainwater harvesting .

REF TYPE 8- NEW TIMBER FRAME REAR WALL (U VALUE -0.09 W/m2K)

6.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex racking board (0.037 W/mK) fixed to timber frame wall structure
7.-220mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between 220x40mm timber frame structure
8.-18mm OSB/ intello airtightness membrane (red) with taped joints at all junctions , (orange) ensure to provide continuity with wall /ceiling .
9.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining to soffit
10.- 250 Dia Insulated (Diffusion Friendly) Exhaust air duct (ORANGE)
11.-Demountable access suspended ceiling system to provide access to services distribution zone bulkhead
12.-Aura natural based diffusion friendly paint finish on skim plaster finish to make good ex plaster
13.-Ex concrete flat roof demolished shown dotted (green)

DETAIL D- TYPICAL NEW EAVES

G

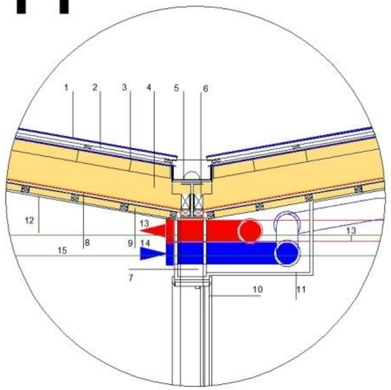


REF TYPE 5- NEW PITCHED ROOF (U VALUE -0.10 W/m2K)

1.-Proprietary standing seam zinc roofing on seperating membrane
2.-25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity
3.-Solitex breather membrane(blue) on 90mm Gutex (0.037 W/mK) vapour permeable sarking board over new roof structure
4.-200mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between timber roof structure
5.- Zinc clad soffit on seperating membrane on 25mm plywood substrate fixed to profiled rafter ends .
6.- Timber roof structure on wall plates bolted to steel frame.
7- RC Concrete ring beam on line of existing concrete roof
8.-18mm OSB/ intello airtightness membrane (red) with taped joints at all junctions , (orange) ensure to provide continuity with wall /ceiling .
9.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining to soffit
10.-Selected triple glazed Passiv certified Aluclad window system (Min U value 0.8W/m2K) fixed using galvanised MS brackets (sides & cill) to existing wall face prior to fixing external insulation.with profiled aluminium cill on dpc.
11.-DPC (green) to window head fitted behind PIR insulation
12.-Fibre cement rainscreen cladding with proprietary metal fixings on vertical battens to create ventilated cavity on breather membrane (blue) on Gutex vapour permeable external insulation board (0.037 W/mK) fixed to existing wall structure
13.-Airtightness layer (Red) consisting of 25mm wet plaster used in conjunction with proprietary airtightness tape (orange) with taped joints at all floor/ ceiling junctions , taped to window frames .
14.-Ex concrete flat roof demolished shown dotted (green)

DETAIL G- BUTTERFLY ROOF EAVES

H



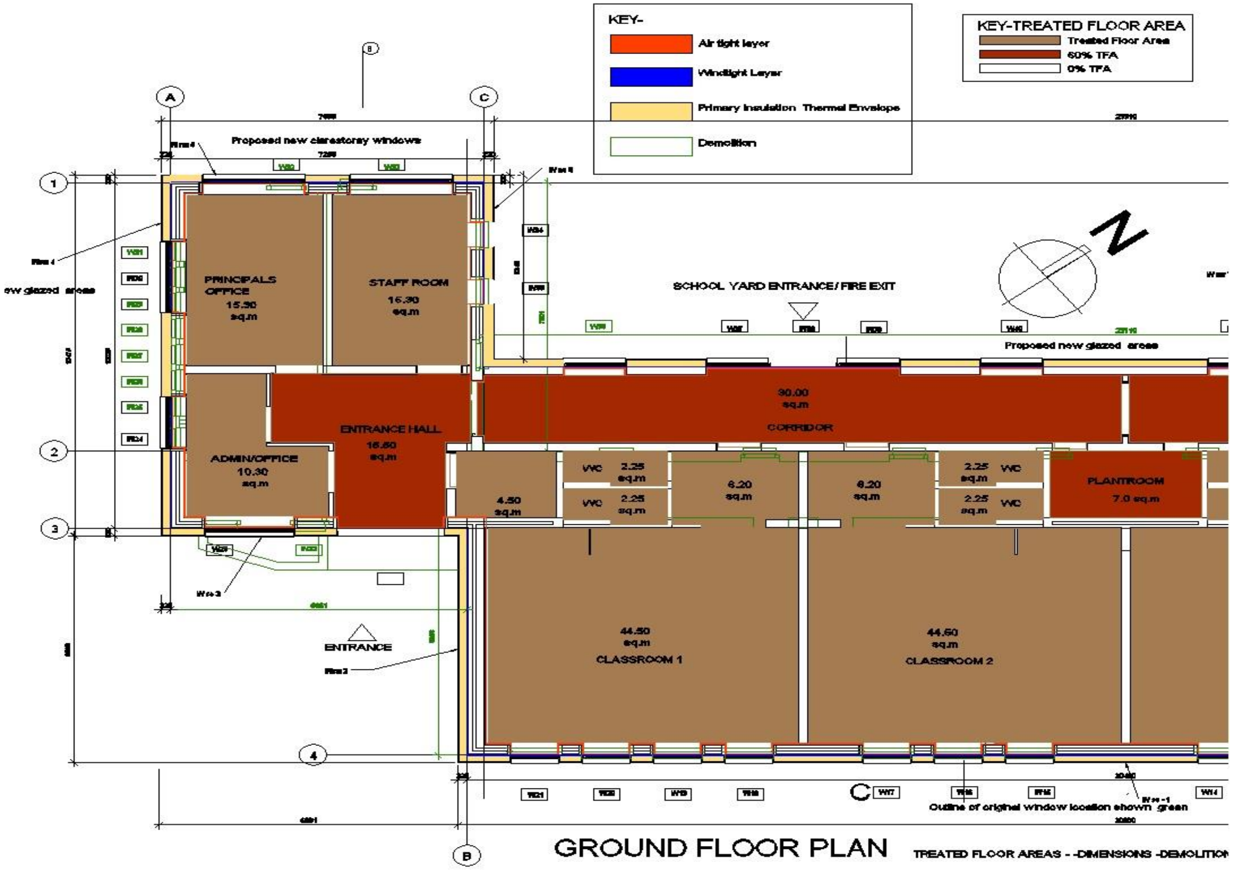
REF TYPE 5- NEW PITCHED ROOF (U VALUE -0.10 W/m2K)

1.-Proprietary standing seam zinc roofing on seperating membrane
2.-25mm plywood sheeting on 50x25 s/w treated battens & counter battens to create 50mm ventilated cavity
3.-Solitex breather membrane(blue) on 90mm Gutex (0.037 W/mK) vapour permeable sarking board over new roof structure
4.-200mm Hemp/Gutex wood fibre insulation (0.037 W/mK) between timber roof structure on wall plates bolted to steel frame.
5.- Zinc clad galvanised steel gutter fixed with brackets to top of rafters with internal lining , rainwater outlet to have special leaf guard for rainwater harvesting .
6.- Timber roof structure on wall plates bolted to steel frame.
7.- New stud partition with 2 layers of plasterboard , and rockwool sound insulation between studs .
8.-18mm OSB/ intello airtightness membrane (red) with taped joints at all junctions , (orange) ensure to provide continuity with wall /ceiling .
9.-50mm services cavity with 50mm Thermohemp (0.038 W/mK) between s/w battens, plasterboard lining to soffit
10.-New 30min fire rated Door & Frame
11.-Demountable access suspended ceiling system to provide access to services distribution zone bulkhead
12.-Aura natural based diffusion friendly paint finish on skim plaster finish
13.- 250 Dia Supply air duct (RED)
14.-250 Dia Extract air duct (BLUE)
15.-Ex concrete flat roof demolished shown dotted (green)

DETAIL H - BUTTERFLY ROOF - VALLEY

Treated Floor Area

Definition of Treated Floor Areas & Demolition Areas



STRATEGY;-

All areas 100% TFA except circulation & plantroom which are 60% . All dimensions are to external face of Thermal Envelope.

Ventilation MVHR

TARGET _Ventilation
hHR,eff ≥ 75 % PHI Certified Unit

Comfort Ventilation
SYSTEM VENTECH LG 4000
Air for living.

Specific electricity consumption of the entire system based on the average volume flow transferred (electrical efficiency): ≤ 0.45 Wh/m3

CONTROL UNIT

integrated on the compact regulator or through operator control unit

Dimensions
W x H x D 160 x 85 x 35 mm
Connecting cable to the power unit required
Cable LiYCY 3x2x0.60;
max. length <100 m

FANS

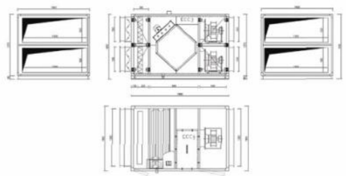
Air flow range
1290 m^3/h to 4700 m^3/h,
adjustable from 20 -100 %
Installation size
R3G355-AY40/EC-drive 0 – 10 V
Power consumption/current/speed
Max. 1700 W / 2.6 A / 2600 r.p.m.
Operation mode
in steps, with constant air volume flow or air pressure

FILTER

Extract air
filter of quality class F7,
optional F9
Supply air
filter of quality class G4,
optional F5

Technical specifications LG 4000

COMPACT DESIGN (MONOBLOCK)



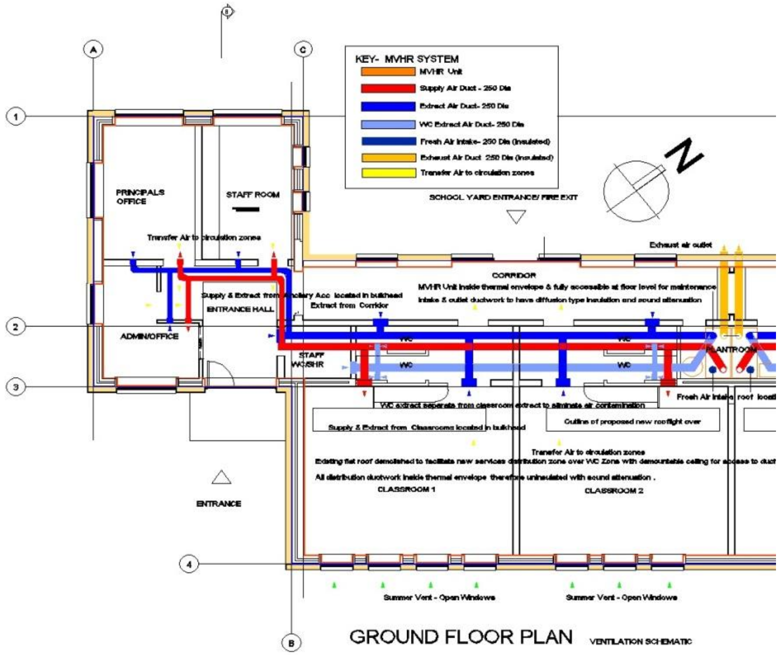
Type	Air volume flow [m^3/h]	Dimensions L x W x H [mm]	Connection h x w [mm]	Condensate drain [mm]	Voltage / Frequency	Weight [kg]
LG4000	1290 to 4700	1990 x 1460 x 1450	550 x 1300	40	400 V/50 Hz	520
LG4000-V		2290 x 1460 x 1450				570
LG4000-N		2290 x 1460 x 1450				570
LG4000-VN		2590 x 1460 x 1450				620

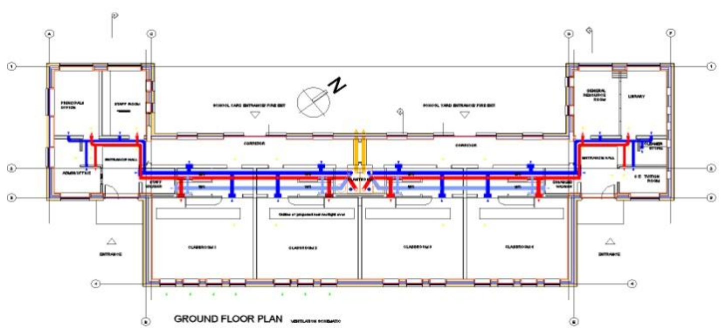
Internal Volume Area							
SCHOOL		Room Name	Area	Room Volume			
CLASSROOM BLOCK	0.01	CLASSROOM 1	50.7	182.52		ROOFLIGHT WELL	6
	0.02	CLASSROOM 1 WC	4.5	13.95		WINDOW/DOOR REVEALS	4.5
	0.03	CLASSROOM 2	50.7	182.52			6
	0.04	CLASSROOM 2 WC	4.5	13.95			3.5
	0.05	CLASSROOM 3	50.7	182.52			6
	0.06	CLASSROOM 3 WC	4.5	13.95			3.5
	0.07	CLASSROOM 4	50.7	182.52			6
	0.08	CLASSROOM 4 WC	4.5	13.95			4.5
	0.09	STAFF WC	4.5	13.95			40
	0.1	DISABLED WC	4.5	13.95			
	0.11	CORRIDOR 1- SOUTH	30	93	*18.0		
	0.12	CORRIDOR 2- NORTH	30	93	*18.0		
	0.13	PLANTROOM	7	21.7			
Total Internal Volume Classroom Block				1021.48			
ANCILARY		Room Name	Area	Room Volume			
SOUTH BLOCK 1	1.01	ENTRANCE HALL	15.5	48.05	*9.30		
	1.02	ADMIN/ GENERAL OFFICE	10.3	31.93			
	1.03	PRINCIPALS OFFICE	15.3	47.43			
	1.04	STAFF ROOM	15.3	47.43			
NORTH BLOCK 2	2.01	ENTRANCE HALL	15.5	48.05	*9.30		
	2.02	GENERAL RESOURCE ROOM	16	49.6			
	2.03	LIBRARY	16	49.6			
	2.04	SPECIAL EDUCATION TUITION	6.4	19.84			
	2.05	CLEANERS STORE	3.5	10.85	*2.1		
Total IV Anciliary Blocks 1&2				352.78			

* DENOTES 60% TFA

MVHR – Schematic -Plan

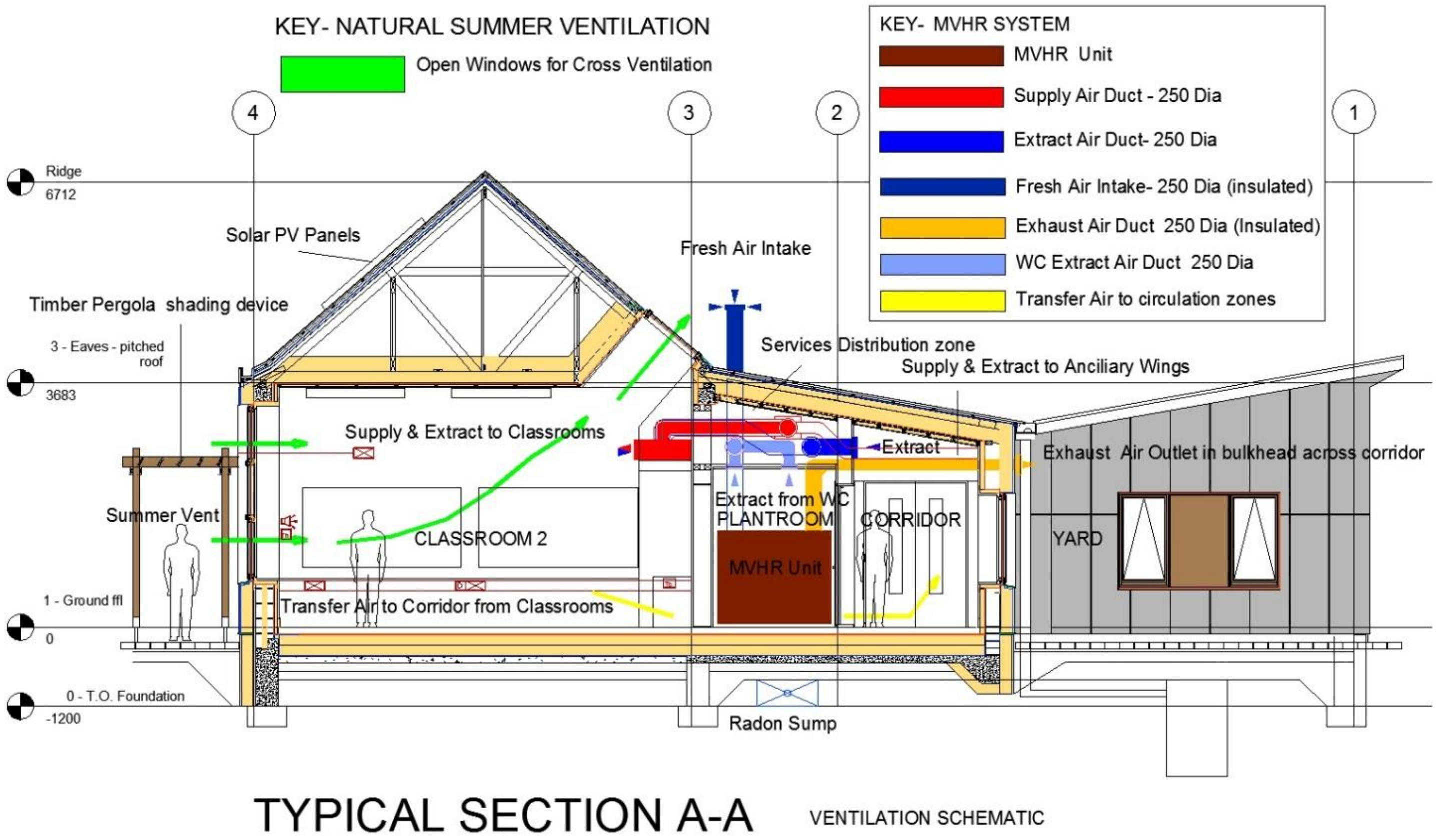
All rooms within the heated building volume must either be connected to a supply air and extract air system with heat recovery or be part of a transferred air zone





The MVHR system is based on two identical units located at floor level for maintenance access in a purpose built plant room , located inside the thermal envelope , within the services distribution zone, accessed from corridor. Supply & extract distribution ductwork serving classrooms and ancilary wings runs in zone over new WC strip with fully accessible ceiling. Hall & corridor are transfer zones .Extract from toilets kept separate from other zones to prevent air contamination.

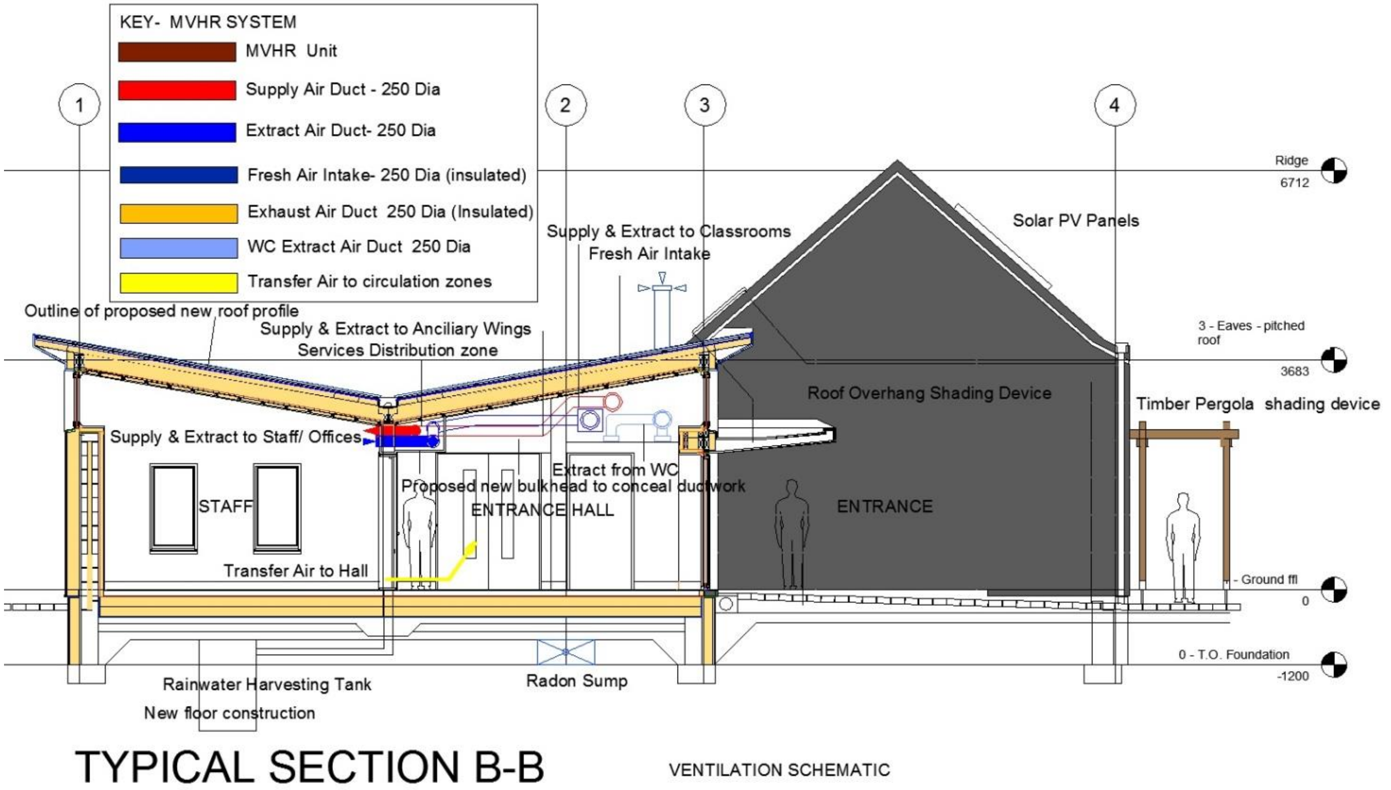
MVHR +Summer Ventilation Schematic -Section



STRATEGY;-

New warm pitched roof replaces flat roof over existing corridor to create services distribution zone with accessible ceiling. New roof light to each classroom to achieve required Daylight Factor (DF) ,with opening vents (on restrictors for security) to facilitate night purge ventilation, in combination with opening vents on restrictors to primary windows, to combat summer overheating.

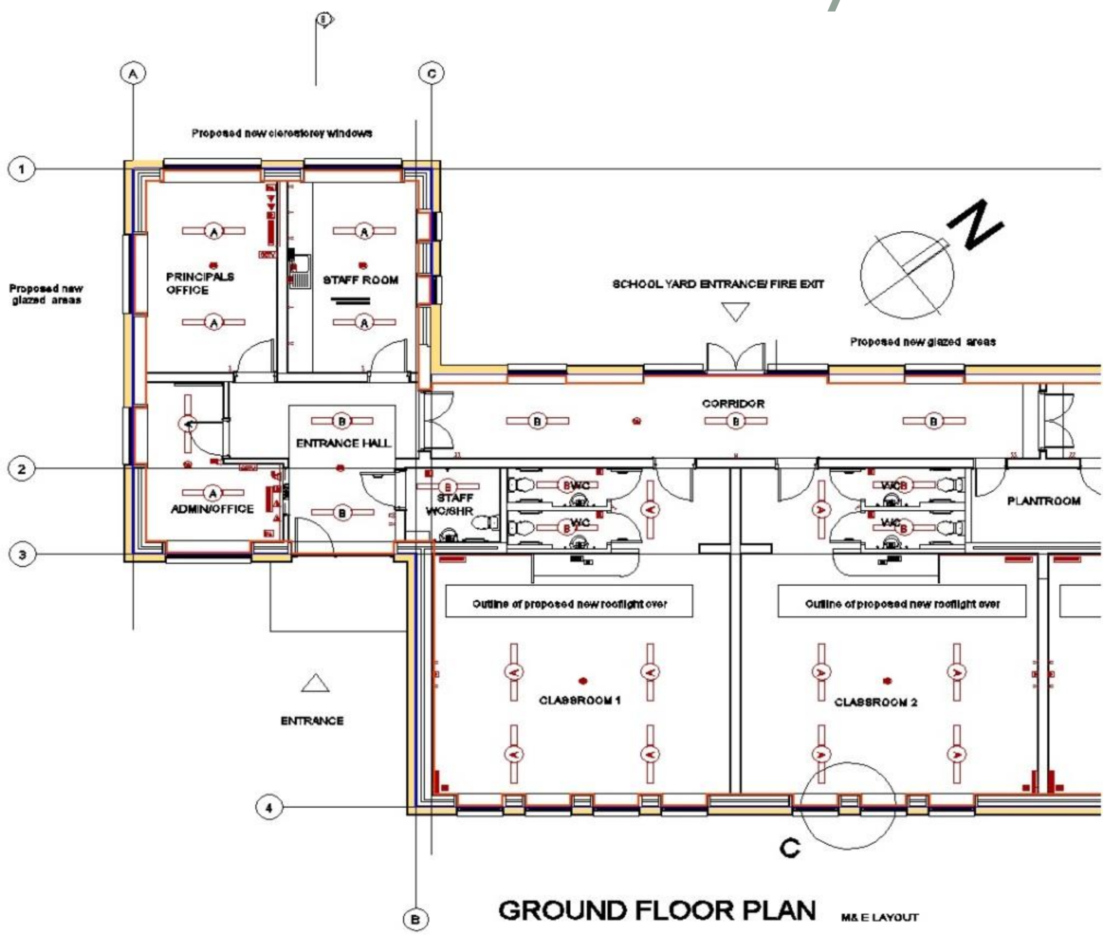
MVHR- Ancilary Blocks Schematic Section



STRATEGY;-

Existing concrete flat roof replaced with new highly insulated ' warm ' butterfly roof which is designed to maximise solar gain , and create enough headroom to accommodate ventilation ductwork in bespoke bulkhead in entrance hall. Supply & extract ductwork to all offices , library , general resource room, and special education tuition room, with transfer air into circulation zones .

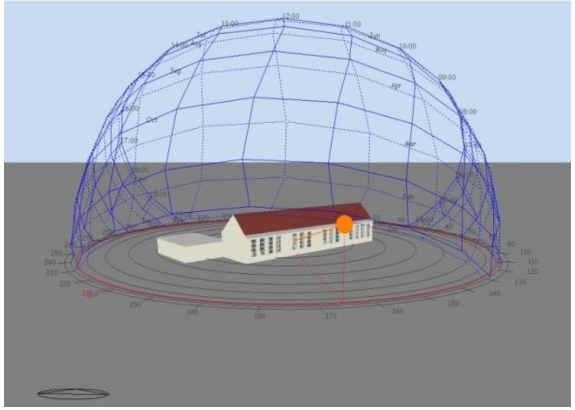
Mech & Elec Layout



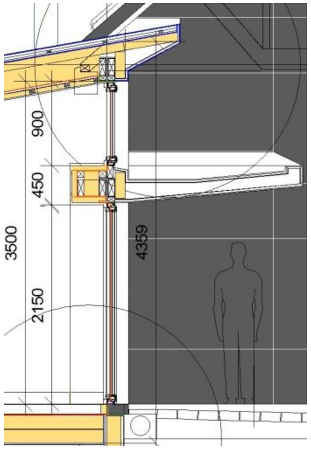
STRATEGY

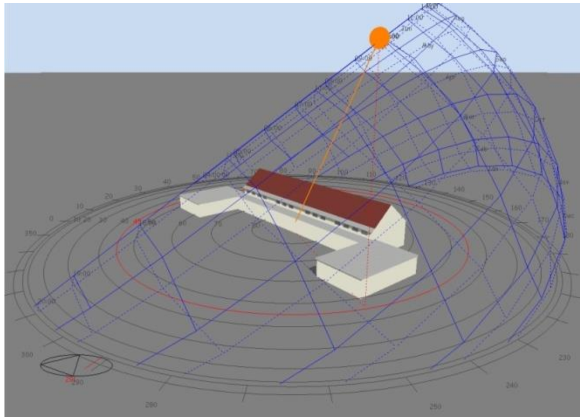
Layout designed to keep external walls ‘service free’ to minimize penetrations of Airtight layer. The exceptions are Classroom 1&4 gables & ceilings , but this is resolved by services cavity creation inside the AT layer. M& E layout as per DoE requirements . Wet Zone services distribution is designed to be as energy efficient as practically possible , by keeping distribution runs to minimum and all within thermal envelope.

Shading Devices

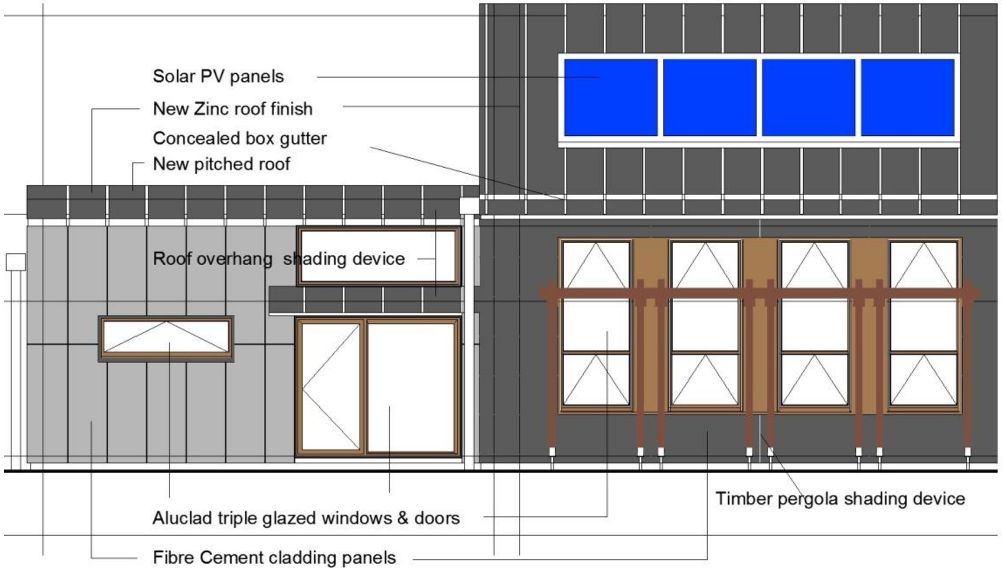


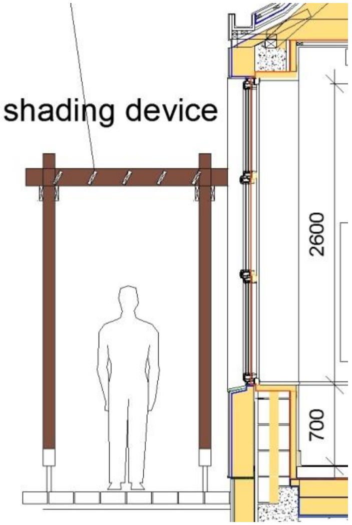
Winter Solstice 11am low sun on classroom windows





Summer Solstice –Noon – Sun high in sky – shading lightshelf required under rooflights





Products

Bord Agrément na hÉireann
Irish Agrément Board

CI/SfB | (21) K

CERTIFICATE NO. 07/0285

ECOCEL Ltd., Unit 33, Haven Hill, Summercove, Kinsale, Co. Cork.

Tel: +353 (0)21 4706826
Fax: +353 (0)21 4706826

Ecocel Loft Insulation

Isolation de grenier
Wärmedämmung

The **Irish Agrément Board** is designated by Government to issue European Technical Approvals.

Irish Agrément Board Certificates establish proof that the certified products are '**proper materials**' suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2006**.

The **Irish Agrément Board** operates in association with the **National Standards Authority of Ireland (NSAI)** as the National Member of UEAtc.

PRODUCT DESCRIPTION:
This Certificate relates to Ecocel Loft Insulation, a cellulose fibre made from recycled paper products, treated with inorganic salts to provide protection against fire, for use as a thermal insulation material mechanically blown into lofts. It is manufactured in accordance with the requirements of BS 5803-3:1985 *Thermal insulation for use in pitched roof spaces in dwellings – Specification for cellulose fibre thermal insulation for application by blowing.*

This Certificate certifies compliance with the requirements of the Building Regulations 1997 to 2006.

USE:
The product is used for the thermal insulation of new or existing lofts using a mechanical blowing system by approved installers, who are trained and monitored by ECOCEL Ltd.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by:

ECOCEL Ltd.,
Unit 33,
Haven Hill,
Summercove,
Kinsale,
Co. Cork.
Tel: +353 (0)21 4706826
Fax: +353 (0)21 4706826

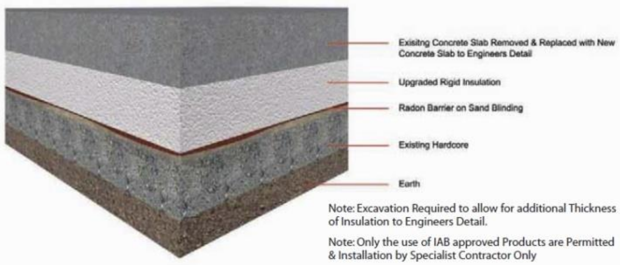
NSAI Agrément (Irish Agrement Board) is designated by Government to issue European Technical Approvals.

NSAI Agrément Certificates establish proof that the certified products are '**proper materials**' suitable for their intended use under Irish site conditions, and in accordance with the **Building Regulations 1997 to 2008**.

Warmfill White Bead
λ value = 0.04 W/(mK)

Warmfill Silver Bead
λ value = 0.033 W/(mK)

Warmfill Super Silver Bead
λ value = 0.031 W/(mK)



Concrete Ground Floor Upgraded to Passivhaus Standard

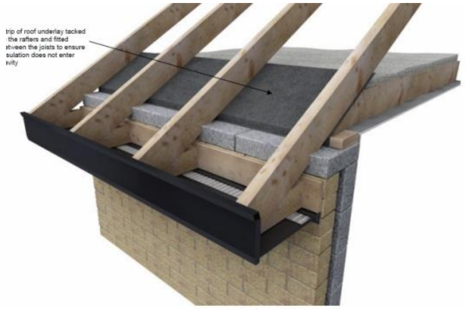


Figure 3: Eaves Detail

Externally insulated window frame reducing heat loss
Source: Optiwin GmbH

07/2011

GUTEX® Multitherm Data Sheet

GUTEX Multitherm, a moisture resistant insulation wood fibreboard with single-ply construction and homogeneous cross section, is an ideal sarking board for exterior walls under facade facing.

Technical Data	Multitherm
Joint type	Tongue and groove
Thickness (mm)	20/40/60/80/100/120/140/ 160
Length x width (mm)	1270 x 600
Actual coverage, length x width (mm)	1250 x 580
Square metres per board (m²)	0.76
Weight per board (kg)	2.1/4.2/6.4/8.5/10.7/12.8/ 14.9/17.1
Weight per m² (kg)	2.8/5.6/8.4/11.2/14/16.8/ 19.6 /22.4
Boards per pallet	220/108/72/54/44/26/20/28
Square metres per pallet (m²)	167.6/82.2/54.86/41.15/ 33.52/ 27.43/24.38/21.34
Weight per pallet (kg)	510
Bulk density (kg/m³)	140
Nominal thermal conductivity λ_D (W/mK)	0.029
Thermal resistance (nominal) R_D (m²K/W)	0.51/1.03/1.54/2.05/2.56/3.08/ 3.59/4.10
Vapour diffusion factor (μ)	3
sd-value (m)	0.06/0.12/0.18/0.24/0.30/ 0.36/0.42/0.48
Compressive stress/ strength (kPa)	70
Tensile strength perpendicular to board surface (kPa)	10
Short-term water absorption (kg/m²)	≤ 2
Air flow resistivity (kPa s/m²)	100
Specific heat capacity (J/kgK)	2100
Fire reaction Euro Class as per DIN EN 13501-1	E

Composition

- Manufactured from untreated Black Forest spruce and fir
- Additives:
  4.0 % polyurethane resin (binder)
  1.0% paraffin (hydrophobic agent)

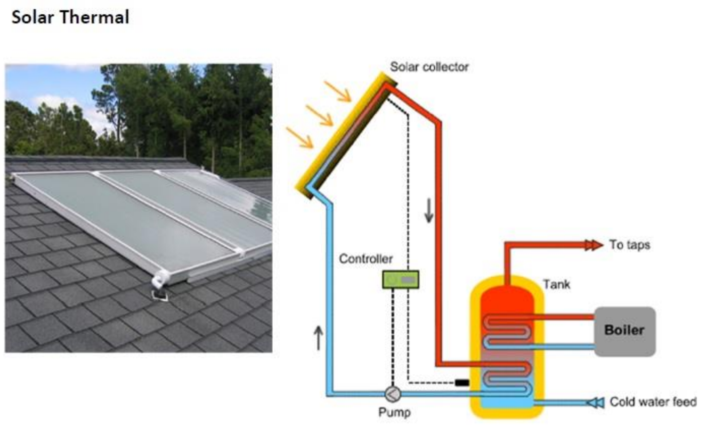
Applications

- Sheathing directly over timber frame constructions, over wood sheathing and over masonry under the facing in vented facade constructions.
- Full boards install under rafters without interruption (not suitable for between rafter use)

Advantages

- Consistently uniform board dimensions make installation quicker and easier
- Homogeneous, single-ply construction
- Makes structures wind-tight
- Superior moisture resistance due to hydrophobic treatment
- Ideal for upgrading the thermal insulation of existing structures
- Reduces thermal bridging
- Exceptional specific heat capacity
  → Maximum protection against the heat in summer
- Significantly improves soundproofing
- Regulates humidity
- Allows vapour diffusion
- Wood is a sustainable, recyclable natural resource.
- Made in Germany
- Biologically safe (natureplus® certified)

Renewables Strategy



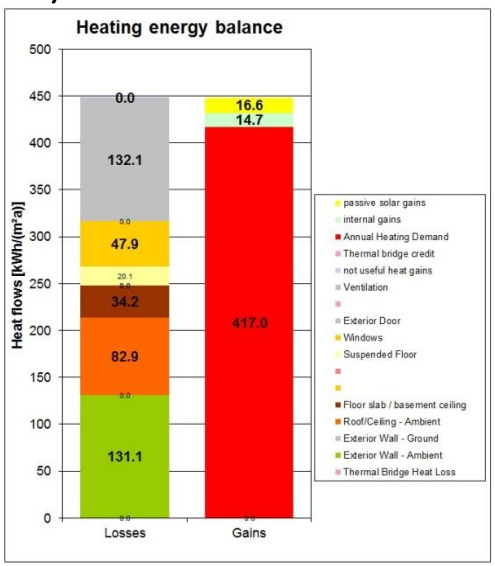
Solar Thermal

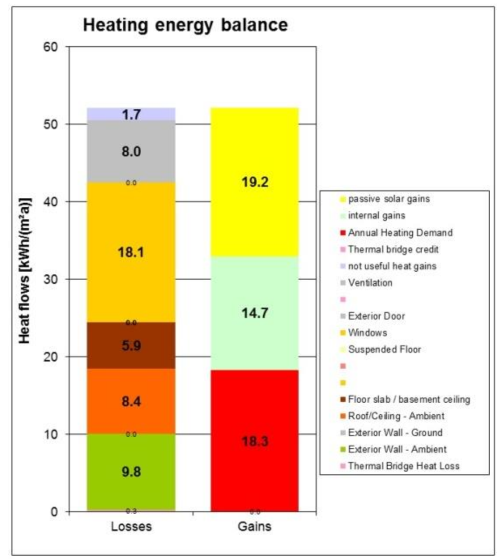
PV Array

48 sq.m of Solar PV / thermal panels set into existing roof of classroom block reduces AHD from 25-17kWh/(m2a) & PE from 156 across the EnerPHit threshold to 106 kWh/(m2a).

Energy Balance-
Pre V Post Retrofit

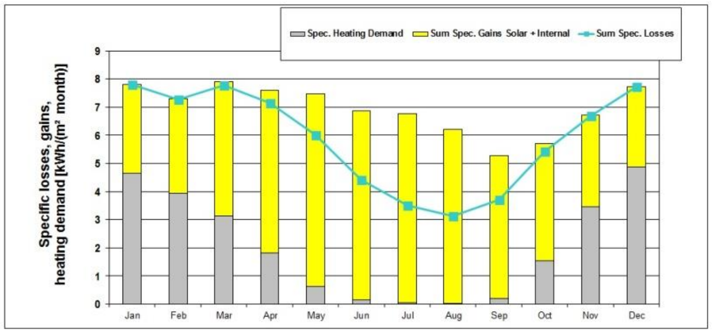
The energy balance of the retrofit must be verified using the latest version of (PHPP).





This image illustrates the Passiv Haus Principle. It is essentially that all of the losses can be minimised to remove the need for the red “heating” part of the chart. With these heat losses minimised, the internal heat sources and the solar gain could in essence cover the heating requirements

Final Design Results



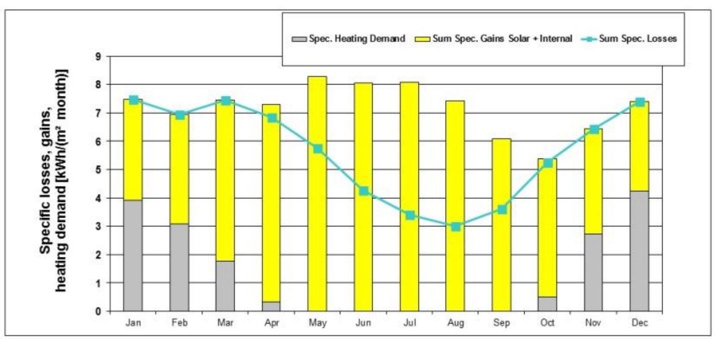
Specific building demands with reference to the treated floor area — use: Monthly method

				Requirements	Fulfilled?*
	Treated floor area	314.0	m²		
Space heating	Annual heating demand	25	kWh/(m²a)	25 kWh/(m²a)	yes
	Heating load	16	W/m²	-	-
Space cooling	Overall specific space cooling demand	4	kWh/(m²a)	-	-
	Cooling load	11	W/m²	-	-
	Frequency of overheating (> 25 °C)		%	-	-
Primary Energy	Space heating and cooling, dehumidification, household electricity.	156	kWh/(m²a)	131 kWh/(m²a)	no
	DHW, space heating and auxiliary electricity	90	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	1.0	1/h	1 1/h	yes

* empty field: data missing; '-': no requirement

EnerPHit building retrofit (acc. to heating demand)?	no

Conceptual Design Results



Specific building demands with reference to the treated floor area — use: Monthly method

				Requirements	Fulfilled?*
	Treated floor area	365.8	m²		
Space heating	Annual heating demand	17	kWh/(m²a)	25 kWh/(m²a)	yes
	Heating load	13	W/m²	-	-
Space cooling	Overall specific space cooling demand	1	kWh/(m²a)	-	-
	Cooling load	13	W/m²	-	-
	Frequency of overheating (> 25 °C)		%	-	-
Primary Energy	Space heating and cooling, dehumidification, household electricity.	106	kWh/(m²a)	122 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	45	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	1.0	1/h	1 1/h	yes

* empty field: data missing; '-': no requirement

EnerPHit building retrofit (acc. to heating demand)?	yes

Final Design Results