264 Belsize Road

Overheating Analysis Report

September 2022

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Executive summary

This report details the methodology and findings of the dynamic overheating assessment of the proposed development of 5 dwelling units (5no. two-bedroom duplexes) located at 264 Belsize Road, Kilburn, London, NW6 4BT. The external shading from adjacent buildings and the safety concerns for Unit 1 northeast bedroom window has also been accounted for. Proposed dwelling units face southeast.

This report aims to demonstrate compliance with the current industry TM59 overheating standard in line with the London Plan (Policy SI 4) and the National Planning Policy Framework (DCLG, July 2021) to support the planning application to Camden Borough Council.

It is assumed that dwellings will utilise openable windows for purge ventilation, with a background mechanical ventilation system. Passive measures such as high-efficiency building fabric, maximised solar control glazing specifications, and the use of external shading in the form of balconies have been explored as far as practicable. Using internal blinds will reduce the risk of overheating further.

The dynamic thermal modelling software Design Builder (V.7) has been used to set up the model and run a dynamic simulation for overheating risk. CIBSE Design Summer Year (DSY) weather data for London Heathrow (representative of low density urban and suburban areas) has been used for the 2020s, high emissions, 50% percentile scenario as required by CIBSE TM59. Additional DSY2 and DSY3 were tested to demonstrate performance under extreme weather conditions (Appendix F Overheating results for DSY 2 2020s- with internal blinds and Appendix G Overheating results for DSY 3 2020s- with internal blinds).

Part O Overheating Checklist is included in 7Appendix A Part O Overheating Checklist.

Unit	Room ref	TM59 Criterion A: Hours of exceedance (pass ≤ 3%)	TM59 Criterion B: Bedroom temperature hours >26°C (pass ≤ 32)	Overall compliance with TM59
		% Hours of overheating	Hours of overheating	
1	Bed Room 1	0.01	20.67	**Pass**
1	Bed Room 2	0.12	16.67	**Pass**
2	Bed Room 1	0	22	**Pass**
2	Bed Room 2	0.19	16.83	**Pass**
3	Bed Room 1	0.05	27	**Pass**
3	Bed Room 2	0.16	19.67	**Pass**
4	Bed Room 1	0.04	26.67	**Pass**
4	Bed Room 2	0.15	17.17	**Pass**
5	Bed Room 1	0	26.17	**Pass**
5	Bed Room 2	0	17.5	**Pass**
1	Living Room/Kitchen	0.48	N/A	**Pass**
2	Living Room/Kitchen	0.56	N/A	**Pass**
3	Living Room/Kitchen	0.62	N/A	**Pass**
4	Living Room/Kitchen	0.63	N/A	**Pass**
5	Living Room/Kitchen	0.62	N/A	**Pass**

TM 59 Overheating results for DSY1 2020s without blinds

All 5 dwellings without any shading device attached across the proposed scheme demonstrate an acceptable overheating level per the current industry best practice CIBSE TM59: 2017 criteria under the DSY1 weather file. Using internal blinds will reduce the risk of overheating further, as results are shown in 7Appendix E.

GLA expects all developments to comply with the DSY1 weather scenario. Further analysis using DSY 2 and 3 is recommended, but compliance with additional weather scenarios is not strictly required. The results indicate that meeting the CIBSE TM59 compliance criteria for additional weather scenarios is challenging. One main reason for overheating in some spaces using DSY2 and DSY 3 is due to the site constraints resulting that cross ventilation is not possible in ground floor bedrooms. The dwelling is primarily ventilated through natural stack effect allowing the warm air to rise up and exit via rooflight.

The proposed mitigation measures included in Table 8 would be beneficial in reducing the overheating problem in DSY 2 and 3 scenarios. Alternatively, additional measures like (i) external shading, (ii) use of a fan to increase ventilation rate through the dwelling, and night cooling with openable windows will be beneficial to reduce the overheating risk under DSY 2 and DSY3 scenario.

TM59 provides a standardised approach to assessing overheating risk. All rooms meet the TM59 criteria, demonstrating an acceptable level of overheating risk per the current industry best practice CIBSE TM59: 2017 criteria under the DSY1 weather file. It should be noted that the perception of overheating is subjective and will also be influenced by occupant behaviour.

The Home Owner's Manual will provide residents with guidance on the ventilation strategy to help mitigate the overheating risk.

The overheating results are based on key design features that follow the London Plan Policy SI 4; Managing Heat Risk, as shown in the table below.

Data Input	Discussion	
Windows and Glazed Doors	A g-value of 0.55 (Frame factor:0.80, average G value:0.44)	*Specified to reduce solar gains and mitigate against overheating while limiting negative effects on CO_2 emissions and internal daylight levels*
External Shading	External shading from balconies where present as per the design drawings, and adjacent buildings were also taken into consideration	*These elements will provide some solar* *shading as the sun tracks around the building*
Internal Shading	High reflectance blinds in operation from 7 am to 6 pm	*The internal shading can help to mitigate residual overheating risk further*
Natural ventilation	Internal doors are only open during the day (7 am until 10 pm) > Unit 1 Ground Floor North East bedroom window has a 15-degree restriction for safety reasons. > No restriction on any other windows, roof lights, or glazed doors, meaning 90- degree openability > Kitchen and living room windows and glazed doors are in operation 9 am – 10 pm > Bedroom windows and glazed doors are in operation 24/7	*Full openability assumes that residents have the freedom to remove window restrictors to enhance natural ventilation.* *Windows are simulated to be open when internal temperatures exceed 22°C and when the external temperature is lower than the internal temperature:* $T_{indoor} > 22°C$, $T_{outdoor} < T_{indoor}$

Proposed Overheating mitigation measures

1 Introduction

1.1 Peter Deer and Associates Ltd (PDA) has been appointed by Control Electrical Engineers Ltd to undertake the design stage overheating analysis for the proposed development of the 5 new dwellings (5no. two-bedroom duplexes).

1.2 This report has been prepared by a Chartered Building Sustainability Engineer, Maitiniyazi Bake (MCIBSE) of PDA, to provide the overheating mitigation strategy for the proposed development to support the full planning application to Camden Borough Council.

1.3 This report presents an analytical study of the potential overheating risks in residential areas. The scope of this study is to report on the likely overheating risk and assess the year that the building has the potential to overheat using current CIBSE weather file data for London Heathrow.

1.4 Dynamic thermal simulations have been carried out for dwellings following the guidance set out in CIBSE TM59: *Design Methodology for the Assessment of Overheating in Homes* to determine whether there is a risk of overheating. Appropriate mitigation measures have been recommended to reduce the overheating risk and ensure comfortable thermal conditions are achieved during occupied hours.

1.5 This document should be read in conjunction with:

- Design and Access Statement
- Energy Statement
- Sustainability Report

Site location

Figure 1 Site location (Open Street Map 2022)

1.6 Location: 264 Belsize Road, Kilburn, London, NW6 4BT. Proposed dwelling units face southeast.

1.7 The site is located in Kilburn within the Borough of Camden. It is located on the northern side of Belsize Road (https://www.openstreetmap.org/#map=19/51.53769/-0.19249). The site area is approximately 470m², previously occupied by an existing redundant non-residential institution building.

1.8 The site is within an Archaeological Priority Area due to its close proximity to an old Roman road, now the A5. It is approximately 40 metres east of Kilburn High Road. It is adjacent to the Priory Road Conservation Area but is not in the Conservation Area itself.

1.9 The top floor studio is located on a mezzanine level which is open to the living room area below.

1.10 The proposed architectural design advances the benefits of stack effect ventilation by using lightwell and openable rooflight features so that the warm air can rise sufficiently from the bedrooms and escape naturally from the roof light, which minimises the overheating risk further.

2 Planning Policy Requirements

National Policy

2.1 Paragraph 153 within The National Planning Policy Framework (DCLG, July 2021) states the importance of mitigating the overheating risk of proposed developments (Table 1).

Planning for climate change
153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[53]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

Table 1 Planning for Climate Change (National Planning Policy Framework, DCLG, July 2021)

London Plan

2.2 The London Plan (March 2021) is the mayor's planning strategy for Greater London. It sets borough-level housing targets and identifies locations for future growth of London-wide importance.

2.3 The London Plan is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20 to 25 years.

2.4 The London Plan is part of the Development Plan. It guides boroughs' development Plans to ensure that they work toward a shared vision for London. It establishes policies that allow everyone involved in new developments to know what is expected.

Policy D6 Housing quality and standards

A. *Housing development should be of high-quality design and provide adequately-sized rooms (see Table 3.1) with comfortable and functional layouts which are fit for purpose and meet the needs of Londoners without differentiating between tenures.*
B. *Qualitative aspects of a development are key to ensuring successful sustainable housing. Table 3.2 sets out key qualitative aspects which should be addressed in the design of housing developments.*
C. *Housing development should maximise the provision of dual aspect dwellings and normally avoid the provision of single aspect dwellings. A single aspect dwelling should only be provided where it is considered a more appropriate design solution to meet the requirements of Part B in Policy D3 Optimising site capacity through the design-led approach than a dual aspect dwelling, and it can be demonstrated that it will have adequate passive ventilation, daylight and privacy, and avoid overheating.*
D. *The design of development should provide sufficient daylight and sunlight to new and surrounding housing that is appropriate for its context, whilst avoiding overheating, minimising overshadowing and maximising the usability of outside amenity space.*
E. *Housing should be designed with adequate and easily accessible storage space that supports the separate collection of dry recyclables (for at least card, paper, mixed plastics, metals, glass) and food waste as well as residual waste.*
F. *Housing developments are required to meet the minimum standards below which apply to all tenures and all residential accommodation that is self-contained.*

Table 2 London Plan Policy D6 (March 2021)

2.5 Climate change means London is already experiencing higher than historical average temperatures and more severe hot weather events. This, combined with a growing population, urbanisation and the urban heat island effect, means that London must manage heat risk in new developments, using the cooling hierarchy above. The cooling hierarchy applies to major developments, and the principles can also be applied to minor development.

2.6 Maintaining thermal comfort conditions in the face of climate change and increasing temperatures is one of the greatest challenges to be addressed by designers. The main objective is to achieve thermal comfort and minimise summertime overheating without using air conditioning systems, which typically have associated greenhouse gas emissions and impact the urban heat island effect.

Policy SI 4 Managing heat risk

A. *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.*
B. *Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:*
   - *reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure*
   - *minimise internal heat generation through energy efficient design*
   - *manage the heat within the building through exposed internal thermal mass and high ceilings*
   - *provide passive ventilation*
   - *provide mechanical ventilation*
   - *provide active cooling systems.*

Table 3 London Plan Policy SI 4 (March 2021)

2.7 In managing heat risk, new developments in London face two challenges – the need to ensure London does not overheat (the urban heat island effect) and that individual buildings do not overheat.

2.8 The urban heat island effect is caused by the extensive built-up area absorbing and retaining heat day and night, leading to parts of London being several degrees warmer than the surrounding area. This can become problematic on the hottest days of the year as daytime temperatures can reach well over 30°C and not drop below 18°C at night. These circumstances can lead many people to feel too hot or unable to sleep, but for certain health conditions and 'at risk' groups, such as some young or elderly Londoners, the effects can be serious and worsen health conditions. Green infrastructure can mitigate this effect by shading roof surfaces and through evapotranspiration. Development proposals should incorporate green infrastructure in line with Policy G1 Green infrastructure and Policy G5 Urban greening.

2.9 Passive ventilation should be prioritised, considering external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. Suppose active cooling systems, such as air conditioning systems, are unavoidable. In that case, these should be designed to reuse the waste heat they produce. Future district heating networks are expected to be supplied heat from waste heat sources such as building cooling systems.

London Borough of Camden

2.10 Adapting to a changing climate is identified in Camden's environmental sustainability plan, Green Action for Change (2011-2020). The three key risks that require adaptation are flooding, drought and overheating. Specific design measures and 'green infrastructure' such as green roofs, green walls and open spaces can help mitigate some of these risks.

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

- a. *The protection of existing green spaces and promoting new appropriate green infrastructure;*
- b. *not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;*
- c. *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
- d. *measures to reduce the impact of urban and dwelling overheating, including the application of the cooling hierarchy.*

Table 4 Camden Local Plan CC2 (March 2021)

2.11 To minimise the risks of climate change, the London Borough of Camden will expect the design of developments to consider anticipated changes to the climate.

2.12 Development should also consider the impacts of overheating and flooding on human health and should be designed so that they are adaptable in accordance with policies CC2 Adapting to climate change and CC3 Water and flooding.

3 Required standards

3.1 Paragraph 9.4.5 within London Plan (March 2021) states that "*The Chartered Institution of Building Services Engineers (CIBSE) has produced guidance on assessing and mitigating overheating risk in new developments, which can also be applied to refurbishment projects. The guidance requires the following guidelines to assess overheating risks:*

- *TM 59 should be used for domestic developments.*
- *TM 52 should be used for non-domestic developments.*
- *TM 49 guidance and datasets should also be used to ensure that all new development is designed for the climate it will experience over its design life. Further information will be provided in guidance on how these documents and datasets should be used*."

CIBSE TM 59 (2017) Assessment Criteria

3.2 The criteria for the assessment of overheating risk have been specified by the Chartered Institute of Building Services Engineers (CIBSE) in the CIBSE TM59: Design methodology for the assessment of overheating risk in homes (2017). CIBSE TM59 provides a standardised approach to predicting overheating risk for both naturally and mechanically ventilated residential buildings.

3.3 The following criteria must be met to demonstrate compliance:

- For living rooms, kitchens and bedrooms: The indoor operative temperature should not exceed the threshold comfort temperature by 1°C or more for more than 3% of occupied hours.
- For bedrooms only: To guarantee comfort during the sleeping hours, the operative temperature in the bedroom from 10 pm to 7 am should not exceed 26°C for more than 1% of annual hours.

4 Modelling Approach

Methodology

4.1 The dynamic thermal modelling software Design Builder (V.7) has been used to set up the model and run a dynamic simulation for overheating risk.

4.2 The performance of the dwellings has been assessed under the CIBSE TM59 guidance and the adaptive thermal comfort model for a primarily naturally ventilated scenario.

4.3 All units with relative layouts, sizes, orientation, external shading, and window openability have been assessed.

4.4 The top floor studio is located on a mezzanine level which is open to the living room area below. so that the living room and top floor studio are regarded as one space in the model. It is analysed as the living room in the daytime.

4.5 The location and the internal layouts of the homes selected for assessment are presented in Appendix C.

Site External Weather Conditions

4.6 External temperatures and solar gains are the greatest during the summer months, coinciding with periods of lower wind speeds. However, solar altitude is highest during the summer, increasing the effects of façade shading from balcony overhangs and window reveals. Such considerations should be accounted for when designing for overheating risks.

4.7 The effects of external conditions are vital in an overheating assessment as they influence:

- Solar heat gains (a function of incident direct & diffuse solar radiation and solar altitude)
- Calculated natural ventilation rates (a function of external temperature, wind direction and speeds).

4.8 Based on the CIBSE TM59 methodology on the use of weather files for overheating assessments:

> *"It Is expected that the CIBSE compliance criteria are met for the DSY1 weather scenario…*
> *…Where the CIBSE compliance criteria are not met for a particular weather file, the applicant must demonstrate that the risk of overheating has been reduced as far as practical and that all passive measures have been explored, including reduced glazing and increased external shading. The applicant should also outline a strategy for residents to cope in extreme weather events, e.g., use of fans."*

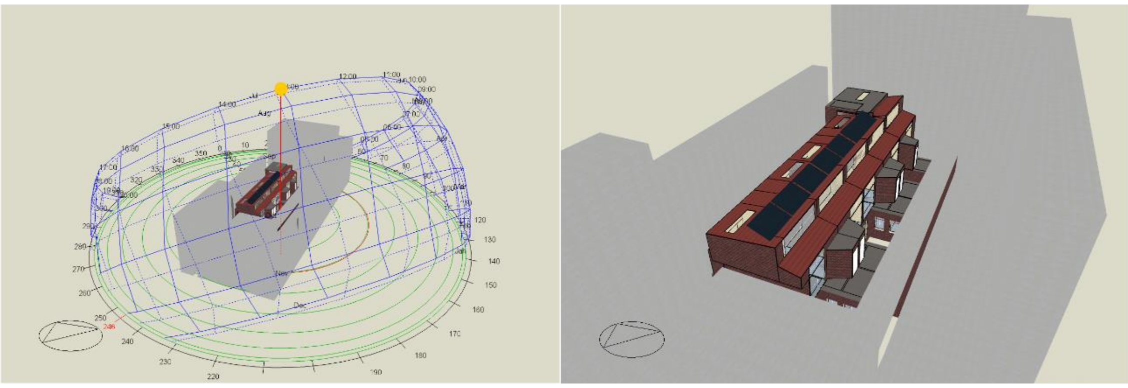
4.9 CIBSE Design Summer year weather data for London Heathrow (representative of low density urban and suburban areas) has been used for the 2020s, high emissions, 50% percentile scenario as required by CIBSE TM59.

4.10 The dwellings assessed were confirmed to have no acoustic risk at night, and as such, the ability for the windows to stay open during the night was incorporated into the overheating analysis.

Model Geometry and Local Shading

4.11 Overshadowing from the adjacent building blocks was considered during simulations based on the model geometry and the site orientation.

4.12 Solar control forms an integral part of overheating mitigation strategies. External shading in the form of balconies and shading from the building frame is across the development as part of the design proposal. These were incorporated into the simulation model and are shown in Figure 2.



(a) (b)

Figure 2 (a) Sun path diagram, 1st July 13:00, (b) close-up view from the south elevation

4.13 Horizontal shading devices such as balconies/overhangs are more efficient when applied in south-orientated facades and midday when the solar angle is high. The role in reducing solar gains in the summer period is paramount.

Design Modelling Inputs for Dwellings

4.14 The following modelling inputs (Table 6) have been set up in the baseline dynamic thermal simulation, in line with the SAP calculation inputs. CIBSE TM59 guidance has been used for all occupancy rates and internal heat gain assumptions, contributing to the overheating risk.

4.15 The thermal insulation levels selected will improve the fabric of the build beyond the minimum Building Regulation standards, limiting the heat losses (and gains) through the building fabric. Table 6 includes the proposed building fabric standards used for the modelling.

4.16 Low U-values have been proposed for the opaque elements in the building envelope. It is assumed that considering the construction form and higher insulation levels, the building envelope's thermal mass is anticipated to be medium (as indicated in Table 5).

Exposed Element	Construction	Cm kJ/m2K
Ground (supported) Floor	Suspended beam and block, screed over insulation	110
Exposed Wall	Cavity wall: dense plaster, AAC block, filled cavity, any outside structure	70
Roof	Plasterboard, insulated flat roof	9
Party wall	Fully filled cavity wall-Plaster on dabs and single plasterboard on both sides, dense cellular block, cavity	70
Door	Solid Wood Door (PAS 24 Locks)	
Window	Solar shading glass (g value 0.55), High-performance acoustic glazing comprising 10/16/8.8 or equivalent having an Rw+Ctr of 38dB.	

Table 5 indicative thermal mass details

4.17 The overheating assessment indicates that the proposed building envelope with medium thermal mass will generally be sufficient to maintain an acceptable indoor temperature within the units.

4.18 A design air permeability of 4m³/h/m² at 50 Pascal's has been proposed for the development, which is broadly equivalent to an infiltration rate of 0.3 air changes per hour (ACH) used in the model.

4.19 It is proposed to use solar control glazing with a solar transmittance (g-value) of 0.55.

Data Input			Discussion
Weather data	Location	CIBSE London Heathrow Design Summer Years (DSYs) for the 2020s, high emissions, 50% percentile scenario	Geographically closest and most representative industry-standard CIBSE weather data file
		Additional DSY2 and DSY3 were tested to demonstrate performance under extreme weather conditions (7Appendix G and Appendix G)	
Building Construction Details	External Walls	0.15 W/m²K	As per SAP calculations
	Flat roof	0.10 W/m²K	As per SAP calculations
	Ground floor	0.10 W/m²K	As per SAP calculations
Building Fabric Construction Details	Ceilings/floors	Assumed to be adiabatic between adjacent floors	The modular construction uses lightweight materials that have a medium thermal mass. Heat loss through ceilings and floors is assumed to be zero between units which are above or below each other (adiabatic)
	Party walls between units	Assumed to be adiabatic between adjacent units, fully filled and sealed	Walls adjacent to other units are assumed to be lightweight partitions. Adjacent units have been included as adiabatic within the dynamic overheating calculations
	Partitions within units	A metal stud wall structure	Fully filled cavity wall with edge sealing
	Internal doors	0.90 m width	As per drawings
Windows & glazed external doors	Windows/rooflights and glazed doors	Doubled glazed 1.20 W/m²K, g-value of 0.55 for all facades. Frame factor weighting is assumed to be 0.8, resulting in a weighted g- a value of 0.44	It is specified to reduce solar gains and mitigate overheating while limiting the negative effects on CO2 emissions and internal daylight levels.
	Reveal depth	External reveal: 150mm	As per drawings
Infiltration	Airtightness	4.0 m³/m²/h @ 50Pa	As per SAP calculations

Table 6 Baseline Dynamic Thermal Modelling Design Assumptions

Internal gains

4.20 Similar to the predicted occupancy hours, the prediction of internal gains (lighting, equipment, people) for occupied areas is incorporated in line with the guidance in TM59.

4.21 The following internal gains assumptions (Table 7) have been used in the dynamic thermal simulations in line with the CIBSE TM59 guidance.

Unit/room type	Occupancy	Equipment Load
2-bedroom apartment: living room/kitchen	2 people from 9am to 10pm; room is unoccupied for the rest of the day	Peak load of 450W from 6pm to 8pm
		200W from 8pm to 10pm
		110W from 9am to 6pm and from 10pm to 12pm
		Base load of 85W for the rest of the day
Double bedroom	2 people at 70% gains from 11pm to 8am, 2 people at full gains from 8am to 9am and from 10pm to 11pm, 1 person at full gain in the bedroom from 9am to 10pm	Peak load of 80W from 8am to 11pm
		Base load of 10W during sleeping hours
Small power	N/A	In accordance with TM59
All rooms – Lighting	N/A	Lighting is assumed to be $2W/m^2$ from 6pm to 11pm

Table 7 Occupancy and Equipment gains (CIBSE TM59)

Ventilation

4.22 The proposed ventilation strategy for the development entails the use of Mechanical Ventilation with Heat Recovery (MVHR) for the whole year. Therefore, the estimated auxiliary ventilation flow rates have been included in the model in line with Part F requirements for background ventilation.

4.23 Natural ventilation was modelled as the preferred ventilation strategy for the summer months to evaluate thermal comfort and mitigate potential overheating risks.

4.24 Natural ventilation can be provided via openable windows and balcony doors. The windows and balcony doors of apartments affected by noise will be open during the day and closed at night. Windows, rooflight, and balcony doors have been modelled to open when internal dry bulb temperatures exceed 22°C for occupied hours, in line with TM59 guidance. The level of exposure and associated coefficients of discharge is set up in accordance with the relative position of each window concerning the site context and building massing.

4.25 For modelling purposes, it is assumed that windows on unit 1 northeast bedroom window will be restricted to a 15° opening angle for security purposes. All other windows and balcony doors are assumed to be open up to a 90° opening angle with 50% of the glazing area. Internal doors are assumed to be left open during the daytime and closed at night in the model as per the TM59 requirements.

4.26 It is proposed that each dwelling will have dedicated mechanical ventilation systems. The proposed MVHR has been modelled to supply the ventilation rates stated in Building Regulations Part F.

5 Proposed Strategy and Summary of Results

5.1 The modelling demonstrates that the proposed mitigation measures are adequate to achieve compliance against the TM59 DSY1 weather data file. The following mitigation options in Table 8 have been incorporated within the design to mitigate overheating risk in dwellings under CIBSE TM59.

Data Input			Discussion
Overheating mitigation measures	Windows and Glazed Doors	A g-value of 0.55	*Specified to reduce solar gains and mitigate against overheating while limiting negative effects on CO_2 emissions and internal daylight levels*
	External Shading	External shading from balconies is present as per the architectural drawings. External shading from adjacent buildings also taken into consideration	*These elements will provide some solar* *shading as the sun tracks around the building*
	Internal Shading	High reflectance blinds in operation from 7am to 6pm	*The internal shading can help to mitigate residual overheating risk further*
	Natural ventilation	Internal doors are only open during the day (7am until 10pm) > Unit 1 Ground Floor North East bedroom window have a 15-degree restriction for safety reasons. > No restriction on windows, roof lights, or glazed doors, meaning 90- degree openability > Kitchen and living room windows and glazed doors are in operation 9am – 10pm > Bedroom windows and glazed doors are in operation 24/7	*Full openability assumes that residents have the freedom to remove window restrictors to enhance natural ventilation.* *Windows are simulated to be open when internal temperatures exceed 22°C and when the external temperature is lower than the internal temperature:* $T_{indoor} > 22°C$, $T_{outdoor} < T_{indoor}$

Table 8 Proposed overheating mitigation measures

5.2 All five units have been assessed against the TM59 overheating criteria using the three CIBSE London Heathrow Airport DSY weather data files. The modelling considers passive design measures such as shading from residential balconies, optimised solar control glazing, internal blinds and appropriate building fabric, and measures such as efficient lighting and mechanical ventilation.

5.3 The overheating modelling results (as seen in Table 9) demonstrate that the apartments with openable windows and balcony doors pass the overheating criteria with the DSY1 weather data file.

5.4 Appendix E demonstrates the acceptance of overheating risk for all dwellings using highly reflective internal blinds and shows that using the internal blinds would mitigate the overheating risk further.

Unit	Room ref	TM59 Criterion A: Hours of exceedance (pass ≤ 3%)	TM59 Criterion B: Bedroom temperature hours >26°C (pass ≤ 32)	Overall compliance with TM59
		% Hours of overheating	Hours of overheating	
1	Bed Room 1	0.01	20.67	**Pass**
1	Bed Room 2	0.12	16.67	**Pass**
2	Bed Room 1	0	22	**Pass**
2	Bed Room 2	0.19	16.83	**Pass**
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5	Bed Room 1	0	26.17	**Pass**
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1	Living Room/Kitchen	0.48	N/A	**Pass**
2	Living Room/Kitchen	0.56	N/A	**Pass**
3	Living Room/Kitchen	0.62	N/A	**Pass**
4	Living Room/Kitchen	0.63	N/A	**Pass**
5	Living Room/Kitchen	0.62	N/A	**Pass**

Table 9 TM59 overheating results for DSY1 2020s without blinds

5.5 Based on the assumptions outlined in Table 6 and Table 7 and the proposed mitigation measures summarised in Table 8, all rooms meet the TM59 criteria, demonstrating an acceptable level of overheating risk (as shown in Table 9). TM59 provides a standardised approach to assessing overheating risk, but it should be noted that the perception of overheating is subjective and will also be influenced by occupant behaviour. The Home Owner's Manual will provide residents with possible measures to mitigate the overheating risk.

5.6 GLA expects all developments to comply with the DSY1 weather scenario. Further analysis using DSY 2 and 3 is recommended, but compliance with additional weather scenarios is not strictly required. The results of the dwellings for DSY 2 and DSY 3 are in Appendix F and Appendix G, respectively. The results indicate that meeting the CIBSE TM59 compliance criteria for additional weather scenarios is challenging. One main reason for overheating in some spaces using DSY2 and DSY 3 is due to the site constraints resulting that cross ventilation is not possible in ground floor bedrooms. The dwelling is primarily ventilated through natural stack effect allowing the warm air to rise up and exit via rooflight.

5.7 The proposed mitigation measures included in Table 8 would be beneficial in reducing the overheating problem in DSY 2 and 3 scenarios. Alternatively, additional measures like (i) external shading, (ii) use of a fan to increase ventilation rate through the dwelling, and night cooling with openable windows will be beneficial to reduce the overheating risk under DSY 2 and DSY3 scenario.

6 Conclusion

6.1 This report details the methodology and findings of the dynamic overheating assessment of All dwelling units within the proposed development at 264 Belsize Road, Kilburn, Camden, London.

6.2 This report assumes that dwellings will utilise openable windows for purge ventilation, a background mechanical ventilation system, and internal shading in the form of high reflectance blinds. Passive measures such as high-efficiency building fabric maximised solar control glazing specifications, and the use of external glazing in the form of balconies have been explored as far as practicable. Safety concerns for ground-floor dwellings have also been accounted for.

6.3 The dynamic overheating assessment of all dwelling units across the proposed scheme demonstrates an acceptable overheating level per the current industry best practice CIBSE TM59: 2017 criteria under the DSY1 weather file. The overheating results are based on key design features that follow the London Plan Policy SI 4: *Managing the heat risk*, as shown in Table 10.

Cooling Hierarchy	Proposed Measures	Discussion
1. Energy efficient design	Highly efficient building fabric and air tightness standards	As per post-planning SAP calculations
2. Reduce the amount of heat entering the building	A g-value of 0.45 for all dwellings	A low G-value reduces the solar gains, therefore assisting in mitigating overheating. However, it has implications on CO2emissions, fabric energy efficiency and internal daylight levels and has therefore been optimised to be kept as high as possible
	External shading: Balcony overhangs are included as per the design proposal Internal Shading: High reflectance blinds on all windows in operation from 7am to 6pm	External and internal shading are considered one of the most effective methods for solar control and overheating mitigation
3. Manage the heat	A concrete slab of 250mm on the ground floor and 225mm on all other floors are used to reduce the risk of overheating in the daytime. This is due to its thermal mass absorbing heat.	
4. Passive ventilation	Windows and glazed doors are fully openable on all floors apart from the ground floor. Here, the windows and glazed doors are restricted to 15 degrees. Kitchens and living rooms have a set operational schedule of window openability from 9am to 10pm. All bedroom windows and glazed doors are fully openable 24/7, considering the caveat of ground floor dwellings.	Windows are simulated to be open when internal temperatures exceed 22°C and when the external temperature is lower than the internal temperature: T indoor > 22°C, T outdoor < Tindoor Night-time ventilation effectively purges excess heat build-up during the day and cools the building fabric, especially if it is thermally massive
5. Mechanical ventilation	Minimum rates to comply with Building Regulations Part F	An assumption made based on domestic mechanical ventilation that will be able to exceed minimum Part F requirements (Appendix B)
6. Active cooling	All homes use a combination of passive mechanical ventilation and natural purge ventilation to mitigate the overheating risk.	
Green Infrastructure	Green Roof and a private garden (in the lightwell) around the site will help reduce the heat island effect.	

Table 10 Design Features to address the cooling hierarchy (London Plan SI 4)

7 Appendices

Appendix A Part O Overheating Checklist

1.1 Building and site details	
Residential building name/number	264
Street	Belsize Road, Kilburn, Camden
Town	London
County	London
Postcode	NW6 4BT
Proposed building use/type of building	Residential Dwelling
Are there any security, noise or pollution issues?	Possible pollution issue exists as the site is close distance to the busy high street and Railway Line
1.2 Designer's details	
Designer's name	Maitiniyazi Bake
Company	Peter Deer and Associates Ltd
Address line 1	Solar House, 282 Chase Road
Address line 2	Southgate, London
Postcode	N14 6HA
Telephone number	0202 3232 0080
Email address	Maitiniyazi.B@pd-a.co.uk

Part 1 - Building details and declarations

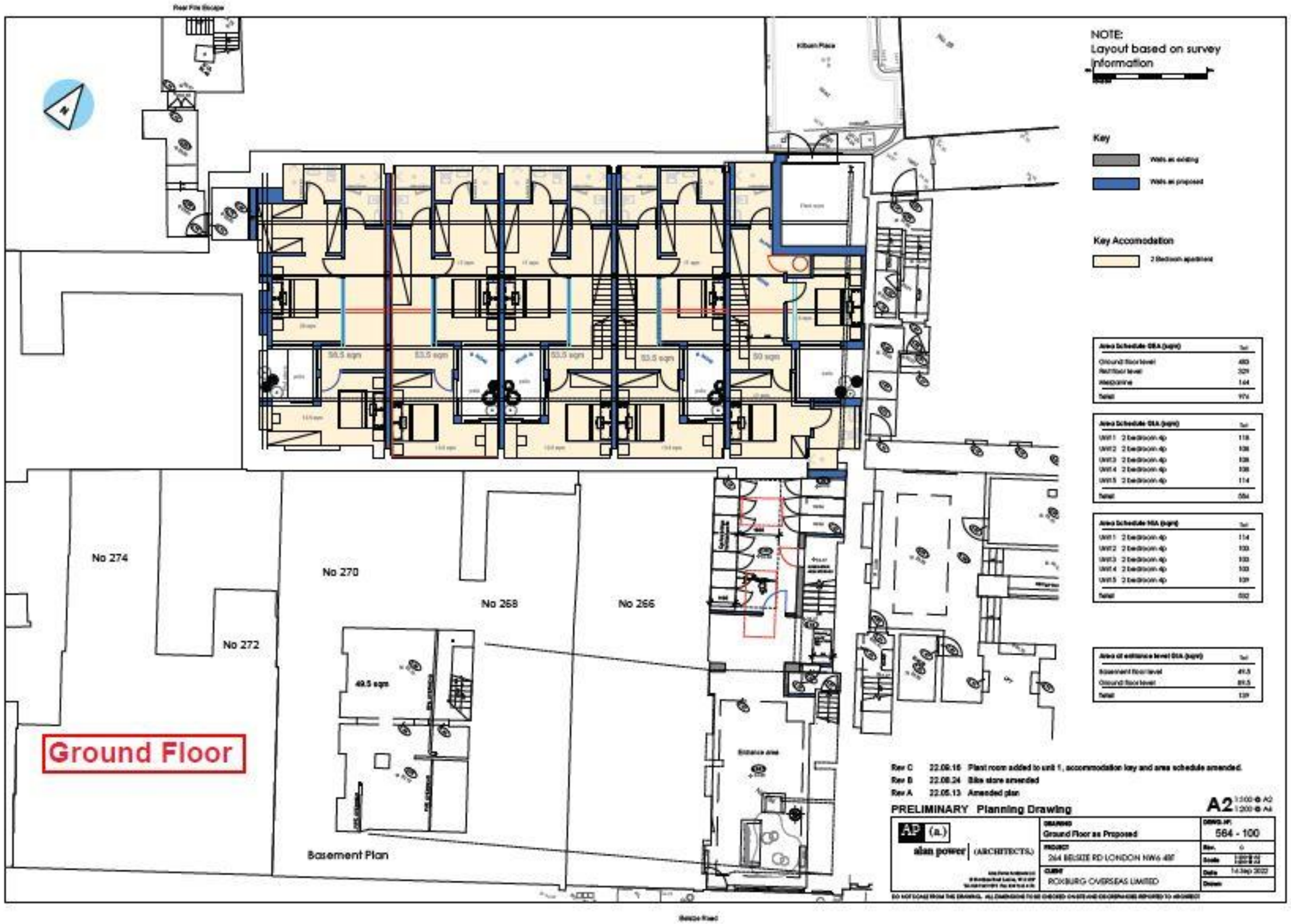
2b.1 Modelling details	
Dynamic software name and version	DesignBuilder 7.1.0.110
Weather file location used, including any additional, more extreme weather files	CIBSE London Heathrow Design Summer Years (DSYs) for the 2020s, high emissions, 50% percentile scenario, Additional DSY2 and DSY3 were tested to demonstrate performance under extreme weather conditions
Number of sample units modelled, including an explanation of why the size/selection has been chosen	all units (5 units)
2b.2 Modelled occupancy	
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6? (1)	Yes
Details of the occupancy profiles used	As per CIBSE TM59 Guidance
Details of the equipment profiles used	As per CIBSE TM59 Guidance
Details of the opening profiles used	As per CIBSE TM59 Guidance
2b.3 Modelled overheating mitigation strategy	
Free areas	Free Areas (50% of glazing area with a discharge coefficient of 0.55) are included in the modelling as per drawings
Infiltration and mechanical flow rates	The infiltration rate is 0.5 air change rate per hour, and the mechanical ventilation rate is shown in Appendix B of this report
Window g-value	All windows and Rooflight are with g-value of 0.55 glazing
Shading strategy	External shading from balconies was present as per the design drawings. External shading from adjacent buildings is also taken into consideration. Internal high reflectance blinds in operation from 7am to 6pm
Mechanical cooling	NA
2b.4 Modelling results	
Has the project passed the assessment described in CIBSE's TM59, taking into account the limits detailed in paragraphs 2.5 and 2.6?	Yes
What is the overall overheating strategy (i.e. what design features are key to the project passing)?	1. highly-reflective internal blinds, 2. solar control glazing 3. openable windows and rooflights to allow natural ventilation stack effect 4. external shading from adjacent buildings and balconies
2b.5 Designer's declaration	
Has the building construction proposal been modelled accurately?	Yes
Designer's name	Maitiniyazi Bake
Designer's organisation	Peter Deer and Associates Ltd
Designer's signature	Maitiniyazi Bake
Registration number (if applicable)	
Date of design	22/08/2022

Design details Part 2b – Dynamic thermal modelling method

Appendix B Proposed indicative Mechanical ventilation rates

Dwelling	Unit 01_2B4P	Unit 02_2B4P	Unit 03_2B4P	Unit 04_2B4P	Unit 05_2B4P
Floor area (m^3)	118	108.7	108.8	108.8	114.4
Averaged Storey height (m)	2.6	2.6	2.6	2.6	2.6
Volume (m^3)	306.8	332.1	330.5	332.0	332.3
Typical Bedroom	6.5	6.5	6.5	6.5	6.5
Kitchen (l/s)	13.0	13.0	13.0	13.0	13.0
Utility cupboard (l/s)	8.0	8.0	8.0	8.0	8.0
Bathroom/WC (l/s)	8.0	8.0	8.0	8.0	8.0
Proposed Boost Rate* (l/s)	45.0	45.0	45.0	45.0	45.0
Whole-dwelling ventilation rate (cu.m/hr)	162.0	162.0	162.0	162.0	162.0

Appendix C Assessed Dwelling Layouts

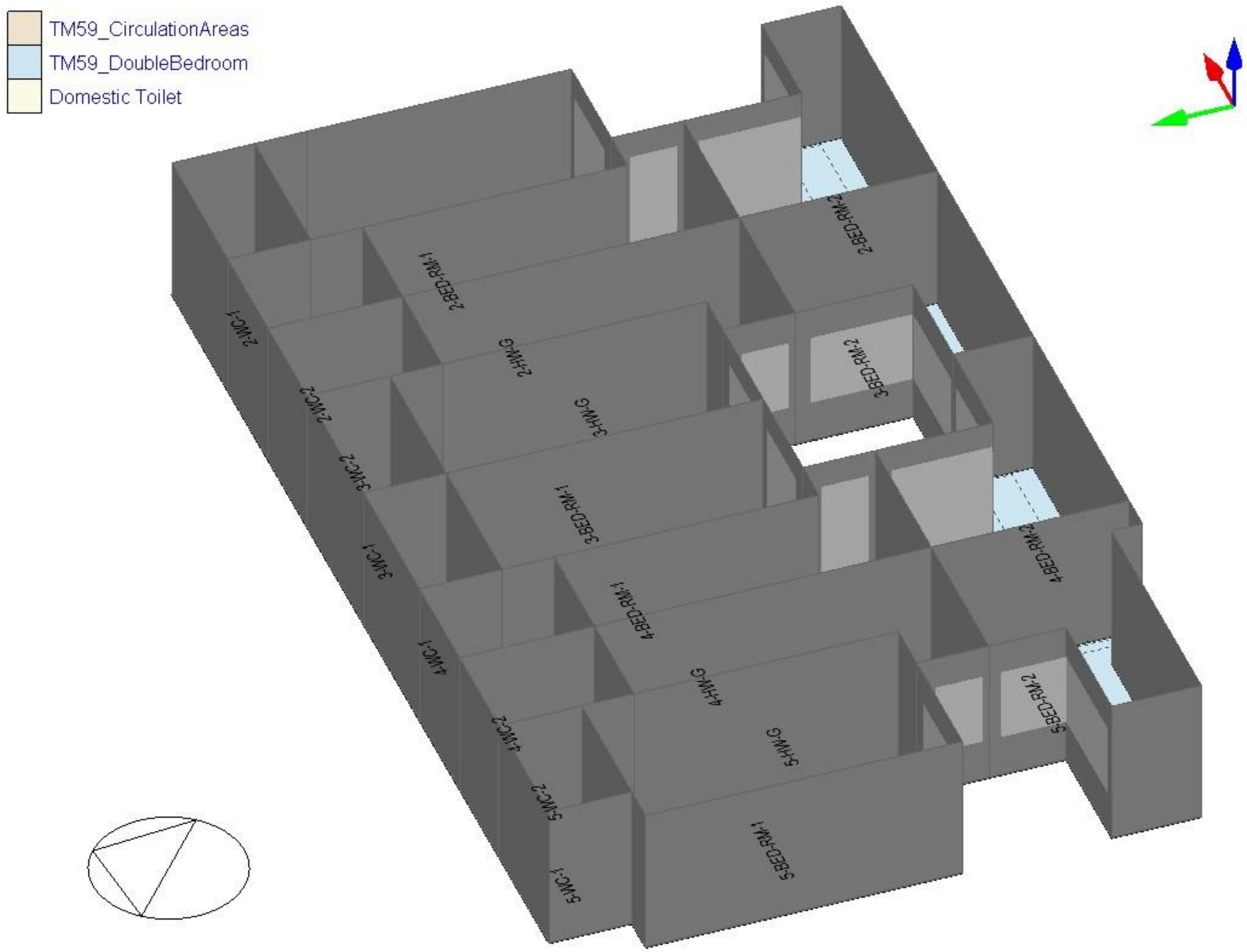



NOTE:
Layout based on survey information
Key
Key Accomodation
UNIT 5
UNIT 4
UNIT 3
UNIT 2
UNIT 1
PRELIMINARY
A2
584 - 101
First Floor as Proposed
264 BELSIZE RD LONDON NW6 4BT
ROXBURG OVERSEAS LIMITED
alan power (ARCHITECTS)
First Floor

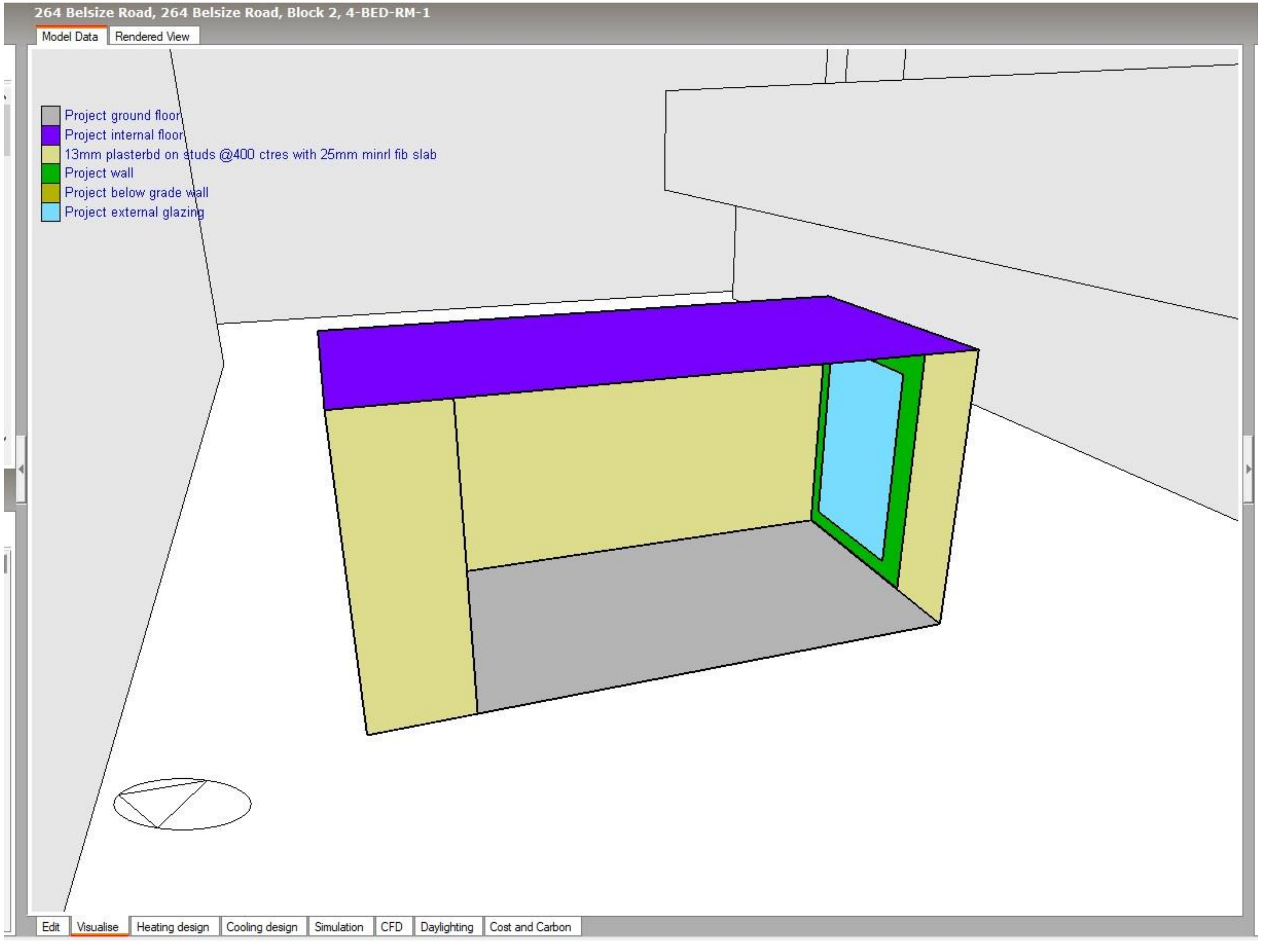

Key Plan
NOTE:
Layout based on survey information
Key
Key Accomodation
Mezzanine Floor
Rev B 22.09.16 Accommodation key and area schedule amended.
Rev A 22.05.13 Amended plan
PRELIMINARY
A2
AP (a.)
alan power (ARCHITECTS)
Mezzanine Floor as Proposed
564 - 102
264 BELSIZE RD LONDON NW6 4BT
ROXBURG OVERSEAS LIMITED

Appendix D Visual Example from DesignBuilder Energy Model

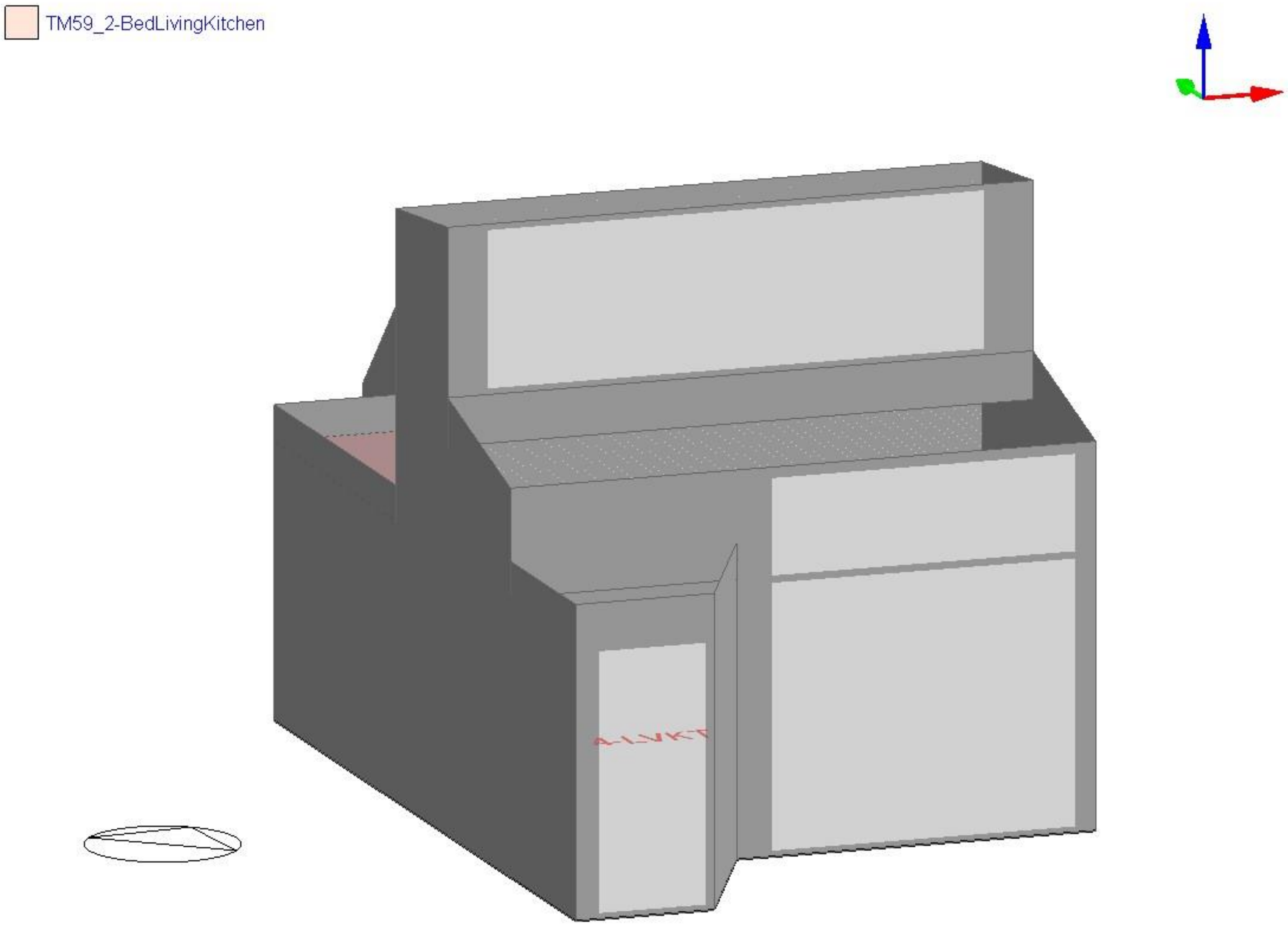
Ground Floor Model Example



Flat 4 Bedroom 1 Model Example



Flat 4 Living Room Model Example



Appendix E Overheating results for DSY 1 2020s- with internal blinds

Unit	Room ref	TM59 Criterion A: Hours of exceedance (pass ≤ 3%)	TM59 Criterion B: Bedroom temperature hours >26°C (pass ≤ 32)	Overall compliance with TM59
		% Hours of overheating	Hours of overheating	
1	Bed Room 1	0	18	Pass
1	Bed Room 2	0.12	16.17	Pass
2	Bed Room 1	0	17.17	Pass
2	Bed Room 2	0.17	15.83	Pass
3	Bed Room 1	0	19.67	Pass
3	Bed Room 2	0.11	18.33	Pass
4	Bed Room 1	0	19.33	Pass
4	Bed Room 2	0.15	16.33	Pass
5	Bed Room 1	0	21.5	Pass
5	Bed Room 2	0	16.67	Pass
1	Living Room/Kitchen	0.38	N/A	Pass
2	Living Room/Kitchen	0.39	N/A	Pass
3	Living Room/Kitchen	0.5	N/A	Pass
4	Living Room/Kitchen	0.5	N/A	Pass
5	Living Room/Kitchen	0.49	N/A	Pass

Appendix F Overheating results for DSY 2 2020s- with internal blinds

Unit	Room ref	TM59 Criterion A: Hours of exceedance (pass ≤ 3%)	TM59 Criterion B: Bedroom temperature hours >26°C (pass ≤ 32)	Overall compliance with TM59
		% Hours of overheating	Hours of overheating	
1	Bed Room 1	0.38	45.5	Fail
1	Bed Room 2	0.41	31	Pass
2	Bed Room 1	0.27	45.83	Fail
2	Bed Room 2	0.72	28	Pass
3	Bed Room 1	0.41	48.17	Fail
3	Bed Room 2	0.73	39	Fail
4	Bed Room 1	0.39	47.33	Fail
4	Bed Room 2	0.59	29.5	Pass
5	Bed Room 1	0.12	55.67	Fail
5	Bed Room 2	0.51	38.5	Fail
1	Living Room/Kitchen	1.68	N/A	Pass
2	Living Room/Kitchen	1.66	N/A	Pass
3	Living Room/Kitchen	1.92	N/A	Pass
4	Living Room/Kitchen	1.94	N/A	Pass
5	Living Room/Kitchen	1.96	N/A	Pass

Appendix G Overheating results for DSY 3 2020s- with internal blinds

Unit	Room ref	TM59 Criterion A: Hours of exceedance (pass ≤ 3%)	TM59 Criterion B: Bedroom temperature hours >26°C (pass ≤ 32)	Overall compliance with TM59
		% Hours of overheating	Hours of overheating	
1	Bed Room 1	0.08	62.67	Fail
1	Bed Room 2	0.45	49.17	Fail
2	Bed Room 1	0.04	65.33	Fail
2	Bed Room 2	0.77	43.33	Fail
3	Bed Room 1	0.15	71.33	Fail
3	Bed Room 2	0.89	62.67	Fail
4	Bed Room 1	0.14	70.67	Fail
4	Bed Room 2	0.67	46.33	Fail
5	Bed Room 1	0	82.83	Fail
5	Bed Room 2	0.42	62.83	Fail
1	Living Room/Kitchen	1.82	N/A	Pass
2	Living Room/Kitchen	2.07	N/A	Pass
3	Living Room/Kitchen	2.74	N/A	Pass
4	Living Room/Kitchen	2.77	N/A	Pass
5	Living Room/Kitchen	2.76	N/A	Pass