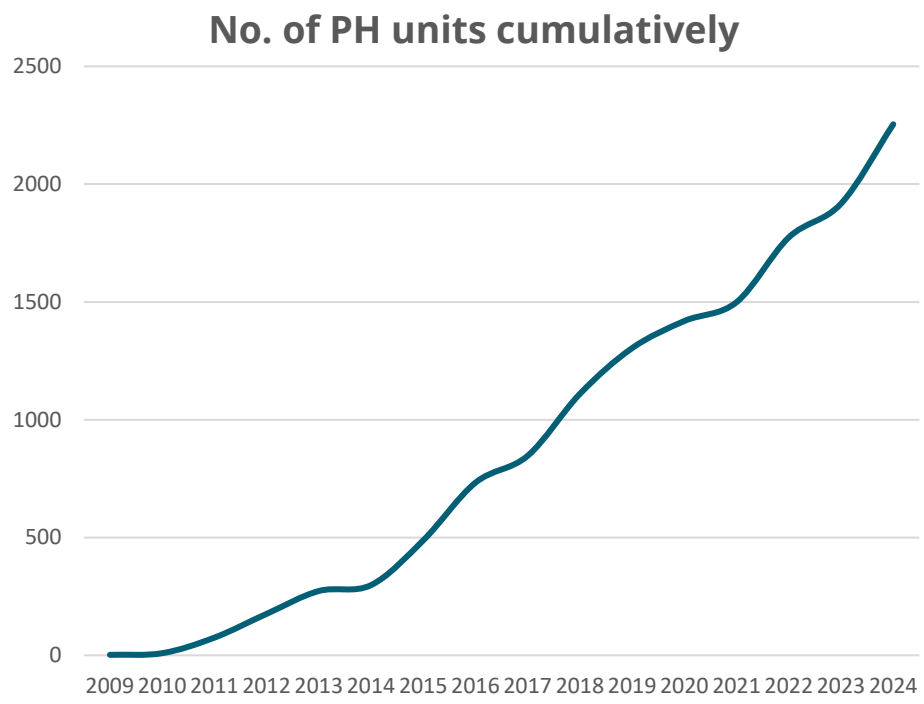
Safe Schools for the Future

1st October 2025 STBA Conference

Passivhaus Trust – Certified projects update



> 470
GB CERTIFIED PROJECTS

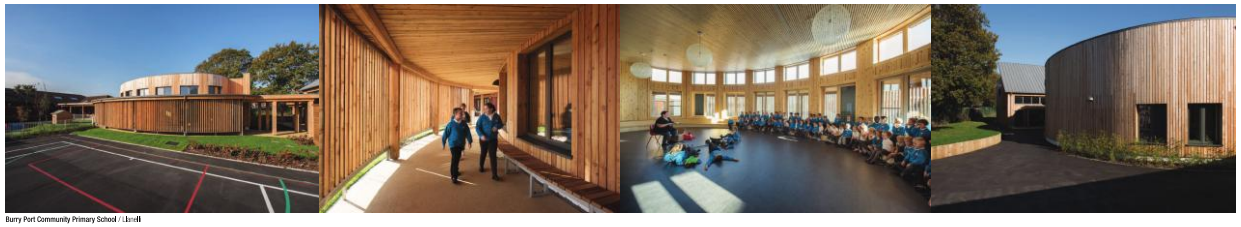
> 2200
GB CERTIFIED DWELLINGS

370,600 m²
TFA CERTIFIED

> 8000
UNITS IN DEVELOPMENT

40 years of sustainable design and data

Diversity of scale and sector new build Passivhaus over 15 years


Burry Port Community Primary School / Llanelli


Oak Meadow Primary School / Wolverhampton


Ysgol Bro Hyddgen / Machynlleth


Wilkinson Primary School / Wolverhampton


Ysgol Parc y Tywyn / Carmarthenshire


Ysgol Trimsaran / Carmarthenshire


Ysgol Maes y Dre and Sakop Road Primary School / Wellspool

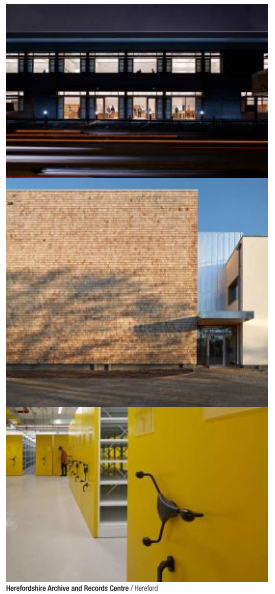

London Dock Secondary School / London


Hackbridge Primary School / London


Swillington Primary School / Leeds


Bushbury Hill Primary School / Wolverhampton


Christ Church Central / Sheffield


Herefordshire Archive and Records Centre / Hereford


The Enterprise Centre - University of East Anglia / Norwich


Imperial War Museum Paper Store / Duxford


Eco Business Centre / Bicester

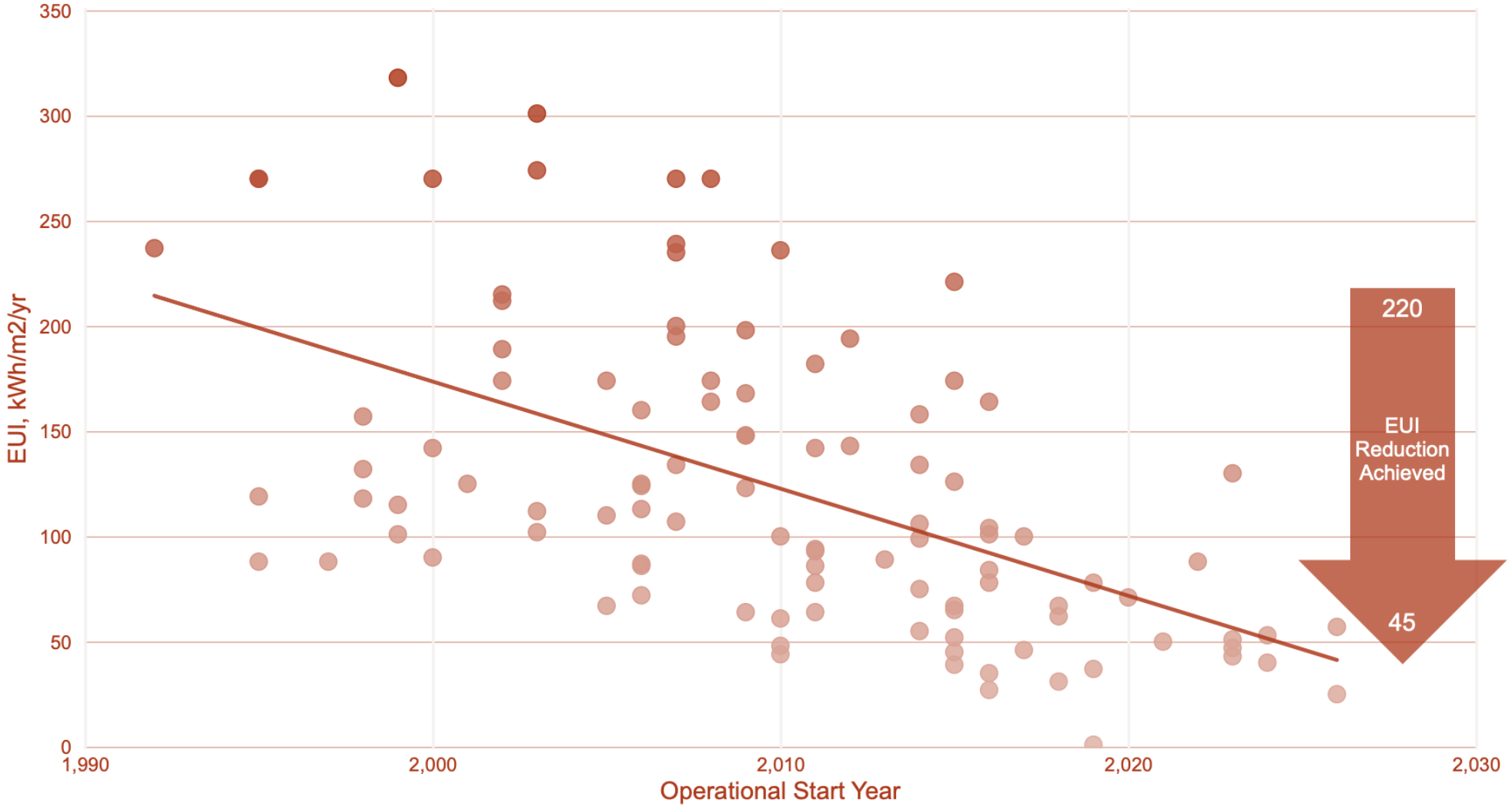

Chester Balmore / Camden, London


Hennerwood Farmhouse / Bromyard, Herefordshire


Callaughton Ash Housing / Much Wenlock, Shropshire

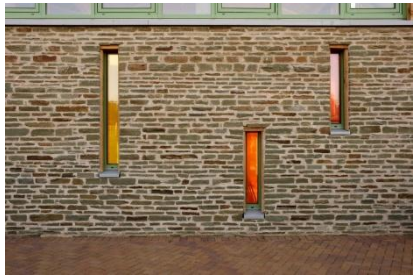

Fishleys House / Colwall, Herefordshire

40 years of sustainable design and data



Architype EUI reduction – 162 buildings over 40 years

Passivhaus – evolving design through POE/BPE



Staunton-on-Wye Endowed (2010)
POE with TSB

Bushbury Hill (2011)
POE with Coventry University

Wilkinson (2013)
POE with Coventry University

Burry Port Community (2015)
POE with UCL

Welshpool Church in Wales Primary School (2020) POE

The Willows (2009)
POE through a KTP with Oxford Brookes University

St Luke's 2008
POE through a KTP with Oxford Brookes University

Bessemer Grange (2010)
POE with TSB

Oak Meadow (2011)
POE with Coventry University

Hackbridge Passivhaus Plus Primary School (2020)
POE with UCL

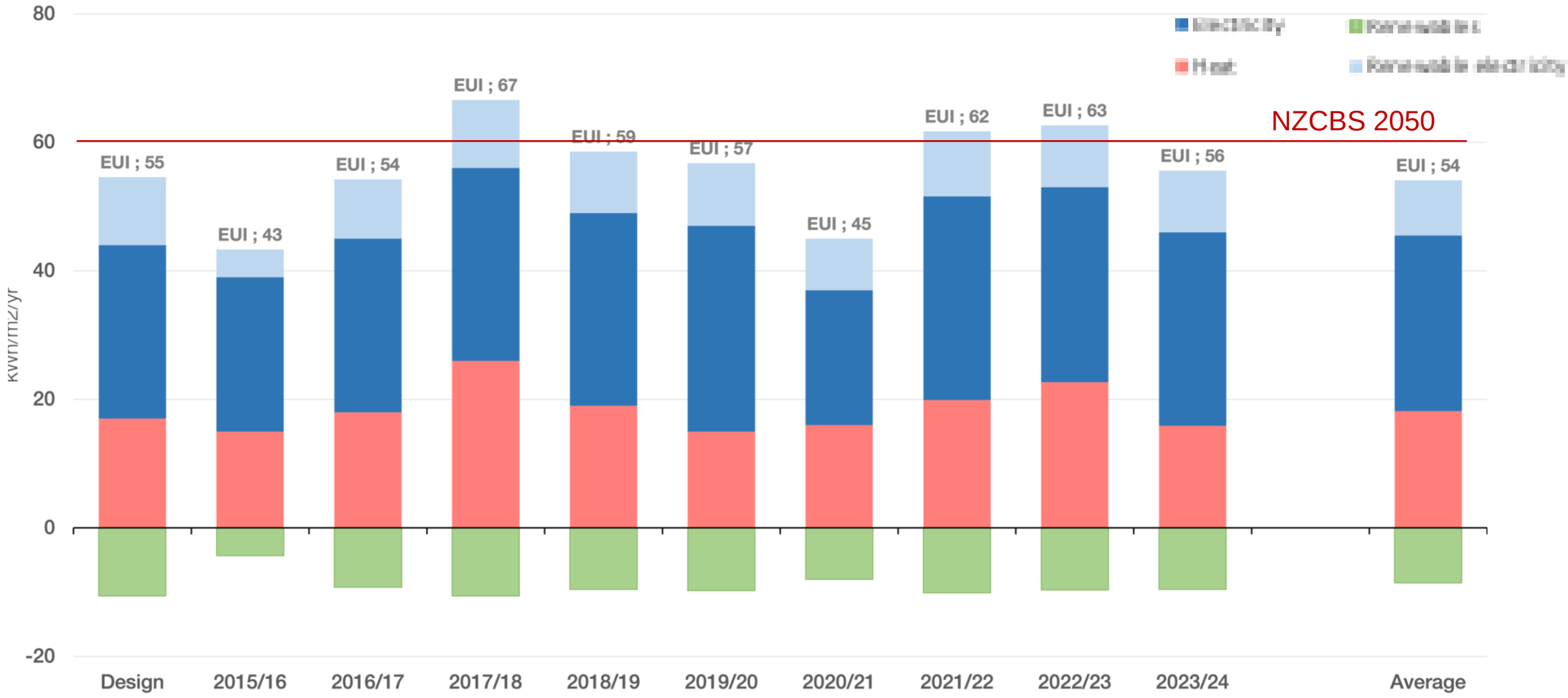
Riverside primary School (2023) POE

Enterprise Centre, University of East Anglia

Enterprise Centre University of East Anglia

NZCBS 2025

NZCBS 2050



Hackbridge Primary School Sutton

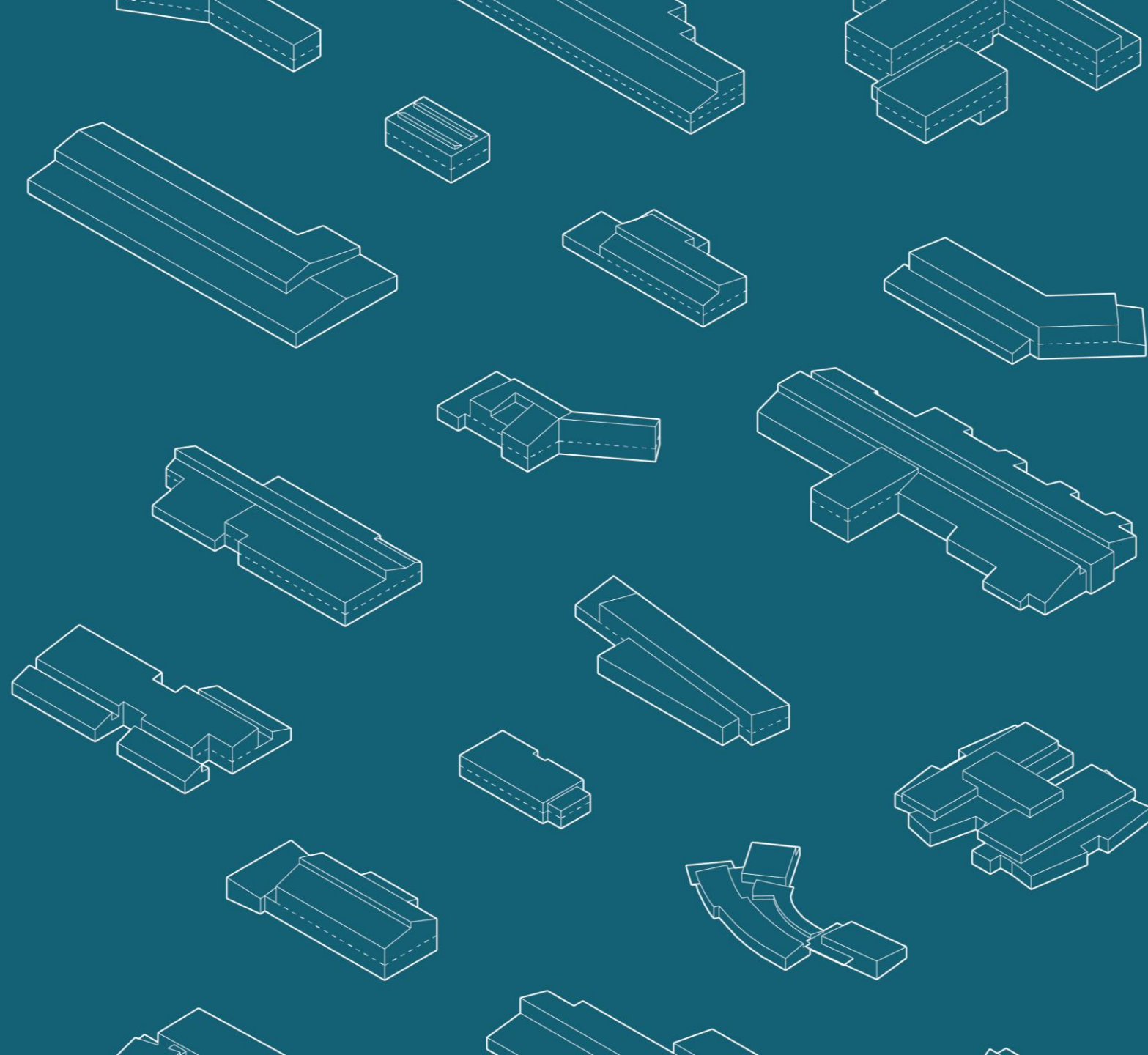
Harris Academy Sutton

Maybury Primary School Edinburgh

Agenda

- Overview of publication
- Context
- Case study for fire research
- Overview of system

Overview



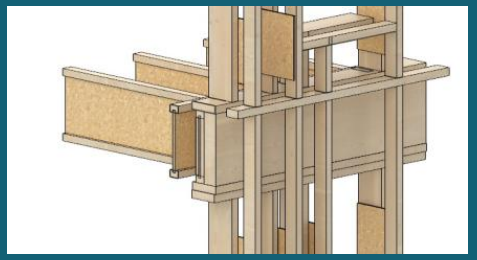
Safe Schools for the Future

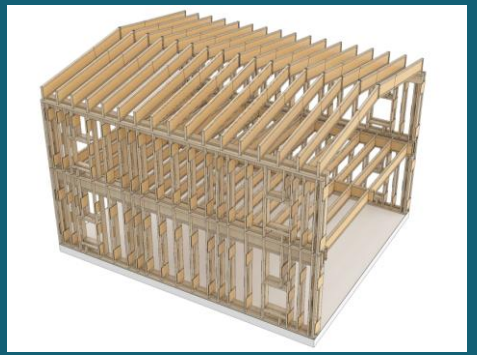
Helping project teams to demonstrate fire safety, so the UK can enjoy the high-performance, low-carbon benefits timber primary schools offer.

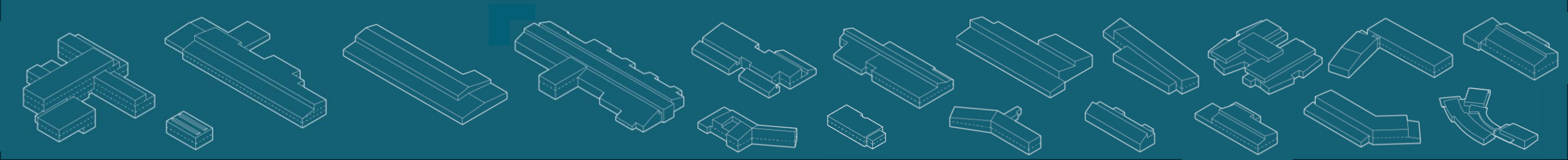
Local Materials
+
Health + Wellbeing
+
Operational Energy
+
Embodied Carbon
+
Fire Resistance

Existing design and performance data across 17 completed schools

Creation of guidance, demonstrated via a case study



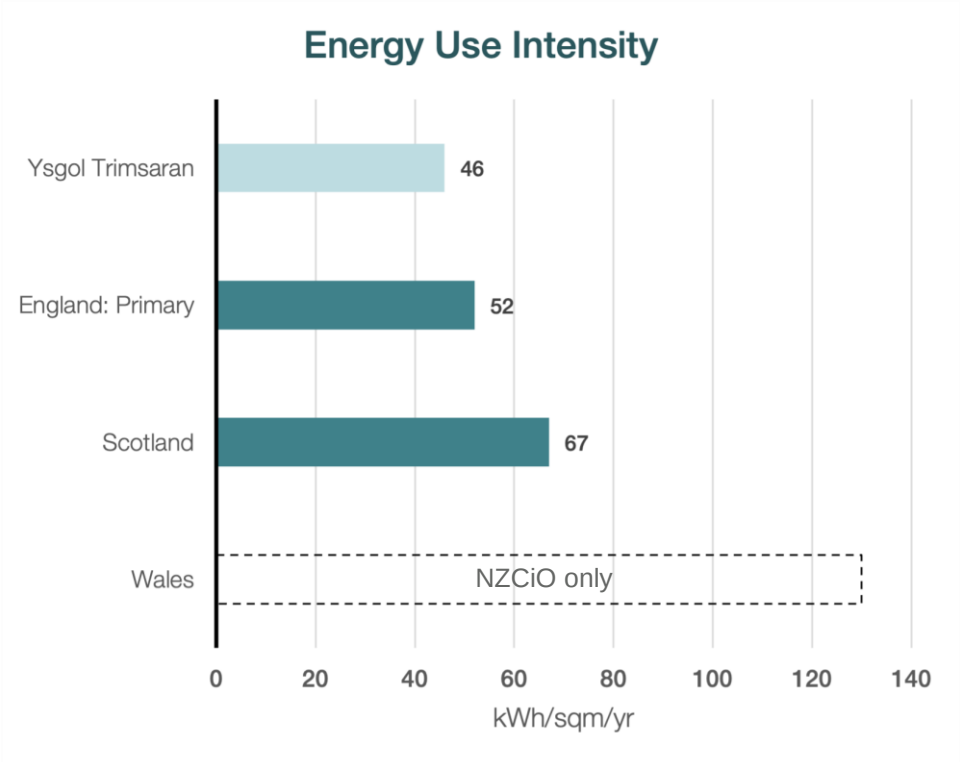


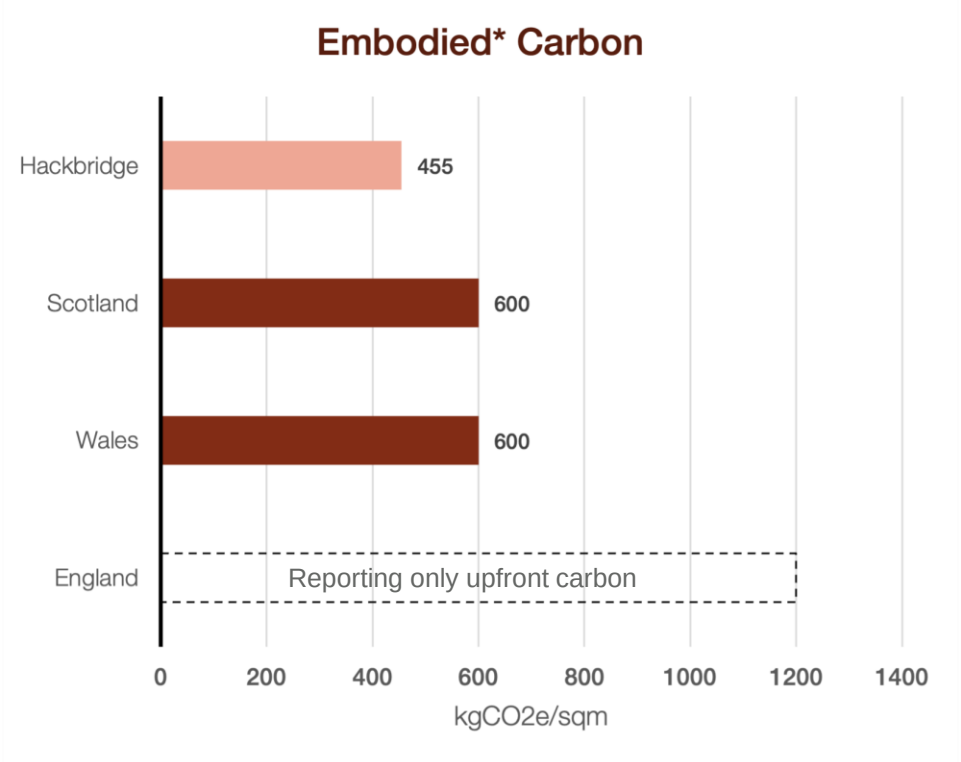


A Safe School

- Holistic system-based
  - Robust fabric
  - Efficient systems
  - Quality assured construction
  - Closed-loop learning
- Tried and tested
- Consistent outcomes
- “Safe” = appropriately safe

Bettering the targets





Data from Department for Education, Scottish Futures Trust and Wales' Sustainable Communities for Learning Programme

Project Team

Lead

Fire Expertise

Industry Advisors

Funding

Government Engagement

ARCHITYPE/PERFORM+

UCL

THE UNIVERSITY of EDINBURGH

IGNIS
Fire • Design • Consulting

woodknowledge WALES

PYC Construction

LOWFIELD TIMBER FRAMES

Rosetta Risk Management

Forestry Commission

Department for Education

Department for Environment Food & Rural Affairs

Ministry of Housing, Communities & Local Government

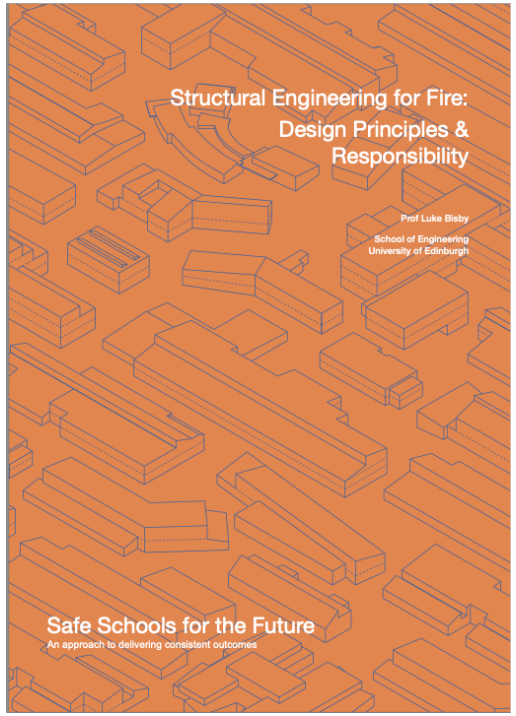
Tried and tested:
17 built examples

- Timber frame
- Predominantly Passivhaus
- Occupant feedback
- Operational + embodied
- Lessons learnt
- Indoor environment quality

ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

Publications

1

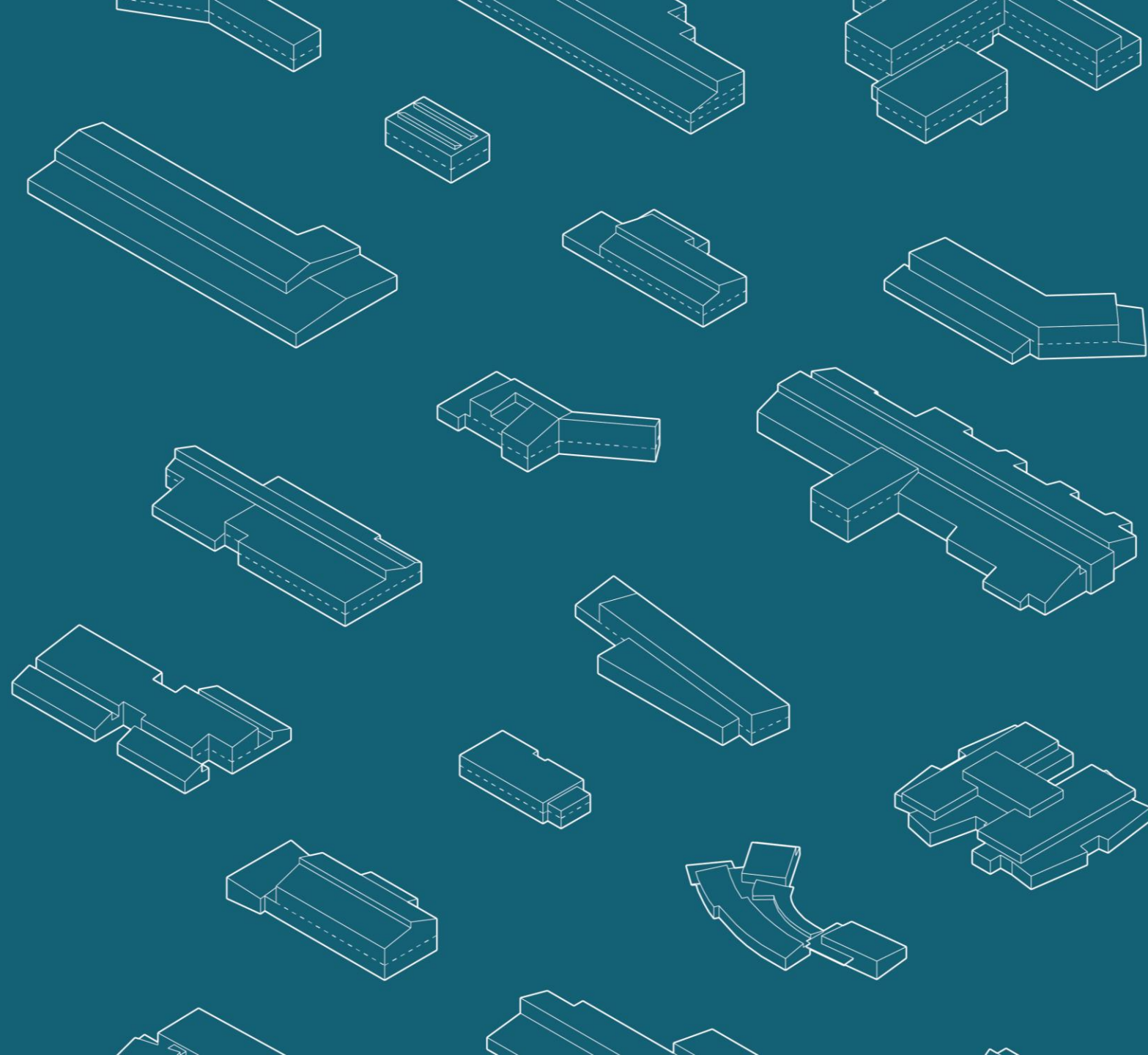


2

3

Context

Regulatory



Approved Document B (2019)

Frequently asked questions (FAQs) – Issued 23rd August 2022

Question:

"Can I apply the guidance in Approved Document B for combustible structures (e.g. timber) in meeting the requirements of the building regulations?"

Slides courtesy of Luke Bisby

Answers

The guidance in Approved Document B is provided for **common** building situations. **Tall, large, or complex** buildings, **where the structure is able to contribute as a source of fuel during a fire, are *not* common building situations**.

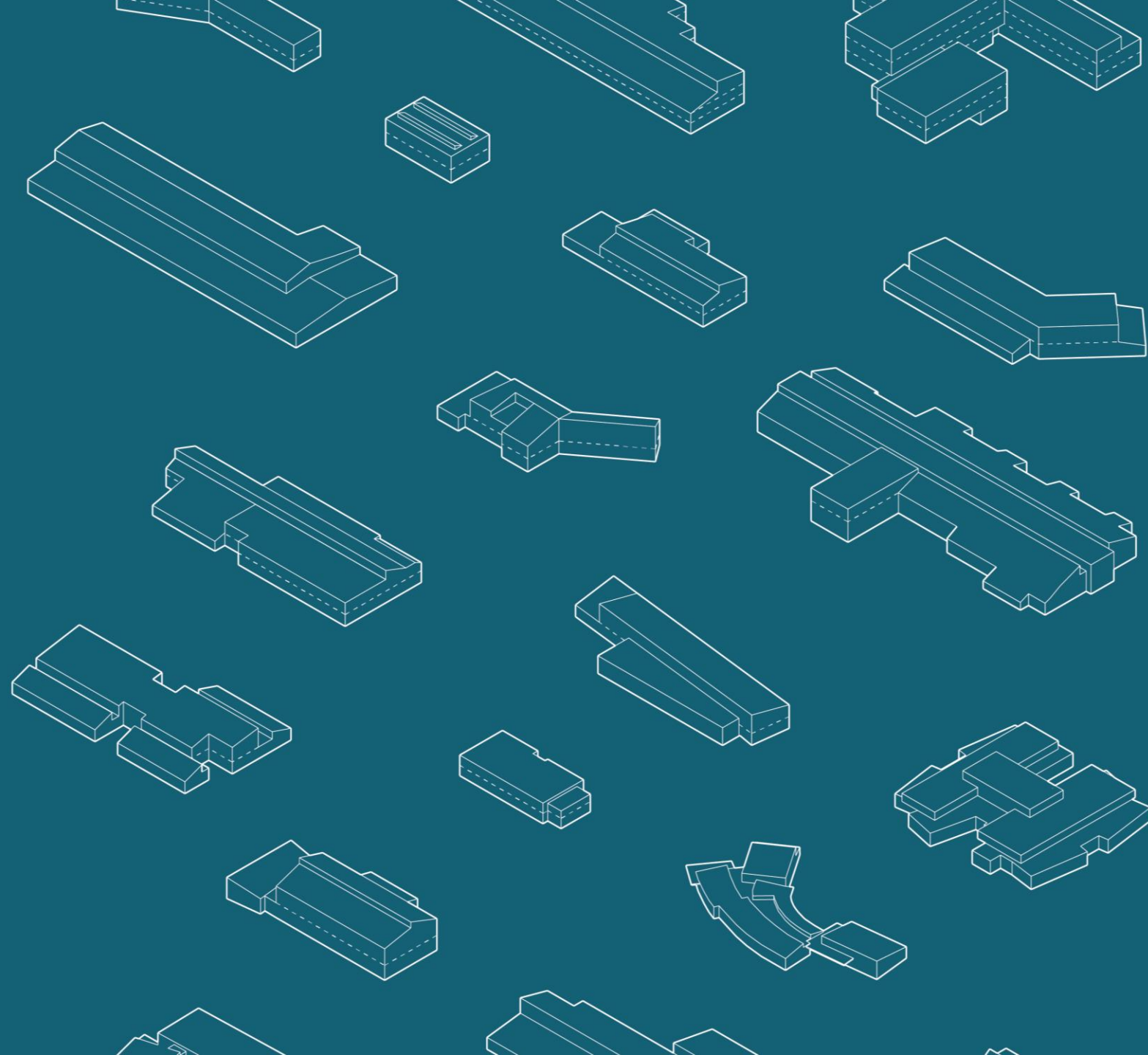
Following the guidance in Approved Document B, including the minimum fire resistance periods and the standard test methods, **may not be sufficient** to meet the requirements of the building regulations.

Where alternative methods of complying with the building regulation requirements are adopted, it is likely to **require a detailed, evidence-based, understanding of fire performance for the specific design demonstrating how *each* of the building regulation requirements will be addressed *directly***.

Slides courtesy of Luke Bisby

Fire Research

Case Study



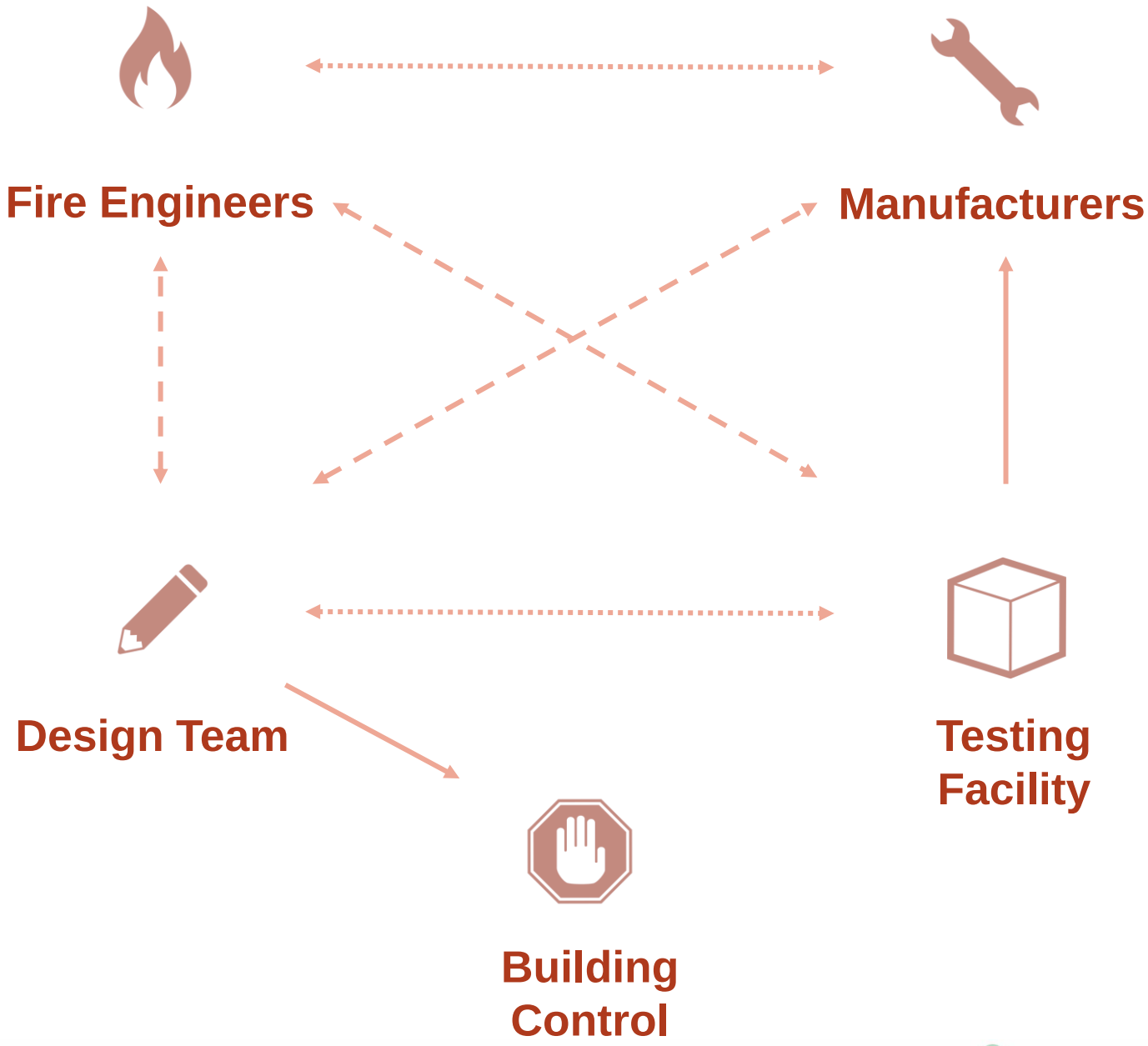
Fire Resistance Case Study

- New primary school
- Scotland
- Funding linked to energy in use
- Passivhaus Certified
- Larsen truss with Warmcell
- Faced significant fire resistance challenges

ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

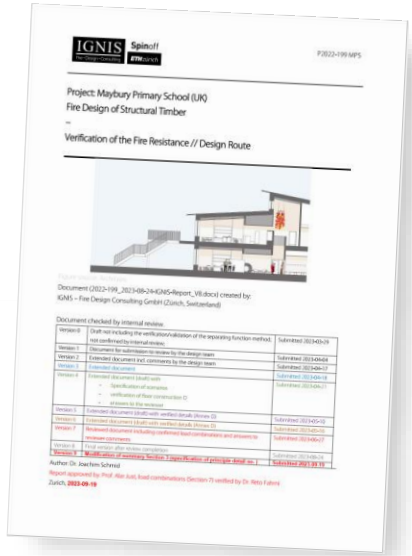
Challenges demonstrating Fire Resistance

- Height
- Loading
- Arrangement
- Dimensions
- Product-specific
- 5-year limit of use
- Expired references
- Non-disclosure agreements
- Materially agnostic issues



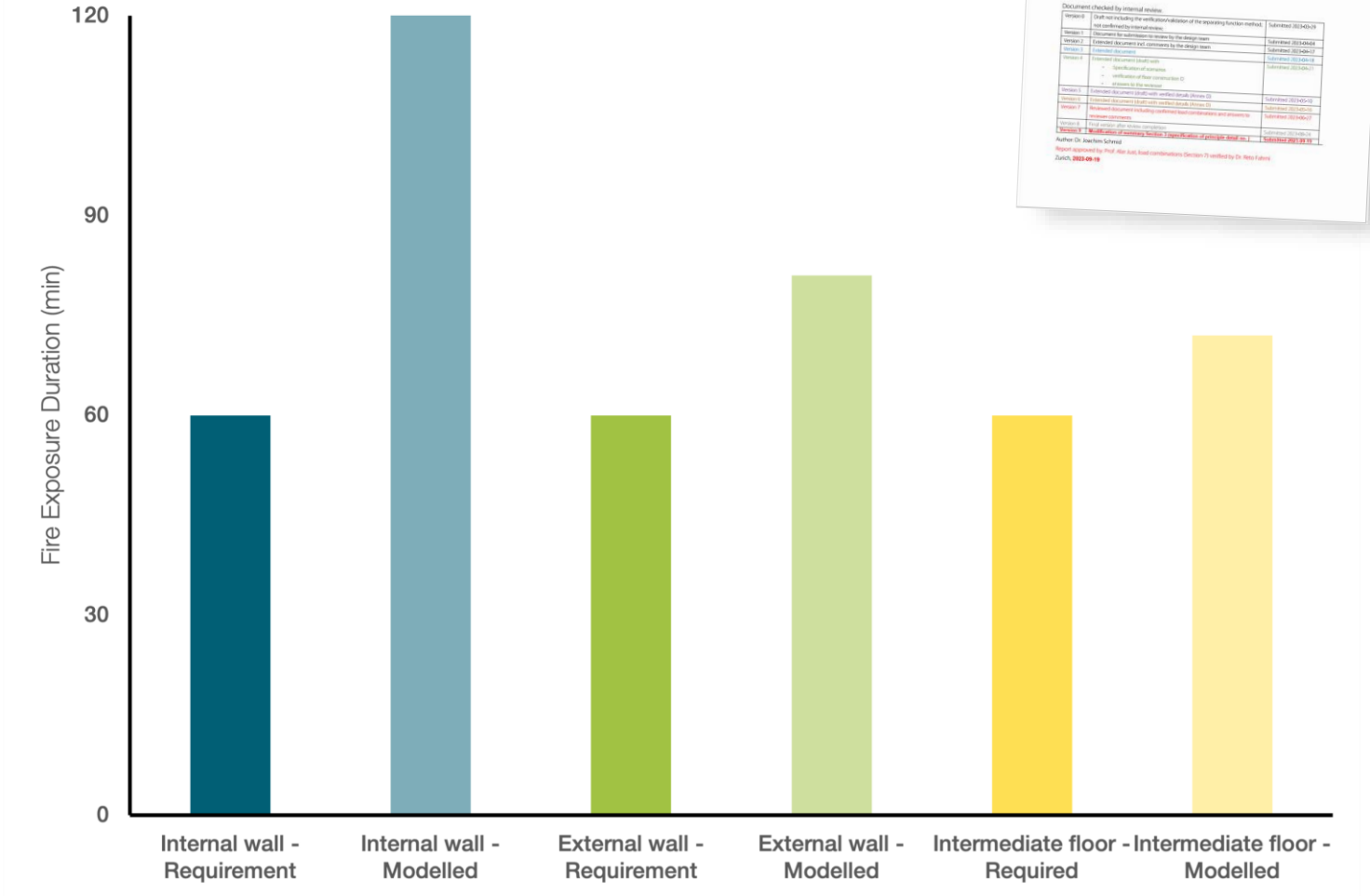
Performance-based approach

- Relatively atypical for UK
- Additional expense and time
- Availability of competent professionals
- Delivered by IGNIS
- Building Control acceptance
- Eurocode 5 UK adoption


IGNIS Spinoff ETH zürich

Project: Maybury Primary School (UK)
Fire Design of Structural Timber

Verification of the Fire Resistance // Design Route



ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

Maybury Primary School

- Opened February 2025
- Industry can’t afford to all go through same learning journey
- More parameters, more optimisation?

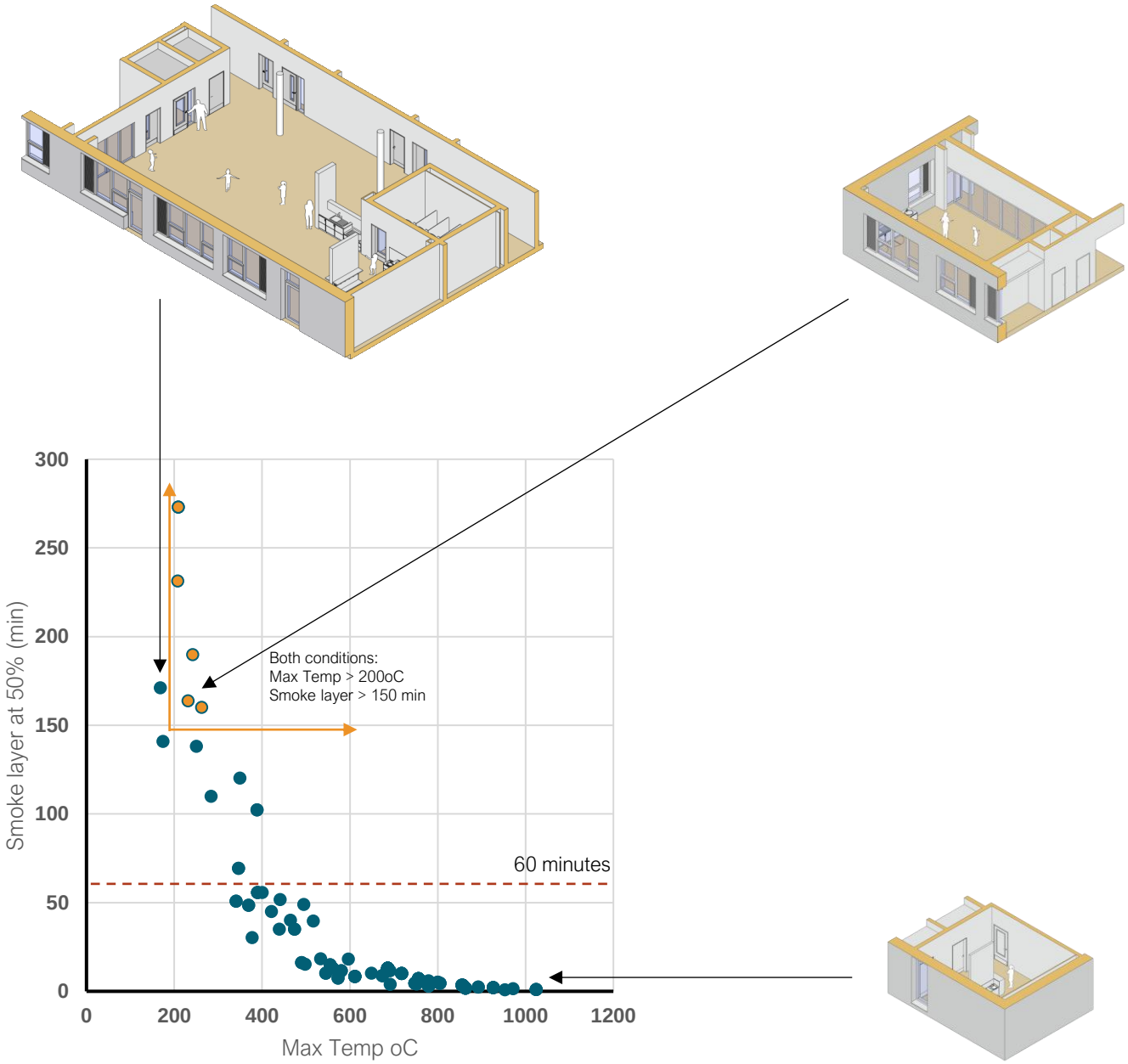
Timber Fire research workflow

- Fundamental barrier = PI Insurance, beyond scope of study
- Structural engineer's responsibility
- Only found two structural engineers in the UK insured to calculate

Physics-based fire scenarios

- Product of surface areas and spatial dimensions
- Large spaces dissipate heat
- Small spaces throttled by smoke

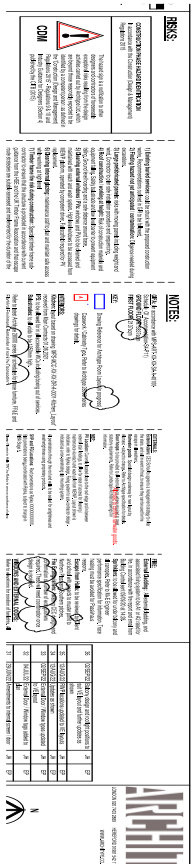
*Assumes one open door open

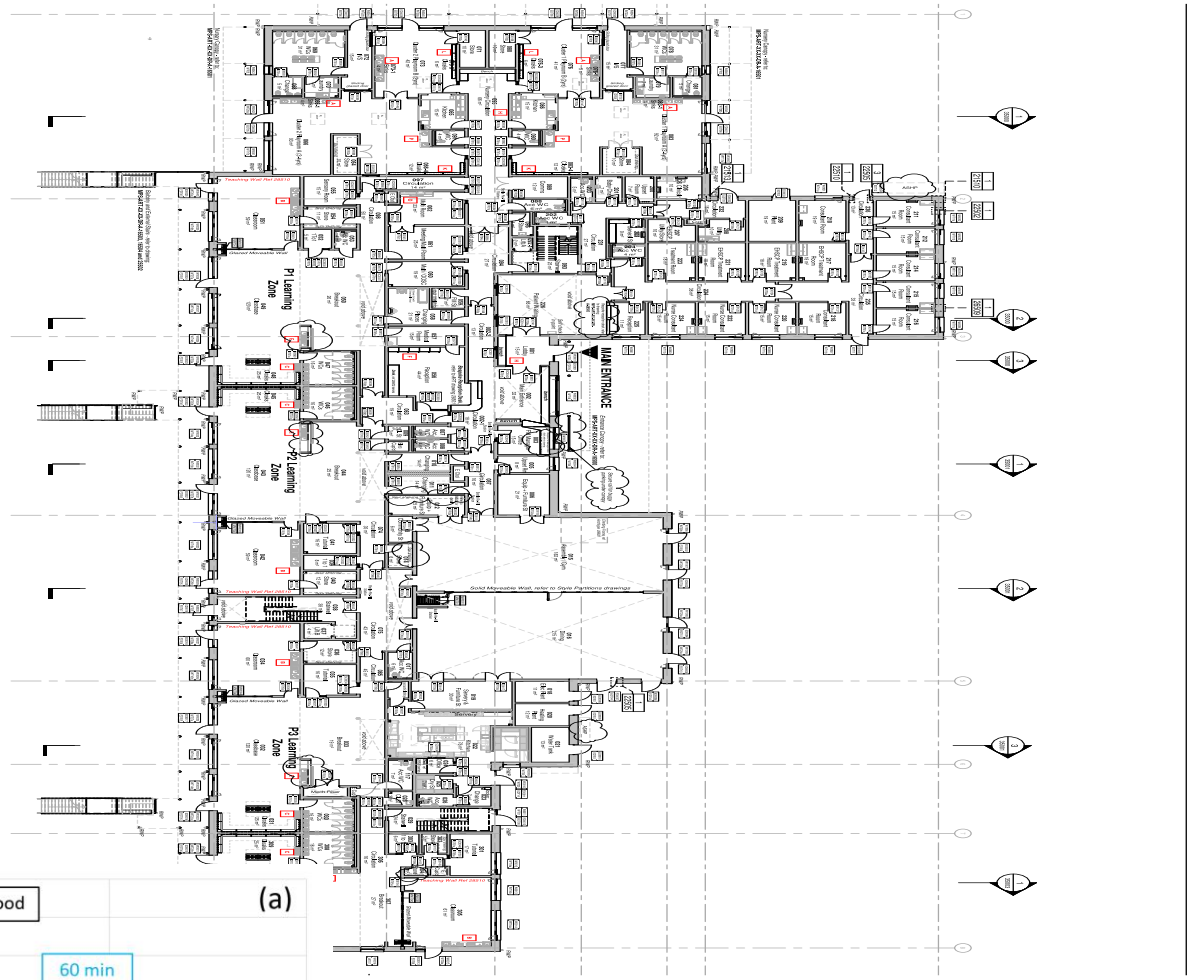


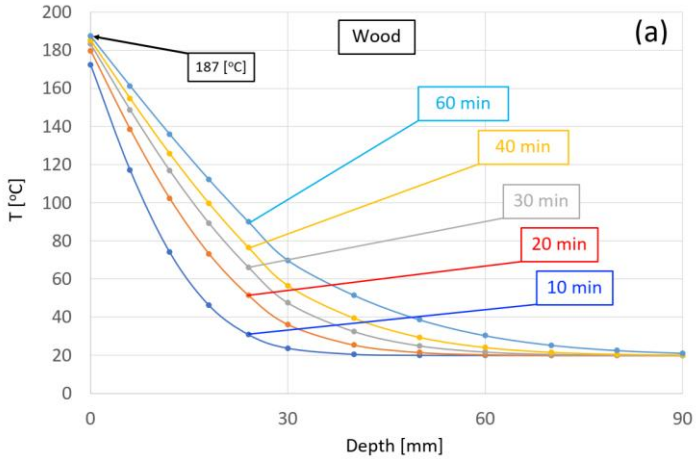
Key findings of fire analysis

- Very conservative, as built, for life and asset protection
- K2 temperatures
- Identified potential for plasterboard optimisation
- No rooms would be subject to onerous fires* without plasterboard

*Refer to report for limitations



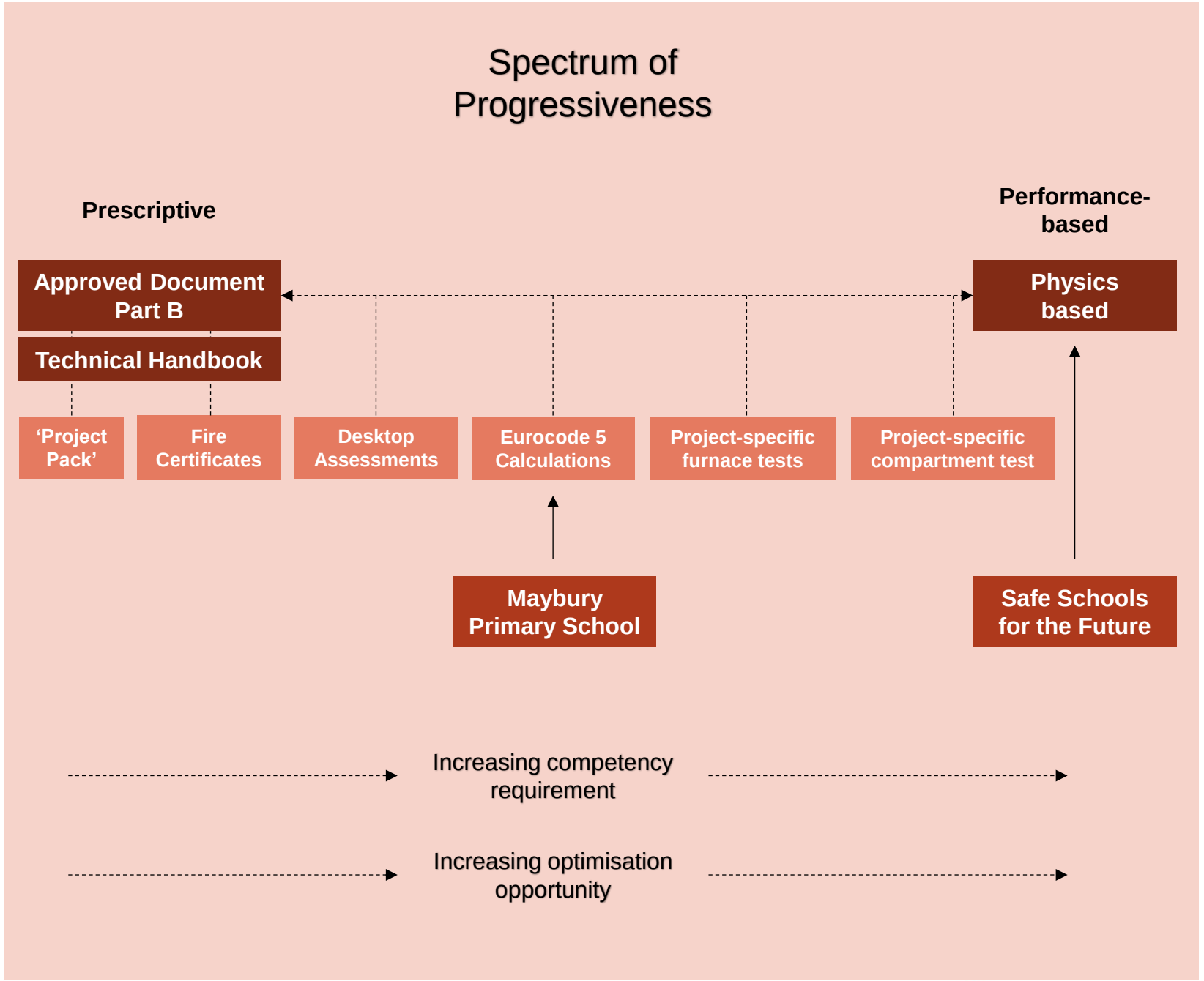




In-depth temperature distributions for exposed timber

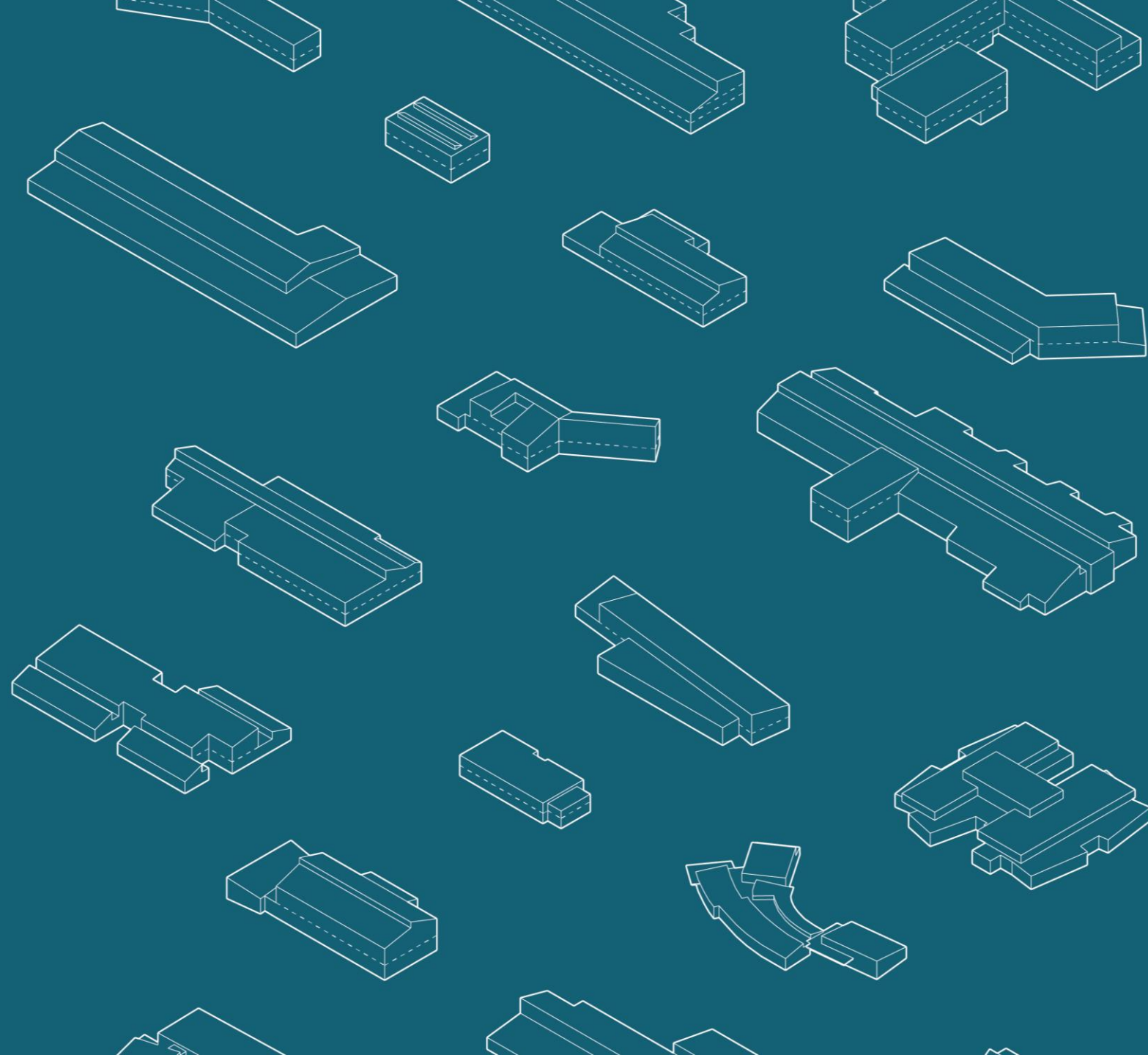
Fire Research

- Route must be consciously decided
- Performance based route for ‘non common’ buildings
- No ‘one size fits all’
- Competency is crucial
- 3rd party review is key
- Progressive approach enables significant optimisation



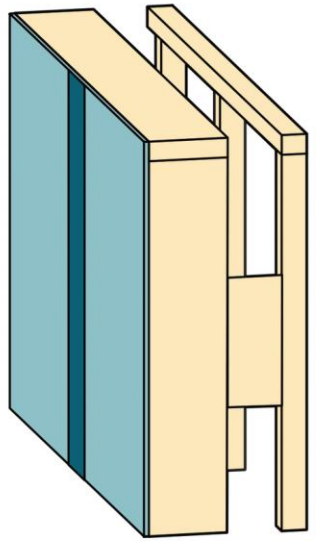
Outputs

Holistic System

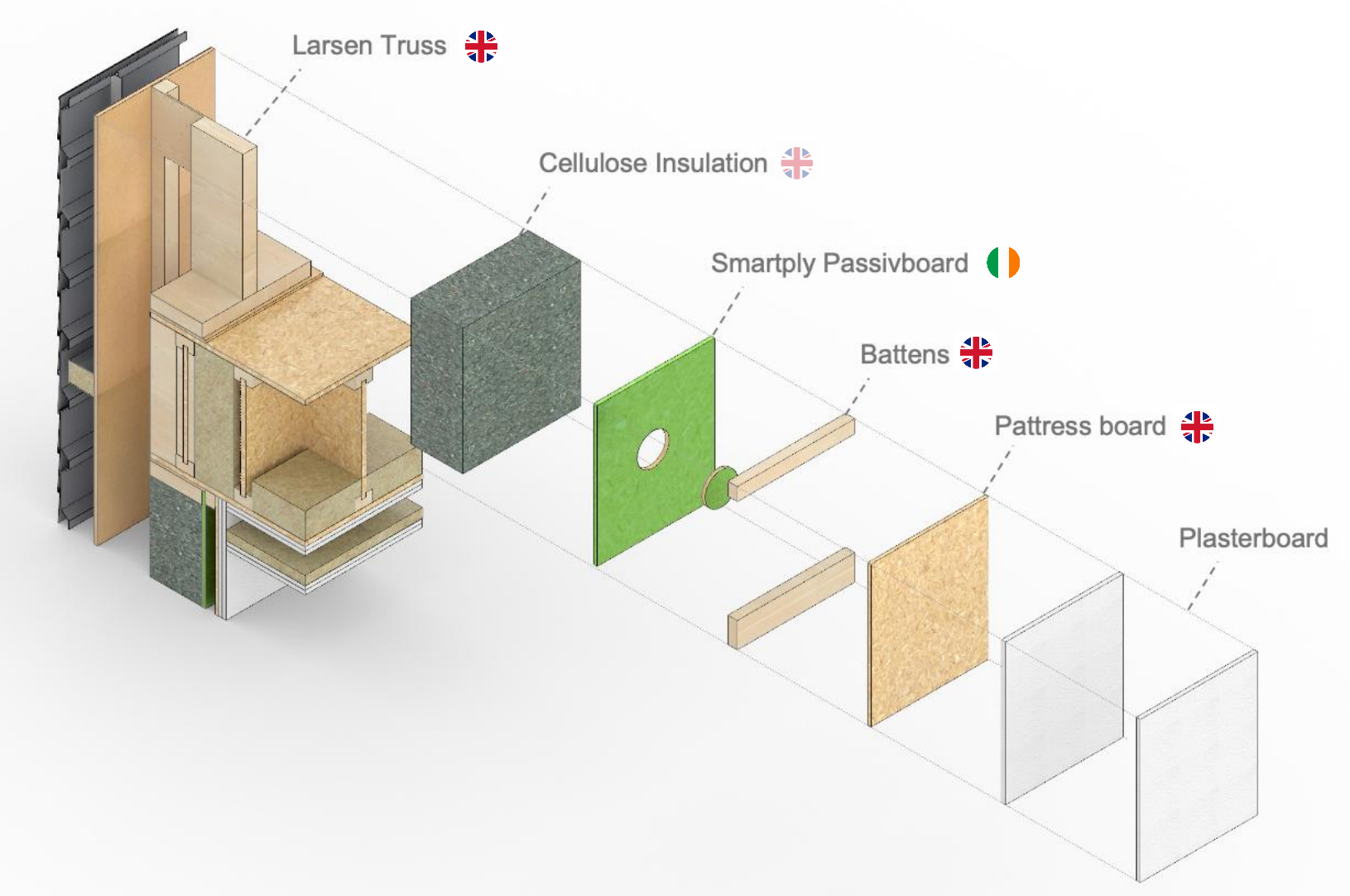


Larsen Truss System

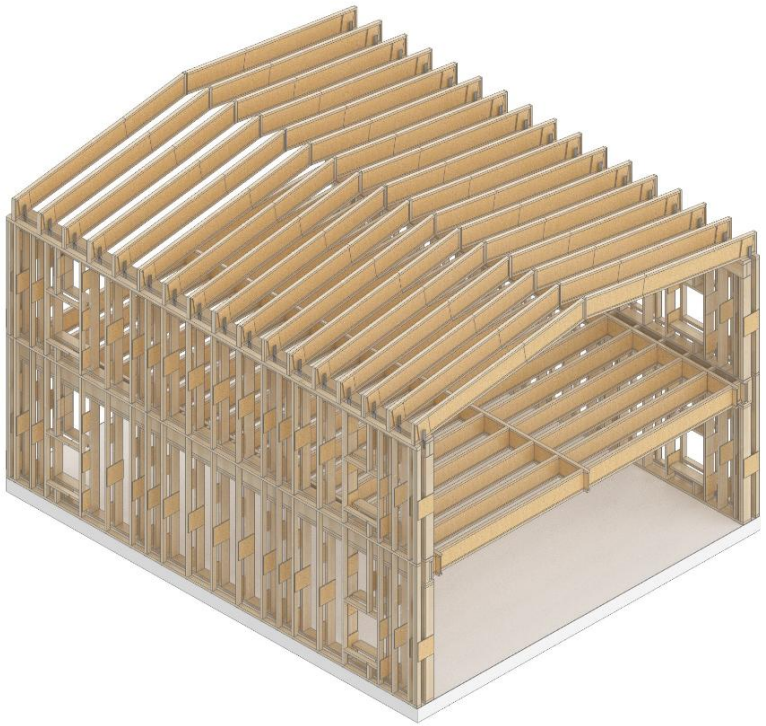
1. Level 2 MMC
2. UK-grown C16
3. Materially efficient
4. Good thermal performance
5. Significant carbon store
6. Deployable at scale
7. Low fabrication set-up costs
8. Fire tested build-ups

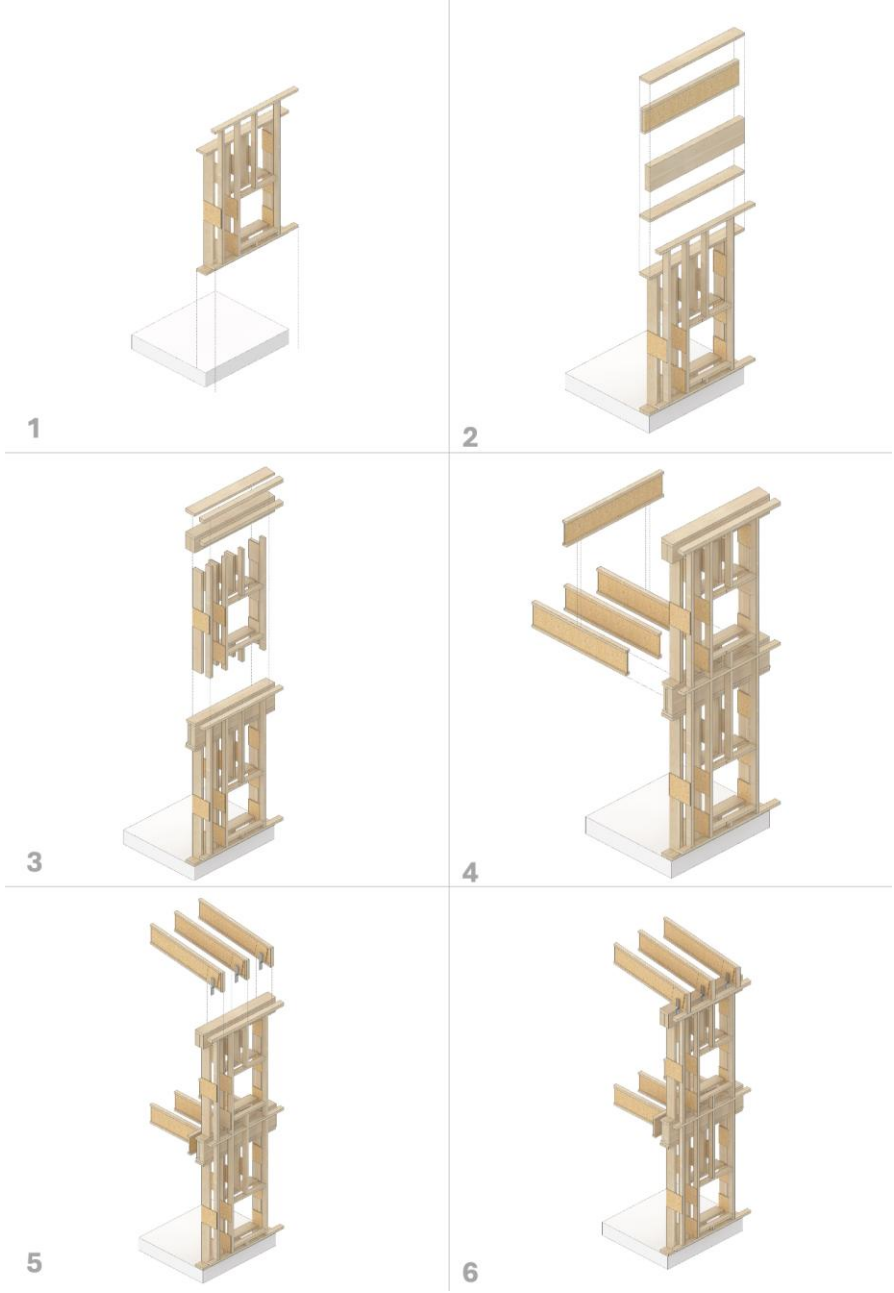


Home grown timber products

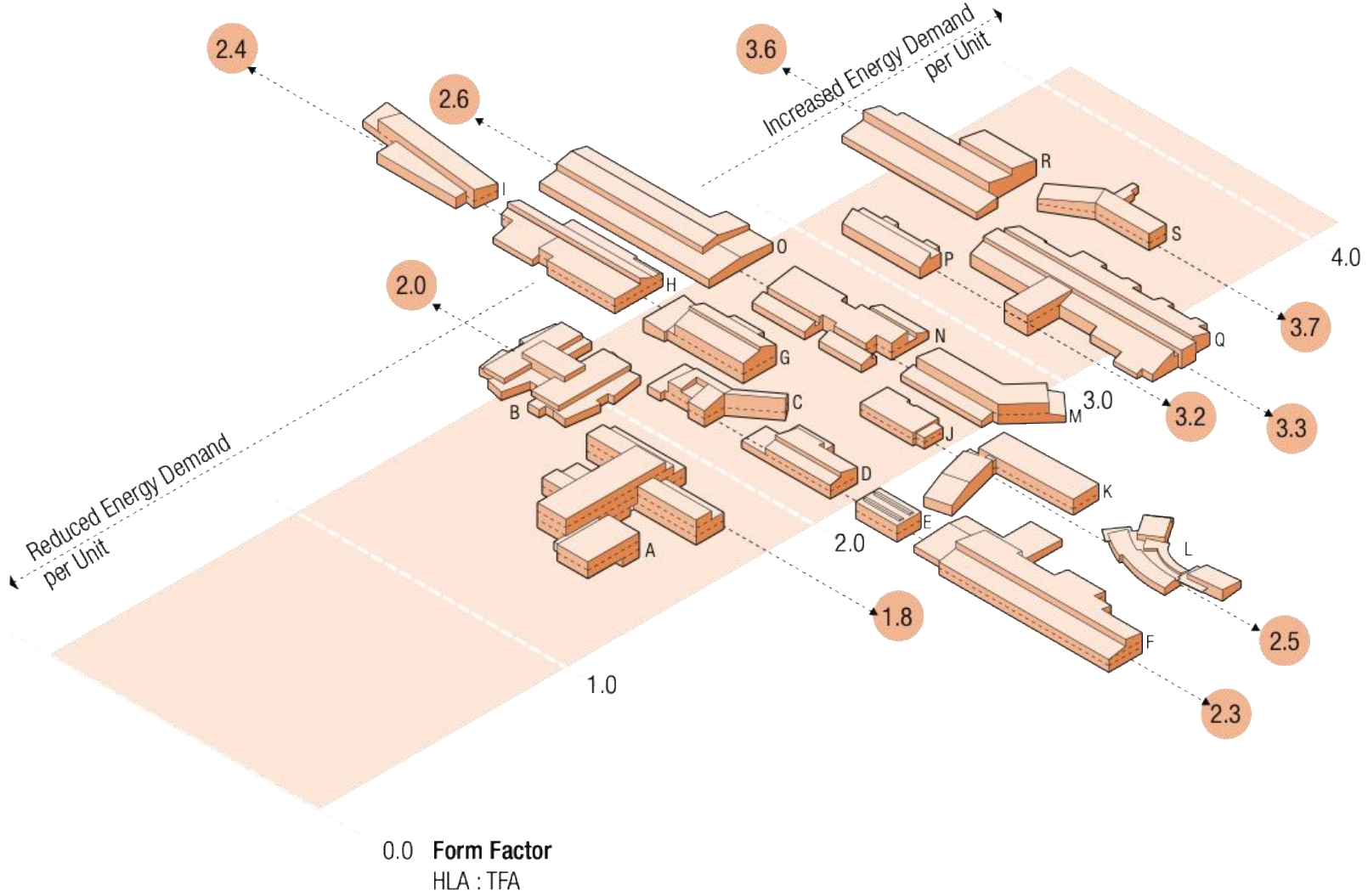


Customisable + robust system

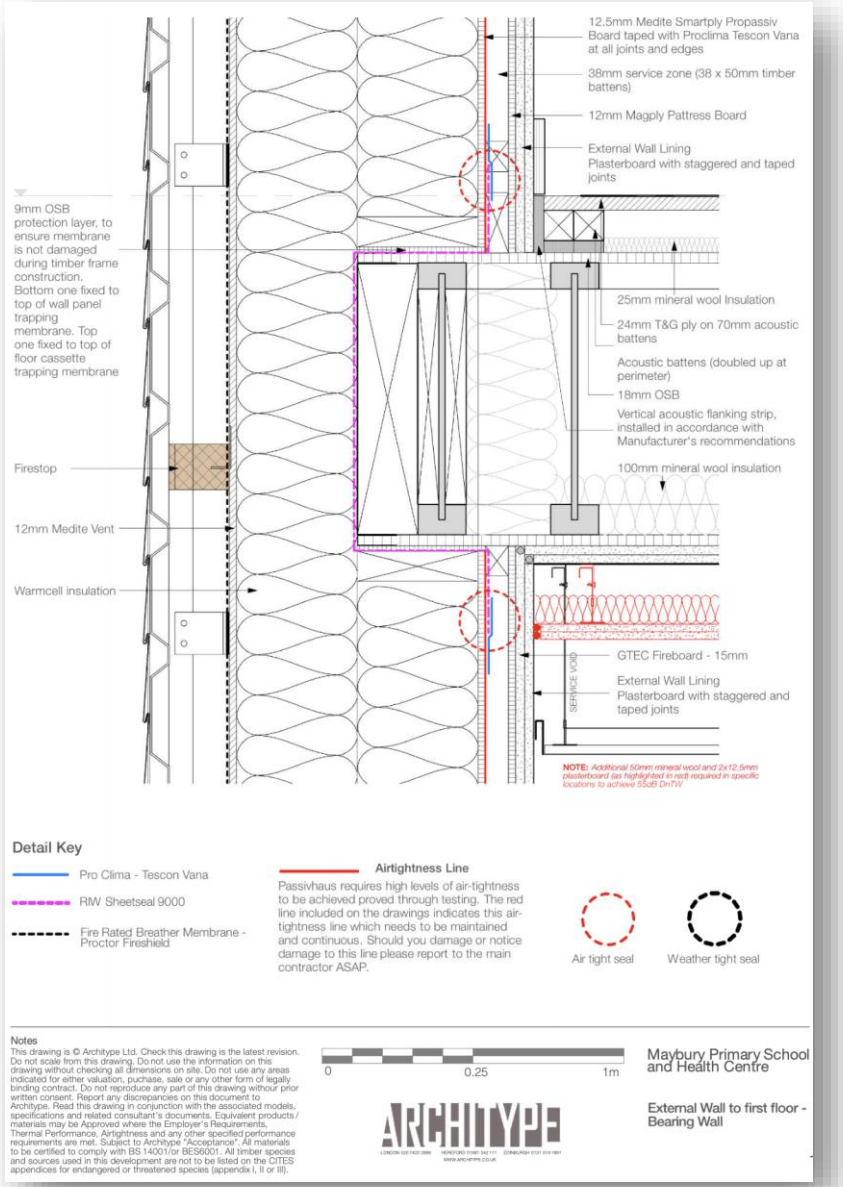




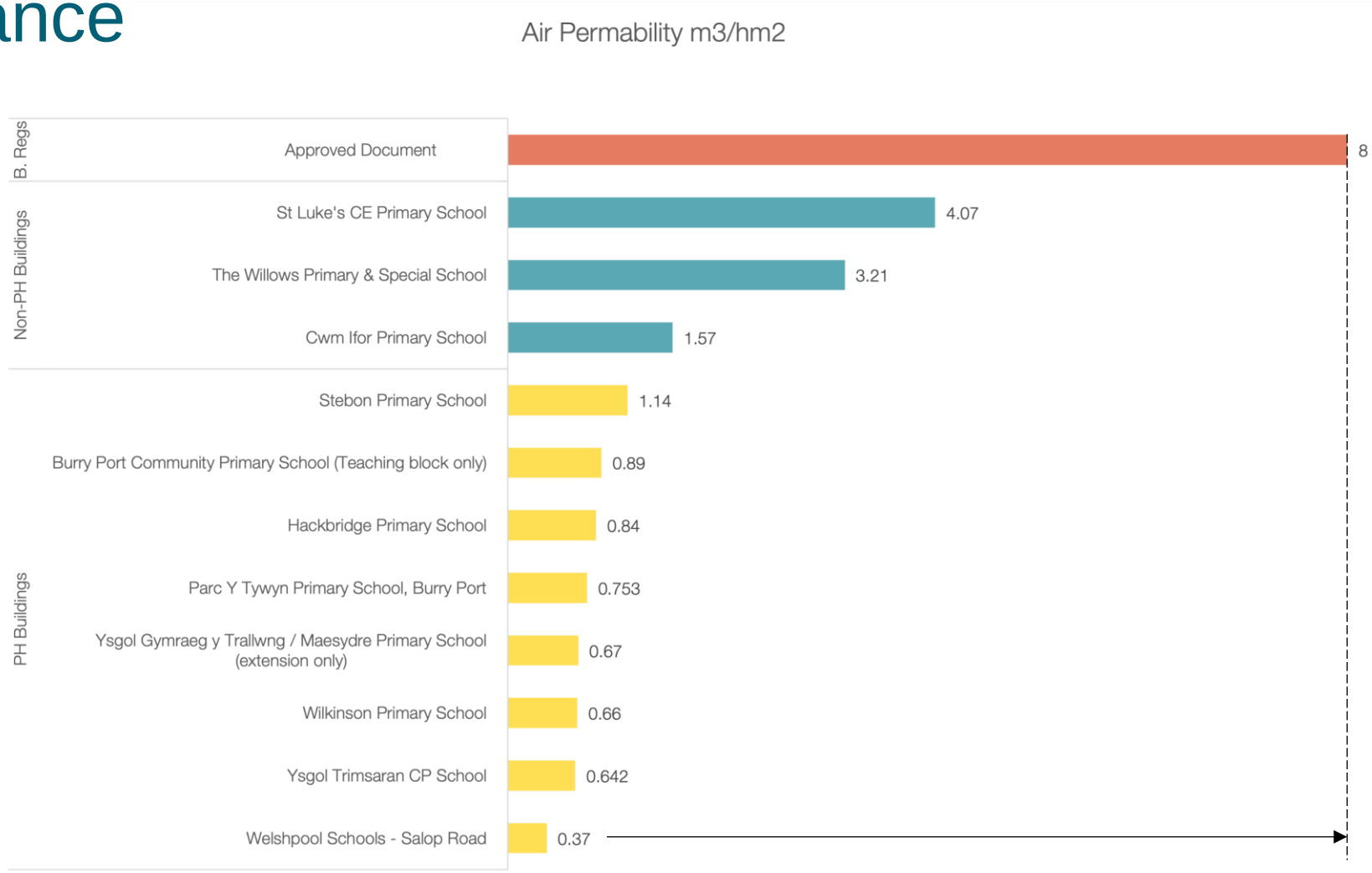
Creative forms



Principal details



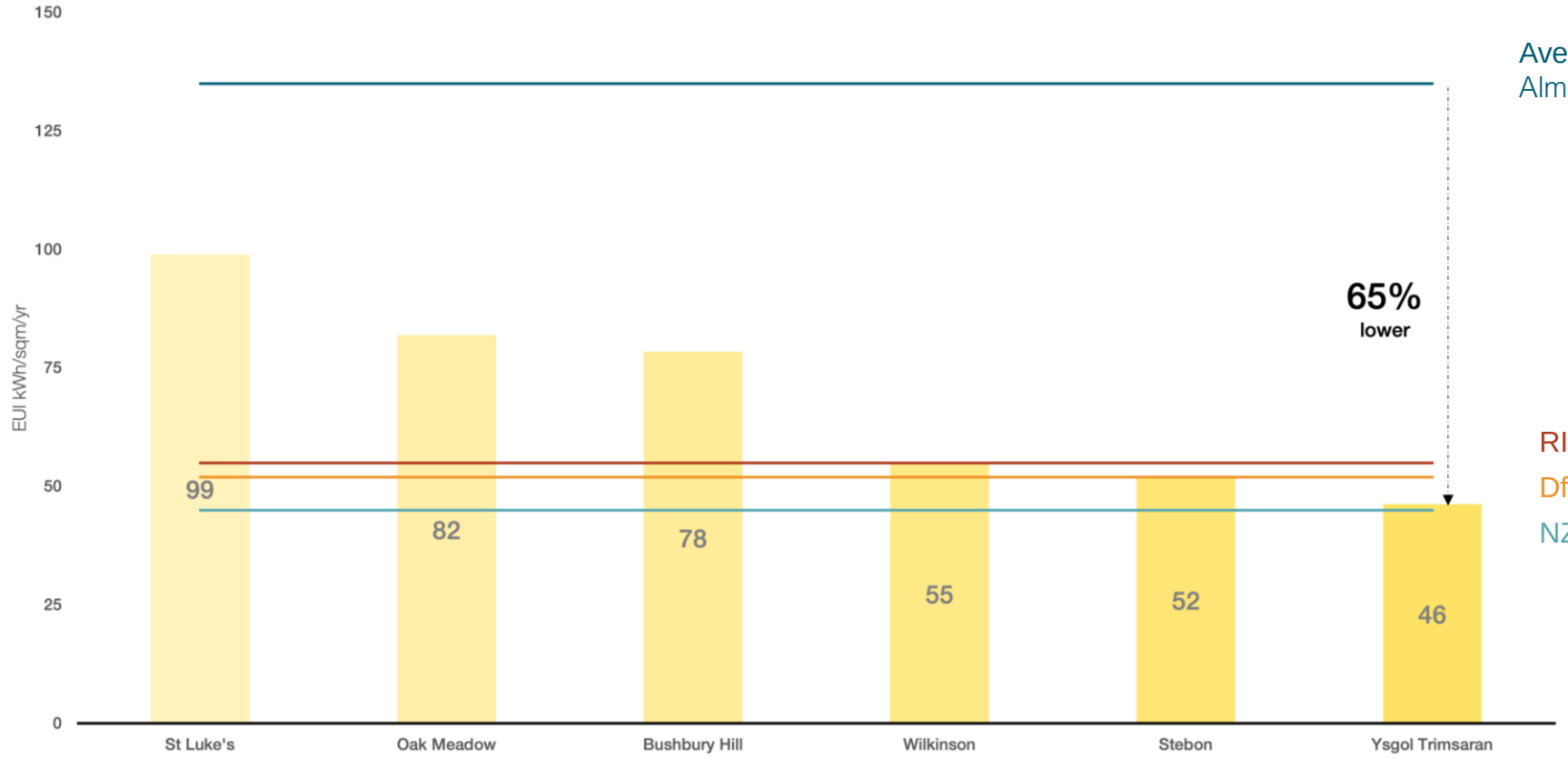
Fabric Performance



20x

the air leakiness

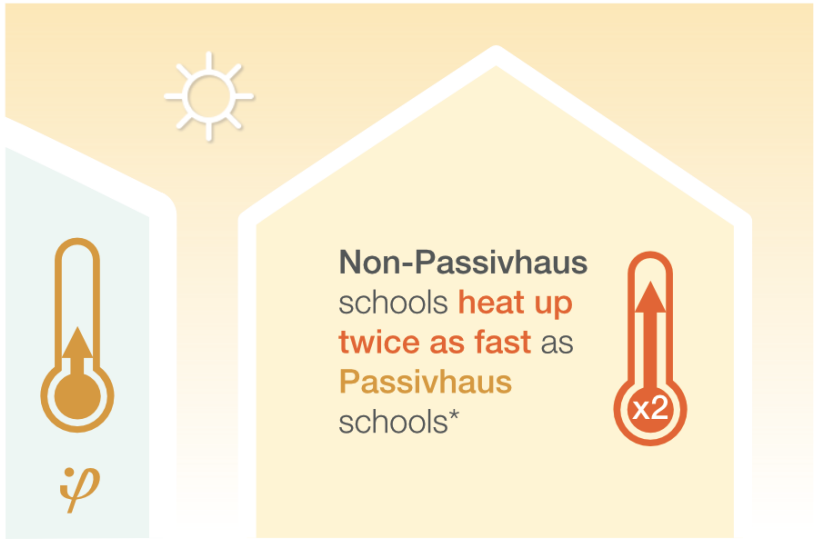
Energy + Cost



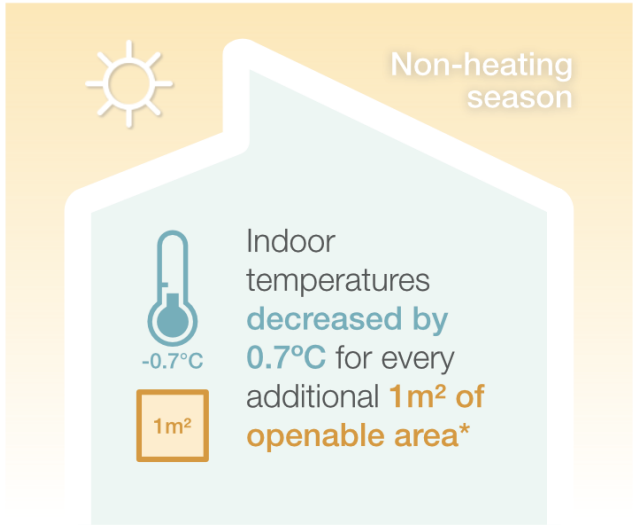
Average school in England
Almost 3 times higher

RIBA 2030
DfE Annex 2H targets
NZCBS 2025

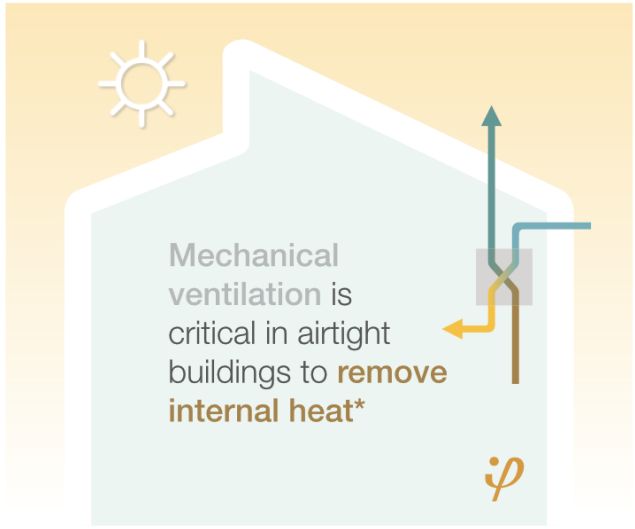
Heatwave Resilience



*Internal air temperature increased 1.6°C (per 4°C external warming), compared to 0.8°C in Architype's Passivhaus schools.

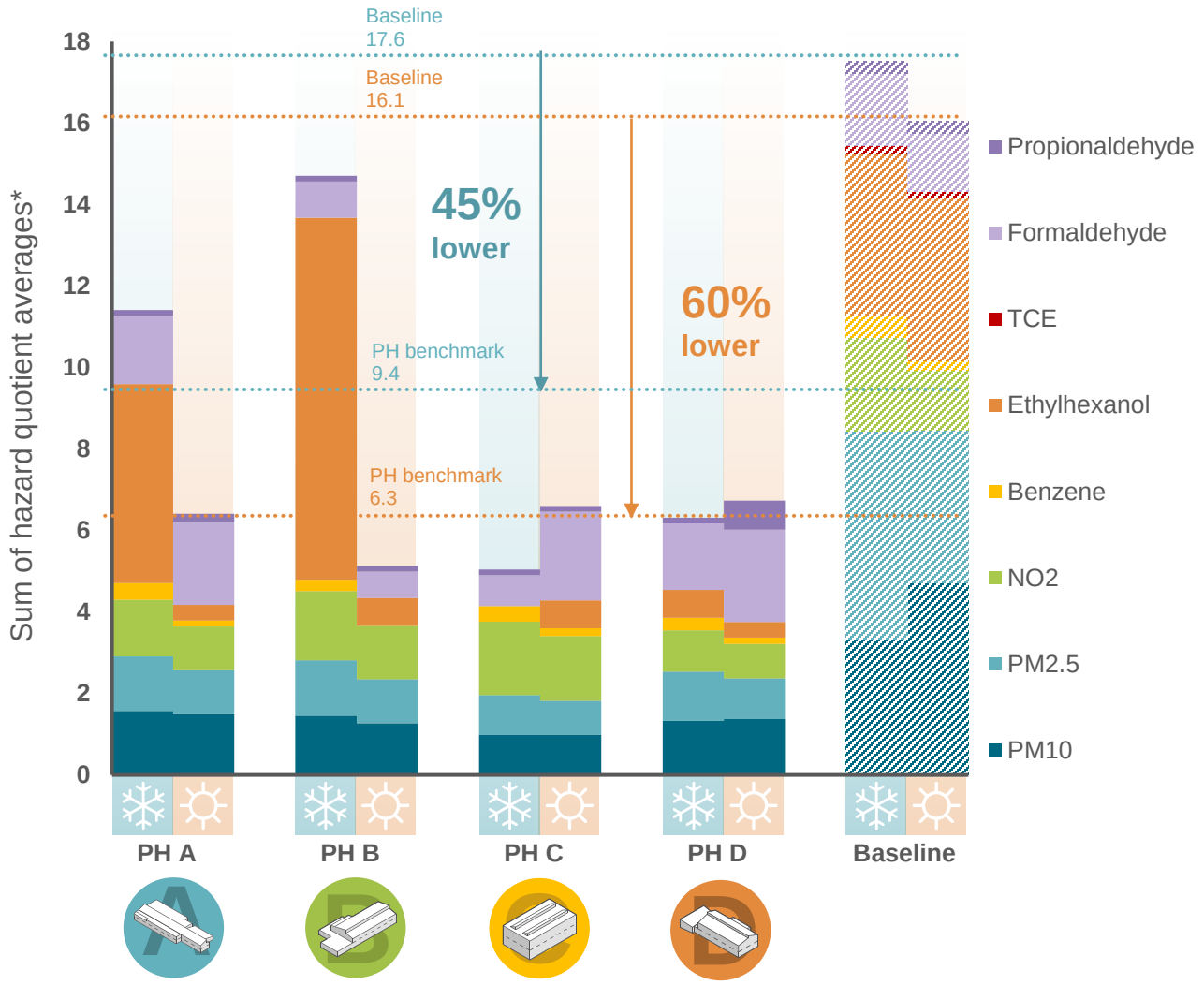


*suggesting window design is a key means to managing overheating in Passivhaus classrooms.



*as airtight, insulated construction decreases the passive diffusion of internal heat

Healthier classrooms



*Total indoor air quality health related index (HI) - sum of hazard quotient averages (selected VOCs, NO_2, $PM_{2.5}$ and PM10)

Chryssa Thoua and UCL 2025

Embodied Carbon

Hackbridge Primary School

Upfront
Carbon Emissions
Modules A1 - A5

NZCBS 2025 limit
530
kgCO2e/m2 [GIA]

NZCBS 2035 limit
260
kgCO2e/m2 [GIA]

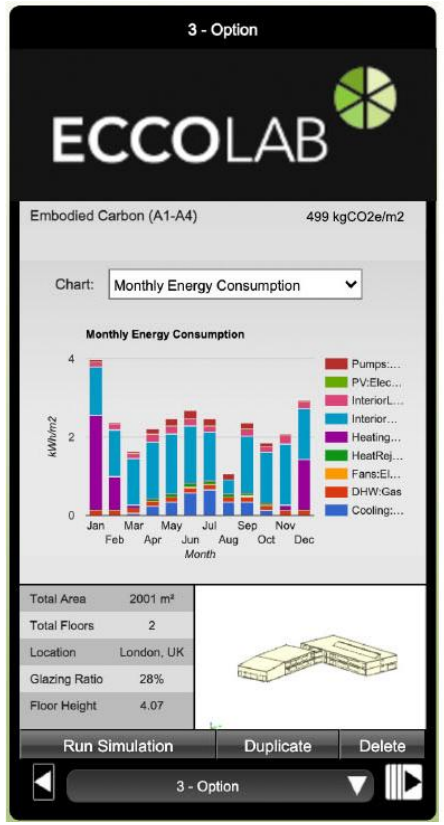
Hackbridge Primary
214
kgCO2e/m2 [GIA]

Embodied
Carbon Emissions
Modules A1 - C5

London Plan WLC
700 - 800
kgCO2e/m2 [GIA]

RIBA 2030 Challenge
540
kgCO2e/m2 [GIA]

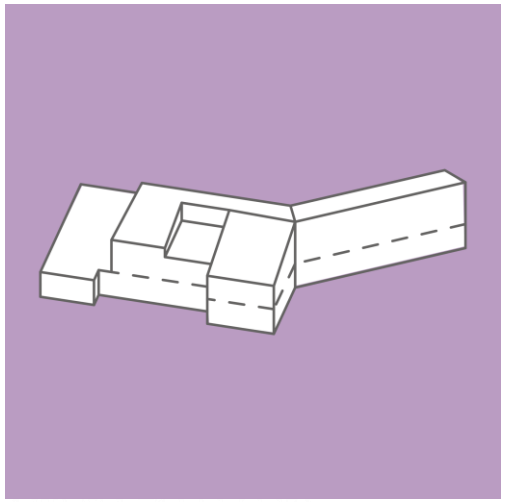
Hackbridge Primary
455
kgCO2e/m2 [GIA]

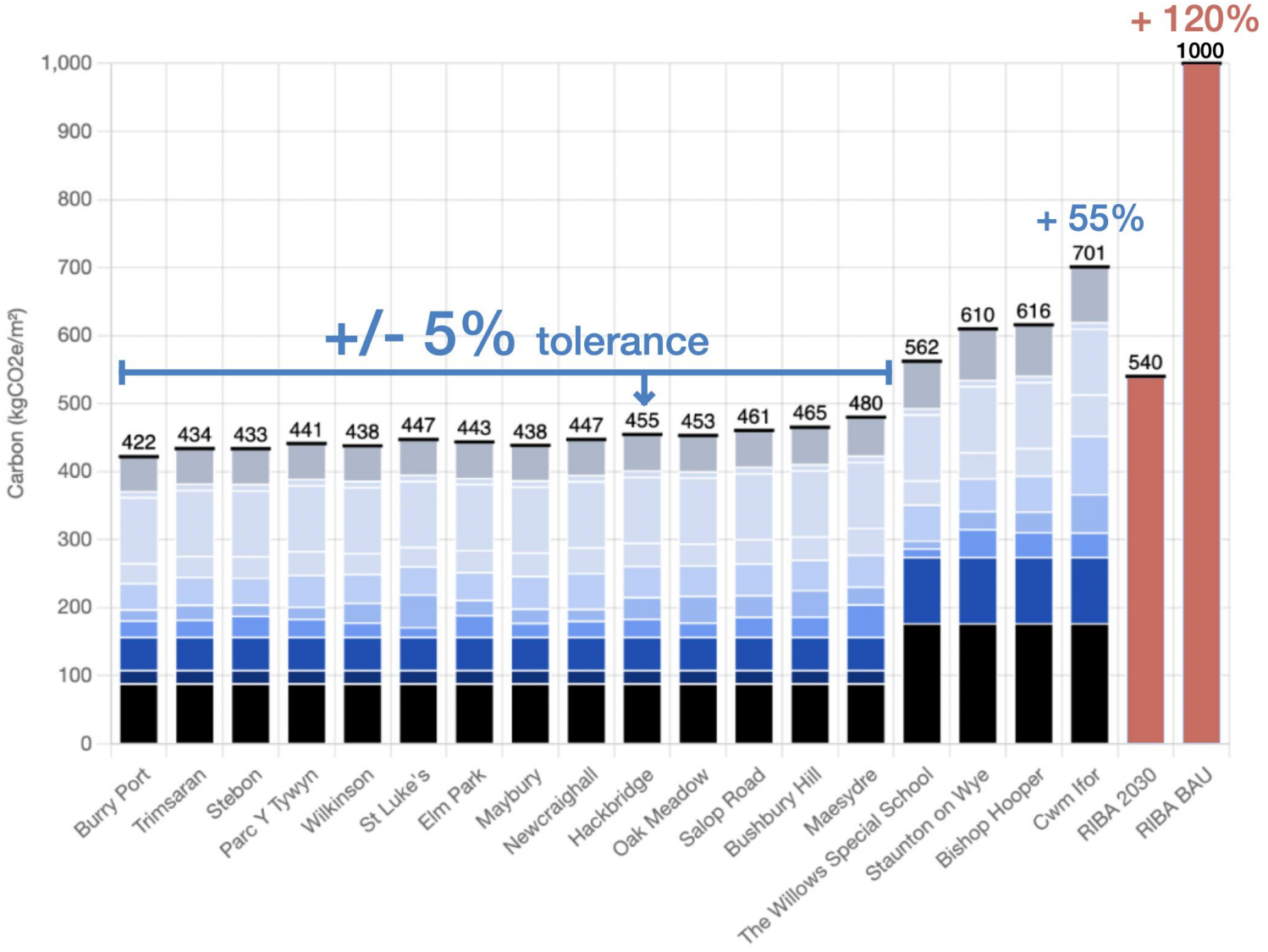


Embodied Carbon

Watch Points:

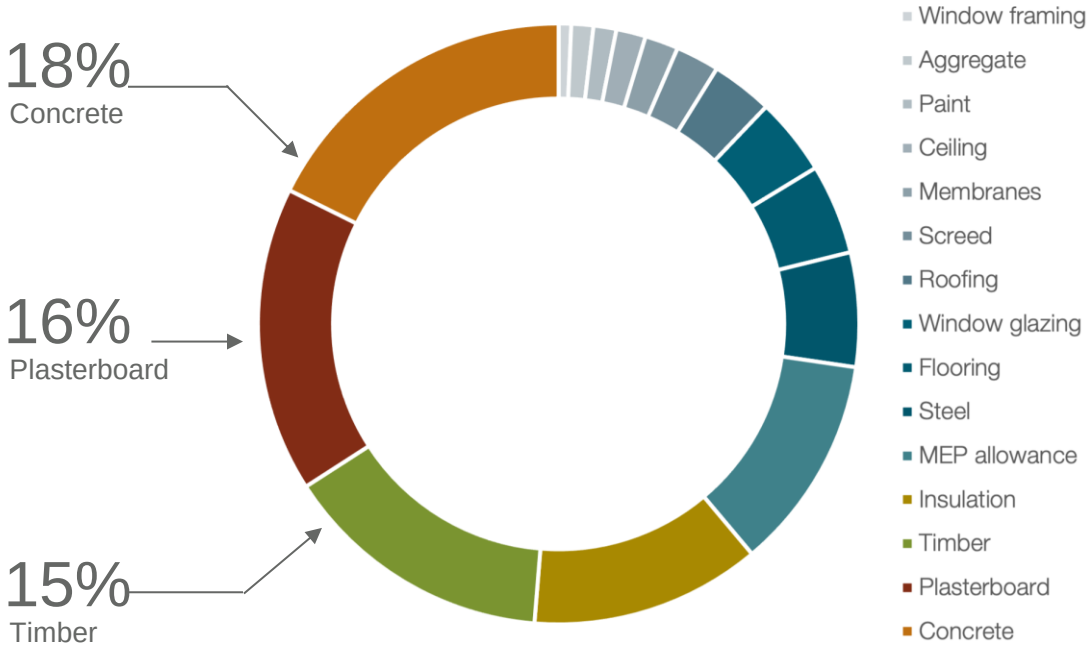
1. Single Story
2. Small Area
3. Poor Form Factor
4. Tall Glazing





Embodied Carbon

Hackbridge Primary School



Case studies

Hackbridge Primary School

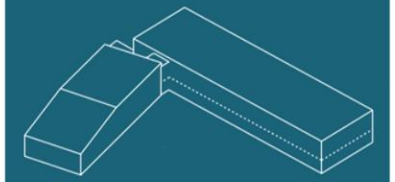


Fig.12 Form Factor Diagram

Fig.13 Hackbridge Primary School

Key Project Data

- Location **Surrey, England**
- Completion Date **2020**
- Gross Internal Floor Area **1865 sqm**
- Certification **Passivhaus**
- Construction cost **£4770/sqm**
- EUI **54.89 kWh/m²/yr**
- Air Permeability **0.84m³/hr/m² @ 50 Pa**
- ACH **0.54 @ 50 Pa**
- Form Factor **2.5**
- Upfront Embodied Carbon **283 kgCO2e/m²**
- Embodied Carbon **519 kgCO2e/m²**
- Total Sequestered Carbon **XX kgCO2e**
- Average Window Ratio **30%**
- Average Glazing Ratio **20%**

Set between a conservation wetlands area of Metropolitan Open Land and the pioneering BedZED eco-village, Hackbridge Primary School provides a playful and natural haven for students in the London Borough of Sutton. The all timber building is a trailblazing example of sustainability, with the Passivhaus Plus design supporting the school's achievement of becoming the first truly zero-carbon school in the UK.

The council required a new two form entry school to complement their existing Hackbridge Road site. Architype saw the unique site as a remarkable opportunity for the UK's first truly zero carbon school, celebrating local ecology and enhancing biodiversity.

Designed as able to expand to a two-form entry school it actively generates more energy than it needs to run, thanks to its highly efficient design and strategy of low carbon technologies.

Designed in 2015, the school meets and will exceed RIBA's 2030 operational energy targets as well as exceeding LETI's 2020 embodied carbon targets. Embodied carbon is half the carbon use of a typical 'business as usual' building.

Themes of flora, fauna, discovery and habitat are evident in every aspect of the design. Physical links to the outdoors – such as extensive glazing and natural textures – actively promote interaction with nature. Sweet chestnut battens clad the school's exterior, echoing the form of a nature retreat, and inside, Architype's material palette include tactile and non-toxic materials to enhance health and wellbeing.

32

Welshpool Church in Wales Primary School

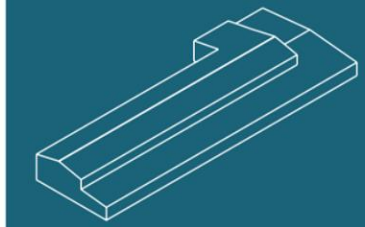


Fig.11 Form Factor Diagram

Fig.10 Welshpool Church in Wales Primary School

Key Project Data

- Location **Welshpool, Wales**
- Completion Date **2020**
- Gross Internal Floor Area **2316 sqm**
- Certification **Passivhaus**
- Construction cost **£XX/sqm**
- EUI **60 kWh/m²/yr**
- Air Permeability **0.37m³/hr/m² @ 50 Pa**
- ACH **0.25 @ 50 Pa**
- Form Factor **2.6**
- Upfront Embodied Carbon **XX kgCO2e/m²**
- Embodied Carbon **XX kgCO2e/m²**
- Total Sequestered Carbon **XX kgCO2e**
- Average Window Ratio **20%**
- Average Glazing Ratio **14%**

The Welshpool Church in Wales Primary School is the first Passivhaus school in Powys. It delivers excellent energy efficiency, ultra-low embodied carbon and inspiring spaces for learning that enhance health and wellbeing for students and staff. The new school building is on the Salop Road playing fields of the existing Welshpool High School in Wales. The design focuses on creating a sense of community, excellent accessibility, and providing a high-quality environment and flexibility in teaching and learning spaces. The eco-minimalist building uses timber and natural healthy materials and provides an exceptional operational energy performance of 56kWh/m/year - more than 80% better than typical new build primary schools. The ultra-energy efficient design means annual bills are reduced by £60,000 compared to a standard build primary school, giving the school millions of pounds over the building's life to spend on books, equipment, and teaching support.

The project's ambitions were high from day one, with the aim to reflect the school's ethos of "bringing out the best in each other". Powys Council wanted a school that would not only align with the Wales 21st Century School Programme, which aims to increase the efficiency and quality of education spaces for a more equal Wales, which also surpasses standard school building delivery to create an exemplar ecological school.

33

ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

Lessons Learned

18 Schools Delivered

160 years combined operation

58,000 square meters

0 insurance claims [1]

Understanding moisture

Moisture ingress is a risk and must be understood and designed for with any materials, and especially when using bio-based materials.

Flat roofs are notoriously susceptible to moisture damage. Combined with the inclement UK weather, it is possible for timber and cellulose insulation to become saturated during construction.

If this occurs and is not allowed to dry out to a safe moisture content prior to being lined with plasterboard, this moisture can become entrapped within the build-up.

Left unaddressed these conditions can lead to mould growth and damage to materials.

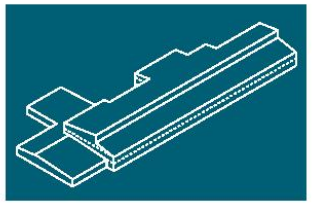
Where moisture has been allowed to become trapped within construction layers, this must be reversed and allowed to fully dry-out, replacing any damaged materials, prior to closing-up.

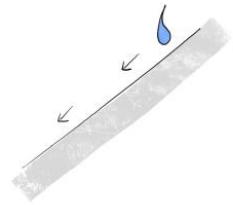
Here is a hierarchy of design strategies we have used across the case study schools to mitigate risks.

Hierarchy alternatives

1: Avoid flat roofs

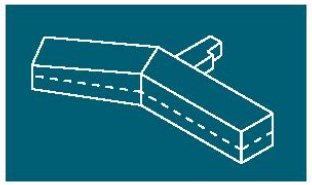
UK climate projections are showing more and heavier rain events. Pitched roofs are the first line of defence.

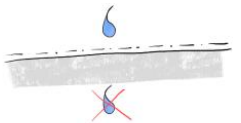




2: Integrated permanent protection membrane

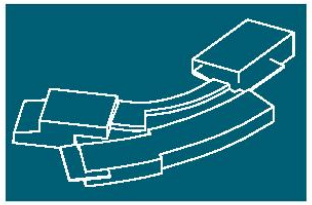
Prioritising up-front protection against programme issues such as prolongation.





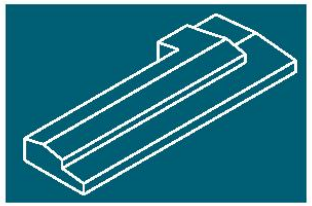
3: Vapour open build-up

High vapour permeability beneficially supports the drying out of high humidity.



4: Ventilated build-up as per pitch roof

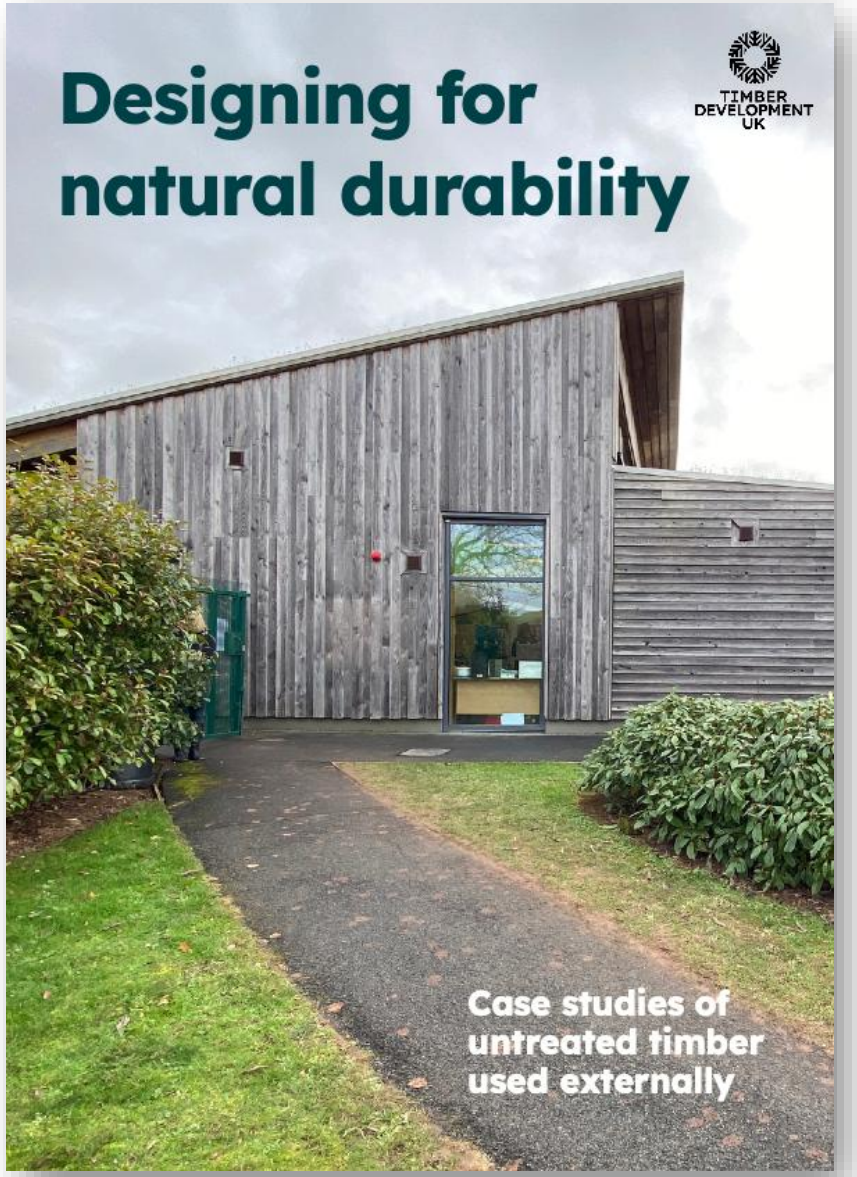
The creates the opportunity for moisture ingress to be ventilated away.



[1] 0 physical loss or damage cover insurance claims made against Architype during both construction and property cover

Cladding solutions

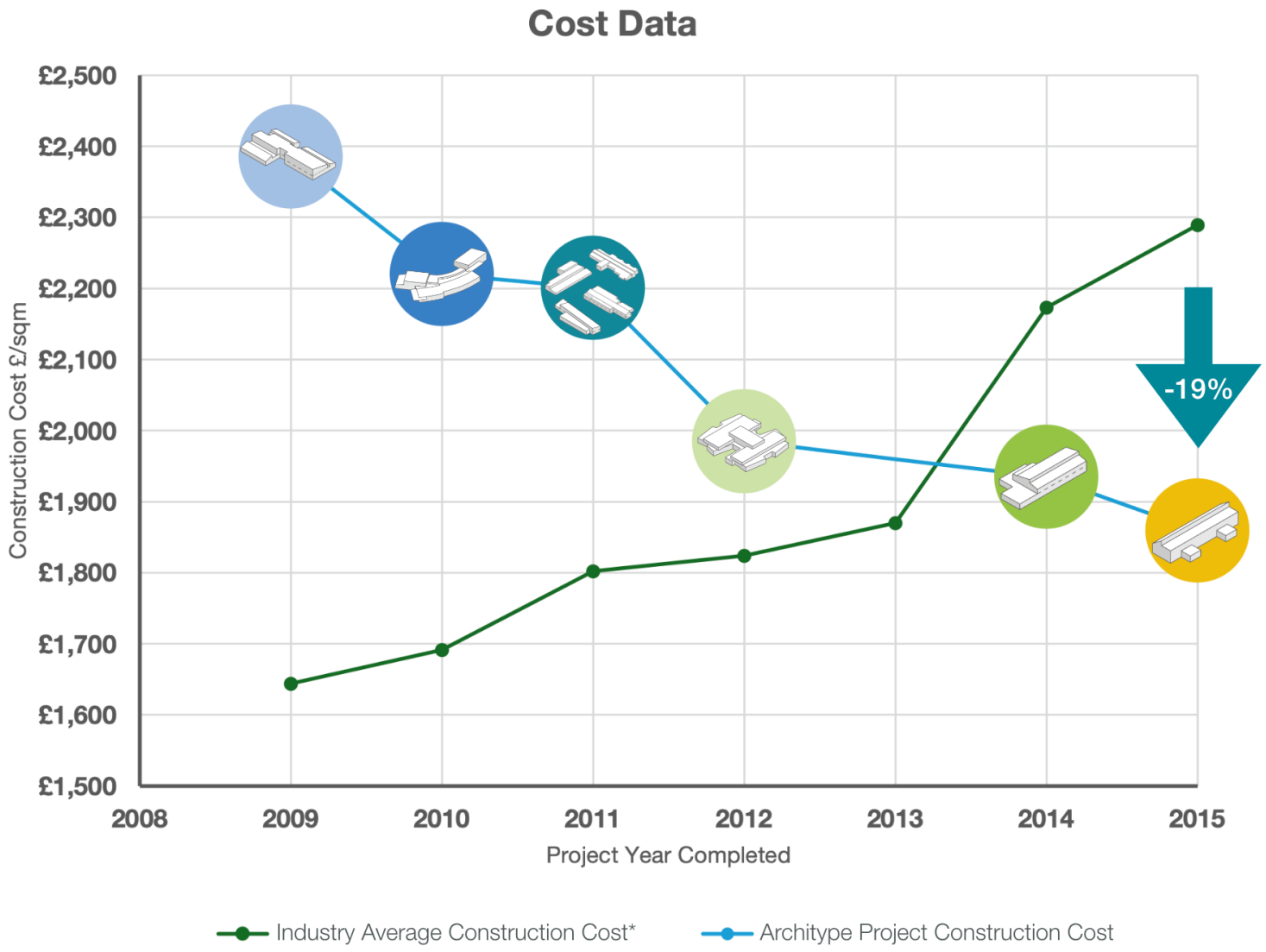
- 23-year retrospective
- 6 real-life buildings



Available on the TDUK website

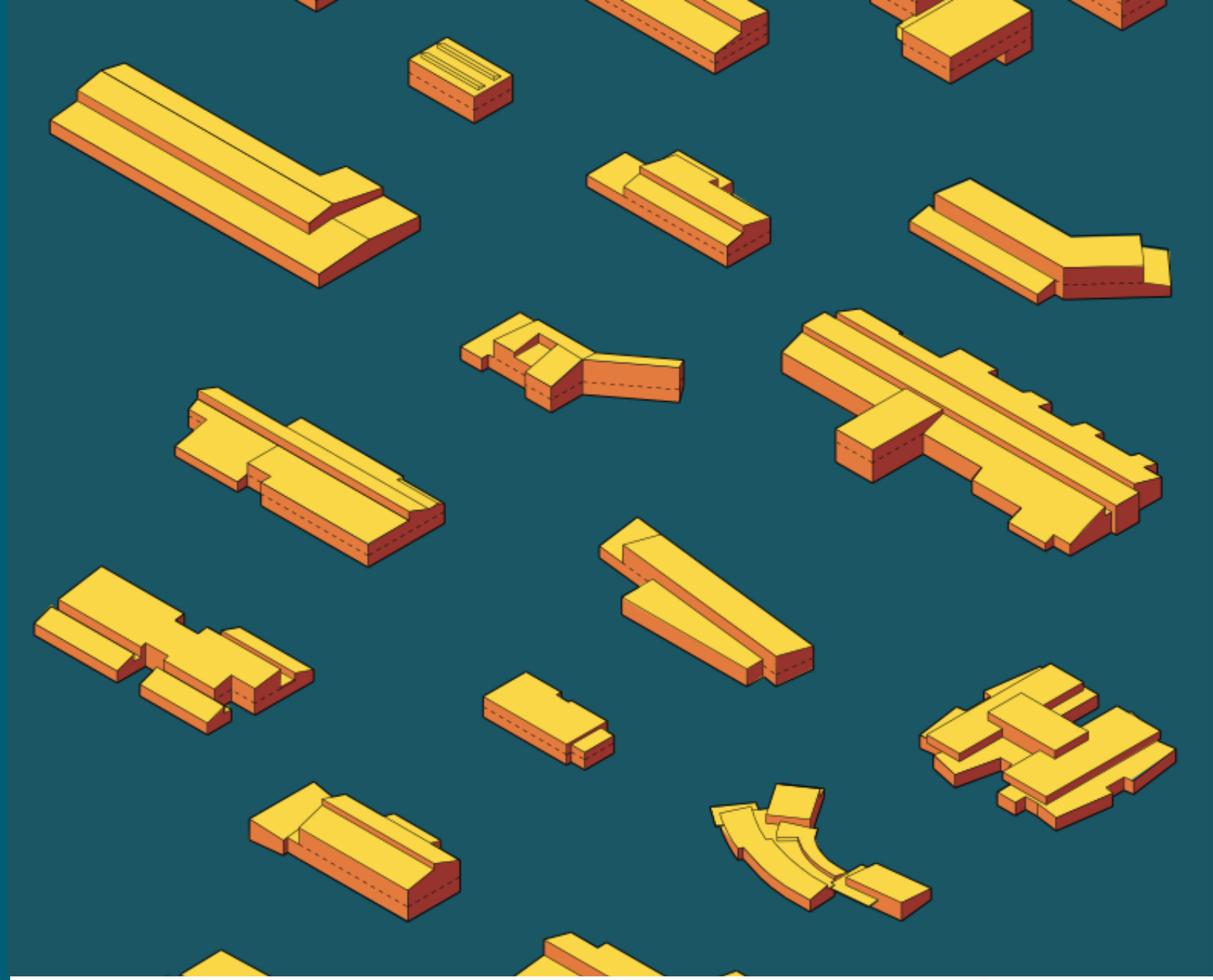
How much does it cost?

Achievable via a repeated project team, learning and implementing lessons



Download the report

www.SafeSchoolsForTheFuture.com



ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

Thank you

With thanks to Seb Laan Lomas (Lead)

Please contact

Seb.laan-lomas@architype.co.uk

ARCHITYPE PERFORM+ UCL THE UNIVERSITY of EDINBURGH IGNIS woodknowledge WALES PYC Construction LOWFIELD TIMBER FRAMES Rosetta Risk Management Forestry Commission

UK + IRL passivhaus conference 2025

Belfast + online | 7 - 8 October

www.ukphc.org.uk

PASSIVE HOUSE ASSOCIATION OF IRELAND

Sponsors

ecological BUILDING SYSTEMS

Metal Technology

SIGA

21°