



Technical Conference

14 November 2007, York Racecourse

Towards 2016: Implications for low and zero carbon housing

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STAMFORD BROOK



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The road to 2016?

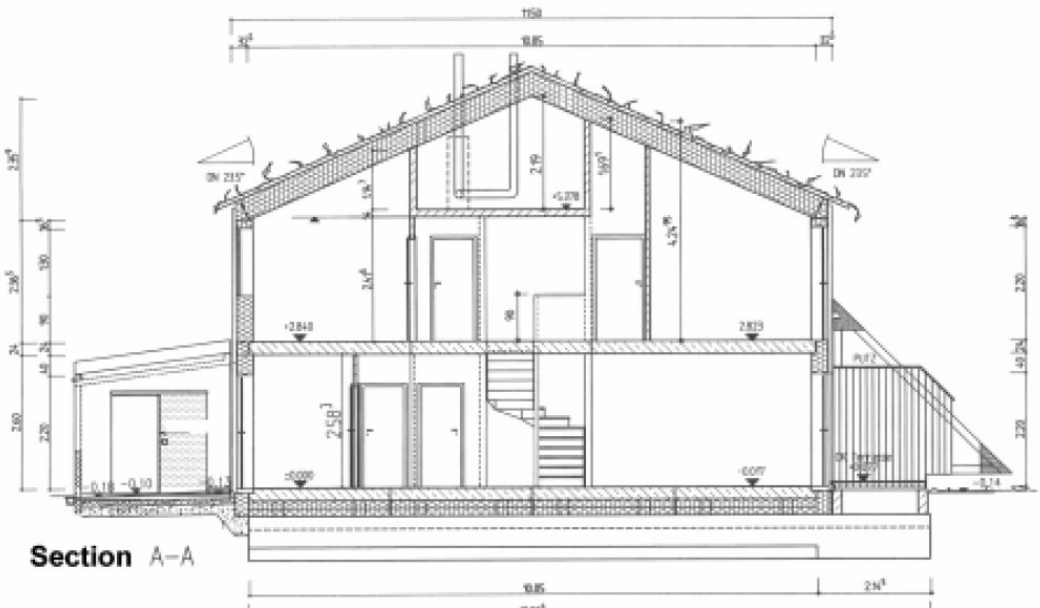
- **Passive House standards**

- Fabric U-Value: $\sim 0.1 \text{ W/m}^2\text{K}$, Window U-Value: $0.8 \text{ W/m}^2\text{K}$
- Airtightness: $< 1 \text{ mh}^{-1} @ 50\text{Pa}$
- MVHR
- Solar Hot Water
- Measured Space Heating: $< 15 \text{ kWh/m}^2\text{.a} = < 1200 \text{ kWh per annum for } 80\text{m}^2 \text{ semidetached house}$

- **Carbon free energy generation**

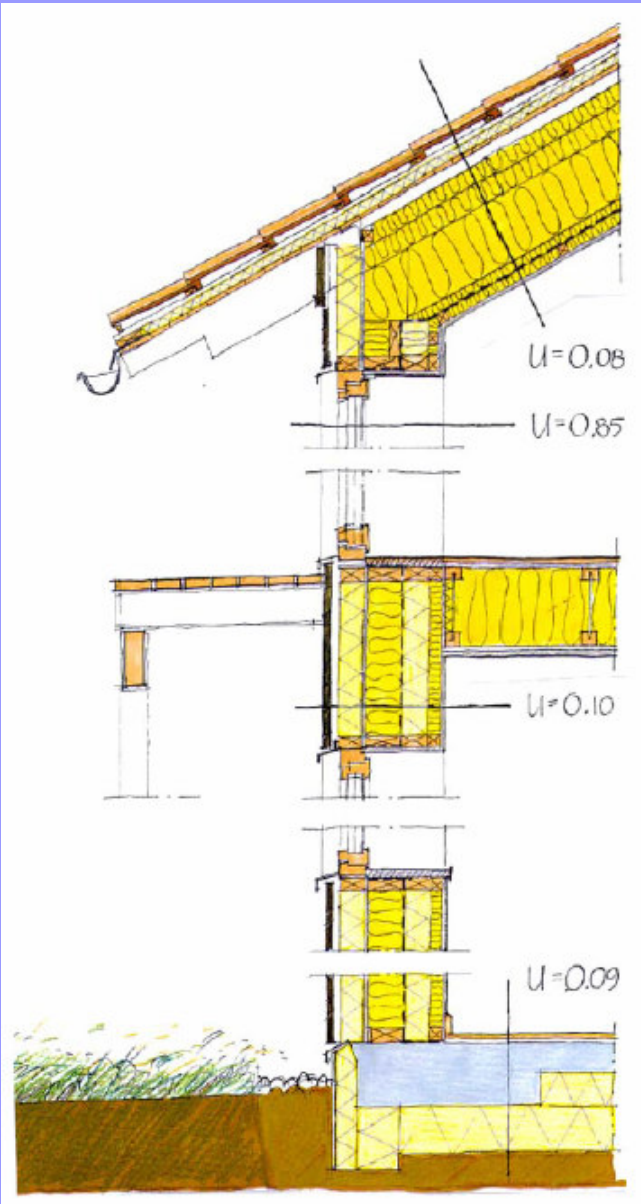
- Code 5 $\sim 1500 - 2200 \text{ kWh}$ (about $17 - 25\text{m}^2$ of good PV)
- Code 6 $\sim 3000 - 4000 \text{ kWh}$ (PV + wind?)

Kronsberg Passive House



- **Kronsberg Passive Houses, Hannover:**
 - **Built 1998, Measured 1999-2001**
 - **Fabric U-Value: $\sim 0.1 \text{ W/m}^2\text{K}$, Window U-Value: $0.8 \text{ W/m}^2\text{K}$**
 - **Airtightness: Mean $0.29 \text{ h}^{-1} @ 50\text{Pa}$ (32 dwellings)**

Passive House Standards



External wall:
U value: $0.10 \text{ W/m}^2\text{K}$
Framed construction with 43 cm insulation.

Roof:
U value: $0.08 \text{ W/m}^2\text{K}$
Masonite beams with 48 cm insulation.

Floor:
U value: $0.09 \text{ W/m}^2\text{K}$
Concrete slab laid on 25 cm insulation.

Windows:
U value: $0.85 \text{ W/m}^2\text{K}$
Three pane windows with two metallic coats and krypton fill.
Energy transmittance 43%.
Light transmittance 63%.

External door:
U value: $0.80 \text{ W/m}^2\text{K}$

Airtightness 1 m/h

Timber frame scheme
Göteborg, 20 dwellings
(120 m²) built 2001.



Source: Wall (2006), Photo: Hans Eek

MVHR – 80% with duct heaters

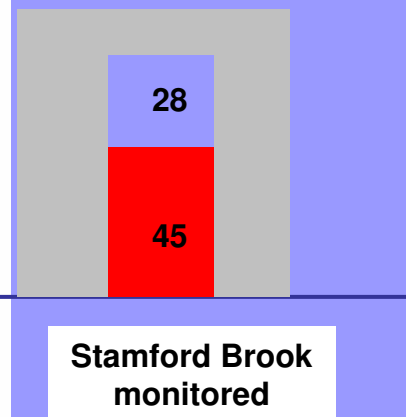
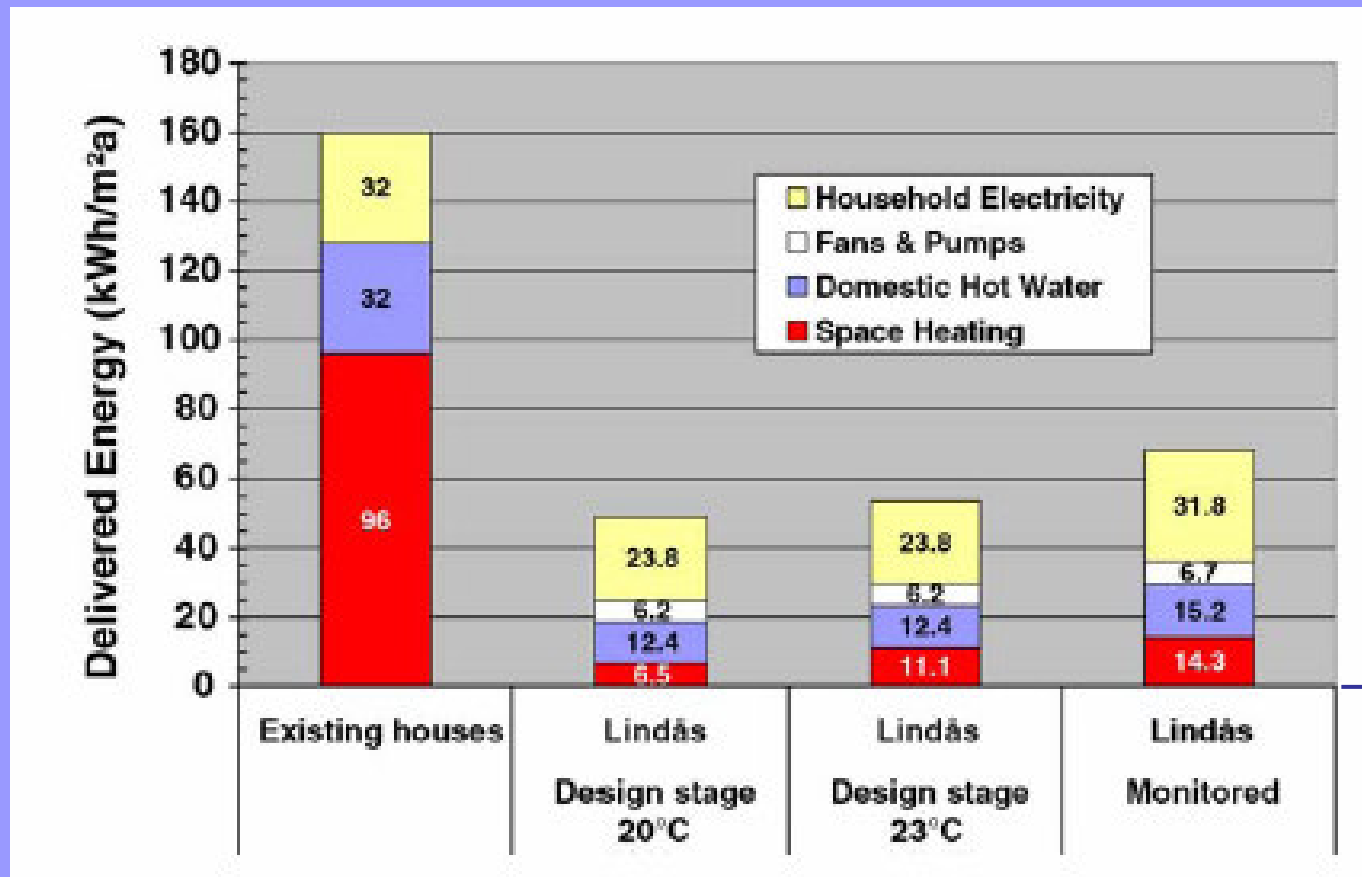
5m² Solar water +
resistance top-up

Passive House Standards

Timber frame scheme Göteborg, Sweden,
120 m²



Source: Wall (2006), Photo: Hans Eek



Source: Wall (2006), Energy and Buildings. 38, pp 627-634

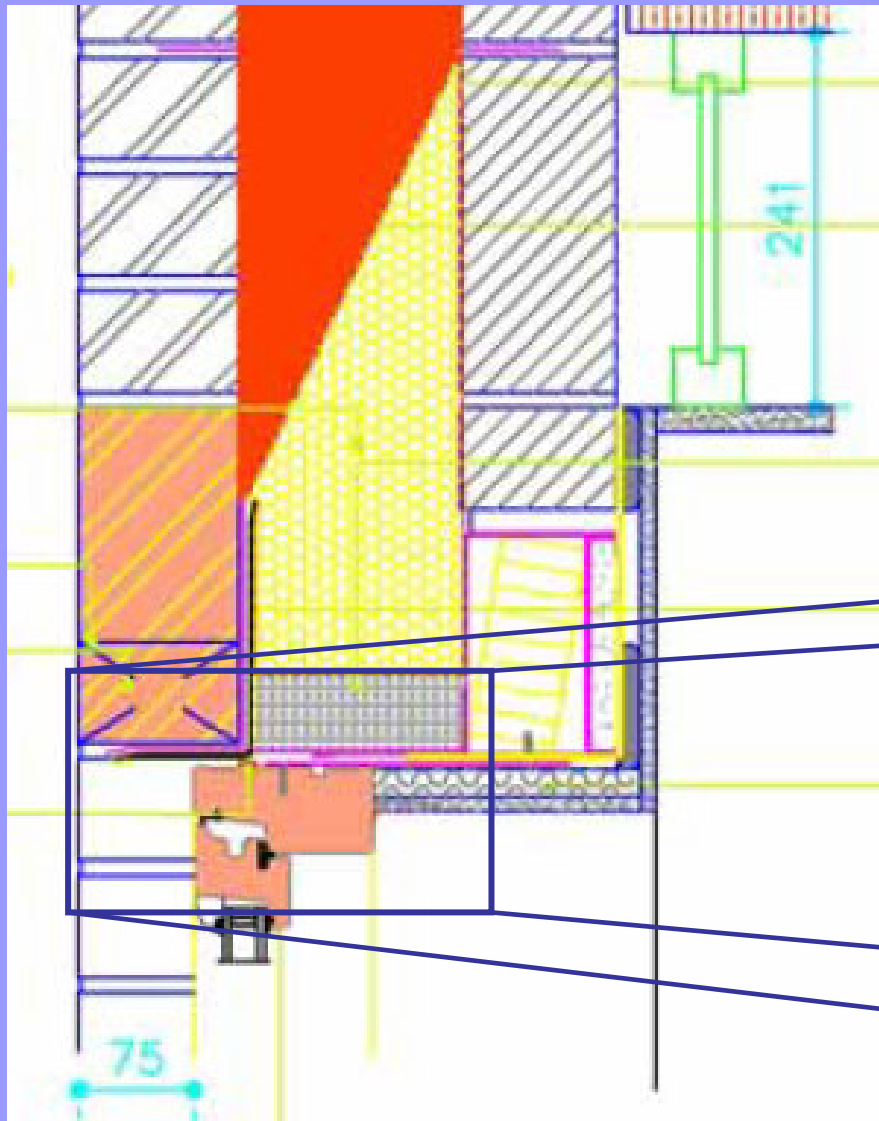
What can Stamford Brook tell us about the journey to 2016?

- Design
- Construction
- The supply chain
- Use – customer advice and guidance
- Regulation
- Education and training
- House building as a production process
- House building as a systems problem

The truth about building houses

Tales from the building trade

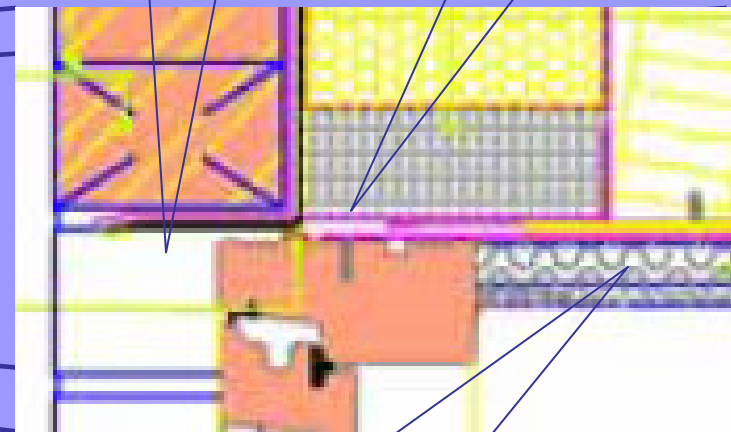
Window head design & construction



Window head detail - ψ
value = 0.068 W/mK

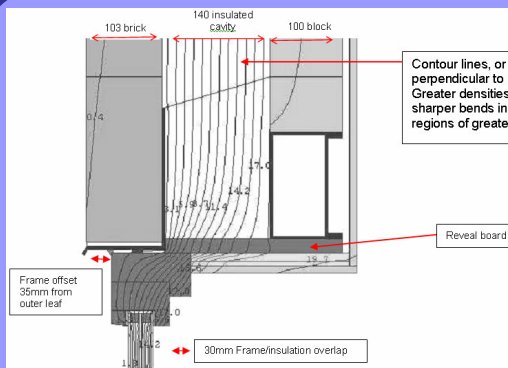
75mm set
back

42mm gap

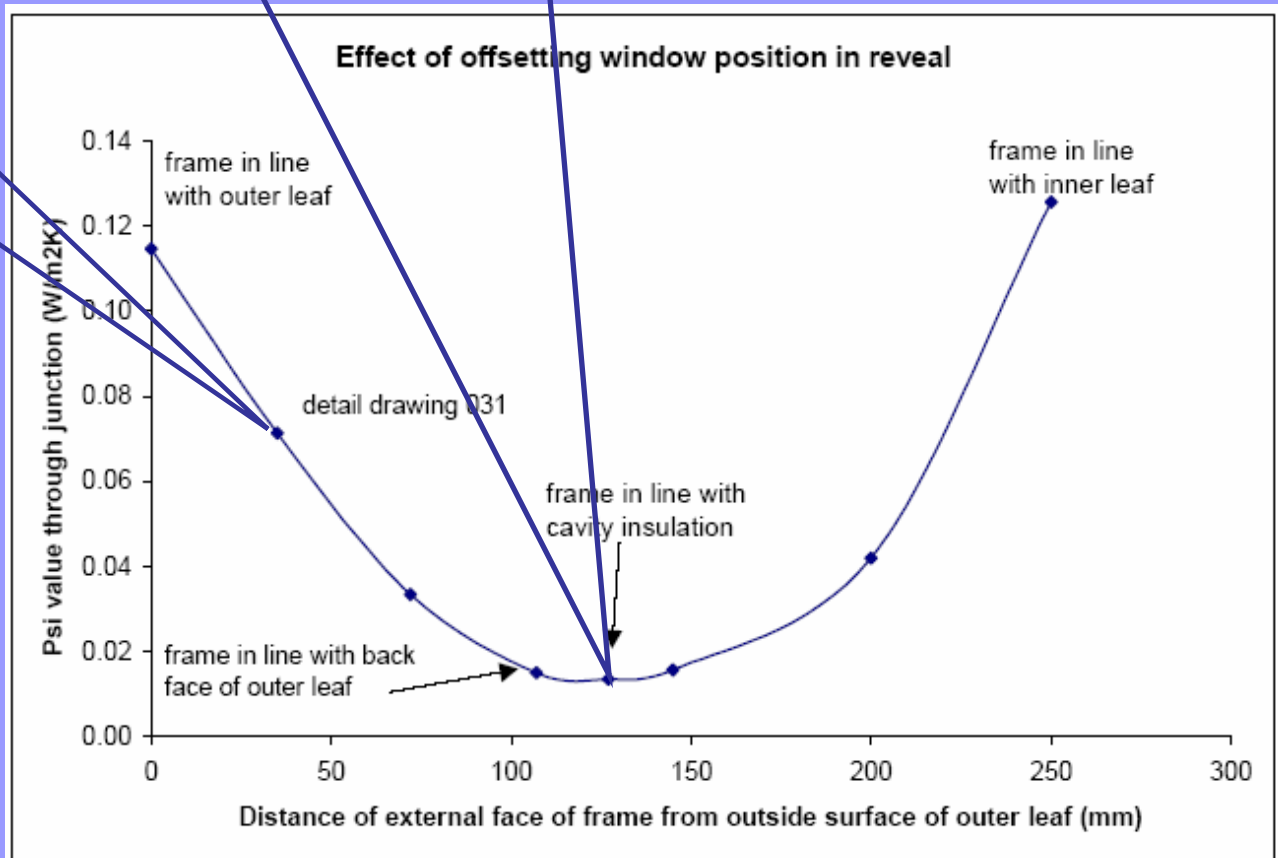


Insulated reveal
board

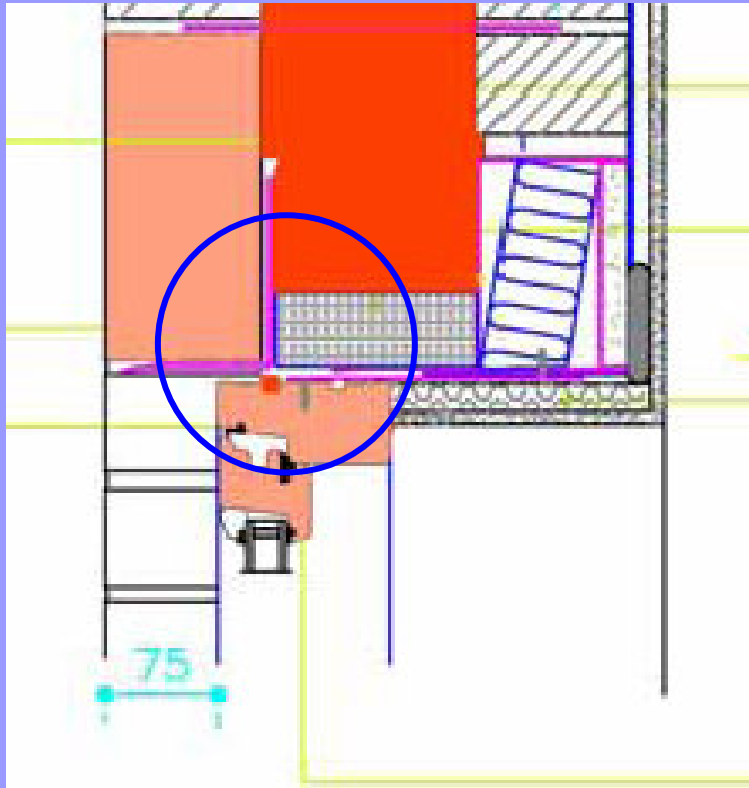
Optimum arrangement



Optimum Ψ value = 0.016 W/m.K
Plain twin lintels, no toe, frame in line with insulation



As constructed



As Designed = 42mm gap
 Ψ value = 0.068 W/mK

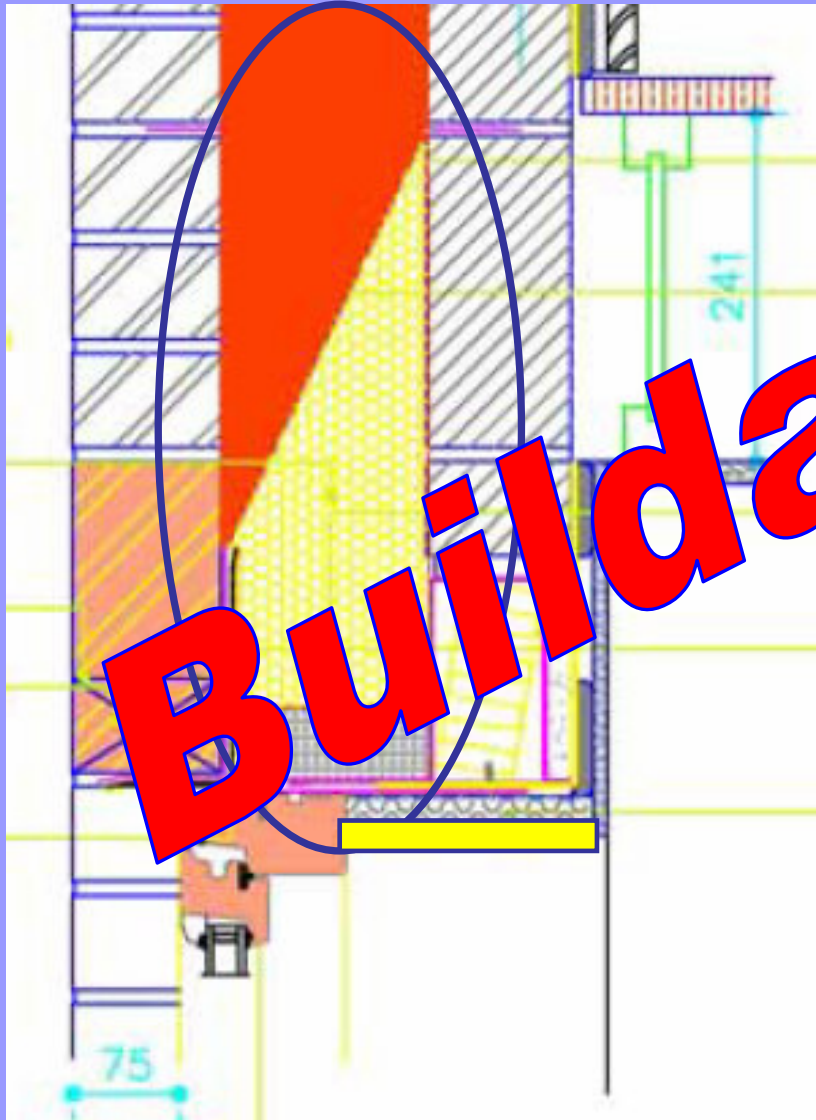


Typical As Built - 20mm gap + air gaps –
no insulated board Ψ value = 0.203 W/mK

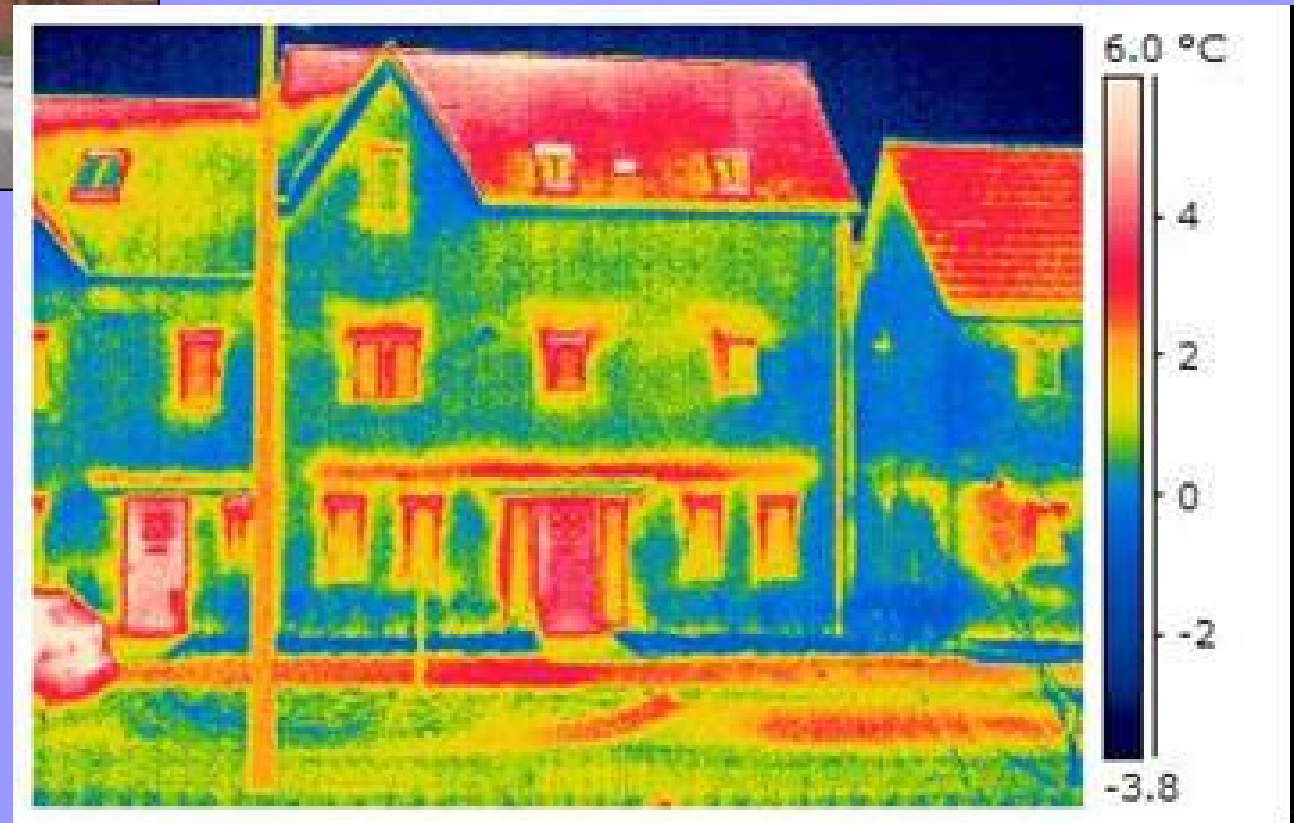
+199%

+1,168% on optimum (0.016 to 0.203)

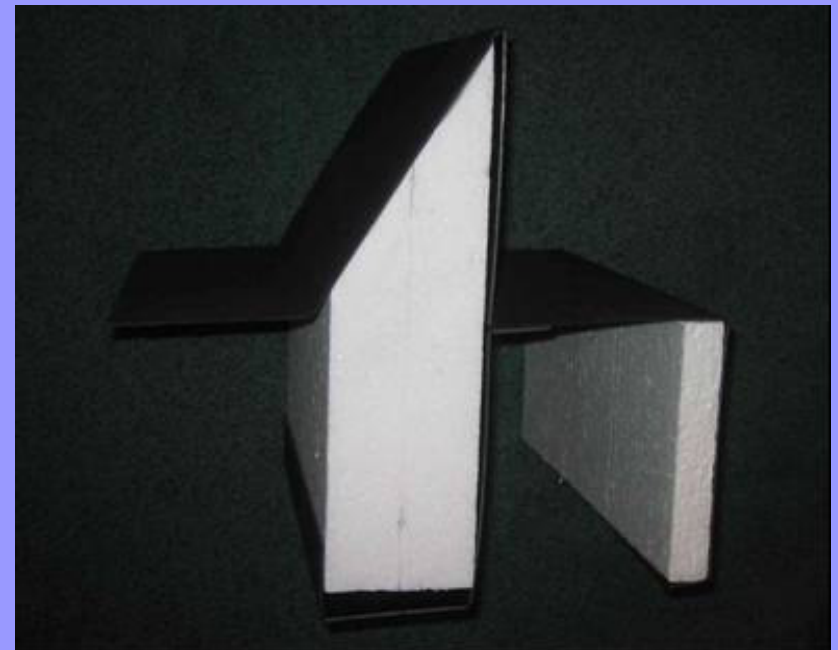
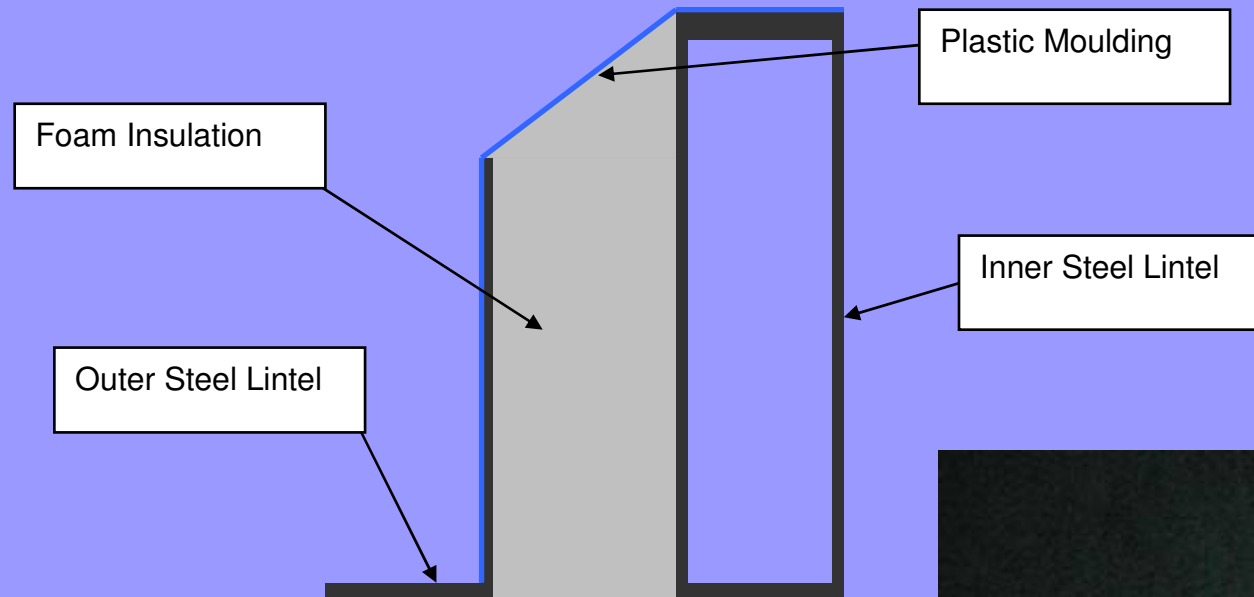
As constructed?



The proof of the pudding!



Driving the supply chain

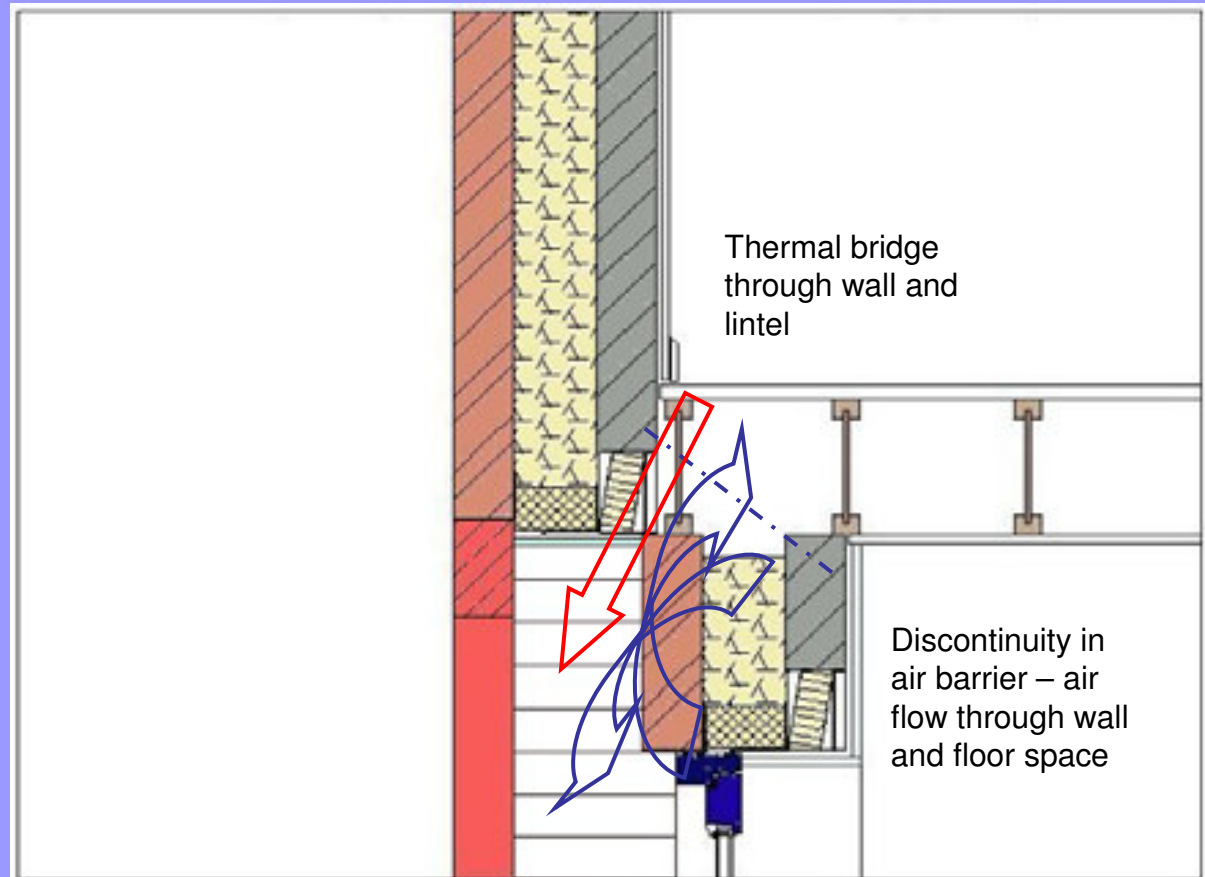
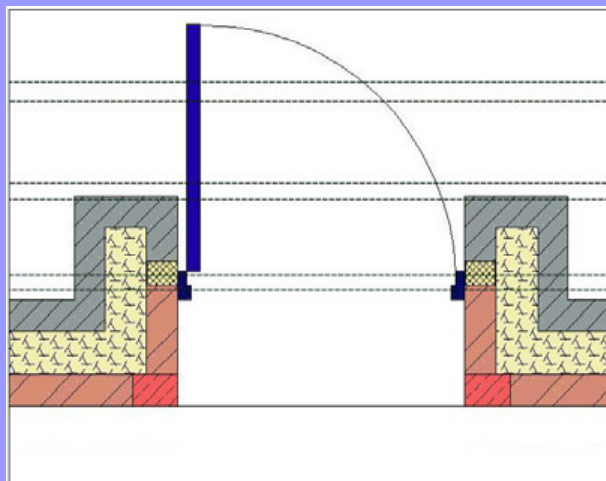


Underlying systems issues

Recessed front door design and construction

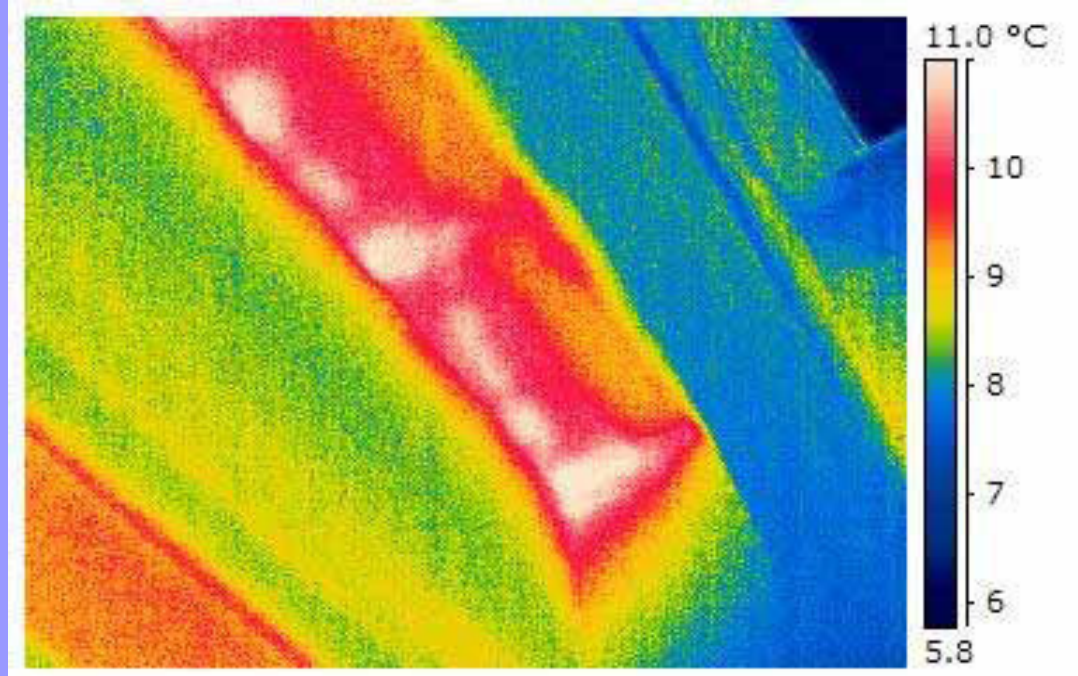


Underlying systems issues



Underlying systems issues

Recessed front door design and construction



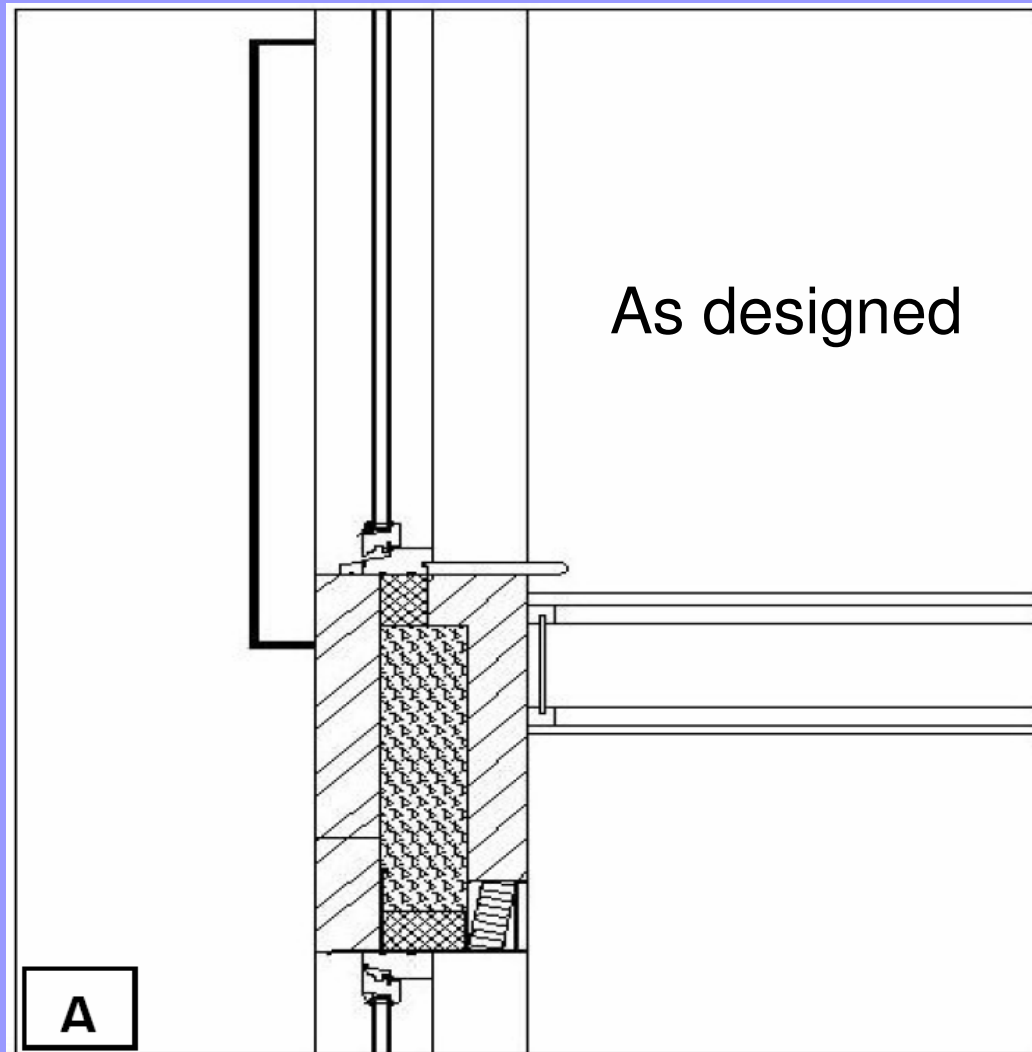
Underlying systems issues

Juliet balcony



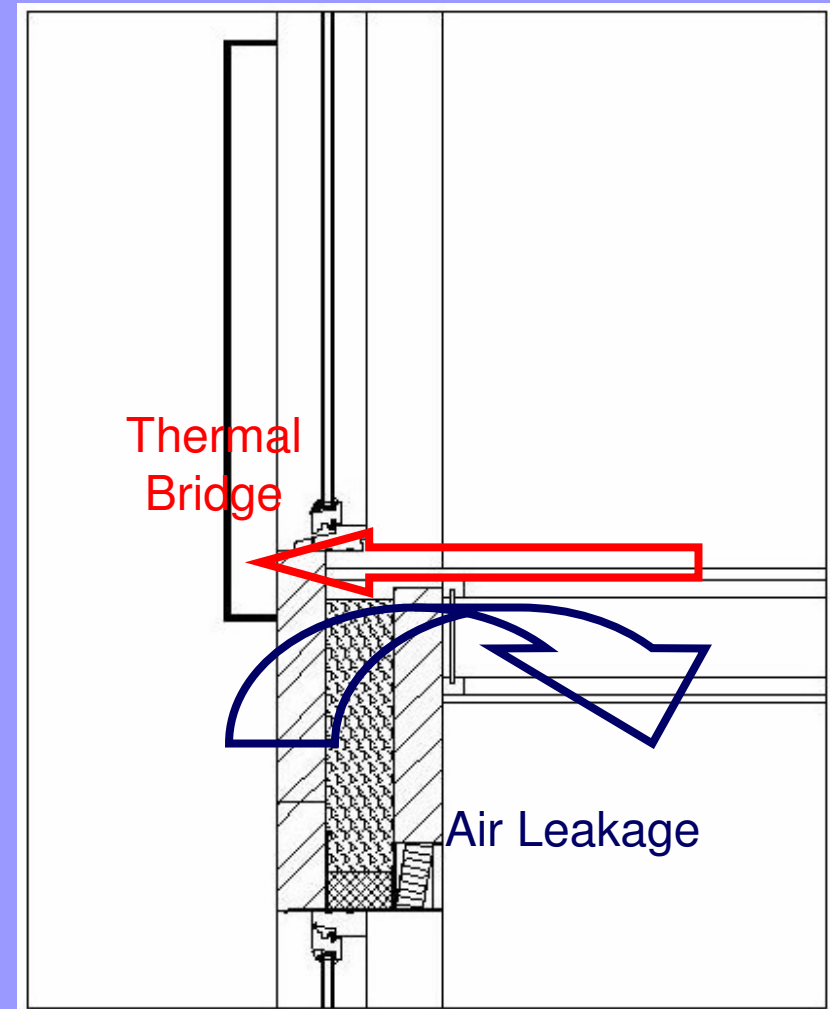
Underlying systems issues

Juliet balcony – as designed



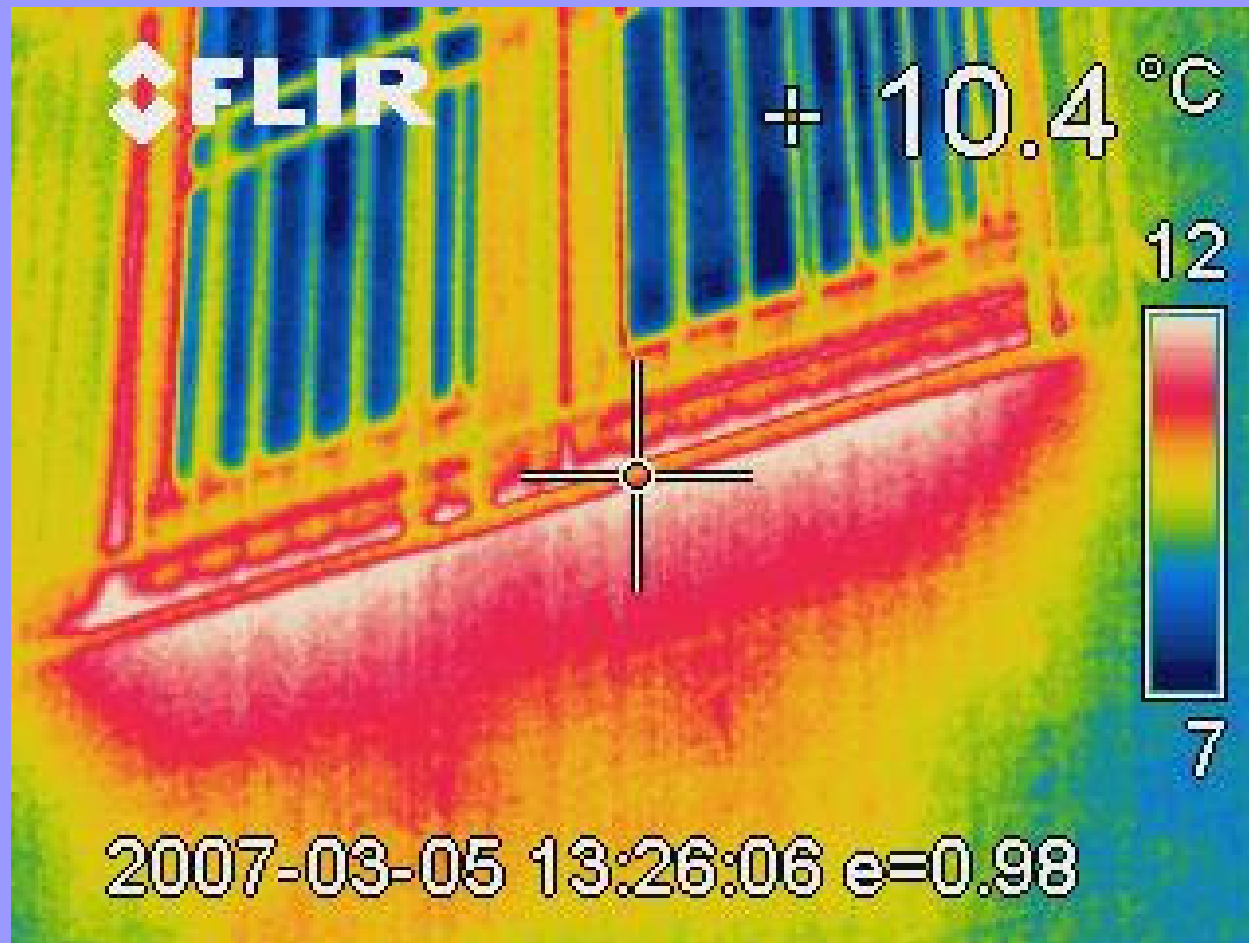
Underlying systems issues

Juliet balcony – as constructed



Underlying systems issues

Juliet balcony



The Hard Questions!

- Do designers & constructors understand thermal performance?
- Do they design details to be thermally efficient?
- Do they make allowance for buildability?
- Do constructors avoid on-site design?
- Are design modifications and material substitutions minimised?
- Are changes thought through and approved?

The Hard Questions!

- Is design fully communicated and in detail?
- Do site teams look at design information?
- Is thermal performance measured routinely?
- Is measurement used to provide feedback on performance?
- Do we learn from our mistakes?
- Do we know if our regulation standards are being achieved on the ground?

The Hard Answers!

- NO - NOT OFTEN!
- At every turn there are systems problems
 - Regulatory issues
 - Industry culture and structure
 - Design and construction process
 - Education & training
 - There is little or no performance measurement
 - There is little or no feedback
 - There is little or no improvement

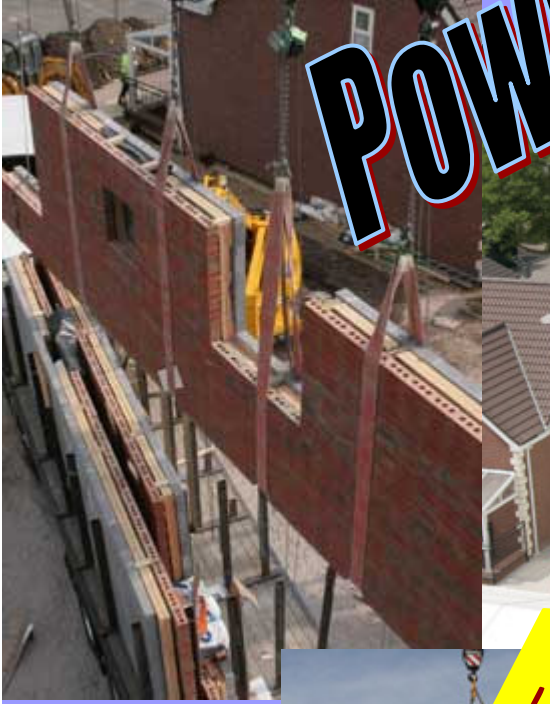
The Road to 2016?

- As very low carbon becomes mandatory small things will matter
- Thermal bridging is important and air gaps make a difference
- Small changes in efficiency will be noticed
- Zero is absolute!

Who is going to save us? – MMC?

(Modern Methods of Construction)

POW!



Splat!



Blam!



MMC can be just as bad

Anonymous example of hidden timber!

There is many a SIP!



MMC can be just as bad

Anonymous example of hidden timber!

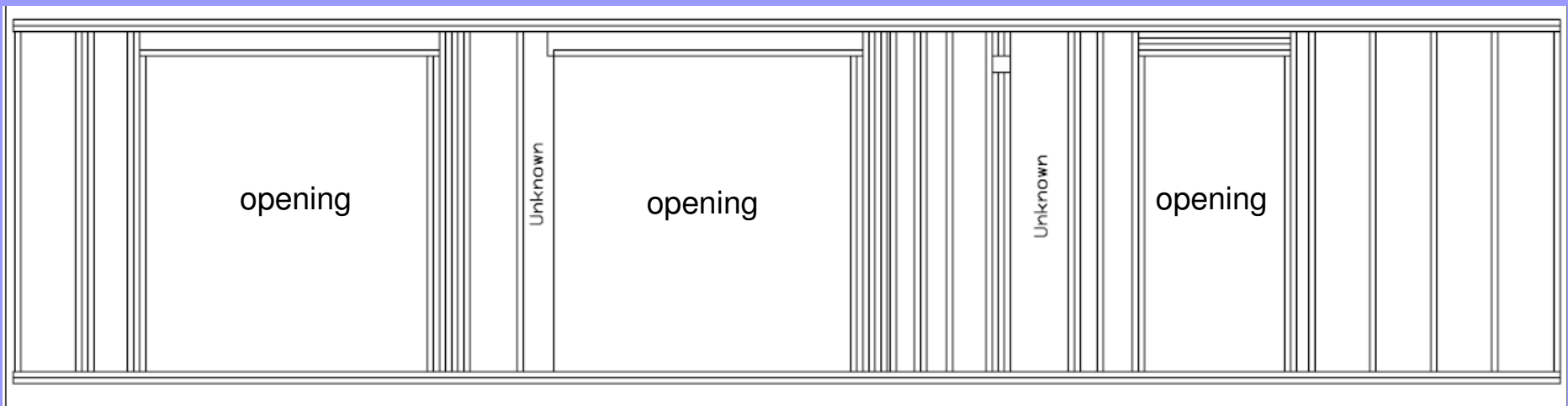
There is many a SIP!



MMC can be just as bad

Anonymous example of hidden timber!

There is many a SIP!



28% strand studs and head/sole plates

2% I beam webs

6% lintels

9% unknown

Total timber fraction 36% to 45% (opaque area)

Nominal $U = 0.18 \text{ W/m}^2\text{K}$

Simple combined area estimate
of Actual $U = 0.26$ or 0.29

The industry must change!

- It has been said before (Latham, Egan...)
- *Plus ça change, plus c'est la même chose* (the more it changes the more it remains the same)
- Old problems persist!
- It is time to retool, to retool cultures and processes as well as technology.

What will change look like?

- A detailed construction process – inception, design, construction and support in use.
- Performance will be guaranteed with consequences for underperformance.
- A quality control process based on measurement not assumption.
- A re-engineered processes will bring economies!
- Constant feedback will bring constant improvement.
- Re-engineered regulations, education, training

The world will not be the same!

We are entering a new paradigm.

As in science, so in construction:
It is time for the industry to Retool!

