Repair and Maintenance in Sustainable Traditional Buildings

John Preston

STBA Heritage Chair; IHBC Green Panel Convenor

“Elements such as walls can be over a third less energy efficient if damp”

BS7913:2013: “Guide to the Conservation of Historic Buildings”

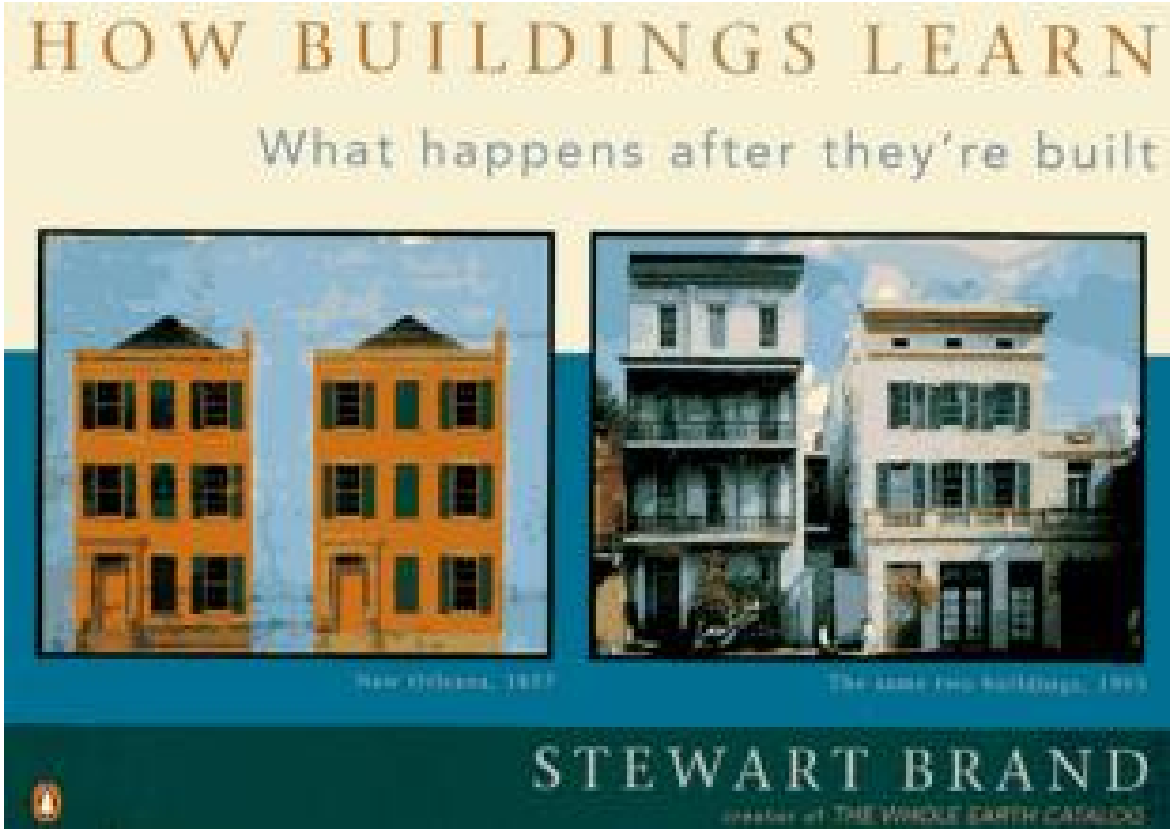
“10. Sustainability and energy efficiency

The most effective way of ensuring energy efficiency and sustainability is to keep historic buildings in good repair so that they last as long as possible, do not need replacement and
do not suffer from avoidable decay that would require energy and carbon to rectify …

bsi.
...making excellence a habit.™

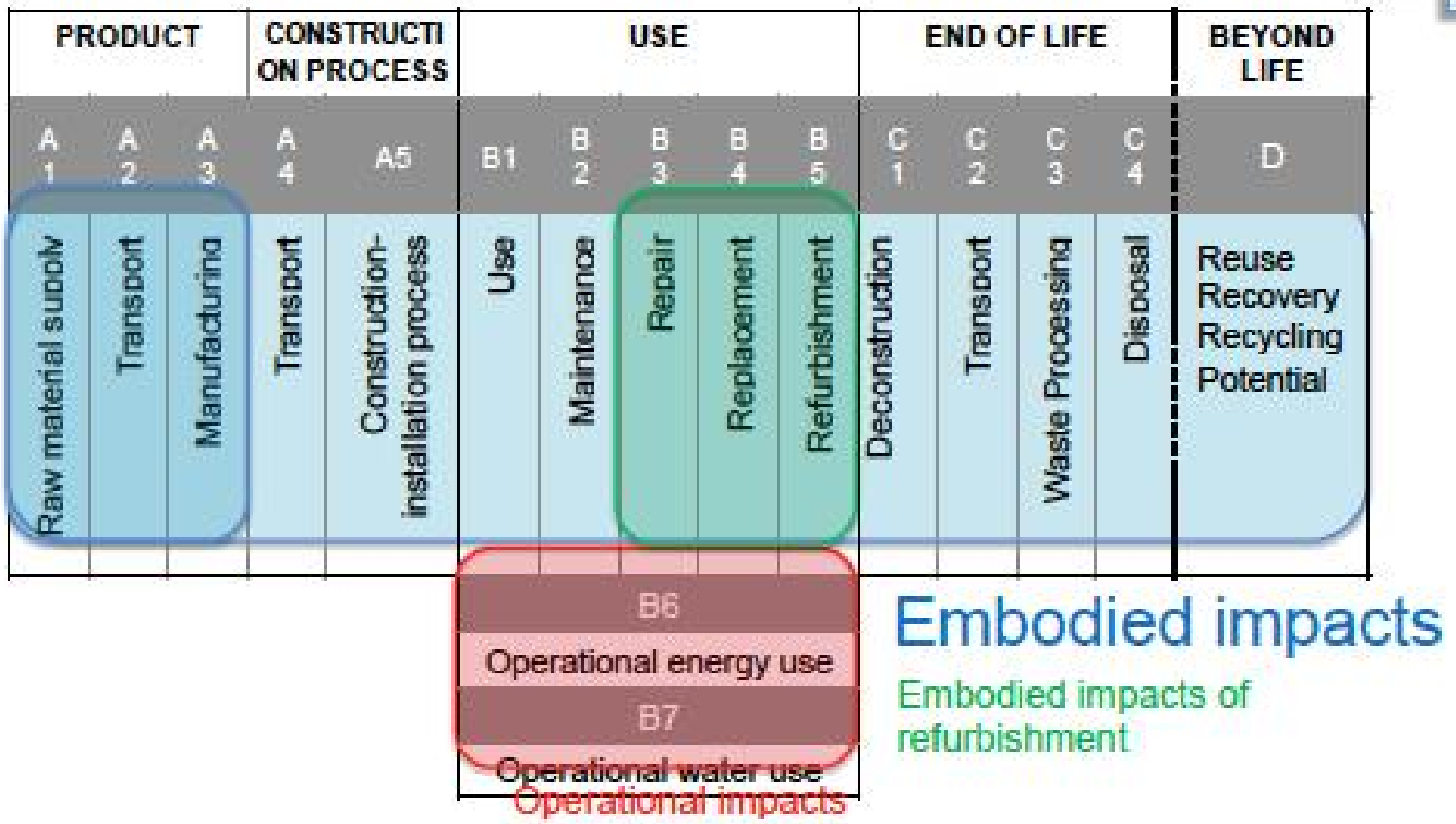
“No maintenance, no building” (Stewart Brand)

- “the root of all evil is water”
- “rain is only the most obvious source of the problem”
- “more pernicious now is internally generated water vapour”



The TC350 sustainability of construction works

BS EN 15978: 2011 defined the life (cycle) in multiple stages



Slide by Alice Moncaster, Open University, TC350 sustainability of construction works

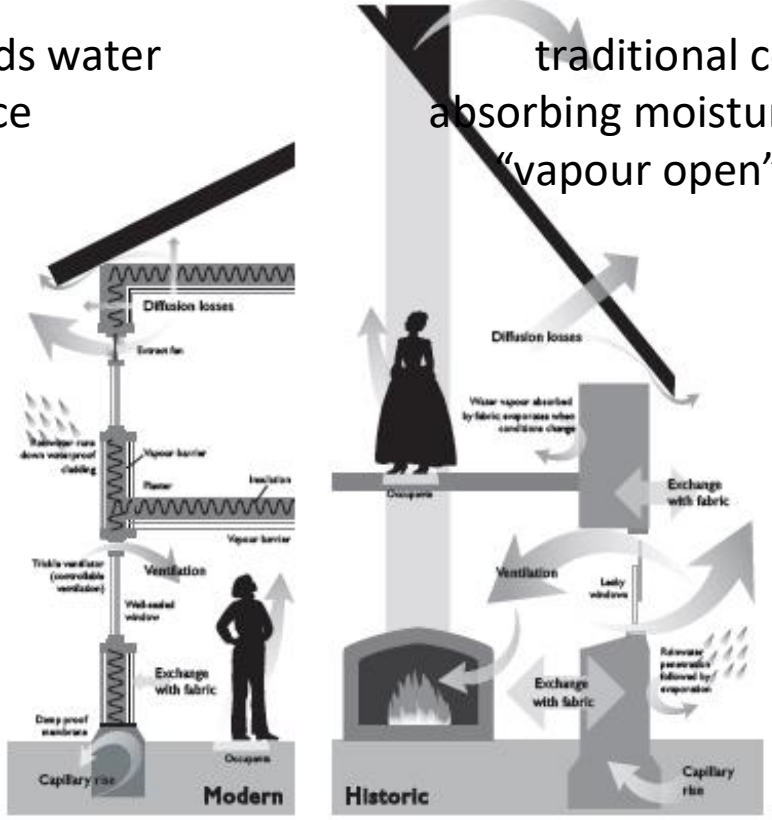
Traditional buildings perform differently…..

Modern

Modern construction sheds water
Impermeable outer surface
"vapour closed"

Traditional

traditional construction "breathes"
absorbing moisture then evaporating it
"vapour open"



Historic England

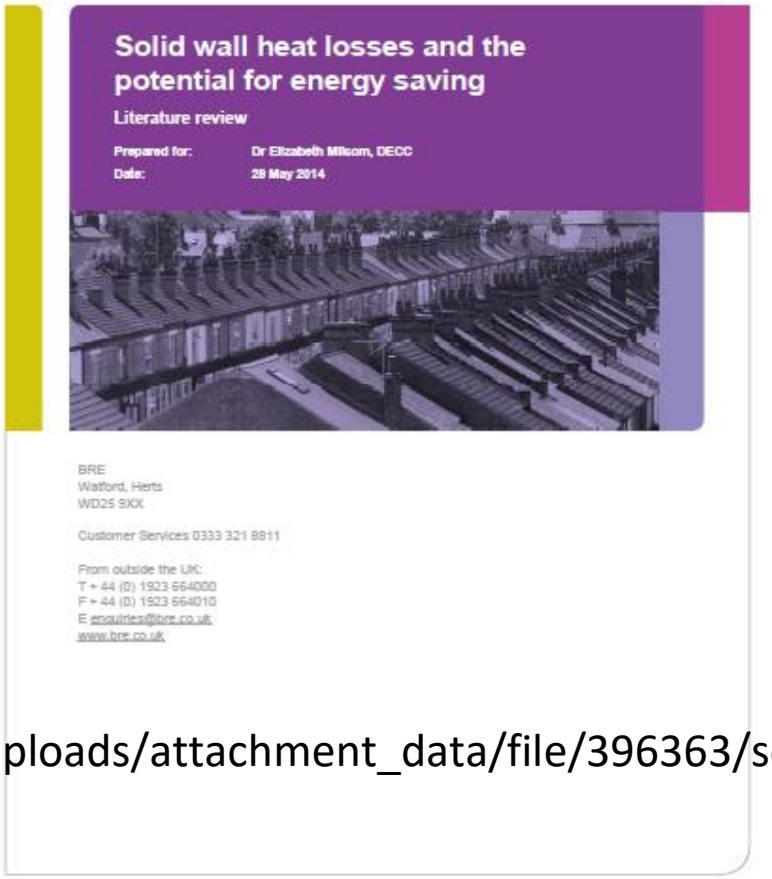
Failure to understand the differences has led to countless problems….

Heritage / traditional - up to 35% of dwellings!

According to BRE's own literature, published by DECC

65% **35%**

"Heritage buildings represent approximately 35% of the existing dwellings in the UK as a whole and a large proportion of solid wall buildings.


bre

www.bre.co.uk

Solid wall heat losses and the potential for energy saving

Literature review

Prepared for: Dr Elizabeth Milsom, DECC

Date: 28 May 2014

BRE
Watford, Herts
WD25 9XX

Customer Services 0333 321 8811

From outside the UK:
T +44 (0) 1923 664000
F +44 (0) 1923 664010
E enquiries@bre.co.uk
www.bre.co.uk

Published on DECC website January 2015
(long before Bonfield Review was commissioned)
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/396363/solid_wall_insulation_literature_review.pdf

Building Regulations safeguards from 2002

introduced following lobbying by Heritage sector

Good principles established in Part L1B and L2B

"Improve energy efficiency as far as reasonably practical"

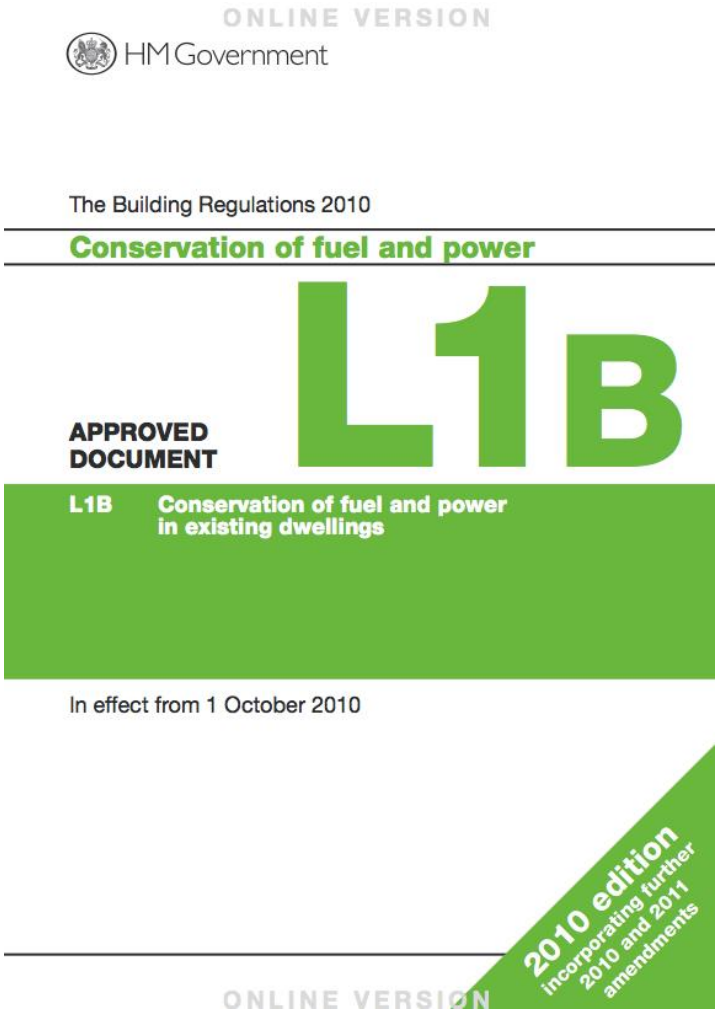
Parts L1B and L2B paras 3.8-3.13

"Special considerations in making reasonable provision"

"3.8c buildings of *traditional construction with permeable fabric that both absorbs and readily allows the evaporation of moisture"*

"3.9 ..the aim should be to *improve energy efficiency as far as is reasonably practicable.*
The work should not prejudice the character of the host building or *increase the risk of long-term deterioration of the building fabric…"*

…….but totally overlooked by DECC!!



Part L

- Applies to major renovation
- Or renovation of more than 50% of element's surface area

- **5.6A *Major renovation*** means the renovation of a building where more than 25% of the surface area of the ***building envelope*** undergoes renovation. When assessing whether the area proportion constitutes a ***major renovation*** of a building, the surface area of the whole of the external ***building envelope*** should be taken into account i.e. external walls, floor, roof, windows, doors, roof windows and roof lights.

Need for repair overlooked in Government Retrofit Schemes

Green Deal
ECO
Private Rented Sector

Rotten bay window – how to repair without damaging SWI?

Green Deal and ECO Qualifying Measures - no mention of repairs!

Green Deal Measures	In ECO (Affordable Warmth)?	In ECO (Carbon Reduction)?
Measures/text in **bold** were added after the consultation	Low income and vulnerable households identified individually through benefits data (measures which reduce the cost of heating the home)	All households
Green Cells	Always eligible	
Blue Cells	Eligible when delivered as part of a package v	
Red Cells	Never eligible	
Air source heat pumps	Y	N
Biomass boilers	Y	N
Biomass room heaters (including with radiators)	Y	N
Cavity wall insulation	Y	P
Cavity wall insulation (HTT)	Y	Y
Cylinder thermostats	Y	N
District heating (not GD)	Y	P
Draught proofing	Y	P
Duct insulation	N	N
Hot water showers (efficient)	Y	N
Hot water systems (efficient)	Y	N
Hot water taps (efficient)	Y	N
External wall insulation systems	Y	Y
Fan-assisted replacement storage heaters	Y	N
Flue gas heat recovery devices	Y	N
Ground source heat pumps	Y	N
Heating controls (for wet central heating system and warm air system)	Y	N
Heating ventilation and air-conditioning controls (including zoning controls)	Y	N
High performance external doors	Y	P
Hot water controls (including timers and temperature control)	Y	N
Hot water cylinder insulation	Y	N
Internal wall insulation (of external walls) systems	Y	Y
Lighting systems, fittings and controls **(including rooflights, lamps and luminaires)**	N	N
Loft or rafter insulation (including loft hatch insulation)	Y	P

Green Deal Measures	In ECO (Affordable Warmth)?	In ECO (Carbon Reduction)?
Measures/text in **bold** were added after the consultation	Low income and vulnerable households identified individually through benefits data (measures which reduce the cost of heating the home)	All households
Green Cells	Always eligible	
Blue Cells	Eligible when delivered as part of a package hard to treat cavity wall insulation	
Red Cells	Never eligible	
Mechanical ventilation with heat recovery	N	N
Micro combined heat and power	Y	N
Micro wind generation	Y	N
Pipe-work insulation	Y	(external pipework only)
Photovoltaics	N	N
Chillers	N	N
Gas-fired condensing boilers	Y	N
Replacement glazing	Y	P
Oil-fired condensing boilers	Y	N
Warm-air units	Y	N
Radiant heating	Y	N
Roof insulation	Y	P
Room in roof insulation	Y	P
Sealing improvements (including duct sealing)	N	N
Secondary glazing	Y	P
Solar water heating	Y	N
Solar blinds, shutters and shading devices	N	N
Transpired solar collectors	N	N
Under-floor heating	Y	N
Under-floor insulation	Y	P
Variable speed drives for fans and pumps	N	N
Waste water heat recovery devices attached to showers	N	N
Water source heat pumps	Y	N

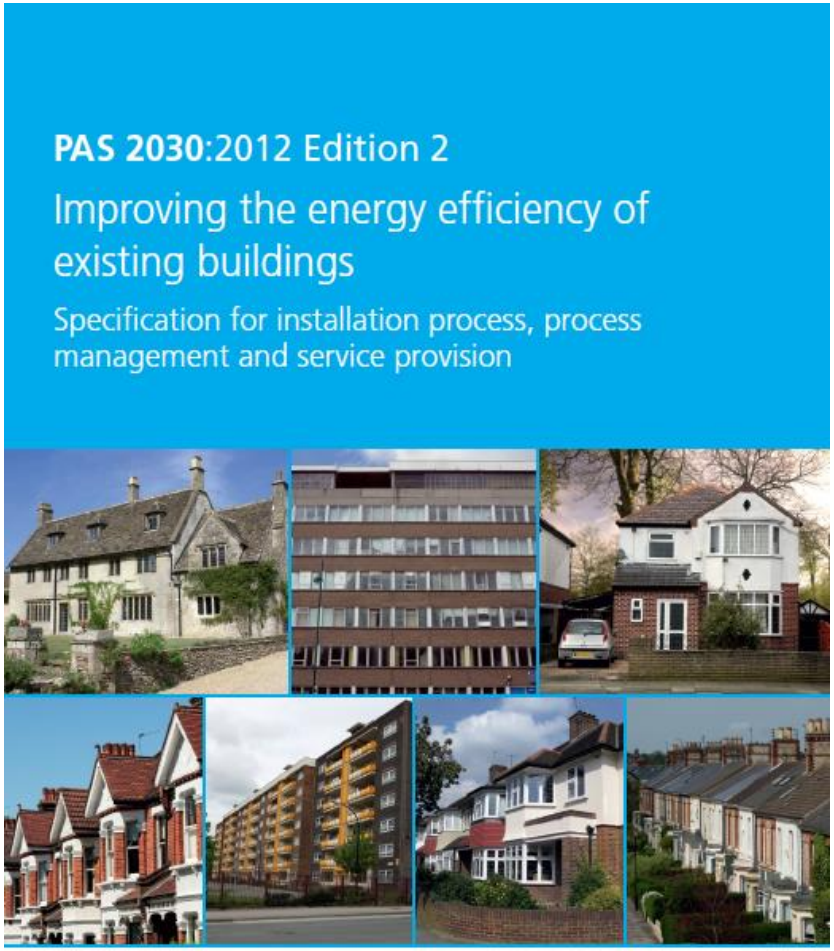
Green Deal Code of Practice (nothing for ECO)

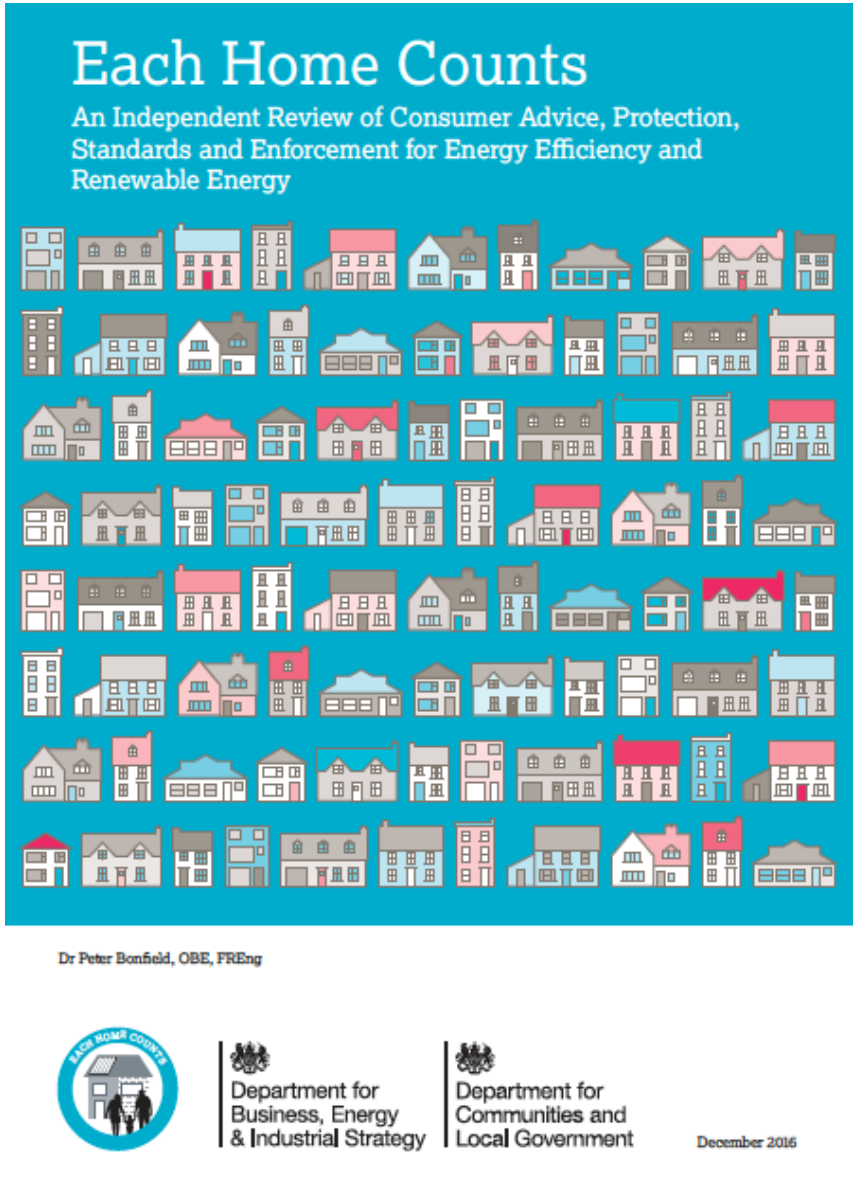
Annex B obligations on GREEN DEAL PROVIDERS

s43 Where the Green Deal Provider considers that the building is a vulnerable building, the Green Deal Provider must ï
(a) **inform the improver and keep a written record** that the building is a **vulnerable buildin**g;
(b) take particular care to ensure that ï
(i) **the proposed improvements are appropriate for the building**;
(ii) the finishes and fabric of the building are **protected from damage resulting from installation of the improvements, by using appropriate materials, products and specifications**; and
(c) advise the **improver to enquire whether Listed Building Consent or any other approval is required** before any work is carried out.

s44 Where the Green Deal Provider considers that the building is a vulnerable building, the Green Deal Provider **must also consider whether an architect or surveyor with specialist skills in respect of vulnerable buildings** should be consulted. If the Green Deal Provider is in any doubt about this, **they must consult the local authority historic buildings or conservation officer**.

Quality and Standards issues





*Meeting **Sustainability criteria***

Kit Pedler's comparison of "Good" and Bad" materials
"The Quest for Gaia", 1979

GOOD	BAD
Low first cost	High first cost
Long Life	Short life
Low fabrication energy	High fabrication energy
Low entropic index	High entropic index
High renewability	Poor renewability

Different building elements have different life cycles

Over the lifetime of the building……

Maintenance

Repair

Replacement

Refurbishment

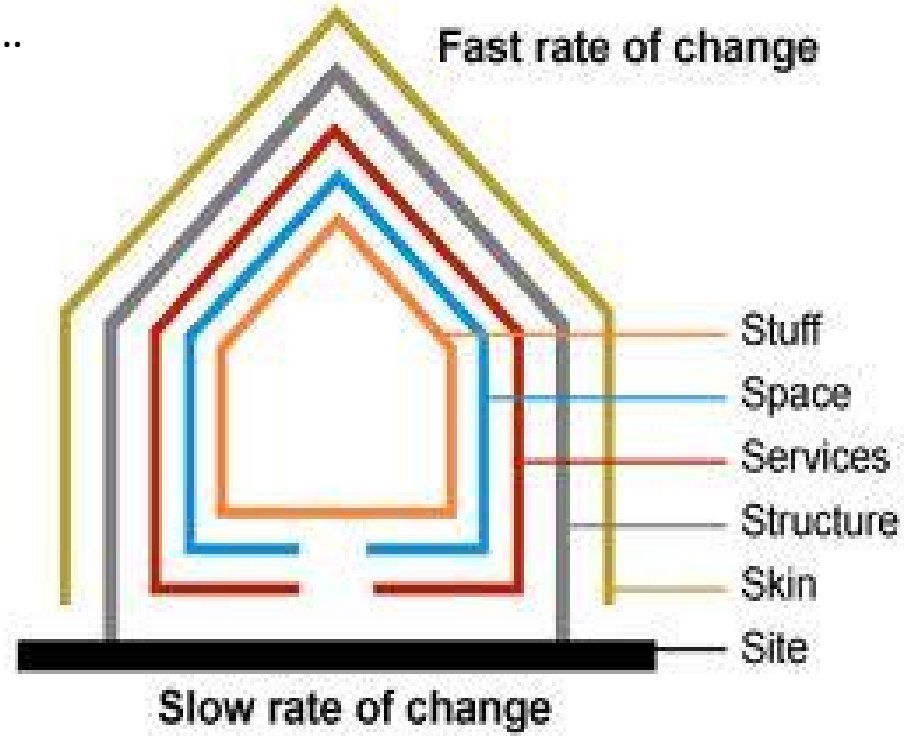


Diagram by Stewart Brand

Traditional buildings are sustainably built

Grundle House: On the Quantities of Timber in Certain East Anglian Buildings in Relation to Local Supplies ***Oliver Rackham*** *Vernacular Architecture 3, 1972*

Large c1500 house in Suffolk

330 trees, 80% oak 20% elm

40 large trees,
rest less than 50 years old

6 years' production from 50 acres of managed woodland

50 such houses per year from Suffolk woodland

- **Minimal embodied energy**
- **Re-usable timber, tiles, clay**
- **Minimum disposal issues**

Traditional construction and maintenance

Water protection
"Good hat and boots" –

Eaves, verges, jetties and reveals shed water and protect vulnerable areas

Brick or stone plinths protecting timber, cob etc

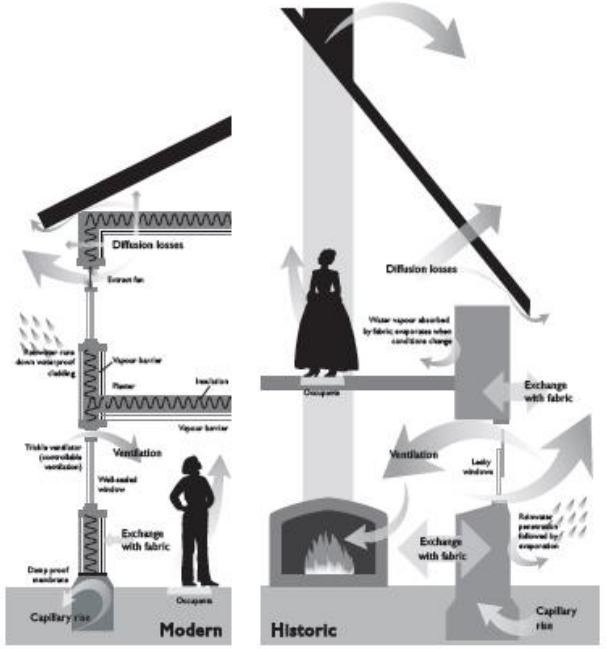
Layers of construction act as rainscreen

Moisture management
Pegged timber construction, lime mortar and lime plaster allow movement with changing humidity

Maintenance

Regular

Skills and materials sourced locally



Timber-framed construction

Peg-jointed – frame adjusts to changing heat and humidity

Traditional infill and lime / hair plaster also flexible

How things go wrong!

- Repair in incompatible materials / methods
- Lack of awareness and skills
- Loss of maintenance culture
  - the “maintenance-free” myth

Damage due to trapped moisture

Rotted timber frame and wattle and daub, due to cement render

Problems…..

Collapse due to trapped moisture

Cement pointing damage on Grade I College

long-lived material needlessly ruined by wrong repair

Cement render damage to brickwork

Planned maintenance??

- Too rarely done…….

Out of sight, out of mind??

Valley gutter left blocked….

Sustainability depends on active use

Unused upper floors.
No maintenance.

Repairs only after fallen masonry endangered the public

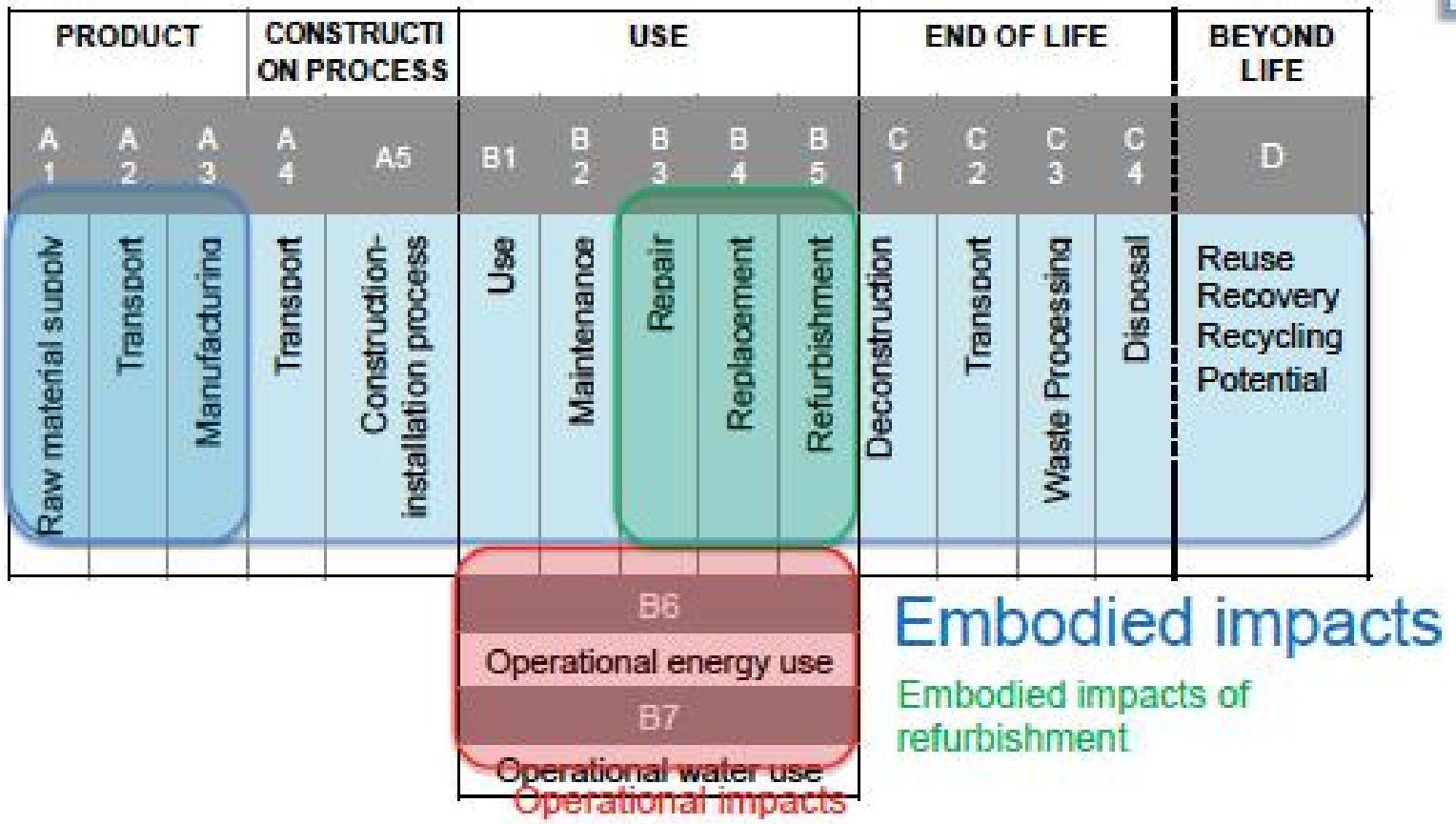
Landlord or leaseholder responsibility?

Neglect leading to failure

Repair or replacement?

The TC350 sustainability of construction works

BS EN 15978: 2011 defined the life (cycle) in multiple stages



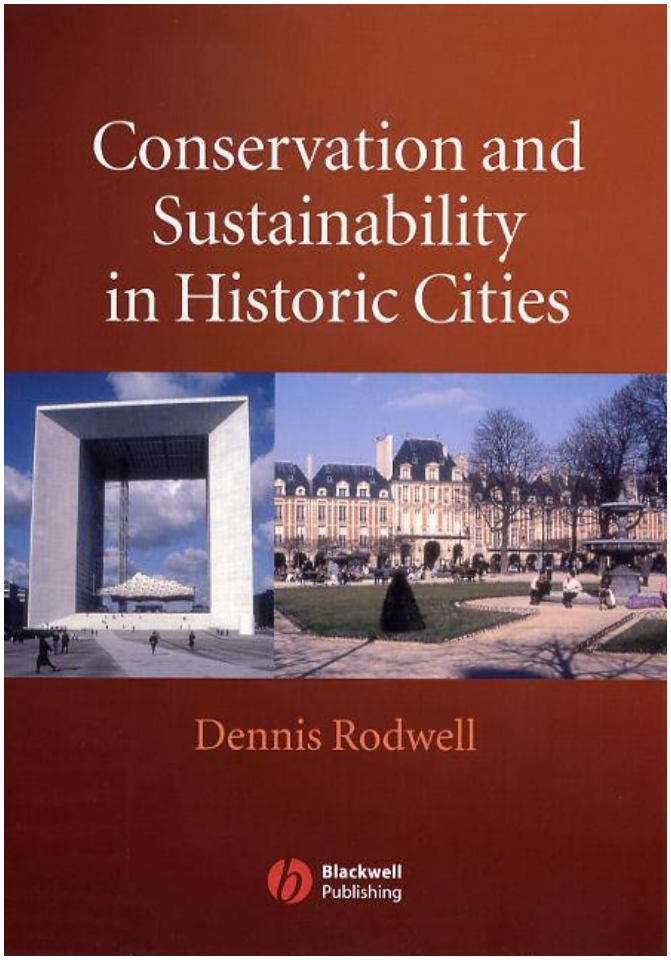
Slide by Alice Moncaster, Open University, TC350 sustainability of construction works

Cement mortar prevents re-use and creates waste

from 2006 survey cited by Dennis Rodwell:

- The UK construction industry uses 6 tonnes of building materials per head of population and creates 35 per cent of all wastes.
- 3.5 billion bricks are manufactured and 2.5 billion destroyed.

lime mortar would have enabled salvage and re-use of the bricks!!

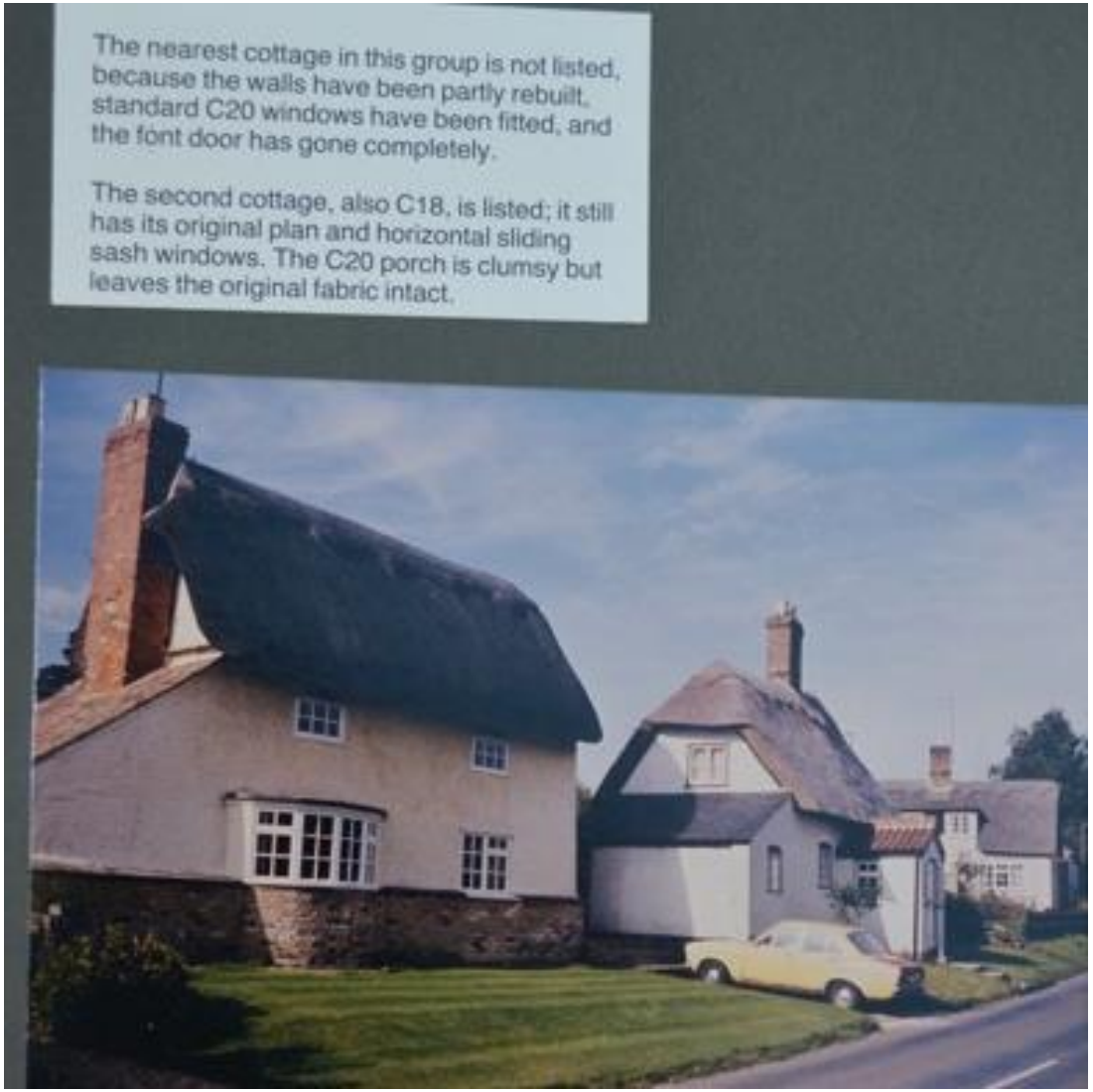


“Salvage and make-up” allows fired materials to be re-used

Replacement issues

Loss of authenticity

Too much replacement
= loss of protection



Window replacement?

Long-life originals, short life replacements

Pressure-grown softwood replacing hardwood?

Substitute materials - manufacturing / disposal issues

“timber-look” PVC-U????

Short-life material, high embodied energy, disposal / pollution issues

Guarantee 10 years

Manufacturer claims “almost maintenance-free”
“ Energy Saving Trust endorsement”

Advice & Guidance

Advice –Energy Saving Trust

Internal wall insulation:

- needs any problems with penetrating or rising damp to be fixed first.

Moisture movement and ventilation:

- In traditionally built properties with solid walls, it is recommended to use breathable (also known as vapour permeable) solid wall insulation materials as these allow continuous movement of air (vapour) and this helps reduce the possibility of moisture build up.
- If you are planning on installing non-breathable (also known as vapour impermeable) solid wall insulation materials in a traditionally built property then we recommend you ask the installer what consideration needs to be given, if anything, to avoid the build-up of moisture in your home.

Advice –Energy Saving Trust

External wall insulation:

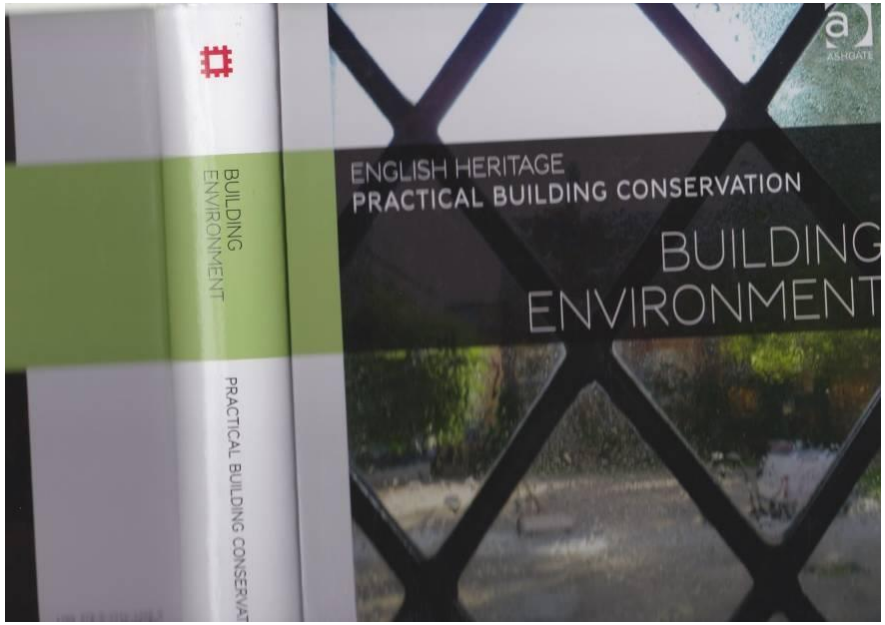
- renews the appearance of outer walls
- improves weatherproofing and sound resistance.
- fills cracks and gaps in the brickwork, which will reduce draughts
- increases the life of your walls by protecting the brickwork
- reduces condensation on internal walls and can help prevent damp (but will not solve rising or penetration damp)
- is not recommended if the outer walls are structurally unsound and cannot be repaired.

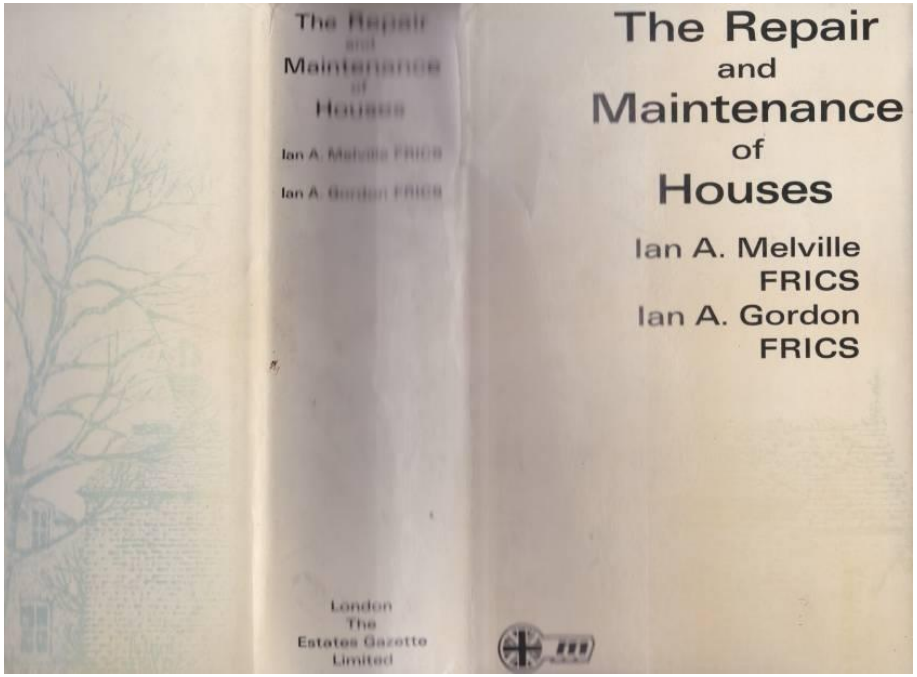
Good advice published, but……

"The Repair and Maintenance of Houses" Melville & Gordon 1973

Cement render will become cracked, allowing moisture to penetrate
Salt damage; freeze-thaw damage

..in bulky & costly books





Heritage bodies' advice

Historic England

Traditional Windows

Their Care, Repair and Upgrading

Historic England

Energy Efficiency and Historic Buildings

Draught-proofing Windows and Doors

Historic Environment Scotland guidance

Building maintenance and repair is an important part of ensuring energy efficiency in traditional buildings.

Thermal performance of traditional buildings is reduced by:

- loose or defective pointing
- poorly maintained windows
- damp masonry

Reduced thermal performance leads to heat loss and higher energy bills.

Gaps around doors or windows let heat escape and cause draughts.

Building defects can cause masonry to become wet or stop water vapour escaping from the walls. A building with damp masonry will feel colder and its walls will also perform less well – heat moves more rapidly through wet material.

Maintenance must be carried out before insulating a building. Defects and water ingress can both stop insulation from performing at its best, and further problems may occur.

https://www.historicenvironment.scot/advice-and-support/your-property/looking-after-your-property/maintenance-of-traditional-buildings/#maintenance-and-saving-energy_tab

STBA

RESPONSIBLE RETROFIT KNOWLEDGE CENTRE

MEASURES › CONCERNS & ACTIONS › REFERENCES › CASE STUDIES › ABOUT ›

Welcome to the Responsible Retrofit Knowledge Centre. It presents information to assist decision making and increase learning about the responsible retrofit of traditional buildings. It is intended as a free resource to support a movement for responsible retrofit both at an individual and at a national level.

Knowledge Centre

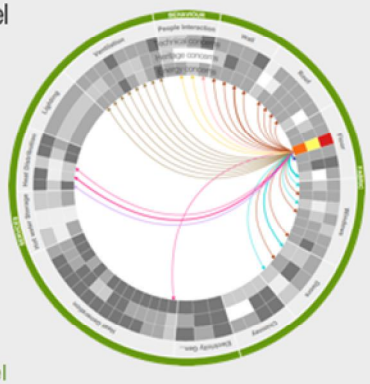
Click below to view information on retrofit measures relating to:

Walls
Roofs
Floors
Windows
Doors
Chimneys

View Services View Behaviour

Guidance Wheel

Click below to explore and use the wheel on a specific building



View Guidance Wheel

Featured Additions

FEATURED MEASURE
Frame infill insulation

Click here to view

FEATURED CONCERN
Use of sympathetic materials

Click here to view

FEATURED REFERENCE
Energy Efficiency In Historic Buildings -Secondary glazing for

Click here to view

FEATURED CASE STUDY
Wells O Wearie Cottage

Click here to view

Most Viewed

CONCERN & ACTION: Trapped/accumulated moisture

Moisture, both as a liquid and a vapour, becoming trapped and possibly accumulating within building fabric as a result of changing either fabric or ventilation conditions. For instance, where there is rising damp in a wall or high levels of moisture within a solid floor, the application of vapour closed materials or reduced whole house ventilation could result in moisture related problems (e.g. timber decay, mould growth)

SUGGESTED ACTIONS

BEFORE IMPLEMENTATION

Prior to refurbishment install moisture monitoring (e.g. through wall or other fabric element) to establish moisture profile of structure and cause of any existing problems. Check fabric for any water leaks. Ensure any existing dampness is resolved before proceeding with measure. Define specific site Exposure conditions for different orientations. Understand the properties of existing materials properties in relation to moisture (vapour permeability, hygroscopicity and capillarity).

DURING IMPLEMENTATION

Ensure the technical properties of any proposed new materials particularly in relation to moisture (vapour permeability, hygroscopicity and capillarity) and behaviour of these in relation to existing fabric are clearly understood. Choose appropriately breathable insulating materials. Develop robust details that avoid trapping moisture in instances of failure e.g. broken gutter, overflowing bath.

AFTER IMPLEMENTATION

Monitore moisture at vulnerable locations and report findings

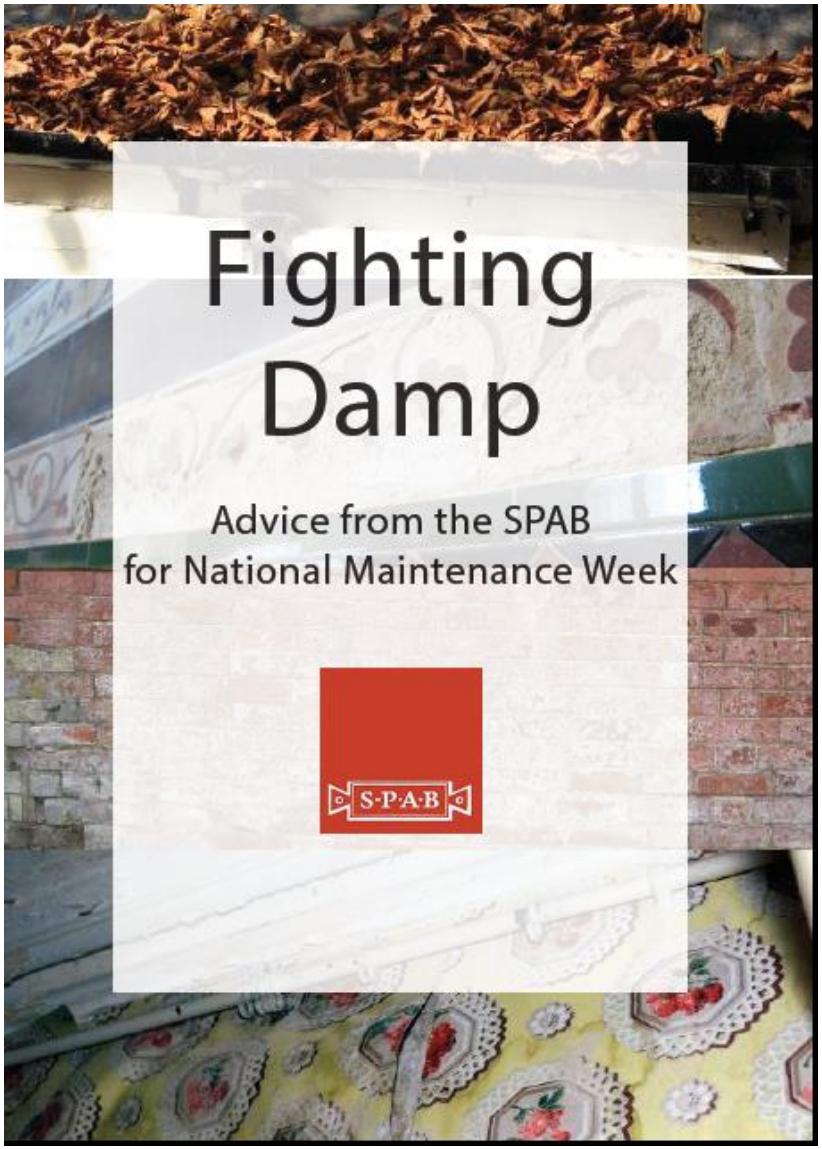
RELATED REFERENCES (9)

Tech Paper 6 - Indoor Air Quality and Energy Efficiency in Traditional Buildings (2009)
Halliday, S., (Gaia Research)
Solid Wall Insulation in Scotland: Exploring barriers, solutions and new approaches (2012)
Changeworks
Warmer Bath: A guide to improving the energy efficiency of traditional homes in the city of Bath (2011)
Bath Preservation Trust & Centre for Sustainable Energy
The Performance of Traditional Buildings: the SPAB Building Performance Survey 2013 (2013)
Rye, C, Scott C & Hubbard, D.
Energy Efficiency And Historic Buildings - Application of Part L of the Building Regulations to historic and traditionally constructed buildings (2011)
English Heritage
Improving Energy Efficiency in Traditional Buildings
Historic Scotland
Breathability: The Key to Building Performance (2005)
May, N.
Guidelines to avoid mould growth in buildings, Advanced Buildings Energy Research, 3, pp. 221-236. (2009)
Altamirano-Medina H., Mumovic D., Davies M., Ridley I. and Oreszczyn T.
Guide to building services for historic buildings -Sustainable services for traditional buildings (2002)
CIBSE

Third sector or self-help???

Å SPAB advice line

Å periodproperty.co.uk



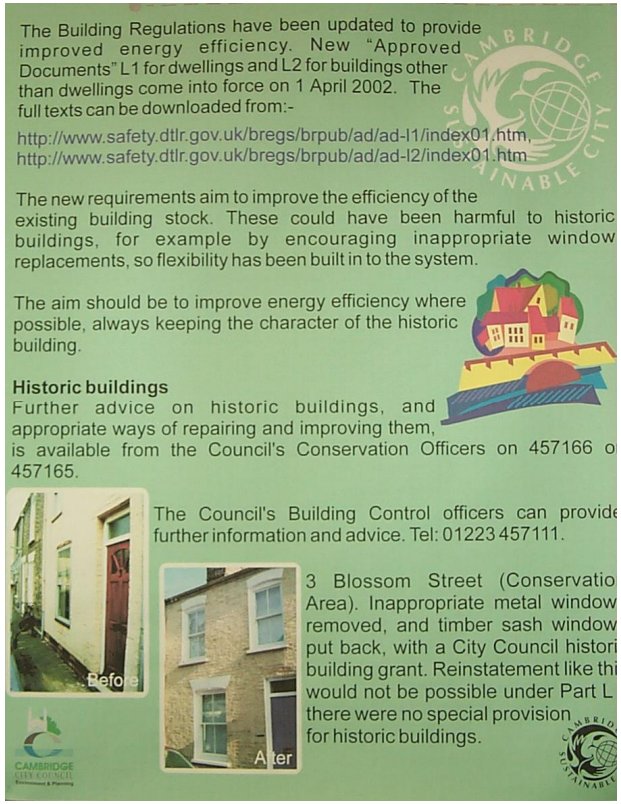
Conservation officers

- **Used to offer free advice to owners**
- **Some had resources for outreach**
- **Cited as contacts in Part L and Green Deal Code of Practice**
- **Linkages and scope diminished by outsourcing of Building Control etc**
- **Loss of knowledge and skills due to cuts**

NOW AN ENDANGERED SPECIES!

Panel from 1980s exhibition on Materials

Part L poster, 2002

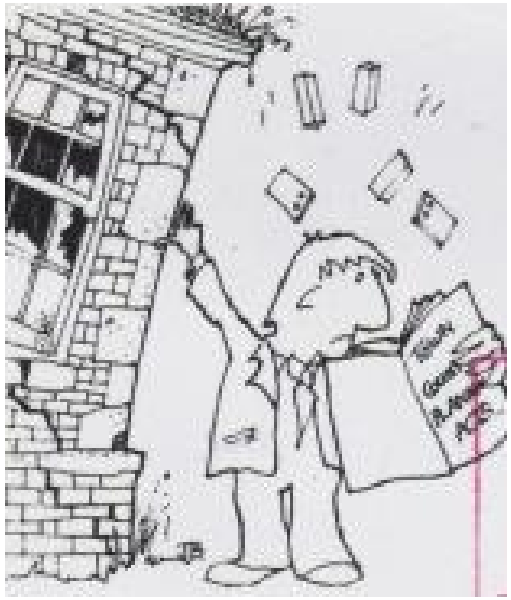


Conservation officers under the axe

e.g. Cornwall (new Unitary + “Each Home Counts” pilot)

12,664 listed buildings and 145 Conservation Areas

- March 2009 11.4 conservation officer posts
- Dec 2010 8.4
- June 2011 7.4
- June 2012 5.4
- June 2014 4 (new) posts, only 2 appointed
- August 2015 2, + 2 graduates
- June 2017 4.6



Figures tell only half the story –

decades of local knowledge and expertise lost!

Caring for your home

A stitch in time…

– *Makes good sense and saves money*

http://ihbconline.co.uk/caring/

It pays to look after your home. The value of the property reflects its state of repair and increases with its surviving character. Your enjoyment of the fabric is assured by regular maintenance and, in keeping a record of its care, you remain one step ahead. This guide takes the homeowner through the basic steps necessary to care for their home

IHBC

© 2016 IHBC Published by The Institute of Historic Building Conservation www.ihbc.org.uk (http://www.ihbc.org.uk)

No maintenance and repair, no sustainability!

“One day, son, all of this will be yours!”

© Louis Hellman 2016

from ”Caring for your home”, IHBC

A stitch in time……..

- Maintain “stave off decay by daily care”
- Repair
- Advice and guidance

Building maintenance and repair is an important part of ensuring energy efficiency in traditional buildings.

Å Know your home

Å Regular inspections

Å Professionals and craftsmen

Å Building elements

© Louis Hellman 2016

Elements to be inspected

Roof coverings

Rainwater disposal system

Walls

External joinery and ironwork

Ceilings and floors

Internal joinery

Central heating & hot water supply

Electrical installations

Sanitary facilities

Fire precautions

External areas

DO's	DON'Ts
Regular inspection & maintenance	Allow serious defects to remain
Get advice from suitably qualified professionals	Expect independent advice from someone who has something to sell you
Repair rather than restore or replace	Attempt to 'improve' by altering the appearance
Use only traditional materials and techniques	Rely on commercially-based claims for products or techniques, or use so-called "maintenance-free" products
Re-use material from the building	Waste re-usable materials
Remedy bad repairs	Bodge repairs
Adopt correct priorities for repairs	Replace windows or doors in non-original patterns or materials
Use reliable contractors / craftspeople	Employ anyone without references

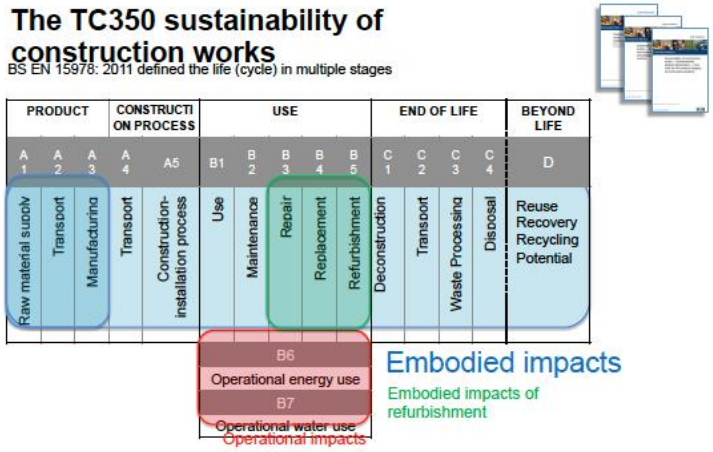
Changing Culture & Opportunities?

Å Repair cafes

Å VAT (cf Sweden)?

Å Brexit opportunities

Å Brexit risks



Thank you

John Preston

Artist - Historic Environment Consultant - Lecturer

jpreston@phonecoop.coop