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Planning Statement
KOKO - Hotel
Overheating Analysis

Document information		
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Assessment information		
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Overheating Analysis
KOKO - Hotel
Introduction

Introduction

Eight Associates has been appointed to undertake an overheating analysis of the Hotel of KOKO in order to provide design stage guidance and maximise occupant comfort levels. The hotel comprises offices, a restaurant and guest rooms. 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.

Building Summary

The scheme is located in the London Borough of Camden. The project comprises the demolition of 65 Bayham Place, 1 Bayham Street and new build development of a 32-bedroom hotel extension to the rear with additional basement areas.

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.

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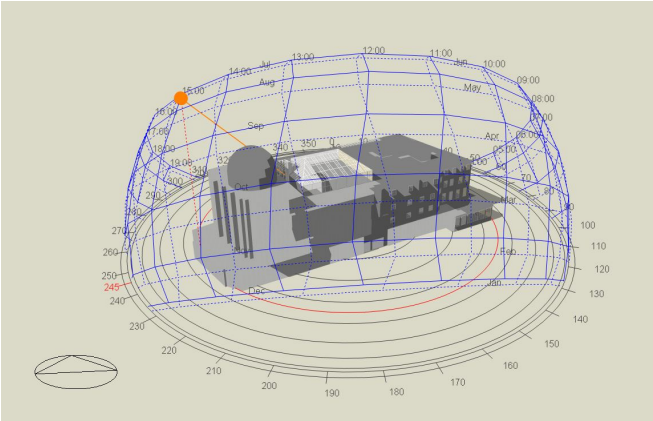
Overheating Analysis
KOKO - Hotel
Model Inputs

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/m^{2}K)
External walls	0.17
Ground floor/Basement floor	0.15
Roof	0.13
Doors	1.40
Windows	1.50

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.

Space	Occupancy people/m^2	Lighting W/m^2 per 100 lux	Small power W/m^2
Bedroom	0.0944	2.5	3.15
Office	0.1061	2.5	12.70
Restaurant	0.1874	2.5	14.72
Lobby	0.1046	2.5	4.72
Kitchen	0.1080	2.5	42.24

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Overheating Analysis
KOKO - Hotel
Results – Initial Case

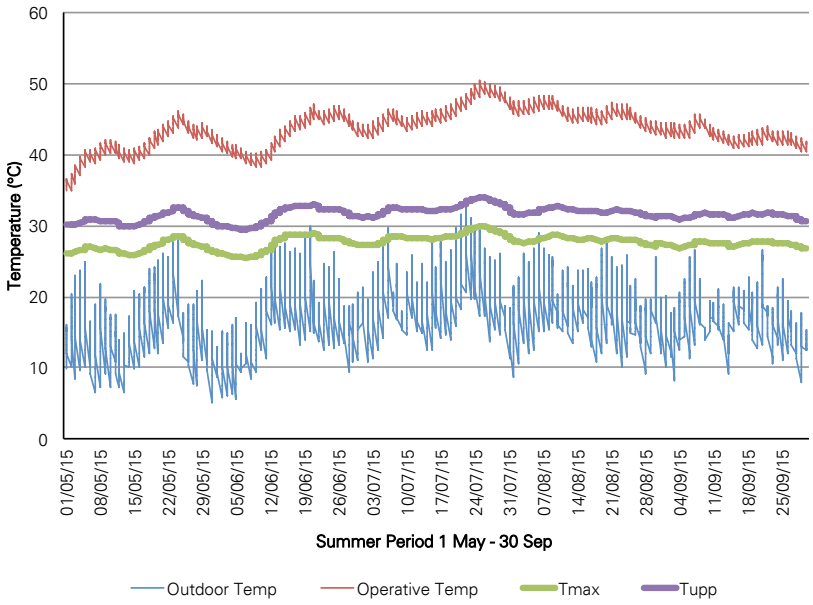
Overview of Results

The graphs below show the outdoor and indoor temperature of the Kitchen, Hope and Anchor, Recording studio and Suite 204, as representative of the whole. The graphs also show the T_{max}, which is the upper range of thermal comfort, and T_{upp}, which is the absolute upper limit of thermal comfort.

In order to comply with the overheating criteria the building must comply with two of the following three criteria.

- Criterion 1 - The percentage of hours with temperature more than the T_{max} should be less than 3%.
- Criterion 2 - The weighted exceedance shall be less than or equal to 6 in any one day
- Criterion 3 - No occupied hour of the building shall exceed the absolute upper limit temperature. ($T_{upp} = T_{max} + 4K$)

Kitchen
Initial Case



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Kitchen	100%	231.90	2754	FAIL

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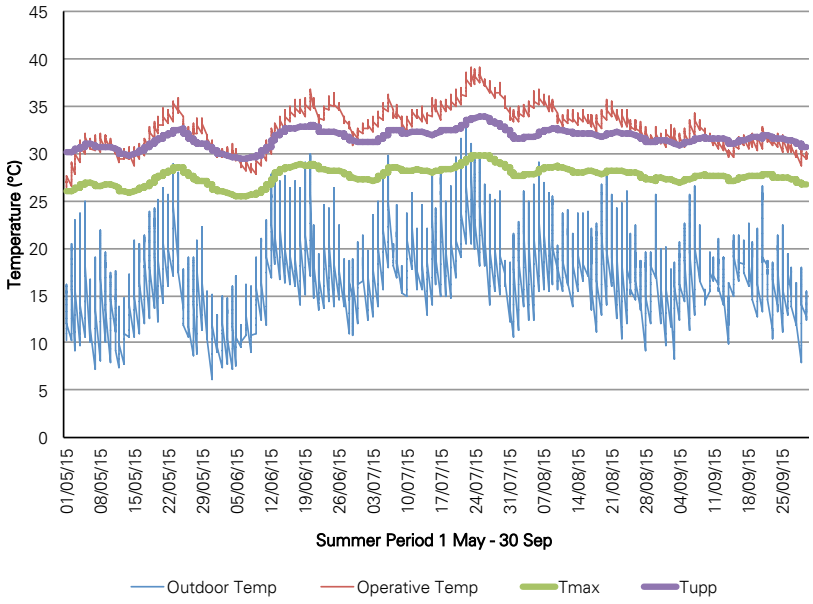
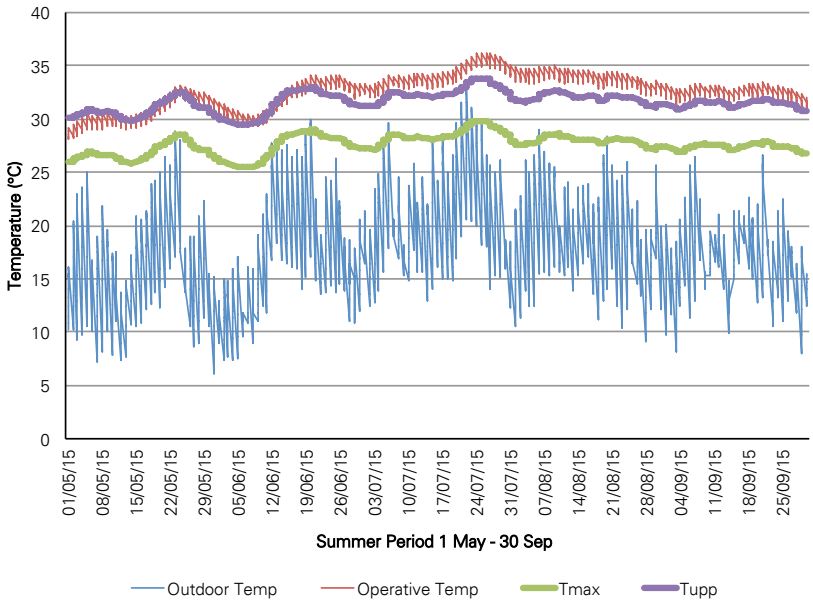
Overheating Analysis
KOKO - Hotel
Results – Initial Case

Hope and Anchor
Initial Case



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Hope and Anchor	100.0%	140.49	1937	FAIL

Recording Studio
Initial Case



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Recording Studio	100.0%	76.72	1468	FAIL

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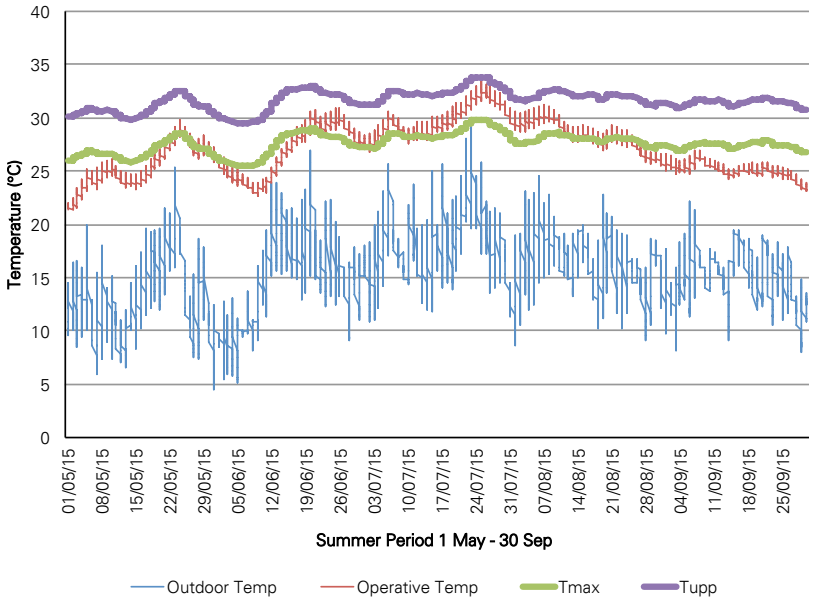
Overheating Analysis
KOKO - Hotel
Results – Initial Case

Suite 204
Initial Case



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Suite 204	38.6%	28.78	0	FAIL

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Overheating Analysis
KOKO - Hotel
Results – Initial Case

Summary of Results
Initial Case

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Basement – Function	100%	102.73	1798	FAIL
Basement – Kitchen	100%	231.90	2754	FAIL
Basement - Catering kitchen	100%	275.55	2754	FAIL
Ground Floor – EDF	19%	26.07	0	FAIL
Ground Floor – Hope and Anchor	100%	140.49	1937	FAIL
Ground Floor – Hotel Reception	91%	88.32	317	FAIL
Ground Floor – KOKO Office	78%	49.17	55	FAIL
First Floor – Room 101	73%	42.84	17	FAIL
First Floor – Room 102	74%	53.25	70	FAIL
First Floor – Room 103	72%	49.09	58	FAIL
First Floor – Room 104	49%	34.24	1	FAIL
First Floor – Room 105	40%	33.05	0	FAIL
First Floor – Room 106	43%	32.98	0	FAIL
First Floor – Room 107	47%	32.10	0	FAIL
First Floor – Room 108	31%	22.82	0	FAIL
First Floor – Room 109	15%	12.67	0	FAIL
First Floor – Room 110	26%	19.53	0	FAIL
First Floor – Room 111	16%	18.01	0	FAIL
First Floor – Artist Box	100%	221.38	1836	FAIL
First Floor – Breakout room	100%	157.80	1836	FAIL
First Floor – Guest Box	100%	84.26	1519	FAIL
First Floor – Kitchen	100%	355.75	2754	FAIL
First Floor – Office	100%	139.83	1811	FAIL
First Floor – Royal Box	100%	211.64	1836	FAIL
Second Floor – Room 201	44%	28.65	0	FAIL
Second Floor – Room 202	43%	37.02	5	FAIL
Second Floor – Room 203	50%	36.49	1	FAIL
Second Floor – Room 204	39%	28.78	0	FAIL
Second Floor – Room 205	27%	26.87	0	FAIL
Second Floor – Room 206	24%	24.69	0	FAIL
Second Floor – Room 207	28%	22.34	0	FAIL
Second Floor – Room 208	21%	19.27	0	FAIL
Second Floor – Room 209	15%	14.80	0	FAIL
Second Floor – Room 210	18%	17.65	0	FAIL
Second Floor – Room 211	16%	18.82	0	FAIL
Second Floor – Room 212	84%	33.40	0	FAIL
Second Floor – Recording Studio	100%	76.72	1468	FAIL

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Overheating Analysis
KOKO - Hotel
Results – Initial Case

Summary of Results Initial Case (Continued)

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Third Floor – Room 212A	3%	7.46	0	FAIL
Third Floor – Room 212C	8%	11.85	0	FAIL
Third Floor – Room 301	24%	20.87	0	FAIL
Third Floor – Room 302	27%	29.14	1	FAIL
Third Floor – Room 303	39%	30.90	1	FAIL
Third Floor – Room 304	33%	26.95	0	FAIL
Third Floor – Room 305	22%	29.01	5	FAIL
Third Floor – Room 306	22%	24.09	0	FAIL
Third Floor – Room 307	19%	23.11	0	FAIL
Third Floor – Room 308	19%	22.99	0	FAIL
Third Floor – Room 309	19%	25.44	0	FAIL
Third Floor – Suite 212D	88%	34.76	6	FAIL

Summary – Initial Case

As it is shown above, no rooms can meet the TM 52 requirements. Therefore, numerous passive design measures will be implemented, as described on the following pages, in order to reduce the cooling demand.

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Overheating Analysis
KOKO - Hotel
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 0.40 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 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 has to 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 60%. Moreover, the scheme has been modelled with a discharge coefficient rate of 0.65 and a wind factor of 1. The windows were open when the internal temperature went above 23°C and when the rooms were occupied.

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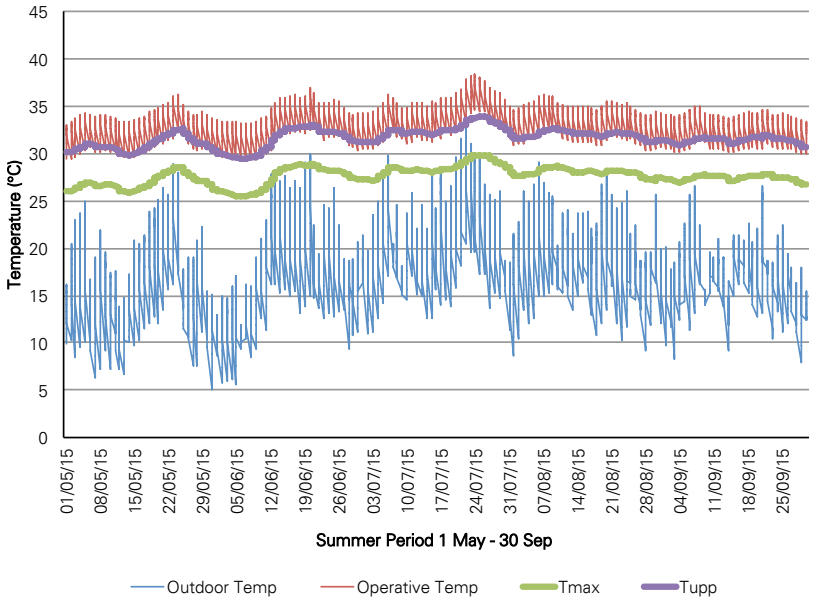
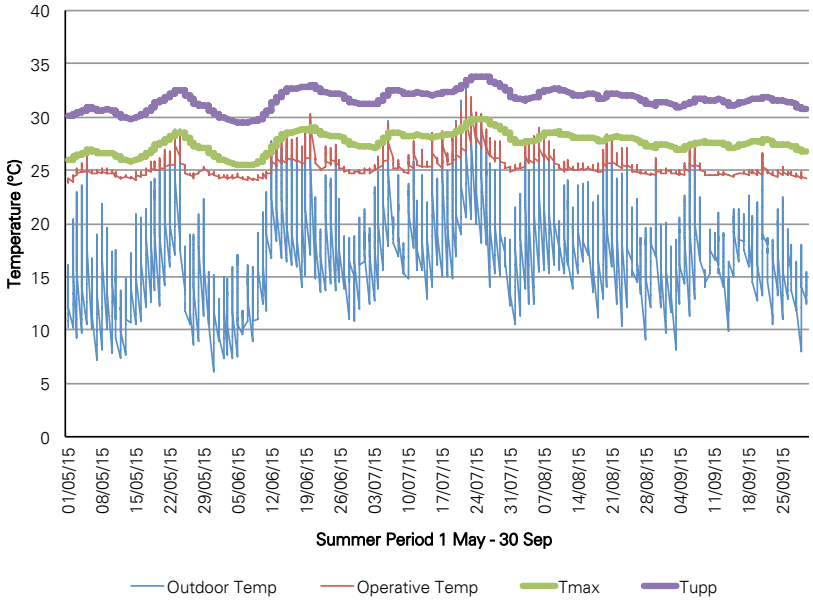
Overheating Analysis
KOKO - Hotel
Results – Passive Measures

Kitchen
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Kitchen	100.0%	137.51	2613	FAIL

Hope and Anchor
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Hope and Anchor	5.32%	24.99	0	FAIL

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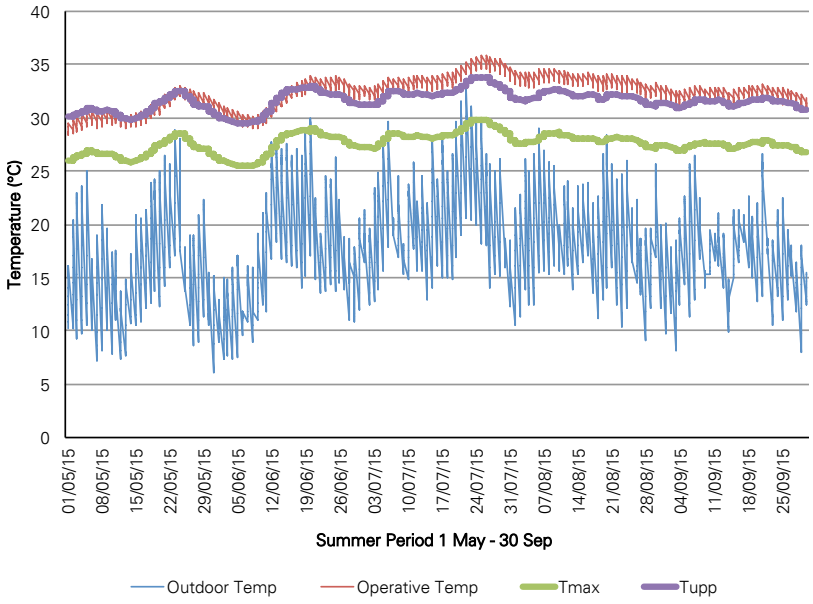
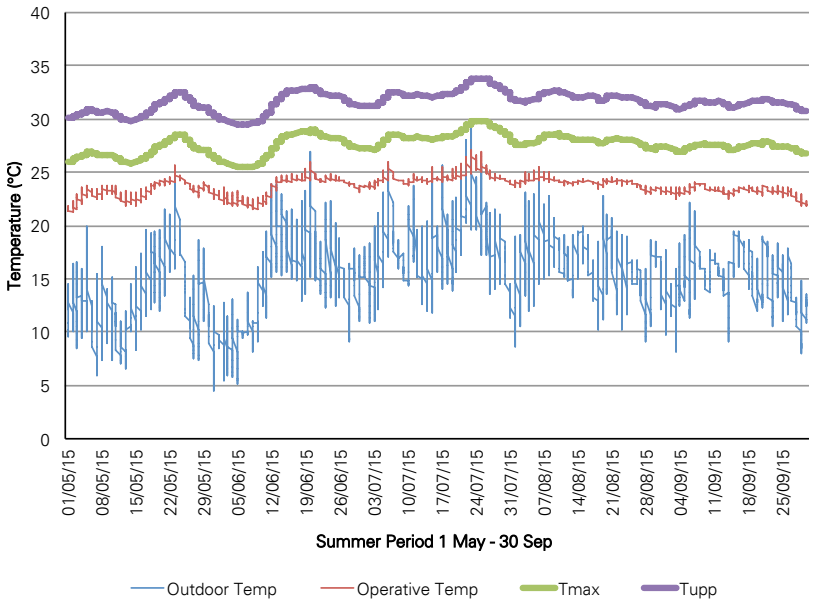
Overheating Analysis
KOKO - Hotel
Results – Passive Measures

Recording Studio
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Recording Studio	100.0%	71.93	1400	FAIL

Suite 204
Passive Measures



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Suite 204	0.0%	0.00	0	PASS

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Overheating Analysis
KOKO - Hotel
Results – Passive Measures

Summary of Results
Passive Measures

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Basement – Function	100%	32.78	0	FAIL
Basement – Kitchen	100%	137.51	2613	FAIL
Basement - Catering kitchen	100%	275.69	2754	FAIL
Ground Floor – EDF	1%	1.65	0	PASS
Ground Floor – Hope and Anchor	5%	24.99	0	FAIL
Ground Floor – Hotel Reception	1%	6.67	0	PASS
Ground Floor – KOKO Office	1%	1.23	0	PASS
First Floor – Room 101	0%	0.00	0	PASS
First Floor – Room 102	0%	0.00	0	PASS
First Floor – Room 103	0%	0.00	0	PASS
First Floor – Room 104	0%	0.00	0	PASS
First Floor – Room 105	0%	0.00	0	PASS
First Floor – Room 106	0%	0.00	0	PASS
First Floor – Room 107	0%	0.00	0	PASS
First Floor – Room 108	0%	0.00	0	PASS
First Floor – Room 109	0%	0.00	0	PASS
First Floor – Room 110	0%	0.00	0	PASS
First Floor – Room 111	0%	0.00	0	PASS
First Floor – Artist Box	100%	221.39	1836	FAIL
First Floor – Breakout room	100%	74.56	1673	FAIL
First Floor – Guest Box	100%	70.82	1244	FAIL
First Floor – Kitchen	27%	59.60	21	FAIL
First Floor – Office	4%	12.95	0	FAIL
First Floor – Royal Box	100%	211.96	1836	FAIL
Second Floor – Room 201	0%	0.00	0	PASS
Second Floor – Room 202	0%	0.00	0	PASS
Second Floor – Room 203	0%	0.00	0	PASS
Second Floor – Room 204	0%	0.00	0	PASS
Second Floor – Room 205	0%	0.00	0	PASS
Second Floor – Room 206	0%	0.00	0	PASS
Second Floor – Room 207	0%	0.00	0	PASS
Second Floor – Room 208	0%	0.00	0	PASS
Second Floor – Room 209	0%	0.00	0	PASS
Second Floor – Room 210	0%	0.00	0	PASS
Second Floor – Room 211	0%	0.00	0	PASS
Second Floor – Room 212	81%	26.35	0	FAIL
Second Floor – Recording Studio	100%	71.93	1400	FAIL

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Overheating Analysis
KOKO - Hotel
Results – Passive Measures

Summary of Results Passive Measures (Continued)

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Third Floor – Room 212A	0%	0.00	0	PASS
Third Floor – Room 212C	0%	0.00	0	PASS
Third Floor – Room 301	0%	0.00	0	PASS
Third Floor – Room 302	0%	0.00	0	PASS
Third Floor – Room 303	0%	0.00	0	PASS
Third Floor – Room 304	0%	0.00	0	PASS
Third Floor – Room 305	0%	0.00	0	PASS
Third Floor – Room 306	0%	0.00	0	PASS
Third Floor – Room 307	0%	0.00	0	PASS
Third Floor – Room 308	0%	0.00	0	PASS
Third Floor – Room 309	0%	0.00	0	PASS
Third Floor – Suite 212D	85%	29.27	0	FAIL

Summary – Passive Measures

As it is shown above, the overheating risk has been reduced with the implementation of the passive design measures. However, some of the rooms cannot meet the TM 52 requirements (mostly office areas and kitchens).

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 275.69 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 2754 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, active cooling will be required to kitchens, offices, restaurant, Room 212 and 212D in order to avoid overheating.

Overheating Analysis
KOKO - Hotel
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 to some rooms (kitchens, offices, restaurant, room 212 and 212D) 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 23 °C and the cooling system was activated when the internal temperature was higher than 23 °C.

The following cooling capacities have been simulated:

- Main Kitchen – 7kW
- Small Kitchens – 2kW
- Offices/Lobby – 1kW
- Restaurant – 7kW
- Room 212 and 212D – 1kW

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.

In addition to the areas identified above, the design team have confirmed that each bedroom within the hotel development will have a small (1-2.5 kW) indoor air conditioning unit to provide comfort cooling. Due to the uncertainty of occupancy levels within hotel developments, particularly during the day, these small units ensure rooms are not susceptible to overheating should the occupancy levels of bedrooms deviate from the assigned values given within National Calculation Methodology (NCM).

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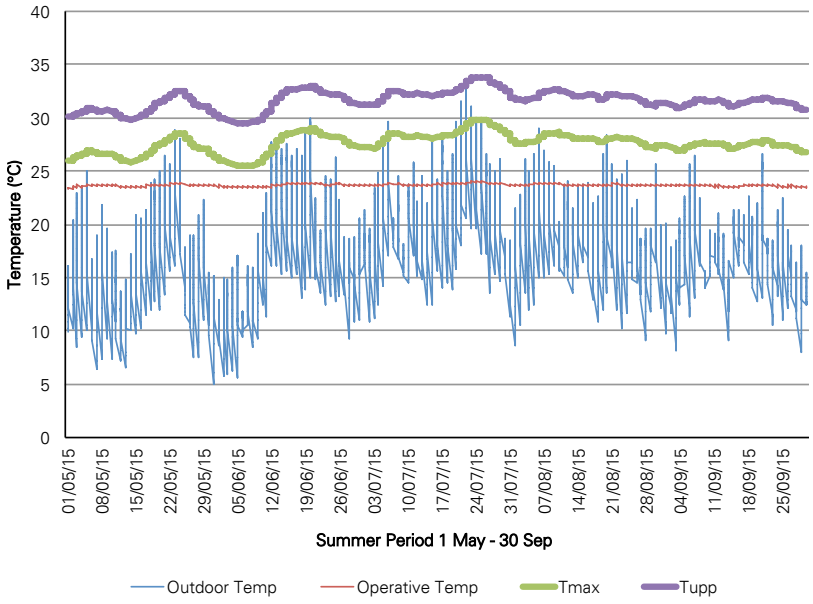
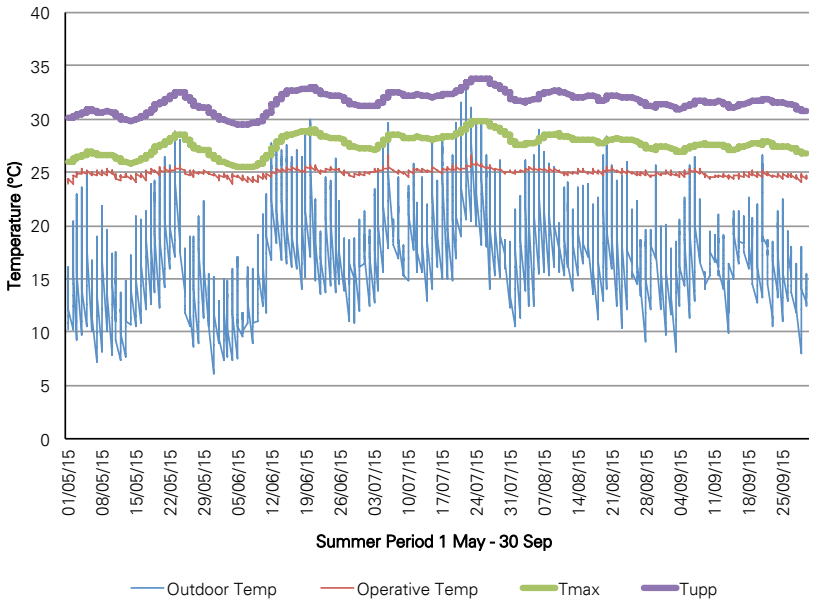
Overheating Analysis
KOKO - Hotel
Results – Active Cooling System

Kitchen
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Kitchen	0.0%	0.00	0	PASS

Hope and Anchor
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Hope and Anchor	0.0%	0.00	0	PASS

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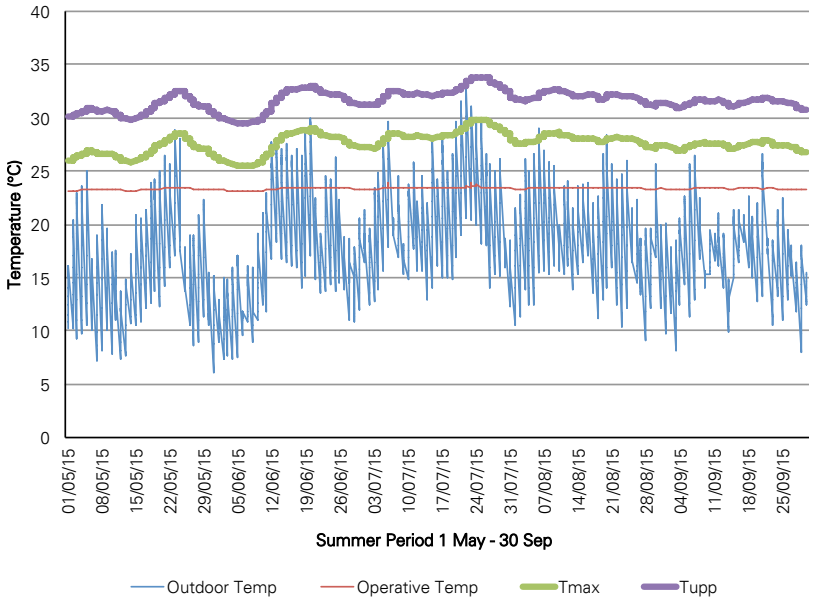
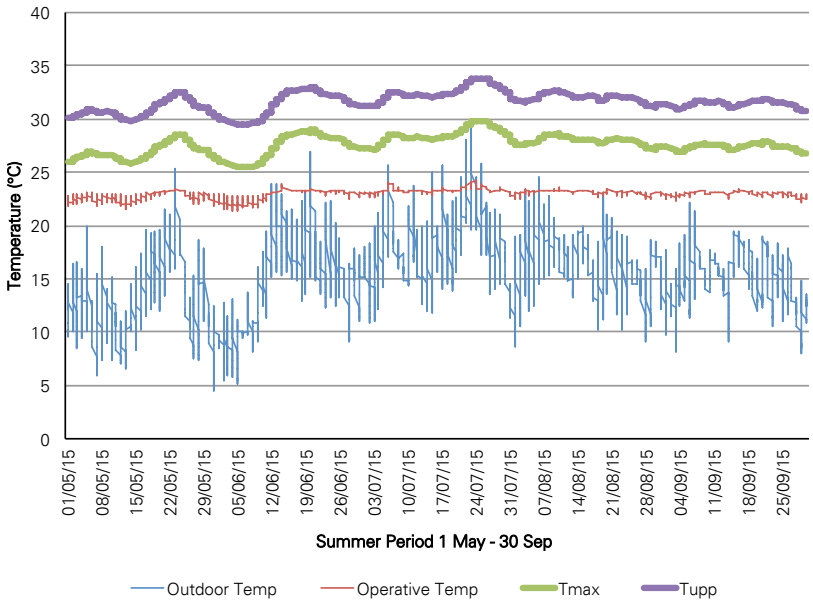
Overheating Analysis
KOKO - Hotel
Results – Active Cooling System

Recording Studio
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Recording Studio	0.0%	0.00	0	PASS

Suite 212D
Active Cooling System



Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Suite 212D	0.0%	0.00	0	PASS

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Overheating Analysis
KOKO - Hotel
Results – Active Cooling System

Summary of Results
Active Cooling System

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Basement – Function	0%	0.00	0	PASS
Basement – Kitchen	0%	0.00	0	PASS
Basement - Catering kitchen	0%	0.00	0	PASS
Ground Floor – EDF	0%	0.00	0	PASS
Ground Floor – Hope and Anchor	0%	0.00	0	PASS
Ground Floor – Hotel Reception	0%	0.00	0	PASS
Ground Floor – KOKO Office	0%	0.00	0	PASS
First Floor – Room 101	0%	0.00	0	PASS
First Floor – Room 102	0%	0.00	0	PASS
First Floor – Room 103	0%	0.00	0	PASS
First Floor – Room 104	0%	0.00	0	PASS
First Floor – Room 105	0%	0.00	0	PASS
First Floor – Room 106	0%	0.00	0	PASS
First Floor – Room 107	0%	0.00	0	PASS
First Floor – Room 108	0%	0.00	0	PASS
First Floor – Room 109	0%	0.00	0	PASS
First Floor – Room 110	0%	0.00	0	PASS
First Floor – Room 111	0%	0.00	0	PASS
First Floor – Artist Box	0%	0.00	0	PASS
First Floor – Breakout room	0%	0.00	0	PASS
First Floor – Guest Box	0%	0.00	0	PASS
First Floor – Kitchen	0%	0.00	0	PASS
First Floor – Office	0%	0.00	0	PASS
First Floor – Royal Box	0%	0.00	0	PASS
Second Floor – Room 201	0%	0.00	0	PASS
Second Floor – Room 202	0%	0.00	0	PASS
Second Floor – Room 203	0%	0.00	0	PASS
Second Floor – Room 204	0%	0.00	0	PASS
Second Floor – Room 205	0%	0.00	0	PASS
Second Floor – Room 206	0%	0.00	0	PASS
Second Floor – Room 207	0%	0.00	0	PASS
Second Floor – Room 208	0%	0.00	0	PASS
Second Floor – Room 209	0%	0.00	0	PASS
Second Floor – Room 210	0%	0.00	0	PASS
Second Floor – Room 211	0%	0.00	0	PASS
Second Floor – Room 212	0%	0.00	0	PASS
Second Floor – Recording Studio	0%	0.00	0	PASS

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Overheating Analysis
KOKO - Hotel
Results – Active Cooling System

Summary of Results Active Cooling System (Continued)

Room	Criterion 1	Criterion 2	Criterion 3	Compliance
Third Floor – Room 212A	0%	0.00	0	PASS
Third Floor – Room 212C	0%	0.00	0	PASS
Third Floor – Room 301	0%	0.00	0	PASS
Third Floor – Room 302	0%	0.00	0	PASS
Third Floor – Room 303	0%	0.00	0	PASS
Third Floor – Room 304	0%	0.00	0	PASS
Third Floor – Room 305	0%	0.00	0	PASS
Third Floor – Room 306	0%	0.00	0	PASS
Third Floor – Room 307	0%	0.00	0	PASS
Third Floor – Room 308	0%	0.00	0	PASS
Third Floor – Room 309	0%	0.00	0	PASS
Third Floor – Suite 212D	0%	0.00	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.

Overheating Analysis
KOKO - Hotel
Conclusions

Conclusions

The analysis has responded to CIBSE TM52 requirements relating to overheating. The report has set out how the habitable rooms of the hotel 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 kitchens, offices/lobby, restaurant, room 212 and 212D 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 0.40 for the windows will help to keep the heat out of the building;
- Internal shading device for the façade will help to minimise the heat that is penetrating the building;
- Mechanical ventilation to provide fresh air and purge the heat out;
- Natural ventilation supplies fresh air to the building through openable windows (as per ventilation rates section on Page 8 within this report) to reduce the need for air conditioning.

Note that the analysis was performed assuming that opening 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.

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.