



Windows / door to have a max frame width 890mm. The window / door will be produced with a factory fitted packer to achieve the ER required S/O widths.

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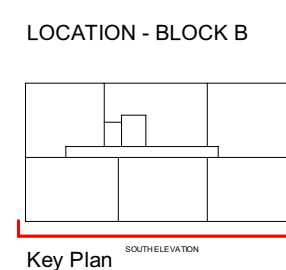
REVISION NOTES			
NO.	DESCRIPTION	DATE	NAME
P1	PRELIMINARY ISSUE	25/11/19	FF
C1	ISSUED FOR CONSTRUCTION	11/03/20	FF
C2	ELEVATION UPDATE: Window tilt panels added, balustrade design updated	17/04/20	FF
C3	Lower ground floor window config. amended. GA plans updated as clouded. MVHR intake/exhaust location added	28/07/20	FF
C4	Balcony Ground floor Slab reviewed as per ACL instruction SC009739/200748 n.18 of 01/07/20	21/08/20	FF
C5	Windows review. ACL instruction email of 04/09/20	24/09/20	FF

	In situ build brickwork. Brick: TERRA, ISIKLAR WHITE WIRECUT FACING BRICK in Flemish bond pattern (herringbone look relief pattern) as per agreed sample.
	In situ build brickwork. Brick: Ibslock, Bedhill dark brick in Flemish bond pattern as per agreed sample.
	In situ build brickwork. Brick: TERRA, ISIKLAR WHITE WIRECUT FACING BRICK in Flemish bond pattern as per agreed sample.
	GRC FACADE as per agreed sample.
	POWER COATED STEEL BALUSTRADE
	ALUMINIUM CLAD WINDOWS AND DOORS

- L - SHAPE LINTEL (<150mm end bearing at each end)
- BRICK SLIP LINTEL SYSTEM
- BSA: BRICK SUPPORT ANGLE LEVEL
- MJ: MOVEMENT JOINT

NOTE:

- FOR PRIVACY SCREEN AND METAL WORK DETAILS REFER TO METAL WORK (M4) SERIES
- FOR RELIEF PATTERN BRICK DIMENSION REFER TO EXTERNAL WALLS (21) SERIES
- FOR PRIVACY WALL OF GARDEN REFER TO LANDSCAPE ARCHITECT DRAWINGS
- FOR LANDSCAPE LEVELS REFER TO LANDSCAPE ARCHITECTS DRAWINGS



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FOR CONSTRUCTION

PROJECT / DRAWING TITLE
Hornsey Town Hall

DRAWING TITLE
RESIDENTIAL BLOCK B
South Elevation

DATE / DRAWN BY
05/07/17 FF

SCALE
1 : 100

PROJECT NO
3596-KDS-BB-XX-DR-A-05-2002

ZONE LEVEL TYPE ROLE CLASS DR. NO.

REV
C5



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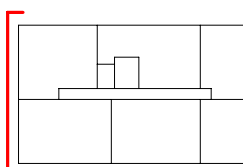
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 - FOR PRIVACY WALL OF GARDEN REFER TO LANDSCAPE ARCHITECT DRAWINGS
 - FOR LANDSCAPE LEVELS REFER TO LANDSCAPE ARCHITECTS DRAWINGS

LOCATION - BLOCK B



Key Plan

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FOR CONSTRUCTION

PROJECT / DRAWING TITLE
Hornsey Town Hall

DRAWING TITLE
**RESIDENTIAL BLOCK B
West Elevation**

DATE / DRAWN BY
05/07/17 FF

SCALE
1 : 100

PROJECT NO
3596-KDS-BB-XX-DR-A-05-2003

REV
C6

HTH: Block B- ,W01D - W05A.2 - solution to be verified

Paul Botten <PBotten@ardmoregroup.co.uk>
11/02/2021 at 09:05:25

From: Paul Botten <PBotten@ardmoregroup.co.uk>
Sent: 11/02/2021 at 09:05:25
To: Katy Venables <katy.venables@whitecode.co.uk>
Cc: Simon Redfern <SRedfern@ardmoregroup.co.uk>, Francesco Fanara <francesco.fanara@kdsassociates.co.uk>, Nikhil Raj <nikhilraj@kdsassociates.co.uk>, Ellen Huelin <ellen.huelin@whitecode.co.uk>

Good morning Katy,

Further to the email below we are again having trouble with the window sizes within block B.

Can you please confirm if the opening lights are removed as indicated in flats B03 & B15 if the rooms still pass. The room has an opening lights on the other elevation so hopefully this can supply the required ventilation.

I look forward to hearing from you.

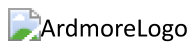
Kind regards

Paul

Paul Botten

Senior Design Coordinator

T: 0208 344 0300 EXT: 40108



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From: Francesco Fanara <francesco.fanara@kdsassociates.co.uk>
Sent: 10 February 2021 13:40
To: Paul Botten <PBotten@ardmoregroup.co.uk>
Subject: Type W01D - W05A.2 - solution to be verified

Paul,

As discussed on the phone see an alternative solution to solve the Type W01D - W05A.2.

This is to be verified with M&E if the ventilation of apartment B03 and B15 is verified omitting the tilt panels in those two types.



Kind regards,

Francesco Fanara
Project Runner/ Architectural Engineer

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WHITECODE
CONSULTING

Hornsey Town Hall Mews

Summer Overheating Assessment

CIBSE TM59:2017

Prepared for Ardmore Group

10687-S-OHTG-0003

Revision AB

26.02.2020



WHITECODE
CONSULTING

Executive Summary

The following report has been produced to assess the dwellings and common areas within the Mews at Hornsey Town Hall development against the following criteria set out in CIBSE Technical Memorandum 59 – *Design methodology for the assessment of overheating risk in homes* (TM59:2017):

- **Criterion 1** – *For living rooms, kitchens and bedrooms*: A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling does not meet the above criteria, then the whole dwelling fails to comply.

The building was simulated using Integrated Environmental Solutions (IES) Virtual Environment (VE) 2023 version 2019.0.1.0, a software suite accredited under CIBSE AM11 for the dynamic simulation of building energy and thermal modelling, to assess the dwellings using the latest CIBSE Design Summer Year (DSY) weather file for London Heathrow (LHR), for the 2020s, high emissions, 50% percentile scenario.

CIBSE TM59:2017 sets out the occupancy profiles for each room. Bedrooms are assumed to be occupied for 24 hours and living rooms and kitchens from 9am to 10pm. It can be assumed that occupants will open glazing in an occupied room when the internal temperature exceeds 22°C. Glazing can only be assumed to be open in unoccupied rooms if they can be locked for security and are weather proofed.

The preferred glazing g-value for the proposed scheme is 0.42 and 0.4329 to lower ground, ground and 1st floor external doors. This reduces solar gains but also still provides sufficient natural daylight, where a lower g-value can often be too dark causing discomfort and an increase in the demand for space heating and artificial lighting.

Glazing in the development consists mainly full height openable side hung doors, full height fixed and half height opening glazed panels. Night-time cooling (NTC) has been applied to all bedrooms, and living rooms above first floor with windows. It is worth noting that some occupants may not operate their windows in this way, and this should be stated in the home manual as a way to reduce the risk of overheating.

Several simulations were run starting with the above specification and then introducing more enhanced passive measures to enable all rooms to pass.

The final strategy used is as follows:

- G value 0.42
- G value 0.4329 to selected doors
- Windows & Doors openable 20 degrees
- Internal doors open 24hrs
- Amended windows as per markup 07.12.20
- NTC to all bedrooms 1st and 2nd floors
- NTC to living rooms tilted windows 1st & 2nd floors
- NTC to rooms with tilted windows and half height bedroom window only on ground floor
- Blinds
- Comfort colling where required

With the above strategy, all rooms in the Mews pass CIBSE TM59:2017

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

The common areas will be provided with environmental ventilation. This is achieved through an extract fan located at the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach-1 permanently
- 2ach-1 when the internal temperature exceeds 25°C



- 3ach-1 when the internal temperature exceeds 28°C

With the above specification applied, all common area rooms assessed comply with the CIBSE TM59:2017 recommendations. This indicates that the internal operative temperature should remain at an acceptable level.



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Revisions:

Rev No.:	Date:	Status/Comments:	Prepared by:	Checked by:
1	26.02.20	Preliminary Issue for Comments	KAV	EH
2	14.07.20	Revised windows	KAV	EH
3	27.04.22	G value and window opening adjustment	KAV	EH
4	21.08.2024	AS BUILT	PM	JM

1.0 Introduction

There are many factors that will determine indoor summer temperatures in dwellings in the UK. These factors include the following:

- The external climate (which will vary with location in the UK)
- Location
- Dwelling orientation
- Room type
- Time of day
- Building fabric characteristics
- Occupant behaviour
- Adjacent buildings and local shading

Current modelling based evidence suggests that the South of the UK is likely to face the largest risk of indoor overheating. It was suggested that comfort targets will not be met in naturally ventilated buildings in London by the middle of the century without some form of mechanical cooling unless some additional adaption measures are carried out (CIBSE 2005). In contrast, it was estimated that Manchester and Edinburgh buildings will only encounter minor overheating problems within the same time frame.

There are a variety of methods that can be used to reduce the risk of indoor overheating and are split into what can be regulated and what cannot be regulated. These are shown in **Tables 1.1** and **1.2**.

What can be regulated	
Air movement	Moving air feels a couple of degrees cooler than still air.
Insulation	Insulation is usually connected with winter warmth, but just as a thermos flask can keep drinks either hot or cold, insulated walls can help homes stay cool. However, insulation won't cool dwellings down if they overheat.
Shading	Strong sunlight through glazing can heat up dwellings. Awnings and internal or external shutters on south and west facing glazing provide shade.
Cooling devices	Evaporative coolers and air conditioners can be installed relatively cheaply. However, unlike the passive measures above, these require power, thereby increasing the carbon footprint of the dwelling and contributing to climate

What can be regulated	
	change. They also pump waste heat into their surroundings, making the surrounding area even hotter.
Low energy	Use low energy light bulbs and appliances.
Ventilation	Replacing the warm air in dwellings with cooler air.
Roofs	As with walls, insulation can help keep dwellings cool in summer. Improving loft insulation is one method, but green roofs are also an option. These use a base layer on which plants can grow, creating biodiversity space for plants and animals and providing a layer of roof insulation.
Outside	Water features help keep surroundings cool by evaporation, and trees provide shade in the summer. Deciduous trees are best, as the leaves drop off in the winter, allowing extra light into your home.
Glazing	Special coatings on glazing reduce the amount of sunlight that can pass through.

Table 1.1 Methods of reducing risk of overheating that can be regulated

What cannot be regulated	
Reducing heat gain	Heat doesn't just come from the sun. Home devices and appliances such as televisions, computers and light bulbs also make a significant contribution. Turning the kitchen fan on while cooking will help.
Windows	Open windows when it's cooler outside than inside, especially at night.
Curtains	Close curtains, blinds or shutters during the day, or use awnings to shade the glazing.
Fans	Use desk or ceiling fans to create a cooling breeze.

Table 1.2 Methods of reducing risk of overheating that cannot be regulated

An unintended consequence of improved building fabric of newly built dwellings may be an increased risk of overheating. Newly constructed highly insulated dwellings were found to have the potential to be at higher risk of overheating than older, less insulated dwellings.

Criterion 3 of Part L1A of the Building Regulations sets out the approach to limiting heat gains within dwellings during the summer months. Appendix P, 'Assessment of Internal Temperature in Summer' within the SAP document provides the calculation methodology to be used to assess a dwelling. Reasonable provision is achieved if the SAP assessment indicates that the dwelling does not have a high risk of high internal temperatures.

This is a self-contained simplified calculation of the whole dwelling average peak internal temperature for a proposed design. It takes into account solar gain (taking account of orientation, shading and glazing transmission); ventilation (taking account of window opening in hot weather), thermal capacity and mean summer temperature for the location of the dwelling. A dwelling is considered to have a high risk of overheating when internal temperatures reach 23.5°C. Appendix P also refers its users to an Energy Saving Trust (EST) guide, CE 129, 'Reducing overheating – a designer's guide', which is based on the use of overheating degree-hours above 27°C.

The assessment should be carried out regardless of whether or not the dwelling has mechanical cooling and if it does have mechanical cooling it should be assessed without it.

Part L1A of the Building Regulations states that designers may want to exceed the requirements in the current Building Regulations. Dynamic simulations allow more scenarios to be included within the model providing a more detailed and accurate set of results.

This report ascertains whether the dwellings will overheat within the Mews. Suggestions on how to avoid overheating involving different glazing specifications, purge ventilation and external shading are provided in this report.

In the event that dwellings are still overheating following implementation of all suitable measures, mechanical cooling may be required. From the results it will be concluded whether extra measures are required to comply with the recommendations within CIBSE TM59:2017.

1.0 Thermal Design Criteria

There are no regulations which deal with overheating in domestic situations. CIBSE have produced Technical Memorandum 59 – *Design methodology for the assessment of overheating risk in homes* (TM59:2017) to provide guidance on how to assess the risk of overheating in homes and common areas. The document states the following:

“Overheating risk has been a growing concern amongst the domestic design, construction and provider community for at least a decade. Domestic overheating has not always been a problem in the UK but climate change, increased urbanisation, construction of highrise apartment blocks and winter energy efficiency measures have all contributed in the amplification of high internal temperatures. Homes that overheat cause significant discomfort and stress to the occupants and can ultimately lead to litigation and costly mitigation measures for the owners/developers.” (CIBSE TM59:2017 – Section 1, page 1)

CIBSE have created two criteria for defining overheating in free-running buildings. These criteria are summarised below:

- **Criterion 1** – *For living rooms, kitchens and bedrooms*: A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling fails, then the whole dwelling is assumed to fail.

CIBSE TM59:2017 states that “*the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them*”. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

2.0 The Development

The Hornsey Town Hall development is situated in the London Borough of Haringey. A layout showing the proposed development's location is shown in **Figure 3.1**.

The proposed development will comprise a newly refurbished 3-storey mixed-use Hornsey Town Hall, a mixed-use 2-storey Broadway Annexe, two 7-storey residential buildings - Block A and Block B, and a 2-storey residential mews building.

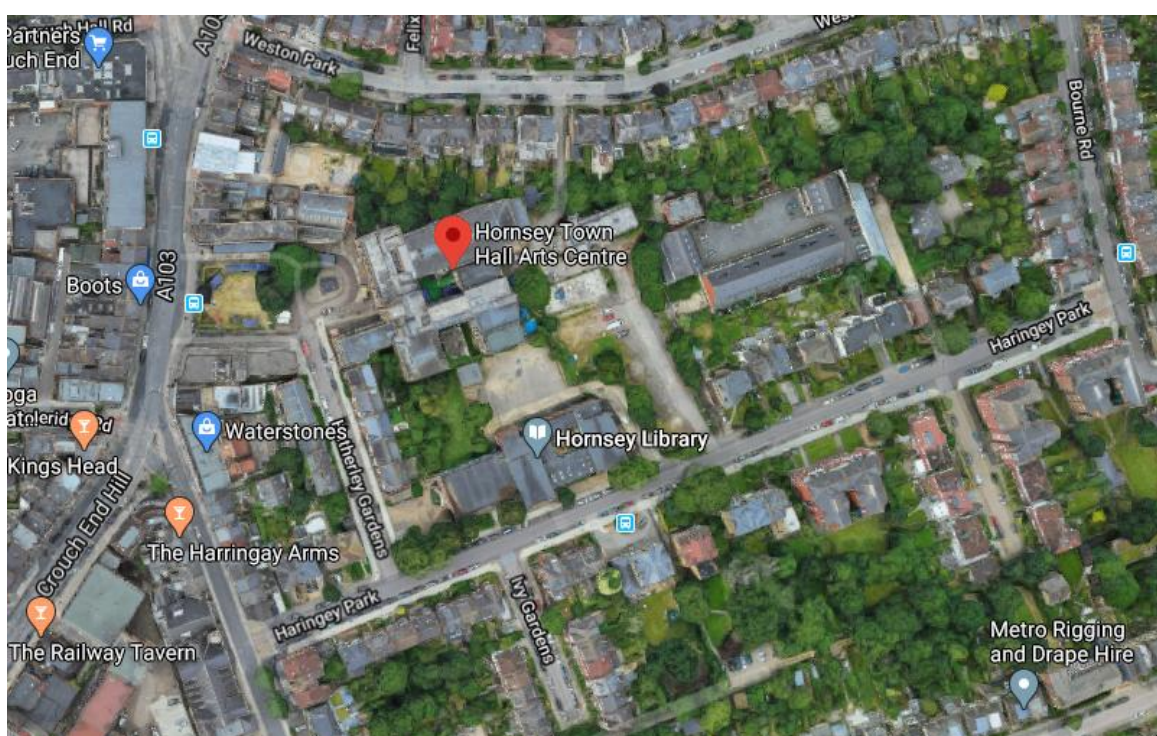


Figure 3.1 Hornsey Town Hall Development

3.0 Orientation

The orientation of the building can have a big effect on the solar gains within a dwelling. South facing facades are more likely to overheat in the summer months as they are subject to the sun for longer periods of the day. East and West facades also are subject to the sun, the East facing in the morning, and the West in the afternoon. This means that they are also subject to solar gain during the day. The North façade will have little exposure to the sun; therefore, will not suffer from solar gains. The sun path diagram below confirms the above:

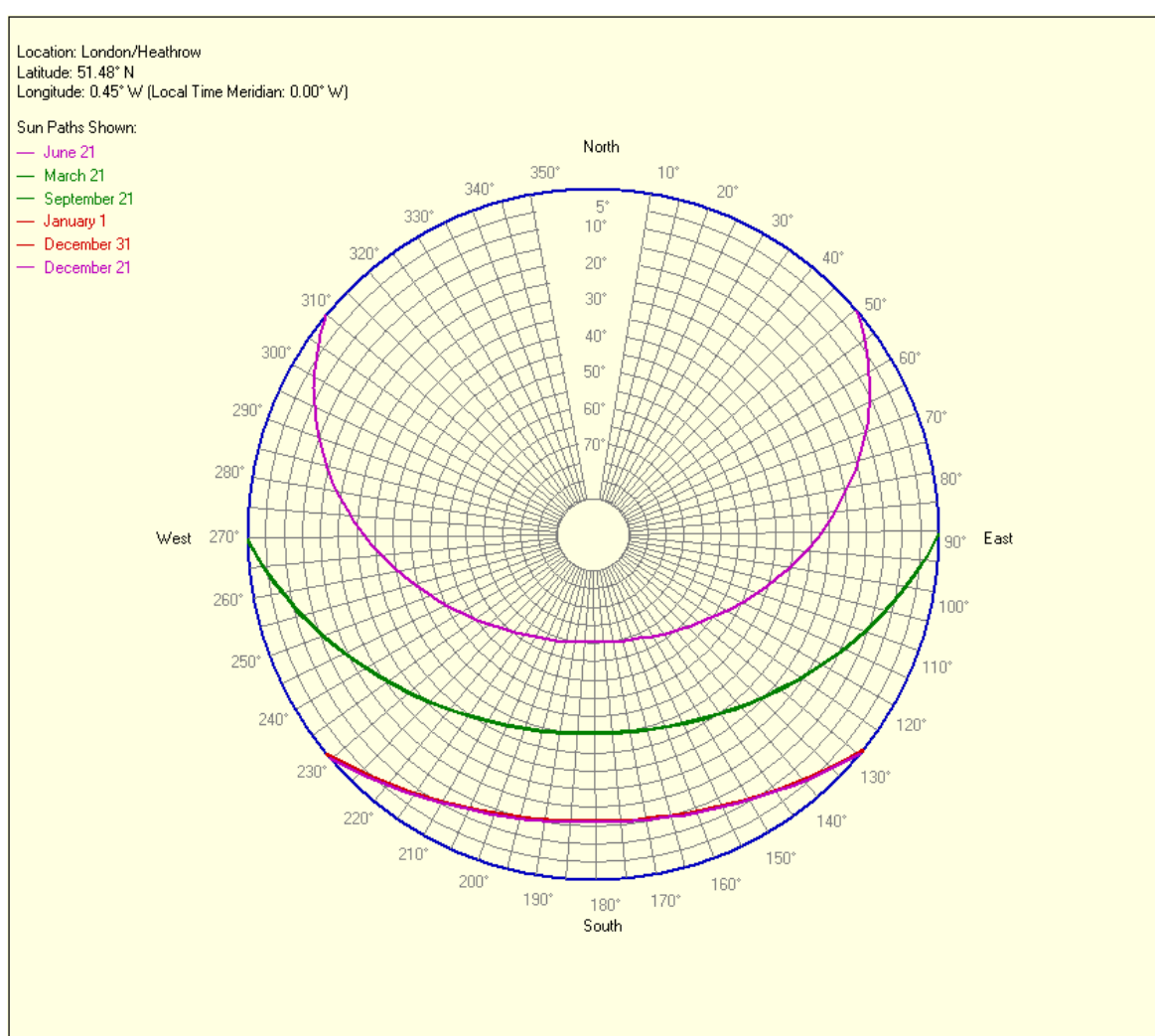


Figure 4.1 Sun path diagram for each season

4.0 The Model

A dynamic 3D model of the the Mews was produced using drawings issued by KDS Associates in August 2019.

All dwellings and common areas have been modelled to provide a good representation of the overheating risk across the development.

In order to calculate the internal operative temperatures of the dwellings and common areas at different times of day, a model was built using Integrated Environmental Solutions Virtual Environment (IES VE) software, version 2019.0.1.0. This model takes into account a range of issues that could have an impact on the building's performance, including building fabric, orientation and external conditions.

Building the Model

The first stage of building the model was to produce a 2D template of each floor. The templates were created using floor plans issued by KDS Associates.

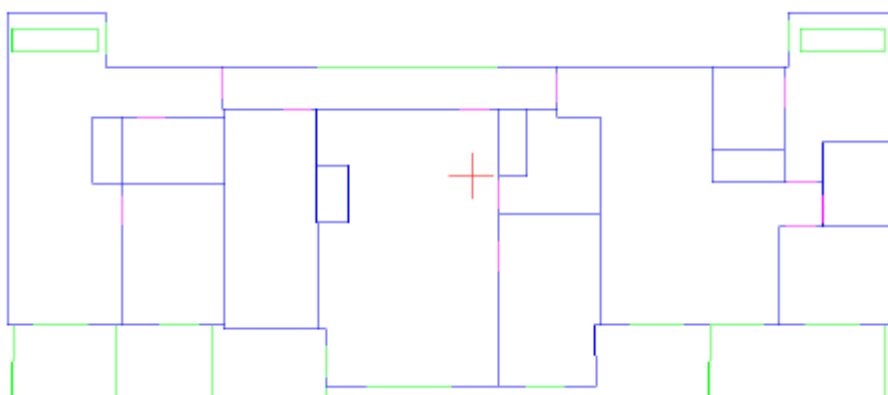


Figure 5.1 IES VE 2D template of example floor plan in the Mews

The next stage was to use the templates in IES VE and elevations issued by KDS Associates in July 2019 to create the 3D model of each floor culminating in the complete model as shown below:

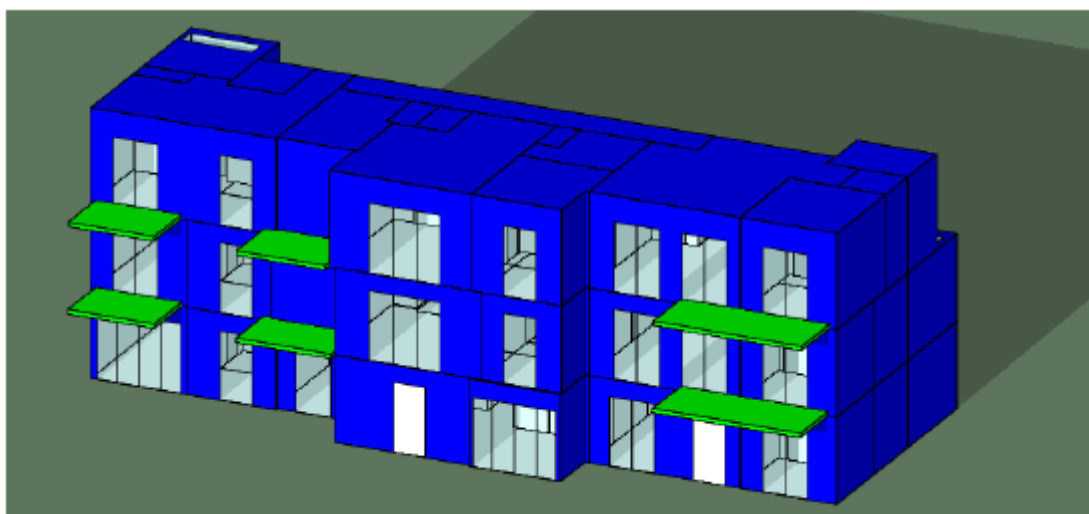


Figure 5.2 IES VE 3D model of the Mews.

The rooms shown in blue in Figure 5.2 were modelled to give a good indication of the thermal make-up of the building. This enables an accurate range of internal operative temperatures to be obtained allowing reasonable conclusions for this development to be given. The local shading (green) was modelled for shading purposes.

Building Fabric

The building is constructed from brick work on steel frame with aluminium frame double glazed windows. frame and glazed facades. The following building fabric specification was used for the thermal model.

Element	Thermal Transmittance (W/m ² K)
Ground/Exposed Floor	0.22
External Wall	0.15
Common Area Wall	0.20
Roof	0.14
Glazing	1.50
Internal Front Doors	1.50

Table 5.1 Building fabric U-values

Different glazing g-values have been investigated (calculated to BS EN 410:2011), as detailed in Section 7.0 of this report.

The building's thermal mass is assessed and factored into the calculations. It has been found that although the building does absorb the heat into the structure, this offsets temperatures when the building becomes cooler at a later stage.

Mechanical Ventilation

Balanced heat recovery mechanical ventilation (System 4) is used throughout the building to comply with Part F of the Building Regulations. The proposed model is the Vent-Axia Sentinel Kinetic B unit. This unit has a summer bypass and allows the internal warm stale air to be extracted from the kitchen and wet rooms whilst supplying fresher external air into the habitable rooms. The flow rates have been calculated using the manufacturer's data and each room has been assigned a relevant rate of air change.

The dwellings are to be served by underfloor heating. This will be served via an CHP system with pipework running up the building and through the ceiling voids of the common area corridors. Common areas are to be provided with environmental ventilation to all corridors. This is achieved through an extract fan located at

the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach⁻¹ permanently
- 2ach⁻¹ when the internal temperature exceeds 25°C
- 3ach⁻¹ when the internal temperature exceeds 28°C

Purge Ventilation (Natural)

Purge ventilation provision is required in each habitable room to comply with Part F of the Building Regulations. This should be capable of extracting a minimum of 4ach⁻¹, per room directly to outside. The 4ach⁻¹ is a minimum air change rate set out in the Building Regulations and is likely to be exceeded in reality through the opening of glazing.

The IES VE software also incorporates opening glazing into the calculations with the use of Macroflo. Although the Building Regulations give a fixed air change rate, the Macroflo software allows for all variables such as area of openable glazing, distance glazing can open and external conditions. This gives more accurate results regarding natural ventilation.

CIBSE TM59:2017 has set the following conditions for occupancy and when glazing and internal doors can be assumed to be open:

- Occupants will open glazing in an occupied room when the internal temperatures exceed 22°C. This is referred to as the threshold temperature.
- If a room is not occupied then the glazing is assumed to be closed, unless the glazing can be locked for security reasons and is weather proofed.

Infiltration

Infiltration is the uncontrolled exchange of air between inside a building and outside through cracks, porosity and other unintentional openings in the building, caused by the pressure difference effects of the wind and/or stack effect. It is assumed that 0.15ach⁻¹ will be achieved through infiltration.

Profiles

Profiles are assigned to the model for occupancy, weather and internal gains. This allows an accurate assessment to be carried out taking into account all particulars that could affect the internal temperature of a dwelling.

Occupancy Profiles and Internal Equipment Gains

CIBSE TM59:2017 sets out proposed people and internal equipment gains that should be used for dynamic simulations, when assessing the risk of overheating in homes. The proposed gains are shown in **Tables 5.2** and **5.3** below:

Dwelling Type and Room:	People Gains:		
	No. of People:	Sensible Peak Load (kW):	Latent Peak Load (kW):
Single bedroom	1	75	55
Double bedroom	2	150	110
Studio dwelling	2	150	110
1 bed – living rooms / kitchens / living and kitchens	1	75	55
2 bed – living rooms / kitchens / living and kitchens	2	150	110
3 bed – living rooms / kitchens / living and kitchens	3	225	165

Table 5.2 People gains for each room type

Description:	Room Type:						
	Single Bedroom	Double Bedroom	Studio	Living & Kitchen	Living Room	Kitchen	Common Area
Equipment gains (kW)	80	80	450	450	150	300	N/A
Lighting profile (W/m ²)	2	2	2	2	2	2	2

Table 5.3 Equipment gains and lighting profile

The following graphs show the time periods and factors that are to be applied for the people and internal gains for each room type:

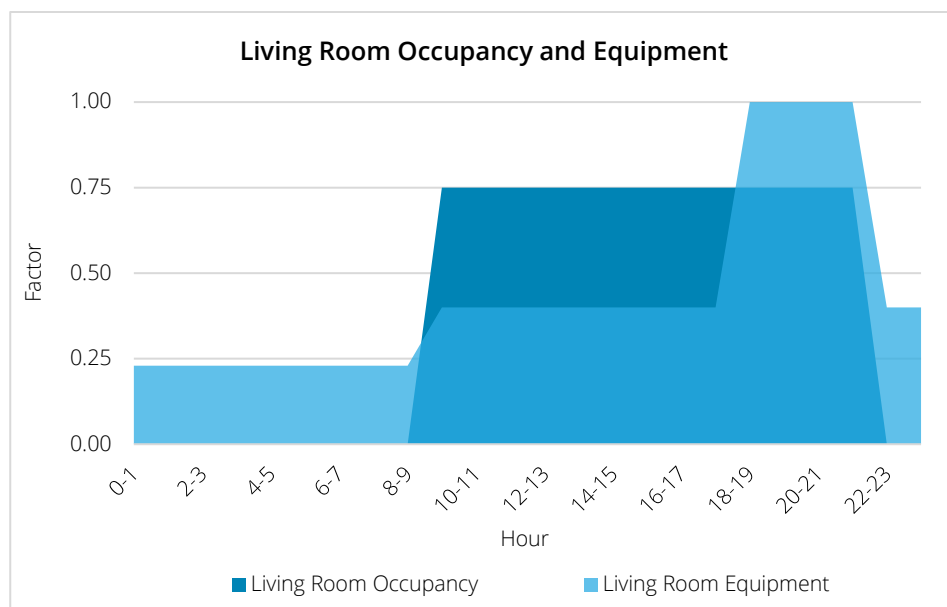


Figure 5.3 Living room occupancy and internal gains profile

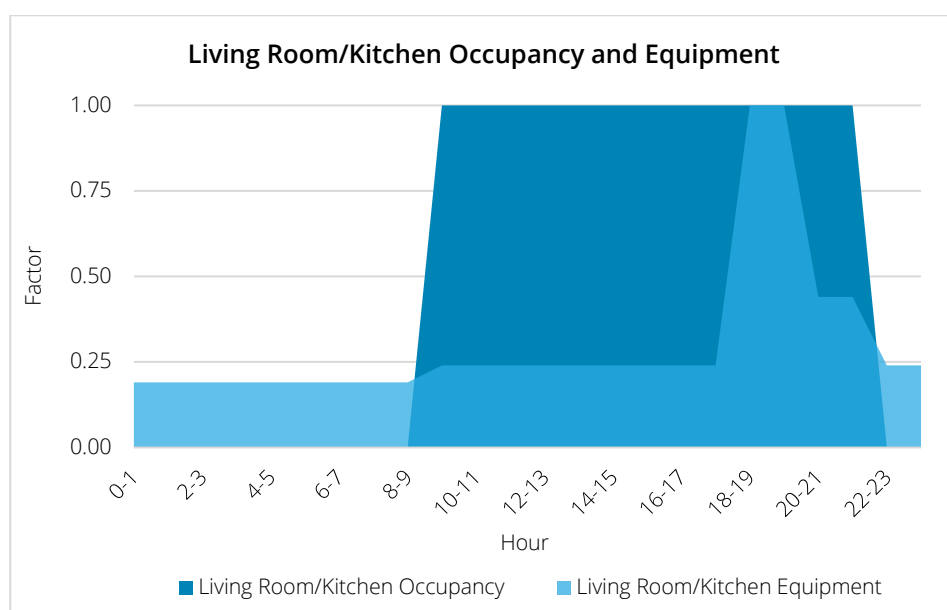


Figure 5.5 Living room/kitchen occupancy and internal gains profile

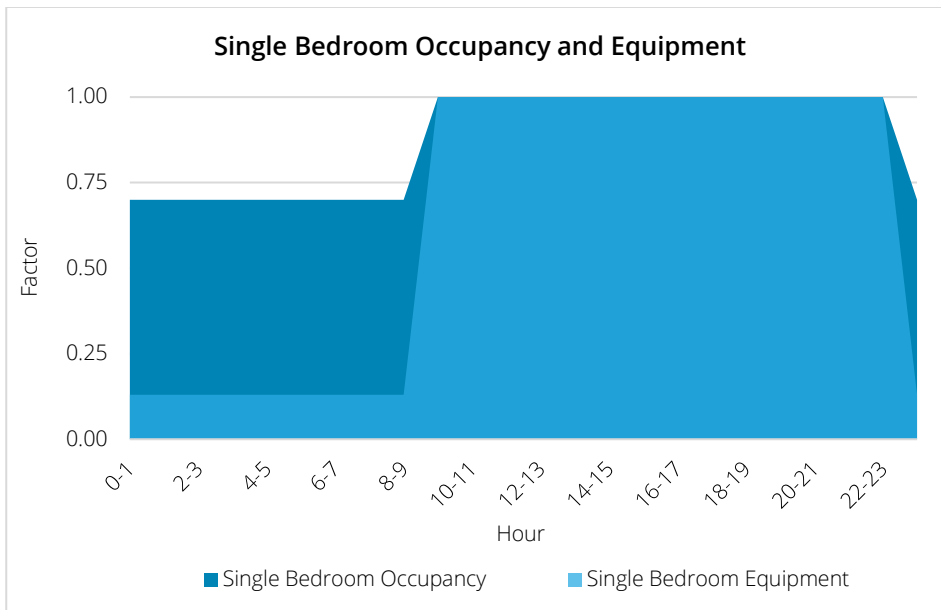


Figure 5.6 Single bedroom occupancy and internal gains profile

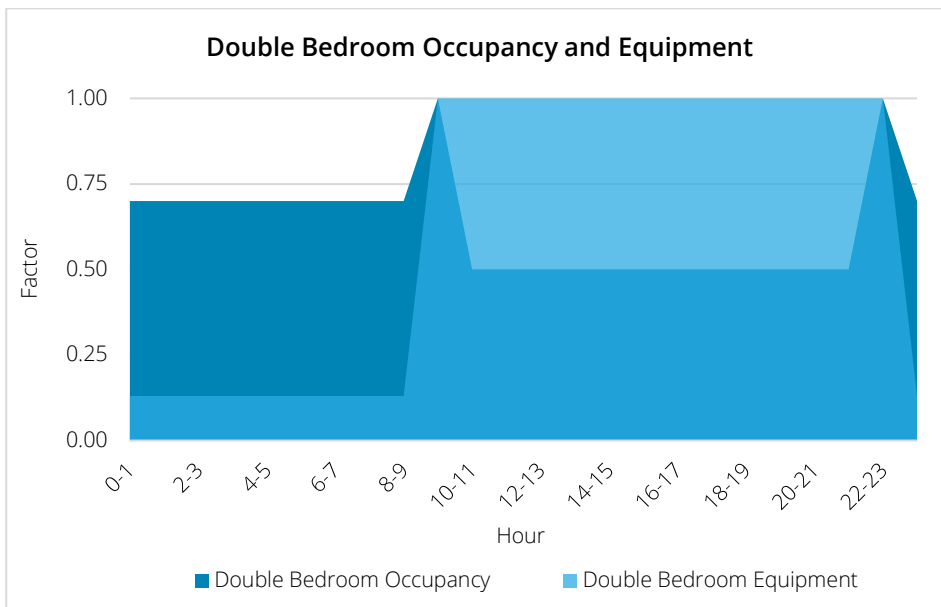


Figure 5.7 Double bedroom occupancy and internal gains profile

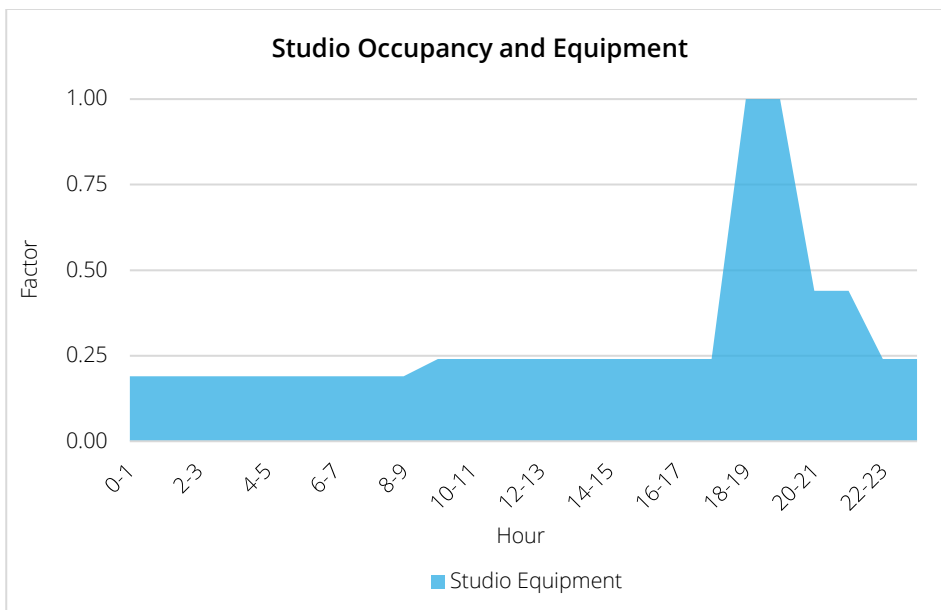


Figure 5.8 Studio occupancy and internal gains profile

The above graphs indicate that the living rooms are assumed to be occupied between 9am to 10pm and the bedrooms are constantly occupied for 24 hours.

Study areas are assumed to have similar profiles to living rooms, and therefore have been assigned with the 1 or 2 Bed Living Room profile.

Twin bedrooms have been assessed as double bedrooms.

Weather Files

CIBSE released a new set of weather files for London in the middle of 2016. This included weather sets for three Design Summer Years (DSY) – 1976, 1989 and 2003. The current DSY is 1989 which represents a moderately warm summer. 1976 is a more extreme year with a long period of persistent warmth and 2003 is another extreme year which has a more intense single warm spell.

CIBSE Technical Memorandum 49, 2014 – Design Summer Years for London, provides guidance for which weather files are to be used. The current DSY (1989) is suitable for assessing buildings under the current climate; however, as it is impossible to prejudge the impact of warm weather conditions, CIBSE TM49:2014 recommends that all three weather files be used to investigate the sensitivity of the design to different weather conditions.



Data from three weather stations have been examined and are available for use in simulation. London Heathrow Airport (LHR) is a representative of intermediate urban and suburban locations. London Gatwick Airport (GTW) and London Weather Centre (LWC) provide representative sites for rural and inner urban locations, respectively. As the proposed development is located in the Crouch End area of Hornsey, North London, the LHR weather profile will be applied.

CIBSE TM59:2017 requires the DSY most appropriate to the location of the development to be used, for the 2020s with high emissions and 50% percentile scenario. The 2020s period is of particular interest as this relates to the period 2011-2040, which is the period we are now in. The 50% percentile changes are viewed as the 'best guess' level of change.

In this report, all habitable rooms will be assessed using the current DSY (1989) weather file, for the 2020s, with high emissions and 50% percentile scenario.

5.0 Shading and Obstructions

Shading

Radiant heat from the sun passes through glass and is absorbed by building elements and furnishings which re-radiate heat back into the space. Re-radiated heat has a longer wavelength and cannot pass back through the glass as easily, thus trapping the radiant heat causing heat gains in the dwelling.

Unprotected glass is often the greatest source of unwanted heat gain in a building. Therefore, it is important to add shading to the model to give a more accurate value for heat gains in the dwellings as the shading will reduce these temperatures.

Building Shading

The first type of shading the glazing will get is from local sources such as overhangs and balconies from the floors above. This is shown on **Figure 5.2** and gives an idea of how the shading from the balconies and protruding walls limit the direct sunlight onto the glazing.

Obstructions

The second type of shading to consider is that which is cast from other buildings or obstructions in the surrounding area. These obstructions can reduce the solar gains by blocking the sun lights path to the modelled building.

6.0 Results

For ease of reference, the CIBSE TM59:2017 criteria are summarised below:

- **Criterion 1** – *For living rooms, kitchens and bedrooms:* A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling fails, then the whole dwelling is assumed to fail.

The current DSY CIBSE weather file (1989) for LHR was used to assess the proposed development as it is in an inner urban location. The 2020s, with high emissions and 50% percentile scenario was applied as required in CIBSE TM59:2017.

The following scenarios were modelled:

- Scenario 1 – A g-value of 0.42 was applied to all glazing. Windows were assumed to be open to 20 degrees and only when the internal room temperature reached 22°C and external temperature was lower. The results indicated that 6 of the 21 rooms failed to comply with the CIBSE TM59:2017 criteria.
- Scenario 2 – For the next simulation, a g-value of 0.4329 was applied to selected doors due to manufacturers constraints. This did not have a significant impact on the results as the number of rooms failing remained at 6.
- Scenario 3 – For the final simulation, blinds were applied to windows in failing rooms. This reduced the total number of failing room to 4 out of 21.
- Comfort cooling required in these rooms.

With the above scenario applied, all rooms comply with CIBSE TM59 criteria.

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

Running the simulation with the glazing having a g-value of 0.42, indicated that all all spaces complied.

The tables in **Appendix A** show the detailed results for all rooms in the dwellings, and **Appendix B** for all rooms in the common areas.

7.0 Discussion

Why Are Rooms Failing?

All failing rooms fail Criterion 2, which indicates that air flow is the main issue. Due to security reasons, windows are only allowed to open 20 degrees. These rooms cannot open fully open windows at night to allow for sufficient night time cooling.

Possible Improvements

Increasing the openable area of the window in this room will improve the results by enabling more air flow.

8.0 Conclusion

The Hornsey Town Hall development is situated in an urban area. Therefore, the CIBSE LHR weather file has been used for the 2020s, high emissions and 50% percentile scenario. This is in line with the criteria in CIBSE TM59:2017.

Results from the final simulation indicate that with the following strategy, only 1414 rooms still fail to comply with CIBSE TM59:2017 criteria:

- G value 0.42
- G value 0.4329 to selected doors
- Windows & Doors openable 20 degrees
- Internal doors open 24hrs
- Amended windows as per markup 07.12.20
- NTC to all bedrooms 1st and 2nd floors
- NTC to living rooms tilted windows 1st & 2nd floors
- NTC to rooms with tilted windows and half height bedroom window only on ground floor
- Blinds

Comfort cooling will be required where the above improvements cannot be applied.

With the above scenario applied, all rooms comply with CIBSE TM59 criteria.

In order to prevent occupants becoming uncomfortable during hot weather, a manual on how to keep cool in the summer should be provided, highlighting the importance of keeping glazing open when possible, to provide purge ventilation, especially during the night when external temperatures are cooler, and the use of internal blinds during daylight hours, to reduce solar gains entering a room.

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

The common areas will be provided with environmental ventilation to all corridors. This is achieved through an extract fan located at the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach⁻¹ permanently
- 2ach⁻¹ when the internal temperature exceeds 25°C
- 3ach⁻¹ when the internal temperature exceeds 28°C

With the above specification applied, all common area rooms assessed comply with the CIBSE TM59:2017 recommendations. This indicates that the internal operative temperature should remain at an acceptable level.



A.1 Appendix A – Detailed Results for Scenario 1-3

Attached to this Appendix are the detailed results for Scenarios 1-3 for dwellings.

Scenario 1:

- G value 0.42
- Windows & Doors openable 20 degrees
- Internal doors open 24hrs
- Amended windows as per markup 03.12.20
- NTC to all bedrooms 1st and 2nd floors
- NTC to living rooms tilted windows 1st & 2nd floors
- NTC to rooms with tilted windows and half height bedroom window only on ground floor

Room Name	Criteria 1	Criteria 2	Pass/Fail
PM 001 Bedroom	0.4	16	PASS
PM001 Living/ kitchen	0.2		PASS
PM002 Bedroom 1	0	15	PASS
PM002 Bedroom 2	0.3	16	PASS
PM002 Living/ Kitchen	0.1		PASS
PM003 Bedroom 1	0	18	PASS
PM003 Bedroom 2	0.4	41	FAIL
PM003 Living/ Kitchen	0.2		PASS
PM101 Bedroom	0.5	44	FAIL
PM101 Living/ Kitchen	0.4		PASS
PM102 Bedroom	0	35	FAIL
PM102 Living/ Kitchen	0		PASS
PM103 Bedroom 1	0.3	23	PASS
PM103 Bedroom 2	0.2	26	PASS
PM103 Living/ Kitchen	0.1		PASS
PM201 Bedroom	1.8	24	PASS
PM201 Living/ Kitchen	2.2		PASS
PM202 Bedroom	2.2	59	FAIL
PM202 Living/ Kitchen	3.3		FAIL
PM203 Bedroom	2.6	37	FAIL
PM203 Living/ Kitchen	2.9		PASS
			6

Scenario 2:

- G value 0.42
- G value 0.4329 to selected doors
- Windows & Doors openable 20 degrees
- Internal doors open 24hrs
- Amended windows as per markup 03.12.20 and 17.12.20
- NTC to all bedrooms 1st and 2nd floors
- NTC to living rooms tilted windows 1st & 2nd floors
- NTC to rooms with tilted windows and half height bedroom window only on ground floor

Room Name	Criteria 1	Criteria 2	Pass/Fail
PM 001 Bedroom	0.4	16	PASS
PM001 Living/ kitchen	0.3		PASS
PM002 Bedroom 1	0	15	PASS
PM002 Bedroom 2	0.3	16	PASS
PM002 Living/ Kitchen	0.1		PASS
PM003 Bedroom 1	0.1	18	PASS
PM003 Bedroom 2	0.4	42	FAIL
PM003 Living/ Kitchen	0.2		PASS
PM101 Bedroom	0.5	43	FAIL
PM101 Living/ Kitchen	0.4		PASS
PM102 Bedroom	0	35	FAIL
PM102 Living/ Kitchen	0		PASS
PM103 Bedroom 1	0.3	23	PASS
PM103 Bedroom 2	0.2	26	PASS
PM103 Living/ Kitchen	0.1		PASS
PM201 Bedroom	1.8	24	PASS
PM201 Living/ Kitchen	2.2		PASS
PM202 Bedroom	2.2	59	FAIL
PM202 Living/ Kitchen	3.3		FAIL
PM203 Bedroom	2.6	37	FAIL
PM203 Living/ Kitchen	2.9		PASS
			6

Scenario 3:

- G value 0.42
- G value 0.4329 to selected doors
- Windows & Doors openable 20 degrees
- Internal doors open 24hrs
- Amended windows as per markup 03.12.20 and 17.12.20
- NTC to all bedrooms 1st and 2nd floors
- NTC to living rooms tilted windows 1st & 2nd floors
- NTC to rooms with tilted windows and half height bedroom window only on ground floor
- Blinds

Room Name	Criteria 1	Criteria 2	Pass/Fail
PM 001 Bedroom	0.4	16	PASS
PM001 Living/ kitchen	0.3		PASS
PM002 Bedroom 1	0	15	PASS
PM002 Bedroom 2	0.3	16	PASS
PM002 Living/ Kitchen	0.1		PASS
PM003 Bedroom 1	0	18	PASS
PM003 Bedroom 2	0.2	41	FAIL
PM003 Living/ Kitchen	0.1		PASS
PM101 Bedroom	0.2	39	FAIL
PM101 Living/ Kitchen	0.4		PASS
PM102 Bedroom	0	30	PASS
PM102 Living/ Kitchen	0		PASS
PM103 Bedroom 1	0.5	24	PASS
PM103 Bedroom 2	0.2	26	PASS
PM103 Living/ Kitchen	0.1		PASS
PM201 Bedroom	2.7	29	PASS
PM201 Living/ Kitchen	3		PASS
PM202 Bedroom	0.7	48	FAIL
PM202 Living/ Kitchen	1.3		PASS
PM203 Bedroom	1.4	33	FAIL
PM203 Living/ Kitchen	2.3		PASS
			4

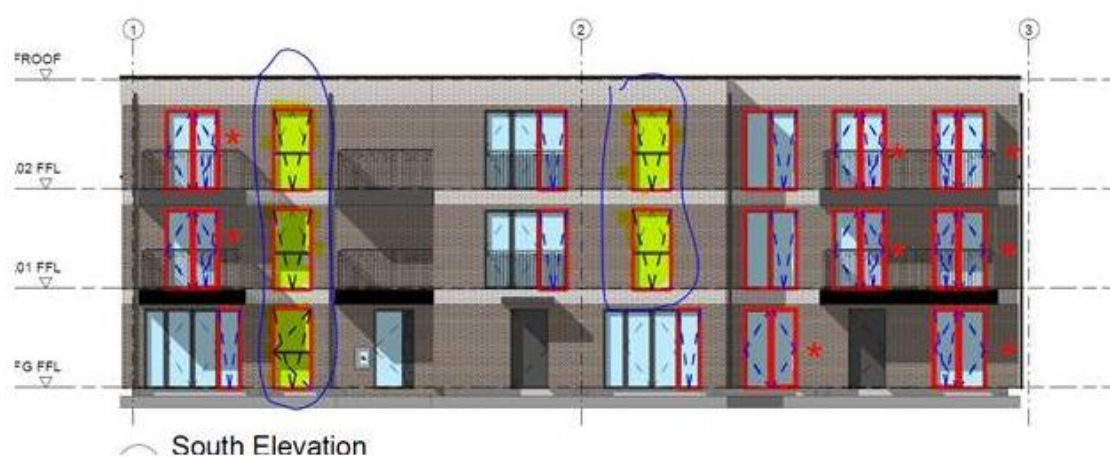
A.2 Appendix B – Detailed Results for Common Areas

Attached to this Appendix are the detailed results for the common areas when a g-value of 0.42 is applied.

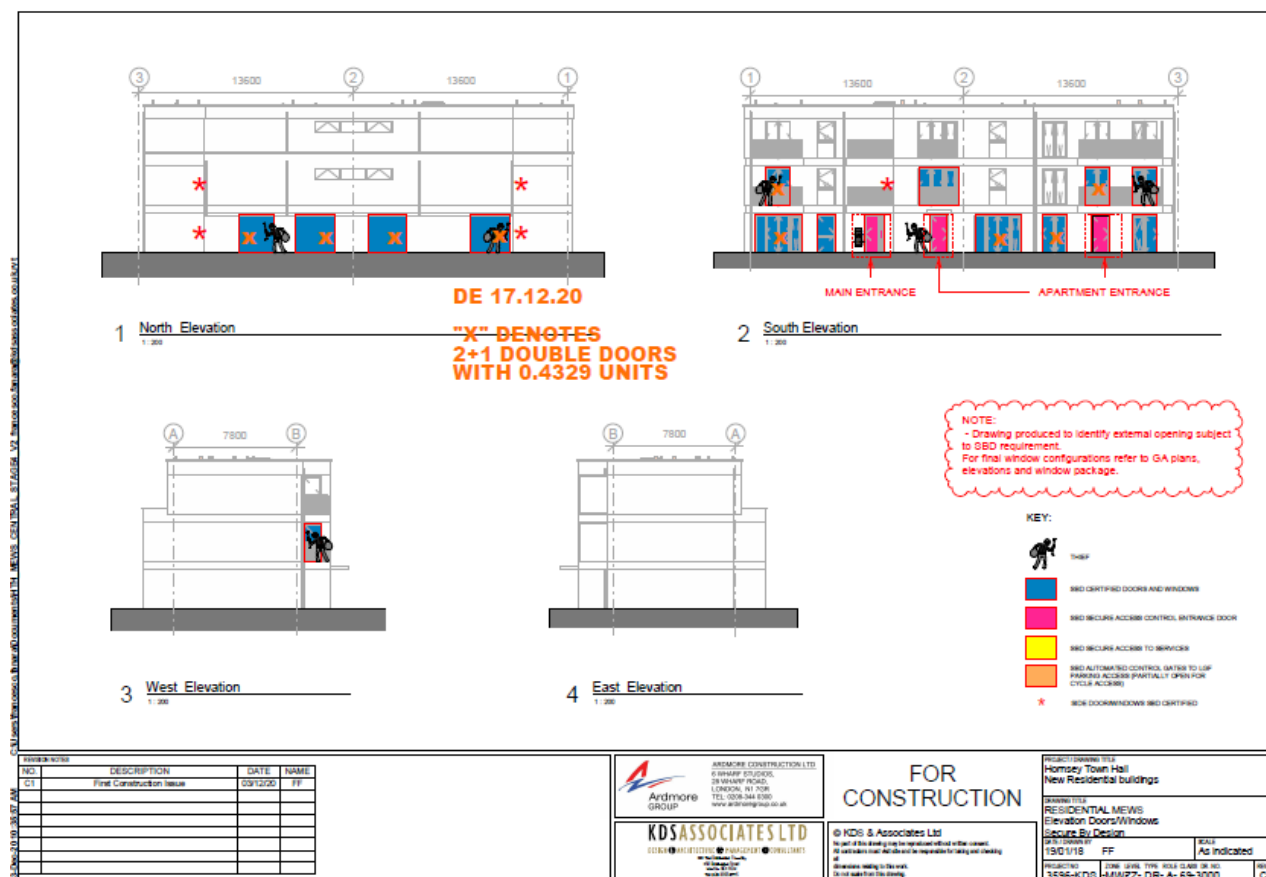
Level/Room Name:	Internal Temperatures >28°C				
	No. of hours >28°C	>1% of annual hours	>2% of annual hours	>3% of annual hours	Pass/Fail to CIBSE TM59:2017
Common Area Stairs (GF)	54	No	No	No	PASS
Common Area (GF)	0	No	No	No	PASS
Common Area Stairs (1st)	9	No	No	No	PASS
Common Area (1st)	22	No	No	No	PASS
Common Area Stairs (2nd)	41	No	No	No	PASS
Common Area (2nd)	17	No	No	No	PASS
Number of Common Areas Failing:					0

A.3 Appendix C – Window Changes

Mark up of window opening changes received 03.12.20



Drawings showing location of windows with g value of 0.4329 received 17.12.20



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WHITECODE
CONSULTING

Hornsey Town Hall Block A

Summer Overheating Assessment

CIBSE TM59:2017

Prepared for Ardmore Group

10687-S-OHTG-0001

Revision AB

26.02.2020



WHITECODE
CONSULTING

Executive Summary

The following report has been produced to assess the dwellings and common areas within Block A at Hornsey Town Hall development against the following criteria set out in CIBSE Technical Memorandum 59 – *Design methodology for the assessment of overheating risk in homes* (TM59:2017):

- **Criterion 1** – *For living rooms, kitchens and bedrooms*: A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling does not meet the above criteria, then the whole dwelling fails to comply.

The building was simulated using Integrated Environmental Solutions (IES) Virtual Environment (VE) 2023 version 2019.0.1.0, a software suite accredited under CIBSE AM11 for the dynamic simulation of building energy and thermal modelling, to assess the dwellings using the latest CIBSE Design Summer Year (DSY) weather file for London Heathrow (LHR), for the 2020s, high emissions, 50% percentile scenario.

CIBSE TM59:2017 sets out the occupancy profiles for each room. Bedrooms are assumed to be occupied for 24 hours and living rooms and kitchens from 9am to 10pm. It can be assumed that occupants will open glazing in an occupied room when the internal temperature exceeds 22°C. Glazing can only be assumed to be open in unoccupied rooms if they can be locked for security and are weather proofed.

The preferred glazing g-value for the proposed scheme is 0.42 and 0.4329 to lower ground, ground and 1st floor external doors. This reduces solar gains but also still provides sufficient natural daylight, where a lower g-value can often be too dark causing discomfort and an increase in the demand for space heating and artificial lighting.

Glazing in the development consists mainly full height openable side hung doors, full height fixed and half height opening glazed panels. Night-time cooling (NTC) has been applied to all bedrooms and living rooms above first floor with windows. It is worth noting that some occupants may not operate their windows in this way, and this should be stated in the home manual as a way to reduce the risk of overheating.

Several simulations were run starting with the above specification and then introducing more enhanced passive measures to enable all rooms to pass.

The final strategy used is as follows:

- G value 0.42 and 0.4329 to selected windows
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- NTC and No NTC profile changed to open at 22 degrees C
- 2-5th floor windows and external doors open all day/night in bedrooms
- 2-5th floor external doors open all day in living rooms and 100mm at night
- Tilt and turn external doors introduced in selected lower ground, ground and first floor to enable NTC.
- MVHR 0.3 l/s/m²
- Blinds in selected rooms
- Comfort cooling where required

With the above strategy, all rooms in Block A pass CIBSE TM59:2017.

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

The common areas will be provided with environmental ventilation. This is achieved through an extract fan located at the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach-1 permanently
- 2ach-1 when the internal temperature exceeds 25°C



- 3ach-1 when the internal temperature exceeds 28°C

With the above specification applied, all common area rooms assessed comply with the CIBSE TM59:2017 recommendations. This indicates that the internal operative temperature should remain at an acceptable level.



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Revisions:

Rev No.:	Date:	Status/Comments:	Prepared by:	Checked by:
1	26.02.20	Preliminary Issue for Comments	KAV	EH
2	14.07.20	Updated results	KAV	EH
3	27.07.20	G value adjustment	KAV	EH
4	21.04.22	Amendments to windows due to manufacturer and security constraints	KAV	EH
5	15.08.24	As Built	PM	JM

1.0 Introduction

There are many factors that will determine indoor summer temperatures in dwellings in the UK. These factors include the following:

- The external climate (which will vary with location in the UK)
- Location
- Dwelling orientation
- Room type
- Time of day
- Building fabric characteristics
- Occupant behaviour
- Adjacent buildings and local shading

Current modelling based evidence suggests that the South of the UK is likely to face the largest risk of indoor overheating. It was suggested that comfort targets will not be met in naturally ventilated buildings in London by the middle of the century without some form of mechanical cooling unless some additional adaption measures are carried out (CIBSE 2005). In contrast, it was estimated that Manchester and Edinburgh buildings will only encounter minor overheating problems within the same time frame.

There are a variety of methods that can be used to reduce the risk of indoor overheating and are split into what can be regulated and what cannot be regulated. These are shown in **Tables 1.1** and **1.2**.

What can be regulated	
Air movement	Moving air feels a couple of degrees cooler than still air.
Insulation	Insulation is usually connected with winter warmth, but just as a thermos flask can keep drinks either hot or cold, insulated walls can help homes stay cool. However, insulation won't cool dwellings down if they overheat.
Shading	Strong sunlight through glazing can heat up dwellings. Awnings and internal or external shutters on south and west facing glazing provide shade.
Cooling devices	Evaporative coolers and air conditioners can be installed relatively cheaply. However, unlike the passive measures above, these require power, thereby increasing the carbon footprint of the dwelling and contributing to climate

What can be regulated	
	change. They also pump waste heat into their surroundings, making the surrounding area even hotter.
Low energy	Use low energy light bulbs and appliances.
Ventilation	Replacing the warm air in dwellings with cooler air.
Roofs	As with walls, insulation can help keep dwellings cool in summer. Improving loft insulation is one method, but green roofs are also an option. These use a base layer on which plants can grow, creating biodiversity space for plants and animals and providing a layer of roof insulation.
Outside	Water features help keep surroundings cool by evaporation, and trees provide shade in the summer. Deciduous trees are best, as the leaves drop off in the winter, allowing extra light into your home.
Glazing	Special coatings on glazing reduce the amount of sunlight that can pass through.

Table 1.1 Methods of reducing risk of overheating that can be regulated

What cannot be regulated	
Reducing heat gain	Heat doesn't just come from the sun. Home devices and appliances such as televisions, computers and light bulbs also make a significant contribution. Turning the kitchen fan on while cooking will help.
Windows	Open windows when it's cooler outside than inside, especially at night.
Curtains	Close curtains, blinds or shutters during the day, or use awnings to shade the glazing.
Fans	Use desk or ceiling fans to create a cooling breeze.

Table 1.2 Methods of reducing risk of overheating that cannot be regulated

An unintended consequence of improved building fabric of newly built dwellings may be an increased risk of overheating. Newly constructed highly insulated dwellings were found to have the potential to be at higher risk of overheating than older, less insulated dwellings.

Criterion 3 of Part L1A of the Building Regulations sets out the approach to limiting heat gains within dwellings during the summer months. Appendix P, 'Assessment of Internal Temperature in Summer' within the SAP document provides the calculation methodology to be used to assess a dwelling. Reasonable provision is achieved if the SAP assessment indicates that the dwelling does not have a high risk of high internal temperatures.

This is a self-contained simplified calculation of the whole dwelling average peak internal temperature for a proposed design. It takes into account solar gain (taking account of orientation, shading and glazing transmission); ventilation (taking account of window opening in hot weather), thermal capacity and mean summer temperature for the location of the dwelling. A dwelling is considered to have a high risk of overheating when internal temperatures reach 23.5°C. Appendix P also refers its users to an Energy Saving Trust (EST) guide, CE 129, 'Reducing overheating – a designer's guide', which is based on the use of overheating degree-hours above 27°C.

The assessment should be carried out regardless of whether or not the dwelling has mechanical cooling and if it does have mechanical cooling it should be assessed without it.

Part L1A of the Building Regulations states that designers may want to exceed the requirements in the current Building Regulations. Dynamic simulations allow more scenarios to be included within the model providing a more detailed and accurate set of results.

This report ascertains whether the dwellings will overheat within Block A. Suggestions on how to avoid overheating involving different glazing specifications, purge ventilation and external shading are provided in this report.

In the event that dwellings are still overheating following implementation of all suitable measures, mechanical cooling may be required. From the results it will be concluded whether extra measures are required to comply with the recommendations within CIBSE TM59:2017.

1.0 Thermal Design Criteria

There are no regulations which deal with overheating in domestic situations. CIBSE have produced Technical Memorandum 59 – *Design methodology for the assessment of overheating risk in homes* (TM59:2017) to provide guidance on how to assess the risk of overheating in homes and common areas. The document states the following:

“Overheating risk has been a growing concern amongst the domestic design, construction and provider community for at least a decade. Domestic overheating has not always been a problem in the UK but climate change, increased urbanisation, construction of highrise apartment blocks and winter energy efficiency measures have all contributed in the amplification of high internal temperatures. Homes that overheat cause significant discomfort and stress to the occupants and can ultimately lead to litigation and costly mitigation measures for the owners/developers.” (CIBSE TM59:2017 – Section 1, page 1)

CIBSE have created two criteria for defining overheating in free-running buildings. These criteria are summarised below:

- **Criterion 1** – *For living rooms, kitchens and bedrooms*: A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling fails, then the whole dwelling is assumed to fail.

CIBSE TM59:2017 states that “*the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them*”. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

2.0 The Development

The Hornsey Town Hall development is situated in the London Borough of Haringey. A layout showing the proposed development's location is shown in **Figure 3.1**.

The proposed development will comprise a newly refurbished 3-storey mixed-use Hornsey Town Hall, a mixed-use 2-storey Broadway Annexe, two 7-storey residential buildings - Block A and Block B, and a 2-storey residential mews building.

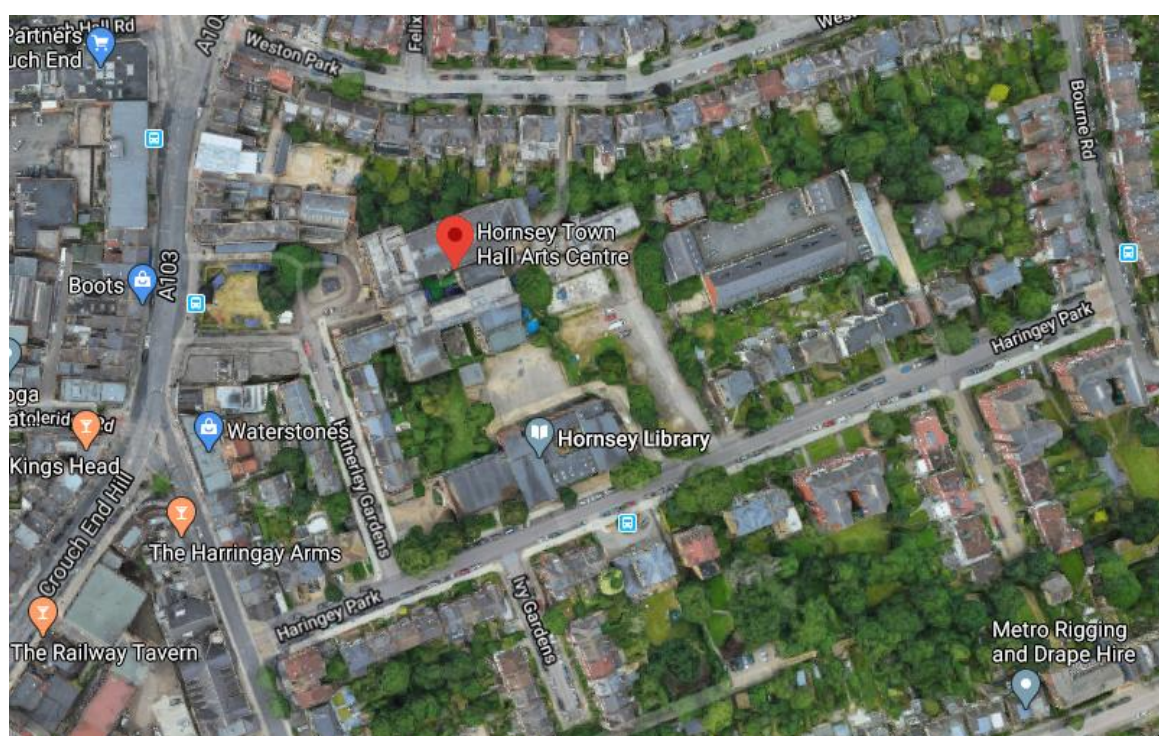


Figure 3.1 Hornsey Town Hall Development

3.0 Orientation

The orientation of the building can have a big effect on the solar gains within a dwelling. South facing facades are more likely to overheat in the summer months as they are subject to the sun for longer periods of the day. East and West facades also are subject to the sun, the East facing in the morning, and the West in the afternoon. This means that they are also subject to solar gain during the day. The North façade will have little exposure to the sun; therefore, will not suffer from solar gains. The sun path diagram below confirms the above:

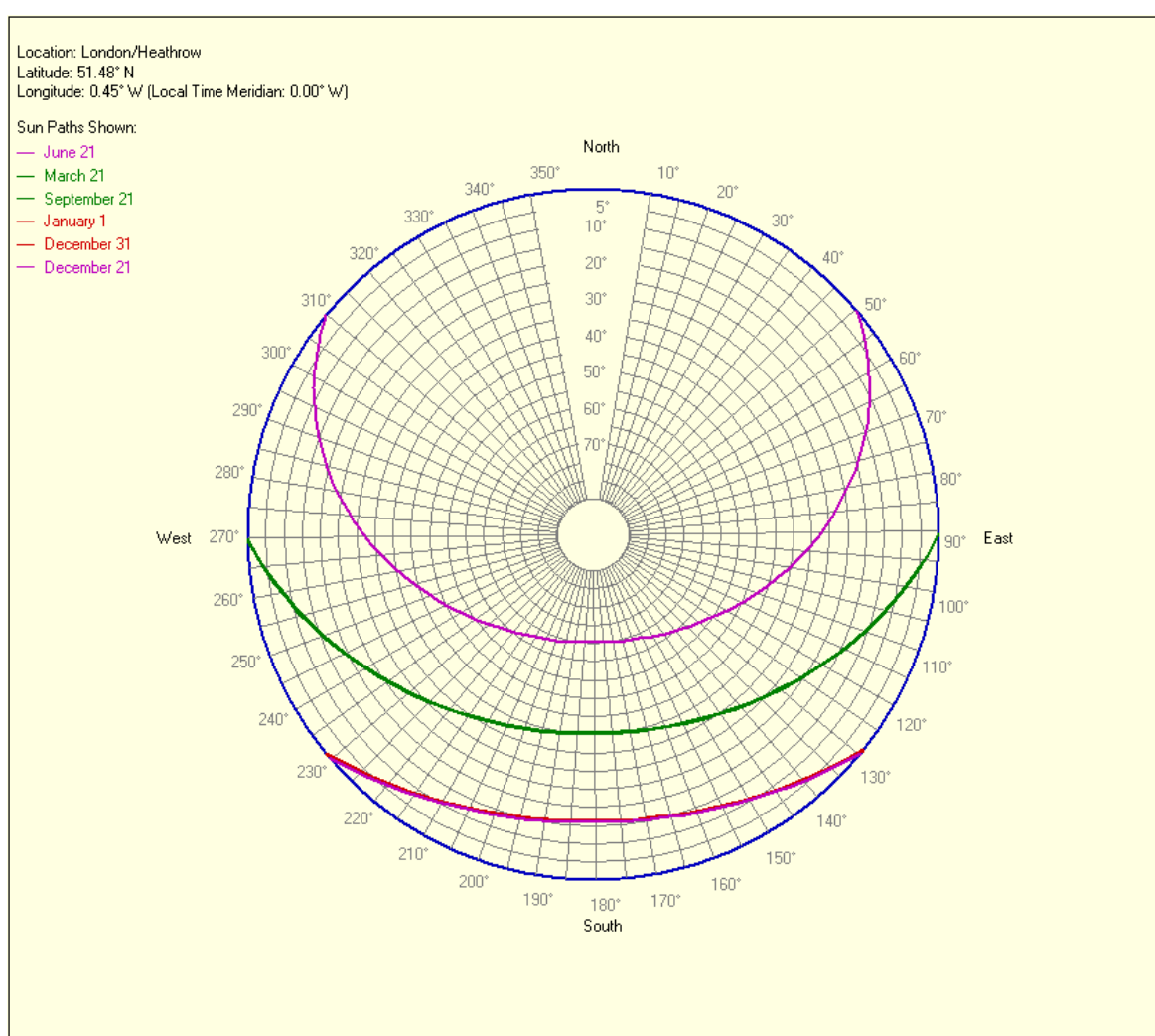


Figure 4.1 Sun path diagram for each season

4.0 The Model

A dynamic 3D model of the Block A was produced using drawings issued by KDS Associates in August 2019.

All dwellings and common areas have been modelled to provide a good representation of the overheating risk across the development.

In order to calculate the internal operative temperatures of the dwellings and common areas at different times of day, a model was built using Integrated Environmental Solutions Virtual Environment (IES VE) software, version 2019.0.1.0. This model takes into account a range of issues that could have an impact on the building's performance, including building fabric, orientation and external conditions.

Building the Model

The first stage of building the model was to produce a 2D template of each floor. The templates were created using floor plans issued by KDS Associates.

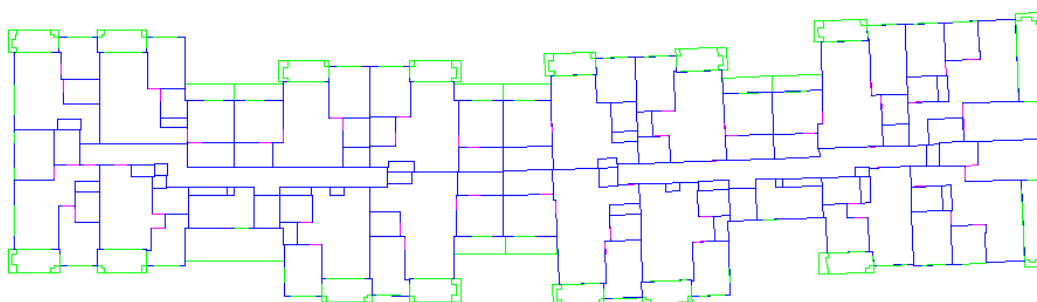


Figure 5.1 IES VE 2D template of example floor plan in Block A

The next stage was to use the templates in IES VE and elevations issued by KDS Associates in July 2019 to create the 3D model of each floor culminating in the complete model as shown below:

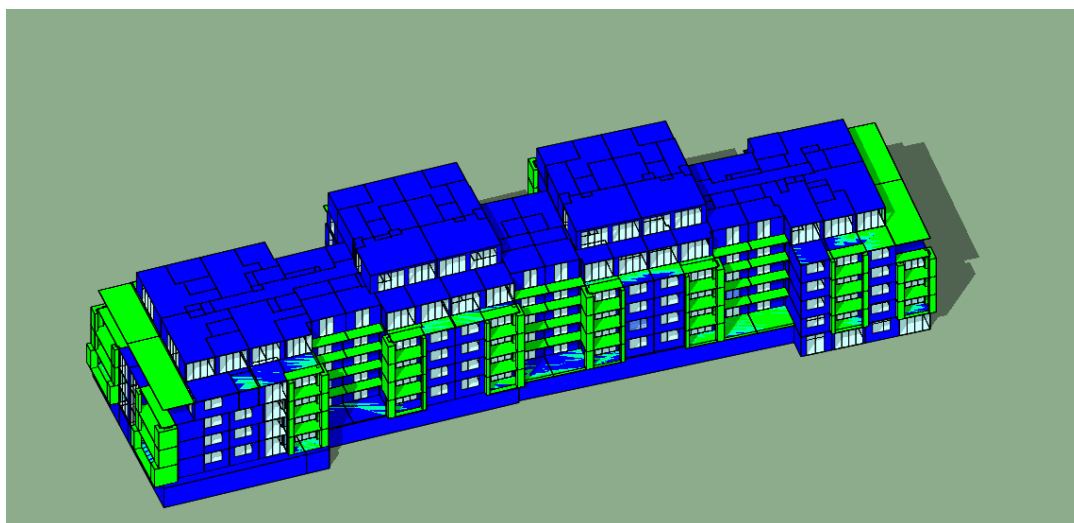


Figure 5.2 IES VE 3D model of Block A.

The rooms shown in blue in Figure 5.2 were modelled to give a good indication of the thermal make-up of the building. This enables an accurate range of internal operative temperatures to be obtained allowing reasonable conclusions for this development to be given. The local shading (green) were modelled for shading purposes.

Building Fabric

The building is constructed from brick work on steel frame with aluminium frame double glazed windows. frame and glazed facades. The following building fabric specification was used for the thermal model.

Element	Thermal Transmittance (W/m ² K)
Ground/Exposed Floor	0.12
External Wall	0.17
Common Area Wall	0.20
Roof	0.13
Glazing	1.40
Internal Front Doors	1.00

Table 5.1 Building fabric U-values

Different glazing g-values have been investigated (calculated to BS EN 410:2011), as detailed in Section 7.0 of this report.

The building's thermal mass is assessed and factored into the calculations. It has been found that although the building does absorb the heat into the structure, this offsets temperatures when the building becomes cooler at a later stage.

Mechanical Ventilation

Balanced heat recovery mechanical ventilation (System 4) is used throughout the building to comply with Part F of the Building Regulations. The proposed model is the Vent-Axia Sentinel Kinetic B unit. This unit has a summer bypass and allows the internal warm stale air to be extracted from the kitchen and wet rooms whilst supplying fresher external air into the habitable rooms. The flow rates have been calculated using the manufacturer's data and each room has been assigned a relevant rate of air change.

The dwellings are to be served by underfloor heating. This will be served via an CHP system with pipework running up the building and through the ceiling voids of the common area corridors. Common areas are to be provided with environmental ventilation to all corridors. This is achieved through an extract fan located at

the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach⁻¹ permanently
- 2ach⁻¹ when the internal temperature exceeds 25°C
- 3ach⁻¹ when the internal temperature exceeds 28°C

Purge Ventilation (Natural)

Purge ventilation provision is required in each habitable room to comply with Part F of the Building Regulations. This should be capable of extracting a minimum of 4ach⁻¹, per room directly to outside. The 4ach⁻¹ is a minimum air change rate set out in the Building Regulations and is likely to be exceeded in reality through the opening of glazing.

The IES VE software also incorporates opening glazing into the calculations with the use of Macroflo. Although the Building Regulations give a fixed air change rate, the Macroflo software allows for all variables such as area of openable glazing, distance glazing can open and external conditions. This gives more accurate results regarding natural ventilation.

CIBSE TM59:2017 has set the following conditions for occupancy and when glazing and internal doors can be assumed to be open:

- Occupants will open glazing in an occupied room when the internal temperatures exceed 22°C. This is referred to as the threshold temperature.
- If a room is not occupied then the glazing is assumed to be closed, unless the glazing can be locked for security reasons and is weather proofed.

Infiltration

Infiltration is the uncontrolled exchange of air between inside a building and outside through cracks, porosity and other unintentional openings in the building, caused by the pressure difference effects of the wind and/or stack effect. It is assumed that 0.15ach⁻¹ will be achieved through infiltration.

Profiles

Profiles are assigned to the model for occupancy, weather and internal gains. This allows an accurate assessment to be carried out taking into account all particulars that could affect the internal temperature of a dwelling.

Occupancy Profiles and Internal Equipment Gains

CIBSE TM59:2017 sets out proposed people and internal equipment gains that should be used for dynamic simulations, when assessing the risk of overheating in homes. The proposed gains are shown in **Tables 5.2** and **5.3** below:

Dwelling Type and Room:	People Gains:		
	No. of People:	Sensible Peak Load (kW):	Latent Peak Load (kW):
Single bedroom	1	75	55
Double bedroom	2	150	110
Studio dwelling	2	150	110
1 bed – living rooms / kitchens / living and kitchens	1	75	55
2 bed – living rooms / kitchens / living and kitchens	2	150	110
3 bed – living rooms / kitchens / living and kitchens	3	225	165

Table 5.2 People gains for each room type

Description:	Room Type:						
	Single Bedroom	Double Bedroom	Studio	Living & Kitchen	Living Room	Kitchen	Common Area
Equipment gains (kW)	80	80	450	450	150	300	N/A
Lighting profile (W/m ²)	2	2	2	2	2	2	2

Table 5.3 Equipment gains and lighting profile

The following graphs show the time periods and factors that are to be applied for the people and internal gains for each room type:

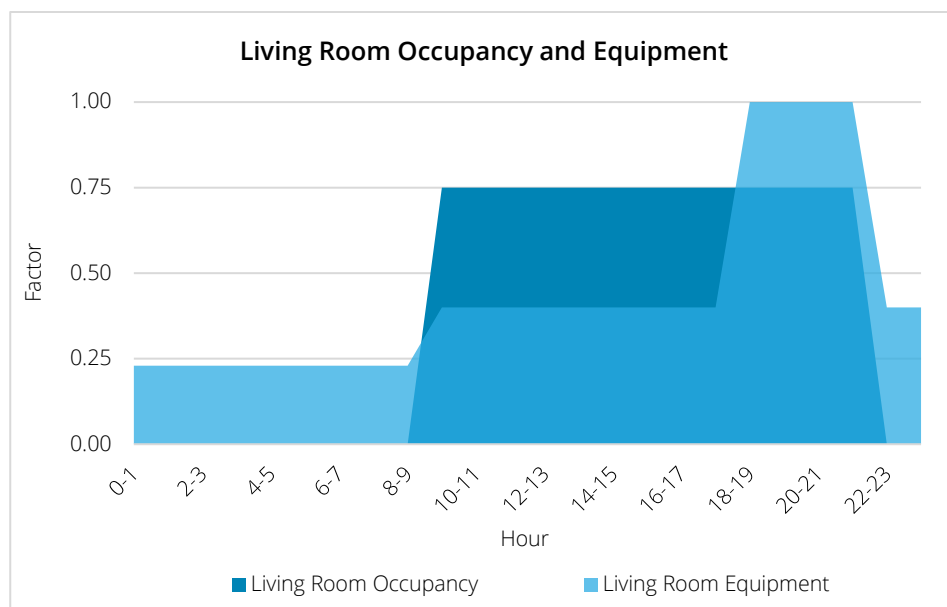


Figure 5.3 Living room occupancy and internal gains profile

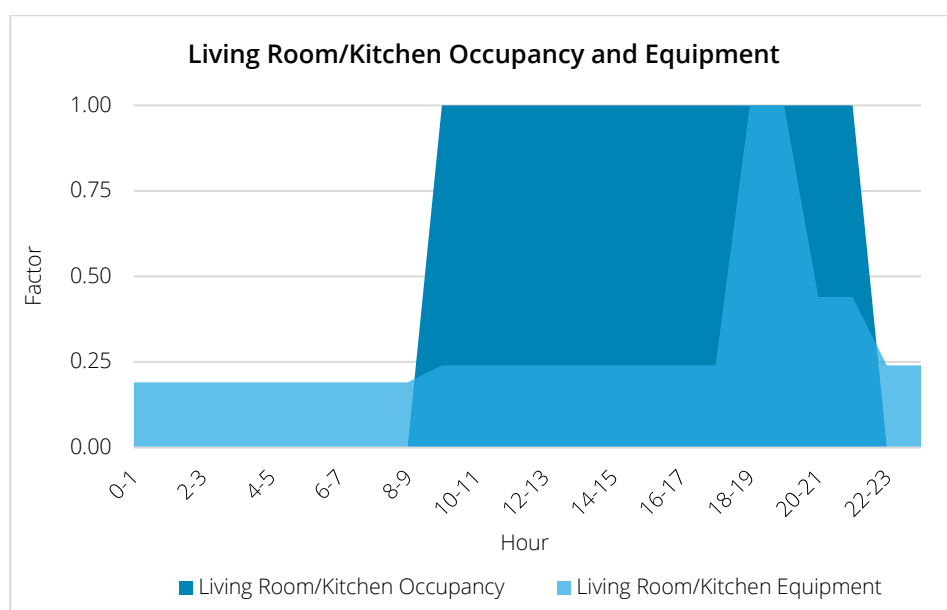


Figure 5.5 Living room/kitchen occupancy and internal gains profile

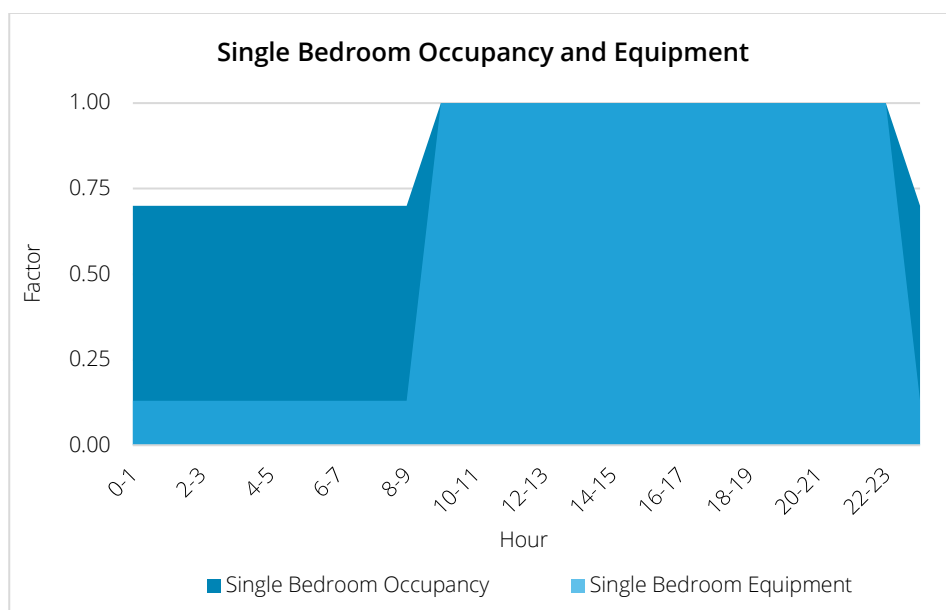


Figure 5.6 Single bedroom occupancy and internal gains profile

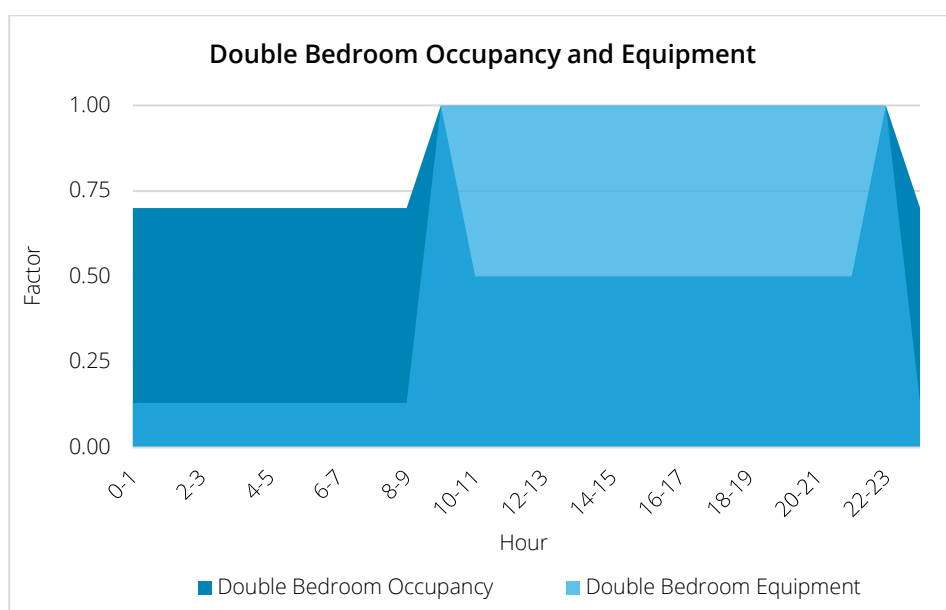


Figure 5.7 Double bedroom occupancy and internal gains profile

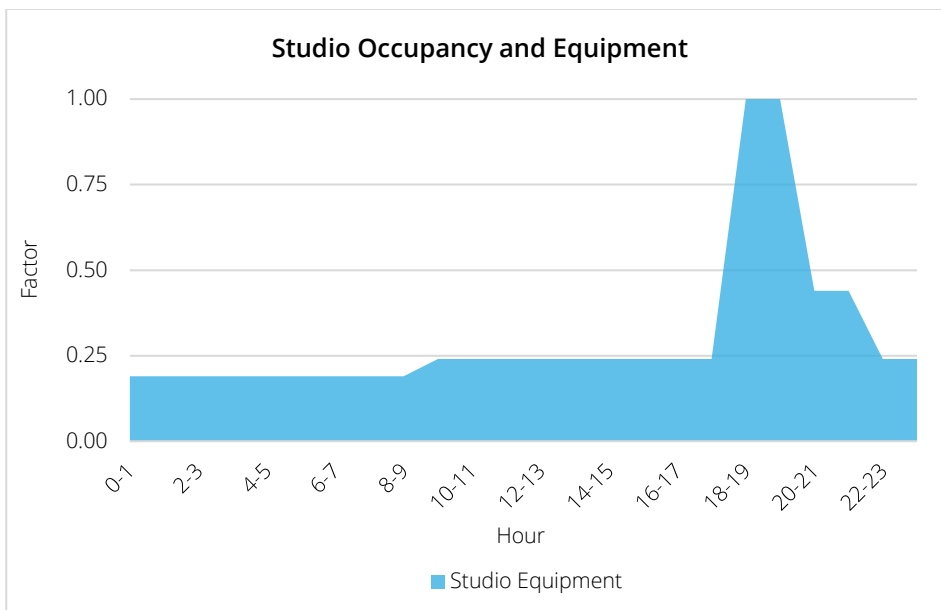


Figure 5.8 Studio occupancy and internal gains profile

The above graphs indicate that the living rooms are assumed to be occupied between 9am to 10pm and the bedrooms are constantly occupied for 24 hours.

Study areas are assumed to have similar profiles to living rooms, and therefore have been assigned with the 1 or 2 Bed Living Room profile.

Twin bedrooms have been assessed as double bedrooms.

Weather Files

CIBSE released a new set of weather files for London in the middle of 2016. This included weather sets for three Design Summer Years (DSY) – 1976, 1989 and 2003. The current DSY is 1989 which represents a moderately warm summer. 1976 is a more extreme year with a long period of persistent warmth and 2003 is another extreme year which has a more intense single warm spell.

CIBSE Technical Memorandum 49, 2014 – Design Summer Years for London, provides guidance for which weather files are to be used. The current DSY (1989) is suitable for assessing buildings under the current climate; however, as it is impossible to prejudge the impact of warm weather conditions, CIBSE TM49:2014 recommends that all three weather files be used to investigate the sensitivity of the design to different weather conditions.

Data from three weather stations have been examined and are available for use in simulation. London Heathrow Airport (LHR) is a representative of intermediate urban and suburban locations. London Gatwick Airport (GTW) and London Weather Centre (LWC) provide representative sites for rural and inner urban locations, respectively. As the proposed development is located in the Crouch End area of Hornsey, North London, the LHR weather profile will be applied.

CIBSE TM59:2017 requires the DSY most appropriate to the location of the development to be used, for the 2020s with high emissions and 50% percentile scenario. The 2020s period is of particular interest as this relates to the period 2011-2040, which is the period we are now in. The 50% percentile changes are viewed as the 'best guess' level of change.

In this report, all habitable rooms will be assessed using the current DSY (1989) weather file, for the 2020s, with high emissions and 50% percentile scenario.

5.0 Shading and Obstructions

Shading

Radiant heat from the sun passes through glass and is absorbed by building elements and furnishings which re-radiate heat back into the space. Re-radiated heat has a longer wavelength and cannot pass back through the glass as easily, thus trapping the radiant heat causing heat gains in the dwelling.

Unprotected glass is often the greatest source of unwanted heat gain in a building. Therefore, it is important to add shading to the model to give a more accurate value for heat gains in the dwellings as the shading will reduce these temperatures.

Building Shading

The first type of shading the glazing will get is from local sources such as overhangs and balconies from the floors above. This is shown on **Figure 5.2** and gives an idea of how the shading from the balconies and protruding walls limit the direct sunlight onto the glazing.

Obstructions

The second type of shading to consider is that which is cast from other buildings or obstructions in the surrounding area. These obstructions can reduce the solar gains by blocking the sun lights path to the modelled building.

6.0 Results

For ease of reference, the CIBSE TM59:2017 criteria are summarised below:

- **Criterion 1** – *For living rooms, kitchens and bedrooms:* A limit is set for the number of hours that the operative temperature can exceed the maximum adaptive temperature. A temperature difference greater than or equal to 1K shall not exceed 3% of the occupied hours of a typical summer (1st May to 30th September).
- **Criterion 2** – *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 (1% of the annual hours between 10pm to 7am for bedrooms is 32 hours).

For a room to be classed as not overheating, both of the above criteria must be passed. If a room within a dwelling fails, then the whole dwelling is assumed to fail.

The current DSY CIBSE weather file (1989) for LHR was used to assess the proposed development as it is in an inner urban location. The 2020s, with high emissions and 50% percentile scenario was applied as required in CIBSE TM59:2017.

The following scenarios were modelled:

- Scenario 1 – A g-value of 0.42 was applied to all glazing. Windows were assumed to be open to 90 degrees and only when the internal room temperature reached 22°C and external temperature was lower. No windows open at night on lower ground, ground and first floor due to security risks. The results indicated that 38 of the 214 rooms failed to comply with the CIBSE TM59:2017 criteria.
- Scenario 2 – For the next simulation, some windows were amended to tilt inwards allowing night time cooling in failing rooms on the lower ground and ground floor bedrooms and failing living rooms. The results indicated that 34 of the 214 rooms failed to comply with the CIBSE TM59:2017 criteria.
- Scenario 3 – For the next simulation, it was discovered during detailed design that some of the windows could only achieve a g-value of 0.4329. The number of rooms failing increased to 35.

- Scenario 4 – The final simulation introduced cream Holland linen blinds with a shading coefficient of 0.40 to the failing rooms. This resulted in only 13 rooms still failing to comply with CIBSE TM59:2017.
- Comfort cooling to this 13 rooms will ensure all rooms comply with CIBE TM59 criteria.

A mark up of the windows with amended g-values is provided in **Appendix C**.

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

Running the simulation with the glazing having a g-value of 0.42, indicated that all 31 spaces complied.

The tables in **Appendix A** show the detailed results for all rooms in the dwellings, and **Appendix B** for all rooms in the common areas.

7.0 Discussion

Why Are Rooms Failing?

9 failing rooms fail Criterion 1, which indicates solar gains is the main issue. The rooms are all located on either the West and East facades, some with dual aspect on the South façade and the majority are located on the top floors with little local shading. The East and West facades attract solar gains early morning and late afternoon respectively, especially during summer months when the sun is in the sky for longer.

The remaining 4 failing rooms are bedrooms located on the lower and ground floors and fail criteria 2 which is associated with air flow. These rooms cannot open fully at night to allow for sufficient night time cooling.

Possible Improvements

To further improve the results there must be changes to other factors. Continuing to decrease the g-value will eventually mean the glazing becomes too dark, which will reduce natural daylight levels. Results from previous simulations already indicated that reducing the g-value has little impact on the results.

Removing the amount of glazing would reduce the amount of solar gains entering the room. Alternatively, introducing more tilt or side hung windows in the living rooms will improve the results in these rooms by enabling night time cooling.

8.0 Conclusion

The Hornsey Town Hall development is situated in an urban area. Therefore, the CIBSE LHR weather file has been used for the 2020s, high emissions and 50% percentile scenario. This is in line with the criteria in CIBSE TM59:2017.

Results from the final simulation indicate that with the following strategy, only 13 rooms still fail to comply with CIBSE TM59:2017 criteria:

- G value 0.4200 and 0.4329 in selected rooms
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- NTC and No NTC profile changed to open at 22 degrees C
- Lower Ground / Ground floor doors tilt and turn 100mm at night
- 1-5th floor doors open all day/night in bedrooms and
- 1-5th floor doors open all day in living rooms and 100mm at night
- MVHR 0.3 l/s/m²
- Blinds in selected rooms

Comfort cooling will be required where the above improvements cannot be applied.

With the above scenario and comfort cooling where required, all rooms comply with TM59 criteria.

In order to prevent occupants becoming uncomfortable during hot weather, a manual on how to keep cool in the summer should be provided, highlighting the importance of keeping glazing open when possible, to provide purge ventilation, especially during the night when external temperatures are cooler, and the use of internal blinds during daylight hours, to reduce solar gains entering a room.

The risk of summer overheating was also assessed for the common area corridors and stair cores. There is no mandatory target to meet for common areas, but if an internal operative temperature of 28°C is exceeded for more than 3% of the total annual hours then this should be identified. 3% of the total annual hours is 262 hours.

The common areas will be provided with environmental ventilation to all corridors. This is achieved through an extract fan located at the top of the mechanical riser which draws the warm stale air from internal to external. The following ventilation rates are proposed:

- 1ach⁻¹ permanently
- 2ach⁻¹ when the internal temperature exceeds 25°C
- 3ach⁻¹ when the internal temperature exceeds 28°C

With the above specification applied, all common area rooms assessed comply with the CIBSE TM59:2017 recommendations. This indicates that the internal operative temperature should remain at an acceptable level.



A.1 Appendix A – Detailed Results for Scenario 1-4

Attached to this Appendix are the detailed results for Scenarios 1-4 for dwellings.

Scenario 1:

- 'G value 0.4200
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- No windows open at night on LG, G and 1st floor as per SBD mark up
- MVHR 0.3 l/s/m²

Room Name:	Criteria 1	Criteria 2	Pass/Fail
AN 01 - 1 Living/Kitchen/Hallway	1.5		PASS
AN 01 - Bedroom	1.6	18	PASS
AN 02 - 2 Living/Kitchen/Hallway	3.1		FAIL
AN 02 - Bedroom 1	1.5	23	PASS
AN 02 - Bedroom 2	0.9	33	FAIL
AN 03 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 03 - Bedroom	1.4	18	PASS
AN 04 - 2 Living/Kitchen/Hallway	0		PASS
AN 04 - Bedroom 1	0.9	15	PASS
AN 04 - Bedroom 2	1.4	16	PASS
AN 05 - 2 Living/Kitchen/Hallway	1.1		PASS
AN 05 - Bedroom 1	0.5	15	PASS
AN 05 - Bedroom 2	0.5	20	PASS
AN 06 - 2 Living/Kitchen/Hallway	1		PASS
AN 06 - Bedroom 1	0.7	16	PASS
AN 06 - Bedroom 2	0.4	19	PASS
AN 07 - 2 Living/Kitchen/Hallway	0.9		PASS
AN 07 - Bedroom 1	0.6	16	PASS
AN 07 - Bedroom 2	0.7	20	PASS
AN 08 - 1 Living/Kitchen/Hallway	1.2		PASS
AN 08 - Bedroom	2.2	24	PASS
AN 09 - 2 Living/Kitchen/Hallway	3.1		FAIL
AN 09 - Bedroom 1	0.9	44	FAIL
AN 09 - Bedroom 2	1.4	47	FAIL
AN 10 - 2 Living/Kitchen/Hallway	1.3		PASS
AN 10 - Bedroom 1	1.8	18	PASS
AN 10 - Bedroom 2	1.1	29	PASS
AN 11 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 11 - Bedroom	2.1	16	PASS
AN 12 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 12 - Bedroom 1	1.7	13	PASS
AN 12 - Bedroom 2	1.6	14	PASS
AN 13 - 1 Living/Kitchen/Hallway	3.4		FAIL
AN 13 - Bedroom	1	15	PASS



AN 14 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 14 - Bedroom 1	1.5	16	PASS
AN 14 - Bedroom 2	0.7	15	PASS
AN 15 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 15 - Bedroom 1	1.7	18	PASS
AN 15 - Bedroom 2	0.8	23	PASS
AN 16 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 16 - Bedroom 1	0.8	17	PASS
AN 16 - Bedroom 2	1.8	23	PASS
AN 17 - 2 Living/Kitchen/Hallway	2.5		PASS
AN 17 - Bedroom 1	1.4	16	PASS
AN 17 - Bedroom 2	1.3	15	PASS
AN 18 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 18 - Bedroom	2.3	16	PASS
AN 21 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 21 - Bedroom	2.2	16	PASS
AN 22 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 22 - Bedroom 1	1.7	13	PASS
AN 22 - Bedroom 2	1	13	PASS
AN 23 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 23 - Bedroom	1.1	15	PASS
AN 24 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 24 - Bedroom 1	1.6	13	PASS
AN 24 - Bedroom 2	0.9	15	PASS
AN 25 - 2 Living/Kitchen/Hallway	2.7		PASS
AN 25 - Bedroom 1	1.6	13	PASS
AN 25 - Bedroom 2	1.2	14	PASS
AN 26 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 26 - Bedroom 1	1.5	13	PASS
AN 26 - Bedroom 2	0.9	15	PASS
AN 27 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 27 - Bedroom 1	1.4	13	PASS
AN 27 - Bedroom 2	1.4	16	PASS
AN 28 - 1 Living/Kitchen/Hallway	2.9		PASS
AN 28 - Bedroom	2.4	16	PASS
AN 31 - 2 Living/Kitchen/Hallway	3.7		FAIL
AN 31 - Bedroom 1	1.4	13	PASS
AN 31 - Bedroom 2	2.6	16	PASS
AN 32 - 3 Living/Kitchen/Hallway	2.7		PASS
AN 32 - Bedroom 1	0.6	15	PASS
AN 32 - Bedroom 2	1.3	19	PASS
AN 32 - Bedroom 3	1.2	15	PASS



AN 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 33 - Bedroom 1	1.6	13	PASS
AN 33 - Bedroom 2	0.8	15	PASS
AN 34 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 34 - Bedroom 1	1.6	13	PASS
AN 34 - Bedroom 2	1.2	15	PASS
AN 35 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 35 - Bedroom 1	1.4	13	PASS
AN 35 - Bedroom 2	1.4	17	PASS
AN 36 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 36 - Bedroom	2.6	16	PASS
AN 41 - 1 Living/Kitchen/Hallway	6		FAIL
AN 41 - Bedroom	4.8	20	FAIL
AN 42 - 2 Living/Kitchen/Hallway	3.5		FAIL
AN 42 - Bedroom 1	2.1	13	PASS
AN 42 - Bedroom 2	1.2	15	PASS
AN 43 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 43 - Bedroom	1.3	15	PASS
AN 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 44 - Bedroom 1	2	13	PASS
AN 44 - Bedroom 2	1.2	15	PASS
AN 45 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 45 - Bedroom 1	1.7	13	PASS
AN 45 - Bedroom 2	2.3	15	PASS
AN 47 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 47 - Bedroom 1	1.9	13	PASS
AN 47 - Bedroom 2	2.1	14	PASS
AS 01 - 1 Living/Kitchen/Hallway	0.9		PASS
AS 01 - Bedroom	1.7	23	PASS
AS 02 - 2 Living/Kitchen/Hallway	0.8		PASS
AS 02 - Bedroom 1	0.5	15	PASS
AS 02 - Bedroom 2	0.7	21	PASS
AS 03 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 03 - Bedroom 1	0.6	16	PASS
AS 03 - Bedroom 2	1	22	PASS
AS 04 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 04 - Bedroom 1	1	16	PASS
AS 04 - Bedroom 2	0.5	21	PASS
AS 05 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 05 - Bedroom 1	1	16	PASS
AS 05 - Bedroom 2	1	29	PASS
AS 06 - 3 Living/Kitchen/Hallway	1.7		PASS



AS 06 - Bedroom 1	1.2	16	PASS
AS 06 - Bedroom 2	0.4	25	PASS
AS 06 - Bedroom 3	1.8	30	PASS
AS 07 - 3 Living/Kitchen/Hallway	2		PASS
AS 07 - Bedroom 1	1.2	15	PASS
AS 07 - Bedroom 2	0.7	27	PASS
AS 07 - Bedroom 3	2.5	31	PASS
AS 08 - 1 Living/Kitchen/Hallway	3.1		FAIL
AS 08 - Bedroom	1.6	40	FAIL
AS 11 - 1 Living/Kitchen/Hallway	2		PASS
AS 11 - Bedroom	2.2	16	PASS
AS 12 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 12 - Bedroom 1	0.5	17	PASS
AS 12 - Bedroom 2	1.2	23	PASS
AS 13 - 2 Living/Kitchen/Hallway	1		PASS
AS 13 - Bedroom 1	0.7	17	PASS
AS 13 - Bedroom 2	1.4	24	PASS
AS 14 - 2 Living/Kitchen/Hallway	1.1		PASS
AS 14 - Bedroom 1	0.8	16	PASS
AS 14 - Bedroom 2	0.7	18	PASS
AS 15 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 15 - Bedroom 1	1.3	20	PASS
AS 15 - Bedroom 2	0.8	36	FAIL
AS 16 - 3 Living/Kitchen/Hallway	1.9		PASS
AS 16 - Bedroom 1	1.2	15	PASS
AS 16 - Bedroom 2	0.6	18	PASS
AS 16 - Bedroom 3	1.4	18	PASS
AS 17 - 3 Living/Kitchen/Hallway	2.4		PASS
AS 17 - Bedroom 1	1.5	16	PASS
AS 17 - Bedroom 2	1.5	21	PASS
AS 17 - Bedroom 3	2.1	22	PASS
AS 18 - 1 Living/Kitchen/Hallway	3.2		FAIL
AS 18 - Bedroom	2	46	FAIL
AS 21 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 21 - Bedroom	2.3	16	PASS
AS 22 - 2 Living/Kitchen/Hallway	2.2		PASS
AS 22 - Bedroom 1	1.3	13	PASS
AS 22 - Bedroom 2	1.2	15	PASS
AS 23 - 2 Living/Kitchen/Hallway	2.6		PASS
AS 23 - Bedroom 1	1.5	13	PASS
AS 23 - Bedroom 2	1.4	15	PASS
AS 24 - 2 Living/Kitchen/Hallway	2.8		PASS



AS 24 - Bedroom 1	1.6	13	PASS
AS 24 - Bedroom 2	1.3	15	PASS
AS 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 25 - Bedroom 1	0.9	13	PASS
AS 25 - Bedroom 2	2	13	PASS
AS 26 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 26 - Bedroom 1	1	18	PASS
AS 26 - Bedroom 2	1.5	18	PASS
AS 27 - 1 Living/Kitchen/Hallway	2.2		PASS
AS 27 - Bedroom	1.5	14	PASS
AS 28 - 2 Living/Kitchen/Hallway	3		PASS
AS 28 - Bedroom 1	2	22	PASS
AS 28 - Bedroom 2	2	22	PASS
AS 29 - 1 Living/Kitchen/Hallway	3.6		FAIL
AS 29 - Bedroom	2.1	17	PASS
AS 31 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 31 - Bedroom	2.4	16	PASS
AS 32 - 2 Living/Kitchen/Hallway	2.5		PASS
AS 32 - Bedroom 1	0.7	13	PASS
AS 32 - Bedroom 2	1.1	15	PASS
AS 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 33 - Bedroom 1	1.5	13	PASS
AS 33 - Bedroom 2	1.3	15	PASS
AS 34 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 34 - Bedroom 1	1.6	13	PASS
AS 34 - Bedroom 2	1.2	15	PASS
AS 35 - 2 Living/Kitchen/Hallway	2.7		PASS
AS 35 - Bedroom 1	1.6	13	PASS
AS 35 - Bedroom 2	1.8	15	PASS
AS 36 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 36 - Bedroom 1	0.8	13	PASS
AS 36 - Bedroom 2	0.4	21	PASS
AS 37 - 1 Living/Kitchen/Hallway	3.1		FAIL
AS 37 - Bedroom 1	1.8	23	PASS
AS 38 - 1 Living/Kitchen/Hallway	3.8		FAIL
AS 38 - Bedroom	2.8	17	PASS
AS 42 - 2 Living/Kitchen/Hallway	3.1		FAIL
AS 42 - Bedroom 1	1.6	13	PASS
AS 42 - Bedroom 2	1.9	13	PASS
AS 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 44 - Bedroom 1	1.7	13	PASS
AS 44 - Bedroom 2	2	15	PASS



AS 45 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 45 - Bedroom 1	1.7	13	PASS
AS 45 - Bedroom 2	1.9	16	PASS
AS 46 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 46 - Bedroom 1	1.8	13	PASS
AS 46 - Bedroom 2	2.2	17	PASS
AS 47 - 1 Living/Kitchen/Hallway	3.7		FAIL
AS 47 - Bedroom	2	14	PASS
AS 48 - 1 Living/Kitchen/Hallway	4.6		FAIL
AS 48 - Bedroom	3.8	17	FAIL
AS 49 - 1 Living/Kitchen/Hallway	4.3		FAIL
AS 49 - Bedroom	4.6	20	FAIL
Number of Rooms Failing (out of 214):			38

Scenario 2:

- 'G value 0.4200
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- Tilt and turn at night on LG, G and 1st floor to failing rooms
- MVHR 0.3 l/s/m²

Room Name:	Criteria 1	Criteria 2	Pass/Fail
AN 01 - 1 Living/Kitchen/Hallway	1.5		PASS
AN 01 - Bedroom	1.6	18	PASS
AN 02 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 02 - Bedroom 1	1.4	21	PASS
AN 02 - Bedroom 2	1.6	19	PASS
AN 03 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 03 - Bedroom	1.4	18	PASS
AN 04 - 2 Living/Kitchen/Hallway	0		PASS
AN 04 - Bedroom 1	0.9	15	PASS
AN 04 - Bedroom 2	1.4	16	PASS
AN 05 - 2 Living/Kitchen/Hallway	1.1		PASS
AN 05 - Bedroom 1	0.5	15	PASS
AN 05 - Bedroom 2	0.5	20	PASS
AN 06 - 2 Living/Kitchen/Hallway	1		PASS
AN 06 - Bedroom 1	0.7	16	PASS
AN 06 - Bedroom 2	0.4	19	PASS
AN 07 - 2 Living/Kitchen/Hallway	0.9		PASS
AN 07 - Bedroom 1	0.6	16	PASS
AN 07 - Bedroom 2	0.7	20	PASS
AN 08 - 1 Living/Kitchen/Hallway	1.2		PASS
AN 08 - Bedroom	2.2	24	PASS
AN 09 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 09 - Bedroom 1	1.4	23	PASS
AN 09 - Bedroom 2	1.7	23	PASS
AN 10 - 2 Living/Kitchen/Hallway	1.3		PASS
AN 10 - Bedroom 1	1.8	18	PASS
AN 10 - Bedroom 2	1.1	29	PASS
AN 11 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 11 - Bedroom	2.1	16	PASS
AN 12 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 12 - Bedroom 1	1.7	13	PASS
AN 12 - Bedroom 2	1.6	14	PASS
AN 13 - 1 Living/Kitchen/Hallway	3.4		FAIL
AN 13 - Bedroom	1	15	PASS



AN 14 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 14 - Bedroom 1	1.5	16	PASS
AN 14 - Bedroom 2	0.7	15	PASS
AN 15 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 15 - Bedroom 1	1.7	18	PASS
AN 15 - Bedroom 2	0.8	23	PASS
AN 16 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 16 - Bedroom 1	0.8	17	PASS
AN 16 - Bedroom 2	1.8	23	PASS
AN 17 - 2 Living/Kitchen/Hallway	2.5		PASS
AN 17 - Bedroom 1	1.4	16	PASS
AN 17 - Bedroom 2	1.3	15	PASS
AN 18 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 18 - Bedroom	2.3	16	PASS
AN 21 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 21 - Bedroom	2.2	16	PASS
AN 22 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 22 - Bedroom 1	1.7	13	PASS
AN 22 - Bedroom 2	1	13	PASS
AN 23 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 23 - Bedroom	1.1	15	PASS
AN 24 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 24 - Bedroom 1	1.6	13	PASS
AN 24 - Bedroom 2	0.9	15	PASS
AN 25 - 2 Living/Kitchen/Hallway	2.7		PASS
AN 25 - Bedroom 1	1.6	13	PASS
AN 25 - Bedroom 2	1.2	14	PASS
AN 26 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 26 - Bedroom 1	1.5	13	PASS
AN 26 - Bedroom 2	0.9	15	PASS
AN 27 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 27 - Bedroom 1	1.4	13	PASS
AN 27 - Bedroom 2	1.4	16	PASS
AN 28 - 1 Living/Kitchen/Hallway	2.9		PASS
AN 28 - Bedroom	2.4	16	PASS
AN 31 - 2 Living/Kitchen/Hallway	3.7		FAIL
AN 31 - Bedroom 1	1.4	13	PASS
AN 31 - Bedroom 2	2.6	16	PASS
AN 32 - 3 Living/Kitchen/Hallway	2.7		PASS
AN 32 - Bedroom 1	0.6	15	PASS
AN 32 - Bedroom 2	1.3	19	PASS
AN 32 - Bedroom 3	1.2	15	PASS



AN 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 33 - Bedroom 1	1.6	13	PASS
AN 33 - Bedroom 2	0.8	15	PASS
AN 34 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 34 - Bedroom 1	1.6	13	PASS
AN 34 - Bedroom 2	1.2	15	PASS
AN 35 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 35 - Bedroom 1	1.4	13	PASS
AN 35 - Bedroom 2	1.4	17	PASS
AN 36 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 36 - Bedroom	2.6	16	PASS
AN 41 - 1 Living/Kitchen/Hallway	6		FAIL
AN 41 - Bedroom	4.8	20	FAIL
AN 42 - 2 Living/Kitchen/Hallway	3.5		FAIL
AN 42 - Bedroom 1	2.1	13	PASS
AN 42 - Bedroom 2	1.2	15	PASS
AN 43 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 43 - Bedroom	1.3	15	PASS
AN 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 44 - Bedroom 1	2	13	PASS
AN 44 - Bedroom 2	1.2	15	PASS
AN 45 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 45 - Bedroom 1	1.7	13	PASS
AN 45 - Bedroom 2	2.3	15	PASS
AN 47 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 47 - Bedroom 1	1.9	13	PASS
AN 47 - Bedroom 2	2.1	14	PASS
AS 01 - 1 Living/Kitchen/Hallway	0.9		PASS
AS 01 - Bedroom	1.7	23	PASS
AS 02 - 2 Living/Kitchen/Hallway	0.8		PASS
AS 02 - Bedroom 1	0.5	15	PASS
AS 02 - Bedroom 2	0.7	21	PASS
AS 03 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 03 - Bedroom 1	0.6	16	PASS
AS 03 - Bedroom 2	1	22	PASS
AS 04 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 04 - Bedroom 1	1	16	PASS
AS 04 - Bedroom 2	0.5	21	PASS
AS 05 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 05 - Bedroom 1	1	16	PASS
AS 05 - Bedroom 2	1	29	PASS
AS 06 - 3 Living/Kitchen/Hallway	1.7		PASS



AS 06 - Bedroom 1	1.2	16	PASS
AS 06 - Bedroom 2	0.4	25	PASS
AS 06 - Bedroom 3	1.8	30	PASS
AS 07 - 3 Living/Kitchen/Hallway	2		PASS
AS 07 - Bedroom 1	1.2	15	PASS
AS 07 - Bedroom 2	0.7	27	PASS
AS 07 - Bedroom 3	2.5	31	PASS
AS 08 - 1 Living/Kitchen/Hallway	3.1		FAIL
AS 08 - Bedroom	1.5	22	PASS
AS 11 - 1 Living/Kitchen/Hallway	2		PASS
AS 11 - Bedroom	2.2	16	PASS
AS 12 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 12 - Bedroom 1	0.5	17	PASS
AS 12 - Bedroom 2	1.2	23	PASS
AS 13 - 2 Living/Kitchen/Hallway	1		PASS
AS 13 - Bedroom 1	0.7	17	PASS
AS 13 - Bedroom 2	1.4	24	PASS
AS 14 - 2 Living/Kitchen/Hallway	1.1		PASS
AS 14 - Bedroom 1	0.8	16	PASS
AS 14 - Bedroom 2	0.7	18	PASS
AS 15 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 15 - Bedroom 1	1.3	20	PASS
AS 15 - Bedroom 2	0.8	36	FAIL
AS 16 - 3 Living/Kitchen/Hallway	1.9		PASS
AS 16 - Bedroom 1	1.2	15	PASS
AS 16 - Bedroom 2	0.6	18	PASS
AS 16 - Bedroom 3	1.4	18	PASS
AS 17 - 3 Living/Kitchen/Hallway	2.4		PASS
AS 17 - Bedroom 1	1.5	16	PASS
AS 17 - Bedroom 2	1.5	21	PASS
AS 17 - Bedroom 3	2.1	22	PASS
AS 18 - 1 Living/Kitchen/Hallway	3.2		FAIL
AS 18 - Bedroom	2	46	FAIL
AS 21 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 21 - Bedroom	2.3	16	PASS
AS 22 - 2 Living/Kitchen/Hallway	2.2		PASS
AS 22 - Bedroom 1	1.3	13	PASS
AS 22 - Bedroom 2	1.2	15	PASS
AS 23 - 2 Living/Kitchen/Hallway	2.6		PASS
AS 23 - Bedroom 1	1.5	13	PASS
AS 23 - Bedroom 2	1.4	15	PASS
AS 24 - 2 Living/Kitchen/Hallway	2.8		PASS



AS 24 - Bedroom 1	1.6	13	PASS
AS 24 - Bedroom 2	1.3	15	PASS
AS 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 25 - Bedroom 1	0.9	13	PASS
AS 25 - Bedroom 2	2	13	PASS
AS 26 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 26 - Bedroom 1	1	18	PASS
AS 26 - Bedroom 2	1.5	18	PASS
AS 27 - 1 Living/Kitchen/Hallway	2.2		PASS
AS 27 - Bedroom	1.5	14	PASS
AS 28 - 2 Living/Kitchen/Hallway	3		PASS
AS 28 - Bedroom 1	2	22	PASS
AS 28 - Bedroom 2	2	22	PASS
AS 29 - 1 Living/Kitchen/Hallway	3.6		FAIL
AS 29 - Bedroom	2.1	16	PASS
AS 31 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 31 - Bedroom	2.4	16	PASS
AS 32 - 2 Living/Kitchen/Hallway	2.5		PASS
AS 32 - Bedroom 1	0.7	13	PASS
AS 32 - Bedroom 2	1.1	15	PASS
AS 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 33 - Bedroom 1	1.5	13	PASS
AS 33 - Bedroom 2	1.3	15	PASS
AS 34 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 34 - Bedroom 1	1.6	13	PASS
AS 34 - Bedroom 2	1.2	15	PASS
AS 35 - 2 Living/Kitchen/Hallway	2.7		PASS
AS 35 - Bedroom 1	1.6	13	PASS
AS 35 - Bedroom 2	1.8	15	PASS
AS 36 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 36 - Bedroom 1	0.8	13	PASS
AS 36 - Bedroom 2	0.4	21	PASS
AS 37 - 1 Living/Kitchen/Hallway	3.1		FAIL
AS 37 - Bedroom 1	1.8	23	PASS
AS 38 - 1 Living/Kitchen/Hallway	3.8		FAIL
AS 38 - Bedroom	2.8	17	PASS
AS 42 - 2 Living/Kitchen/Hallway	3.1		FAIL
AS 42 - Bedroom 1	1.6	13	PASS
AS 42 - Bedroom 2	1.9	13	PASS
AS 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 44 - Bedroom 1	1.7	13	PASS
AS 44 - Bedroom 2	2	15	PASS



AS 45 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 45 - Bedroom 1	1.7	13	PASS
AS 45 - Bedroom 2	1.9	16	PASS
AS 46 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 46 - Bedroom 1	1.8	13	PASS
AS 46 - Bedroom 2	2.2	17	PASS
AS 47 - 1 Living/Kitchen/Hallway	3.7		FAIL
AS 47 - Bedroom	2	14	PASS
AS 48 - 1 Living/Kitchen/Hallway	4.6		FAIL
AS 48 - Bedroom	3.8	17	FAIL
AS 49 - 1 Living/Kitchen/Hallway	4.3		FAIL
AS 49 - Bedroom	4.6	20	FAIL
Number of Rooms Failing (out of 214):			34

Scenario 3:

- 'G value 0.42
- G value 0.4329 to selected LG, GF and 1st floor doors
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- Tilt and turn at night on LG, G and 1st floor to failing rooms
- MVHR 0.3 l/s/m2

Room Name:	Criteria 1	Criteria 2	Pass/Fail
AN 01 - 1 Living/Kitchen/Hallway	1.6		PASS
AN 01 - Bedroom	1.6	18	PASS
AN 02 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 02 - Bedroom 1	1.6	21	PASS
AN 02 - Bedroom 2	1.6	20	PASS
AN 03 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 03 - Bedroom	1.4	18	PASS
AN 04 - 2 Living/Kitchen/Hallway	0		PASS
AN 04 - Bedroom 1	0.9	15	PASS
AN 04 - Bedroom 2	1.5	16	PASS
AN 05 - 2 Living/Kitchen/Hallway	1.1		PASS
AN 05 - Bedroom 1	0.6	15	PASS
AN 05 - Bedroom 2	0.5	20	PASS
AN 06 - 2 Living/Kitchen/Hallway	1		PASS
AN 06 - Bedroom 1	0.7	16	PASS
AN 06 - Bedroom 2	0.4	19	PASS
AN 07 - 2 Living/Kitchen/Hallway	0.9		PASS
AN 07 - Bedroom 1	0.6	16	PASS
AN 07 - Bedroom 2	0.7	20	PASS
AN 08 - 1 Living/Kitchen/Hallway	1.2		PASS
AN 08 - Bedroom	2.2	24	PASS
AN 09 - 2 Living/Kitchen/Hallway	3.1		FAIL
AN 09 - Bedroom 1	0.9	44	FAIL
AN 09 - Bedroom 2	1.4	46	FAIL
AN 10 - 2 Living/Kitchen/Hallway	1.3		PASS
AN 10 - Bedroom 1	1.8	18	PASS
AN 10 - Bedroom 2	1.1	29	PASS
AN 11 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 11 - Bedroom	2.1	16	PASS
AN 12 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 12 - Bedroom 1	1.7	13	PASS
AN 12 - Bedroom 2	1.6	14	PASS
AN 13 - 1 Living/Kitchen/Hallway	3.4		FAIL



AN 13 - Bedroom	1	15	PASS
AN 14 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 14 - Bedroom 1	1.5	16	PASS
AN 14 - Bedroom 2	0.7	15	PASS
AN 15 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 15 - Bedroom 1	1.2	19	PASS
AN 15 - Bedroom 2	0.7	23	PASS
AN 16 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 16 - Bedroom 1	0.8	17	PASS
AN 16 - Bedroom 2	1.8	23	PASS
AN 17 - 2 Living/Kitchen/Hallway	2.5		PASS
AN 17 - Bedroom 1	1.4	16	PASS
AN 17 - Bedroom 2	1.3	15	PASS
AN 18 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 18 - Bedroom	2.3	16	PASS
AN 21 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 21 - Bedroom	2.2	16	PASS
AN 22 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 22 - Bedroom 1	1.7	13	PASS
AN 22 - Bedroom 2	1	13	PASS
AN 23 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 23 - Bedroom	1.1	15	PASS
AN 24 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 24 - Bedroom 1	1.6	13	PASS
AN 24 - Bedroom 2	0.9	15	PASS
AN 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 25 - Bedroom 1	1.6	13	PASS
AN 25 - Bedroom 2	1.2	14	PASS
AN 26 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 26 - Bedroom 1	1.5	13	PASS
AN 26 - Bedroom 2	0.9	15	PASS
AN 27 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 27 - Bedroom 1	1.4	13	PASS
AN 27 - Bedroom 2	1.4	16	PASS
AN 28 - 1 Living/Kitchen/Hallway	2.9		PASS
AN 28 - Bedroom	2.4	16	PASS
AN 31 - 2 Living/Kitchen/Hallway	3.7		FAIL
AN 31 - Bedroom 1	1.4	13	PASS
AN 31 - Bedroom 2	2.6	16	PASS
AN 32 - 3 Living/Kitchen/Hallway	2.7		PASS
AN 32 - Bedroom 1	0.6	15	PASS
AN 32 - Bedroom 2	1.3	19	PASS



AN 32 - Bedroom 3	1.2	15	PASS
AN 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 33 - Bedroom 1	1.6	13	PASS
AN 33 - Bedroom 2	0.8	15	PASS
AN 34 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 34 - Bedroom 1	1.6	13	PASS
AN 34 - Bedroom 2	1.2	15	PASS
AN 35 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 35 - Bedroom 1	1.4	13	PASS
AN 35 - Bedroom 2	1.4	17	PASS
AN 36 - 1 Living/Kitchen/Hallway	3.1		FAIL
AN 36 - Bedroom	2.6	16	PASS
AN 41 - 1 Living/Kitchen/Hallway	6		FAIL
AN 41 - Bedroom	4.8	20	FAIL
AN 42 - 2 Living/Kitchen/Hallway	3.5		FAIL
AN 42 - Bedroom 1	2.1	13	PASS
AN 42 - Bedroom 2	1.2	15	PASS
AN 43 - 1 Living/Kitchen/Hallway	3.3		FAIL
AN 43 - Bedroom	1.3	15	PASS
AN 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 44 - Bedroom 1	2	13	PASS
AN 44 - Bedroom 2	1.2	15	PASS
AN 45 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 45 - Bedroom 1	1.7	13	PASS
AN 45 - Bedroom 2	2.3	15	PASS
AN 47 - 2 Living/Kitchen/Hallway	3.4		FAIL
AN 47 - Bedroom 1	1.9	13	PASS
AN 47 - Bedroom 2	2.1	14	PASS
AS 01 - 1 Living/Kitchen/Hallway	0.9		PASS
AS 01 - Bedroom	1.7	24	PASS
AS 02 - 2 Living/Kitchen/Hallway	0.8		PASS
AS 02 - Bedroom 1	0.5	15	PASS
AS 02 - Bedroom 2	0.7	21	PASS
AS 03 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 03 - Bedroom 1	0.6	16	PASS
AS 03 - Bedroom 2	1	22	PASS
AS 04 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 04 - Bedroom 1	1.1	16	PASS
AS 04 - Bedroom 2	0.5	21	PASS
AS 05 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 05 - Bedroom 1	1	16	PASS
AS 05 - Bedroom 2	1	29	PASS



AS 06 - 3 Living/Kitchen/Hallway	1.8		PASS
AS 06 - Bedroom 1	1.2	16	PASS
AS 06 - Bedroom 2	0.4	25	PASS
AS 06 - Bedroom 3	1.8	30	PASS
AS 07 - 3 Living/Kitchen/Hallway	2		PASS
AS 07 - Bedroom 1	1.2	15	PASS
AS 07 - Bedroom 2	0.7	27	PASS
AS 07 - Bedroom 3	2.5	31	PASS
AS 08 - 1 Living/Kitchen/Hallway	2.4		PASS
AS 08 - Bedroom	1.5	22	PASS
AS 11 - 1 Living/Kitchen/Hallway	2		PASS
AS 11 - Bedroom	2.2	16	PASS
AS 12 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 12 - Bedroom 1	0.5	17	PASS
AS 12 - Bedroom 2	1.2	23	PASS
AS 13 - 2 Living/Kitchen/Hallway	1		PASS
AS 13 - Bedroom 1	0.7	17	PASS
AS 13 - Bedroom 2	1.4	24	PASS
AS 14 - 2 Living/Kitchen/Hallway	1.1		PASS
AS 14 - Bedroom 1	0.8	16	PASS
AS 14 - Bedroom 2	0.7	18	PASS
AS 15 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 15 - Bedroom 1	1.3	20	PASS
AS 15 - Bedroom 2	0.8	36	FAIL
AS 16 - 3 Living/Kitchen/Hallway	1.9		PASS
AS 16 - Bedroom 1	1.2	15	PASS
AS 16 - Bedroom 2	0.6	18	PASS
AS 16 - Bedroom 3	1.4	18	PASS
AS 17 - 3 Living/Kitchen/Hallway	2.4		PASS
AS 17 - Bedroom 1	1.5	16	PASS
AS 17 - Bedroom 2	1.5	21	PASS
AS 17 - Bedroom 3	2.2	22	PASS
AS 18 - 1 Living/Kitchen/Hallway	3.2		FAIL
AS 18 - Bedroom	2	46	FAIL
AS 21 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 21 - Bedroom	2.3	16	PASS
AS 22 - 2 Living/Kitchen/Hallway	2.2		PASS
AS 22 - Bedroom 1	1.3	13	PASS
AS 22 - Bedroom 2	1.2	15	PASS
AS 23 - 2 Living/Kitchen/Hallway	2.6		PASS
AS 23 - Bedroom 1	1.5	13	PASS
AS 23 - Bedroom 2	1.4	15	PASS

AS 24 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 24 - Bedroom 1	1.6	13	PASS
AS 24 - Bedroom 2	1.3	15	PASS
AS 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 25 - Bedroom 1	0.9	13	PASS
AS 25 - Bedroom 2	2	13	PASS
AS 26 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 26 - Bedroom 1	1	18	PASS
AS 26 - Bedroom 2	1.5	18	PASS
AS 27 - 1 Living/Kitchen/Hallway	2.2		PASS
AS 27 - Bedroom	1.5	14	PASS
AS 28 - 2 Living/Kitchen/Hallway	3		PASS
AS 28 - Bedroom 1	2	22	PASS
AS 28 - Bedroom 2	2	22	PASS
AS 29 - 1 Living/Kitchen/Hallway	3.6		FAIL
AS 29 - Bedroom	2.1	16	PASS
AS 31 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 31 - Bedroom	2.4	16	PASS
AS 32 - 2 Living/Kitchen/Hallway	2.5		PASS
AS 32 - Bedroom 1	0.7	13	PASS
AS 32 - Bedroom 2	1.1	15	PASS
AS 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 33 - Bedroom 1	1.5	13	PASS
AS 33 - Bedroom 2	1.3	15	PASS
AS 34 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 34 - Bedroom 1	1.6	13	PASS
AS 34 - Bedroom 2	1.2	15	PASS
AS 35 - 2 Living/Kitchen/Hallway	2.7		PASS
AS 35 - Bedroom 1	1.6	13	PASS
AS 35 - Bedroom 2	1.8	15	PASS
AS 36 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 36 - Bedroom 1	0.8	13	PASS
AS 36 - Bedroom 2	0.4	21	PASS
AS 37 - 1 Living/Kitchen/Hallway	3.1		FAIL
AS 37 - Bedroom 1	1.8	23	PASS
AS 38 - 1 Living/Kitchen/Hallway	3.8		FAIL
AS 38 - Bedroom	2.8	17	PASS
AS 42 - 2 Living/Kitchen/Hallway	3.1		FAIL
AS 42 - Bedroom 1	1.6	13	PASS
AS 42 - Bedroom 2	1.9	13	PASS
AS 44 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 44 - Bedroom 1	1.7	13	PASS



AS 44 - Bedroom 2	2	15	PASS
AS 45 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 45 - Bedroom 1	1.7	13	PASS
AS 45 - Bedroom 2	1.9	16	PASS
AS 46 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 46 - Bedroom 1	1.8	13	PASS
AS 46 - Bedroom 2	2.2	17	PASS
AS 47 - 1 Living/Kitchen/Hallway	3.7		FAIL
AS 47 - Bedroom	2	14	PASS
AS 48 - 1 Living/Kitchen/Hallway	4.6		FAIL
AS 48 - Bedroom	3.8	17	FAIL
AS 49 - 1 Living/Kitchen/Hallway	4.3		FAIL
AS 49 - Bedroom	4.6	20	FAIL
Number of Rooms Failing (out of 214):			35

Scenario 4:

- 'G value 0.42
- G value 0.4329 to selected LG, GF and 1st floor doors
- Windows openable 90 degrees 100% area
- Internal doors open 24 hours
- Tilt and turn at night on LG, G and 1st floor to failing rooms
- MVHR 0.3 l/s/m2
- Blinds

Room Name:	Criteria 1	Criteria 2	Pass/Fail
AN 01 - 1 Living/Kitchen/Hallway	1.6		PASS
AN 01 - Bedroom	1.6	18	PASS
AN 02 - 2 Living/Kitchen/Hallway	3		PASS
AN 02 - Bedroom 1	1.6	21	PASS
AN 02 - Bedroom 2	1.6	20	PASS
AN 03 - 1 Living/Kitchen/Hallway	2.2		PASS
AN 03 - Bedroom	1.4	18	PASS
AN 04 - 2 Living/Kitchen/Hallway	0		PASS
AN 04 - Bedroom 1	0.9	15	PASS
AN 04 - Bedroom 2	1.5	16	PASS
AN 05 - 2 Living/Kitchen/Hallway	1.1		PASS
AN 05 - Bedroom 1	0.6	15	PASS
AN 05 - Bedroom 2	0.5	20	PASS
AN 06 - 2 Living/Kitchen/Hallway	1		PASS
AN 06 - Bedroom 1	0.7	16	PASS
AN 06 - Bedroom 2	0.4	19	PASS
AN 07 - 2 Living/Kitchen/Hallway	0.9		PASS
AN 07 - Bedroom 1	0.6	16	PASS
AN 07 - Bedroom 2	0.7	20	PASS
AN 08 - 1 Living/Kitchen/Hallway	1.2		PASS
AN 08 - Bedroom	2.2	24	PASS
AN 09 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 09 - Bedroom 1	0.9	44	FAIL
AN 09 - Bedroom 2	1.4	46	FAIL
AN 10 - 2 Living/Kitchen/Hallway	1.3		PASS
AN 10 - Bedroom 1	1.8	18	PASS
AN 10 - Bedroom 2	1.1	29	PASS
AN 11 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 11 - Bedroom	2.1	16	PASS
AN 12 - 2 Living/Kitchen/Hallway	3		PASS
AN 12 - Bedroom 1	1.7	13	PASS
AN 12 - Bedroom 2	1.6	14	PASS



AN 13 - 1 Living/Kitchen/Hallway	2.9		PASS
AN 13 - Bedroom	1	15	PASS
AN 14 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 14 - Bedroom 1	1.5	16	PASS
AN 14 - Bedroom 2	0.7	15	PASS
AN 15 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 15 - Bedroom 1	1.2	19	PASS
AN 15 - Bedroom 2	0.7	23	PASS
AN 16 - 2 Living/Kitchen/Hallway	1.4		PASS
AN 16 - Bedroom 1	0.8	17	PASS
AN 16 - Bedroom 2	1.8	23	PASS
AN 17 - 2 Living/Kitchen/Hallway	2.5		PASS
AN 17 - Bedroom 1	1.4	16	PASS
AN 17 - Bedroom 2	1.3	15	PASS
AN 18 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 18 - Bedroom	2.3	16	PASS
AN 21 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 21 - Bedroom	2.2	16	PASS
AN 22 - 2 Living/Kitchen/Hallway	3		PASS
AN 22 - Bedroom 1	1.7	13	PASS
AN 22 - Bedroom 2	1	13	PASS
AN 23 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 23 - Bedroom	1.1	15	PASS
AN 24 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 24 - Bedroom 1	1.6	13	PASS
AN 24 - Bedroom 2	0.9	15	PASS
AN 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 25 - Bedroom 1	1.6	13	PASS
AN 25 - Bedroom 2	1.2	14	PASS
AN 26 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 26 - Bedroom 1	1.5	13	PASS
AN 26 - Bedroom 2	0.9	15	PASS
AN 27 - 2 Living/Kitchen/Hallway	2.6		PASS
AN 27 - Bedroom 1	1.4	13	PASS
AN 27 - Bedroom 2	1.4	16	PASS
AN 28 - 1 Living/Kitchen/Hallway	2.9		PASS
AN 28 - Bedroom	2.4	16	PASS
AN 31 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 31 - Bedroom 1	1.4	13	PASS
AN 31 - Bedroom 2	2.6	16	PASS
AN 32 - 3 Living/Kitchen/Hallway	2.7		PASS
AN 32 - Bedroom 1	0.6	15	PASS



AN 32 - Bedroom 2	1.3	19	PASS
AN 32 - Bedroom 3	1.2	15	PASS
AN 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 33 - Bedroom 1	1.6	13	PASS
AN 33 - Bedroom 2	0.8	15	PASS
AN 34 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 34 - Bedroom 1	1.6	13	PASS
AN 34 - Bedroom 2	1.2	15	PASS
AN 35 - 2 Living/Kitchen/Hallway	2.8		PASS
AN 35 - Bedroom 1	1.4	13	PASS
AN 35 - Bedroom 2	1.4	17	PASS
AN 36 - 1 Living/Kitchen/Hallway	2.8		PASS
AN 36 - Bedroom	2.1	16	PASS
AN 41 - 1 Living/Kitchen/Hallway	4.5		FAIL
AN 41 - Bedroom	3.1	20	FAIL
AN 42 - 2 Living/Kitchen/Hallway	3.3		FAIL
AN 42 - Bedroom 1	2.1	13	PASS
AN 42 - Bedroom 2	1.2	15	PASS
AN 43 - 1 Living/Kitchen/Hallway	2.7		PASS
AN 43 - Bedroom	1.3	15	PASS
AN 44 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 44 - Bedroom 1	2	13	PASS
AN 44 - Bedroom 2	1.2	15	PASS
AN 45 - 2 Living/Kitchen/Hallway	2.9		PASS
AN 45 - Bedroom 1	1.7	13	PASS
AN 45 - Bedroom 2	2.3	15	PASS
AN 47 - 2 Living/Kitchen/Hallway	3		PASS
AN 47 - Bedroom 1	1.9	13	PASS
AN 47 - Bedroom 2	2.1	14	PASS
AS 01 - 1 Living/Kitchen/Hallway	0.9		PASS
AS 01 - Bedroom	1.7	24	PASS
AS 02 - 2 Living/Kitchen/Hallway	0.8		PASS
AS 02 - Bedroom 1	0.5	15	PASS
AS 02 - Bedroom 2	0.7	21	PASS
AS 03 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 03 - Bedroom 1	0.6	16	PASS
AS 03 - Bedroom 2	1	22	PASS
AS 04 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 04 - Bedroom 1	1.1	16	PASS
AS 04 - Bedroom 2	0.5	21	PASS
AS 05 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 05 - Bedroom 1	1	16	PASS



AS 05 - Bedroom 2	1	29	PASS
AS 06 - 3 Living/Kitchen/Hallway	1.8		PASS
AS 06 - Bedroom 1	1.2	16	PASS
AS 06 - Bedroom 2	0.4	25	PASS
AS 06 - Bedroom 3	1.8	30	PASS
AS 07 - 3 Living/Kitchen/Hallway	2		PASS
AS 07 - Bedroom 1	1.2	15	PASS
AS 07 - Bedroom 2	0.7	27	PASS
AS 07 - Bedroom 3	2.5	31	PASS
AS 08 - 1 Living/Kitchen/Hallway	2.4		PASS
AS 08 - Bedroom	1.5	22	PASS
AS 11 - 1 Living/Kitchen/Hallway	2		PASS
AS 11 - Bedroom	2.2	16	PASS
AS 12 - 2 Living/Kitchen/Hallway	0.9		PASS
AS 12 - Bedroom 1	0.5	17	PASS
AS 12 - Bedroom 2	1.2	23	PASS
AS 13 - 2 Living/Kitchen/Hallway	1		PASS
AS 13 - Bedroom 1	0.7	17	PASS
AS 13 - Bedroom 2	1.4	24	PASS
AS 14 - 2 Living/Kitchen/Hallway	1.1		PASS
AS 14 - Bedroom 1	0.8	16	PASS
AS 14 - Bedroom 2	0.7	18	PASS
AS 15 - 2 Living/Kitchen/Hallway	1.3		PASS
AS 15 - Bedroom 1	1.3	20	PASS
AS 15 - Bedroom 2	0.8	36	FAIL
AS 16 - 3 Living/Kitchen/Hallway	1.9		PASS
AS 16 - Bedroom 1	1.2	15	PASS
AS 16 - Bedroom 2	0.6	18	PASS
AS 16 - Bedroom 3	1.4	18	PASS
AS 17 - 3 Living/Kitchen/Hallway	2.4		PASS
AS 17 - Bedroom 1	1.5	16	PASS
AS 17 - Bedroom 2	1.5	21	PASS
AS 17 - Bedroom 3	2.2	22	PASS
AS 18 - 1 Living/Kitchen/Hallway	2.1		PASS
AS 18 - Bedroom	1.2	38	FAIL
AS 21 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 21 - Bedroom	2.3	16	PASS
AS 22 - 2 Living/Kitchen/Hallway	2.2		PASS
AS 22 - Bedroom 1	1.3	13	PASS
AS 22 - Bedroom 2	1.2	15	PASS
AS 23 - 2 Living/Kitchen/Hallway	2.6		PASS
AS 23 - Bedroom 1	1.5	13	PASS

AS 23 - Bedroom 2	1.4	15	PASS
AS 24 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 24 - Bedroom 1	1.6	13	PASS
AS 24 - Bedroom 2	1.3	15	PASS
AS 25 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 25 - Bedroom 1	0.9	13	PASS
AS 25 - Bedroom 2	2	13	PASS
AS 26 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 26 - Bedroom 1	1	18	PASS
AS 26 - Bedroom 2	1.5	18	PASS
AS 27 - 1 Living/Kitchen/Hallway	2.2		PASS
AS 27 - Bedroom	1.5	14	PASS
AS 28 - 2 Living/Kitchen/Hallway	3		PASS
AS 28 - Bedroom 1	2	22	PASS
AS 28 - Bedroom 2	2	22	PASS
AS 29 - 1 Living/Kitchen/Hallway	3		PASS
AS 29 - Bedroom	2.1	16	PASS
AS 31 - 1 Living/Kitchen/Hallway	2.6		PASS
AS 31 - Bedroom	2.4	16	PASS
AS 32 - 2 Living/Kitchen/Hallway	2.5		PASS
AS 32 - Bedroom 1	0.7	13	PASS
AS 32 - Bedroom 2	1.1	15	PASS
AS 33 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 33 - Bedroom 1	1.5	13	PASS
AS 33 - Bedroom 2	1.3	15	PASS
AS 34 - 2 Living/Kitchen/Hallway	2.9		PASS
AS 34 - Bedroom 1	1.6	13	PASS
AS 34 - Bedroom 2	1.2	15	PASS
AS 35 - 2 Living/Kitchen/Hallway	2.7		PASS
AS 35 - Bedroom 1	1.6	13	PASS
AS 35 - Bedroom 2	1.8	15	PASS
AS 36 - 2 Living/Kitchen/Hallway	2.8		PASS
AS 36 - Bedroom 1	0.8	13	PASS
AS 36 - Bedroom 2	0.4	21	PASS
AS 37 - 1 Living/Kitchen/Hallway	2.7		PASS
AS 37 - Bedroom 1	1.8	23	PASS
AS 38 - 1 Living/Kitchen/Hallway	3.2		FAIL
AS 38 - Bedroom	2.8	17	PASS
AS 42 - 2 Living/Kitchen/Hallway	2.6		PASS
AS 42 - Bedroom 1	1.6	13	PASS
AS 42 - Bedroom 2	1.9	13	PASS
AS 44 - 2 Living/Kitchen/Hallway	2.7		PASS



AS 44 - Bedroom 1	1.7	13	PASS
AS 44 - Bedroom 2	2	15	PASS
AS 45 - 2 Living/Kitchen/Hallway	3.3		FAIL
AS 45 - Bedroom 1	1.7	13	PASS
AS 45 - Bedroom 2	1.9	16	PASS
AS 46 - 2 Living/Kitchen/Hallway	2.7		PASS
AS 46 - Bedroom 1	1.8	13	PASS
AS 46 - Bedroom 2	2.2	17	PASS
AS 47 - 1 Living/Kitchen/Hallway	3.3		FAIL
AS 47 - Bedroom	2	14	PASS
AS 48 - 1 Living/Kitchen/Hallway	3.7		FAIL
AS 48 - Bedroom	2.6	17	PASS
AS 49 - 1 Living/Kitchen/Hallway	3.6		FAIL
AS 49 - Bedroom	2.8	20	PASS
Number of Rooms Failing (out of 214):			13



A.2 Appendix B – Detailed Results for Common Areas

Attached to this Appendix are the detailed results for the common areas when a g-value of 0.42 is applied.

Level/Room Name:	Internal Temperatures >28°C					Internal Temperatures >30°C				Internal Temperatures >32°C			
	No. of hours >28°C	>1% of annual hours	>2% of annual hours	>3% of annual hours	Pass/Fail to CIBSE TM59:2017	No. of hours >30°C	>1% of annual hours	>2% of annual hours	>3% of annual hours	No. of hours >32°C	>1% of annual hours	>2% of annual hours	>3% of annual hours
Block AN - 00 - Common Area Corridors	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AN - 00 - Common Area Corridors	64	No	No	No	PASS	19	No	No	No	3	No	No	No
Block AN - 00 - North Core Entrance	4	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AN - 00 - North Core Stairs	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AN - 00 - Common Area Corridors	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 00 - South Core Stairs	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 00 - Common Area Corridors	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 00 - Common Area Corridors	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block A - 00 - Common Area Corridors	0	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AN - 0 - North Core Stairs	3	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AN - 0 - Common Area Corridors	70	No	No	No	PASS	16	No	No	No	0	No	No	No
Block AS - 0 - South Core Entrance	23	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 0 - South Core Stairs	9	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 0 - Common Area Corridors	21	No	No	No	PASS	0	No	No	No	0	No	No	No
Block AS - 0 - Common Area Corridors	78	No	No	No	PASS	20	No	No	No	0	No	No	No
Block AN - 1 - North Core Stairs	82	No	No	No	PASS	27	No	No	No	4	No	No	No
Block AN - 1 - Common Area Corridors	131	Yes	No	No	PASS	38	No	No	No	3	No	No	No
Block AS - 1 - Common Area Corridors	122	Yes	No	No	PASS	38	No	No	No	2	No	No	No
Block AS - 1 - South Core Stairs	83	No	No	No	PASS	25	No	No	No	4	No	No	No
Block AN - 2 - North Core Stairs	93	Yes	No	No	PASS	27	No	No	No	4	No	No	No
Block AN - 2 - Common Area Corridors	134	Yes	No	No	PASS	39	No	No	No	3	No	No	No
Block AS - 2 - South Core Stairs	82	No	No	No	PASS	25	No	No	No	4	No	No	No
Block AS - 2 - Common Area Corridors	129	Yes	No	No	PASS	38	No	No	No	2	No	No	No
Block AN - 3 - North Core Stairs	57	No	No	No	PASS	18	No	No	No	0	No	No	No
Block AS - 3 - South Core Stairs	39	No	No	No	PASS	9	No	No	No	0	No	No	No
Block AN - 3 - Common Area Corridors	164	Yes	No	No	PASS	45	No	No	No	4	No	No	No
Block AS - 3 - Common Area Corridors	141	Yes	No	No	PASS	39	No	No	No	3	No	No	No
Block AN - 4 - Common Area Corridors	154	Yes	No	No	PASS	41	No	No	No	3	No	No	No
Block AN - 4 - North Core Stairs	97	Yes	No	No	PASS	28	No	No	No	4	No	No	No
Block AS - 4 - Common Area Corridors	148	Yes	No	No	PASS	39	No	No	No	2	No	No	No
Block AS - 4 - South Core Stairs	84	No	No	No	PASS	25	No	No	No	4	No	No	No

Number of Rooms Failing:

0



A.3 Appendix C – Mark Up of Window Changes

	THIEF
	SBD CERTIFIED DOORS AND WINDOWS
	SBD SECURE ACCESS CONTROL ENTRANCE DOOR
	SBD SECURE ACCESS TO SERVICES
	SBD AUTOMATED CONTROL GATES TO LGF PARKING ACCESS (PARTIALLY OPEN FOR CYCLE ACCESS)
	INSET BALCONY OR TERRACE DOOR/WINDOWS SBD CERTIFIED



1 : 200

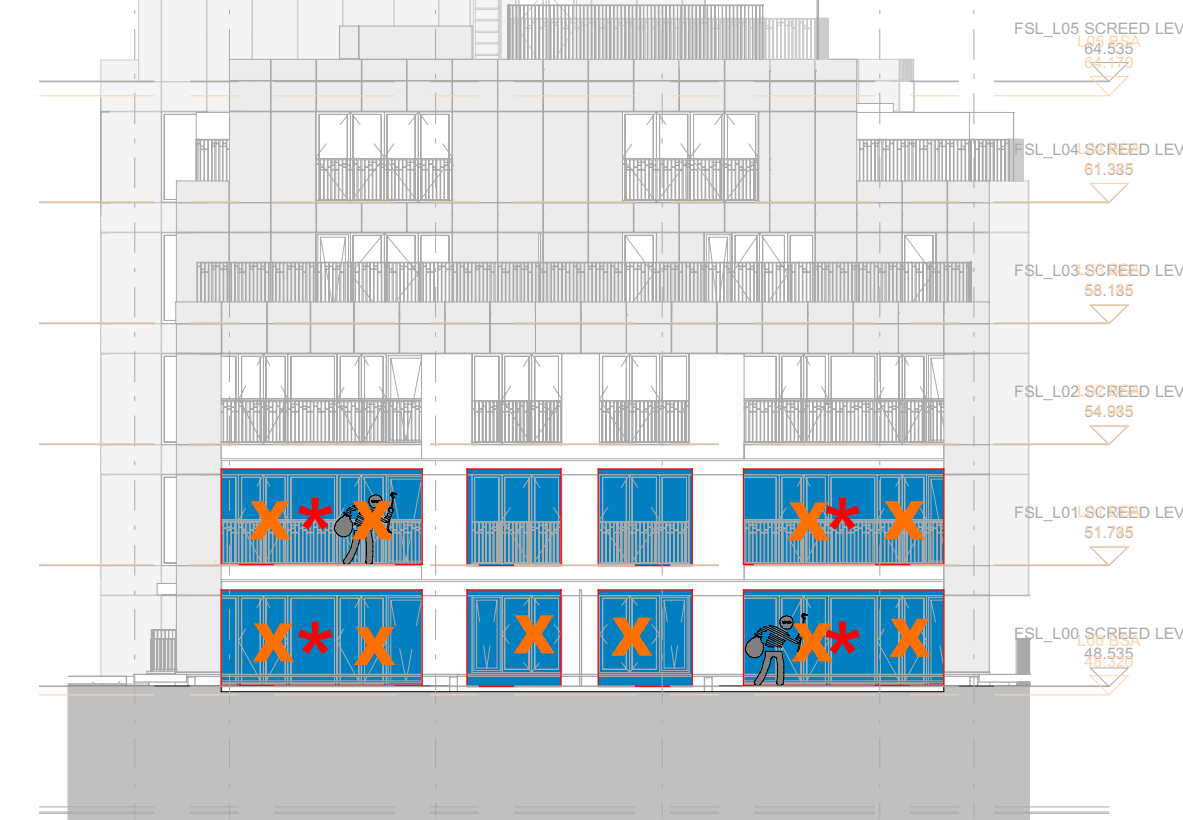
**"X" DENOTES
2+1 DOUBLE DOORS
WITH 0.4329 UNITS**



1 : 200



1 : 200



1 : 200

PROJECT NO	ZONE	LEVEL	TYPE	ROLE	CLASS	DR. NO.	REV
3596-KDS	-BA	-ZZ	-DR	-A	-69	-1000	C1

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