WE MAKE BUILDINGS WORK.
SUSTAINABLY.

CBG
CONSULTANTS

WE MAKE BUILDINGS WORK.
SUSTAINABLY.

CBG
CONSULTANTS

36-38 PARKHILL ROAD

LONDON PLAN OVERHEATING REPORT

Prepared by:	CBG Consultants Ltd
	South House, 3 Farmoor Court, Cumnor Road, Oxford, OX2 9LU
	Tel: 01865 864500
	www.cbgc.com
Prepared for:	Asco Design & Construction Ltd
	52 St. Georges Road, London
	NW11 0LR

COPYRIGHT & DISCLAIMERS

Version	Comments	Author	Checked	Approved	Date
0	First issue	GM	ZA	GMW	08.08.22
1	Updated following comments	GK	ZA	GMW	06.03.23

All information provided here is based on plans and information available at the time of writing. Prior to implementation of the options discussed, further detailed study, design, and costing, based on ground surveys, structural analysis, over shading studies, etc., as relevant to each renewable/low carbon source, is necessary.

CONTENTS

1. EXECUTIVE SUMMARY

This report assesses the overheating risk of the existing development at 26-38 Parkhill Road in line with CIBSE TM59 - Design methodology for the assessment of overheating risk in homes.

The analysis examines the compliance of the rooms with the TM59 overheating requirements under a natural ventilation scenario. According to this scenario, windows and balcony doors would need to be open fully during the occupied hours. However, this strategy is limited in this dwelling due to security concerns.

Extensive dynamic thermal modelling has shown that the rooms cannot comply with the overheating criteria without the requirement of cooling.

2. INTRODUCTION

This analysis examines whether the current performance of the building conforms to the CIBSE TM59 overheating standards.

All results are based on the output from dynamic computer modelling software and should be taken as an indication of the likely final situation. These conditions, however, cannot be guaranteed and can be influenced by a variety of factors, including occupant lifestyle, where behaviour can change to modelled assumptions.

2.1 Description of the project

36-38 Parkhill Road dwelling is a detached house estimated that was built between 1930 and 1949. The property consists of two originally semi-detached houses and 2 side extensions. In particular, there are 5no. rooms used as bedrooms and approximately 10no. used as living room areas

The dwelling is currently provided with active cooling, which provides thermal comfort to two of the bedrooms of the house.

The scope of this analysis is to examine if passive cooling is adequate to ensure no overheating risk to the rest of the rooms.

3. OVERHEATING CRITERIA

The overheating assessment needs to be conducted in line with the guidance in CIBSE TM59

CIBSE TM59 outlines a specific methodology for how residential buildings should be modelled. This includes:

- Standardised heat gains.
- Standardised variation profiles.
- Constraints for opening windows and doors.
- Specific compliance criteria.

The compliance criteria are listed below:

CIBSE TM59: Criteria for homes predominately naturally ventilated

The following applies for naturally ventilated homes[1]:

> *(a) For living rooms, kitchens and bedrooms: the number of hours during which ΔT 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. (CIBSE TM52 Criterion 1: Hours of exceedance).*

To comply with Criteria (a) the percentage of occupied hours should not be greater than 3%

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

To comply with Criteria (b) the number of hours should not exceed 32 hours.

These criteria will be used to assess the natural ventilation scenario.

CIBSE TM59: Criteria for Homes Predominantly Mechanically Ventilated

> *For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours.*

[1] CIBSE TM59: 2017, Section 4

4. COOLING HIERARCHY

4.1 Reducing the Amount of Heat Entering the Building

The dwelling is located in an area of low-rise residential properties with garden areas meaning that the impact of any overshading is limited. There are some existing trees within the property's garden, but these only provide a minor shade.

No alterations can be provided to the façade of the building as this is located in a conservation area.

4.2 Minimising Internal Heat Generation

Internal gains are set by the CIBSE TM59 methodology.

4.3 Use of Thermal Mass & High Ceilings

A Medium- Weight construction has been assumed for the overheating modelling with no exposed concrete soffits throughout.

Room heights varies from 2.5m FFL to ceiling to 3.3m FFL to ceiling.

4.4 Passive Ventilation

Natural ventilation will be used to help manage overheating, through openable windows and balcony doors

To meet the TM59 overheating requirement, windows and balcony doors would need to be open fully when the room is occupied, including during the night in bedrooms. However, this strategy cannot fully be applied. Only few rooflights can remain open during the night due to security issues raised by the occupants.

4.5 Mechanical Ventilation

No mechanical ventilation currently provided.

4.6 Existing Active cooling systems

There is active cooling in the dwelling, which provides thermal comfort to two of the bedrooms of the house. I.e Staff Bedroom and Girls Bedroom. The existing condenser Daikin model 4MXS80E is capable of providing a cooling load of 5.83kW.

CBG has carried out a cooling load calculation which shows that the cooling capacity required is 6.13 kW. Therefore, the existing condensers are not capable of providing any additional cooling to the rooms.

L02_Girls Bedroom – 3.097 kW

L02_Staff Bedroom – 3.032 kW

5. THERMAL MODEL

Both architectural drawings from KSR Architects and drawings from Asco Design & Construction Ltd were used to create a 3D model for the overheating analysis.

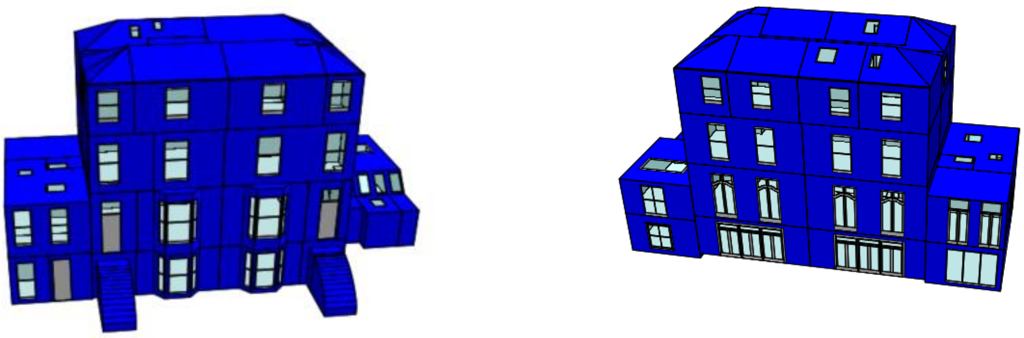

Figure 1: Overheating modelling IES VE software.

5.1 Weather File

The CIBSE TM59 guide states the following in relation to weather files:

> *'Developments should refer to the latest CIBSE design summer year (DSY) weather files and be required to pass using the DSY1 file most appropriate to the site location, for the 2020s, high emissions, 50% percentile scenario'*

The projected DSY1 2020 weather file not only allows for the performance to be tested against more stringent weather conditions (moderately warm summer), but also takes into account a climate change scenario.

Therefore, based on the location of the dwelling, the weather file that has been used is the following:

- London Weather Centre (LWC) - DSY1: 2020 High 50

5.2 Constructions

Thermal properties of the building fabric can be seen in the table below:

Element	U-Value (W/m^2K)	G-Value
Walls	1.70	-
Floor	0.70	-
Roof	2.30	-
Opaque Doors	3.00	-
Window	4.80	0.85
Rooflight	2.80	0.76

Table 1: Building fabric U-Values.

These values are based on the limited building construction details provided to us by Asco Design & Construction Ltd and the aged band of the building (Appendix S Appendix S: Reduced Data SAP for existing dwellings- Age Band C (1930-1949)).

The windows for 36-38 Park Hill are not being replaced. These are single glazed sash windows with a U value of 4.8 and g value of 0.85 used within the overheating analysis.

5.2.1 Thermal Mass

A lightweight construction has been assumed for the overheating modelling with no exposed concrete soffits.

5.2.2 Air Leakage

The following air leakage rates have been assumed:

Air Permeability ($m^3/h.m^2$ at 50Pa):	15
Air Permeability (ach):	0.75

5.3 Internal Gains

Internal gains from occupants, lighting and equipment are set by the CIBSE TM59 methodology. Whilst all homes will be occupied differently, these set profiles represent a robust test that ensures the key aspects of overheating are captured. The test is intended to ensure the dwellings will perform reasonably during the day and night. The table below shows their variation on a daily basis[2].

[2] CIBSE TM59 2017, Figure 1 Heat Gain Profile, Page 8.

# people	Description	Peak load (W)		Period																							
		Sensible	Latent	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
				Hour-ending																							
				1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single bedroom occupancy	75	55	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double bedroom occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio occupancy	150	110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1-bed: living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1-bed: living occupancy	75	55	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1-bed: kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bed: living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2-bed: living occupancy	150	110	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2-bed: kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3-bed: living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3-bed: living occupancy	225	165	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3-bed: kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile]	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

Table 2: CIBSE TM59 internal gains.

5.4 Opening Windows

It is understood that sash windows of the building have restrictor and only 50% of the window can be openable.

Balcony/Full height windows can be fully openable.

Rooflight windows have been modelled as being top hung with a clear 200mm opening.

Generally, windows have been modelled to open whenever the internal temperature exceeds 22°C and the room is occupied.

However, the windows in bedrooms can open only during the daytime (8a.m.-11p.m) and remain closed during the night due to security concerns raised by the occupants. Only the rooflights at the second floor can stay open during the sleeping hours.

Refer to the graphics and table below showing the window opening types in the model:

Ref	Description	Exp. Type	Pivot Type	Calc. Method	Height (mm)	Width (mm)	Open. Angle (°)	Open. Dist. (mm)	Free Area (%)	Free Area (m^2)
A	Rooflight A	04	Top Hung	Dist.	1183	595		200	16.9%	0.119
B	Rooflight B	03	Top Hung	Dist.	1053	750		200	19.0%	0.150
C	Rooflight C	03	Top Hung	Dist.	910	465		200	22.0%	0.093
D	Rooflight D	03	Top Hung	Dist.	632	377		200	31.6%	0.075
E	Rooflight E	02	Top Hung	Dist.	1010	958		200	19.8%	0.192
F	Rooflight F	02	Top Hung	Dist.	659	709		200	30.3%	0.142

Table 3: Rooflight Opening Types.

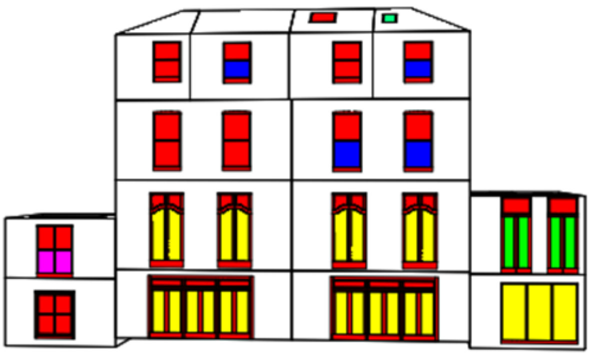

Figure 4: East Elevation

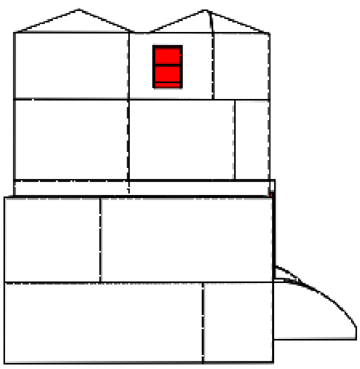

Figure 3: North Elevation

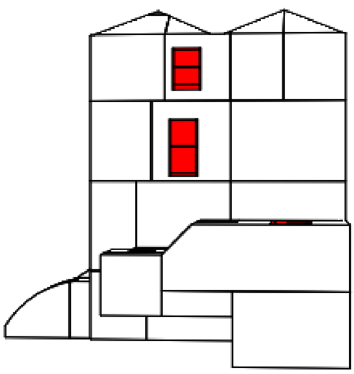

Figure 2: South Elevation

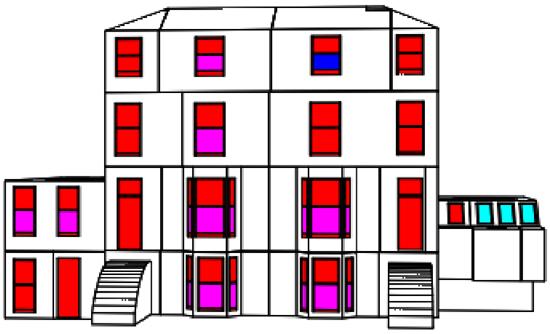

Figure 6: West Elevation

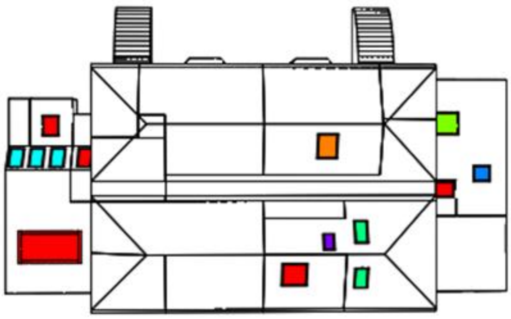

Figure 5: Top Elevation

5.5 Ventilation & Cooling Strategy

The table below details the ventilation and cooling strategy on a room-type basis.

Room Name	Temperature Control Strategy	Nat Vent Free Area (% Floor Area)	Cooling Set Point (°C)	Night time Nat. Vent	Blinds	Exposed Soffit
L00_Annex Bedroom 1	Nat. Vent.	20.81		N	N	N
L00_Annex_Living/Kitchen	Nat. Vent.	4.72		N	N	N
L00_Cupboard	None	-		N	N	N
L00_Ensuite	None	-		N	N	N
L00_Living Room 1	Nat. Vent.	8.52		N	N	N
L00_Living Room 2	Nat. Vent.	8.40		N	N	N
L00_Office	Nat. Vent.	3.63		N	N	N
L00_Stairs 1/Entrance	None	-		N	N	N
L00_Stairs 2/ Entrance	None	-		N	N	N
L00_Stairs 3	None	-		N	N	N
L00_Storage	None	-		N	N	N
L00_Utility 1	None	-		N	N	N
L00_WC	None	-		N	N	N
L01_Dressing Room	None	-		N	N	N

Room Name	Temperature Control Strategy	Nat Vent Free Area (% Floor Area)	Cooling Set Point (°C)	Night time Nat. Vent	Blinds	Exposed Soffit
L01_Kitchenette	None	-		N	N	N
L01_Master Bathroom	None	-		N	N	N
L01_Master Bedroom	Nat. Vent.	3.37		N	N	N
L01_Pajamas Lounge	Nat. Vent.	3.05		N	N	N
L01_Stairs 1	None	-		N	N	N
L01_Stairs 2	None	-		N	N	N
L02_Bathroom	None	-		N	N	N
L02_Corridor/Stairs 1	None	-		N	N	N
L02_Cupboard	None	-		N	N	N
L02_Ensuite 1	None	-		N	N	N
L02_Ensuite 2	None	-		N	N	N
L02_Ensuite 3	None	-		N	N	N
L02_Girls Bedroom	Comfort Cooling	1.45	23	N	N	N
L02_Playroom	Nat. Vent.	2.45		Y	N	N
L02_Son's Bedroom	Nat. Vent.	2.76		Y	N	N
L02_Staff Bedroom	Comfort Cooling	1.91	23	N	N	N
L02_Stairs 2	None	-		N	N	N
L02_Washing Machine Cupboard	None	-		N	N	N
LB1_Cupboard 1	None	-		N	N	N
LB1_Cupboard 3	None	-		N	N	N
LB1_Entance 2	None	-		N	N	N
LB1_Entrance 1	None	-		N	N	N
LB1_Gym	Nat. Vent.	19.30		N	N	N
LB1_Living/Kitchen/Dining Area	Nat. Vent.	8.71		N	N	N
LB1_Office	Nat. Vent.	3.40		N	N	N
LB1_Plantroom 1	None	-		N	N	N
LB1_Plantroom 2	None	-		N	N	N
LB1_Server	None	-		N	N	N
LB1_Shower	None	-		N	N	N
LB1_Stairs 1	None	-		N	N	N
LB1_TV/Snug	Nat. Vent.	15.78		N	N	N
LB1_Utility 2	None	-		N	N	N
LB1_WC	None	-		N	N	N

Table 4: Ventilation & cooling strategy.

5.6 Blinds

Blinds have not been included in the model.

6. OVERHEATING RESULTS: PROPOSED DESIGN

6.1 Design Summer Year (DSY) 1 Results

With the model constructed, a simulation was run.

During these dynamic simulations the room temperatures were calculated on an hourly basis for the whole year. The results for all the rooms are shown below:

The results show a number of rooms fail to meet the TM59 criteria.

Room Name	Room Area (m2)	Cat.	Peak Temp (°C)	TM52 Criterion 1 Nat Vent: Living, Kitchen & Bedrooms (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Outcome
L00_Annex Bedroom 1	16.1	III	33.9	1.1	45	Fail
L00_Annex_Living/Kitchen	25.5	III	34.5	4.0	-	Fail
L00_Cupboard	1.0	III	33.5	-	-	-
L00_Ensuite	3.6	III	35.2	-	-	-
L00_Living Room 1	61.0	III	33.1	1.3	-	Pass
L00_Living Room 2	61.9	III	33.1	1.4	-	Pass
L00_Office	27.8	III	38.6	12.4	-	Fail
L00_Stairs 1/Entrance	14.3	III	33.3	-	-	-
L00_Stairs 2/ Entrance	13.1	III	34.2	-	-	-
L00_Stairs 3	6.8	III	38.9	-	-	-
L00_Storage	12.1	III	29.7	-	-	-
L00_Utility 1	4.7	III	36.2	-	-	-
L00_WC	2.3	III	33.5	-	-	-
L01_Dressing Room	41.1	III	32.8	-	-	-
L01_Kitchenette	4.8	III	33.9	-	-	-
L01_Master Bathroom	23.7	III	36.5	-	-	-
L01_Master Bedroom	33.0	III	32.9	0.9	142	Fail
L01_Pajamas Lounge	21.6	III	35.1	4.8	-	Fail
L01_Stairs 1	14.6	III	34.0	-	-	-
L01_Stairs 2	9.9	III	35.9	-	-	-
L02_Bathroom	5.5	III	38.5	-	-	-
L02_Corridor/Stairs 1	18.0	III	34.1	-	-	-
L02_Cupboard	2.4	III	34.6	-	-	-
L02_Ensuite 1	8.4	III	38.0	-	-	-
L02_Ensuite 2	7.7	III	33.4	-	-	-
L02_Ensuite 3	6.1	III	38.3	-	-	-
L02_Girls Bedroom	25.3	III	25.6	-	-	-
L02_Playroom	22.5	III	35.4	6.2	-	Fail
L02_Son's Bedroom	22.7	III	34.7	1.9	38	Fail
L02_Staff Bedroom	21.0	III	25.1	-	-	-
L02_Stairs 2	8.2	III	36.6	-	-	-
L02_Washing Machine Cupboard	1.0	III	32.6	-	-	-
LB1_Cupboard 1	1.5	III	30.0	-	-	-
LB1_Cupboard 3	1.6	III	31.4	-	-	-

Room Name	Room Area (m2)	Cat.	Peak Temp (°C)	TM52 Criterion 1 Nat Vent: Living, Kitchen & Bedrooms (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Outcome
LB1_Entance 2	6.1	III	32.0	-	-	-
LB1_Entrance 1	5.7	III	30.9	-	-	-
LB1_Gym	33.4	III	32.4	-	-	-
LB1_Living/Kitchen/Dining Area	70.2	III	32.8	1.0	-	Pass
LB1_Office	27.7	III	33.2	1.2	-	Pass
LB1_Plantroom 1	6.3	III	31.9	-	-	-
LB1_Plantroom 2	4.7	III	32.7	-	-	-
LB1_Server	0.7	III	31.8	-	-	-
LB1_Shower	5.7	III	36.1	-	-	-
LB1_Stairs 1	8.1	III	30.3	-	-	-
LB1_TV/Snug	32.8	III	33.1	1.3	-	Pass
LB1_Utility 2	19.9	III	31.6	-	-	-
LB1_WC	4.4	III	30.2	-	-	-

Table 5: Overheating DSY 1 results.

6.2 Design Summer Year (DSY) 1 Results with fans

An additional simulation has been carried out introducing fans to the spaces where cooling has been proposed. The below table shows that the results have improved, however the spaces still fail to comply with the TM59 analysis.

One of the reason the spaces does not pass is that assigning the fans also add an additional gain to the space. With existing glazing and high g value it is difficult to provide thermal comfort to the failed spaces. Therefore, active cooling has been proposed.

Room Name	Room Area (m2)	Cat.	Peak Temp (°C)	TM52 Criterion 1 Nat Vent: Living, Kitchen & Bedrooms (% Occupied Hours)	Nat Vent: Bedrooms Operative Temperature (Hours @ Night > 26°C)	Outcome
L00_Annex Bedroom 1	16.1	III	33.9	0.6	85	Fail
L00_Annex_Living/Kitchen	25.5	III	34.5	3.3	-	Fail
L00_Living Room 1	61.0	III	33.1	0.6	-	Pass
L00_Living Room 2	61.9	III	33.1	0.6	-	Pass
L00_Office	27.8	III	38.6	6.0	-	Fail
L01_Master Bedroom	33.0	III	32.9	0.7	265	Fail
L01_Pajamas Lounge	21.6	III	35.1	3.4	-	Fail
L02_Playroom	22.5	III	35.4	3.9	-	Fail
L02_Son's Bedroom	22.7	III	34.7	1.2	58	Fail
LB1_Living/Kitchen/Dining Area	70.2	III	32.8	0.4	-	Pass
LB1_Office	27.7	III	33.2	0.5	-	Pass
LB1_TV/Snug	32.8	III	33.1	0.5	-	Pass

7. OVERHEATING CONCLUSION

7.1 Design Summer Year (DSY) 1

Results also show that a significant number of rooms fails to comply with TM59 criteria. Due to the limitations of the passive measures that can be implemented (no building fabric improvements /window opening restrictions due to window types and security issues), additional active cooling deems necessary so that TM59 compliance can be achieved to occupied areas.

An additional simulation has been carried out using fans within the spaces which are predicted to be overheating. However the results show the spaces still fail to comply with the TM59 analysis. Therefore, in order to achieve thermal comfort within these rooms active cooling has been proposed.

OXFORD: South House, Farmoor Court, Cumnor Road, Oxford, OX2 9LU Tel: 01865 864500 Email: oxf@cbgc.com

LONDON: 38 Warren Street, London, W1T 6AE Tel: 02073 874 175 Email: lon@cbgc.com

www.cbgc.com