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Thermal Comfort Assessment

10a & 11-12 South Square, Gray's Inn, London

Project ref: 24030

Revision P1 28/11/2024

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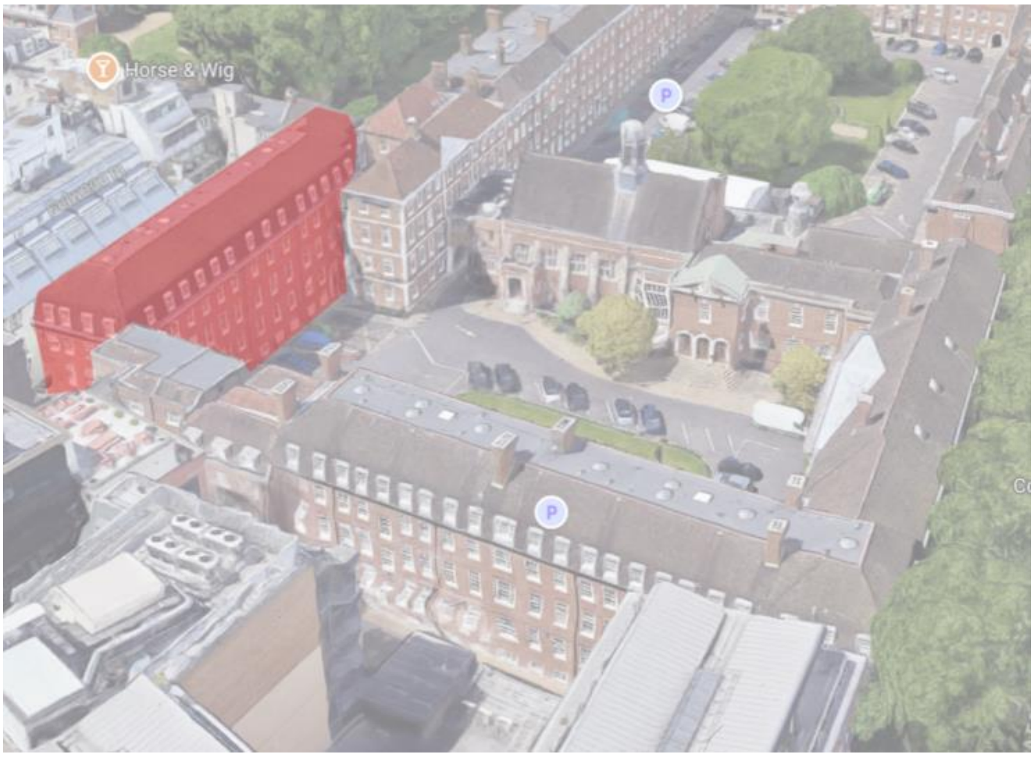
1. Executive Summary

The following report details the findings of a thermal comfort and overheating assessment undertaken for the existing building at 10a & 11-12 South Square, Gray's Inn, London. The plan below shows the extent of the buildings included, which occupy the Western side of South Square. The study assesses the overheating risk in the occupied rooms of the building and the effectiveness of passive measures in controlling overheating in the building.

The assessment uses CIBSE TM52 as the overheating criteria with which to define compliance and follows the procedures and guidance referred to as the 'cooling hierarchy' as defined in Camden Planning Guidance documents.

The building is modelled using computational thermal modelling software and compliance with the guidance is checked after each measure is introduced.

The study has identified that opportunities for introducing passive measures to the existing building is limited due to the constraints of the building and that passive measures have limited impact on controlling overheating. The majority of occupied rooms in the building require active cooling to adequately control overheating in summer and maintain comfortable conditions for occupants.



2. Introduction

Oscar MEP Ltd have been appointed by The Honourable Society of Gray's Inn to undertake a thermal comfort study of the occupied rooms in 10a & 11-12 South Square, in support of a planning application for new associated plant space. The report has been undertaken to demonstrate that the 'cooling hierarchy' detailed in Camden's Planning Guidance has been followed and to identify the need for active cooling within the building.

The assessment is based on guidance from the Chartered Institute of Building Services Engineers (CIBSE) and assesses the overheating risk and thermal comfort of occupied rooms in the existing building. The assessment has been undertaken by a Chartered Engineer and member of CIBSE.

The following overheating assessment includes all upper floors of the building, from ground floor to third floor.

3. Policy Guidance

The London borough of Camden Planning Policy requires that a 'cooling hierarchy' is followed when assessing the need for cooling. The Requirements are set out in the Camden Local Plan Policy CC2 and can be found within the Camden Planning Guidance Energy Efficiency and Adaptation document, section 10, 'sustainable design and construction measures'.

With changing climate and warmer summers, the planning guidance recognises the increasing risk of overheating in occupied buildings. The cooling hierarchy contained in the planning guidance sets out to reduce the need for active cooling by prioritising passive measures first as a way to mitigate overheating risks.

The Cooling hierarchy comprises the following:

1. Minimise internal heat generation through energy efficient design.
2. Reduce the amount of heat entering a building in summer.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
4. Passive Ventilation
5. Mechanical Ventilation
6. Active Cooling.

As can be seen above, active cooling should be the last measure to control overheating. This assessment and report explores the opportunities to reduce overheating risk in the building, following the priorities of the cooling hierarchy.

4. Assessment Criteria (Defining 'overheating')

CIBSE TM52 The Limits of Thermal Comfort: Avoiding Overheating in European Buildings is the basis of the overheating criteria to which the following assessment is undertaken. This technical memorandum document was released in 2013, replacing the previous CIBSE Guide A overheating criteria, which failed to account for adaptive comfort.

The following three criteria taken together are used to assess the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

1. The first criterion sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1°C or more during the occupied hours of a typical non-heating season (1st May to 30th September). The criterion is set such that the operative temperature shall not exceed the maximum temperature by more than 1°C for more than 3% of the occupied hours.

2. The second criterion deals with the severity of overheating within any one day. This can be as important as its frequency, and the level of which is a function of both temperature rise and its duration. The daily weighted exceedance (hours x ΔT) shall be less than or equal to 6 in any one day.

3. The third criterion sets an absolute maximum daily temperature for a room. The operative indoor temperature shall not exceed the maximum value by 4°C.

5. Cooling Hierarchy

5.1. Minimise internal heat generation through energy efficient design.

The first point on the hierarchy is to minimise the heat that is generated. The less heat produced, the less risk of overheating and less need for cooling. The following are guidance notes and examples contained within Camden's planning guidance:

- Layout and uses: locate any spaces that need to be kept cool or that generate heat on cooler sides of developments.
- Reducing heat gains e.g. including low energy lighting.
- Seal/ insulate heat generating processes.
- Reduce the distance heat needs to travel and insulate pipework.
- Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
- Consider evaporation cooling which cools air through the evaporation of water.
- Consider 'free cooling' or 'night cooling', which uses the cooling capacity of ambient air to directly cool the space.

The building on the west side of South Square is an existing building with solid masonry walls and existing single glazed sash windows throughout. The layout and orientation of the building cannot be influenced or altered as it is existing. Similarly, the floor plans are inflexible due to existing load bearing walls and orientation of circulation corridors and stairs. The presence of the central corridor on all floors restricts opportunity for cross flow ventilation, and the ceiling heights are fixed.

The opportunity for 'night cooling' is very limited due to the location of the building preventing windows being left open overnight when the building is not occupied, as this would introduce a security risk.

In any refit of the spaces which includes replacement lighting, it would be proposed to install LED lighting, which is high efficiency and low energy, reducing the waste heat created.

ACTION : For this assessment it is assumed that all lighting will be LED throughout.

5.2. Reduce the amount of heat entering a building in summer.

The following are guidance notes and examples contained within Camden's planning guidance on ways to reduce the heat entering the building from external sources:

- Consider the angle of the sun and optimum daylight and solar gain balance.
- Orientate and recess windows and openings to avoid excessive solar gain.
- Consider low g-values and the proportion, size and location of windows.
- Make use of shadowing from other buildings.
- Include adequate insulation.
- Design in shading: e.g. include internal courtyards, large shade-providing trees and vegetation, balconies, louvers, internal or external blinds, and shutters.

As noted within the first point on the cooling hierarchy, the building is existing, with existing windows of fixed size and position. Due to the historic nature and appearance of the building and its location, external shading devices (e.g. brise soleil) would be impractical to install.

The existing building has clear glazing to the windows. There are companies that provide solar control films that can be retrofitted to existing windows to reduce the 'g-value' of the glass. This film blocks some of the suns heat (solar transmittance) and prevents it from entering the building, thereby reducing the overall heat entering the building.

ACTION: This assessment will investigate the impact of lowering the g-value of the existing glazing to 0.5 to simulate the application of solar film being installed ("Scenario 2", refer to Section 6 of the report).

5.3. Manage the heat within the building through exposed internal thermal mass and high ceilings.

Again, given that the building is existing, the opportunity for adding thermal mass or increasing ceiling height is not feasible. However, the building is constructed from solid masonry walls and has concrete slabs, which will contribute to the benefits of thermal mass in the building. In addition to this, the lower ground floor is partly below ground level, thereby benefiting from the thermal mass of the ground bearing walls. This thermal mass of the existing building has been modelled within the overheating assessment.

It is worth noting that the benefits of thermal mass are greatest when night cooling can be implemented to purge the building of excess heat overnight. Unfortunately, as described previously, the opportunity for night cooling is limited as windows cannot be left open overnight.

5.4. Passive ventilation

Passive ventilation comprises ventilating a building using natural driving forces for air movement, such as exploiting the change in buoyancy of air with temperature change (the 'stack effect') and capturing the difference in air pressures due to wind movement.

The position of the building means that it is relatively sheltered from main roads and therefore it would be feasible to open windows for ventilation and purging heat. To the West, the windows face onto a narrow long alley facing neighbouring properties and to the East face onto the open square known as 'South Square'. It is feasible for windows facing both west and east to be opened in warm weather to assist with controlling overheating, however it is assumed that ground floor windows remain shut due to concerns with security and privacy.

ACTION: the assessment will investigate the benefits of opening windows throughout the building, with the exception of ground floor windows facing South Square (“Scenario 3”, refer to section 6 of the report).

5.5. Mechanical ventilation

The following are guidance notes and examples contained within Camden’s planning guidance on implementing Mechanical Ventilation as a way to control overheating and reduce cooling requirements:

- Ensure the most efficient system possible.
- Consider mechanical ventilation with heat recovery.

As almost all rooms have the facility to open windows for ventilation, the addition of mechanical ventilation would not provide any further benefit to controlling temperatures in the rooms.

As previously mentioned, the windows at ground floor facing South Square are assumed to stay shut due to privacy and security concerns. As such, it is likely that these rooms will need some form of mechanical ventilation. Whilst the scope of this assessment does not include developing a mechanical ventilation design, it is assumed that all occupied rooms will be provided with a minimum of 10 litres/second of fresh outdoor air per person to comply with latest Building Regulations. This is what has been included in the base case model (“Scenario 1), and this fresh air will assist with reducing internal heat build up in the summer months.

In addition to the minimum fresh air requirements, it may be possible to increase the mechanical ventilation to the rooms, such that fresh outdoor air is provided at a rate of 15 litres/second per person. This is the maximum practical amount of outdoor air that is envisaged to be able to be provided to the rooms– any higher air rate would require excess amounts of ventilation plant and ductwork, which would be impractical to fit within the existing building with limited ceiling voids, plant space, and limited scope for external louvres to bring the air into the building.

ACTION: the assessment will investigate enhanced mechanical ventilation to the rooms at ground floor facing South Square to provide 15 l/s/person. As well as the natural ventilation to the rooms elsewhere, this enhanced mechanical ventilation is included within “Scenario 3”.

5.6. Active cooling

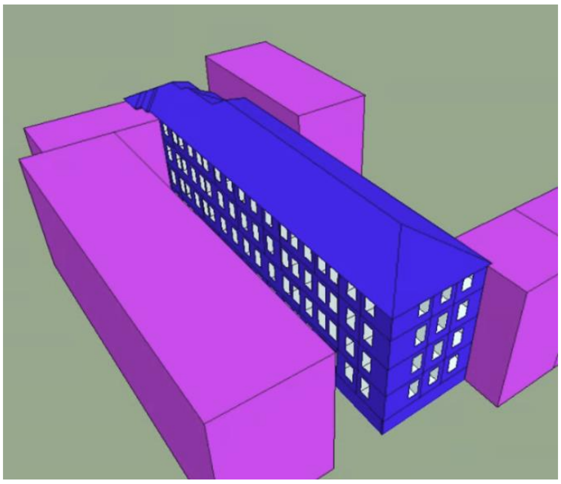
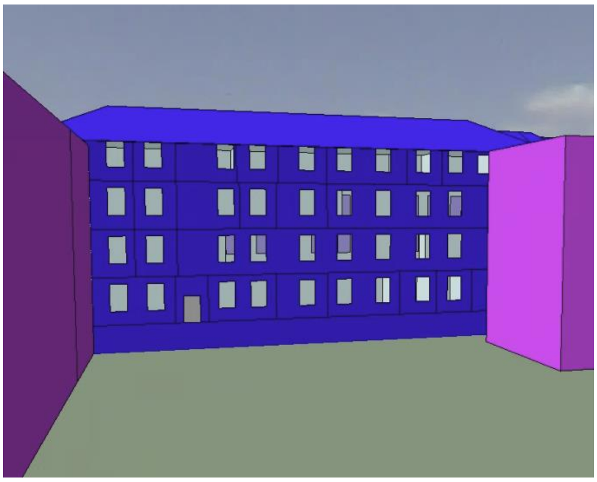
Following all of the above measures that have been identified as being practical within the constraints of the existing building, if any of the rooms still fail the TM52 overheating test, then active cooling will be modelled (“Scenario 4” refer to section 6 of the report).

6. Thermal Model

6.1. The model

In order to assess the risk of overheating and accurately model the building and compliance with CIBSE TM52 criteria, a dynamic thermal model was produced. The analysis was undertaken using IES Virtual Environment 2024 software, with the model being created in compliance with CIBSE AM11.

The thermal model includes details of the thermal fabric of the building, geometry, and internal heat gains in each room and space.

Images from thermal modelling software (purple blocks represent adjacent buildings, which provide natural shading)

6.1.1. Building Fabric

The thermal model includes details of the fabric of the building. Based on the age of the building and visual surveys, the following thermal performance was used to model the building:

Element	Thermal Performance (U-Value, W/m²K)
Walls	1.3
Windows	5.1 (g-value = 0.8)
Floors	3.0
Roof	2.0

6.1.2. Internal Heat Gains

Internal heat gains have been applied to the rooms and spaces in the building to represent real world heat generated within the building.

Internal Heat Source	Modelled heat gain
Lighting	10 W/m²
People	90W sensible heat gain
Equipment (within meeting rooms and offices)	500 W
Occupied hours (during which internal heat gains are present)	8am to 6pm, Monday to Friday

6.2. Climate

Within the modelling software (IES Virtual Environment) different weather files can be selected to simulate differing climates. In accordance with the planning guidance, CIBSE DSY (Design Summer Year) weather files have been used to simulate summer, based on the location of Central London and considering future proofing for future impacts of overheating from climate change.

The weather file used in this assessment is the London Weather Centre 'Design Summer Year' LWC_DSY 2, which is the most onerous of the three DSY weather files available and is representative of a property in the central London urban zone.

6.3. Scenario 1: The Existing building prior to implementing the cooling hierarchy.

The base case scenario assumes the building envelope and fabric is as existing, no active cooling is installed, and occupied spaces are provided with minimum fresh air requirements of outdoor air.

The following results demonstrate the performance of the building relative to the requirements of CIBSE TM52 overheating criteria:

Room	Occupied Summer Hours	Criterion 1: % Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: Hours Exceeding Absolute Limit	Pass / Fail
Office L00	1000	13.1	37	5	Fail
Office L00	1000	15.6	55	8	Fail
Office L00	1000	51.3	89	12	Fail
Office L00	1000	8.3	28	4	Fail
Office L00	1000	20.4	51	7	Fail
Office L00	1000	6.8	27	4	Fail
Office L00	1000	8.2	31	5	Fail
Office L00	1000	12.7	35	5	Fail
Office L00	1000	18.9	47	6	Fail
Office L00	1000	21.9	51	6	Fail
Office L00	1000	14.9	41	5	Fail
Office L00	1000	16.5	44	6	Fail
Office L00	1000	15.6	41	5	Fail
Office L00 - open plan	1000	9.6	33	5	Fail
Office L00	1000	10.3	28	4	Fail
Office L00	1000	5.4	24	4	Fail
Office L00	1000	6.4	34	5	Fail
Office L01	1000	26.5	52	7	Fail
Office L01	1000	35.8	61	8	Fail
Office L01	1000	33.1	61	8	Fail
Office L01	1000	36.9	74	10	Fail
Office L01	1000	62.5	106	14	Fail
Office L01	1000	25.4	71	10	Fail
Office L01 - open plan	1000	27.5	52	7	Fail
Office L01 - open plan	1000	14	41	6	Fail
Office L01	1000	11.3	37	5	Fail
Office L01	1000	12.2	33	5	Fail
Office L01	1000	37.8	45	7	Fail
Office L01	1000	21.8	37	6	Fail
Office L02	1000	29.2	58	8	Fail
Office L03	1000	15.2	41	6	Fail
Office L02	1000	27.9	76	10	Fail
Office L02	1000	63.5	110	14	Fail
Office L02	1000	39.6	79	10	Fail
Office L02	1000	37.8	68	9	Fail
Office L02	1000	41.3	75	9	Fail
Office L02	1000	28.9	56	7	Fail
Office L02	1000	43.2	75	9	Fail
Office L02	1000	29	62	8	Fail
Office L02	1000	26.7	49	7	Fail
Office L02	1000	19.4	46	7	Fail
Office L03	1000	13	28	6	Fail
Office L03	1000	12.1	31	5	Fail
Office L03	1000	14.6	37	6	Fail
Office L03	1000	15.1	31	6	Fail
Office L03	1000	10.5	19	4	Fail
Office L03	1000	4.6	18	3	Fail
Office L03	1000	15.5	35	4	Fail
Office L03	1000	8.9	24	3	Fail
Office L03	1000	13.8	30	4	Fail
Office L03	1000	16.6	34	4	Fail
Office L03	1000	14.4	31	4	Fail
Office L03	1000	12.4	29	4	Fail
Office L03	1000	19.9	48	6	Fail
Office L03	1000	18.8	48	6	Fail
Office L03	1000	20.8	49	6	Fail
Office L03	1000	20.3	51	6	Fail
Office L03	1000	19.2	49	6	Fail
Office L03	1000	27	62	8	Fail
Office L03	1000	33.5	75	10	Fail
Office L03	1000	21.1	61	8	Fail

6.4. Scenario 2: The addition of solar film to existing windows.

The g-value of the existing windows was lowered to 0.5 to simulate the application of solar control film applied to glazing, and the overheating assessed again:

Room	Occupied Summer Hours	Criterion 1: % Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: Hours Exceeding Absolute Limit	Pass / Fail
Office L00	1000	8.2	34	5	Fail
Office L00	1000	8.2	45	6	Fail
Office L00	1000	38	76	10	Fail
Office L00	1000	4	24	4	Fail
Office L00	1000	11	45	6	Fail
Office L00	1000	3.8	24	4	Fail
Office L00	1000	4.6	26	4	Fail
Office L00	1000	7.8	29	4	Fail
Office L00	1000	11.2	39	5	Fail
Office L00	1000	13.3	43	6	Fail
Office L00	1000	6.4	34	5	Fail
Office L00	1000	8.8	38	5	Fail
Office L00	1000	6.7	34	4	Fail
Office L00 - open plan	1000	6	29	4	Fail
Office L00	1000	6	27	4	Fail
Office L00	1000	2.6	19	4	Pass
Office L00	1000	3.7	27	4	Fail
Office L01	1000	16.5	46	7	Fail
Office L01	1000	23	53	7	Fail
Office L01	1000	20.6	52	7	Fail
Office L01	1000	23.8	63	9	Fail
Office L01	1000	48	92	12	Fail
Office L01	1000	15.2	62	8	Fail
Office L01 - open plan	1000	17	47	6	Fail
Office L01 - open plan	1000	9.6	37	6	Fail
Office L01	1000	6.5	33	5	Fail
Office L01	1000	6.3	27	4	Fail
Office L01	1000	26.5	42	6	Fail
Office L01	1000	14.1	35	5	Fail
Office L02	1000	18.5	50	7	Fail
Office L03	1000	9.6	34	5	Fail
Office L02	1000	17.5	63	8	Fail
Office L02	1000	48.4	92	12	Fail
Office L02	1000	27	68	9	Fail
Office L02	1000	25	59	8	Fail
Office L02	1000	27.4	65	8	Fail
Office L02	1000	17.8	48	6	Fail
Office L02	1000	27.8	64	8	Fail
Office L02	1000	18.5	52	7	Fail
Office L02	1000	16.6	44	6	Fail
Office L02	1000	11.6	39	6	Fail
Office L03	1000	6.7	24	5	Fail
Office L03	1000	7.2	25	4	Fail
Office L03	1000	9.4	32	5	Fail
Office L03	1000	9.4	26	5	Fail
Office L03	1000	6.8	18	3	Fail
Office L03	1000	2.2	15	3	Pass
Office L03	1000	8.7	32	4	Fail
Office L03	1000	3.8	20	3	Fail
Office L03	1000	7.3	23	3	Fail
Office L03	1000	10.3	30	4	Fail
Office L03	1000	7.4	24	3	Fail
Office L03	1000	6.7	23	3	Fail
Office L03	1000	13.4	39	5	Fail
Office L03	1000	12	39	5	Fail
Office L03	1000	14.1	42	6	Fail
Office L03	1000	13.5	43	6	Fail
Office L03	1000	12.5	42	5	Fail
Office L03	1000	17.5	55	7	Fail
Office L03	1000	21.7	64	8	Fail
Office L03	1000	13.8	53	7	Fail

6.5. Scenario 3: The addition of natural ventilation and enhanced mechanical ventilation.

Following on from Scenario 2, rooms were modelled with opening windows during occupied hours in the day. The results are below:

Room	Occupied Summer Hours	Criterion 1: % Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: Hours Exceeding Absolute Limit	Pass / Fail
Office L00	1000	2.6	23	4	Pass
Office L00	1000	2.8	30	5	Fail
Office L00	1000	8.5	49	8	Fail
Office L00	1000	1.8	18	3	Pass
Office L00	1000	3.5	30	5	Fail
Office L00	1000	1.3	16	3	Pass
Office L00	1000	1.5	18	4	Pass
Office L00	1000	2.3	21	4	Pass
Office L00	1000	5.4	34	5	Fail
Office L00	1000	6.6	40	5	Fail
Office L00	1000	3.2	30	4	Fail
Office L00	1000	4.3	31	4	Fail
Office L00	1000	3.2	30	4	Fail
Office L00 - open plan	1000	3.5	26	4	Fail
Office L00	1000	2.1	19	4	Pass
Office L00	1000	1	14	3	Pass
Office L00	1000	1.3	17	4	Pass
Office L01	1000	4.6	31	6	Fail
Office L01	1000	6	36	6	Fail
Office L01	1000	5.6	34	6	Fail
Office L01	1000	6.6	43	7	Fail
Office L01	1000	11.5	54	9	Fail
Office L01	1000	4.2	35	6	Fail
Office L01 - open plan	1000	4.2	30	5	Fail
Office L01 - open plan	1000	4.1	30	5	Fail
Office L01	1000	1.6	21	4	Pass
Office L01	1000	1.8	19	4	Pass
Office L01	1000	9.8	36	6	Fail
Office L01	1000	4.1	23	4	Fail
Office L02	1000	5.8	34	6	Fail
Office L03	1000	3	21	4	Fail
Office L02	1000	4.8	38	6	Fail
Office L02	1000	11.9	56	9	Fail
Office L02	1000	7.3	43	7	Fail
Office L02	1000	6.8	40	7	Fail
Office L02	1000	7.4	43	7	Fail
Office L02	1000	5.5	33	5	Fail
Office L02	1000	7.5	43	7	Fail
Office L02	1000	5.6	36	6	Fail
Office L02	1000	5.3	30	5	Fail
Office L02	1000	3.4	25	5	Fail
Office L03	1000	2.6	17	4	Pass
Office L03	1000	2.4	17	4	Pass
Office L03	1000	3.1	21	4	Fail
Office L03	1000	3.2	20	4	Fail
Office L03	1000	2.1	13	3	Pass
Office L03	1000	0.8	10	2	Pass
Office L03	1000	2	18	3	Pass
Office L03	1000	1	13	2	Pass
Office L03	1000	1.7	17	3	Pass
Office L03	1000	2.4	18	3	Pass
Office L03	1000	1.7	17	3	Pass
Office L03	1000	1.5	17	3	Pass
Office L03	1000	4.3	29	5	Fail
Office L03	1000	3.5	25	4	Fail
Office L03	1000	4.9	30	5	Fail
Office L03	1000	3.9	29	5	Fail
Office L03	1000	3.5	27	5	Fail
Office L03	1000	6.3	39	6	Fail
Office L03	1000	6.7	39	6	Fail
Office L03	1000	4.3	34	6	Fail

6.6. Scenario 4: Controlling overheating with active cooling.

The assessment in Scenario 3 demonstrates that with practical passive measures and enhanced ventilation provision, the overheating severity is reduced, but many rooms are still not compliant with TM52. Therefore, a final scenario has been undertaken with active cooling included within the thermal model. The results are shown below:

Room	Occupied Summer Hours	Criterion 1: % Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: Hours Exceeding Absolute Limit	Pass / Fail
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00 - open plan	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L00	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01 - open plan	1000	0	0	0	Pass
Office L01 - open plan	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L01	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L02	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
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Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass
Office L03	1000	0	0	0	Pass

7. Conclusions

7.1. The need for active cooling

The overheating assessment has determined that passive measures alone (following the cooling hierarchy) are not sufficient to ensure compliance with TM52 for overheating. This is largely due to the existing building constraints providing limited scope for passive measures, such as lack of cross flow ventilation due to building orientation and layout.

As existing spaces within the building are refurbished and updated, the development will look to implement passive measures where practical and feasible, including low energy LED lighting and exposed thermal mass to assist with controlling overheating.

The application of active cooling in the rooms within the buidling has provided a way to demonstrate compliance with CIBSE TM52 overheating criteria.

7.2. Optimising the active cooling design

It is intended that wherever possible, active cooling will be provided by the proposed central heat pump systems that will also be used to provide space heating. This type of simultaneous heating and cooling system is highly energy efficient, allowing heat to be recovered from one area of the building and put to use to heat other areas of the building, rather than simply wasting the heat energy by rejecting it to outside air. It will provide Gray's Inn with a holistic, energy efficient approach to heating and cooling, designed to future proof against anticipated climate change.