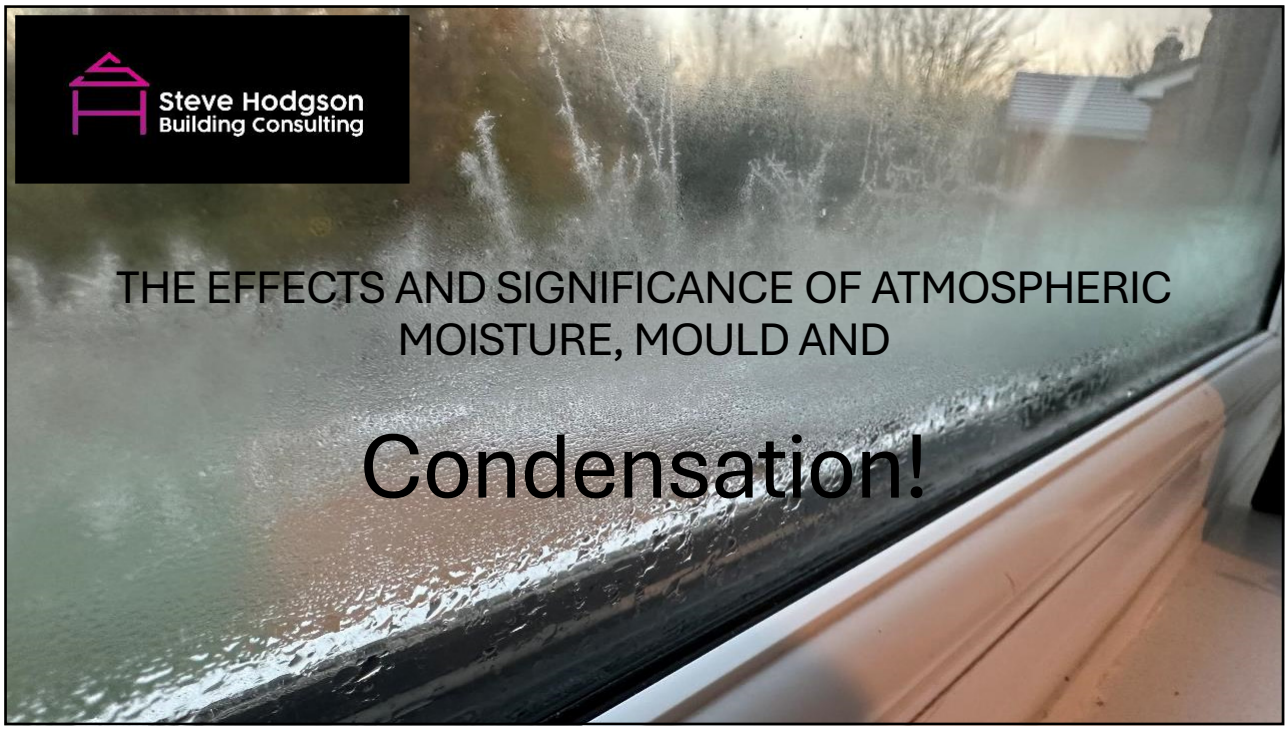


Stephen Hodgson

Steve Hodgson
Building Consulting

I was at the Property Care Association for a bit. I am now happily engaged with real buildings again.

Involved in lots of stuff relating to dampness.

In my opinion, moisture created by occupation is sometimes ignored, is easily underestimated and often misunderstood.

steve@hodgsonconsulting.co.uk
07712 867801

What are we going to look at today?

- Recognise the sources of atmospheric moisture
- Consider the science of water vapour and how it moves through and around buildings
- Bring clarity to the some of the common terms used to describe materials that transmit water.
- Examine the implications of atmospheric moisture excess and how it is controlled
- Understand the diverse implications of atmospheric moisture excess and condensation on building fabrics.
- Communicate the need for surveyors to see atmospheric moisture management as a system critical function of all occupied buildings

Steve Hodgson
Building Consulting

Where does the water in the air come from?

= 15+ litres per day

Steve Hodgson
Building Consulting

Mechanics of condensation & mould growth

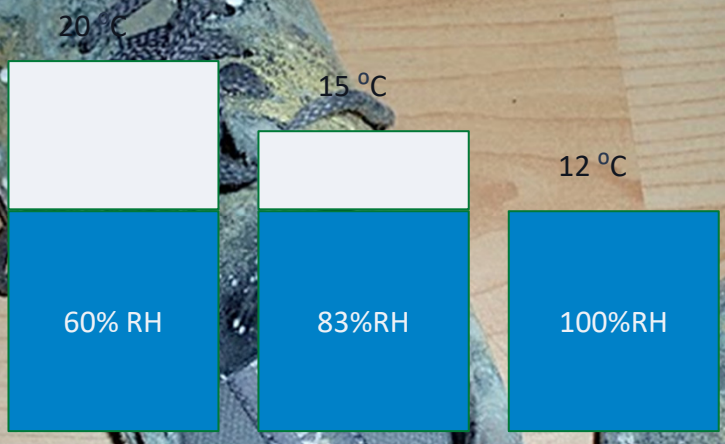
Condensation occurs when water changes from a 'gas to a liquid.

This only happens when the air reaches a relative humidity of 100%

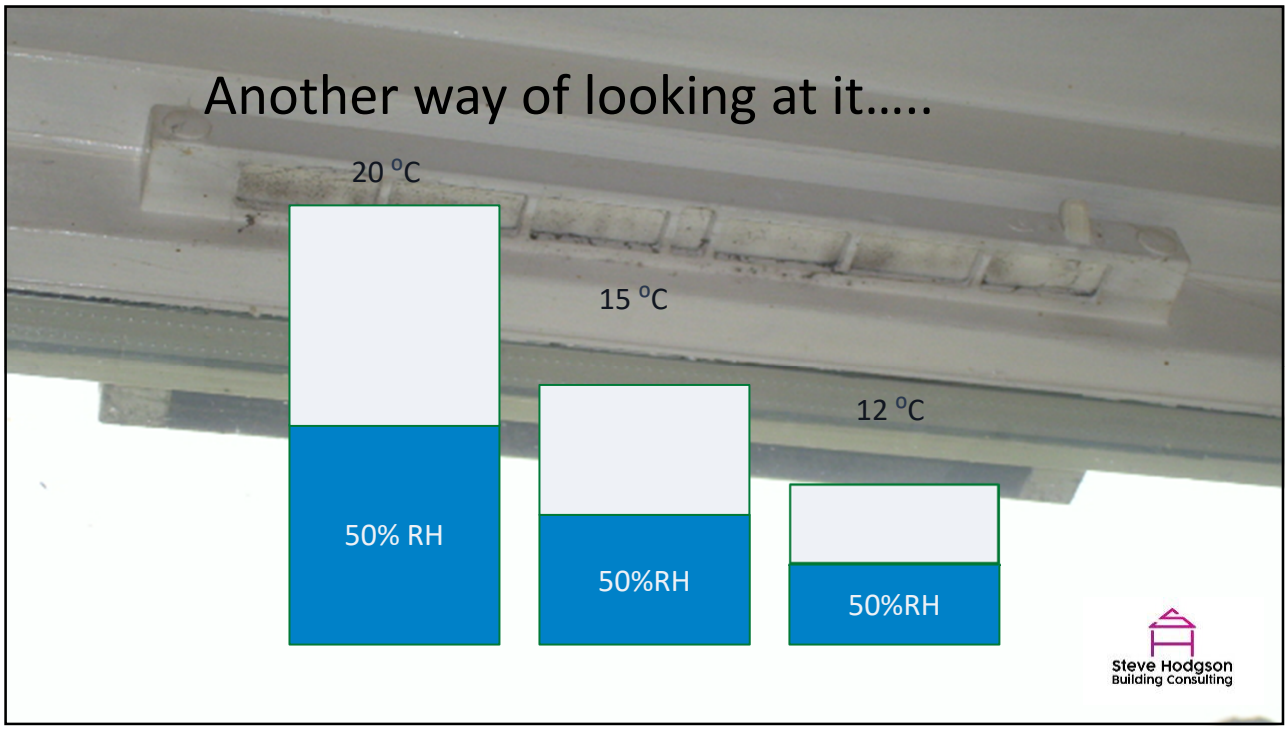
The **temperature** at which the water changes from a gas to a liquid is the '**Dew Point**'

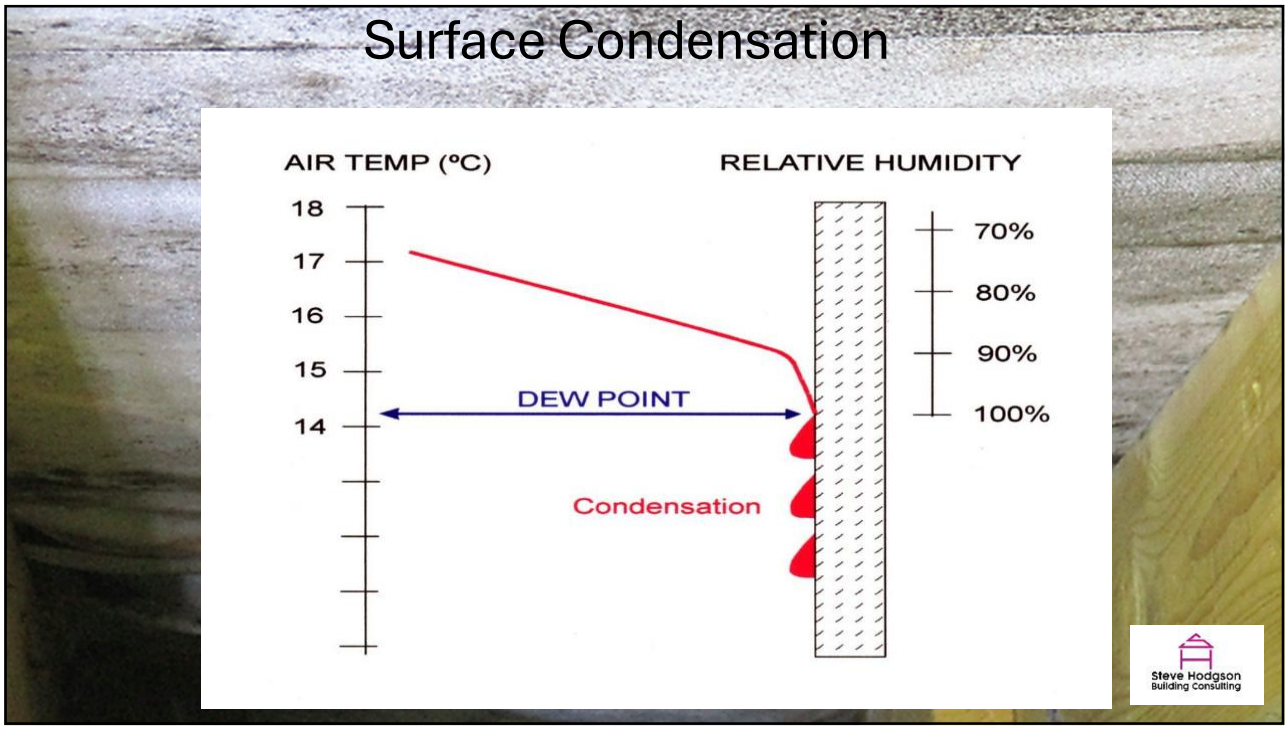
Steve Hodgson
Building Consulting

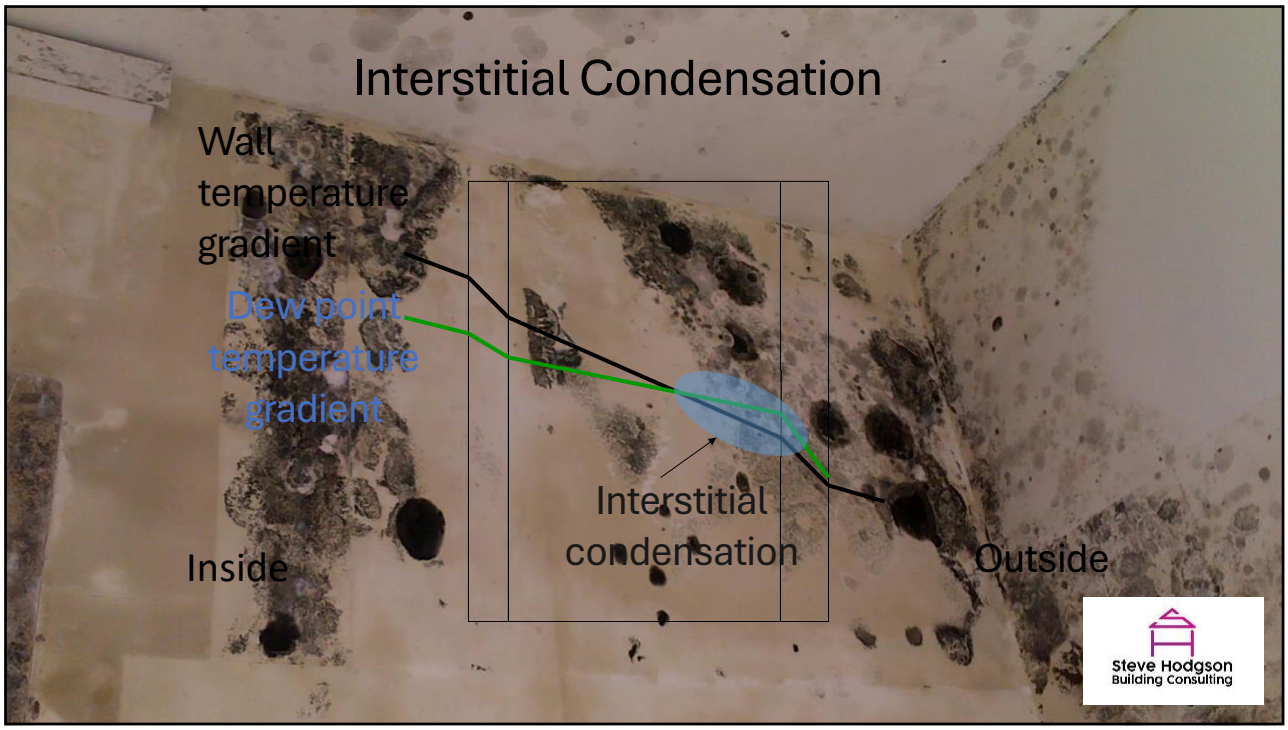
Effects of cooling air on Relative Humidity (RH)

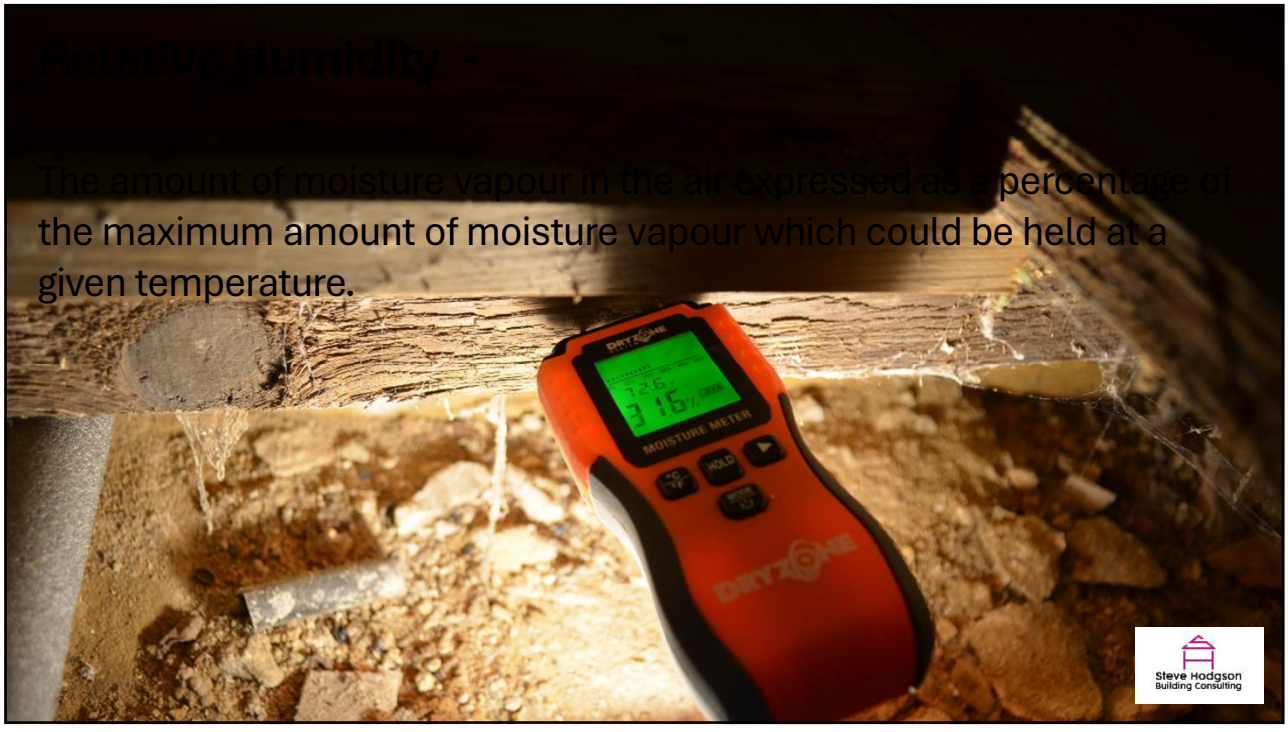


Warm air has the potential to hold eater than cool air


Another way of looking at it…..
20 °C
15 °C
12 °C
50% RH
50%RH
50%RH
Steve Hodgson
Building Consulting


Surface Condensation
AIR TEMP (°C)
RELATIVE HUMIDITY
18
17
16
15
14
70%
80%
90%
100%
DEW POINT
Condensation
Steve Hodgson
Building Consulting


Interstitial Condensation
Wall temperature gradient
Dew point temperature gradient
Interstitial condensation
Inside
Outside
Steve Hodgson
Building Consulting


Relative Humidity -
The amount of moisture vapour in the air expressed as a percentage of the maximum amount of moisture vapour which could be held at a given temperature.
DRYZONE
MOISTURE METER
HOLD
Steve Hodgson
Building Consulting

Vapour Pressure

Water vapour in the air experts a pressure (vapour pressure).

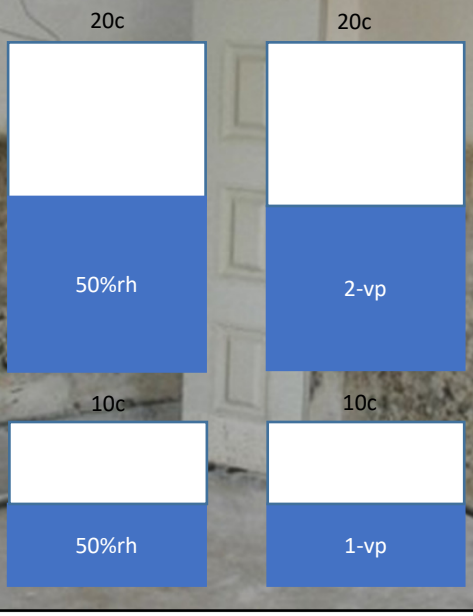
The vapour pressure is **directly** related to the amount of water vapour held within the air.

The more water vapour in the air, the greater the vapour pressure.

VP is NOT proportionate to relative humidity. Relative Humidity is dependent on temperature – Pressure is not!

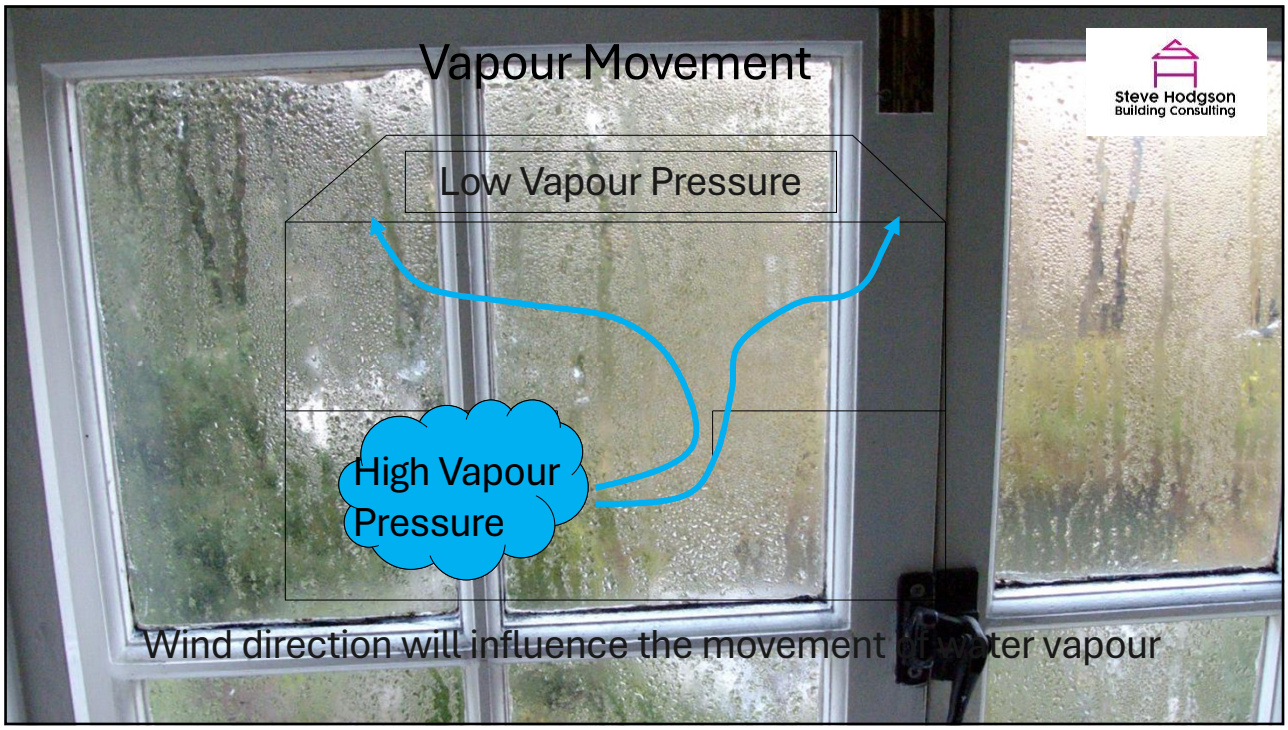
Relative humidity

The water vapour in the air as a proportion of the saturation level of water vapour



Vapour pressure

A direct measurement of the water present in the air


Vapour Movement
Steve Hodgson
Building Consulting
Low Vapour Pressure
High Vapour Pressure
Wind direction will influence the movement of water vapour


Not all buildings handle moisture in the same way.
But do any of them "breath"?

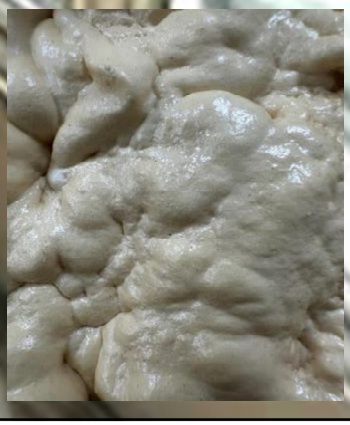
Permeability

Permeability refers to the ability of a substance to allow gases or liquid to pass through it. It has a significant impact as to how much water will penetrate the building fabric and the rate of penetration.

The more permeable the material, the greater the rate of water penetration. For example, a dense engineering brick will be less permeable than a soft facing brick, and a dense concrete block will be less permeable than a lightweight thermalite block.

Porosity

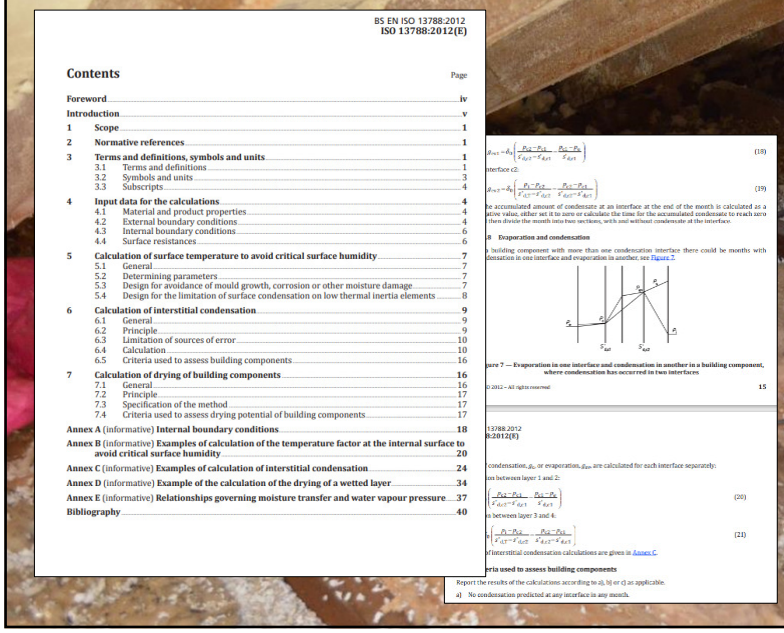
Porosity is "*the quality or degree of having minute spaces or holes through which liquid or air may pass*".



Permeability and Porosity are not the same thing!

If the holes don't link up, an apparently porous material can be highly impermeable to gas and liquid.

Condensation risk modelling



BS EN ISO 13788:2012
ISO 13788:2012(E)

Contents

(18)

interface c2:

(19)

be accumulated amount of condensate at an interface at the end of the month is calculated as a ative value, either set it to zero or calculate the time for the accumulated condensate to reach zero then divide the month into two sections, with and without condensate at the interface.

8 Evaporation and condensation

a building component with more than one condensation interface there could be months with densation in one interface and evaporation in another, see Figure 7.

ure 7 — Evaporation in one interface and condensation in another in a building component, where condensation has occurred in two interfaces

2012 – All rights reserved 15

13788:2012
n:2012(E)

condensation, g_c, or evaporation, g_{ev}, are calculated for each interface separately:

ors between layer 1 and 2:

(20)

n between layer 3 and 4:

(21)

of interstitial condensation calculations are given in Annex C.

eria used to assess building components

Report the results of the calculations according to a), b) or c) as applicable.

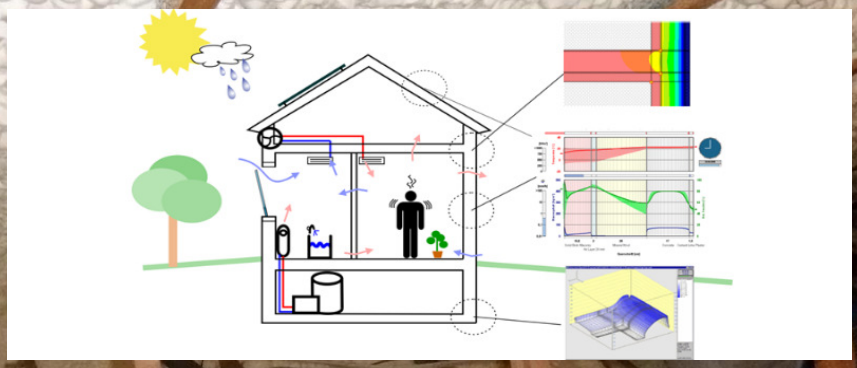
a) No condensation predicted at any interface in any month.

The sums

The retrofit coordinator does not need to understand how to make these calculations work.

The document provides the user with standardised formula for set out calculations for atmospheric moisture risk.

Modelling



The accepted standard relating to hygrothermal simulations is BS EN 15026:2007. This relates one-dimensional moisture movements.

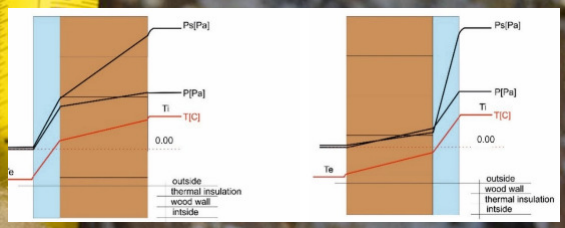
WUFI, developed by the Fraunhofer Institute
Delphin, developed by the Dresden University of Technology.

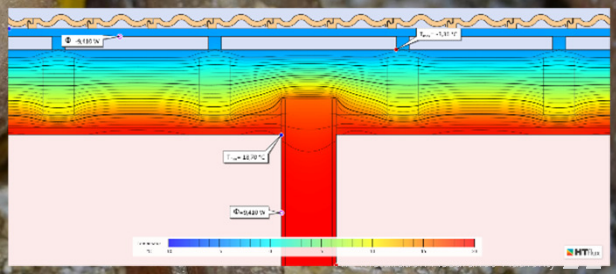
Simulations use building physics to model the combined heat and moisture transfer of a system subject to defined moisture loads, to estimate moisture levels within a building component

Modeling

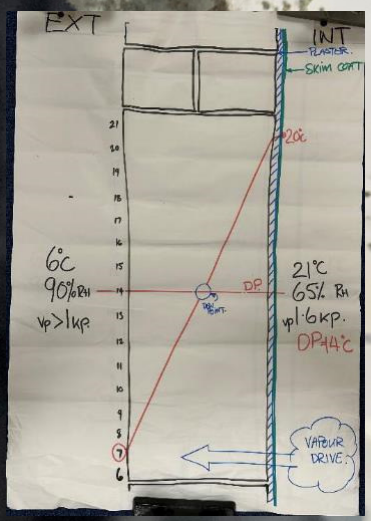
The Glaser method
An assessment procedure for the risk of moisture accumulation in building mono-dimensional structures. Used to evaluate mould risk and interstitial condensation risk.

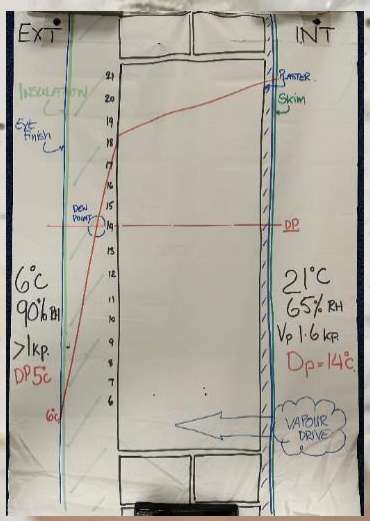
It is based on a simplified model that does not represent the real phenomenon and its limitations are well-known …

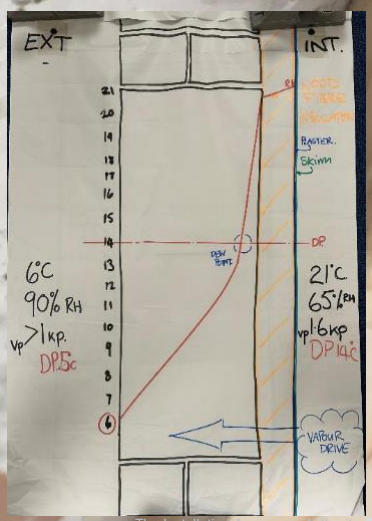




Interstitial Condensation








Atmospheric moisture imbalance and surveying
Steve Hodgson
Building Consulting


Surface Condensation
Steve Hodgson
Building Consulting

Surface Condensation

Surface Condensation


Surface Condensation
Steve Hodgson
Building Consulting


Condensate
Steve Hodgson
Building Consulting

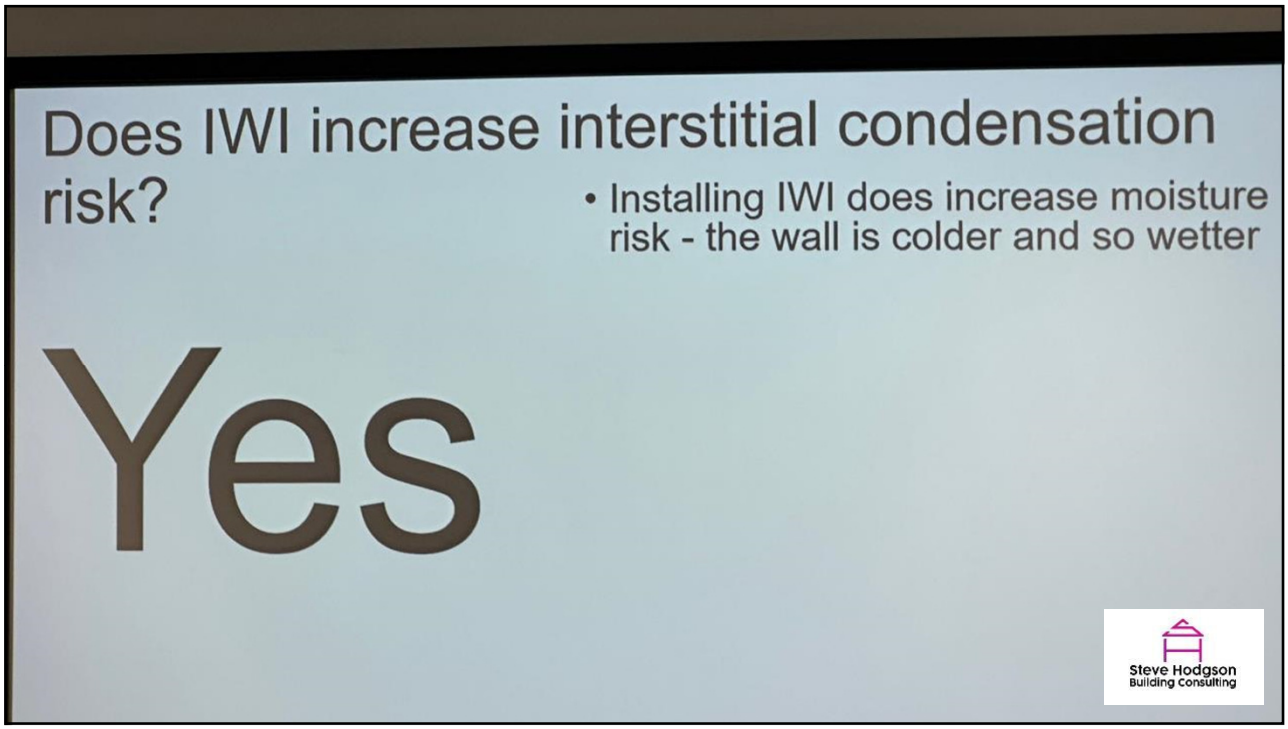

Hygroscopicity
Steve Hodgson
Building Consulting

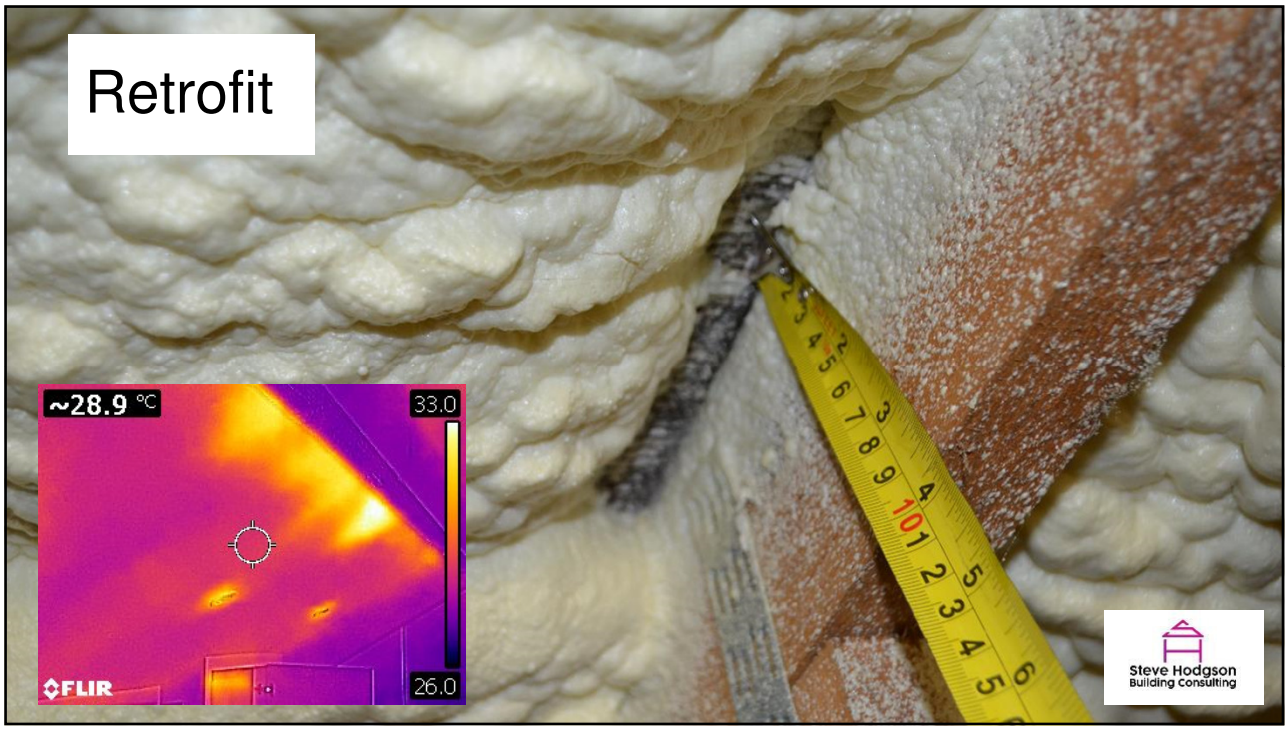

Timber
Steve Hodgson
Building Consulting

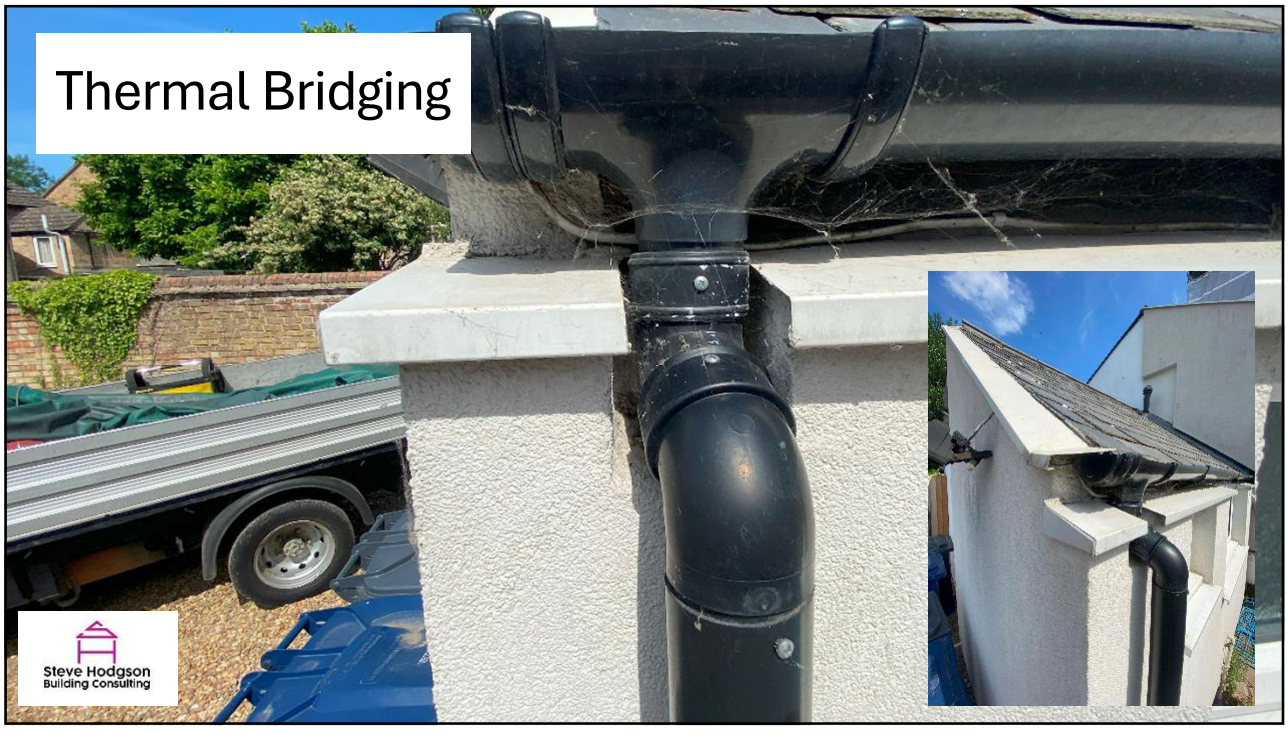
Odd Stuff

Basements


New Challenges
Steve Hodgson
Building Consulting


Does IWI increase interstitial condensation risk?
• Installing IWI does increase moisture risk - the wall is colder and so wetter
Yes
Steve Hodgson
Building Consulting


Retrofit
~28.9 °C
33.0
26.0
FLIR
Steve Hodgson
Building Consulting


Thermal Bridging
Steve Hodgson
Building Consulting

Thermal bypass

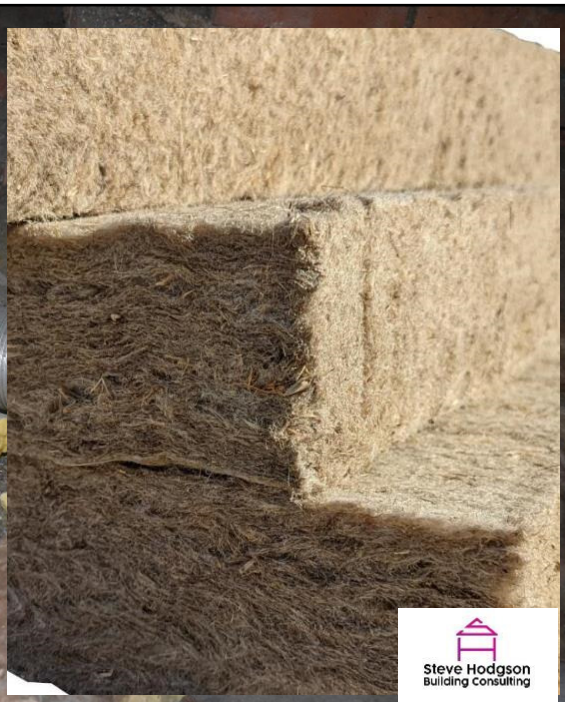
Moisture Buffering

A term given for the ability of a material to take on and release moisture

Often used to describe the action of “natural” particle fibre or clay insulants being able to absorb atmospheric water.

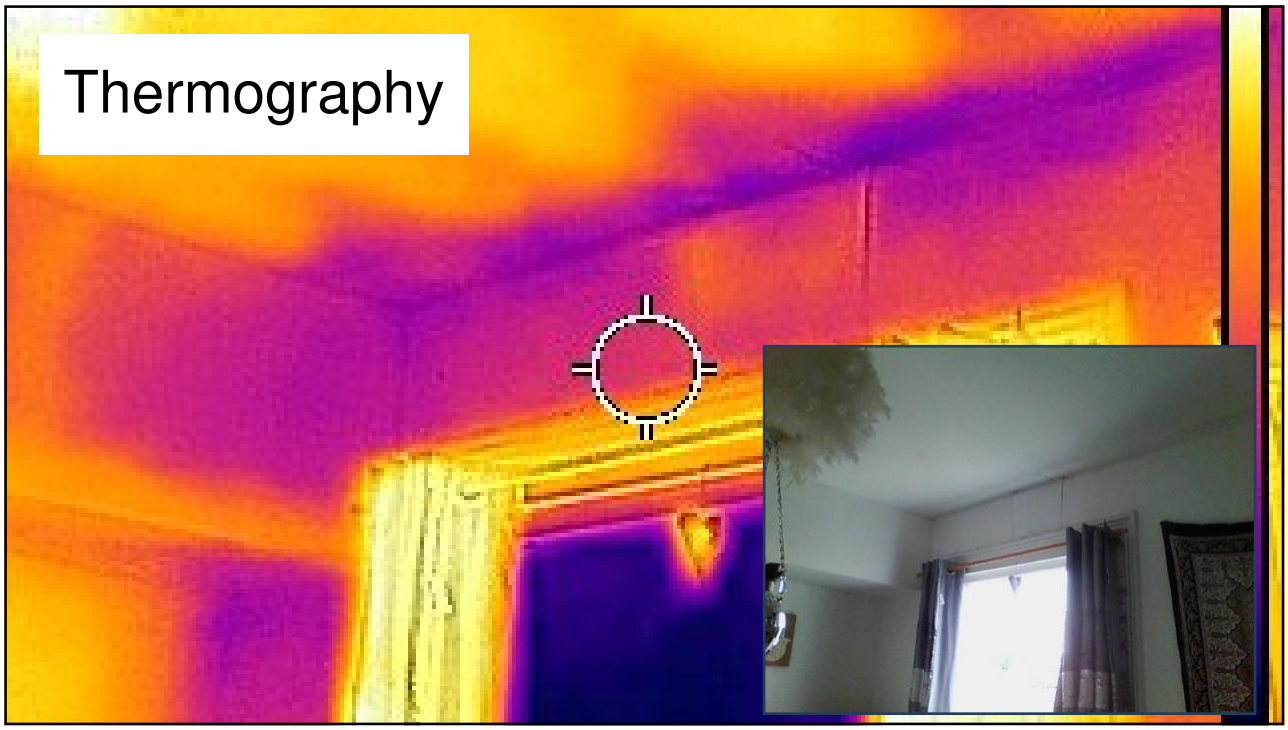
Most permeable materials buffer to some extent!

It is a thing but is it a good thing?

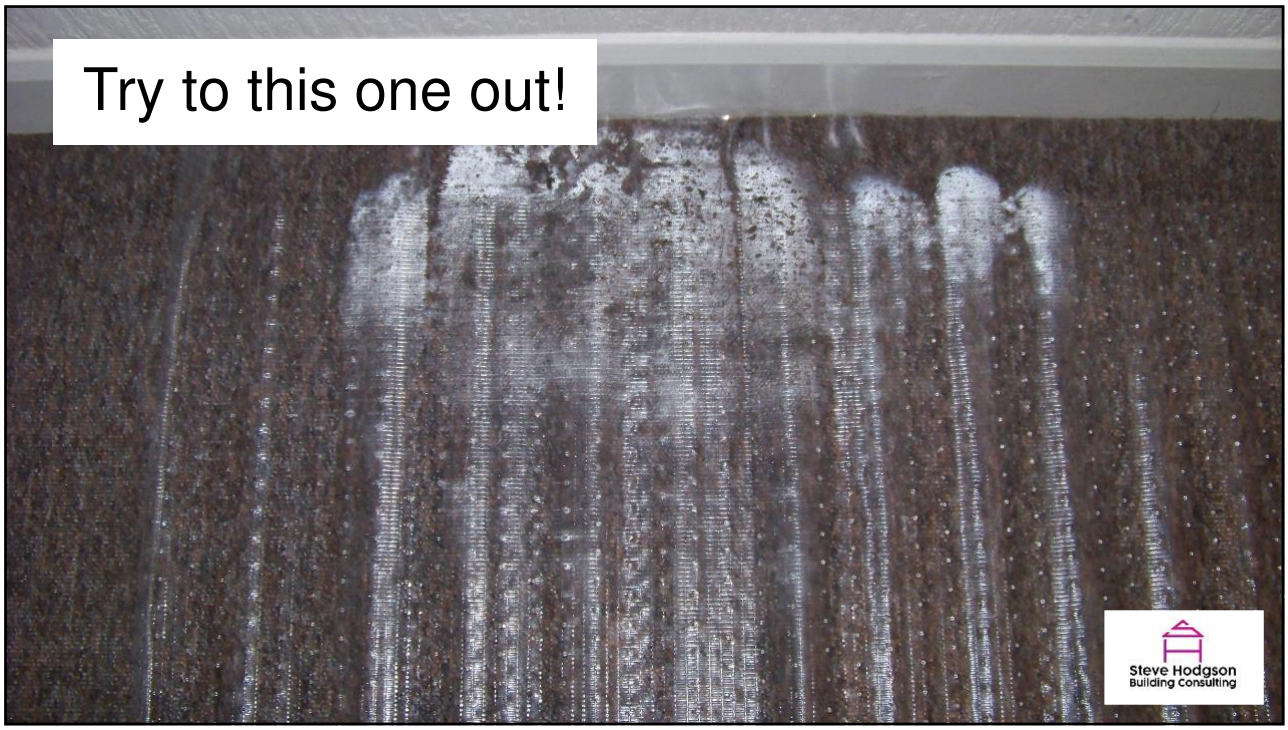



What can we look at
Ventilation
Steve Hodgson
Building Consulting


What can we look at
Thermal capacity
Steve Hodgson
Building Consulting


Thermography


What's happening here?
Steve Hodgson
Building Consulting


Try to this one out!
Steve Hodgson
Building Consulting

My Contact details…….

Steve Hodgson
Building Consulting

steve@hodgsonconsulting.co.uk

07712 867801