

Post Installation Performance of Cavity Wall & External Wall Insulation

St George's Hotel, Llandudno

22nd November 2016



Gordon Brown

Director
Constructing Excellence in Wales





BRE: Post Installation Performance of Cavity and External Wall Insulation

Colin King

Part of the BRE Trust



Content

- Limitations of the research
- Standards in place CWI
- Findings
- Recommendations
- Standards for EWI
- Findings
- Recommendations



Cavity Wall Insulation



Introduction

- Reported increase or higher profile of problems associated to dwellings post improvement measures
- Discussions raised in the Assembly and Westminster
- Requested by Constructing Excellence Wales to investigate, the scale of the issue and probable cause
- Provide recommendations

Limitations on the Research

- Undertaken via a “Call for Evidence”
- Sample not large enough to extrapolate results across the whole of Wales.
- Time scale since the work was undertaken (CWI) with few records kept, on surveys, assessment and workmanship

Context

- Wales has the oldest properties in the UK
- Largest percentage of damp properties*
- Lowest SAP Average
- Highest % of HHSRS excess cold

	England	N. Ireland	Wales	Scotland
Age - % pre 1919	20.8	13.0	30.2	18.9
Age - % pre 1945	37.3	23.4	41.1	32.5
% solid masonry walls (not cavity)	26.6	19.8	31.1	21.8
% penetrating dampness	3.2	1.4	6.9	4.2
% any dampness (incl. condensation)	7.6	4.1	12.9	12.5
Mean SAP (energy efficiency, out of 100)	51.5	57.6	50.3	58.0
% HHSRS Category 1 hazard excess cold	8.5	4.2	11.1	Not Measured

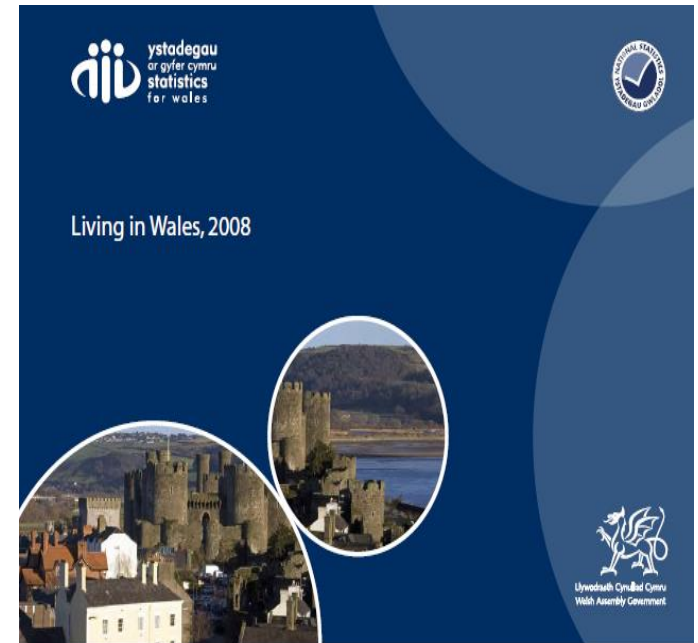
Table 1: UK national comparative housing statistics, 2008.

Statistics summarised from: Fiddington et al, Housing in the UK, IHS BRE Press FB 62, Watford, 2013.

*Source BRE FB62

Cavity Wall Insulation

- 900,000 cavity walls in Wales
- Approximately 50% filled*
- Likely to be a higher percentage now, with multiple support schemes in place since then.



* Source - Living in Wales 2008 Survey

Methodology

- Call for Evidence
- Self selecting sample
- Only properties with issues
- Some reporting received of no issues

Results of call for evidence

The Call for Evidence resulted in 31 submissions from either Local Authorities or Registered Social Landlords. Of these 24 submissions were relating to properties where there were reported problems with Cavity Wall Insulation (CWI) and described in Table 1, and seven related to the application of External Wall Insulation (EWI) and described in Table 2.

The submissions included areas with both multiple and singular reported problems. The total number of properties which have been contributed to this report were:

CWI - 503 properties

EWI - 330 properties

The locations of the reported issues provided as part of the call for evidence are shown right in Figure 1

The map shows the reported cases of external and cavity wall insulation. The circle markers on the map represent Cavity Wall Insulations and square markers, External Wall Insulation. The markers represent the general location of the properties. Therefore, one pin in certain circumstances could represent several properties or issues reported.

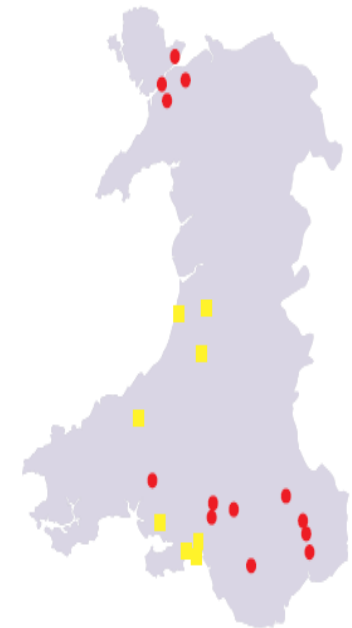


Figure 1: Location of cases reported as part of the Call for Evidence

Standards in Place

Part C earlier edition(s)										Part C 1992 edition										Part C 2004 edition									
1980s					1990s					2000s					2010s														
8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5		
BBA Information 10 (withdrawal date unknown, probably around 1995)																													
BS5617:1978					BS5617:1985 Specification for UF foam systems suitable for thermal insulation of cavity walls																								
BS5618:1978					BS5618:1985 Code of practice for thermal insulation of cavity walls (masonry) with UF foam																								
DD93 Assessing WDR										BS8104 Code of practice for assessing exposure of walls to WDR																			
															BS8208 Assessment of suitability of cavity walls for filling														
															CIGA established 1995 and guidance published 1996														

Note: titles are sometimes abbreviated. WDR: wind driven rain

Table 3: Standards for Installation and Surveying of Cavity Wall Insulation

Standards in Place

- Research indicated many older installations, but all experiencing issues before the end of the warranty period or with no warranty.
- Multiple standards in place, with no clear hierarchy, and little evidence they were followed, with no requirement until recently to retain records of surveys and condition of buildings

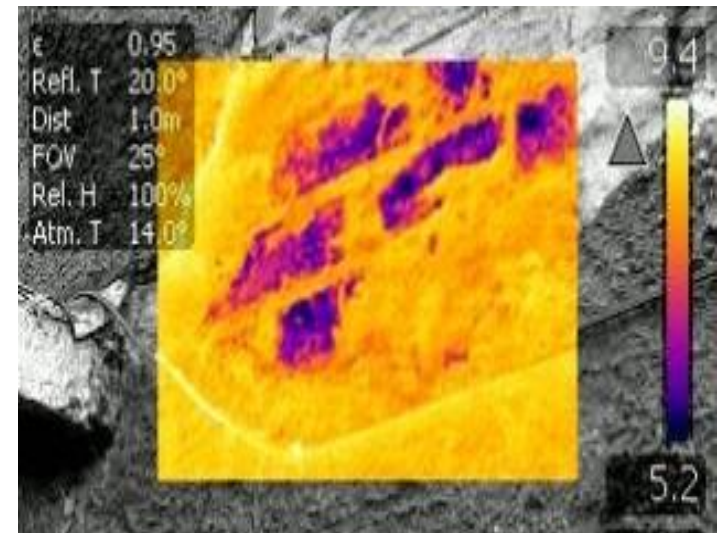


Standards in Place

- Consistent approach – proceed with caution in severe and very severe locations.
 - Check for local geographical features that provide protection
 - Buildings to be surveyed and checked as per the guidance in place at the time
 - Use the requirements of the testing certificates
- Form of construction and site conditions
 - Age of the building
 - Condition of cavity
 - Extent of cavity to be filled
 - Outer leaf
 - Inner leaf
 - Services within the cavity
 - Ventilation
- *Is the building free from unrectified signs of dampness or water penetration?*
 - *Cracks in the external walls exceeding 1mm width should be investigated and resolved.*
 - *Any other signs of distress such as bulging or leaning should be investigated and resolved.*
 - *Is the brickwork, mortar and render in good condition?*
 - *Are the walls free from spalled brickwork?*
 - *Are there signs that the gutters and downpipes are leaking?*

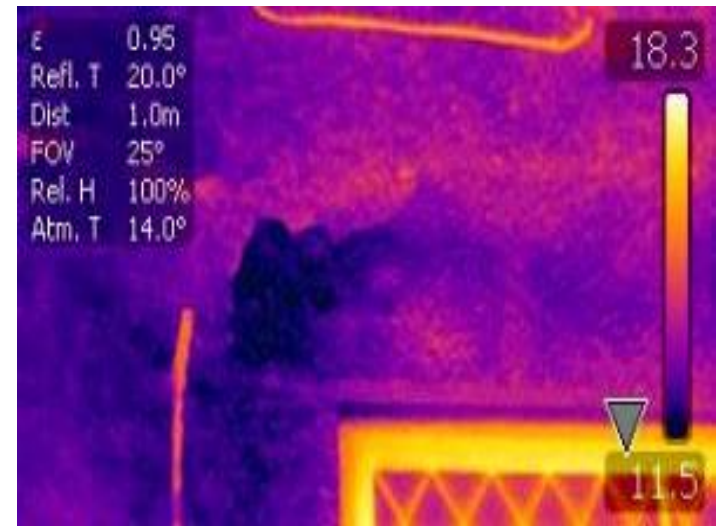
Findings

- Clusters of buildings with issues
- A range of reasons for non performance
- Narrow cavities <50mm outside of testing range



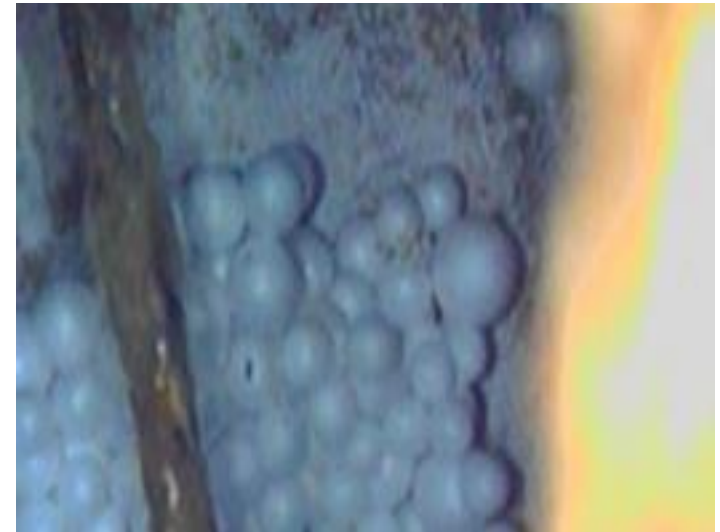
Findings

- No protection from local features
- Lack of maintenance and repair



Findings

- Blocked cavities or partially filled
- Installations, outside certification
- No reference to BBA



Findings

- Wet insulation extracted
- Clumping
- Saturated walls



Figure 3: Example of saturated insulation

Other properties visited during the research were showing signs of issues associated with condensation and moisture ingress, which could be the result of saturation and the subsequent failure of the CWI.



Figure 5: mould on saturated brickwork



Figure 4: Example of saturated insulation

Many of the properties had experienced damage and deterioration as a result of the exposure to the weather. Mortar and bricks used in the construction are already saturated, with discolouration and mould growth evident. Examples are shown in Figures 5 & 6 below.



Figure 6: mould on saturated render panels

Findings

- Poor pointing
- Movement cracks
- Poor original design



Figure 11: Erosion of mortar by weather



Figure 12: Cracked and missing

Other issues were identified where rainwater has overblown the roof and has saturated elements of the wall as shown in Figures 13 & 14 below.



Figure 13: Wall staining from water blown off the roof



Figure 14: Staining from roof water run off

Impact

- Significant costs to extract
- Process for pursuing warranty provision, difficult. No sites investigated, were successful in claiming, burden of proof difficult to build with no original data.
- No historic evidence on older installations

Type of house	Indicative cost of installation of CWI*	Average CWI area (m ²)	Average Costs for extraction of CWI
Terrace	£370	54	£1,890
Semi-detached	£475	106	£3,710

*For the calculation above the average figure of £35 per m² was used

External Wall Insulation



EWI

- No IWI assessed as limited in its application, with few certified systems.
- Self selected sample
- No National Standard to judge performance, all governed by system providers



Findings

- Little quality control on site
- Poor detailing
- Some evidence of correct practice, but not widespread

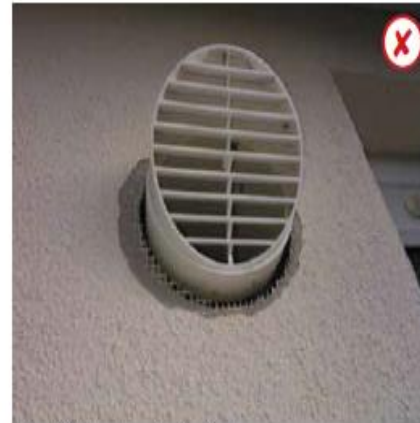


Figure 34: Unsealed extract fan in a bungalow



Figure 35: Unsealed pipe penetration



Figure 36: Unsealed wire penetration



Figure 37: sealed penetration (good practice)

Findings

- Inconsistent approach on the same schemes
- Lack of understanding on dealing with cold bridging



Figure 38 – cable clipped

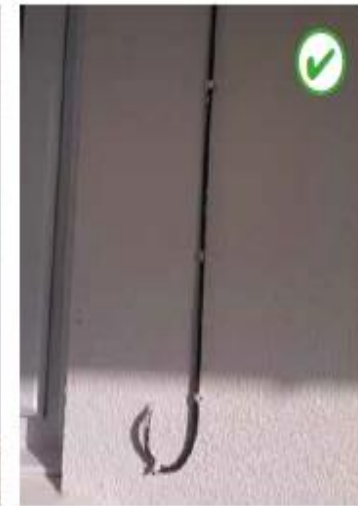


Figure 39 – cable clipped (good practice)

Findings

- Poor design or no design
- Poor workmanship
- Moisture ingress less than 4 months after installation

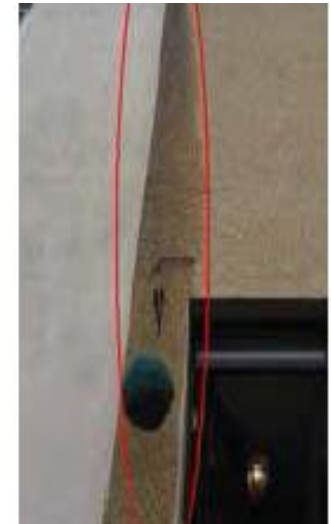


Figure 48: Plant growth allowed by poor detailing



Figure 49: Close proximity of plant requiring pruning

Findings

- Ventilation never assessed
- Mould growth after short periods of time, indicating systemic weaknesses in process
- Part F requirements for make it no worse ?



Figure 50: Damp in the kitchen



Figure 51: Damp in the bathroom



Figure 52: Damp in the wardrobe



Figure 53: Damp behind a bed, removed for inspection

bre

Impact



Impact

- Materials not recyclable
- Early systems incorporating formaldehyde, difficulty in extraction
- Destined for landfill at declared 1% rate
360,000m³

Recommendations



Recommendations

- Larger study to obtain primary evidence on failure rates
 - Review of the skill levels of the industry
 - Importance of maintenance set out early in the process.
1. To undertake a larger and nationally representative, primary data collection exercise in Wales to identify the extent of the issues which have been identified.
 2. To undertake an assessment of the competent person's scheme, in particular the surveying and installation elements, with a view to providing specific guidance for improvements to processes such as the assessment of risks regarding the level of exposure to wind driven rain.
 3. To develop a concise maintenance guide for installers, housing managers and occupants to help ensure that basic measures are taken to protect the insulation installation and thus make failure less likely.

Recommendations

- Inline with work undertaken for DECC
- Evidence used to make changes to Industry Practise
- Work underway on multiple layers, look out for the Every Home Counts Report

Recommendations Table

Research (UK and WG)	Standards & Policy (UK and WG)	Standards & Policy (WG)	Training & Behaviour (Industry)
<p>1. More in situ Testing</p> <p>Move away for reliance on unrealistic lab results. Wider research into walls that have received CWI for moisture content</p>	<p>4. Standards update</p> <p>Updates to BS5250:2011 to account for performance gap (UK wide)</p>	<p>7. Building Regs U-value update</p> <p>Remove encouragement to achieve 0.3 in all instances</p>	<p>10. Training provision for surveying for exposure and building condition</p> <p>Training on exposure and building defects</p>
<p>2. Wider scoping study of failure rates</p> <p>A comprehensive review of failure rates and causes in Wales and the wider UK. Including improvements in internal conditions post extraction of CWI</p>	<p>5. Process control improvements</p> <p>Review PAS 2030 and CWI competent persons schemes. Regarding On-site controls and sign off and increased inspection rates</p>	<p>8. Creation of standard details for EWI</p> <p>Creation of proven thermal bridging details and principles to reduce risk</p>	<p>11. Training of professionals</p> <p>Review course content for professionals to cover the principles of condensation and moisture movement in structures</p>
<p>3. New weather data</p> <p>Weather data for modelling performance (wind driven rain included)</p>	<p>6. Funding linked to performance</p> <p>Ensure funding schemes are tied to best practice and require consideration of whole house and moisture issues</p>	<p>9. Building Regulations ventilation and moisture risk update</p> <p>Part C and F reviewed and considered as part of thermal upgrades</p>	<p>12. Encourage good occupant behaviour</p> <p>Requirement for guidance on hand over to the occupants of improved properties</p>

Figure 59: Route map for change from DECC Report

bre

Thank you for listening



Case study presentation on refurbishment works at Peulwys Estate, North Wales



Owain Roberts

CARTREFI
CONWY
creu cymunedau i fod yn falch ohonynt
creating communities to be proud of

Background

LOCATION:

- Llysfaen, Old Colwyn

SCALE:

- 266 Properties
- 231 Cartrefi Conwy
- 35 Owner Occupiers



Lowton Cubitt Construction

- Modular, system built
- Built in mid-1960's – early 1970's
- Erected quickly to last for 20-30 years



- Hybrid of steel frame construction and separating walls of a cavity arrangement
- Gas filled concrete panels for the inner leaf and brickwork for the outer leaf

Reason for change

- Peulwys ranked in top 15% of most deprived estates in Wales
- Fuel Poverty
- 40% of heat generated in homes – escaping through the walls
- Draughty
- Damp and condensation
- Area of high weather exposure
- Aesthetically poor



Solution

- Commissioned BRE to explore options to improve energy efficiency and to assist in specifying the work:
 1. Internal wall insulation (**disturbance to tenants**)
 2. Ventilated rainscreen panels (**excessive wall thickness**)
 3. **External wall insulation/insulated render system** (**practical option**)

Funding

- Community Energy Savings Programme (CESP)
- Tender exercise involving 6 main National utility companies
- Awarded on best return for £/per tonne of carbon
- Anticipated 40,000 tonnes of carbon reduction
- Scottish and Southern Energy - **£1.72m**



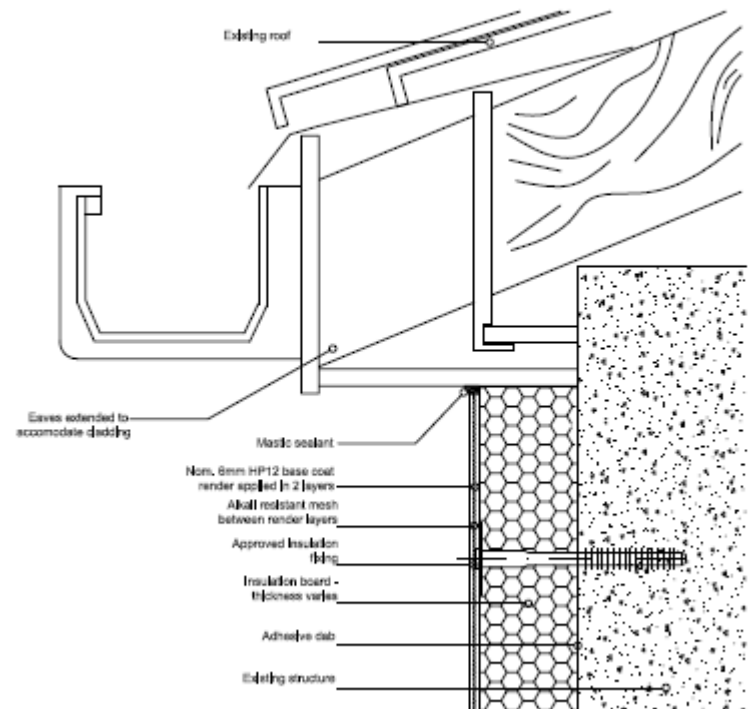
Project Brief

- External wall insulation
- Structural Fabrication
- Roofline configuration
- Porch replacement
- Boiler replacement
- Loft insulation
- Draft proofing



Challenges

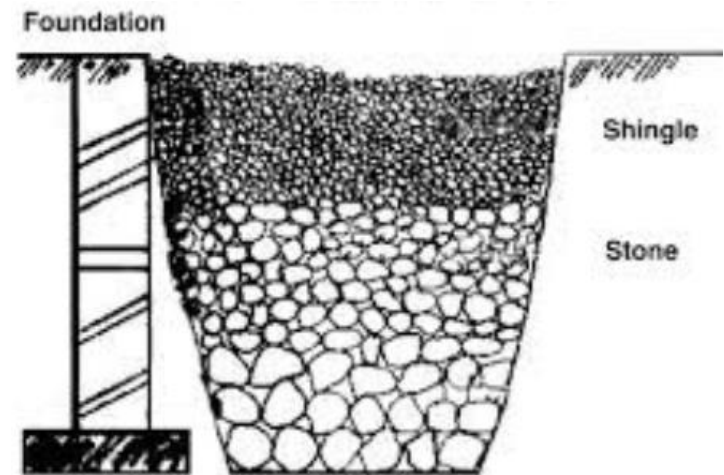
1. Insufficient eaves and gable overhangs



Extend the roofline

Challenges

2. Ground levels bridging DPC



Insert draining trench

Challenges

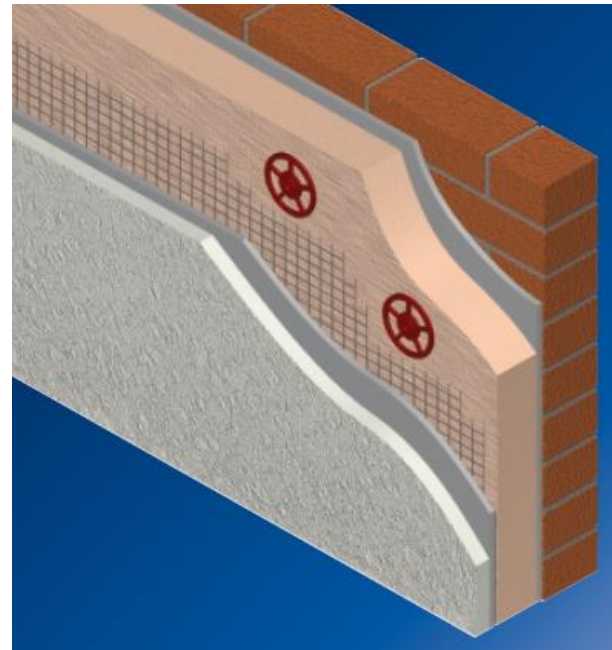
3. Cold bridging to existing porches



Remove, insulate and replace

Challenges

4. Cold bridging to window reveals



Use of thinner high performing insulation

Key Stats

- **32** week contract
- **£4m** Total Scheme Cost
- Boilers improved from **68% to 92%** efficient
- U-values to walls improved from **2.1 to 0.3**
- Actual carbon reduction - over **70,000 tonnes**
- Average SAP increased from **60 to 78**
- **100% funding for owner occupiers** (£15k pp)
- Average annual **fuel bill saving of £300**
- **95%** tenant satisfaction

Improved Thermal Efficiency

**B
E
F
O
R
E**



**A
F
T
E
R**



Improved estate appearance



Legacy

- Consequence of the work has reversed so called 'sink estate' label
- Is now a sustainable and viable residential area in terms of tenancy retentions and reduction in antisocial behaviour
- Asset Performance Model now shows this asset group as commercially viable in terms of NPV
- Additional £2m spent on Environmental Improvements
- First residential housing estate in UK to receive Green Flag status
- Now a more popular, desirable place to live

Q&A

