ANC Conference: Noise, Ventilation and Overheating
21 June 2017

Prof Kevin J Lomas, CEng FCIBSE MEI
School of Civil & Building Engineering, Loughborough University

Loughborough University

Overheating in dwellings: the emerging challenge

Loughborough University

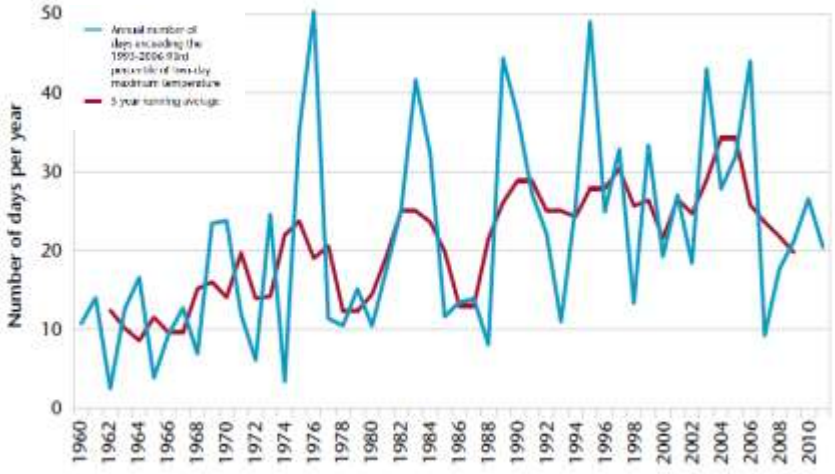
Five Questions about Overheating

- What are the causes summertime overheating.
- When is a building overheated?
- How widespread is summertime overheating?
- How do we predict the likelihood of overheating?
- How do we design to avoid overheating?

What are the causes summertime overheating?

The Changing Climate

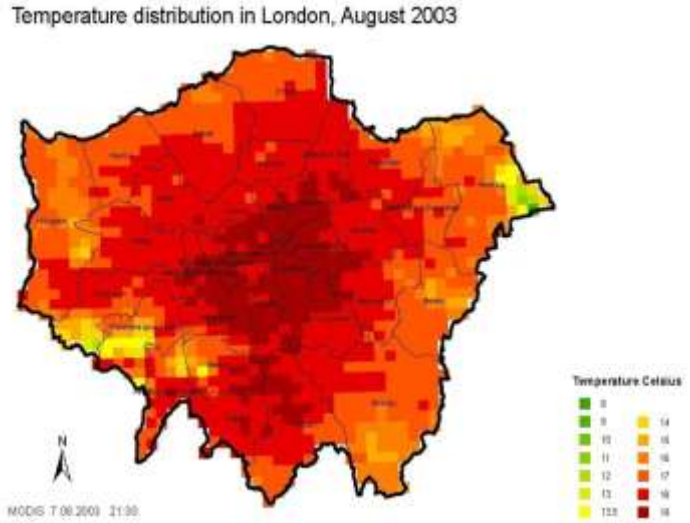
- Warmer summers and more variability.
- More frequent, longer and more intense heat waves.
- By 2050 the hot summer of 2003 will be normal.
- National alert system



Level 0	Long-term planning - All year
Level 1	Heatwave and Summer preparedness programme - 1 June – 15 September
Level 2	Heatwave is forecast – Alert and readiness - 60% risk of heatwave in the next 2 to 3 days
Level 3	Heatwave Action - temperature reached in one or more Met Office National Severe Weather Warning Service regions
Level 4	Major incident – Emergency response - central government will declare a Level 4 alert in the event of severe or prolonged heatwave affecting sectors other than health

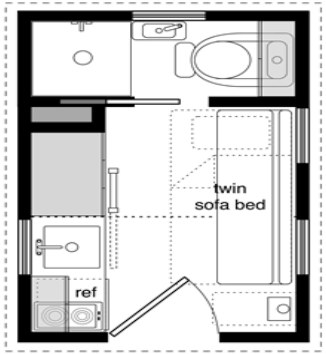
Urbanisation

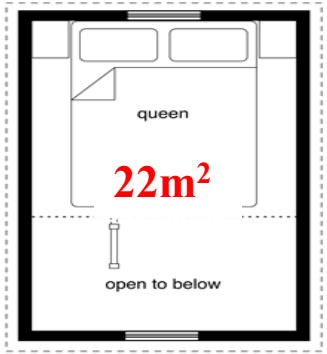
- Urban heat island – may be 7K warmer in centre than surroundings
- Noise, pollution, security risks
- Reduced effectiveness and likelihood of window opening.



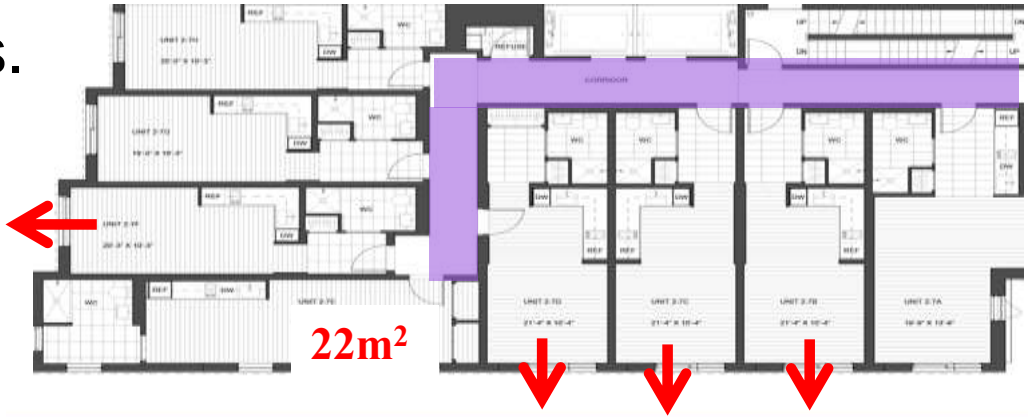
Design contributes to overheating

- High rise – solar gain, hot air rises, piped hot water.
- Window opening restrictors.
- Single aspect, low ceilings, blind corridors.
- ‘Compact’ homes and flats.





Just £450,000 !



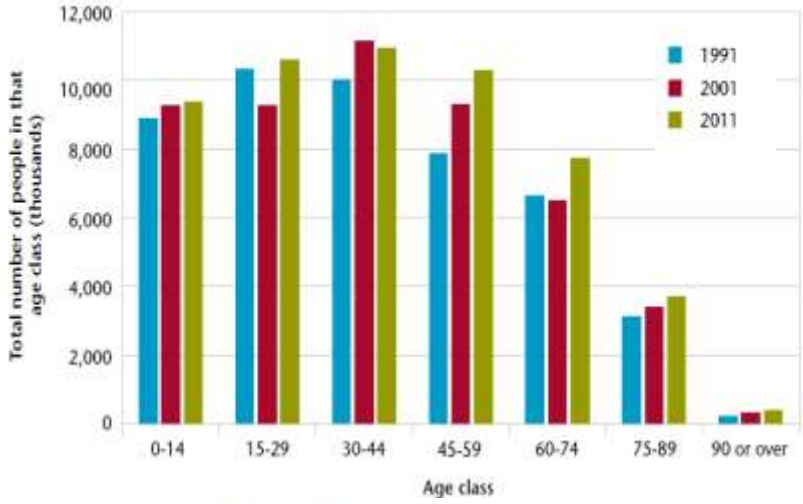
Construction practice can make things worse

- Faster, less time on site
  - ‘Modern methods of construction’
  - Prefabrication = light weight – steel, plasterboard, plastic, wood.
  - No external shading.
  - ‘Simple’ windows.
  - No noise control
- Cost control
  - Unreliable, noisy ventilation devices
  - Unskilled labour
  - ‘Value engineering’

Our aging population

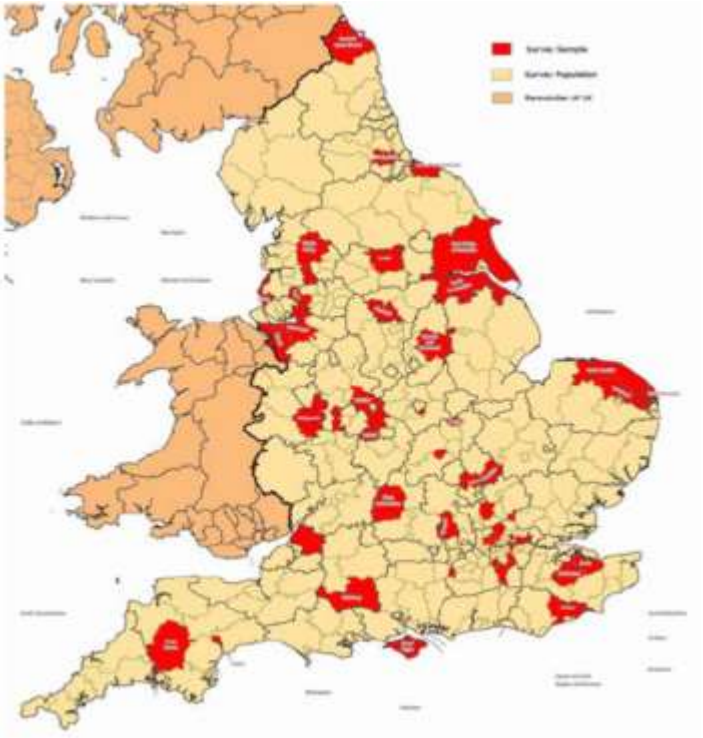
- More than 20 million over 60 by 2030.
- Less able to sense heat.
- Less able to regulate body temperature.
- More affected by heat.
- Medication further impairs thermo-regulation.
- Physically less able to take action.
- Cognitively less capable of understanding what to do.
- At home during the day.

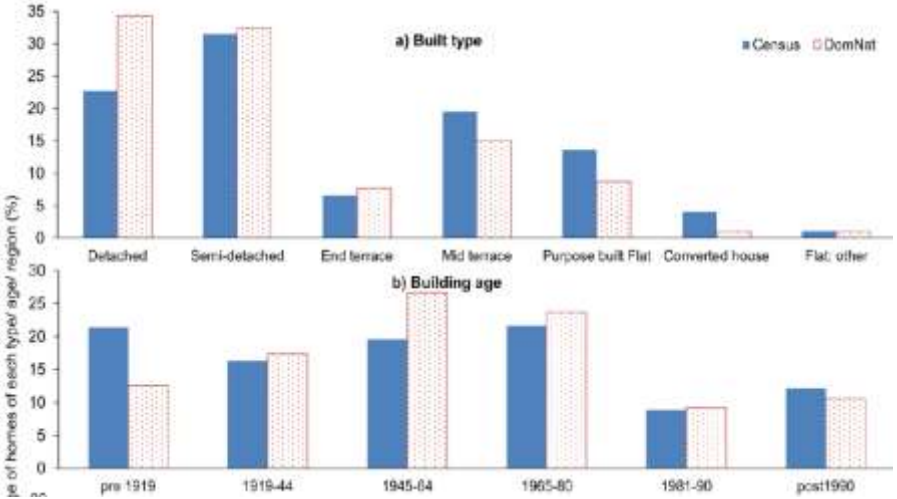
Figure 5.4: UK population by age class between 1991 and 2011



How widespread is summertime overheating?

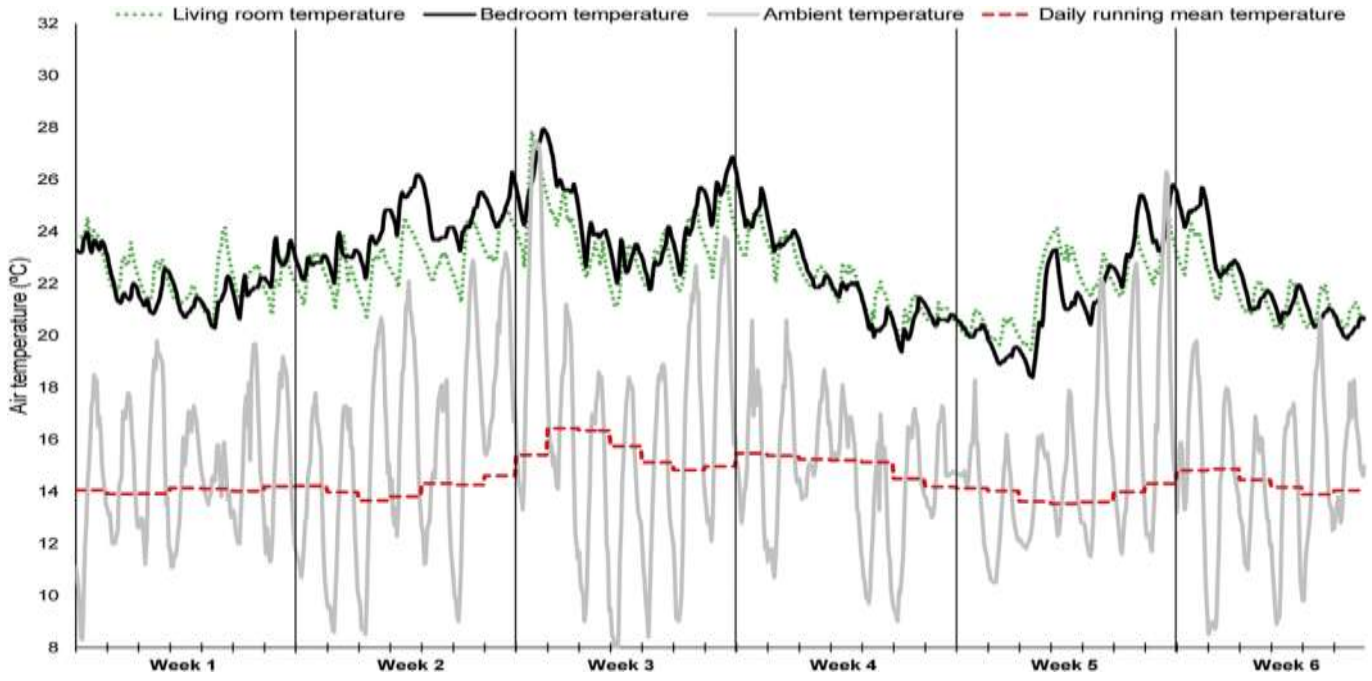
How widespread is summertime overheating?





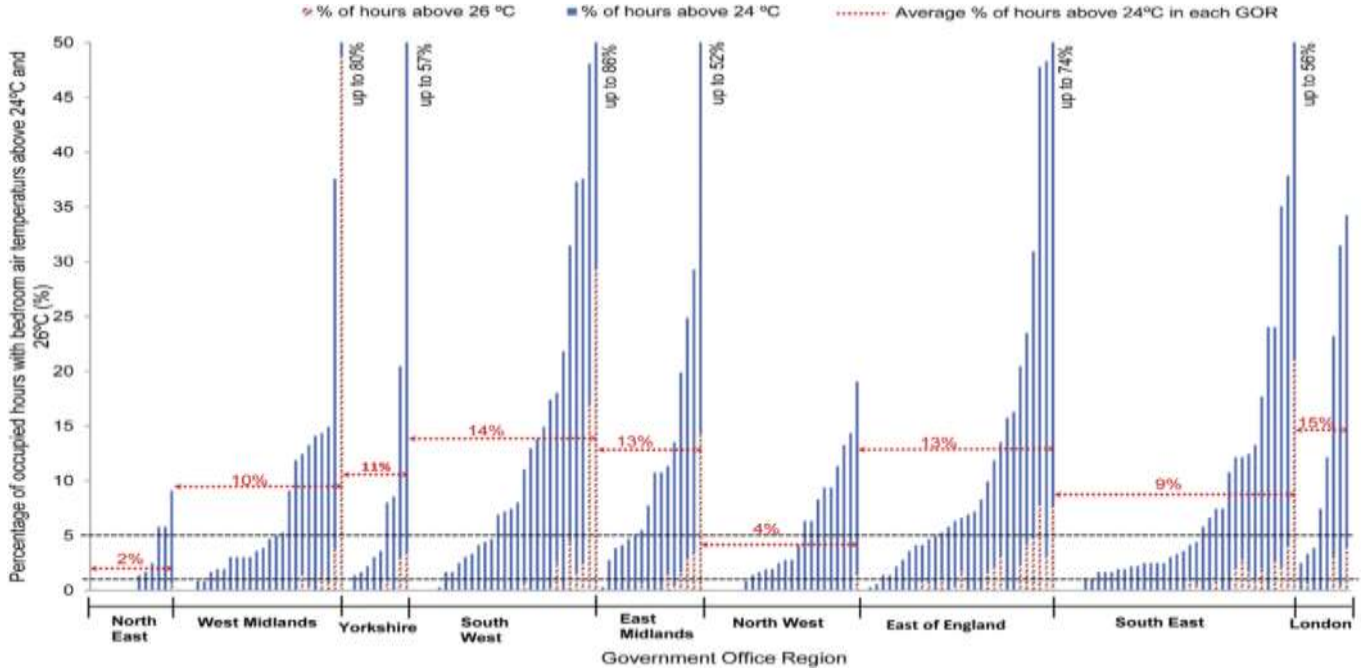
Source: Beizaee A, Lomas KJ and Firth SK, *National survey of summertime temperatures and overheating risk in English homes*, Building and Environment, 65, pp1-17 (2013)

Example measured temperatures



Measured bedroom temperatures?

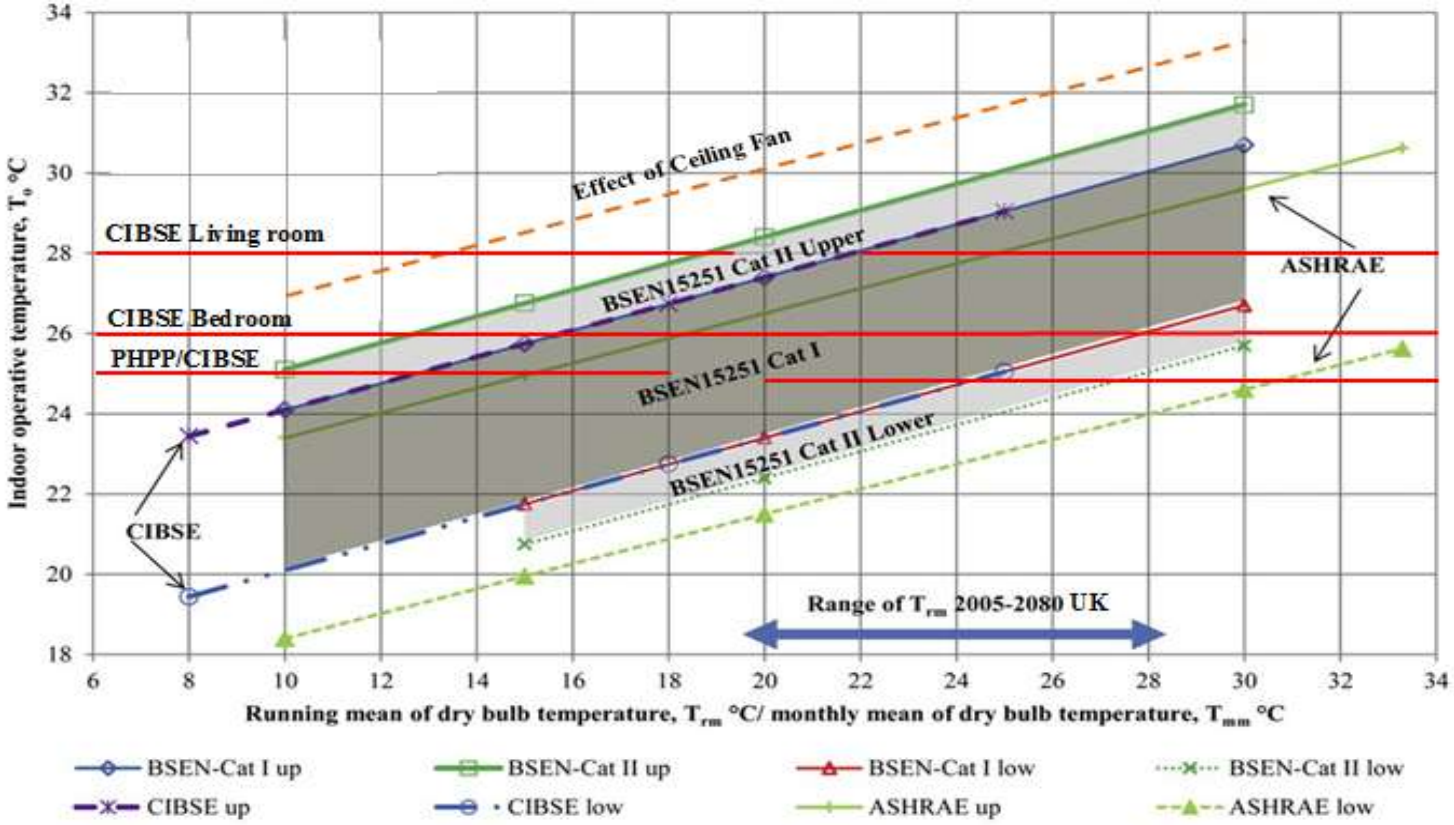
Bedroom temperatures – % hours over 24°C and 26°C



Source: Beizaee A, Lomas KJ and Firth SK, *National survey of summertime temperatures and overheating risk in English homes*, Building and Environment, 65, pp1-17 (2013)

When is a building overheated?

When is a building overheated?



Temperature and comfort are not he same thing

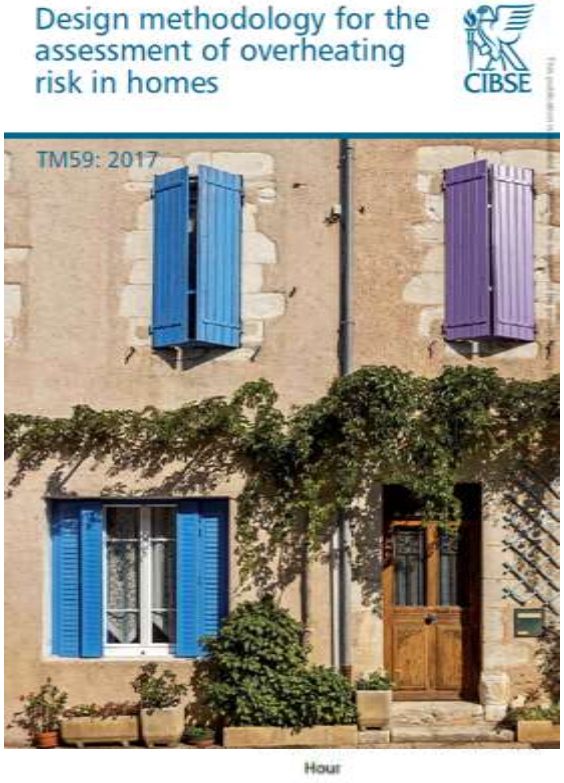
- Comfort: That state of mind that expresses satisfaction with the thermal environment.

- ‘*in certain households, what is defined … as overheating is simply the desired comfort range of the occupants*’.

How do we predict the likelihood of overheating?

Latest CIBSE Guidance: TM59

- Advice for dynamic thermal modelling.
- Focus is flats and apartments.
- Weather - Design summer year (moderately warm summer) for the building location for the 2020s[1].
- Use internal heat gain profiles stated.
- Simulate for a whole year.
- Count hours for which temperature is over Cat.I for vulnerable occupants, Cat.II for others (**DT**).



[1]High emissions, 50% percentile scenario.

Overheating criteria: TM59

(a) For living rooms, kitchens and bedrooms: the number of hours during which **DT** is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3 per cent of occupied hours.

(b) For bedrooms only: the operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours.

TM59: Overheating, ventilation and acoustics

- In order to allow the occupants t… habitable room needs operable windows with a n… …ies the purge ventilation criteria set in … for England (NBS, 2010) …. i.e. the … at least 1/20th of the floor area of the room.

But design for overheating ventilation is much more onerous than for purge ventilation.

- …med **should take into account** any security, …ty issues that limit opening a… (e.g. … floors).

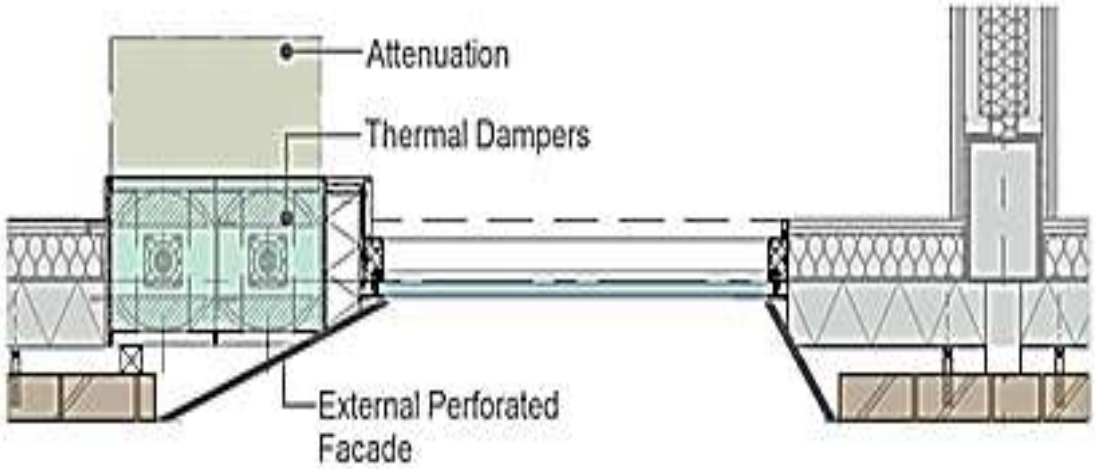
Does?

Means what?

- Control of overheating **may** require accessible, secur… …on with a significant openable (*sic*) area.

How do we design to avoid overheating?

Noise control and background ventilation



Noise control and ventilation

Noise control and shading

Conclusions

- The overheating risk to UK citizens has increased and will continue to escalate.
- Overheating can kill. Curtailment of sleep harms health and well-being.
- People will take adaptive action to maintain thermal comfort.
- People feel hot at different temperatures. They will take action at different times and in different ways.
- People must be provided with opportunity to act - this includes noise-free ventilation.
- Should the building regulations include overheating avoidance?

The End

Thank you