Summer Comfort on Large Schemes

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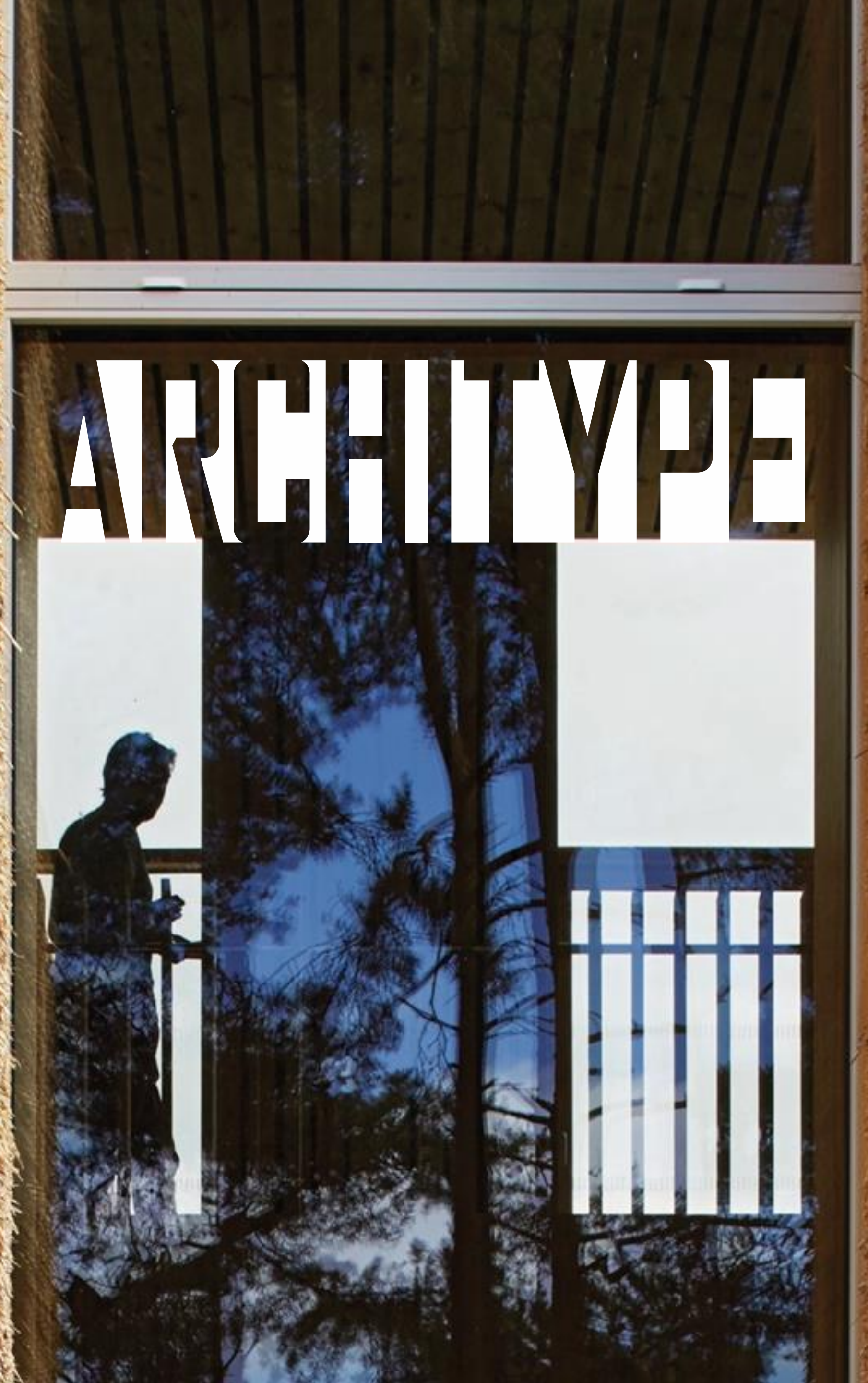


Architype believes any performance gap to be ***totally unacceptable*** and is committed to delivering buildings with no performance gap.

The building performance gap

> Buildings using 3 to 5 times as much energy as designed *(CIBSE Carbon Bites)*
> Uncomfortable and inadequate internal environments
> Systems that are difficult to control effectively

Sustainability
The Beginning, The Middle, The End

Performance

The backbone to design

Sufficiency:

A new design vernacular

Architype: projects

Burry Port Community Primary School / Llanelli

Oak Meadow Primary School / Wolverhampton

Ysgol Parc y Tywyn / Carmarthenshire

London Dock Secondary School / London

Hackbridge Primary School/ London

Swillington Primary School / Leeds

Ysgol Bro Hyddgen / Machynlleth

Bushbury Hill Primary School / Wolverhampton

Ysgol Trimsaran / Carmarthenshire

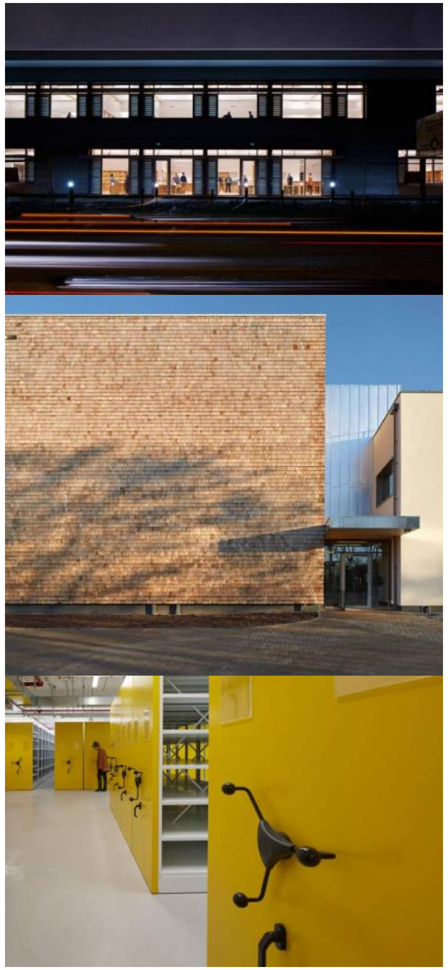
Wilkinson Primary School / Wolverhampton

Ysgol Maes y Dre and Salop Road Primary School / Welshpool

Sutton Secondary School / London

Architype: projects

Christ Church Central / Sheffield



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Agar Grove Housing / Camden, London

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An investigation into future performance and overheating risks in Passivhaus dwellings

CrossMark

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ABSTRACT

In response to UK govern
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a rapid uptake in the ado
zero carbon buildings in
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changing UK climate. Th
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overheating risks. Scen
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Overheating risk in Passivhaus dwellings

Rachel Mitchell and Sukumar Natarajan

bre

Passivhaus Trust

The UK Passive House Organisation

Designing for Summer Comfort in the UK

October 2016
Revision 0.1

Overheating in urban flats

Prepared for: Peter Thompson, Energy Saving Trust

18 May 2007

Client report number 234742
Rev1

Overheating in new homes

A review of the evidence

Research Review

NHBC FOUNDATION

Housing research in partnership with BRE Trust

ZERO CARBON HUB

Other relevant summer comfort criteria

Standard	Building Type	Peak Summer Temp.	Durations of Time	Permitted Exceedance
DfES BB87	Schools	28°C	Occupied hours/year	80 hours
Housing Health & Safety Rating System (HHSRS)	Dwellings	25°C	Occupied hours/year (inferred)	Unspecified.

Table 1a: DfES and HHSRS overheating standards

Standard	Building Type	Acceptable Range	PMV*	Max. Daily Temp. Summer	Duration of Time	Occupied Hours Exceeding θmax	Assessment of Daily Overheating Severity
CIBSE Guide A (section 1.5.3.2) based upon BS EN 15251 (Category II)	Dwelling	± 3 K	± 0.5	26°C	Occupied hours/year	< 3% when ΔT > 1K between May and Sept.	Weighted exceedance < 6
	Offices	± 3 K	± 0.5	26°C			
	Retail	± 3 K	± 0.5	25°C			
	Schools	± 3 K	± 0.5	25.5°C			

For more information on these standards refer to CIBSE Guide A. *Predicted mean vote.

Table 1b: CIBSE overheating standards

Standard	Building Type	Calculated Peak Temperature	Evaluation
SAP* Appendix P (Table P2)	Dwellings	< 20.5°C	Not significant
		≥ 20.5°C & <22°C	Slight
		≥ 22°C & <23.5°C	Medium
		≥ 23.5°C	High

* It should be noted that the Standard Assessment Procedure (SAP) is a regulatory tool, not a design tool.

Table 1c: SAP overheating standards

Passivhaus (PHPP)

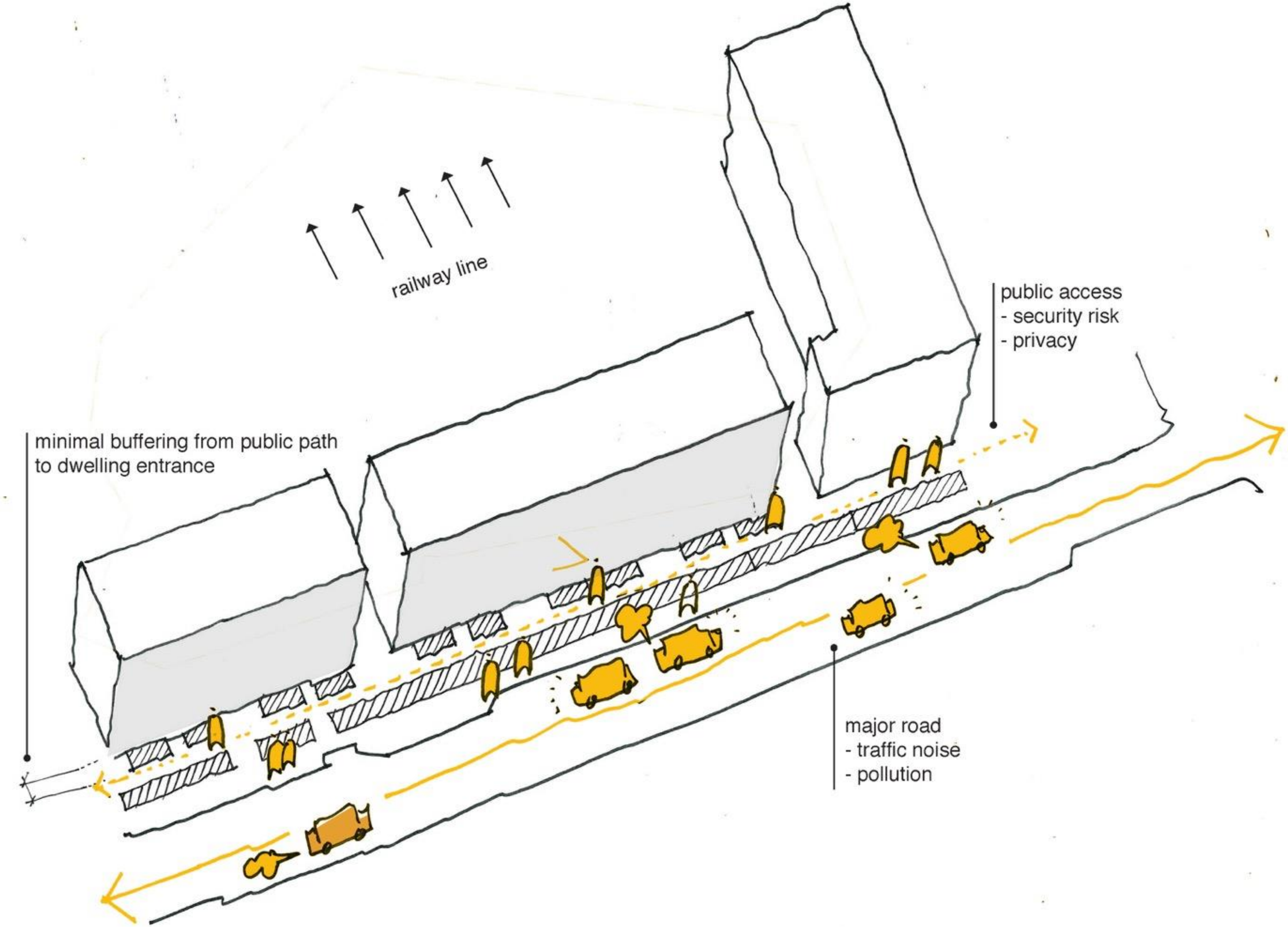
Hours >25°C	Hours/year	Assessment
> 15%	>1314	Catastrophic
10-15%	876-1314	Poor
5 – 10%	438-876	Acceptable
2 – 5%	175-438	Good
0 – 2%	0-175	Excellent
Maximum daily temperature swing according to PHPP 3K (to ensure reliable modelling)		

Passivhaus Trust
The UK Passive House Organisation

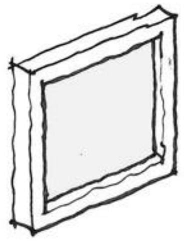
How do we approach design to test and evaluate summer comfort at scale?

1. Identify risks & constraints

Parameter	Behaviour/ Opportunity Affected	Likelihood	Severity	Risk	Risk Management Activity
NOISE					
Noise from outside	Window vent.				
Ground floor ventilation only?	Window vent.				
Vehicles	Window vent.				
Pedestrian passers-by at night	Window vent.				
Lack of opportunity for secure night ventilation	Window vent.				
Indoor mechanical noise	Switching off/down of vent. system				
Breakout noise from MVHR into adjacent dwellings	Neighbouring dwellings keep windows closed – resulting in overheating				
OBSTRUCTIONS					
Will internal doors be left open?	Ability to cross ventilate				
Will curtains/ blinds obstruct vent strategy?	Window vent.				
Size of the ventilation opening dim. realistic?	Window vent.				

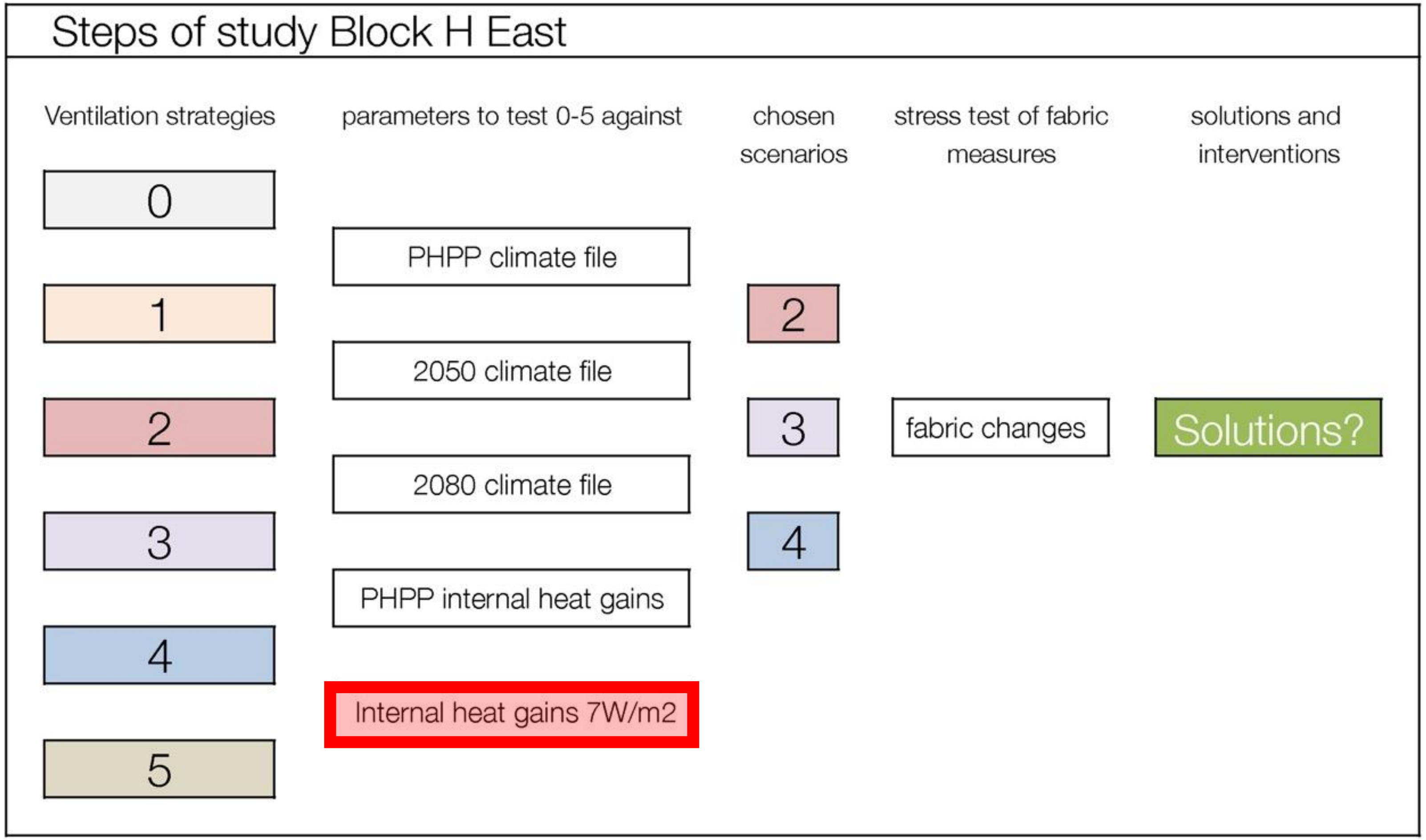


2 Establish design device options within the approach



Establish current 'proposed' option performance

3. Establish methodology of testing



4. Develop communication of impacts to stakeholders

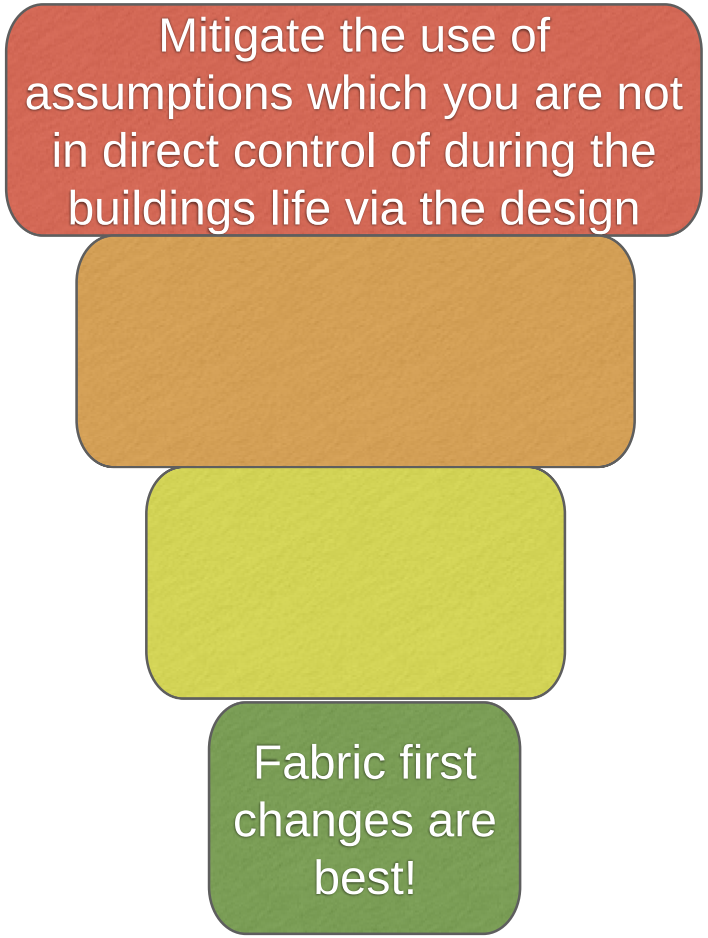
Suggested interventions to mitigate overheating risk*				
Impact	No	Proposed action	Project impact	Passivhaus Compliant?
Least	0	Agreeing strategy with occupants about strict use of window opening if noise security and pollution concerns are addressed	time	?
	1	glazing spec change for g-value benefit	cost and potentially time	
	2	Assess acceptable levels of air change above normal for high internal temperatures applied to whole flat one system	cost, time, risk to primary energy value in PHPP	
	3	Themal active cooling: via radiant floor conditioning in locations where thermal inertia is high risk (kitchens, near large glazed openings)	cost, time, primary energy risk in PHPP	
	4	Bedrooms to have a separate ventilation zone with high exchange rate to ensure sleep comfort as minimum	cost, time, visual impact, risk to primary energy value in PHPP	
	5	Cooling coil active cooling using mechanical means (this is NOT full conditioning of the air)	cost, time, primary energy risk in PHPP	
	6	Secure vent options for windows in ground floor	cost, time, external visual impact	
	7	Shading devices (daylighting and other criteria to be tested)	cost, time, external visual impact	
Most	8	Window ratio reduction	cost, time, external visual impact, heat energy and solar gains impact to be assessed	

** Please note this list is not exhaustive and may be a combination of part measures subject to more detailed dynamic assessment*

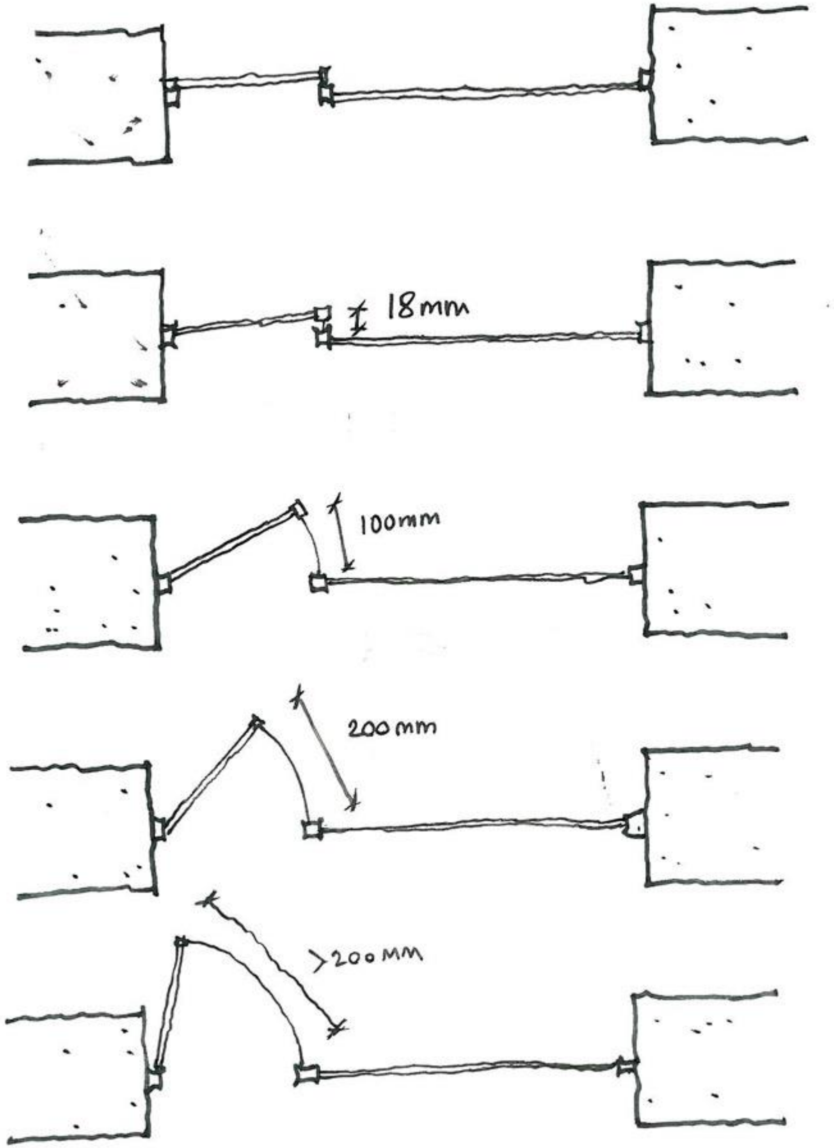
4. Develop communication of impacts to stakeholders

Suggested interventions to mitigate overheating risk*

Impact	No	Proposed action
Least	0	Agreeing strategy with occupants about strict use of window opening if noise security and pollution concerns are addressed
	1	glazing spec change for g-value benefit
	2	Assess acceptable levels of air change above normal for high internal temperatures applied to whole flat one system
	3	Themal active cooling: via radiant floor conditioning in locations where thermal inertia is high risk (kitchens, near large glazed openings)
	4	Bedrooms to have a separate ventilation zone with high exchange rate to ensure sleep comfort as minimum
	5	Cooling coil active cooling using mechanical means (this is NOT full conditioning of the air)
	6	Secure vent options for windows in ground floor
	7	Shading devices (daylighting and other criteria to be tested)
Most	8	Window ratio reduction



5. Clearly record assumptions through the process



Example of completed Design Statement for the Management of Overheating Risks:

To provide summer comfort and minimise the risk of overheating, assumptions have been made. In consultation with the project team, including the client and user group representatives, the following conditions apply:

Building Type: Residential
Utilisation pattern: Dwelling

1) Automatic summer bypass (provided by the MVHR unit) is the primary means of providing cooling (i).
2) Window opening activities have been minimised. It has been assumed that ventilation will be used at night (ii). Openable windows have been provided in each room. Window stays permit controlled ventilation.
3) Internal heat gains from lighting and electrical appliances have been and will be minimised (iii).
4) Design occupancy has been assumed to be 5 people (iv).
5) External shading mechanisms are manually controlled (v).
6) No active cooling is provided (vi).

On the understanding that these conditions are met it is predicted that the operational temperature of the building will not rise above 25°C for more than 1 % of the year.

Where these conditions are not observed summer comfort will be compromised and overheating risks will increase.

Technical Clarifications:

i) The ventilation rate is at least 0.45 air changes per hour.
ii) Night time ventilation is assumed to provide a maximum cooling of 0.1 ac/K. This ventilation rate will be provided for 12 hours each night. As viewed from the inside, the inward opening windows provide a minimum of 50mm of clear opening has been provided at the window head and jambs. (Refer to construction details: 6975/DE/031/001, 6975/DE/031/002, 6975/DE/031/003)
iii) Based upon the PHPP IHG worksheet it has been assumed internal gains are less than 2.6 W/m^2.
iv) The User Determined Occupancy has been used for assessment (rather than 'Standard')
v) The assumed summer shading reduction factor has been derived from (Refer to construction details: 6975/EL/020/001, 6975/EL/020/002, 6975/EL/020/003)
vi) The cooling load has been mitigated by passive measures.

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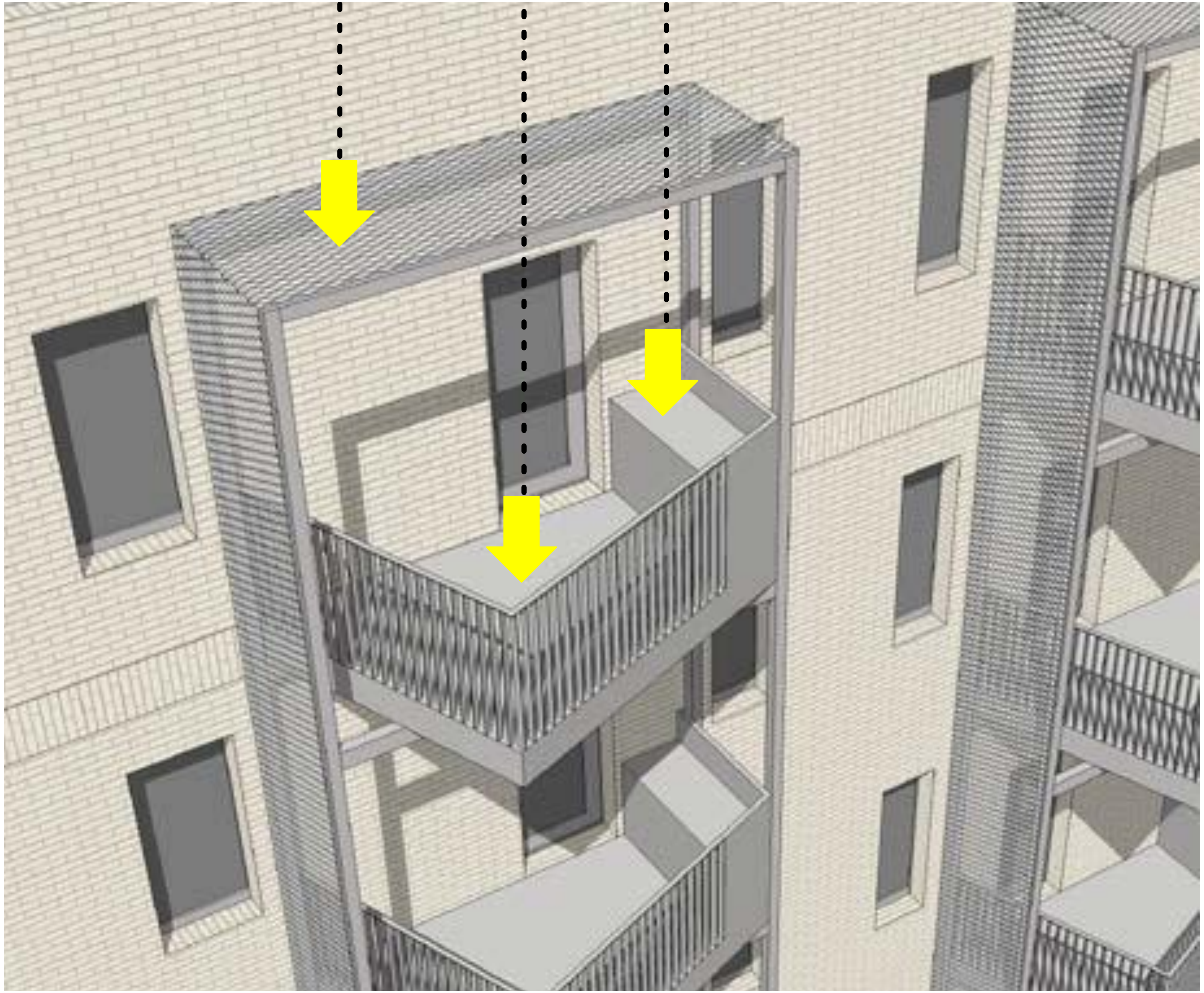
Special external features

- Metal wrap around screen for solar shading and to grow a vertical garden

- Large balcony to allow for seating and safe wheel chair turning

- Planter designed as part of balcony so residents can grow their own mini garden



St Loyes Extra Care

Discussion and Recommendations for future 2080 climate

Discussion

1. The building performs well using the **current** Exeter climate data. The only exceptions are the fourth floor dining and waiting areas. Adding solar control to the rooflights ensured the building met the overheating criteria.

2. The building will exceed the overheating criteria using the **2080 climate** data with no interventions. Interventions will be required to minimise overheating hours to acceptable levels.

3. The most effective method to reduce overheating hours is to cool the supply air and seal the building i.e. no natural ventilation. Additional external window shutters will reduce the overheating hours further but are not required to meet the overheating criteria.

Recommendations

1. Allow for cooling coils in the central air handling units supply air duct. This should be used in conjunction with sealing the building i.e. no openable windows.

2. Consider external shutters to reduce solar gain on hot and sunny days.

3. Exposed thermal mass helps manage temperature peaks but is not critical to reducing overeating hours.

Key assumptions that we recommend are verified:

- Constructions, U values and glazing g-values
- Ventilation free areas (in particular compliance with building regs / protection from falls / Part M).
- Occupancy numbers

2080 Tests Internal Air Temperatures of an East-Facing Bedroom

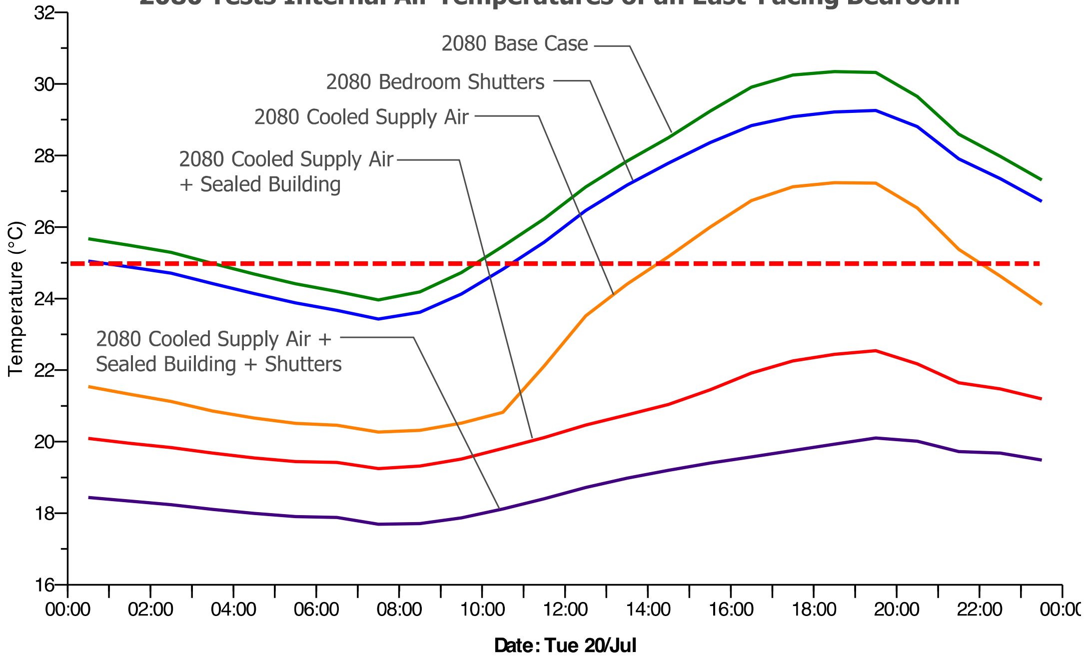


Table showing percentage reduction of overheating hours

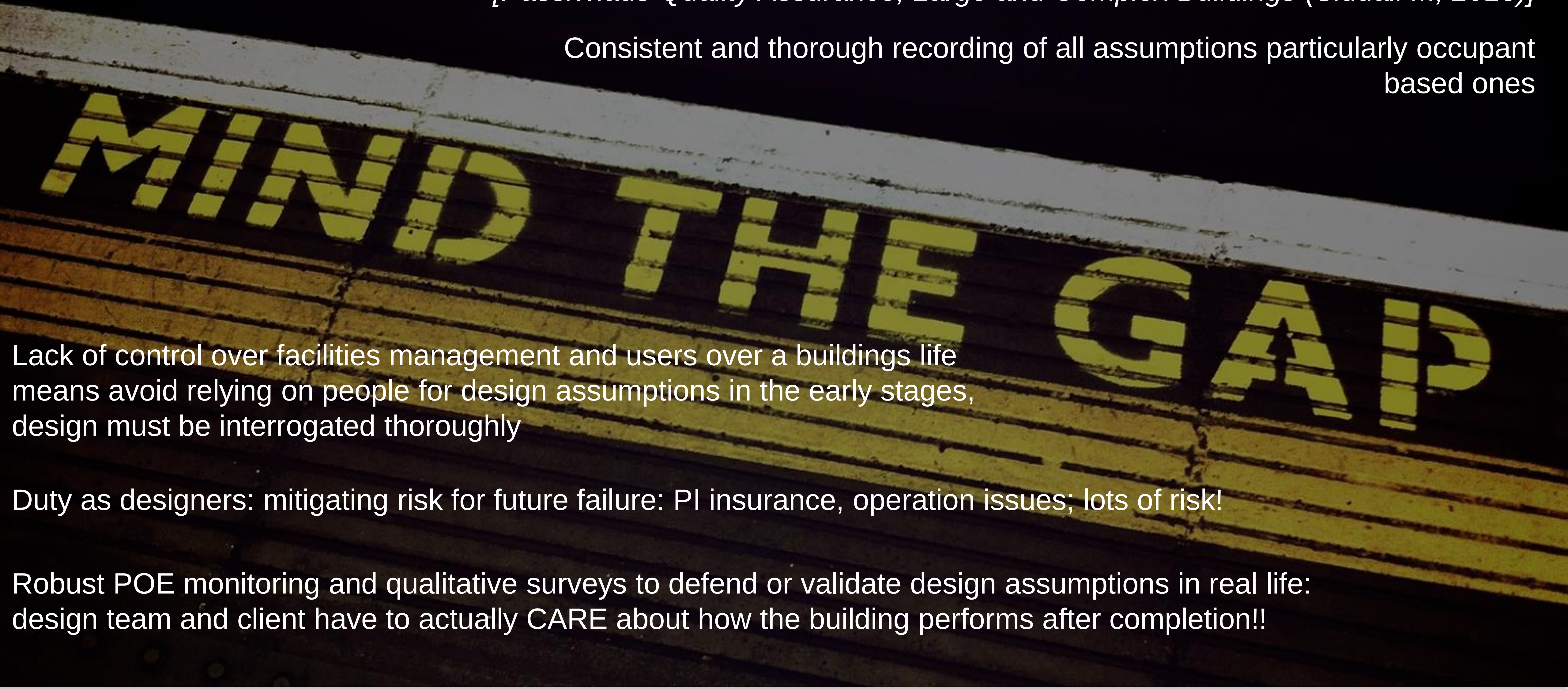
Test	Total Overheating Hours	% Improvement on 2080
Current Data	47	
2080 Base Case	16020	
Bedroom Shutters	12036	25
Cooled Air	1744	89
Cooled Air + Sealed Building	331	98
Cooled Air + Sealed Building + Bedroom Shutters	137	99

Conclusions

Client engagement and awareness

Design team engagement and awareness
[Passivhaus Quality Assurance; Large and Complex Buildings (Siddall M, 2015)]

Consistent and thorough recording of all assumptions particularly occupant based ones



Lack of control over facilities management and users over a buildings life means avoid relying on people for design assumptions in the early stages, design must be interrogated thoroughly

Duty as designers: mitigating risk for future failure: PI insurance, operation issues; lots of risk!

Robust POE monitoring and qualitative surveys to defend or validate design assumptions in real life: design team and client have to actually CARE about how the building performs after completion!!

AJ 100

Sustainable Architect of the Year 2019

Thank You

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