BRE: Post Installation Performance of Cavity and External Wall Insulation

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Content

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

Cavity Wall Insulaiton

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

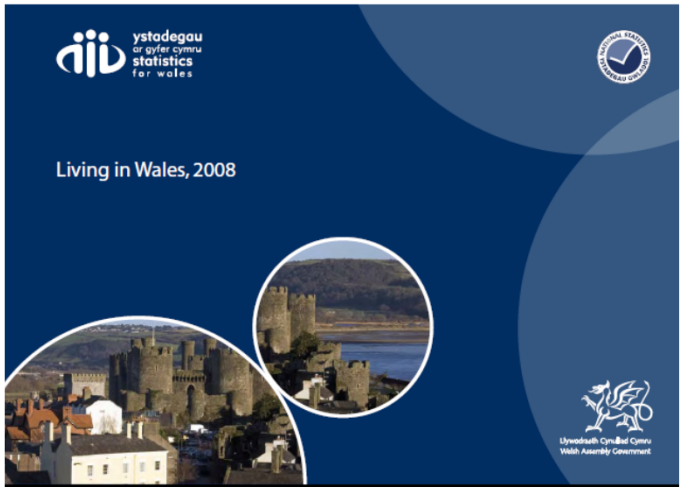
	England	N. Ireland	Wales	Scotland
Age - % pre 1919	20.8	13.0	30.2	18.9
Age - % pre 1945	37.3	23.4	41.1	32.5
% solid masonry walls (not cavity)	26.6	19.8	31.1	21.8
% penetrating dampness	3.2	1.4	6.9	4.2
% any dampness (incl. condensation)	7.6	4.1	12.9	12.5
Mean SAP (energy efficiency, out of 100)	51.5	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: Piddington 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.

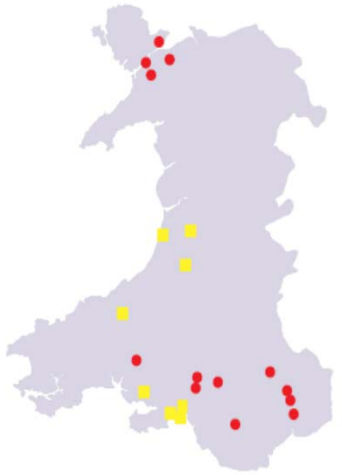


Figure 1: Location of cases reported as part of the Call for Evidence

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	6	7	8	9	0	1	2	3	4	5

BBA Information 10 (withdrawal date unknown, probably around 1995

BS5617:1978 BS5618:1978

BS5617:1985 Specification for UF foam systems suitable for thermal insulation of cavity walls
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


BRITISH STANDARD

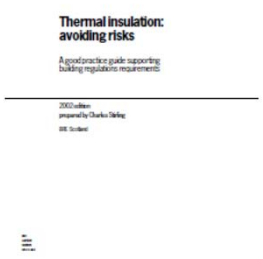
BS 8104 : 1992

Code of practice for

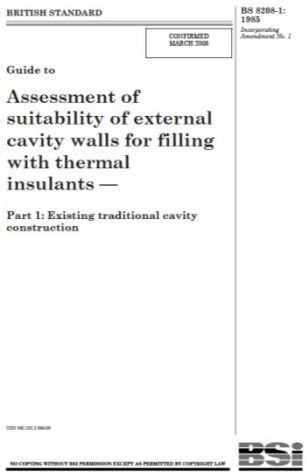
Assessing exposure of walls to wind-driven rain

Confirmed March 2008

BSI


Thermal insulation: avoiding risks

A good practice guide supporting building regulations requirements


BRITISH STANDARD

BS 8208-1: 1985

CONFIRMED MARCH 2008

Guide to

Assessment of suitability of external cavity walls for filling with thermal insulants —

Part 1: Existing traditional cavity construction

BSI


The Building Regulations 2000

Site preparation and resistance to contaminants and moisture

C

APPROVED DOCUMENT

C1 Site preparation and resistance to contaminants

C2 Resistance to moisture

ONLINE VERSION

2004 edition

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

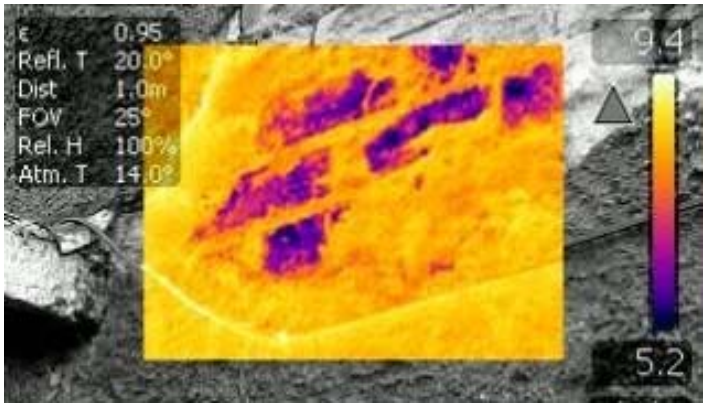
– Use the requirements of the testing certificates

- 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

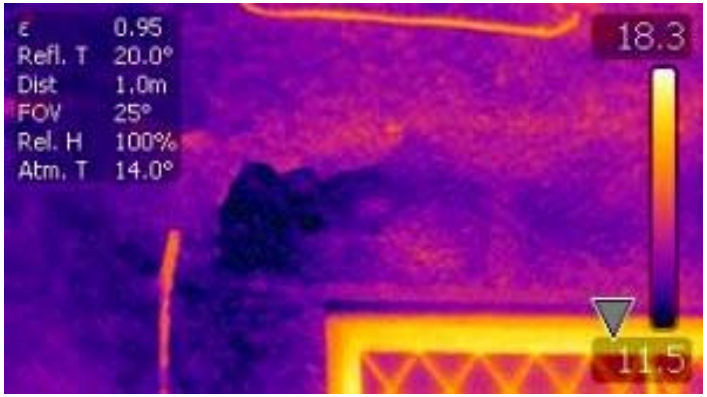
- Clusters of buildings with issues
- A range of reasons for non performance
- Narrow cavities <50mm outside of testing range



Findings

– No protection from local features

– Lack of maintenance and repair

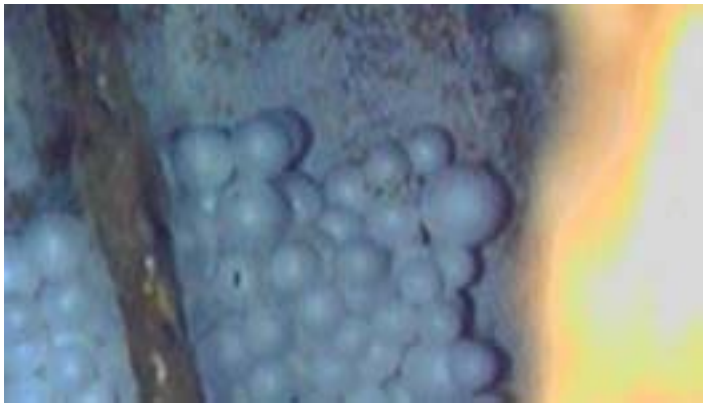


Findings

– 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

Figure 4: Example of saturated insuletion

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.

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 5: mould on saturated brickwork

Figure 6: mould on saturated render panels

Findings

- Poor pointing
- Movement cracks
- Poor original design

Figure 11: Erosion of morter 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[5]	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 m^2 was used

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External Wall Insulation

2

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

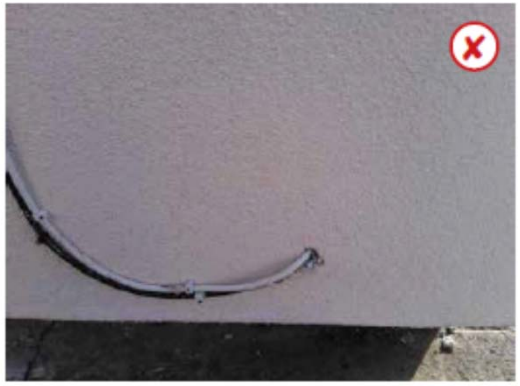


Figure 38 – cable clipped

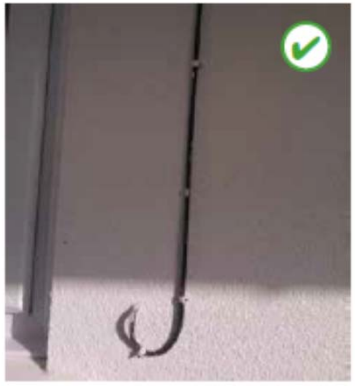


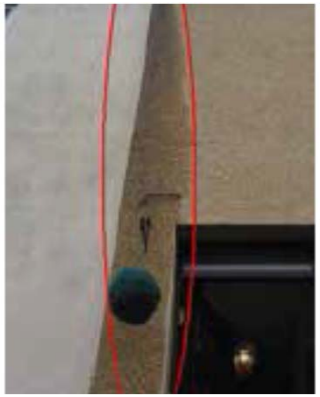
Figure 39 – cable clipped (good practice)

Findings

– Poor design or no design

– Poor workmanship

– Moisture ingress less than 4 months after installation



re 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

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

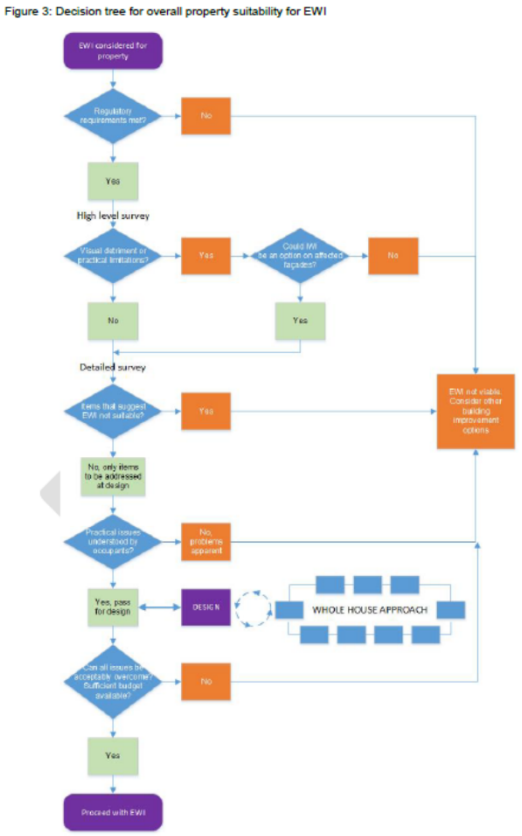
Figure 59: Route map for change from DECC Report

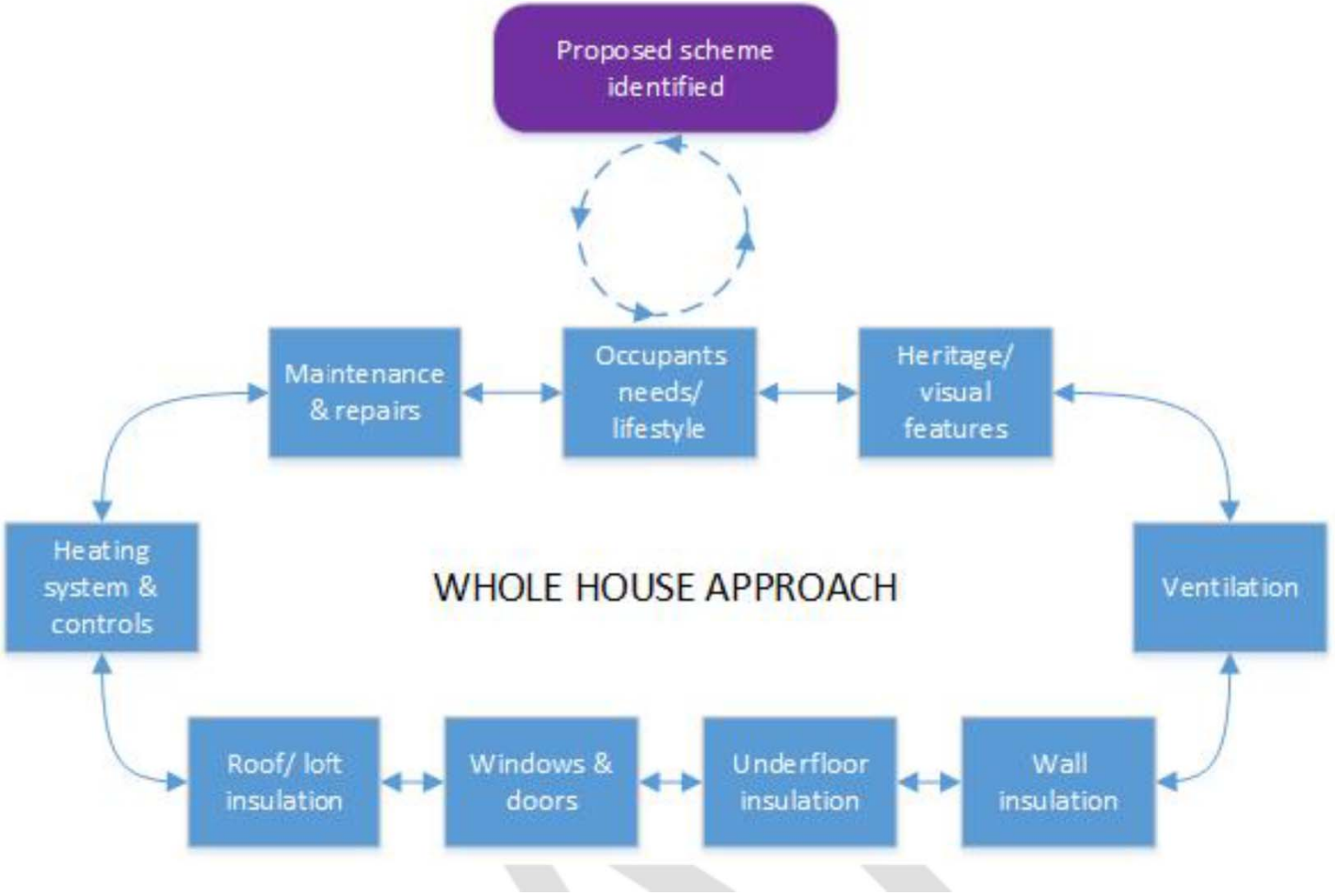
Guide Contents

- Industry guidance not always good practice, with details being acceptable even though predicted to cause condensation.
- Other sources of design guidance setting out key information and steps that need to be followed
- Typical Unintended Consequences and why they happen (contributing factors)

Guide Contents

- Process setting out the Whole House Approach
- Ensuring that the work is sequenced in such a way that future improvements are not restricted
- Guidance on Building Regulations and Planning requirements
- Decision trees for scheme suitability




Proposed scheme identified
Maintenance & repairs
Occupants needs/ lifestyle
Heritage/ visual features
Heating system & controls
WHOLE HOUSE APPROACH
Ventilation
Roof/ loft insulation
Windows & doors
Underfloor insulation
Wall insulation

Guide Contents

- Determining the suitability of properties, exposure capacity, context and caution
- Guidance on high level considerations and detailed considerations to increase the potential for good performance
- Managing occupant expectations during the process
- How to assemble the right team to deliver the works – specific skills and attributes required by surveyors, designers and installers. Independent Quality Control

Guide Content

- Selection of materials, systems and products, based on the individual characteristics of the properties to be improved.
- System Accreditation
- Fixings and trims
- Maintenance requirements and warranties (what could or should be covered)

Table 2: Types of insulation materials and key properties

Type of insulation	Examples	Key properties/ benefits
Thermoset polymer	Polyisocyanurate (PIR) foam Phenolic foam	λ = approx. 0.020-0.028 W/mK Most thermally efficient mainstream insulation, hence thinner profiles for equivalent thermal performance
Thermoplastic polymer	Expanded polystyrene (EPS) Extruded polystyrene (XPS)	λ = approx. 0.030-0.038 W/mK Moisture resistant Typically the most cost effective material choice when considering performance vs cost XPS has relatively high compressive strength
Mineral fibre	Stone/ rock wool Glass wool	λ = approx. 0.034-0.040 W/mK Non-combustible
Natural fibre	Wood fibre Cellulose fibre	λ = approx. 0.035-0.060 W/mK Low embodied impact due to renewable material feedstock Some products vapour permeable

Guide Content

- Of all the issues in EWI or retrofit in general, the most important factor is to consider the adequacy and suitability of the property ventilation systems (passive, mechanical, & background)
- Part F makes a requirement of “no worse” yet in most cases it is never assessed.

How to use the Guide

- It sets out in a sequential process all the issues that must be considered if EWI is going to be successful
- Points the reader in the direction of more detailed information
- Sets out the different levels of warranty and coverage
- Helps housing stock providers to ask the right questions, and appoint the right team to increase the chance of success.

- Helps to inform that buildings needed to be treated differently and according to their age, construction type and materials
- Increases awareness that the context and exposure of the building is essential to understand when making decisions.
- Case Studies of work that was done well

Thank you for listening