



Llywodraeth Cymru
Welsh Government

www.cymru.gov.uk

Sustaining Our Traditional Buildings ~ how and why?



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 **Cadw**

Climate change – our biggest threat!

Weather in Wales 15th August 2012



- Weather patterns uncertain
- Wettest UK summer since 1912
- Extreme weather conditions – effecting buildings!
- Energy efficient buildings part of the solution!
- Understanding solutions!

Affecting traditional buildings



Affecting all traditional buildings



Retrofit - everywhere!

Retrofit global
value £95 Billion
up to 2020



Retrofit - everywhere!



Traditional Buildings – how many?

Percentage Built pre 1919

Republic of Ireland 10%

Northern Ireland 16%

Scotland 20%

England 22%

Wales 34%

*Not just about Listed Buildings and
Scheduled Monuments*

THE PROBLEM!

These buildings are the different

Modern

Traditional



They perform differently

but this is not understood by the majority...

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



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

Treated the same
when it should



POOR SKILLS

LACK OF KNOWLEDGE

WRONG EXPERTISE!

and differently –
it should be the same

Understanding Buildings!

What is the most energy efficient building?

1. Pre 1900 – **most energy efficient** –per sq. Metre.
2. 1990's and 2000's – second most energy efficient - **8% less efficient than pre 1900.**
3. 1970's to 80's – **20%** less efficient than pre 1900.
4. 1900 to 1930 - **25%** less efficient than pre 1900.
5. 1960's - **35%** less efficient than pre 1900.
6. 1940's and 50's - **45%** less efficient - worst.

Understanding Buildings!



Eland House, HQ of the Department of Communities and Local Government received an **“F”** rating as part of its own *Display Energy Certificate* initiative.

Eland House, designed as “C” rated

some new buildings do not perform as well as expected!

Traditional buildings misunderstood

UK compliance with EU *Energy Performance in Buildings Directive...*



Energy Performance Certificate for dwellings

Energy Performance Certificate

Address of dwelling and other details

100 Any Street,
AnyVillage,
Anywhere,
XY1 2Z

Dwelling type: [e.g. Detached house]
Name of protocol organisation: [if applicable, otherwise N/A]
Membership number: [if applicable, otherwise N/A]
Date of certificate:
Total floor area:
Main type of heating and fuel: [e.g. air-source heat pump, electric]

This dwelling's performance rating(e)

This dwelling has been assessed using the [insert methodology calculation tool e.g. SAP]
Its performance is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs* and environmental impact based on carbon dioxide (CO₂) emissions. Carbon dioxide is a greenhouse gas that contributes to climate change.

Energy Efficiency Rating*	
Current	Potential
[insert existing rating]	[insert revised rating]

Environmental Impact (CO ₂) Rating	
Current	Potential
[insert existing rating]	[insert revised rating]

Scotland EU Directive 2002/91/EC

The energy efficiency rating* is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Approximate current energy use per m² of floor area: [insert in kWh/m² per year]

Approximate current CO₂ emissions: [insert in kg/m² per year]

Cost effective improvements

Below is a list of lower cost measures that will raise the energy performance of the dwelling to the potential indicated in the table(s) above.

- [e.g. Fit 100% low energy lighting]
-
-

N.B. THIS CERTIFICATE MUST BE AFFIXED TO THE DWELLING AND NOT BE REMOVED UNLESS IT IS REPLACED WITH AN UPDATED VERSION

[A full energy report is appended to this certificate*]

* Requirement for dwellings subject to 'Single Survey' - optional for Scottish building regulations

- Building Regulations
- EPCs
- incentive schemes

Traditional buildings misunderstood

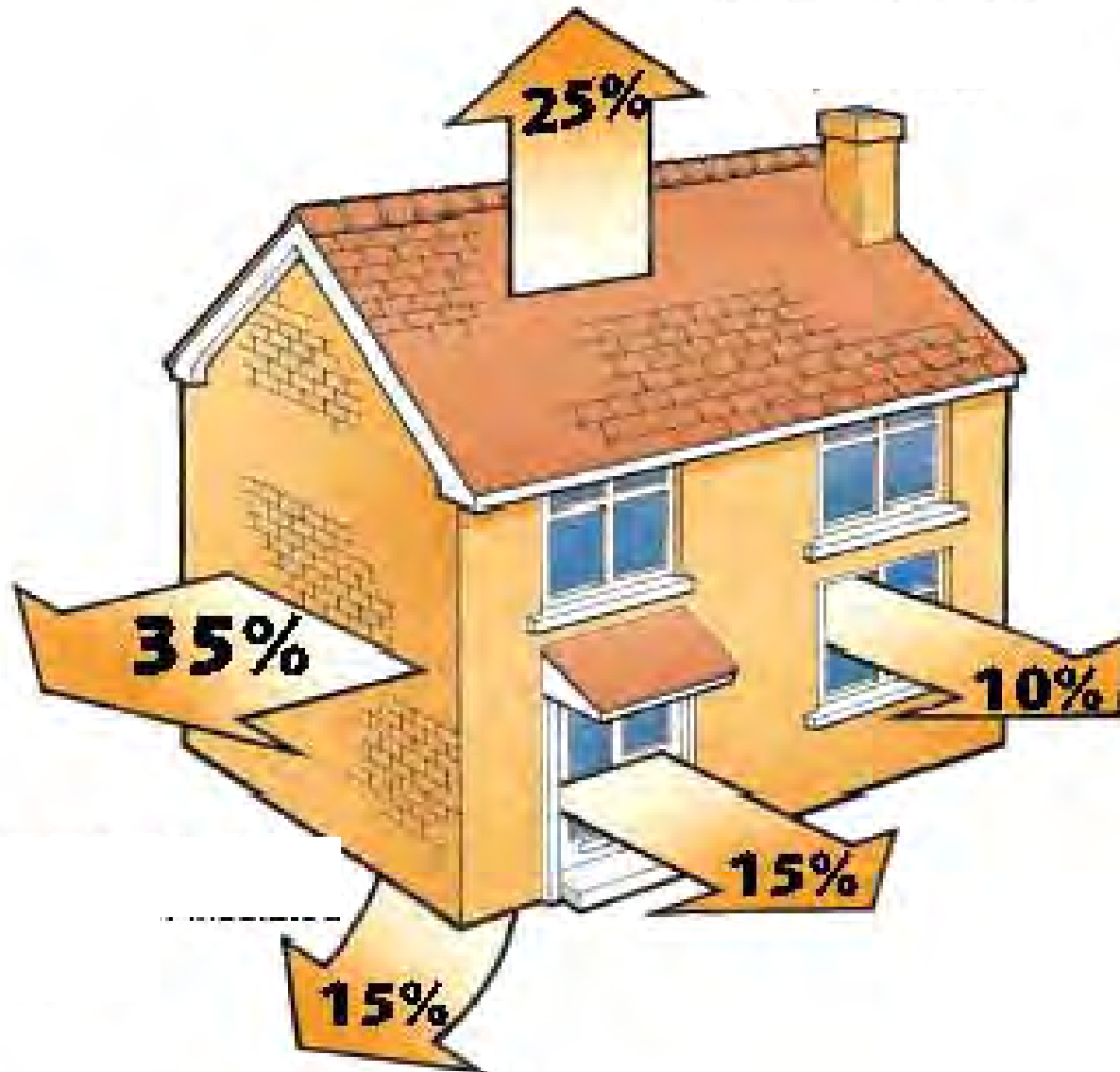
More efficient



Less efficient

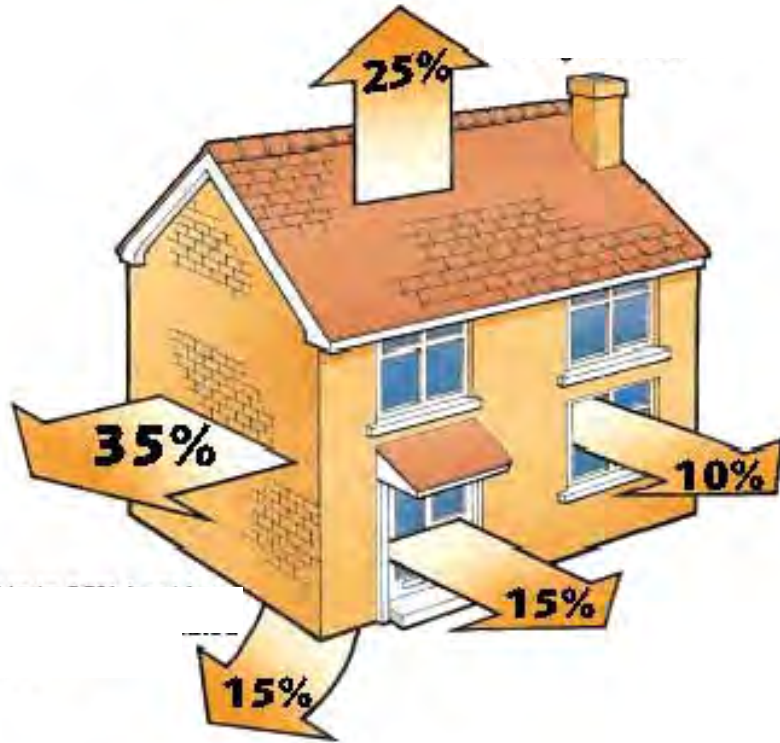
1. Design and construction
2. Performance of the building at present
3. Performance of the building after retrofit
4. Is the condition of the building affecting its performance?

Retrofit – usual choices?



Where are we losing energy?

Retrofit – usual choices?



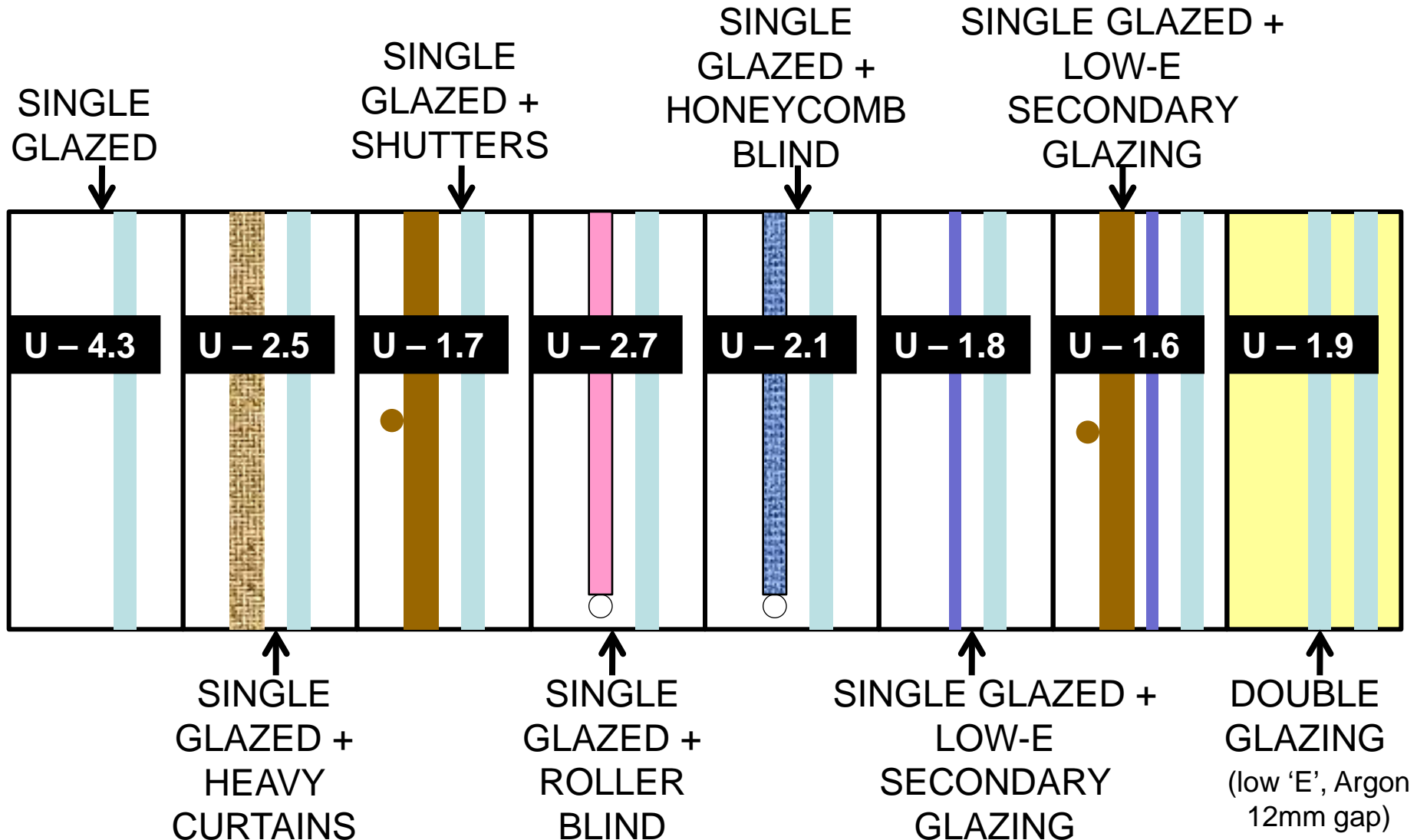
Is double glazing a good choice?

uPVC – “service life of at least 35 years under normal urban & non-aggressive conditions” British Plastics Federation

Payback = up to 124 years (RICS)

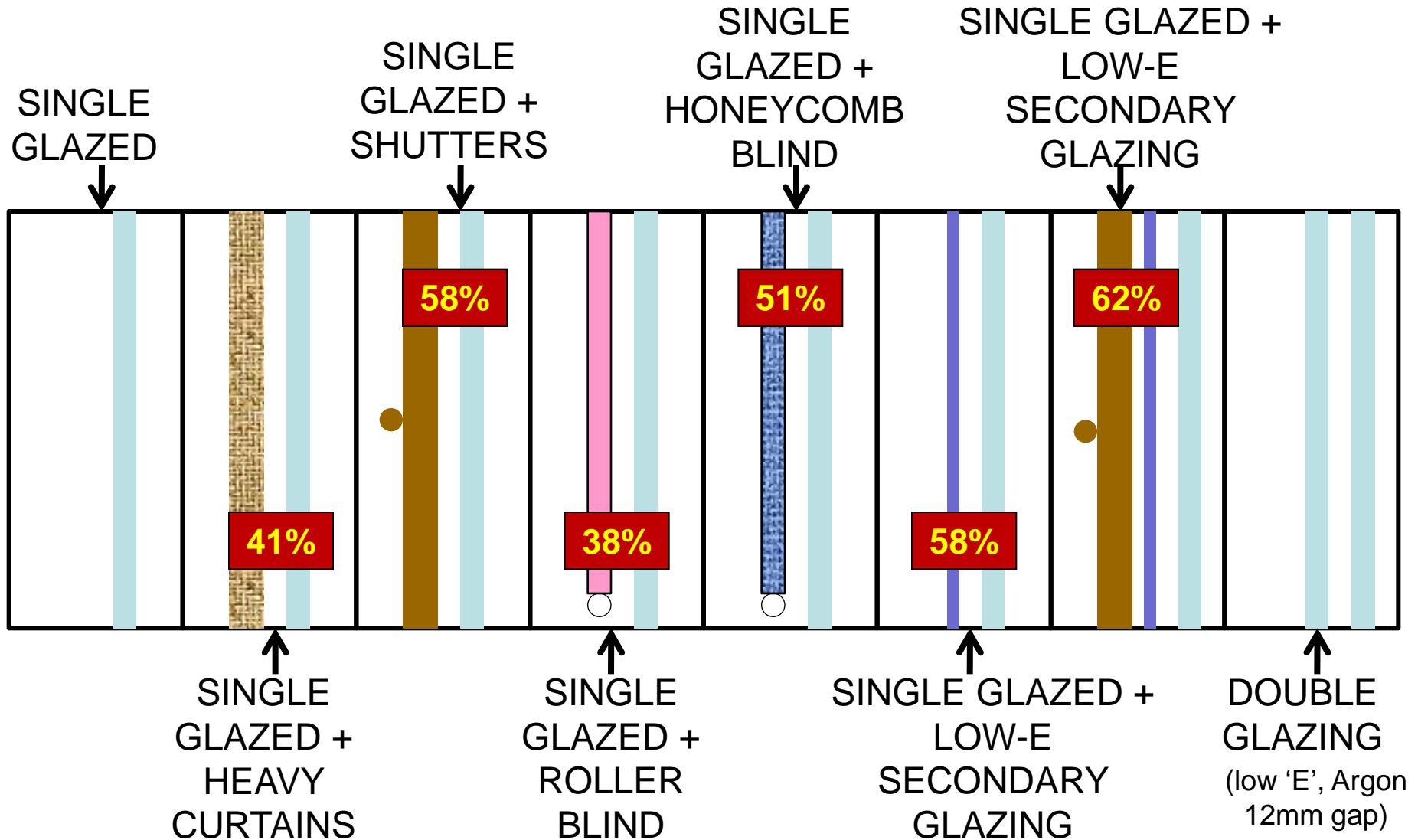
Windows – is double glazing required?

Research by Glasgow Caledonian University



Windows – Heat Loss Improvements

Research by Glasgow Caledonian University



Walls – what is the thermal value?

Solid Walls U-Value Research by the SPAB

Solid wall (homogenous)



Wall build up

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

46.3% better

In situ U-value **1.75** W/m²K

Build Desk U-value **2.56** W/m²K

Courtesy Caroline Rye / SPAB

Walls – what is the thermal value?

Walls with Cavities – Limestone & Plasterboard



Wall build up

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

95.9% better

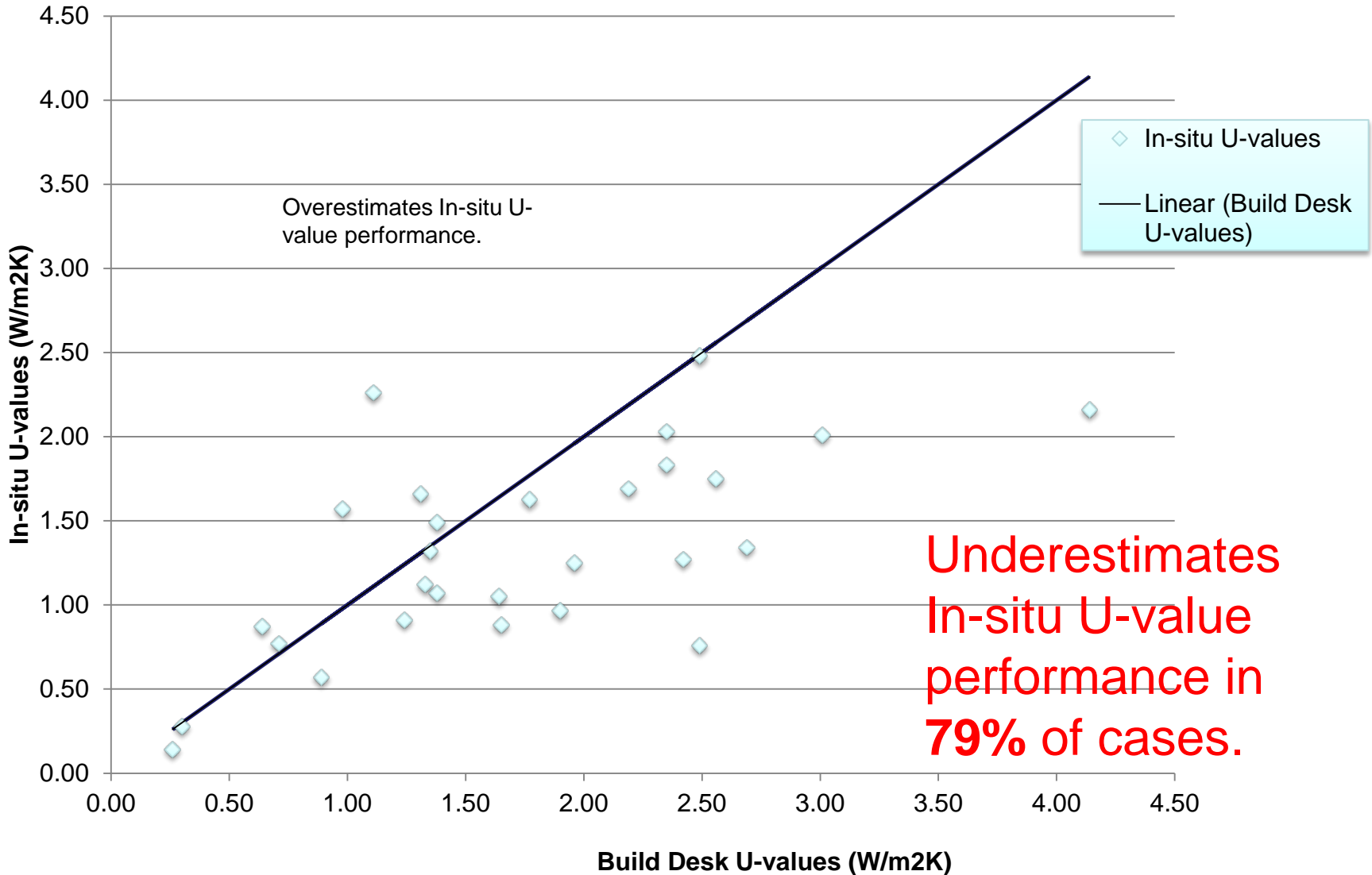
Insitu U-value 0.96 – **0.97** W/m²K

Build Desk U-value **1.90** W/m²K

(Without Dry Lining = 2.0 W/m²K)

Walls – what is the thermal value?

BuildDesk/In-situ U-value Comparison



Walls – what is the thermal value?

Solid Walls U-Value Research by the SPAB

Solid wall (homogenous)



Wall build up

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In situ U-value **1.75** W/m²K

Build Desk U-value **2.56** W/m²K

Walls – real thermal improvement!

Predicted U Value 2.56

With IWI 43% improvement

Real U Value 1.75

With IWI 17% improvement

Real U Value 46.3% better

Real overall improvement = 5%

Theoretical analysis

Predicted 15% overall improvement to the building based on 35% heat loss through walls

Wall build up

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

46.3% better

In situ U-value **1.75** W/m²K

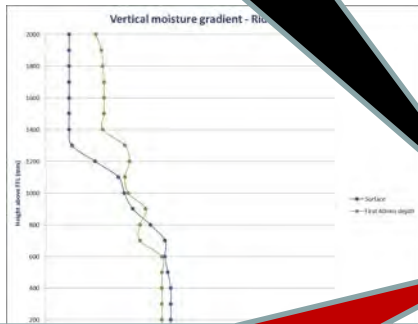
Build Desk U-value **2.56** W/m²K

Damp Walls – less thermally efficient

Relationship between wall moisture and U - Values

DAMP

DRY



0.76 W/m²K @ 1790 mm above ffl

1.05 W/m²K @ 630 mm above ffl

Greatest heat loss through the dampest area

1.24 W/m²K @ 1800 mm above ffl

1.50 W/m²K @ 800 mm above ffl

Courtesy Caroline Rye / SPAB



Damp wall due to: Poor repair, interstitial condensation, trapped moisture, inappropriate insulation.....

Understanding the basics...

Do you know?

1. The materials and tools required for re-pointing stone / brick joints in traditional buildings.
2. The implications of not re-pointing joints properly.



Understanding the basics...

Re-pointing stone/brickwork

Which tools should be used?



Pointing irons



TRADITIONAL BUILDINGS



Pointing trowels

Understanding the basics...

Re-pointing stone/brickwork

Which tools should be used?



Pointing irons



TRADITIONAL BUILDINGS

These are the same – treat them the same!



Pointing trowels

Wrong tools = inferior work = energy inefficiency

Poor / Inappropriate Work

Waste money & energy/ Deterioration

Repairs to Stone Wall

Repair Type	Durability – well executed	Durability – sub standard
Stone indent / piecing in	100+ yrs	10-20 yrs
Mortar repairs in sheltered locations	30-60 yrs	5-15 yrs
Mortar repairs in exposed locations	Avoid	< 10 yrs
Mortar joint re-pointing	60-120 yrs	5-15 yrs
Stone replacement	100+ yrs	< 30 yrs
Brick replacement	100+ yrs	< 30 yrs

Best Practice Retrofit

STBA

SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

Created to promote a better understanding and more informed approach to traditional buildings by both mainstream and heritage crafts and professions

download at:

www.retrofitbuildings.com

Best Practice Retrofit

STBA

SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

1. Responsible Retrofit
2. Understanding of Moisture Risk
3. Heat Loss
4. Internal Wall Insulation

download at:

www.retrofitbuildings.com

Best Practice Retrofit - STBA

1. Responsible Retrofit

- **What knowledge exists**
- **Quality of knowledge**
- **Gaps**
- **Actions needed to fill gaps and up lift quality**
- **Risk analysis approach to retrofit**

download at:

www.retrofitbuildings.com

Best Practice Retrofit - STBA

2. Moisture Risk

“BS 5250:2011 (and the calculations given in *BS EN ISO 13788:2002*) *should not be used as the sole form of moisture calculation risk for traditional buildings.*

The use of BS 5250:2011 **is insufficient for solid wall buildings where driven rain** and other sources of fabric moisture are present. **This makes it inadequate as a means to assess all risks posed by moisture to the building fabric and occupants of traditional buildings.** In particular, for all Internal Wall Insulation applications to solid walls, numerical modelling according to BS EN 15026:2007 should be used, with substantial safety margins built in due to the lack of data and research. The same applies to all EWI applications where construction moisture is likely to exist, due to previous weathering, lack of damp proof courses etc.”

Best Practice Retrofit - STBA

2. Moisture Risk

“The use of BS 5250:2011 as the only method of assessing the moisture content of traditional buildings and of such buildings where retrofit insulation is applied, could lead to considerable fabric decay and risks to human health, as well as waste of material and financial resources. Furthermore problems resulting from incorrect assessment may occur and become apparent only after some time (sometimes several years). This means that policies for retrofit run the risk of incurring significant long term liabilities unless adjusted in the near future.”

Best Practice Retrofit - STBA

2. Moisture Risk

*“In general where sufficient weather and material properties data exist the use of BS EN 15026:2007 as a method of calculating moisture risks should be encouraged. In the short term the limitations of BS 5250:2011 need to be clearly noted in standards and certifications and should not be permitted to form the sole basis for moisture risk assessment in traditional buildings. Ultimately, **the current practice within the building industry of only a partial test of moisture risk via the use of BS 5250:2011 needs to be corrected by the development of a new standard that assesses all moisture risks arising within all buildings.**”*

Best Practice Retrofit - STBA

3. Heat Loss

BR334

- **Calculating heat loss (U Values) – referred to in Part L Building Regulations**
- **U Value software**
- **U Values inaccurate**
- **Reliant on identified materials with known thermal qualities**
- **Solid walls – make up unknown**
- **Little thermal conductivity data available for UK building materials**
- **Calculated U Values unable to consider thermal mass**
- **Default U Values too high and need urgent review**

Best Practice Retrofit

STBA

SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

1. Responsible Retrofit
2. Understanding of Moisture Risk
3. Heat Loss
4. Internal Wall Insulation

What is the real knowledge gap?

**Did
you
know?**

Does
mainstream
understand?

*“If we repair traditional buildings with modern materials and techniques we will inhibit their breathability – **this can lead to accelerated deterioration and greater heat loss**”.*

What is the real knowledge gap?

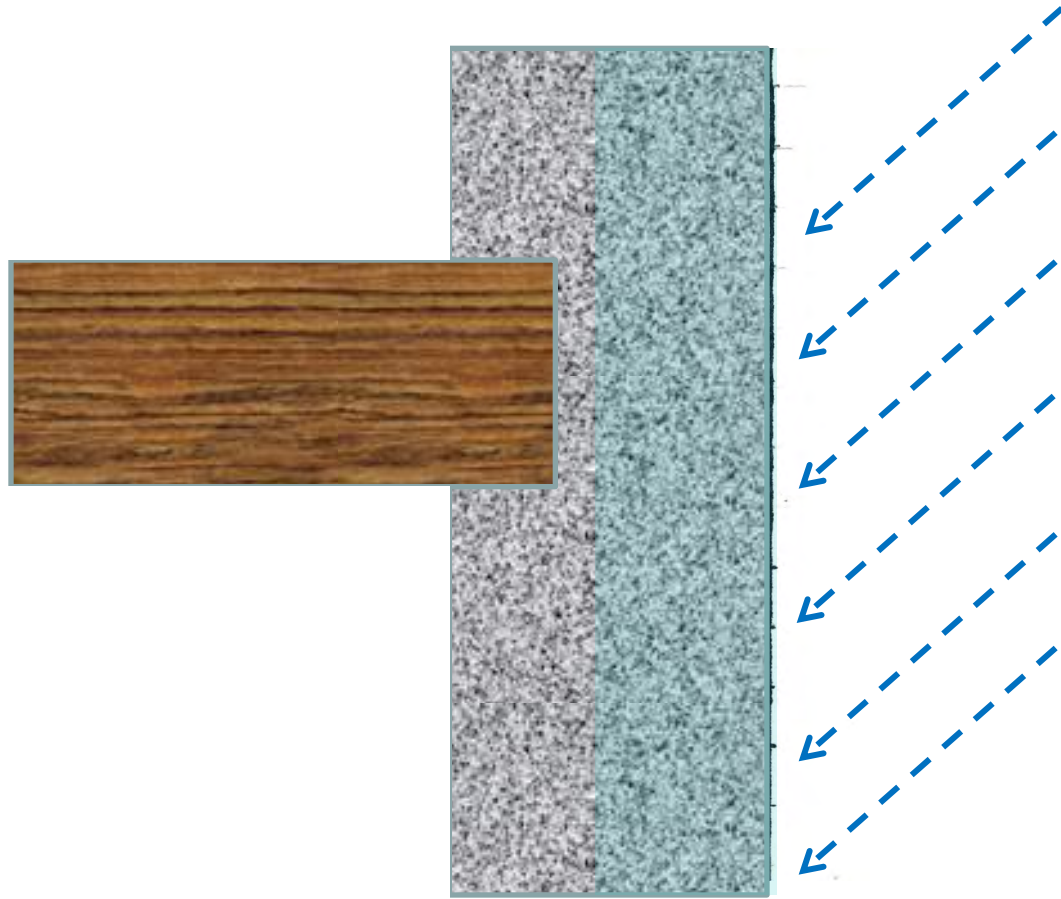
*“Research has shown that existing **single glazed windows** can easily be upgraded to provide better **U Values** than provided by replacement modern double glazed windows – costing less and a greener approach”*

**Did
you
know?**

Does
mainstream
understand?

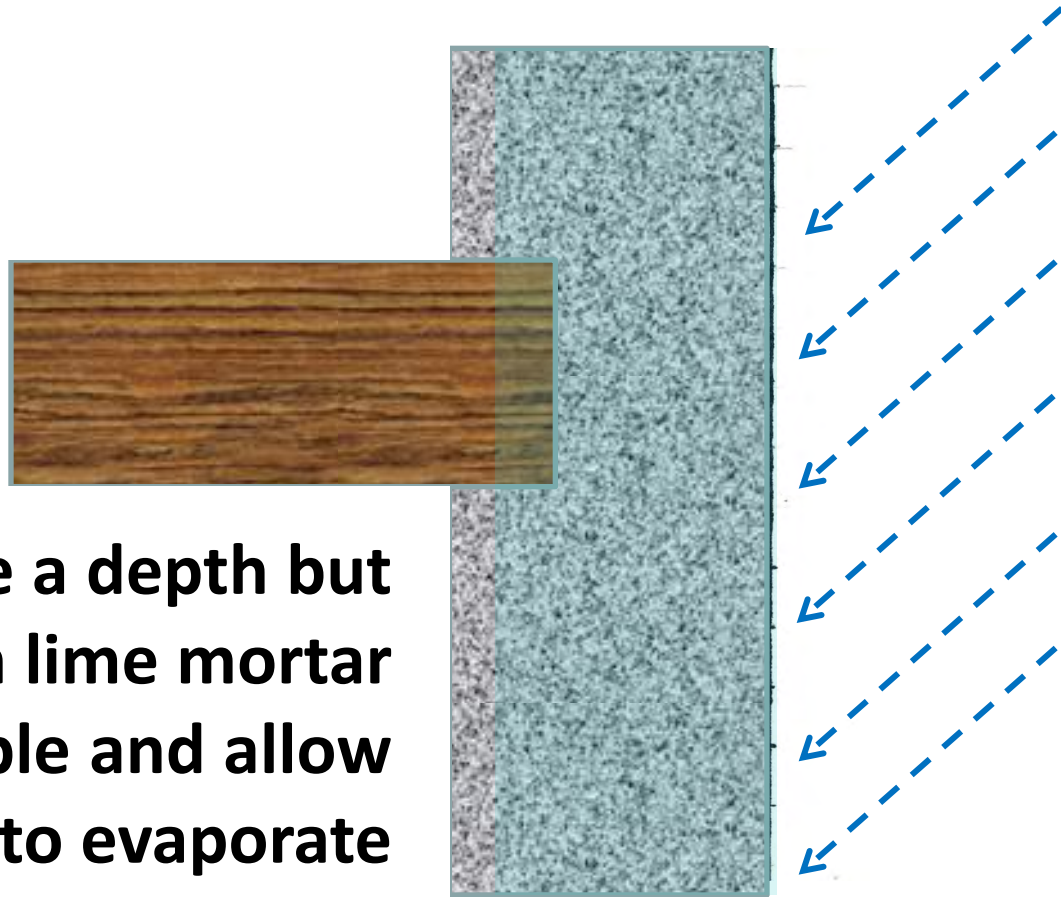
Research by
Historic
Scotland/English
Heritage/ Glasgow
Caledonian
University

Walls – hygrothermal physics



Moisture ingress from rainfall

Walls – hygrothermal physics

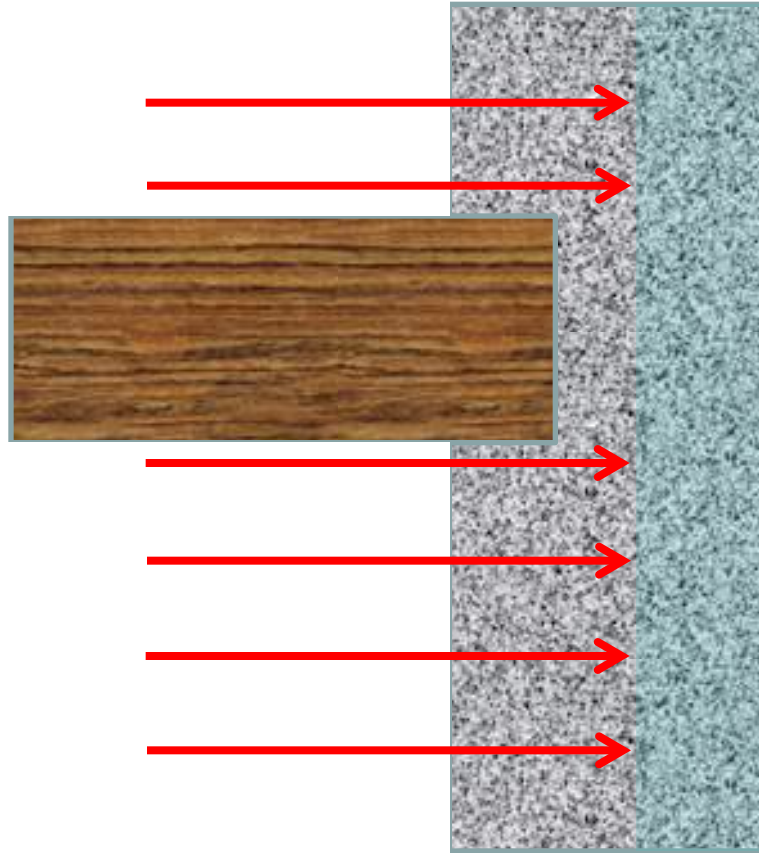


**Can reach quite a depth but
walls built in lime mortar
are breathable and allow
moisture to evaporate**

Moisture ingress from rainfall

Walls – hygrothermal physics

Heat inside
building
helps to
remove
moisture
from wall



Moisture ingress from rainfall

Walls – hygrothermal physics

**Without heat
inside
building the
wall will be
damp longer
– causing
greater heat
loss and
building
deterioration**



Moisture ingress from rainfall

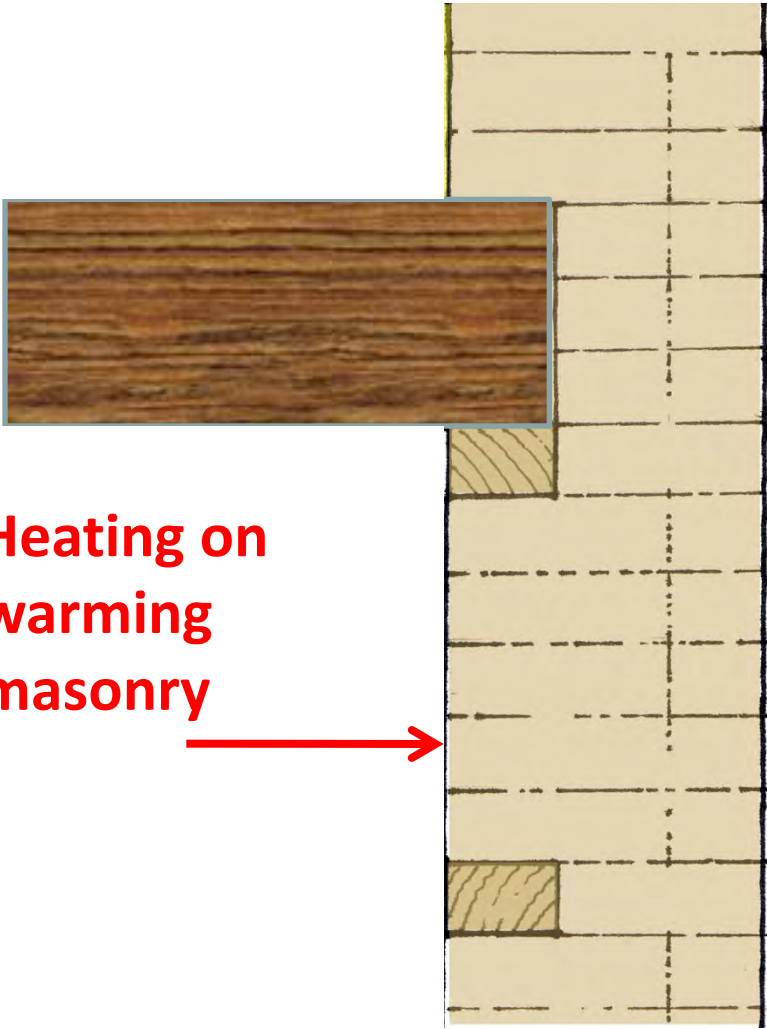
Walls – hygrothermal physics

Heat inside building buffered from the wall by insulation.
Wall will be damp longer – causing greater heat loss and building deterioration



Moisture ingress from rainfall

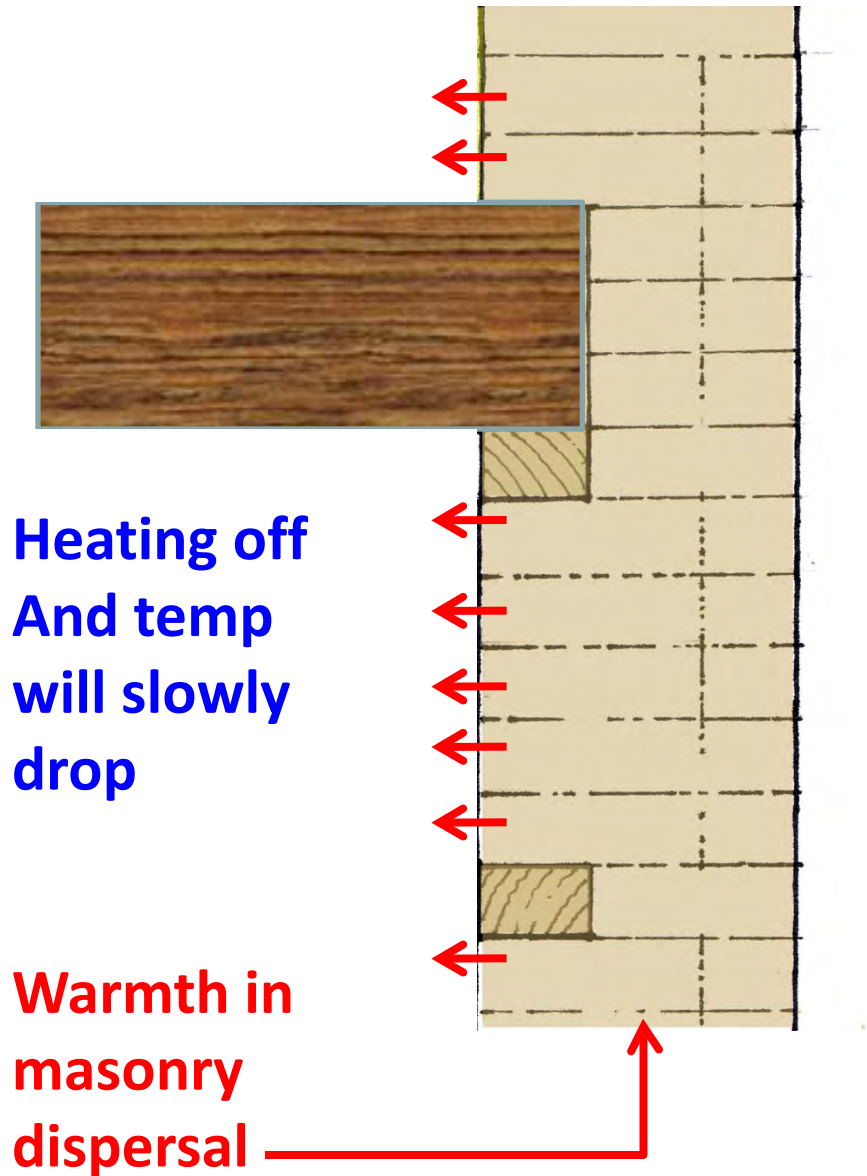
Thermal Mass



Heating on
warming
masonry



Thermal Mass

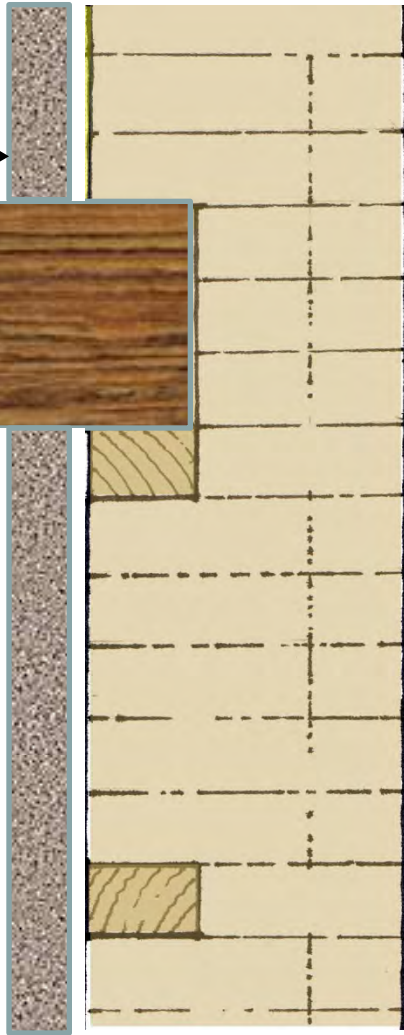


No Thermal Mass

Internal Wall
Insulation →

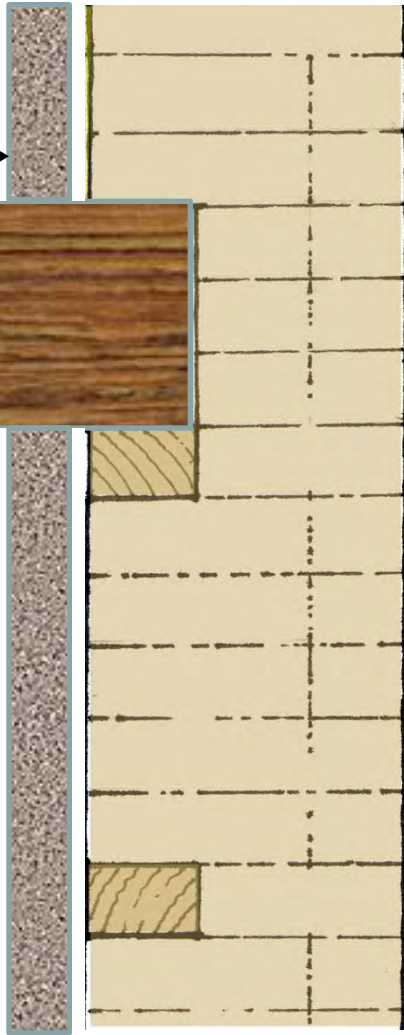


Heating on



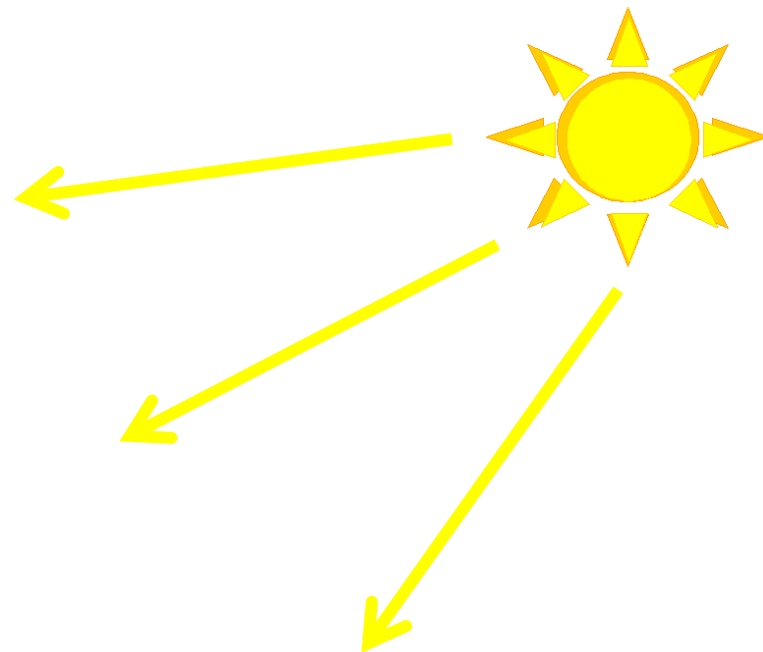
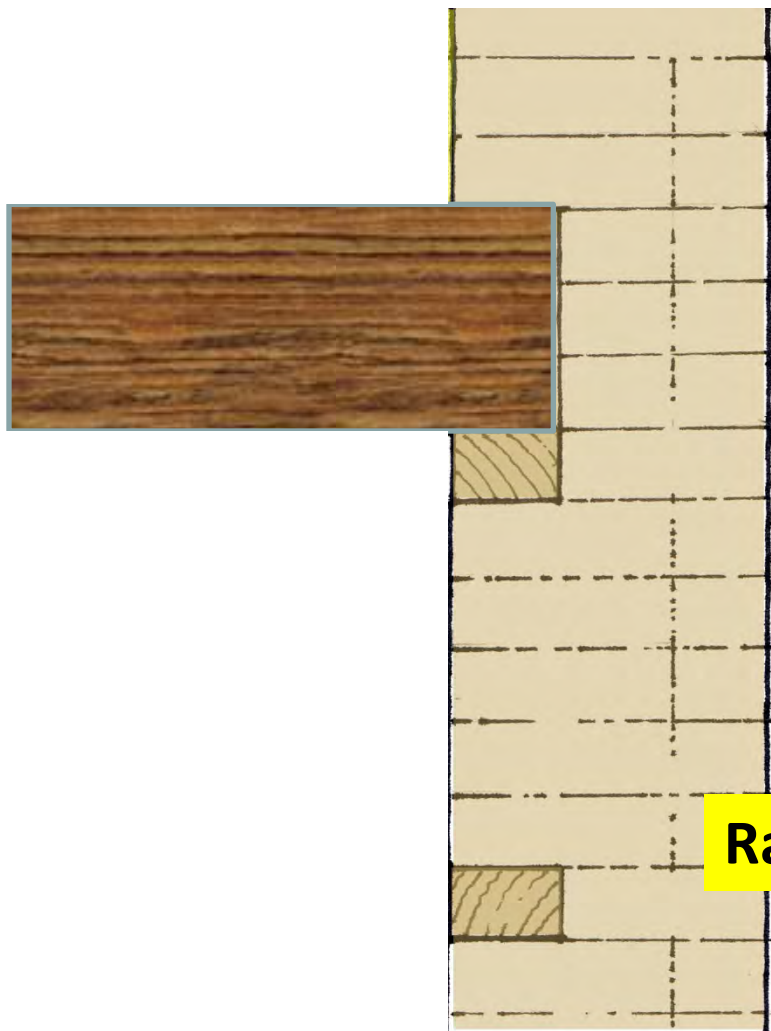
No Thermal Mass

Internal Wall
Insulation →



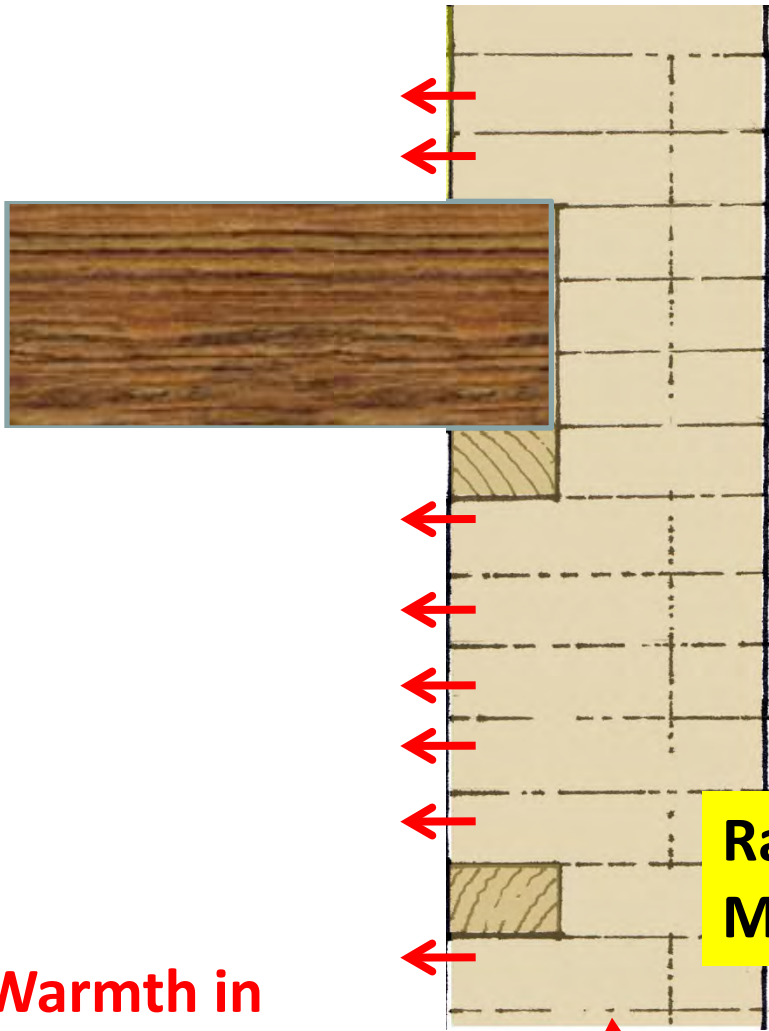
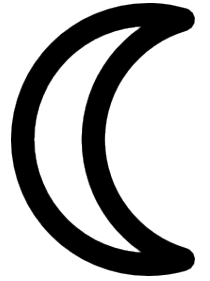
Heating off
with
immediate
temperature
reduction

Thermal Mass



Radiant Heat Warming Masonry

Thermal Mass



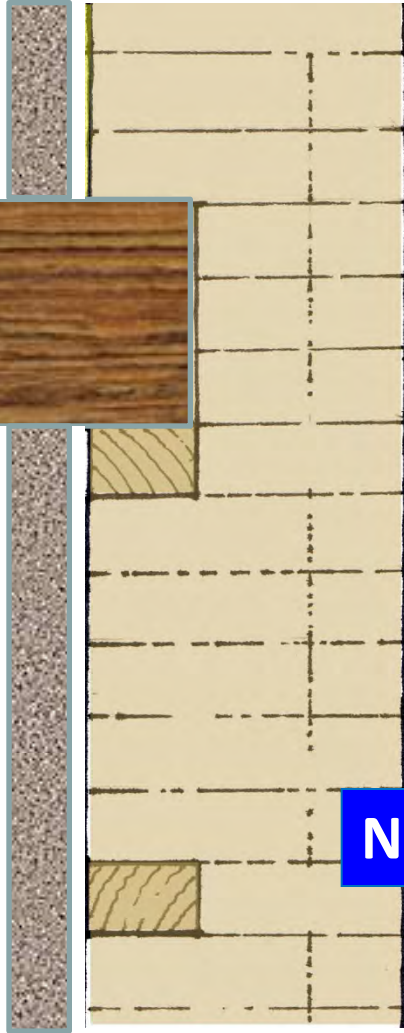
**Radiant Heat Warmed
Masonry during day time**

**Warmth in
masonry
dispersal**

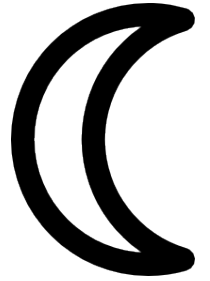
Dependant on wall thickness

No Thermal Mass

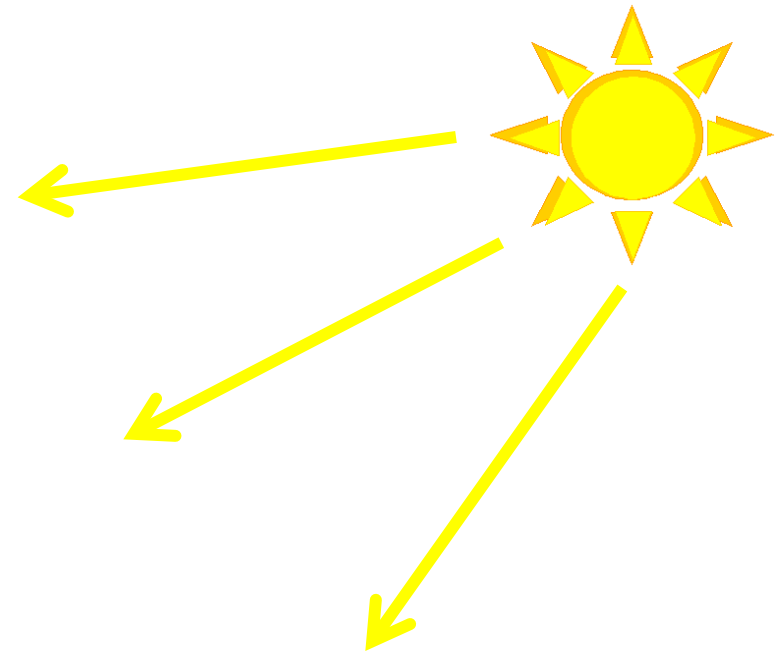
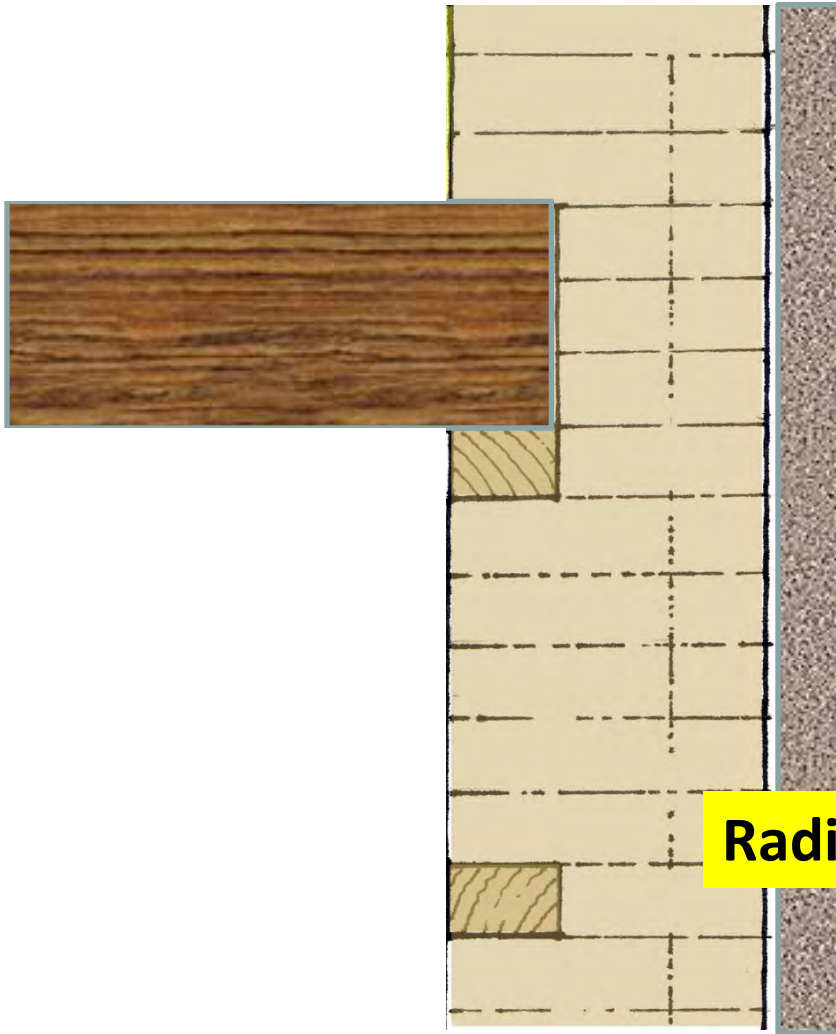
Internal Wall
Insulation



No Radiant Heat Benefit



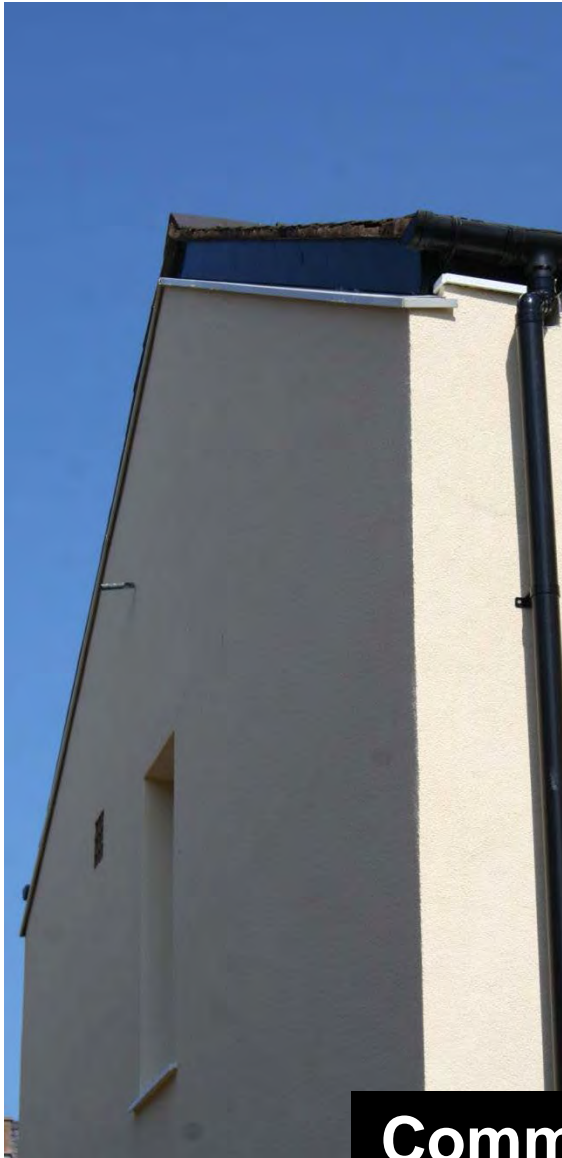
No Thermal Mass



Radiant Heat NOT Warming Masonry

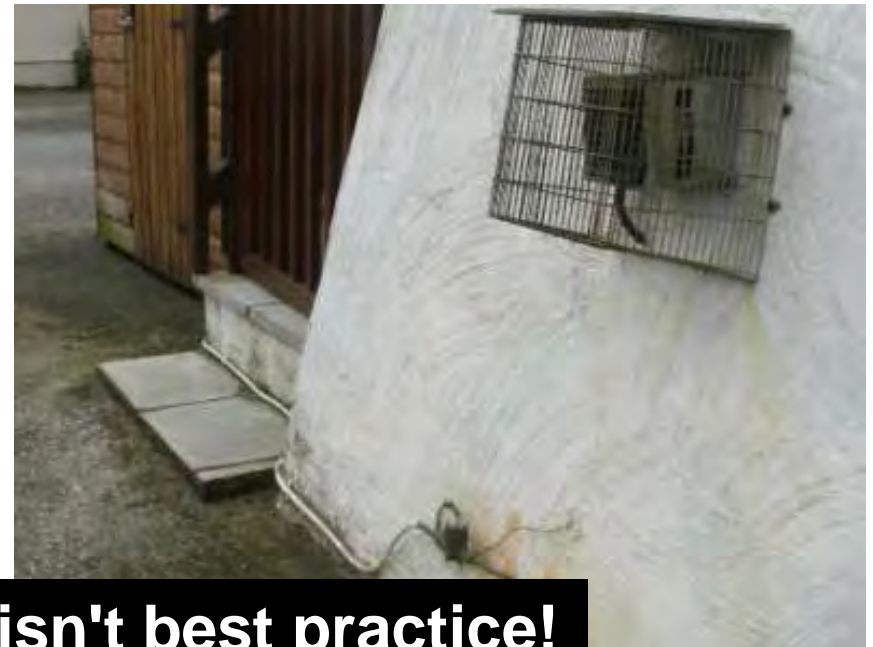
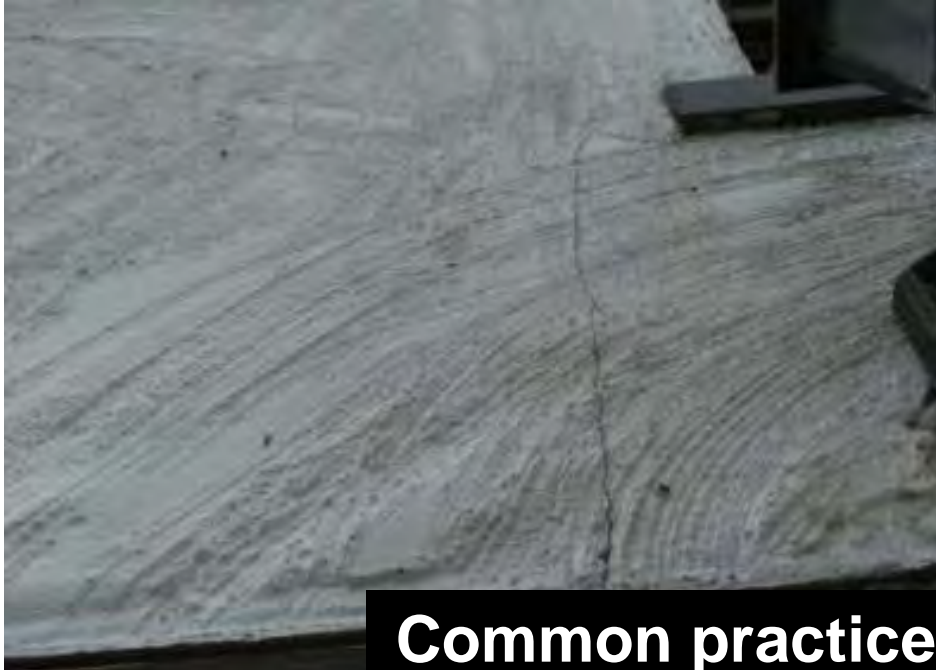
← External Wall Insulation

External Wall Insulation



Common practice isn't best practice!

External Wall Insulation



Common practice isn't best practice!

External Wall Insulation

STBA

SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

Most systems in the UK have BBA approval – a requirement for warranties and insurance.

“None of the certificates (resulting from tests) examined noted any **special requirements for traditional buildings.**”**no acknowledgment of the different thermal performance of traditional buildings.** Neither is there **any acknowledgment of particular moisture conditions ...** or any special requirement in terms of assessment or application”. Page 41

Character and Aesthetics



Pontypool – no Listed buildings but lots of character!

Character and Aesthetics



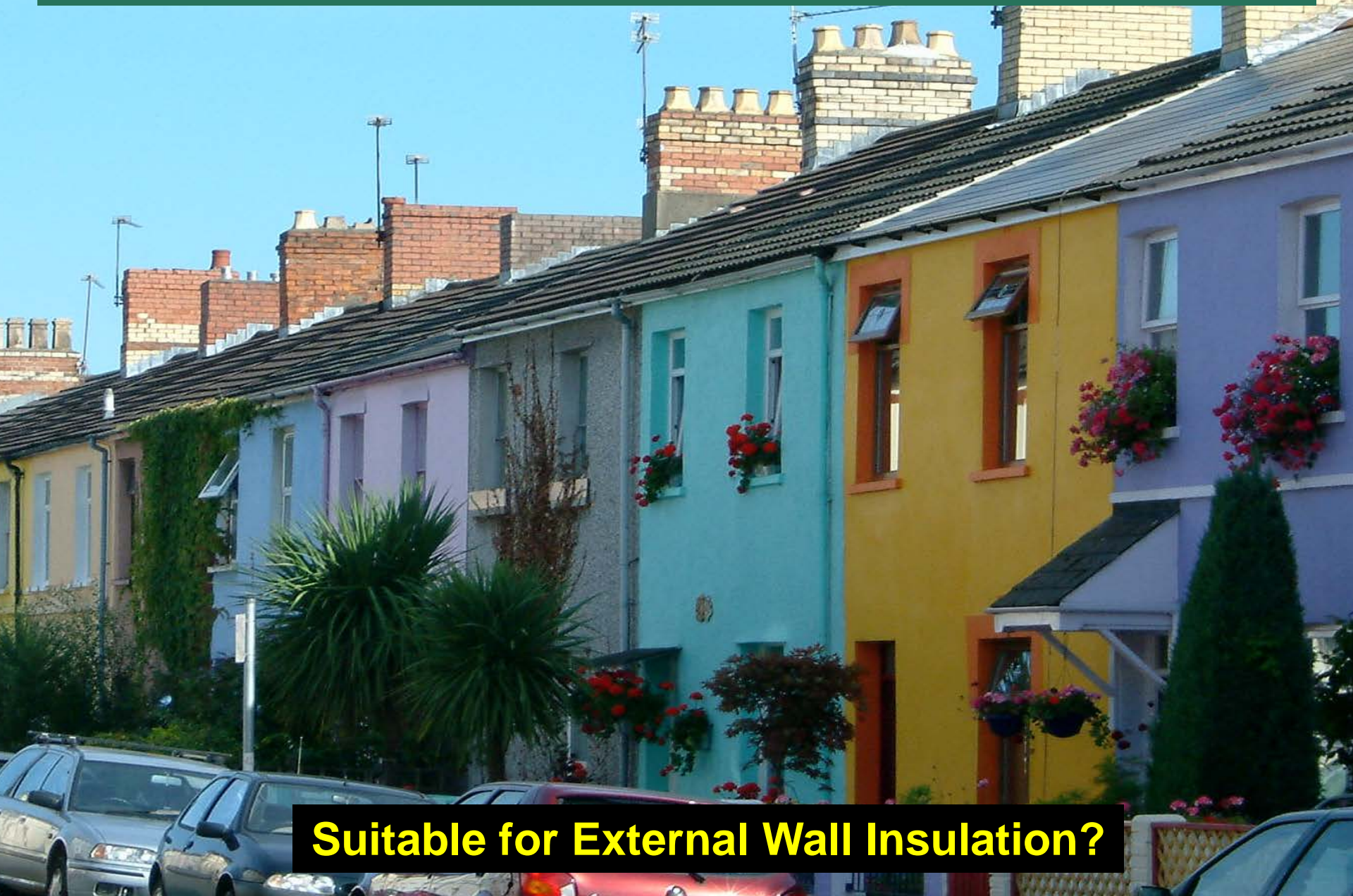
Pontypool – no Listed buildings but lots of character!

Character and Aesthetics



Suitable for External Wall Insulation?

Character and Aesthetics



Suitable for External Wall Insulation?

Character and Aesthetics



Suitable for External Wall Insulation?

Character and Aesthetics



Suitable for External Wall Insulation?

Cared for by conservation experts...



- **Listed Building /Scheduled Monument Consents**
- **Building Regulation exemptions**
- **More likely to have proper expertise**
- **Green Deal – more expert approach**

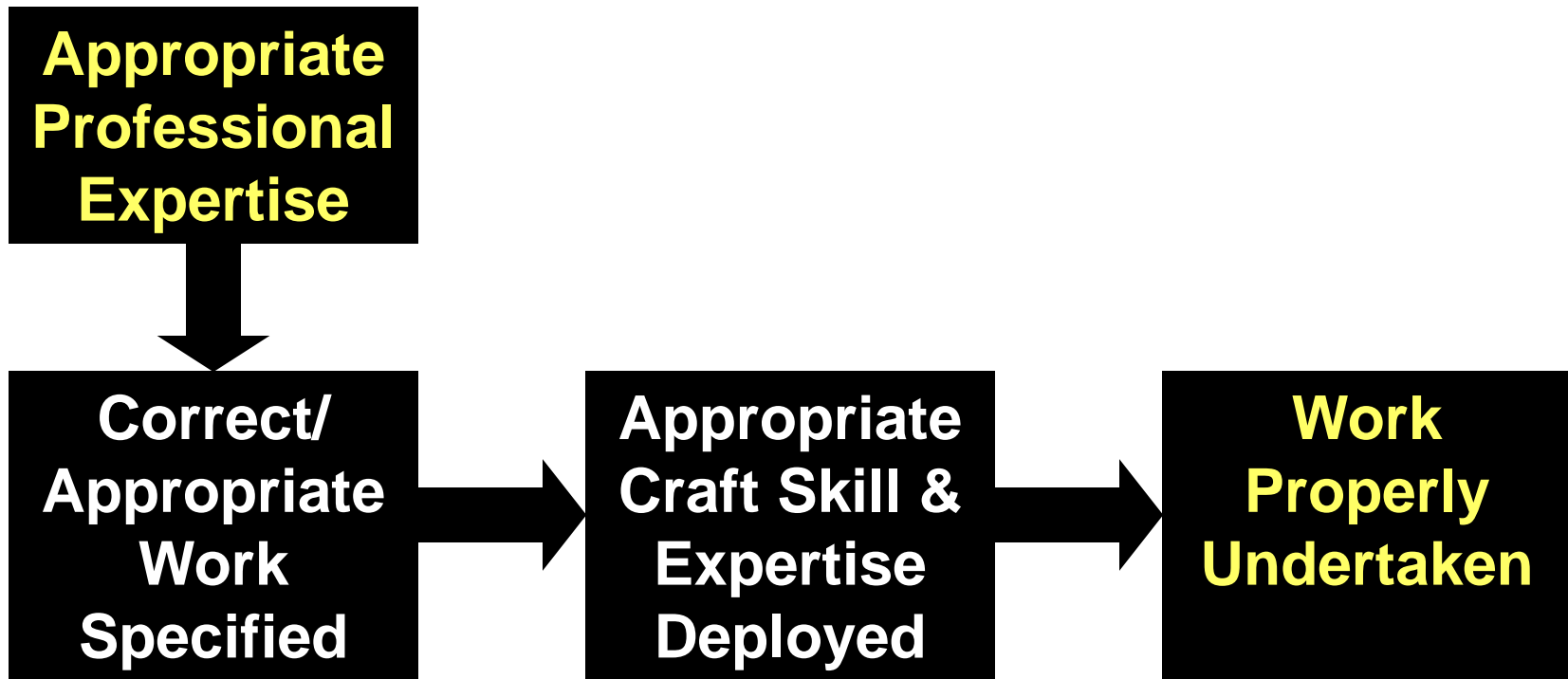
Will mainstream properly care for these?

- **No planning consents for most measures**
- **Building Regulations – ‘Special Considerations’ – but will they be applied for or granted?**
- **Much less likely to have proper expertise – from ‘mainstream’**
- **Green Deal – risks to buildings, paybacks. Unlikely to receive ‘expertise’ from the Green Deal Advisor**



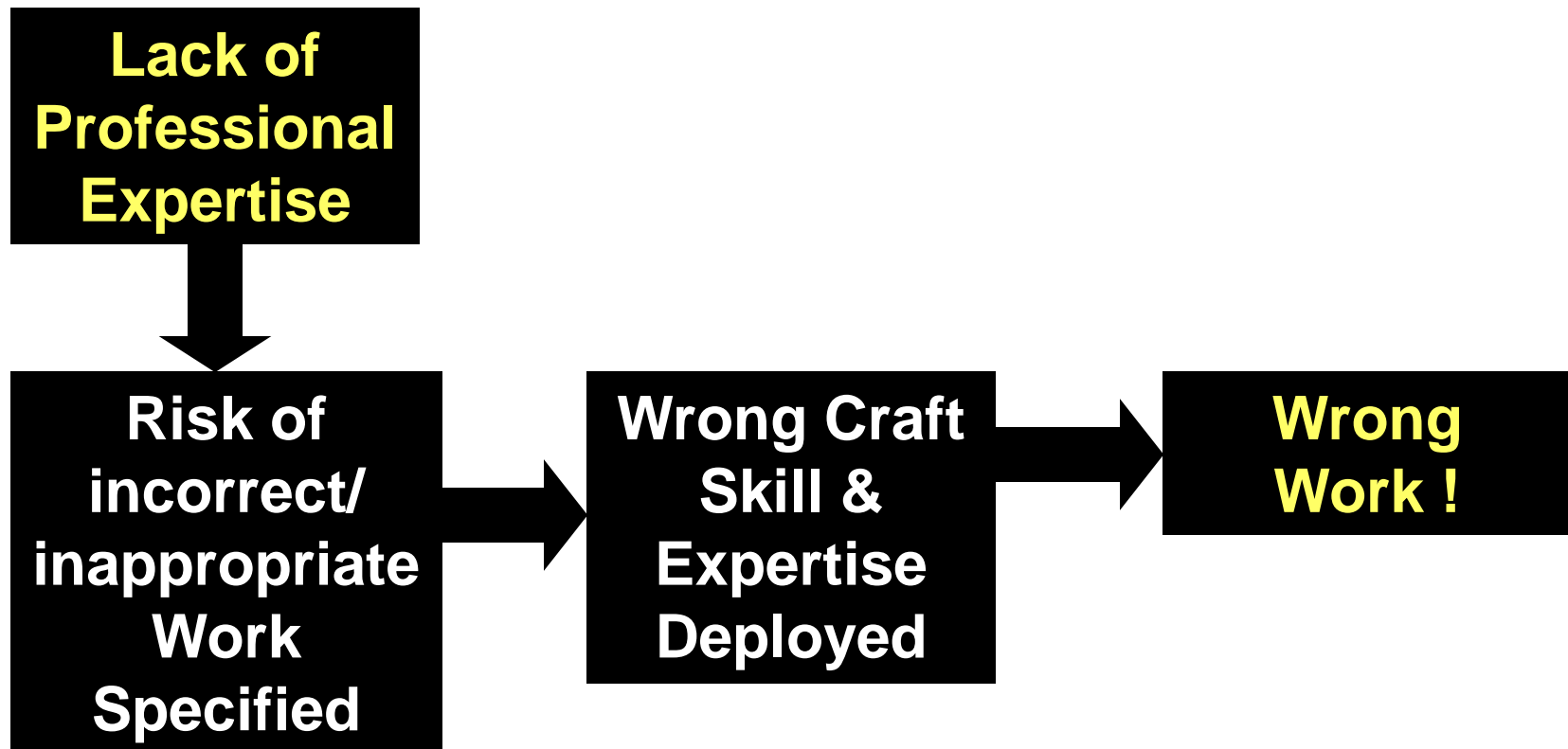
Sustaining traditional buildings

Whose responsible?



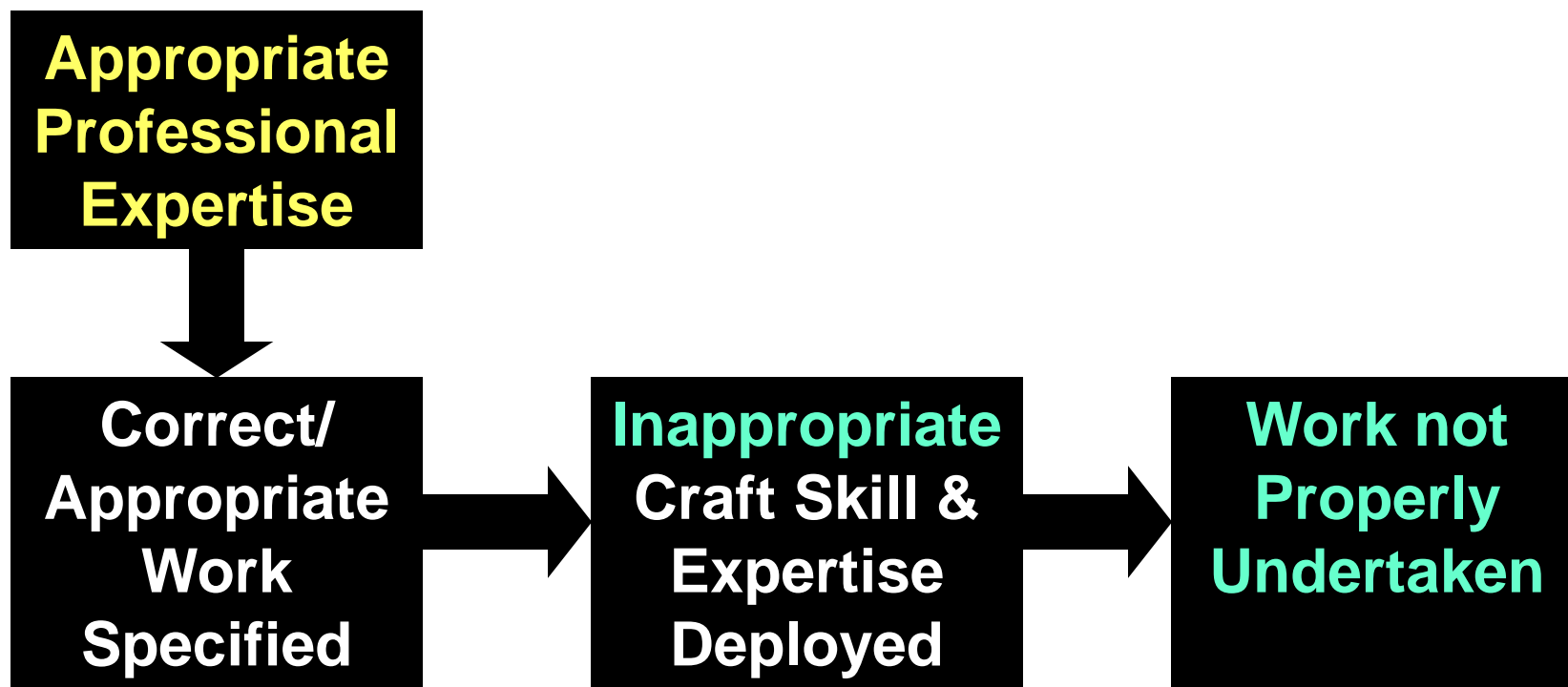
Sustaining traditional buildings

Whose responsible?



Sustaining traditional buildings

Whose responsible?



Heritage Cottage



3 David Street, Cwmdare

Heritage Cottage



3 David Street, Cwmdare

Heritage Cottage

- Tests & analysis
- Understanding performance
- Inputting into the pool of expertise being developed
- Knowledge to influence other parts of Welsh Government
- Guidance – Cadw & mainstream partners
- Training – crafts & professions



3 David Street, Cwmdare

Sustaining Traditional Buildings

Summary

- **Traditional and other buildings are different**
- **Character and aesthetics**
- **Common practice is often poor practice**
- **The very first measure is repair**
- **Need to understand building performance**
- **Risk analysis approach**
- **Some measures will be harmful**
- **Links to skills, training and education**



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Thank you - any questions?

Cadw www.cadw.wales.gov.uk/

Society for the Protection of Ancient Buildings www.spab.org.uk

Retrofit Buildings for Climate Change www.retrofitbuildings.com

Climate Change and Your Home www.climatechangeandyourhome.org.uk

Carbon Action 2050 www.carbonaction2050.com

STBA www.stbauk.org