

# Energy Efficiency and Historic Buildings - *Historic Buildings are Different!*

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# ***Difference – ‘Historic’ & ‘Traditional’ Buildings***

**Similar design~**

**Similar  
Construction ~**

**Similar  
performance**

**Requires Similar  
Repairs**

**Same  
understanding!**

**Both have  
Significance – at  
different levels**

**Un-designated –  
no protection**



**Common 19<sup>th</sup> Century  
Terraced House**

**Grade 1 Listed – has  
special protection**



**Castell Coch –  
19<sup>th</sup> Century Castle**

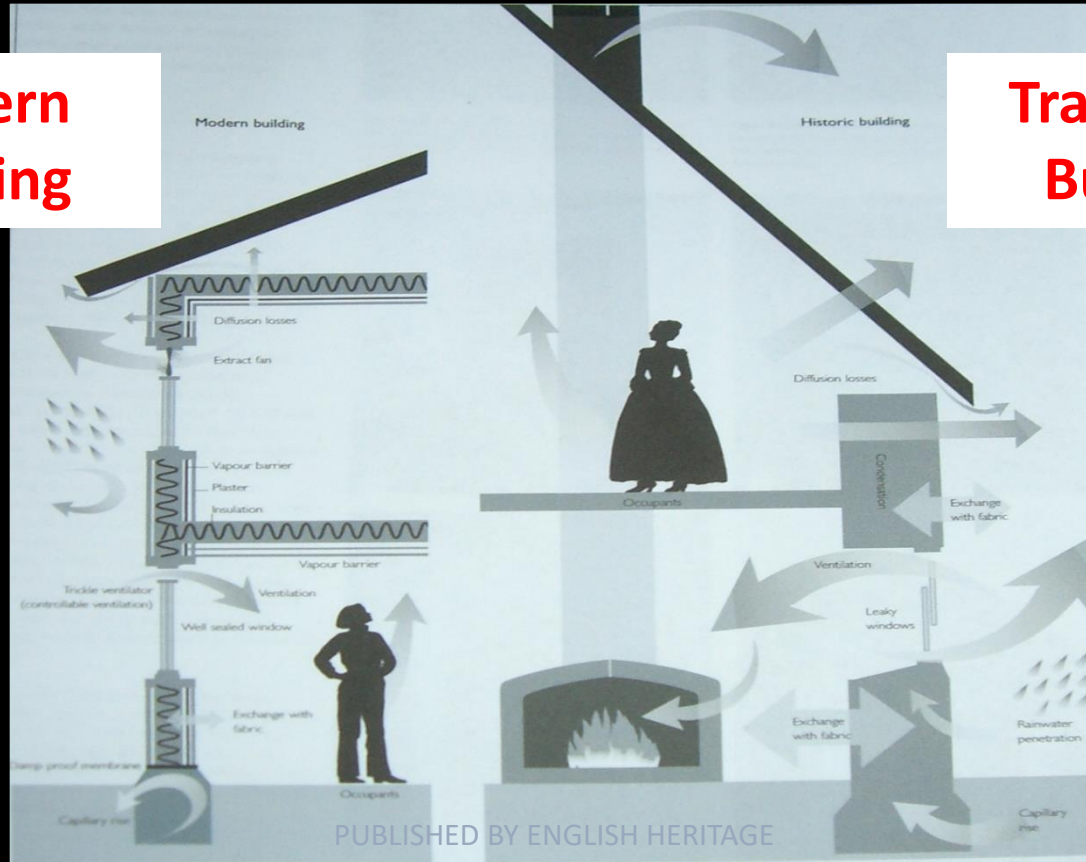
***All traditional / older buildings some ‘significance’***

# Difference – ‘Modern’ & ‘Traditional’ Buildings

*The basic understanding – we all need to have...*

**Modern  
Building**

**Traditional  
Building**



**These buildings are different - They perform differently**

**They have to be treated differently**

# *The need to 'sustain' older buildings..*

## **Principles & Facts – taking an holistic approach**

1. How many of today's buildings will be with us in 2050? 80-90%
2. First objective - retain the performance of existing fabric
3. 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
4. They should provide occupancy in an efficient manner, involving minimal production of carbon and use of energy without harming significance or the physical performance of the historic fabric.
5. Elements such as walls can be over a third less energy efficient if damp
6. Some energy efficient measures can have an adverse effect on sustainability
7. The actual energy efficiency of historic buildings and their potential energy efficiency with the addition of energy efficient measures should be taken in account at the outset

# ***Difference – ‘Modern’ & ‘Traditional’ Buildings***

**The need to understand technical issues**



**The need to understand  
‘significance’ – heritage values**

***Older buildings – require greater understanding!***

# Technical / Thermal Performance

## Solid Walls - Comparing 'Real' with 'Calculated' Methods

Solid wall (homogenous)



Wall build up

**46.3% better**

Lime Plaster	15
Granite	400
Cement render	13
Lime roughcast render	25
Overall	453mm

*Insitu U-value* **1.75** W/m<sup>2</sup>K

Build Desk U-value **2.56** W/m<sup>2</sup>K

Courtesy Caroline Rye / SPAB

# Technical / Thermal Performance

## Solid Walls - Comparing 'Real' with 'Calculated' Methods

Walls with Cavities – Limestone & Plasterboard



Wall build up

Gypsum skim	3
Plasterboard	13
Cavity	10
Limestone (ashlar)	170
Overall	196mm

**95.9% better**

Insitu U-value 0.96 – **0.97** W/m<sup>2</sup>K

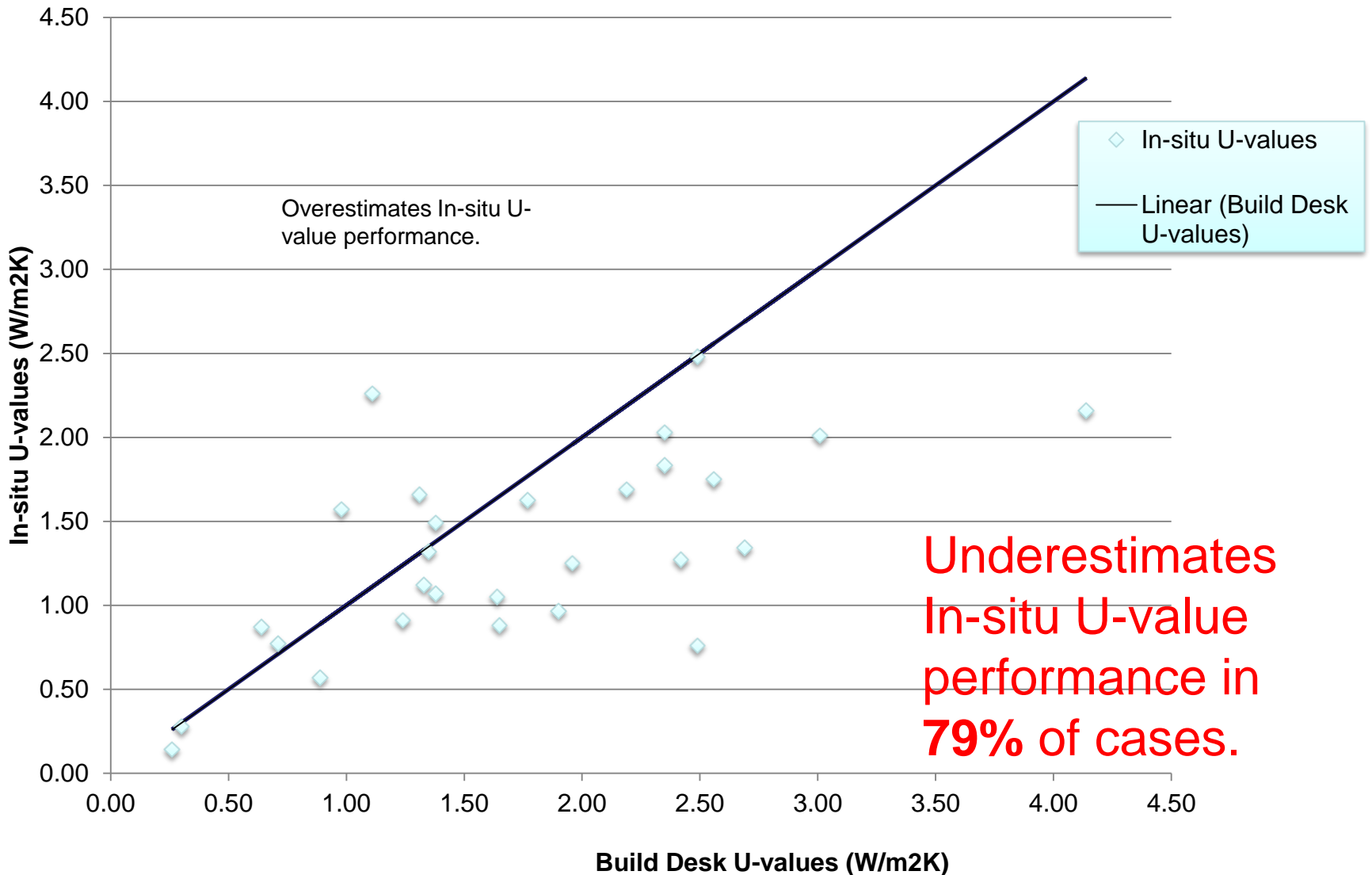
Build Desk U-value **1.90** W/m<sup>2</sup>K

(Without Dry Lining = 2.0 W/m<sup>2</sup>K)

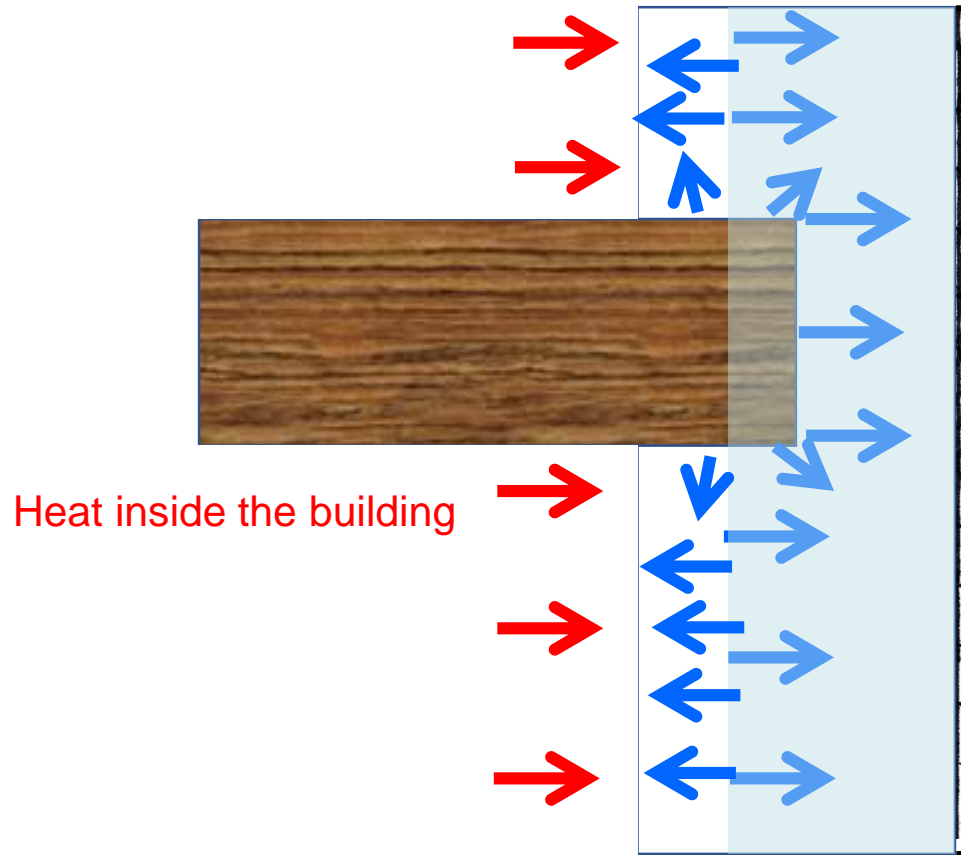
Courtesy Caroline Rye / SPAB

# Technical / Thermal Performance

## BuildDesk/In-situ U-value Comparison



# Technical / Thermal Performance



This puts timber joist ends at risk of rot.

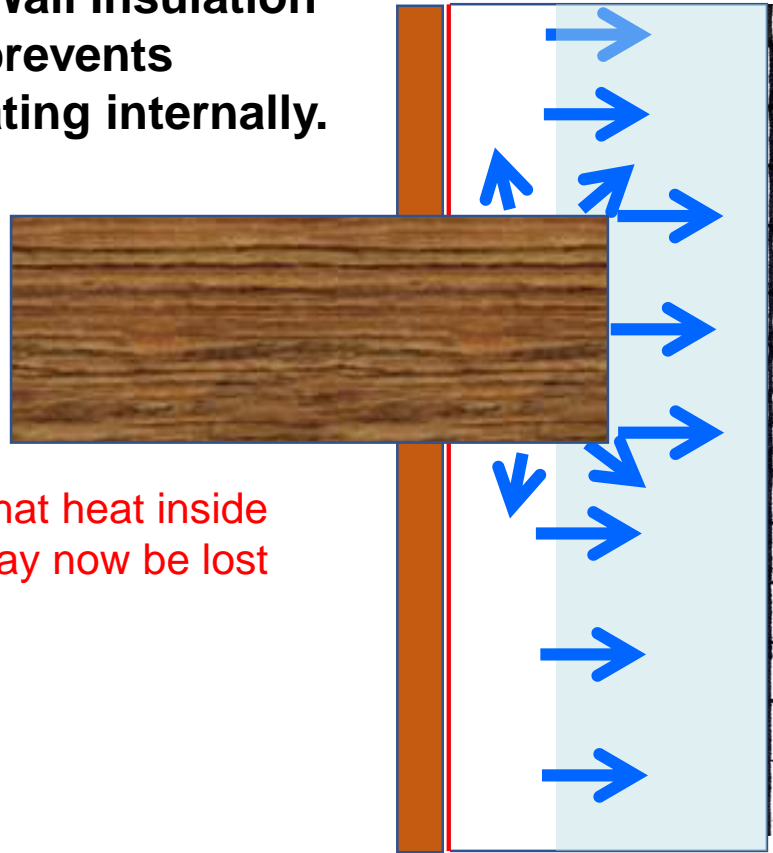
What if impervious materials such as **cement** is used on the external face – preventing moisture from evaporating?

Some additional Moisture may evaporate from the internal surface of the wall

*Understanding the basics - moisture*

# Technical / Thermal Performance

**Impermeable Internal Wall Insulation with moisture barrier prevents moisture from evaporating internally.**



Note the benefit from that heat inside the building may now be lost

Moisture penetrates from rainfall but also evaporates through lime mortar joints

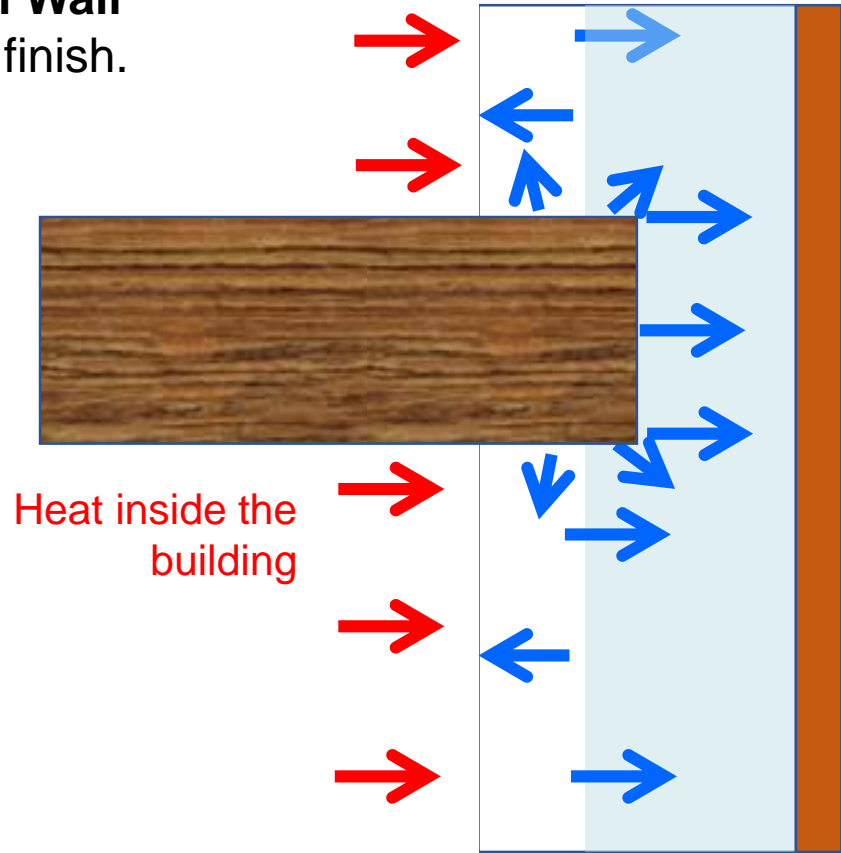
This puts timber joist ends at risk of rot.

Opportunity for some of the moisture to evaporate from the internal surface of the wall is lost due to IWI

***Understanding the basics - moisture***

# Technical / Thermal Performance

**Impermeable External Wall  
Insulation** with render finish.



Moisture (rising damp, penetrating damp, interstitial condensation) within structure will be trapped.

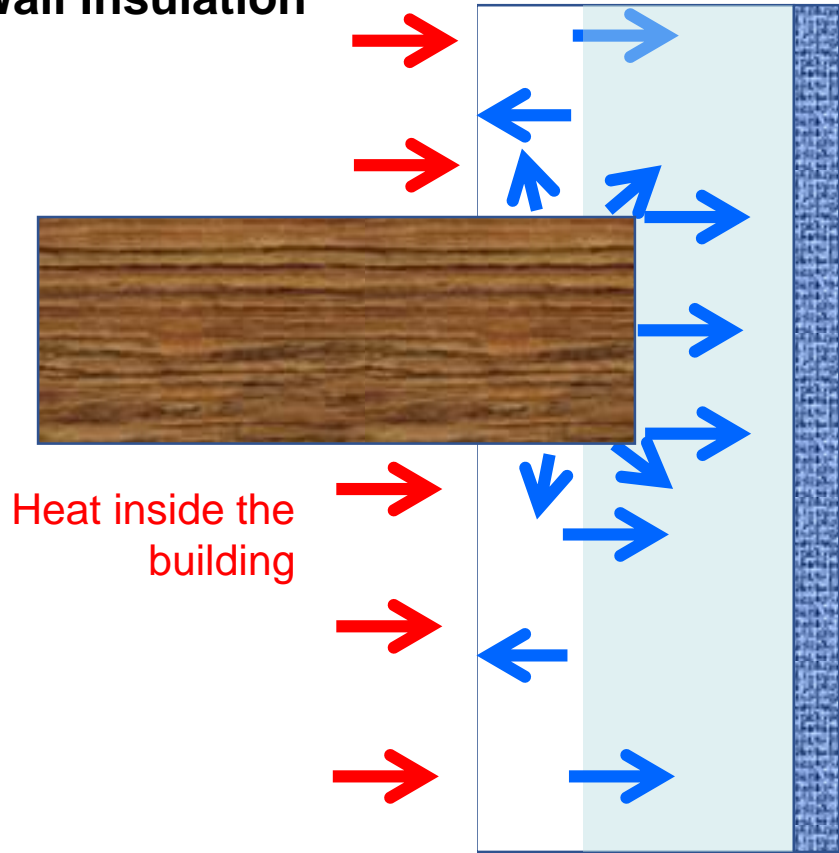
This puts timber joist ends at risk of rot.

Some additional Moisture may evaporate from the internal surface of the wall

*Understanding the basics - moisture*

# Technical / Thermal Performance

## Permeable External Wall Insulation with render finish.



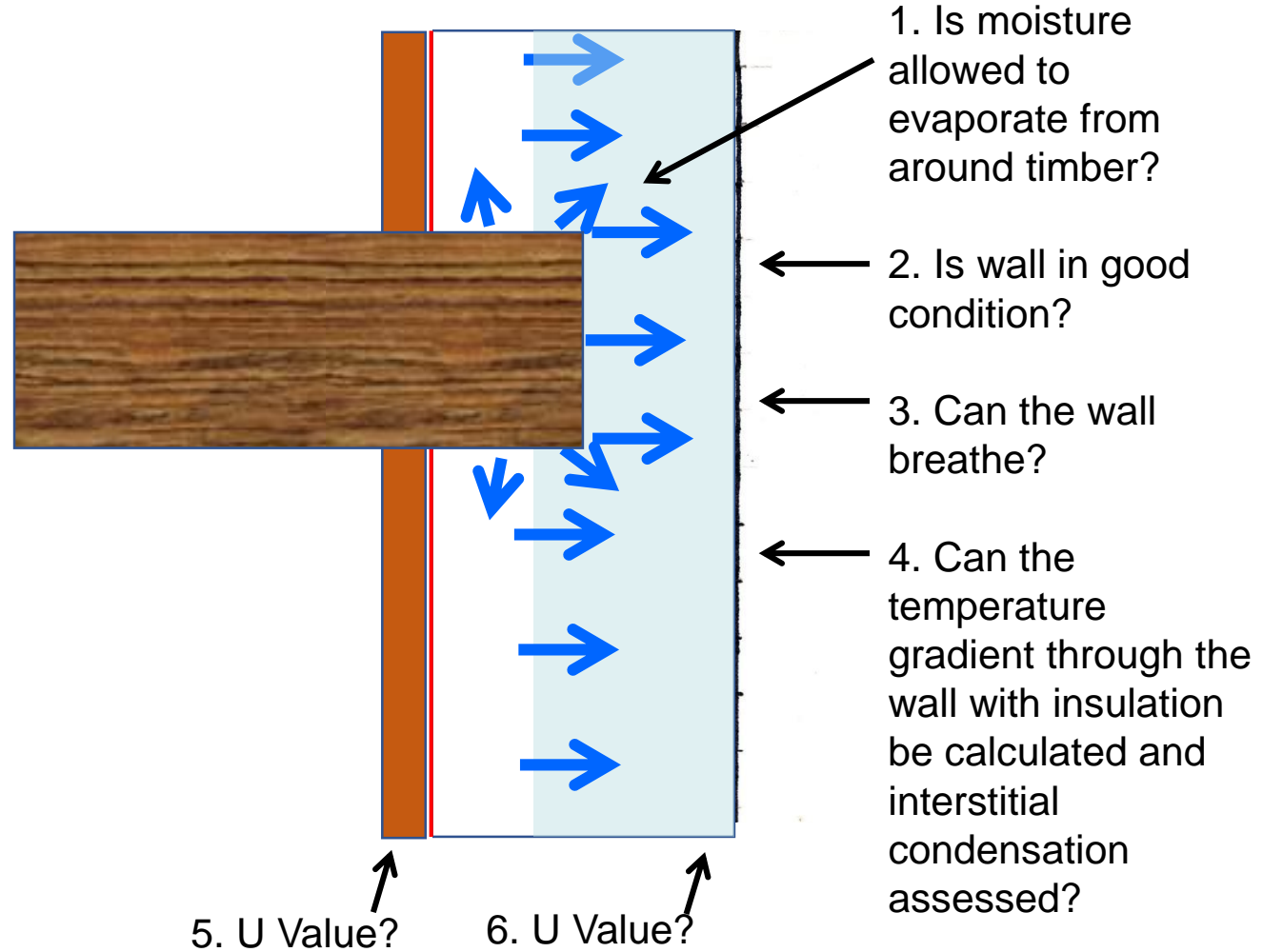
Moisture (different sources of moisture inc interstitial condensation) within structure will have some capacity to evaporate – but the render has to be vapour permeable.

Some additional Moisture may still evaporate from the internal surface of the wall

*Understanding the basics - moisture*

# Technical / Thermal Performance

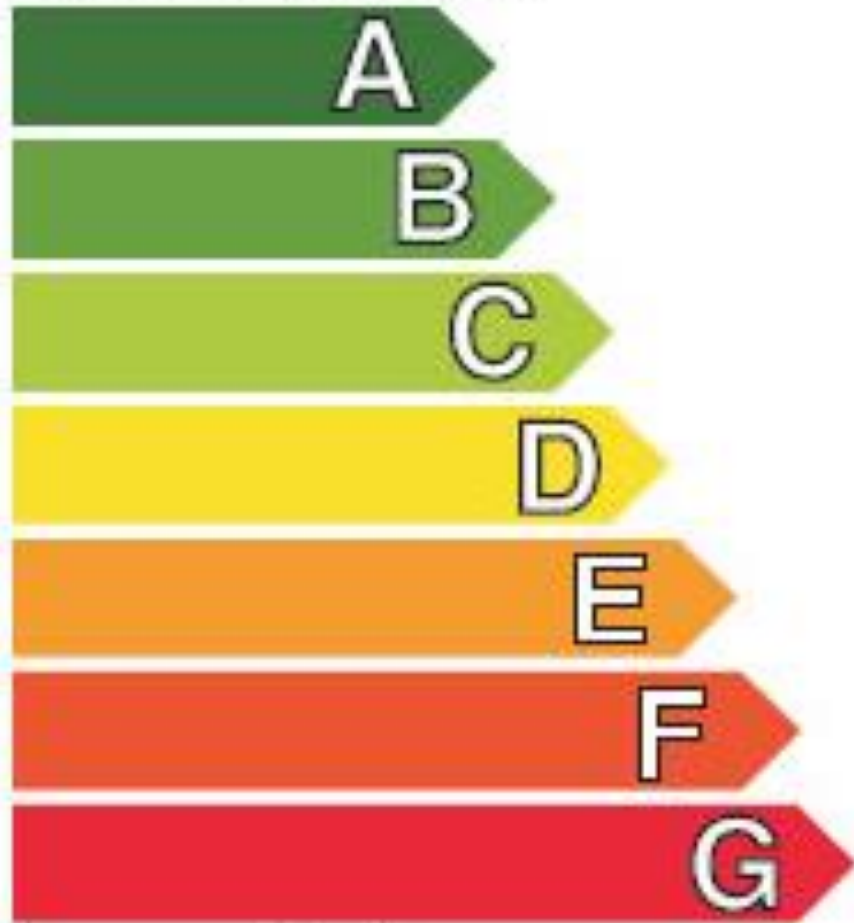
## Design issues



***Understanding the basics - moisture***

# Be holistic – can't just rely on this...

More efficient



Less efficient

# Being holistic means lots of things...

**Being holistic – following this guidance**



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BUILDING · CONSERVATION

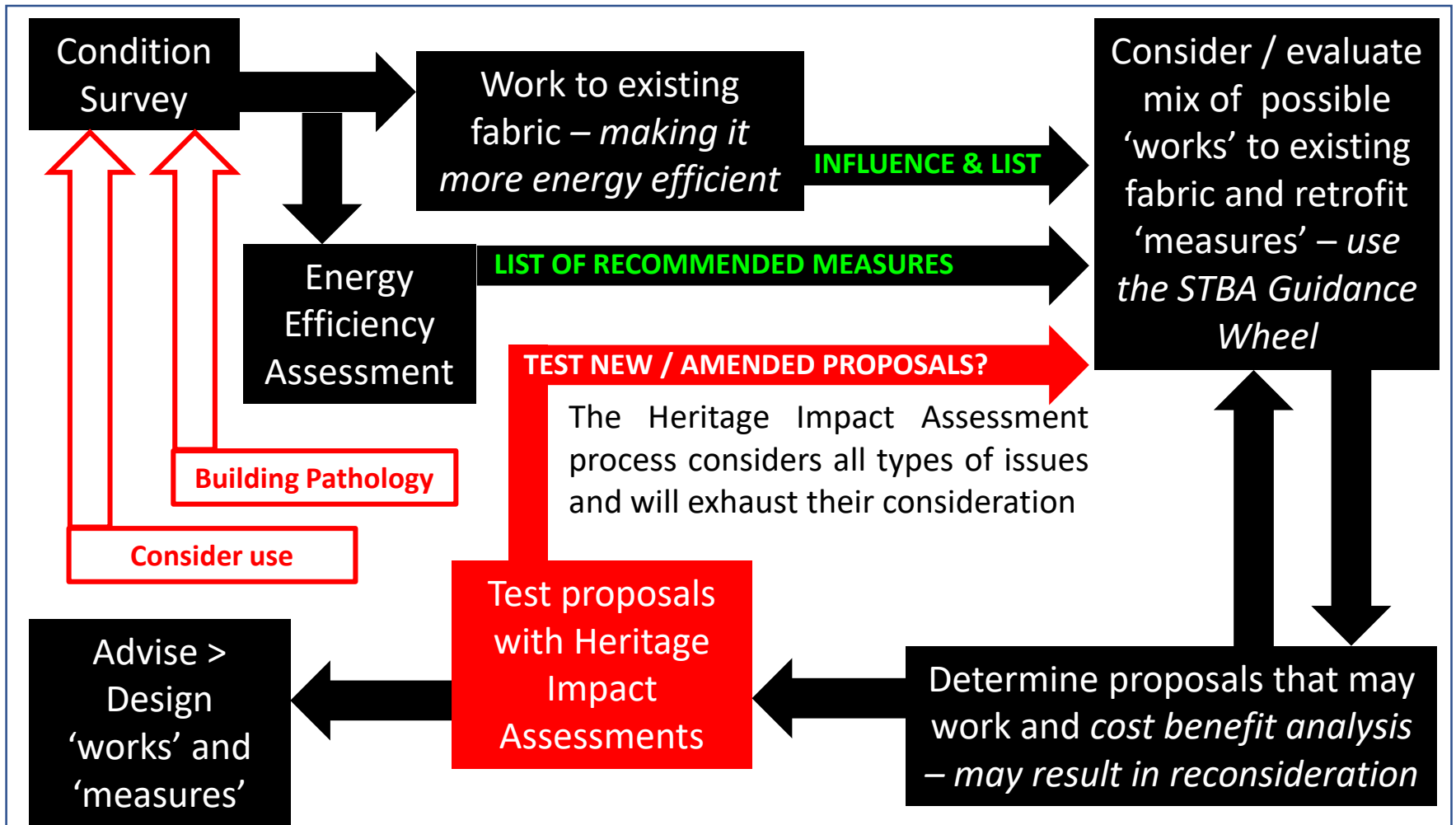


# **IHBC GUIDANCE NOTES**

## **Retrofitting of Traditional Buildings**

This is one of a series of occasional Guides  
The Institute of Historic Building Conservation  
offer current and practical advice on  
promoting the conservation of historic buildings

# Process - IHBC Retrofit Guidance up to Advice



The holistic retrofit process following BS 7913: 2013 up to the advice and design stage: Dealing with existing fabric first. © Edwards Hart Ltd. For further information go to: [environmentstudycentre.org](http://environmentstudycentre.org)



# Condition Surveys first part of the process

## Some of the essentials:

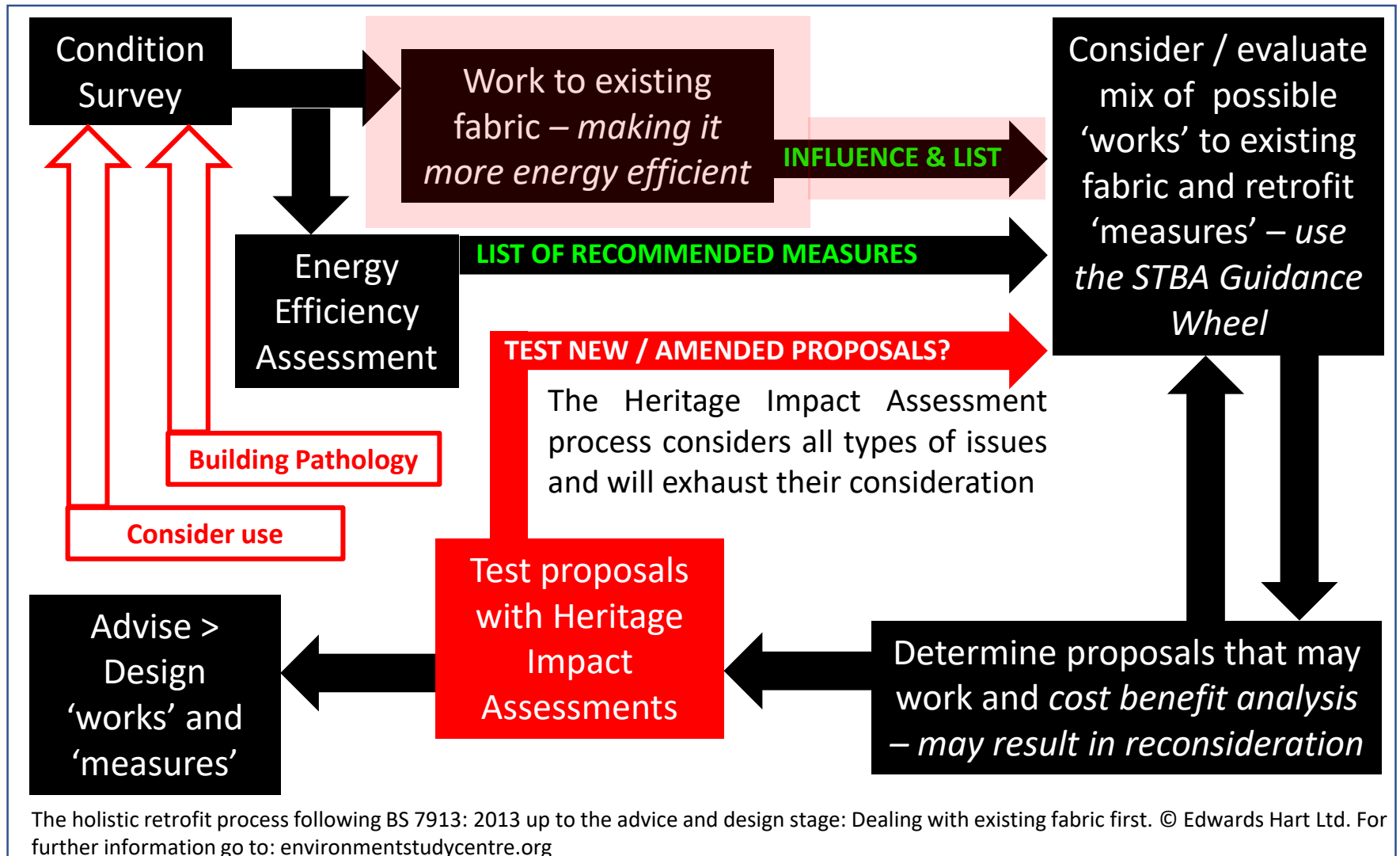
- Carried out by **competent persons** – understands significance
- Consistent & logical
- TSI's
- Location and orientation
- Ascertain the cause of problems... Building pathology
- Dampness – causes & solutions
- Use of the building/ environment

# Condition Surveys first part of the process

## Quality of outcome:

- **the type of building survey:** the choice between a purely visual inspection or a building pathological analysis (RICS Level 3!)
- **the competence of the surveyor:** professionally qualified surveyor or not - conservation accredited /certified or not
- **the equipment used:** this can range from a simple electric moisture meter to a range of surveying equipment that can test the strength of materials, analyse the source of moisture and record true moisture levels and environmental conditions.

# Process - IHBC Retrofit Guidance up to Advice



**Conclusions and recommendations from the condition survey...**

# Condition Surveys > Recommended Work...

## Examples

Both these examples relate to moisture



Lead capping required to ledge



Lime mortar repointing required

**High moisture = energy loss**



# Energy Efficiency Assessment > Measures

## Example


### Energy Performance Certificate

3, David Street, Cwmdare, ABERDARE, CF44 8UE

Dwelling type: Mid-terrace house      Reference number: 8684-7022-0470-8046-9922  
 Date of assessment: 26 February 2014      Type of assessment: RdSAP, existing dwelling  
 Date of certificate: 03 March 2014      Total floor area: 55 m<sup>2</sup>

**Use this document to:**


- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures



**Estimated energy costs of dwelling for 3 years:** £ 5,454

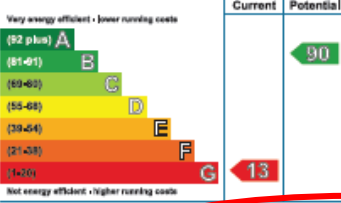
**Over 3 years you could save** £ 4,299

**Estimated energy costs of this home**

	Current costs	Potential costs	Potential future savings
Lighting	£ 213 over 3 years	£ 105 over 3 years	
Heating	£ 3,906 over 3 years	£ 735 over 3 years	
Hot Water	£ 1,335 over 3 years	£ 315 over 3 years	
<b>Totals</b>	<b>£ 5,454</b>	<b>£ 1,155</b>	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

**Energy Efficiency Rating**



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

**Top actions you can take to save money and make your home more efficient**

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£ 1,002	✔
2 Internal or external wall insulation	£4,000 - £14,000	£ 980	✔
3 Floor insulation	£800 - £1,200	£ 186	✔

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit [www.direct.gov.uk/savingenergy](http://www.direct.gov.uk/savingenergy) or call 0300 123 1234 (standard national rate). The Green Deal may allow you to make your home warmer and cheaper to run at no up-front cost.

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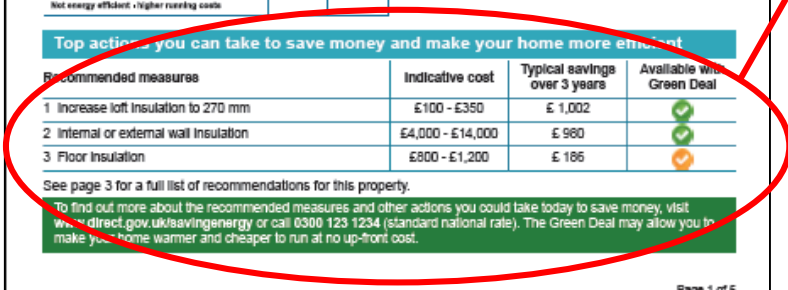
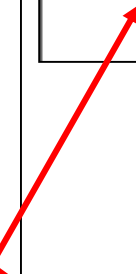
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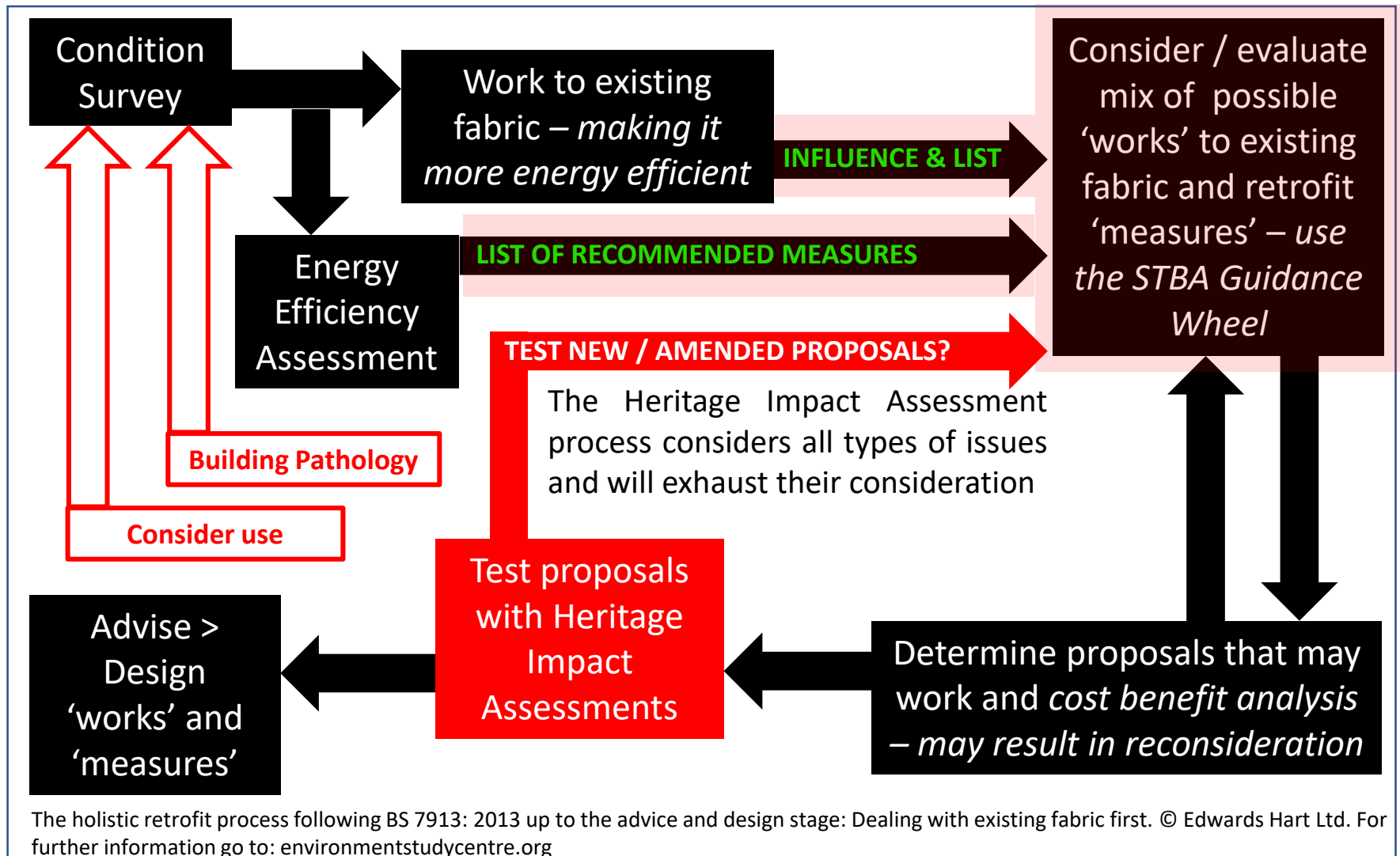
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# Process - IHBC Retrofit Guidance up to Advice

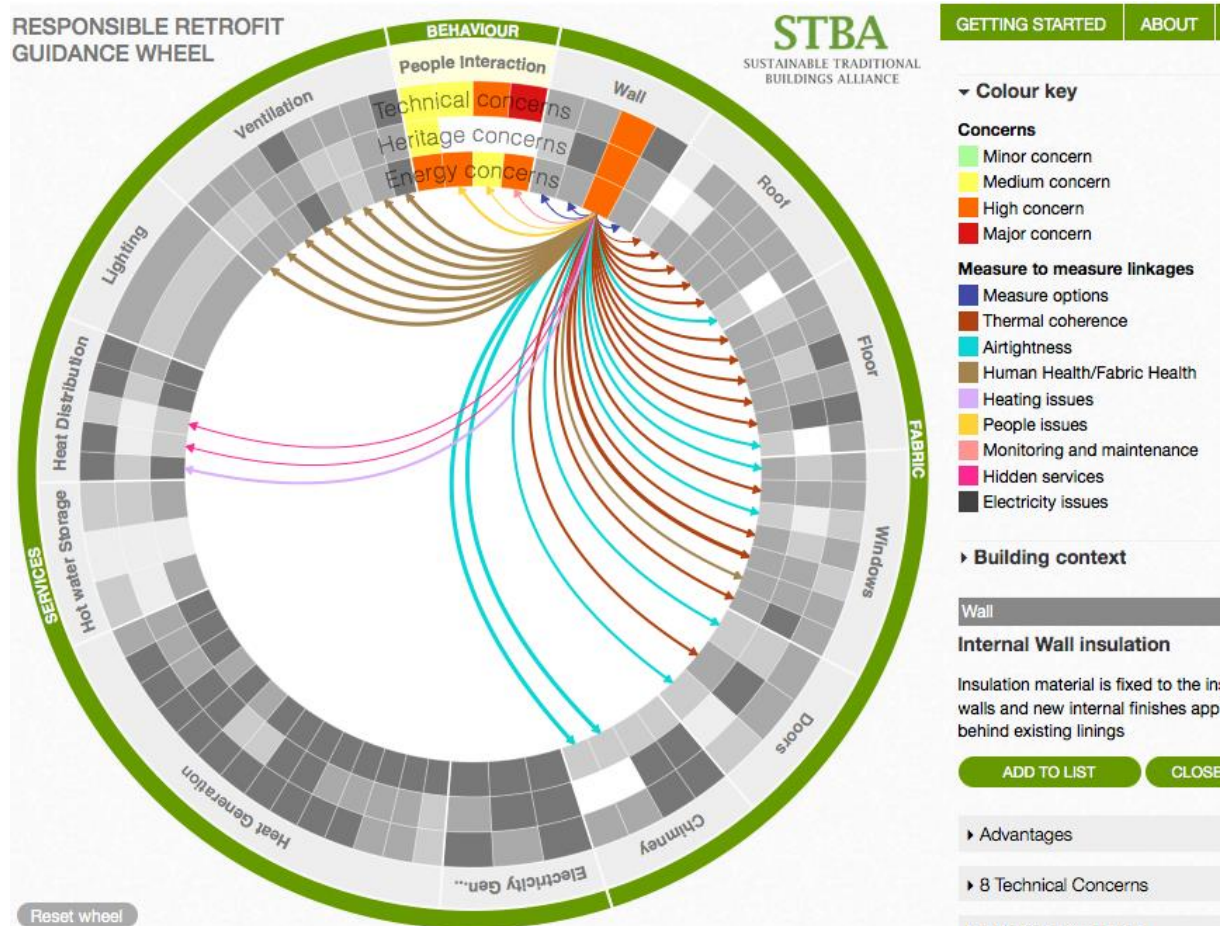


The holistic retrofit process following BS 7913: 2013 up to the advice and design stage: Dealing with existing fabric first. © Edwards Hart Ltd. For further information go to: [environmentstudycentre.org](http://environmentstudycentre.org)

**Consider & EVALUATE a mix of 'WORKS' and 'MEASURES'**

# Evaluate mix of 'measures' & 'works'

This will help, but its just retrofit – work to existing fabric and use also needs to be in the mix



Consider & EVALUATE a mix of 'WORKS' and 'MEASURES'



# Cost /Benefit Analysis – Works/ Measures

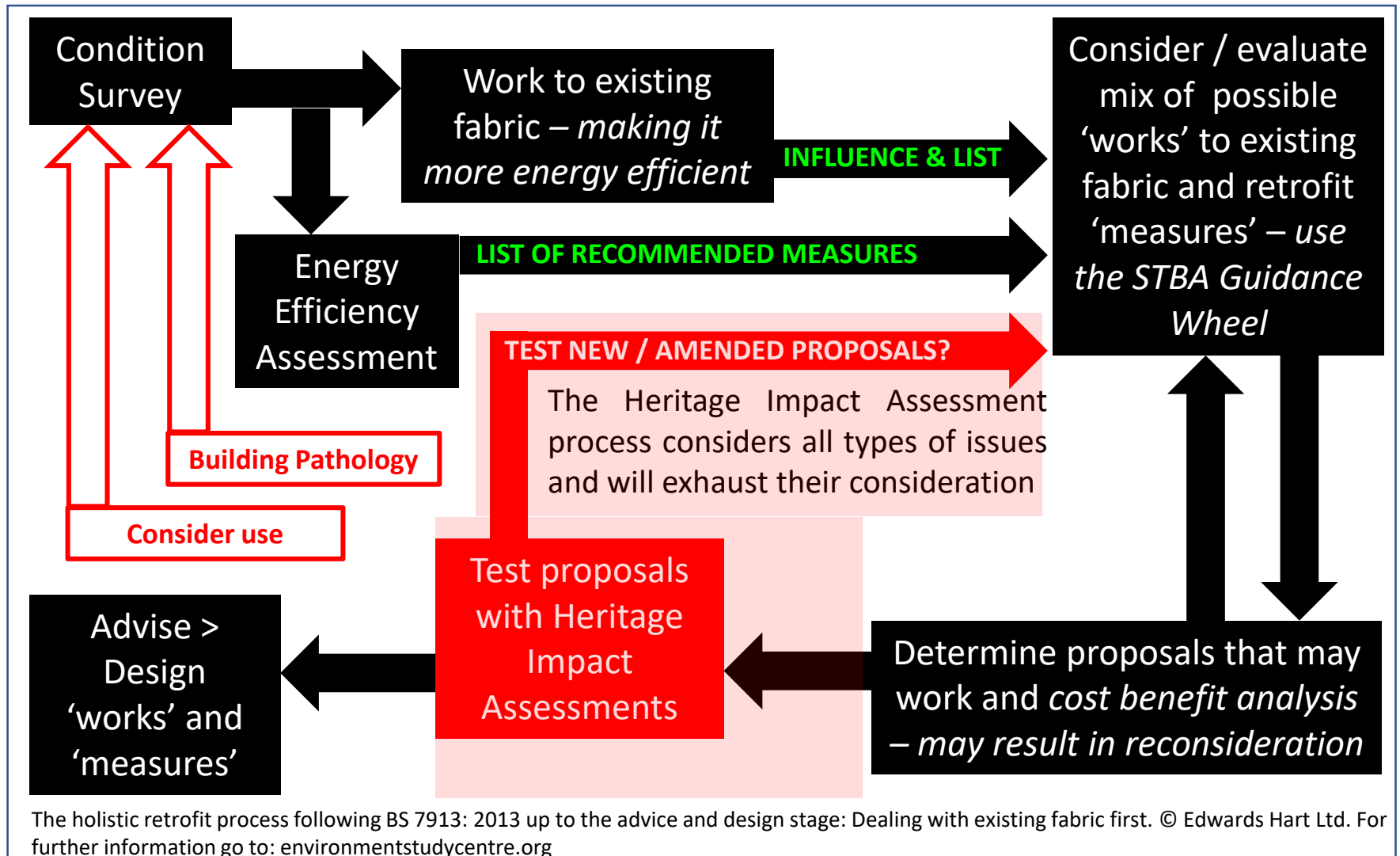
## Example

Measure	Lowest cost	Highest cost	Estimated savings	Payback on lowest cost	Payback on highest cost
IWI/ EWI	£4,000	£14,000	£240	16.7 years	58.3 years
Draught proofing	£80	£120	£43	1.9 years	2.8 years
Double glazing	£3,300	£6,500	£103	32 years	63.1 years

## Essential:

- **Performance**
- **Cost**
- **Lifespan**
- **Payback**
- **Estimated savings!**

# Process - IHBC Retrofit Guidance up to Advice



The holistic retrofit process following BS 7913: 2013 up to the advice and design stage: Dealing with existing fabric first. © Edwards Hart Ltd. For further information go to: [environmentstudycentre.org](http://environmentstudycentre.org)

**Test proposals with a (Heritage) Impact Assessment**

# Test Proposals - HIA

## Example

High moisture levels @ string course



High moisture = energy loss

## Proposal

**Lead to ledges –  
discharging  
rainwater away from  
the face**

# Test Proposals - HIA

*Requires 'significance' to be assessed first...*

**Heritage values assessed into groups:** BS 7913: 2013: Section 4.2

- a) **aesthetic value** - ways in which people draw sensory and intellectual stimulation from a place;
- b) **communal value**, - the meanings of a place for people who relate to it in different ways, associations with social groups and individuals;
- c) **evidential value** - potential of a place to yield evidence about the past (e.g. archaeology); and
- d) **historical value** - ability of a place to demonstrate or illustrate an aspect of the past or association with historic figure or event.

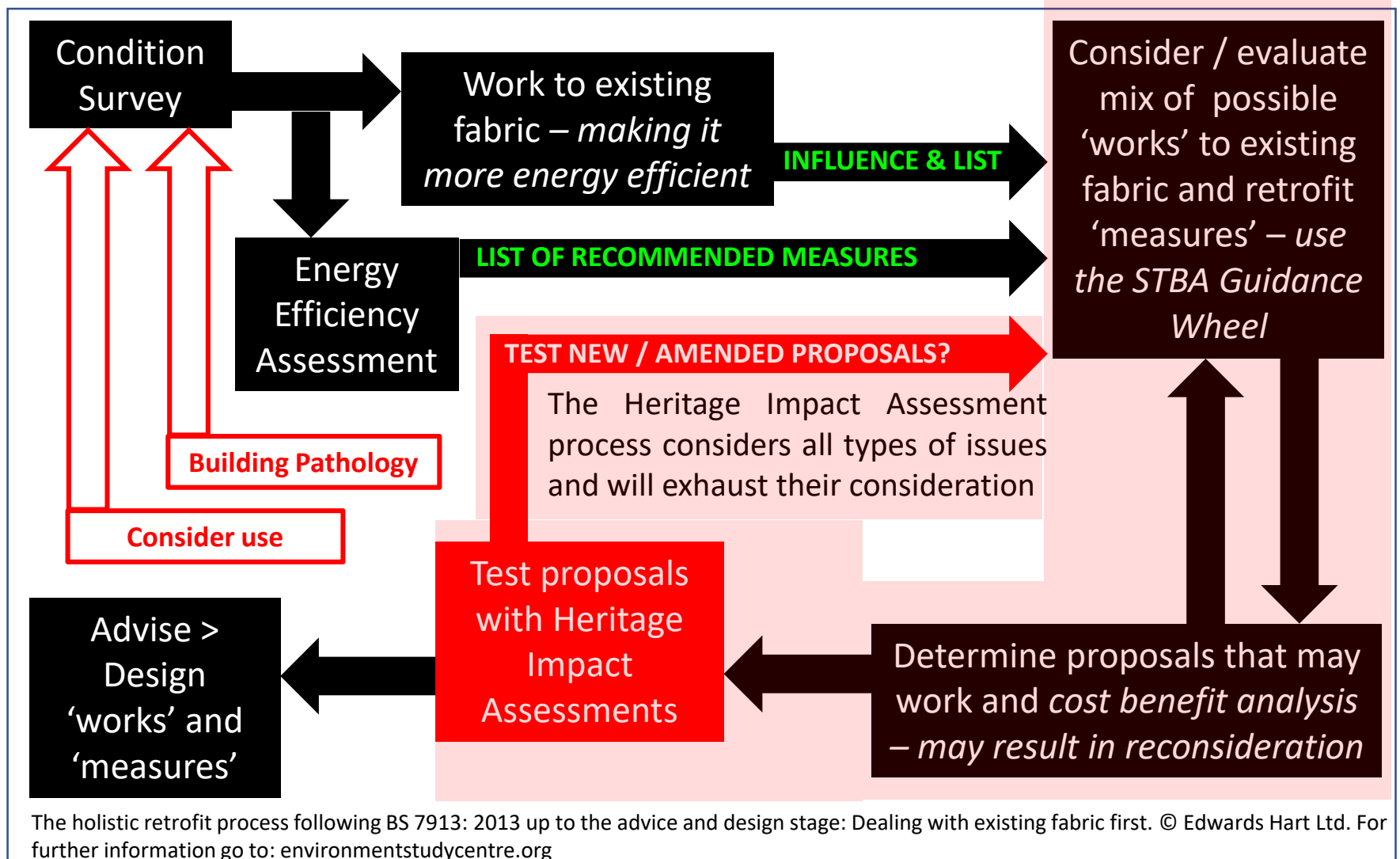
*Requires the right type of 'competence' – 'properly' & 'consistently'*

# Test Proposals - HIA

## HIA's for Improvements

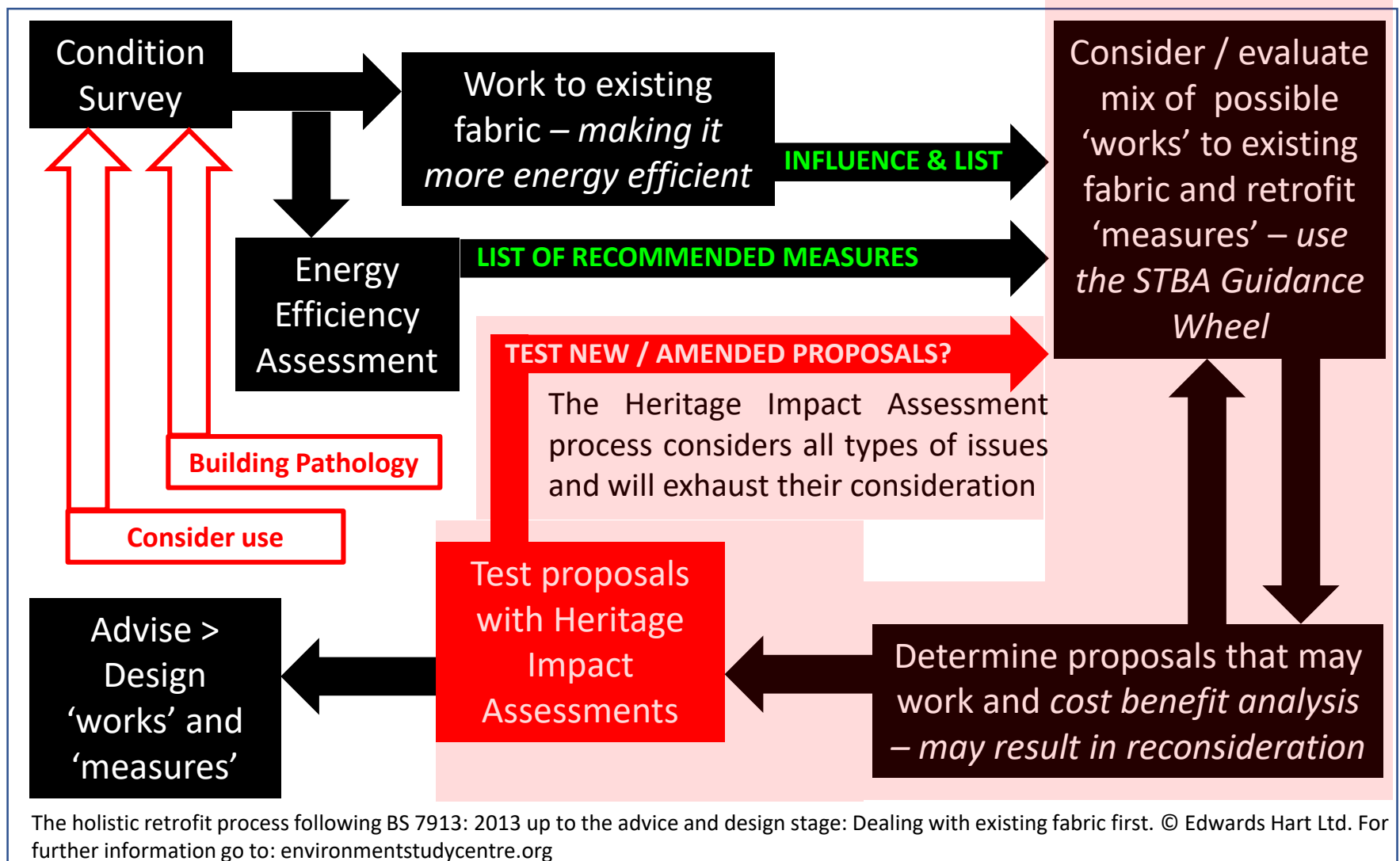
Ref	Proposal & Location	Reason for proposal	Significance	Ref / Research	Possible Impact on Significance	Mitigation	Other options considered	Conclusions
D	<b>Provide lead capping to lowest string course above long window area</b> in order to project rainwater away from the building. All as described in Appendix 1 of the Energy Report.	Rain water currently discharges from the string course and down the face of the building. The hygrothermal modelling using local predicted weather data that takes climate change into account suggests that rainwater penetration into the fabric is going to increase. This work will make a contribution towards mitigating this.	High overall but aesthetic value is medium / high.	█ report sections 7. Energy Efficiency Report section 2(d).	<p>Evidential value – no impact.</p> <p>Historical value – no impact.</p> <p>Aesthetic value – there will be some negative impact, but we consider this to be acceptable due to the benefit it provides.</p> <p>Communal value – no impact</p>	It is not possible to mitigate the impact on aesthetics.	There isn't an alternative that will provide the required drip detail apart from replacing the stone with the same profile but with the addition of a drip detail. However, this would mean removing original building fabric and replacing with new.	The lead capping is necessary in order to help protect the building from the adverse effects of moisture.

# Process - IHBC Retrofit Guidance up to Advice



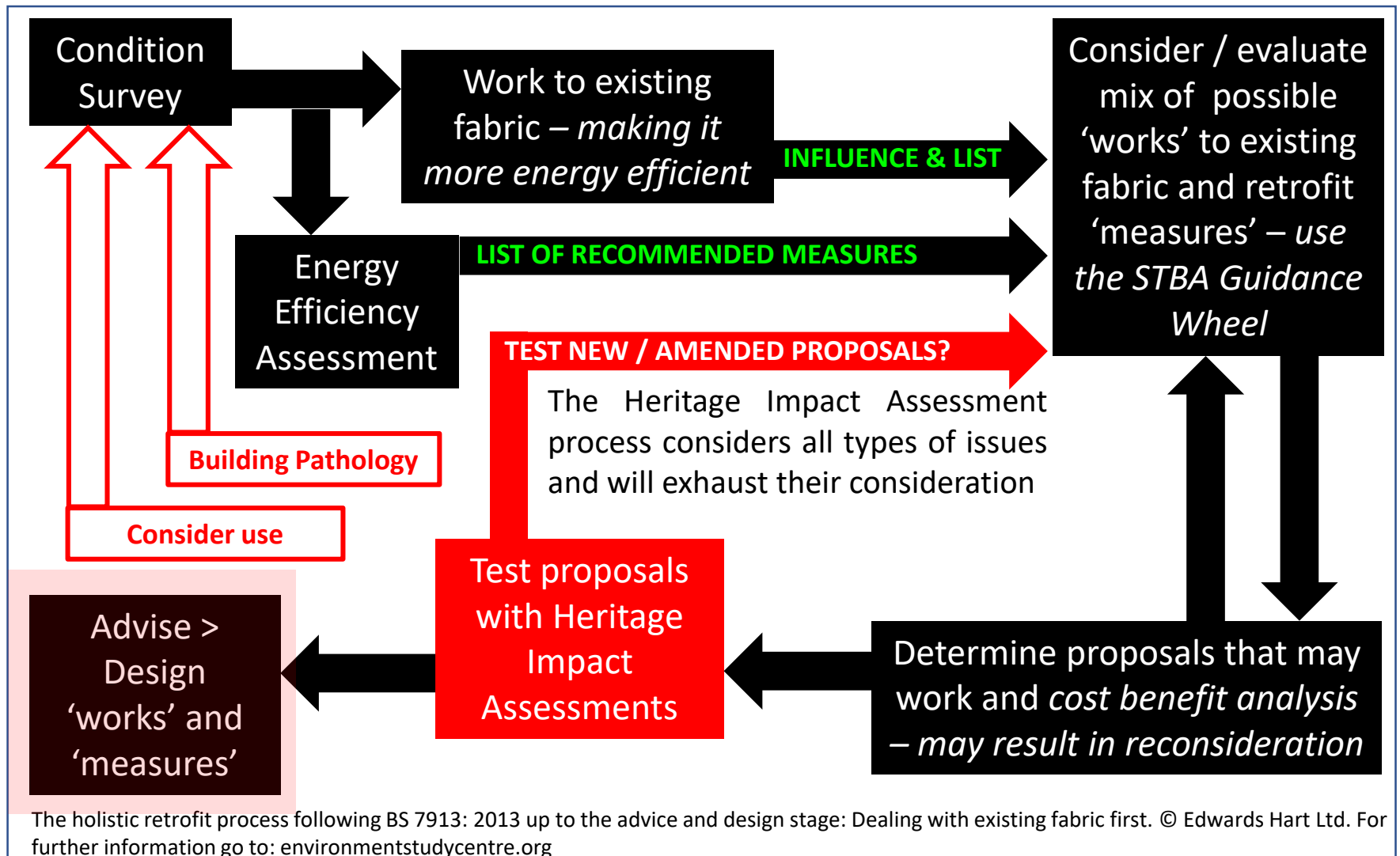
**Retest proposals with a (Heritage) Impact Assessment if necessary**

# Process - IHBC Retrofit Guidance up to Advice



**Re-testing and re-testing proposals with a HIA**

# Process - IHBC Retrofit Guidance up to Advice



**ADVICE followed by DESIGN – ‘WORKS’ & ‘MEASURES’**

# Process - IHBC Retrofit Guidance

*from Advice > Audit*

1. **Specification non compliance risk assessment**
2. **Design / specification** – risk management requirements
3. **Installation & commissioning / soft landing.....**
4. **POE** – has it worked? Benefits? Unintended consequences?
5. **Audit** – a check on quality... consider @ beginning of process...

# ***Challenge for Older Buildings – deal with this...***

**Treated the same –  
when it should be different**



**Treated differently –  
when it should be the same**

# Challenge – dealing with mainstream...

## *Inferior for older buildings – at least in part*

PAS 2035:2019



Retrofitting dwellings for improved energy efficiency – Specification and guidance



1. A standard/ specification for retrofit only – not holistic
2. Acknowledges the difference between older buildings and others, but weaknesses in delivery
3. Qualifications / memberships a requirement – but not competency testing
4. BUT much, much better than was in place previously

# Challenge – mainstream to look at this...

## *Guidance & Practice – should be holistic...*



### IHBC GUIDANCE NOTES

**Retrofitting of Traditional Buildings** GN2019/4  
June 2019

*This is one of a series of occasional Guidance Notes published by The Institute of Historic Building Conservation (IHBC). IHBC Guidance Notes offer current and recent guidance into topics that we consider crucial to the promotion of good built and historic environment conservation policy and practice. The Notes necessarily reflect knowledge and practice at the time they were developed, while the IHBC always welcomes new case examples, feedback and comment to [research@ihbc.org.uk](mailto:research@ihbc.org.uk) for future revisions and updates.*

**Introduction**

1. Buildings are and will continue to be under pressure to be made more energy efficient and whilst this is sensible, experience to date suggests that risks of unintended consequences are common.
2. This guidance intends to provide an outline on the most appropriate approach, which is a holistic one. It also provides comment on competencies and new publications by the British Standards Institution (BSI) on retrofit.
3. Note that this guidance applies to traditional buildings with and without statutory protection as well as modern buildings with statutory protection with some limitation.
4. For more on the legislative and policy context, and sources of advice, see the IHBC's Guidance Note on Climate Change and Older Buildings – key sources

**General Approach**

5. The approach is as generally outlined in BS 7913: 2013: Guide to the conservation of historic buildings.<sup>(1)</sup> This means that individuals must be sufficiently competent in what they do.
6. It is essential that those involved understand that retrofitting is not the first thing to think of when considering how to make a building more energy efficient. First of all try and get the original building fabric to perform as the best it can with appropriate maintenance and repair as well as providing it with appropriate use. After which, it is essential to start with the easy things first and then work up to those things which are more difficult and costly. The overall approach is described in the article *Energy efficiency of traditional building* published in 2016.<sup>(2)</sup>

1.

1. Use
2. Maintenance / repair
3. Retrofit
4. Essential to consider ‘Technical’ & ‘Significance’

# Energy Efficiency and Historic Buildings - *Historic Buildings are Different!*

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# Thankyou – Danke