264 Belsize Road, NW6 4BT

Overheating Assessment Report

July 2023

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Executive summary

This report details the methodology and assessment of the dynamic overheating of the proposed development of 5 dwelling units which comprise 5 no. two-bedroom duplexes located at 264 Belsize Road, Kilburn, London, NW6 4BT.

This report aims to demonstrate compliance with CIBSE 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 submission to Camden Borough Council.

The proposed development has been modelled 3-dimensionally using IES VE software to perform the overheating assessments. The model is based on the architectural floor plans and proposed site layout.

The overheating assessment for the residential part of the development has been carried out in accordance with the guidance set out in CIBSE TM59: Design Methodology for the Assessment of Overheating in Homes with inputs from The Building Regulations Approved Part O: Overheating, and CIBSE TM52: The limits of thermal comfort: avoiding overheating in European buildings for the non-residential parts.

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.

It is assumed that the 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 and the use of external shading via balconies have been assessed. Internal blinds have been considered to reduce the risk of overheating.

The modelling results show that all the assessed dwellings pass the overheating criteria with the proposed overheating mitigation strategy using DSY 1 weather file. Generally, this overheating assessment is more difficult to achieve using the future weather file (DSY2 and DSY3). To achieve compliance with the overheating criteria for any climate change scenarios, it is recommended to consider incorporating overheating adaptation measures into the design. These measures can include but is not limited to the following:

- External shading that can be easily retrofitted without requiring a major redesign of the building.
- Natural ventilation measures such as acoustic panels sized to take account of climate change scenarios.
- Internal and external space provision to retrofit active cooling without requiring a major redesign of the building.

The results for DSY2 and DSY 3 can be seen in Appendix D and Appendix E.

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

Space Name	Occupied days	TM59 Criterion A: Hours of exceedance (pass ≤ 3%) % Hours of overheating	TM59 Criterion B: Bedroom temperature hours >26°C (%hrs) Hours of overheating	Overall compliance with TM59
Unit 1 Bedroom 1	100%	1.1%	0.4%	Pass
Unit 1 Bedroom 2	100%	0.8%	0.4%	Pass
Unit 2 Bedroom 1	100%	1.2%	0.4%	Pass
Unit 2 Bedroom 2	100%	1.6%	0.4%	Pass
Unit 3 Bedroom 1	100%	0.8%	0.4%	Pass
Unit 3 Bedroom 2	100%	1.9%	0.4%	Pass
Unit 4 Bedroom 1	100%	1.1%	0.4%	Pass
Unit 4 Bedroom 2	100%	1.6%	0.4%	Pass
Unit 5 Bedroom 1	100%	0.8%	0.5%	Pass
Unit 5 Bedroom 2	100%	1.3%	0.4%	Pass
Unit 1 Kitchen/Dining	100%	2.7%	N/A	Pass
Unit 1 Living Room	100%	2.6%	N/A	Pass
Unit 2 Kitchen/Dining	100%	2.8%	N/A	Pass
Unit 2 Living Room	100%	2.7%	N/A	Pass
Unit 3 Kitchen/Dining	100%	3.0%	N/A	Pass
Unit 3 Living Room	100%	2.9%	N/A	Pass
Unit 4 Kitchen/Dining	100%	2.9%	N/A	Pass
Unit 4 Living Room	100%	2.8%	N/A	Pass
Unit 5 Kitchen/Dining	100%	2.7%	N/A	Pass
Unit 5 Living Room	100%	2.2%	N/A	Pass

TM 59 Overheating results for DSY1 2020s without blinds

All 5 dwellings without any shading device demonstrate an acceptable overheating level as to 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 the occupant behaviour.

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 essential. The results indicate that in meeting CIBSE TM59 criteria for additional weather scenarios is a challenging requirement. The dwelling is primarily ventilated through the natural stack effect allowing the warm air to rise and egress via the rooflight.

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

The homeowner’s manual will provide the residents with guidance on the ventilation strategy to alleviate 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 0.38 (Frame factor:0.80)	*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 Northeast 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

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 (5 no. two-bedroom duplexes

1 This report has been prepared by Arshpreet Chugh of PDA, to provide the overheating assessment for the proposed development forming part of the full planning application to Camden Borough Council.

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

Dynamic thermal simulations have been used adopting the methodology of CIBSE TM59: *Design Methodology for the Assessment of Overheating in Homes* to determine whether there is a risk of overheating or otherwise. Appropriate mitigation measures have been recommended to reduce the overheating risk and thus providing comfortable thermal conditions during occupied hours.

This document should be read in conjunction with:

- Design and Access Statement
- Energy Statement
- Sustainability Report

1.1 Site location

Figure 1-1 Site location (Open Street Map 2022)

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

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.

The site is within an Archaeological Priority Area due to its 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.

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

The proposed architectural design maximise the principle of stack effect ventilation by using the lightwell and openable rooflight features so that the warm air can rise sufficiently from the bedrooms and escape naturally through the roof light, which reduces the overheating risk.

2 Planning Policy Requirements

2.1 National Policy

Paragraph 153 within The National Planning Policy Framework (DCLG, July 2021) states the importance of mitigating the overheating risk of proposed developments (Table 2-1).

Planning for climate change
153. Plans should take a proactive approach to mitigating and adapting to climate change, considering 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 2-1 Planning for Climate Change (National Planning Policy Framework, DCLG, July 2021)

2.2 London Plan

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.

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.

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

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.

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.

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.

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.

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.

Housing developments are required to meet the minimum standards below which apply to all tenures and all residential accommodation that is self-contained.

Table 2-2 London Plan Policy D6 (March 2021)

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.

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

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and the incorporation of green infrastructure.

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 2-3 London Plan Policy SI 4 (March 2021)

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.

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.

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.

2.3 London Borough of Camden

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:

The protection of existing green spaces and promoting new appropriate green infrastructure. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems.

incorporating bio-diverse roofs, combination green and blue roofs, and green walls where appropriate; and measures to reduce the impact of urban and dwelling overheating, including the application of the cooling hierarchy.

Table 2-4 Camden Local Plan CC2 (March 2021)

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.

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 Overheating Assessment Methodology and Criteria

3.1 Required standards

Paragraph 9.4.5 of the London Plan (March 2021) states that CIBSE has produced guidance on assessing and mitigating overheating risk in new developments, which can 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."

3.2 CIBSE TM 59 (2017) Assessment Criteria

The criteria for the assessment of overheating risk have is referred to CIBSE TM59: Design methodology for the assessment of overheating risk in homes (2017). This guidelines provides a standardised approach to predicting overheating risk for both naturally and mechanically ventilated residential buildings.

Under TM59 methodology:

- Allows different designs to be compared with a common approach, based on set assumptions for occupancy and internal gains.
- Supports design decisions that improve comfort without cooling.
- Provides consistency across the industry as all consultants will be using the same methodology for overheating risk prediction.

This methodology will not:

- Guarantee that people will always be comfortable in the rooms.
- consider unusual use.

Approved Document Part O: Overheating gives guidance on how to comply with Part O of the Building Regulations. This guidance applies to new residential buildings only. CIBSE's TM59 method requires the modeller to make limited choices. The limits described in Part O document relate to the appropriate modelling of the openings.

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.

3.3 Modelling Software

The Dynamic Simulation Modelling (DSM) software IES VE 2022 is utilised to carry out the overheating assessment for the building. IES VE is a recommended design tool in accordance with CIBSE AM11: Building Energy and Environmental Modelling.

An axonometric view of the IES VE model of the proposed development is provided in Figure 3-1. This is simply a 3-dimensional model of the proposed development. The inputs and assumptions used in the simulations are covered in the following sections.

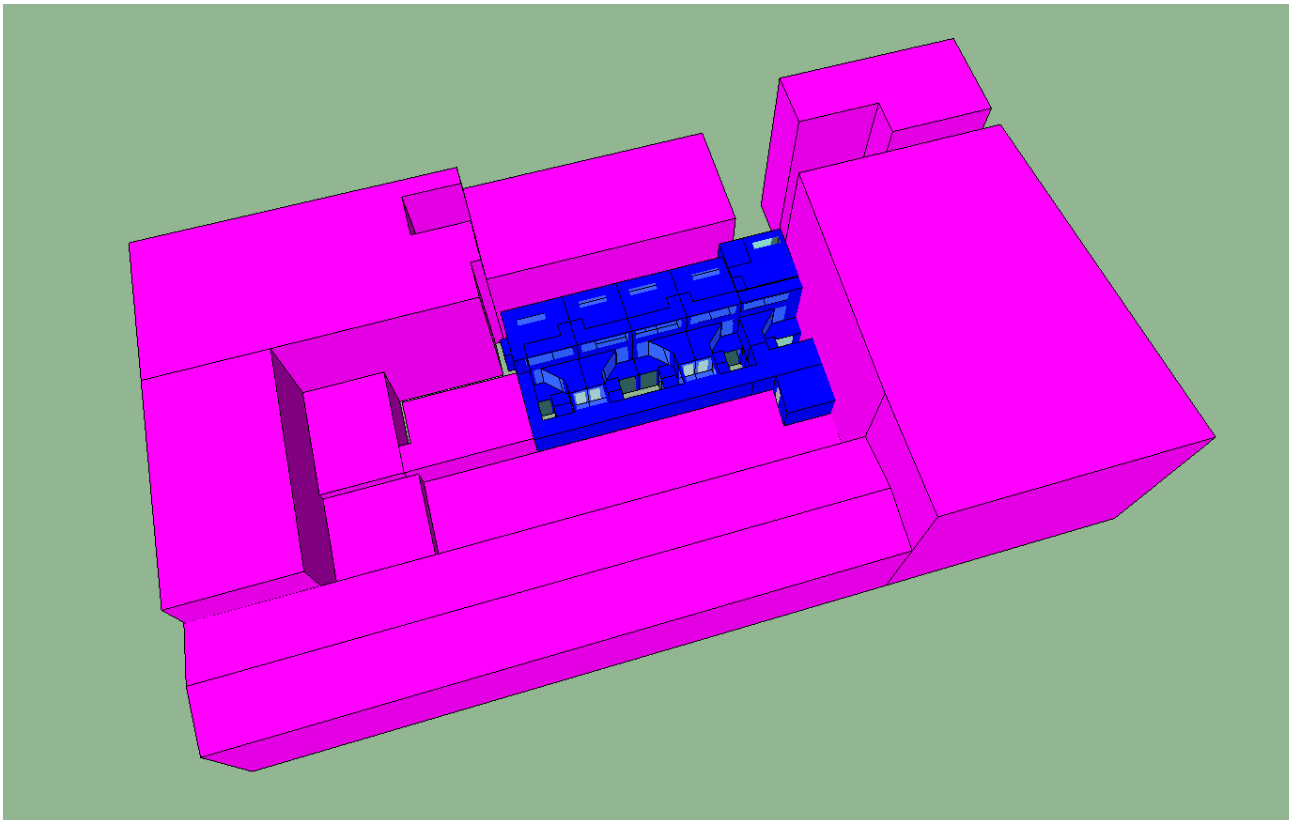


Figure 3-1 – 3D model of the proposed Pinehurst design modelled on IES

The process for using DSM tools for predicting the overheating risk is that a model of the building is created adopting the building geometry, internal layout, location and orientation of the building, construction details, internal gains, ventilation details and weather data.

The proposed development is a residential dwelling and Category II has been selected in accordance with CIBSE recommendation as presented in Table 3-1.

Table 3-1 - CIBSE suggested applicability of the categories/acceptable temperature range

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

The assessments were conducted using computer software, but it must be noted that building dynamic simulations provide an estimate of the building performance. This estimate is based on a simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee of the building operational performance can be fully replicated from the results.

3.4 Weather Data

The latest DSY weather files should be used when carrying overheating risk assessments. It is required to pass the overheating criteria using the DSY1 file most appropriate to the site location for the 2020s, high emissions, 50% percentile scenario.

The weather file used in this analysis is the London Heathrow Airport (HLR) Design Summer Year 1 (DSY1) 2020s, high emissions, 50% percentile scenario. This weather file was used to represent the site's type of terrain.

3.5 Overheating Assessment Criteria

TM59 sets different overheating compliance criteria for homes that are predominantly naturally ventilated[1]

and for homes that are predominantly mechanically ventilated[2].

[1] Naturally ventilated homes are homes that are predominantly ventilated using windows and/or trickle or passive background ventilators, with good opportunities for natural ventilation in the summer, and can include homes that have mechanical ventilation systems.

[2] Mechanically ventilated homes are homes that are predominantly ventilated using active measures (fans, heat recovery ventilation etc.) because they have either no opportunity or extremely limited opportunities for opening windows (e.g., due to noise levels or poor air quality).

[3]. Adaptive Criteria – 'Adaptive' comfort models express the indoor comfort temperature through its relationship with the outdoor temperature in naturally ventilated buildings when they are in free-running mode.

For homes that are predominantly naturally ventilated, the method alongside two criteria should be used to assess overheating. The first overheating criteria which applies to both living rooms/kitchens and bedrooms is an adaptive criterion[3], while the second overheating criterion is a fixed temperature criteria which applies only to bedrooms. Both criteria must be met to demonstrate compliance for all spaces within a home.

For mechanically ventilated homes, the fixed temperature method with a single criterion should be used to assess overheating. This single criterion must be met for all spaces (living rooms/kitchens and bedrooms) within a mechanically ventilated home to demonstrate compliance.

In this case, the dwellings are to be predominantly naturally ventilated, therefore only criteria A and B (see Table 3-2) are relevant.

Table 3-2 – Summary of the TM59 criteria for naturally and mechanically ventilated homes

Assessment Criteria	Applicable Rooms	Occupied Hours	Naturally Ventilated Homes (open windows)	Mechanically Ventilated Homes (closed windows)
Criterion A	Living rooms, kitchens, and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	The number of hours during which external and internal temperature difference is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.	Not Applicable
Criterion B	Bedrooms only	Bedrooms – 24-hour occupancy	The operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26°C for more than 1% of annual hours. 33 or more hours above 26˚C will be a failure.	Not Applicable
Criterion C	Living rooms, kitchens, and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	Not applicable	The operative temperature in occupied all occupied rooms should not exceed 26˚C for more than 3% of the annual occupied annual hours. 143 or more hours above 26˚C for living rooms and kitchens will be a failure. 263 or more hours above 26 ˚C for bedrooms will be a failure.

The methodology also sets separate overheating compliance criteria for communal corridors. Additionally, the inclusion of communal corridors in the overheating analysis is also required. The overheating criterion for corridors is a fixed temperature target as table 3.3 below.

Table 3-3.

Assessment Criteria	Applicable Rooms	Criterion Description
Criterion 1	Communal corridors	The operative temperature in corridors shell not exceed 28°C for more than 3% of total annual hours.

Table 3-3 - TM59 Overheating compliance criteria for communal corridors

The corridor overheating temperature target is not a mandatory target, however where the target is exceeded, such corridors should be identified as communal areas with a significant risk of overheating.

4 Overheating Assessment Inputs and Assumptions

4.1 Building Fabric

The proposed building fabric standards used for the modelling are provided in Table 4-1.

Table 4-1 – Proposed building fabric specification

Category	U-value (W/m²K)
Roof	0.10
External Wall	0.15
Ground Floor	0.11
Window	1.00 (g-value: 0.38; FF:0.80)
Door	1.2

It is proposed to use solar control glazing with a solar transmittance (g-value) of 0.38. This g-value is lower than the suggested range within the LETI guide to account for the proposed higher percentage of glazing on the facades. Additionally, air tightness is specified to 4.0m^3/h.m^2@50Pa in accordance with the guidance.

4.1.1 External Shading

Balconies are included in the architectural design of the development. Balconies to each apartment are generally connected to the living rooms, providing shading at different periods of the day to reduce heat gains.

The top floor apartments do not have balconies above them and therefore will not benefit from shading and this has been reflected in the modelling.

The development is surrounded by pre-existing trees. However, to model a “worst case scenario” for the overheating assessment, the shading from the trees has not been included.

4.1.2 Internal Shading

Internal blinds are not used as a mitigation measure for this development. However, the internal blinds could be considered for the communal areas to reduce solar gains.

4.2 Internal Gains

The occupancy and equipment gain of for the residential units have been modelled in accordance with CIBSE TM59 as seen in Table 4-2. Following the predicted occupancies, the prediction of the internal gains (lighting, equipment, people) for occupied areas is incorporated in line with the guidance in TM59.

Table 4-2 - Occupancy and Equipment gains (CIBSE TM59)

Unit/room type	Occupancy	Equipment Load
2-bedroom apartment: living room	2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day	Peak load of 150W from 6 pm to 10 pm
		60W from 9 am to 6 pm and from 10 pm to 12 pm
		Base load of 35W for the rest of the day
2-bedroom apartment: Dining 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

Additionally, the internal gains' profiles were modified to ensure that no sensible gains for the energy efficient lighting have been included in communal corridors due to provision of PIRs.

4.3 Ventilation and Cooling

All homes use a combination of passive mechanical ventilation and purge ventilation to mitigate the overheating risk. The proposed ventilation strategy for the development entails the use of Mechanical Ventilation with Heat Recovery (MVHR) throughout the year. The MVHR units are proposed for each dwelling and communal areas which provides contentious ventilation of 10 l/s per person all year round in line with Part F- Ventilation requirement for background ventilation.

4.3.1 Dwellings

The following assumptions have been used to model natural ventilation strategy in accordance with Part O.

- When a room is occupied during the day (8am to 11pm), openings should be modelled to do all the following:
    - Windows partially open when the internal temperature exceeds 22°C.
    - Fully open when the internal temperature exceeds 26°C.
    - Partially close when the internal temperature falls below 26°C.
    - Fully closed when the internal temperature falls below 22°C.

At night (11pm to 8am), openings should be modelled as fully open if both of the following apply:

- The opening is on the first floor or above and not easily accessible.

    - The internal temperature exceeds 23°C at 11pm.
- When a ground floor or easily accessible room is unoccupied, the following apply:
    - Daytime, windows, patio doors and balcony doors are modelled as open,
    - At night, windows, patio doors and balcony doors are modelled as closed.
- An entrance door should be included, which should be shut all the time.

The balcony patio doors to the living room and the bedroom windows were modelled as side hung as per the architectural design, with the opening percentage specified based on the noise assessment report. All external windows were modelled with a 20% frame factor and a 225mm external recess based on architectural drawings.

4.3.2 Communal Corridors

Communal corridors are currently modelled with infiltration only without any openable windows.

5 Overheating Assessment Results and Analysis

5.1 Current Weather File Assessment Results

The current weather file used for the overheating analysis is the London Heathrow Airport (LHR) Design Summer Year 1 (DSY1) 2020s, high emissions, 50% percentile scenario.

5.2 Dwellings

Table 5-1 and Table 5-2 show a summary of the percentage of hours each occupied room exceeds the overheating criteria, and further stating whether that room passed or failed the overheating assessment.

Table 5-1 – Apartment bedrooms overheating results

Space Name	Occupied days (%)	Criterion A (%hrs)	Results	Criterion B (%hrs)	Results
Unit 1 Bedroom 1	100%	1.1%	Pass	0.4%	Pass
Unit 1 Bedroom 2	100%	0.8%	Pass	0.4%	Pass
Unit 2 Bedroom 1	100%	1.2%	Pass	0.4%	Pass
Unit 3 Bedroom 1	100%	0.8%	Pass	0.4%	Pass
Unit 4 Bedroom 1	100%	1.1%	Pass	0.4%	Pass
Unit 5 Bedroom 1	100%	0.8%	Pass	0.4%	Pass
Unit 5 Bedroom 2	100%	1.3%	Pass	0.4%	Pass
Unit 2 Bedroom 2	100%	1.6%	Pass	0.4%	Pass
Unit 3 Bedroom 2	100%	1.9%	Pass	0.5%	Pass
Unit 4 Bedroom 2	100%	1.6%	Pass	0.4%	Pass

Table 5-2 – Apartment kitchen/dining and living rooms overheating results

Space Name	Occupied days (%)	Criterion A (%hrs)	Results
Unit 1 Kitchen/Dining	100%	2.7%	Pass
Unit 1 Living Room	100%	2.6%	Pass
Unit 2 Kitchen/Dining	100%	2.8%	Pass
Unit 2 Living Room	100%	2.7%	Pass
Unit 3 Kitchen/Dining	100%	3.0%	Pass
Unit 3 Living Room	100%	2.9%	Pass
Unit 4 Kitchen/Dining	100%	2.9%	Pass
Unit 4 Living Room	100%	2.8%	Pass
Unit 5 Kitchen/Dining	100%	2.7%	Pass
Unit 5 Living Room	100%	2.2%	Pass

The outcome of the modelling as presented in Tables 5-1 and 5-2 shows that all the assessed dwellings pass the overheating strategy.

5.3 Communal Corridors

Table 5-3 shows the results of the overheating assessment on the communal corridors within the building.

Table 5-3 - Communal corridors overheating results

Space Name	Criterion 1 (%hrs)	Results
Communal Corridor	0.5 %	Pass

The modelling shows that communal corridors pass the overheating criteria without mechanical ventilation or cooling.

5.4 Future Weather File Assessment Results Summary

Additionally, the weather file used for the future climate overheating analysis is the London Heathrow Airport (LHR) Design Summer Year 2 and 3 (DSY2 and DSY3) 2050s, high emissions, 50% percentile scenario. The summaries of the future weather file assessment results are provided in section 5.2.The modelling shows that communal corridors pass the overheating criteria without mechanical ventilation or cooling.

Table 5-5 to Table 5-9 shows the summary of overheating results. The detailed overheating results for the future weather file DSY 2 and 3 are presented in Appendix D and Appendix E.

Table 5-4 – Summary of DSY2 overheating results for apartment bedrooms

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion A	10	10	0
TM59-Criterion B	10	10	0

The modelling shows that communal corridors pass the overheating criteria without mechanical ventilation or cooling.

Table 5-5 - Summary of DSY2 overheating results for apartment kitchen/dining and living rooms

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion A	10	0	10

The modelling shows that all kitchen/dining and living rooms failed the overheating criteria without mechanical ventilation or cooling.

Table 5-6 - Summary of DSY2 overheating results for communal corridors

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion 1	1	1	0

The modelling shows that communal corridors passed the overheating criteria without mechanical ventilation or cooling.

Table 5-7 – Summary of DSY3 overheating results for apartment bedrooms

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion A	10	6	4
TM59-Criterion B	10	5	5

The assessment results of the bedrooms show that some bedrooms failed the overheating criteria when assessed using the future weather file. In addition, the results show that the temperature in all other bedrooms will exceed the 26°C temperature threshold more often during night-time hours which increases the overheating risk.

Table 5-8 - Summary of DSY3 overheating results for apartment kitchen/dining and living rooms

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion A	10	0	10

The assessment results of the living rooms/kitchens show that all kitchen/dining and living rooms failed the overheating criteria when assessed using the future weather file.

Table 5-9 - Summary of DSY3 overheating results for communal corridors

Criteria	Rooms Assessed	Rooms Pass	Rooms Fail
TM59-Criterion 1	1	1	0

The modelling shows that communal corridors passed the overheating criteria without mechanical ventilation or cooling.

Generally, the overheating assessment shows that it is onerous to achieve compliance with the overheating criteria when the development is assessed using the future weather file. To achieve compliance with the overheating criteria for any climate change scenarios, it is recommended to consider incorporating overheating adaptation measures into the design. These measures can include but are not limited to the following:

- External shading that can easily be retrofitted without requiring a major redesign of the building.
- Natural ventilation measures such night ventilation in place.
- Internal and external space provision to retrofit active cooling without requiring a major redesign of the building.

6 Proposed Strategy and Summary of Results

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 6-1 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 0.38	*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 Northeast 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 6-1 Proposed overheating mitigation measures

All five dwelling units have been assessed against 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.

The overheating modelling results in Table 6-2 demonstrates that the apartments with openable windows and balcony doors passes the overheating criteria with the DSY1 weather data file. Appendix D also 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.

Space Name	Occupied days	TM59 Criterion A: Hours of exceedance (pass ≤ 3%) % Hours of overheating	TM59 Criterion B: Bedroom temperature hours >26°C (%hrs) Hours of overheating	Overall compliance with TM59
Unit 1 Bedroom 1	100%	1.1%	0.4%	Pass
Unit 1 Bedroom 2	100%	0.8%	0.4%	Pass
Unit 2 Bedroom 1	100%	1.2%	0.4%	Pass
Unit 2 Bedroom 2	100%	1.6%	0.4%	Pass
Unit 3 Bedroom 1	100%	0.8%	0.4%	Pass
Unit 3 Bedroom 2	100%	1.9%	0.4%	Pass
Unit 4 Bedroom 1	100%	1.1%	0.4%	Pass
Unit 4 Bedroom 2	100%	1.6%	0.4%	Pass
Unit 5 Bedroom 1	100%	0.8%	0.5%	Pass
Unit 5 Bedroom 2	100%	1.3%	0.4%	Pass
Unit 1 Kitchen/Dining	100%	2.7%	N/A	Pass
Unit 1 Living Room	100%	2.6%	N/A	Pass
Unit 2 Kitchen/Dining	100%	2.8%	N/A	Pass
Unit 2 Living Room	100%	2.7%	N/A	Pass
Unit 3 Kitchen/Dining	100%	3.0%	N/A	Pass
Unit 3 Living Room	100%	2.9%	N/A	Pass
Unit 4 Kitchen/Dining	100%	2.9%	N/A	Pass
Unit 4 Living Room	100%	2.8%	N/A	Pass
Unit 5 Kitchen/Dining	100%	2.7%	N/A	Pass
Unit 5 Living Room	100%	2.2%	N/A	Pass

Table 6-2 TM59 overheating results for DSY1 2020s without any shading devices.

Table 6-2 demonstrates that all rooms meet the TM59 criteria, informing an acceptable level of overheating risk. TM59 assesses the overheating risk, but the perceived overheating level is subjective and will also be influenced by the occupant behaviour. The homeowner's manual will provide residents with possible measures to mitigate the overheating risk.

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 D and Appendix E respectively. The results for DSY 2 and 3 indicate that meeting the CIBSE TM59 compliance criteria for additional weather scenarios is challenging.

The proposed mitigation measures included in Table 6-1 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.

7 Conclusion

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 NW6 4BT

This report assumes that the 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.

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 7-1.

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 0.38 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 optimized 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. However, due to the commercial requirements of the project, active cooling is proposed for this development	
Green Infrastructure	Green Roof and a private garden (in the lightwell) around the site will help reduce the heat island effect.	

Table 7-1 Design Features to address the cooling hierarchy (London Plan SI 4)

8 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 but no noise issue 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

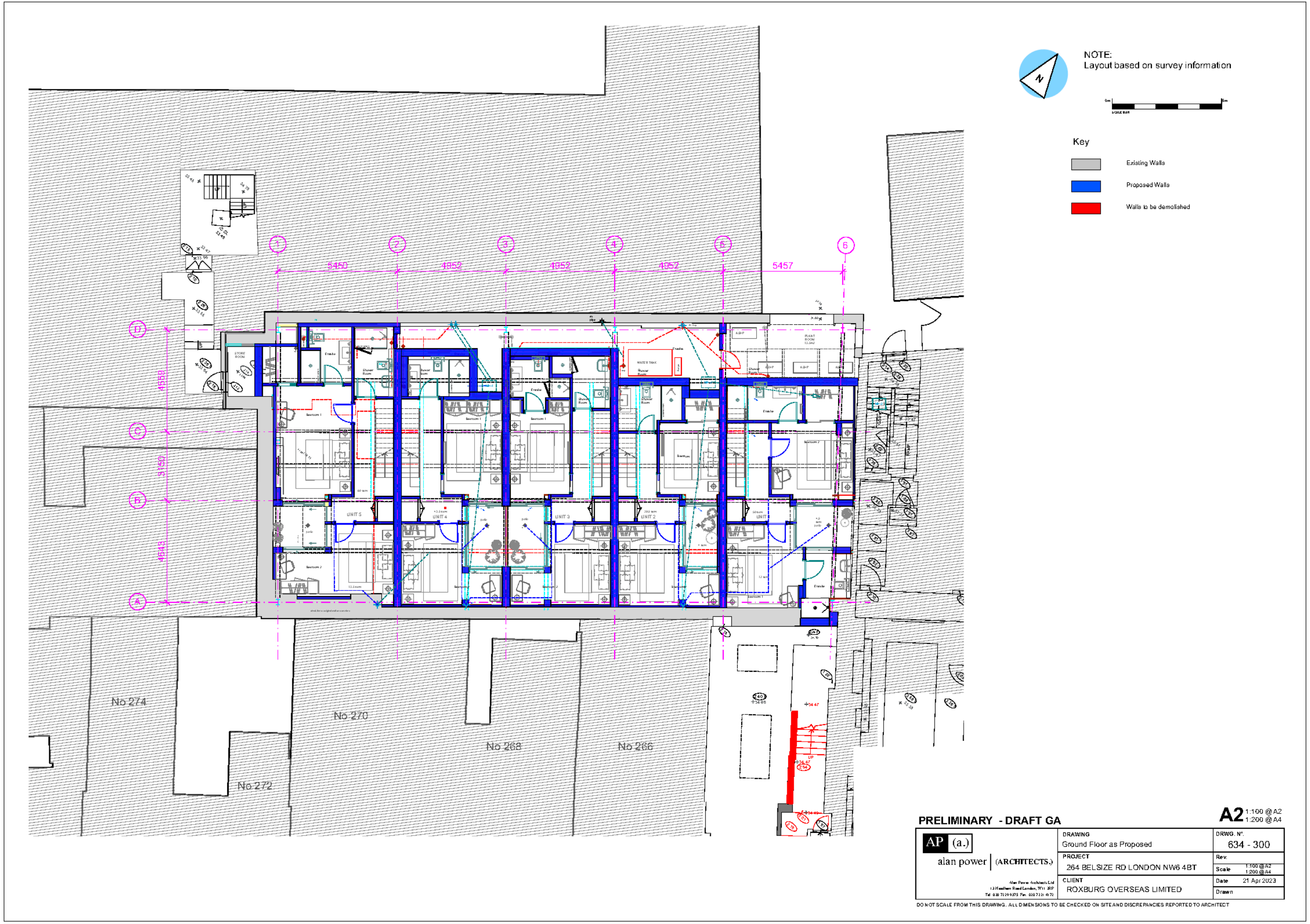
2b.1 Modelling details	
Dynamic software name and version	IES VE 2022.3.0.0
Weather file location used, including any additional, more extreme weather files	CIBSE London Heathrow Design Summer Years (DSYs) for the 2020s, high emissions, 50% percentile scenario, Additional DSY2 and DSY3 were tested to 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 0.38 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	14/07/2023

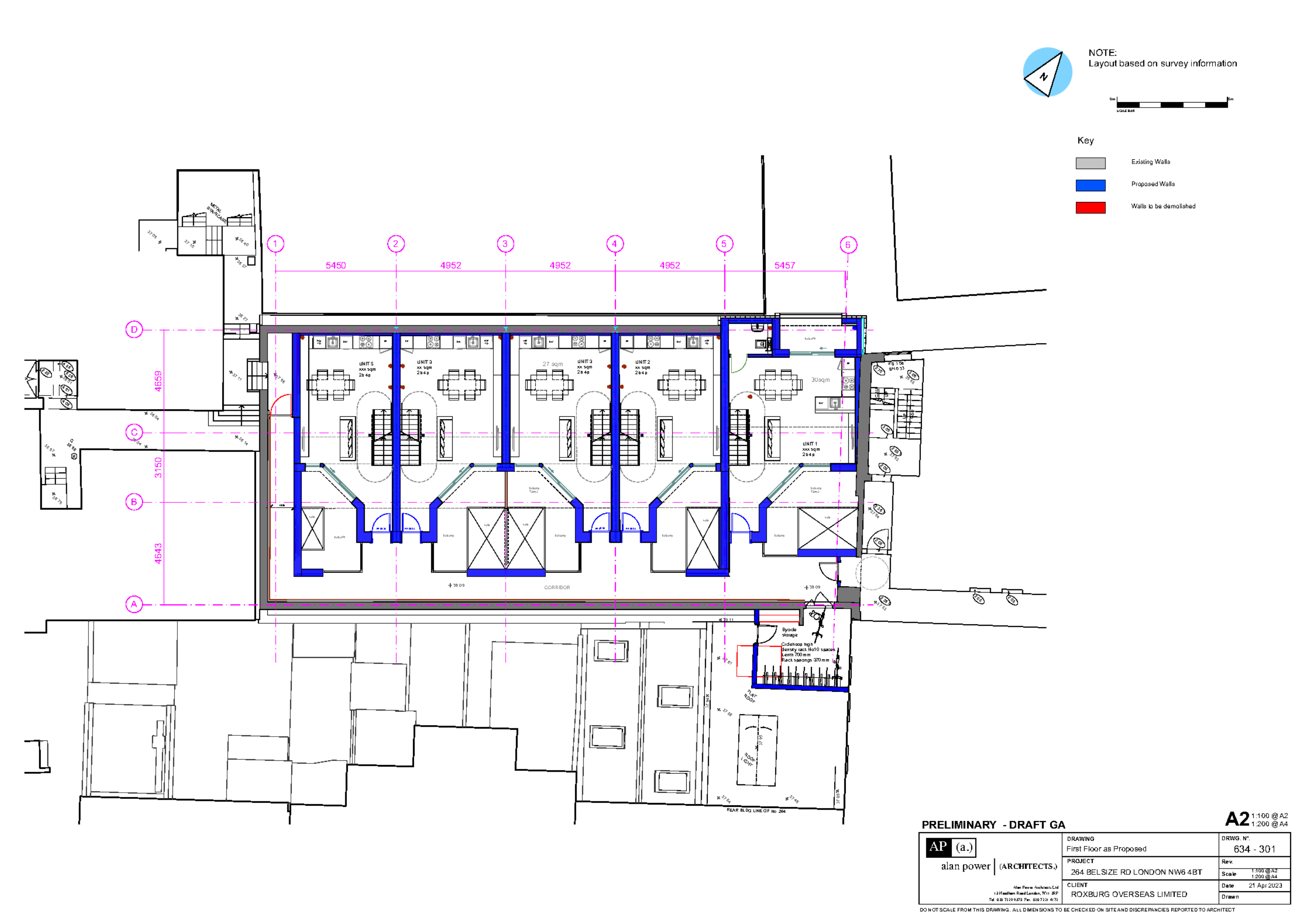
Design details Part 2b – Dynamic thermal modelling method

Appendix B Proposed indicative Mechanical ventilation rates

Dwelling	Unit 1 2B_4P	Unit 2 2B_4P	Unit 3 2B_4P	Unit 4 2B_4P	Unit 5 2B_4P
Floor area (m^3)	116.5 m^2	89.0 m^2	95.5 m^2	92.5 m^2	112.5 m^2
Averaged Storey height (m)	2.90	2.80	2.77	2.77	2.77
Volume (m^3)	338 m^3	246 m^3	264 m^3	256 m^3	311 m^3
Typical Bedroom	6.50	6.50	6.50	6.50	6.50
Kitchen (l/s)	13.00	13.00	13.00	13.00	13.00
Utility cupboard (l/s)	8.00	8.00	8.00	8.00	8.00
Bathroom/WC (l/s)	8.00	8.00	8.00	8.00	8.00
Proposed Boost Rate* (l/s)	53.00	45.00	45.00	45.00	45.00
Whole-dwelling ventilation rate (cu.m/hr)	190.80	162.00	162.00	162.00	162.00

Appendix C Assessed Dwelling Layouts

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Layout based on survey information
Key
Existing Walls
Proposed Walls
Walls to be demolished
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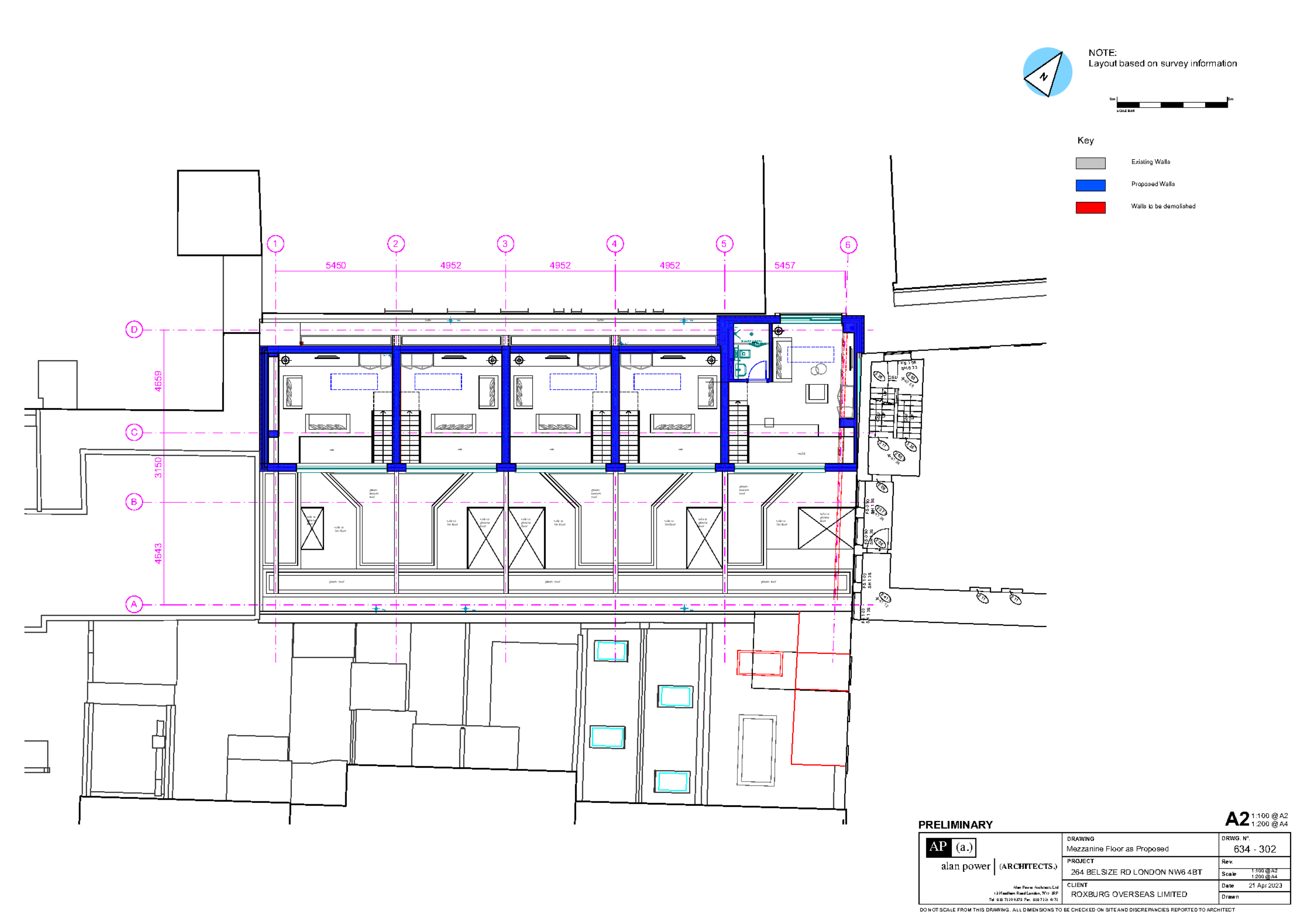
4952
4952
4952
5457
4659
3150
4643
CORRIDOR
PRELIMINARY - DRAFT GA
A2
1:100 @ A2
1:200 @ A4
AP (a.)
alan power (ARCHITECTS.)
DRAWING
First Floor as Proposed
DRWG. N°.
634 - 301
PROJECT
264 BELSIZE RD LONDON NW6 4BT
CLIENT
ROXBURG OVERSEAS LIMITED
Date
21 Apr 2023
DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE AND DISCREPANCIES REPORTED TO ARCHITECT


NOTE:
Layout based on survey information
Key
Existing Walls
Proposed Walls
Walls to be demolished
5450
4952
4952
4952
5457
4659
3150
4643
PRELIMINARY
A2 1:100 @ A2 1:200 @ A4
AP (a.)
alan power (ARCHITECTS)
DRAWING
Mezzanine Floor as Proposed
PROJECT
264 BELSIZE RD LONDON NW6 4BT
CLIENT
ROXBURG OVERSEAS LIMITED
DRWG. N°
634 - 302
Rev.
Scale
Date
21 Apr 2023
Drawn
DO NOT SCALE FROM THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE AND DISCREPANCIES REPORTED TO ARCHITECT

Appendix D Overheating results for DSY 2 2020s

Space Name	Occupied days	TM59 Criterion A: Hours of exceedance (pass ≤ 3%) % Hours of overheating	TM59 Criterion B: Bedroom temperature hours >26°C (%hrs) Hours of overheating	Overall compliance with TM59
Unit 1 Bedroom 1	100%	1.6%	0.6%	**Pass**
Unit 1 Bedroom 2	100%	1.6%	0.6%	**Pass**
Unit 2 Bedroom 1	100%	1.9%	0.6%	**Pass**
Unit 2 Bedroom 2	100%	2.2%	0.5%	**Pass**
Unit 3 Bedroom 1	100%	1.6%	0.6%	**Pass**
Unit 3 Bedroom 2	100%	2.4%	0.5%	**Pass**
Unit 4 Bedroom 1	100%	1.9%	0.6%	**Pass**
Unit 4 Bedroom 2	100%	2.2%	0.5%	**Pass**
Unit 5 Bedroom 1	100%	1.7%	0.7%	**Pass**
Unit 5 Bedroom 2	100%	2.0%	0.6%	**Pass**
Unit 1 Kitchen/Dining	100%	4.0%	N/A	Fail
Unit 1 Living Room	100%	3.9%	N/A	Fail
Unit 2 Kitchen/Dining	100%	4.0%	N/A	Fail
Unit 2 Living Room	100%	3.9%	N/A	Fail
Unit 3 Kitchen/Dining	100%	4.1%	N/A	Fail
Unit 3 Living Room	100%	4.0%	N/A	Fail
Unit 4 Kitchen/Dining	100%	4.1%	N/A	Fail
Unit 4 Living Room	100%	4.0%	N/A	Fail
Unit 5 Kitchen/Dining	100%	4.0%	N/A	Fail
Unit 5 Living Room	100%	3.6%	N/A	**Fail**

Appendix E Overheating results for DSY 3 2020s

Space Name	Occupied days	TM59 Criterion A: Hours of exceedance (pass ≤ 3%) % Hours of overheating	TM59 Criterion B: Bedroom temperature hours >26°C (%hrs) Hours of overheating	Overall compliance with TM59
Unit 1 Bedroom 1	100%	2.6%	0.9%	Pass
Unit 1 Bedroom 2	100%	2.4%	0.9%	Pass
Unit 2 Bedroom 1	100%	2.9%	1.0%	Pass
Unit 2 Bedroom 2	100%	3.4%	0.8%	Fail
Unit 3 Bedroom 1	100%	2.5%	1.0%	Pass
Unit 3 Bedroom 2	100%	3.7%	0.9%	Fail
Unit 4 Bedroom 1	100%	2.9%	1.0%	Pass
Unit 4 Bedroom 2	100%	3.3%	0.8%	Fail
Unit 5 Bedroom 1	100%	2.4%	1.1%	Fail
Unit 5 Bedroom 2	100%	3.1%	0.9%	Fail
Unit 1 Kitchen/Dining	100%	6.0%	N/A	Fail
Unit 1 Living Room	100%	5.8%	N/A	Fail
Unit 2 Kitchen/Dining	100%	6.1%	N/A	Fail
Unit 2 Living Room	100%	5.8%	N/A	Fail
Unit 3 Kitchen/Dining	100%	6.3%	N/A	Fail
Unit 3 Living Room	100%	6.1%	N/A	Fail
Unit 4 Kitchen/Dining	100%	6.2%	N/A	Fail
Unit 4 Living Room	100%	6.0%	N/A	Fail
Unit 5 Kitchen/Dining	100%	6.1%	N/A	Fail
Unit 5 Living Room	100%	5.1%	N/A	Fail