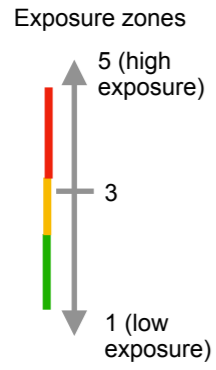
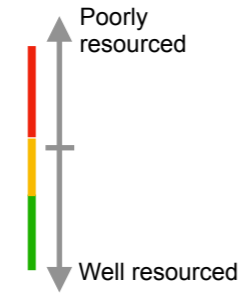


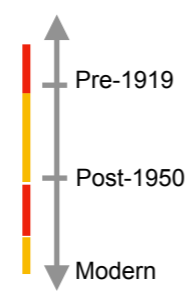
### Geographical



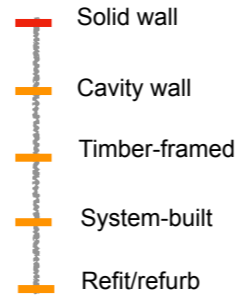
### Resources



### Era



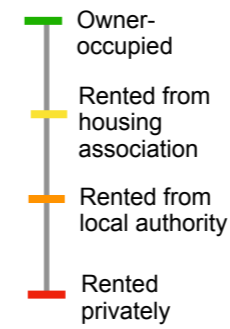
### Construction



### Perceived risk (at conception) \*



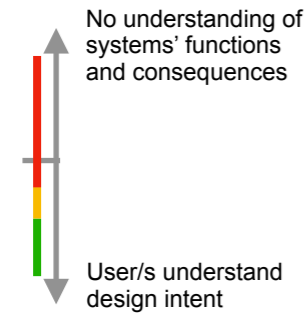
### Tenure



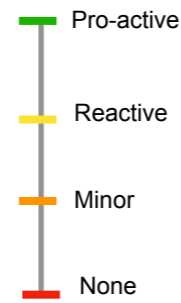
\* Also can feature as an action depending on age of building.

CONDITIONS

### User actions



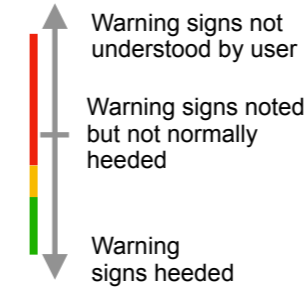
### Maintenance



### Density of occupation

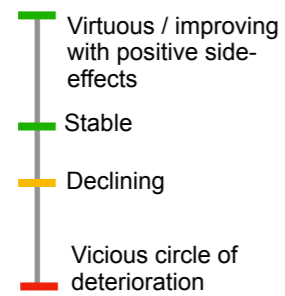


### Perceived risk (in use)



ACTIONS

### System state



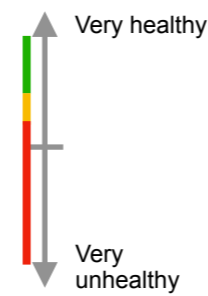
- Moisture balance

### Needs met

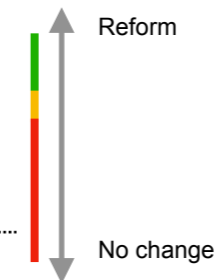


- Adaptive comfort
- Occupant health
- Public policy

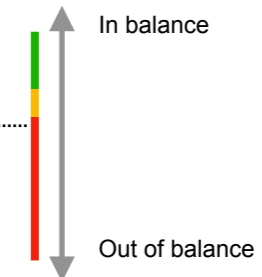
### Occupant health



### Public policy



### Moisture balance



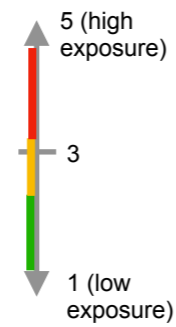
OUTCOMES

(CONDITIONS)

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### Geographical

Exposure zones



### Associated themes

- West-east
- Areas of flooding
- Driving rain
- Insufficient external cladding

### Example quotes

- B5/1 Areas of high exposure certainly seem to fair considerably worse. This can be due to local differences in micro climate as well as regional differences.
- B5/5 I believe that moisture problems will be worse in areas of high rainfall and wind-driven rain. Serious moisture issues will be present in areas at risk of flooding.
- B5/6 I suspect that various combinations of fuel poverty, social housing, ill-health, exposure zones 3-4, poor maintenance regimes, sloppy renovations and inadequate insulation and ventilation greatly effect the likelihood of serious moisture problems.
- B5/7 I would anecdotally say no, anywhere where overcrowding, poor ventilation, low or no maintenance and a fear of bills from running extract or heating
- B5/8 I'm mainly based in NW England, so generally damp. Would be good to know if things are very different in East Anglia!

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## Resources



### Associated themes

- Fuel poverty
- Affordable homes

## Example quotes

B6/12 In my experience, solid wall properties suffer very easily but partly because fuel poverty has a disproportionate impact. Flats in high and mid rise (partly due to nature of ventilation, but also because ducts etc have become blocked over the years).

B19/8 Health expenditure Quality of life needlessly impaired. Potential cost of remedial work over next 30 years, diverting resources and capacity from the enormous task of bringing the nation's homes up to a good standard of comfort and energy efficiency.

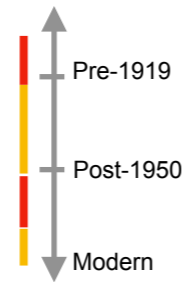
B19/22 "New generation" of moisture problems caused by rush to retrofit without thinking it through, and changes in new build construction (e.g. airtight buildings). At the same time, there is a culture of not bothering to maintain existing housing stock and waiting until issues become critical before dealing with them.

B9/7 Drying clothes internally, several members of same family using same bathroom where extract nowhere near sufficient to remove moisture. All holes, gaps around under doors blocked up with draft excluders and chimneys have balloons in them to stop drafts. As the issue is always about cost of heat, home owners do what it take to stop this escaping.

(CONDITIONS)

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### Era



### Associated themes

- Super-insulation
- Performance gap

### Example quotes

B6/1 1960s - 1980s seem worst for internally generated moisture loads,

B6/3 Solid-walled properties typically built >100 years ago are more likely to suffer from structural forms of dampness such as rising damp or penetrating damp.

B6/13 Moisture problems will be present in all buildings, but their causes may be different. It is perhaps more prevalent in older buildings, where it is likely going to be due to condensation from poorly insulated windows, moisture ingress through solid walls, interstitial condensation in internal solid walls.

B6/7 I think 'old = hard to heat / problematic' is greatly over-stated. A lot of old buildings have been treated appallingly which has made them respond badly to the modern heat and moisture levels we impose (partial renovations, poor maintenance, walls covered in PVA then acrylic paints applied reducing moisture buffering capacity, pavements raised, etc).

B6/12 In my experience, solid wall properties suffer very easily but partly because fuel poverty has a disproportionate impact. Flats in high and mid rise (partly due to nature of ventilation, but also because ducts etc have become blocked over the years).






B6/20 Insulation impeding airflow

B6/23 Poorly insulated homes ie pre-2000 are prone, although super-insulated (new) homes can be problematic if the performance gap causes defects and other factors present.

B6/25 [It] depends on many factors as even an older property with damp walls and draughts can be made to feel comfortable but it may take a lot of heating in the winter time to achieve this. For example I grew up in a four hundred year old thatched house with a Rayburn (type of Aga) which was lit all day and with open log fires in other rooms and walls with rising damp but it felt cosy. People generally will not run heating all day so as to save costs so older poorly insulated homes are at the greatest risk of moisture problems.

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## Construction

-  Solid wall
-  Cavity wall
-  Timber-framed
-  System-built
-  Refit/refurb

### Associated themes

- Air-tightness
- Air-conditioning
- Energy efficiency
- Insulation impeding natural air-flow
- Rubble walls
- Fibrous insulation in cavity
- Impervious render

### Susceptible parts of buildings

- Eaves boxes
- Bathrooms
- Projections
- Blocked vents under suspended floor
- Injection-type cavity wall insulation
- Complex junctions
- Over-heated roof spaces
- Thermal laminate board
- MHVR degradation
- External wall degradation
- Soakaway drains
- Chimney flashing
- Trims
- Plants blocking vents
- Modern hollow and solid concrete blocks

## Example quotes

- B7/9 I think the key issue is about condition and actions, not typologies. Solid wall (including modern hollow and solid concrete blocks) may be most likely to have low surface temperatures. Cavity wall may be structurally vulnerable if poorly built. Timber frame may be most hygrothermally vulnerable is built or renovated poorly. Low energy housing can be most vulnerable to poor indoor air quality (IAQ).
- B7/9 “Serious problems stem from a host of issues including their use as well as structural elements therefore, it is my opinion that all properties have the potential to suffer the same problems.”
- B7/9 “Solid wall (more specifically rubble walls), brick and block with fibrous insulation in the cavity. Loft spaces where the householder has blocked off the eaves ventilation or boarded over the loft .”
- B7/25 “Traditional solid wall houses where there is external vapour impervious render and/or paint coatings and to some extent hard cement and not lime pointing to masonry joints suffer particularly from interstitial condensation. This is due to the inability of the fabric to allow vapour to escape to the external air. “
- B7/5 “Cavity wall after having the cavity filled”
- B7/6 “Cavity wall, timber frame and "low energy" housing”
- B7/24 “Timber frames have an elevated risk due to the damage moisture may cause for mould growth, degradation, and wood warping. Damp risks will exist in all dwellings that do not have a design appropriate for the surrounding conditions.“
- B7/15 “Poorly maintained homes are probably the worse, but with types I would think that cavity and solid walls are the worse.”

(CONDITIONS)

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### Perceived risk (at conception) \*



#### Associated themes

- Modern construction has better ventilation. Older properties may suffer because ventilation not designed into the structure.

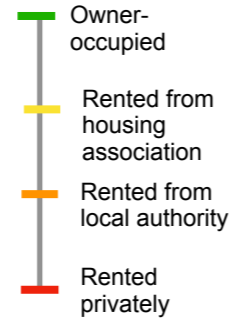
#### Example quotes

- B7/24 Timber frames have an elevated risk due to the damage moisture may cause for mould growth, degradation, and wood warping. Damp risks will exist in all dwellings that do not have a design appropriate for the surrounding conditions.
- B8/21 There is insufficient advice on ventilation. Building Regulations set out systems that are acceptable for new build or refurbishment but it is left to the designer to make the selection. There should be more information on when it is considered necessary to have continuous ventilation in preference to intermittent. For example in building which have vapour control layers in floors, walls and ceilings the structure cannot breathe so moisture removal has to be via the ventilation system and in such cases intermittent ventilation maybe insufficient to keep the internal environment healthy.
- B9/21 There is a lack of awareness about how much moisture people and activities produce, but the challenge is getting people to believe you. In many cases they are looking for a physical cause - eg leaks, poor quality work - when in reality it is often poor design interacting with occupant behaviour. But occupants rarely want to listen to how they can be part of the solution. I have tried to convince tenants with uncovered fish tanks that the water evaporating daily from the tank is a considerable part of the condensation issue they were having, to no avail.
- B1/15 I think deep retrofit is much riskier than many clients appreciate, and ventilation/ moisture risk is one of the most risky and most neglected areas. I work with social landlords, and the concern for me is that they think the standard practice they use for day to day retrofit - windows, boilers etc - is adequate for deep retrofit. They are also driven by grant regimes for deep retrofit rather active, professional clienting, so they will seek to mitigate risk in as far as the grant programme acknowledges and pays for it, which is normally quite superficial. They are also generally unaware of Each Home Counts and the current work following that. My interest is in trying to raise the level of clienting skill, ensure we don't put people and properties at risk and shift people towards thinking about value and outcome rather than cost and specification.

(CONDITIONS)

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### Tenure



### Example quotes

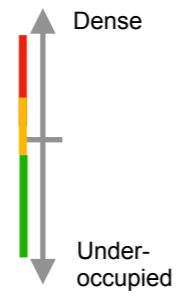
B10/20 There is not much difference between types of non domestic buildings in respect of damp. It all comes down to how they were built in the first place and how they are maintained. The main difference is between those that are owner occupied and those that are rented where the latter are usually worse maintained and therefore prone to damp than owner occupied who have the vested interest of maintaining capital values rather than gross rental income.

B21/8 Building regulations for retrofit need to follow on from the good work done for the new PAS 2035. The government needs to stop funding poor piecemeal retrofit and instead let the owner of the property decide what it is best to do. More training is required in the industry for contractors, developers, building owners to understand the health implications of moisture in buildings, and their responsibilities under the health and safety act for homes.

(ACTIONS)

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### Density of occupation



### Example quotes

B9/5 Density of occupation probably more significant than particular habits/lifestyles. So can be more of an issue in smaller socially rented homes, where bedroom tax is forcing this and times of occupation may be extended (e.g. elderly/retired).

B20/10 Demographic and lifestyle - denser occupation driven by economics and benefits cuts - exacerbating problems.

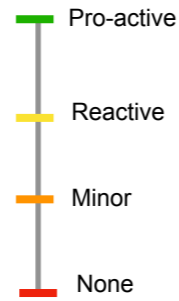
B6/21 Better surveys and understanding of existing condition, with patterns of occupation also taken into account.



(ACTIONS)

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### Maintenance



### Associated themes

- Disconnecting extractor fans
- Blocking air bricks
- Preventing cross-vent in roof spaces
- Closing chimney flues
- Under-heating
- Under-ventilation

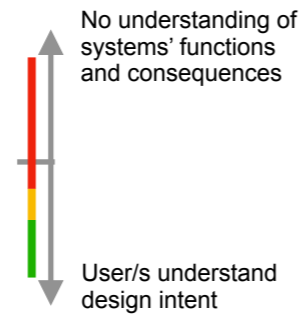
### Example quotes

- B8/16 Relative to other countries, there is very little attention paid to the need for maintenance in the UK - i.e. clearing gutters and drains. People are often conscious of the risks from internal solid wall insulation, but choose to rule it out rather than evaluate the risks. Inappropriate internal surface materials may cause problems because of their moisture buffering capacity
- B18/16 There should be only improvements to lifestyle, people must be able to live in their homes how they see fit. There are likely to be increased maintenance requirements as it seems mechanical fans and associated filters are valuable enough in moisture, energy/ cost, and air quality terms. Can this be balanced by reduction in heating maintenance requirements?
- B20/7 Cost of carrying our repairs and maintenance is too high for most people - due to a number of issues such as - VAT is chargeable on building repairs \* - Building repairs tend to be labour intensive and difficult to automate due to variability of the housing stock - Certain regulations - e.g. working at heights - makes minor maintenance such as gutter clearance prohibitively expensive for many - Lack of skilled tradespeople able to carry out this type of work (apprenticeship and training schemes tend to focus on new build)
- B18/1 All energy saving measures bring a need to change lifestyle. Boiler and effective heating systems should be balanced, with TVRs set for optimum settings and these should be registered (never happens), control of the thermostat takes getting used to as people perceive it costs a lot more than intermittent on off heating. Loft requires eaves remain clear, Cavity requires good roof, gutter and pointing maintained and solid wall requires control of impact, raising of paths and fixing things into it. All retrofits should come with a section for the home owner, how to use, do, do not, then there should be a section for any contractors who come in to do any work that would interface with the retrofit undertaken with a list of do, do not etc.

(ACTIONS)

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### User actions



### Example quotes

B4/14 Most homes lack good facilities to properly heat and ventilate them in order to control the moisture within them. This is often due to inadequate heating, ventilation and thermal insulation in older properties. In newer properties designers often provide systems to achieve good energy ratings for building regulation approval without considering the understanding or willingness of the occupants to properly operate the systems provided, particularly if those systems require the occupants to do, or not do, certain things to achieve the intended performance.

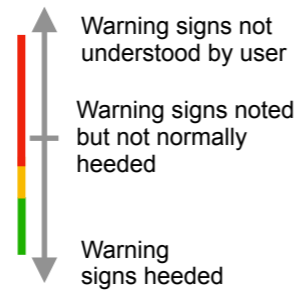
B9/14 Lifestyles are so very different that it is difficult to design for. But having worked for 13 years with one of the larger housing associations one learnt to design for the most challenging lifestyle. These were where occupants would not operate complex controls for heating and ventilation, would not open windows, would seal over trickle vents and turn off electrically operated ventilation systems in the mistaken belief that they were using electric so were expensive to run. The consequences of such actions meant that internal environments could quickly become unhealthy. I have heard that some housing associations who fitted MVHR systems, for energy efficiency, have experienced very bad condensation problems due to occupants turning off the systems and then having no ventilation, including no background ventilation. Is this the fault of the occupants or the designer for not anticipating the occupant's behaviour?

B18/17 This is a real problem. How do you get a householder to open the windows and heat the home, when the resulting dampness problem is at a remove, intangible? By nature, human beings on the whole tend to respond to authority. They are more likely to act upon an authoritative, simple-to-watch, 3-minute video explaining why it is so important to do this, rather than heed the advice of a landlord or make the additional effort of reading a leaflet. Is this something UKCMB could promote? To make such a video and ensure that all window fitters supply customers with one?

(ACTIONS)

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### Perceived risk (in use)



B18/13 People need to be re-acquainted with their building and made to understand how new or adjusted behaviours are advisable. Leaky buildings and buildings with low levels of moisture generation are forgiving! A bit like climate change people expect they can judge the future from what happened in the past but a higher level of airtightness with higher levels of moisture generation may have the same address but is effectively a different building.

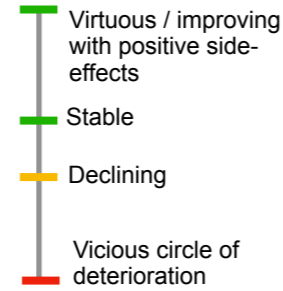
### Example quotes

B11/7 I believe that a combination of inadequate heating and poor ventilation in alliance with the householder's failure to understand their importance. I consider the interaction of these three to be most important. The problem is made all the worse because the householders do not think that such simple things as opening the windows and heating the house can really make a big difference. In another timber-framed house rented out, recent tenants also started to experience dampness where the house had been dry for years before. We believe that this resulted from the fact the occupants did not ever leave the relatively newly-installed windows (lacking window vents) open on the secondary latch, for fear of "throwing heat out of the window". People want high tech solutions, the letting agent want to have mechanical ventilation installed! Another tenant sealed the kitchen fan vent to prevent heat losses. Tenants, often on low incomes, try to save on heating, but in so doing create problems of dampness.

B17/2 All elements (walls floor and roofs) have their challenges and solutions. The myriad of interfaces between the elements is the hardest issue to resolve. This takes time and experience and costs money. The occupant needs to appreciate that the home may not need heating as hard as before and that there may be a mechanical system regulating the ventilation. They need to understand that if the ventilation system fails or is switched off that may adversely affect the air quality and humidity levels inside. They should also be aware that if they see a damp patch it may be more important to get it fixed than in a non retrofit.

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### System dynamics



### Associated themes

- Condensation
- Mould
- Damp
- RH
- Smell

Green scores in combination are likely to lead to stable or improving outcomes. Most buildings will be declining to some extent, some very rapidly if red scores predominate.

### Example quotes

- B11/7 A combination of inadequate heating and poor ventilation in alliance with the householder's failure to understand their importance. I consider the interaction of these three to be most important. The problem is made all the worse because the householders do not think that such simple things as opening the windows and heating the house can really make a big difference. In another timber-framed house rented out, recent tenants also started to experience dampness where the house had been dry for years before. We believe that this resulted from the fact the the occupants did not ever leave the relatively newly-installed windows (lacking window vents) open on the secondary latch, for fear of "throwing heat out of the window".  
People want high tech solutions, the letting agent want to have mechanical ventilation installed! Another tenant sealed the kitchen fan vent to prevent heat losses. Tenants, often on low incomes, try to save on heating, but in so doing create problems of dampness.
- B11/7 I suspect that various combinations of fuel poverty, social housing, ill-health, exposure zones 3-4, poor maintenance regimes, sloppy renovations and inadequate insulation and ventilation greatly affect the likelihood of serious moisture problems.
- B11/7 Failure of UK buildings earlier than needed. Effects to health for occupants, a tacit acceptance that you can do nothing about it. A lack of confidence in solutions when clearly a high percentage mistreat/ misdiagnose damp now and will do in the future unless some regulation / training is made mandatory.
- B11/7 I suspect that various combinations of fuel poverty, social housing, ill-health, exposure zones 3-4, poor maintenance regimes, sloppy renovations and inadequate insulation and ventilation greatly effect the likelihood of serious moisture problems.

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### Needs met



### Example quotes

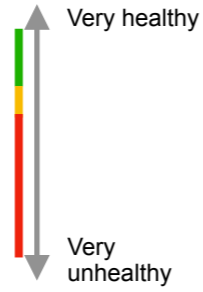
B16/1 ... even an older property with damp walls and draughts can be made to feel comfortable but it may take a lot of heating in the winter time to achieve this. For example I grew up in a four hundred year old thatched house with a Rayburn (type of Aga) which was lit all day and with open log fires in other rooms and walls with rising damp but it felt cosy. People generally will not run heating all day so as to save costs so older poorly insulated homes are at the greatest risk of moisture problems.

B2/17 I suspect that various combinations of fuel poverty, social housing, ill-health, exposure zones 3-4, poor maintenance regimes, sloppy renovations and inadequate insulation and ventilation greatly affect the likelihood of serious moisture problems.

B19/6 Failure of UK buildings earlier than needed. Effects to health for occupants, a tacit acceptance that you can do nothing about it. A lack of confidence in solutions when clearly a high percentage mistreat/ misdiagnose damp now and will do in the future unless some regulation / training is made mandatory.

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### Occupant health



### Associated themes

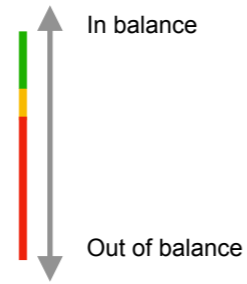
- Wellbeing

### Example quotes

- B21/23 Tackle fuel and health policy by dealing with the poorest in societies buildings, not just underfunded insulation and boiler measures. Regulations on moisture should have a direct link to part L and part F as all three stand and fall together. Stop schemes that start in the winter and have to be finished in April as this is THE worst time to be carrying out the work, or, make sheeting mandatory to protect the building when working in winter conditions
- B19/8 Health expenditure Quality of life needlessly impaired. Potential cost of remedial work over next 30 years, diverting resources and capacity from the enormous task of bringing the nation's homes up to a good standard of comfort and energy efficiency.
- B4/8 Every home I have ever lived in has faced some minor moisture issues, such as minor leaks, condensation and mould. Several homes felt unhealthy in terms of RH levels. Every building I have surveyed has shown signs of moisture issues, such as timber decay. The only problems that clients have raised post completion relate to moisture - both leaks due to defective workmanship (such as defective flashing or damaged roof membrane following the installation of plant on top ) and water escape either as a result of appliance failure (washing machines etc) or pipes that have leaked.

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### Moisture balance

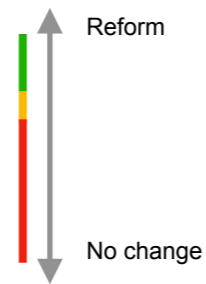


### Example quotes

- B12/24 Utilising the existing ventilation measures and understanding the importance of a balance of heat and ventilation to maintain optimum internal atmospheric conditions.
- B17/7 Inadequate ventilation - for deep retrofit it must be continuous, have excess capacity and be demand-controlled. Excessive insulation of vapour permeable solid walls inhibiting moisture movement/balance IWI - because of difficulty of achieving moisture balance or air-tightness, and the need for adequate ventilation
- B9/12 I believe that opening windows (especially when drying clothes) and under-heating are exceedingly important. I cite the example of a house which we have been renting out out for decades without any signs of dampness to different tenants over the years. A recent tenant started to experience very bad dampness and the mould in the kitchen. A single man, working irregular hours, we believe that the problem resulted from the fact that he simply did not heat the house sufficiently, his reasoning no doubt being "Why heat any other room than the room I am currently in?" When questioned about his heating of the house and use of the ventilation fan in the kitchen, he claimed that he heated the kitchen and ventilated the kitchen. He clearly did not. It also illustrates the difficulties of relying too heavily upon householder surveys when admitting to the truth may result in some kind of embarrassment (eg poverty (or meanness in the case of our tenant). It is easier to look to place the blame elsewhere.

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**Public policy**



B21/3 Any further increases in thermal insulation values should take into consideration the risk of overheating. Perhaps a method should be investigated for estimating the balancing point between providing enough insulation to gain maximum thermal efficiency before having to provide a cooling system. Ventilation levels should be assessed on the basis of what is needed to provide a healthy environment for air quality in preference to reducing ventilation to save energy. This could help illustrate the need for higher ventilation rates for impervious structures and a lower ventilation rate for breathable structures which allow some of the water vapour to disperse through the structure. This could also establish whether certain types of structure would require continuous ventilation or whether intermittent ventilation systems would be sufficient.

**Example quotes**

- B8/21 There is insufficient advice on ventilation. Building Regulations set out systems that are acceptable for new build or refurbishment but it is left to the designer to make the selection. There should be more information on when it is considered necessary to have continuous ventilation in preference to intermittent. For example in building which have vapour control layers in floors, walls and ceilings the structure cannot breathe so moisture removal has to be via the ventilation system and in such cases intermittent ventilation maybe insufficient to keep the internal environment healthy.
  
- B20/11 ECO schemes where cost per unit of carbon is everything. Situation where will acknowledge that up to a third may have terrible moisture issues identified in their survey but if having any other measure than insulation, nothing will be done about it. Government needs to get out of its silo mentality, where each dept. has a budget and look at policy effects across the piece. Providing decent retrofit, including robust moisture management strategy alongside energy efficiency will not only help the environment dep't meet its goals, it will reduce health service costs, improve tax revenue and create jobs, but any "funding" is seen as a cost and it all comes from the one area.
  
- B21/9 Buildings could be inspected on a regular basis and basic repairs and maintenance carried out (e.g. gutter clearing, replacement of perished window seals, crack repairs etc...) much in the same way that one would expect to have to service a car on a regular basis. Certain elements of part C of the Building Regulations could be applied to existing buildings as a level of performance to aspire to - e.g. protecting moisture-vulnerable building elements from moisture from the ground, rain penetration, condensation etc...