

BRE: Post Installation Performance of Cavity and Why it Fails

Colin King

Part of the BRE Trust



Session Content

- *Guidance on how to identify when a cavity wall installation has not been installed correctly*
- *Examples and case studies of when cavity walls have gone wrong*
- *Techniques for reporting these defects appropriately to the client*



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: Piddington et al, Housing in the UK, IHS BRE Press FB 62, Watford, 2013.

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

Urban Myths

- CWI not suitable for Wales
- Part C does not allow full fill insulation in very severe exposure zones
- Guarantees will pay for the removal of CWI if it fails
- All CWI in Wales needs to be removed.



bre

Cavity Wall Insulation



Standards in Place

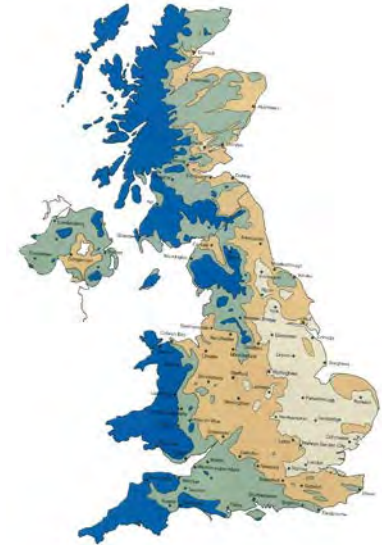
Part C earlier edition(s)										Part C 1992 edition										Part C 2004 edition																													
1980s										1990s										2000s										2010s																			
8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5												
BBA Information 10 (withdrawal 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

BR 262: Thermal insulation: Avoiding risks

- Moisture ingress as a result of wind driven rain a significant risk
- General guidance given in BR 262 based on maps of exposure and tables of tolerance for various wall finishes
- Zones from 1 to 4, from sheltered to very severe



Exposure zones	Approximate wind-driven rain* (litres/m ² per spell)
 1 Sheltered	less than 33
 2 Moderate	33 to less than 56.5
 3 Severe	56.5 to less than 100
 4 Very severe	100 or more

* Maximum wall spell index derived from BS 8104

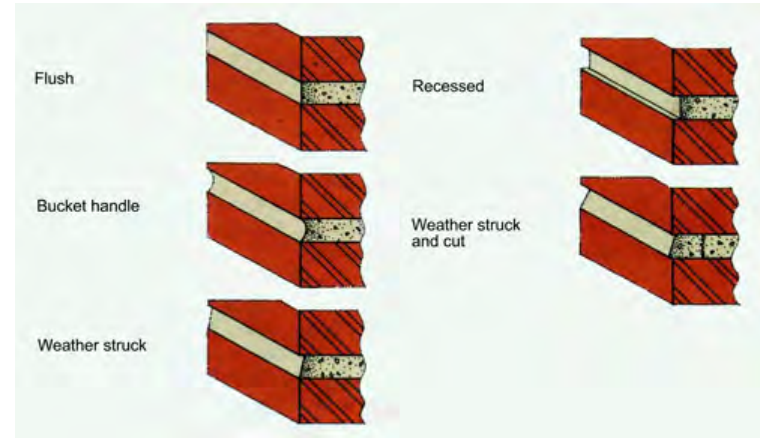
BR 262: Table and guidance on maximum exposure zones for insulated masonry walls

- Table assumes high quality construction.
Recommends that where the construction quality cannot be relied on or guaranteed, reduce the maximum recommended exposure zone by one category

Wall construction	Cavity	Exposure zone suitability				
		Impervious cladding		Rendered finish	Facing masonry	
		Full height	Above facing brickwork	Full height	Tooled flush joints	Recessed mortar joints
Built in full fill	50mm	4	3	3	2	1
Built in full fill	100mm	4	4	4	3	1
Partial fill, residual cavity	50mm	4	4	4	3	1
Partial fill, residual cavity	100mm	4	4	4	4	2

Finishes

- Exposed/ facing brickwork
 - Ensure that the mortar used is compatible with the strength of the masonry to minimise cracking
 - Recessed joints increase risk of moisture penetration
 - Flush, bucket handle or weather struck joints offer better protection



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?*

Issues to Consider – Moisture / Defects

- Most early CWI materials are hydrophobic
- Mineral wool requires a minimum width of cavity to create a suitable density to resist moisture passage -
- The base of the cavity must be clear
- Cavity trays and closers must be correctly installed
- No bridging debris
- No significant cracking, defects, broken seals or leaking gutters when the cavity is insulated or during the life of the building – ABIS conditions

Regime for Certification

- Correct drilling pattern needs to have been followed
refer to BBA Certificate or manufacturer
- BBA Certificate exposure rating
- Construction Suitability – not all are suitable
- Render should not bridge the DPC
- Render should not go to the ground
- There must be 2 courses clear above external ground level

bre

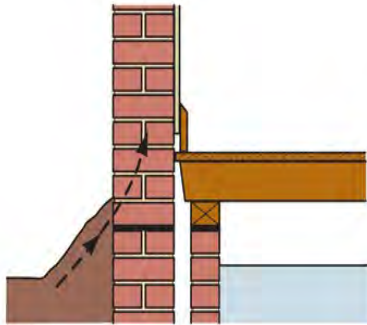
So why does CWI Fail

2

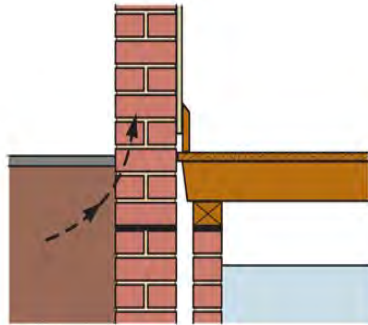
Moisture, Defects , Poor workmanship

- Moisture, either water penetration through the structure
- Internal moisture creation with inadequate ventilation or heat
- Rising damp (not common)
- Lateral movement of water (ground levels)

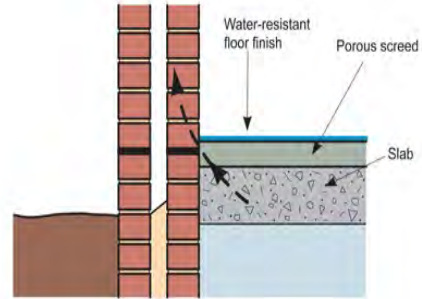




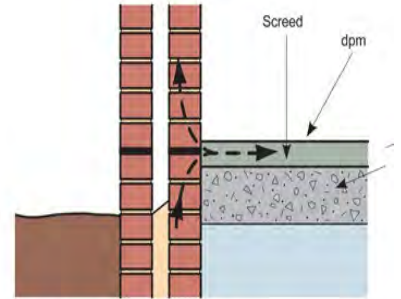
Bridging by earth



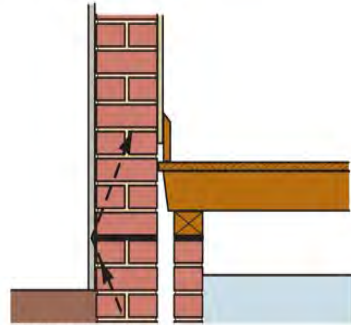
Bridging by path



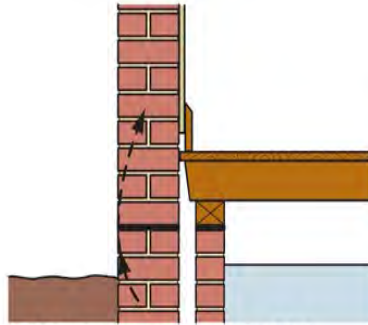
Bridging by floor screed



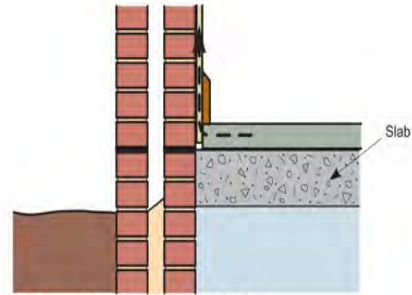
Bridging by floor screed



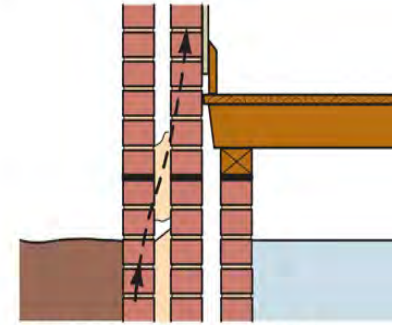
Bridging by rendering



Bridging by mortar pointing over DPM

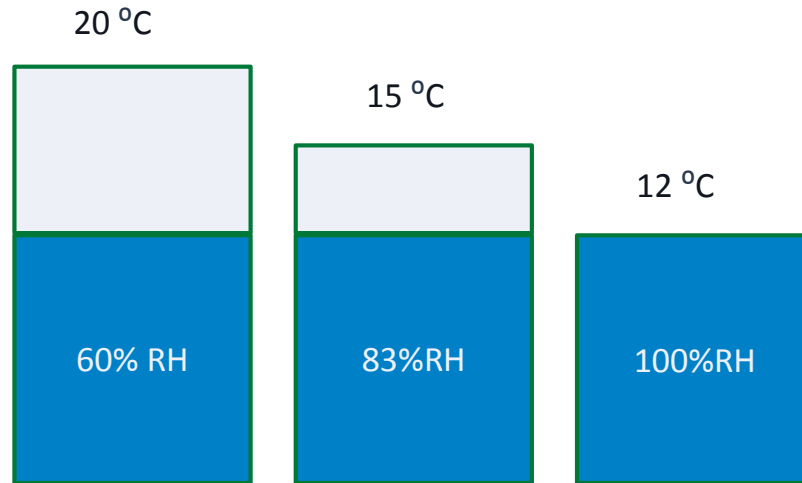


Bridging by plaster taken below finished floor level



Bridging by mortar dropping in cavity

Effects of cooling air on Relative Humidity (RH)



Temp 15 DegC

At this Temperature Deg C	and this R/H %	Condens at Deg C	Number of Days to get Mould	Notes
15	56	6		
15	58	7		
15	60	7		
15	62	8		
15	64	8		
15	66	9		
15	68	9		
15	70	10		
15	72	10		
15	74	10	53	
15	76	11	34	
15	78	11	22	
15	80	12	15	
15	82	12	11	
15	84	12	8	
15	86	13	6	
15	88	13	5	
15	90	13	4	
15	92	14	4	
15	94	14	3	

Temp 17 DegC

At this Temperature Deg C	and this R/H %	Condens at Deg C	Number of Days to get Mould	Notes
17	56	8		
17	58	9		
17	60	9		
17	62	10		
17	64	10		
17	66	11		
17	68	11		
17	70	11		
17	72	11	92	
17	74	12	53	
17	76	12	32	
17	78	12	21	
17	80	13	14	
17	82	13	10	
17	84	13	8	
17	86	15	6	
17	88	15	5	
17	90	15	4	
17	92	15	3	
17	94	16	3	

Temp 19 DegC

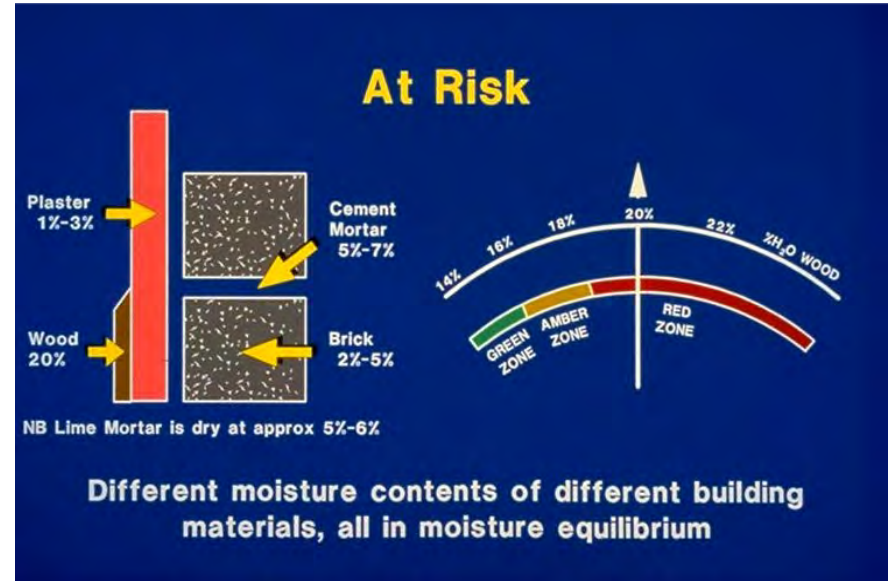
At this Temperature Deg C	and this R/H %	Condens at Deg C	Number of Days to get Mould	Notes
19	56	10		
19	58	11		
19	60	12		
19	62	12		
19	64	12		
19	66	12		
19	68	13		
19	70	13	168	
19	72	14	88	
19	74	14	50	
19	76	15	31	
19	78	15	20	
19	80	15	14	
19	82	16	10	
19	84	16	8	
19	86	17	6	
19	88	17	5	
19	90	17	4	
19	92	18	3	
19	94	18	3	

Temp 21 DegC

At this Temperature Deg C	and this R/H %	Condens at Deg C	Number of Days to get Mould	Notes
21	56	12		
21	58	12		
21	60	12		
21	62	13		
21	64	13		
21	66	14		
21	68	14	340	
21	70	15	163	
21	72	15	86	
21	74	16	49	
21	76	16	30	
21	78	16	19	
21	80	17	13	
21	82	17	10	
21	84	18	7	
21	86	18	6	
21	88	18	5	
21	90	19	4	
21	92	19	3	
21	94	20	3	

Wood Moisture Equivalent – WME – values in a damp wall

- Damo meters can provide an indication – best used in search mode
- Don't forget their limitations
- Use them as a guide not as a definitive answer



Ashworth Speedy Tester

Portable %mc
measurement capability

6 step test procedure

Calcium carbide reagent
Approved by ASTM4944,
ASSHTO T217 and
DIN18365



Defects

- Cracks in Render
- Missing DPC
- Windows not sealed
- Leaking gutters
- Spalled brickwork



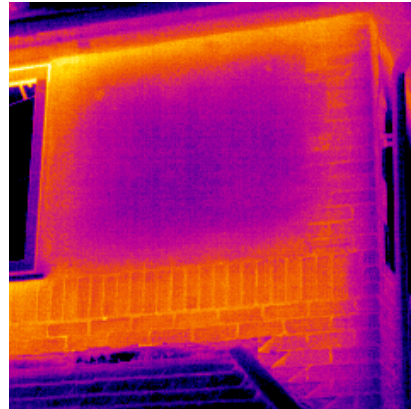
Defects

- Cavities not closed
- Bad or partial repairs
- Poor gutter alignment



Workmanship

- Incomplete fill – does not achieve density
- Base of cavity not fully cleared
- Insufficient width of cavity
- Wrong material choice



bre

Case Study



Case Study

- Property hard to keep warm
- Electrical sockets blowing
- Plaster falling off walls in unusual patterns
- Render delaminating

Method of Diagnosis

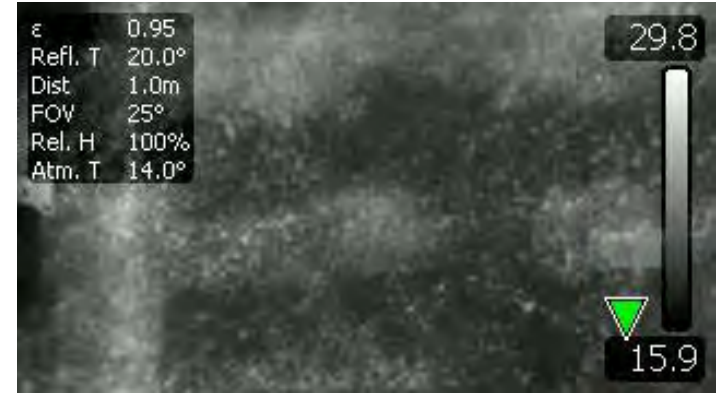
- Initial survey to ascertain context
 - Location
 - Construction – Ground levels etc
 - Defects
 - Preliminary Investigations IR, Moisture readings

Evidence gathering no judgement, no guessing. Based on facts and science



Initial Survey Findings

- No protection from local features
- Lack of maintenance and repair
- Probable missing insulation and or wet insulation
- Narrow cavities

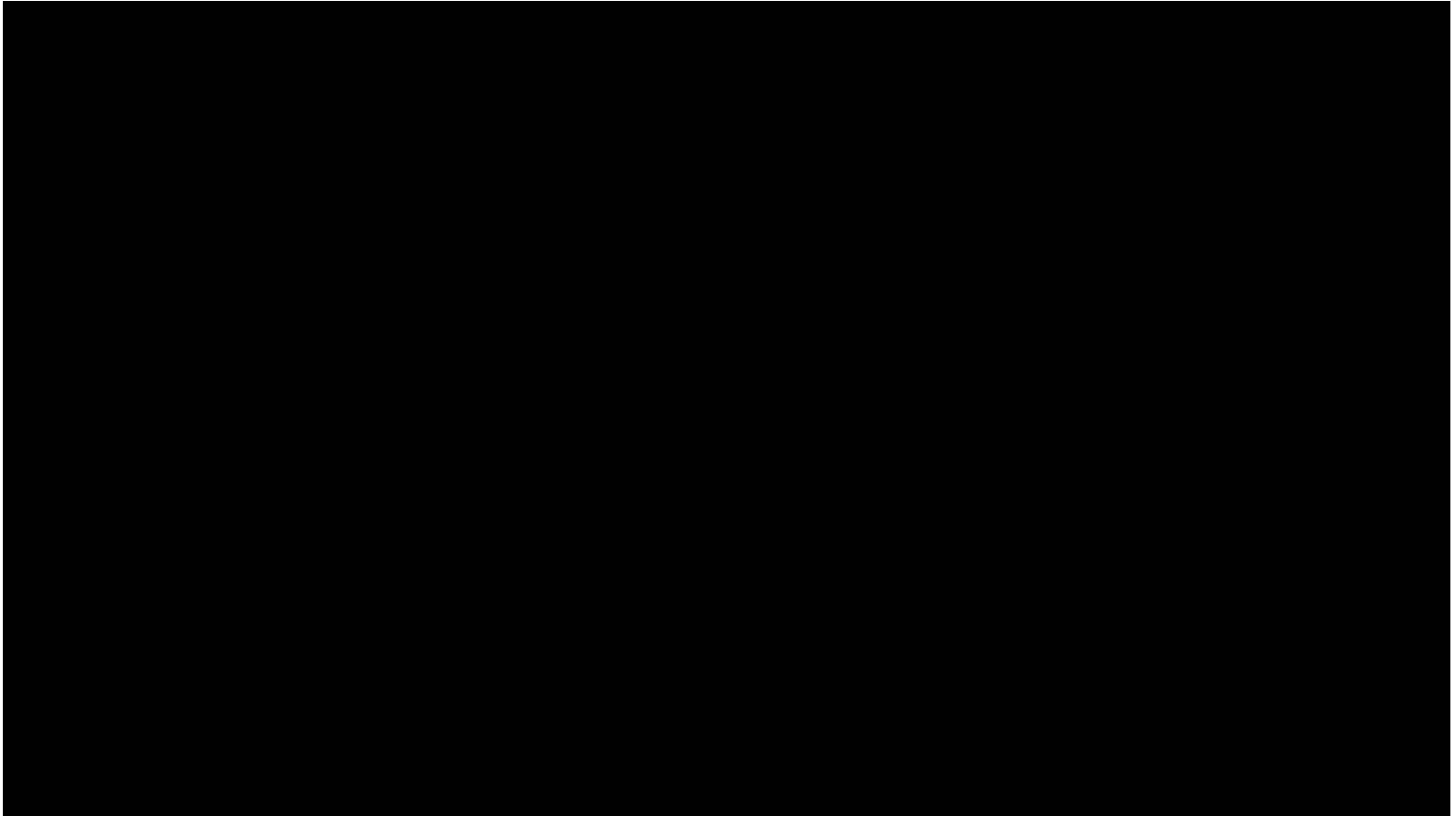


Findings

- Blocked cavities or partially filled
- Installation, outside certification
- Render to ground level



bre



bre



Informing the Client

- Don't scare them – there could be significant financial issues
- The results have to be based on evidence, science and fact (no guessing, no assumptions)
- Explain the difficulties of claiming (Guarantee process is painful and lengthy, rarely successful)
- Options

bre

Thank you for listening
Questions

