QUEENSBERRY DESIGN LTD.
ENGINEERING, SUSTAINABILITY & ARCHITECTURAL CONSULTANTS

elmhurst energy APPROVED OVERHEATING COMPETENCY SCHEME MEMBER

ESCP Business School – Loft Conversion
527 Finchley Road
London NW3 7BG

Active Cooling Assessment
CIBSE TM52:2013 Report

Ref: QD2238-02

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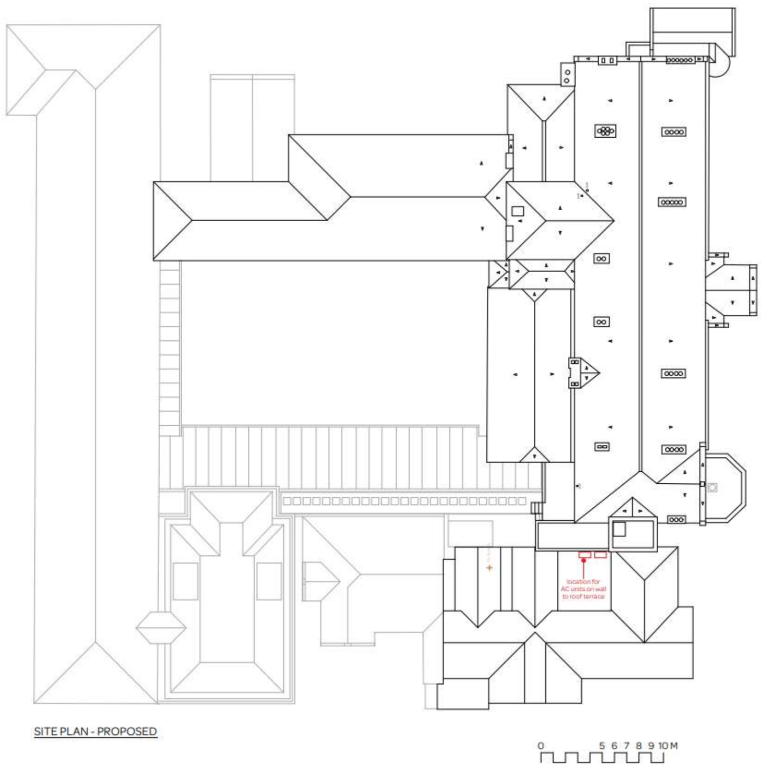


Image courtesy of Square Feet Architects.

Disclaimer

This report is based on the information provided by the client. Should this information prove to be inaccurate, or the original design specification change the findings and conclusions of this report will be invalidated. This report includes simulation results for the estimated thermal performance of the building (part of the building) using detailed modelling methods. Within the calculations, assumptions are made based on NCM defaults and practical industry standards that may not reflect the actual building. Although Queensberry Design takes great care in producing a high-quality simulation model, variables in building construction and external factors outside the CIBSE TM52 & TM59 metric requirements will affect the actual performance of the building. It is therefore the responsibility of the designers and construction team to construct the building appropriately.

1.0 Executive Summary

A detailed dynamic thermal model of ***ESCP Business School, 527 Finchley Road London,*** has been produced using Design Builder Energy Plus. The model has been used to simulate the performance of the proposed teaching/lecture space within the loft refurbishment. The simulations will determine any expected overheating as per the thermal comfort metrics CIBSE TM52:2013. The building data inputs are detailed in section 6 of this report, and the full results of the simulation model are illustrated in section 7 of this report.

1.1 Results - 2020's weather scenario

Overheating simulations have been completed for the proposed lecture and breakout spaces within the converted loft/attic, under the methodology of CIBSE TM52:213. Results confirm there is an overheating risk within these spaces, due to significant existing south-facing windows.

Table 1 – Overheating Risk without Active Cooling, (CIBSE TM52:2013)				
Zone	**Criteria 1 (%)**	**Criteria 2 (K.hr)**	**Criterion 3 (hr)**	**Pass / Fail**
Attic Breakout Area 1&2	26.94	31.17	0.83	**Fail**
Attic Breakout Area 3	89.93	65.17	183.83	**Fail**
Attic Lecture 1	94.02	62.33	174.83	**Fail**
Attic Lecture 2	57.74	47.33	9.67	**Fail**

Mitigation measures have been considered in accordance with the London Plan's 'cooling hierarchy', see section 8 of this report. In conclusion, other mitigation measures are deemed inappropriate for this existing building justifying the use of active cooling.

Proposed Overheating Mitigation:

Fan and Coil heating and cooling system
Air Conditioning Units
Heat Recovery fresh air units.

2.0 Introduction

This report has been produced to assess the potential overheating risk for the converted loft/attic at the existing ***ESCP Business School, 527 Finchley Road London*** against the overheating criteria outlined by CIBSE TM52:2013. The calculations have been prepared by Queensberry Design Ltd. The outcome of the overheating analysis is intended to demonstrate how the London Plan's 'cooling hierarchy' has been followed and demonstrate if active cooling (air conditioning) is required to mitigate the overheating risk.

("Map data ©2024 Google")

3.0 Overheating Criteria

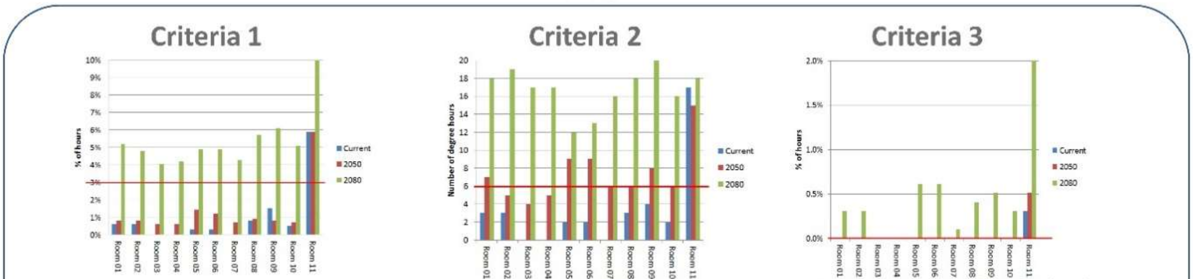
The most recognised methodology for assessing thermal comfort in non-domestic spaces is CIBSE TM52:2013. The building is considered Category II.

3.1 CIBSE TM52

CIBSE TM52 provides a methodology for the assessment of overheating risk in non-domestic buildings. The criteria are split into 3 sections 1, 2 and 3:

- Criterion 1 - Hours of Exceedance (He): 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 one degree or more during the occupied hours of a typical non-heating season (1st May to the 30th September)
- Criterion 2 - Daily Weighted Exceedance (We): deals with the severity of overheating, which can be as important as its frequency, the level of which is a function of both temperatures rise and its duration. This criterion sets a daily limit for acceptability.
- Criterion 3 - Upper Limit Temperature (Tupp): sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

TM52



TM52 - hours exceeding comfort range (%)

TM52 – peak daily weighted exceedance (degree hours)

TM52 – hours exceeding absolute limit (%)

Modelling Software

To carry out the thermal simulations, Queensberry Design Ltd has modelled the building in an appropriate Dynamic Simulation software: Design Builder Energy Plus version 7.2.0.032.

The DSM model can be used to provide:

- Overheating analysis (this report)
- Energy consumption prediction
- Heating and Cooling Load prediction
- Thermal Fluid Dynamics Assessment
- Building Compliance Assessment (Building Regulations Part-L and EPC)

5.0 3D Generated Models

A three-dimensional thermal model of the building has been produced based on information provided by the client/architect or otherwise stated in this report. Where specific information is provided building fabric, occupancy densities, profiles, and small power gains were based on the TM52 profiles and NCM assumptions. Specific lighting, heating and ventilation are as per the information provided (see section 6).

6.0 Summary of Model Inputs

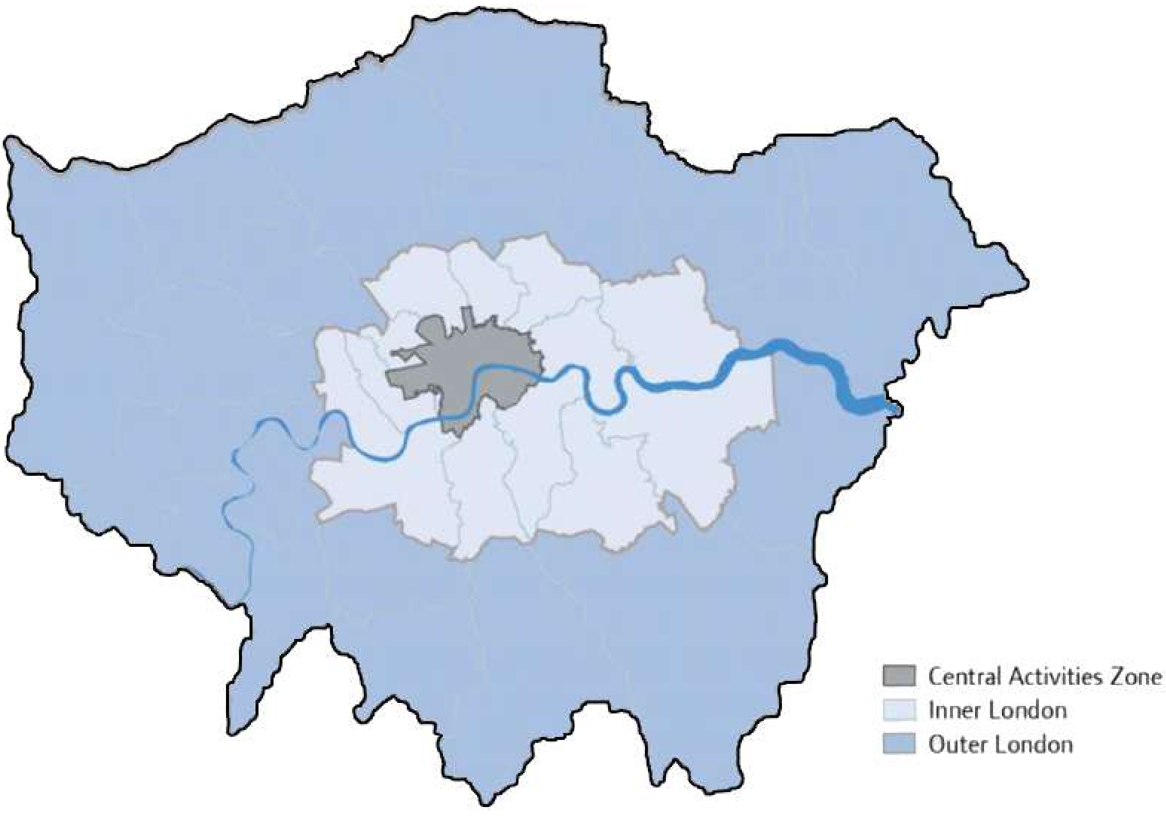
6.1 Location Data

Building type: Non-Domestic
Building Location: 527 Finchley Road, London, NW3 7BG
Orientation: All variations
Latitude: 51.55° North
Longitude: -0.19°
Weather file: DSY 1 (Design Summer Year) 2020's, high emissions, 50% percentile scenario.

6.2 Weather Data Report

In accordance with TM52 the DSY1 weather file used for the simulation model is based on the site location, as shown on the map below. There are three weather files for London, each representing different areas:

- Central Activity Zone: London Weather Central
- Inner London: London Heathrow weather file
- Outer London: London Gatwick weather file



6.3 Building Fabric

The existing ESCP building was constructed in the later part of the 19th century pre-1900's with later additions in 1900-1950. Fabric upgrades include fully insulating the pitched roof to current standards, and replacement windows to current Part L standards. The remainder of the existing building build-ups are based on wall thickness default construction types and SAP appendix S assumptions for construction of this period.

Table 2 – Building Fabric		
Element	**Construction**	**U-Value**
Solid Brick Wall approx. 590 mm	2-3 imperial brick layers, internal plasterboard on dabs.	
Wall in roof	Uninsulated timer stud wall	
Roof	82.5mm Kooltherm K118 insulated plasterboard, 100 Kooltherm K107 insulation between rafters, slates on battens.	**0.13 W/m2K**
Table 3 – Glazing Specification		
Replacement Windows	Assumed Typical G-Value 0.7	**2.20 W/m2K**

6.4.1 Building Services:

- ***Heating and hot waters**:* Existing radiator heating via gas boiler.
- ***Lighting:*** In the absence of project-specific lighting heat gains data, the inputs are based on sensible heat gains taken from CIBSE Guide A: Environmental design:
  Education – Lecture theatres, Teaching rooms, and Seminar rooms 12 W/m2 should be assumed
- ***Toilet Ventilation**:* Ventilation based on extract ventilation. No product extract rates are available, so rates are based on minimum NCM assumptions listed in the Non-domestic EPC convention guide (see appendix 10.1)
- ***Lecture and breakout area Ventilation**:* Mechanical ventilation is proposed as part of the mitigation measures (active cooling) air conditioning system with heat recovery.

6.5 Internal Heat Gains

The simulation software automatically calculates the solar gains based on the building orientation, window openings, and glazing specifications.

As no project-specific schedules are available for this development and no equipment gain information has not been provided by the design team, default schedules for inputs are based on NCM default schedules or each activity type.

It is not clear if there is any communal corridor pipework. If pipework is present the calculation will be invalid and should be re-simulated with the correct pipework gains included.

6.6 Air Infiltration Rate

The air permeability of the building envelope must conform to the standard set by the criterion of Part L for new buildings. For existing buildings such as this, it is not practical to test the building's permeability, however, it is assumed it would not be as airtight as a new build construction. The airtightness crack template is set to medium in the simulation model.

6.7 Window Openings

All openable windows are projected to be opened manually by the end-user when the internal temperature exceeds 22-24°C. However, elevations do not indicate any openable windows within the attic space, so these are modelled as closed.

7. Results and Simulation Outcomes – 2020's Weather Data

7.1 Simulation Baseline Results

The simulation model has been completed for TM52 overheating analysis, a simulation has taken place for the occupied zones, defined as a space within the building that is likely to be occupied for 30 minutes or more by a building user.

Results confirm there is an overheating risk for the proposed lecture and breakout spaces within the converted loft/attic. All inputs used for this scenario can be found in section 6 of this report, including the mitigation measures.

Table 3 – 2020's Initial Simulation Results (CIBSE TM52:2013)

Zone	Criteria 1 (%)	Criteria 2 (K.hr)	Criterion 3 (hr)	Pass / Fail
Attic Breakout Area 1&2	26.94	31.17	0.83	Fail
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8. Mitigation measures 'cooling hierarchy'

8.1 London Plan

All new developments will be expected to demonstrate how the London Plan's 'cooling hierarchy' has informed the building design. Any development that is likely to be at risk of overheating (for example due to large expanses of south or south west facing glazing) will be required to complete dynamic thermal modelling to demonstrate that any risk of overheating has been mitigated.

The cooling hierarchy includes:
• Minimise internal heat generation through energy efficient design;
• Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls;
• Manage the heat within the building through exposed internal thermal mass and high ceilings;
• Passive ventilation;
• Mechanical ventilation; and Active cooling.

Active cooling (air conditioning) will only be permitted where dynamic thermal modelling demonstrates there is an overheating risk. The results in section 7 of this report confirm the overheating risk.

8.2 Mitigation - Energy Efficient Design

As an existing building, the orientation and construction of the building is already predetermined. The building sits on the edge of Camden's conservation area and is named on the local list of 'non-designated heritage assets'. As a result, any changes to the exterior of the building such as external shading are unlikely to receive planning permission as they would affect the significance of a non-designated heritage asset.

8.2 Mitigation - Internal Thermal Mass

As an existing building, the existing thermal mass of the building and ceiling heights is already predetermined. The existing solid walls do provide high levels of thermal mass which will assist in reducing the overheating risk. However, simulation results confirm there is still a potential risk.

8.3 Mitigation - Passive Ventilation

Passive ventilation has been considered by the client's mechanical services engineer; however, they have confirmed the required fresh air ventilation rate will not be met:

The environmental design conditions for ventilation and overheating are defined by the Approved Document F – Ventilation, Approved Document O – Overheating, CIBSE Guide A – Environmental Design, CIBSE Guide B2 – Ventilation and Ductwork and CIBSE Guide B3 – Air Conditioning and Refrigeration.

The design criteria for lecture halls defined by these documents are as follows:

Fresh Air Ventilation Rate – 10l/s per person.

Winter Design Space Temperature – 19-21 °C.

Summer Design Temperature – 21-25° C.

The required fresh air ventilation rate and the internal heat loads are high due to the 90 – 100 occupants in each space and passive or mechanical ventilation is therefore not an adequate means to remove the heat from the indoor environment.

8.4 Mitigation - Mechanical ventilation; and Active cooling.

To justify active cooling (air conditioning) all other mitigation measures have been considered in line with the cooling hierarchy. All other mitigation measures are deemed inappropriate for this existing building, and justify the use of active cooling.

The client’s mechanical services engineer proposes a combined heating and cooling system with heat recovery. The air conditioning systems are a form of the heat pump type and can therefore efficiently provide heating and cooling for the space.

Proposed Overheating Mitigation:

Fan and Coil heating and cooling system
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9. Conclusions

A detailed dynamic thermal model of ***ESCP Business School, 527 Finchley Road London,*** has been produced using Design Builder Energy Plus. The model has been used to simulate the performance of the proposed teaching/lecture space within the converted loft/attic.

The objective of the simulation was to determine any overheating risk as determined by the thermal comfort metrics CIBSE TM52:2013. A full set of results of the simulation model are illustrated in section 7 of this report.

9.1 Results Summary

Results confirm there is an overheating risk. All inputs used for this scenario can be found in section 6 of this report, including the mitigation measures.

Table 4 – 2020's Simulation Results, Sample units (CIBSE TM52:2013)

Zone	Criteria 1 (%)	Criteria 2 (K.hr)	Criterion 3 (hr)	Pass / Fail
Attic Breakout Area 1&2	26.94	31.17	0.83	Fail
Attic Breakout Area 3	89.93	65.17	183.83	Fail
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10. Appendix

10.1 NCM – Local mechanical exhaust rates

Room or Building	Air Changes per Hour
Assembly Rooms	10
Bakeries	30
Banks/Building Societies	6
Bathroom (non domestic) without Shower	8
Bathroom (non domestic) with Shower	20
Bathroom (domestic)	10
Bedrooms	4
Boiler Rooms	30
Cafés and Coffee Bars	15
Canteens	12
Cellars	10
Cinemas and Theatres	10
Club / Games Rooms	10
Compressor Rooms	20
Conference Rooms	10
Dairies	10
Night Club / Disco	20
Dye Works	30
Electroplating Shops	12
Engine Rooms	30
Entrance Halls, Corridors	5
Factories and Workshops	10
Fitness Centres	12
Foundries	30
Garages (workshop)	10
Glass houses	60
Hairdressing Salons	15
Hotel Bars	10
Kitchens – Non Domestic	40
Kitchens – Domestic	15
Laboratories	15
Launderettes / Laundries	15
Lecture Theatres	10
Libraries	4
Living Rooms	6
Meeting Room	10
Offices	6
Photo and X-ray Darkrooms	8
Public House Bars	15
Recording Studios	12
Restaurants	15
Schoolrooms	10 l/s/Person
Shops and Supermarkets	10
Sports Hall / Squash Courts / Gymnasiums	6