DWELLING OVERHEATING
RISK ASSESSMENT UPDATE

FOR

CITROEN SITE
BRENTFORD

VERSION 3.5

MAY 2018

Issued by:-

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PROJECT REVISION SHEET

CITROEN SITE, BRENTFORD

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Revision 3.5

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Prepared by: A Sturt

Revision	Date	Details	Changes	Author	Checked
1.0	22/09/2017	For comment		A Sturt	
1.1	27/09/2017	For comment	Minor amendments	A Sturt	
2.0	06/10/2017	Final	Updated to suit elevation amendments	A Sturt	J Roche
2.1	10/10/2017	Final	Minor amendments	A Sturt	J Roche
2.2	11/10/2017	Final	Minor amendment	A Sturt	J Roche
2.3	13/10/2017	Final	Minor amendment	A Sturt	J Roche
3.0	09/04/2018	Final	Lounge windows revised	A Sturt	J Roche
3.1	11/04/2018	Final	Minor Comments	A Sturt	J Roche
3.2	17/04/2018	Final	Minor Comments	A Sturt	J Roche
3.3	25/04/2018	Final	Minor Comments	A Sturt	J Roche
3.4	25/04/2018	Final	Minor Comments	A Sturt	J Roche
3.5	14/05/2018	Final	Minor Comments	A Sturt	J Roche

EXECUTIVE SUMMARY

This Overheating Risk Assessment has been prepared by Silcock Dawson and partners on behalf of L&Q to assess the risk of dwellings overheating at the proposed development.

For robustness and ease of reading, the whole report has been updated; this report supersedes the previous version 2.3 from October 2017 and reflects the following amendments to the dwellings to reduce the risk of overheating.

- An increase in glazed area to the stepped gable ends.
- Translucent windows with opening sections added to return walls to Core 1, and between Cores 4&5
- Internal blinds fitted by the applicant to the winter garden glazing

The site will be redeveloped to provide a mixed use scheme of 441 (from 427 in the previous submission) residential units (class C3) including 50% affordable housing with ancillary facilities, flexible uses within classes (A1, A2, A3, and B1) and a nursery (class D1). Comprising buildings of 12, 13, 16, 17 and 18 storeys in height, with associated cycle cycle parking, carparking, playspace, landscaping and public realm improvements.

Thermal modelling for the assessment has been undertaken in accordance with the recommendations of CIBSE Technical Memoranda 59, Design Methodology for the Assessment of Overheating Risk in Homes and all apartments are classified as predominantly naturally ventilated.

The mechanical ventilation allowance and construction details are outlined below:

Item	Dwellings Construction
Window Properties	Window U value: 1.3W/m^2K Glazing G value: 0.4 Glazing Light Transmittance: 0.7
Blinds	Combined window / blind G value = 0.24
Translucent Window Properties	Window U value: 1.3W/m^2K Glazing G value: 0.3
External wall construction	Brick outer surface, with lightweight structural frame system and plasterboard inner surface.
Party wall construction	25mm Plasterboard, cavity, insulation, cavity and 25mm plasterboard.
Internal wall construction	Plasterboard stud walls with 15mm plasterboard both sides
Intermediate floor construction	Plasterboard ceiling, air gap, 275mm concrete/screed, insulation layer OSB, or wood finish.
Ventilation rates	In accordance with rates detailed in AD F typically around 0.4 air changes by MVHR with auto summer bypass. 0.25 air changes by infiltration. Additional ventilation is from opening windows when the internal temperature is above 22 ºC. Windows and internal doors have also been modelled in a partially open position during night time hours to promote cross flow ventilation.

All apartment types on the tenth floor were modelled to simulate the dwelling performance, because at this level the effect of shading from the surrounding buildings will have a minimal impact on the conditions within the apartments. In addition a selection of apartments at second floor level were included to illustrate the difference in performance where noise and air quality will have a greater impact.

The CIBSE weather file for London Heathrow was selected at the most appropriate location for the site. In accordance with the guidelines within TM59, Design Summer Year (DSY)1 – 2020, High 50th Percentile was used for the assessment.

The developer has incorporated the following design features to minimise the impact of solar gains, and provide measures for natural ventilation by:

- Locating balconies above all balcony doors.
- Utilising solar control glazing with a G value of 0.4.
- Reducing the low level glazing within the bedrooms.

The updated results demonstrate that conditions within the apartments will significantly improve from the previous version of this assessment (V2.3).

The updated results demonstrate that conditions within the apartments will improve from the previous version of this assessment (V2.3). Apartments that previously failed to comply by a large margin, have significantly improved results and are considerably closer to the compliance targets.

Sample floor (10th) Lounge Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Orientation	Balcony Above
Core 1: Sample 1 - Lounge	1989	59	72	NE	Y
Core 1: Sample 2 - Lounge	1989	59	92	NW	Y
Core 1: Sample 3 - Lounge	1989	59	88	NW	Y
Core 1: Sample 4 - Lounge	1989	59	92	NW	Y
Core 1: Sample 5 - Lounge	1989	59	63	SE	Y
Core 1: Sample 6 - Lounge	1989	59	68	SE	Y
Core 1: Sample 8 - Lounge	1989	59	62	SE	Y
Core 2: Sample 1 - Lounge	1989	59	65	W	Y
Core 2: Sample 2 - Lounge	1989	59	54	W	N
Core 2: Sample 3 - Lounge	1989	59	68	W	Y
Core 2: Sample 4 - Lounge	1989	59	82	E	Y
Core 2: Sample 5 - Lounge	1989	59	78	E	Y
Core 3: Sample 1 - Lounge	1989	59	78	E	Y
Core 3: Sample 2 - Lounge	1989	59	71	W	N
Core 3: Sample 3 - Lounge	1989	59	49	E	Y
Core 3: Sample 4 - Lounge	1989	59	70	W	Y
Core 3: Sample 5 - Lounge	1989	59	57	SW	Y
Core 4: Sample 1 - Lounge	1989	59	65	SW	Y
Core 4: Sample 2 - Lounge	1989	59	86	SW	Y
Core 4: Sample 3 - Lounge	1989	59	84	SW	Y
Core 4: Sample 4 - Lounge	1989	59	72	NE	N
Core 4: Sample 5 - Lounge	1989	59	43	SW	Y
Core 5: Sample 1 - Lounge	1989	59	65	SW	Y
Core 5: Sample 2 - Lounge	1989	59	89	SW	Y
Core 5: Sample 3 - Lounge	1989	59	93	NE	N
Core 5: Sample 4 - Lounge	1989	59	50	SW	Y

Sample floor (2nd) Lounge Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range
2nd Core 3: Sample 4 - Lounge	1989	59	70
2nd Core 4: Sample 3 - Lounge	1989	59	78
2nd Core 5: Sample 2 - Lounge	1989	59	83

Sample floor (10th) Bedroom Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Total Annual Hours ≥ 26.0 (33 Hours)	Orientation	Balcony Above
Core 1: Sample 1 - Bedroom 2	3672	110	93	38	NE	N
Core 1: Sample 1 - Bedroom 1	3672	110	48	18	NW	N
Core 1: Sample 2 - Bedroom 1	3672	110	141	87	NW	Y
Core 1: Sample 2 - Bedroom 2	3672	110	120	80	NW	N
Core 1: Sample 3 - Bedroom 1	3672	110	92	74	NW	Y
Core 1: Sample 4 - Bedroom 1	3672	110	119	74	NW	N
Core 1: Sample 4 - Bedroom 2 s	3672	110	89	70	NW	Y
Core 1: Sample 5 - Bedroom 1	3672	110	71	35	SE	Y
Core 1: Sample 5 - Bedroom 2	3672	110	61	23	SW	N
Core 1: Sample 5 - Bedroom 3 s	3672	110	60	16	SW	N
Core 1: Sample 6 - Bedroom 1	3672	110	64	49	SE	Y
Core 1: Sample 7 - Lounge	3672	110	83	74	SE	Y
Core 1: Sample 8 - Bedroom 1	3672	110	46	21	NE	N
Core 1: Sample 8 - Bedroom 2	3672	110	71	89	SE	Y
Core 2: Sample 1 - Bedroom 1	3672	110	49	55	N	N
Core 2: Sample 2 - Bedroom 1	3672	110	42	23	W	N
Core 2: Sample 2 - Bedroom 2 (s)	3672	110	75	18	W	N
Core 2: Sample 3 - Bedroom 1	3672	110	55	20	W	N
Core 2: Sample 3 - Bedroom 2 (s)	3672	110	59	22	W	N
Core 2: Sample 4 - Bedroom 1	3672	110	72	41	E	Y
Core 2: Sample 5 - Bedroom 1	3672	110	80	80	N	N
Core 3: Sample 1 - Bedroom 1	3672	110	48	20	E	Y
Core 3: Sample 2 - Bedroom 1	3672	110	62	26	W	N
Core 3: Sample 2 - Bedroom 2 (s)	3672	110	98	19	W	N
Core 3: Sample 3 - Bedroom 1	3672	110	70	54	W	N
Core 3: Sample 3 - Bedroom 2	3672	110	59	54	W	N
Core 3: Sample 4 - Bedroom 1	3672	110	71	69	S	N
Core 3: Sample 5 - Bedroom 1	3672	110	48	17	W	Y
Core 4: Sample 1 - Bedroom 1	3672	110	76	15	S	N
Core 4: Sample 1 - Bedroom 2	3672	110	58	19	E	Y
Core 4: Sample 2 - Bedroom 1	3672	110	86	71	E	Y
Core 4: Sample 3 - Bedroom 1	3672	110	83	69	NW	N
Core 4: Sample 4 - Bedroom 1	3672	110	34	44	NW	N
Core 4: Sample 4 - Bedroom 2 (s)	3672	110	49	38	SW	Y
Core 4: Sample 5 - Bedroom 1	3672	110	38	24	SW	Y
Core 4: Sample 5 - Bedroom 2	3672	110	44	20	NE	N
Core 5: Sample 1 - Bedroom 1	3672	110	45	43	NE	N
Core 5: Sample 1 - Bedroom 2 (s)	3672	110	55	32	NE	N
Core 5: Sample 2 - Bedroom 1	3672	110	85	71	NE	N
Core 5: Sample 3 - Bedroom 1	3672	110	58	20	NE	N
Core 5: Sample 3 - Bedroom 2	3672	110	85	13	NE	N
Core 5: Sample 4 - Bedroom 2	3672	110	58	22	SW	Y

Sample floor (2nd) Bedroom Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Total Annual Hours ≥ 26.0 (33 Hours)
2nd Core 1: Sample 7 - Lounge	3672	110	71	68
2nd Core 3: Sample 4 - Bedroom 1	3672	110	69	70
2nd Core 4: Sample 3 - Bedroom 1	3672	110	80	74
2nd Core 4: Sample 3 - Bedroom 2	3672	110	89	70
2nd Core 5: Sample 2 - Bedroom 1	3672	110	80	67

Key Plan

1 INTRODUCTION

1.1 Background

Silcock Dawson and Partners have been appointed by L&Q. to provide an Overheating Risk Assessment for the proposed new development at the Citroen Site in Brentford.

For robustness and ease of reading, the whole report has been updated; this report supersedes the previous version 2.3 from October 2017 and reflects the following amendments to reduce the risk of overheating.

- An increase in glazed area to the stepped gable ends.
- Translucent windows with opening sections added to return walls to Core 1, and between Cores 4&5
- Internal blinds fitted by the applicant to the winter garden glazing

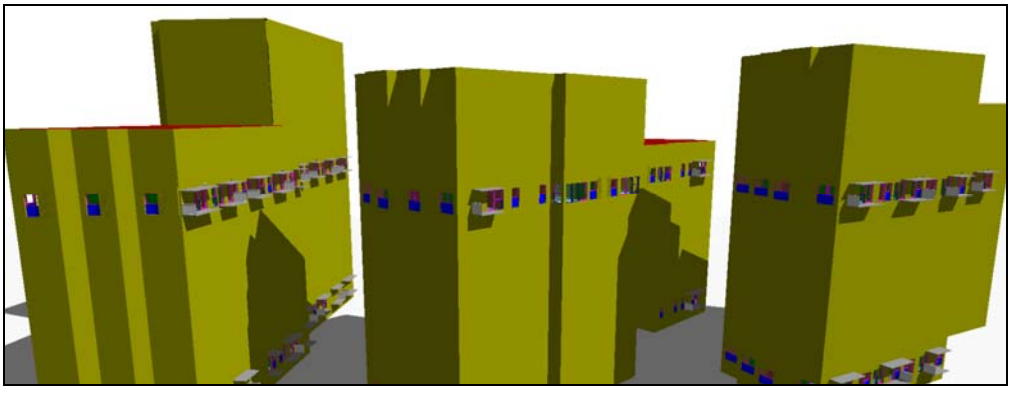
The aim of this report is to document the findings of the thermal modelling that has been undertaken to quantify the overheating risk to the dwellings. Modelling has been undertaken in accordance with the recommendations of CIBSE Technical Memoranda 59

1.2 Description of the Site and Building

The site is located on the Northern side of the South Circular Road with Capital Interchange flanking the South Western and North Western edges. The site is bounded by the Fountain Leisure Centre to the South East and a car dealership to the North East.

The site will be redeveloped to provide a mixed use scheme of 441 (from 427 in the previous submission) residential units (class C3) including 50% affordable housing with ancillary facilities, flexible uses within classes (A1, A2, A3, and B1) and a nursery (class D1). Comprising buildings of 12, 13, 16, 17 and 18 storeys in height, with associated cycle cycle parking, carparking, playspace, landscaping and public realm improvements.

2nd and 10th floor plans



View of thermal model (looking southeast)

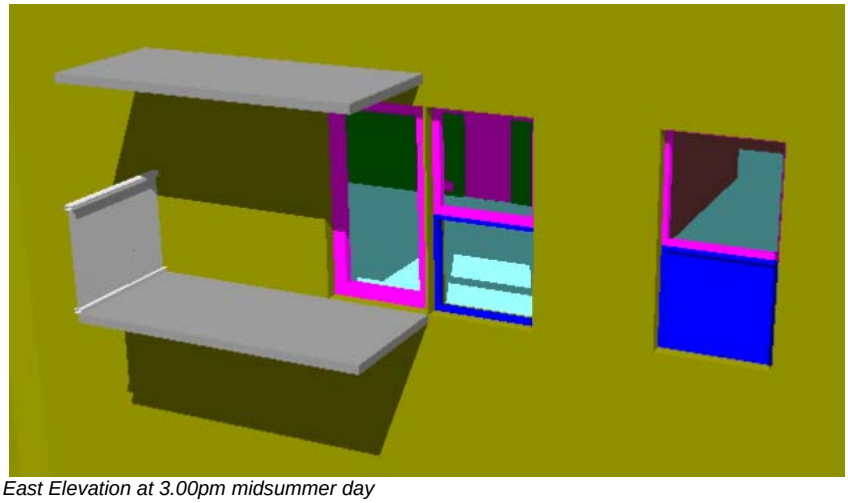
2 ENERGY EFFICIENT DESIGN

The development energy consumption should be minimised through the orientation of the buildings, and the minimal openings on the North and South Facades. The following section details the energy efficiency features of the development, that will have an impact in minimising unwanted heat gains.

2.1 Physical Form of the Building

The proposed building is of a medium weight construction, comprising structural framing system wall construction with a brick external finish. Floors and flat roofs will constructed of concrete, which will increase the thermal mass of the development, but the effect of this will be reduced by the use of suspended ceiling and floor finishes.

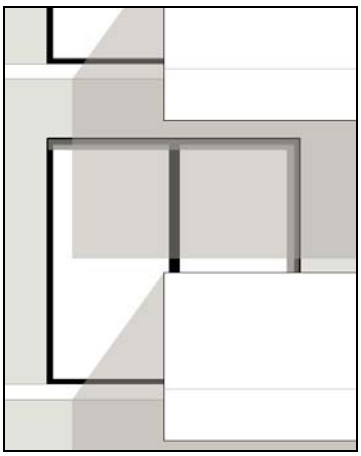
Balconies will be provided to all apartments which will provide additional shading to the units below, particularly on the South and West elevations which have the greatest impact on reducing solar gain in dwellings.



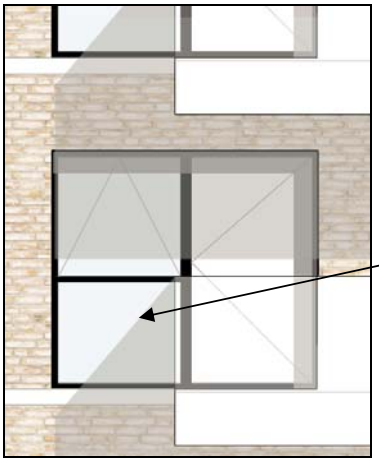
Core 2: East Elevation at 3.00pm midsummer day

The image above indicates a typical balcony arrangement to provide optimum shading to the largest glazed areas within apartments.

As part of the design development the total area of glass was reviewed to limit the solar gain by having the minimum impact on the daylight entering the apartments. This resulted in a reduction of window heights and clear glazing being removed from the lower potions of the bedroom windows as illustrated in the images below.



Design Development

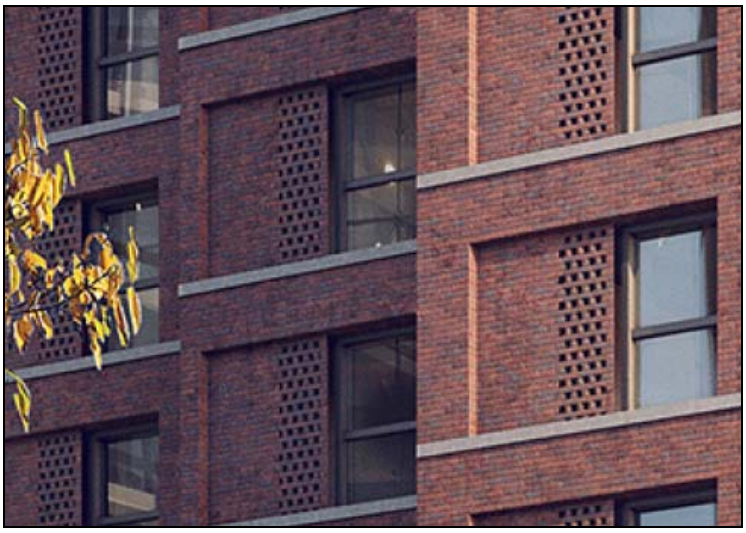


Proposed Arrangement

The results tables in Section 4 indicate the main window orientation and the presence of a balcony above providing shading to the apartments.

Additional ventilation openings are also included for sections of the development to provide natural ventilation without solar gain in the form of a perforated brick detail on the external elevation. This is complimented with an insulated panel inside to improve the thermal performance during the winter.

The image below illustrates the external appearance of the vent where applied on one of the North / South facing elevations.



2.2 Background Ventilation Strategy

A very efficient mechanical ventilation system with heat recovery (MVHR) with automatic summer bypass is proposed for the scheme. An efficient unit has been assumed (Specific Fan Power (SFP): 0.50W/L/s). The summer bypass will provide continuous ventilation during the summer, which will help to mitigate the risk of overheating.

2.3 Lighting and Appliances

High efficiency low energy lighting and controls will be specified throughout all common circulation spaces, and residential spaces will utilise 100% low energy lighting. Lighting gains used within the assessment procedure are detailed within section 3.6.

3 OVERHEATING ASSESSMENT

3.1 Adaptive Thermal Comfort

The overheating assessment is based on the adaptive comfort model following the methodology and recommendations from EN 15251, and modelling has been undertaken following the procedure set out in CIBSE TM52 and TM59.

The thermal modelling has been carried out using EDSL TAS v9.4.1 software. This modelling software is approved by 2013 Building Regulations and is also compliant with CIBSE AM11 requirements. This modelling has been used to test various strategies for ventilation, solar gain reduction, and the use of building's structure to absorb heat.

TM52 tests three criteria to assess overheating risk; all are defined in terms of the difference between the actual operative temperature in the room at any time (T_{op}) and the limiting maximum acceptable temperature (T_{max}). The difference between these temperature values is the 'delta T' (ΔT). The criteria are tested for the summer period May to September only. However, TM59 which deals specifically with dwellings and only requires compliance with Criterion 1 – Hours of Exceedance.

DEFINITIONS

Operative Temperature

T_{OP} = 0.5 T_{air} (AirTemp) + 0.5 T_{mrt} (Mean Radiant Temp)

Maximum acceptable temperature

TMAX = 0.33Trm + 21.8

where:

Running Mean Temperature, Trm, is the running average of recent external temperatures. The running mean is calculated using a complicated equation that weights the significance of external temperatures according how recently they occurred. This weighting gives a greater influence for recent days, reducing with time passed as people "forget".

Criterion 1 – Hours of Exceedance (He): The number of hours that the actual operative temperature in the room (Top) exceeds the limiting maximum acceptable temperature (Tmax) by one degree (K) or more, must be less than 3% of the summer occupied hours.

This criterion provides an understanding of how often a room is likely to exceed its comfort range and can provides a good assessment of acceptability.

Frequency Assessment

In addition to the adaptive comfort a second test is also carried out for bedrooms to provide an assessment of comfort during the sleeping hours. The operative temperature in bedrooms from 22:00 to 07:00 shall not exceed 26°C for more than 1% of the occupied hours annually. For bedrooms to comply the space must comply with both tests.

3.2 Building / Room Categories

TM52 suggests four categories of performance under which buildings should be assessed. The CIBSE suggestion is that designers should aim to remain within the Category II limits for building not used by groups that may be adversely affected by warmer environments.

Category	Explanation	Suggested acceptable range (K)
I	High level of expectation only used for spaces occupied by very sensitive and fragile persons	± 2
II	Normal expectation (for new buildings and renovations)	± 3
III	A moderate expectation (used for existing buildings)	± 4
IV	Values outside the criteria for the above categories (only acceptable for a limited periods)	>4

For the purposes of this study all rooms are assessed as Category II.

Only rooms that are normally occupied are assessed, this includes lounges, dining areas & kitchens (the assessment will be combined where a space serves two or more functions), and bedrooms.

3.3 Weather Files

The London Heathrow weather file has been selected as the most representative from the data base, suitable for an area with a suburban climate close to London. The exact weather file for the assessment is London_LHR_DSY1_2020High50 in accordance with the requirements detailed within TM59.

3.4 Rooms Assessed

A total of 27 apartments have been assessed, representing each of the apartment types and orientations at 10th floor level with four of these repeated at 2nd floor to inform of the performance at the lower levels, where shading will be more prevalent.

Key plans are included within Appendix A1 detailing the apartments assessed.

3.5 Building Construction and Ventilation

The following table sets out the assumptions made for the calculations for the dwellings.

Item	Dwellings Construction
Window Properties	Window U value: 1.3W/m^{2}K Glazing G value: 0.4 Glazing Light Transmittance: 0.7
Blinds	Combined window / blind G value = 0.24
Translucent Window Properties	Window U value: 1.3W/m^{2}K Glazing G value: 0.3
External wall construction	Brick outer surface, with lightweight structural frame system and plasterboard inner surface.
Party wall construction	25mm Plasterboard, cavity, insulation, cavity and 25mm plasterboard.
Internal wall construction	Plasterboard stud walls with 15mm plasterboard both sides
Intermediate floor construction	Plasterboard ceiling, air gap, 275mm concrete/screed, insulation layer OSB, or wood finish.
Permanent Ventilation	In accordance with rates detailed in AD F typically around 0.4 air changes by MVHR with auto summer bypass. The utility cupboards, containing the heat interface units will also have a permanent extract rate of 8.0 l/s. 0.25 air changes by infiltration.

3.5.1 Opening Windows and Doors

Various windows have additional treatment applied to reduce the solar gain. The developer will be installing blinds within the winter garden spaces. Blinds have been included within the simulation to the fixed panes only.

To improve ventilation additional panes are proposed on the return walls, these will be translucent to ensure privacy is maintained, and the panes are simulated with a lower G value of 0.3 to minimise the potential for solar gain.

As the development is considered a predominantly naturally ventilated site, windows and balcony doors have been simulated to open when the internal air temperature is above 22°C in accordance with TM59. In addition, it is anticipated that the apartments will be occupied by single households, so it felt acceptable for bedroom doors to be left partially open overnight to promote cross ventilation.

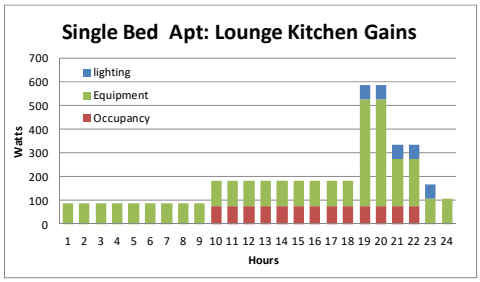
Windows on the long elevations will be of the tilt and turn type, and simulated open using the turn function during the day and tilt at night. Windows at the gable ends are top hung.

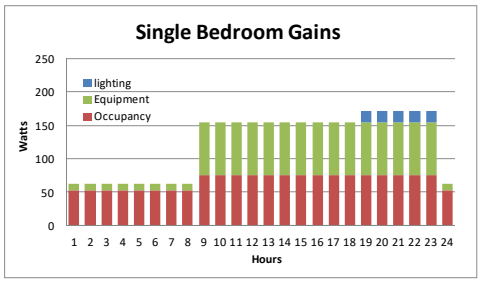
Windows and other openings have been simulated open and closing to the following limits.

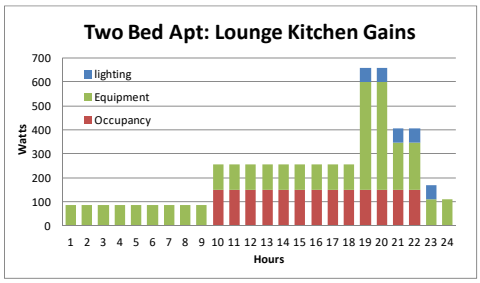
Door / Window	Maximum daytime opening	Maximum night time opening
Balcony door	Fully open	Closed
Top hung window	500mm	250mm
Obscured vents	Fully open	Fully open
Internal doors	Fully open	200mm
Tilt and Turn windows	Fully open	100mm

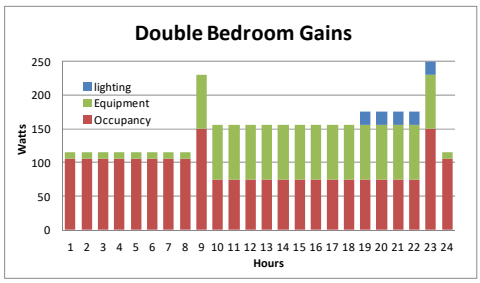
3.5.2 Internal Gains

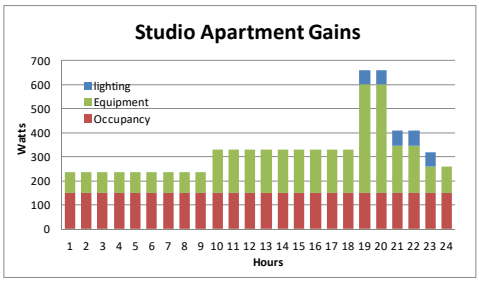
The following graphs show the internal heating gains for the dwellings and the times at which the gains are present as detailed within TM59.











Lounge heat gains also include heat gains from cooking which are applied from 19:00 to 21:00 the back ground equipment gains are from the refrigerator and other equipment left on standby.

Equipment and occupant gains are based on absolute values, but lighting is based on $2W/m^2$, therefore the lighting gains are based on typical apartment floor areas and will vary to suit apartment floor area.

It is apparent from the graphs above that the bedrooms are assumed to be occupied 24 hours, this is intended to reflect the possibility that these rooms could be used as home offices or study areas for students during the day.

A detailed breakdown of heat gains and when they are applied can be found within CIBSE TM59.

4 SIMULATION RESULTS

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Orientation	Balcony Above
Core 1: Sample 1 - Lounge	1989	59	72	NE	Y
Core 1: Sample 2 - Lounge	1989	59	92	NW	Y
Core 1: Sample 3 - Lounge	1989	59	88	NW	Y
Core 1: Sample 4 - Lounge	1989	59	92	NW	Y
Core 1: Sample 5 - Lounge	1989	59	63	SE	Y
Core 1: Sample 6 - Lounge	1989	59	68	SE	Y
Core 1: Sample 8 - Lounge	1989	59	62	SE	Y
Core 2: Sample 1 - Lounge	1989	59	65	W	Y
Core 2: Sample 2 - Lounge	1989	59	54	W	N
Core 2: Sample 3 - Lounge	1989	59	68	W	Y
Core 2: Sample 4 - Lounge	1989	59	82	E	Y
Core 2: Sample 5 - Lounge	1989	59	78	E	Y
Core 3: Sample 1 - Lounge	1989	59	78	E	Y
Core 3: Sample 2 - Lounge	1989	59	71	W	N
Core 3: Sample 3 - Lounge	1989	59	49	E	Y
Core 3: Sample 4 - Lounge	1989	59	70	W	Y
Core 3: Sample 5 - Lounge	1989	59	57	SW	Y
Core 4: Sample 1 - Lounge	1989	59	65	SW	Y
Core 4: Sample 2 - Lounge	1989	59	86	SW	Y
Core 4: Sample 3 - Lounge	1989	59	84	SW	Y
Core 4: Sample 4 - Lounge	1989	59	72	NE	N
Core 4: Sample 5 - Lounge	1989	59	43	SW	Y
Core 5: Sample 1 - Lounge	1989	59	65	SW	Y
Core 5: Sample 2 - Lounge	1989	59	89	SW	Y
Core 5: Sample 3 - Lounge	1989	59	93	NE	N
Core 5: Sample 4 - Lounge	1989	59	50	SW	Y

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range
2nd Core 3: Sample 4 - Lounge	1989	59	70
2nd Core 4: Sample 3 - Lounge	1989	59	78
2nd Core 5: Sample 2 - Lounge	1989	59	83

The above results indicate that the majority of lounges exceed the TM59 compliance standard by relatively small margin just 1% above the criteria, with the worst performing lounge exceeding the criteria by just 1.46%, which is a significant improvement on the peak conditions reported in the previous assessment V2.3.

Whilst the lounges are identified as overheating, it should be noted that the assessment is based on these spaces being continuously occupied between the hours of 10.00 until 22.00, and for the majority of cases it would be expect the apartments to be unoccupied for a period during this time.

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Total Annual Hours ≥ 26.0 (33 Hours)	Orientation	Balcony Above
Core 1: Sample 1 - Bedroom 2	3672	110	93	38	NE	N
Core 1: Sample 1 - Bedroom 1	3672	110	48	18	NW	N
Core 1: Sample 2 - Bedroom 1	3672	110	141	87	NW	Y
Core 1: Sample 2 - Bedroom 2	3672	110	120	80	NW	N
Core 1: Sample 3 - Bedroom 1	3672	110	92	74	NW	Y
Core 1: Sample 4 - Bedroom 1	3672	110	119	74	NW	N
Core 1: Sample 4 - Bedroom 2 s	3672	110	89	70	NW	Y
Core 1: Sample 5 - Bedroom 1	3672	110	71	35	SE	Y
Core 1: Sample 5 - Bedroom 2	3672	110	61	23	SW	N
Core 1: Sample 5 - Bedroom 3 s	3672	110	60	16	SW	N
Core 1: Sample 6 - Bedroom 1	3672	110	64	49	SE	Y
Core 1: Sample 7 - Lounge	3672	110	83	74	SE	Y
Core 1: Sample 8 - Bedroom 1	3672	110	46	21	NE	N
Core 1: Sample 8 - Bedroom 2	3672	110	71	89	SE	Y
Core 2: Sample 1 - Bedroom 1	3672	110	49	55	N	N
Core 2: Sample 2 - Bedroom 1	3672	110	42	23	W	N
Core 2: Sample 2 - Bedroom 2 (s)	3672	110	75	18	W	N
Core 2: Sample 3 - Bedroom 1	3672	110	55	20	W	N
Core 2: Sample 3 - Bedroom 2 (s)	3672	110	59	22	W	N
Core 2: Sample 4 - Bedroom 1	3672	110	72	41	E	Y
Core 2: Sample 5 - Bedroom 1	3672	110	80	80	N	N
Core 3: Sample 1 - Bedroom 1	3672	110	48	20	E	Y
Core 3: Sample 2 - Bedroom 1	3672	110	62	26	W	N
Core 3: Sample 2 - Bedroom 2 (s)	3672	110	98	19	W	N
Core 3: Sample 3 - Bedroom 1	3672	110	70	54	W	N
Core 3: Sample 3 - Bedroom 2	3672	110	59	54	W	N
Core 3: Sample 4 - Bedroom 1	3672	110	71	69	S	N
Core 3: Sample 5 - Bedroom 1	3672	110	48	17	W	Y
Core 4: Sample 1 - Bedroom 1	3672	110	76	15	S	N
Core 4: Sample 1 - Bedroom 2	3672	110	58	19	E	Y
Core 4: Sample 2 - Bedroom 1	3672	110	86	71	E	Y
Core 4: Sample 3 - Bedroom 1	3672	110	83	69	NW	N
Core 4: Sample 4 - Bedroom 1	3672	110	34	44	NW	N
Core 4: Sample 4 - Bedroom 2 (s)	3672	110	49	38	SW	Y
Core 4: Sample 5 - Bedroom 1	3672	110	38	24	SW	Y
Core 4: Sample 5 - Bedroom 2	3672	110	44	20	NE	N
Core 5: Sample 1 - Bedroom 1	3672	110	45	43	NE	N
Core 5: Sample 1 - Bedroom 2 (s)	3672	110	55	32	NE	N
Core 5: Sample 2 - Bedroom 1	3672	110	85	71	NE	N
Core 5: Sample 3 - Bedroom 1	3672	110	58	20	NE	N
Core 5: Sample 3 - Bedroom 2	3672	110	85	13	NE	N
Core 5: Sample 4 - Bedroom 2	3672	110	58	22	SW	Y

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Total Annual Hours ≥ 26.0 (33 Hours)
2nd Core 1: Sample 7 - Lounge	3672	110	71	68
2nd Core 3: Sample 4 - Bedroom 1	3672	110	69	70
2nd Core 4: Sample 3 - Bedroom 1	3672	110	80	74
2nd Core 4: Sample 3 - Bedroom 2	3672	110	89	70
2nd Core 5: Sample 2 - Bedroom 1	3672	110	80	67

Rooms annotated bedroom 1 indicate the either the largest bedroom or the bedroom with an ensuite bathroom. The third bedroom will always be the smallest bedroom and single bedrooms have bed denoted with an ‘s’.

As blinds are detailed for the apartment winter gardens, the tables below illustrate the results to the affected rooms without the blinds in place.

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range
Core 2: Sample 1 - Lounge	1989	59	66
Core 2: Sample 2 - Lounge	1989	59	76
Core 3: Sample 2 - Lounge	1989	59	120
Core 3: Sample 3 - Lounge	1989	59	52
Core 4: Sample 4 - Lounge	1989	59	76
Core 4: Sample 5 - Lounge	1989	59	66
Core 5: Sample 1 - Lounge	1989	59	67
Core 5: Sample 4 - Lounge	1989	59	73

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Total Annual Hours ≥ 26.0 (33 Hours)
Core 2: Sample 1 - Bedroom 1	3672	110	69	57
Core 2: Sample 1 - Bedroom 2	3672	110	68	57
Core 2: Sample 2 - Bedroom 1	3672	110	51	23
Core 2: Sample 2 - Bedroom 2 (s)	3672	110	84	18
Core 3: Sample 2 - Bedroom 1	3672	110	72	27
Core 3: Sample 2 - Bedroom 2 (s)	3672	110	114	20
Core 3: Sample 3 - Bedroom 1	3672	110	95	56
Core 3: Sample 3 - Bedroom 2	3672	110	90	57
Core 4: Sample 4 - Bedroom 1	3672	110	52	51
Core 4: Sample 4 - Bedroom 2 (s)	3672	110	56	46
Core 4: Sample 5 - Bedroom 1	3672	110	39	25
Core 4: Sample 5 - Bedroom 2	3672	110	57	22
Core 5: Sample 1 - Bedroom 1	3672	110	61	49
Core 5: Sample 1 - Bedroom 2 (s)	3672	110	72	34
Core 5: Sample 4 - Bedroom 1	3672	110	58	22
Core 5: Sample 4 - Bedroom 2	3672	110	69	23

The adaptive performance of the bedrooms is very good, with just three failures each of which by a small margin. However, around a third of the bedrooms fail to maintain temperatures below 26°C for the recommended 32 hours per year. The average hours for all rooms exceeding the recommended criteria is 62, which equates to approximately an additional 6 nights where temperatures would be considered uncomfortable.

It is also be noted that the site sits within a location with NOx levels at the lowest 2 floors above the threshold requiring additional filtration to be fitted to the back ground ventilation system. The proximity of the M4 also has an impact on some dwellings, particularly those on the East elevation of the block nearest the road and single aspect apartments on this elevation have a semi exposed buffer space to reduce the impact of the noise.

Typically these apartments fail to meet the overheating criteria within the lounges and bedrooms, but by a very small margin and due to the east facing aspect, and absence of low evening sun the afternoon temperatures remain fairly constant with a low peak temperature.

Occupants in these apartments are less likely to experience extremely high peak temperatures In summer if the windows are closed for short periods.

Occupants on the lower two floors are also less likely to experience the higher peak temperatures due to shading from surrounding buildings, including potential future developments, which may reduce the solar gain as indicated in the results for the second floor sample dwellings, which all show an improvement over the sample tenth floor.

This report identifies that the majority of sample apartments modelled are typically compliant, or close to meeting the criteria set out in TM59. The level of glazing has been reviewed and the number of opening lights increased to improve ventilation rates.

The updated results demonstrate that conditions within the apartments will significantly improve from the previous version of this assessment (V2.3).

5 COMMON AREAS

As circulation spaces are only occupied for very short periods, a less stringent standard is applied to these areas. CIBSE TM59 sets an acceptable standard for common areas, at 28°C which should not be exceeded for more than 3% of the total annual hours.

The following profiles have been applied to the heat gains. As the spaces will be occupied for short periods of time and at low density rates, heat gains from people have not been included within the simulation.

Two light settings are assumed within the corridors, controlled by presence detectors. When no movement is detected approximately half of the light fittings will not be operating, and when a presence is detected all the light fittings will activate. We have assumed that there will be sufficient traffic within the periods below to enable the lights to operate continuously at full output.

Lighting Sensible Gain	
07.00-09.00 and 17.00-22.00	8.0W/m^2
All other times	4.0W/m^2

The other source of heat is the community heating pipework, and whilst the temperature is designed to vary to suit seasonal conditions, there will be little fluctuation throughout the day, therefore a constant rate is assumed. Insulation standards above the minimum British Standards are required to minimise the heat emitted as far as practicable the value stated below is an approximation based on Part L requirements, however it is anticipated higher insulation performance will be achieved in final design.

LTHW Community Heating Pipework	
Sensible Gain	13.0W/m^2

Heat gain profiles for pipework and lighting will be reviewed as the design develops and the ventilation rate amended accordingly to ensure satisfactory conditions are achieved within the final design.

Simulation of a typical corridor space for each core types indicates that circulation spaces within this development may become uncomfortable unless forced ventilation or cooling is provided. The following section describes the mechanical ventilation strategies applied to the corridors.

5.1.1 Corridor ventilation strategy

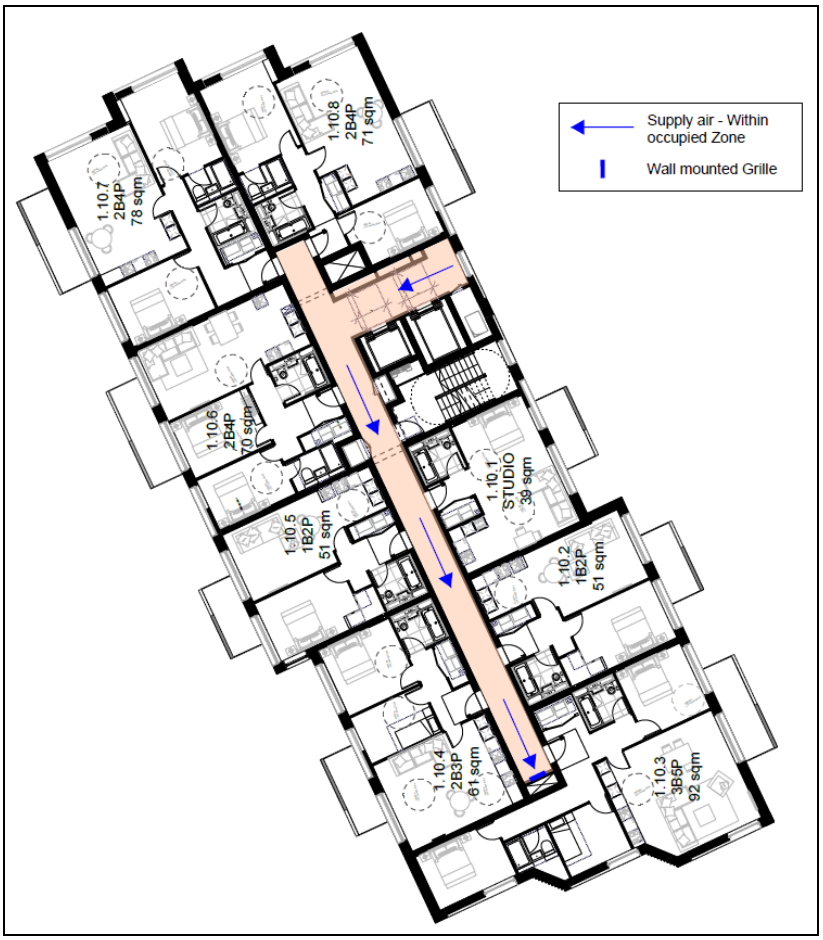
Each of the five corridors follow a similar design, with Core 1 being slightly longer, and all will follow a similar ventilation strategy. Cores 3 and 5 are similar to cores 2 and 4, therefore core 2 will adequately represent the results for Core 3, with Core 5 represented from the results for Core 4.

Fresh air will enter the corridor via the window adjacent to the lift. The window will be actuated and operate at the dictate of a room sensor. Exhaust air will be extracted via an opening in the smoke shaft, as the corridor to Core 1 is longer than cores 2-5 an additional smoke shaft is detailed at the far end of the corridor. The ventilation outlet will therefore be located below the AOV inlet. The exhaust air grilles within Cores 2-5 will be above the suspended ceilings and air will enter the ceiling void via a grille as far along the corridor as possible whilst remaining in the same fire compartment as the smoke shaft. All doors within the corridor will be held open, on fire controlled devices to promote air flow to the ceiling extract point. Providing this extended air path ensures cooler air passes through as much of the corridor as practical and removes a proportion of the heat from the ceiling void before it enters the occupied zone.

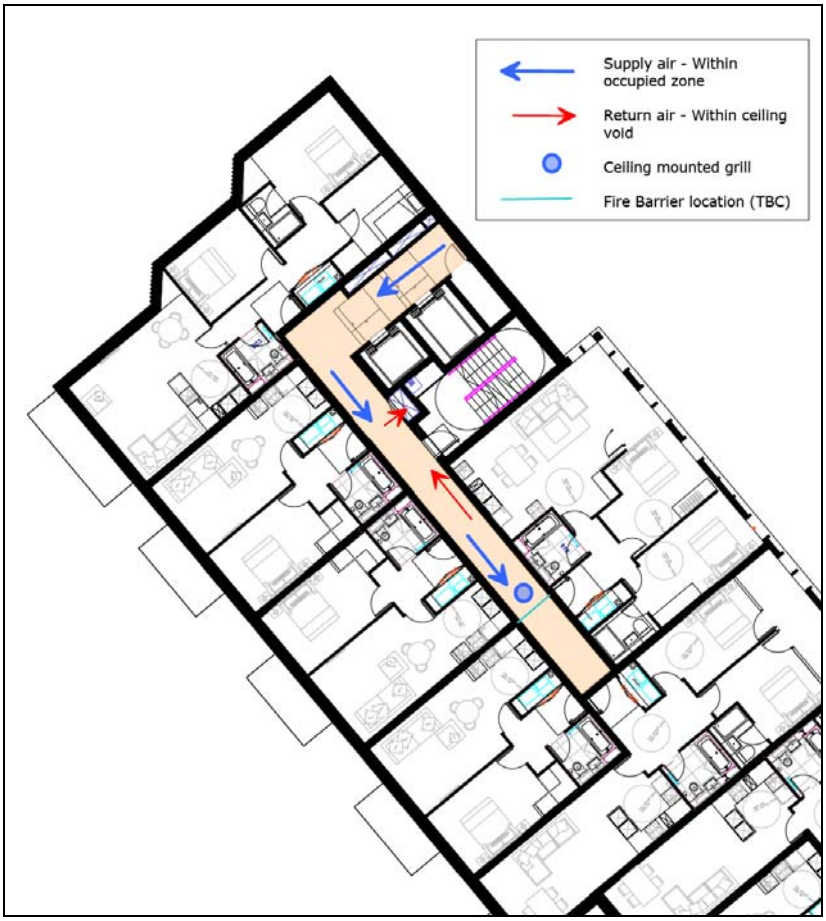
The environmental ventilation system shall be linked to the smoke ventilation system to ensure that it is disabled and smoke dampers on closed on fire condition. The environmental fan shall also be variable speed to ensure only the minimum ventilation rates are applied in cooler conditions when ventilation may not be required at all levels simultaneously.

The sketches below illustrate the air paths described above.

Core 1



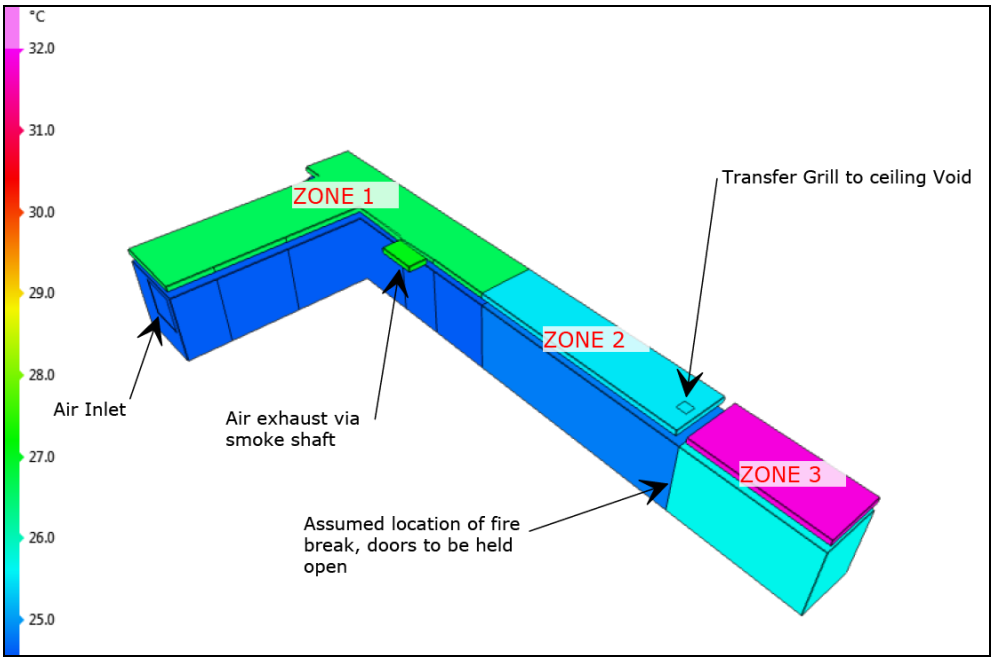
Cores 2-4 Typical example



Due to the lower air flow at the ends of the corridors these zones are expected to experience higher temperatures,

The results for each corridor are split into three zones, lift entrance, stairwell to assumed fire break location and dead leg at the end of the corridors (at the time of writing locations of fire breaks are still to be determined). The image below extracted from the simulation results for Core 2 indicates the temperatures experienced at mid day on a hot day with an external air temperature of 24.1°C, the small high level blocks represent the ceiling void.

The conditions within Zone 3 have the potential for improvement, if the services can be arranged to allow additional smoke and fire dampers to be installed within the ceiling void, and this will be investigated during the detailed design stage.



Zone	Ventilation Rate	Total hours >28°C	% Hours >28°C	Total hours >29°C	% Hours >29°C	Total hours >30°C	% Hours >30°C
Core 1 - Zone 1	5 ach	139	1.6	74	0.8	44	0.5
Core 1 - Zone 2	5 ach	193	2.2	92	1.1	52	0.6
Core 1 - Zone 3	5 ach	259	3.0	123	1.4	62	0.7
Core 2 - Zone 1	3.5 ach	86	1.0	50	0.6	29	0.3
Core 2 - Zone 2	3.5 ach	102	1.2	54	0.6	32	0.4
Core 2 - Zone 3	3.5 ach	166	1.9	97	1.1	50	0.6
Core 4 - Zone 1	3.5 ach	67	0.8	43	0.5	23	0.3
Core 4 - Zone 2	3.5 ach	83	0.9	49	0.6	24	0.3
Core 4 - Zone 3	3.5 ach	136	1.6	74	0.8	41	0.5

The simulation indicates that all zones will remain within the criteria.

6 CONCLUSION

L and Q have considered the effects of overheating within the design of the apartments.

This report identifies that a proportion of the sample apartments modelled are compliant, with the remaining majority close to meeting the criteria set out in TM59.

The design team has taken the following steps to minimise the solar gain, and improve ventilation rates.

- Balconies are located above all balcony doors to maximize the shading potential.
- All glazing will have a maximum G value of 0.4 with a light transmission factor close to 70% to mimimise the impact to the daylight.
- Internal blinds will be fixed by the developer within the winter gardens.
- Bedroom windows that are not used to access the balconies have a cill height of around 1.0m as opposed to full height glazing to limit the solar gain.
- An increase in glazed area and openable windows to the stepped gable ends.
- Translucent windows with opening sections added to return walls to Core 1, and between Cores 4&5

The reduction of the glazed areas will also have a beneficial impact on the energy assessment by providing more opaque areas, which provide a better thermal performance than glazing, and good natural ventilation is achievable in all apartment types.

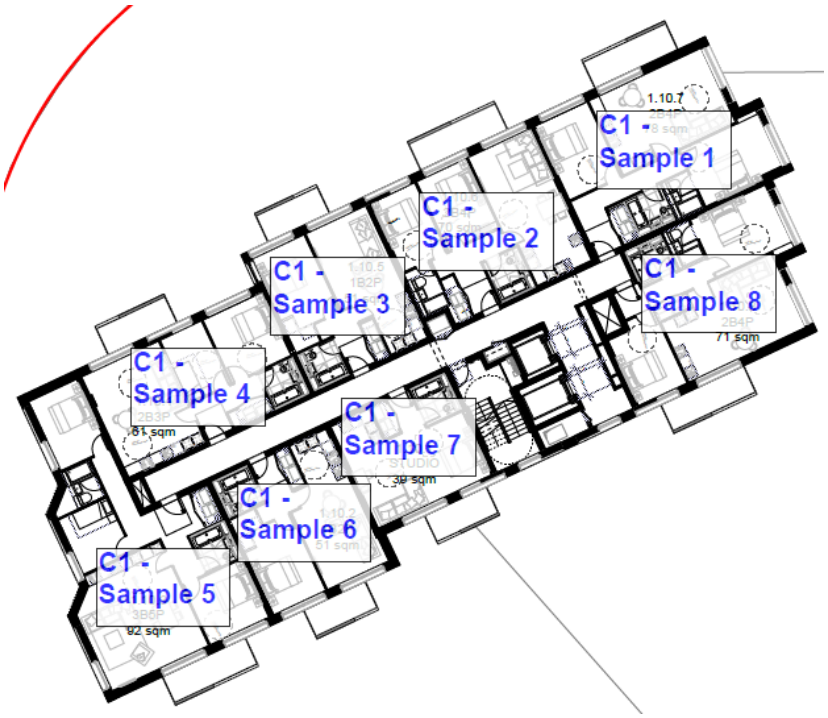
The majority of lounges exceed the TM59 compliance standard by relatively small margin just 1% above the criteria, with the worst performing lounge exceeding the criteria by just 1.46%.

The adaptive performance of the bedrooms is very good, with just three failures, each of which by a small margin. Overnight temperature results indicate that the majority of the bedrooms will exceed the criteria, by a small margin, this would equate to around an additional 6 nights where temperatures would be considered uncomfortable.

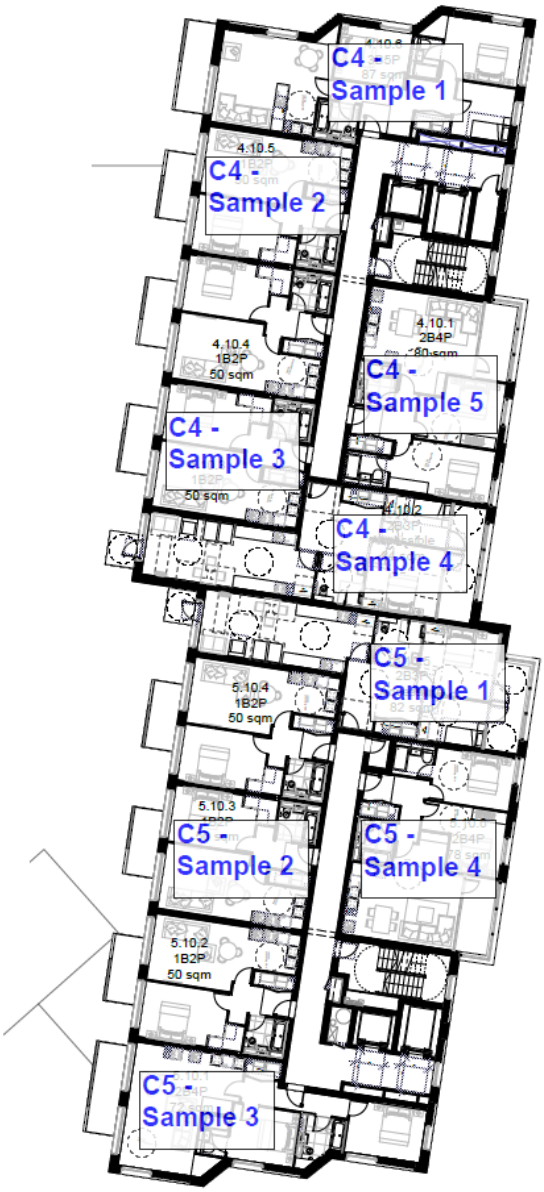
The updated results demonstrate that conditions within the apartments will significantly improve from the previous version of this assessment (V2.3).

A ventilation strategy has been developed for the circulation spaces to maintain acceptable conditions (meeting the recommendation within TM59) utilising a combination of façade openings and smoke ventilation shafts, with mechanical ventilation equipment.

APPENDIX 1 SAMPLE DWELLING KEY




C3 -
Sample 1
C3 -
Sample 5
C3 -
Sample 2
C3 -
Sample 3
C3 -
Sample 4
C2 -
Sample 1
C2 -
Sample 2
C2 -
Sample 5
C2 -
Sample 3
C2 -
Sample 4
70 sqm
50 sqm


C4 -
Sample 1
4.10.5
C4 -
Sample 2
4.10.4
1B2P
50 sqm
4.10.1
2B4P
C4 -
Sample 5
C4 -
Sample 3
50 sqm
C4 -
Sample 4
C5 -
Sample 1
5.10.4
1B2P
50 sqm
5.10.3
C5 -
Sample 2
C5 -
Sample 4
5.10.2
1B2P
50 sqm
C5 -
Sample 3

APPENDIX 2 DRAWINGS USED FOR BUILDING MODEL

1699_DWG_PL_xx_20_100 R03
1699_DWG_PL_xx_20_101 R03
1699_DWG_PL_xx_20_102 R03
1699_DWG_PL_xx_20_103 R03
1699_DWG_PL_xx_20_104 R03
1699_DWG_PL_xx_20_105 R03
1699_DWG_PL_xx_20_106 R03
1699_DWG_PL_xx_20_107 R03
1699_DWG_PL_xx_20_108 R03
1699_DWG_PL_xx_20_109 R03
1699_DWG_PL_xx_20_110 R03
1699_DWG_PL_xx_20_111 R03
1699_DWG_PL_xx_20_112 R03
1699_DWG_PL_xx_20_113 R03
1699_DWG_PL_xx_20_114 R03
1699_DWG_PL_xx_20_115 R03
1699_DWG_PL_xx_20_116 R03
1699_DWG_PL_xx_20_117 R03
1699_DWG_PL_xx_20_118 R03
1699_DWG_PL_01_20_300 R02
1699_DWG_PL_01_20_301 R02
1699_DWG_PL_01_20_302 R02
1699_DWG_PL_01_20_303 R02
1699_DWG_PL_0203_20_300 R02
1699_DWG_PL_0203_20_301 R02
1699_DWG_PL_0203_20_302 R02
1699_DWG_PL_0203_20_303 R02
1699_DWG_PL_0405_20_300 R02
1699_DWG_PL_0405_20_301 R02
1699_DWG_PL_0405_20_302 R02
1699_DWG_PL_0405_20_303 R02

APPENDIX 3 GLA DOMESTIC OVERHEATING CHECKLIST

Section 2 - Design features implemented to mitigate overheating risk		Please respond
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	Only partial cover
	Will green roofs be provided?	Green spaces will be provided to some room roof areas.
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	No
Materials	Have high albedo (light colour) materials been specified?	Buildings to be constructed with a brick finish of various colours
Dwelling aspect	% of total units that are single aspect	Approximately 60%
	% single aspect with N / NE / NW orientation	15%
	% single aspect with E orientation	18%
	% single aspect with S / SE / SW orientation	23%
	% single aspect with W orientation	6%
Glazing ratio -What is the glazing ratio (glazing; internal floor area) on each facade?	N / NE / NW	Varies per block ranging from 27% to 36%
	E	36%
	S / SE / SW	Varies per block ranging from 27% to 36%
	W	27%
Daylighting	What is the average daylight factor range?	Please refer to Daylight report.
Window opening	Are windows openable?	Yes
	What is the average percentage of openable area for the windows?	90%
Window opening: What is the extent of the opening?	Fully openable	Yes
	Limited (e.g. for security, safety, wind loading reasons)	No
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	No apartments located at ground floor level.
Shading	Is there any external shading?	Shading is from balconies above
	Is there any internal shading?	Blinds to be provided within winter gardens.

Glazing specification	Is there any solar control glazing?	Yes G=0.4, Lt =0.7
Ventilation – What is the ventilation strategy?	Natural – background	No
	Natural – purge	Yes
	Mechanical – background (e.g. MVHR)	Yes
	Mechanical – purge	No
	What is the average design air change rate	MVHR to meet AD Part L requirements
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	70°C / 40°C
	Have horizontal pipe runs been minimised?	Yes
	Do the specifications include insulation levels in line with the London Heat Network Manual	Yes