#UKPHC19

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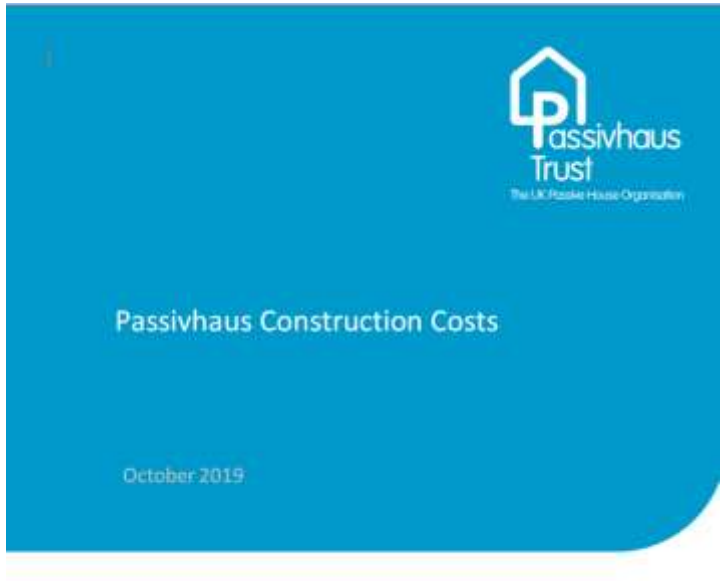
Passivhaus Costs

Kate de Selincourt



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Passivhaus Trust cost study

- Residential Passivhaus developments, 3-70 dwellings
- Mostly for LAs/HAs
- Semis, terraces & flats
- Many construction methods & materials
- Most info is from contracts, dated 2013-2019

Two aims

- To find out what the Passivhaus costs extra
- To arrive at some idea of overall £/m2

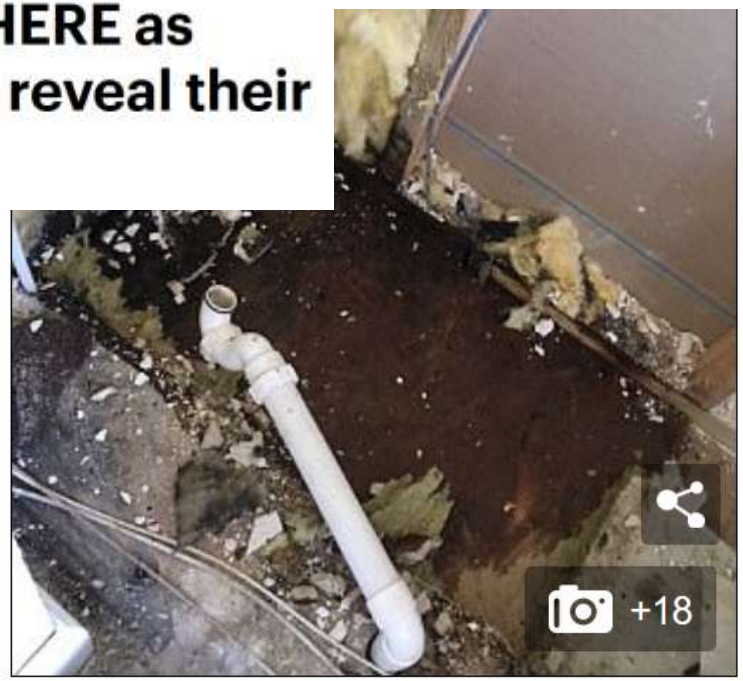
How much more does it cost to do Passivhaus? – it depends!

The first question has to be – how much more than what?!

What are we comparing with?

We want to try to compare like with like!

Your new house nightmares: Black mouldstains, builders' mugs left behind and leaks EVERYWHERE as buyers of new build homes reveal their property horrors



She has had to replace an entire bathroom due to mould, and has mould growing around the property

How much is really “extra”?

40% performance gap!

One day…

CCC: “Future standards and legislation will seek to close [the] performance gap … additional quality assurance mechanisms will need to be implemented at a national level.”

“UK Housing: Fit for the Future”

Committee on Climate Change, 2019

Baby steps...

"To ensure that airtightness is appropriately tested and understood across developments, and to align with changes to Part F, we plan to mandate airtightness testing in all new dwellings."

- Future Homes Standard Consultation, BEIS, October 2019

So - should we include site supervision?

Is site supervision only seen as a ‘cost’ because weirdly, mainstream construction is happy to leave the crews to build what they always have?

How much should doing things properly be seen as a cost?

(we included it for now)

What else?

Inevitably determined by what gets recorded, and what could be shared

- Non-negotiable and costable: triple glazing, MVHR, airtightness work and materials, extra insulation
- Non-negotiable but nebulous – QA, site supervision
- “Optional” – things only *needed* if you choose not to optimise for PH: shutters, expensive thermal breaks etc

What else did we include?

What was recorded, what could be shared:

- Non-negotiable and costable: triple glazing, MVHR, airtightness work and materials, extra insulation
- Non-negotiable but nebulous – QA, site supervision
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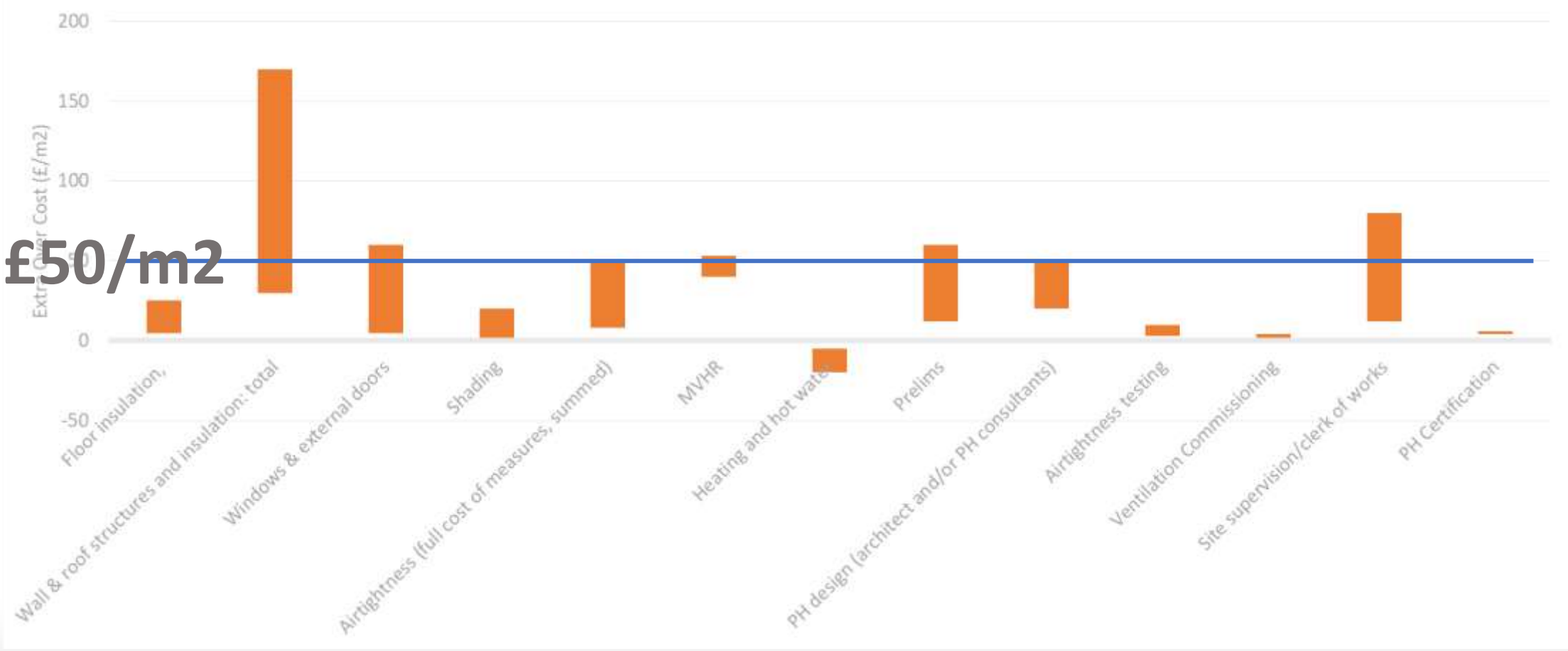
How much more does it cost to do Passivhaus? – it depends!



What made costs vary?

Complex forms and complex structures

Set-backs, overhangs, balconies, cantilevers…

Harder to detail and build, but also, more expensive to insulate.

Specialist thermal breaks don't come cheap

Not saying these features are wrong, but just that, in a typical regs dwelling, they will screw the thermal performance.

So in a Passivhaus, be prepared to **pay** for these features **not** to screw the thermal performance.

Insulation extra over costs per m2

- Big range – one was £120/m2 extra, for walls & roofs
- Simpler designs around £30-£60 extra per m2,
- Specialist components such as cavity ties and flooring systems

Glazing & shading

Projects with fairly modest glazing...

..had modest glazing extra-overs

- ~£5 -£15 over for modest builds for RSLs/LAs, larger-scale developments, good procurement
- Others up to £50/m2 more

Shading?

Shading - a cost that is ‘optional’ in general: some projects had shading, most didn’t

MVHR

- Consistently £40-£50/m2 across most projects

Heating and hot water

- Usually a net saving in Passivhaus, as smaller heat source and fewer heat emitters required, compared to a standard build.

- minus £5 – minus £15 /m2

Site supervision

- How much ‘extra’ this costs depends on experience of everyone involved, on the way sites are usually managed – and what you are comparing it with!

- Some pinned down to £10 - £30 /m2 in projects where there was an indication – but mainly there wasn’t

Supervision as upskilling: ie investment

- Frankly this is an investment in upskilling the construction industry and should probably be paid for out of economic development budgets
- For now, clients are subsidising this

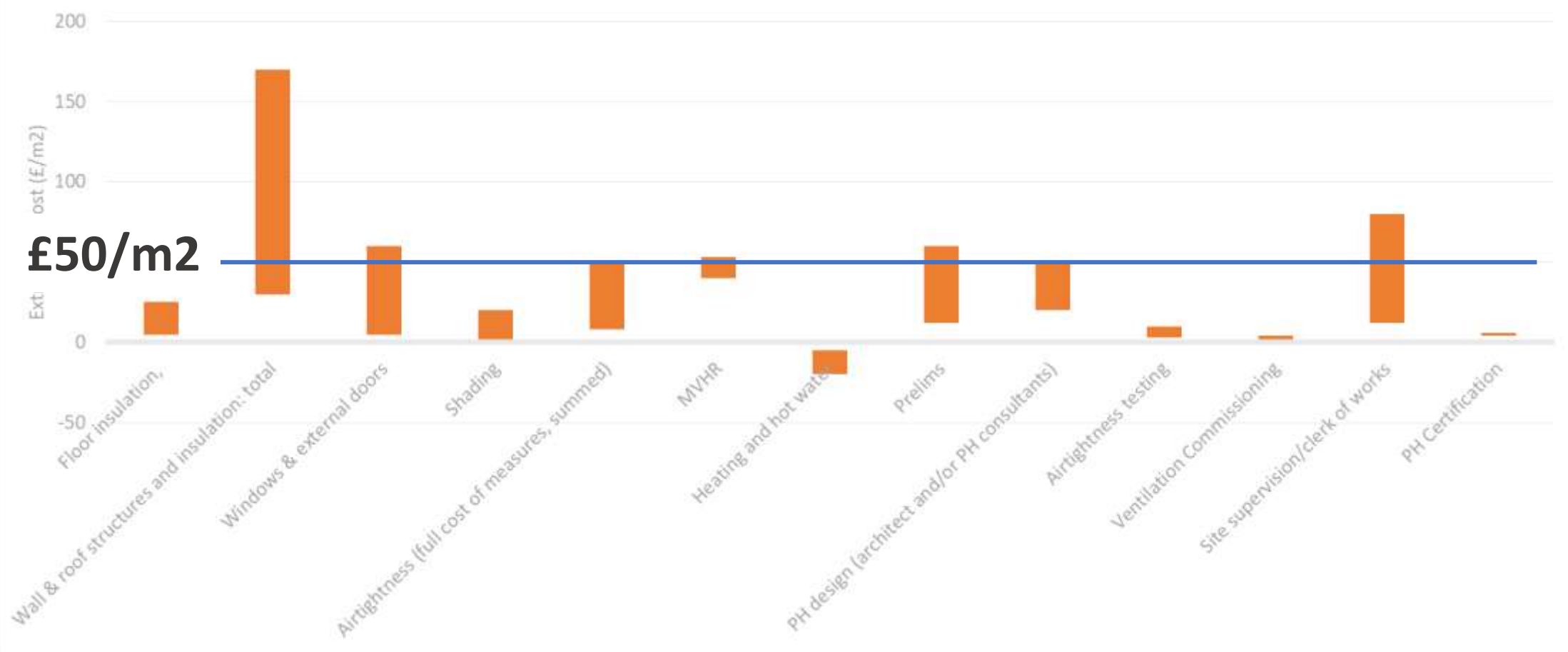
airtightness

- Again, hard to break out
- Some figures of £25-£30
- Projects that spent more (~£50) were generally first-timers

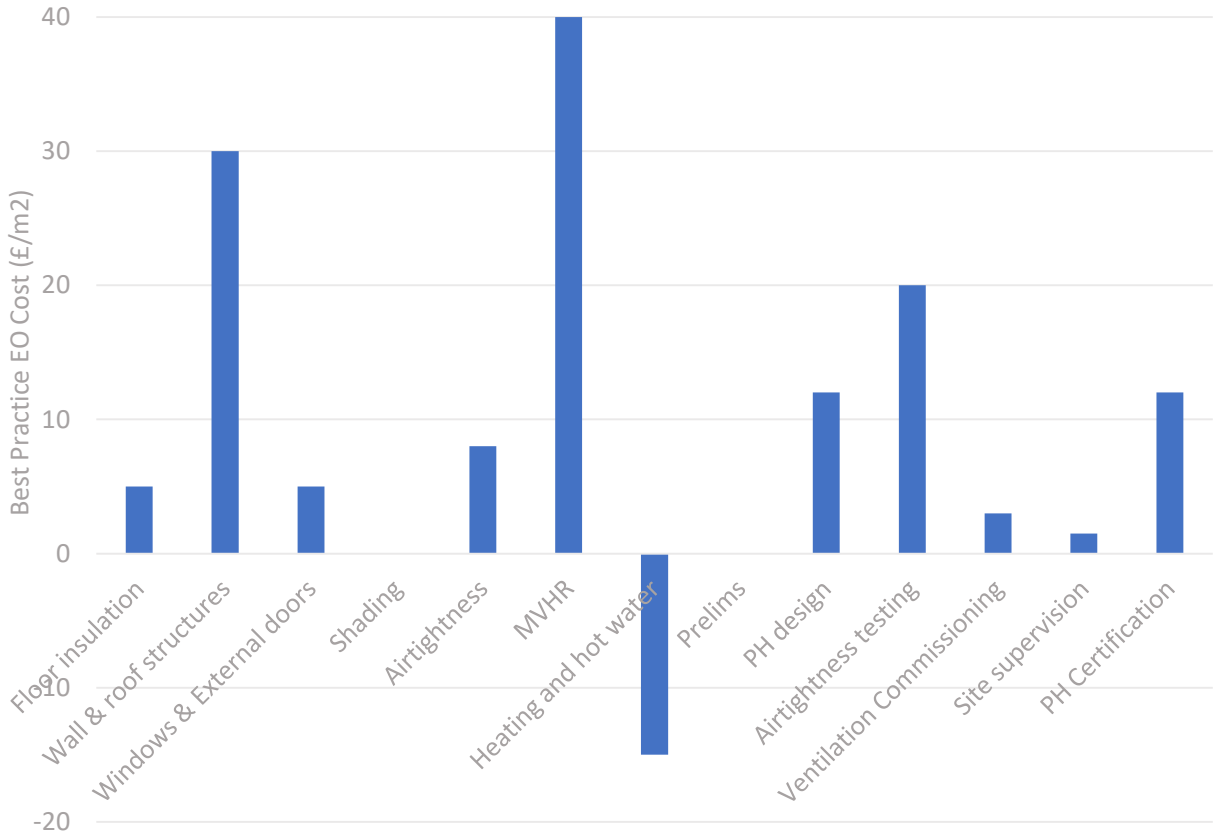
Specialist fees

- Design fees structured differently on different projects
- All had specialist air test , and of course certification
- Neither of these two large : airtesting ranged from £200 to £750/unit, mainly depending on scale

Taking the lowest…



£50


Best Practice EO Cost (£/m2)
40
30
20
10
0
-10
-20
Floor insulation
Wall & roof structures
Windows & External doors
Shading
Airtightness
MVHR
Heating and hot water
Prelims
PH design
Airtightness testing
Ventilation Commissioning
Site supervision
PH Certification

A notional best-practice project

- overall Passivhaus extra-over cost of £115/m2
- 11% of the average Spons UK build cost for terraced housing

BUT

- 7% of the Baker Ruff Hannon social homes average (more comparable to our sample, ie modest-sized social housing developments)

Overall build costs

Trying to be fair...

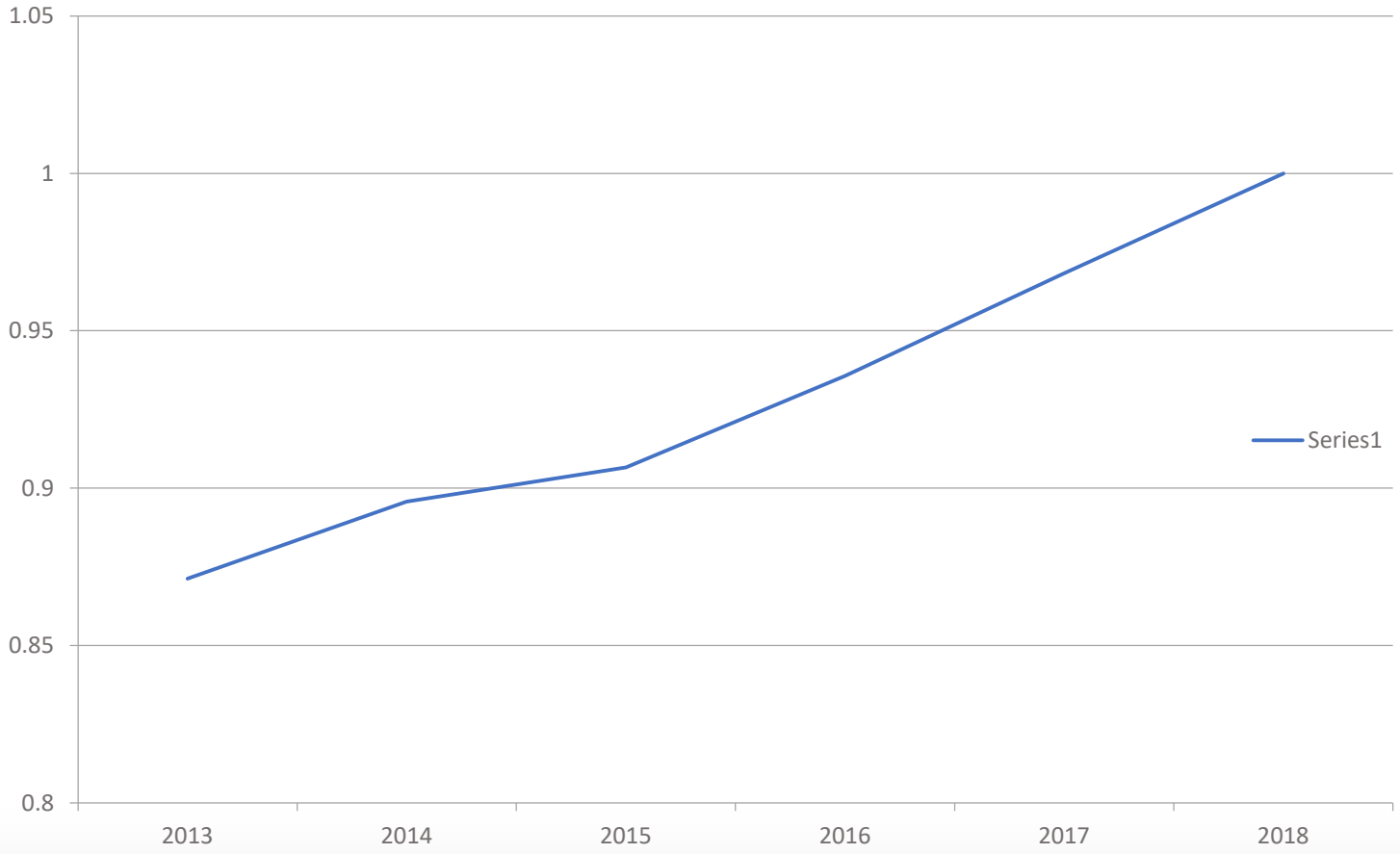
Development size

How many ‘ordinary’ developers are going to build just a one-off pair of semis?

From: Report for The Federation of Small Businesses August 2015

Development Size	Median Cost (£/m2) (Adjusted to 2018/19 equivalent)	Correction Factor (£/m2) to normalise to 1-10 dwellings
1-5 Dwellings	1187	**-56**
1-10 Dwellings	1131	**0**
>10 Dwellings	1078	**+52**

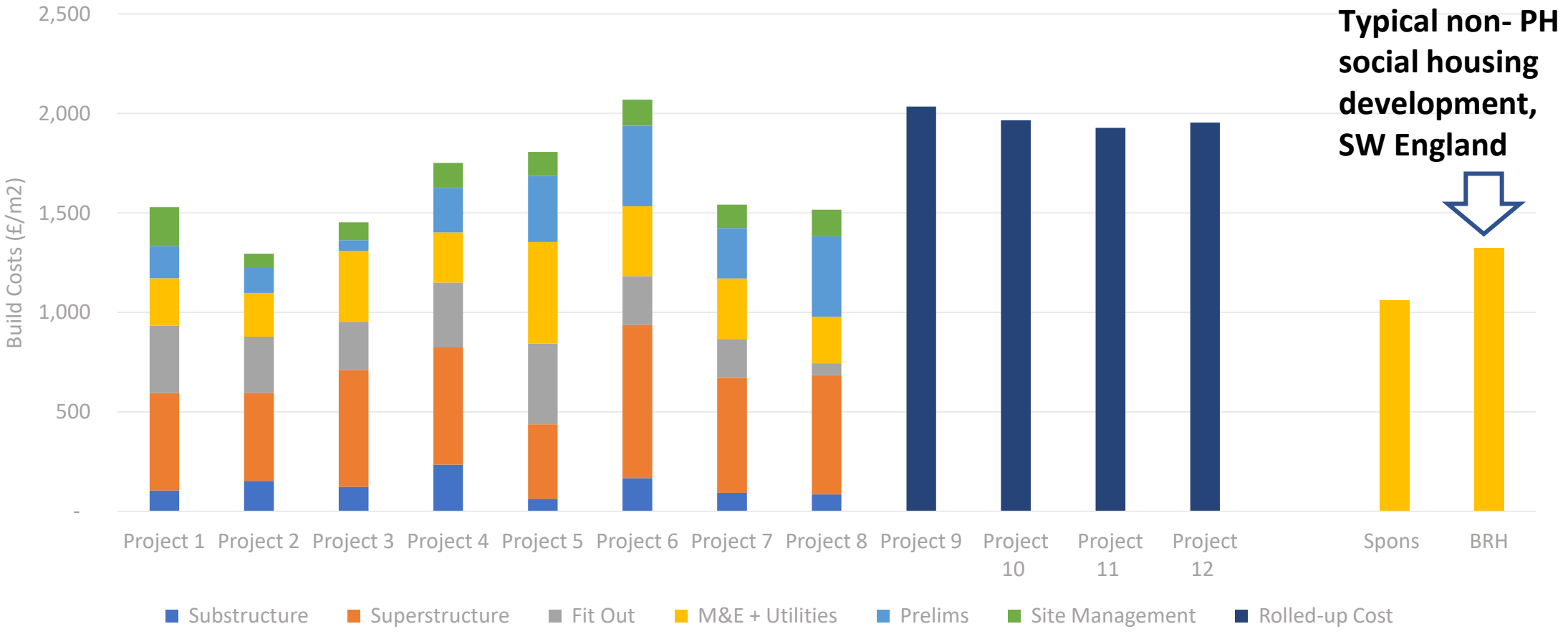
Date:
prices up 15% between 2013 & 2018 (ONS)



Other factors too:

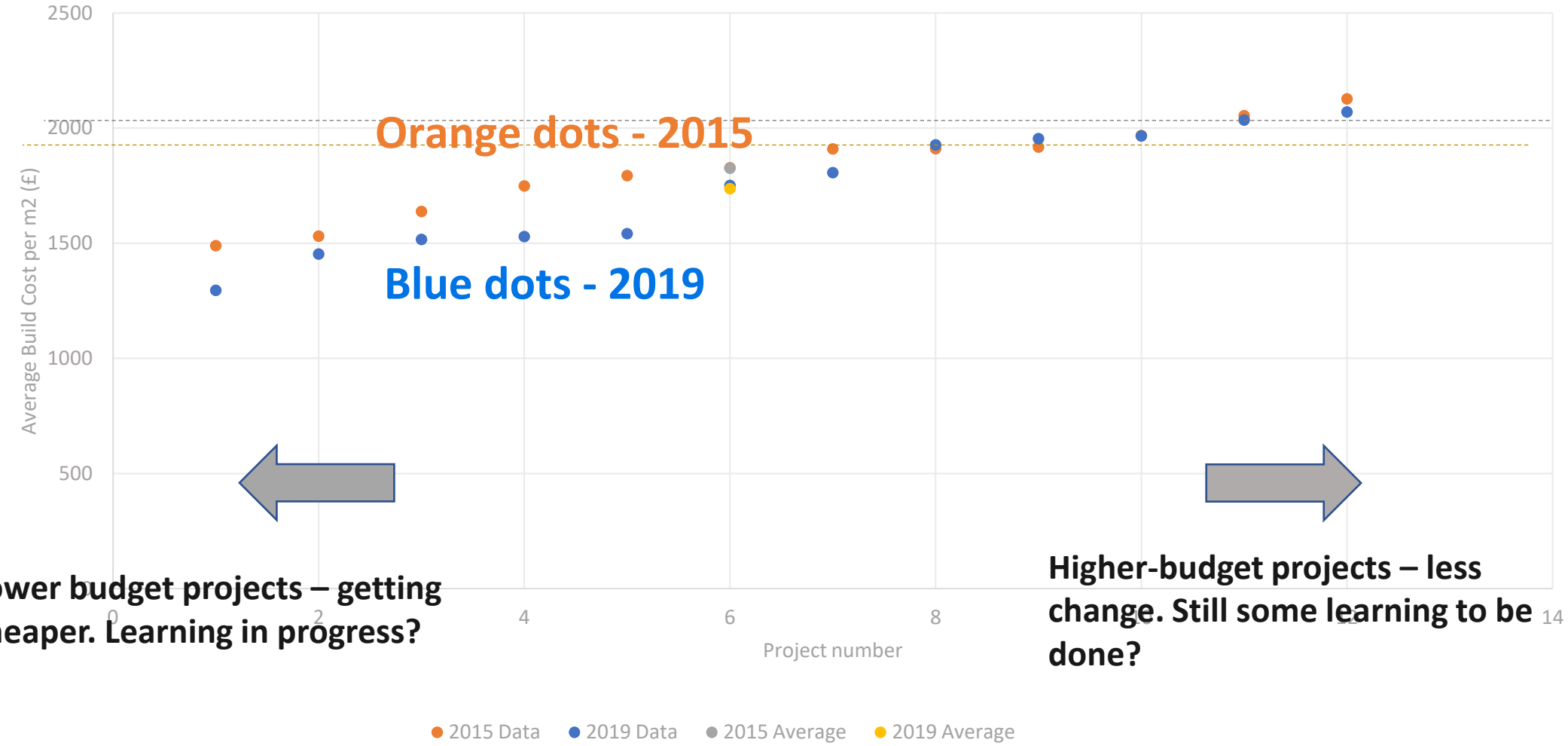
- Flats vs houses
- Location (London vs Newcastle etc)

12 PH projects – cost/m2 (adjusted to compare with 2018 terrace baseline, neutral cost region)
External works (roads, site drainage etc) excluded.



What did we learn?

Costs are falling



Lower budget projects – getting cheaper. Learning in progress?

Higher-budget projects – less change. Still some learning to be done?

Keep it simple!

Once again, complexities (even minor ones) can hurt a PH budget

Same client, same spec, but:

No dormers, step-backs or recesses. Ideal for Passivhaus

Planning conditions required a “fussier” look

Glazing bars -> larger frame area -> increasing heat loss

Glazing bars -> windows larger to admit same daylight

Double increase in losses had to be compensated by more expensive spec

Higher form factor added pressure on fabric performance, adding expense.

Images posed by models

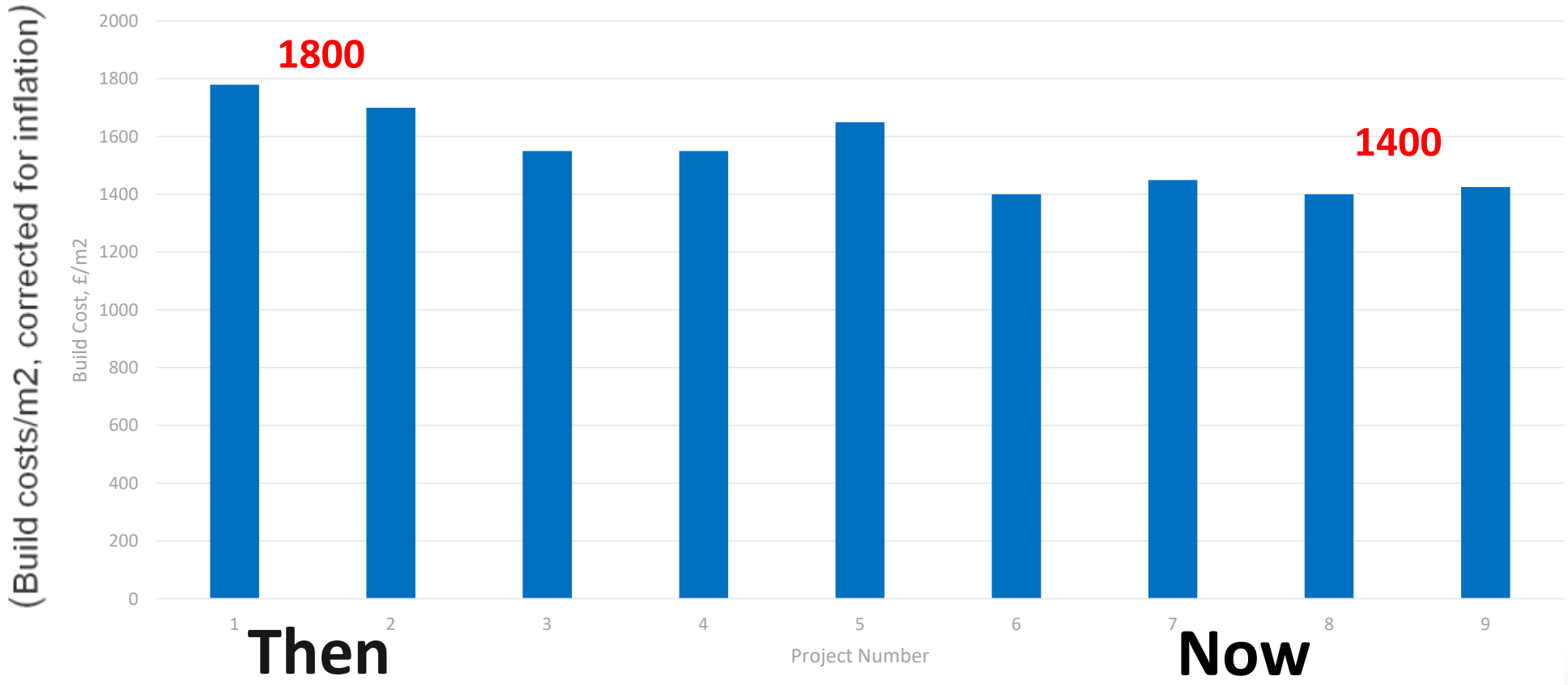
Architects - the QS is your friend!!

- Omission of some radiators in bedrooms £6.4/m2
- Reducing size of some MVHR units £8/m2
- Losing some dormers £5/m2
- Replacing some brick with render finish £2.5/m2

total saving £21.9/m2 *(thanks to Hamson Barron Smith)*

As experience grows, costs fall

Exeter's experience is paying off... Almost £400/m2 saved in real terms (ie corrected for inflation)



How have Exeter done this?

Money- (and hassle-) saving changes, building on their experience:

Simplified building form (no dormers etc)

Introduced generic details - easier to get right quickly, more repetition and easier estimating- less risk to contractor.

Different build system (Porotherm blocks) with less wet cement/mortar. This enabled a faster build and faster drying-out

Leaner specification: smaller MVHR unit, better located (shorter ducts), fewer radiators

Approaching a generic house type – economies of scale in design

learnings

It’s an expanding field, so many of the Passivhaus projects we looked at were first-time Passivhaus projects

The first pancake:

It’s still a pancake, it’s perfectly edible, but it didn’t turn out quite as you hoped

1st-time costs - examples

Over-cautious?

Extensive taping plus specialist sarking board to be sure of achieving airtightness target - extra-over cost around £50/m2 for airtightness

–plan for next project is to use less tape (getting more of it it right first time!) and just OSB

Unfamiliar materials

Leaving a freshly-taped building element to get rained on proved expensive for one team – but it won't happen on the next project!

Learning from experience – savings next time around

- Plan for some next times round – cash in on all that effort!
- And learn from the experience of others – PH people love to share!

Be more Exeter!

Benefits now!

What makes sense in a Passivhaus, makes sense

"We realise now that this is not just good practice for Passivhaus, it is good practice for all our builds."

(this eg was glazing)

What makes sense in a Passivhaus, makes sense

“There was a tricky bit of sequencing where the vapour check membrane had to be wrapped around some joists, and this was not always being done properly.

“We picked this up and resolved it on the Passivhaus builds, and after that, the same detail was done properly on the rest of the site too.”

Quality

“Our oldest Passivhaus dwellings are almost 10 years old and so far we haven’t had to replace a single component.”

Emma Osmundsen, Managing Director of Exeter City Living Ltd

The future

Passivhaus is still young, and to date projects have tended to be scattered one-offs. As Baker Ruff Hannon point out:

- There is insufficient volume from any single commissioning body to drive a standard design or a standard approach.
- The geographic spread of projects across the country has not exposed the supply chain to the practice required, so there is limited skills-building, experience or learning being generated.

Volume will change this

Baker Ruff Hannon highlights economies available in mainstream commercial house-building:

- A systematised approach: build, repeat, move on
- Using common components
- Repeat layouts in different ‘skins’

“There is no reason why the economies of scale available in the commercial housebuilding model would not be equally applicable to mass construction to Passivhaus, provided Passivhaus became the norm.”

Analysis for CCC hazards a price:

Analysis by Currie and Brown for CCC

Space heating demand 15 kWh/m^2.year (but not Passivhaus QA)

Once costs had stabilised at volume, the extra over cost was an estimated **£4,800 per dwelling**

equivalent **to £57 per m^2 or 3.3%** of the current Baker Ruff Hannon average build cost.

Passivhaus as a driver for skills and quality uplift

UK skills gap in design and construction.

The success of these Passivhaus projects suggests both that the skills are all achievable given the right context – and that designing and building to Passivhaus is a good way to embed these skills in future practice.

ukpassivhaus conference 2019

Thank you…

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