



# *Identifying and treating damp, mould and condensation*

**Professor John Edwards** MA, DipBldgCons, CEnv, FRICS, FCIQB, IHBC



# Welcome

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### Professional Status

- Chartered Building Surveyor
- Chartered Construction Manager
- Chartered Environmentalist
- Certified Conservation /Heritage expert by the CIOB & RICS
- Retrofit lead @ Construction Wales Innovation Centre (CWIC)

### Experience & Expertise

- Includes inspecting / analysing buildings since 1981
- Trained DEA / Home Inspector & Retrofit Coordinator

### Developing Expertise, Standards & Guidance

- BS 7913: 2013 – Lead
- BSI B/560 Committee on Heritage
- IHBC Technical Panel – Chair
- CIOB Retrofit Guidance (2011) – co-author
- IHBC Retrofit Guidance (2019) – author
- Developed the only UK course in traditional building retrofit with a qualification
- BSI PAS 2035 Steering Group
- BSI PAS 2038 Steering Group
- BSI PAS 2030 Steering Group
- BSI Retrofit Standards Task Group
- Construction Site Management Retrofit National Occupational Standards production panel for CITB

# ***Damp is a common problem...***

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***“The most common single cause of building deterioration is dampness, and it has been estimated that over 1.5 million dwellings in the UK are seriously affected by dampness problems. The principal sources of dampness are rain water penetration through roofs and external walls, rising damp through walls and solid floors, and condensation. Because its causes and prevention are different from those of other sources of dampness, condensation is dealt with separately. Owing to the increased humidity created through modern cooking and heating devices and reductions in natural ventilation, condensation is responsible for a large proportion of dampness and mould growth. The causes of moisture can come from inside or outside the building, and it is essential that proper investigation is undertaken to determine the cause of dampness before any remedial action is taken”.***

Gorse & Highfield (2009), Ch.6, Section 6.1, p.122

# *What does it all mean....*

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**Condensation:** the process whereby water is deposited from air containing water vapour when its temperature drops to or below the dewpoint.

**Dampness:** used here to cover a wide variety of phenomena relating to the unwanted presence of water or water vapour, whatever its cause.

**Dewpoint temperature of the air:** the temperature at which condensation of liquid water starts when air is cooled, at constant vapour pressure.

**Rain penetration of walls and roofs:** results from water entering the structure to such an extent that the resulting dampness or dripping of water becomes a nuisance.



# *What does it all mean....*

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**Relative humidity:** the ratio, normally expressed as a percentage, of the actual amount of water vapour present to the amount that would be present if the air were saturated at the same temperature.

**Rising damp:** normally the upward transfer of moisture in a porous material due to capillary action.

**Thermal bridge (old term: cold bridge):** part of a structure of lower thermal resistance which bridges adjacent parts of higher thermal resistance and which can result in localised cold surfaces on which condensation, mould growth and/or pattern staining can occur.

# *What does it all mean....*

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**Porosity** - a measure of open space is within material.

**Permeability** - a measure of the ease with which a fluid can move through a porous material

**Absolute Humidity** is the measure of the actual water vapour in the air.

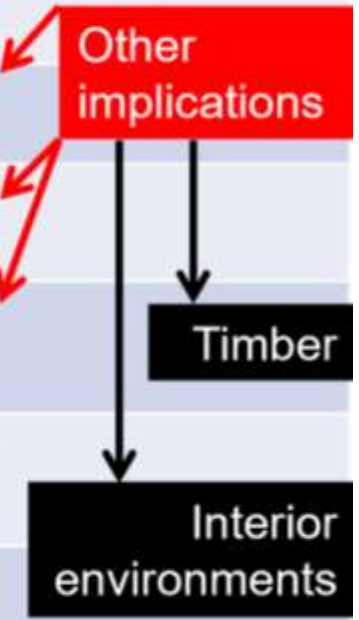
**Vapour Pressure** – the actual moisture in the air

**Vapour diffusion** - the movement of water vapour through vapour-permeable materials.

# So what is damp and what isn't ?

**Materials have a threshold above which the moisture content is too high – hence they are then known as damp**

MATERIAL	DAMAGE UNLIKELY	ACTION REQUIRED	DAMAGE LIKELY
Timber (electrical resistance)	<18	>20	>24
Brick (engineering)	<4	>6	>8
Brick (commons)	<10	>14	>20
Brick (facing)	<8	>10	>20
Concrete block (high density)	<8	>12	>15
Concrete block (low density)	<6	>10	>12
Render	<3	>5	>8
Plaster	<2	>3	>4



## Most common:

- Condensation
- Rain penetration
- Rising damp (capillary attraction)

## Other causes:

- Construction moisture
- Pipe leakage
- Leakage at roofing features and abutments
- Spillage
- Ground and surface water
- Contaminating salts in solution



# ***Laws – and when it fails!***

**Awaab Ishak died in 2020 from a respiratory condition caused by mould**



***We need to learn lessons!***

# Laws – and when it fails!

## Botched insulation scheme leaves residents suffering with damp for years



*We need to learn lessons!*

## **Renting Homes (Wales) Act 2016**

### **Potential landlord actions:**

- **damp proof courses**, membranes and detailing around doors and window openings
- external fabric kept in good repair **to avoid rain penetration**
- frost protection for **pipes and tanks**
- properly installed **baths, sinks** etc., with properly installed **drainage**
- properly installed and maintained **rainwater goods**
- **properly ventilated** roof and under floor spaces to **ensure timber remains air dry**
- **adequate extraction of moisture laden air** during peak times, such as cooking, bathing and laundry



## **Renting Homes (Wales) Act 2016**

### **Potential landlord actions – dealing with damp and mould:**

- continuous low-level background **ventilation** where necessary
- sufficient means of **ventilation** to cope with moisture from normal domestic activities without the need to open windows that could lead to heat loss, noise and security risks
- appropriate **ventilation** for dwellings of high occupant density

### **Recognising that dust mite and mould and fungal growth are linked to moisture:**

- **reduced ventilation levels**
- **increased humidity, especially beyond 70 per cent**
- **warmer indoor temperatures in winter because of dwelling design in renovated houses.**

*Renting Homes (Wales) Act 2016*

# Keeping people safe & healthy

## Damp and mould growth Includes:

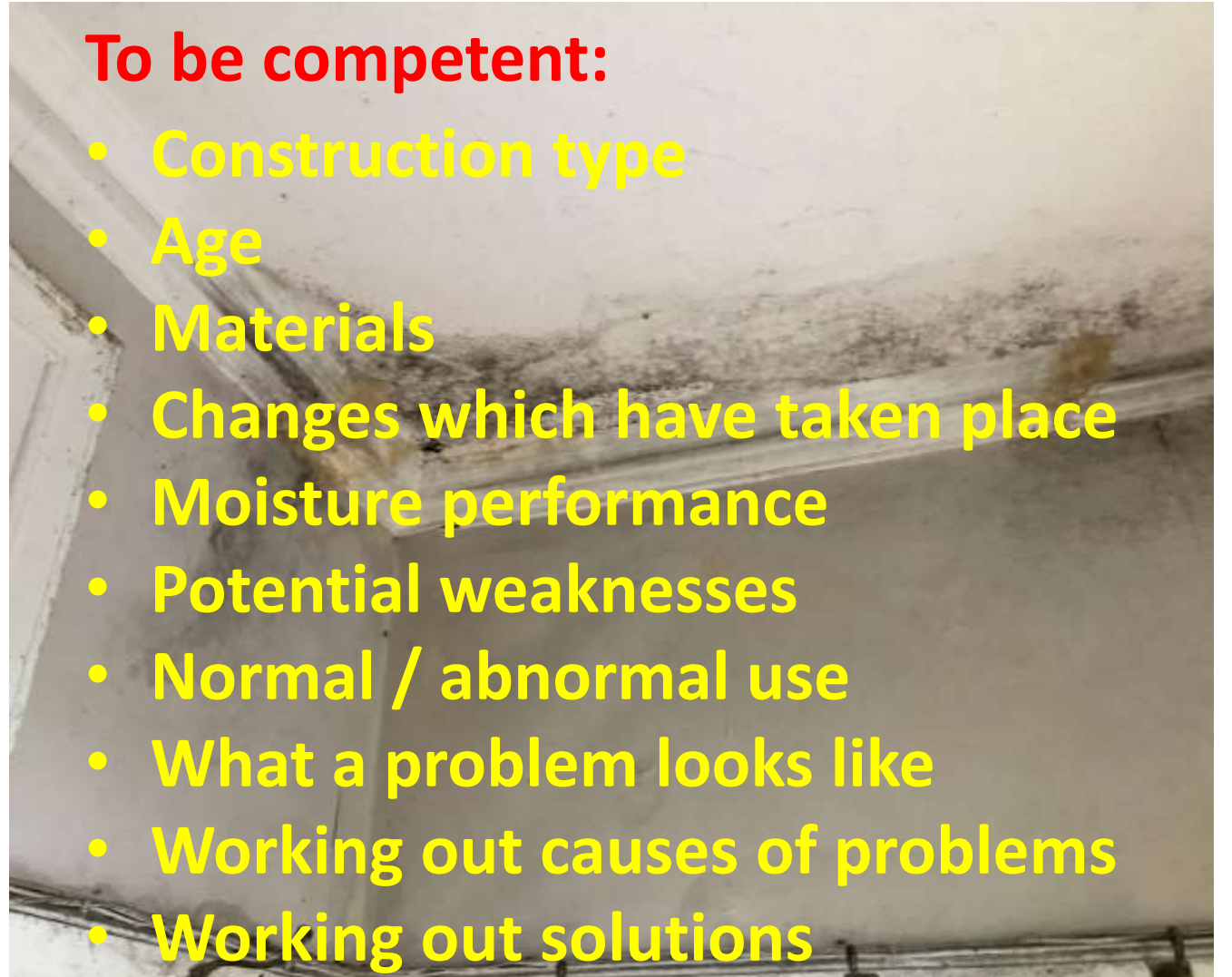
- Setting out possible problems
- Detailing the causes
- Detailing actions for landlords
- Responsibility of tenants

## We also need senior management:

- Understand importance priority
- Understand how to deal with it
- Set down principles and processes
- **Make sure everyone who deals with it is competent and has necessary resources**

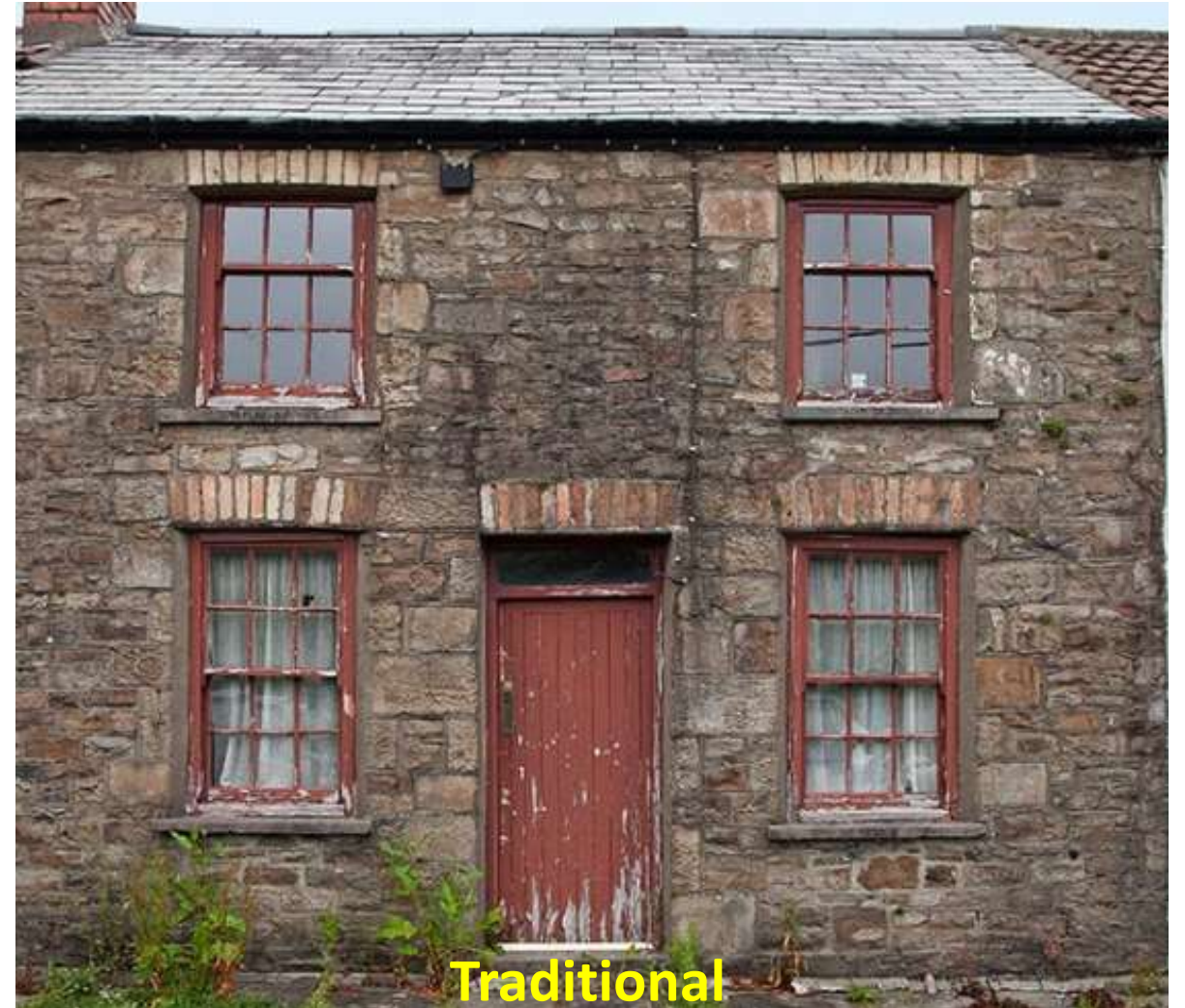
## To be competent:

- Construction type
- Age
- Materials
- Changes which have taken place
- Moisture performance
- Potential weaknesses
- Normal / abnormal use
- What a problem looks like
- Working out causes of problems
- Working out solutions



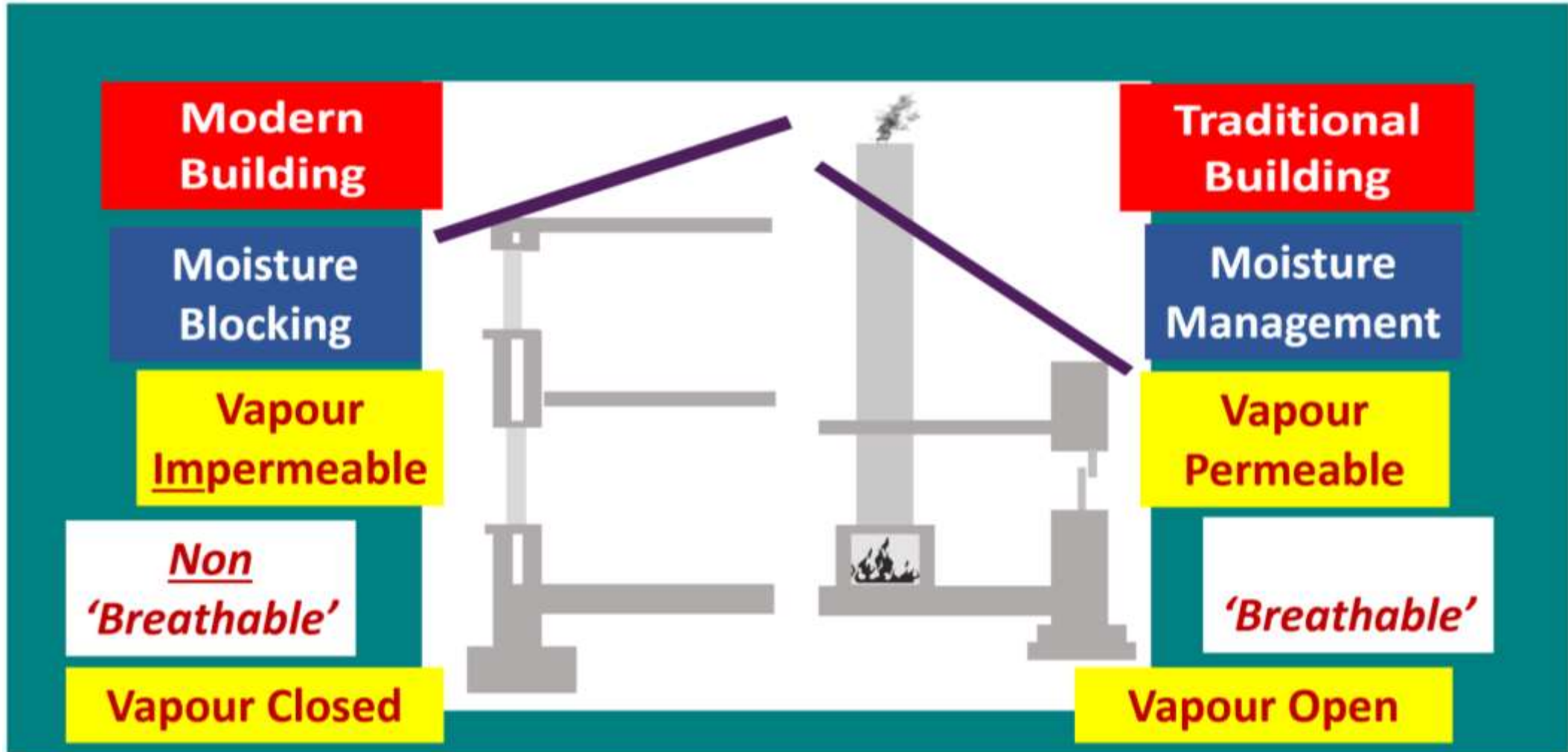


# *Understanding the building – old and new..*



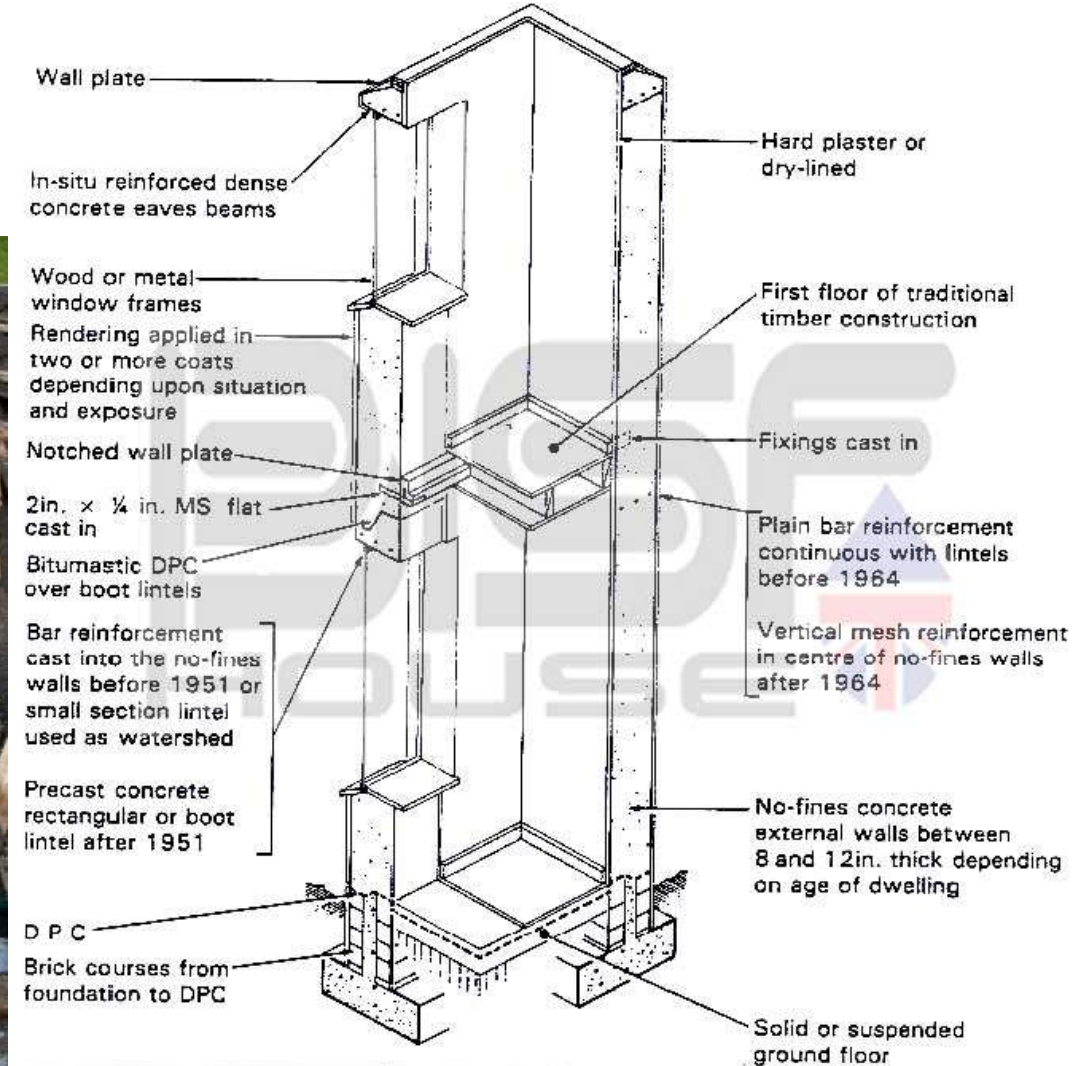
# Understanding the building – old and new...

*and what it means for moisture...*





# Different types of modern...





# *Different types of old...*



*Subtle differences that need to be understood – affecting the way moisture works*



# *Different types of modern...*

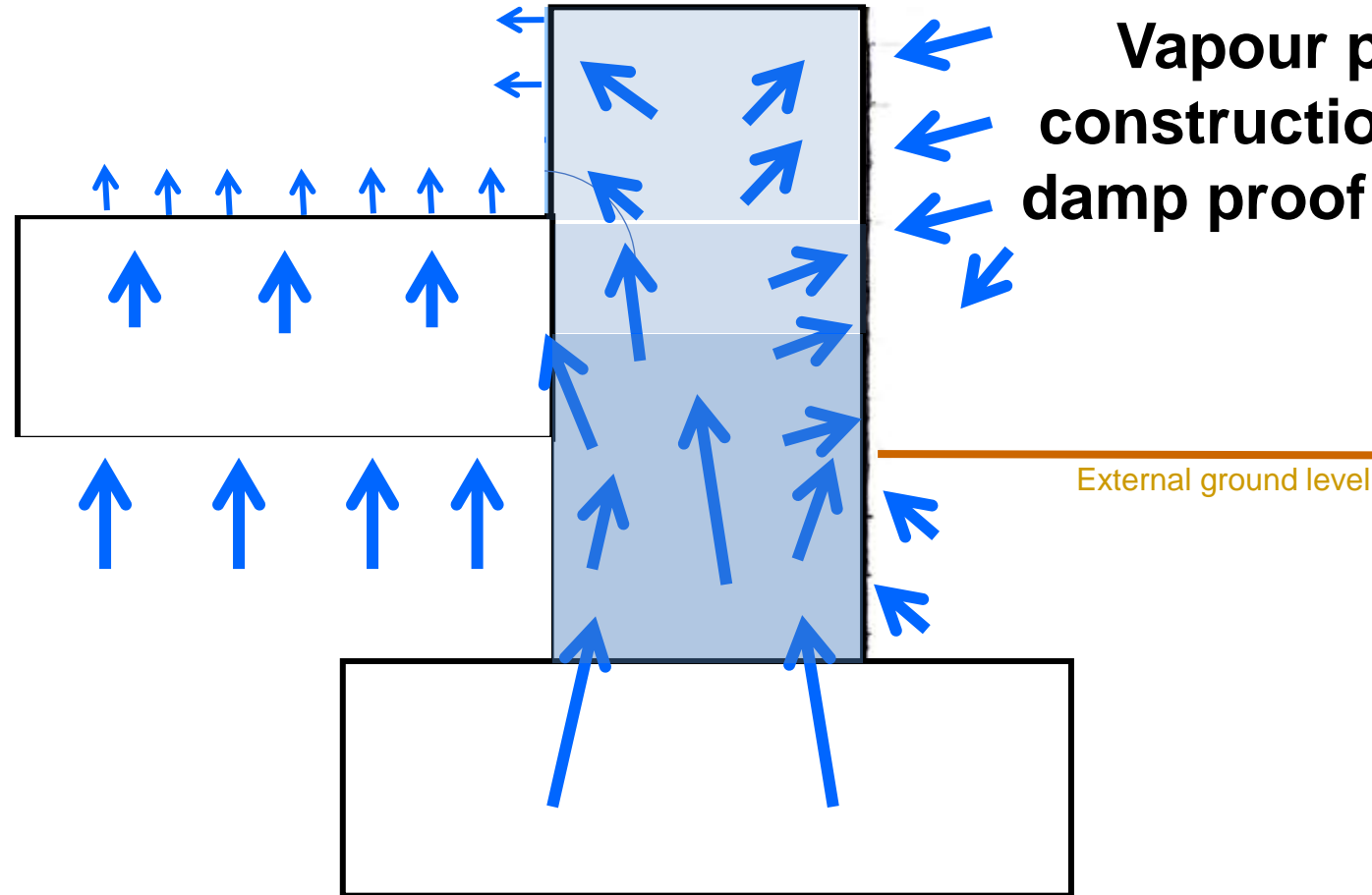


*Not so Subtle differences that need to be understood – affecting moisture*



# Ground floor wall junction

**Traditional  
buildings up to  
about 1875**

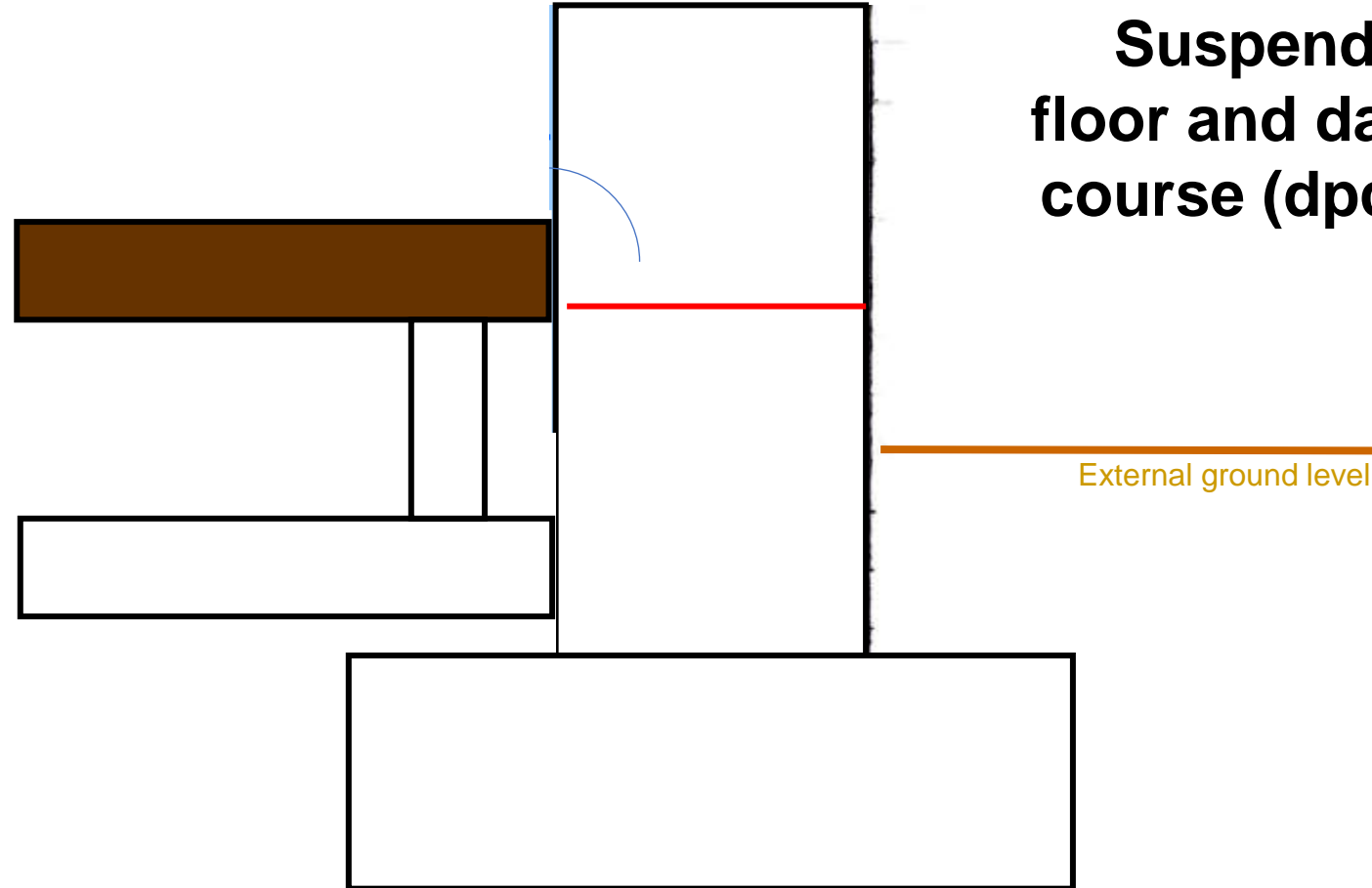


**Vapour permeable  
construction without  
damp proof materials**

External ground level

# Ground floor wall junctions

**Traditional  
buildings after  
about 1875**

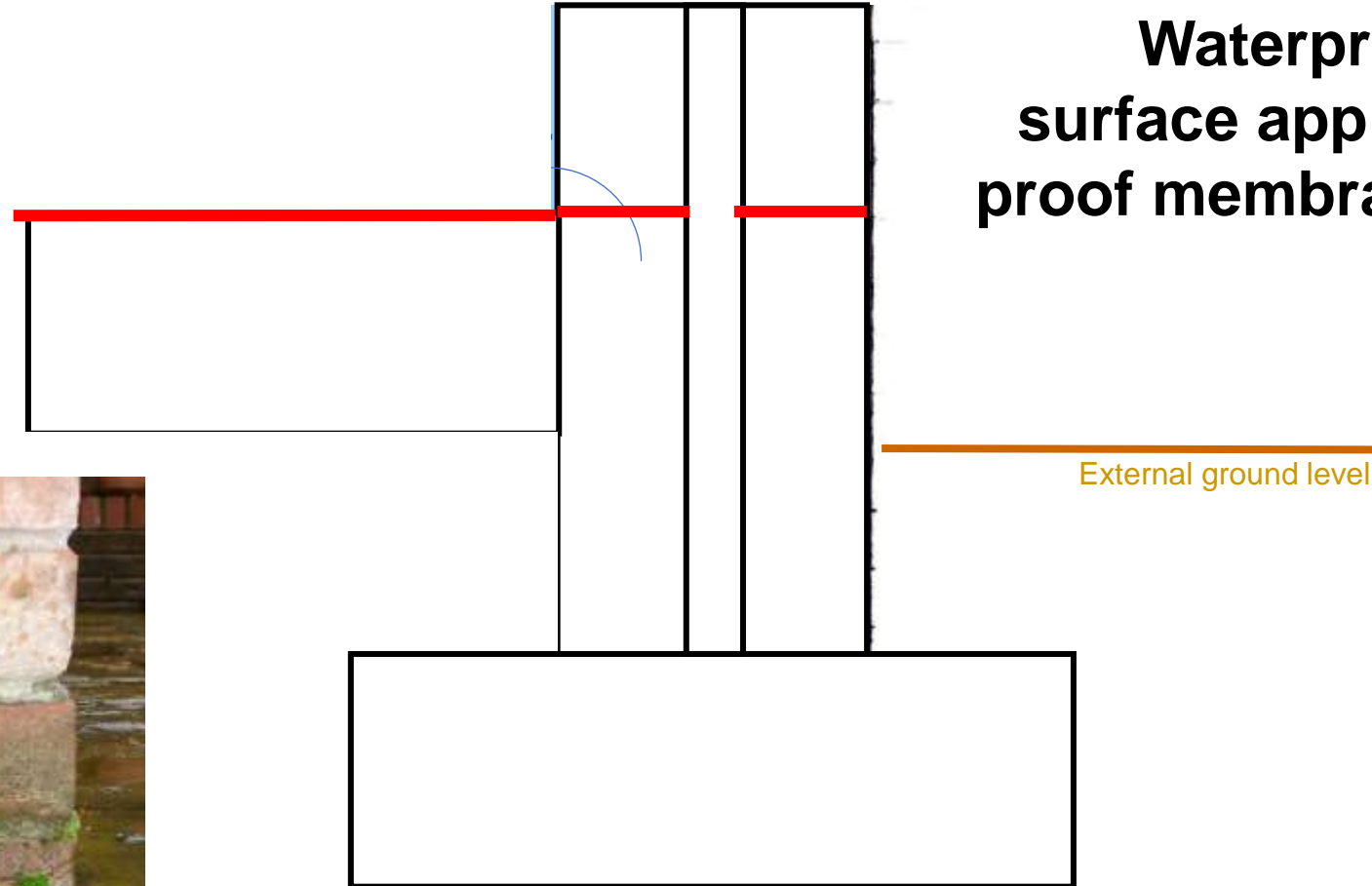


**Suspended timber  
floor and damp proof  
course (dpc) in walls**

External ground level

# Ground floor wall junctions

Modern buildings  
from about 1945  
to 1960 ish

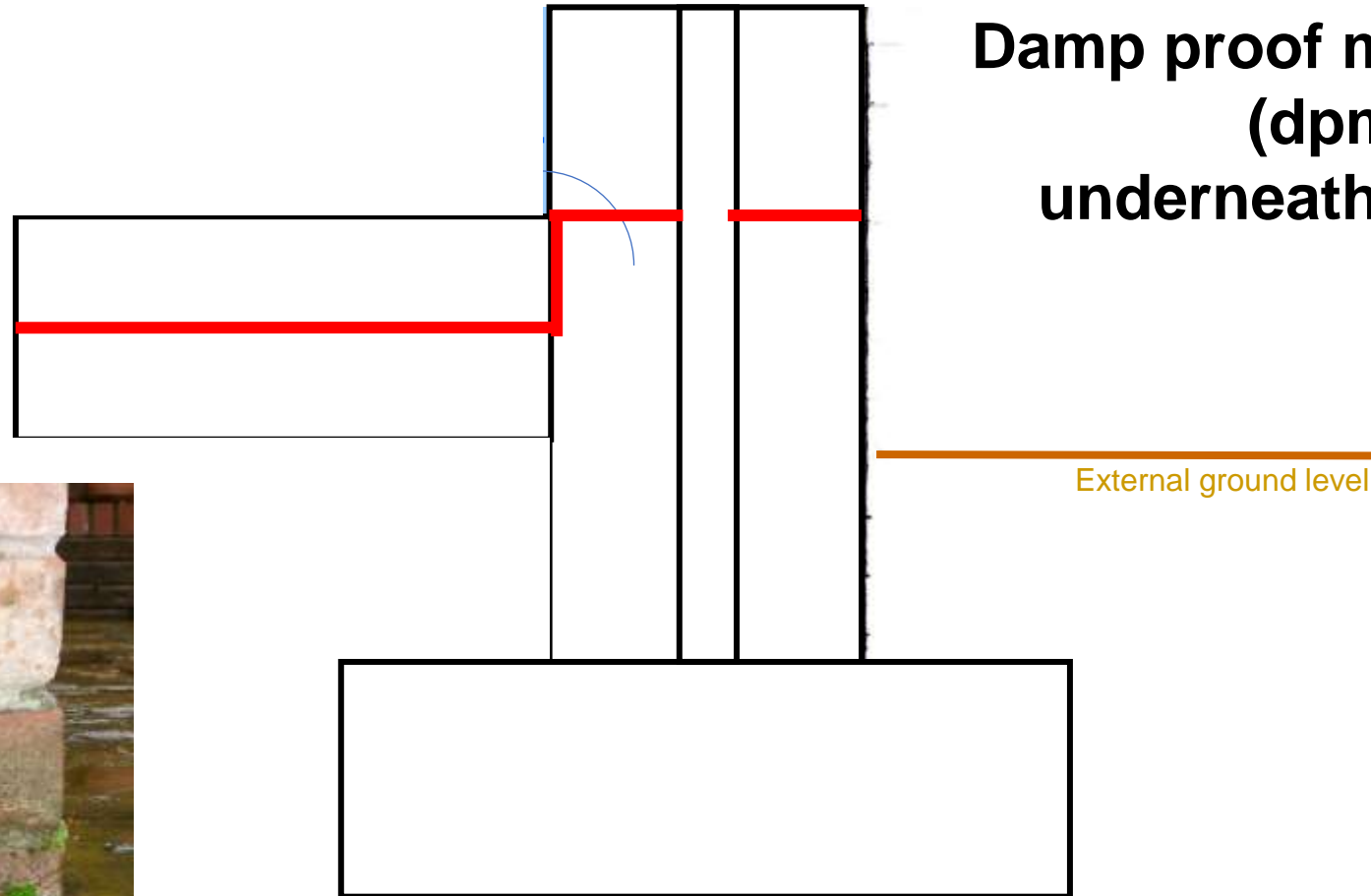


Waterproof floor /  
surface applied damp  
proof membrane (dpm)

External ground level

# Ground floor wall junction

Modern buildings  
after 1960 ish



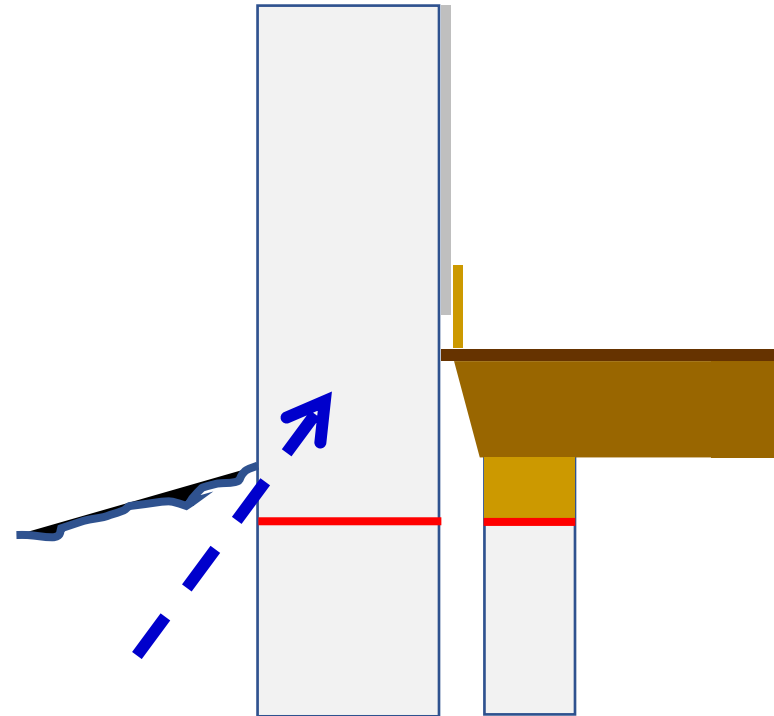
Damp proof membrane  
(dpm) located  
underneath concrete  
floor slab

External ground level



# Rising Damp – things to note

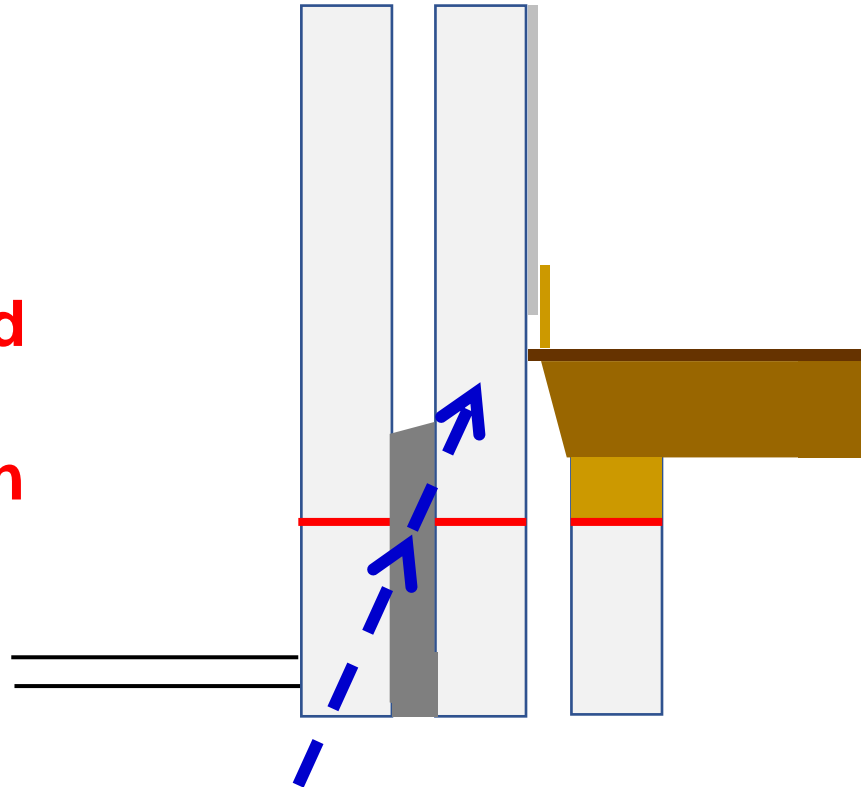
**DPC bridged  
by soil**





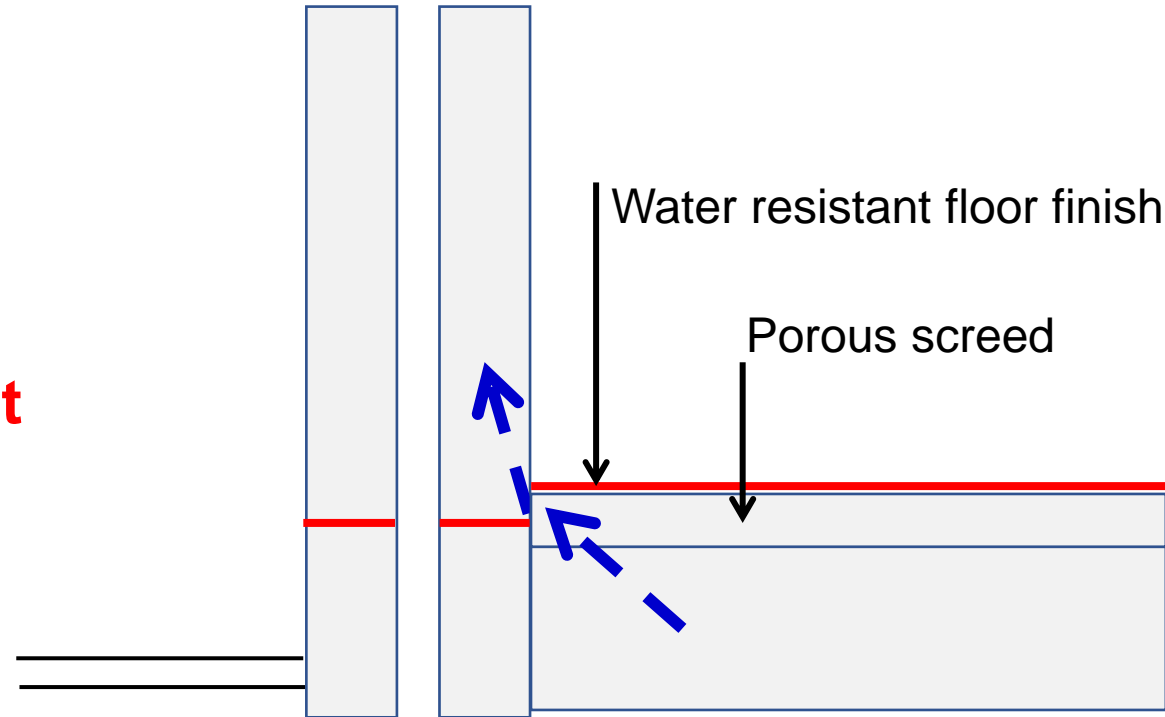
# Rising Damp – things to note

**DPC bridged  
by mortar  
droppings in  
cavity**



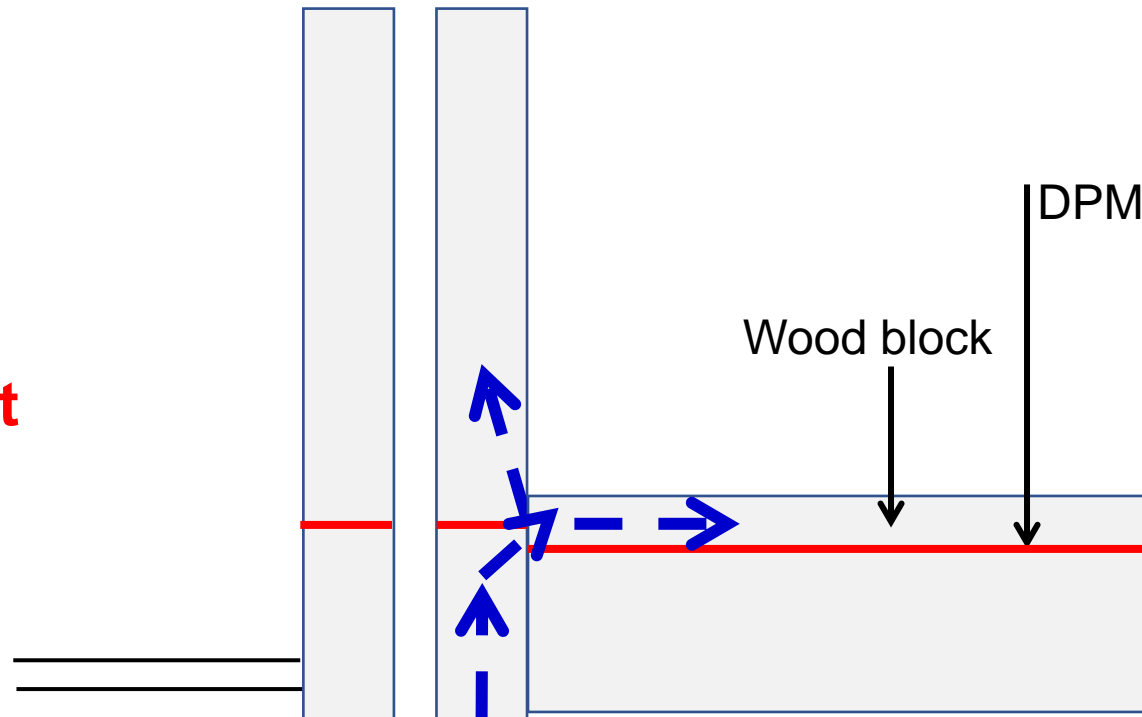
# Rising Damp – things to note

**DPC /DPM  
detachment**



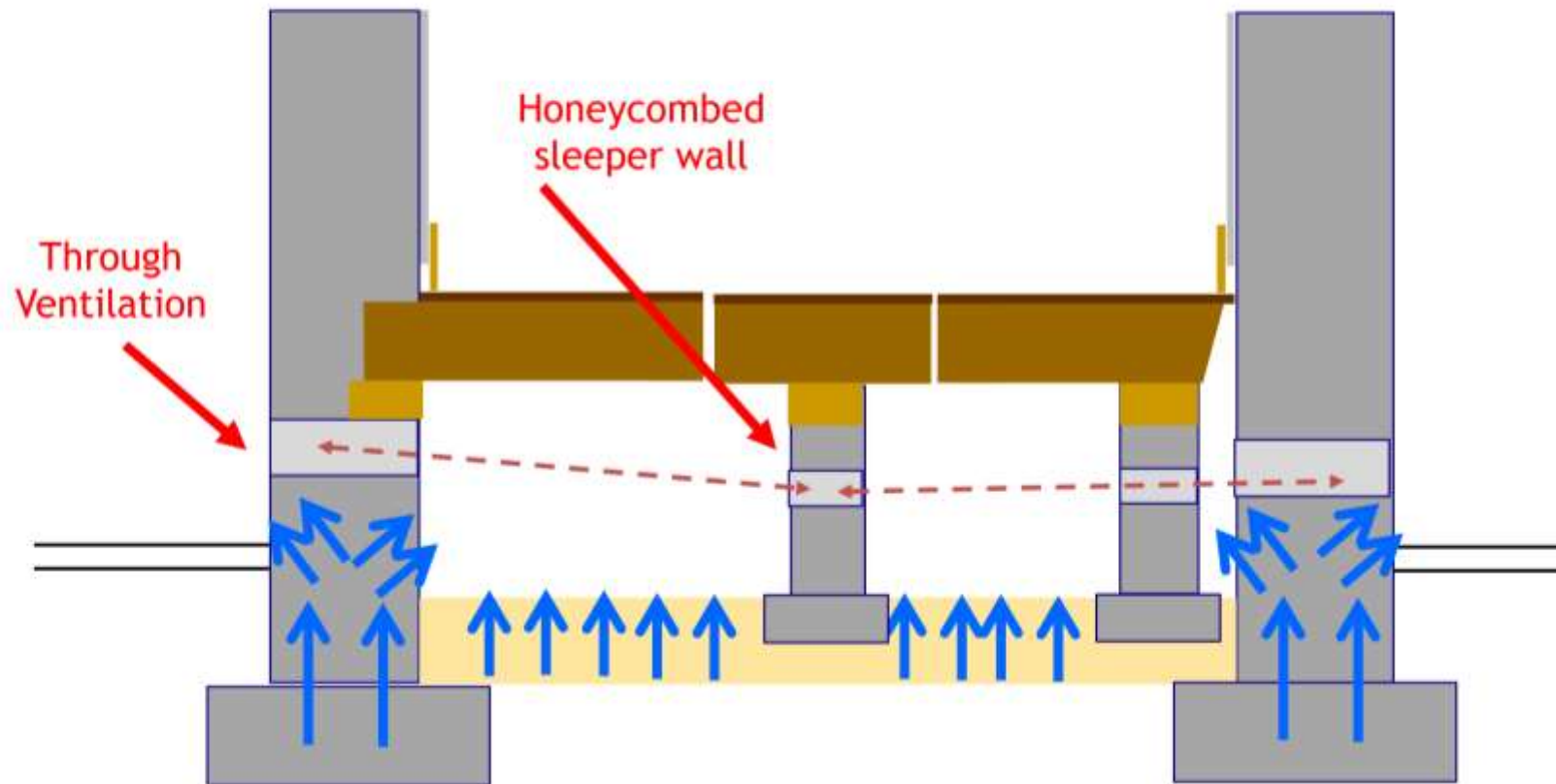
# Rising Damp – things to note

**DPC /DPM  
detachment**



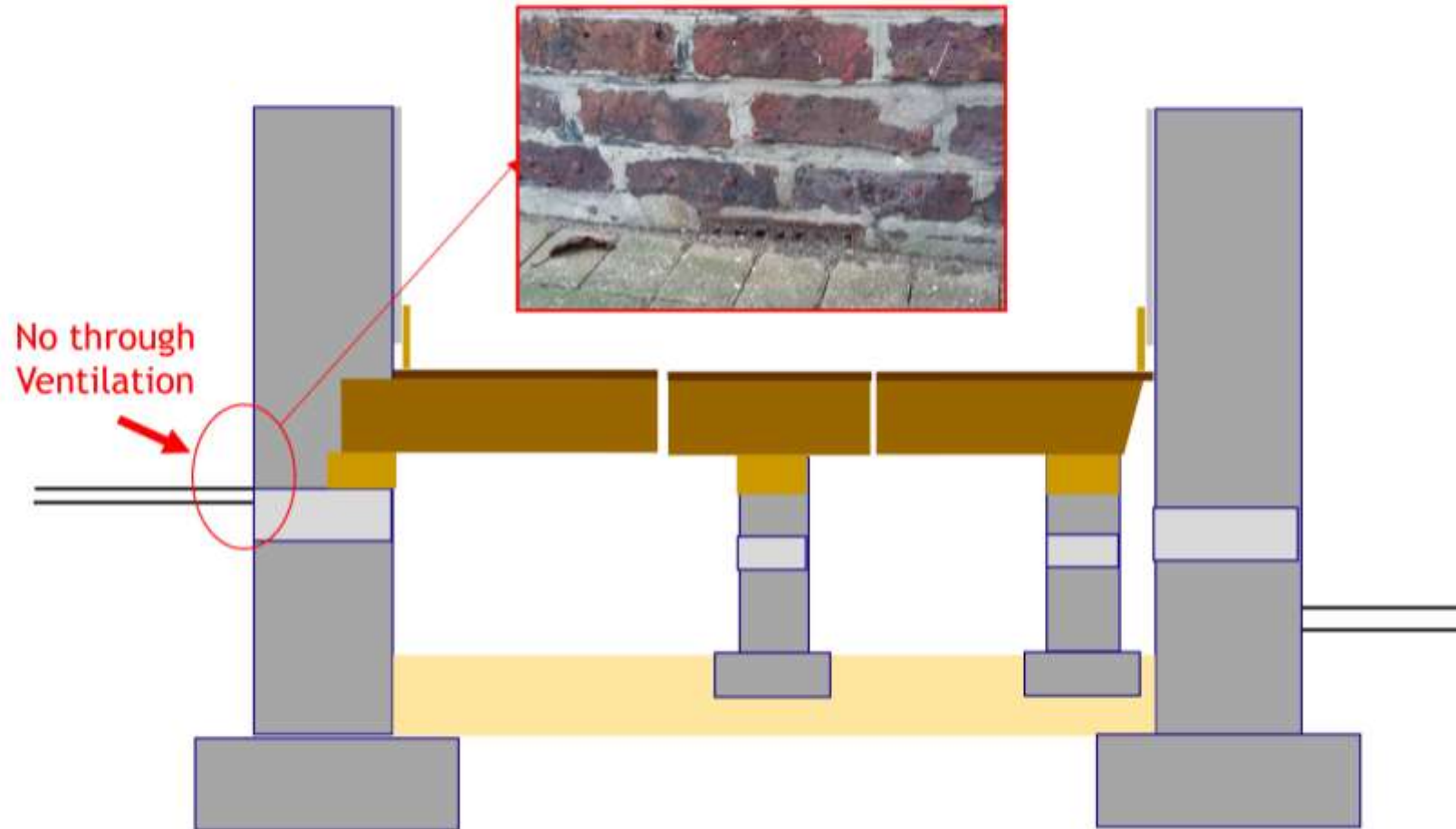
# Rising Damp – related issues...

*The way it worked originally... MOISTURE WAS MANAGED!*



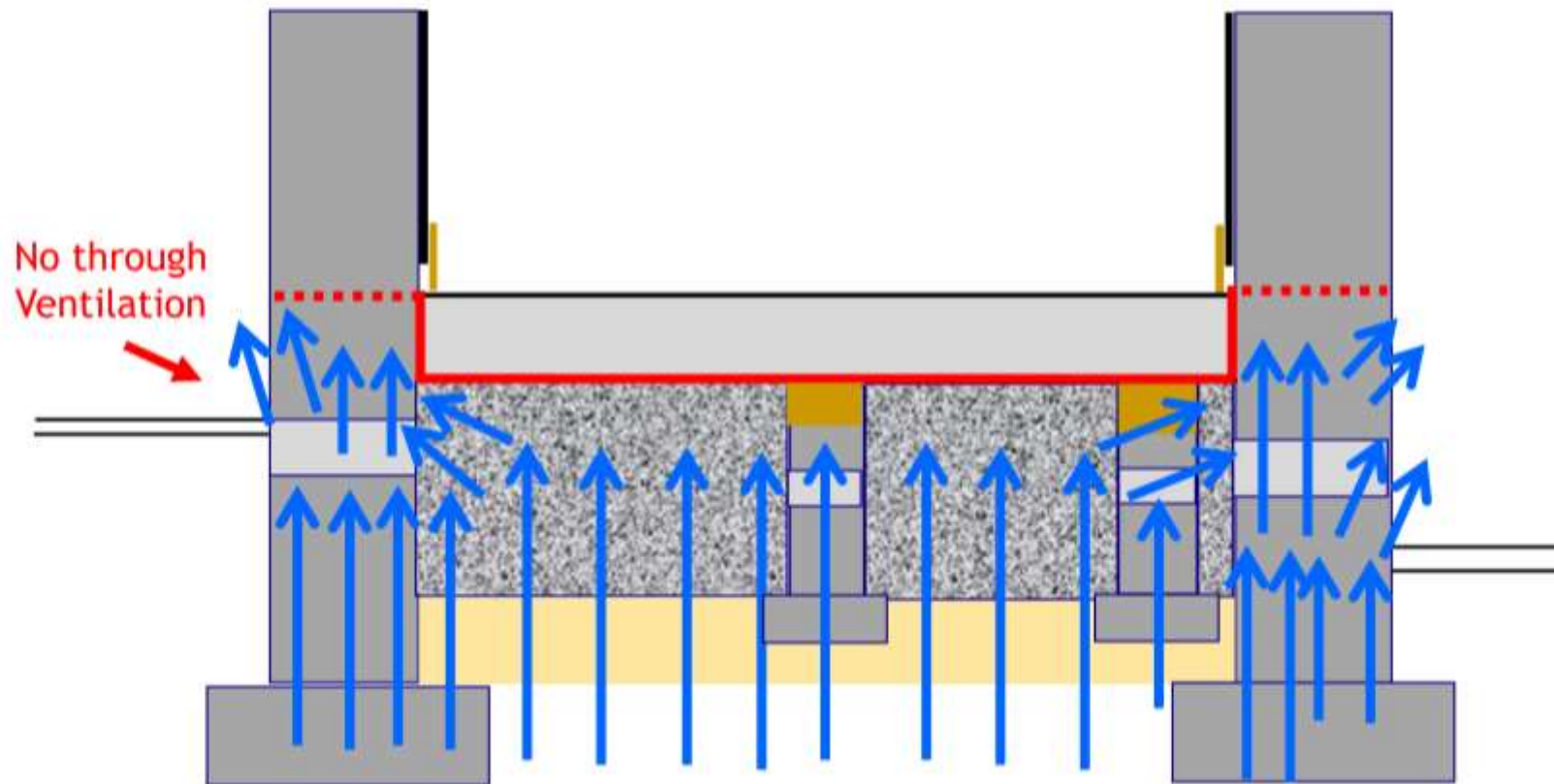
# Rising Damp – related issues...

*Then the vent was blocked – high RH in sub floor...*



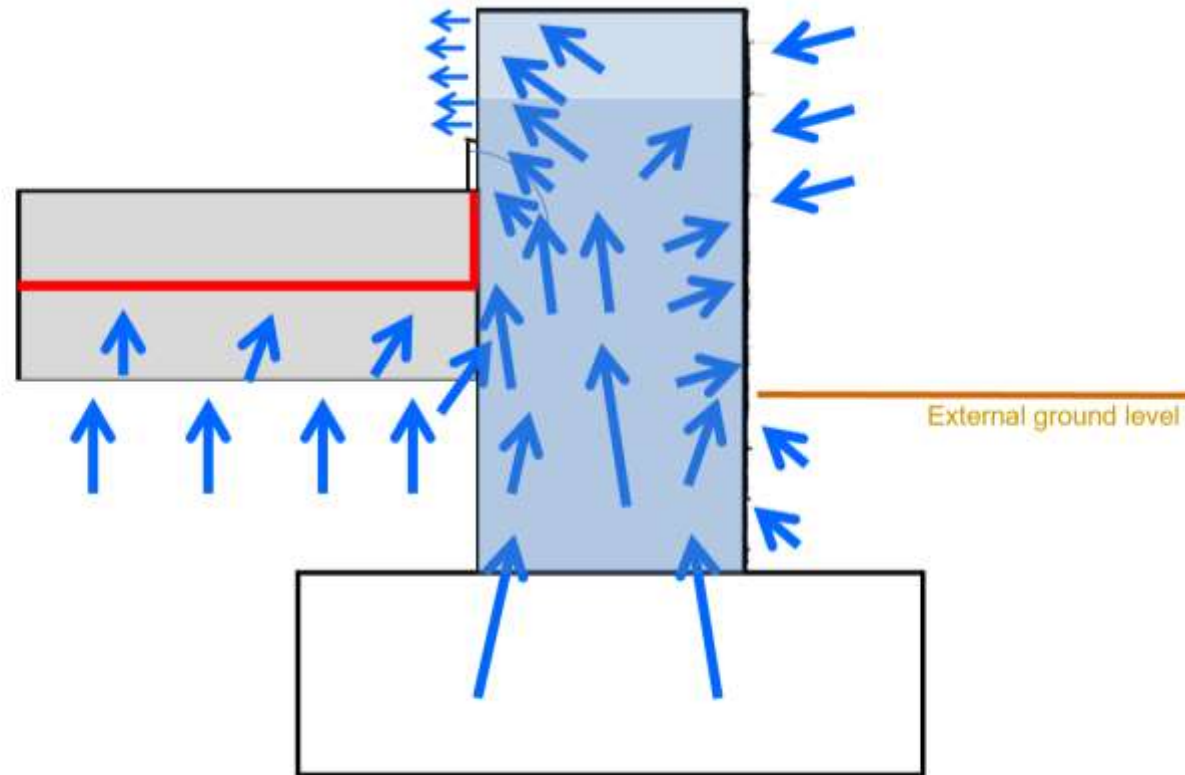
# Rising Damp – related issues...

*Retrofitted dpc into walls... addressing the symptom!*



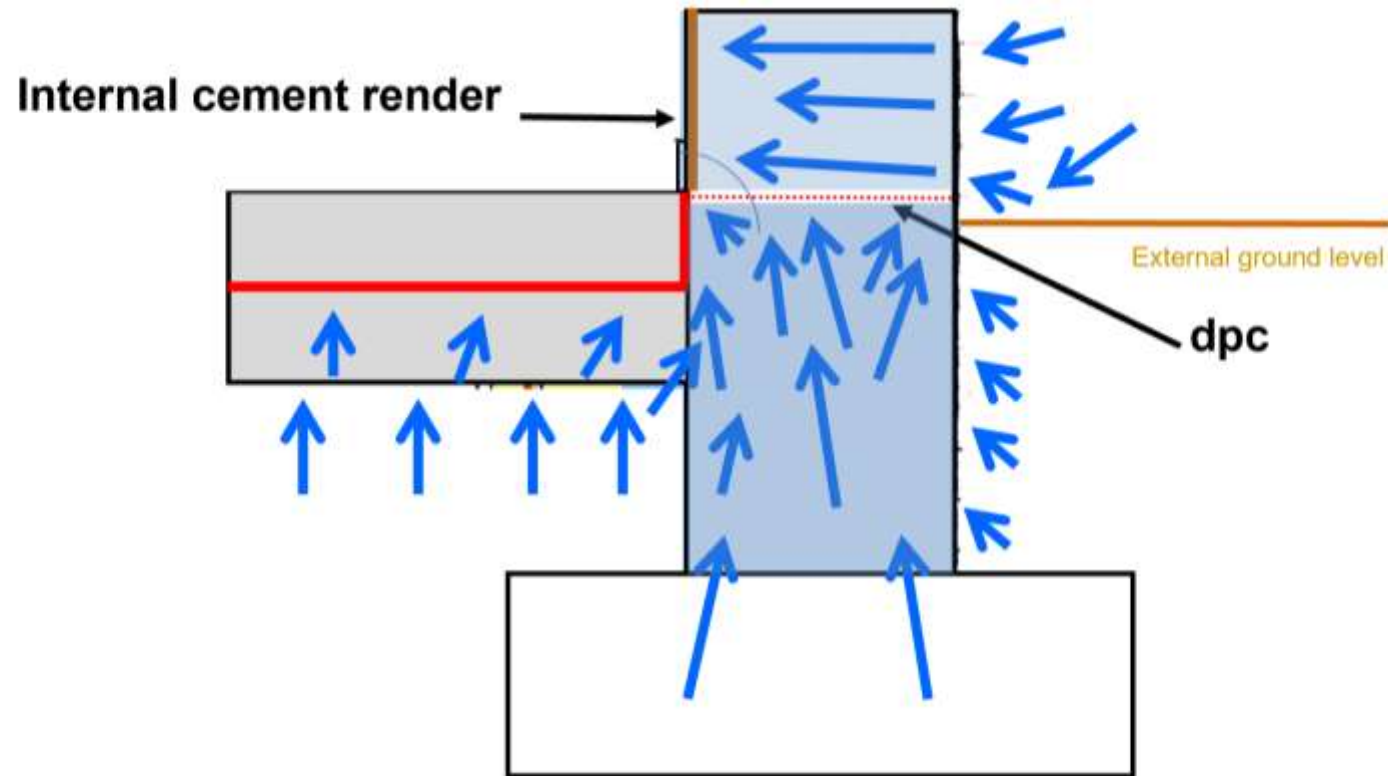


# Rising Damp – things to note



***Now we have problems***

# Rising Damp – things to note



***Treating the symptom!***

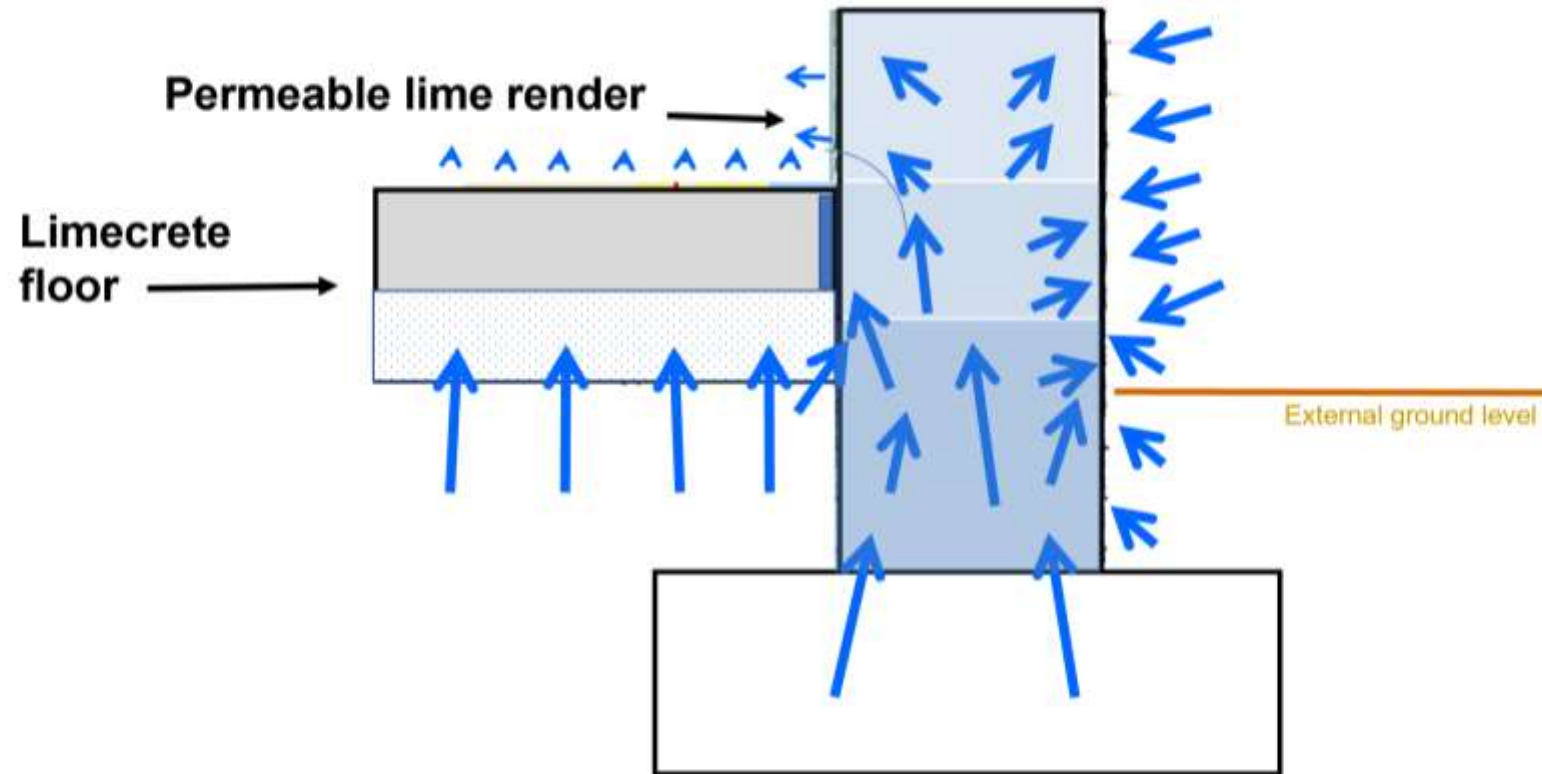
# *Rising Damp – things to note*



***Retrofitted dpc***

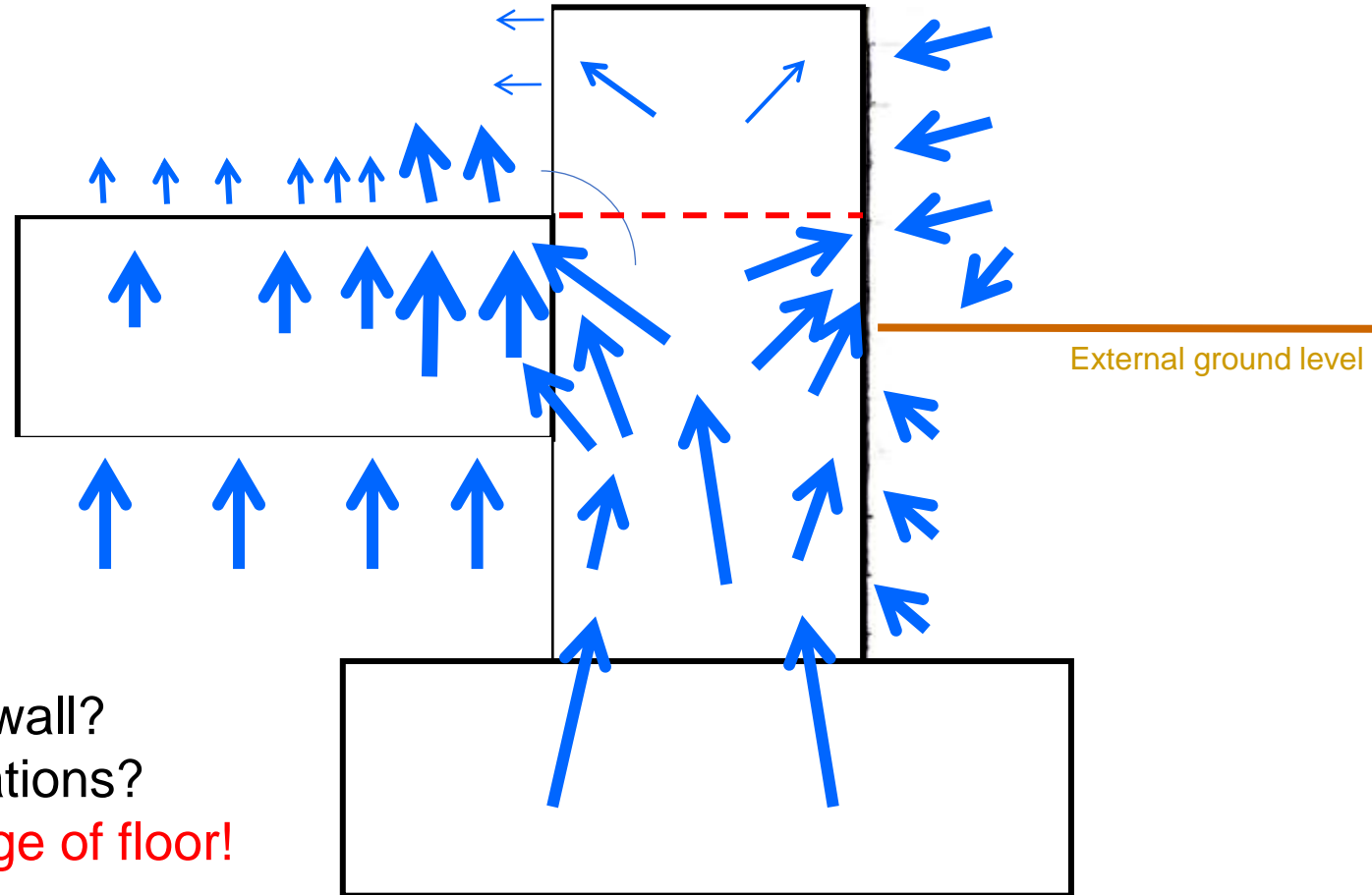


# Rising Damp – things to note



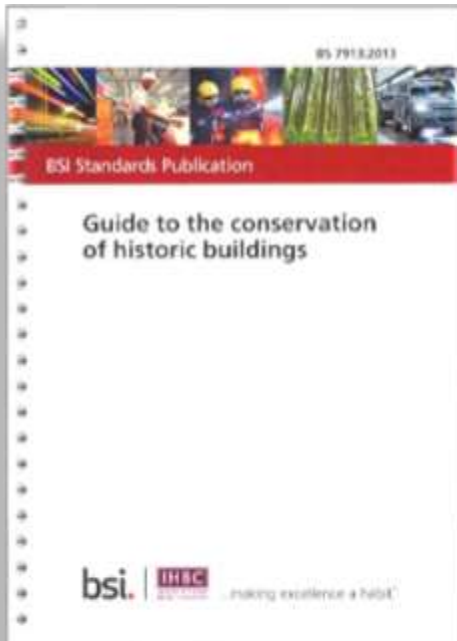
***But you should treat the cause***

# Rising Damp – things to note



Would you install a dpc in the wall?  
If you did are there any implications?  
**Increased moisture around edge of floor!**

## BS 7913: 2013: Section 5.3.1



## Sustainability

.....“Elements such as walls can be over a third less energy efficient if damp. Some energy efficient measures can have an adverse effect on sustainability. 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 (see 6.3). The need for energy efficiency and low carbon might also influence the selection of materials and work methods as they can impact on thermal performance and weather resistance. Building materials and products should be sourced and procured in a sustainable manner” .....



## Relationship between wall moisture and U - Values

**DAMP**

**DRY**



**0.76 W/m<sup>2</sup>K @ 1790 mm above ffl**

**1.05 W/m<sup>2</sup>K @ 630 mm above ffl**

**Greatest heat  
loss through the  
dampest area**

Courtesy Caroline Rye / SPAB

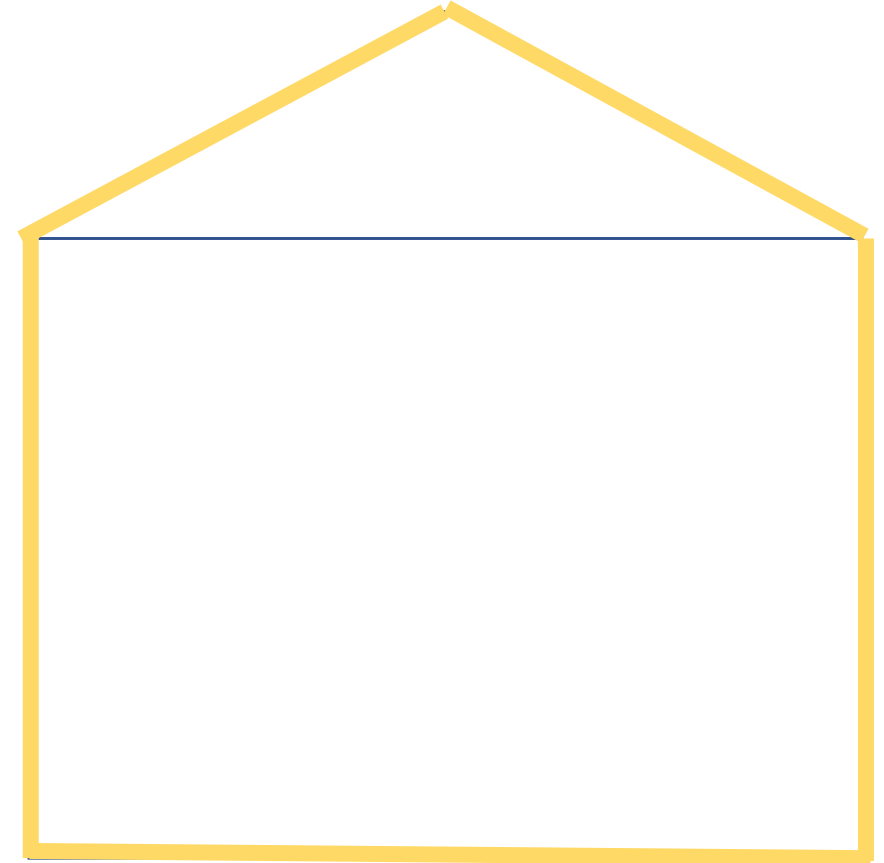


# *The building envelope – heat and moisture*

## *The buffer between the inside and outside*

1. Floors
2. Walls
3. Doors and windows
4. Roof / ceiling

*A need for thermal consistency - cohesion*



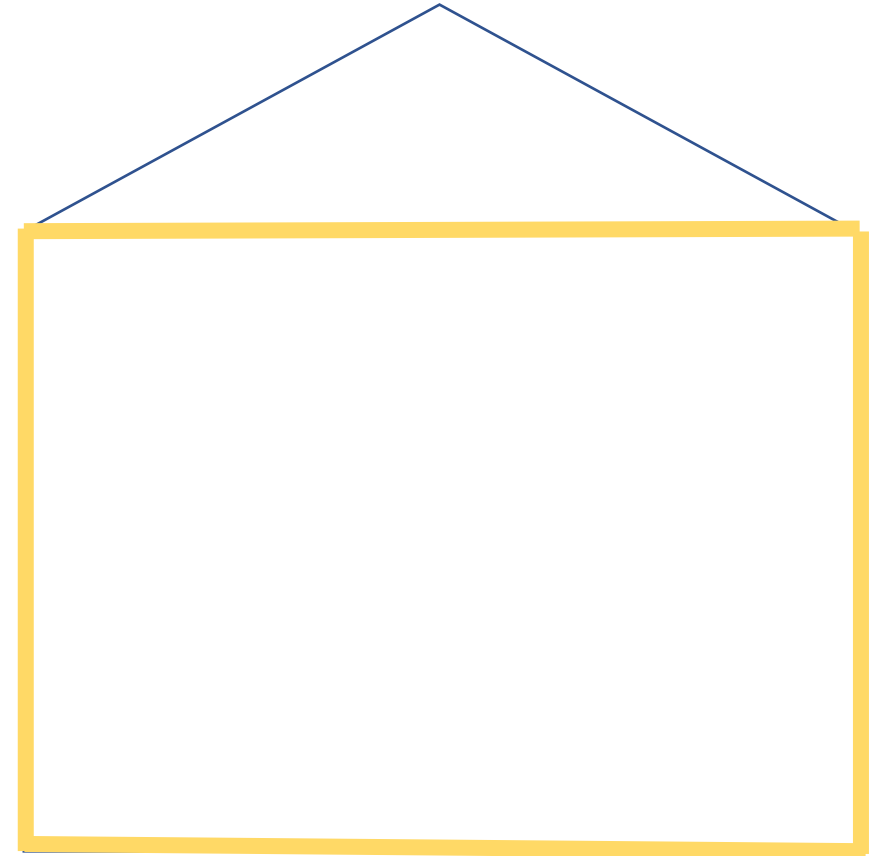
*Retrofit must retain thermal cohesion – if not it will result in weaknesses (thermal bridging)*

# *The building envelope – heat and moisture*

## *The buffer between the inside and outside*

1. Floors
2. Walls
3. Doors and windows
4. Roof / ceiling

*Often the 'thermal' envelope will be the ceiling*

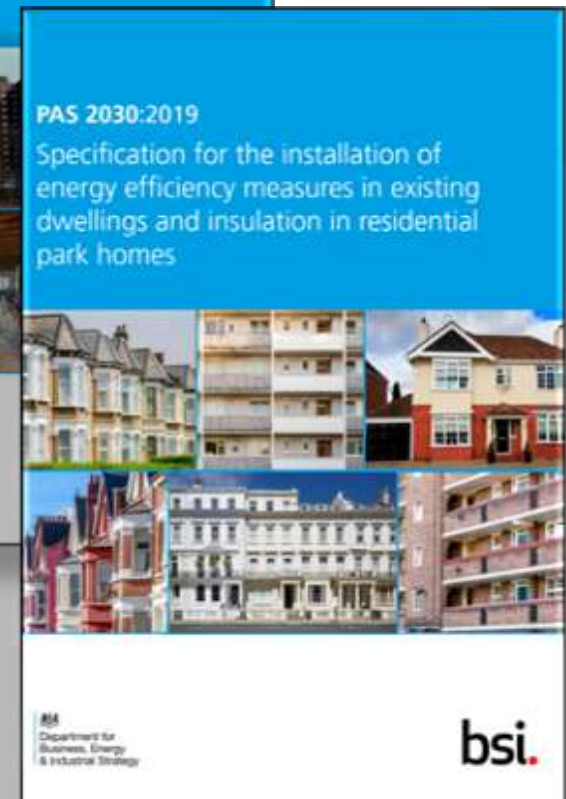
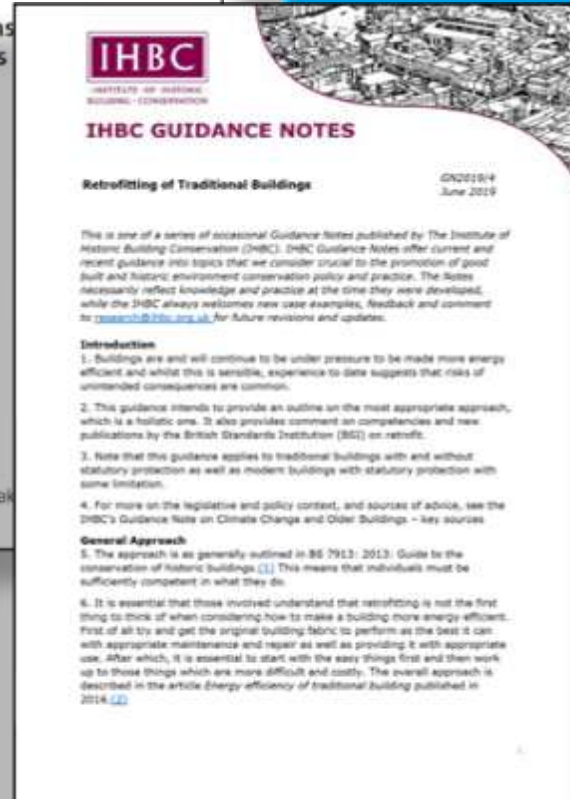
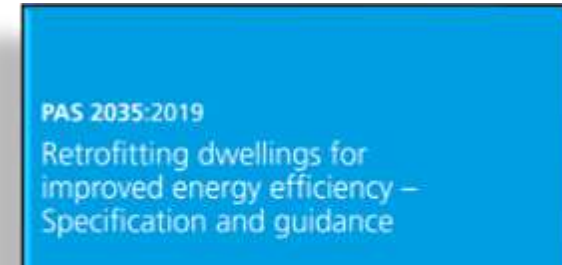


*A need for thermal consistency - cohesion*

*Retrofit must retain thermal cohesion – if not it will result in weaknesses (thermal bridging)*

# The building envelope – heat and moisture

All have a focus on the thermal envelope, minimising thermal bridging, the need for ventilation and to deal with damp first, but..



But not all take the most appropriate approach to understanding moisture...



# Specific guidance...

## Investigation of moisture and its effects on traditional buildings

Principles and competencies

Joint position statement, 1st edition, September 2022



# Specific guidance...

Investigation of moisture and its effects in traditional buildings

## Explanatory notes

This document outlines the principles and competencies that surveyors and contractors should adopt to deliver best practice when investigating moisture-related issues in traditional buildings. It goes on to list specific items that surveyors and contractors should have knowledge of and consider at each stage of the diagnostic investigation and repair process.

This document is intended to be a framework that can be used for moisture investigations in buildings of all types and ages. It is important to note that the term 'traditional' refers to buildings with solid walls built from permeable materials such as brick, stone, earth, timber and lime-based mortars, plasters and renders. Traditional construction absorbs moisture but allows it to evaporate when conditions become drier. This is in contrast to modern construction, which relies on impermeable barriers to prevent moisture entering the fabric.

It should be appreciated that there are existing regulations, standards and guidance that will be applicable to traditional buildings. While it is not practical or necessary to list them all in this document, it is assumed that competent surveyors be aware of these documents and will understand when they should be applied in the diagnosis of moisture.

Additional considerations apply where a building is deemed to be a 'heritage asset', either by statutory designation (e.g. being a Listed Building) or by being identified as such by the local planning authority. Although measures to investigate and deal with moisture problems will still be determined primarily by technical issues, the potential impact on a building's heritage values and significance should influence the approach taken.

Consulting the relevant Historic Environment Record (held by the local Planning authority) will help to establish whether the building is a 'heritage asset' (either designated or undesignated), what might be important about it and whether statutory consent will be needed for any proposed works, including invasive investigations.

This document is aimed at those providing consultancy advice or surveys to owners and buyers of a building, and assumes that a non-invasive inspection will be undertaken initially, with an invasive inspection to follow if it is deemed necessary.

It is also assumed that impartiality in the context of this paper means that the surveyor is acting within the limits of their respective organisation's ethical standards and rules of conduct, and therefore any report will be impartial in that it gives a fair and unbiased opinion. For example, it is appreciated that surveyors and contractors may be asked to visit a property and provide a quotation to solve a damp problem, rather than just providing a report with no quotation included. In these cases, impartiality is taken to mean that the contractor will report objectively on the facts of the problem, only suggest remedial works that are proportionate to any defects discovered and respect the nature of the property.

It is also noted that, in the context of this document, the declaration of any conflicts of interest are stipulated in the knowledge that any report with a quotation may involve the surveyor or contractor being remunerated for work. However, what is intended is that any remedy specified by the surveyor or contractor does not contain a product, treatment or process that will benefit the surveyor or their firm financially without declaring this

3

**Principles and competencies**

**For everyone**

**Provides a framework – all types of buildings**

**Understanding what is a 'traditional' building**

**If you are competent – you will understand laws and guidance**

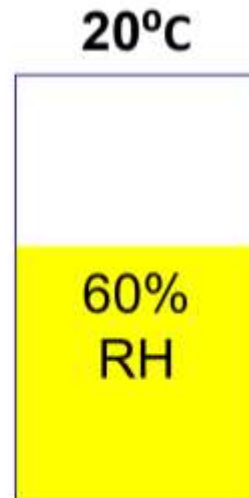
**Dealing with 'heritage' issues and consents**

**Assumes non invasive inspections – followed possibly by invasive**

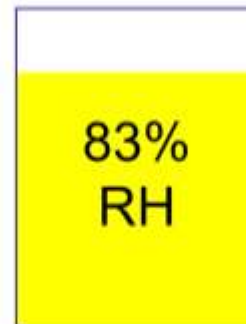
# Condensation – things to note

## Ascertain Condensation *water vapor in the air*

The warmer the air the more moisture air can hold



When the temperature drops from 20°C to 15°C the capacity to hold moisture is reduced



The Dew Point temperature

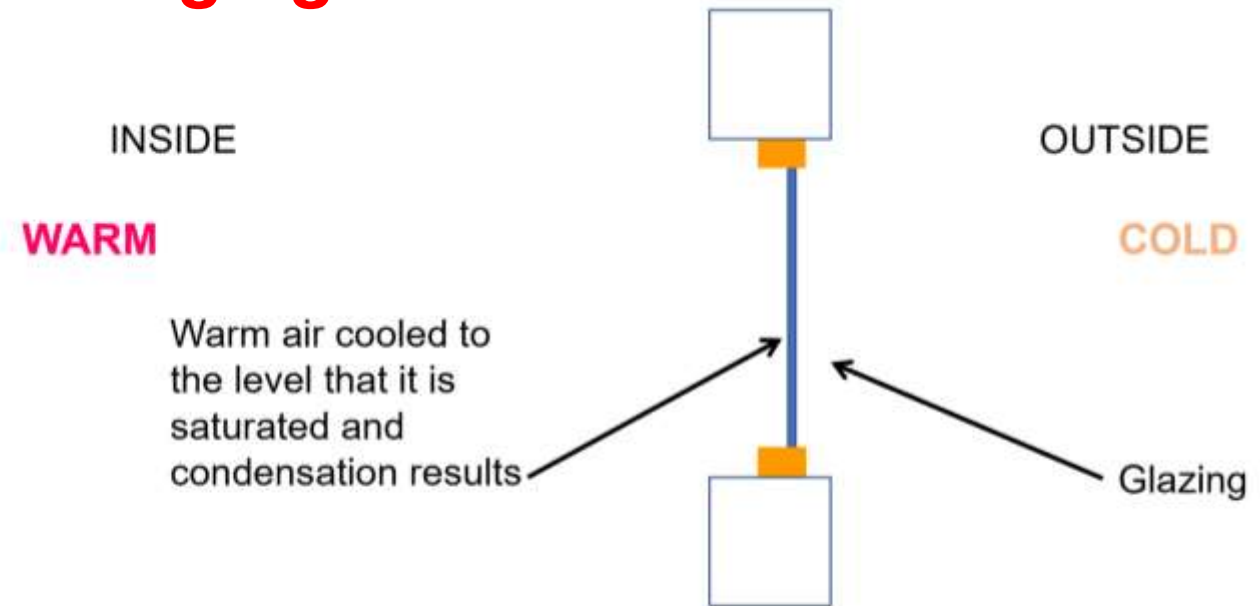
When the temperature is reduced to 12°C the capacity to hold moisture is reduced further



**Note the amount of moisture (g/M<sup>3</sup>) stays the same**

# Condensation – things to note

## Condensation and Thermal Bridging



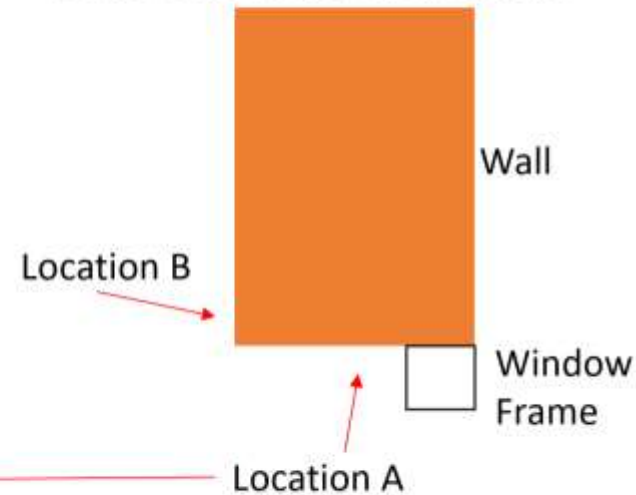


# It's not just Condensation...

## Thermal Bridging



Consider the different thicknesses of walling which is the buffer between the inside and outside



# *It's not just Condensation...*

## *Mould – what is it?*

- Black, white, spotted, or just about any colour. It may appear powdery, cottony, or velvety.
- It has a musty, earthy smell.
- There's a nearby source of moisture, but not much light.
- You see warping, cracking, or peeling of whatever material it's growing on.
- A drop of bleach lightens its colour in a minute or two.
- Unchecked mould will continue to grow.



# *It's not just Condensation...*

## *Risks of mould growth*

Touching or inhaling – symptoms:

- runny nose and congestion
- eye irritation
- sneezing
- coughing
- sore throat
- skin rash
- headache
- lung irritation
- wheezing



# *It's not just Condensation...*

## *Mould prevention*

- Fix water leaks immediately
- Windows / openings in good repair
- RH 50% or lower
- The thermal envelope!
- Don't carpet rooms such as bathrooms, laundry rooms, or basements.
- Good ventilation
- Use cleaning products that kill mould.
- Wipe down tiles and allow shower curtains to dry.
- Don't leave wet towels / clothes in a pile or sitting in a laundry hamper or washing machine.





# *It's not just Condensation...*

## *Mould removal*

- PPE / H&S - ventilation
- Water with bleach or white vinegar
- Soak a cloth in the solution and apply it over the surface.
- Let the solution sit for about an hour, and then scrub and rinse with warm water.
- Remember to deal with the cause!



# *It's not just Condensation...*

## *What might have caused this mould?*

1. Thermal bridging
2. Lack of heat & high RH%
3. Lack of ventilation
4. Low surface temperatures

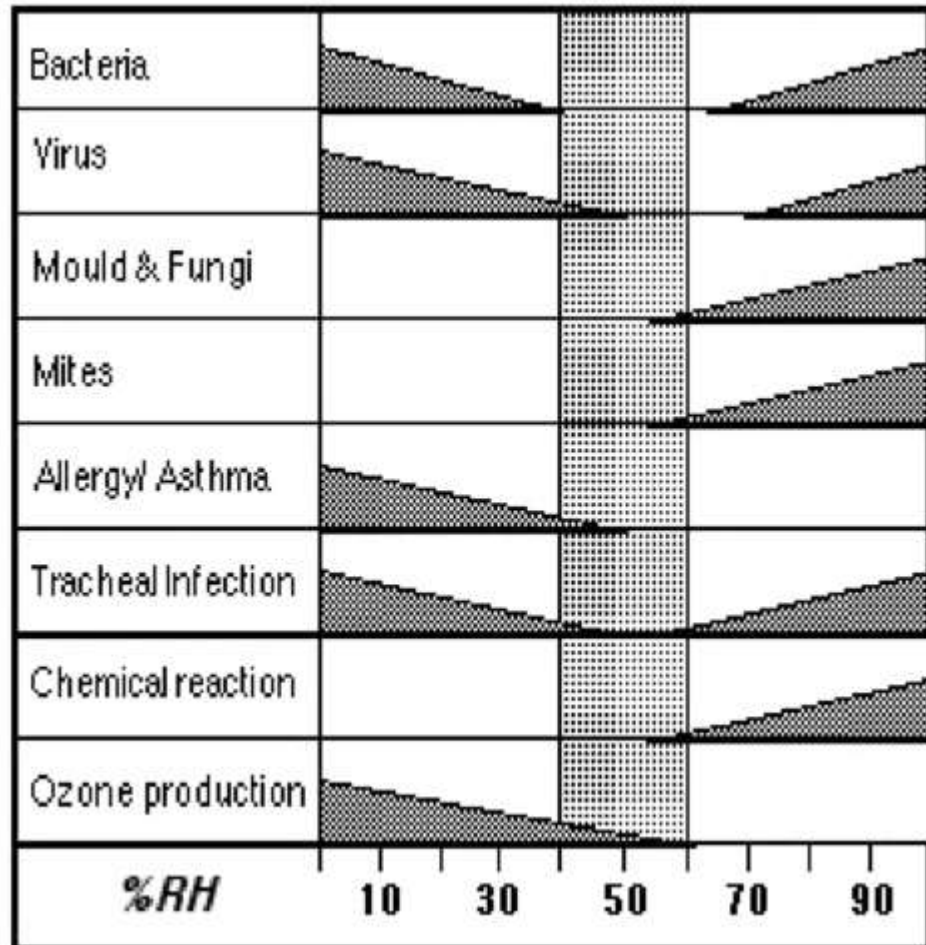
## *Possible remedies?*

1. Make sure exterior is in good repair
2. Removal / treat mould
3. Insulation on ceiling
4. Improve heating
5. Improve ventilation
6. Insulated paper



# It's not just Condensation...

## Relative Humidity



Health of occupants



### Health of the building

Diagram showing the health risks associated with high and low relative humidity extremes

Based on the 'Sterling Bar Chart' introduced in "Indirect Health Effects of Relative Humidity in Indoor Environments" by Anthony V. Arundel, Elia M. Sterling, Judith H. Biggin and Theodor D. Sterling. Environmental Health Perspectives, Vol. 65, (Mar., 1986), pp. 351-361.



# It's not just Condensation...

## Absolute Humidity

### 1.5 Weather and Environmental Conditions at the Time of Survey:

Dry and overcast / sunny  
Temperature: 17.50°C  
Relative Humidity (RH) 55.50 %  
Absolute Humidity (AH) 7.02 g/m<sup>3</sup>

EXTERNAL ENVIRONMENT

### 2.3.1 Space A

- a) Our recorded data for this area is as follows:
- Temperature: 18.3°C
  - RH: 76.4%
  - Dew point: 14°C
  - AH: 9.9 g/m<sup>3</sup>

INTERNAL ENVIRONMENT



### REPORT ON TIMBER & DAMP

Pandy Bach, Gelliydan, Snowdonia



 edwards  
hart  
consultants

October 2017

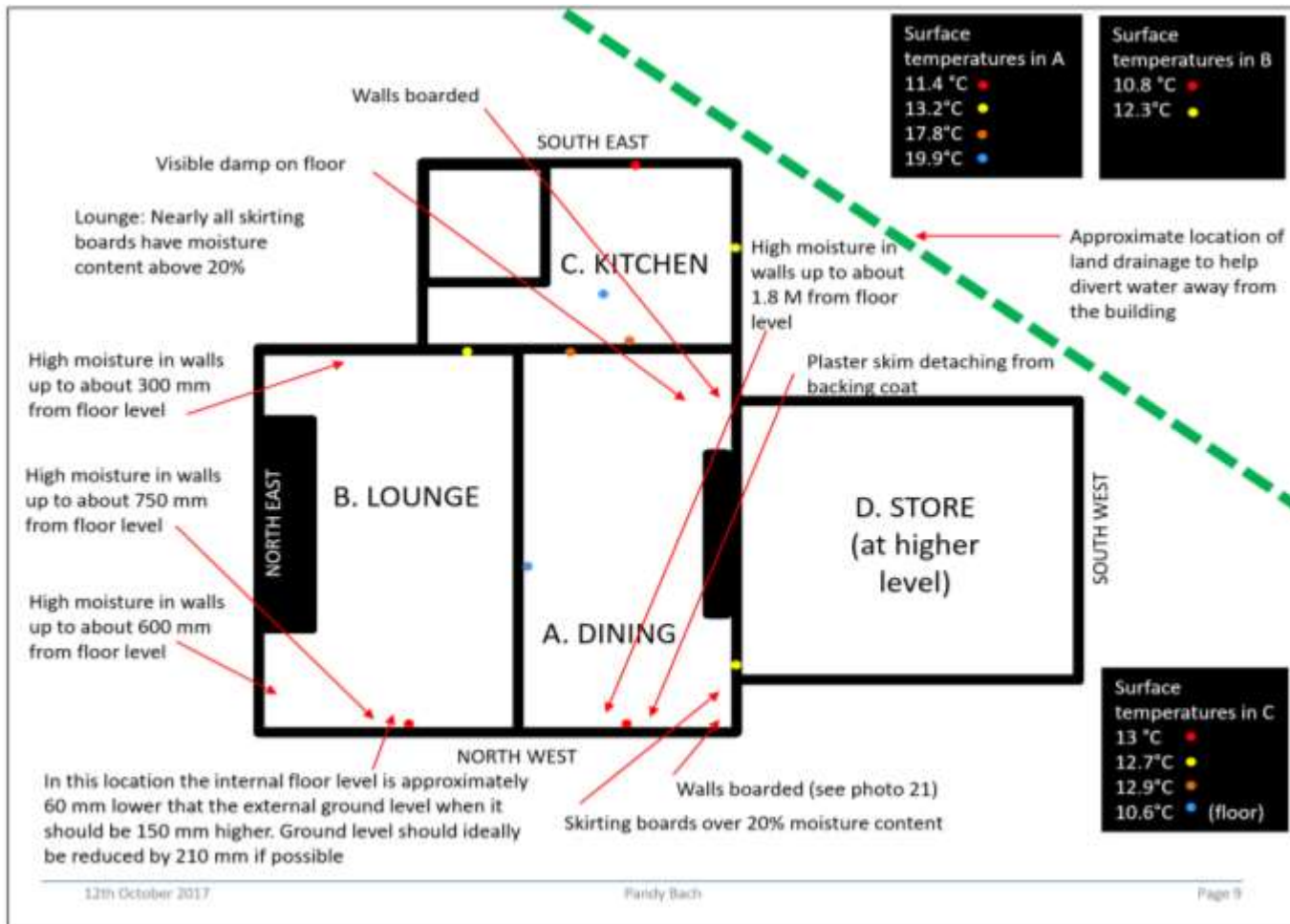
- Analysis:**
1. Why is the AH approx. 30% greater internally?
  2. Is it the use?
  3. Is it the moisture in the building fabric?
  4. A lack of ventilation?

**Requires expertise, appropriate equipment & the recording of data**



# It's not just Condensation...

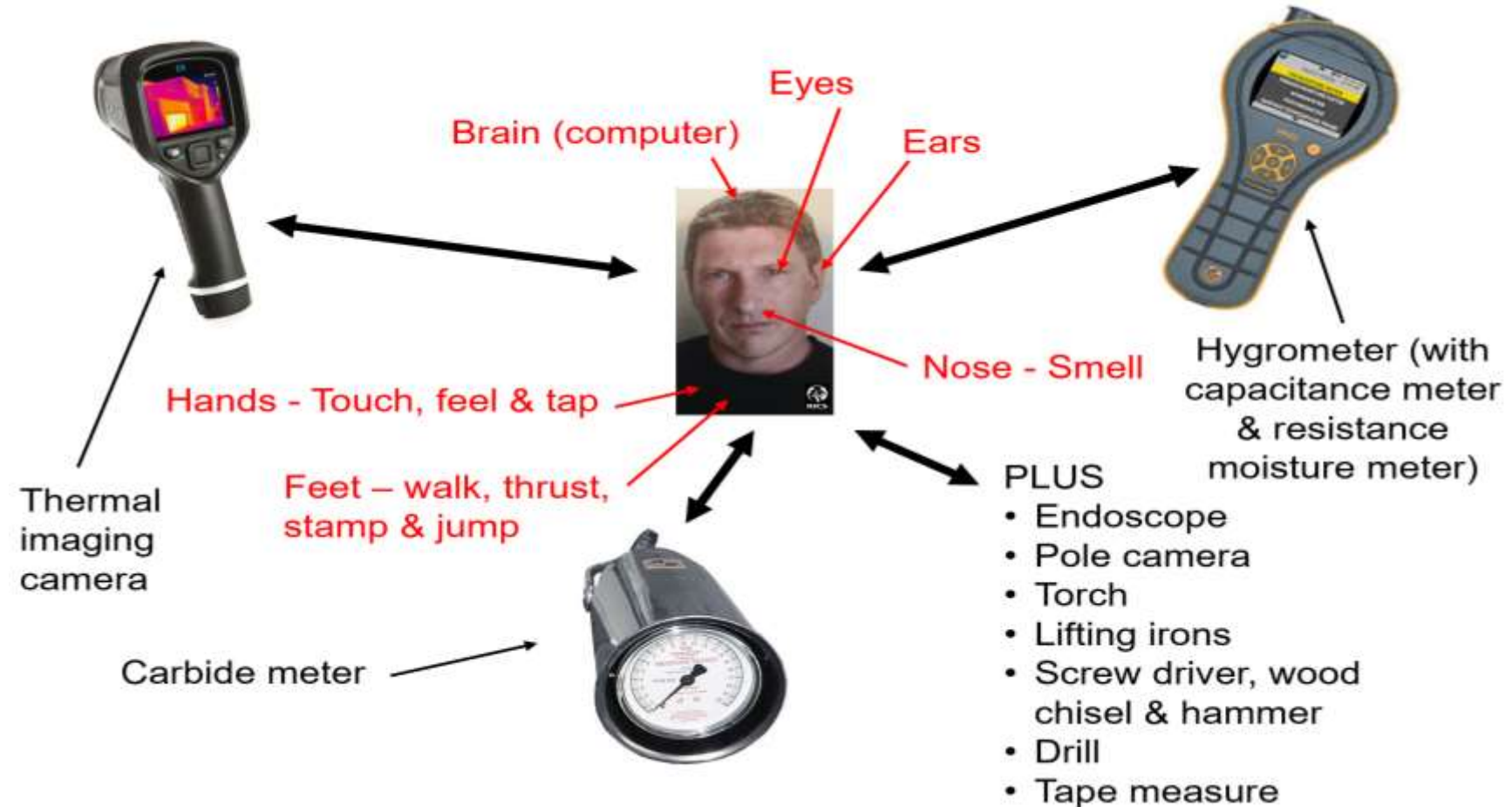
## Absolute Humidity



# Necessary resources...

## The tools and how to use them

Determine construction, materials, condition and relationship with use & environment



# *Necessary resources...*

## *Environmental Monitoring*



# Assess and understand

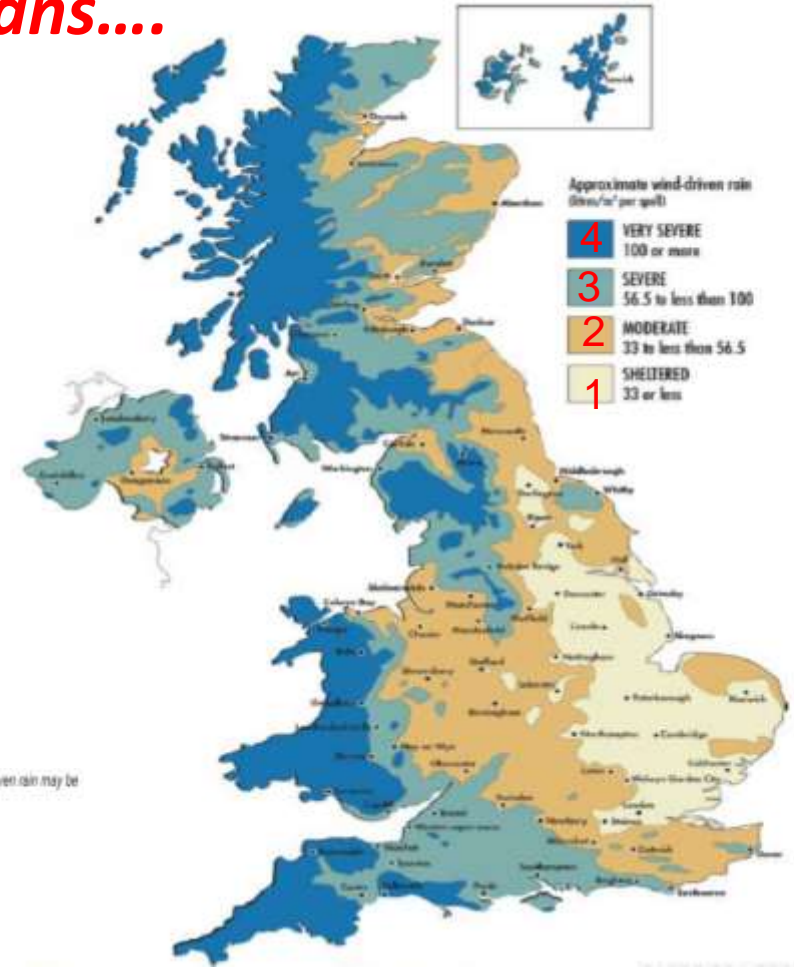
*its location, geography and what it means....*

## UK and Ireland Weather Exposure Zones



*(note Ireland is an interpretation)*

Maps showing geographical exposure to wind-driven rain for Ireland & the UK. Some experts believe that areas with high levels of wind-driven rain may be unsuitable for cavity wall insulation. (Irish map: Joseph Little, adapted from BS 5262 coloured as per BR 262 UK map: BR 262)

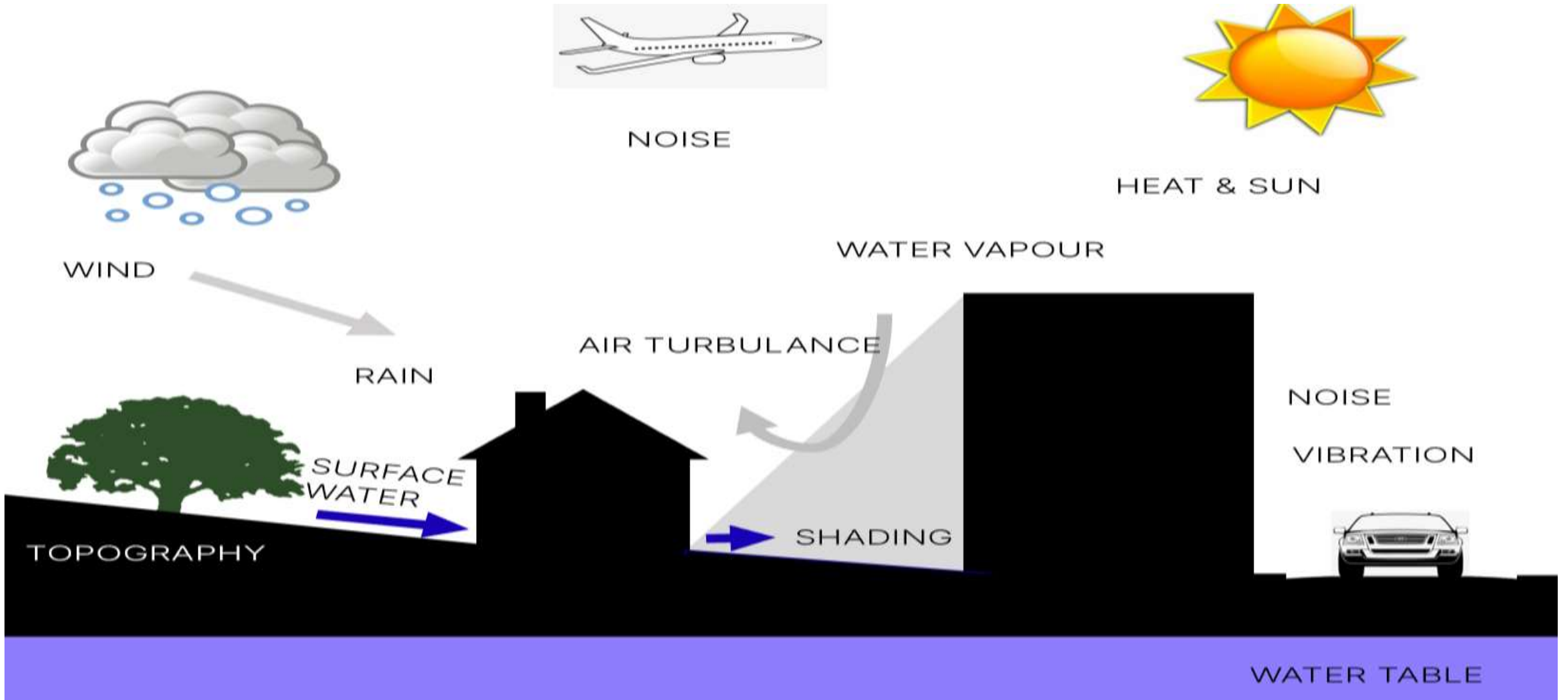


Approximate wind-driven rain (litres/m<sup>2</sup> per year)

4	VERY SEVERE	100 or more
3	SEVERE	56.5 to less than 100
2	MODERATE	33 to less than 56.5
1	SHELTERED	33 or less



# Assess and understand



# *What does a problem look like?*

## **Damp, Mould and Condensation**



*What is this  
and is it  
acceptable?*

- 1. Does it require investigation?*
- 2. Find the cause*
- 3. Deal with the cause*

# What does a problem look like?

## Damp, Mould and Condensation



***But what  
about this?***



***HEALTH OF  
OCCUPANTS***



# Damp, Mould and Condensation

**Must be understood and dealt with properly – otherwise...**

- *Appropriate expertise*
- *Optimum inspections and investigation*
- *Optimum management and suitability of use*
- *Good and appropriate maintenance and repair*
- *Changes (including retrofit) must be appropriate*



**Consequences affecting buildings and occupants**



# Further training...



## 1 day course

### ***Damp, Mould & Condensation***

Individual bookings 20<sup>th</sup> November 2023 (live online)  
plus in-house group bookings (live online or in-person)

## 1/2 day course

### ***Damp, Mould & Condensation – for the non-technical***

In-house group bookings only (live online or in-person)

## 2 day course

### ***Traditional Building Retrofit (Level 3 Award qualification req by PAS 2035 & PAS 2038)***

Individual bookings 16/ 17th October 2023, 30th/ 31st  
October 2023 (live online) plus in-house group  
bookings (live online or in-person) its **FREE IN WALES** plus FREE E-BOOK

[www.environmentstudycentre.org](http://www.environmentstudycentre.org)

**Finally...**

***Identifying and treating damp,  
mould and condensation***

***Thanks for  
listening***

***Professor John Edwards***

*MA, DipBldgCons, CEnv, FRICS, FCIOB, IHBC*

**1 day course**

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