

Delivering Healthy, Low Embodied Carbon, Passivhaus Buildings

Seb Laan Lomas, Architype



**Natural Fibre Insulation
Summit 2023**
Thursday 12th October, 2-4pm, Online

Introduction

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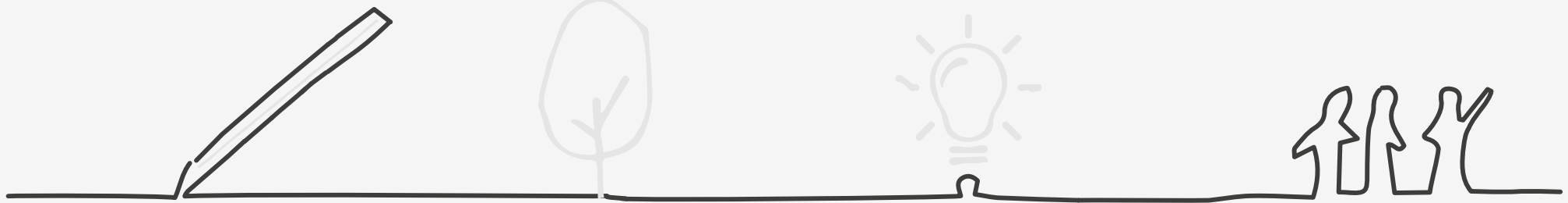
**Delivering
Healthy,
Low Embodied Carbon,
Passivhaus Buildings**



Architype

ARCHITYPE/PERFORM⁺





CREATIVE

We pioneer imaginative, sustainable solutions, creating beautiful architecture that performs well. We strive for clarity, not complexity.

ECOLOGICAL

We design holistically. Our buildings are healthy, inspiring, empowering environments for people and communities. We take action to minimise our impact on the planet.

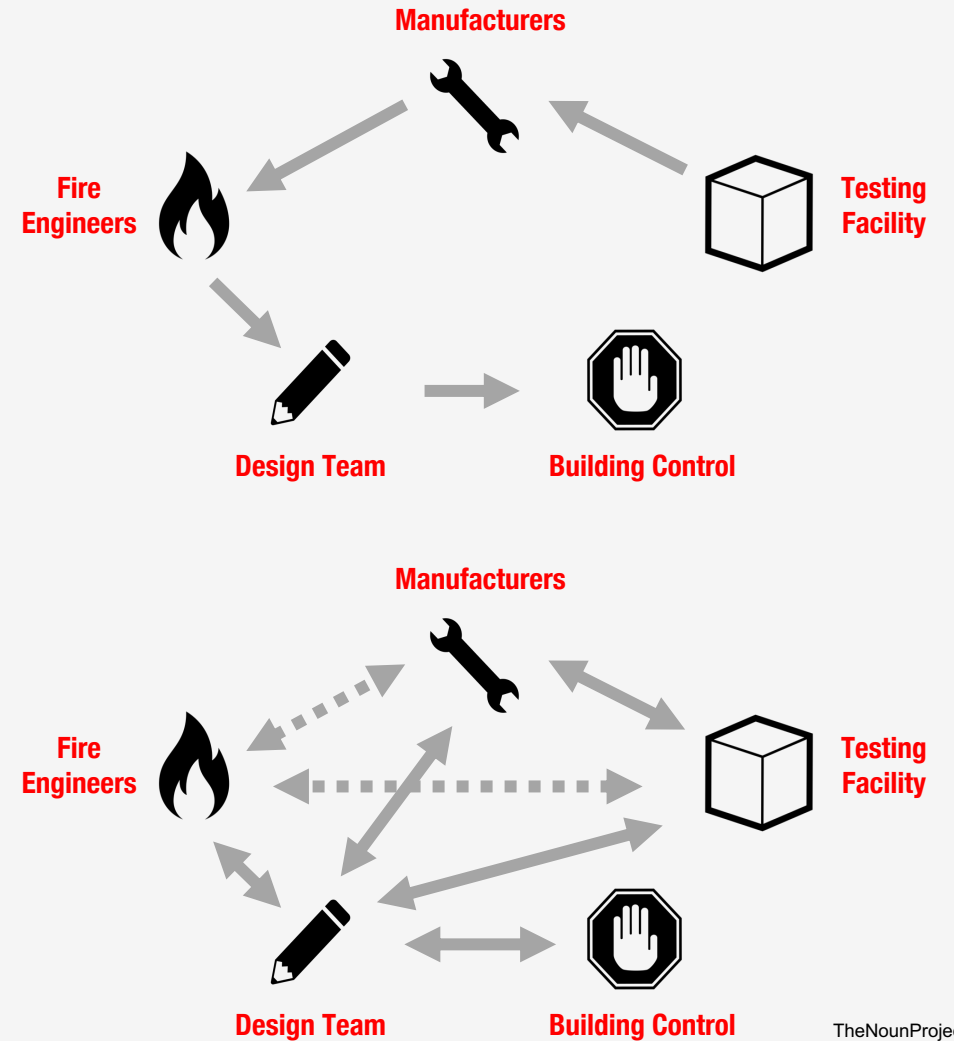
PROGRESSIVE

We are always driven to do more, using rigour and technical know-how to deliver the highest quality sustainable design we can.

COMMUNITY

We work collectively to create a common vision. Integrity, respect and honest communication are the hallmarks of our co-design process.

Fire / Challenge





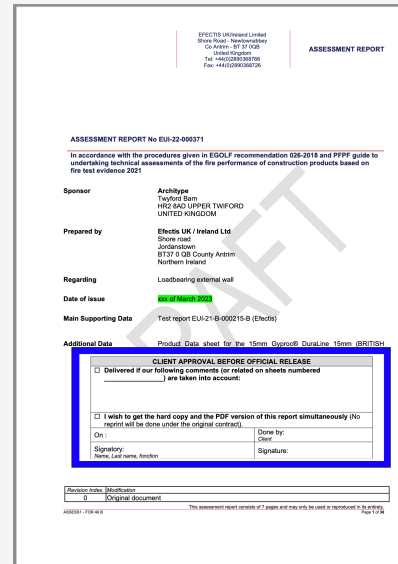
“I don’t like to think about it too much!”

Quote from leading UK fire consultant

Furnace Tests



Desktop Assessments



Calculation Based

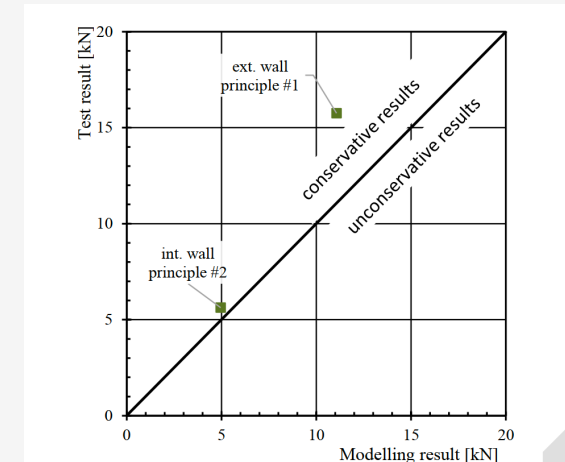
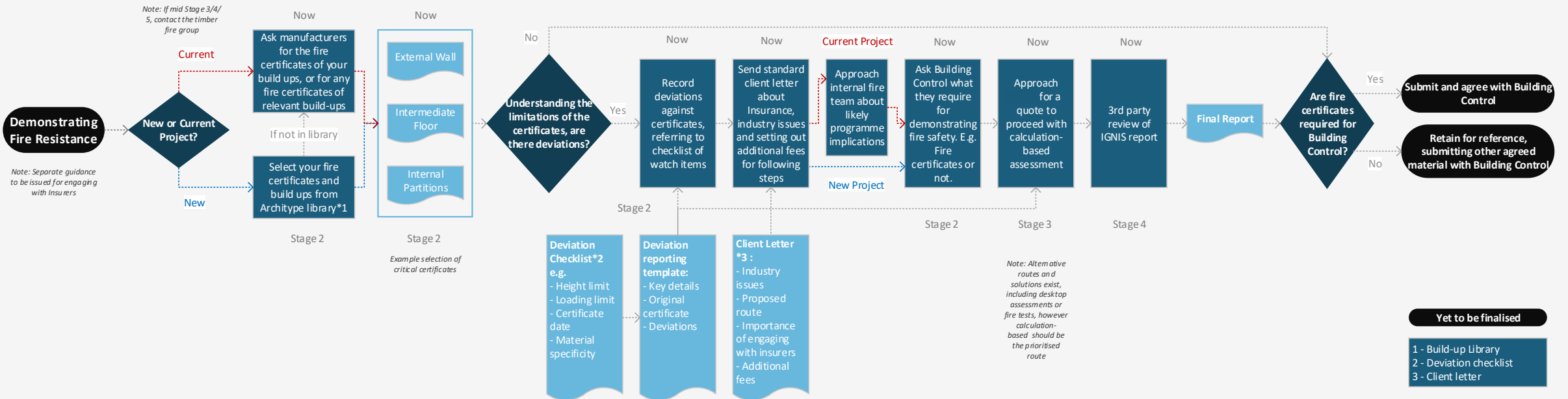


Figure 7: Comparison of fire test results for buckling (external and internal wall construction) and the modelling expressed as load per stud (in kN).



Fire / Now



Fire / Insurance

The Mass Timber Insurance Playbook:

A guide to insuring mass timber buildings



Co-authored by Philip Callow and Jim Glocking, Funded by Built by Nature, Marsh and Zurich Resilience Solutions.



Appendix B: Essential Principles

Appendix B - Essential Principles

These Essential Principles apply to all building types and are not exclusive to mass timber buildings.

B.1 Fire

*Some of these are not in the gift of building design to alter – operational mitigations.

Principle A Strategically Assess Resilience

Assess susceptibility, vulnerability and recoverability in the structure, construction and services systems against risks in fire, escape of water, water ingress and flooding, to define a strategy for the development project, to be critically reviewed over time.

- Access or determine client's business continuity plan and assess how building design can contribute to mitigating shortcomings identified in the Business Impact Analysis
- Undertake risk assessments for fire, flood, water ingress, infestation, rot and escape of water to be available and updated throughout the design process
- Assemble suitable subject matter experts to contribute to the determination of and delivery of, the building design and safety brief
- Understand the meaning of the building design and safety brief to each stakeholder, including client, insurers, fire service, LABC, etc.
- Understand the balance of risk transfer between client and insurers
- Ensure dependant systems and methods are resilient enough in themselves to meet the overall required resilience ambition

Principle B Engage Insurers Early

Engage with professional indemnity, construction, latent defects, new home warranty, building and contents insurers from the earliest RBA Work Stage in project planning, to interrogate the value of the Essential Principles and optimise the insurability of the building in use.

- Engage with construction, latent defects, new home warranty, property and business insurers at the earliest opportunity and ensure continuous engagement throughout the project
- Provide information in a format that the insurers will understand (relevance to EML)
- Use insurers approved standards and support 3rd party quality work schemes
- Comply with RISCAuthority, FPA and Contractors Legal Group (CLG) publication "Fire Prevention on Construction Sites: The Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation – 10th Edition: August 2022"
- Invite insurers to witness supporting research and provide input in to proof of concept testing

Principle C Support Fire fighting Operations

Consult with the Fire and Rescue Services to facilitate operations in pursuit of life safety with an emphasis on timely self-evacuation, understanding that rescue is a statutory obligation but protection of the asset requires additional measures.

- Engage early and seek input from the Fire Service
- Understand building features that support fire fighter effectiveness including:
 - High integrity detection systems (believable call-out request)
 - Access
 - Water provision
 - Structural stability
 - Suppression systems
 - Smoke control systems
 - Fire fighting shafts, dry risers, wet risers, etc.
 - Familiarisation visits
- Understand building features that can impair effective fire fighting:
 - Poor false and unwanted alarm record
 - Fire spread in voids
 - External fire spread
 - Limited stairwell access
 - Smoke generation (visibility) and toxic gases
 - Impairment of progress by cables and pipes detaching from roof mountings
 - Put an effective salvage plan in place with the Fire Service
 - Rehearse evacuation plans and consider disabled egress

Principle D Maximise Non-Combustibility

Use non-combustible construction materials and products within systems, elements and spaces, so far as is reasonably practicable, as methods of construction that make minimal contribution to fire development and the generation of smoke.

- Consideration of the use of mass timber in structural elements of the building needs to be given and maintain the use of timber if the associated property risks are adequately managed through the design elsewhere and not in breach of regulation (e.g. insulation/cladding in some residential developments)
- In areas where a greater level of protection against fire is required than wood can achieve (i.e. main access and egress routes, high risk areas), use other non-combustible materials
- Encapsulate the timber behind higher performing materials
- Make an audit of accessible versus encapsulated combustible surfaces
- Do not allow combustible voids (design out or adopt IBC approach of filling, lining or suppressing)

Section 4: Mass Timber Insurance Playbook – Guidance Sheets



0

Strategic Definition

4.2 Strategic Definition

Key Themes:

Undertake Early Consultation. Establish the client attitude/motivation for using mass timber (Sustainability / Visual).

Risk Mitigation Actions:

Risk Mitigation needs to be a key pillar of design, construction and operation of the building from Stage 0 to Stage 7. Be prepared to demonstrate this at any stage. Design and construction methodologies must be underpinned by risk mitigation.

Delivery team selection/make up:

- Suitable experience, competency, training and resources
- Architect
- Fire Risk Engineering
- Structural and MEP engineers
- Project Managers

Contractual relationship – Design and build may require additional peer review to ensure competency of design for risk mitigation. Lay foundations for a long and equitable partnership.

Lay foundations for a long and equitable partnership.

Design must lead all aspects of risk mitigation:

- Improve risk profile – reduce EML
- Limit scope to within current knowledge
- Set principles for peer review
- No combustible voids
- Resilience against fire and water perils
- Reparability
- Foundations for Fire Management (Including STA 16 Steps to Fire Safety and Fire Prevention on Construction Sites – Joint Code of Practice 10th Edition (FPA & RISCAuthority)
- Foundations for Water Management (Including essential principals for escape of water as well as water ingress)
- Non-negotiables
- Logic – do not let aesthetic design reduce risk mitigation

Essential Principles for Fire Mitigation

A: Strategically Assess Resilience

Build for resilience
not just life safety

Insurance Actions:

Select your Insurance Broker.

(Not all market relationships are equal, do your research and don't be afraid to insist on relevant experience. Lack of experience is not a barrier but insist on senior brokers taking the lead).

- Check market appetite/trends
 - Action points from this?
 - Recent learnings
- Map out strategy together based on MTP
- Be realistic with timelines
- Broker led insurance market research
- Broker to ask markets to be involved at this stage and seek to speak to insurers' risk engineers if appropriate

Promote effective two-way communication between both parties. Be open and transparent, all parties want the project to succeed for mutual financial success (few win in the event of a claim).

Prepare for Property Insurance. Same broker is preferable and push for common insurers if possible.



Fire / Moisture

Sensor solution for sustainable quality assurance to eliminate building damages

- Sensor
- Platform
- Alarms



WOODSENSE Home / Sensors / 5f803a983b7750004d96f7d / Values

Overview Sensors Groups Reports Alarms Gateways Blueprints Settings Logout Admin dashboard

Woody026

Wood moisture 15% Temperature 14°C Humidity 83%

Moisture and Precipitation
Measured moisture content from the sensor and the amount of precipitation in the local area

Temperature and humidity
Measured temperature and humidity from the sensors

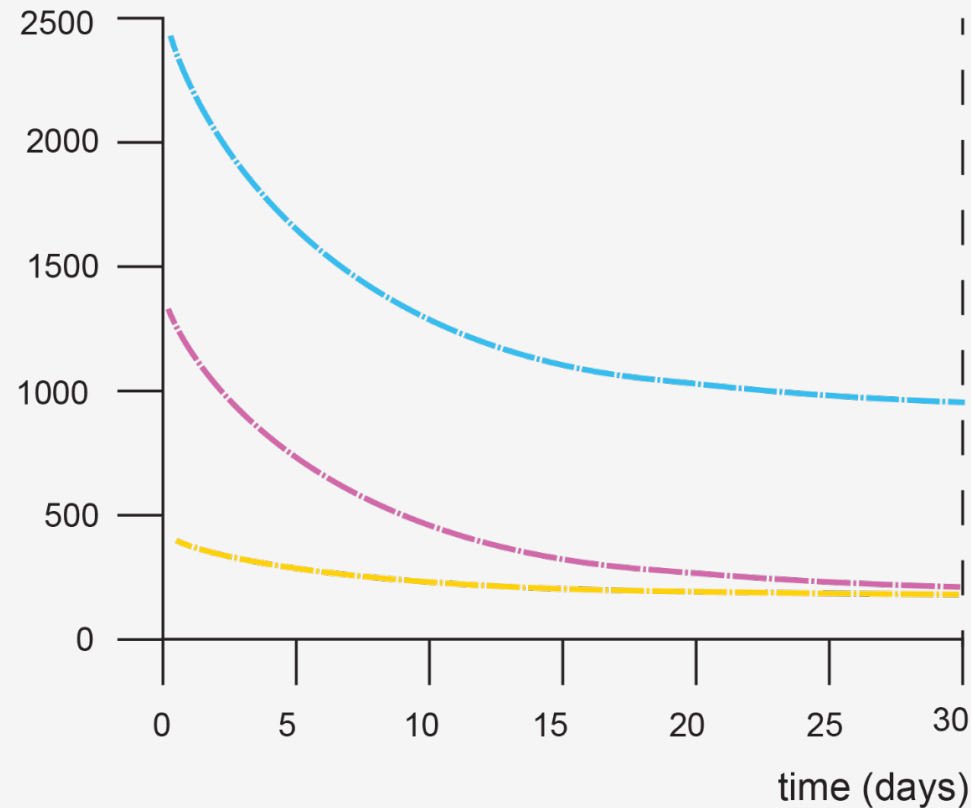


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emission rates
of example
flooring
materials
($\mu\text{g m}^{-2} \text{h}^{-1}$)

- PVC
- linoleum
- rubber



Preliminary monitoring results
from passive sampling in PH
primary school classrooms

Confirmed no or minimal
contribution from the specified
products on indoor air
concentrations of compounds
selected as typical of emission
from these types of materials.

Healthy / Hidden

ARCHITYPE/PERFORM⁺



Healthy / Hackbridge

ARCHITYPE/PERFORM⁺



“Dear Prince Harry,
Could you come to our ECO school please? Our new ECO school is Hackbridge Primary School. Our school is clean. Our school has no rubbish. We have a pond. We have so many trees. Our school is made of wood. We hope to hear from you soon.”

Love from Qihang

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Embodied / Systems



Embodied / Health

	Standard Specification (kgco2e/m²)		Alternative Specification (kgco2e/m²)					
Wall	7.891 Dulux Paint		0 Expose CLT/Timber	0.716 Clay Plaster	7.721 Graphenstone Low VOC Paint	32.741 Kein Low VOC Paint	75.698-79.722 Ceramic Tiles	11.7-406.2 Living Wall - Excluding Backing Wall
	12.688 Rockfon Tiles		0 Expose CLT/Timber	11.198 Ecophon Acoustic Panels	12.558 Slatted Timber Ceiling	13.99 Plywood Panels 12mm	30.298 Ecophon Solo Baffle at 600mm Centres	35.146 Troldekt Woodwool Panels
Ceiling	98.865 Tarkett IQ One	91.822 Tarkett Carpet Tile	2.62 Micro Concrete	22.193 ERFMI Cork Tiles	27.235 Jura Limestone Tiles	27.595 Resandable Engineered Timber		
	72.694 Tarkett Timber	13.959 Tarkett Lino						

Embodied / Health

Wall Finish	Embodied Carbon (kgco2e/m ²)	Dependent on partition or structure material?	Health and Wellbeing Benefits			Building Performance Benefits	
			Improves Indoor Air Quality	Lowers Stress	Removes Pollutants/Smells	Buffers Temperature	Moderates Humidity
Dulux Paint	7.175	No	No	No	No	No	No
Exposed CLT/Timber	0	Yes	Yes	Yes	No	No	Yes
Clayworks Clay Plaster	0.716	No	Yes	Yes	Yes	Yes	Yes

Figure 23 / Material evaluations of the embodied carbon, practicalities and benefits of analysed wall finishes

Embodied / Rewards

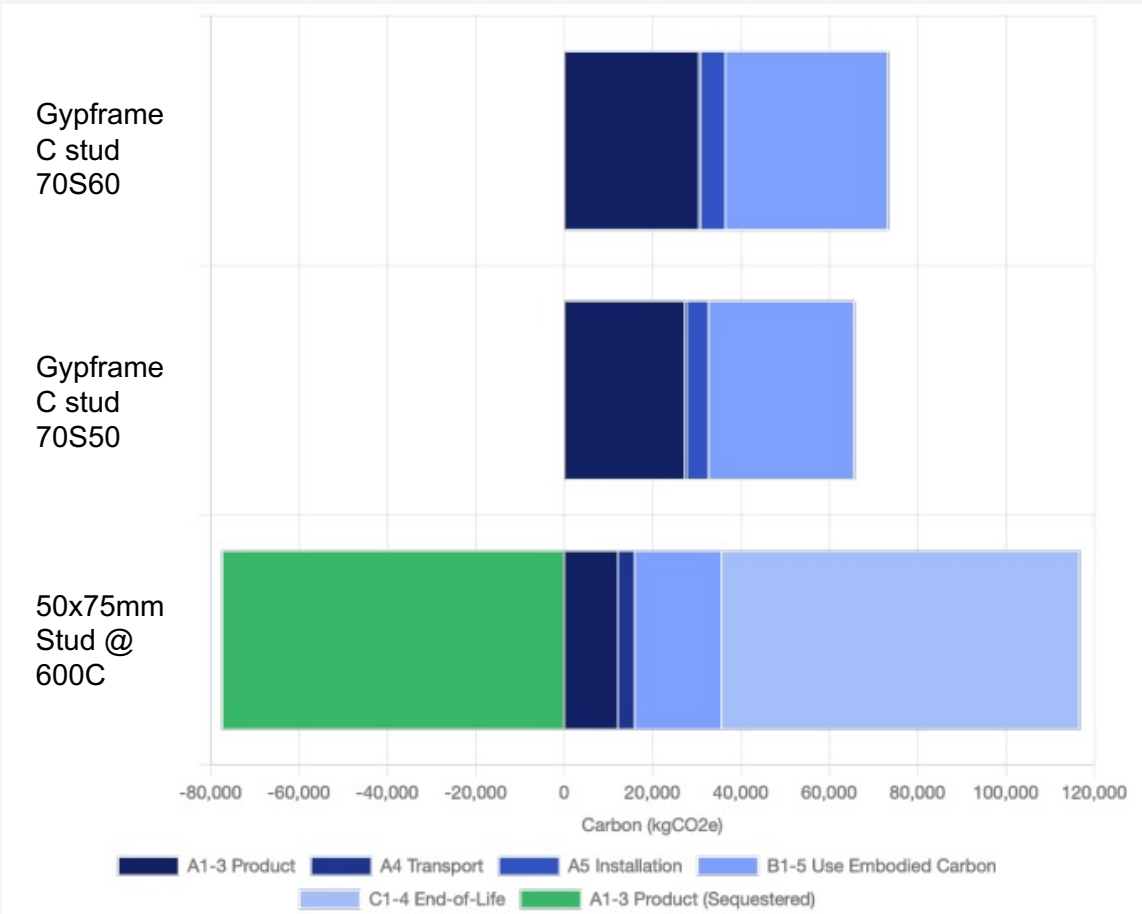


Figure 17 / Internal Partitions: Potential embodied carbon reduction across building

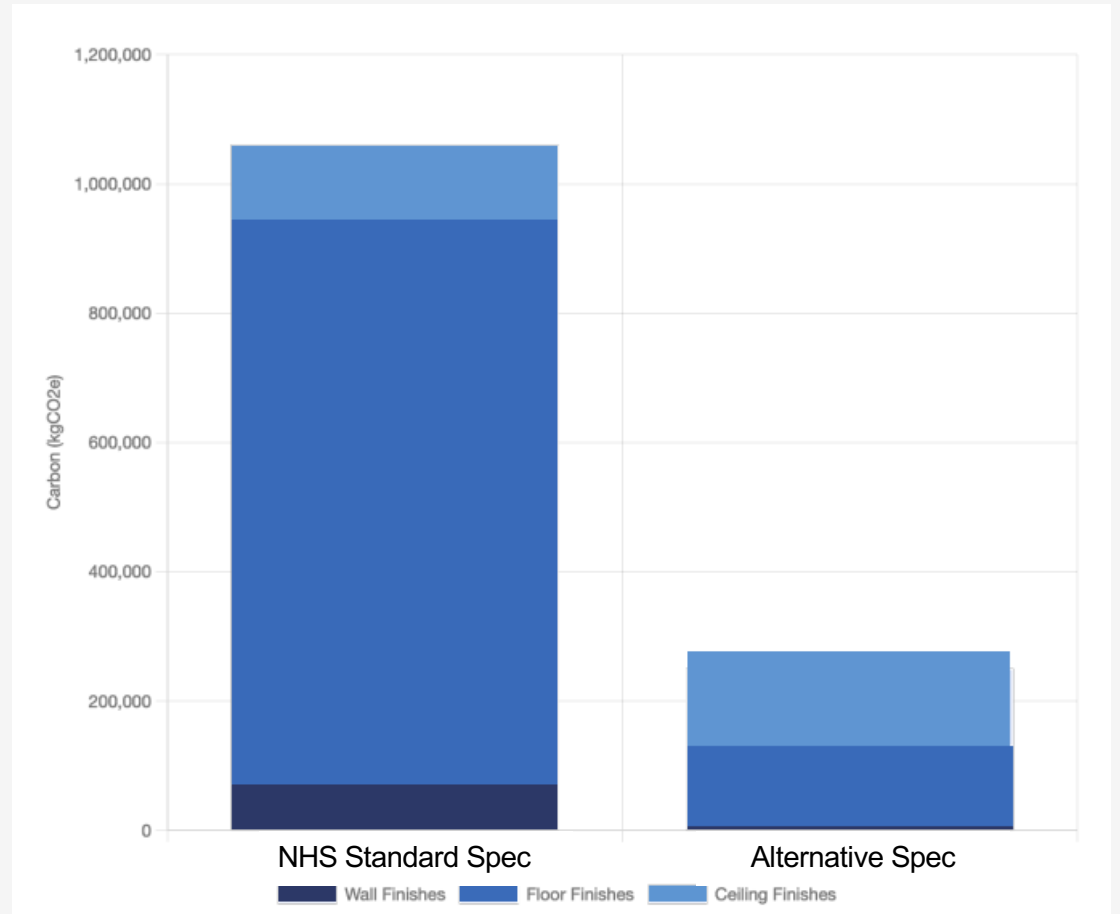


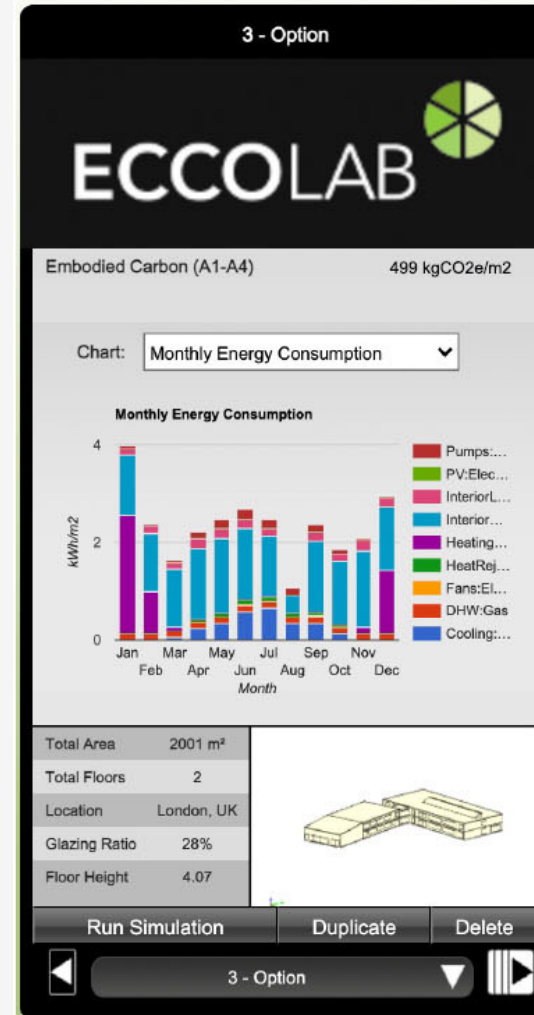
Figure 15 / Potential embodied carbon reduction across building

Embodied / Results

Education sector

Embodied Energy Emissions
Stages A1-A5 Only

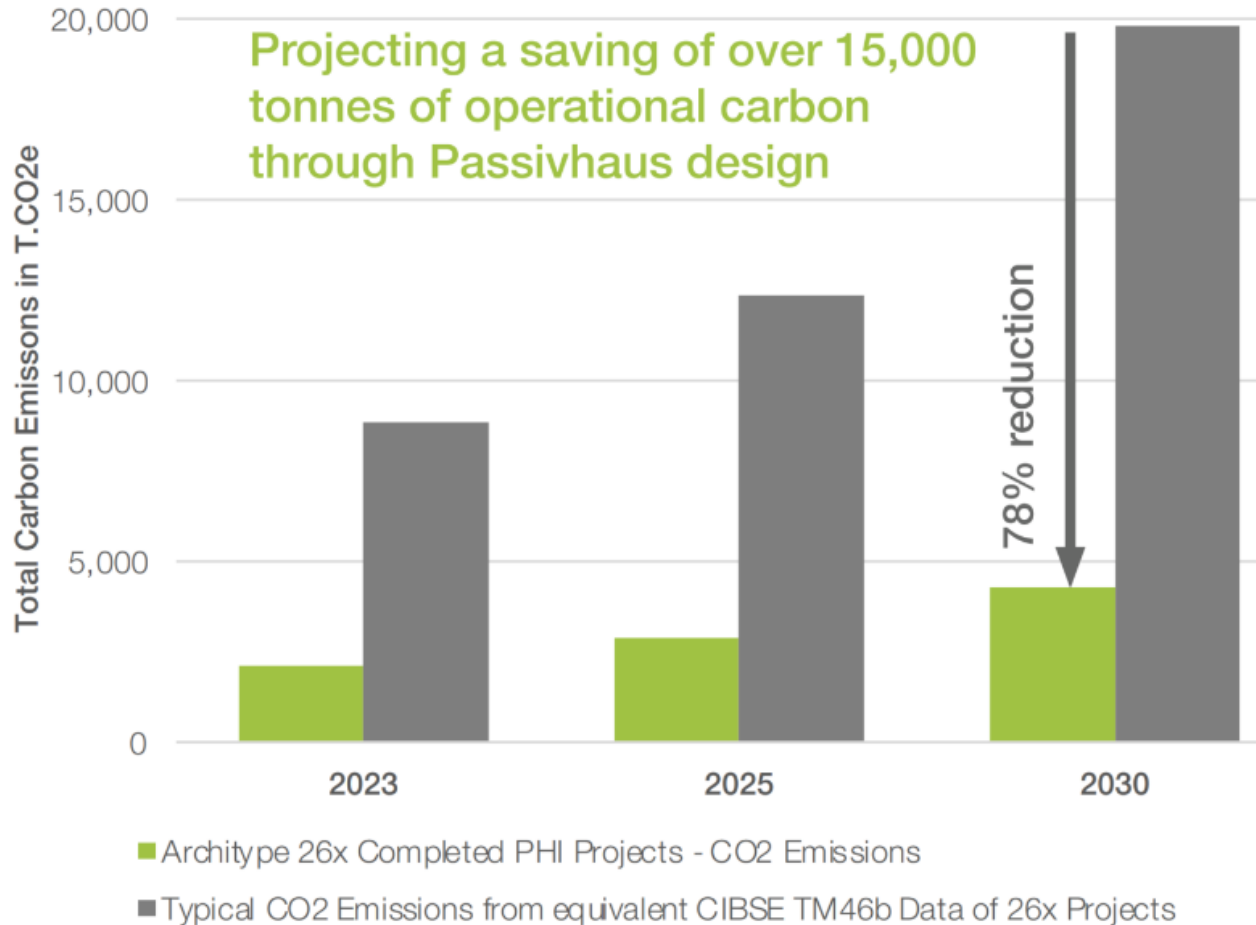
- LETI 'Business as usual' [Benchmark]
750-1000 kgCO₂e/m² [GIA]
- London Plan [WLC Benchmark]
700-800 kgCO₂e/m² [GIA]
- LETI 2020
500 kgCO₂e/m² [GIA]
- London Plan [Aspirational WLC benchmark]
500 kgCO₂e/m² [GIA]
- Hackbridge Primary excl. sequestration
499 kgCO₂e/m² [GIA]
- Hackbridge Primary incl. sequestration
405 kgCO₂e/m² [GIA]
- RIBA 2030 Target
400 kgCO₂e/m² [GIA]
- LETI 2030 Target
300 kgCO₂e/m² [GIA]



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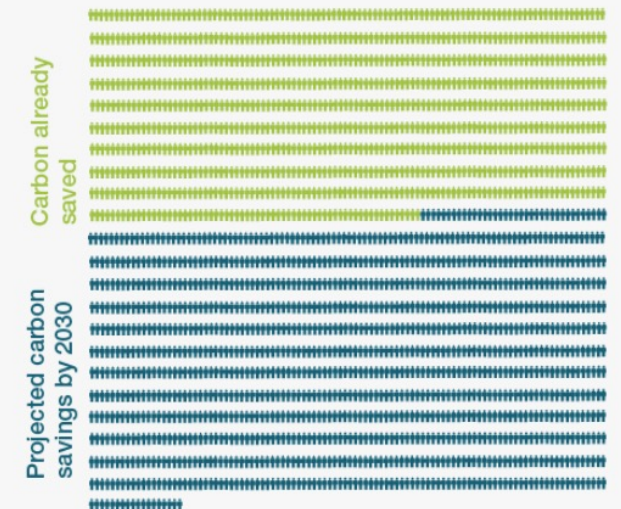


Passivhaus / Progress

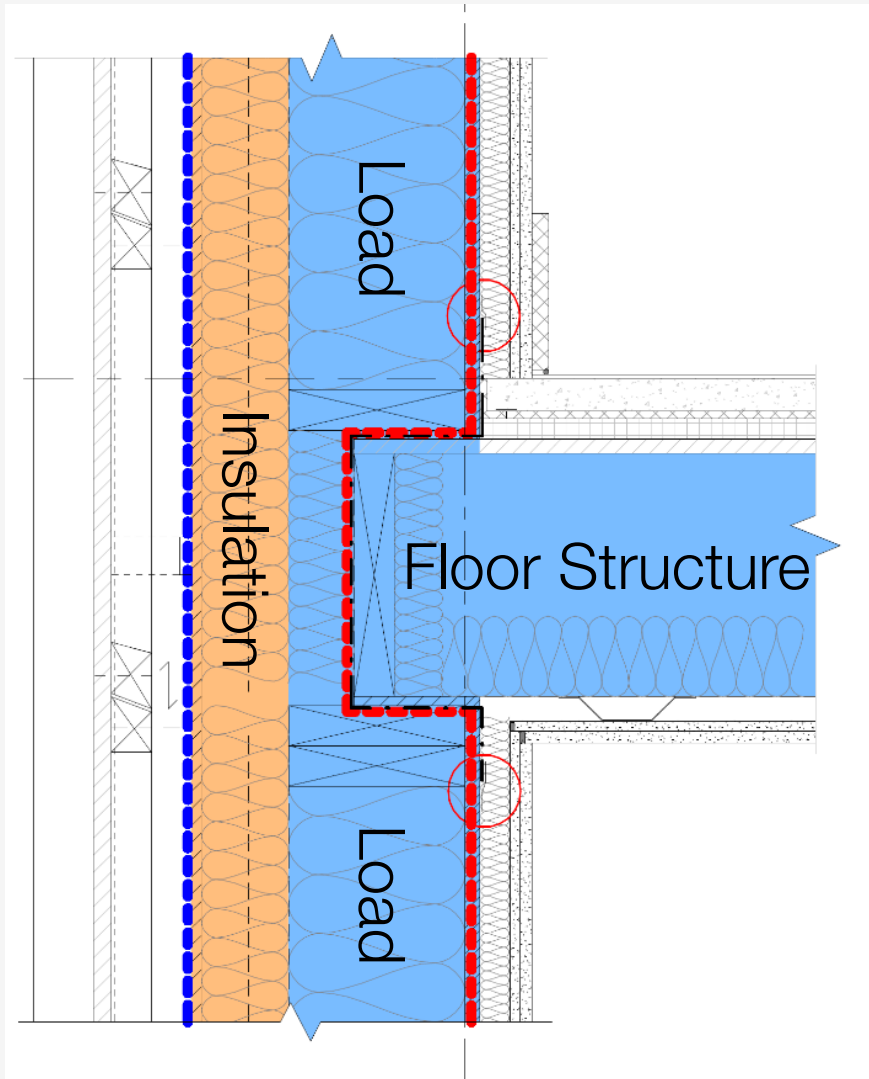


How much carbon are we saving?

The average human creates 7,000kgs of carbon emissions per year



Passivhaus / Co-benefits and Coordination



Horizon



An industry-proposed amendment to The Building Regulations 2010

Whole life carbon

INDUSTRY-PROPOSED DOCUMENT



Z1 Carbon assessments

Z2 Carbon intensity

Disclaimer: This document is not part of the Building Regulations. It has been produced by and in conjunction with the construction industry as proof of concept in order to demonstrate one way in which embodied carbon could be introduced into UK regulation. For accompanying commentary on this document, visit www.part-z.uk, or contact hello@part-z.uk

Proposal revision 1
26 April 2022

A proposal from the construction industry



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Energy Standards Review – Scottish Passivhaus Equivalent: Working Group

Overview

In response to Alex Rowley MSP's [Proposed Domestic Building Environmental Standards \(Scotland\) Bill](#), in December 2022, the Minister for Zero Carbon Buildings, Active Travel and Tenants' Rights [confirmed](#) that the Scottish Government will make legislation by December 2024 to deliver "a Scottish equivalent to the Passivhaus standard".

This aligns with the [Shared Policy Programme](#) agreement on "explicit support for passivhaus and equivalent standards" and the recommendation from our [Climate Assembly](#), "to ensure that, within the next 5 years, all new housing is built to Passivhaus standards (or an agreed Scottish equivalent)".

To develop proposals, a further review of energy standards within building regulations was initiated at the beginning of 2023. The review will consider standards for both new homes and new non-domestic buildings.

Remit

A working group to support the next review of energy standards was convened in June 2023, with an initial focus on two key themes:

- to develop a package of measures that use reliable solutions to optimise building fabric and service performance, reduce delivered energy demand and provide a healthy indoor environment
- that the design and construction of new buildings must be supported by quality assurance and verification processes that result in buildings that meet the high standards set.



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About us



Our thoughts on Doughnut Economics

As part of a drive to increase awareness of what Doughnut Economics is about and also to inform Cambridgeshire residents that there is an active group in Cambridge we have recently produced 3 videos. About Doughnut Economics About CAMDEAG Shorter

READ MORE →



Stories from Cambridge Resilience Web

Back in March, Cambridge Resilience Web ran its first Pecha Kucha event, showcasing five local community groups who are doing wonderful work in Cambridge. The video is available to watch below. It was well attended and provided a rich discussion

READ MORE →



Cambridge Resilience Webs Pecha-Kucha on 24th March at 19:30

Since launching last year, the webs have grown and grown – we are really excited about what is happening in Cambridge to build a stronger, more versatile community! We are hosting an hour of short pecha-kucha style talks from groups

READ MORE →

Thank you

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