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Planning Statement
KOKO - Private members' club
Overheating Analysis

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Overheating Analysis
KOKO - Private members’
Introduction

Introduction

Eight Associates has been appointed to undertake an overheating analysis of the Private members’ club of KOKO and the roof top lobby in order to provide design stage guidance and maximise occupant comfort levels. Thermal modelling has been undertaken to demonstrate compliance with CIBSE TM52 requirements. The current proposal is to minimise overheating risk by following the Cooling Hierarchy.

Planning Context

The Camden Local Plan does not set out any specific requirement for avoiding overheating. This report is aligned with national standards and regulations. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. Minimise internal heat generation through energy efficient design;
2. Reduce the amount of heat entering a building in summer through shading, albedo, fenestration, insulation and green roofs and walls;
3. Manage the heat within the building through exposed internal thermal mass and high ceilings;
4. Passive ventilation;
5. Mechanical ventilation;
6. Active cooling systems (ensuring they are the lowest carbon options).

Methodology

The methodology used within this report has been to establish the thermal comfort levels in the occupied spaces through the use of dynamic simulation modelling and respond with suitable passive design measures to mitigate solar gains; provide adequate ventilation and increase thermal mass.

National regulations have set high standards and numerous iterations have been undertaken to determine suitable fabric improvements. All assumptions in the modelling are provided in the model inputs section of this report.

Criteria for defining overheating

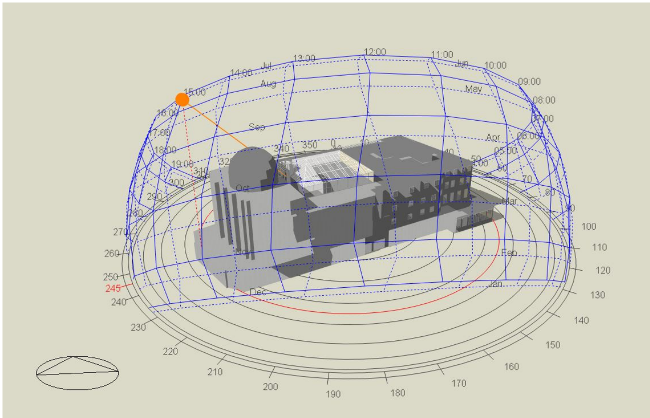
According to the CIBSE TM 52 – The limits of thermal comfort: avoiding overheating in European buildings (2013) and CIBSE Guide A – Environmental Design (2015), to reduce the risk of overheating the space has to comply with at least two of the following three criteria:

a) 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 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).
b) The second criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.
c) The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

Overheating Analysis
KOKO - Private members’ club
Model Inputs

Simulation Software

An overheating analysis has been undertaken using Dynamic Simulation Modelling, Design Builder has been employed for this. Design Builder is a DCLG approved simulation environment that complies with the requirements of CIBSE Guide A. A screenshot of the model is shown below.



Weather File

The CIBSE Design Summer Year (DSY) Current Series, London Heathrow, has been used for the purposes of this report.

Building Fabric U-Values

Element	Proposed U-value (W/m²K)
External walls	0.17
Ground floor/Basement floor	0.15
Roof	0.13
Windows	1.50
Roof top glazing	1.70

Internal Gains

Typical hours based on the relative activity for class use, on weekdays and weekends throughout the year have been specified for lighting, equipment and occupancy.

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Overheating Analysis
KOKO - Private members’ club
Passive Design Measures

Cooling Strategy	The cooling strategy is to implement energy efficient lighting and appliances to reduce internal heat gains; create a super-insulated fabric with shading devices and solar control glazing to keep the heat out.
Windows	Glazing will be a crucial aspect to ensure thermal comfort of the occupied spaces. In order to minimise solar gains, and consequently cooling demand, windows with a solar factor of 0.28 have been modelled for every glazed area.
Shading	Internal shading roll or blinds with high reflective slats have been modelled to reduce solar gains. The shading device should have a reflectance of 0.5 and a solar transmittance of 0.05. This system will operate automatically using inside air temperature controls, shading will be activated when the inside temperature exceeds the threshold temperature of 22°C.
Mechanical Ventilation Rates	Mechanical ventilation has been specified. The system will provide an air change rate of 1 AC/H throughout the occupied spaces.
Natural Ventilation Rates	Natural ventilation through openable windows has been adopted for this scheme. The ventilation rate has been calculated by the software according to the percentage of openable windows and skylights and the varying environmental conditions throughout the year. This percentage of openable windows has been estimated to be 20% for the private members’ club and 60%for the roof top pavilion. Moreover, the scheme has been modelled with a discharge coefficient rate of 0.65 and a wind factor of 1. The windows were opened when the internal temperature exceeds 22°C and when the rooms were occupied.

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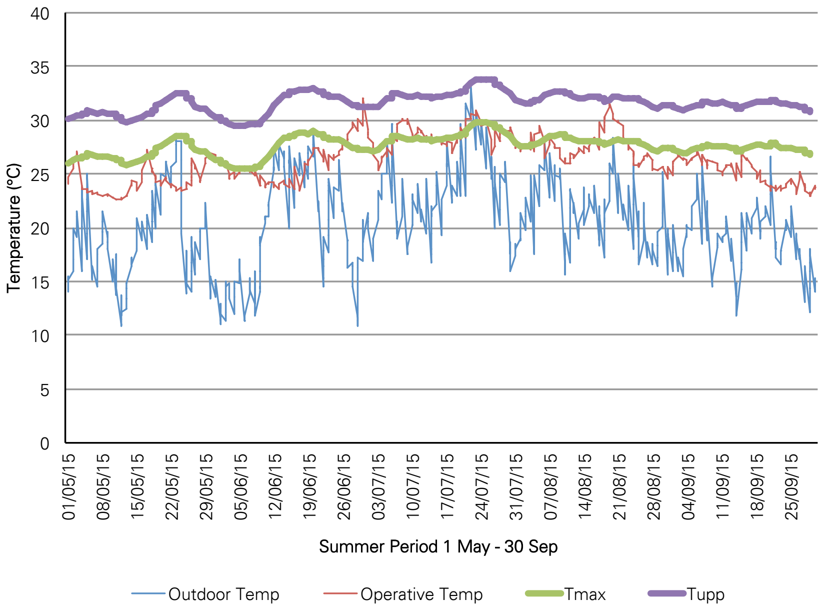
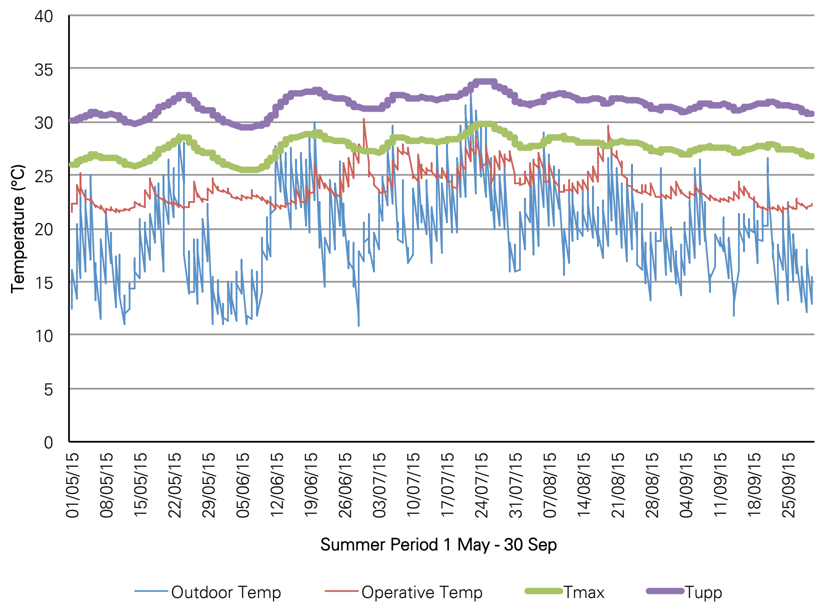
Overheating Analysis
KOKO - Private members' club
Results – Passive Measures

Gallery Bar
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Gallery bar	14.1%	32	3	FAIL

Private Members 3
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Private members 3	1.2%	19	0	PASS

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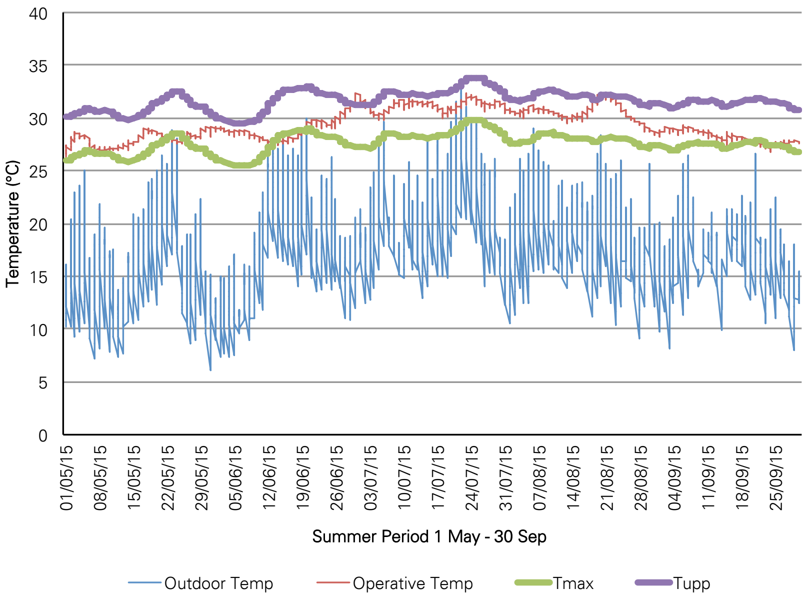
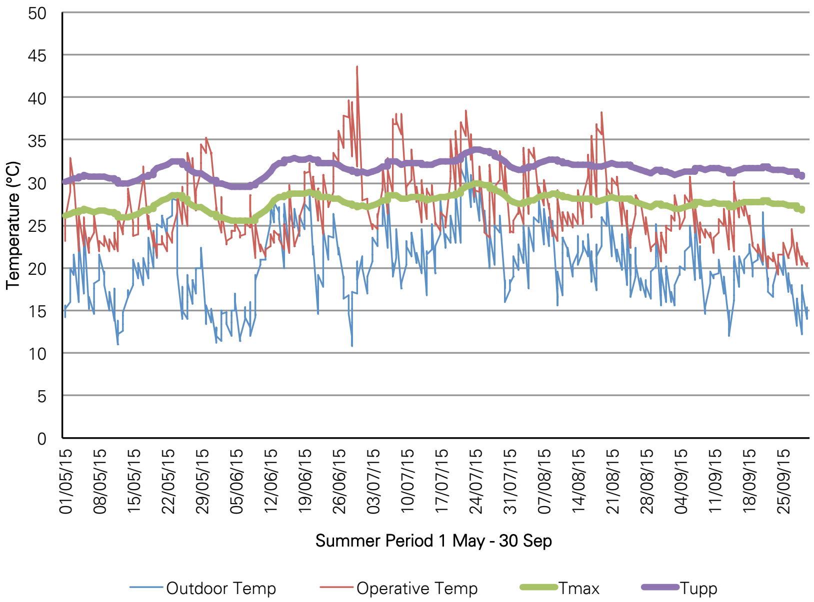
Overheating Analysis
KOKO - Private members’ club
Results – Passive Measures

Lobby
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Lobby	81.2%	79	15	FAIL

Pavilion
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Pavilion	33.0%	96	114	FAIL

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Overheating Analysis
KOKO - Private members' club
Results – Passive Measures

Summary of Results Passive Measures

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
First Floor – Kitchen	8.8%	32	4	FAIL
First Floor – Function room 1	1.0%	17	0	PASS
First Floor – Function room 2	3.1%	23	0	FAIL
First Floor – Dining	5.8%	28	2	FAIL
Second Floor – Gallery bar	14.1%	32	3	FAIL
Second Floor – Private members 1	2.1%	25	0	PASS
Second Floor – Private members 2	3.4%	25	0	FAIL
Second Floor – Private members 3	1.2%	19	0	PASS
Second Floor – Lobby	81.2%	79	15	FAIL
Third Floor – Bedroom	25.3%	58	10	FAIL
Third Floor – Recording studio	7.0%	26	0	FAIL
Third Floor – Private member suite	1.9%	24	0	PASS
Third Floor – Lounge	6.0%	27	0	FAIL
Fourth Floor – Pavilion	33.0%	96	114	FAIL

Summary – Passive Measures

As shown above, there is high risk of overheating in most of the habitable rooms.

Criterion 1 shows that some of the rooms will experience temperatures above the thermal comfort T_{max} for more than 3% of the total summer occupied hours. This value is outside of the acceptable range.

Criterion 2 shows that the maximum weighted exceedance is up to 96 within one day (this value is a function of temperature rise and its duration). According to CIBSE Guide A and TM 52, no one day should have a weighted exceedance more than 6.

Criterion 3 shows than there are up to 114 hours above the absolute maximum daily temperature.

Please note that according to CIBSE TM52, the space has to comply with at least two of the three criteria.

In summary, passive measures are not adequate to provide the required thermal comfort in the habitable rooms, therefore active cooling will be required in order to avoid overheating.

Overheating Analysis
KOKO - Private members' club
Active Cooling System

Active Cooling System

The results above confirm that the passive design measures are not adequate to provide the required thermal comfort range in all habitable rooms. Therefore, an active cooling system will be required in order to retain the thermal comfort in the occupied spaces.

The proposed development has been simulated with an active cooling system with an Energy Efficiency Ration (EER) of 3.6.

A mixed mode strategy has been implemented. The development has been modelled with natural ventilation and an active cooling system. The windows were open when the internal temperature was higher than 22 °C and the cooling system was activated when the internal temperature was higher than 23 °C.

The following cooling capacities have been simulated:

Room	Cooling capacity (kW)
First Floor – Kitchen	10.5
First Floor – Function room 1	4
First Floor – Function room 2	2.5
First Floor – Dining	13.5
Second Floor – Gallery bar	5.5
Second Floor – Private members 1	5.5
Second Floor – Private members 2	3
Second Floor – Private members 3	3.5
Second Floor – Lobby	5
Third Floor – Bedroom	1.5
Third Floor – Recording studio	3
Third Floor – Private member suite	2
Third Floor – Lounge	4
Fourth Floor – Pavilion	80

These capacities are indicative and must be subject to a detailed analysis by the building services engineer/installer. The heating and cooling capacities for each unit have been modelled as indicated above.

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Overheating Analysis
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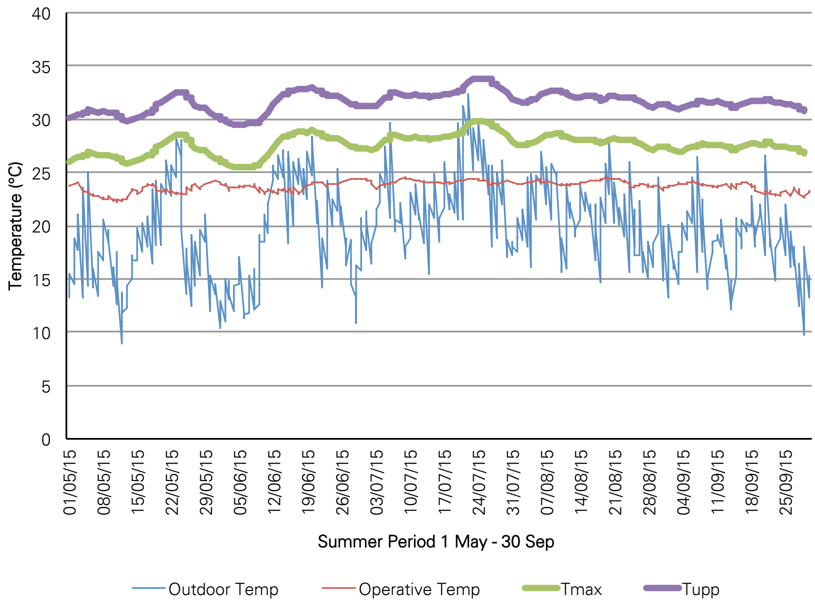
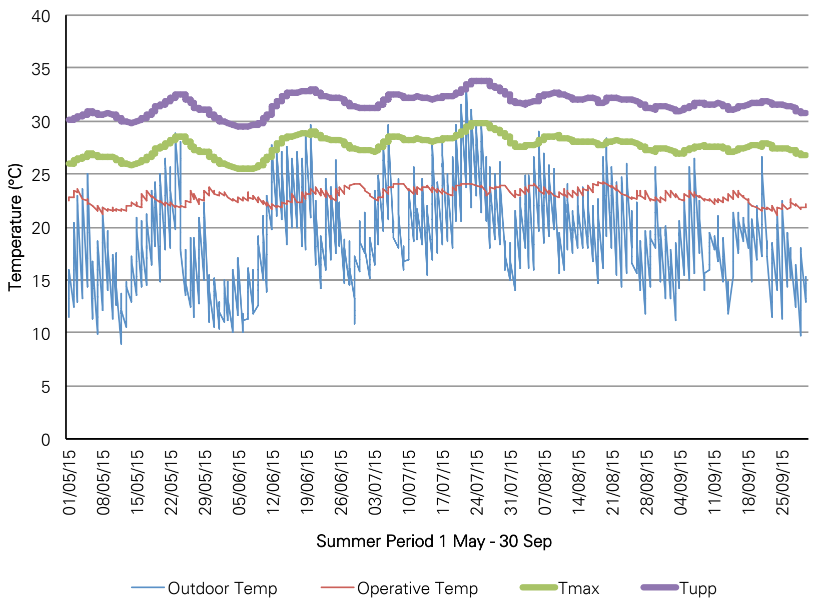
Results – Active Cooling System

Gallery Bar
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Gallery bar	0.0%	0	0	PASS

Private Members 3
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Private members 3	0.0%	0	0	PASS

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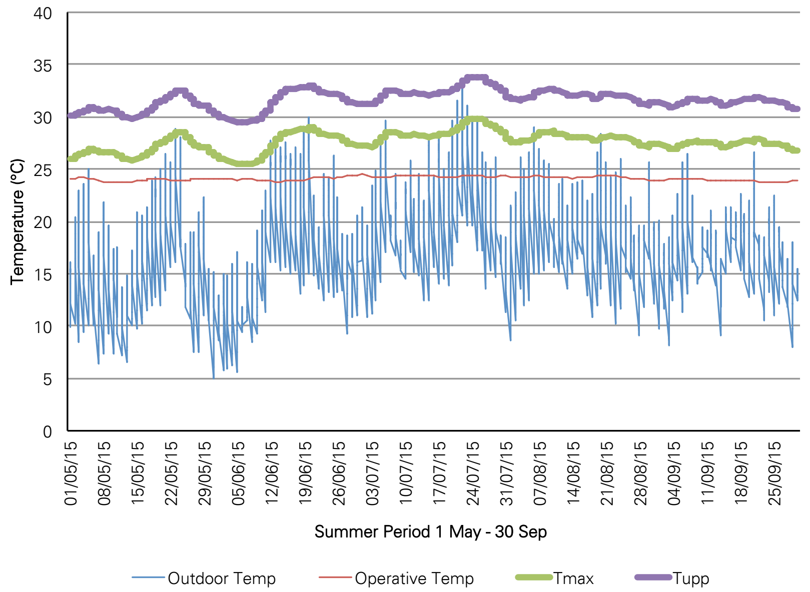
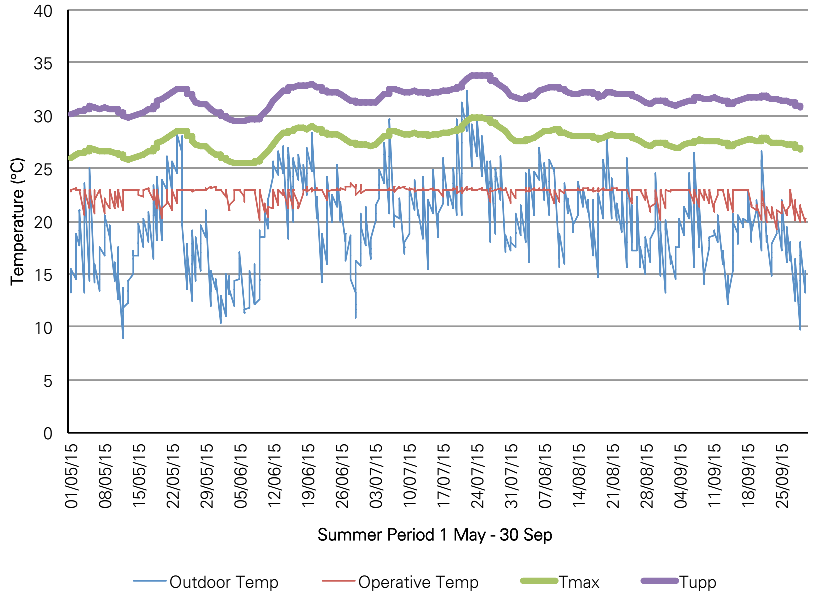
Overheating Analysis
KOKO - Private members' club
Results – Active Cooling System

Lobby
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Lobby	0.0%	0	0	PASS

Pavilion
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Pavilion	0.0%	0	0	PASS

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Overheating Analysis
KOKO - Private members' club
Results – Active Cooling System

Summary of Results Active Cooling System

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
First Floor – Kitchen	0.0%	0	0	PASS
First Floor – Function room 1	0.0%	0	0	PASS
First Floor – Function room 2	0.0%	0	0	PASS
First Floor – Dining	0.0%	0	0	PASS
Second Floor – Gallery bar	0.0%	0	0	PASS
Second Floor – Private members 1	0.0%	0	0	PASS
Second Floor – Private members 2	0.0%	0	0	PASS
Second Floor – Private members 3	0.0%	0	0	PASS
Second Floor – Lobby	0.0%	0	0	PASS
Third Floor – Bedroom	0.0%	0	0	PASS
Third Floor – Recording studio	0.0%	0	0	PASS
Third Floor – Private member suite	0.0%	0	0	PASS
Third Floor – Lounge	0.0%	0	0	PASS
Fourth Floor – Pavilion	0.0%	0	0	PASS

Summary – Active Cooling System

The development meets the overheating requirements in all habitable rooms with a mixed mode strategy.

Criterion 1 shows that no spaces will experience temperatures above the thermal comfort T_{max}. According to CIBSE TM 52, no space should experience temperatures above the thermal comfort T_{max} for more than 3% of the total summer occupied hours.

Criterion 2 shows that the maximum weighted exceedance is up to 0.00 within one day (this value is a function of temperature rise and its duration). According to CIBSE Guide A and TM 52, no one day should have a weighted exceedance more than 6.

Criterion 3 shows than there are no hours above the absolute maximum daily temperature.

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Overheating Analysis
KOKO - Private members' club
Conclusions

Conclusions

The analysis has responded to CIBSE TM52 requirements relating to overheating. The report has set out how the habitable rooms of the Private members' club perform against strict thermal comfort standards for overheating. The scheme has implemented passive design measures and majority of the rooms comply with the TM52. However, active cooling is required in order to comply with overheating criteria.

The proposal maximises passive design measures by responding to the local context in the following ways:

- Energy efficiency lighting and appliances have been recommended to reduce internal heat gains;
- The building will be well insulated over the standards set out by Building Regulations;
- Reduced solar gains with a solar factor of 0.28 for the windows will help to keep the heat out of the building;
- Internal shading devices for the windows will help to minimise the heat that is penetrating the building;
- Mechanical ventilation to provide fresh air and purge the heat;
- Natural ventilation supplies fresh air to the building through openable windows (as per ventilation rates section) to reduce the need for air conditioning.

Note that the analysis was performed assuming that open windows and shading devices were controlled based on the level of occupancy and the operative indoor temperature of the space. To achieve the thermal comfort levels shown in this report the level of occupant control for the opening windows would need to be optimum i.e. fully responsive to indoor temperature.

Moreover, the roof top pavilion should be designed with an appropriate BMS system, which will be able to control the cooling set point according to the operative temperature of the room. Thermostatic control based on internal air temperature will not be adequate to avoid overheating as a result of the thermal inertia the roof top pavilion will experience. The BMS (or alternative system) therefore needs to account for the surface temperatures of the structure via an external sensor or a weather compensation data circuit, or similar, that will supplement the internal air temperature sensor.

It is also necessary to note that external temperatures are likely to increase because of climate change. The consequences of increased summer peak temperatures would be non-compliance with the thermal comfort recommendations unless active cooling measures are implemented.