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

Wakefield Affordable Warmth Action Plan

WDH

Tues 29th September 2015

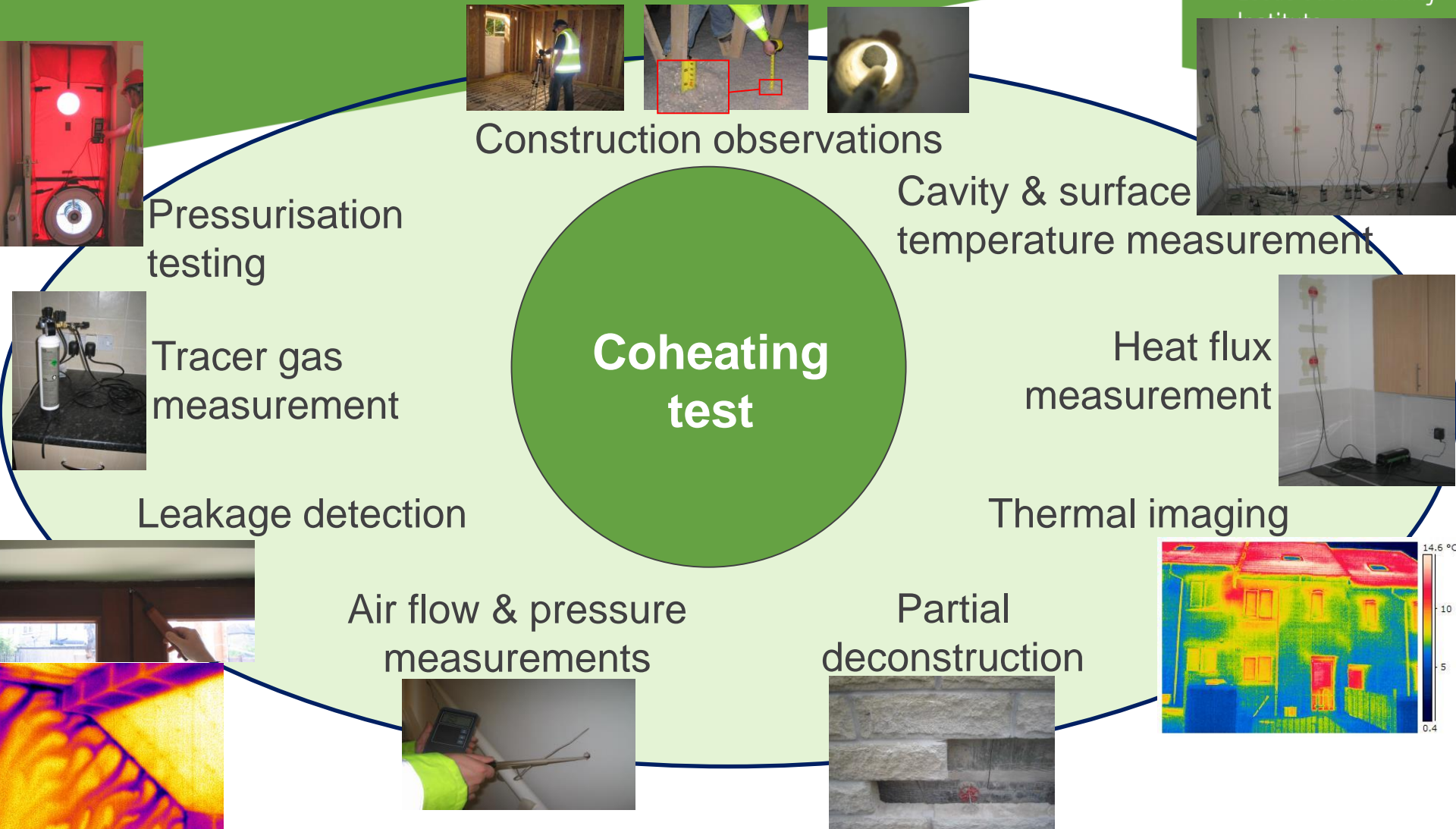


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Airtightness testing and thermographic analysis of 20 WDH dwellings:

- **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



Airtightness testing and thermographic analysis of 19 WDH dwellings:

- **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)**

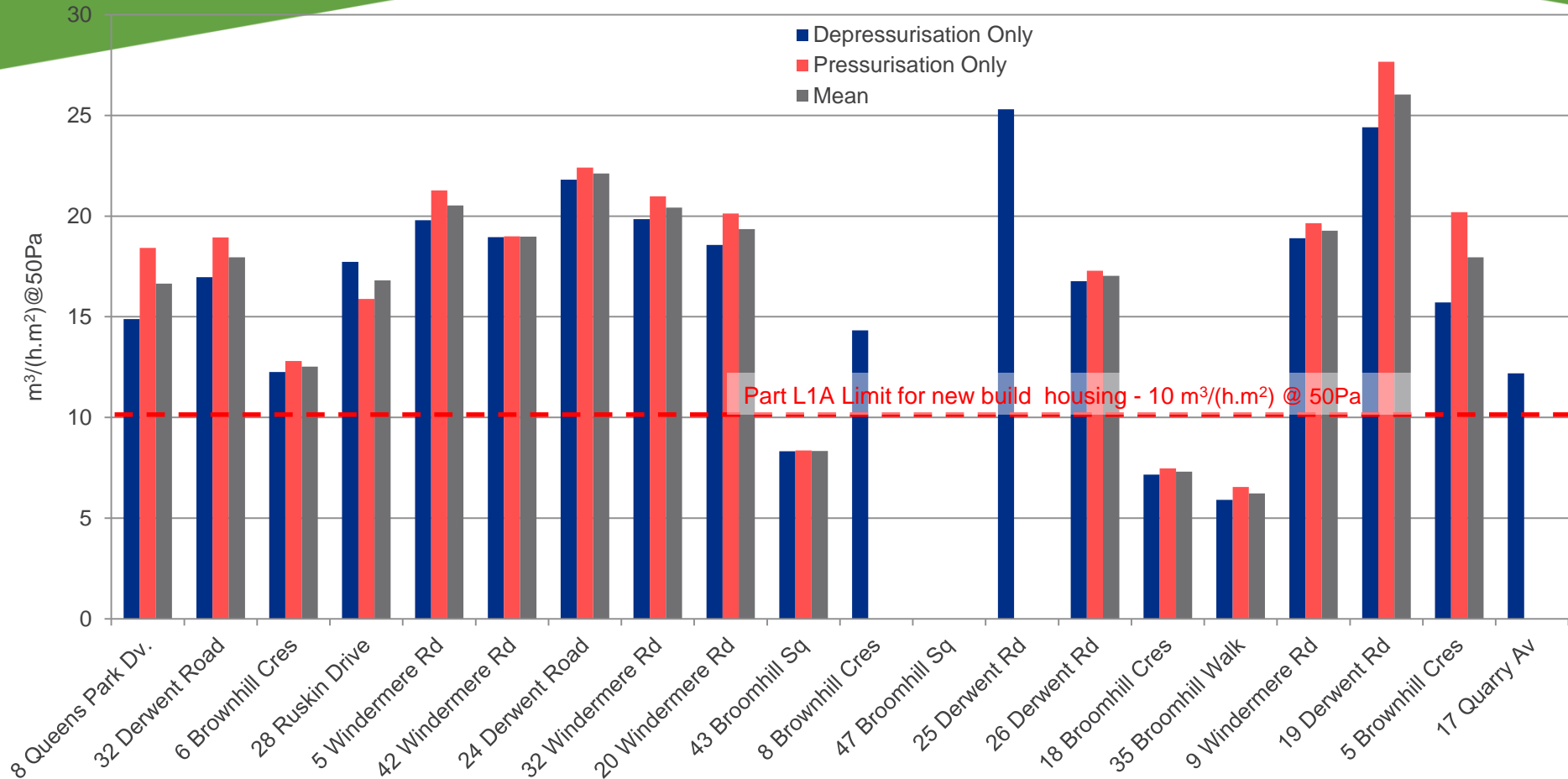
Airtightness testing and thermographic analysis of 19 WDH dwellings: BISF Houses



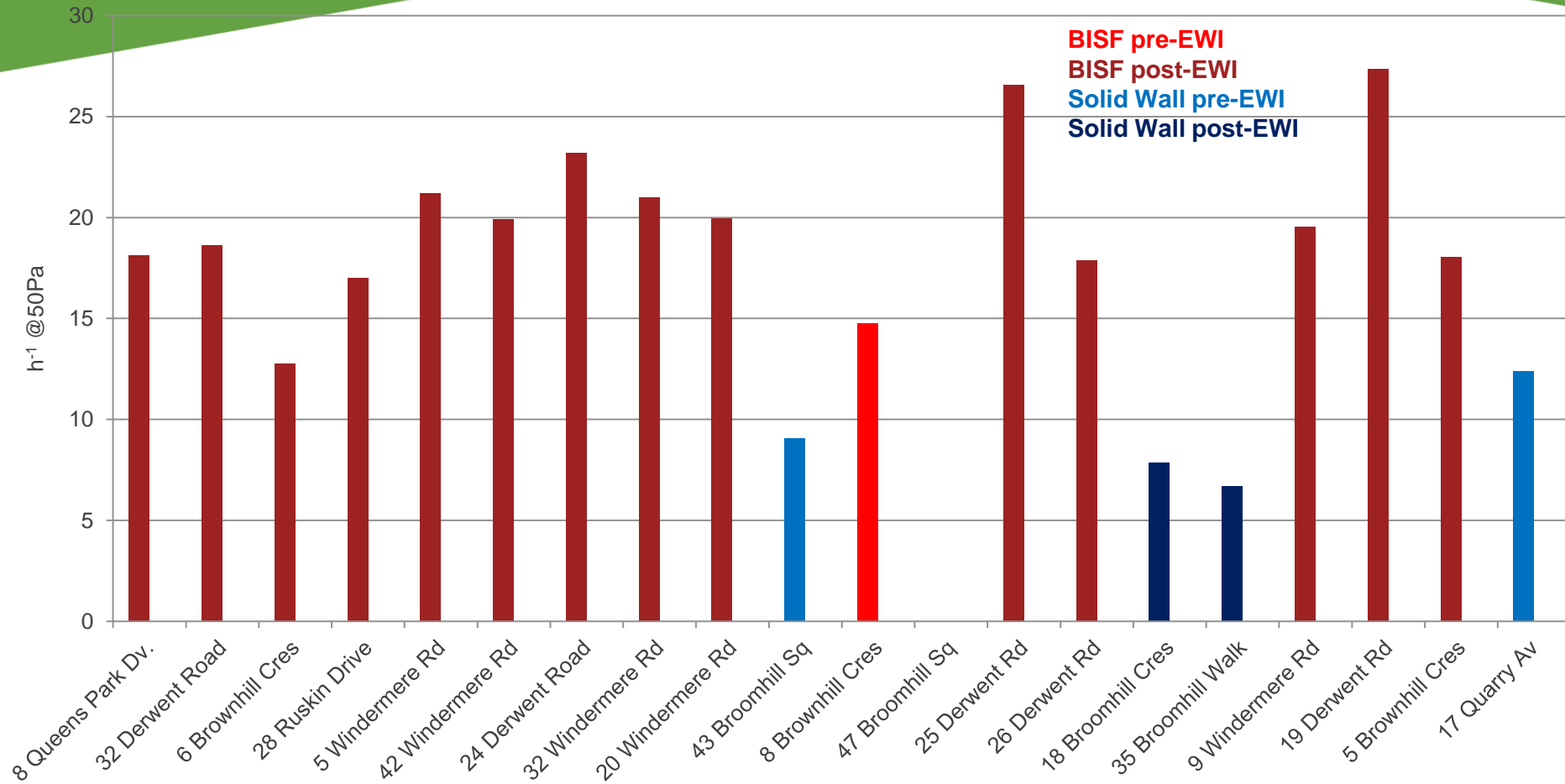
Airtightness testing and thermographic analysis of 19 WDH dwellings: Solid-wall Masonry Houses



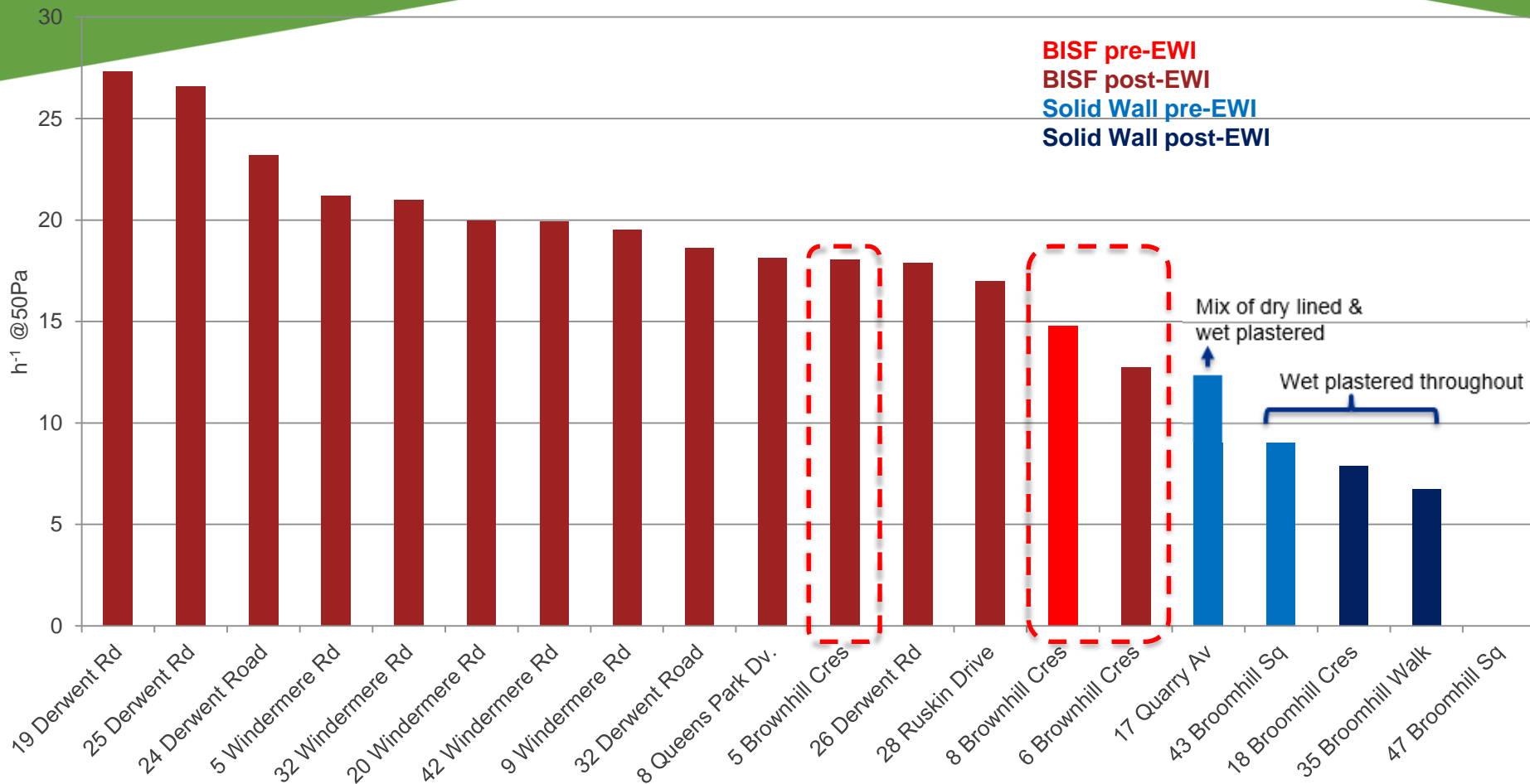
Airtightness testing results: Air permeability



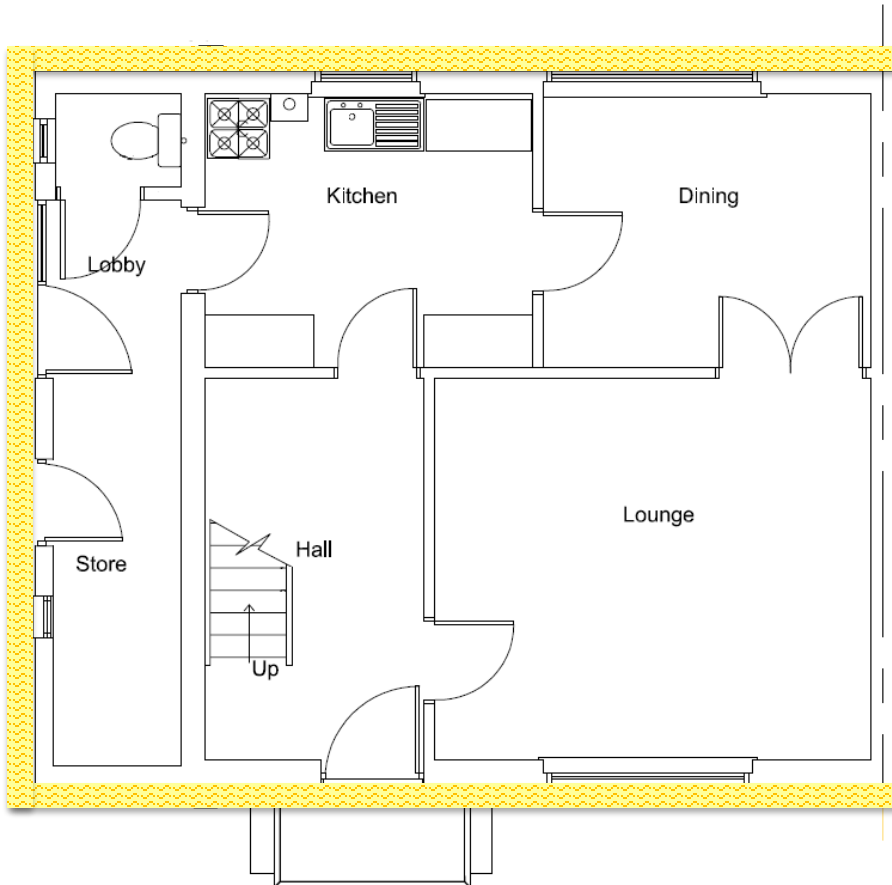
Airtightness testing results: Air leakage rate (mean)



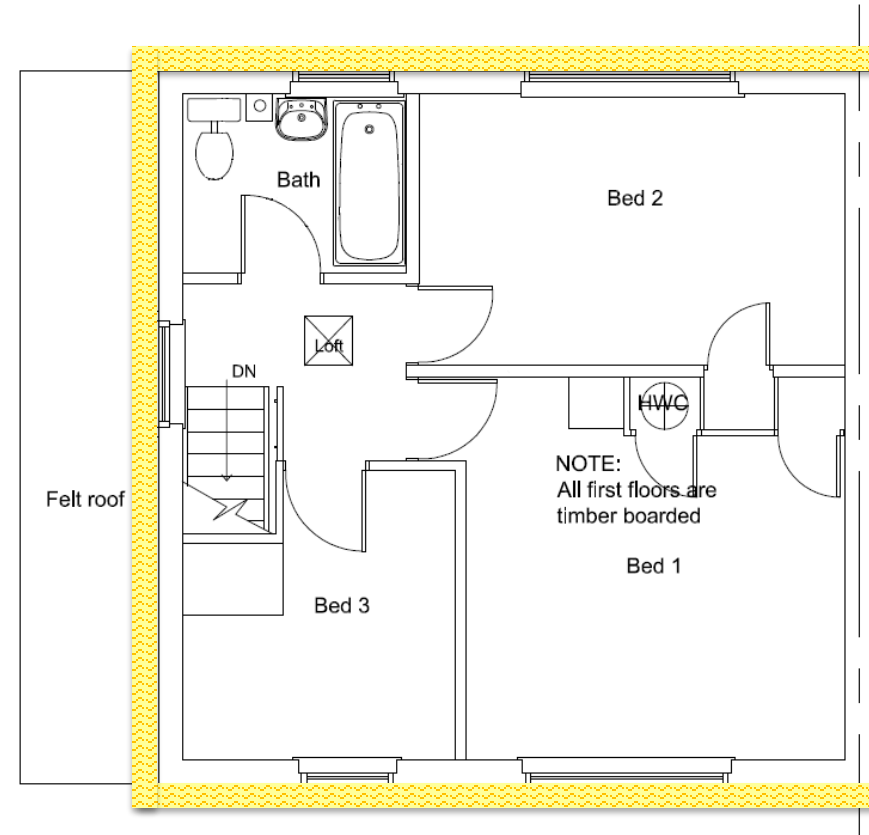
Airtightness testing results: Air leakage rate



Airtightness testing: BISF houses



Ground Floor

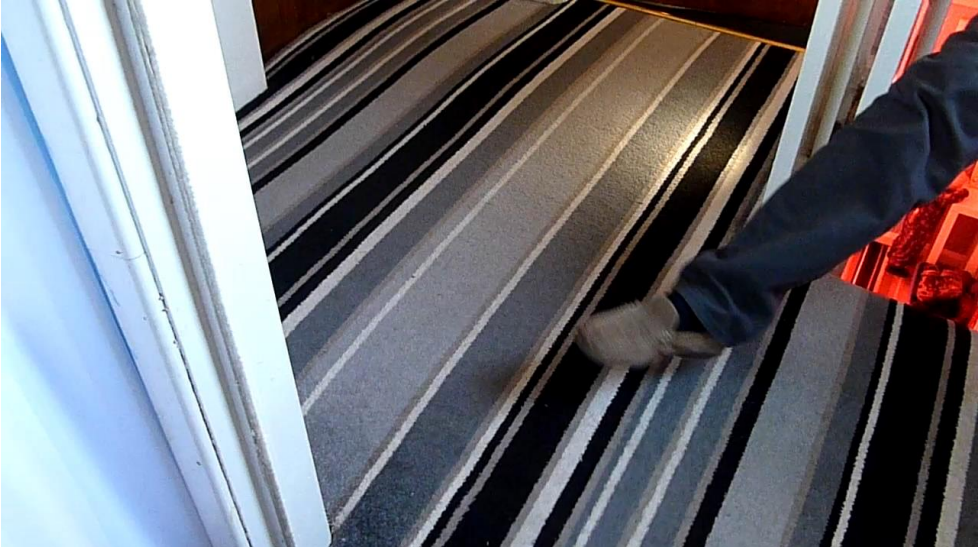
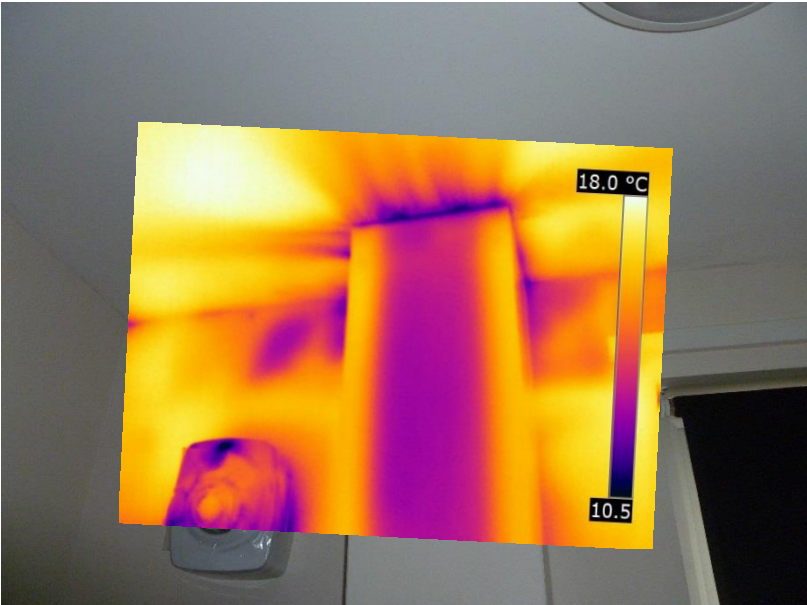
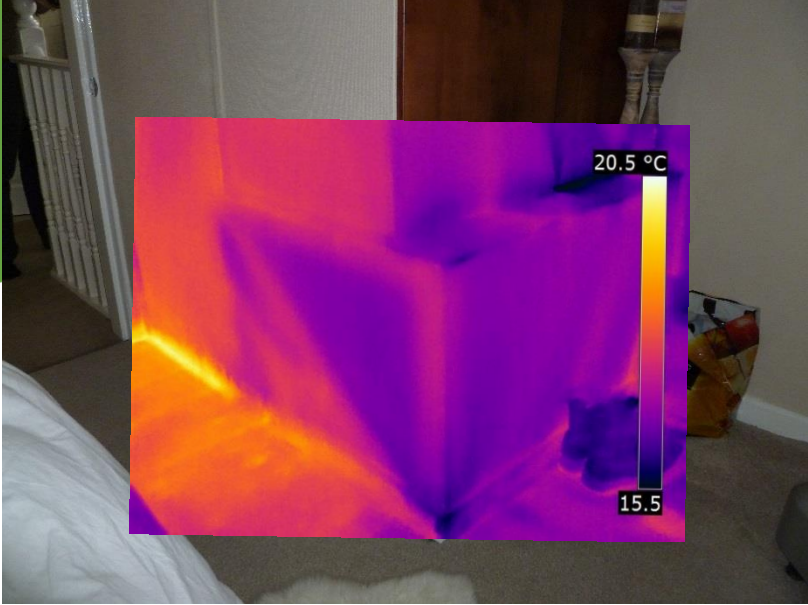


First Floor

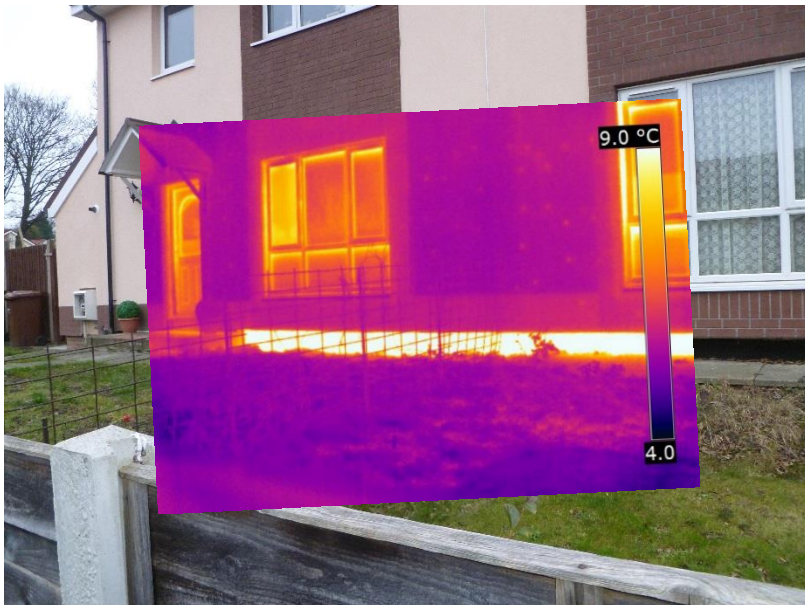
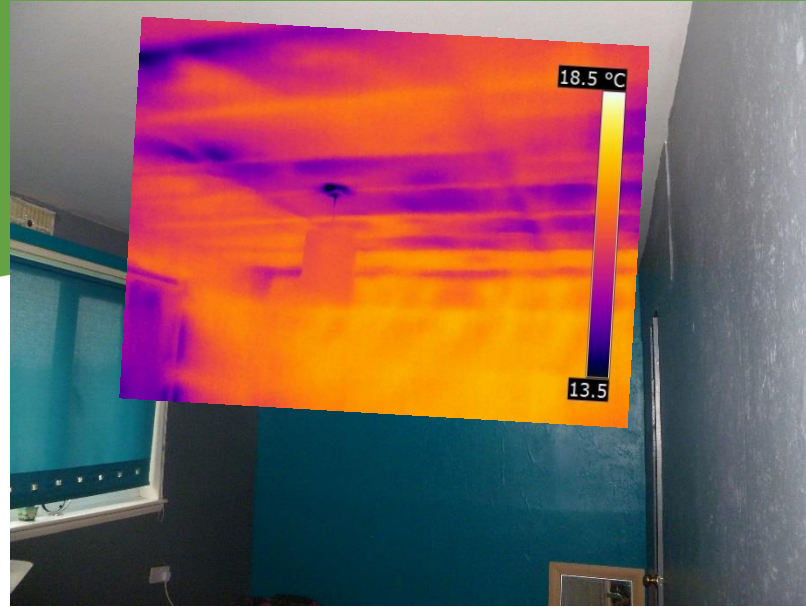
Airtightness testing: BISF houses



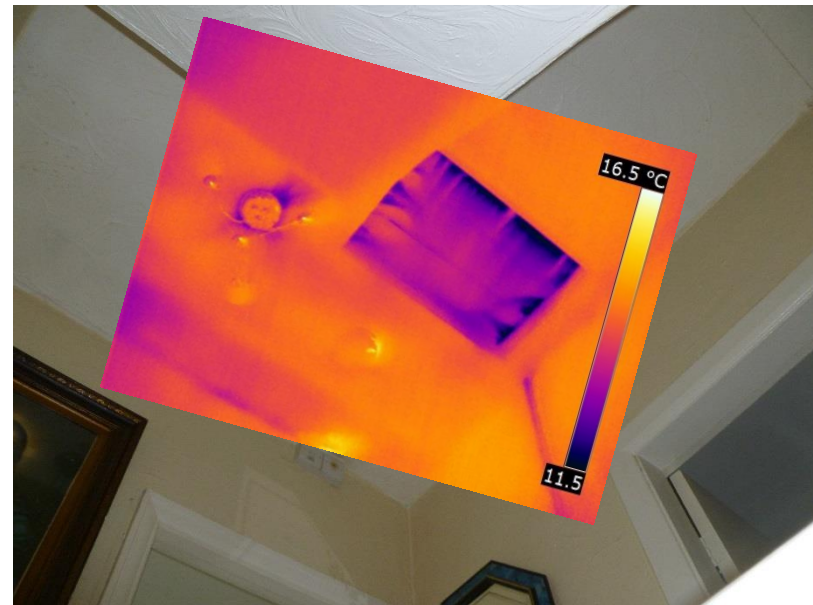
Airtightness testing: BISF houses



Airtightness testing: BISF houses



Airtightness testing: Solid-wall masonry houses



Airtightness testing results: Solid-wall masonry houses



Airtightness testing: Solid-wall masonry houses



Thermographic surveys:

Temperature factor - f_{Rsi}

- Using thermography to determine the severity of thermal anomalies
- Temperature Factor $\rightarrow f_{Rsi} = \frac{(T_{Surface} - T_{ExtAmb})}{(T_{IntAmb} - T_{ExtAmb})}$
- 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: $T_i=21^{\circ}\text{C}$, $T_e=5^{\circ}\text{C}$, $f_{Rsi} < 0.75$ where $T_s < 17^{\circ}\text{C}$
 $T_i=21^{\circ}\text{C}$, $T_e=10^{\circ}\text{C}$, $f_{Rsi} < 0.75$ where $T_s < 18.25^{\circ}\text{C}$

Thermographic surveys:

Temperature factor - f_{Rsi}

$T_i=17.7^{\circ}\text{C}$, $T_e=5.9^{\circ}\text{C}$, $f_{Rsi} < 0.75$ where $T_s < 14.7^{\circ}\text{C}$

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Airtightness testing and thermographic analysis of 20 WDH dwellings:

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.