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Senior Research Fellow, Leeds Beckett University

Airtightness testing and thermographic analysis of 20 WDH dwellings – Nov ’14 to Feb ’15

Wakefield Affordable Warmth Action Plan

WDH

Tues 29th September 2015

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Airtightness testing and thermographic analysis of 20 WDH dwellings:

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- Introduction - Who are LSi and what do we do?
- Airtightness testing results
- Observations - BISF houses
- Observations - Solid-wall masonry houses
- Summary

Leeds Sustainability Institute:
Measurement & analysis of fabric performance

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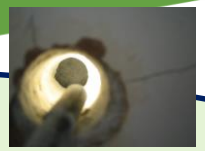


Construction observations

Pressurisation testing

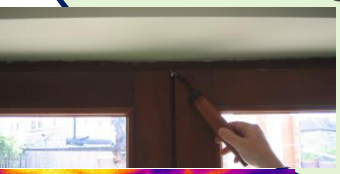
Cavity & surface temperature measurement

Tracer gas measurement

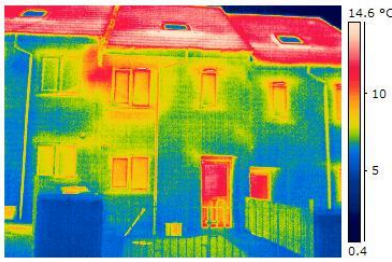
Coheating test

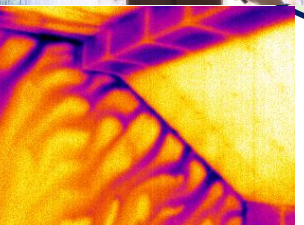
Heat flux measurement

Leakage detection



Thermal imaging





Air flow & pressure measurements

Partial deconstruction

Airtightness testing and thermographic analysis of 19 WDH dwellings:

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- Tests conducted in Nov/Dec 2014 & Feb 2015
- Airtightness tests with thermographic leakage detection under dwelling depressurisation
- Houses at Flanshaw, Kelsey & Knottingley
- Mixed tenure – social housing & owner occupied
- 15 BISF houses - 14 with EWI, 1 without
- 5 Solid-wall masonry houses - 2 with EWI, 3 without (1 no-test)

Airtightness testing and thermographic analysis of 19 WDH dwellings:

BISF Houses

Airtightness testing and thermographic analysis of 19 WDH dwellings:

Solid-wall Masonry Houses

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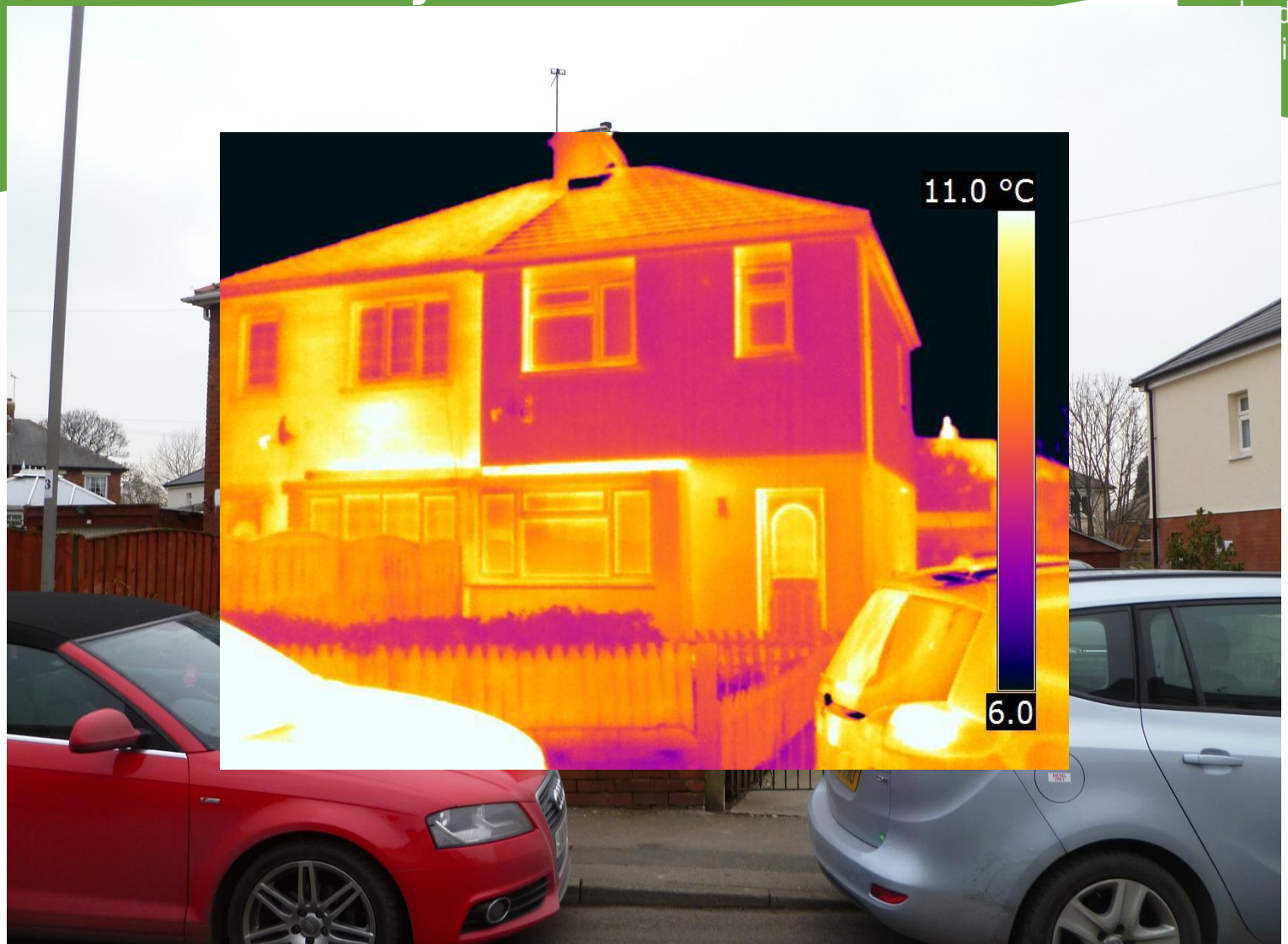

Airtightness testing results:
Air permeability

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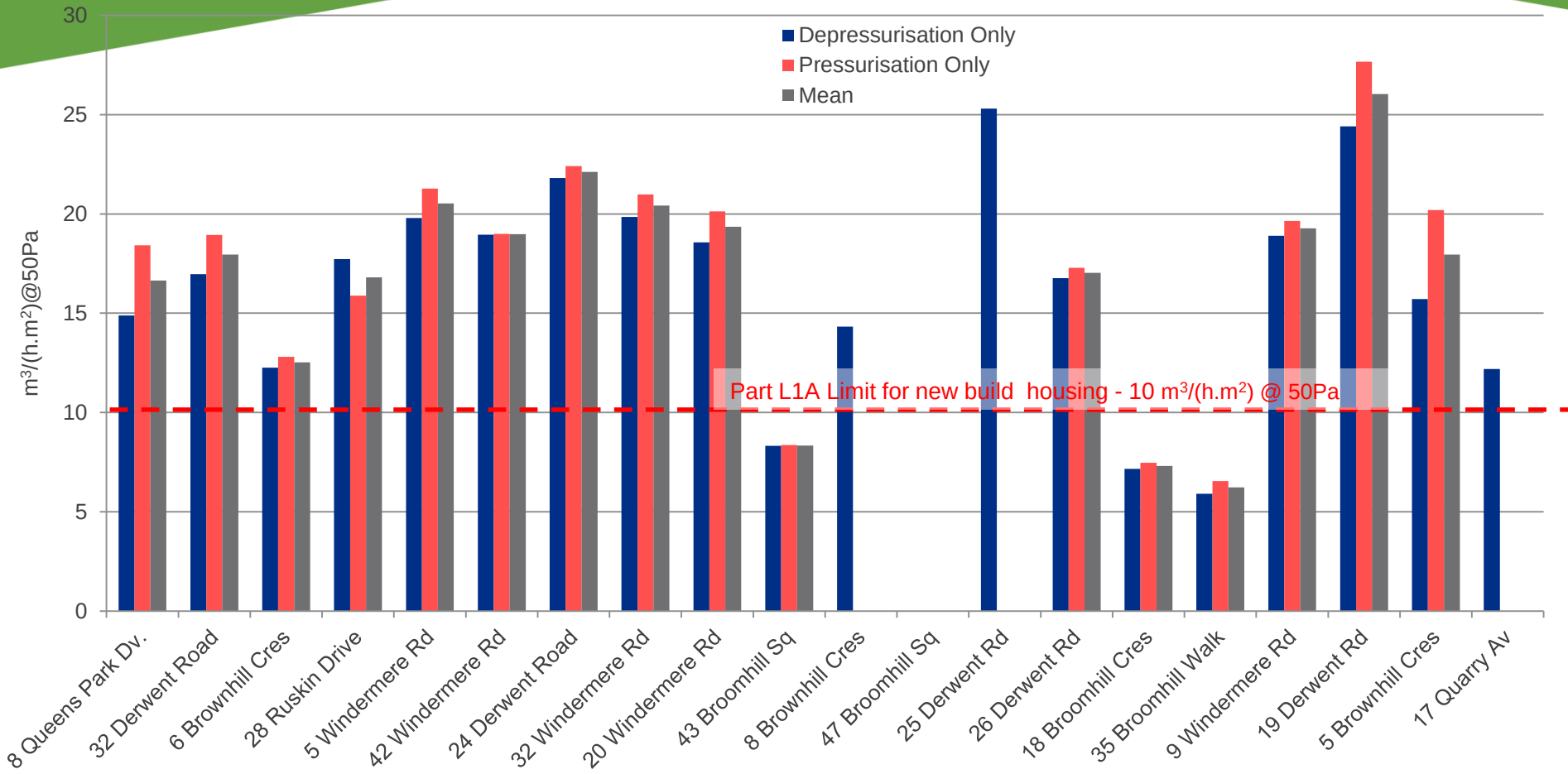

Airtightness testing results:
Air leakage rate (mean)

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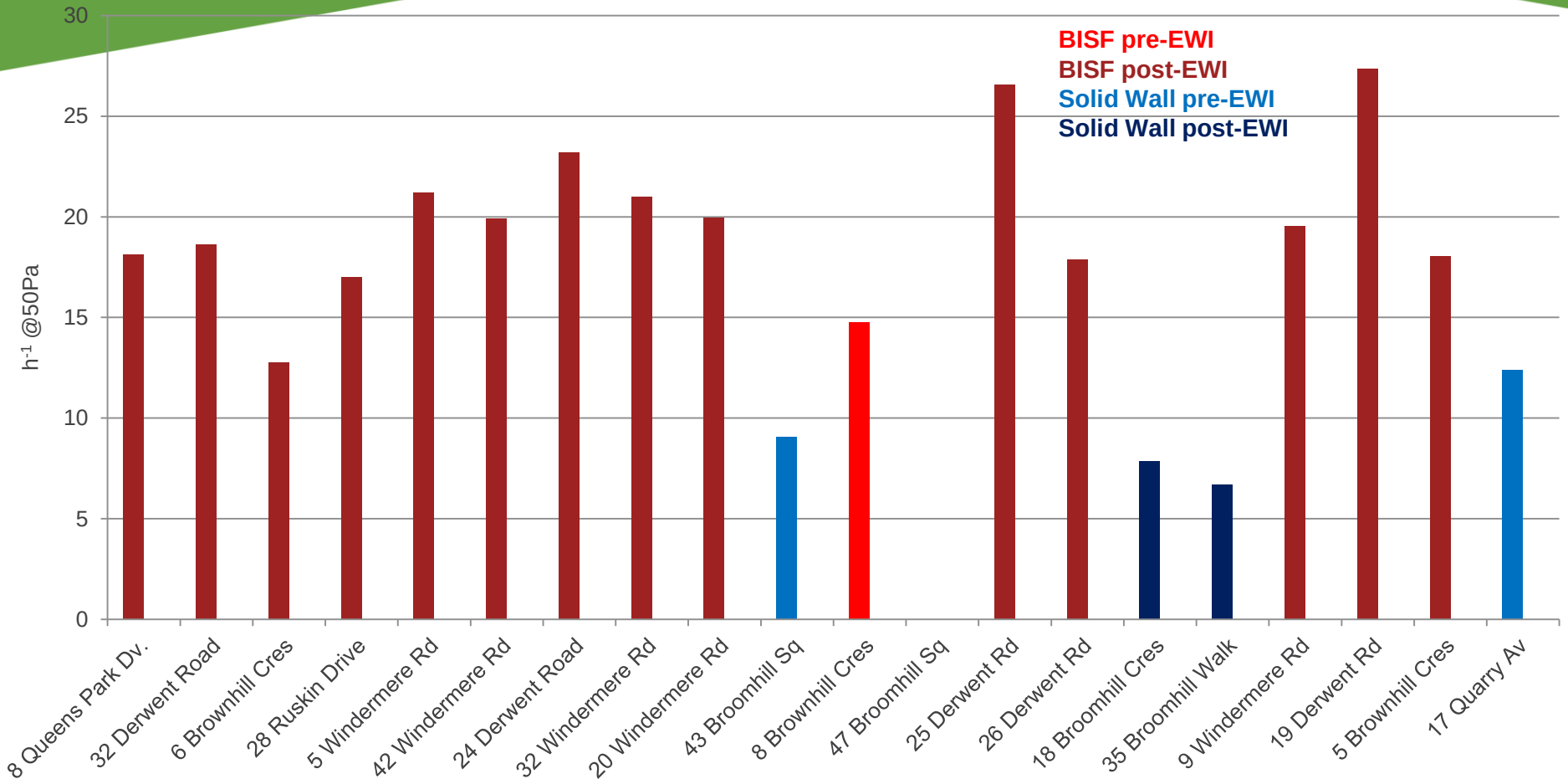

Airtightness testing results:
Air leakage rate

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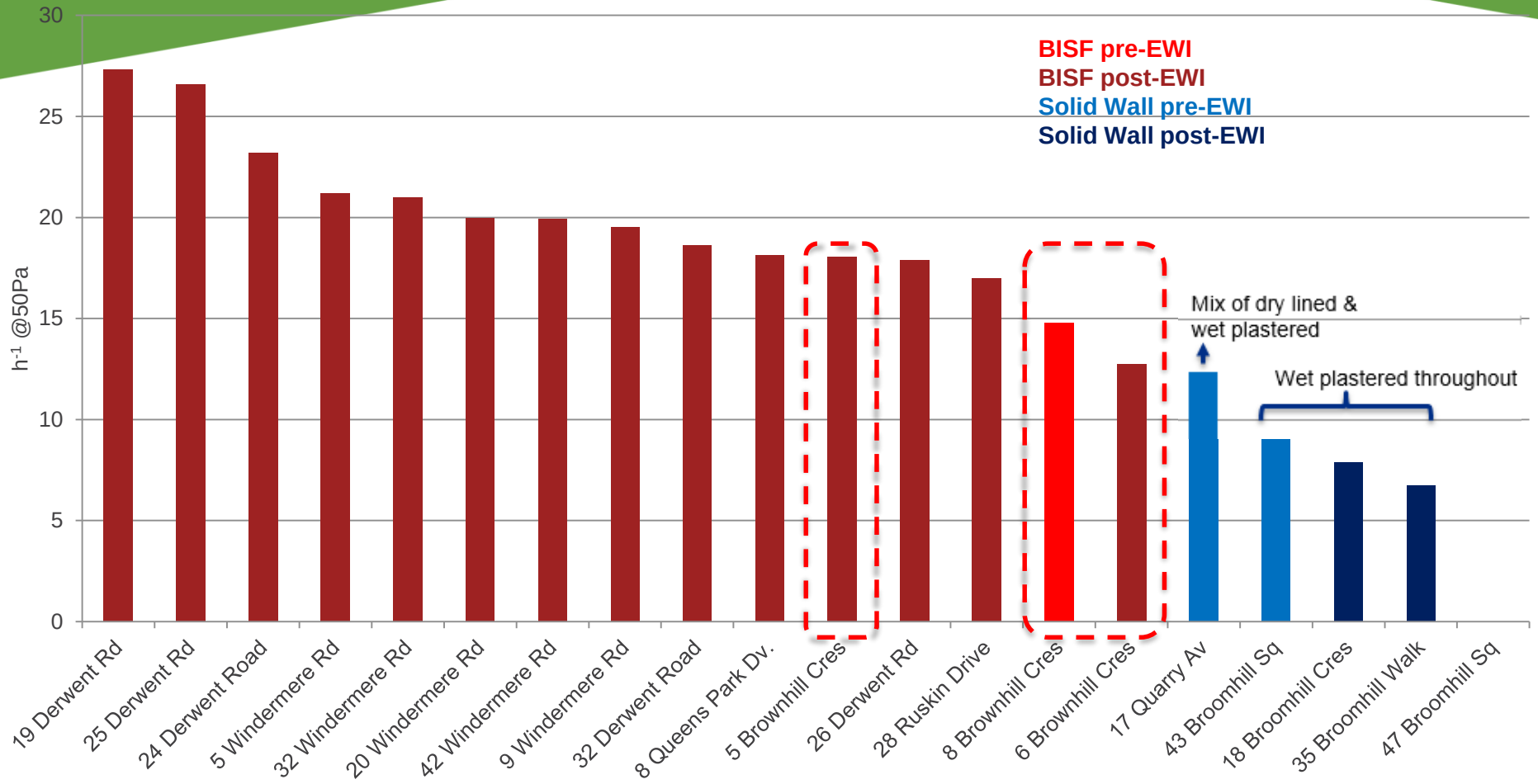

Airtightness testing: BISF houses

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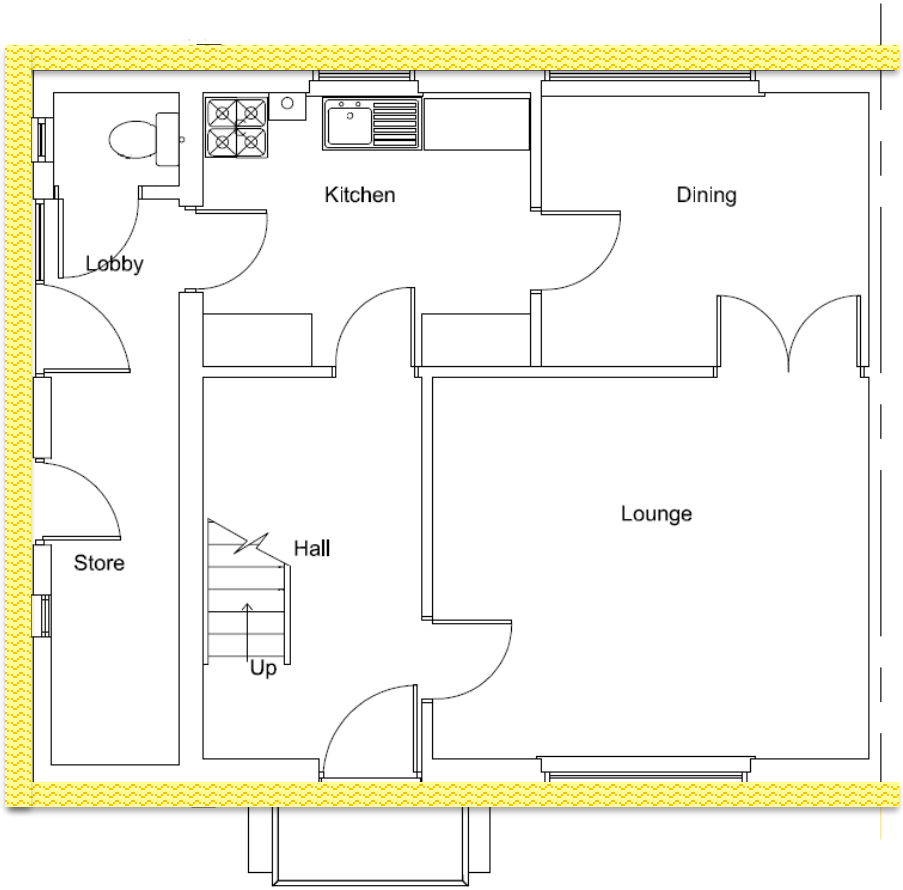
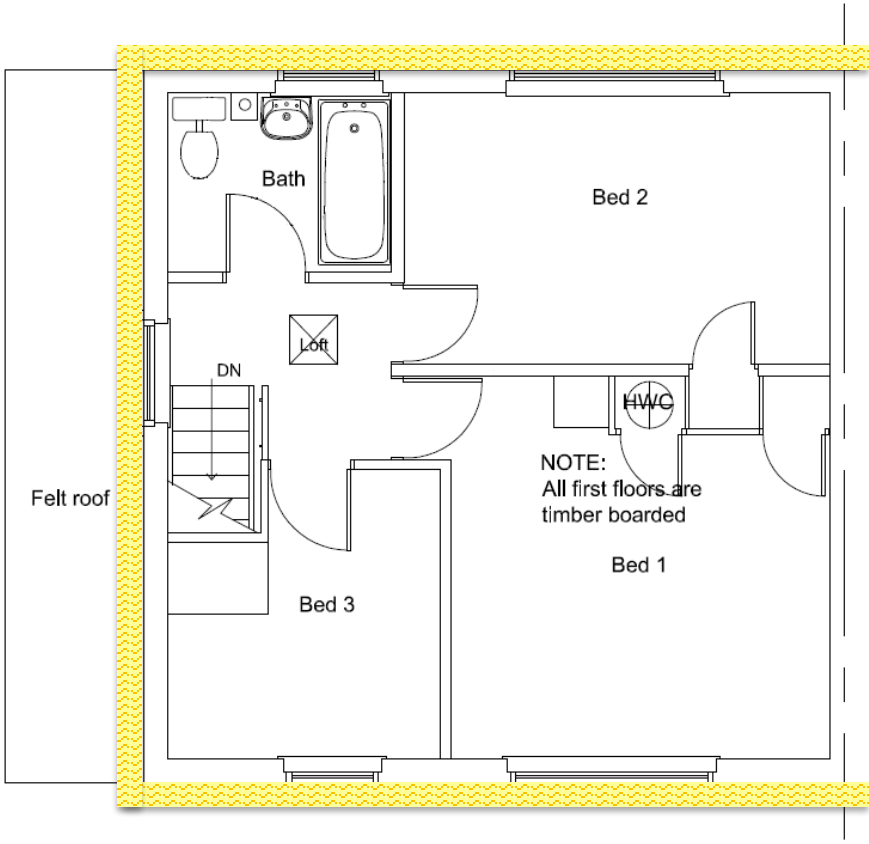


Ground Floor



First Floor

Airtightness testing:
BISF houses

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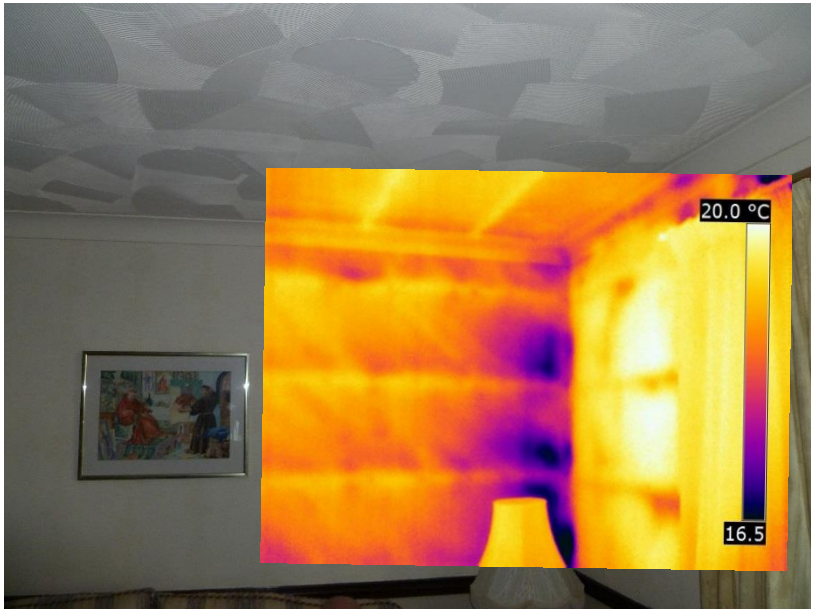

Airtightness testing:
BISF houses

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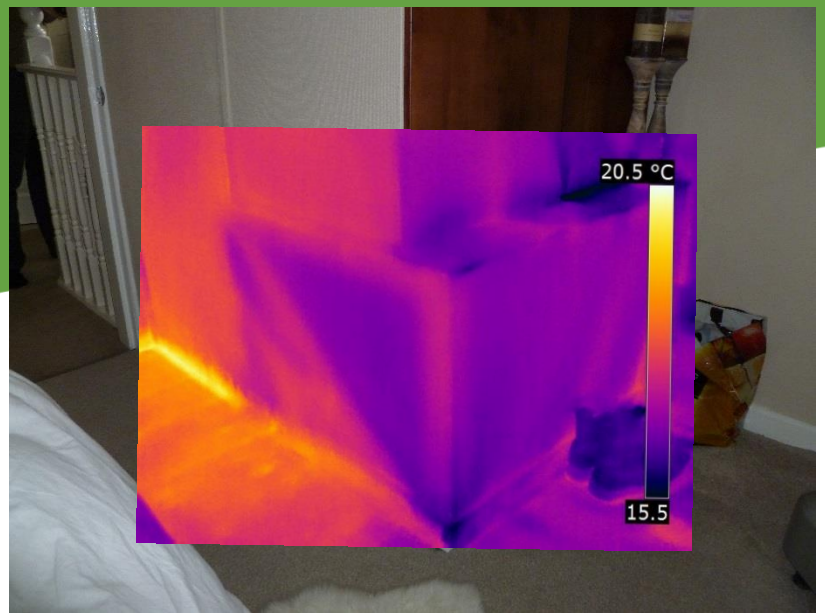

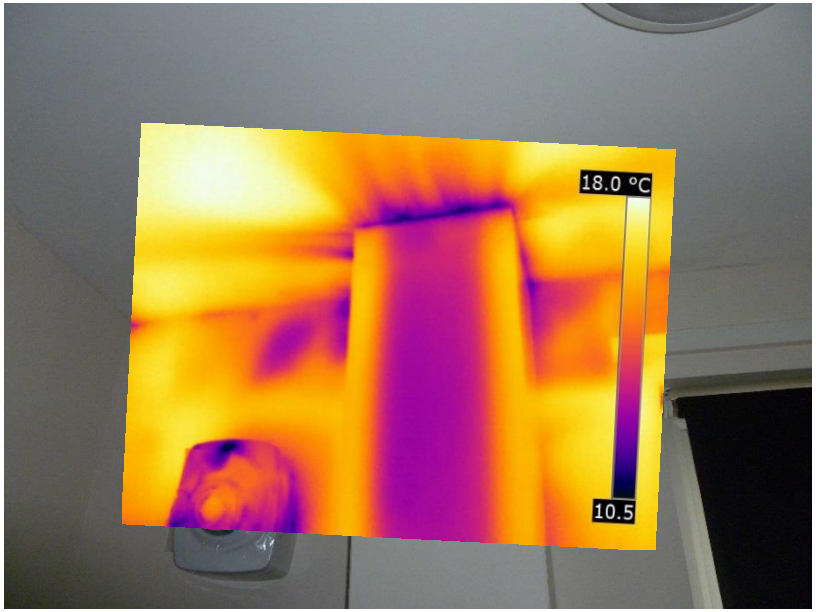

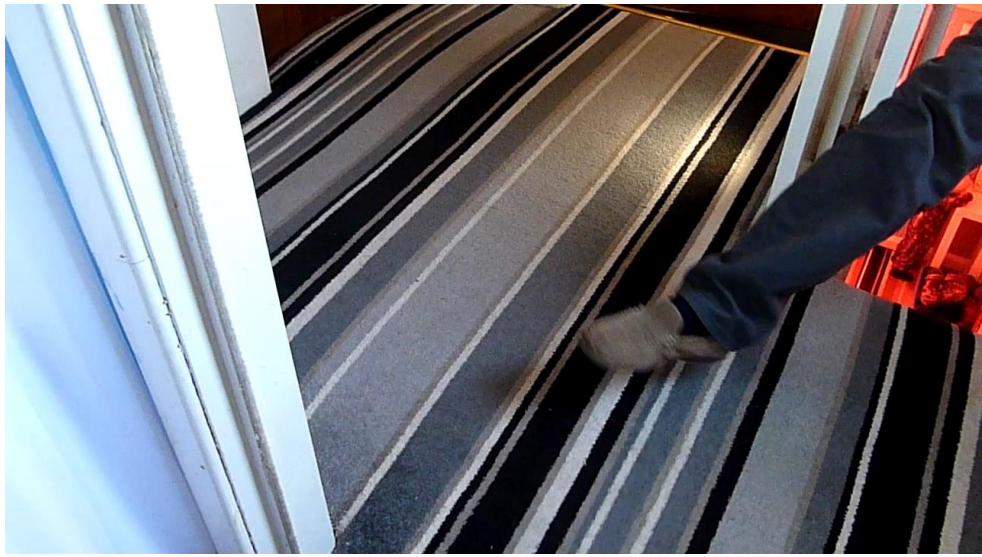

Airtightness testing:
BISF houses

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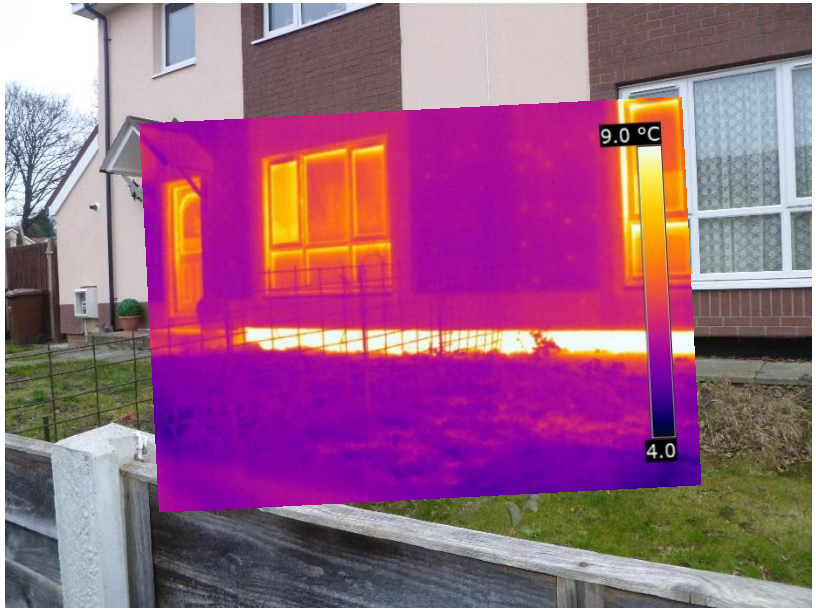

Airtightness testing:
Solid-wall masonry houses

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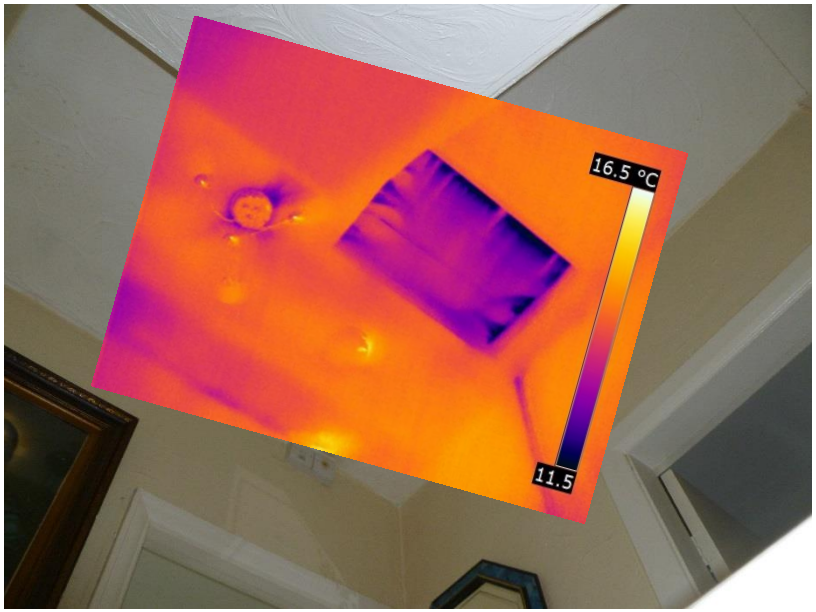

Airtightness testing results: Solid-wall masonry houses

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Airtightness testing:
Solid-wall masonry houses

Thermographic surveys:

Temperature factor - f_{Rsi}

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- **Using thermography to determine the severity of thermal anomalies**

- **Temperature Factor** → f_{Rsi} : $\dfrac{(T_{Surface} - T_{ExtAmb})}{(T_{IntAmb} - T_{ExtAmb})}$

- For steady-state models: If $f_{Rsi} < 0.75$, high risk of surface condensation

  can easily be misinterpreted: surface properties, thermal mass, moisture, etc.

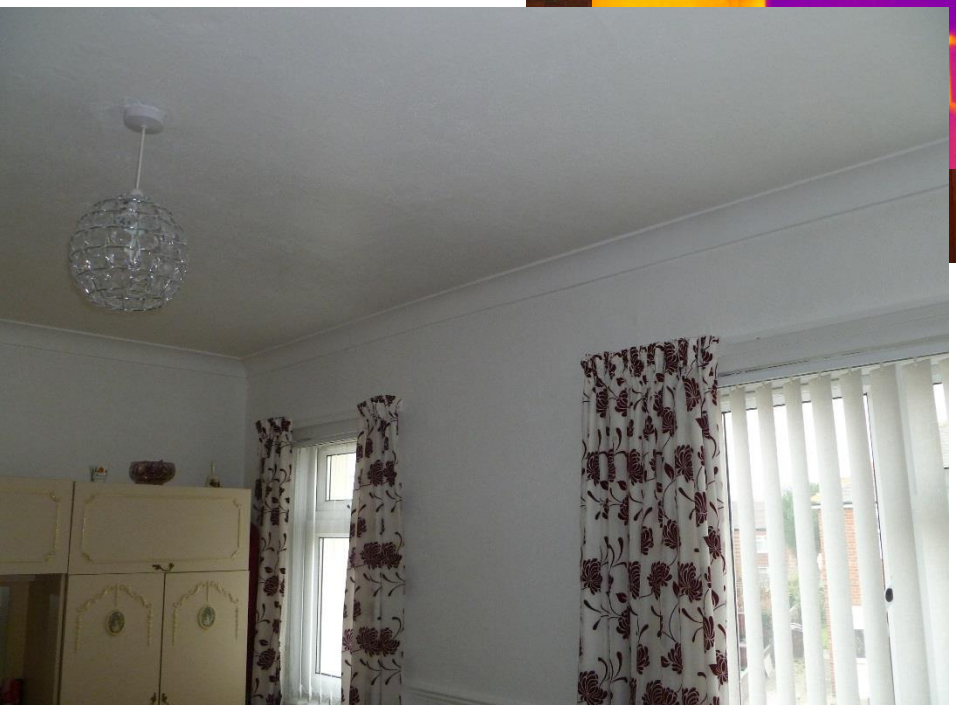
- Examples: $T_i = 21^oC$, $T_e = 5^oC$, $f_{Rsi} < 0.75$ where $T_s < 17^oC$

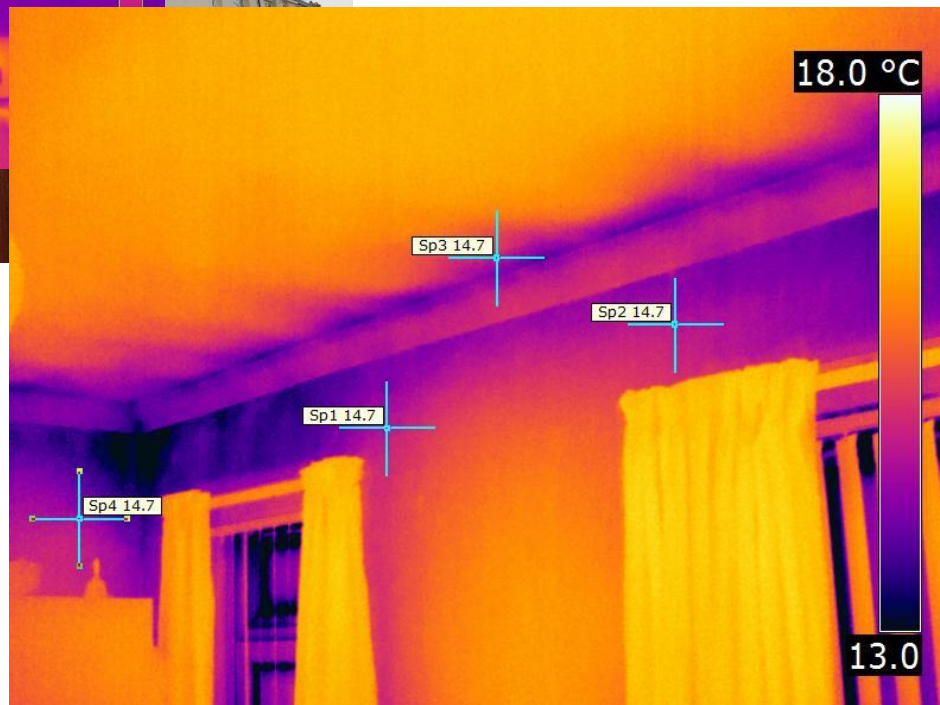
  $T_i = 21^oC$, $T_e = 10^oC$, $f_{Rsi} < 0.75$ where $T_s < 18.25^oC$

Thermographic surveys:

Temperature factor - f_{Rsi}

T_i=17.7°C, T_e=5.9°C, f_{Rsi} < 0.75 where T_s<14.7°C





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Summary:

- **EWI – Aesthetic improvements**
  - Benefits beyond energy performance?
- **Airtightness testing results**
  - No obvious airtightness strategy – needs reviewing for future renovations, particularly of BISF properties.
- **BISF houses**
  - Improved conductive heat loss (lower U-values) means ventilation heat loss becomes proportionally more important.
- **Solid-wall houses**
  - Improved plain-element conductive heat loss means thermal bridging becomes proportionally more important.