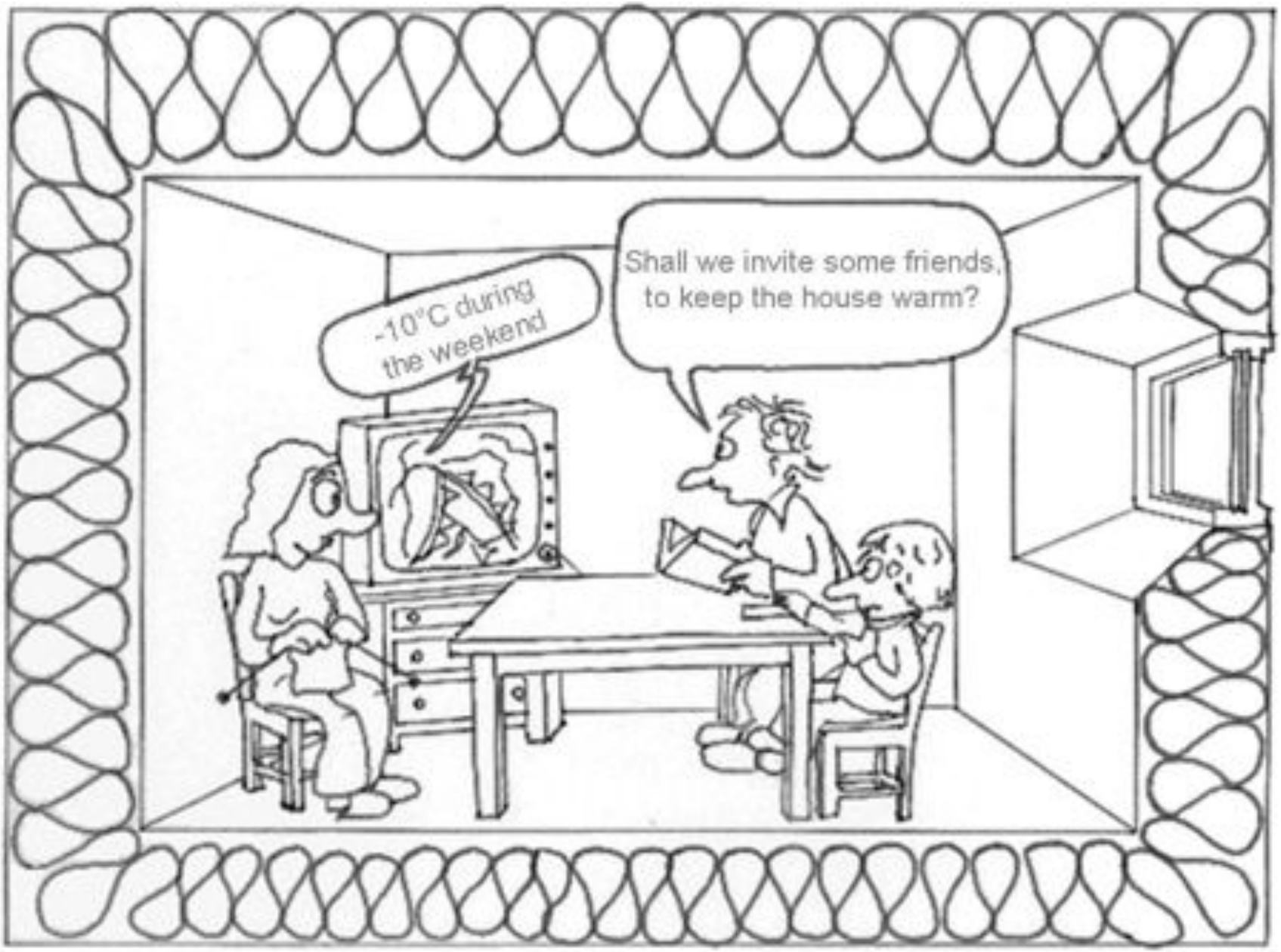
Friends, please remember the DE Christmas party!



passnet

passivhaus trust

Intelligent Energy Europe

Centre for Disability Studies

Passivhaus Design & Delivery

AECB

Part 1: The Passivhaus concept

Part 2: DE construction – building fabric

Part 3: DE construction - energy and services

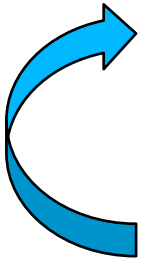
Part 4: Monitoring and Performance

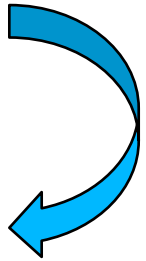
Basic principle sustainable energy
=
Trias-Energetica

First **limiting** the energy use

Very **efficient** use of fossil fuels

Then use **renewable** energy





Much debate

Applying the basic principles

LIMITING ENERGY LOSSES

Limiting transmission losses through fabric – *thick walls and roofs*

Limiting losses via uncontrolled air leakage – *not just energy , but comfort*

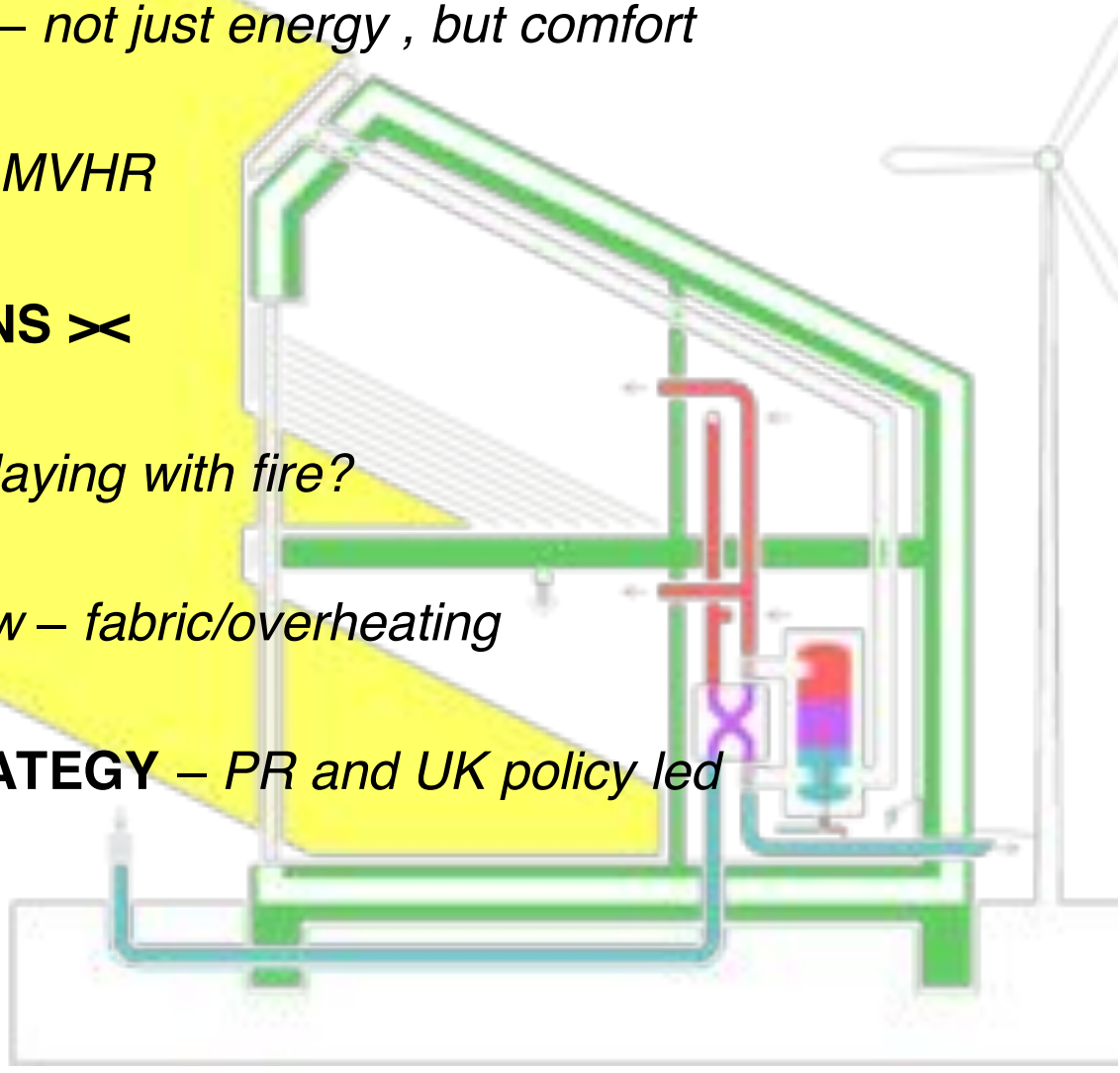
Limiting losses associated with ventilation - *MVHR*

MAXIMISING & OPTIMIZING ENERGYGAINS ><

OPTIMIZING PASSIVE SOLAR GAINS – *playing with fire?*

INTERNAL HEAT GAINS - *the need to know – fabric/overheating*

IDENTIFYING BEST RENEWABLES STRATEGY – *PR and UK policy led*



A passive building?

A building **without** heating??!!

A building with such a low space heating load that a **CONVENTIONAL** space heating system **CAN** be eliminated!

Why haven't we done that here?

…..specifically because of the building form…..

Passive House Criteria?

1. Heat demand ≤ 15 kWh/m²year [15 Wing A and 14 Wing B]

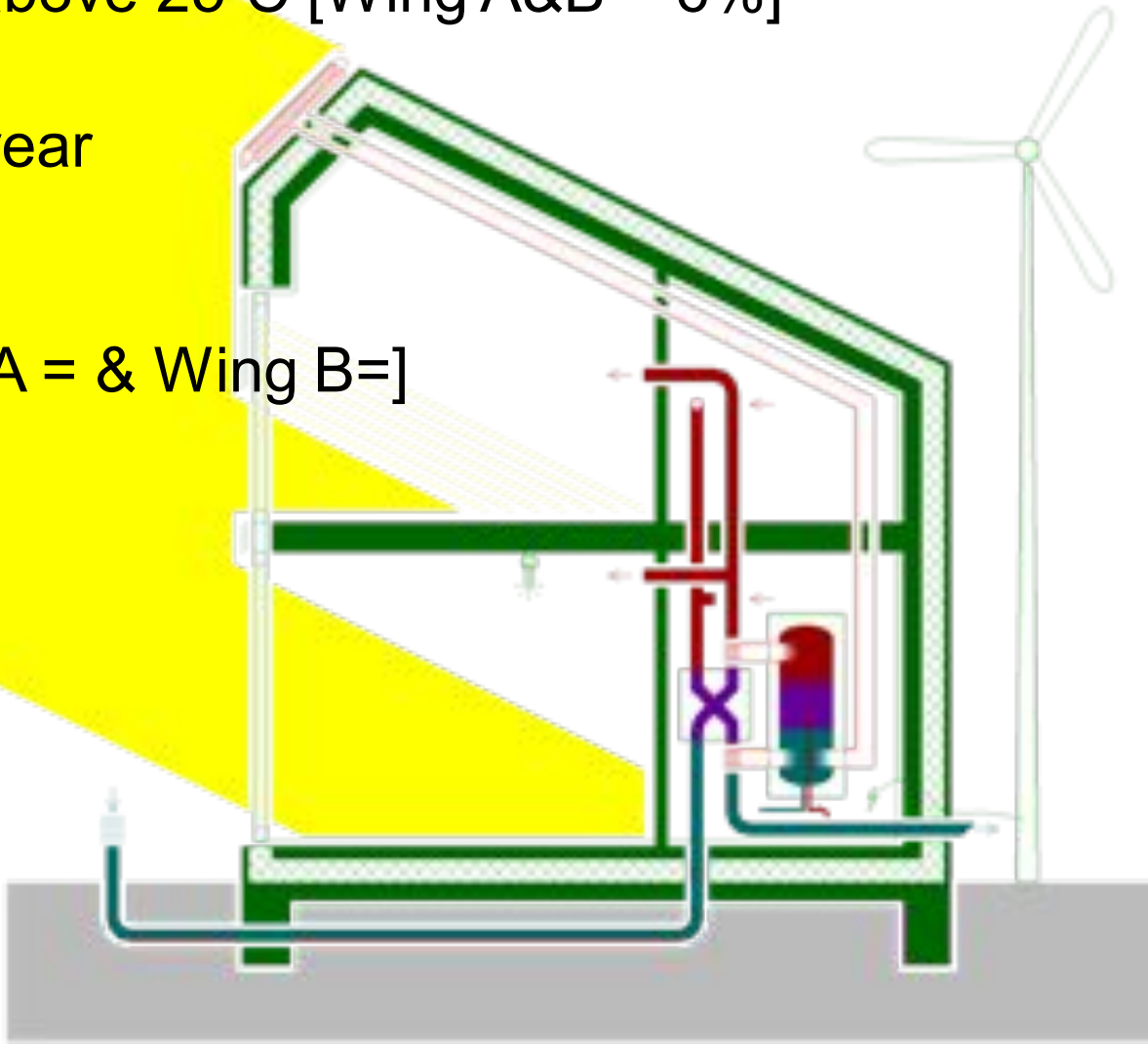
2. Airtightness: n_{50}-value ≤ 0,6 h^{-1} [Wing A&B = each 0.3]

3. Overheating ratio ≤ 10% year above 25˚C [Wing A&B = 6%]

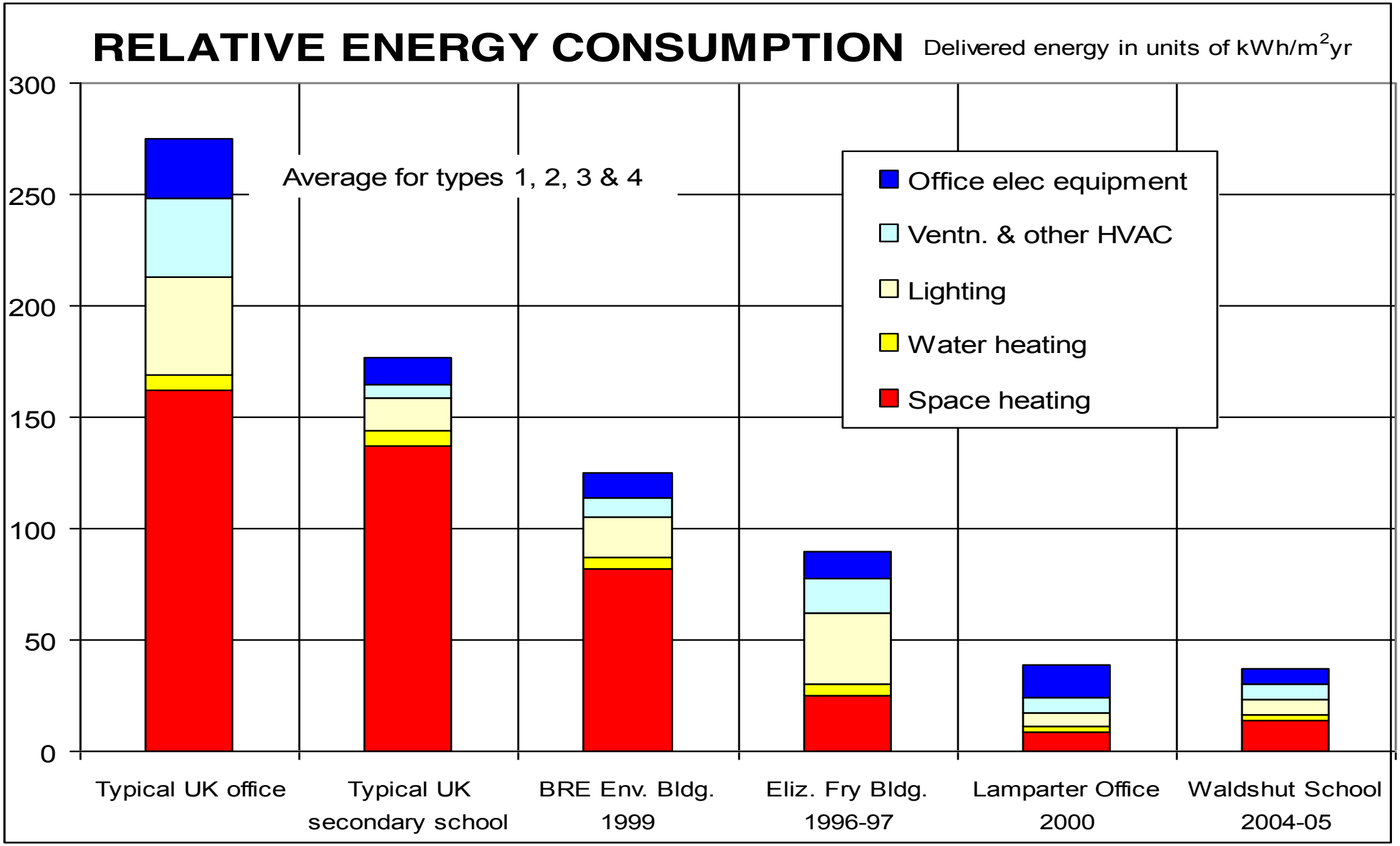
4. Primary energy ≤ 120 kWh/m²year
   [Wing A=90*, Wing B = 117*]

1. Heating load ≤ 10 W/m² [Wing A = & Wing B=]

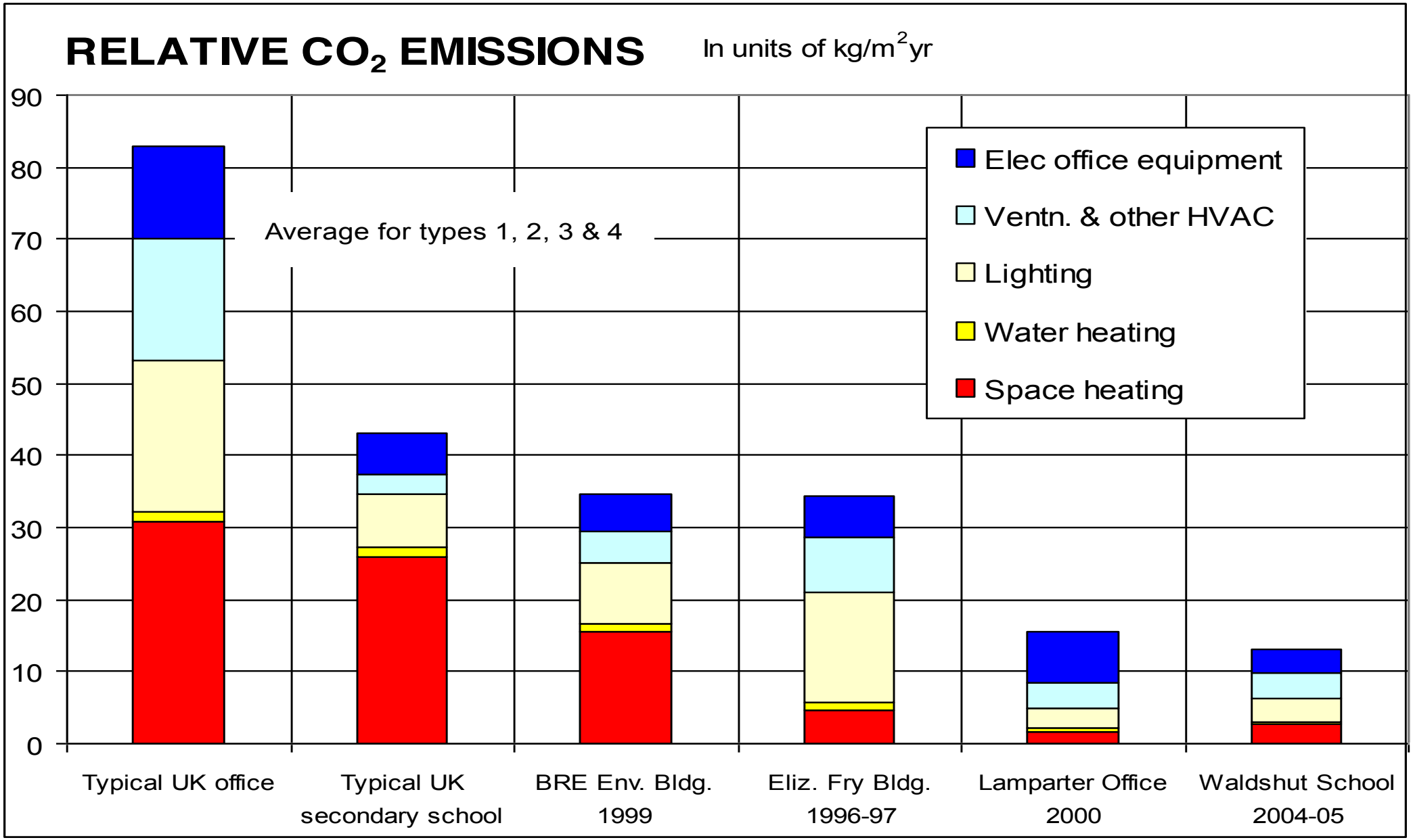
** Dependent on adoption of Design Team's recomendations for e.e. IT & office equipment and any domestic appliances (over time?). Seperate report to client.*



Impact of Energy Performance Standards on Non-Domestic Building Energy Use



Impact of Energy Performance Standards on Non-Domestic Building CO_2 Emissions



Important Building Characteristics

- THERMAL COMFORT
- ACOUSTIC COMFORT
- AIR QUALITY
- VISUAL COMFORT

Construction methods

The PH concept is suitable for every construction method;

- Timber construction
- Masonry construction
- Steel construction
- Innovative methods e.g. Straw bale

Some are easier to use than others to achieve a successful result, some require more industry experience of successful low energy design and construction (e.g. Steel frame)

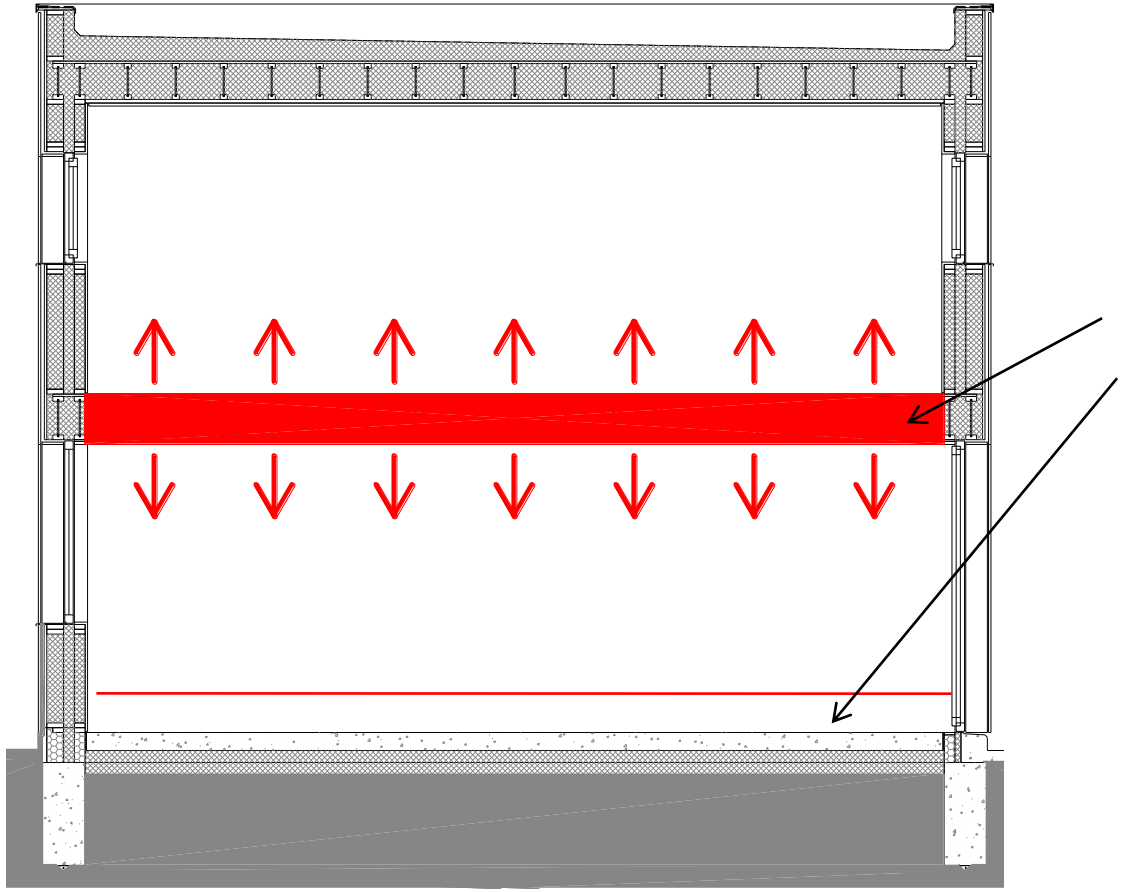


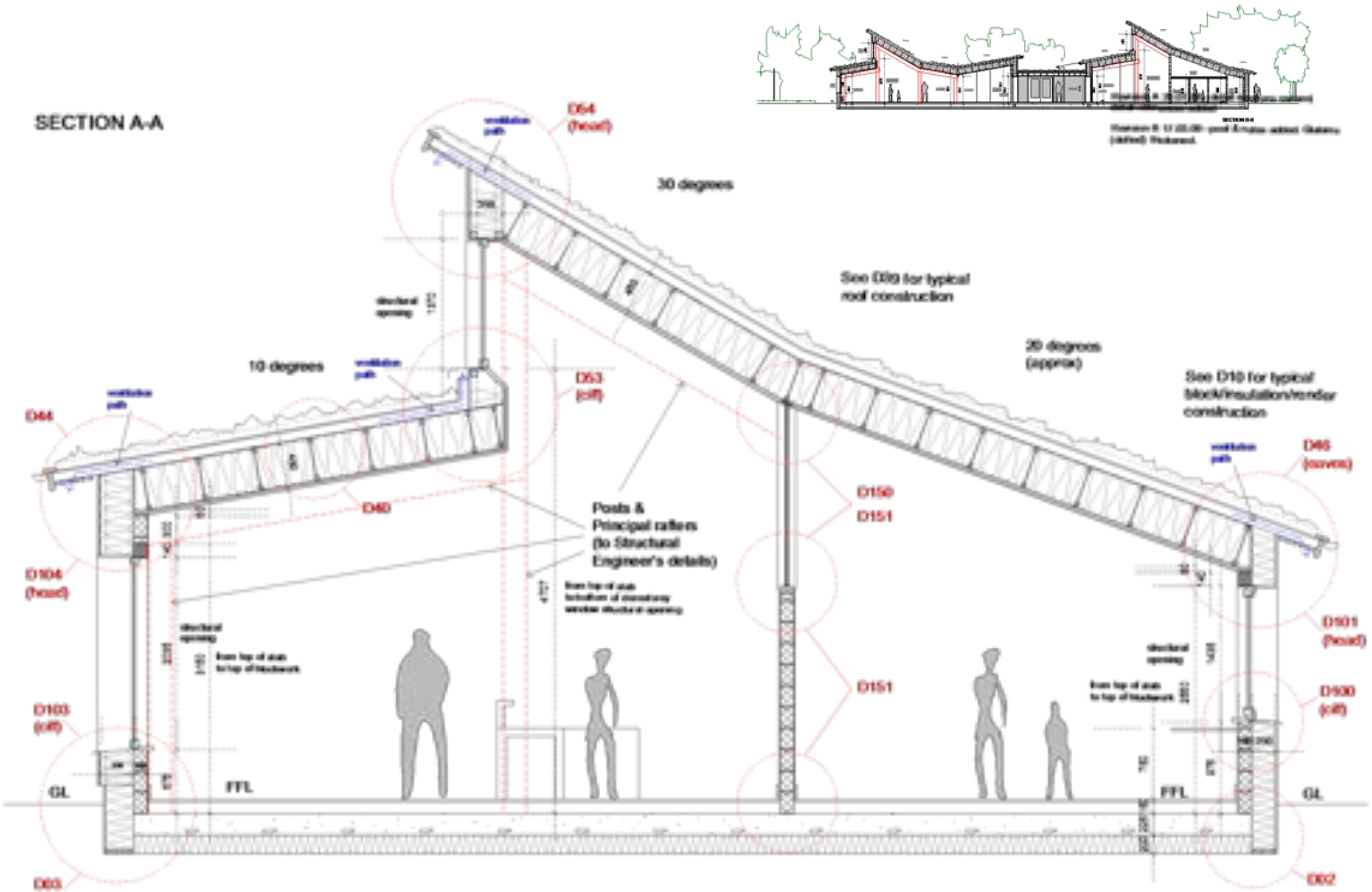

Selected key design principles

Construction methods

Some methods aid PH construction e.g.,

- Lattice floor joists (MVHR ducts)
- Raised access floors (insulated pipework)
- Dense masonry (maximise useful solar gain)

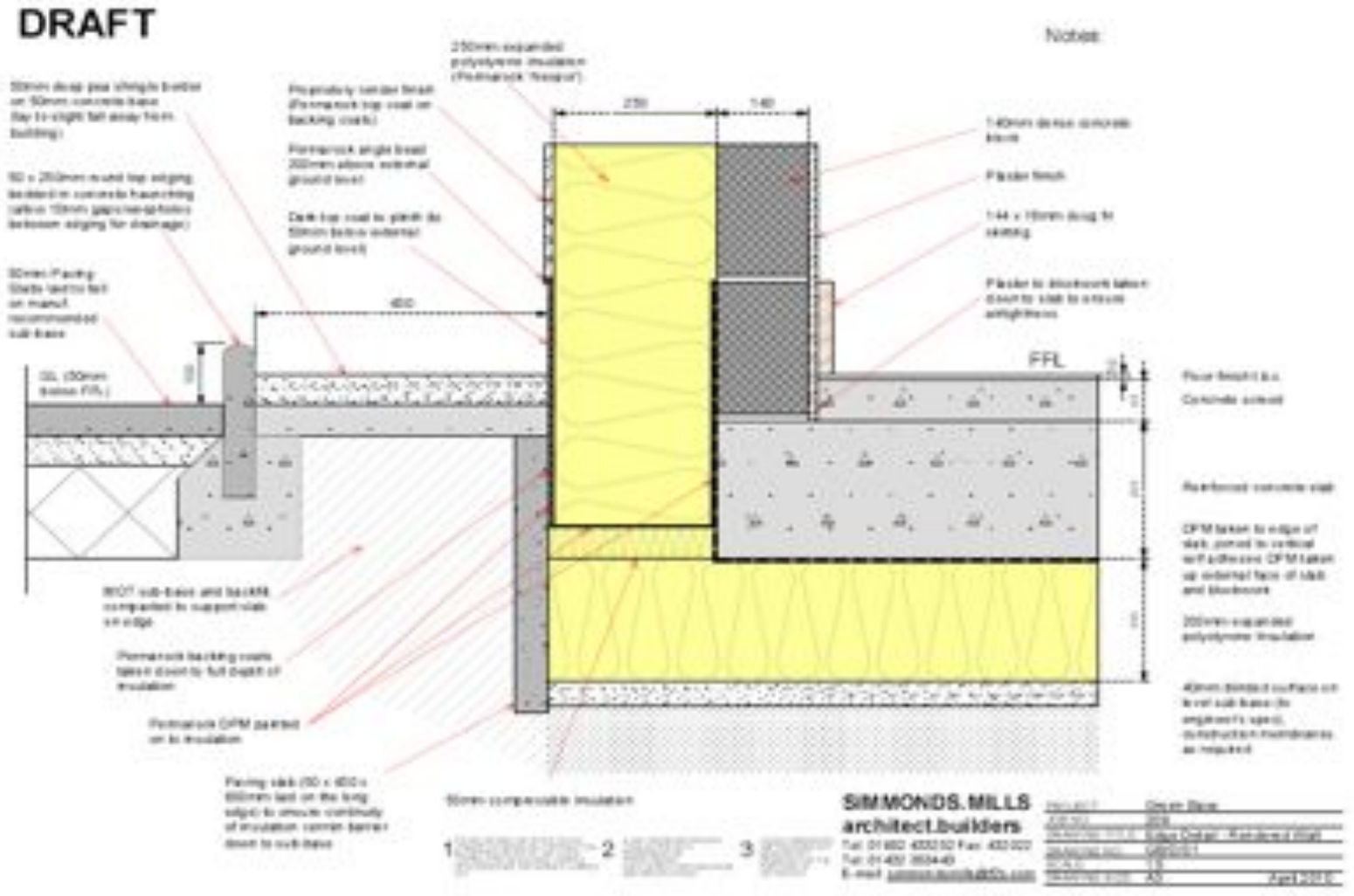


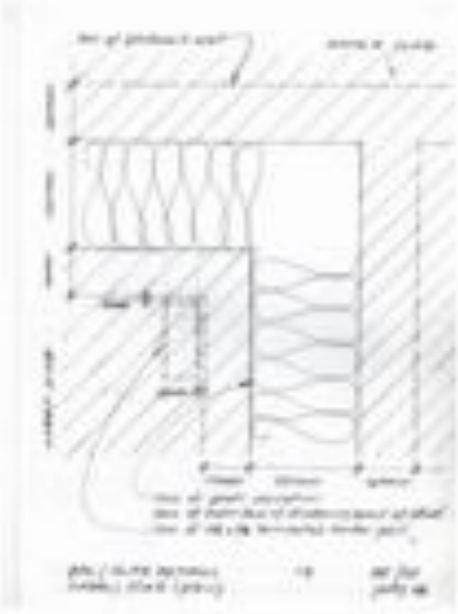


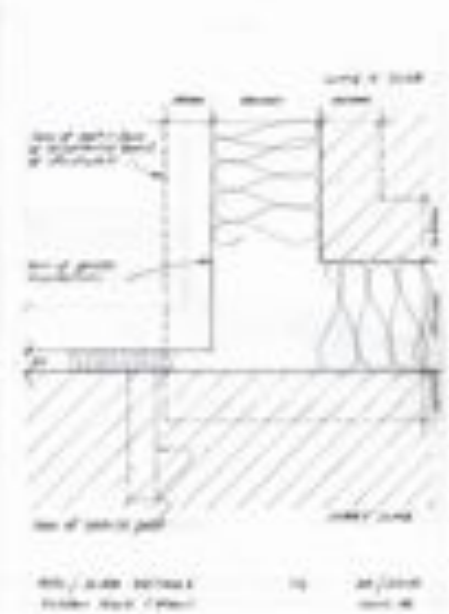
THERMAL MASS: **WELL DISTRIBUTED THERMALLY MASSIVE ELEMENTS: CONCRETE & GYPSUM/CELLULOSE BOARDS**

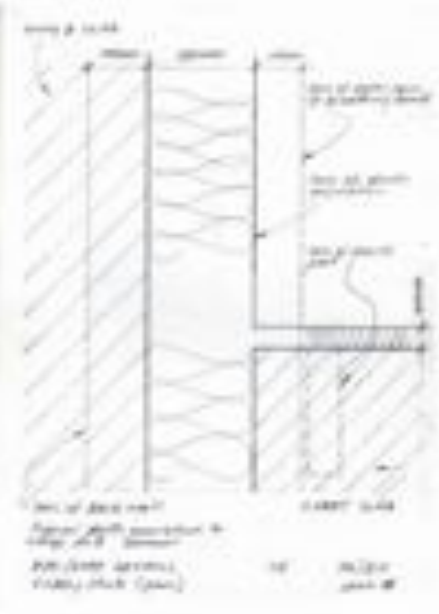
Thermal bridge free construction

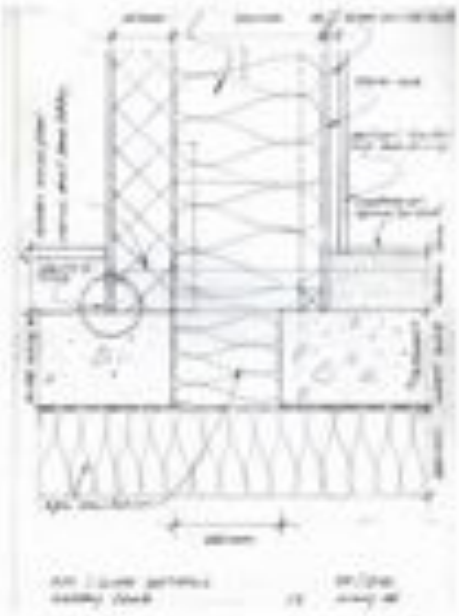
≤ 0.1 W/mK [rule of thumb, c. 200mm insulation uninterupted around a junction

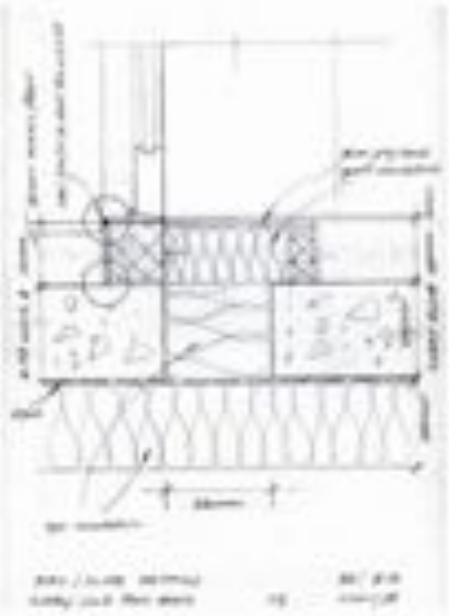


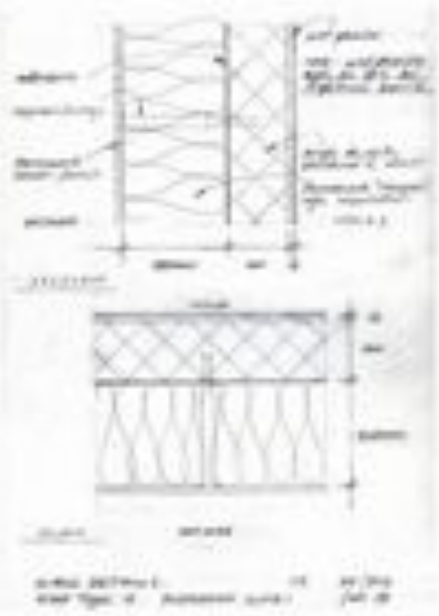


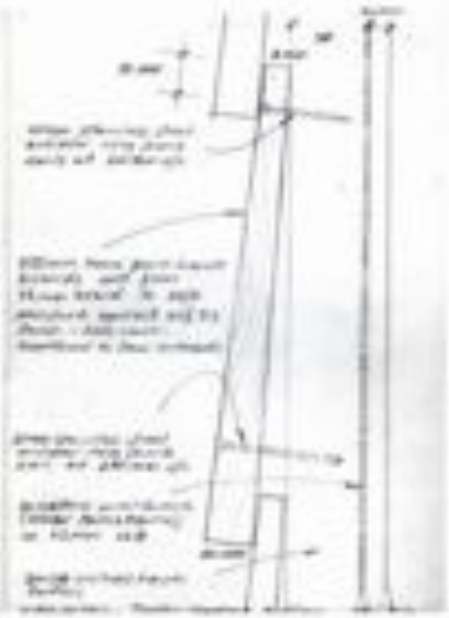


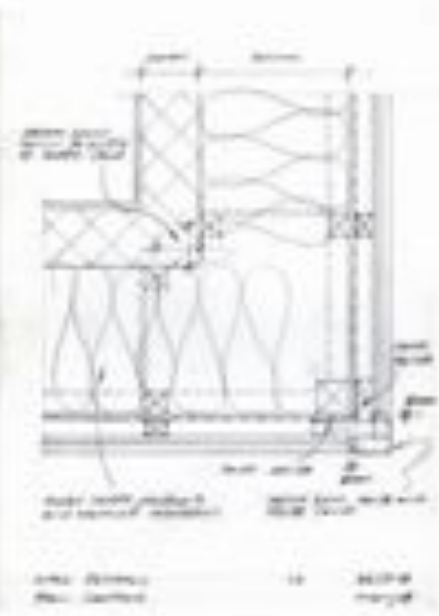


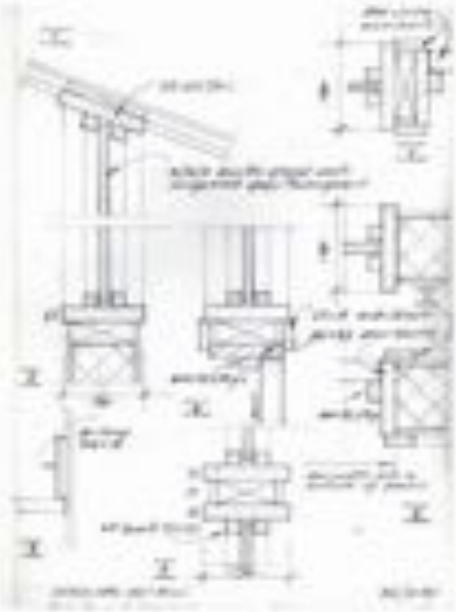


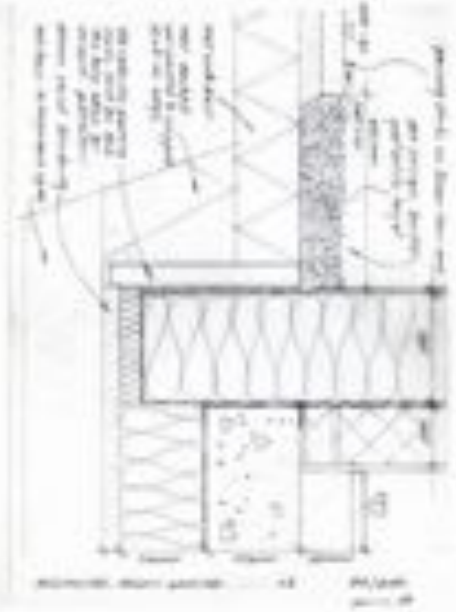


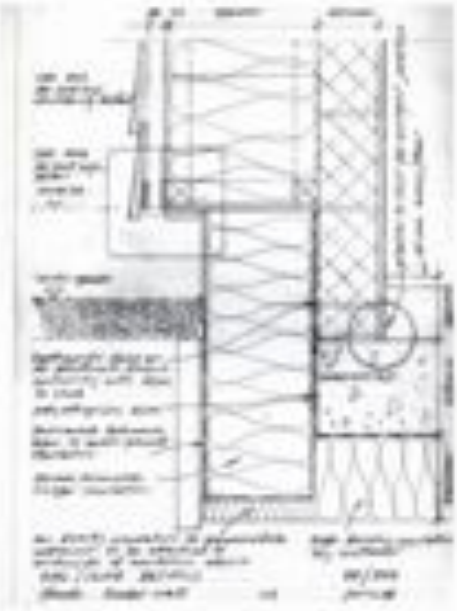


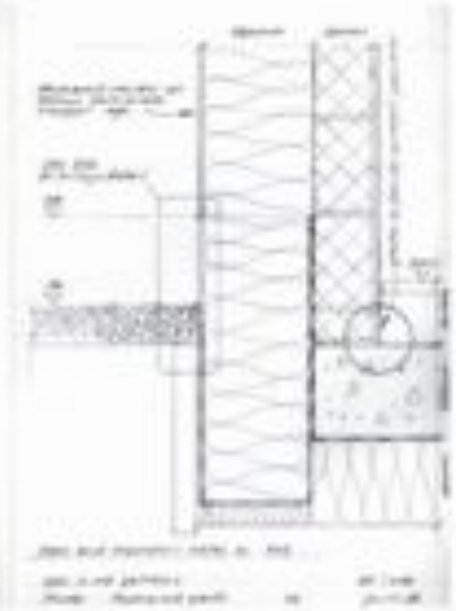


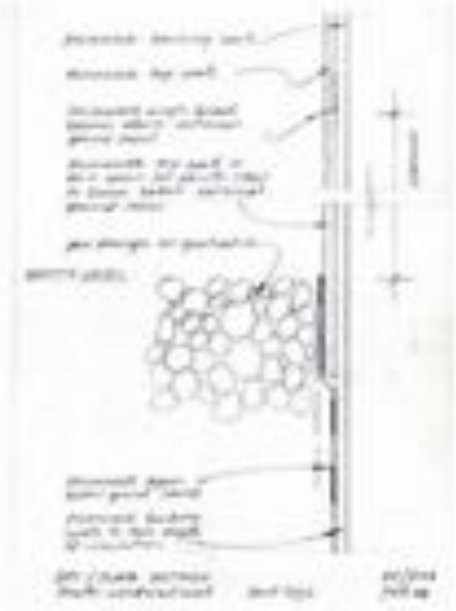


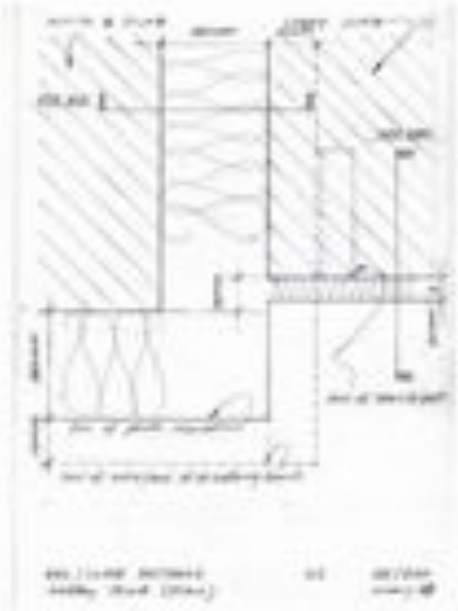


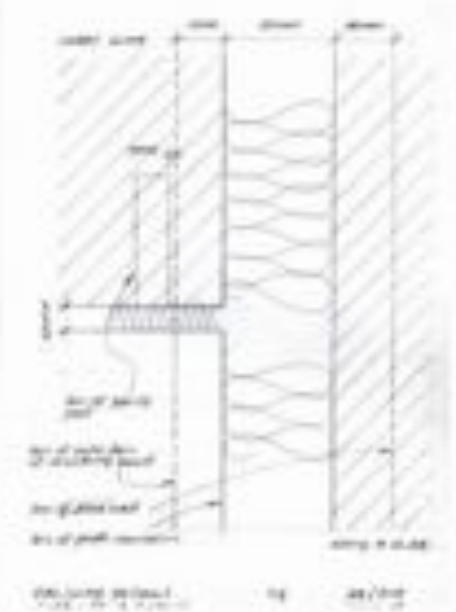




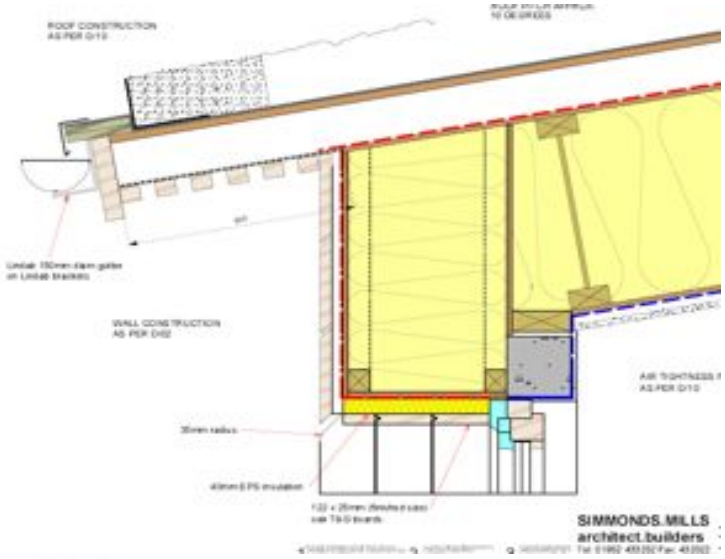




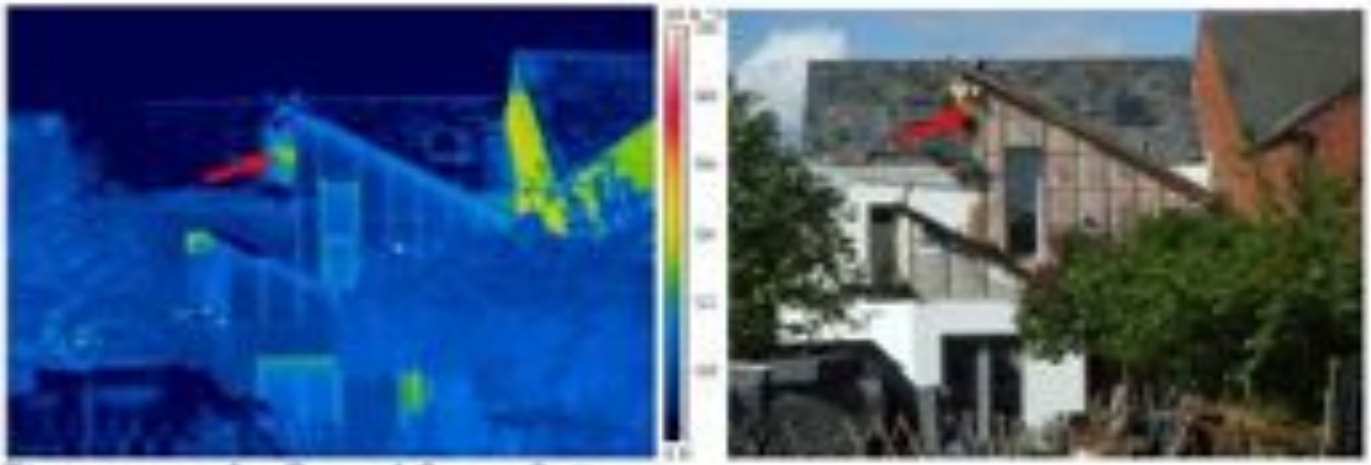




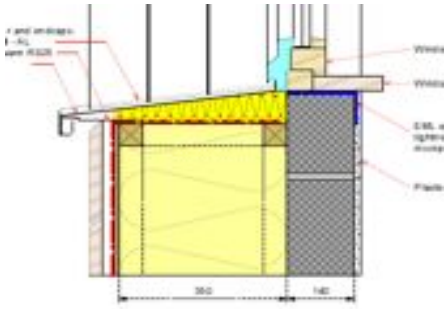
Investigations



Thermal Inspections



Thermogram 9 – Rear of Grove Cottage

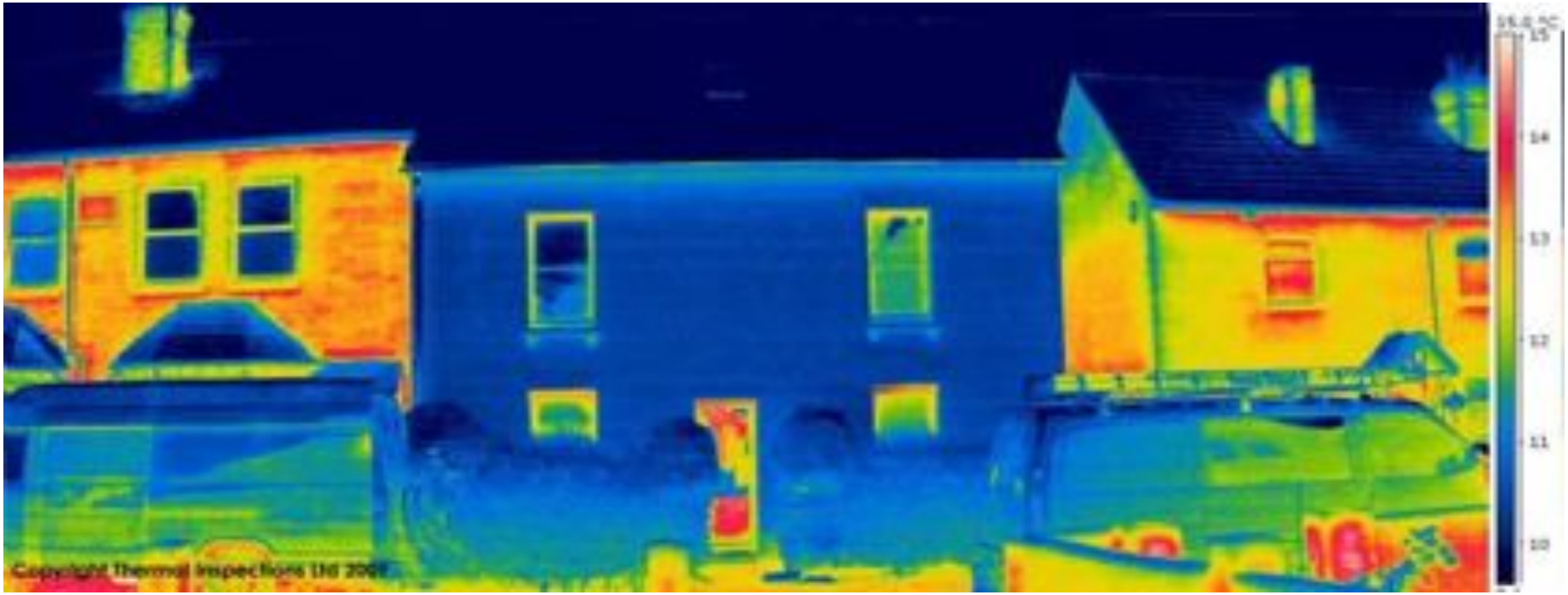


Overall – infrared view

Grove Cottage

Case Study in low energy refurbishment

Project: *refurbishment of solid walled Victorian townhouse, Hereford*



Thermal bridge free construction



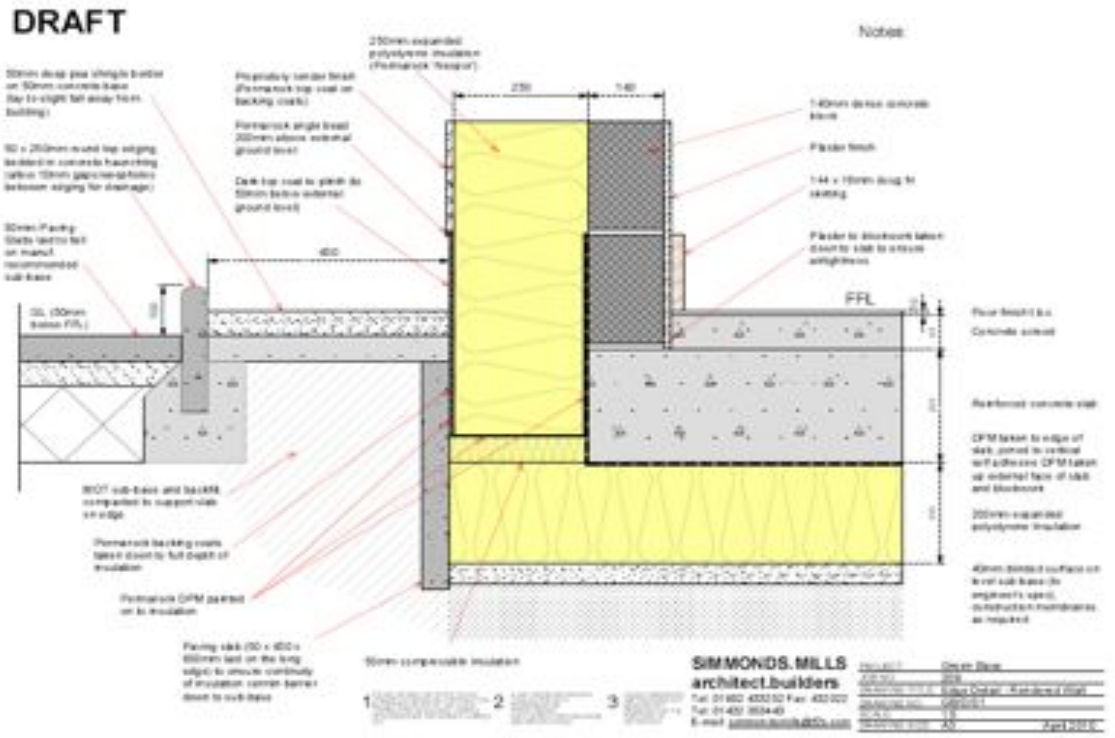






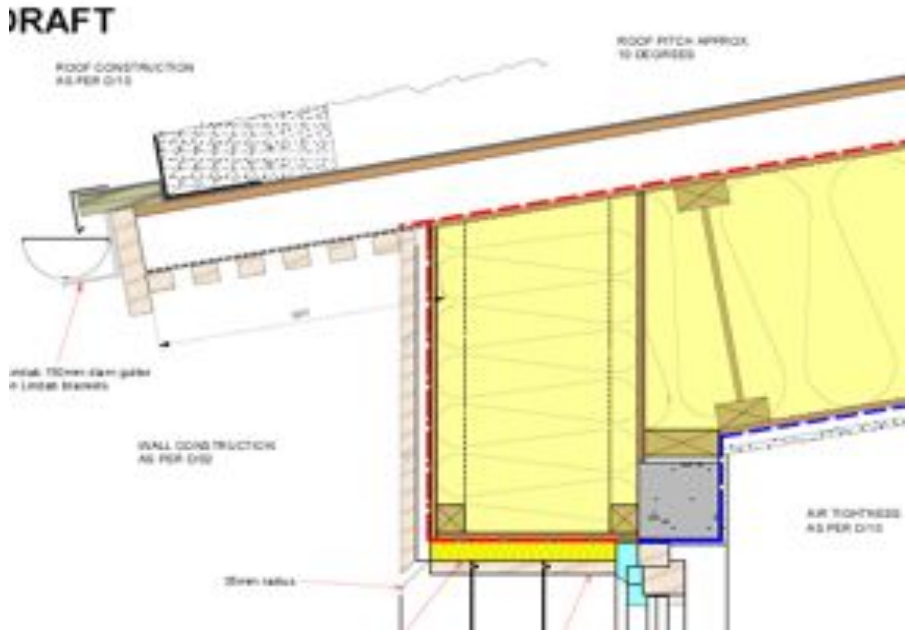



Thermal bridge free construction



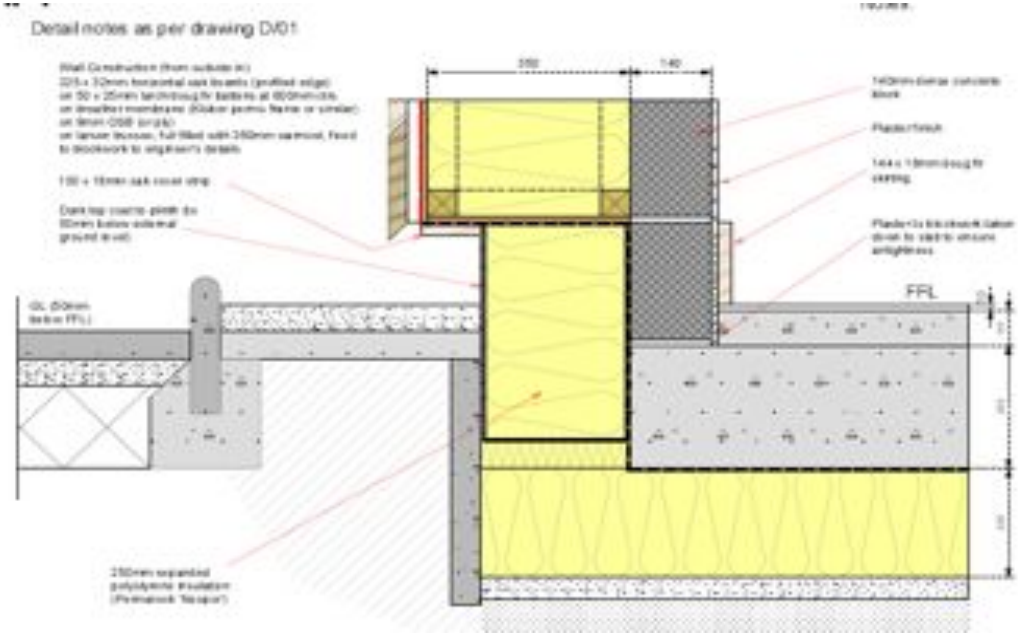
Thermal bridge free construction

Reduce the timber fraction

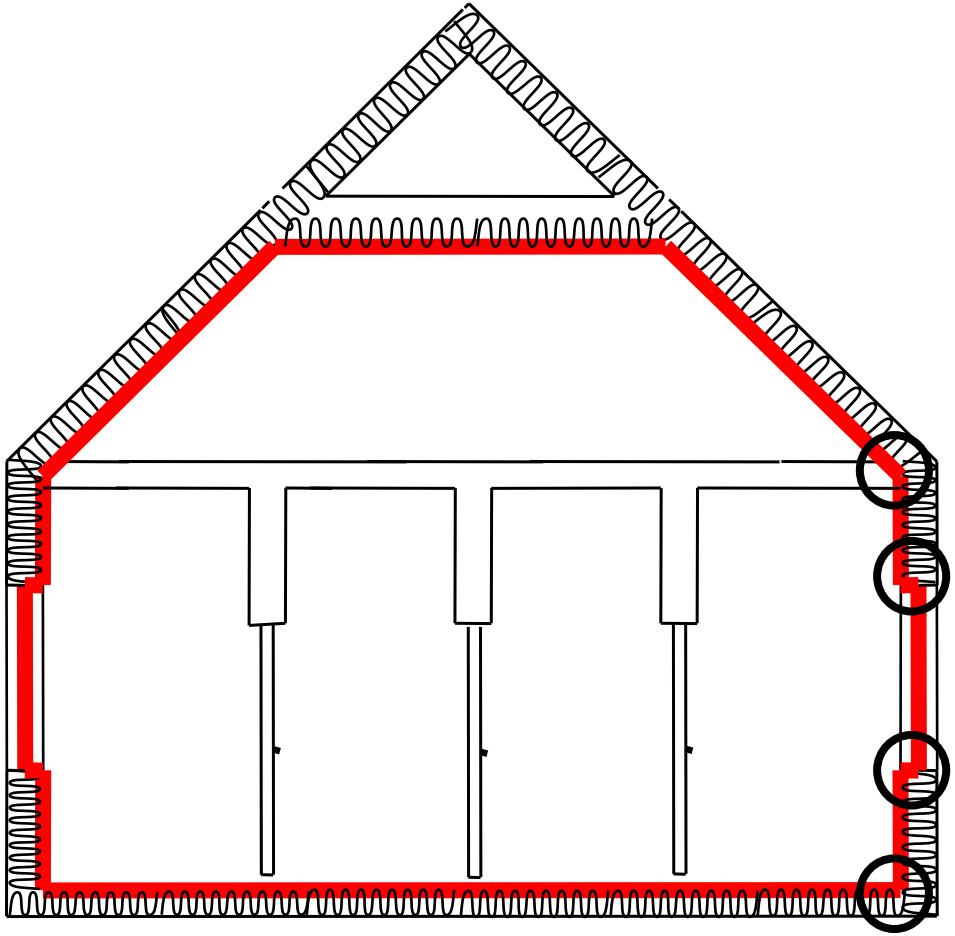


Thermal bridge free construction

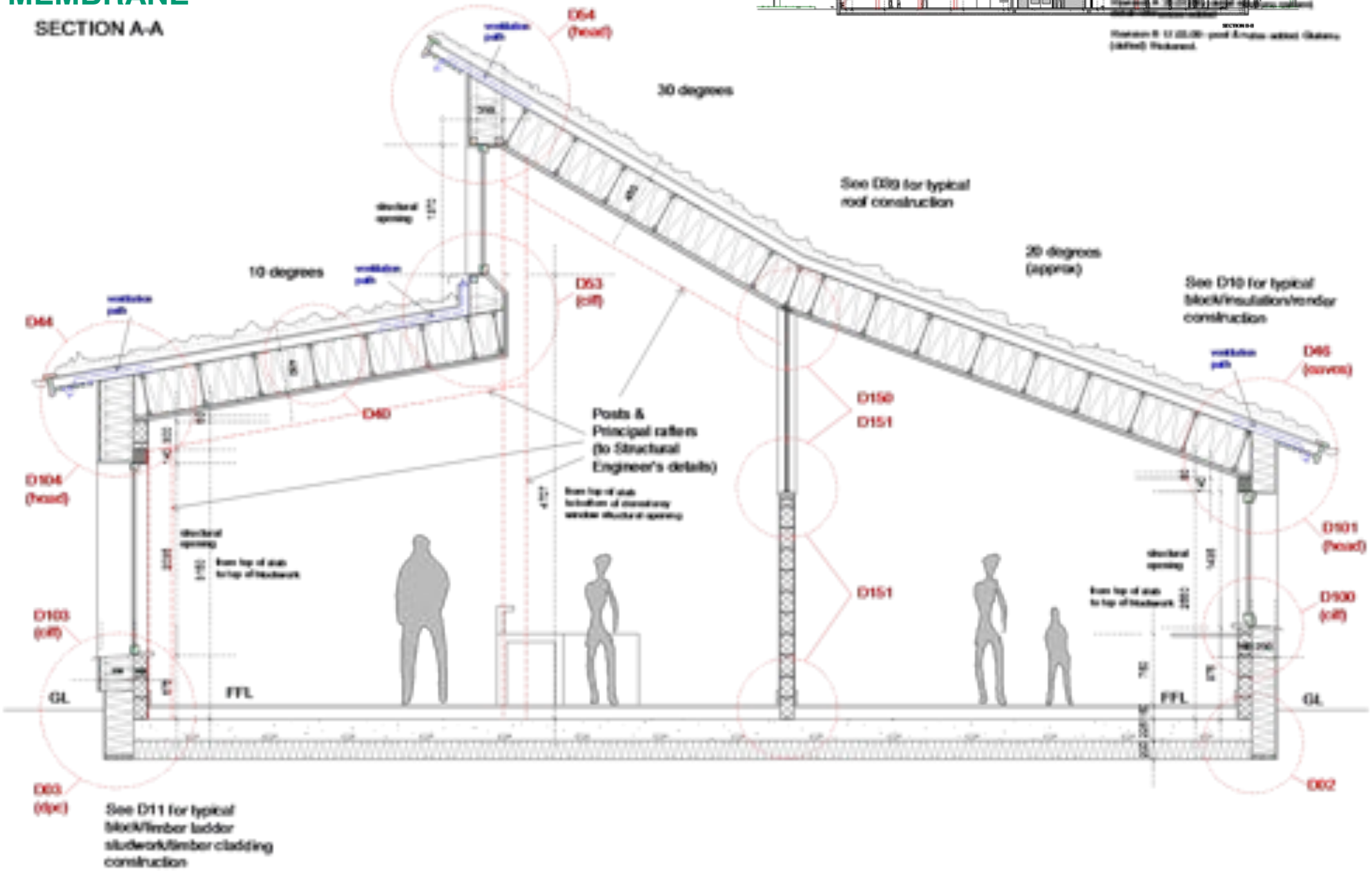
Relies on thermal integrity too – no gaps in your insulation!


Detail notes as per drawing D/01
350
140
FRL

Airtightness has to be designed!

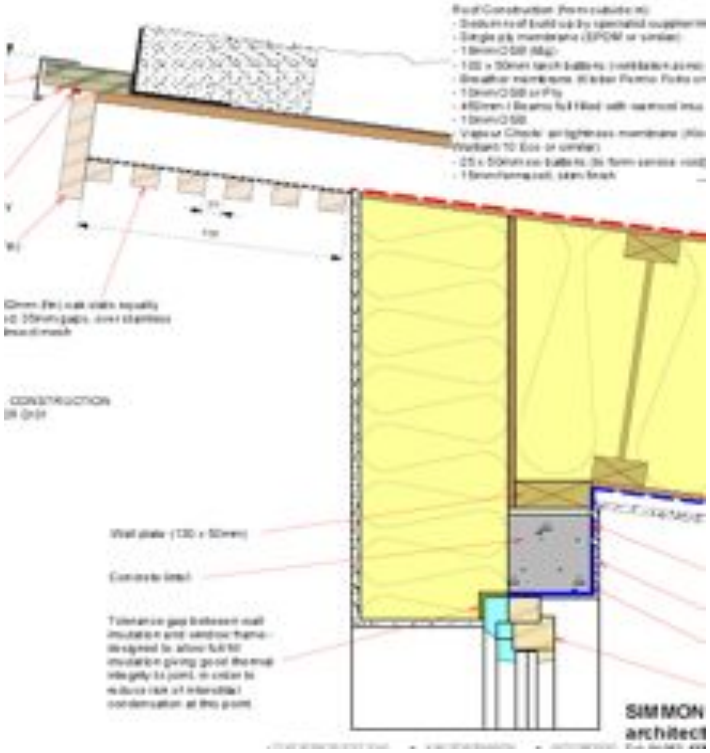


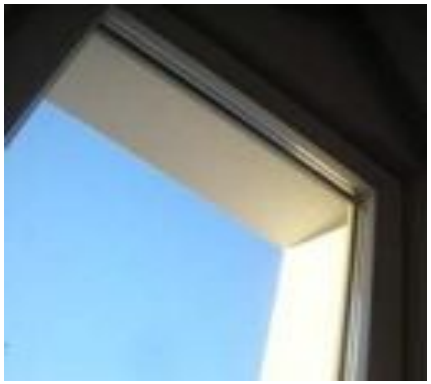
AIRTIGHTNESS: PLASTER, CONCRETE & TAPED MEMBRANE

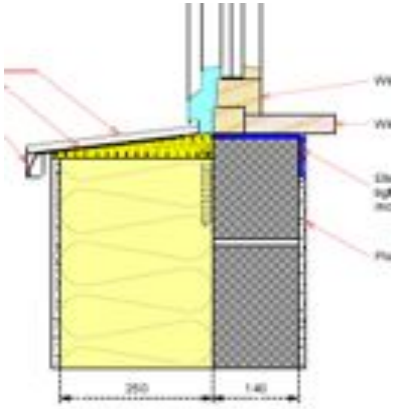



Tyvek

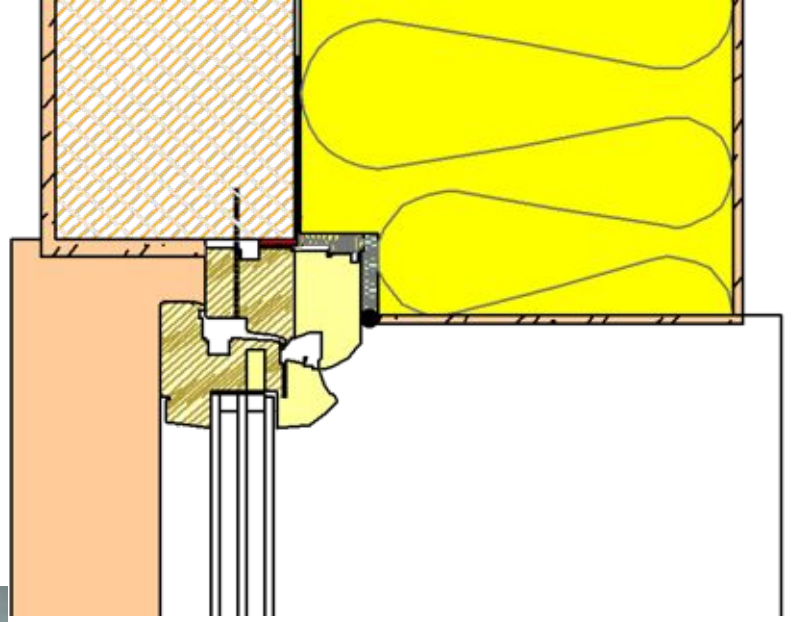
Products: the importance of windows

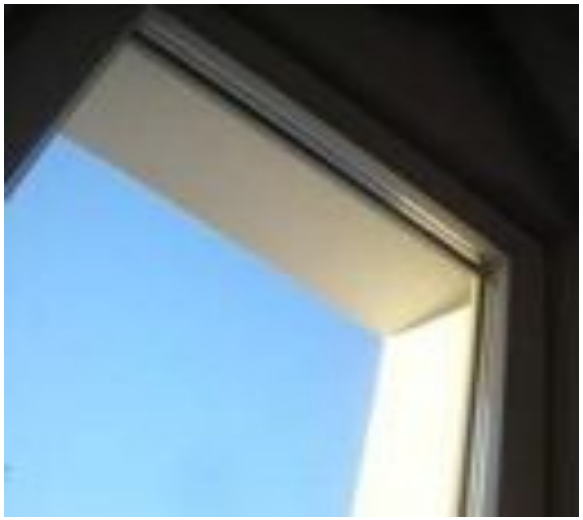


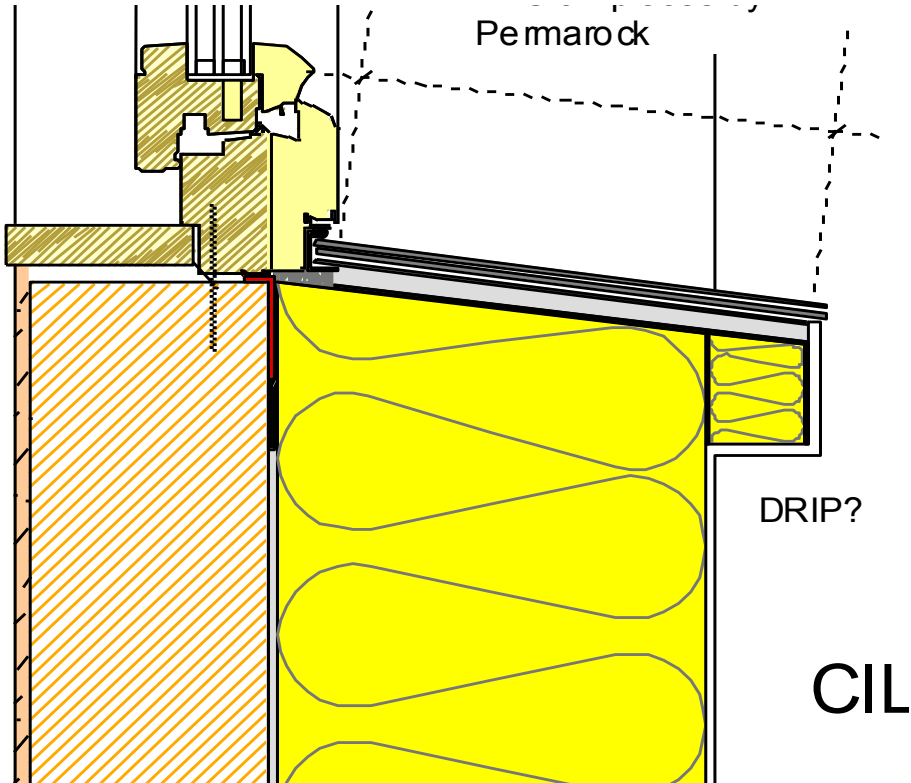




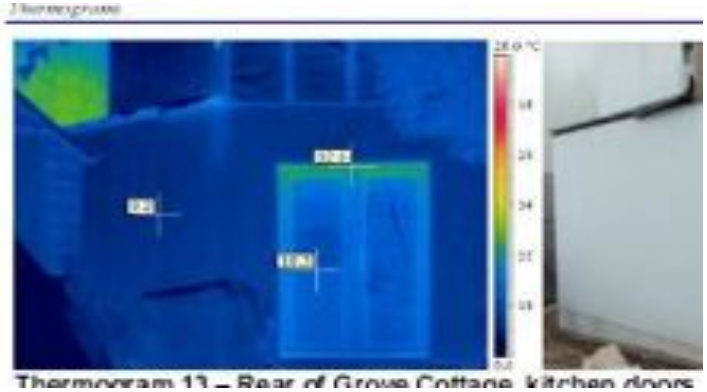
Insulation strategy – windows



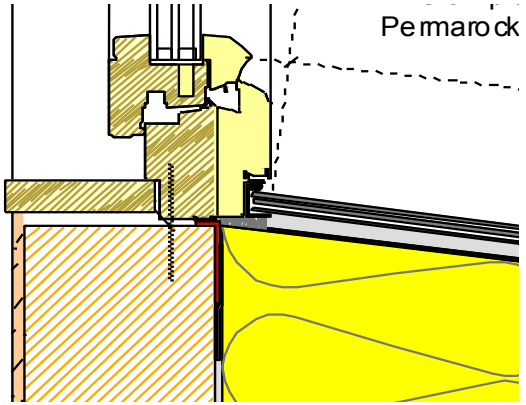


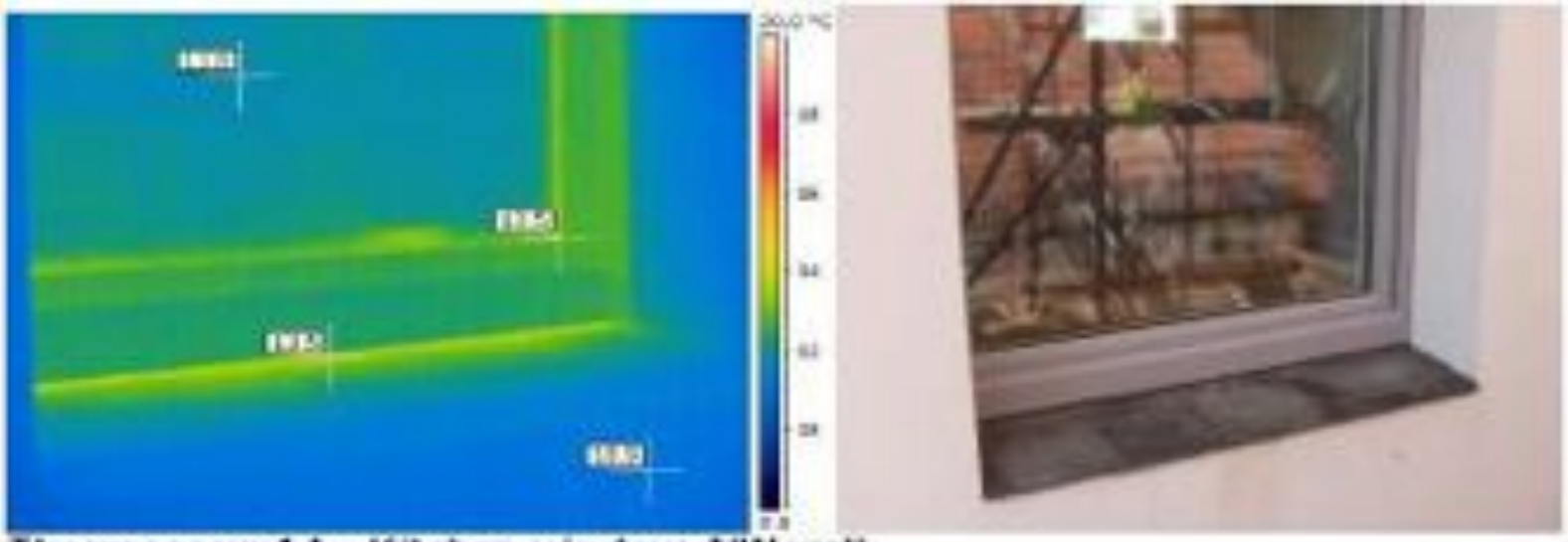


CIL



Thermogram 13 – Rear of Grove Cottage, kitchen doors





Thermogram 14 – Kitchen window, NW wall

Building services

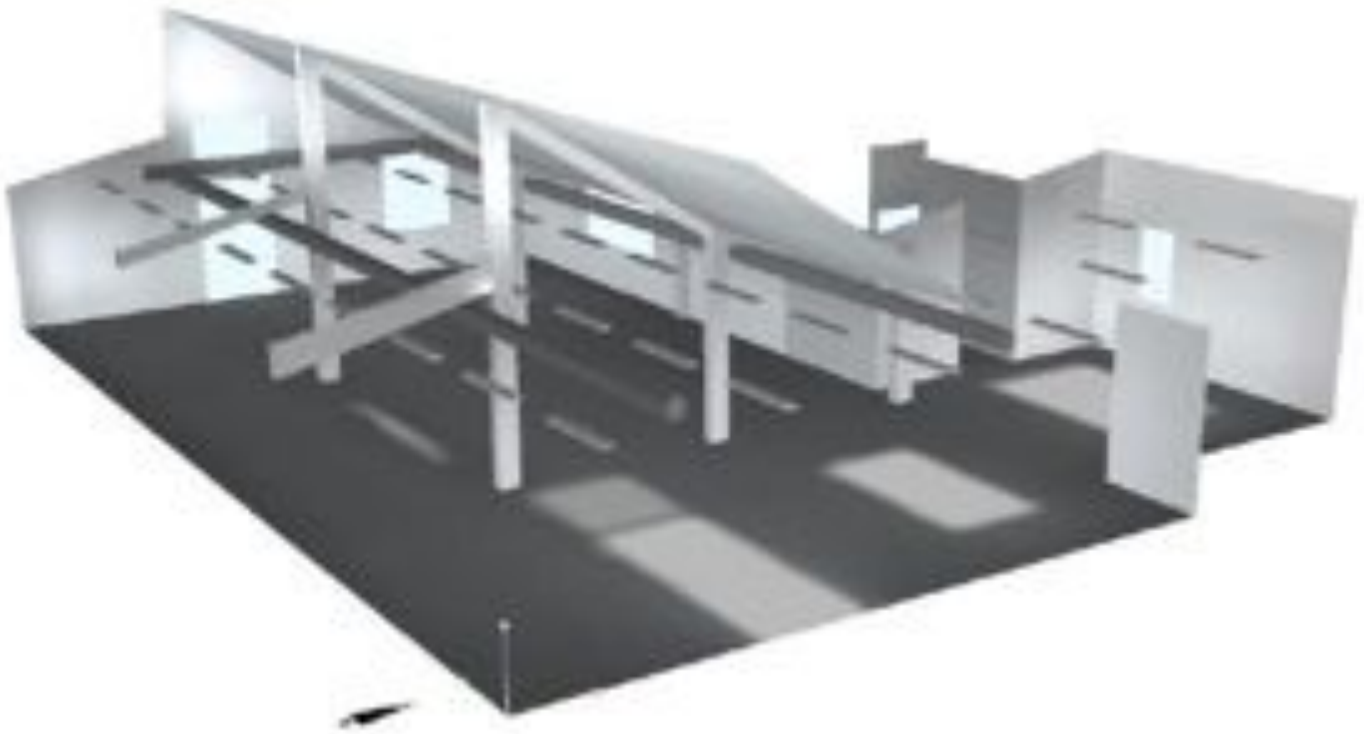
- Heating
- Ventilation
- Hot and cold water
- Lighting

- Heating
  - Gas boiler and radiators
  - Oversized radiators for low temperature
  - Weather compensation for control and efficiency
  - Thermostatic radiator valves for user control
  - Straightforward technology – not expensive

- Ventilation
  - Mechanical heat recovery ventilation
  - Airtight building needs fresh air ventilation system
  - Heat recovery needed for passivhaus energy level
  - Exposed ductwork
  - 3 MVHR units for simple zoning:
    1. Wing A
    2. Training room
    3. Wing B

- Hot and cold water
  - Gas boiler and solar thermal collector
  - Highly insulated cylinder
  - Microbore distribution
  - Low water use taps
  - 4 litre syphon flush WCs
  - Waterless urinals

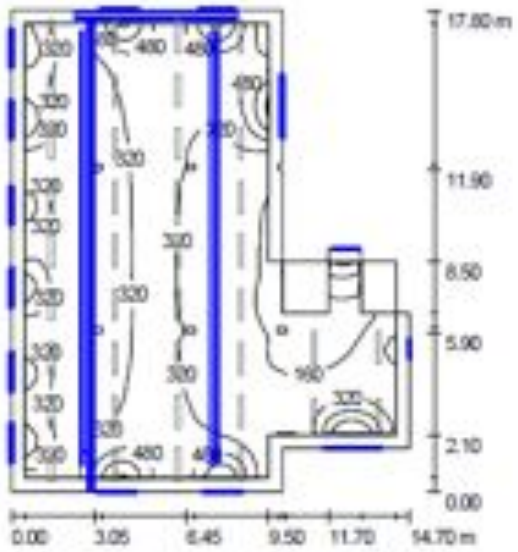
- Lighting
  - Design for daylight – modelled in lighting program
  - Light, high reflectance internal surfaces
  - Electric lighting designed for 300 lux
  - Efficient high light output fittings and T5 tubes – 5.9 W/m² for internal lighting (+0.3 W/m² external)
  - Daylight dimming in communal areas
  - PIR in WC & corridor, manual in small offices



Integrated daylight and electric lighting design

Operator
Telephone
Fax
e-Mail

Wing B / daylight factor / Summar



Height of Room: 5.300 m, Mounting Height: 2.500 m, Maintenance factor: 0.90
Values in Lux, Scale 1:2

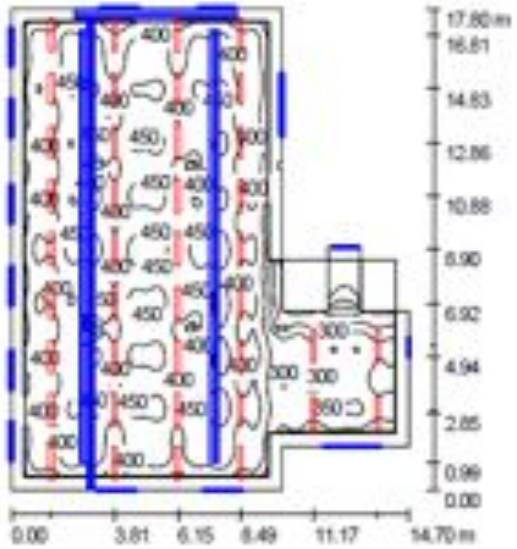
Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	
Workplane	/	306	94	867	0.3
Floor	20	321	62	1561	0.1
Walls (9)	60	147	36	561	

Workplane:
Height: 0.750 m
Grid: 128 x 128 Points
Boundary Zone: 0.500 m
Illuminance Quotient (according to LG7): Walls / Working Plane: - , Ceiling / Working Plane: - .

Pure daylight scene, no luminaires involved.

Operator
Telephone
Fax
e-Mail

Wing B / electric lighting / Summary



Height of Room: 5.300 m, Mounting Height: 2.500 m, Maintenance factor: 0.90
Values in Lux, Scale 1:229

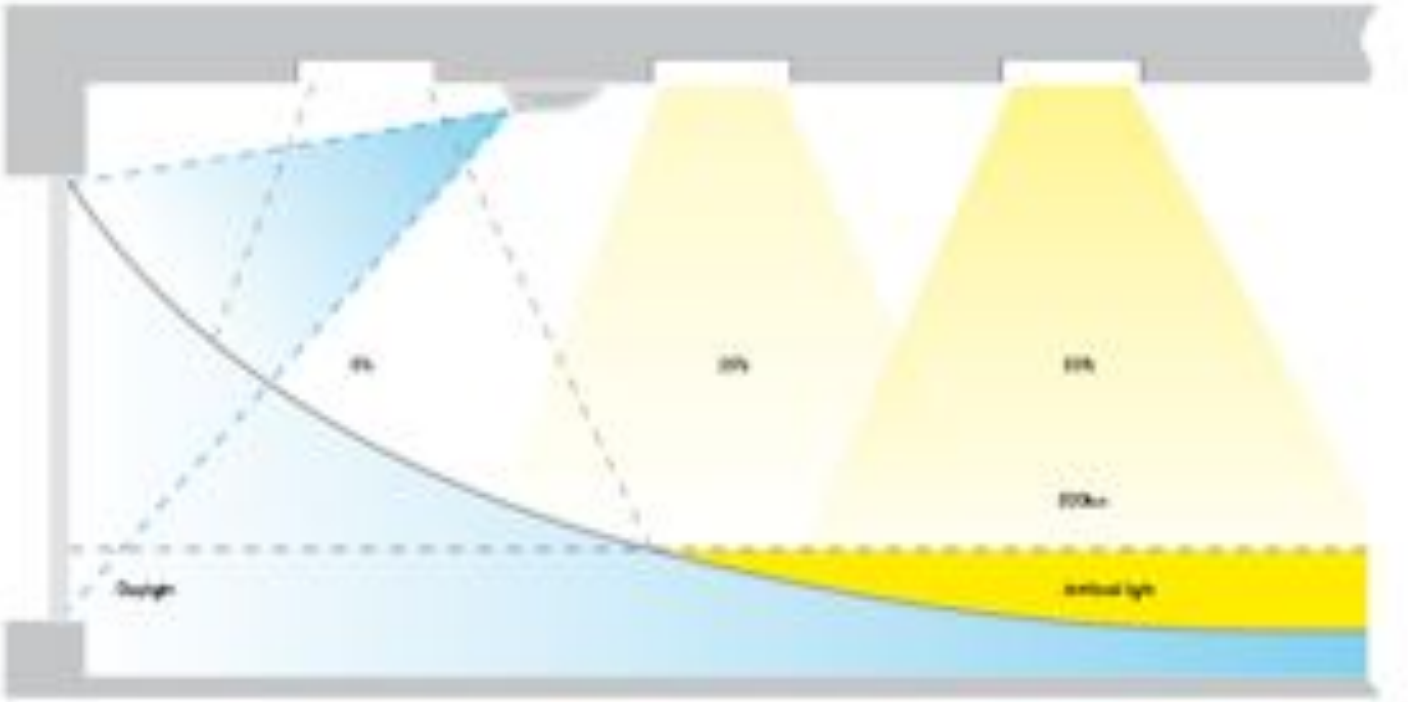
Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	395	32	474	0.080
Floor	20	352	19	482	0.054
Walls (9)	60	120	8.11	275	/

Workplane:
Height: 0.750 m
Grid: 128 x 128 Points
Boundary Zone: 0.500 m
Illuminance Quotient (according to LG7): Walls / Working Plane: - , Ceiling / Working Plane: - .

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ [lm]	P [W]
1	40	Thorn Set 96234025 JUPITER 2S DI 1x28w HF + 96233016 JUPITER 2 1X28 DMB [STD] (1.000)	2600	31.0
		Total:	104000	1240.0

Specific connected load: 5.83 W/m² = 1.48 W/m²/100 lx (Ground area: 212.78 m²)



Daylight dimming in large rooms

- Heating / ventilation interlock
  - Problem: the vent system can provide fresh air cooling at the same time as the heating is on
    - *Sunny winter day → fresh air cooling*
    - *Cold air in through vents → turn the heating up*
    - *Even more cold air in...*

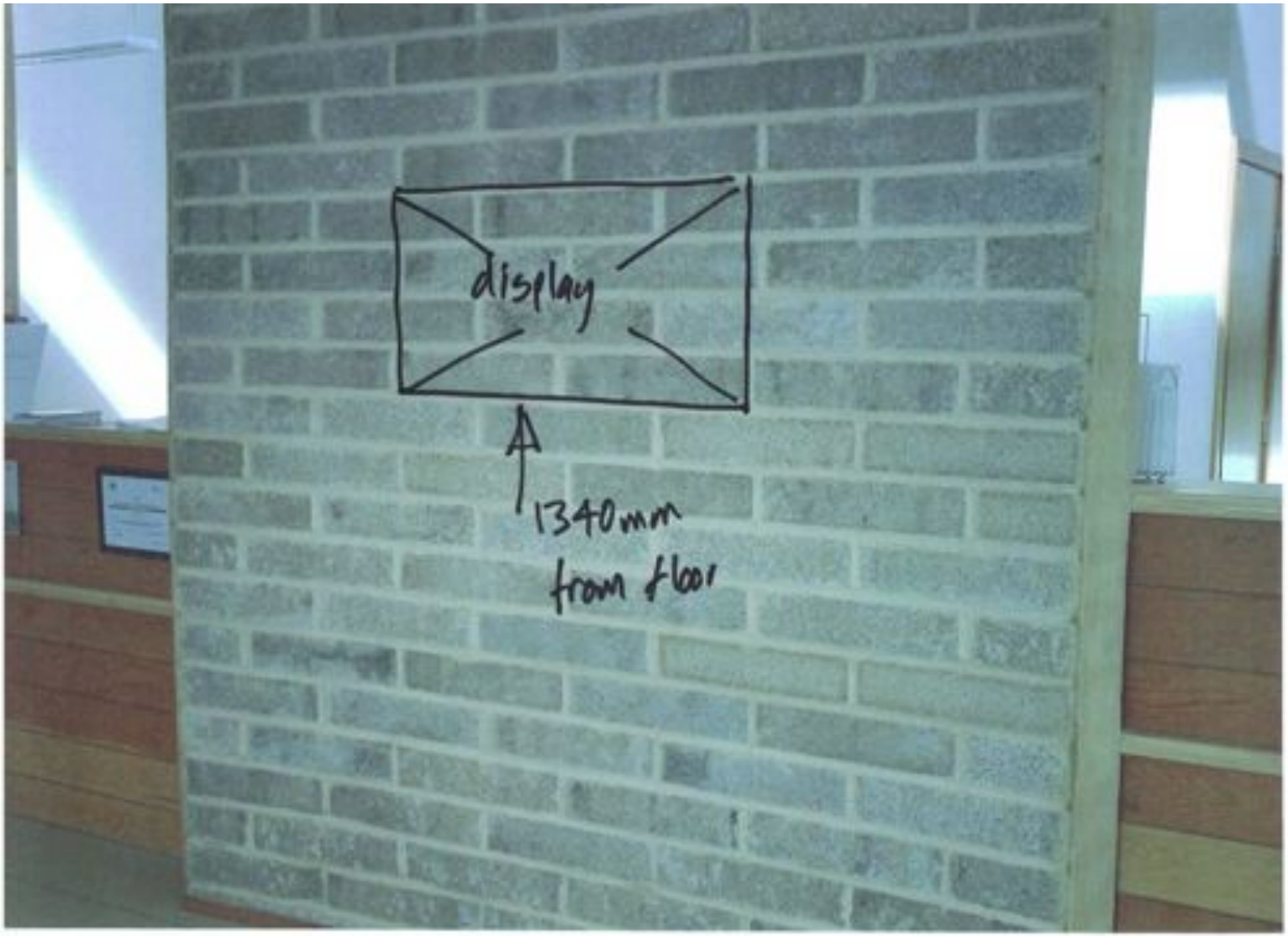
    Result: discomfort + high energy consumption

- Solution: one overall controller
  - This provided by ventilation controls – designed for duct heater, but here controls radiator zone valve
    - *Winter – vent controls set to "heating on" - won't provide fresh air cooling (summer bypass)*
    - *Summer – manual switch to "heating off" –ventilation bypasses heat recovery when warm*


T-intake : 08.0°C
T-supply : 18.5°C
T-heat : 12.6°C
T-exhaust : 11.8°C
T-outside : 07.0°C
PAUL

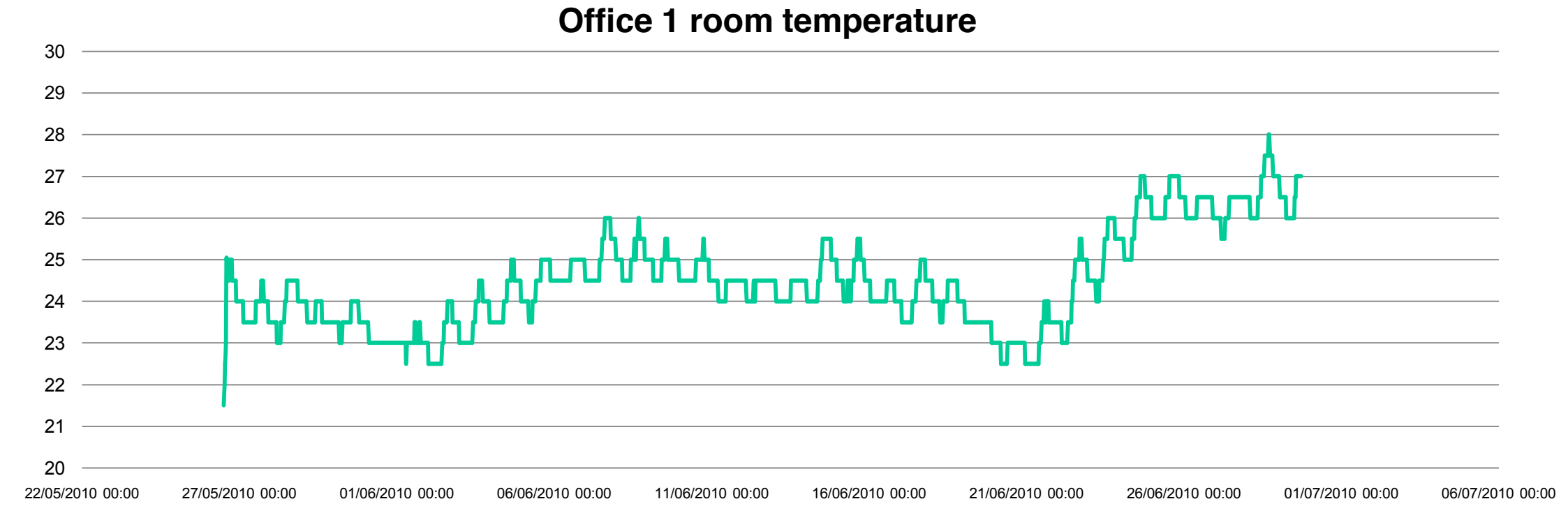
The outakes - bits that didn’t go quite right


PAUL


display
1340mm
from floor

- Problems in use
  - Drying out – the heating energy needed to dry out a just-completed wet plastered masonry structure is far more than Passivhaus heat loss
  - High electrical use – by tennant's IT equipment

- MVHR is NOT air conditioning
  - Daily swing 1.5-2C, but temp creeps up each day
  - Without night cooling this building can overheat



- What about next time?
  - Radiators again – that was easy!
  - Simpler boiler controls
  - Combi hot water – don’t use much at all
  - Simpler vent controls – and CO_2 speed control
  - No daylight dimming of lighting – just auto-off
  - ALL south windows shaded
  - Write user manual BEFORE users move in

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Intelligent Energy Europe

Centre for Disability Studies

Passivhaus Design & Delivery

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