HAPPI HOUR - PASSIVHAUS FOR ACTIVE AGEING

PASSIVHAUS IN THE CONTEXT OF WELSH HEALTH AND WELLBEING CENTRES

TUESDAY 12 OCTOBER, 2021 | 4.00 PM

Pádraig McMorrow
IBI Group

Setting the scene

Live project examples

The passivhaus approach

Global examples

Government Strategy & Policy

TOP DOWN DIRECTION

HEALTHIER WALES

DECARBONISATION DELIVERY PLAN

NHS Wales Decarbonisation Strategic Delivery Plan

2021-2030

(including Technical Appendices)

Published March 2021

Integrated Community Healthcare

HEALTH BOARDS & TRUSTS

LOCAL AUTHORITIES

3RD SECTOR ORGANISATIONS

Cardiff and Vale University Health Board

Shaping Our Future Wellbeing Strategy

2015 - 2025

GIG CYMRU NHS WALES

Bwrdd Iechyd Prifysgol Caerdydd a'r Fro

Cardiff and Vale University Health Board

NEWPORT EAST HWBC

NEWPORT, WALES

AT THE HEART OF RINGLAND
REGENERATION MASTERPLAN

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Aneurin Bevan University Health Board

NEWPORT CITY COUNCIL
CYNGOR DINAS CASNEWYDD

newport city homes
first for people, places and partnerships

Masterplan by Powell Dobson Architects.

IBI

NEWPORT EAST HWBC

NEWPORT, WALES

SWANSEA HWBC

SWANSEA, WALES

AT THE HEART OF
SWANSEA URBAN VILLAGE

Masterplan by Holder Mathias Architects.

SWANSEA HWBC

SWANSEA, WALES

Park View HWBC

ELY, CARDIFF, WALES

Park View HWBC

ELY, CARDIFF, WALES

SATELLITE RADIOTHERAPY UNIT

ABERGAVENNY, WALES

3D VISUAL FOR ARRIVAL AT SATELLITE RADIOTHERAPY UNIT

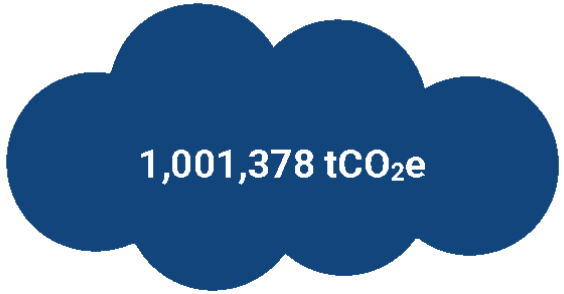
Decarbonisation

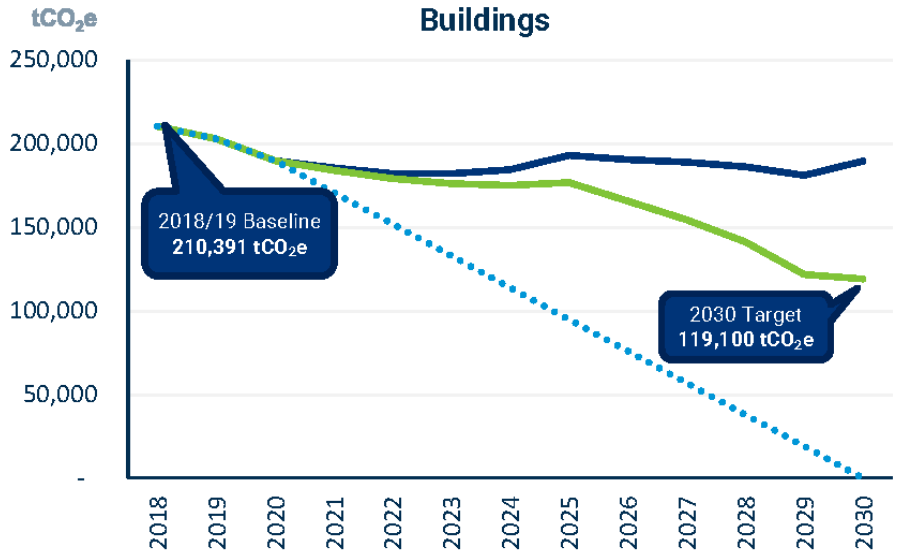
NHS EMISSIONS

TARGETED REDUCTION

FOCUSED INITIATIVES

Total NHS Wales Carbon Emissions 2018/19





NHS Wales Decarbonisation Strategic Delivery Plan

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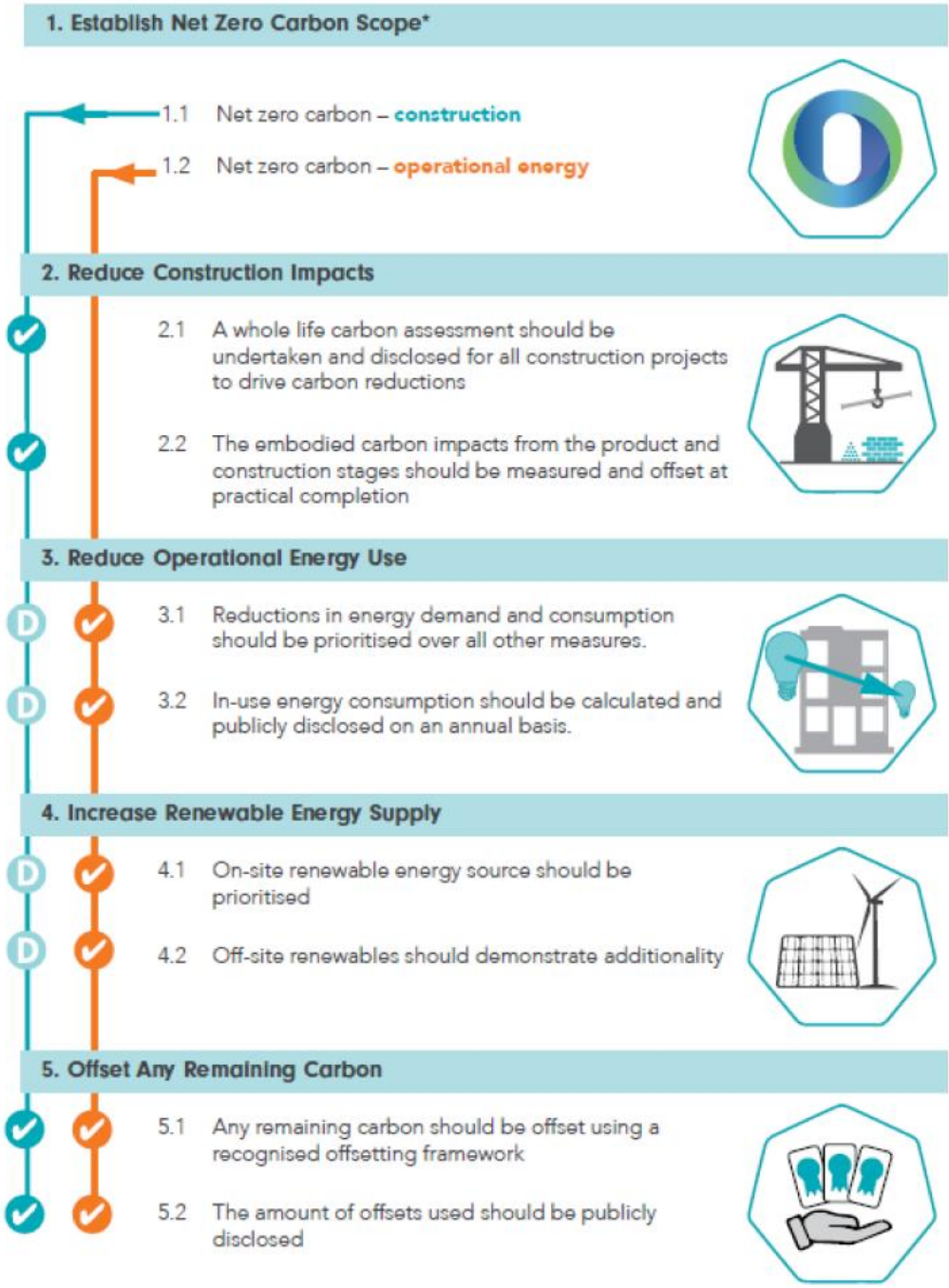
UK GBC Net Zero Definition

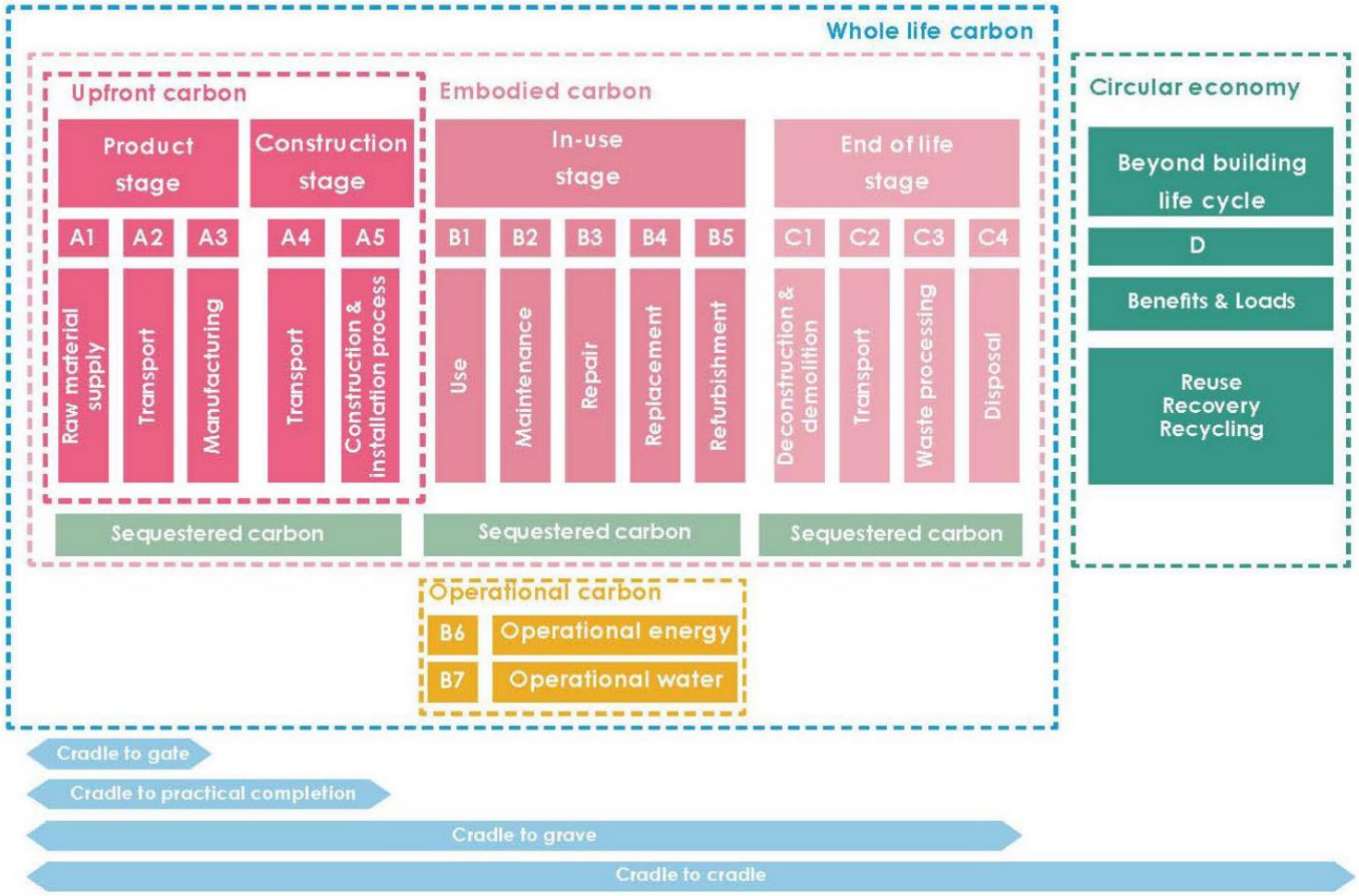
Net zero carbon – construction

"When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy."

Ref: Net Zero Carbon Buildings: A Framework Definition



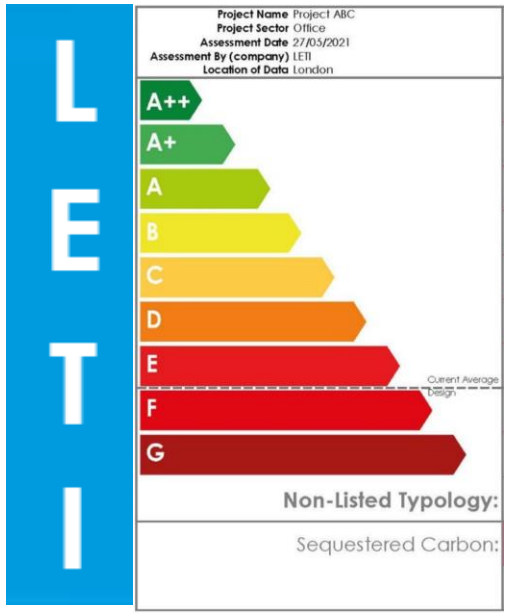
Carbon Targets



Defining and Aligning:
Whole Life Carbon & Embodied Carbon

Net Zero Carbon Targets

Embodied Carbon, A1-5, B1-5, C1-4 (inc. sequestration)



RIBA 2030 Built Target

Band	Education
A++	<125
A+	<260
A	<400
B	<540
C	<675
D	<835
E	<1000
F	<1175
G	<1350

All values in $kgCO_2e/m^2$ (GIA)

RIBA 2030 Climate Challenge – version 2 (2021)

The Targets v2 (2021)

RIBA 2030 Climate Challenge target metrics for non-domestic (new build offices)

RIBA Sustainable Outcome Metrics	Business as usual (new build, compliance approach)	2025 Targets	2030 Targets	Notes
Operational Energy $kWh/m^2/y$	130 $kWh/m^2/y$ DEC D (90)	< 75 $kWh/m^2/y$ DEC B (50) and/or NABERS Base build 5	< 55 $kWh/m^2/y$ DEC B (40) and/or NABERS Base build 6	Targets based on GIA. Figures include regulated & unregulated energy consumption irrespective of source (grid/ renewables). 1. Use a 'Fabric First' approach 2. Minimise energy demand. Use efficient services and low carbon heat 3. Maximise onsite renewables
Embodied Carbon $kgCO_2e/m^2$	1400 $kgCO_2e/m^2$	< 970 $kgCO_2e/m^2$	< 750 $kgCO_2e/m^2$	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 UK schemes (CCC) BAU aligned with LETI band E; 2025 target aligned with LETI band C and 2030 target aligned with LETI band B.
Portable Water Use Litres/person/day	16 l/p/day (CIRA W11 benchmark)	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G.

Whole Life Carbon = Operational Carbon + Embodied Carbon

Healthcare Embodied Carbon Project Progression

NEWPORT EAST HWBC

ABERGAVENNY SRU

PARKVIEW HWBC

Embodied Carbon Results

A to C (exc. B6, B7)
725 KgCO2e /m2 @ RIBA 2

Excluding hard landscaping
625 KgCO2e /m2 @ RIBA 2

A to C (exc B6, B7)
1500 KgCO2e /m2 BREEAM Exc
1250 KgCO2e /m2
1075 KgCO2e /m2 RIBA3

A to C (exc. B6, B7)
901 KgCO2e /m2 Initially reduced to;
774 KgCO2e /m2 @ RIBA 2

Key Carbon Reductions:

-3 Stories form factor
-Passivhaus Standard

-2 Stories
-50% GGBS concrete
-CLT Roof
-Linac concrete Bunkers
-Passivhaus Standard

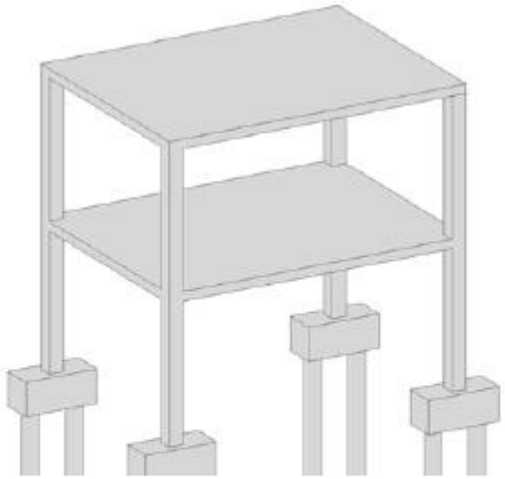
R-32 used in the chiller, GWP
Leak detection in chiller

SATELLITE RADIOTHERAPY UNIT

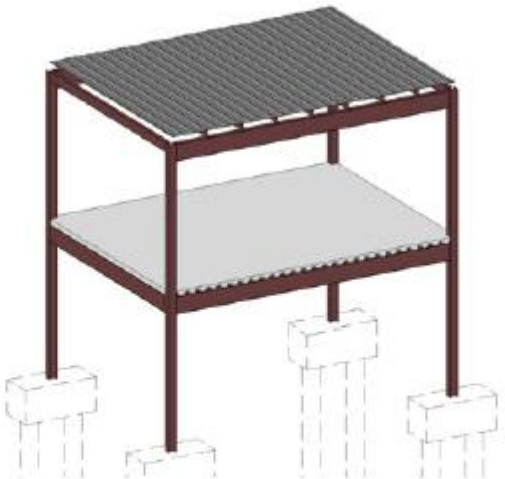
ABERGAVENNY, WALES

3D VISUAL FOR ARRIVAL AT SATELLITE RADIOTHERAPY UNIT

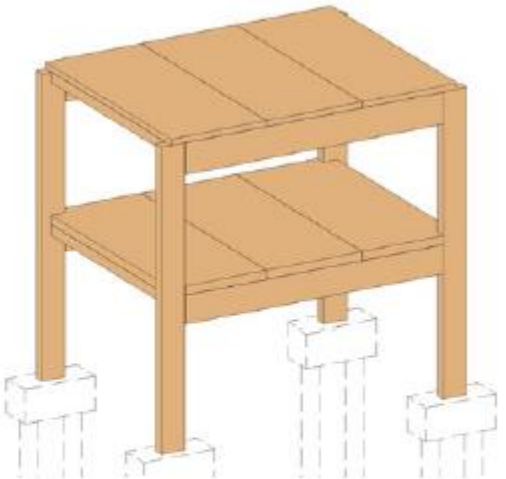
Decarb Strategy



Concrete frame baseline

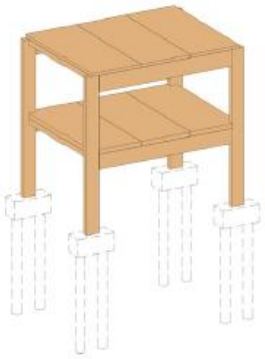


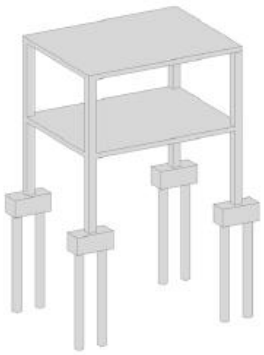
Steel frame baseline

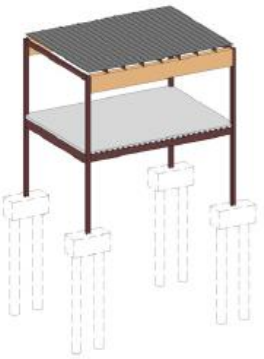


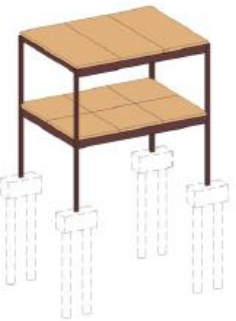
Timber frame / CLT baseline

Potential Carbon Reduction Options:

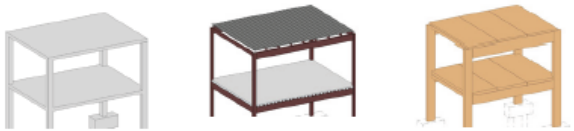








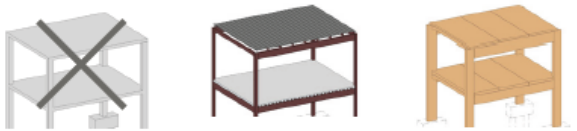
Decarb Strategy



Initial Frame Assessment

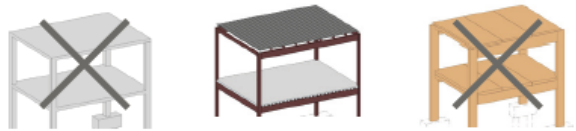
Viable Options:

- Concrete frame
- Timber Frame
- Steel Frame



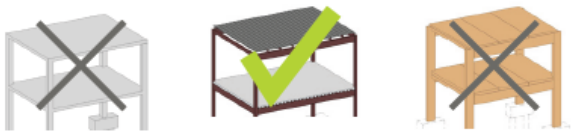
Concrete Frame discounted

- Sustainability/Carbon Impact
- Cost
- Buildability: slow



Timber Frame discounted

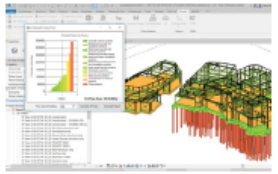
- Beam depths and structural zone restrictions (1m deep beams with separate MEP zones)
- Layout difficulties
- Buildability – construction phasing



Steel Frame chosen

- Very Flexible
- Relatively low embodied carbon impact compared to concrete frame
- Speed of erection
- Lean design achievable through good design

Layout Proposals



Design Development during RIBA Stage 3

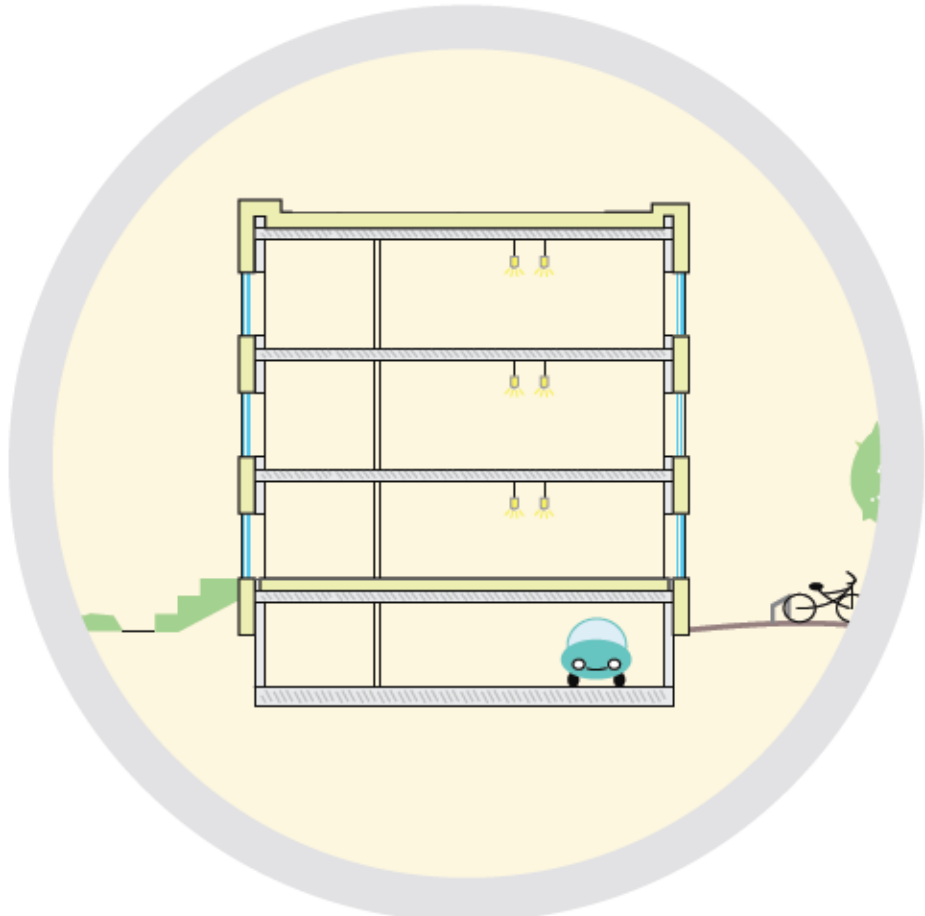
KEY STRATEGIES

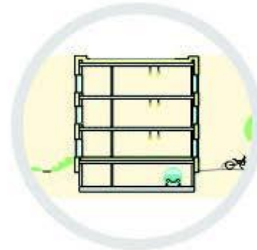
1. Optimal Insulation

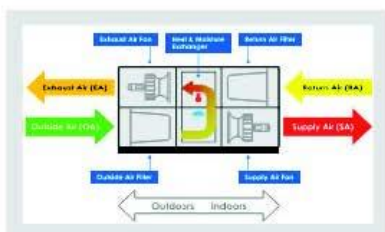
CoV Wall Exclusions:

Policy of up to 7" excluded

Typical ~10" Exterior Wall Insulation







KEY STRATEGIES

1. Optimal Insulation

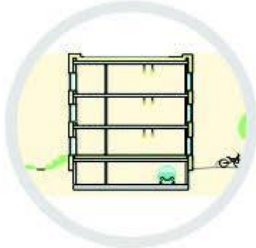
2. Airtight building envelope

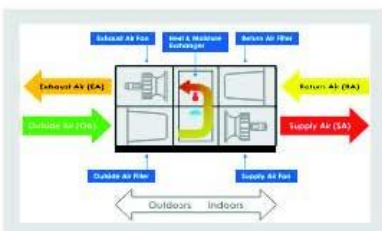
Construction team training listed in performance specification.

4 day Tradesperson course at BCIT High performance Building Lab

CERTIFIED PASSIVE HOUSE TRADESPERSON

TRADESPERSON





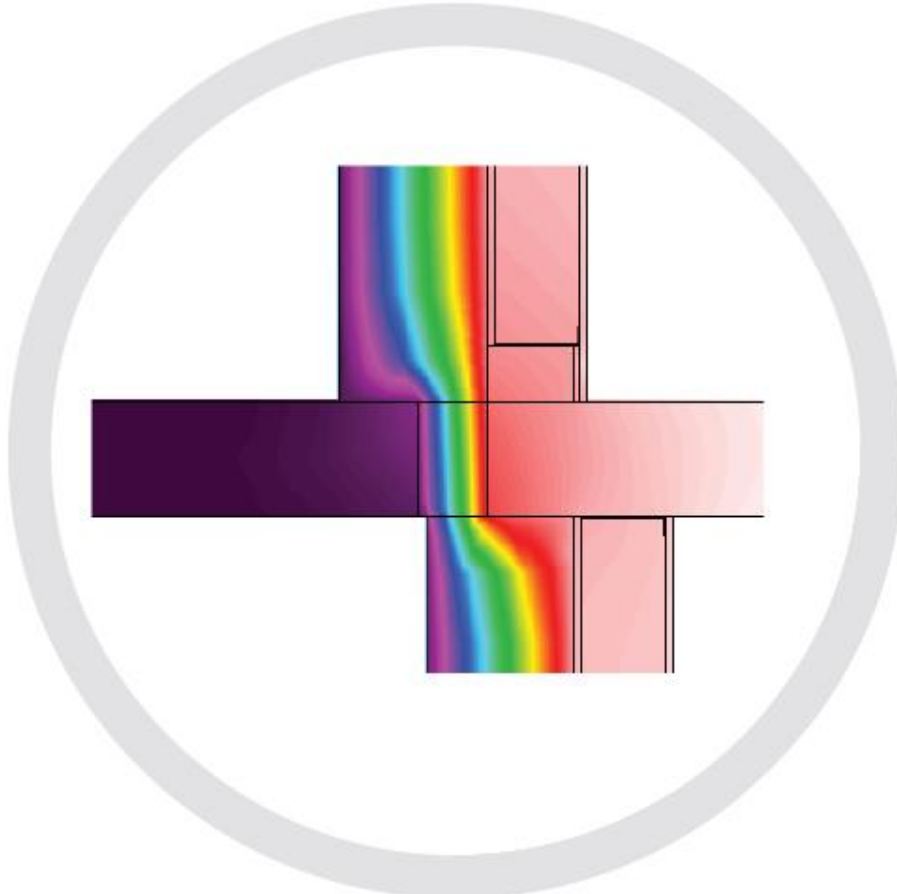
KEY STRATEGIES

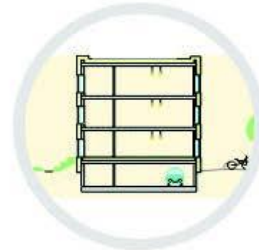
1. Optimal Insulation

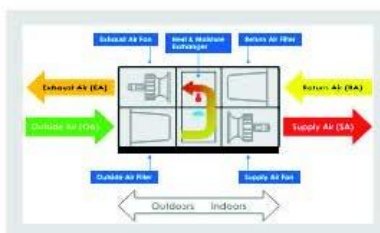
2. Airtight building envelope

3. Thermal bridge free building

Schöck Isokorb®







KEY STRATEGIES

1. Optimal Insulation

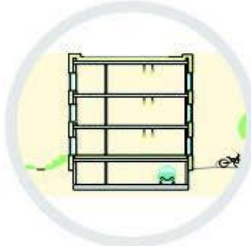
2. Airtight building envelope

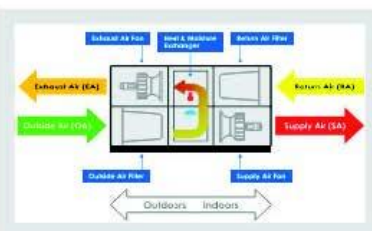
3. Thermal bridge free building

4. Passive House Windows & Doors

Triple Glazed – PHI Certified

CASCADIA UNIVERSAL SERIES

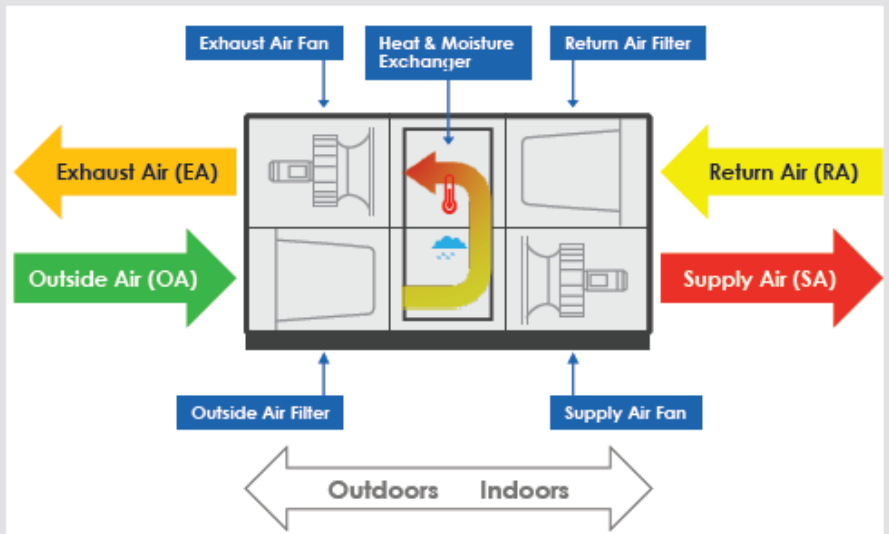


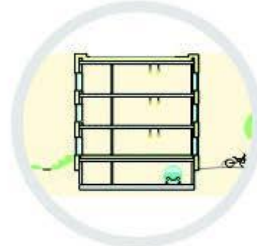


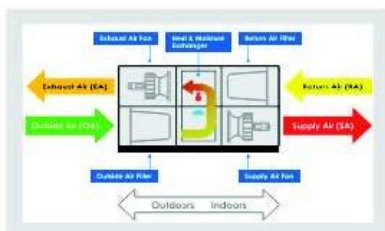
KEY STRATEGIES

1. Optimal Insulation
2. Airtight building envelope
3. Thermal bridge free building
4. Passive House windows
5. **Heat recovery ventilation system**

Efficent Heat Exchange
to Ventilation air







SATELLITE RADIOTHERAPY UNIT

PASSIVHAUS FABRIC FIRST APPROACH

	PART L MIN	PART L /BREEAM EXC *	OPTION 1 PROPOSED*
WALL	0.35	0.18 (49%)	0.14 (60%)
FLOOR	0.25	0.20 (20%)	0.13 (48%)
ROOF	0.25	0.185 (26%)	0.12 (52%)
WINDOWS	2.2	1.6 (27%)	1.30 (41%)
g VALUE	n/a	0.37	0.33

*improvement (%) on Part L min values

	PART L MIN*	ErP 2018 Directive*	OPTION 1 PROPOSED*	OPTION 2 PASSIVHAUS ENHANCED*
Plate Heat Exchanger Effectiveness	50%	73% (46%)	75% (50%)	90% (80%)

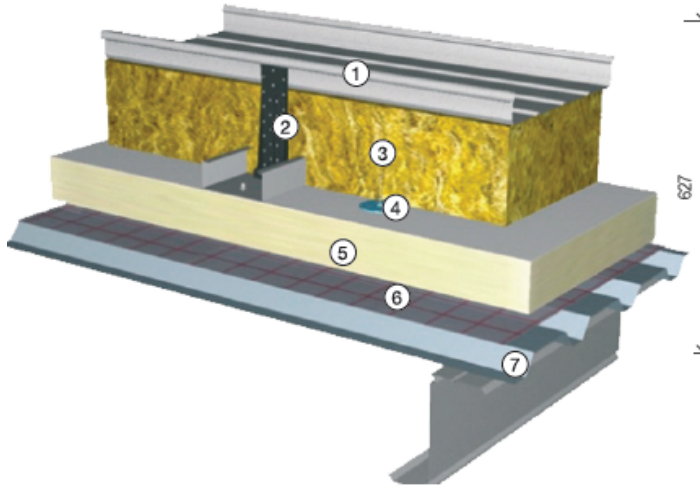
*improvement (%) on Park L min values

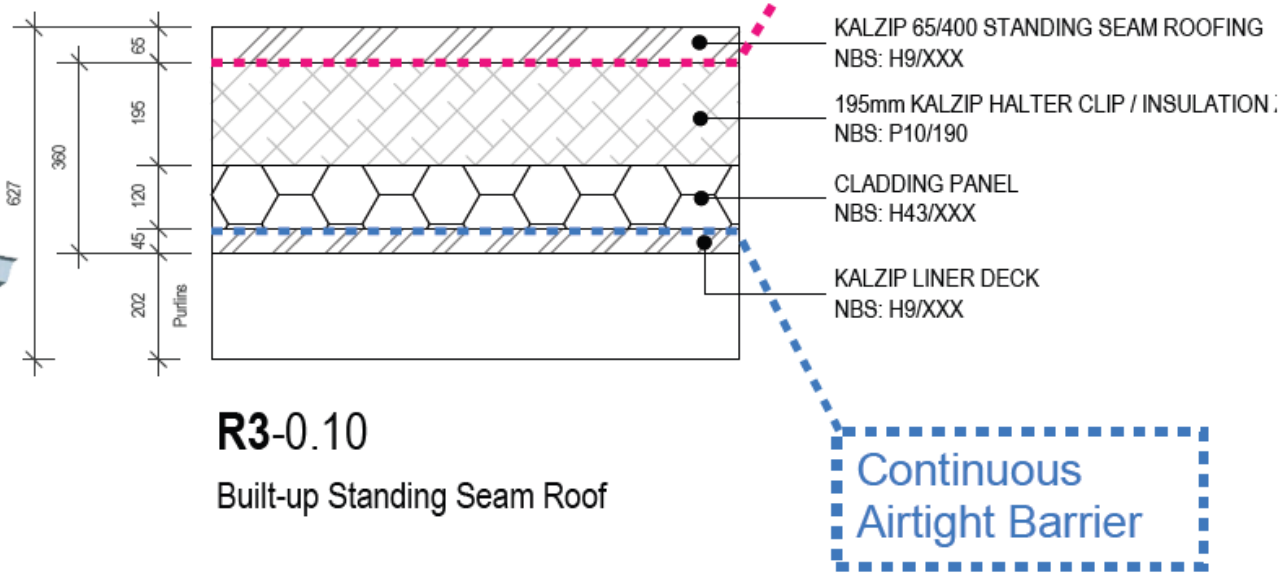
	PART L MIN	PART L /BREEAM EXC*	OPTION 1 PROPOSED*	OPTION 2 PASSIVHAUS ENHANCED*
Air Tightness	10	3 (70%)	3 (70%)	1 (90%)

Typical Insulation thickness needed to achieve target U-Values

SATELLITE RADIOTHERAPY UNIT

ABERGAVENNY, WALES





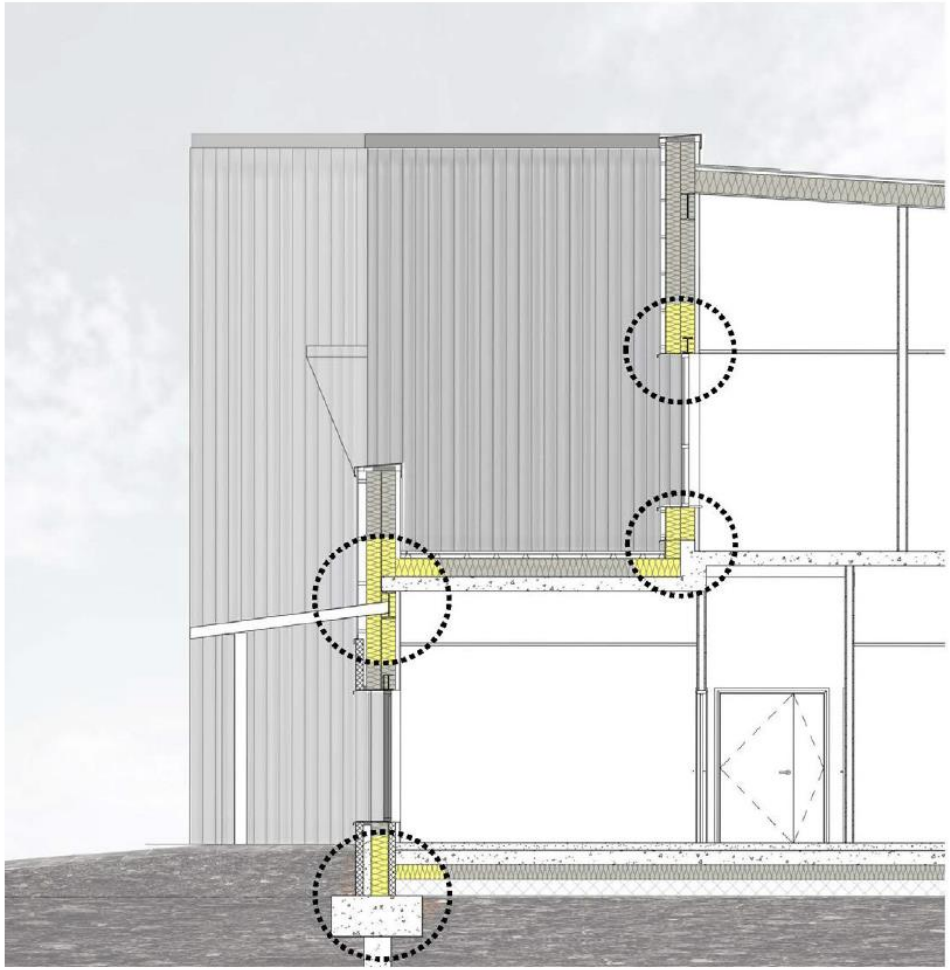
R3-0.10

Built-up Standing Seam Roof

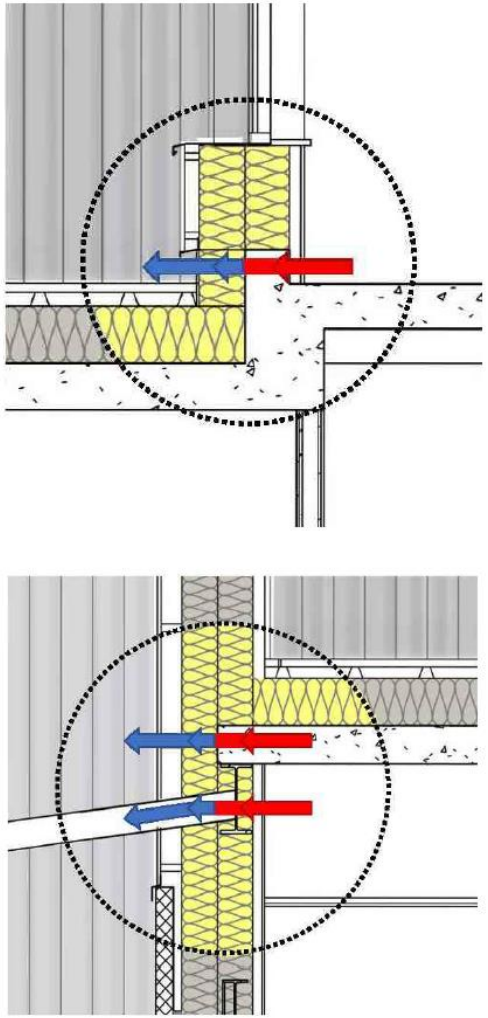
1. Kalzip top sheet
2. Kalzip E clips fixed to inverted channel
3. Mineral fibre quilt insulation
4. SFS Iso-Tak fastener system
5. Kalzip insulation 23 (2400 mm x 1200 mm)
6. Kalzip vapour control layer
7. Inverted liner sheet over purlins

SATELLITE RADIOTHERAPY UNIT

ABERGAVENNY, WALES



Sketch Section showing the important structural junctions that will need to be considered in terms of thermal bridging.



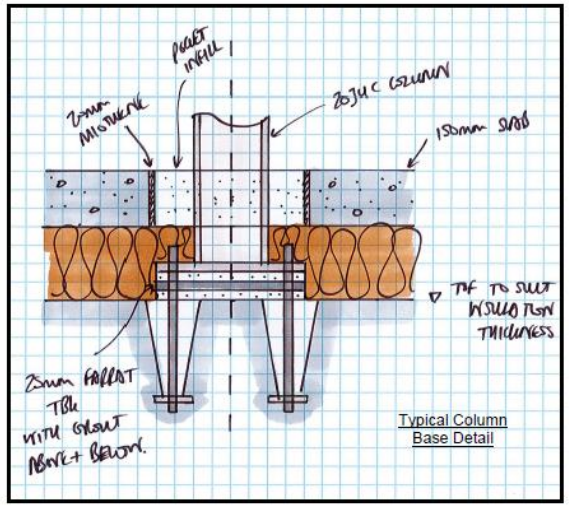
A continuous insulation line helps minimise thermal bridging

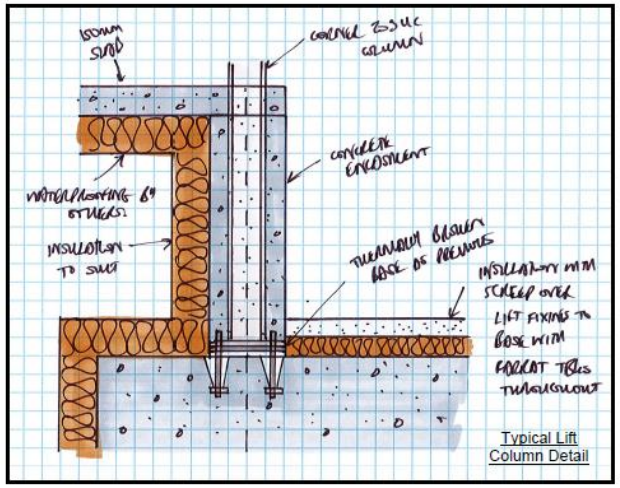
SATELLITE RADIOTHERAPY UNIT

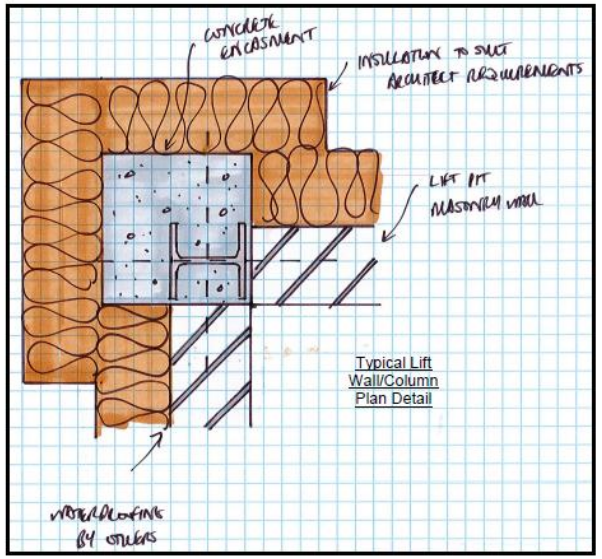
- BIOPHILIC DESIGN
- CONTINUATION OF NATURE
- TIMBER FOR WARMTH & SUSTAINABILITY

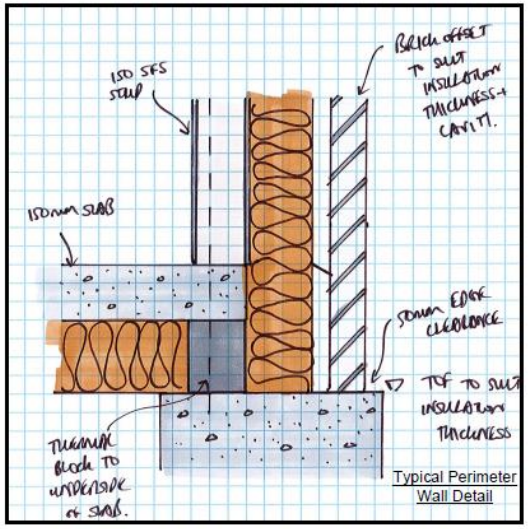
3D VISUAL FOR ARRIVAL AT SATELLITE RADIOTHERAPY UNIT

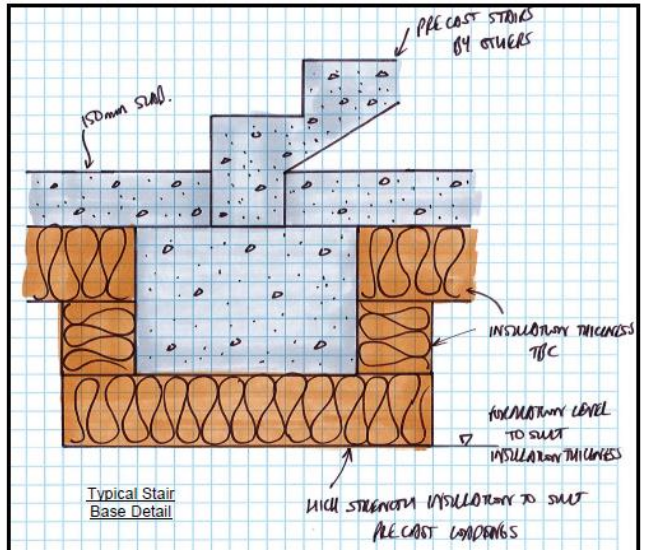
SRU Wales: Passivhaus Structural Thermal Break Strategy

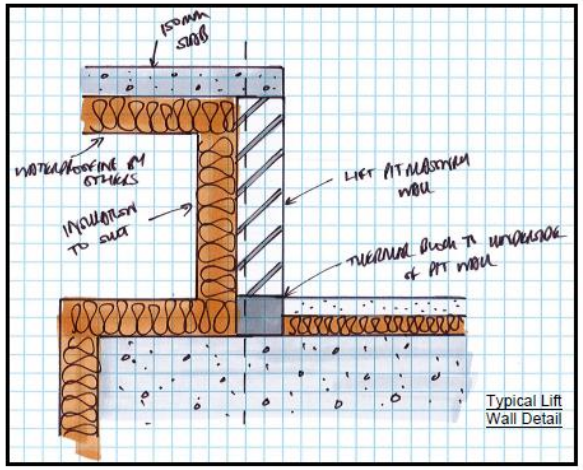




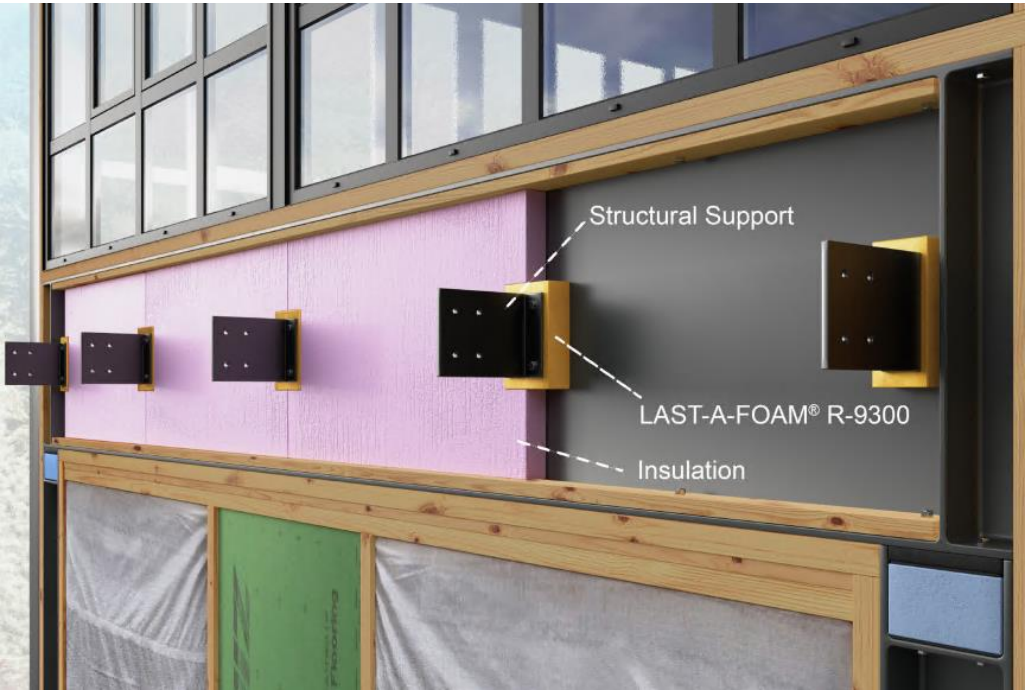


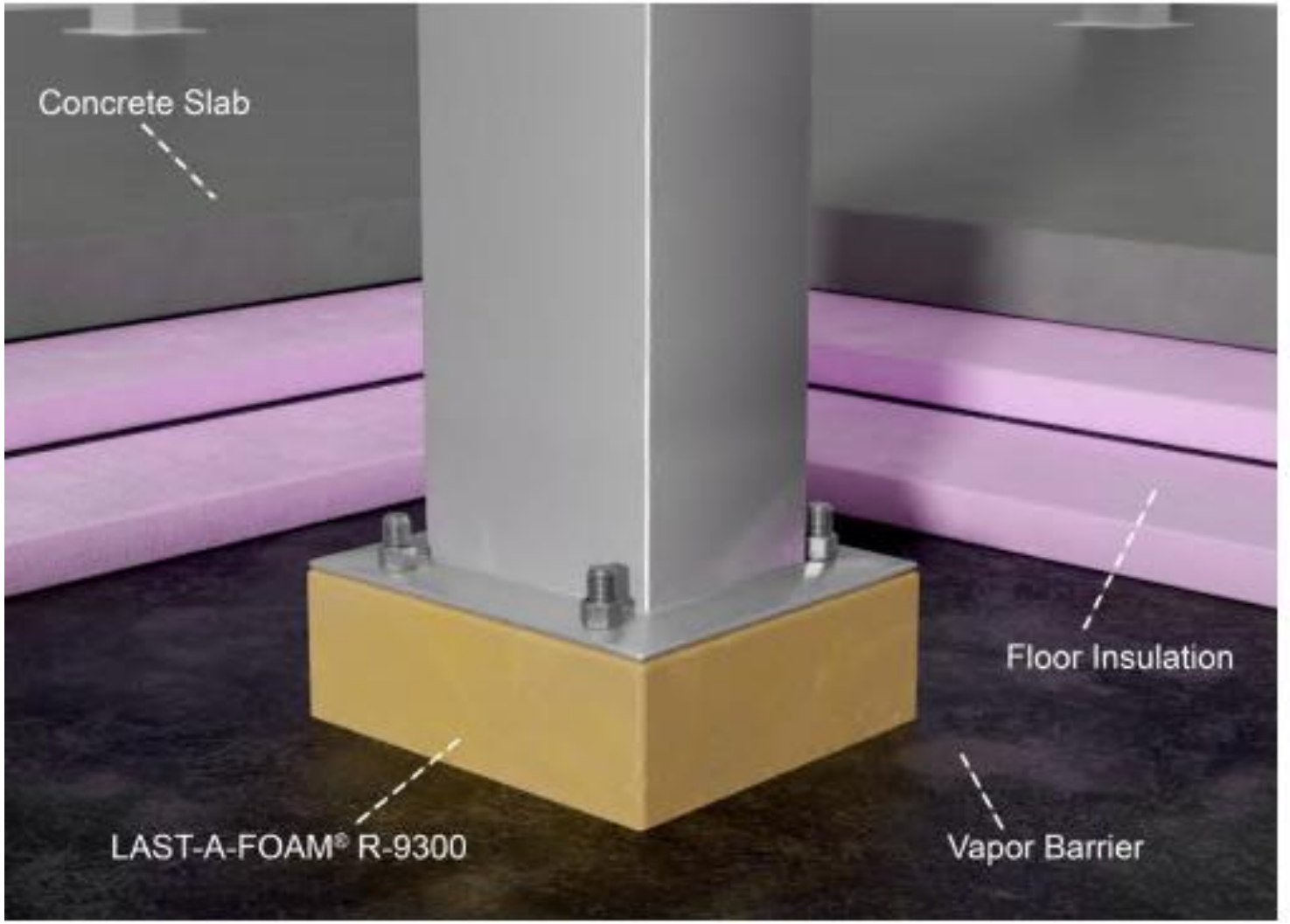






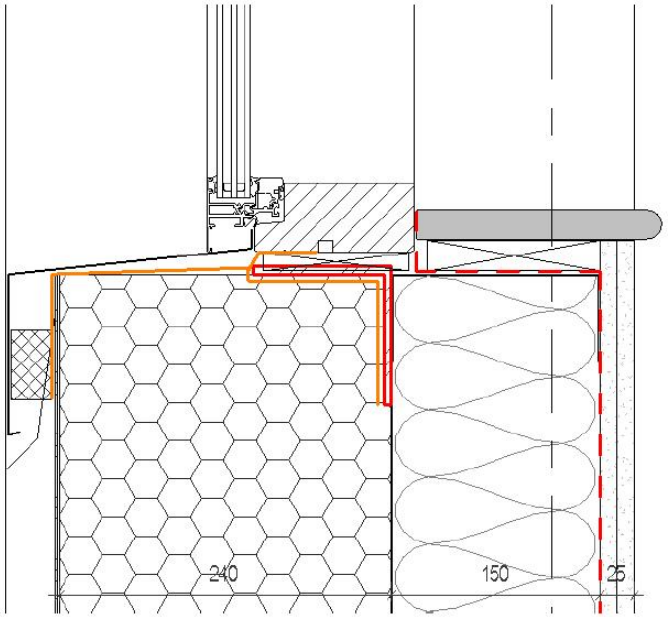
Thermal breaks



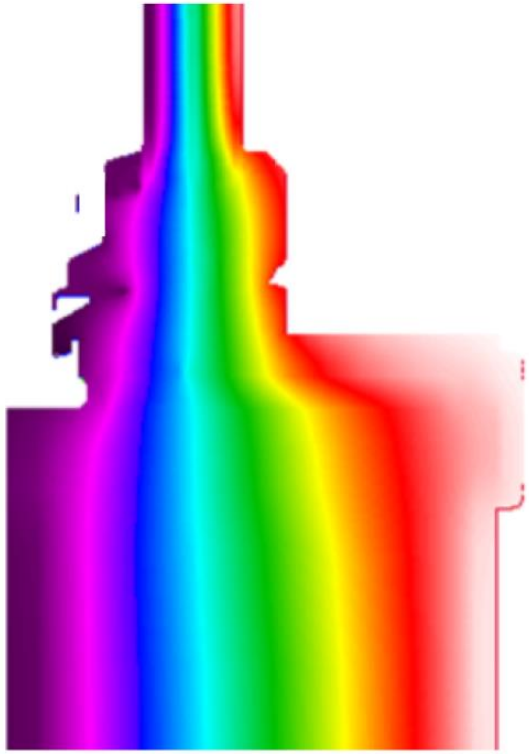


SATELLITE RADIOTHERAPY UNIT

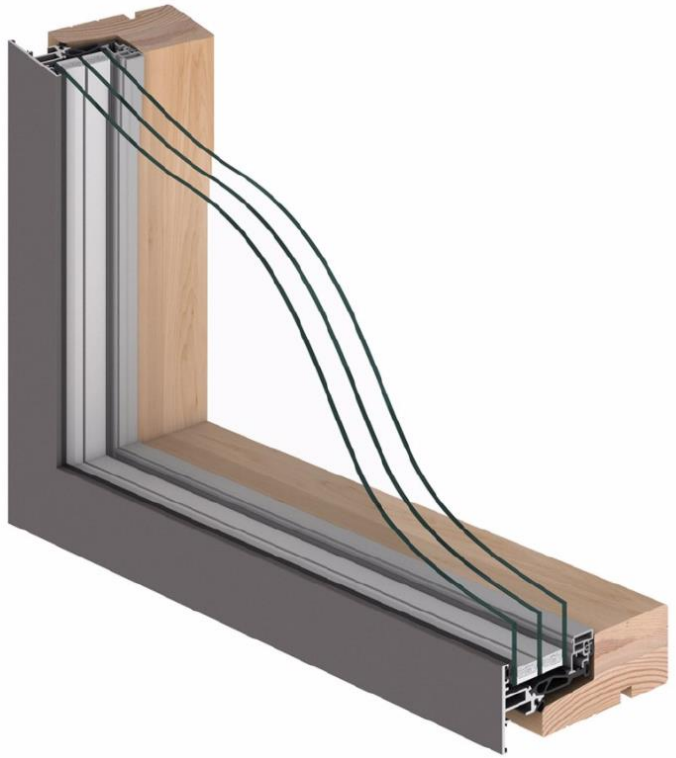
ABERGAVENNY, WALES



SRU High performance window install
Window is placed into the insulation layer for improved thermal performance.
Intermittent angles are required to support the framing in the centre of the insulation layer



Thermal High Performance window install
Window in Insulation Layer
This is the typical isotherm of window placed into insulation layer. Straight lines are good as heat transfer occurs at "pinch points"

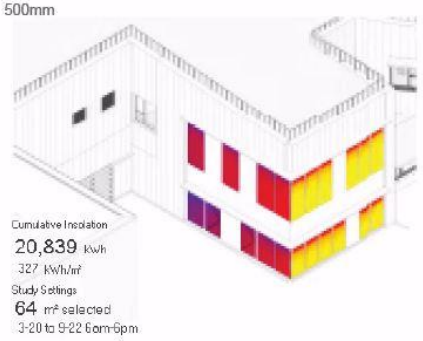


SOLAR SHADING STUDIES – BRISE SOLEIL

Baseline - Horizontal Shades at Window Heads only

Summer Season: Spring Equinox to Autumn Equinox

500mm



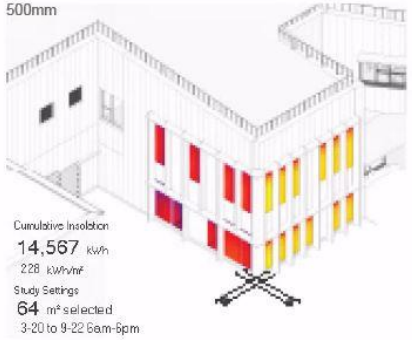
Winter Season: Autumn Equinox to Spring Equinox

500mm

Current Optimised Design: Full Vertical Shading

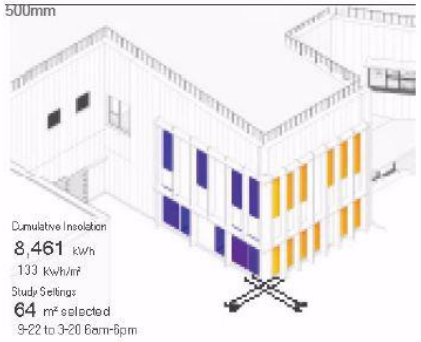
Summer Season: Spring Equinox to Autumn Equinox

500mm



Winter Season: Autumn Equinox to Spring Equinox

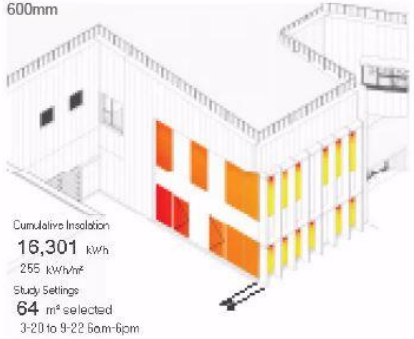
500mm



Solar Study 1: Partial Vertical Shading

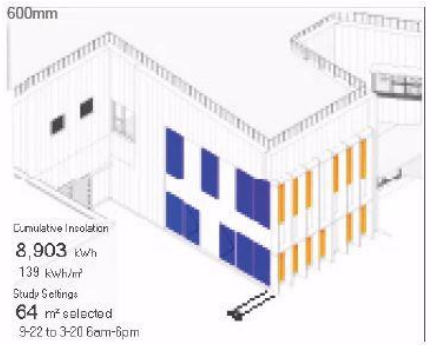
Summer Season: Spring Equinox to Autumn Equinox

600mm



Winter Season: Autumn Equinox to Spring Equinox

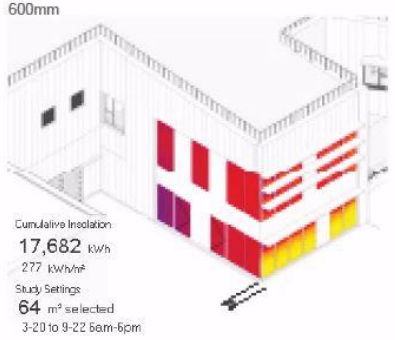
600mm



Solar Study 2: Partial Horizontal Shading

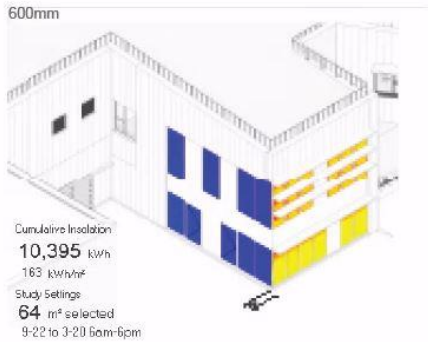
Summer Season: Spring Equinox to Autumn Equinox

600mm



Winter Season: Autumn Equinox to Spring Equinox

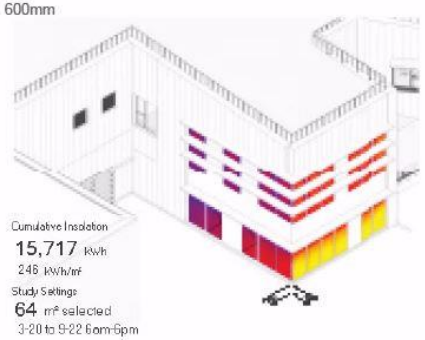
600mm



Solar Study 3: Full Horiztonal Shading

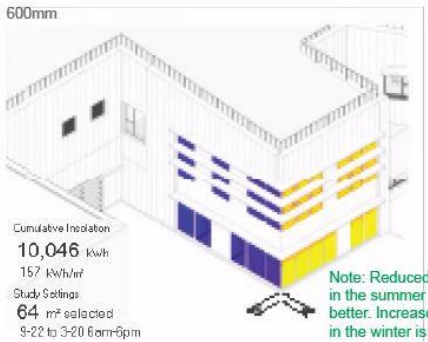
Summer Season: Spring Equinox to Autumn Equinox

600mm



Winter Season: Autumn Equinox to Spring Equinox

600mm



Note: Reduced kWh in the summer is better. Increased kWh in the winter is better.

825 Pacific
Artist's Studios and Gallery
Vancouver BC.

825 Pacific

Artist's Studios and Gallery

- 7 storeys, 24,000 sf
- In-kind Community Amenity Contribution for The Pacific
- Transferred to the City of Vancouver ("CoV") at completion
- Multi-purpose arts and culture hub
- CoV will provide long-term lease to BC Artscape (not-for-profit organization)
- Passive House is a requirement of agreement with CoV

Passive House Verification

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	1528,4				
Space heating	Heating demand	kWh/(m²a)	9	≤	15	-	yes
	Heating load	W/m²	10	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	4	≤	15	15	yes
	Cooling load	W/m²	8	≤	-	11	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0,6	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	135	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	60	≤	60	-	yes
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	-	≥	-	-	

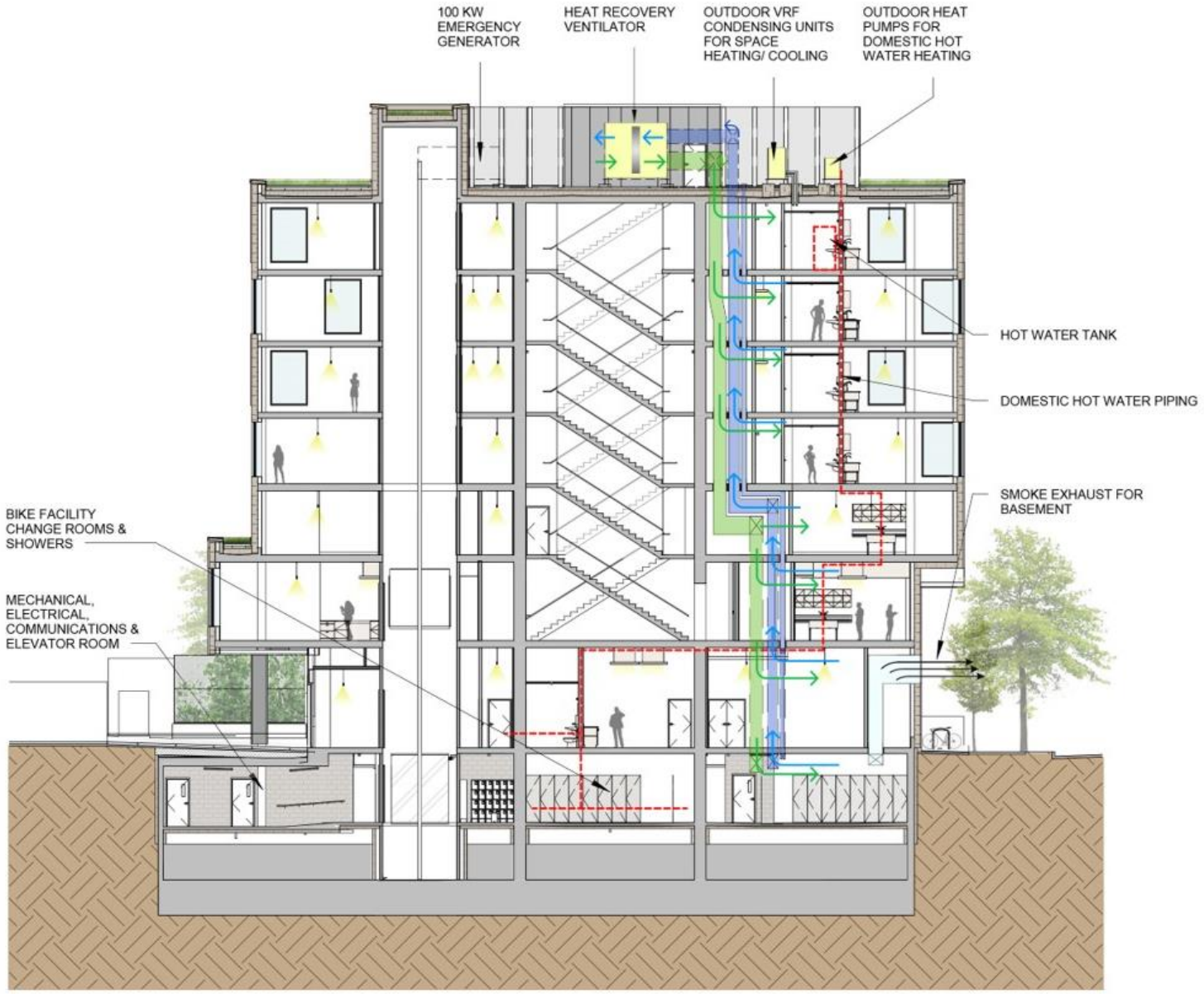
[2] Empty field: Data missing; "-": No requirement

Table 13.1: Artscape Envelope Details Thermal Performance Summary

Detail #	Description	U-Value Btu/h ft² °F (W/m² °K)	Ψ-Value W/m.K (BTU/hr.°F.ft)
	Clear Field: Concrete Backup Wall	0.027 (0.153)	-
	Clear Field: Steel Stud Backup Wall	0.021 (0.120)	-
1	Typical Footing	-	0.139 (0.080)
2	Elevator Shaft	-	0.462 (0.267)
3	Ground Floor Base of Wall	-	0.065 (0.037)
4	Parapet	-	-0.026 (-0.015)
5	Window Head	-	0.015 (0.009)

825 Pacific

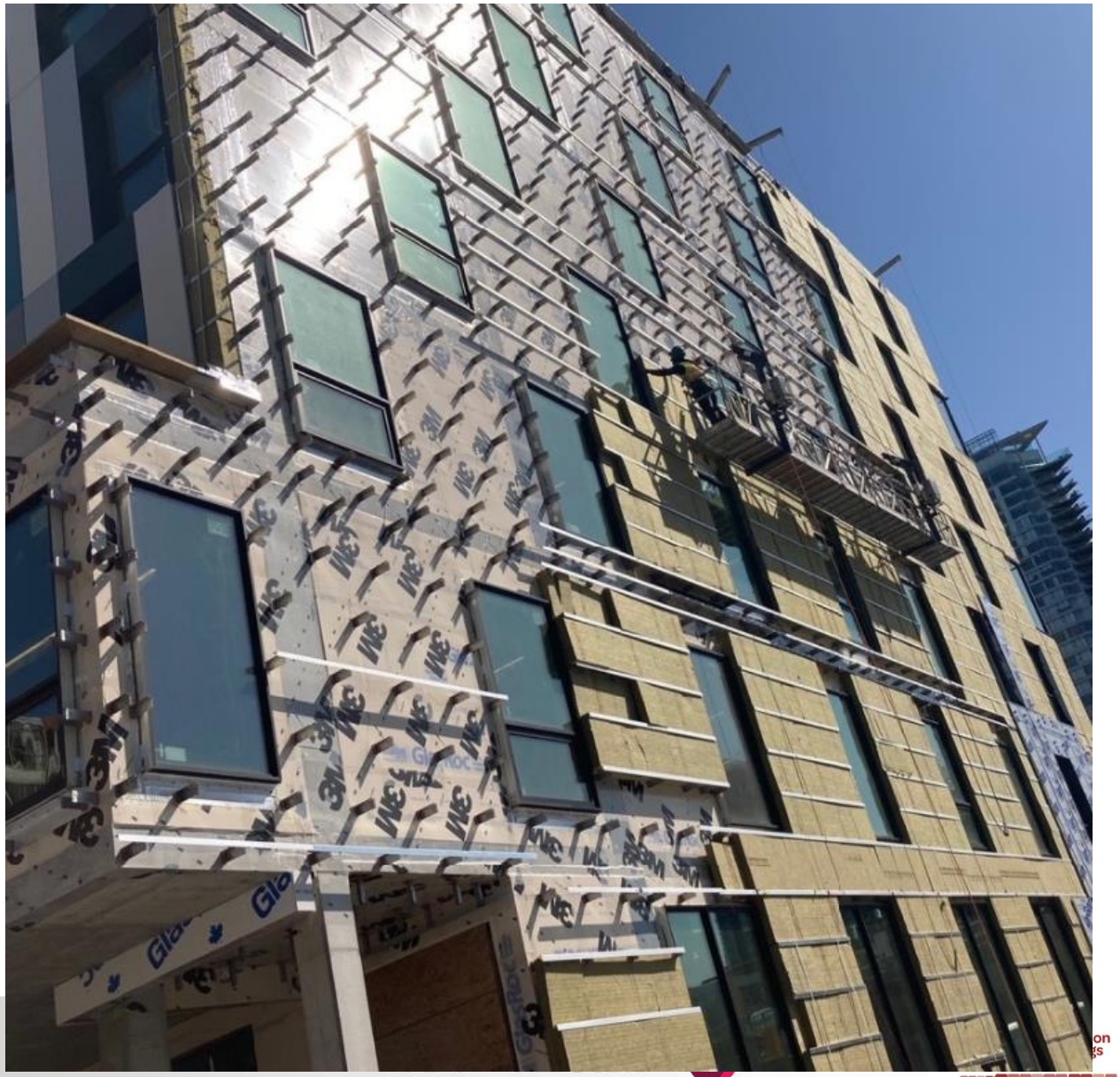
Artist’s Studios and Gallery



BUILDING SECTION SCALE: 3/16" = 1'-0"

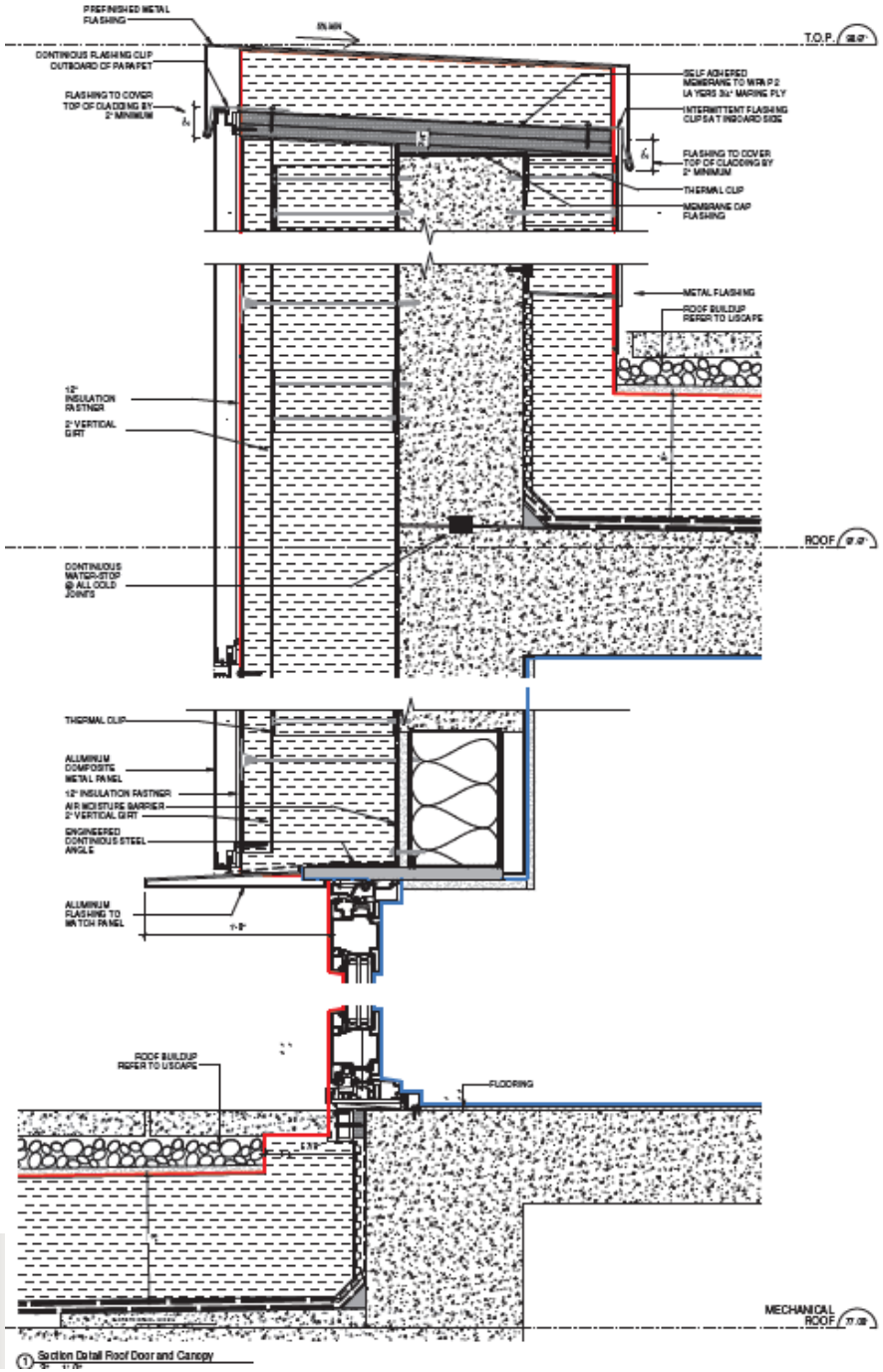
Airtight Envelope

- Design team begins CA
- PH Consultant monitors on-site practices to ensure compliance with PH
- Update modelling as required
- Prepares documentation for certification submission



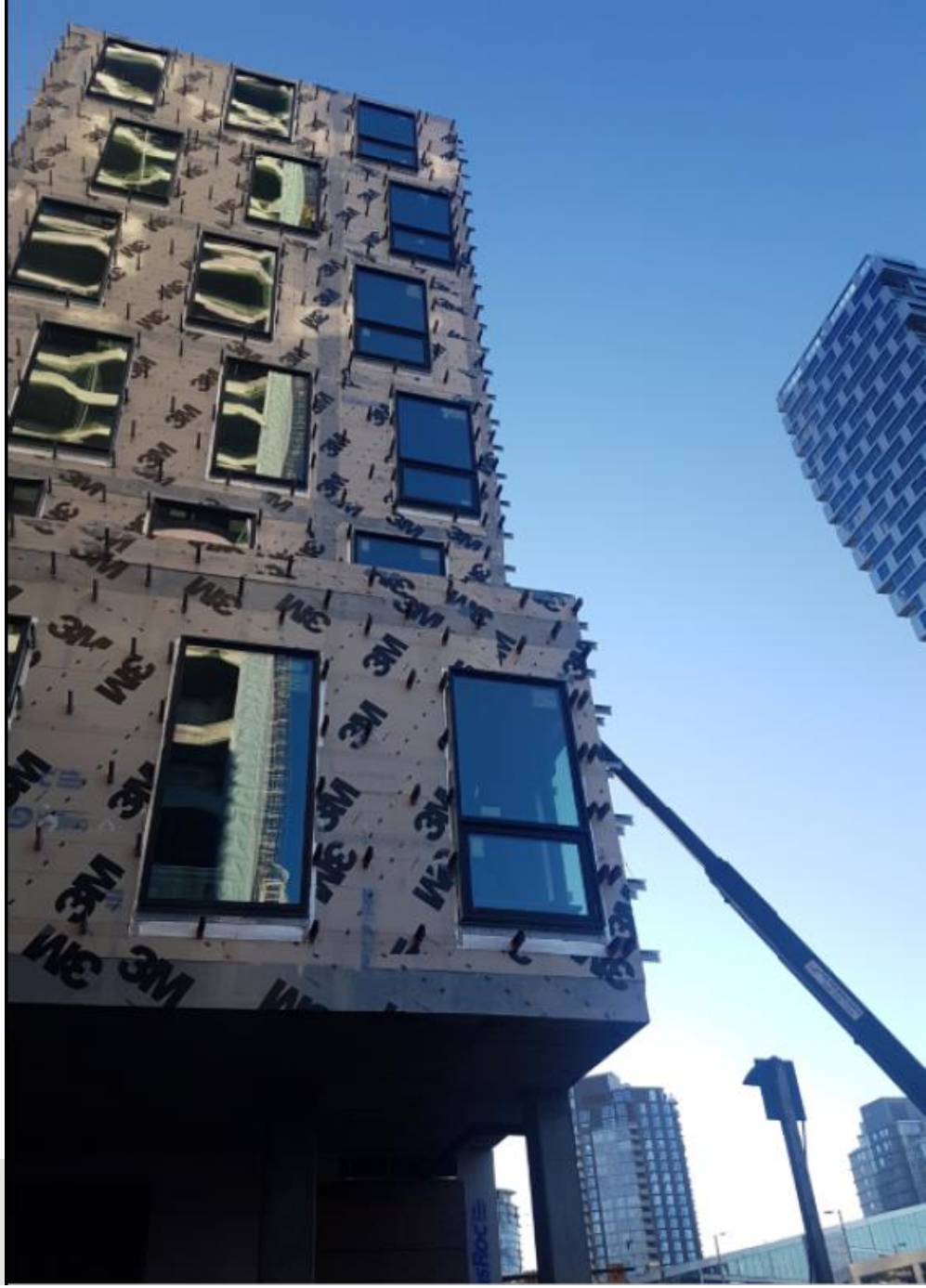
Super insulated Airtight Envelope

- Exterior insulation: 8” mineral wool.
- Exterior Membrane = Primary Air Barrier
- Update modelling as required
- Fibreglass Windows and doors



Thermal Bridge Free

Rigid Polyurethane Thermal Bridging Solutions



Site Design

Building A – north: 7 storeys, 115 units
Building B – west: 7 storeys, 114 units
Building C – south: 4 storeys, 42 units

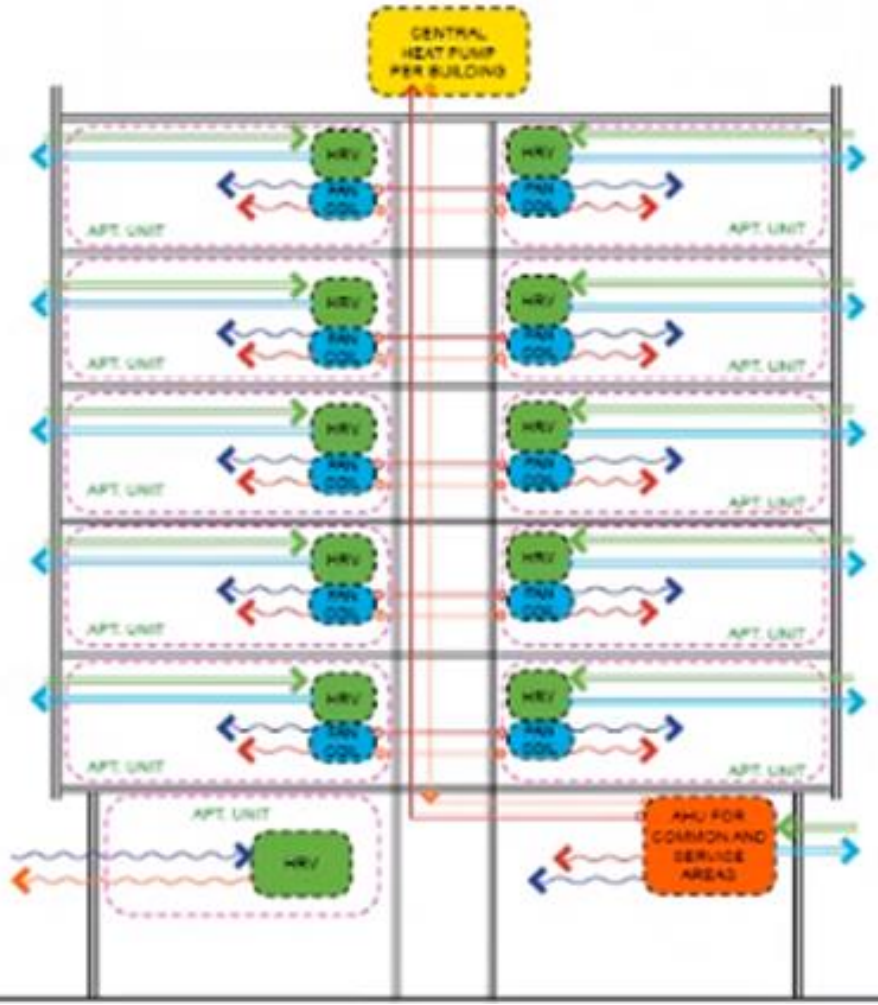
SOUTHWEST AERIAL VIEW
RENDERING CREDIT: RICARDO MATURANA

Ottawa Community Housing

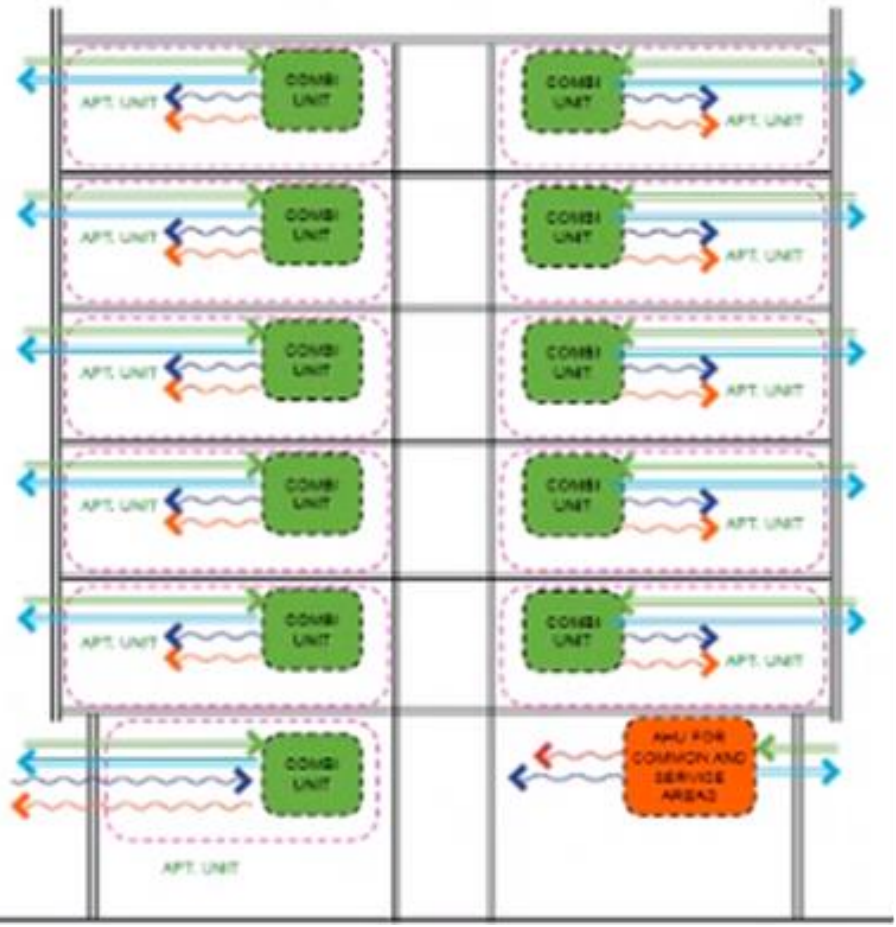
Passive House

Ventilation

DECENTRALIZED HEAT RECOVERY VENTILATION
CENTRAL HEATING AND COOLING DUCTED FAN



DECENTRALISED HEAT PUMP AND VENTILATION
COMBINATION UNIT - MINOTAIR OR SIMILAR



1075 Nelson Housing

75% Market

With

25% Social Housing

WEST END PLAN	FAR	FAR AREA
PERMITTED FAR RATIO	2.50	43,267
PROVIDED FAR AREA	24.93	431,424

1075 Nelson

INNOVATIVE CONSTRUCTION

Pre-fabricated Large Panel Concept

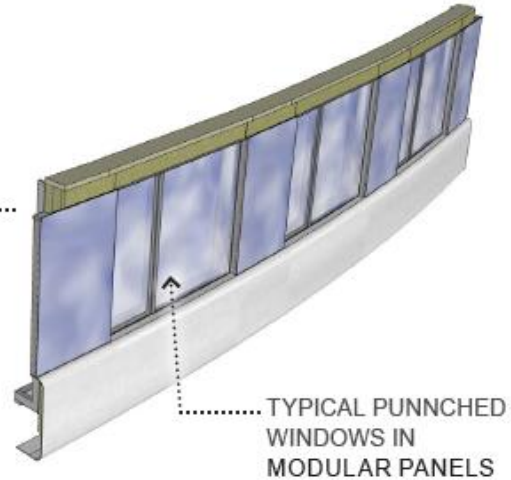
40% Window Wall

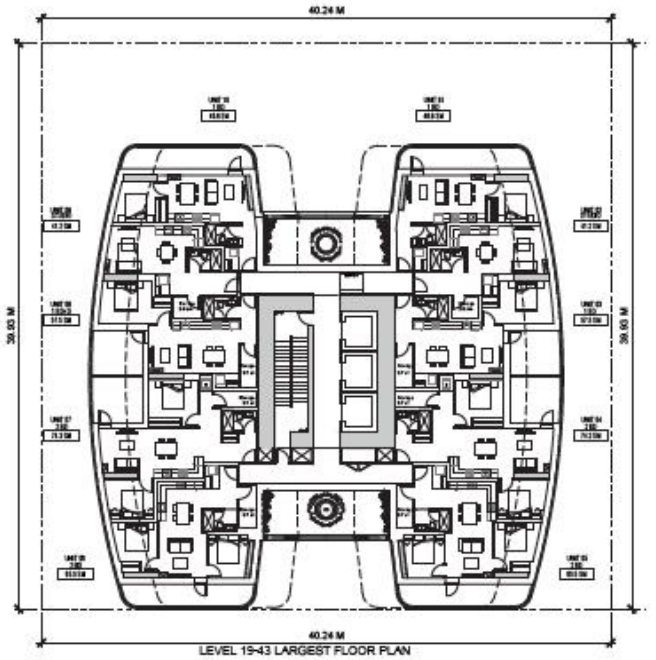
Glazed Spandrel 10" Insulation

Modular and Prefabricated

Electrocromatic Smart Glass

Curved Metal Panel Bands

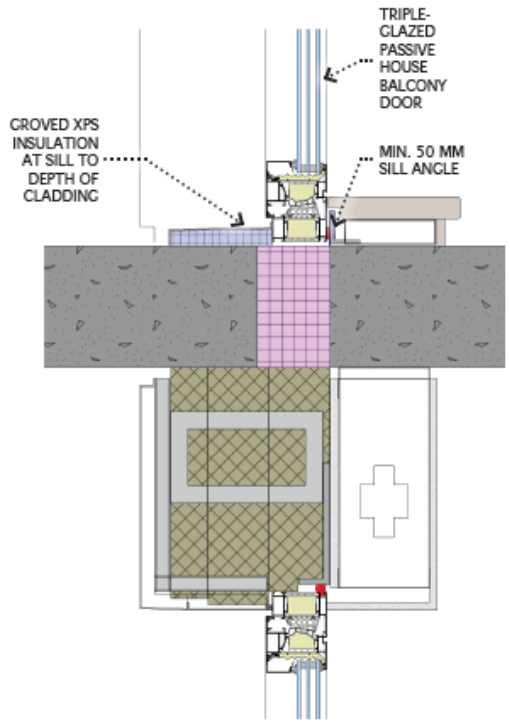




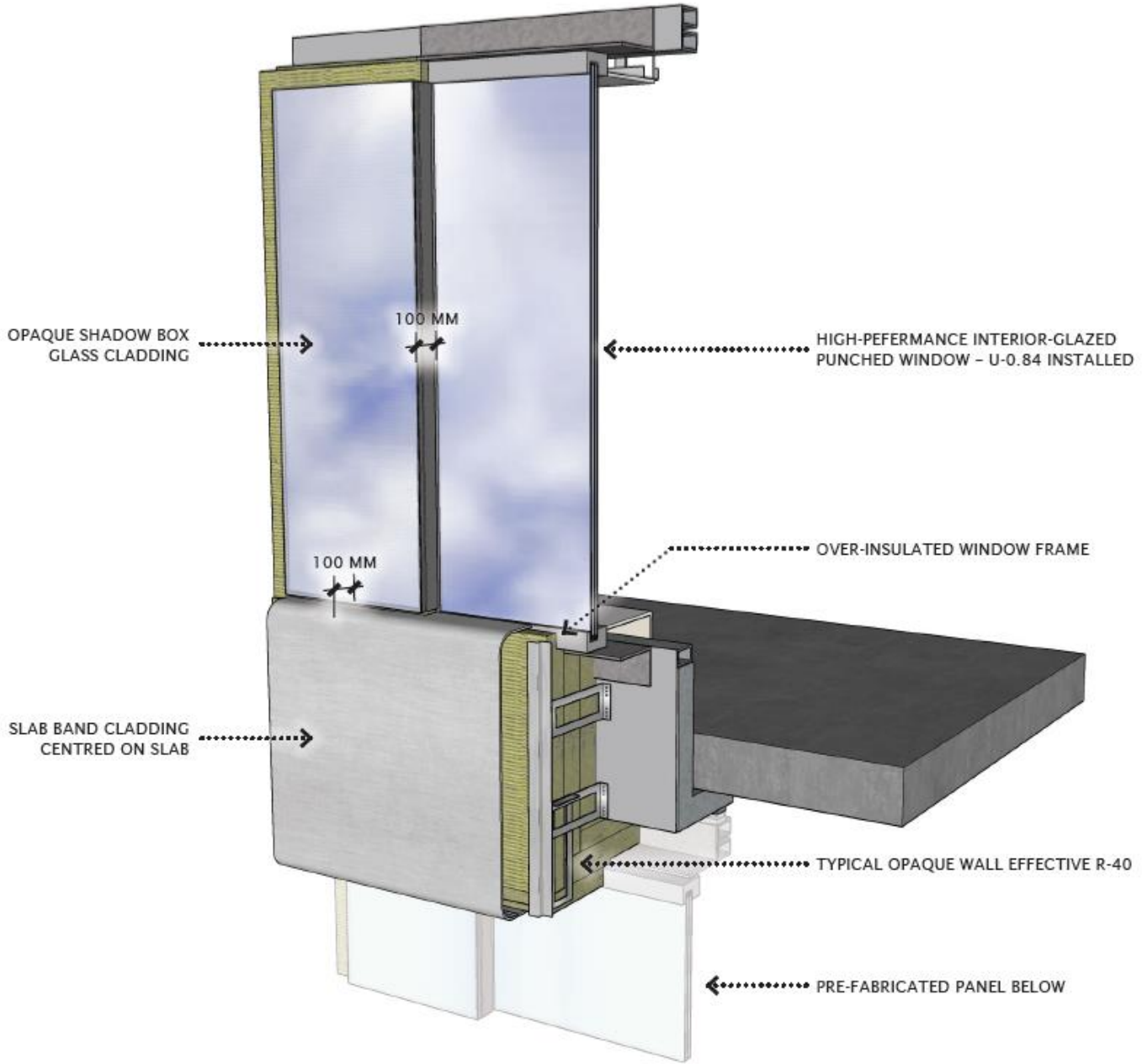
LEVEL 19-43 LARGEST FLOOR PLAN

1075 Nelson: Envelope Details

Schöck Isokorb®

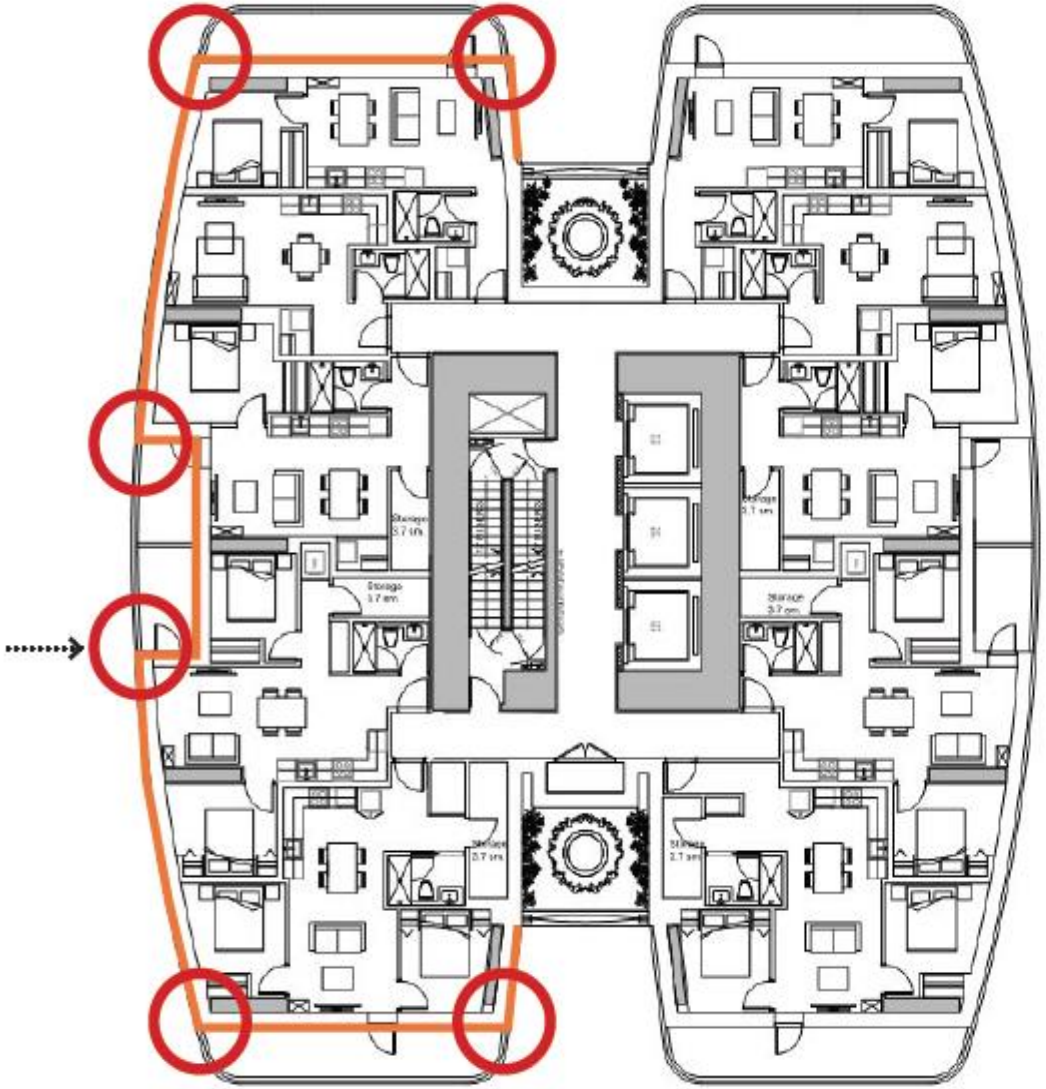


TYPICAL BALCONY DOOR SILL

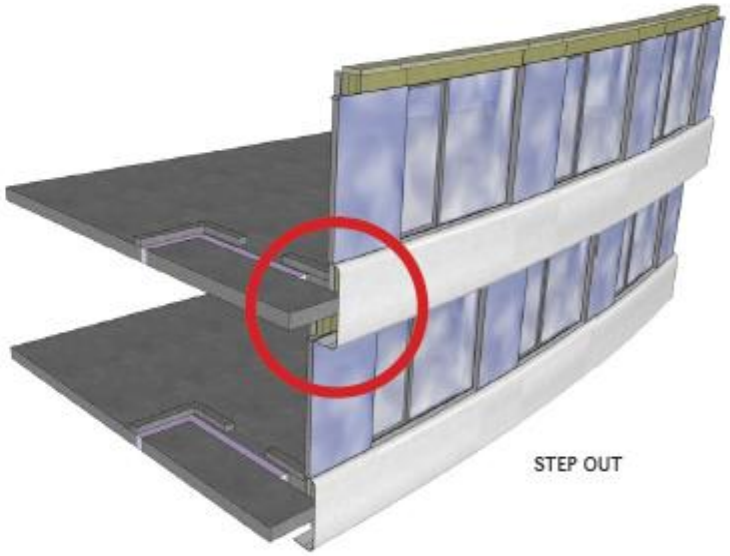


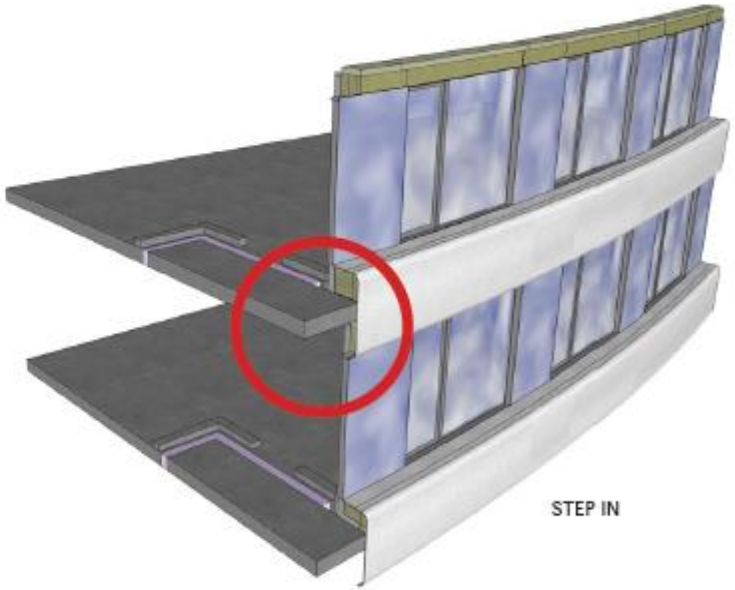
FACADE PANEL 3D CUTAWAY

1075 Nelson



Typical Floor plate
Balcony Thermal Bridge Study

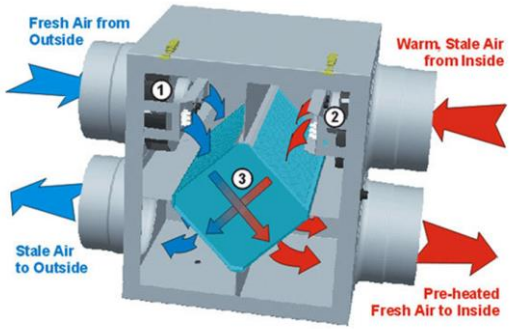


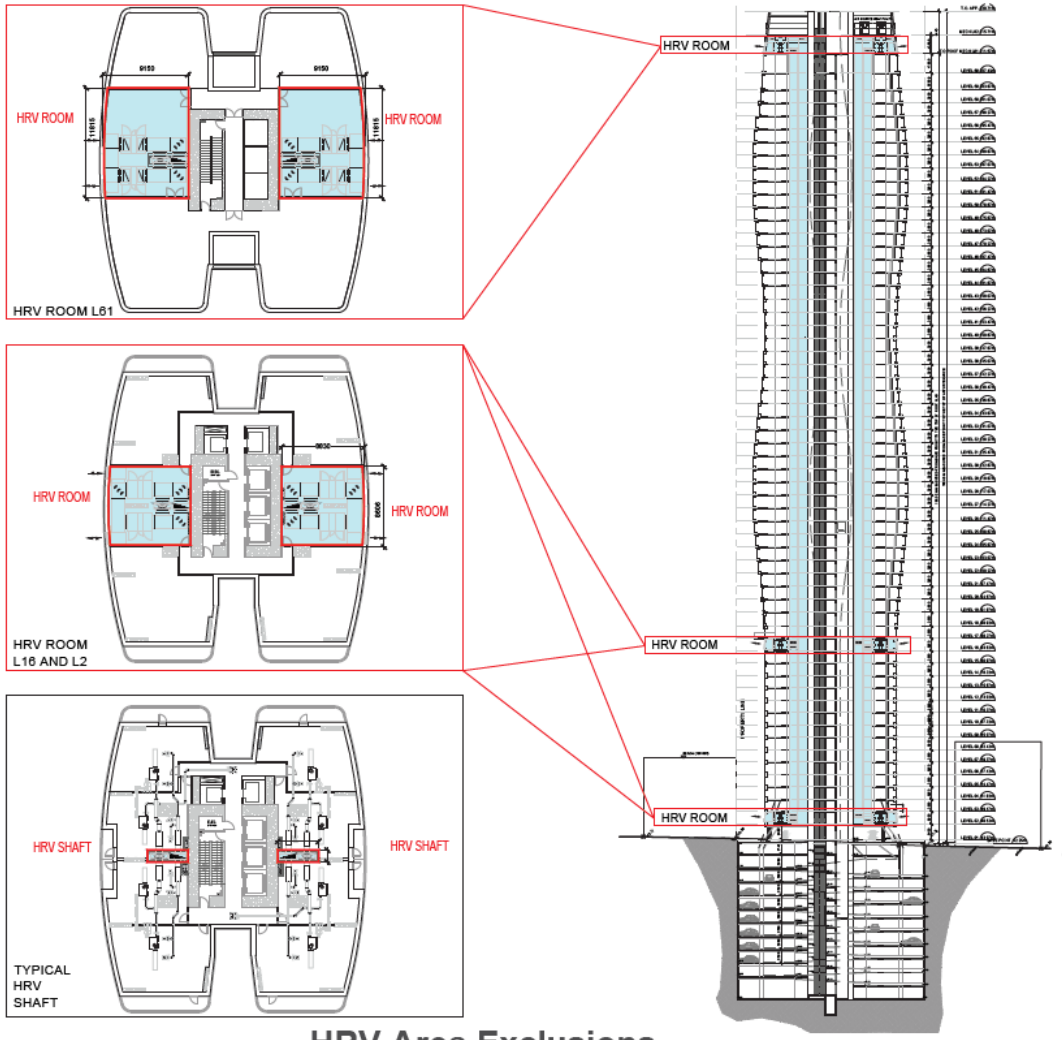


5. Mechanical Ventilation With Heat Recovery (HRV / ERV)

Efficiency of HRV:

Minimum 75% effective heat recovery required.





HRV Area Exclusions