PRICE & MYERS

REPORT

1-11 Hawley Crescent, Camden NW1 8NP

Thermal Modelling Report for overheating assessment

Prepared by:	**Jisoo Kim**
Reviewed by:	**Deepika Singhal**
Job Number:	**25299.001**

Date	**Version**	**Notes/Amendments/Issue Purpose**
19/06/2018	V2	

37 Alfred Place London WC1E 7DP 020 7631 5128 mail@pricemyers.com www.pricemyers.com

Contents

Executive Summary

This report summarises the results of thermal comforts studies undertaken for the proposed scheme at 1-11 Hawley Crescent in the London Borough of Camden. The proposed scheme involves part demolition of existing residential flats at third and fourth floors and construction of new three storey extension to provide 9 new flats in addition to the 6 existing flats. Lower two storeys will accommodate commercial units.

Overheating studies were undertaken only for representative residential units within the proposed building. Dynamic thermal model was generated to test compliance with CIBSE Guide A (2015) and CIBSE TM52 (2013) in line with the requirements set out in the London Plan and Camden's Local Plan. To ascertain the risk of overheating adaptive thermal comfort methodology was undertaken in line with TM52. According to the guidance, a room that meets 2 out of the 3 criteria of overheating is unlikely to overheat.

The test was undertaken for the worst performing rooms on the hottest day of the year in the current weather scenario. Various passive design measures and mechanical ventilation system were incorporated into the test model. The results showed that even after these measures 3 out of 10 rooms are likely to overheat. Analysis showed that these rooms failed on the hotter days only and by a margin. As a result, internal shading in form of blinds was further tested.

The final outcome confirmed that all the tested rooms within the identified units meet the CIBSE TM52 criteria for overheating and follow the cooling hierarchy set by London Plan in order to minimise the risk of overheating.

In future climate scenario, it was found that most of the living rooms will fail to meet the overheating criteria with the mixed mode strategy in the near future. Therefore, an active cooling system will be required to ensure summer comfort for the occupants throughout the lifetime of the building.

It should be noted that incorporating cooling systems should be carefully considered with mechanical engineers in early stage of design.

1. Introduction

The site is located within the London Borough of Camden. The proposed scheme involves part demolition of existing residential flats at third and fourth floors and construction of new three storey extension to provide 9 new flats in addition to the 6 existing flats. The site is oriented east-west (Figure 1-1), as a result the units are either north or south facing and the corner units are dual aspect.

The assessment is based on drawings provided by Chassay and Last Architects for the proposed development.

Figure 1-1 Orientation of the development

2. Policy

2.1 London Plan

Strategic

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
   1. minimise internal heat generation through energy efficient design
   2. reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
   3. manage the heat within the building through exposed internal thermal mass and high ceilings
   4. passive ventilation
   5. mechanical ventilation
   6. active cooling systems (ensuring they are the lowest carbon options).

C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

LDF preparation

D. Within LDFs boroughs should develop more detailed policies and proposals to support the avoidance of overheating and to support the cooling hierarchy

2.2 Camden Local Plan

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.
We will ensure that schemes include appropriate climate change adaptation measures, to reduce the impact of urban and dwelling overheating.

Overheating

The Council will discourage the use of air conditioning and excessive mechanical plant. In addition to increasing the demand for energy, air conditioning and plant equipment expel heat from a building making the local micro-climate hotter. Where the use of this equipment is considered acceptable by the Council, for example where sterile internal air is required, we will expect developments to provide an appropriate level of mitigation towards cooling the local environment.

Cooling measures could be passive or active, such as introducing planting in the public realm, green walls and roofs or other measures as recommended in the Mayor's Sustainable Construction and Design Supplementary Planning Guidance.

Trees grown near buildings to mitigate the heat effect are best placed to the west, south-west or south of buildings with small leafed species likely to offer the greatest impact. Green spaces and wider green infrastructure should be a minimum of 0.5ha in order to achieve cooling at significant distances beyond site boundaries (Forestry Commission, Air temperature regulation by urban trees and green infrastructure, 2013).

To help reduce the need for air conditioning, all new developments and developments that require a need for cooling will be expected to submit a statement demonstrating how the London Plan's 'cooling hierarchy' has informed the building design.

2.3 Guidance

The proposed development is designed to have natural ventilation therefore overheating assessment has been undertaken. The assessment follows adaptive thermal comfort methodology in line with CIBSE TM52 and TM59. Details with respect to alternative approach can be found in section 5.10.1 'Acceptable temperatures' in CIBSE Guide A.

3. Thermal modelling

Thermal modelling has been carried out using EDSL TAS Building Designer v. 9.4.1 Dynamic Simulation Modelling (DSM) software which is in line with CIBSE AM:11 Building Performance Modelling (2015b). This is also in accordance with the Camden local policy described in section 2.

The modelling analysis demonstrates the overheating thresholds for thermal comfort of the residential units within the development. The units selected for the assessment represent the worst case scenarios which have a higher risk of overheating such as south-facing units and units with large glazing area. These are likely to receive high solar gains.

The tested units can be found in Appendix A.

Figure 3-1 below illustrates the computer model of the proposed development.

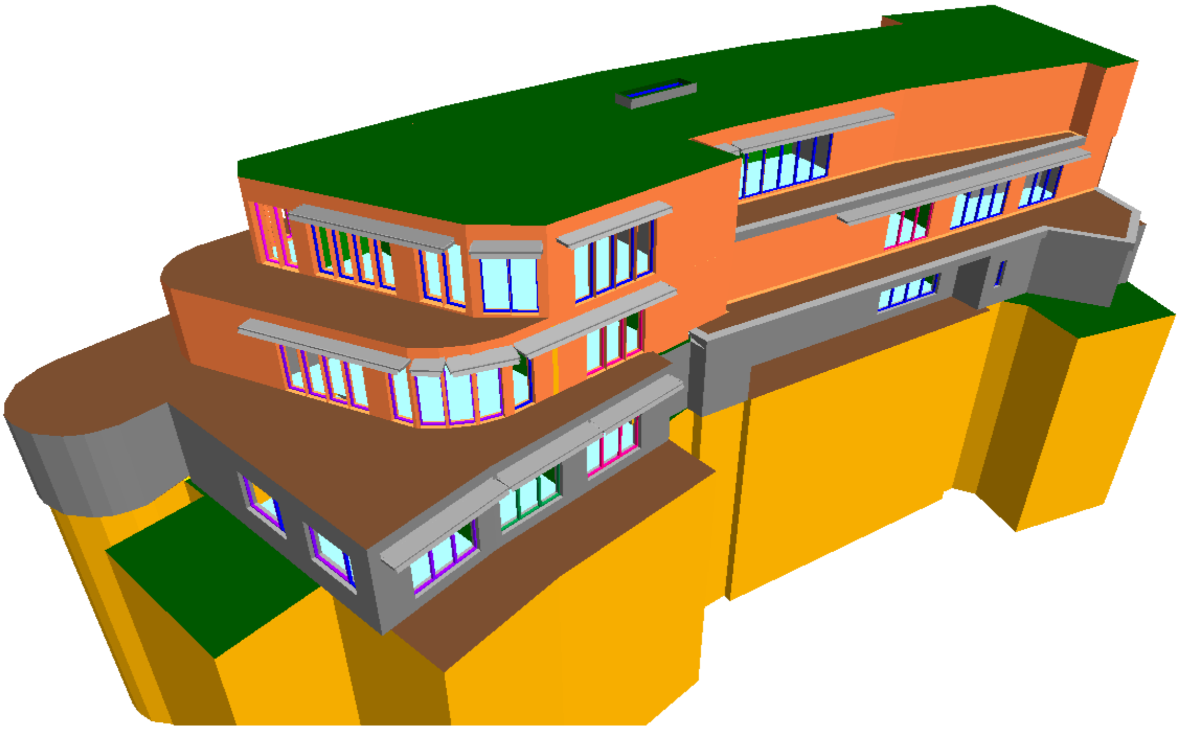


Figure 3-1 TAS 3D Model of the development

4. Model Assumptions

The fabric properties have been assigned based on the proposed energy strategy. These values have been proposed to meet and exceed limiting fabric parameters specified in the Part L document and therefore all values are in compliance with current building regulations.

Table 4-1 shows the proposed U-values that have been considered for the development and used for this thermal modelling analysis.

Parameters	Glazing
U-value	1.2
G-value	0.7
Light Transmittance	0.7

Element	U-Value - Proposed
External wall	Brick Wall: 0.14 W/m^2K
	Aluminium Cladding: 0.14 W/m^2K
Internal wall	0.25 W/m^2K
Green roof	0.13 W/m^2K
Heat loss floor	0.22 W/m^2K
Entrance Door of Units	1.4 W/m^2K

Table 4-1 Building fabric U-values

Simulation Assumptions

- CIBSE London weather data (DSY-Design Summer Year) was used for the assessment.
- The calendar was set such that summer season is between 1st May and 30th September).
- The occupied hours in the tested rooms were assumed on the basis of space use. This is shown in the table below :

Room Type	Occupied Hours																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
LKD																								
Bedrooms																								

Table 4-2 Occupied hours of the tested rooms

- The window openings were set such that they are controlled by internal temperature of the zone and operable during only occupied hours. They were scheduled such that they begin to open when the temperature exceeds 19˚C and are fully open when the temperature reaches 21˚C.

- It has been assumed that the foldable windows are 100% openable whereas all the other windows are only 30%.
- The internal gains that have been assumed in the assessment are presented below:

Internal Gains (W/m2)	Livingroom	Bedrooms
Lighting Gain	8.0	4.0
Occupancy Sensible Gains	5.0	1.5
Occupancy Latent Gains	3.0	0.5
Equipment Sensible Gains	5.0	2.9

Table 4-3 internal gains of the each zone types

5. Overheating Criteria

5.1 Adaptive Thermal Comfort Methodology CIBSE TM52

To ascertain the risk of overheating, adaptive thermal comfort methodology was undertaken in line with TM52. It suggests that in case of free running or natural ventilation, a room or building that fails any two of the following three criteria is classed as overheating:

1. The number of hours during which temperature difference between the actual operative temperature in the room and the limiting maximum acceptable temperature (ΔT) is greater than or equal to one degree during the period May to September inclusive shall not be more than 3% of occupied hours.
2. To allow for the severity of overheating the weighted exceedance shall be less than or equal to 6 in any one day.
3. To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4°C.

6. Cooling Hierarchy

In line with the London Plan and Camden's policy on overheating the following cooling hierarchy has been followed to reduce the risk of overheating.

6.1 Minimise internal heat generation

The development doesn't have any community heating therefore there are no ducts running in the communal spaces or within the units which are likely to contribute to internal heat gains as a result of the distribution losses.

6.2 Reducing the amount of heat entering the building

The site is oriented east-west therefore some units face south. Brise-soleil is proposed on the south and west facades (refer Appendix A) to reduce direct solar gains.

Large foldable windows would allow better flow of air and effective natural ventilation.

Biodiverse green roofs have been provided on the available roof space. These would not only reduce heat loss in winter but also attenuate heat gain in summer. The insulation of exposed building elements has been adjusted to maintain heat gains and losses.

6.3 Manage the heat within the building

The brick walls would absorb heat during daytime and help night ventilation. The reasonable floor to ceiling height would ensure that there is enough volume for lighter hot air to rise and not affect the users.

6.4 Passive Ventilation

The passive design assessment was carried out to determine thermal comfort in the habitable rooms of the selected units and the aim of the test was to achieve comfort benchmarks with passive design itself. Detailed assumptions and passive measures for the assessments are presented in section 4.

The assessments with the proposed design shows that 9 out of 13 rooms are able to meet the recommended CIBSE TM52 benchmark as 2 out of 3 criteria are met.

Exceptions are the rooms that contain a large south and west-facing windows.

Table 6-1 shows the results of the overheating assessment with passive design only.

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
A-Apt.2 Bed 1	2448	73	29	13.0	0	Pass
A-Apt.2 LKD	1224	36	17	8.0	1	Fail
A-Apt.5 Bed 1	2448	73	22	4.0	2	Pass
A-Apt.5 LKD	1224	36	25	6.0	2	Pass
B-Apt.1 Bed 1	2448	73	34	8.0	2	Fail
B-Apt.1 Bed 2	2448	73	25	5.0	2	Pass
B-Apt.1 LKD	1224	36	45	5.0	6	Fail
B-Apt.4 Bed 1	2448	73	31	6.0	2	Pass

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
B-Apt.4 LKD	1224	36	57	7.0	9	Fail
B-Apt.7 Bed 1	2448	73	2	1.0	0	Pass
B-Apt.7 Bed 2	2448	73	23	4.0	2	Pass
B-Apt.7 LKD	1224	36	20	4.0	2	Pass
B-Apt.8 LKD	1224	36	3	3.0	0	Pass
Total						**9 pass**

Table 6-1 Results of the Overheating assessment with initial proposed design

6.5 Mechanical Ventilation

The energy strategy for the proposed scheme has mechanical ventilation as an energy efficient measures in line with the energy hierarchy. Therefore, subsequent assessments were carried incorporating mechanical ventilation measures.

The ventilation rate was assumed based on Table 1.5 in CIBSE Guide A and the value of 10 l·s-1 per person. In this case, the ventilation rate of 1.2 l/s/m^2 was assumed for the bedrooms and 2.0 l/s/m^2 for the Living room and Kitchen (LKD). The mechanical ventilation operates when the temperature in the zone reaches the lower limit (19 ˚C) and increases proportionally until the upper limit (21 ˚C) is reached.

The results indicate that 10 out of 13 rooms could meet the recommended CIBSE TM52 criteria, however, 3 rooms still fail to meet the standard. Table 6-2Table 6-1 shows the results of the overheating assessment with mechanical ventilation:

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
A-Apt.2 Bed 1	2448	73	13	8.0	0	Pass
A-Apt.2 LKD	1224	36	16	6.0	0	Pass
A-Apt.5 Bed 1	2448	73	21	4.0	2	Pass
A-Apt.5 LKD	1224	36	24	6.0	2	Pass
B-Apt.1 Bed 1	2448	73	33	8.0	2	Fail
B-Apt.1 Bed 2	2448	73	26	5.0	2	Pass
B-Apt.1 LKD	1224	36	42	5.0	5	Fail
B-Apt.4 Bed 1	2448	73	31	6.0	2	Pass
B-Apt.4 LKD	1224	36	57	7.0	9	Fail
B-Apt.7 Bed 1	2448	73	2	1.0	0	Pass
B-Apt.7 Bed 2	2448	73	23	4.0	2	Pass
B-Apt.7 LKD	1224	36	23	5.0	2	Pass
B-Apt.8 LKD	1224	36	3	3.0	0	Pass
Total						**10 pass**

Table 6-2 Results of the Overheating assessment with mechanical ventilation

The results indicate that even after mechanical ventilation 3 out of 10 tested rooms continue to fail and therefore additional measures were tested. Analysis showed that the rooms failed by a margin only on some of the hotter days. Therefore, internal blinds were applied in order to have further reduction in solar gains.

Blinds were incorporated in the 3D model so as to have a lower solar transmittance as compared to the typical glazing specification. Table 6-3 below shows the reduced solar transmittance with blinds:

Parameters	Glazing
U-value	1.2
G-value	0.22

Table 6-3 Glazing U values and G values that incorporated blinds

Table 6-4 below confirms that all the rooms are able to meet the the recommended CIBSE TM52 with the use of internal blinds and mechanical ventilation. The detailed results of the analysis at this stage can be found in Appendix C.

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
A-Apt.2 Bed 1	2448	73	13	8.0	0	Pass
A-Apt.2 LKD	1224	36	16	6.0	0	Pass
A-Apt.5 Bed 1	2448	73	21	4.0	2	Pass
A-Apt.5 LKD	1224	36	24	6.0	2	Pass
B-Apt.1 Bed 1	2448	73	5	4.0	0	Pass
B-Apt.1 Bed 2	2448	73	15	6.0	1	Pass
B-Apt.1 LKD	1224	36	19	5.0	2	Pass
B-Apt.4 Bed 1	2448	73	21	4.0	2	Pass
B-Apt.4 LKD	1224	36	12	6.0	1	Pass
B-Apt.7 Bed 1	2448	73	2	1.0	0	Pass
B-Apt.7 Bed 2	2448	73	23	4.0	2	Pass
B-Apt.7 LKD	1224	36	20	4.0	2	Pass
B-Apt.8 LKD	1224	36	3	3.0	0	Pass

Table 6-4 Results of the Overheating assessment with mechanical ventilation and blinds

6.6 Active Cooling Systems

Adapting to a changing climate is identified in Camden's environmental sustainability plan, Green Action for Change (2011-2020).
Analysis for climate change scenarios were undertaken to investigate the increased risk of overheating in the near future and identify any risks of overheating. CIBSE weather data, London 2020s Medium-High DSY has been used to anticipate overheating risks in the future.

Table 6-5 below shows that only 8 out of 13 rooms are able to meet the the recommended CIBSE TM52 with the use of internal blinds and mechanical ventilation.

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
B-Apt.1 LKD	1224	36	42	5.0	5	Fail
B-Apt.1 Bed 1	2448	73	12	8.0	0	Pass
B-Apt.1 Bed 2	2448	73	30	6.0	3	Pass
A-Apt.2 LKD	1224	36	41	6.0	4	Fail
A-Apt.2 Bed 1	2448	73	22	14.0	0	Pass
B-Apt.4 LKD	1224	36	31	7.0	3	Fail
B-Apt.4 Bed 1	2448	73	43	6.0	5	Pass
A-Apt.5 LKD	1224	36	47	6.0	5	Fail
A-Apt.5 Bed 1	2448	73	45	6.0	5	Pass
B-Apt.7 LKD	1224	36	44	5.0	6	Fail
B-Apt.7 Bed 1	2448	73	7	5.0	0	Pass
B-Apt.7 Bed 2	2448	73	38	5.0	7	Pass
B-Apt.8 LKD	1224	36	14	8.0	0	Pass
Total						**8 pass**

Table 6-5 Results of the Overheating assessment with mechanical ventilation and blinds

The results indicate that in the predicted future climate scenario, the living rooms are highly likely to overheat. Thus it is recommended to consider active cooling system to ensure comfortable conditions in the future. Based on the results of tested units, other units within the development that require comfort cooling have been anticipated and these are illustrated in Appendix B.

It should be noted that identifying appropriate systems based on the prediction of building performance in future climates is crucial not only for thermal comfort issues, but also to prevent costly and energy intensive cooling services being installed to buildings a short time into their lifetimes. In this case, therefore, issues associated with the cooling services should be carefully considered in early stage of design and collaborated with mechanical engineers.

7. Conclusion

Overheating studies were undertaken for representative units in the proposed scheme. Dynamic thermal model was generated to test compliance with CIBSE Guide A (2015) and CIBSE TM52 (2013) in line with Camden's local plan. To ascertain the risk of overheating adaptive thermal comfort methodology was undertaken in line with TM52. According to the guidance, a room that meets 2 out of the following 3 criteria is unlikely to overheat:

1. The number of hours during which temperature difference between the actual operative temperature in the room and the limiting maximum acceptable temperature (ΔT) is greater than or equal to one degree during the period May to September inclusive shall not be more than 3% of occupied hours.
2. To allow for the severity of overheating the weighted exceedance shall be less than or equal to 6 in any one day.
3. To set an absolute maximum value for the indoor operative temperature the value of ΔT shall not exceed 4˚C.

The test was undertaken for the worst performing rooms on the hottest day of the year in the current weather scenario. Various passive design measures and mechanical ventilation system were incorporated into the test model. The results showed that even after these measures 3 out of 13 rooms are likely to overheat. Analysis showed that these rooms failed on the hotter days only and by a margin. As a result, internal shading in form of blinds was further tested.

The final outcome confirmed that all the tested rooms within the identified units meet the CIBSE TM52 criteria for overheating and follow the cooling hierarchy set by London Plan in order to minimise the risk of overheating.

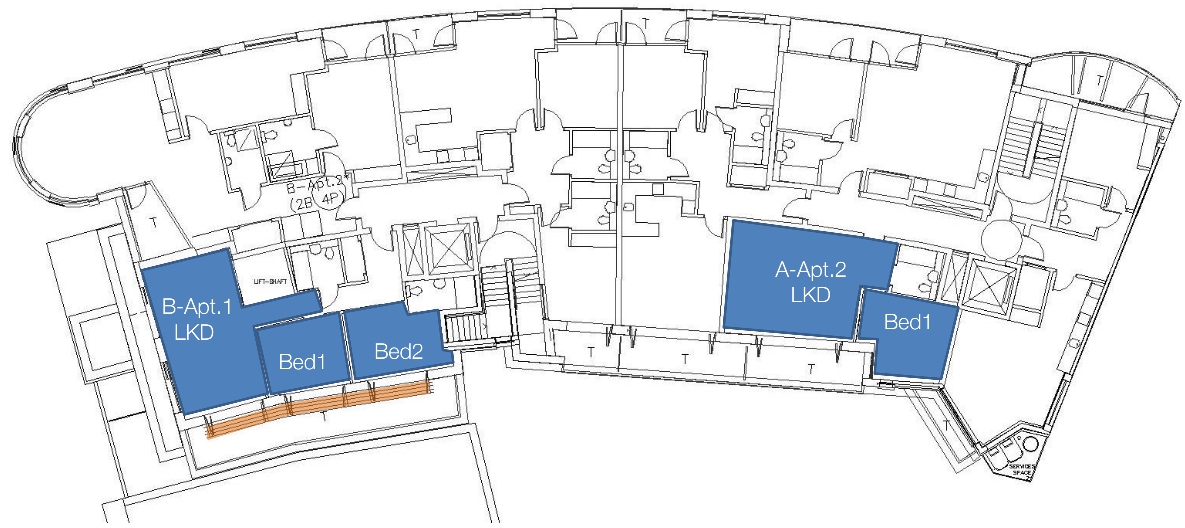
In future climate scenario, it was found that most of the living rooms will fail to meet the overheating criteria with the mixed mode strategy in the near future. Therefore, an active cooling system will be required to ensure summer comfort for the occupants throughout the lifetime of the building.

It should be noted that incorporating cooling systems should be carefully considered with mechanical engineers in early stage of design.

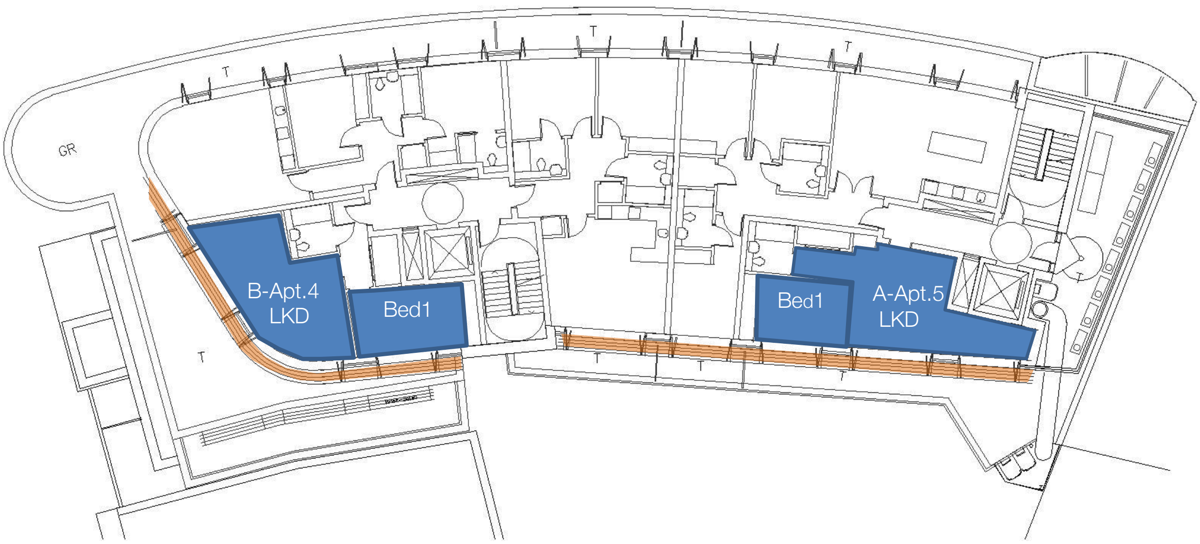
Appendix A

Tested rooms in residential unit

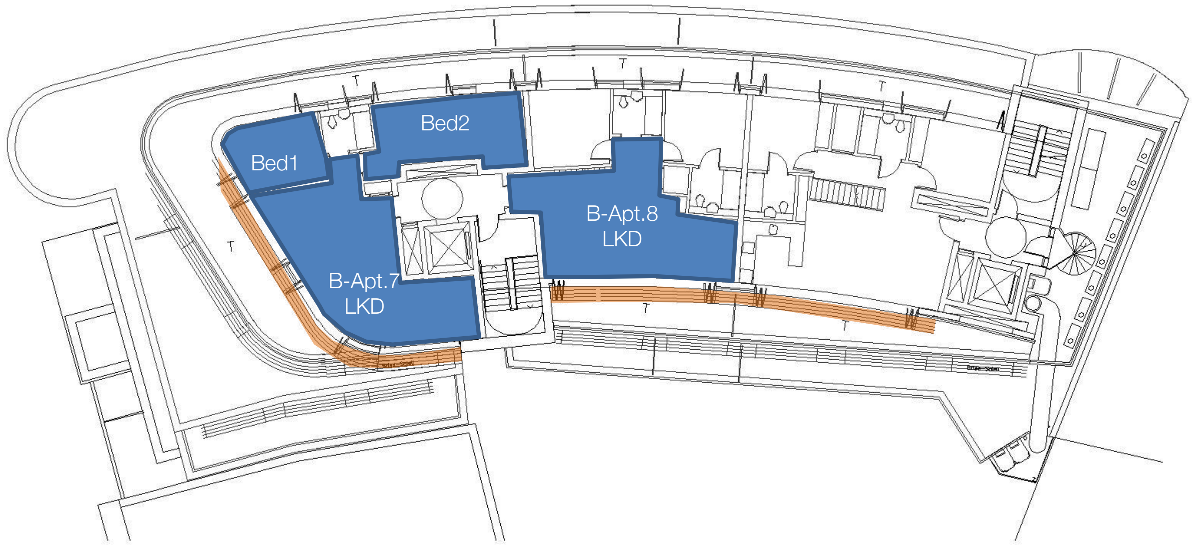
3rd Floor



4th Floor



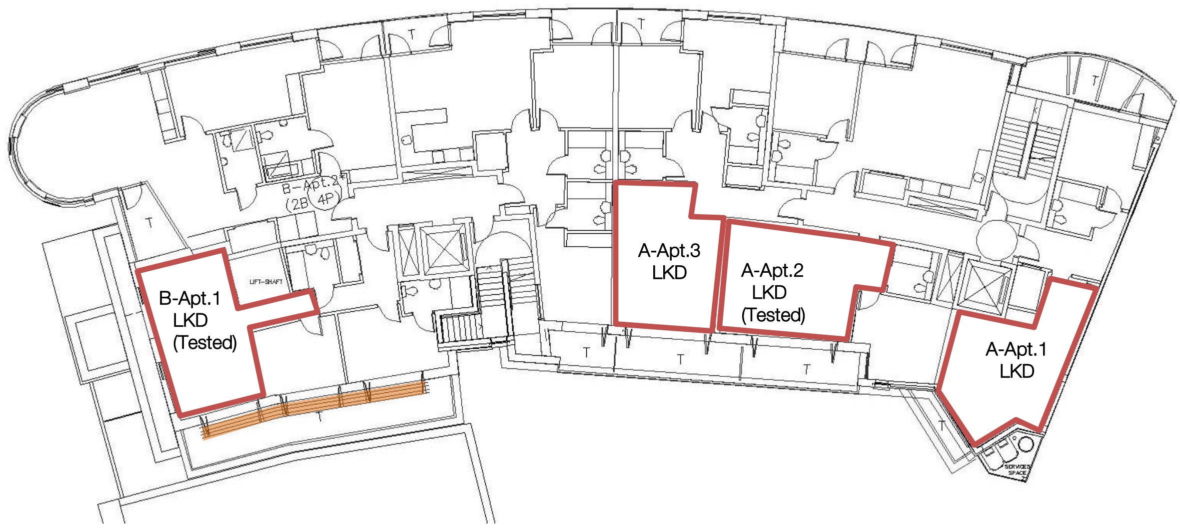
5th Floor



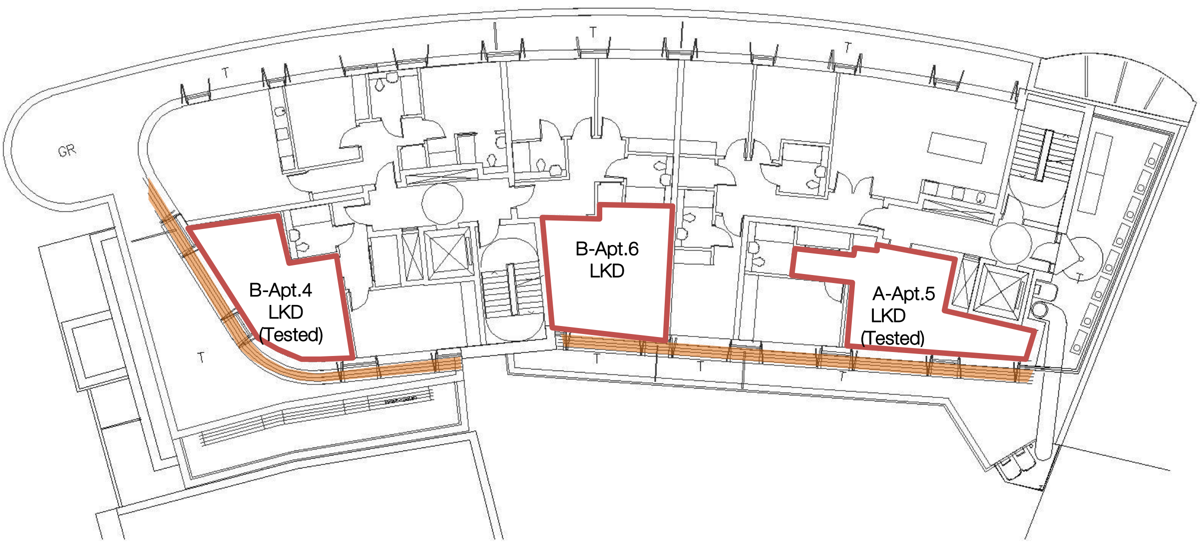
Appendix B

Units require comfort cooling

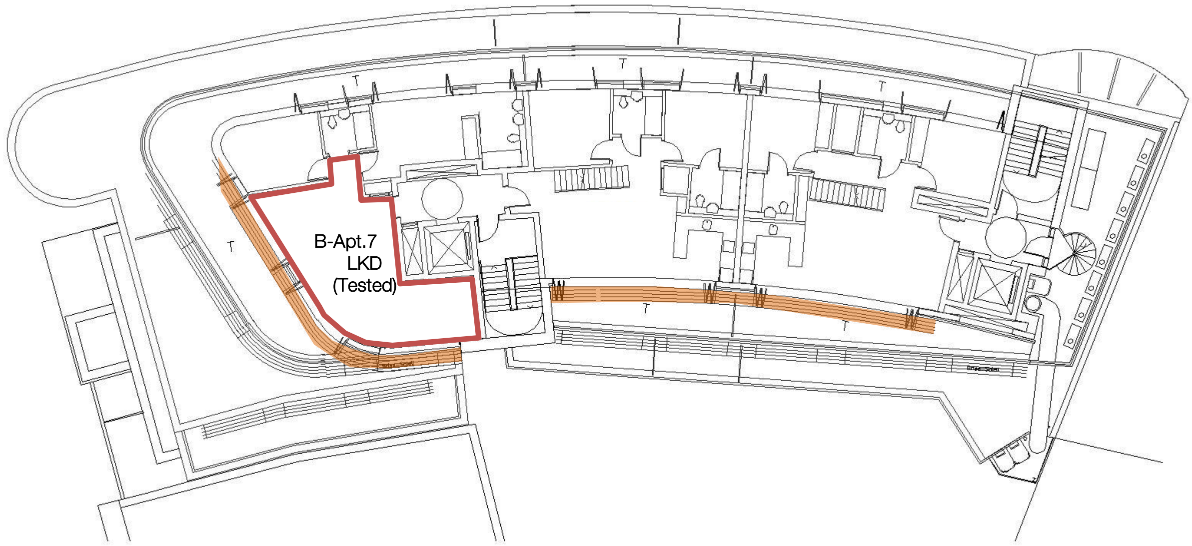
3rd Floor



4th Floor



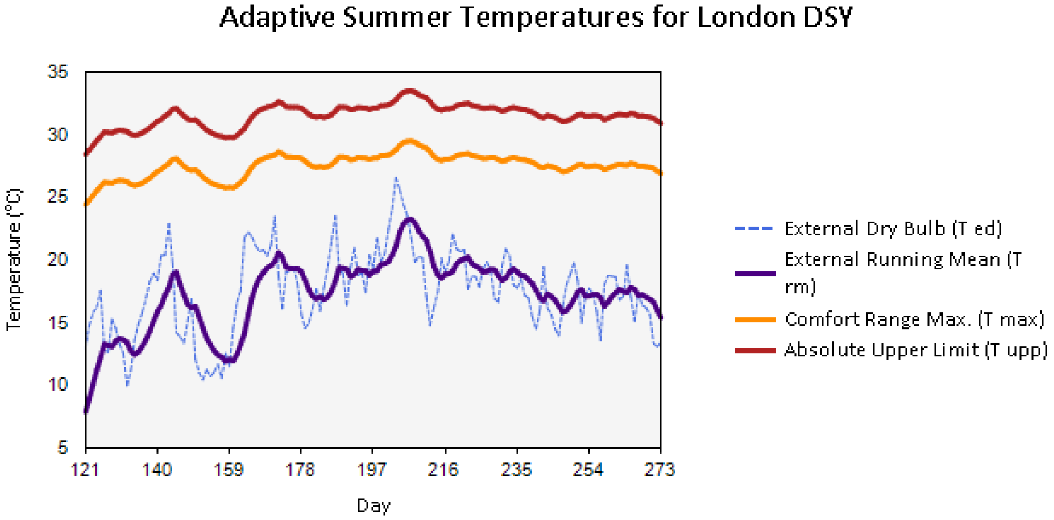
5th Floor



Appendix C

hawley crescent MV with Blinds.tsd

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then it is said to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): hawley crescent MV with Blinds.tbd
Simulation Results File (.tsd): hawley crescent MV with Blinds.tsd
Date: 09 November 2017
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
A-Apt.2 Bed 1	2448	73	13	8.0	0	Pass
A-Apt.2 LKD	1224	36	16	6.0	0	Pass
A-Apt.5 Bed 1	2448	73	21	4.0	2	Pass
A-Apt.5 LKD	1224	36	24	6.0	2	Pass
B-Apt.1 Bed 1	2448	73	5	4.0	0	Pass
B-Apt.1 Bed 2	2448	73	15	6.0	1	Pass
B-Apt.1 LKD	1224	36	19	5.0	2	Pass
B-Apt.4 Bed 1	2448	73	21	4.0	2	Pass
B-Apt.4 LKD	1224	36	12	6.0	1	Pass
B-Apt.7 Bed 1	2448	73	2	1.0	0	Pass
B-Apt.7 Bed 2	2448	73	23	4.0	2	Pass
B-Apt.7 LKD	1224	36	20	4.0	2	Pass
B-Apt.8 LKD	1224	36	3	3.0	0	Pass