63-66 Hatton Garden, London

Cooling Strategy

Prepared for Hatton Garden Properties Ltd

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Quality Control

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Issue Date:	20/01/2025	Purpose:	Planning application
Revision:	P2		Additional modelling results
Project Name:	Hatton Garden	Project Number:	240342

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Executive Summary

This report has been undertaken to describe and detail the proposed cooling strategy to maintain thermal comfort in 63-66 Hatton garden refurbishment works.

Thermal models have been created and used to conduct TM52 overheating assessments to ascertain if active cooling is required to achieve required comfort levels.

The initial models and TM52 assessment were based on having no cooling provided and only relying on natural ventilation via openable windows for heat rejection and another model with the introduction of blinds. This analysis showed all zones would fail TM52 thermal comfort criterion but that blinds would offer a slight reduction in exceedance as well as allowing 2 zones to Pass without active cooling.

Overall, however the occupied zones still fail without active cooling.

A water based active cooling and heating system was design to facilitate the removal of the gas fired boilers and to provide a more sustainable cooling system than a split or VRV system already in place by current tenants to provide summertime cooling.

The proposed design consists of 1 v bank reversable chiller unit and a 4 pipe air source heat pump which would provide low grade LTHW to basement WSHP to provide domestic hot water and heating and also a chilled water supply loop to provide comfort cooling to the terminal Artus FCUs on each floor serving the newly refurbished office spaces.

The Proposed system in which natural ventilation is still used to meet the indoor air quality requirements for the occupants has shown that it passes the TM52 thermal comfort criterion and blinds can be utilized to further reduce peak solar gains via occupant manual operation.

Modelling details are given in the report and results published in Appendices 1 ,2 & 3.

Building Assessment

Building Description

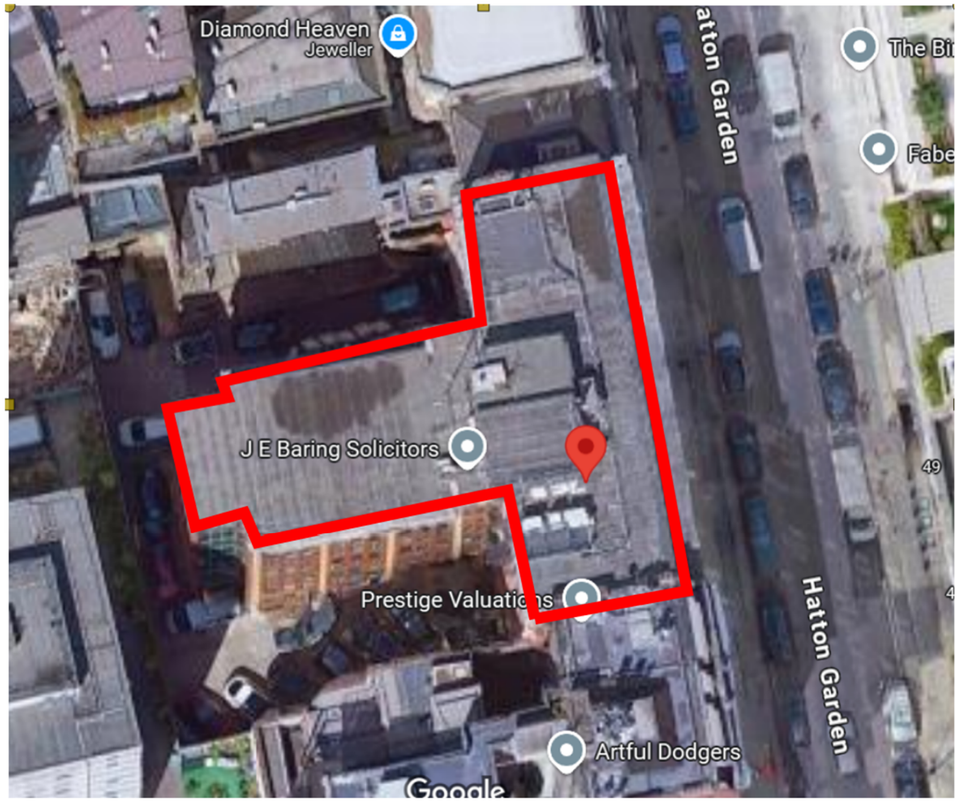
63-66 Hatton Garden is an existing commercial office building comprising commercial office space on floors 1st[st] through to 7[th] floor. The roof at level 8 has been proposed for installation of the external plant and a roof terrace.

On the ground floor, there is the main entrance with storage space and BOH offices at the basement level of the building.

The proposals include an entrance lobby at the ground floor as well as a number of landlord rooms at basement level including shower rooms and there will be cycle storage added. There is also service plant rooms used to serve the rest of the building.

The building is to be completely refurbished to provide more modern and efficient lettable office space and improve ancillary rooms such as changing rooms.

The refurbishment includes the reconfiguring of the office floors and cores above ground as well as the entrance area on the ground floor. The refurbishment is to include the replacement of the building engineering services throughout all areas included in the proposals.



TM52 Overheating Assessment

An aim to reduce the amount of energy demand was to try and keep as much of the existing office naturally ventilated as per the base building conditions and also because of space constraints for plant equipment.

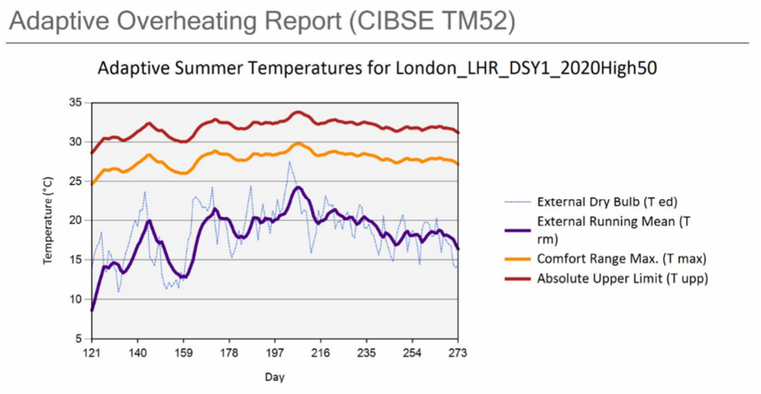
To make sure that this would be possible a detailed dynamic model was made to perform a TM52 overheating assessment.

Due to the nature and use of the building the need to be able to provide active cooling was identified from an initial run of the building in TM52 using natural ventilation only. This resulted in all occupied zones failing, results are shown in 'Appendix 5 TM52 No active cooling'. The current building tenants have employed the use of split or VRV refrigerant systems.

It was identified from the TM 52 results that a new cooling system would be required and the proposed ASHP, chiller and WSHP cascade system was preferred since it offered a more efficient replacement for the heating and hot water than the boilers. It is more efficient than the current condensers and greatly reduces the amount of refrigerant used with harmful GWP levels. Water based systems hold less embodied carbon as well as being much safer to distribute throughout the building.

Weather Data

London_LHR_DSY1_2020High50
Weather files used in accordance with TM49 & TM52.



Design parameters

Summer zone design temperature and occupancy:

Room	Temp °C	Occupancy
Office	23*	10m2/person
Reception	23*	3 people
Lounge	23*	26 people
Phone booth	23*	1 people
Scope room	23*	2 people
Meeting Room 1	23*	10 people
Meeting Room 2	23*	12 people

*This is the desired summertime operating temperature, but it was modelled so that occupants would employ natural ventilation to expel heat until it could no longer be kept below 25 degrees Celsius, at this point active cooling is employed and windows are kept closed unless CO_2 levels rise above 750ppm.

Ventilation

Element	Values
System	Natural Ventilation via openable windows for open plan offices
Ventilation rate:	Based on occupants opening windows between 600-750PPMV(CO2). BCO requires >800PPM(CO2)
System	Mechanical ventilation with heat recovery for cellurised offices and meeting rooms
Ventilation rate	Minimum Part F requirement of 10l/s/person

The meeting rooms and cellurised offices were unable to keep the co2 levels below 800PPM due to the small volume of the zones, inability to cross ventilate and the the high occupancy density. Therefore mechanical ventilation with heat recovery has been introduced to maintain air quality within these zones.

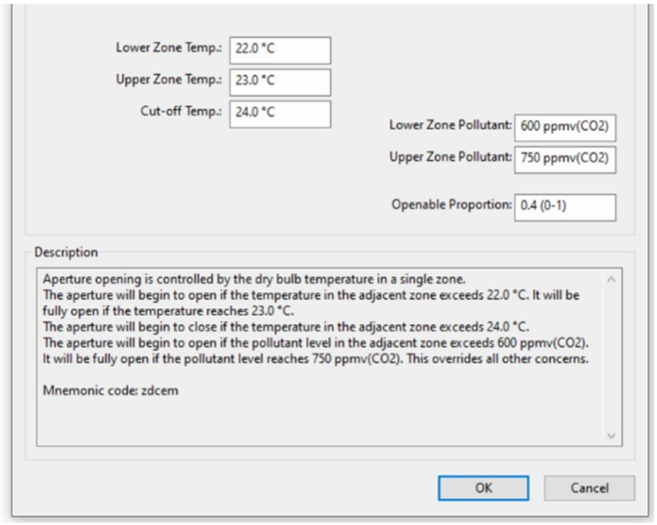
Gaines & schedule profies

For the overheating TM52 assessment the following gains and usage profiles were used.

Gain	Sensible (W)	Latent (W)	Profile
Occupants	75	55	8am-6pm
Equipment	25W/m2	N/A	8am-6pm
Lighting gain	4.5W/m2	N/A	8am-6pm

Aperatures/ opening windows

All windows in occupied areas are to be replaced with better performance spec windows and to remain openable as per current design.
In this new revision the aperture details were updated to suit the details sent by the architect for each window type.
It has also been assumed that the windows will be manually operational, so they have the same schedule as the occupants 8am-6pm.
The screenshot below depicts the internal conditions that drive the manual operation of the window.



These rules essentially reflect occupants opening the windows fully when it reaches 23 degrees, and the cut-off temperature illustrates occupants starting to close windows when the temperature continues to rise 24-25 degrees Celsius.

The AC design temperature is set at 25 degrees Celsius to avoid inefficient use of the system and to take full advantage of free cooling if the outdoor conditions allow.

However, if the internal CO2 level rises from 600-750ppmv (CO2) the occupants will open irrespective of the internal temperature. This is to mimic occupants from overriding fresh air over any other internal condition to maintain adequate indoor air quality.

Blind performance/ operation

Blind performance has been based on venetian type blinds and typical shading coefficient data from BRE below.

Table 8 Shading Coefficient and Short-wave Radiant Fraction for Blinds and Curtains

Shading device	Shading Coefficient	Short-wave Radiant Fraction
Dark green open-weave plastic blind	0.81	0.5
Venetian blind	0.61	0.3
White cotton curtain	0.54	0.3
Cream Holland linen blind	0.40	0.3
Mid-pane Venetian blind (From BRE data)	0.44	0.4

Blinds are designed to be manually operated using a operating profile based on the zone occupancy schedule 8am-6pm.

Proposed Cooling system

Roof top Plant

The current proposal is based on the use of 1 reversible 2 pipe ASHP and 1 4 pipe ASHP within a roof top enclosure to provide screening and acoustic treatment.

These ASHPs are able to meet the building's heating and cooling requirements as well as provide domestic hot water for the building by working in cascade design with WSHPs located within the basement plant room.

Terminal units Artus FCUs

The current proposal is based on using 4 pipe Artus Fan coil units which have high efficiency fans and will be able to provide comfort cooling or heating which can be controlled via local controllers

Benefits

The benefit of this system is that we will get high efficiency cooling and heating while greatly reducing the volume of refrigerant used compared to an alternative VRV or split system.

Refrigerants all carry with them varying values of Global Warming potential (GWP) and if we are able to reduce the volume of refrigerants used in building service systems, we can reduce the global warming effect of air conditioning systems as well as greatlreduce the risk of leakages that would release large volumes of refrigerant into the atmosphere.

Another major benefit is that the proposed system reduces the amount of individual plant equipment required on the roof which makes it easier to maintain and hide external plant equipment in one specified area.

Thermal Performance Conclusion

The results of the TM52 analysis showed that none of the occupied zones failed the TM52 criterion as long as active cooling was implemented and analysis showed cooling loads averaged 60-70W/m2 without blinds and 50-60W/m2 with blinds. This is low considering the type of building and its intended use.

Even with the utilization of blinds all the zones fail the overall TM52 assessment, but they do offer a notable decrease in peak solar gains.

Even though utilizing the blinds does not enable us adequately to reduce the solar gains enough to pass TM52 criterion for all zones. Blinds can be adopted to further reduce peak cooling load for the air conditioning plant. However blind operation can rarely be guaranteed by the occupants.

The combination of reasonable control parameters and the existing thermal mass and infiltration of the existing fabric that will not be upgraded leads to large amounts of excess heat in the summer being rejected from the building to the atmosphere during the evenings without any manual nighttime purging controls.

This means the building takes longer to increase its internal temperature in the mornings and in the cooler morning periods occupants can maintain their fresh air rate while also expelling excess gains to the atmosphere using the openable windows when the outside temperature is cooler without needing to engage the air conditioning.

Air conditioning requirements will be driven largely by the increased solar gains later in the day that are coupled with the expected internal occupant and equipment gains. Meeting rooms when occupied will rely on the air conditioning to offset the increased occupant gains.

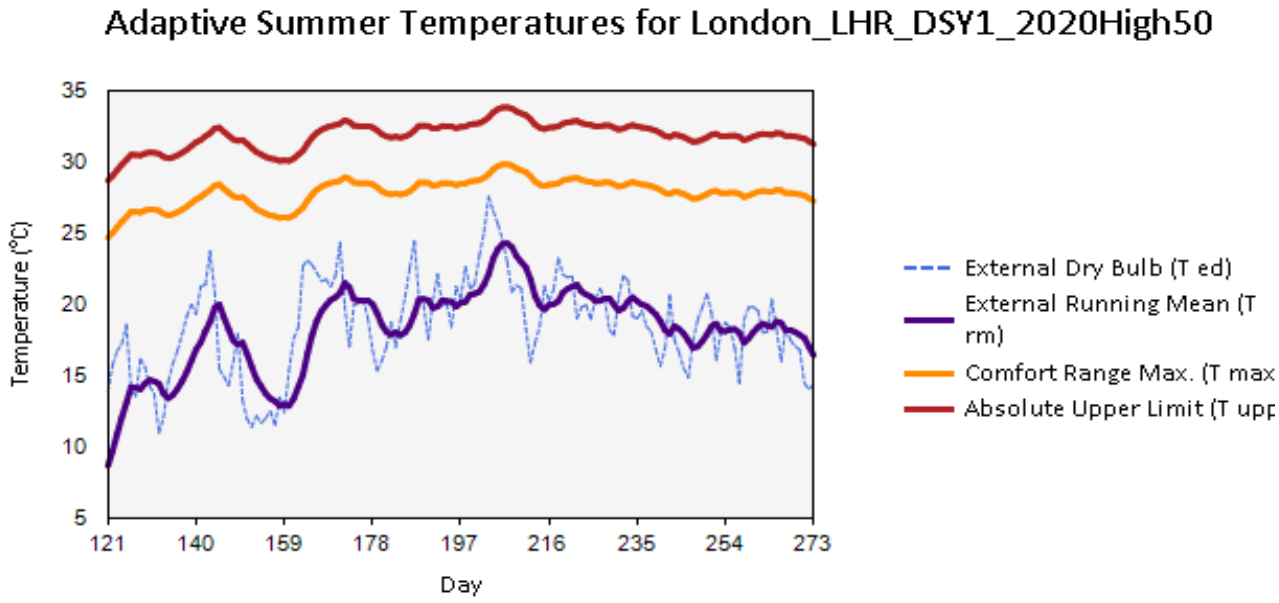
The reduced loads also allow main plant selections to remain as small as possible on the roof and providing a system that can serve the whole building also limits the amount of individual split or VRV units scattered on the roof adding additional noise, using larger volumes of refrigerant and adding increased plant enclosures that decrease the look of the local skyline.

Appendix 1

TM52 results Active cooling

See supporting PDFs attached

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperatur or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptabil
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): OH Hatton Gardens 3Dmodel_new.tbd
Simulation Results File (.tsd): 241124 - OH HG run with Brukl design_new.tsd
Date: 25 November 2024
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
00 Office 00-02	1408	42	0	0.0	0	Pass
00 01 Reception	1166	34	0	0.0	0	Pass
01 Office 01-02	1408	42	0	0.0	0	Pass
01 Office 01-01	1408	42	0	0.0	0	Pass
01 Meeting Room 1	1060	31	0	0.0	0	Pass
01 Meeting Room 2	1060	31	0	0.0	0	Pass
B1 Office	1408	42	0	0.0	0	Pass
02 Office 02-01	1408	42	0	0.0	0	Pass
02 Office 02-02	1408	42	0	0.0	0	Pass
02 Meeting Room 1	848	25	0	0.0	0	Pass
02 Meeting Room 2	1060	31	0	0.0	0	Pass
02 Meeting Room 3	1060	31	0	0.0	0	Pass
02 Meeting Room 4	1060	31	0	0.0	0	Pass

Adaptive Overheating Report (CIBSE TM52)

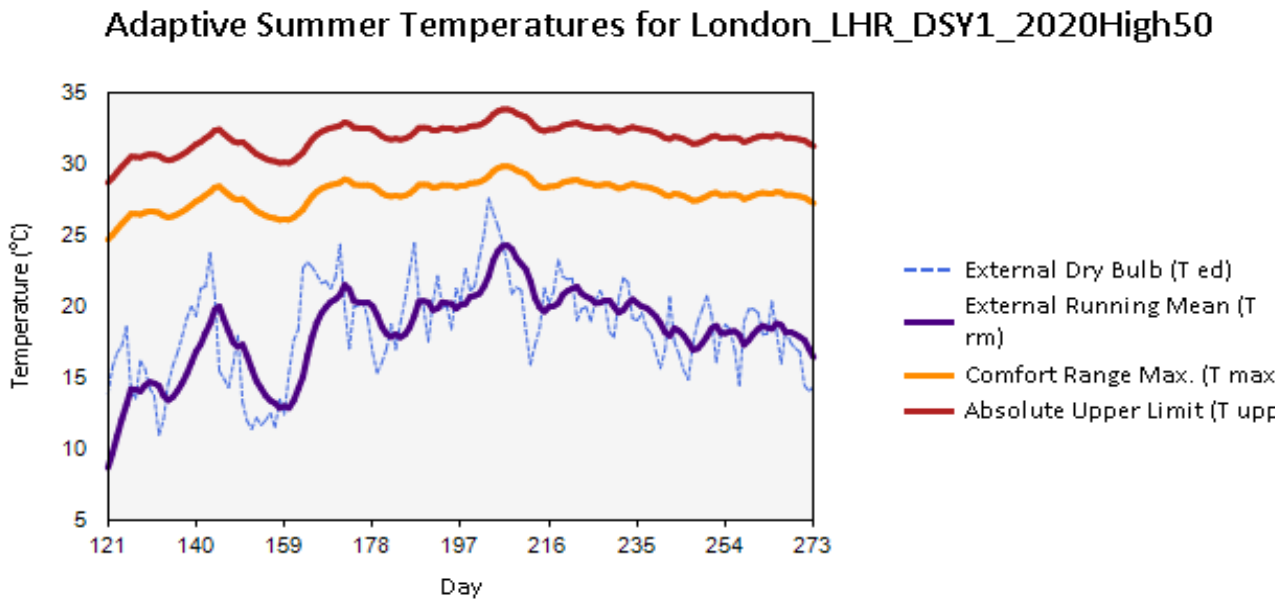
03 Office 03-01	1408	42	0	0.0	0	Pass
03 Office 03-02	1408	42	0	0.0	0	Pass
03 Meeting Room 1	1060	31	0	0.0	0	Pass
03 Meeting Room 2	1060	31	0	0.0	0	Pass
03 Phone Booth	1060	31	0	0.0	0	Pass
04 Office 04-01	1408	42	0	0.0	0	Pass
04 Office 04-02	1408	42	0	0.0	0	Pass
04 Meeting Room 1	848	25	0	0.0	0	Pass
04 Meeting Room 2	1060	31	0	0.0	0	Pass
04 Phone Booth	1060	31	0	0.0	0	Pass
05 Office 05-01	1408	42	0	0.0	0	Pass
05 Office 05-02	1408	42	0	0.0	0	Pass
06 Office 06-01	1408	42	0	0.0	0	Pass
06 Office 06-02	1408	42	0	0.0	0	Pass
07 Office 07-01	1408	42	0	0.0	0	Pass
07 Office 07-02	1408	42	0	0.0	0	Pass
08 Lounge 08-04	1166	34	13	4.0	0	Pass

Appendix 2

TM52 results No cooling

See supporting PDFs attached

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperatur or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptabil
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): OH Hatton Gardens 3Dmodel_new -no active clg.tbd
Simulation Results File (.tsd): OH Hatton Gardens 3Dmodel_new -no active clg.tsd
Date: 26 November 2024
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
00 Office 00-02	1408	42	970	29.0	238	Fail
00 01 Reception	1166	34	592	32.0	255	Fail
01 Office 01-02	1408	42	1280	28.0	1026	Fail
01 Office 01-01	1408	42	1093	32.0	430	Fail
01 Meeting Room 1	1060	31	719	27.0	119	Fail
01 Meeting Room 2	1060	31	419	26.0	39	Fail
B1 Office	1408	42	337	28.0	3	Fail
02 Office 02-01	1408	42	1145	30.0	568	Fail
02 Office 02-02	1408	42	1288	28.0	1054	Fail
02 Meeting Room 1	848	25	228	20.0	20	Fail
02 Meeting Room 2	1060	31	598	23.0	200	Fail
02 Meeting Room 3	1060	31	1060	25.0	971	Fail
02 Meeting Room 4	1060	31	851	30.0	420	Fail

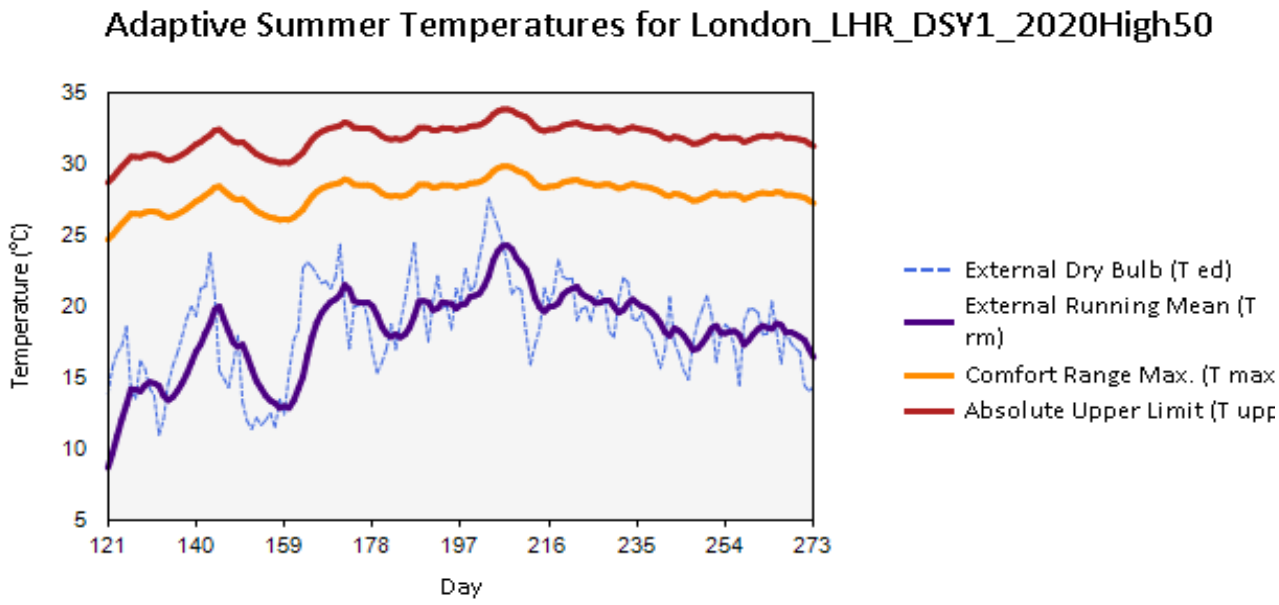
Adaptive Overheating Report (CIBSE TM52)

03 Office 03-01	1408	42	1127	32.0	453	Fail
03 Office 03-02	1408	42	1272	29.0	1004	Fail
03 Meeting Room 1	1060	31	772	27.0	271	Fail
03 Meeting Room 2	1060	31	709	25.0	223	Fail
03 Phone Booth	1060	31	213	20.0	15	Fail
04 Office 04-01	1408	42	1105	32.0	413	Fail
04 Office 04-02	1408	42	1199	30.0	818	Fail
04 Meeting Room 1	848	25	581	21.0	239	Fail
04 Meeting Room 2	1060	31	872	30.0	452	Fail
04 Phone Booth	1060	31	251	25.0	11	Fail
05 Office 05-01	1408	42	1096	32.0	427	Fail
05 Office 05-02	1408	42	1202	28.0	829	Fail
06 Office 06-01	1408	42	1091	32.0	443	Fail
06 Office 06-02	1408	42	1203	30.0	828	Fail
07 Office 07-01	1408	42	1060	27.0	718	Fail
07 Office 07-02	1408	42	495	29.0	42	Fail
08 Lounge 08-04	1166	34	1166	7.0	1159	Fail

Appendix 2

TM52 results No cooling with blinds

Adaptive Overheating Report (CIBSE TM52)



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1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperatur or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptabil
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): OH Hatton Gardens 3Dmodel_new -no active clg - Blinds.tbd
Simulation Results File (.tsd): OH Hatton Gardens 3Dmodel_new -no active clg - Blinds.tsd
Date: 17 January 2025
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
00 Office 00-02	1408	42	878	29.0	154	Fail
00 01 Reception	1166	34	495	30.0	106	Fail
01 Office 01-02	1408	42	1242	30.0	963	Fail
01 Office 01-01	1408	42	1044	31.0	328	Fail
01 Meeting Room 1	1060	31	663	27.0	54	Fail
01 Meeting Room 2	1060	31	339	23.0	17	Fail
B1 Office	1408	42	289	25.0	1	Fail
02 Office 02-01	1408	42	1117	33.0	433	Fail
02 Office 02-02	1408	42	1244	30.0	987	Fail
02 Meeting Room 1	848	25	183	17.0	9	Fail
02 Meeting Room 2	1060	31	529	24.0	128	Fail
02 Meeting Room 3	1060	31	1059	24.0	954	Fail
02 Meeting Room 4	1060	31	822	29.0	345	Fail

Adaptive Overheating Report (CIBSE TM52)

02 Scope Room 1	1060	31	29	13.0	0	Pass
02 Scope Room 2	1060	31	18	6.0	0	Pass
03 Office 03-01	1408	42	1086	32.0	335	Fail
03 Office 03-02	1408	42	1227	30.0	926	Fail
03 Meeting Room 1	1060	31	723	26.0	214	Fail
03 Meeting Room 2	1060	31	641	22.0	172	Fail
03 Phone Booth	1060	31	120	21.0	1	Fail
04 Office 04-01	1408	42	1057	30.0	315	Fail
04 Office 04-02	1408	42	1153	30.0	680	Fail
04 Meeting Room 1	848	25	514	21.0	155	Fail
04 Meeting Room 2	1060	31	850	29.0	375	Fail
04 Phone Booth	1060	31	164	28.0	1	Fail
04 Scope Room	1060	31	419	30.0	81	Fail
05 Office 05-01	1408	42	1046	31.0	328	Fail
05 Office 05-02	1408	42	1159	30.0	696	Fail
06 Office 06-01	1408	42	1051	30.0	350	Fail
06 Office 06-02	1408	42	1155	31.0	682	Fail
07 Office 07-01	1408	42	1010	27.0	605	Fail
07 Office 07-02	1408	42	362	25.0	24	Fail
08 Lounge 08-04	1166	34	1166	9.0	1155	Fail