WINDING OAK STAIRCASE & HOME

RAISED DECKING & STAIRCASE

WELSH DRESSER
My first project for a client at 12 years old

Oak flooring and stairs

OFFICE REFURBISHMENT AND COMPUTER DESK

MUM'S SALVAGED SHED a great mini architecture project

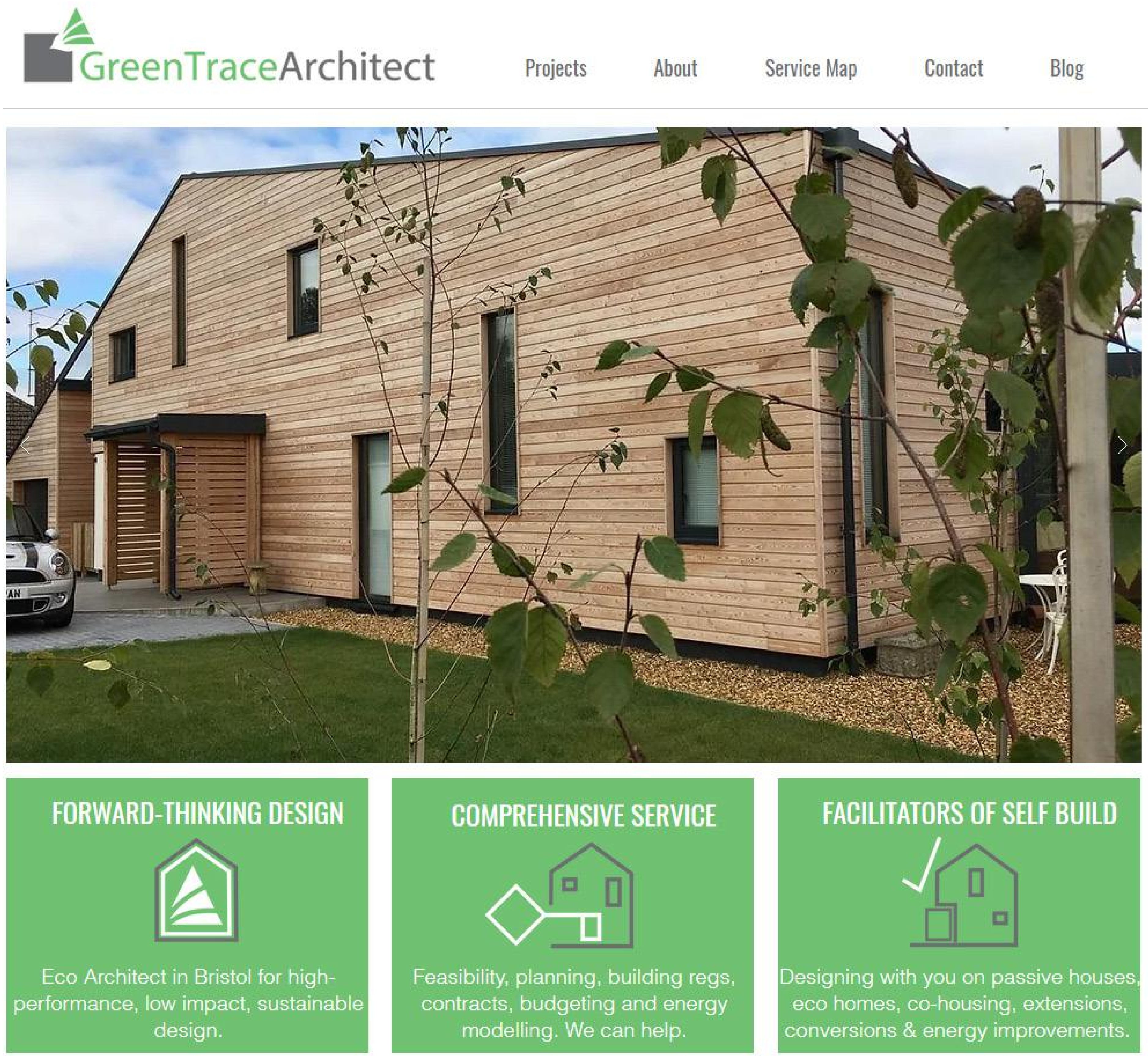
Carpentry work whilst studying architecture







Sapiens



My Practice - Greentrace Architect (founded 2019)

Why?

GreenTrace Architect is a sustainable architecture practice founded in 2019 operating in the South-West of England and beyond. The practice has one overarching aim:

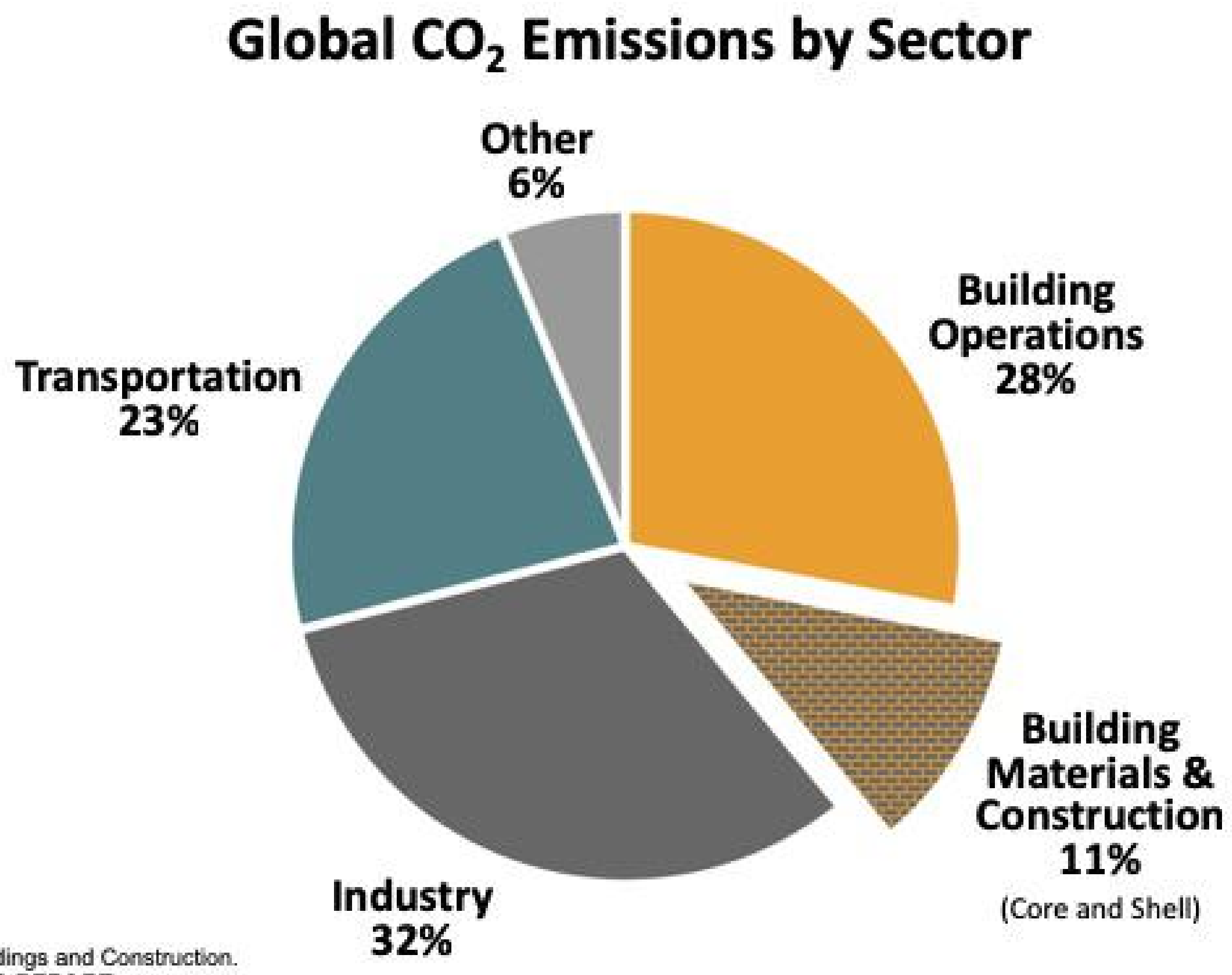
To create architecture that enables people and communities to **thrive** within the **means of the planet.**

Thrive:

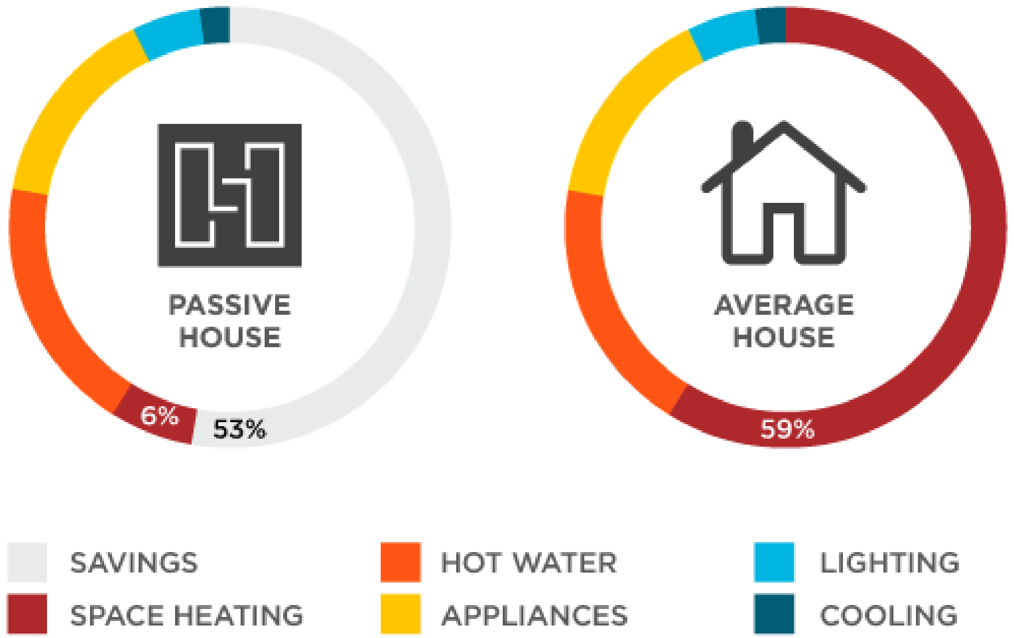
Joy, Resilience, Health, Community, Play, Creativity.

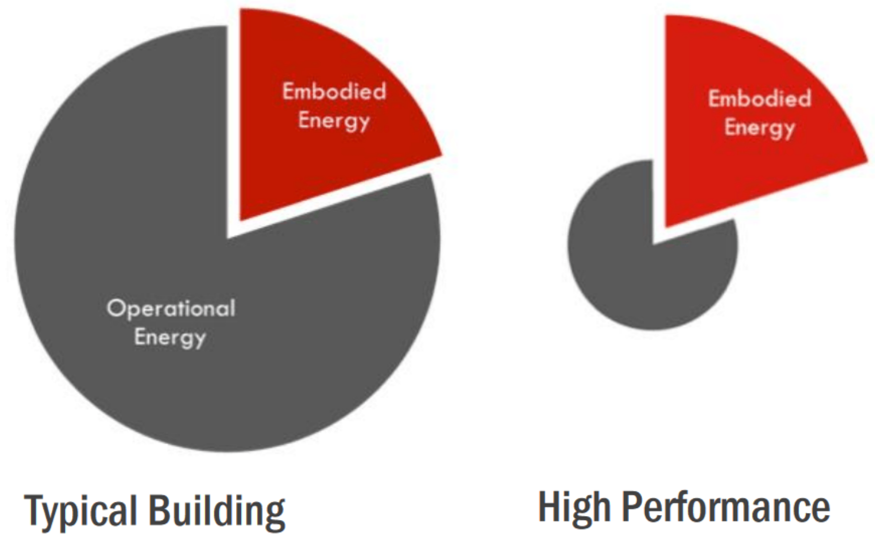
Means of the planet:

Carbon Neutral, Circular Economy, One-Planet Living, Regeneration.



Source:
Global Alliance for Buildings and Construction.
2018 GLOBAL STATUS REPORT.





Passivhaus PER is based on Treated Floor Area not GIA (slightly different calculation)

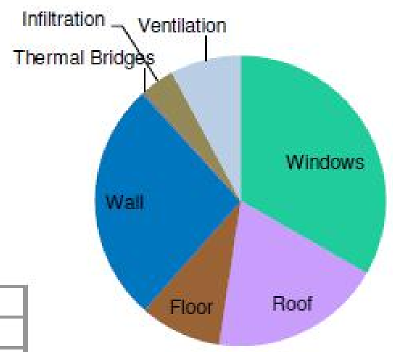
RIBA 2030 Climate Challenge target metrics for domestic / residential

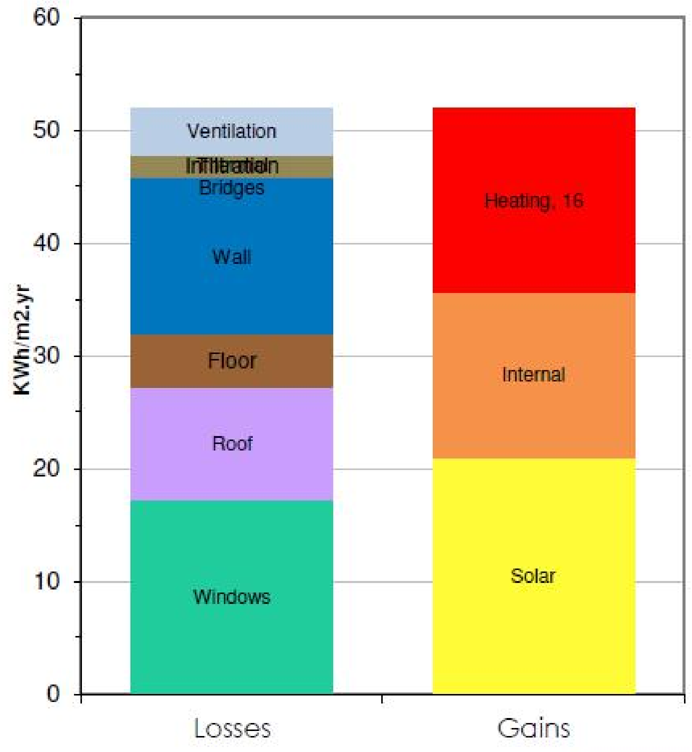
RIBA Sustainable Outcome Metrics	Business as usual (new build, compliance approach)	2025 Targets	2030 Targets	Notes
Operational Energy $kWh/m^2/y$	120 $kWh/m^2/y$	< 60 $kWh/m^2/y$ Passivhaus Classic	< 35 $kWh/m^2/y$ Passivhaus Premium (almost)	Targets based on GIA. Figures include regulated & unregulated energy consumption irrespective of source (grid/renewables). BAU based on median all electric across housing typologies in CIBSE benchmarking tool. 1. Use a 'Fabric First' approach 2. Minimise energy demand. Use efficient services and low carbon heat 3. Maximise onsite renewables
Embodied Carbon $kgCO_2e/m^2$	1200 $kgCO_2e/m^2$	< 800 $kgCO_2e/m^2$	< 625 $kgCO_2e/m^2$	Use RICS Whole Life Carbon (modules A1-A5, B1-B5, C1-C4 incl sequestration). Analysis should include minimum of 95% of cost, include substructure, superstructure, finishes, fixed FF&E, building services and associated refrigerant leakage. 1. Whole Life Carbon Analysis 2. Use circular economy strategies 3. Minimise offsetting & use as last resort. Use accredited, verifiable schemes (see checklist). BAU aligned with LETI band E; 2025 target aligned with LETI band C and 2030 target aligned with LETI band B.
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G.

Treated floor area: 96 m^2

Monthly Method Heat Balance - kWh/(m²·yr)

	Losses	Gains
Windows	17.3	
Roof	9.9	
Floor	4.7	
Wall	13.9	
	0.0	
	0.0	
Thermal Bridg	0.2	
Infiltration	1.9	
Ventilation	4.0	
Solar		20.9
Internal		14.8
Heating		16.2
Totals	*51.9*	*51.9*

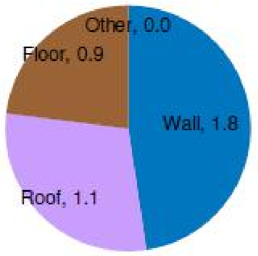




Turn off htg display? *No*

Form Heat Loss Factor (FHLF):
(What is it?)

Total: 3.71



Window Breakdown

Shading Breakdown

	Area m2 (% of wall)	Shading Winter %	Shading Summer %
North	1.6 (5% of N. wall)	67%	62%
East	13.7 (34% of E. wall)	66%	55%
South	5.8 (13% of S. wall)	51%	27%
West	5.8 (14% of W. wall)	58%	57%
Horizontal		100%	100%
Total	26.8 (10% of wall+roof)	-	-

Key: Highly shaded — Minimally shaded

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	95.6				
Space heating	Heating demand	kWh/(m²a)	14.99	≤	15	-	yes
	Heating load	W/m²	9.61	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	0	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	20		yes
Airtightness	Pressurization test result n_{50}	1/h	0.1	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)		≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	51	≤	60	60	yes
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	40	≥	-	-	

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

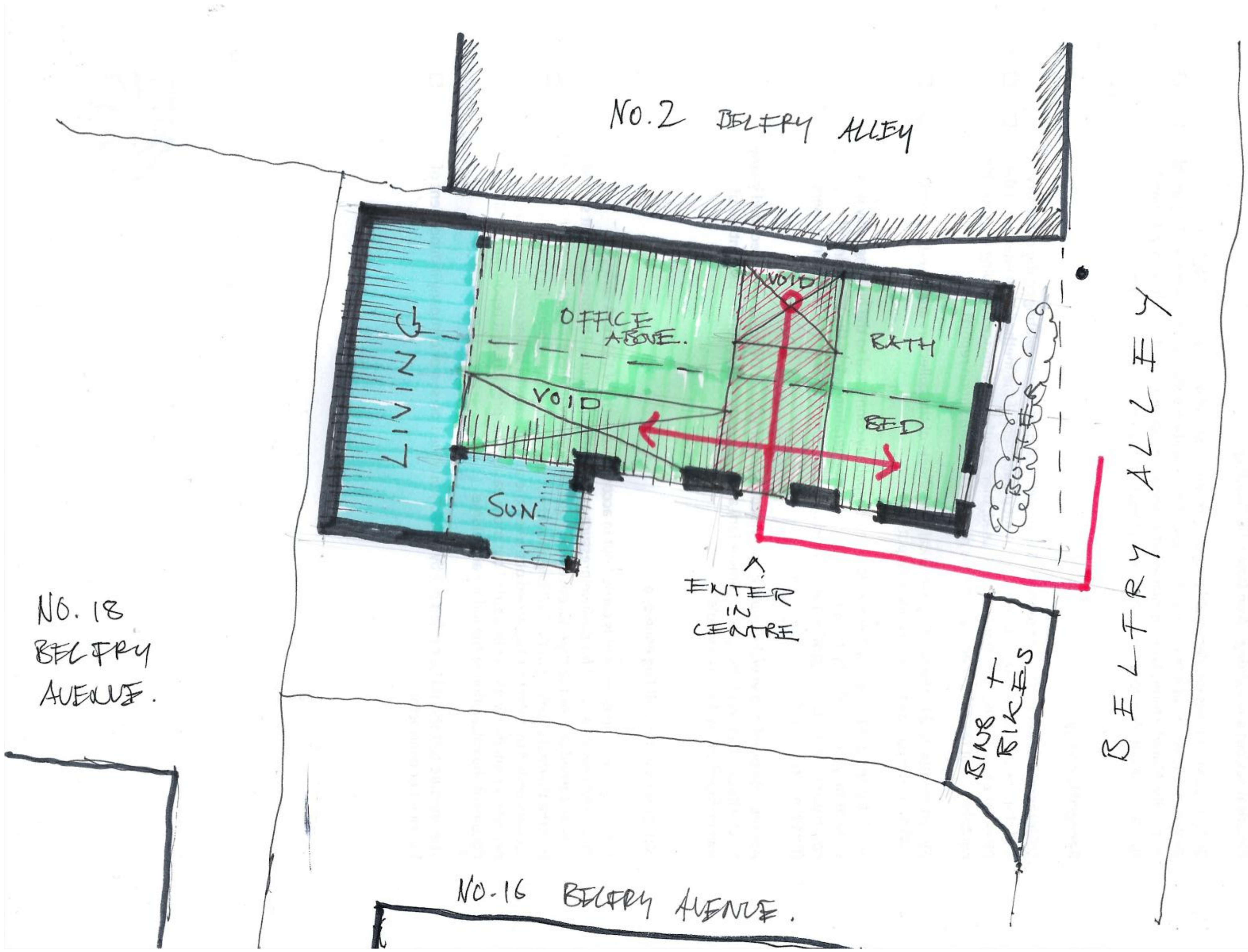
I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

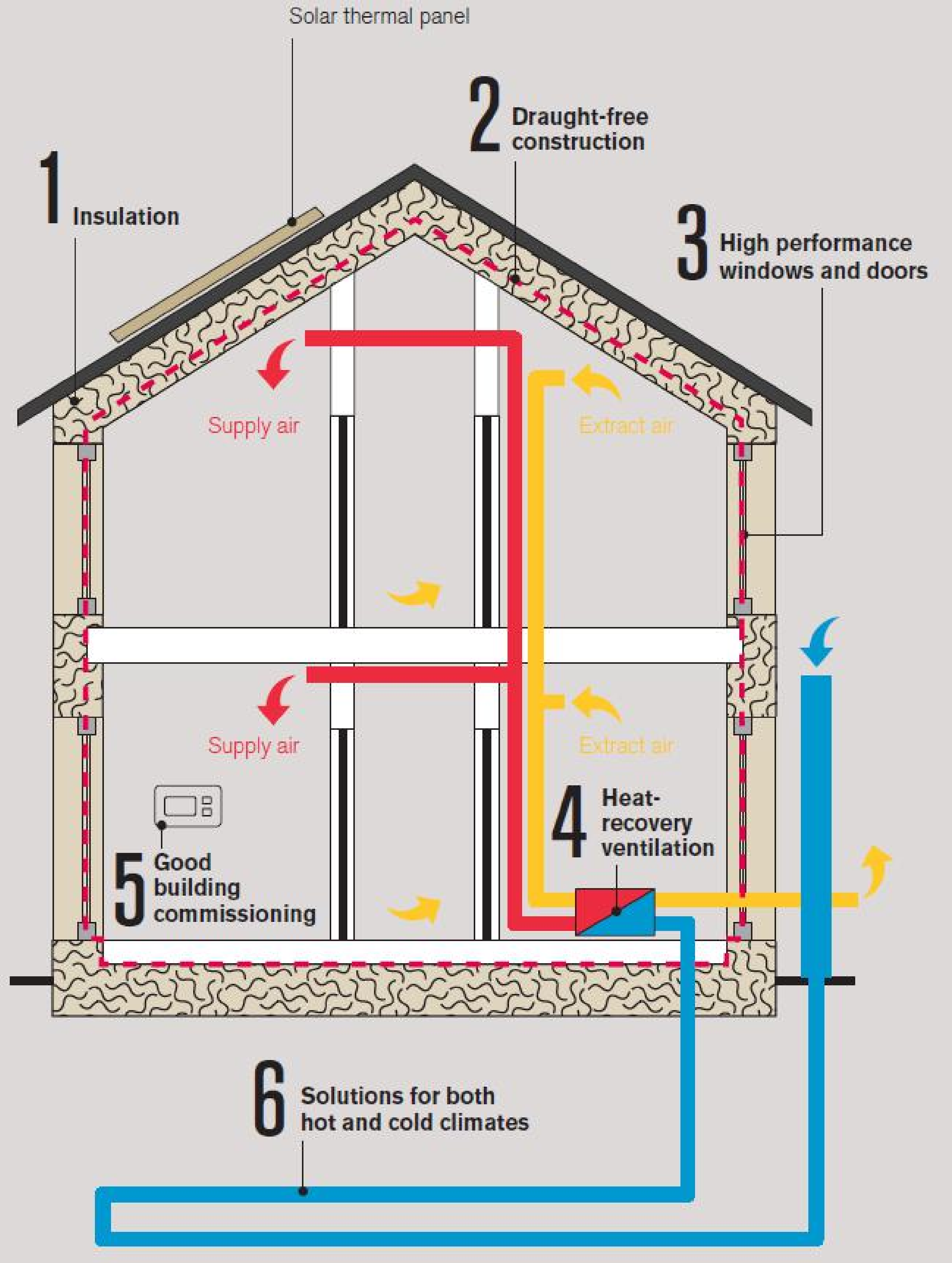
Recent project - Hazel Tree Passive House

Current Project - Bridge Farm Co-housing Community

The Site - A constrained but sustainable location



Parti diagram - Access in centre, void=light, 2 forms



Form and orientation

The thermal envelope of the building should be as simple as possible. This reduces the exposed surface area for heat loss and simplifies construction junctions. However, the thermal envelope is often different to the visual massing and is defined by a continuous insulation line enclosing all warm spaces in the building.

The orientation and massing of the building should be optimised to allow solar gains and prevent significant overshadowing in winter.

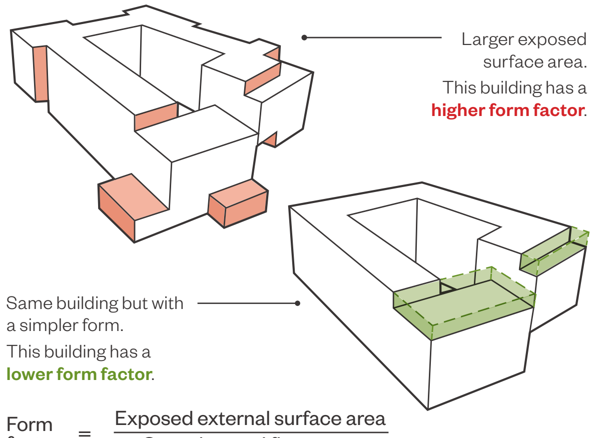
1 Compact building massing

Decreasing the surface area of the building results in reduced heat loss and therefore less energy consumption for space heating. This can be quantified by the form factor.

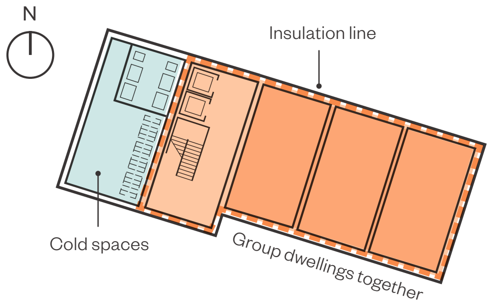
The lower the form factor the more energy efficient the building is. A form factor of below two is typically expected for a mid-rise apartment building.

Join homes into terraces and simplify the form of apartment buildings where possible.

Be strategic about adding articulation to the building form. Emphasise a few key design features that really matter in the context. The fewer stepped roofs, roof terraces, overhangs and inset balconies, the lower the heat loss from the building.



$$\text{Form factor} = \frac{\text{Exposed external surface area}}{\text{Gross internal floor area}}$$



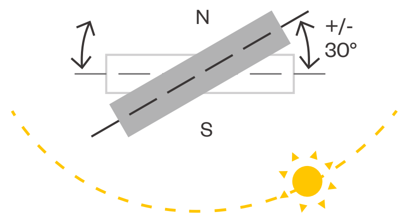
2 Space for unheated facilities

Keep cold spaces, such as bin/bike stores and substations, separate or towards the north end of buildings where possible. Group cold spaces rather than pepper-potting them across the ground floor.

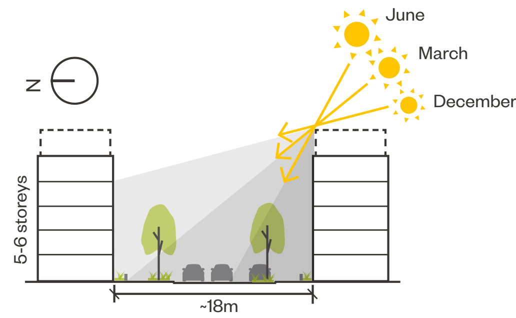
When these spaces are neighbouring a warm part of the building, such as a dwelling, the party wall and separating floor above need to be highly insulated.

Draw the insulation and airtightness line around dwellings early and consider whether circulation space should be within or outside of the insulated volume.

3 Heat from the sun in winter

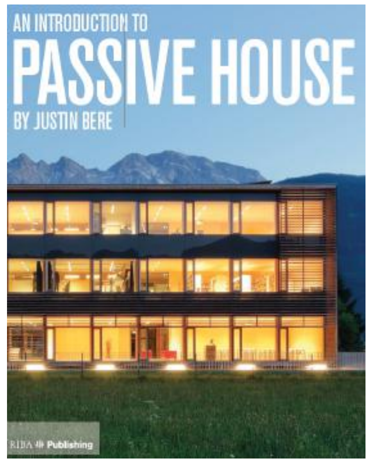


Prioritise dual aspect, south-facing dwellings. Overheating risk increases proportionally as the building faces away from due south. Anything beyond +/- 30° is no longer a south-facing façade.



Avoid overshadowing of buildings, this reduces the heat gain from the sun in winter. Allow 1-1.5m of distance for every 1m of height.

SOURCE:



SOURCE:

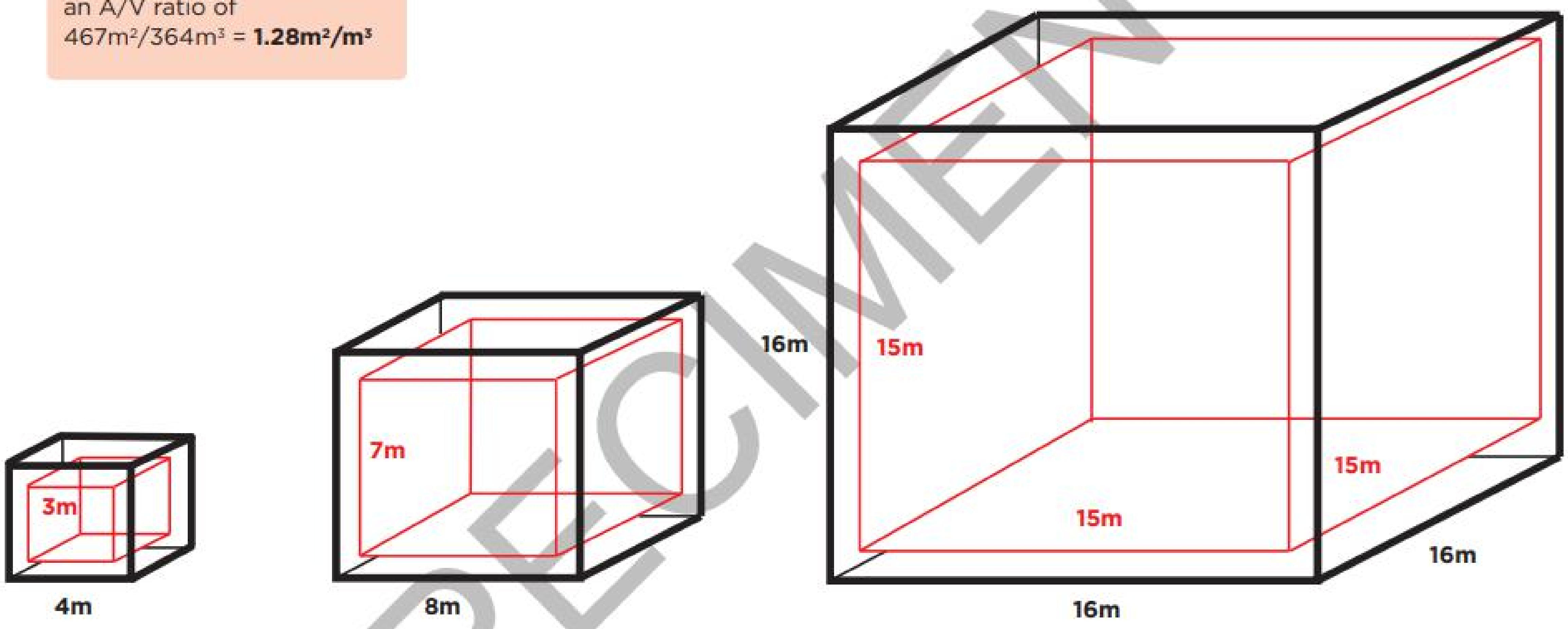
Principles of a low-energy home

Form Factor

The more compact the building, the less energy it will require.

Ratio of the external building envelope to the internal volume (A/V ratio).

Our case study house has an A/V ratio of $467m^2/364m^3$ = **$1.28m^2/m^3$**



Small cube

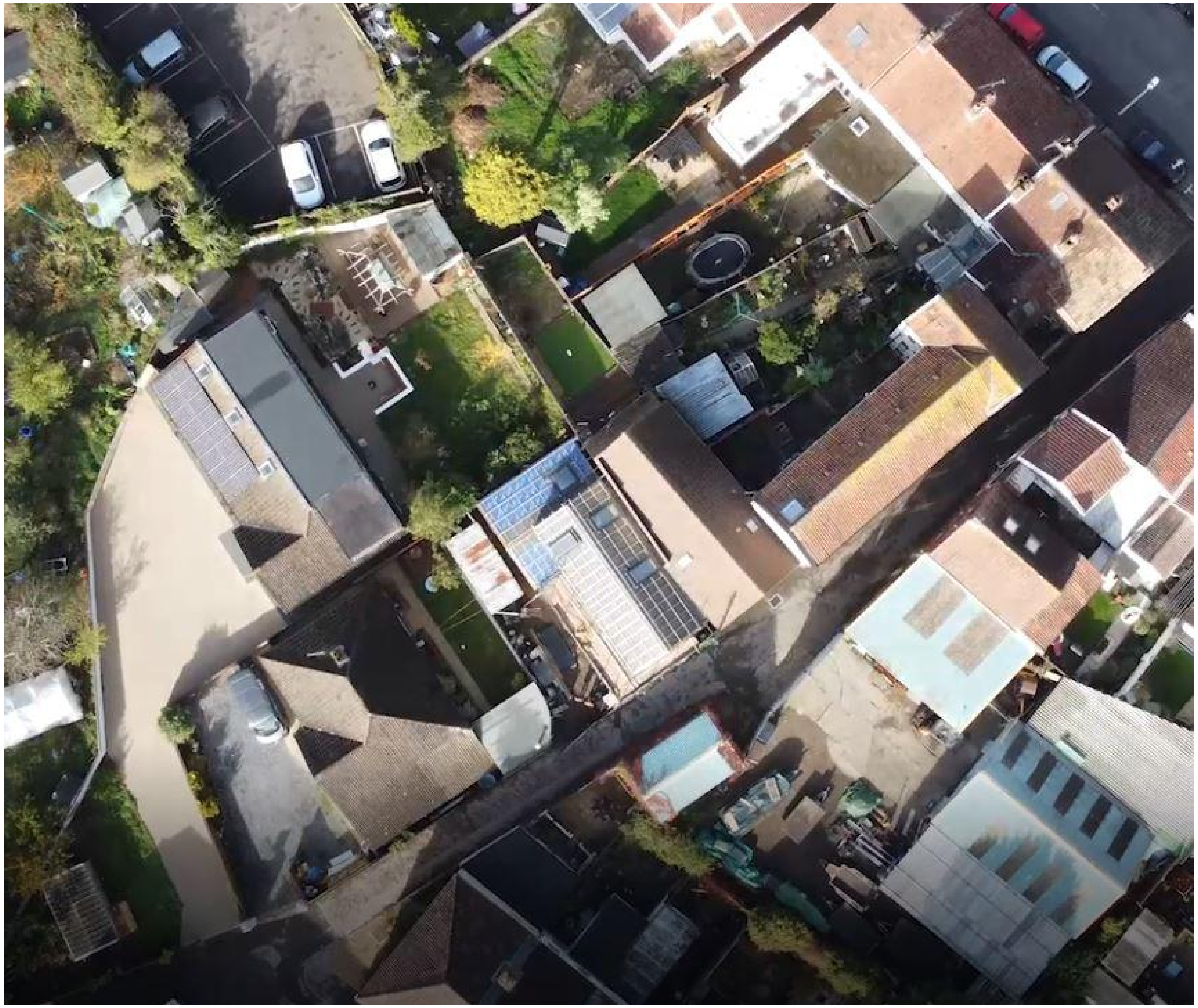
External surface area = $96m^2$
Internal volume = $27m^3$
A/V ratio = $3.6m^2/m^3$

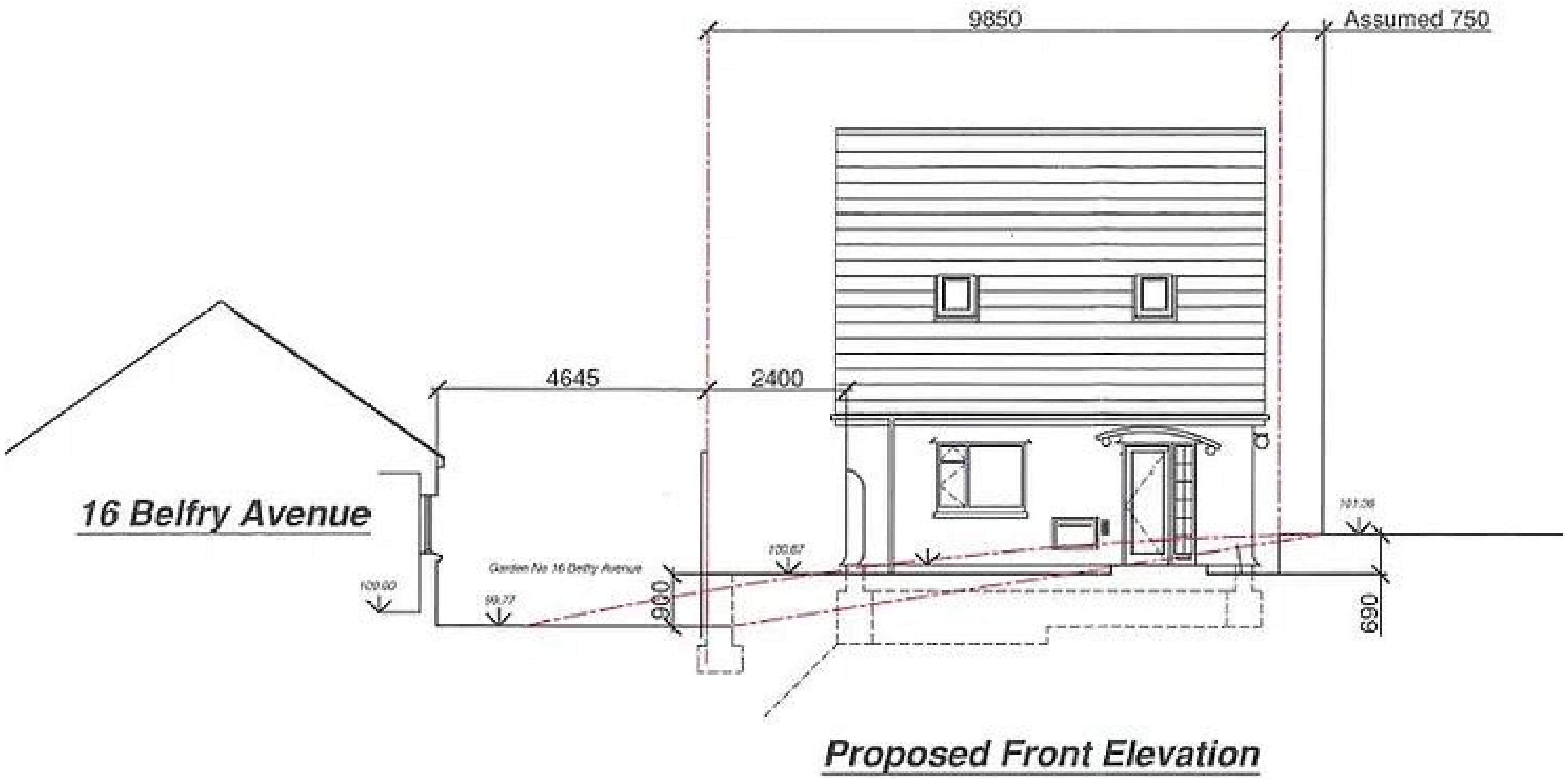
Medium cube

External surface area = $384m^2$
Internal volume = $343m^3$
A/V ratio = $1.1m^2/m^3$

Large cube

External surface area = $1536m^2$
Internal volume = $3375m^3$
A/V ratio = $0.46m^2/m^3$

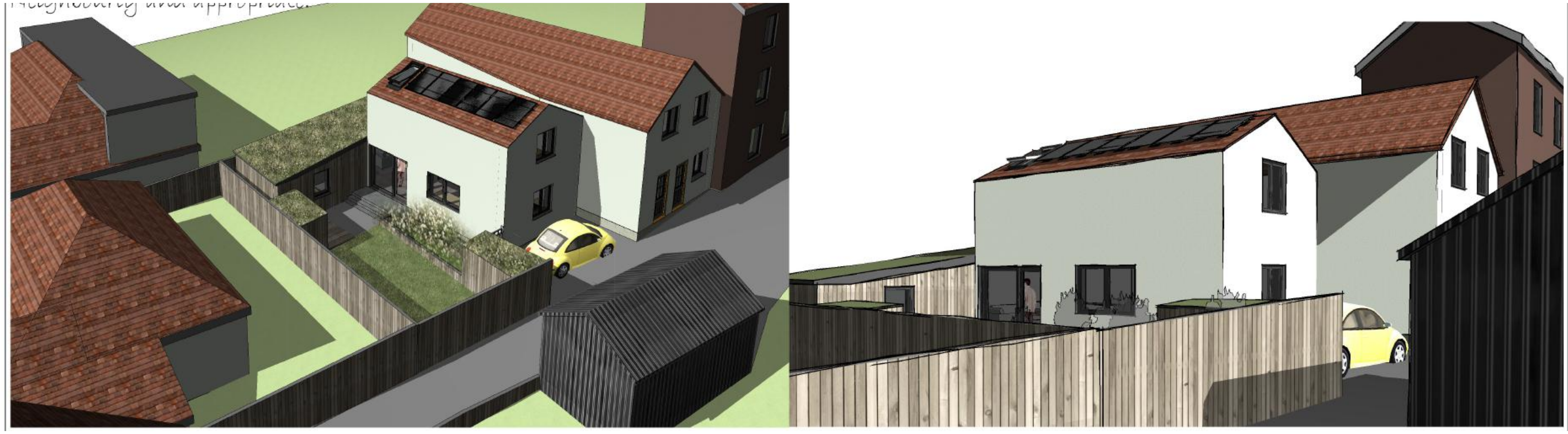




Failed planning permission - draughtsperson drawing...

REFUSED DESIGN (not mine)

- Overlooking
- Overbearing
- Overshadowing
- Daylight to no.16
- Solar panels?
- Loss of garden
- Odd relationship
- Awkward Parking



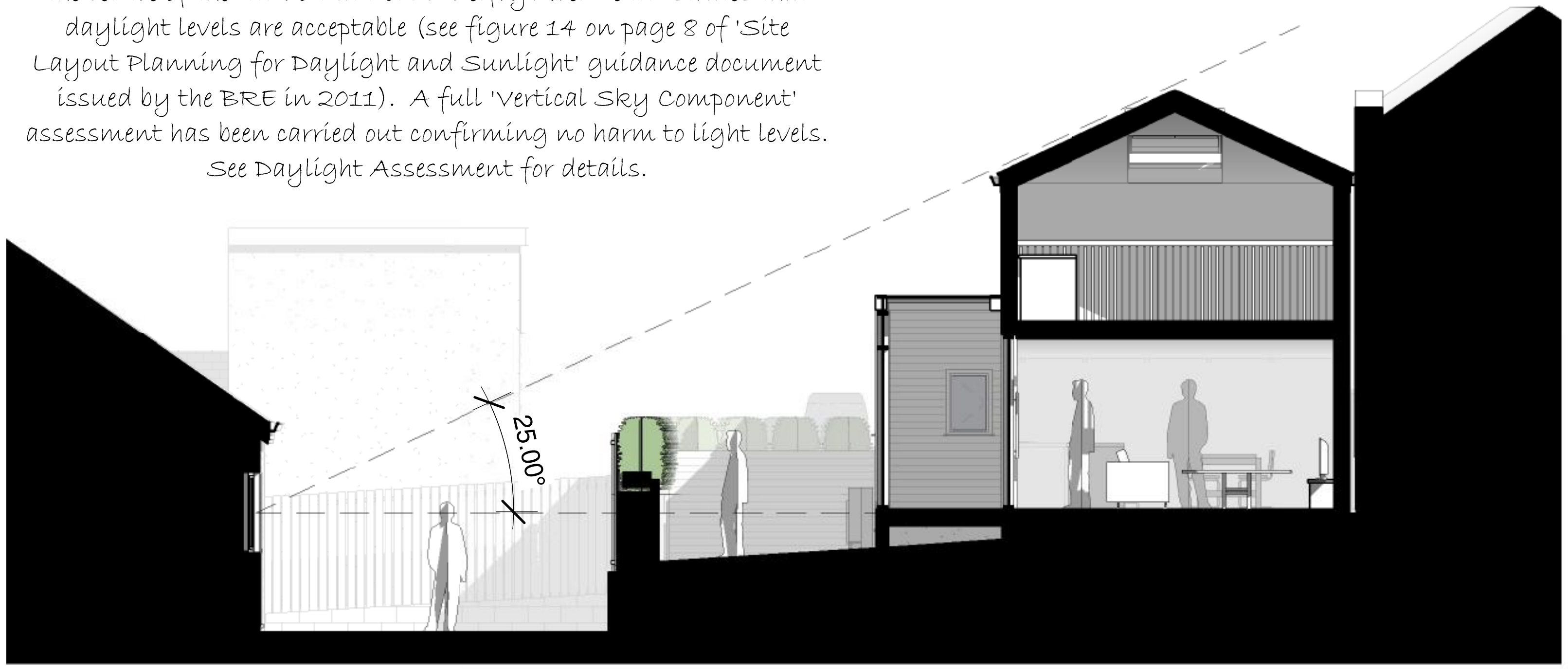
PRE-APP DESIGN

- No overlooking
- Fits in snug
- Reduced shadows
- Daylight to no.16 OK
- Solar orientation
- 50% garden
- Rain garden
- No parking
- POSITIVE RESPONSE!

Planning permission Granted in October 2022

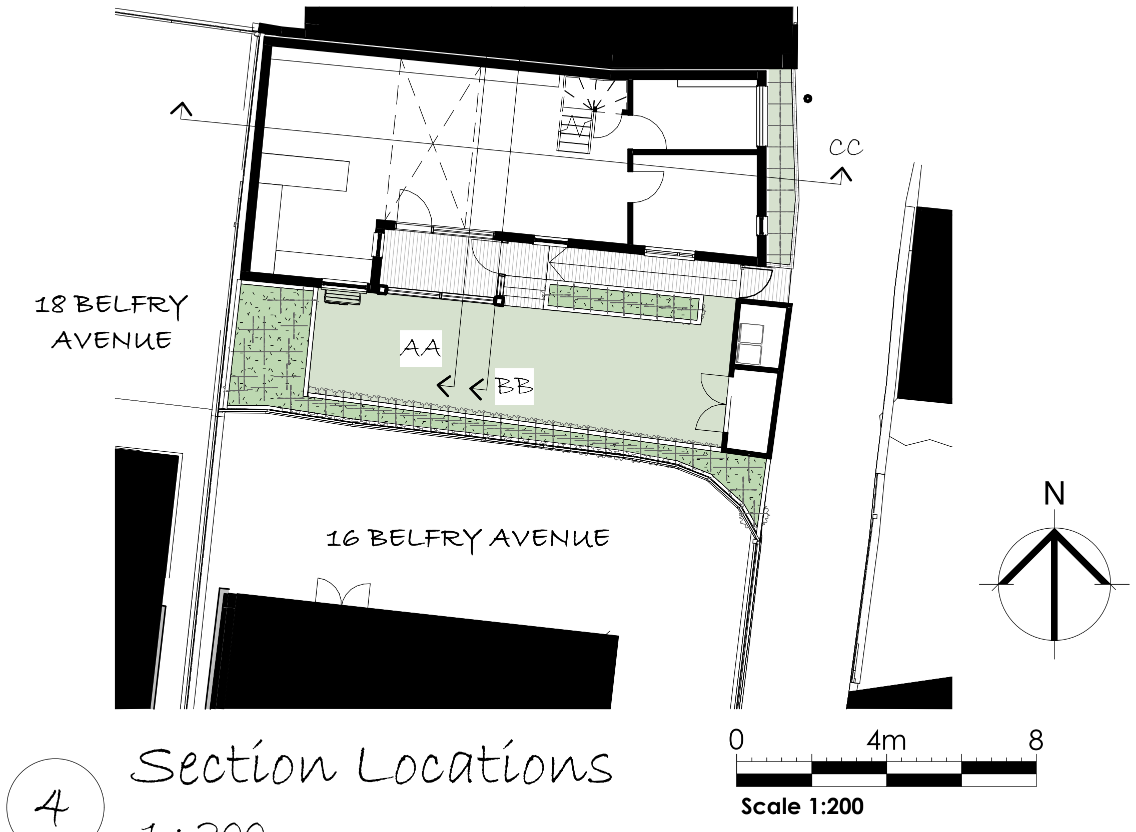
DAYLIGHT FOR 16 BELFRY AVENUE

Applying the BRE daylight test using a 25 degree line taken from the centre of the window at no. 16 Belfry Avenue illustrates that daylight levels are acceptable (see figure 14 on page 8 of 'Site Layout Planning for Daylight and Sunlight' guidance document issued by the BRE in 2011). A full 'Vertical Sky Component' assessment has been carried out confirming no harm to light levels. See Daylight Assessment for details.



1 Section AA

1 : 100

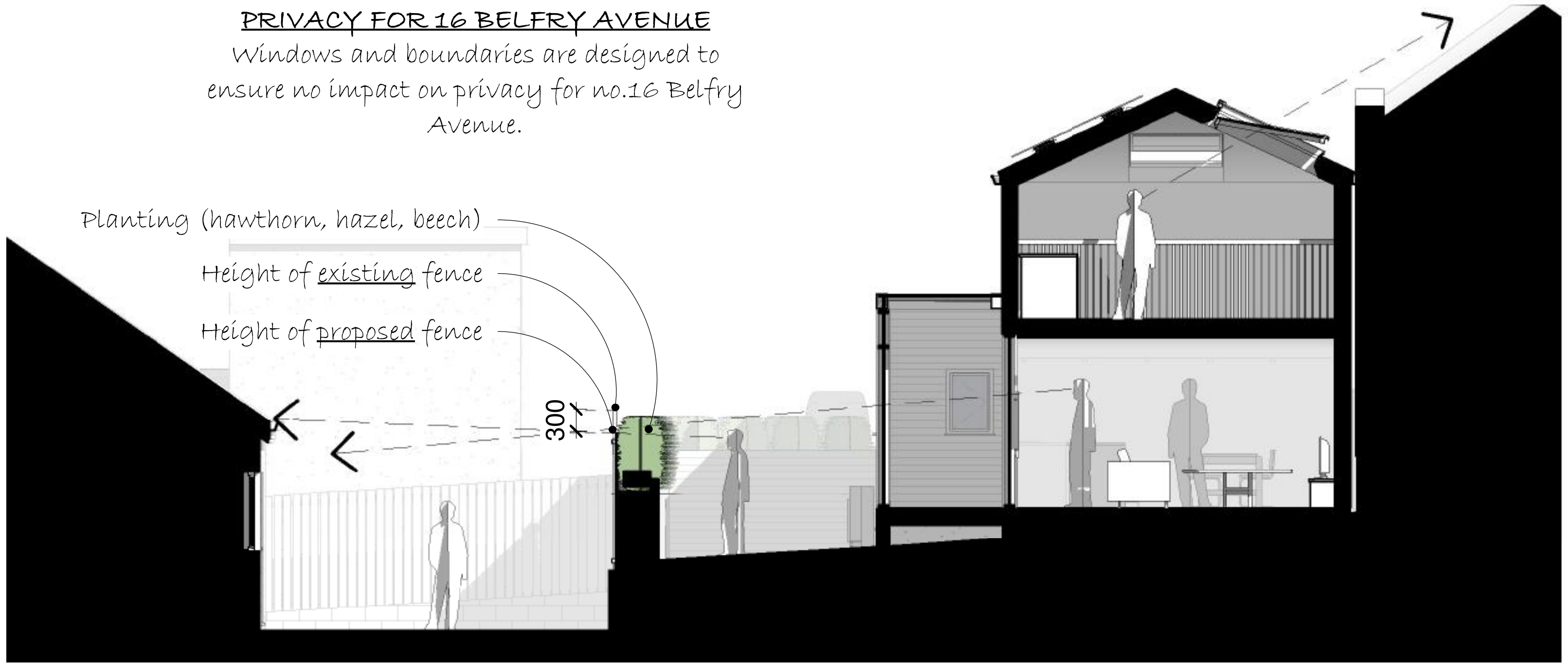


4 Section Locations

1 : 200

PRIVACY FOR 16 BELFRY AVENUE

Windows and boundaries are designed to ensure no impact on privacy for no.16 Belfry Avenue.

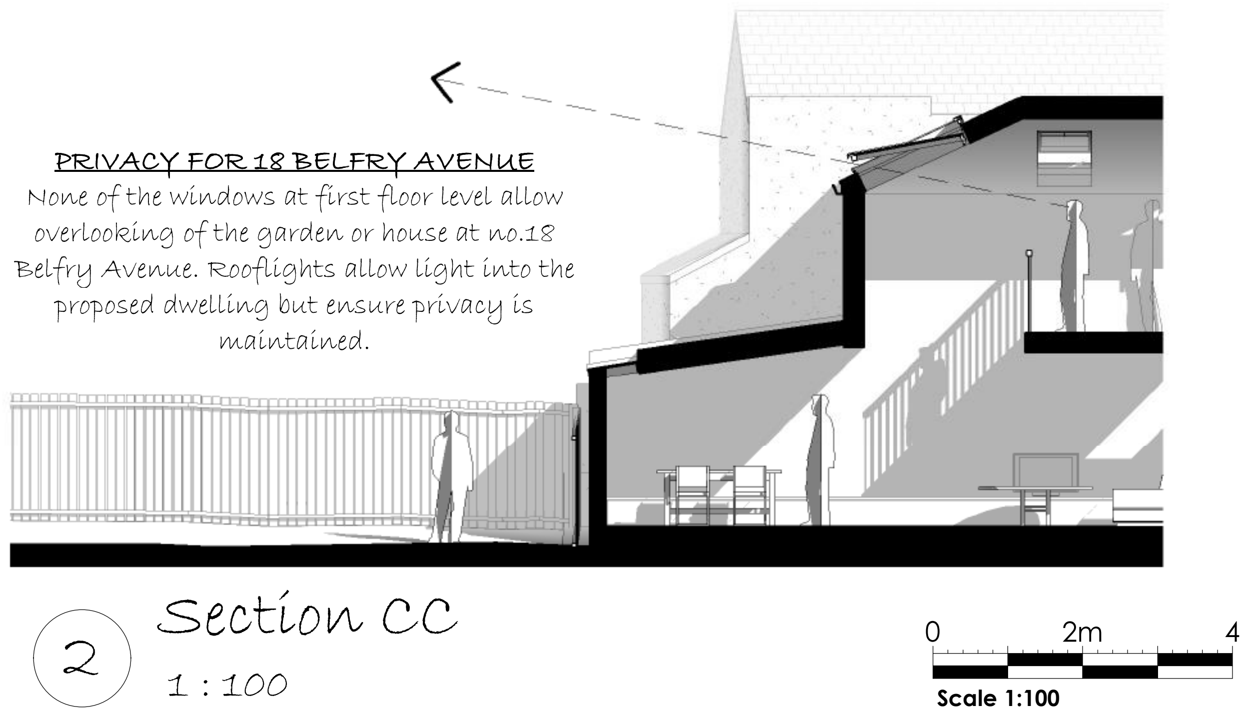


3 Section BB

1 : 100

PRIVACY FOR 18 BELFRY AVENUE

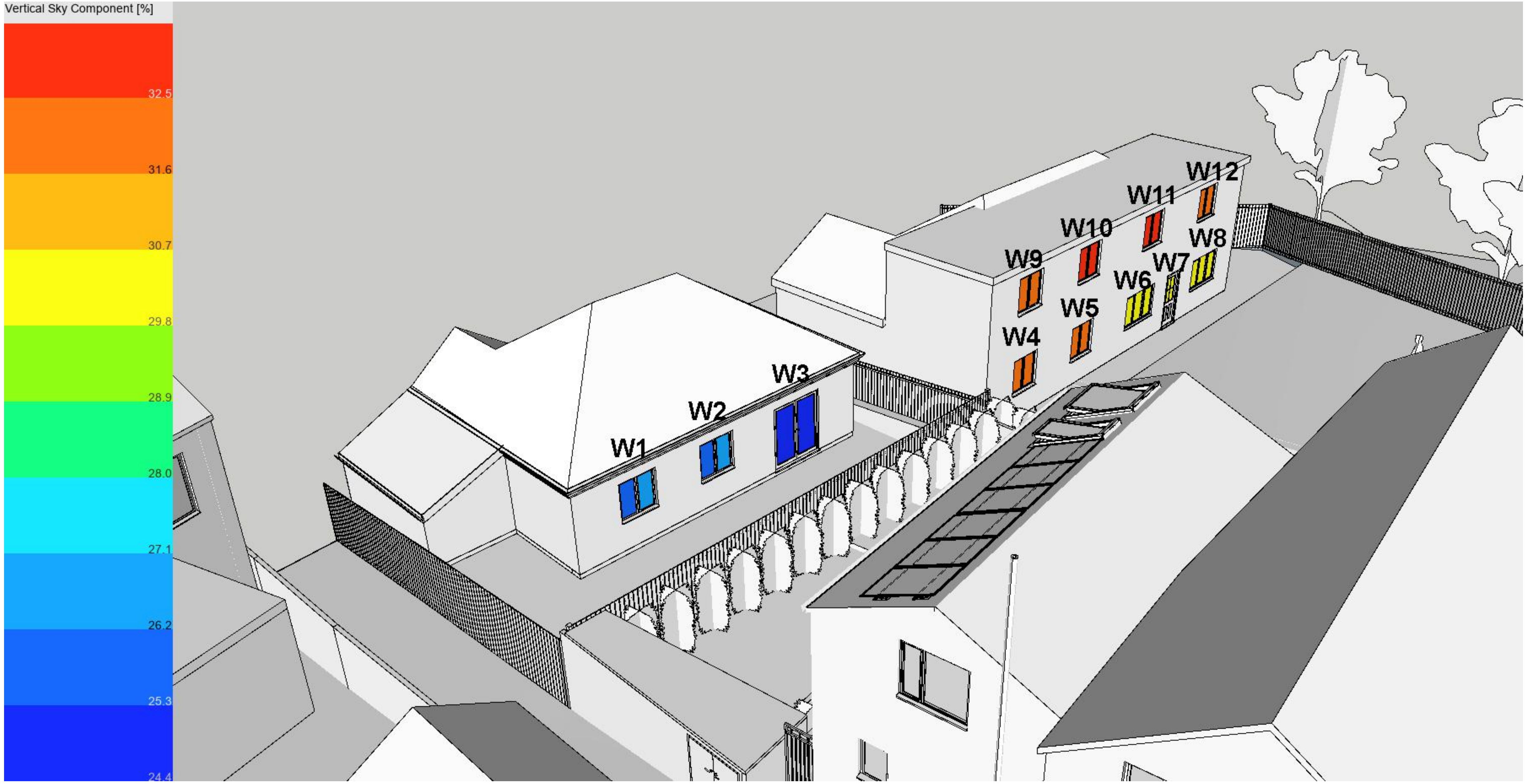
None of the windows at first floor level allow overlooking of the garden or house at no.18 Belfry Avenue. Rooflights allow light into the proposed dwelling but ensure privacy is maintained.



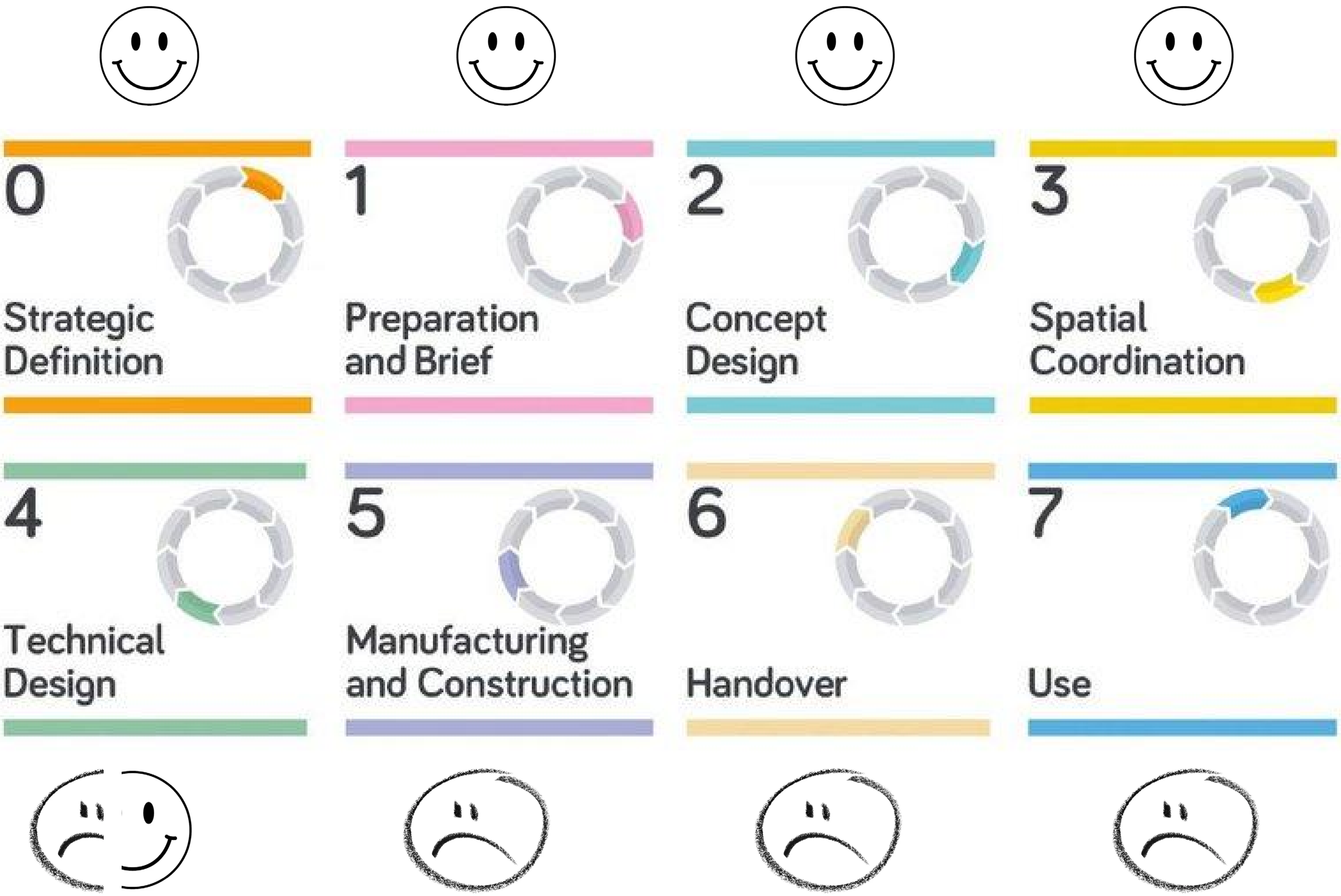
2 Section CC

1 : 100

Daylight, privacy, overshadowing, etc...



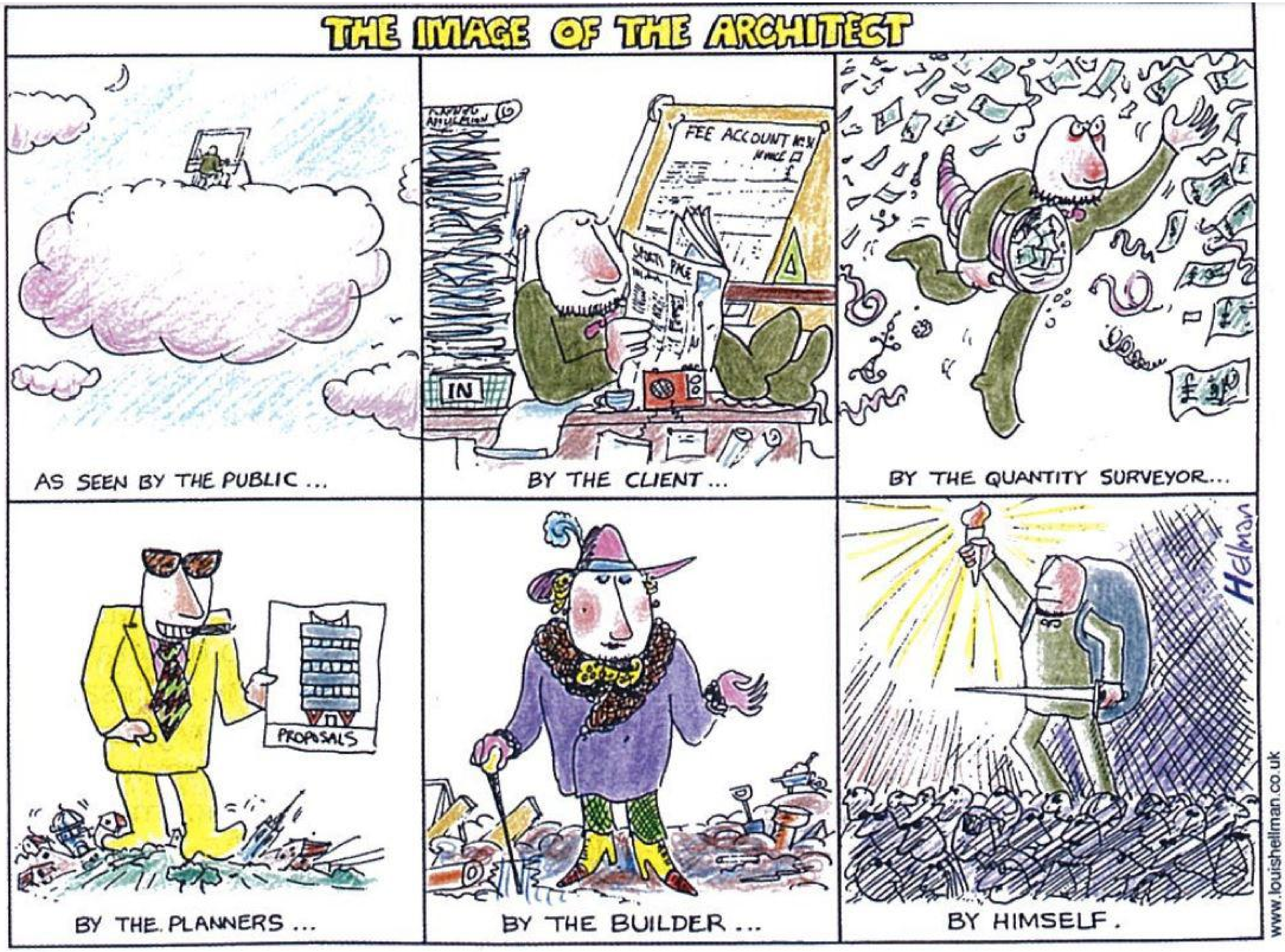
A measure of the amount of sky visible from a given point.
DL-LIGHT plugin for Sketchup (by DeLeminae)

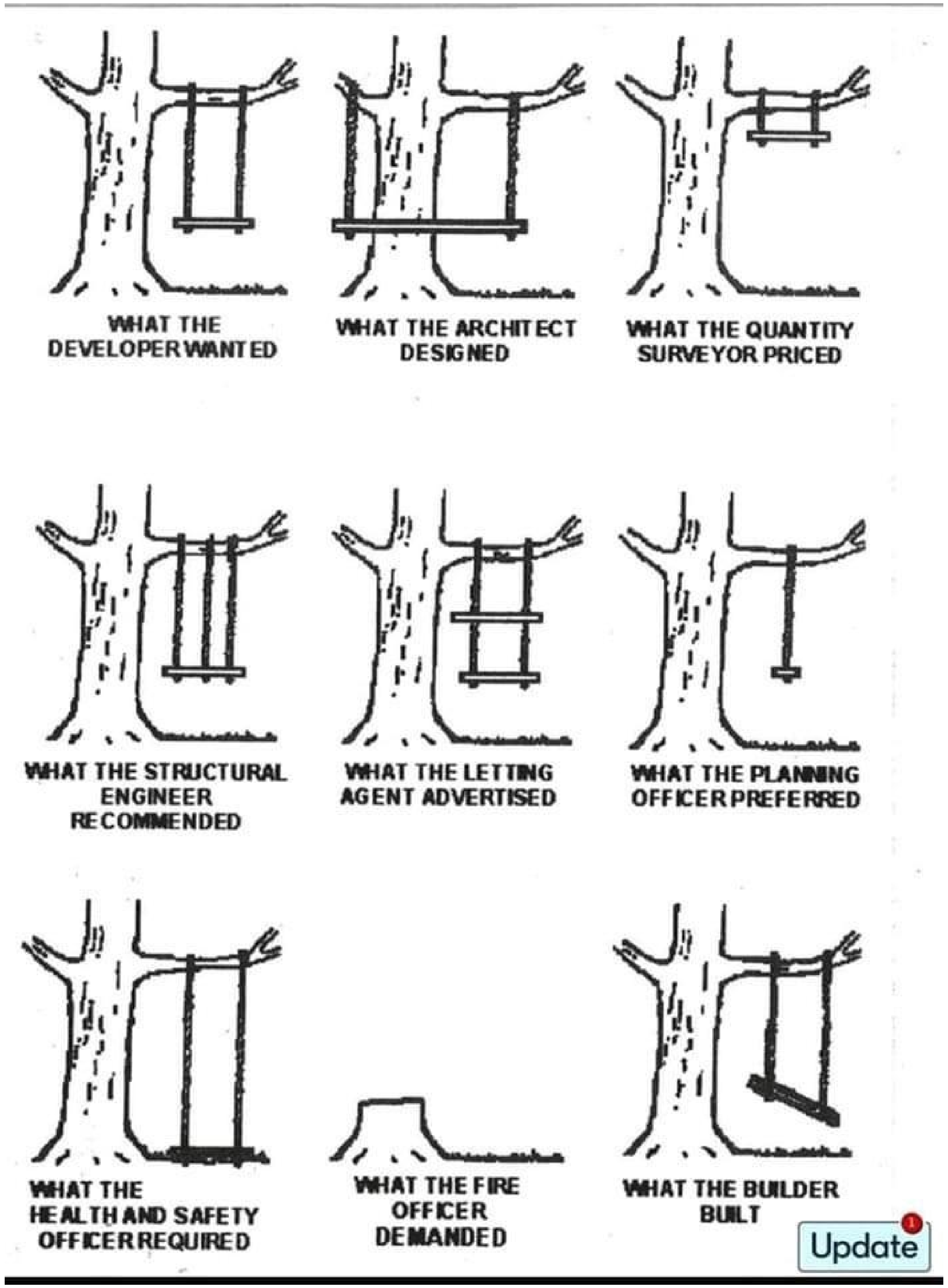


How much design does/ should the builder do?

How well does the building perform and what can we learn for next time?

RIBA plan of work - less experience in later stages


THE IMAGE OF THE ARCHITECT
AS SEEN BY THE PUBLIC ...
FEE ACCOUNT
SPORTS PAGE
IN
BY THE CLIENT ...
BY THE QUANTITY SURVEYOR...
PROPOSALS
BY THE PLANNERS ...
BY THE BUILDER ...
Hellman
BY HIMSELF.
www.louishellman.co.uk



- Builders dubious of architect's construction knowledge.
- We need to add value at all scales and stages of a project.
- We lack 'on the ground' building knowledge – danger of having our head in the digital cloud.
- This puts architects at risk - mistakes and/or reduced responsibilities in the profession

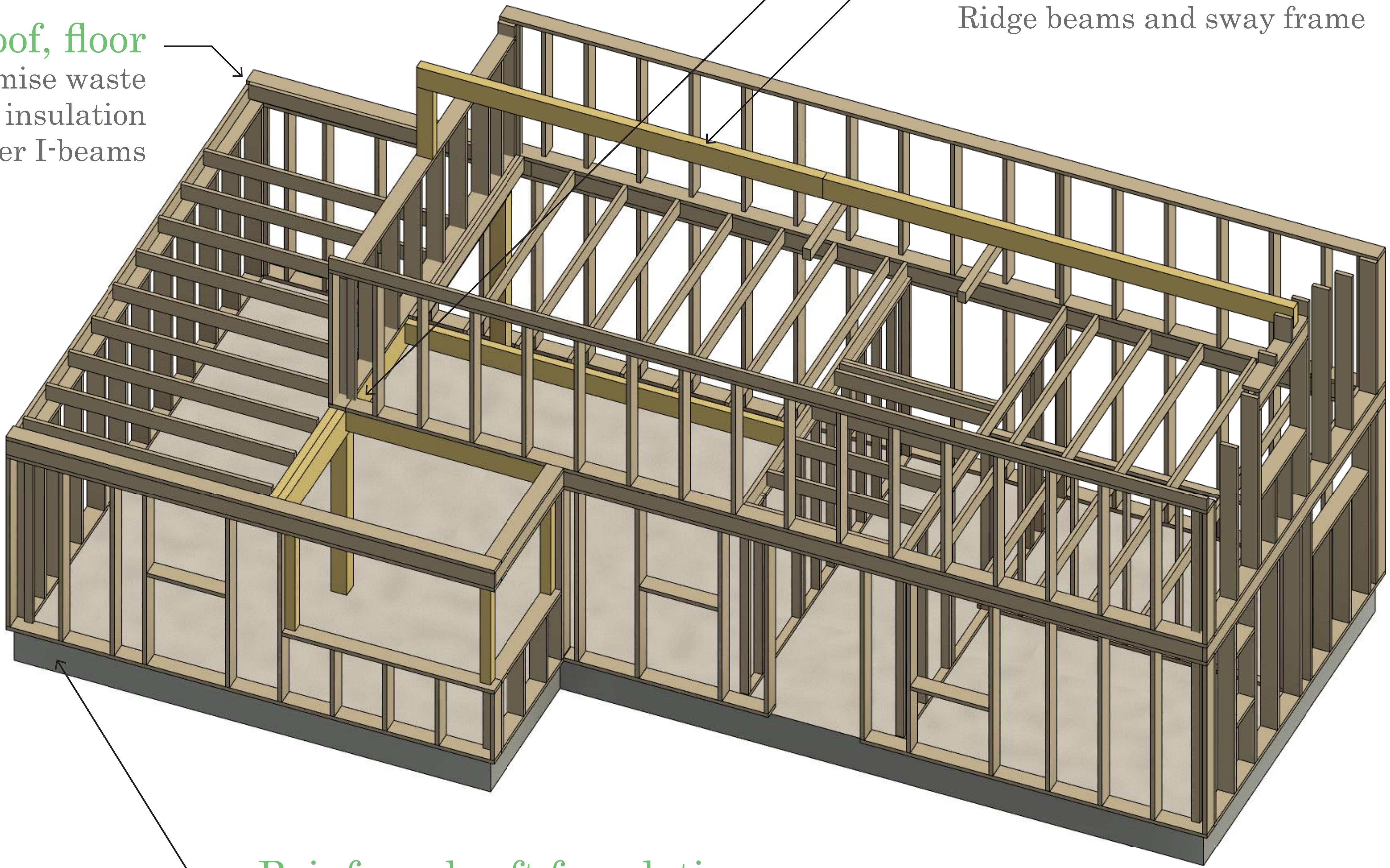
How to solve this?

- Use typical construction methods and don't deviate… not my style
- Draw/specify as little as possible…not my style
- Seek as many opinions as possible
- Post occupancy analysis
- **Ultimately, build a house and live in it**

Glulam primary structure

Timber walls, roof, floor
All the same to minimise waste
195mm deep for insulation
cheaper than timber I-beams

Glulam primary structure
Ridge beams and sway frame

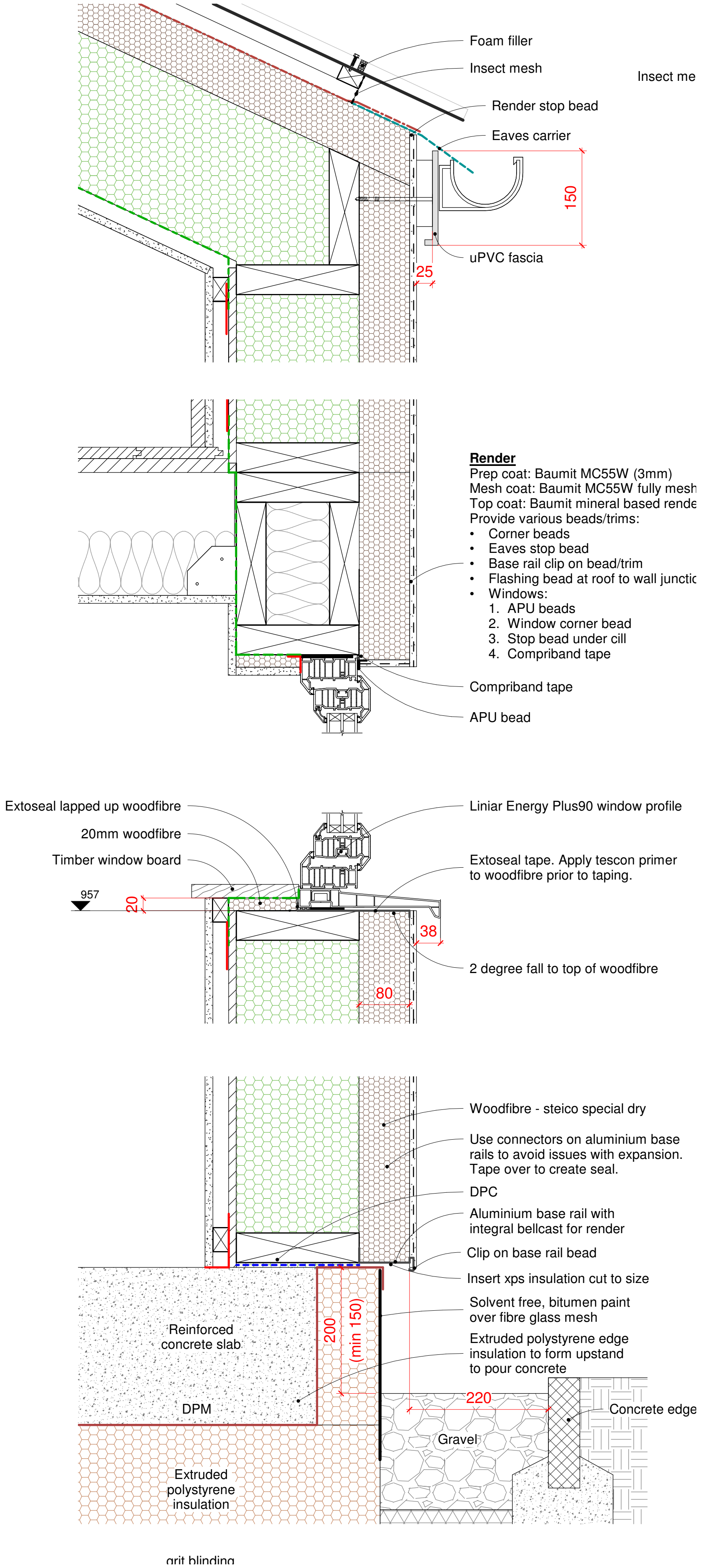


Reinforced raft foundation

- Navigates potential coal mining issues
- No Party Wall Agreement required (excavations no deeper than neighbouring foundations
- Can withstand heave caused by volume change potential of soil due to the close soakaway

With thanks to...

ELEMENT STRUCTURES



Airtight, thermal bridge free, breathable, natural, low carbon

ROOF

- SAME AS WALL apart from;
- Profiled steel sheets
- Batten & counter batten
- Diffusion variable vapour check & airtightness membrane (Intello)

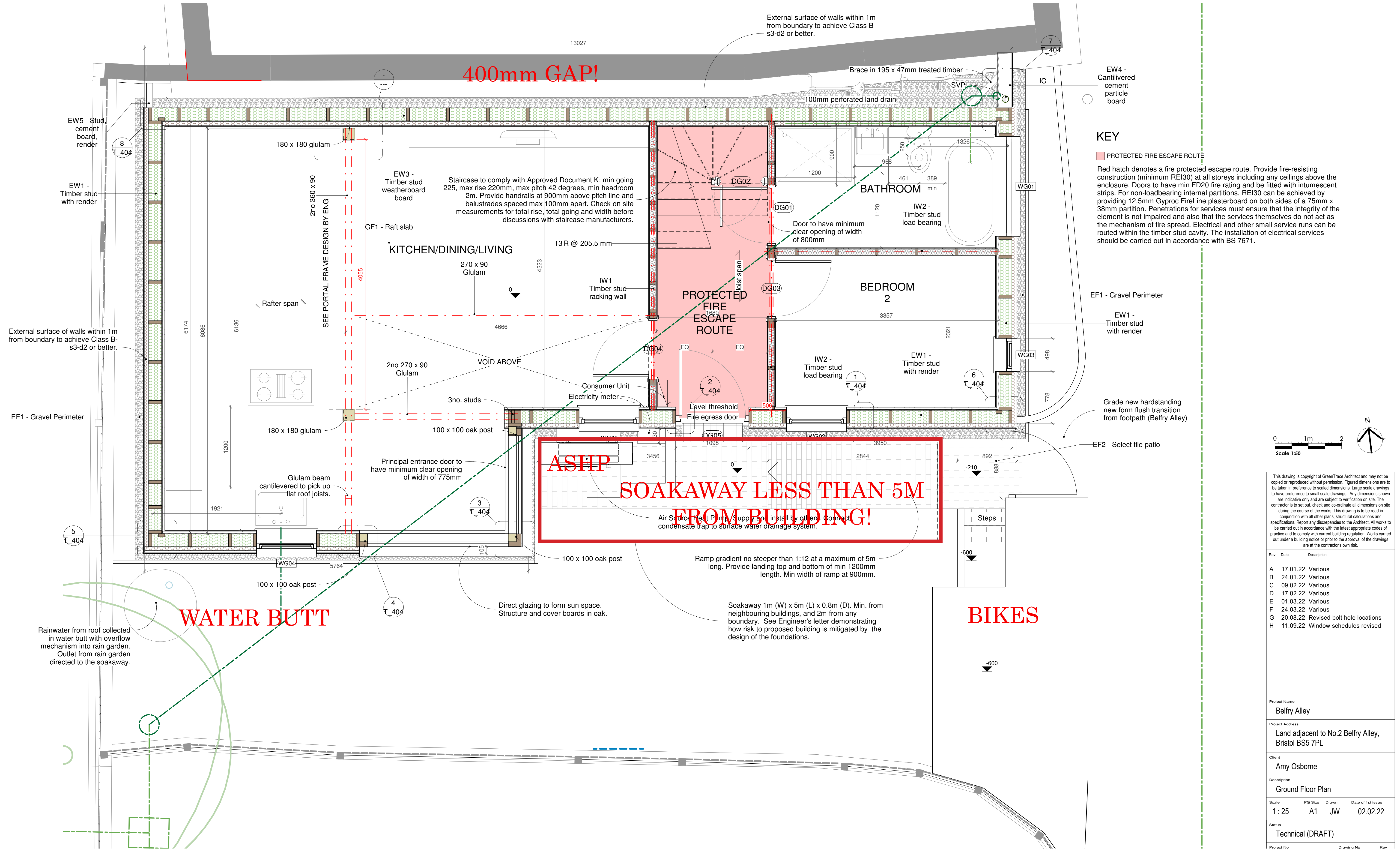
SOURCE: The PH15 system

WALL

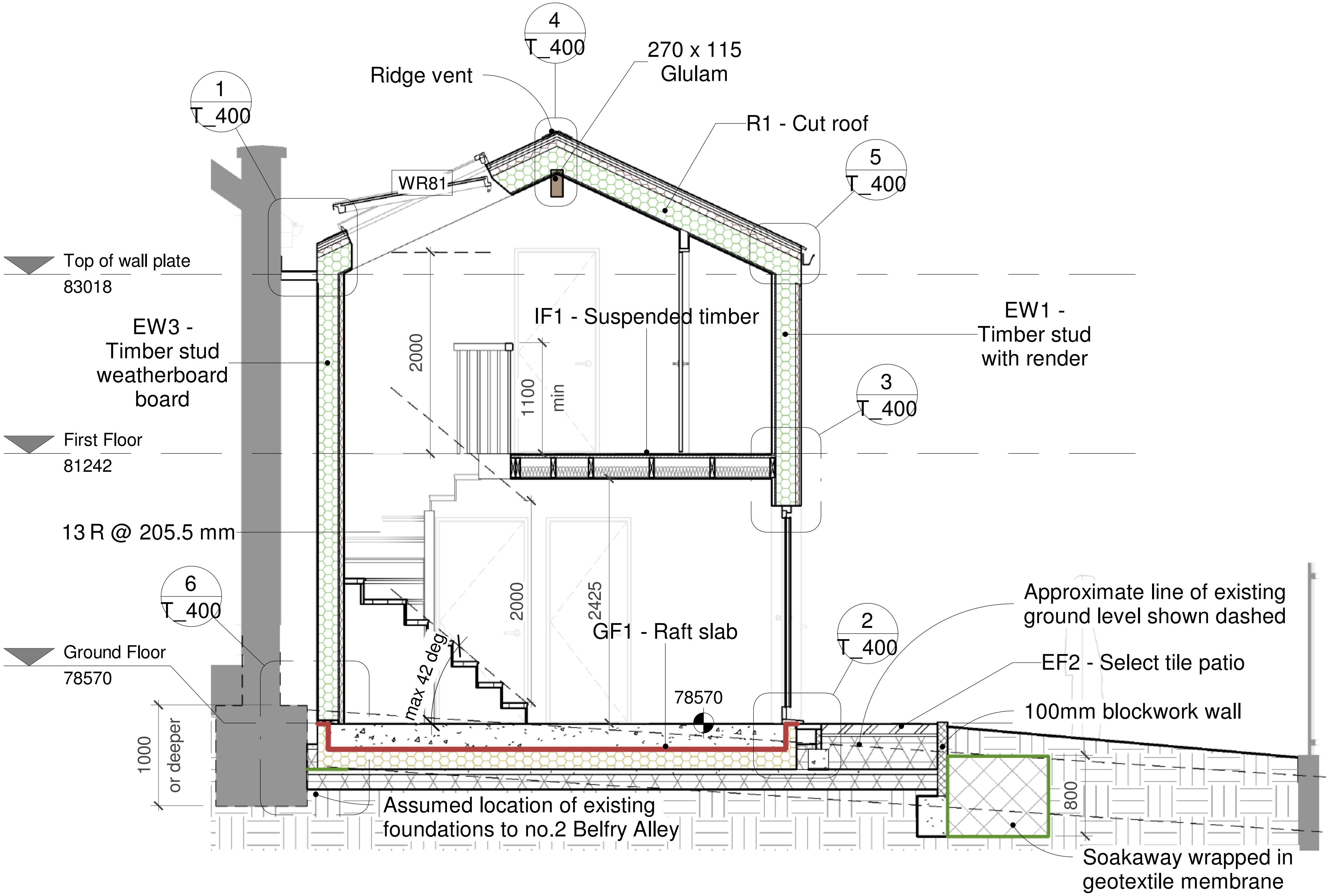
- 11mm lime plaster (Baumit MC55W & SilikonTop)
- 80mm wood fibre external insulation (Steico Protect)
- 195mm timber studs & rafters @ 600cc
- Blown cellulose insulation infill (recycled paper)
- 12.5mm Durelis Vapourblock airtight sheathing board and tape
- 25mm service void and plasterboard over

FLOOR

- 250mm reinforced concrete raft slab foundation (finished floor)
- 200mm thick extruded polystyrene (100mm thick slab edge)



Ground Floor Plan - Just about fits in with soakaway!



Section - showing soakaway and neighbours foundations

RIBA 2030 Climate Challenge

RIBA 2030 Climate Challenge target metrics for domestic / residential

RIBA Sustainable Outcome Metrics	Business as usual (new build, compliance approach)	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	120 kWh/m²/y	< 60 kWh/m²/y	< 35 kWh/m²/y	Targets based on GIA. Figures include regulated & unregulated energy consumption irrespective of source (grid/renewables). BAU based on median all electric across housing typologies in CIBSE benchmarking tool. 1. Use a 'Fabric First' approach 2. Minimise energy demand. Use efficient services and low carbon heat 3. Maximise onsite renewables

AECB Building Standard

Parameter	Target	Notes
Delivered Heat and cooling	≤ 40kWh/(m².a)	According to the methodology described in the PHPP* handbook.
Primary Energy (P.E.)	Varies kWh/(m².a)****	As per PHPP for each country
Primary Energy Renewable (P.E.R)	≤ 75 kWh/(m².a)	ditto
Air tightness (n50)	≤ 1.5 h^{-1} (≤ 3 h^{-1})	With MVHR (with MEV) **
Thermal Bridges ***	Psiexternal <0.01 W/mK	Calculated if > 0.01 W/mK
Summer overheating	<10%	<5% recommended

Our self build on PHPP

Specific building characteristics with reference to the treated floor area

		Value		Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	106.5				
Space heating	Heating demand kWh/(m²a)	39	≤	40	-	yes
	Heating load W/m²	18	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	1	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	1.5	≤	1.5		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)		≤	#N/A		#N/A
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	67	≤	75	-	yes
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	34	≥	-	-	

[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.

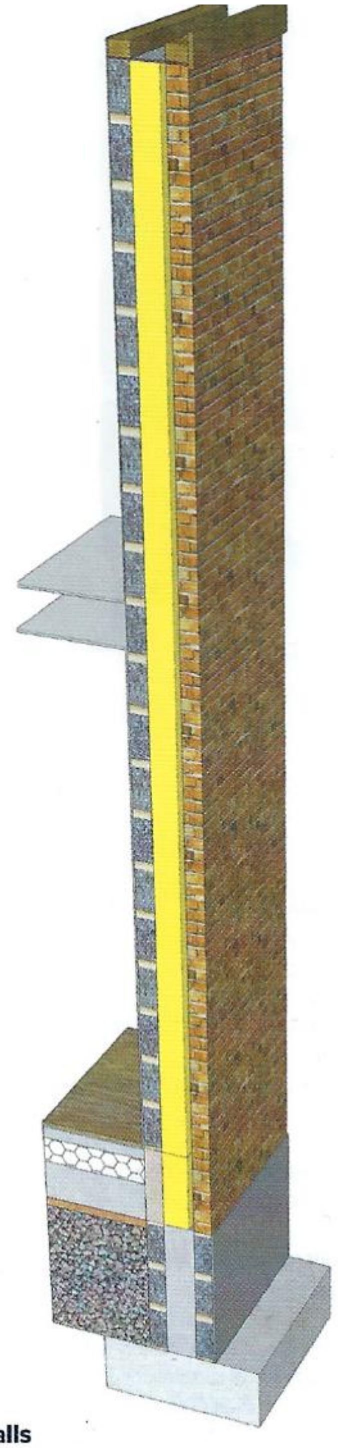
PHI Low Energy Building? **yes**

Task:	First name:	Surname:	Signature:
1-Designer	Joshua	Wood	

Form factor: 2.9 Achievable if the void is used as floor space (4th bedroom in future)

Operational Energy Targets - Meets AECB but not RIBA

TRADITIONAL CONSTRUCTION



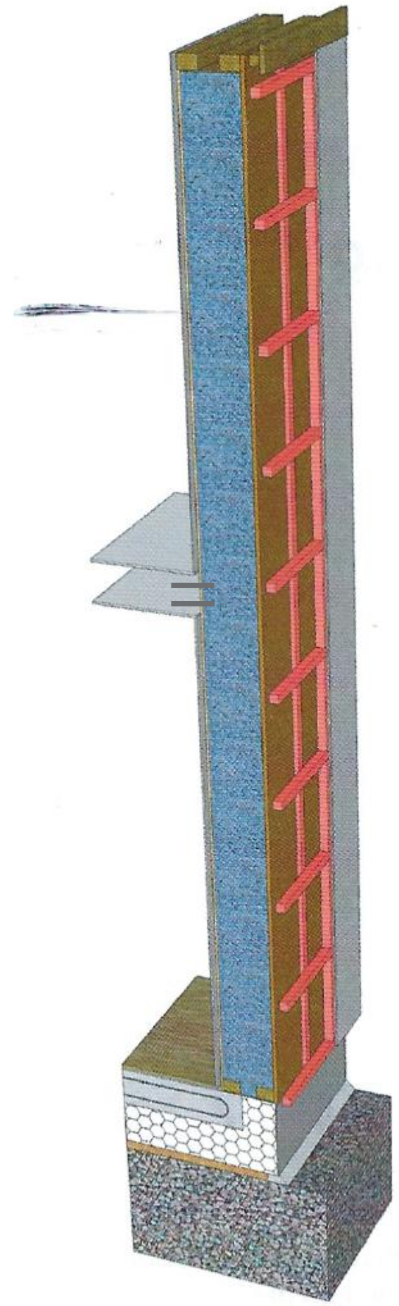
20.7 tonnes embodied carbon

Walls
12.5 mm plaster
100 mm blockwork
140 mm PIR
40 mm air gap
102.5 mm brick

Floor
20 mm engineered timber floor
75 mm cementitious screed
150 mm PIR
225 mm concrete + strip foundation
150 mm aggregate

Embodied Carbon $kgCO_2e/m^2$	1200 $kgCO_2e/m^2$	< 800 $kgCO_2e/m^2$	< 625 $kgCO_2e/m^2$

MODERN TIMBER CONSTRUCTION



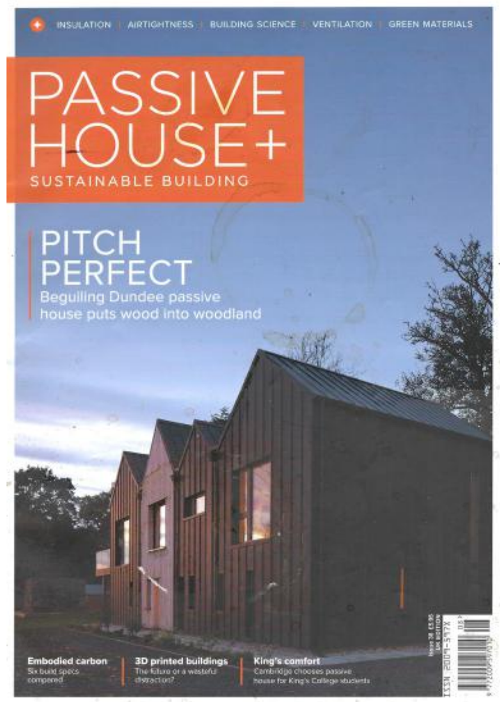
9 tonnes embodied carbon

= 192kgCO2e/m2 (Modules A-C)

Walls
Plasterboard and skim
25 mm battens @ 600 centres
12 mm structural airtight board
300 mm cellulose in I-beam
22 mm WF sheathing
Battens, counterbattens,
12.5 mm cement fibre board
8 mm proprietary silicone render

Floor
75 mm screed
200 mm concrete (50% GGBS)
250 mm EPS150

SOURCE:



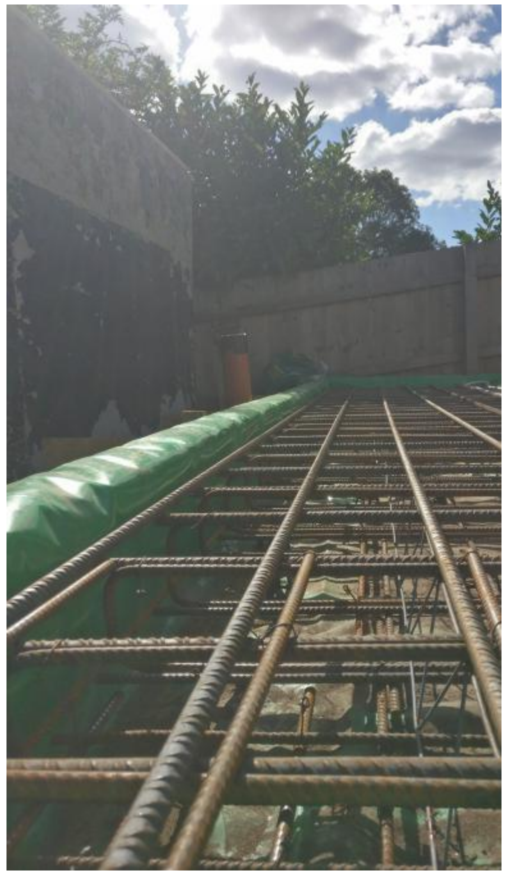
Embodied carbon of construction systems assessed for RICS stages A1-A3 (cradle to factory gate) for a 76m2 end-of-terrace house




Excavation - raft foundation = just topsoil removed

Soakaway, services, sub-base

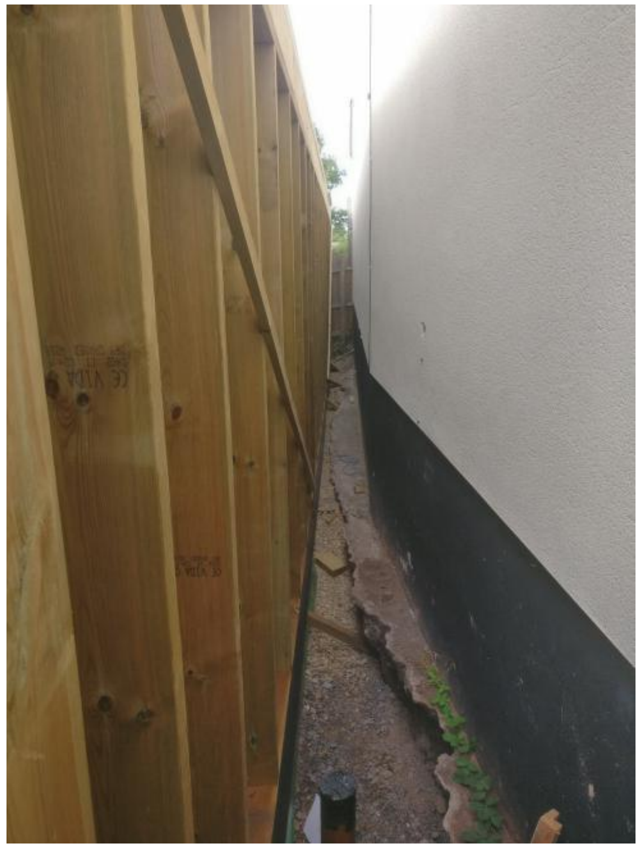
Slab insulation - XPS below concrete & shuttering




WK08 YME

Pouring the slab!





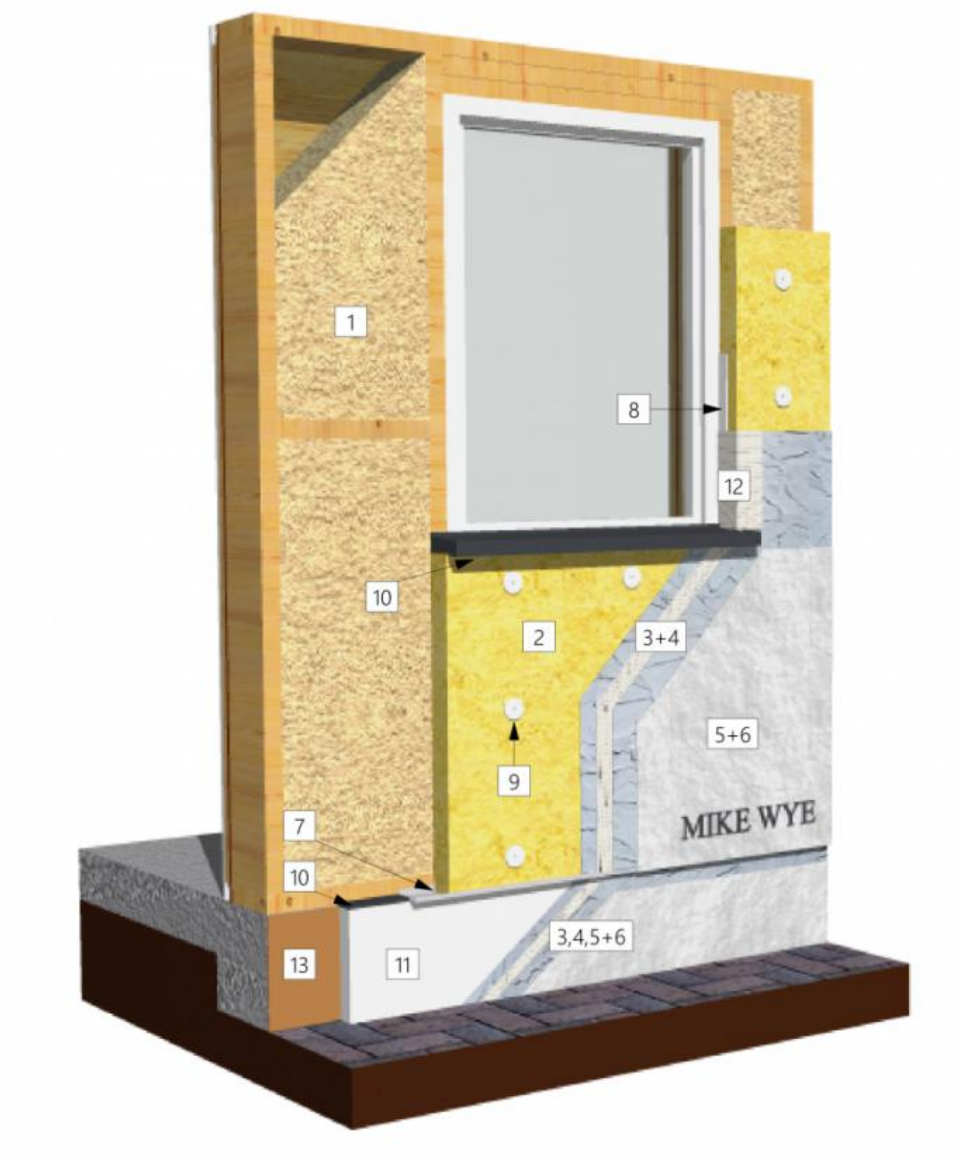
SterlingOSB Zero

GreenTrace


With thanks to Rob @

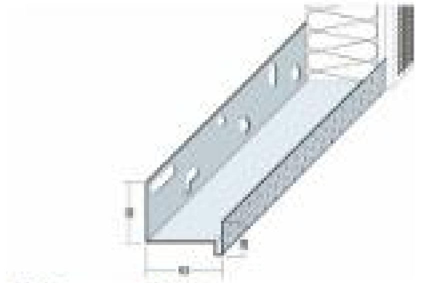
Klímashell

Envelope - Wood fibre insulation - detailing is key



SOURCE: MIKE WYE.CO.UK

2 STEICO Protect Dry



7 Base Rail

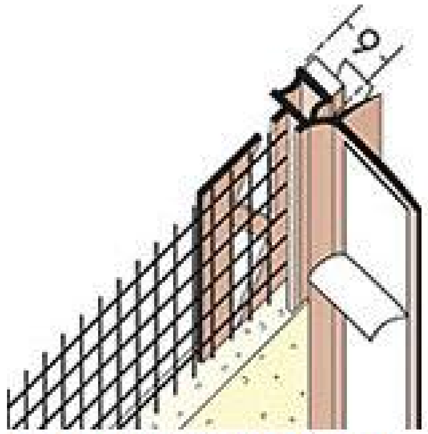
9 STR-H Fixing

11 Plinth Board

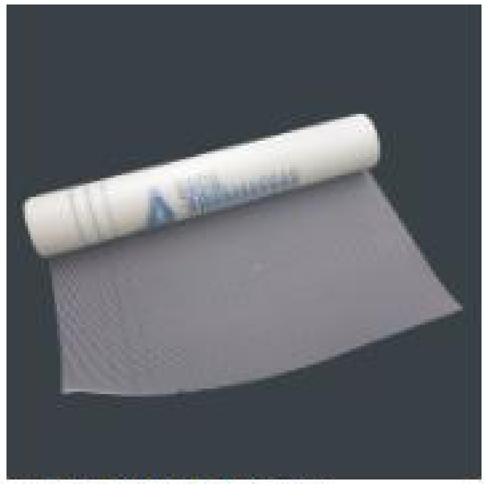
10 Iso-Bloco 600

Wood fibre benefits:

- λ = 0.04 W/ (m*K)
- High heat storage - buffer summer heat
- Temporary weather resistance
- Thermal external wrap
- Passivhaus certified
- Noise reduction
- Vapour permeable
- Healthy
- Store CO2
- Performs better than many other insulations in fire
- Good value - £5,000 for whole house



8 Window Bead (APU)



4 Fibre Glass Mesh

Baumit SilikonTop Top Coat Render

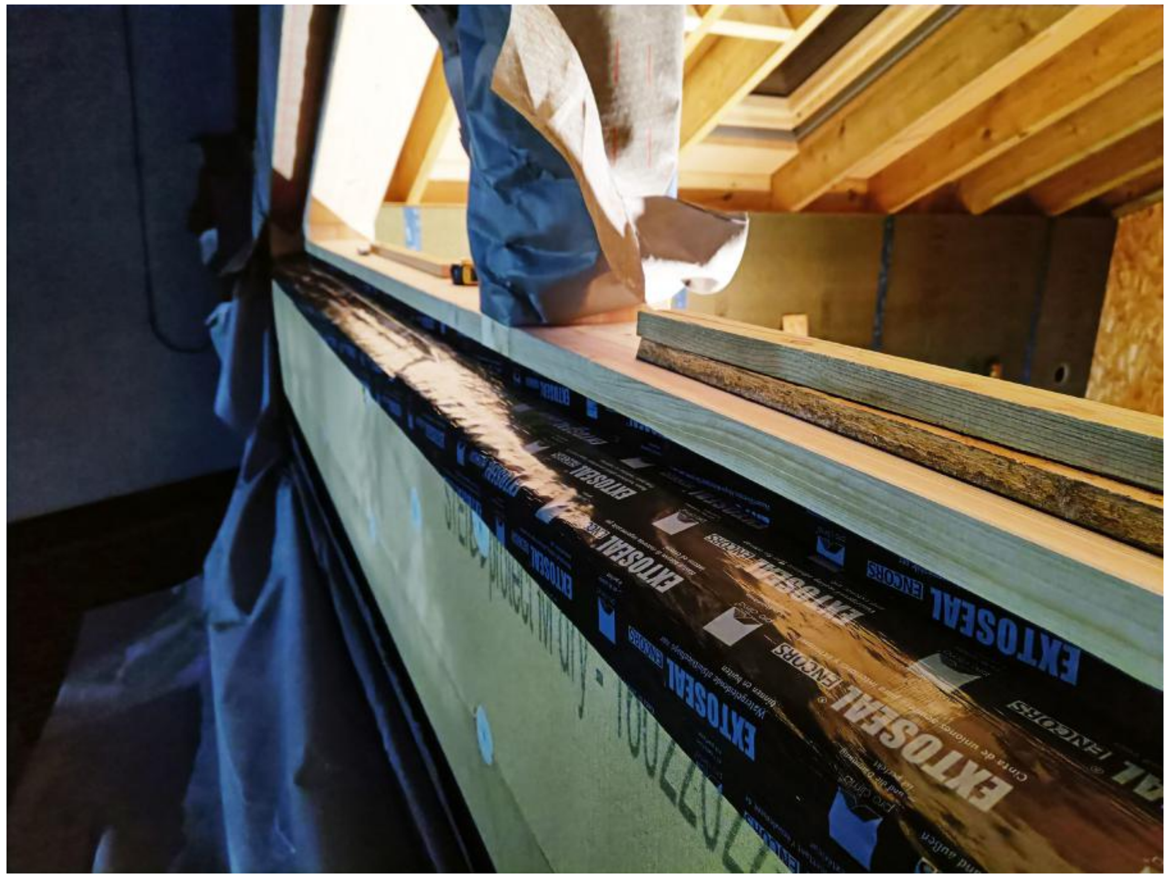
Baumit MC55 W External Base Coat

Lime render benefits

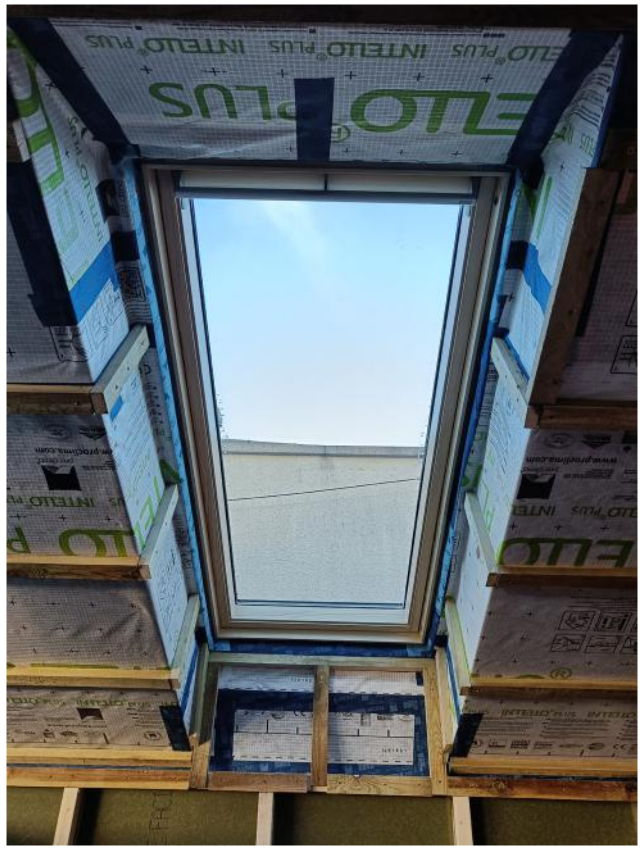
- Less energy/carbon
- More flexible
- Lovely to use
- Breathable
- Absorb moisture so less chance of unsightly mould

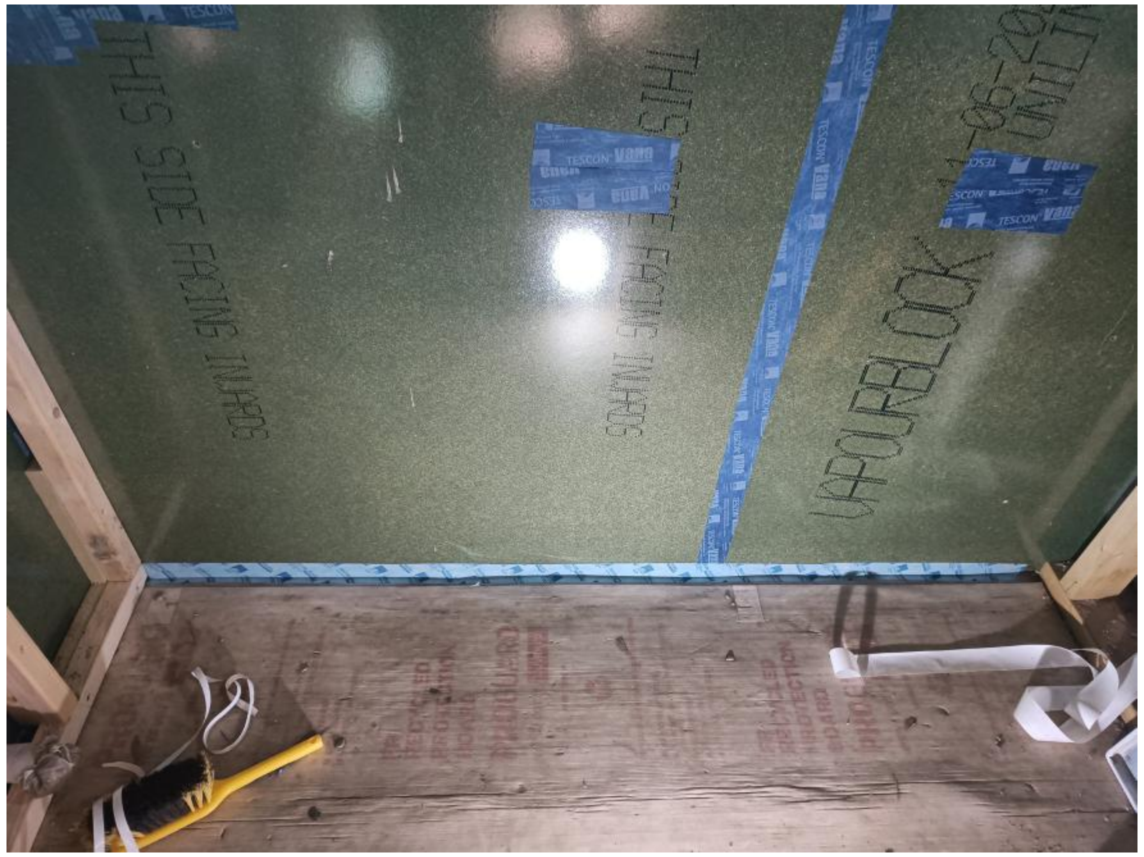
Wood fibre & lime render products & details

Roofing - profile steel roof sheets, EPDM gutter



Detailing at openings - multiple lines of defence - assume cills fail, no cavity to vent ingress

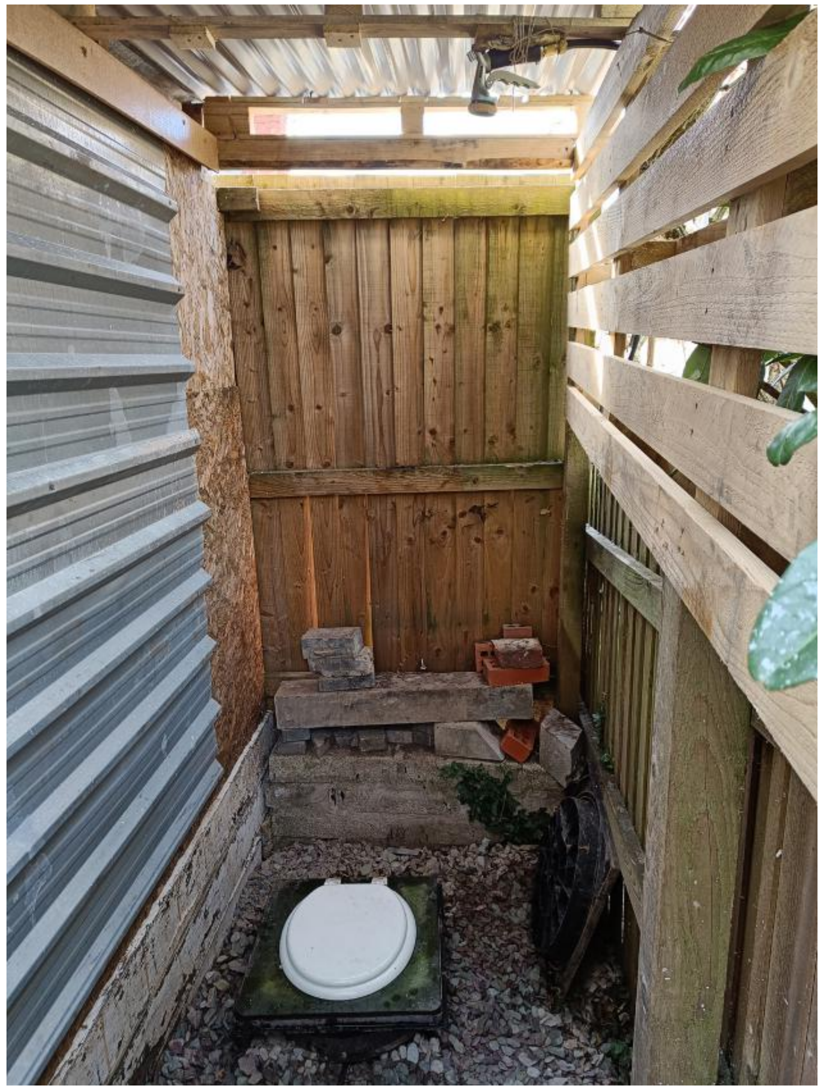


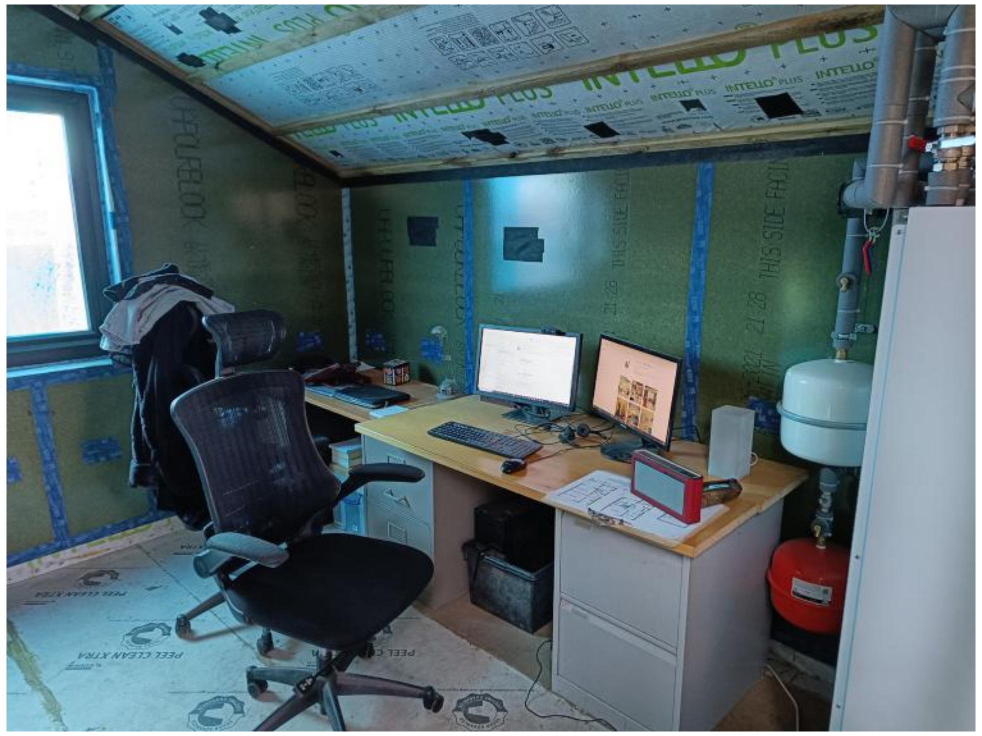


Airtightness target: ACH (n50) ≤ 0.6 h-1 @ 50 - equivalent to credit card size

Airtightness time! - Humidity variable vapour check


Minifant M99
MITSUBISHI ELECTRIC





Current stage - we've moved in!...and its warm (ish)

LESSONS LEARNT

1. Creative Pessimism
2. Communication is key
3. Do less, but better
4. Stop, look, listen
5. Empathy

18 *Principles for building*

1 HIGH > LOW	● Gravity (water flow/structure) ● Temperature gradient ● Vapour pressure gradient ● Air pressure gradient ● Reversion (steel > iron)	[DAMP > DRY] [HOT > COLD] [MOIST > DRY] [HIGH > LOW] [PROCESSED > ORIGINAL]	CONSTRAINTS
2 SEPARATE LIVES	● Differential movements ● Differential durability ● Incompatible materials ● The process of assembly		
3 CREATIVE PESSIMISM	Allowances for UNCERTAINTY because the properties of all materials, their assembly and performance and the way a building is used are neither totally ideal nor totally predictable		CONTROL
4 CONTINUITY	● Structure ● Thermal insulation ● Fire protection ● Cavity separator ● Damp-/waterproofing		OBJECTIVES
5 BALANCE	● With surroundings ● Laminates ● Between the parts and the whole	[temperature/moisture] [plywood/facings]	

Chart C1/1 *Principles for building*

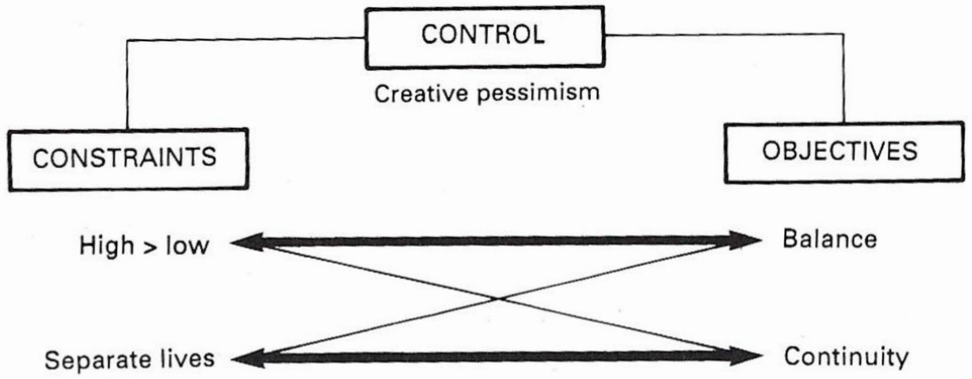
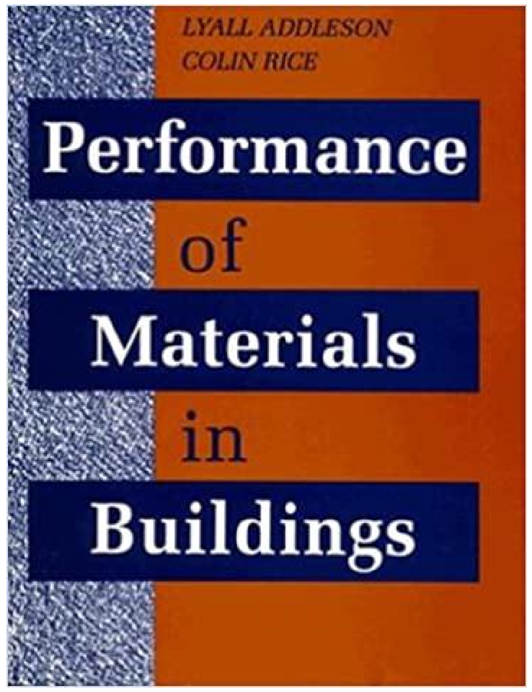


Chart C1/2 *Connections and relationship between the principles in Chart C1/1*

- Unknown unknowns
- Manufacturer's guidance not always applicable
- Need to apply creative pessimism and understand key principles to consider details
- Allowance for uncertainty
- Multiple lines of defence

SOURCE:



Creative Pessimism

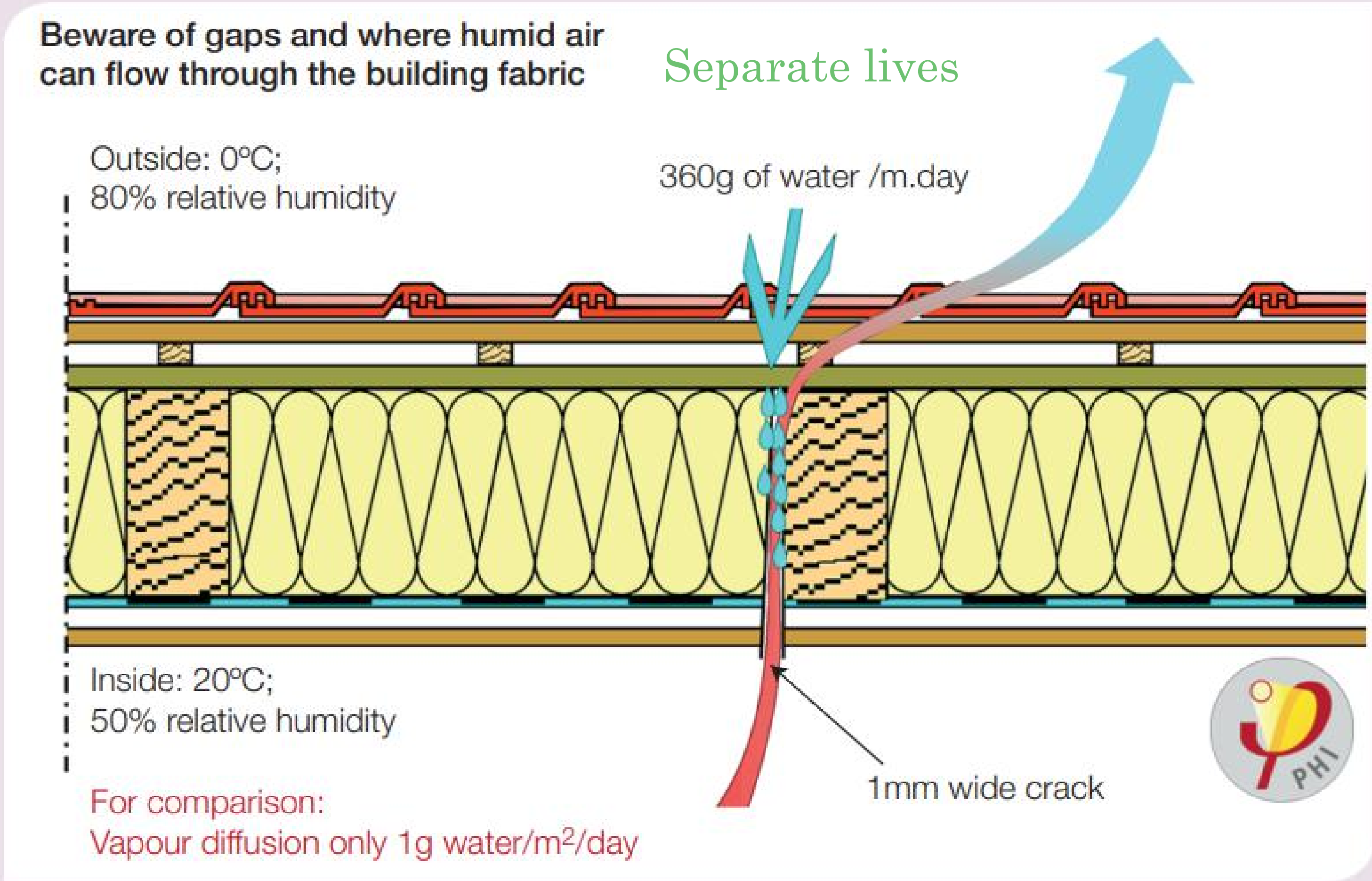
High to Low




When warm moist air flows out through a gap in the building fabric the air cools down and as the air cools its capacity to hold water vapour is reduced. When the warm air comes in to contact with a sufficiently cold surface the water vapour condenses to a liquid state.

Over time, if the interstitial condensate remains trapped in the building fabric, it will lead to a deterioration in the fabric U-values and possibly structural damage and mould growth. High to Low (entropy)

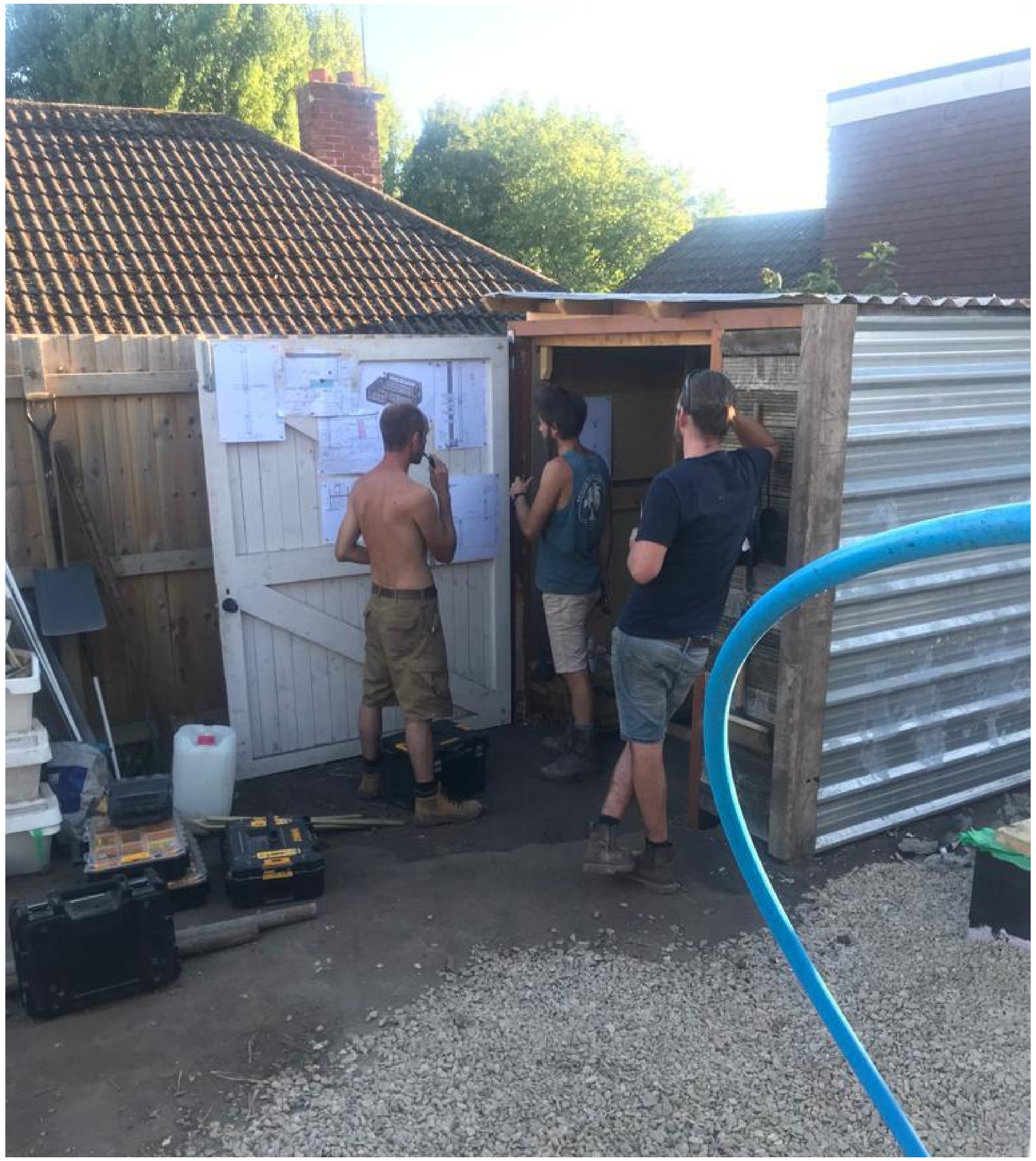
Watch Homes from Hell!



Separate lives

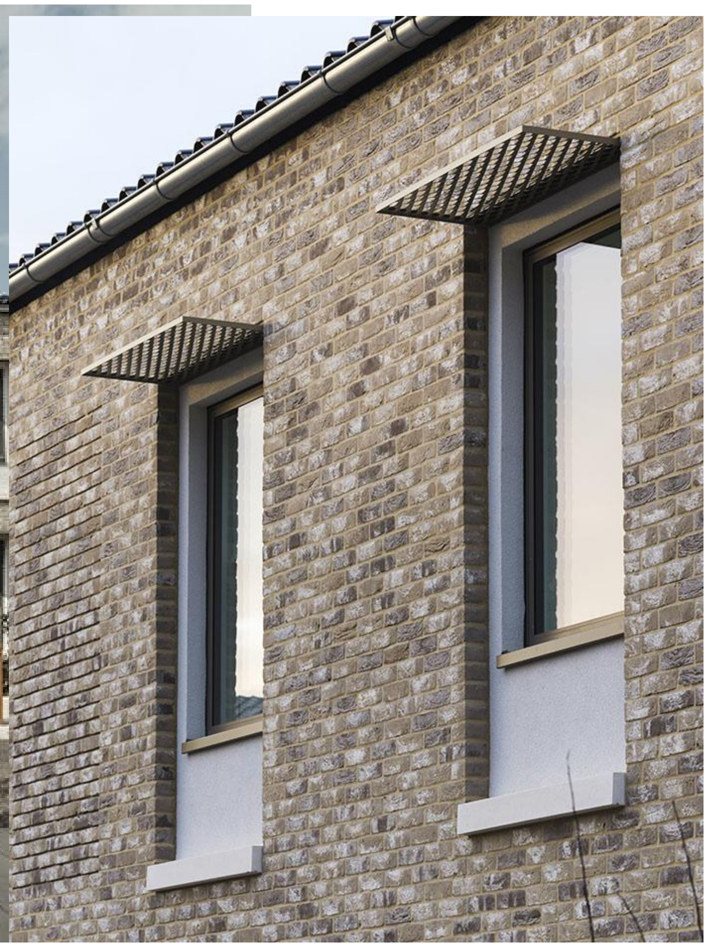
Figure 3 Implications of moisture vapour ingress through a 1mm crack (Source PHI/ Sariri)

Continuity



- Ambiguity creates problems
- Architects coordinate everyone else's work
- Speak different languages – (tradesmen, engineers, planners, clients, neighbours, etc)

Communication is key



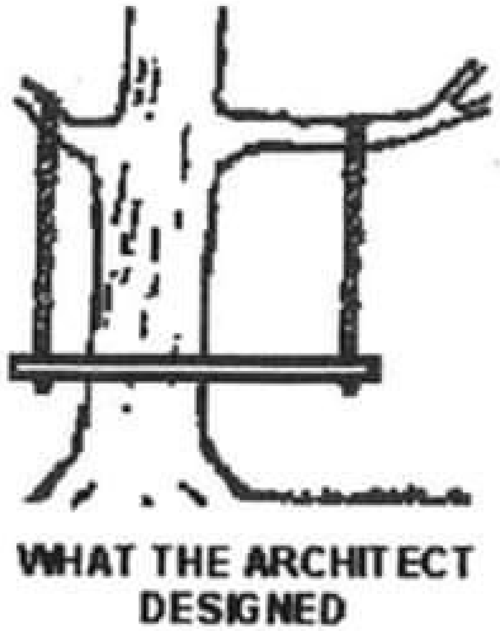
Goldsmith Street

by Mikhail Riches with Cathy Hawley

RIBA Stirling Prize winner 2019

Passive house community

- Function over form
- Keep it simple stupid (KISS)
- Use space efficiently
- Low-energy buildings start with modesty
- Fabric first
- Beware social media



High to Low
Separate lives

- Slow and steady wins the race
- Observe & ask questions
- Seek multiple opinions

- Architect
- Builder
- Client

Next few years: monitor the performance of the home and assess areas for improvement.

If you would like to visit, the Green Register are organising a field trip on the 29th March.