





Overheating Assessment

FOR

30 Lincoln's Field

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1 EXECUTIVE SUMMARY

This report has been prepared to perform an overheating assessment for 30 Lincoln's Field, London. BSE3d have been appointed by Mr Philip Ardley of The Honourable Society of Lincoln's Inn to conduct the overheating assessment for the existing office building to assess whether cooling is required during its refurbishment.

This assessment has been conducted using the industry recognised IES VE for Engineers 2021 software. IES VE for Engineers can perform the overheating simulations based on CIBSE TM 52 for non-residential buildings. The building fabric and building services input data for the thermal model is assumed based on the building age, appearance, and applicable Building Regulations then. An overheating report is produced whereby all rooms with a natural ventilation strategy are assessed under the TM52 overheating criteria.

After running overheating simulations, the results showed significant failure when attempting to naturally ventilate the building. Progressing from this, the windows were simulated with 30 Degree, 60 Degree to max 90 Degree angles open.

Through multiple iterations, the natural ventilation programme has been optimised for the building, involving a multitude of window openings. Each opening type, specific location, and operation profile is explained within this report.

1.1 PROPOSED REURBISHMENT

This report has been prepared to assess whether the cooling is required during the refurbishment of the existing building at 30 Lincoln's Field via CIBSE TM 52 overheating assessment for naturally ventilated non-residential building.

This assessment has been conducted using IES VE 2021 software. The building and building services input data for the thermal model is contained within this report.

2 THERMAL MODELLING

Thermal modelling has been conducted using IES Virtual Environment (Version 2021). IES software is approved by CIBSE AM11 'Building Energy and Environmental Modelling' (2015) to provide full dynamic thermal analysis.

The model geometry (Figure 1) was based on the plans received from the client.

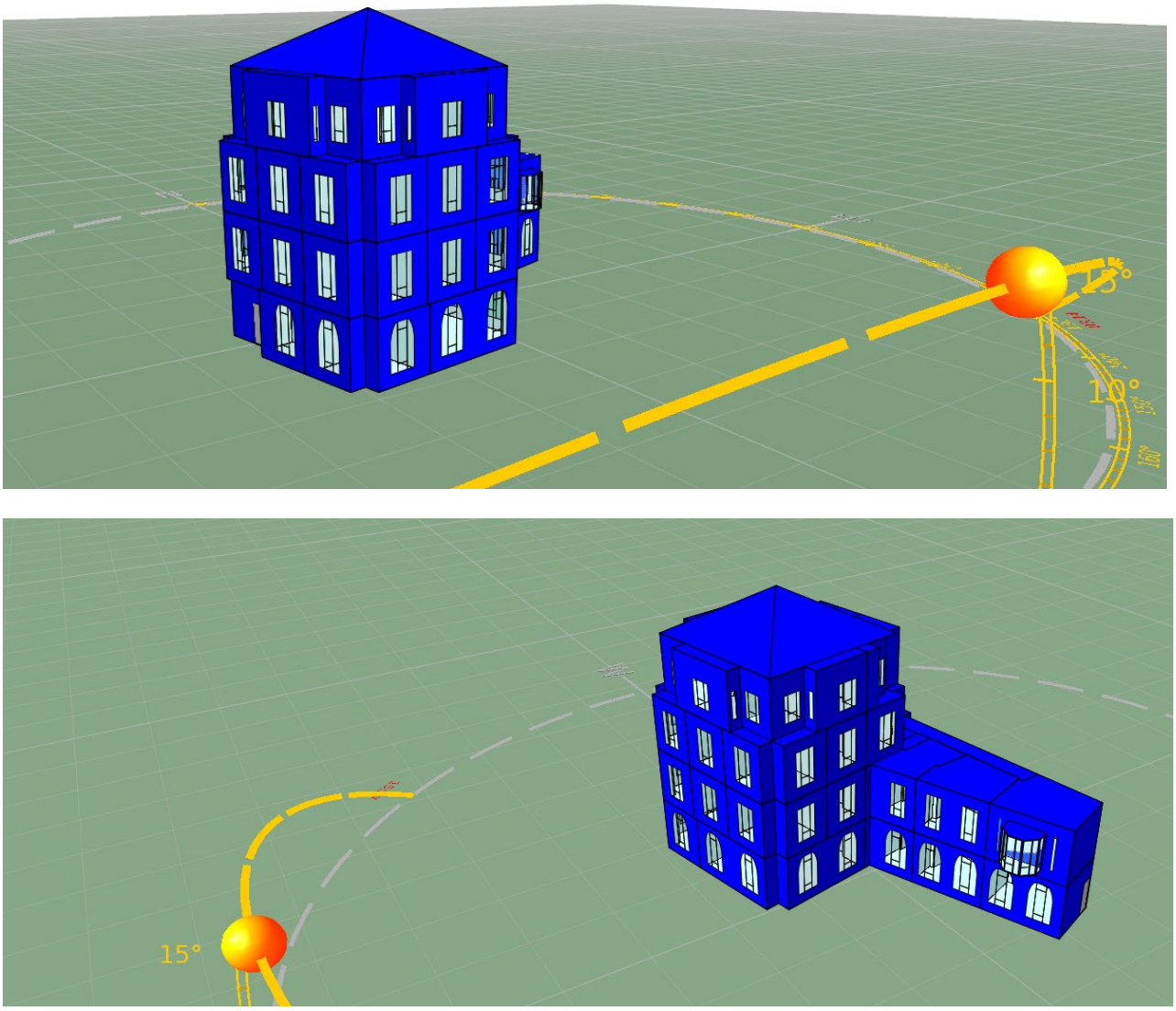

Figure 1 30 Lincoln's Field – IES thermal model

3 OVERHEATING CRITERIA

3.1 CIBSE TM 52 OVERHEATING ASSESSMENT FOR NON-RESIDENTIAL BUILDINGS

The overheating assessment for the 30 Lincoln's Field has been conducted in accordance with CIBSE TM52. The limits of thermal comfort: avoiding overheating in European buildings. CIBSE is the Chartered Institution of Building Services Engineers and TM52 is the industry standard document to which overheating assessments are conducted. TM52 is the industry standard method of assessing overheating in non-domestic buildings.

It is based on the principle of adaptive thermal comfort which in short means the high temperature is outside, the higher the temperatures the human body is likely to tolerate, given occupants dress appropriately for the weather. Therefore, this means that in summer the temperature a human can be comfortable at is higher than that in winter. The criterion outlined below relate to this principle and the room must pass a minimum of two out of the three to be considered to pass the overheating assessment.

3.1.1 Criterion 1

Criterion 1 states that "the number of hours during which the temperature difference is greater than or equal to one Degree (K) during the period of 1st May to 30th September inclusive shall not be more than 3 per cent of occupied hours".

This criterion is centred around how often a building is likely to exceed its comfort range during the summer months, this can provide useful information about the building's thermal characteristics and potential risk of overheating over the range of weather conditions to which it will be subjected.

This simple 'hours of exceedance' criterion is something that designers are familiar with and provides a good first assessment of acceptability. A maximum of 3 per cent of occupied hours is suggested in BS EN 15251.

3.1.2 Criterion 2

Criterion 2 states that "To allow for the severity of overheating the weighted exceedance shall be less than or equal to 6 hours in any one day". This criterion sets an acceptable level for the severity of overheating and is based on Annex F Method B, 'Degree hours criteria' in BS EN 15251.

It is the time during which the operative temperature exceeds the specified range during the occupied hours, weighted by a factor that is a function dependent on how many Degrees the range has been exceeded.

The value of the weighting factor is based on the observed increase in the percentage of occupants voting 'warm' or 'hot' on the ASHRAE scale with each Degree increase in ΔT, the temperature above the comfort threshold temperature.

3.1.3 Criterion 3

Criterion 3 states that "to set an absolute maximum value for the indoor operative temperature, the value of ΔT shall not exceed 4 K".

The threshold or upper limit temperature is self-explanatory and sets a limit beyond which normal adaptive actions will be insufficient to restore personal comfort and most occupants will complain of being 'too hot.' This criterion covers the extremes of hot weather conditions and future climate scenarios.

4 MODELLING INPUT DATA

Building category	Category III: Normal expectation (for existing buildings and renovations)

Sample size	All offices have been included in the analysis and assessed against the CIBSE TM52 criteria.

Weather file	As required by TM52, the study has been conducted using the latest CIBSE Design Summer Year (DSY1, representing a moderately warm summer) weather file for 2020s, high emissions, 50% percentile scenario for the location London.

Ventilation strategy	It was assumed that each floors windows (middle Pane) can be fully openable to allow for single-sided or cross natural ventilation in single-aspect and dual-aspect units respectively and to mitigate the risk of overheating

Windows and door openings	Windows in each room have been modelled to open when the internal dry bulb temperature exceeds 22^{o}C. In summary, middle pane of windows on each floor have been assumed with double openings side-hung type by max 90 Degree.
Shading devices	The assessment is for an existing building and the windows are modelled as can be seen from the elevations of the building.

Air speed	The modelled air speed inside the rooms have been set at 0.1 m/s in line with the TM52 methodology.
Exposure type	Depending on the location of each window, various exposure types have been applied in the thermal model.
Air infiltration	0.5 ACH

Building Fabrics: The 30 Lincoln's Field is an existing building dated 1980s and the U values (including G value for glazing) have been assumed based on the building age, appearance, and Building Regulations applicable then as per table below.

	U Value	G Value	Source
External Wall	0.5	N/A	Brick Block Wall with Internal Cavity unfilled
Exposed Floor	0.7	N/A	Uninsulated Solid Ground Floor
Exposed Roof	1.6	N/A	Lightweight Tiled Roof
External Glazing	3.2	0.7	Double Glazing (4-10-4 Assumed)

Internal Gains:

Room Type	Lighting (Watts/m2)	People (m2/person)	Gain per Person (Sensible Watts / Latent Watts)	Small Power (Watts/m2)
Offices	12	2.5	90 / 60	25

5 TM 52 RESULTS

To pass TM52, a room must fail no more than one criterion. The table below shows the results of the simulations. Three scenarios have been modelled with windows openable till 30 Degree, 60 Degree and max 90 Degree angle.

5.1 Openable Windowpane at Max 30 Degree Angle

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Degree. Hrs)	Criteria 3 (Max. Delta T)	Criteria failing
1F OFFICE 01	GF000017	71.2	14.6	40	6	1 & 2 & 3
1F OFFICE 02	GF000013	71.2	12.1	44	6	1 & 2 & 3
1F OFFICE 03	GF000014	71.2	33	71	8	1 & 2 & 3
1F OFFICE 04	GF00001E	71.2	19.6	60	8	1 & 2 & 3
1F OFFICE 05	GF00001A	71.2	31	72	8	1 & 2 & 3
1F OFFICE 06	GF000023	71.2	19.2	56	7	1 & 2 & 3
1F OFFICE 07	GF000011	71.2	32.7	70	7	1 & 2 & 3
1F OFFICE 08	GF00001D	71.2	21.7	58	6	1 & 2 & 3
1F OFFICE 09	GF00001C	71.2	21.9	58	8	1 & 2 & 3
1F OFFICE 10	GF00002D	71.2	13.6	50	6	1 & 2 & 3
2F OFFICE 01	GF00002F	71.2	11.7	45	7	1 & 2 & 3
2F OFFICE 02	GF000030	71.2	32	71	8	1 & 2 & 3
2F OFFICE 03	GF000031	71.2	19.1	61	8	1 & 2 & 3
2F OFFICE 04	GF000034	71.2	30.3	72	8	1 & 2 & 3
2F OFFICE 05	GF000036	71.2	18.5	55	7	1 & 2 & 3
2F OFFICE 06	GF000033	71.2	33.3	72	7	1 & 2 & 3
3F OFFICE 01	GF00003D	71.2	12.2	43	6	1 & 2 & 3
3F OFFICE 02	GF000029	71.2	32.3	74	8	1 & 2 & 3
3F OFFICE 03	GF00002A	71.2	21	66	7	1 & 2 & 3
3F OFFICE 04	GF00002C	71.2	21.3	61	7	1 & 2 & 3
GF OFFICE 01	GF000001	71.2	32	63	9	1 & 2 & 3
GF OFFICE 02	GF000002	71.2	21.3	61	8	1 & 2 & 3
GF OFFICE 03	GF000003	71.2	24.7	63	7	1 & 2 & 3
GF OFFICE 04	GF000005	71.2	28	63	8	1 & 2 & 3
GF OFFICE 05	GF000000	71.2	25.9	61	7	1 & 2 & 3
GF TEA	GF00000E	71.2	22.5	54	6	1 & 2 & 3

5.2 Openable Windowpane at Max 60 Degree Angle

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Degree. Hrs)	Criteria 3 (Max. Delta T)	Criteria failing
1F OFFICE 01	GF000017	71.2	10.2	32	5	1 & 2 & 3
1F OFFICE 02	GF000013	71.2	7	36	6	1 & 2 & 3
1F OFFICE 03	GF000014	71.2	20.6	54	7	1 & 2 & 3
1F OFFICE 04	GF00001E	71.2	12.2	47	7	1 & 2 & 3
1F OFFICE 05	GF00001A	71.2	19.4	53	6	1 & 2 & 3
1F OFFICE 06	GF000023	71.2	11	42	6	1 & 2 & 3
1F OFFICE 07	GF000011	71.2	19.6	53	6	1 & 2 & 3
1F OFFICE 08	GF00001D	71.2	15.1	46	6	1 & 2 & 3
1F OFFICE 09	GF00001C	71.2	15.2	50	7	1 & 2 & 3
1F OFFICE 10	GF00002D	71.2	8.9	40	6	1 & 2 & 3
2F OFFICE 01	GF00002F	71.2	7.2	36	6	1 & 2 & 3
2F OFFICE 02	GF000030	71.2	20.5	54	7	1 & 2 & 3
2F OFFICE 03	GF000031	71.2	11.5	46	7	1 & 2 & 3
2F OFFICE 04	GF000034	71.2	19	53	6	1 & 2 & 3
2F OFFICE 05	GF000036	71.2	10.5	43	6	1 & 2 & 3
2F OFFICE 06	GF000033	71.2	19.3	54	6	1 & 2 & 3
3F OFFICE 01	GF00003D	71.2	7.2	34	5	1 & 2 & 3
3F OFFICE 02	GF000029	71.2	21.7	60	7	1 & 2 & 3
3F OFFICE 03	GF00002A	71.2	13.5	48	6	1 & 2 & 3
3F OFFICE 04	GF00002C	71.2	12.8	45	6	1 & 2 & 3
GF OFFICE 01	GF000001	71.2	21.1	51	7	1 & 2 & 3
GF OFFICE 02	GF000002	71.2	14.1	49	7	1 & 2 & 3
GF OFFICE 03	GF000003	71.2	15.2	49	6	1 & 2 & 3
GF OFFICE 04	GF000005	71.2	17.9	53	7	1 & 2 & 3
GF OFFICE 05	GF000000	71.2	17.7	49	6	1 & 2 & 3
GF TEA	GF00000E	71.2	14.4	39	5	1 & 2 & 3

5.3 Openable Windowpane at Max 90 Degree Angle

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Degree. Hrs)	Criteria 3 (Max. Delta T)	Criteria failing
1F OFFICE 01	GF000017	71.2	9.6	31	5	1 & 2 & 3
1F OFFICE 02	GF000013	71.2	6.6	34	6	1 & 2 & 3
1F OFFICE 03	GF000014	71.2	19.3	51	7	1 & 2 & 3
1F OFFICE 04	GF00001E	71.2	11.2	45	7	1 & 2 & 3
1F OFFICE 05	GF00001A	71.2	17.4	50	6	1 & 2 & 3
1F OFFICE 06	GF000023	71.2	9.7	39	6	1 & 2 & 3
1F OFFICE 07	GF000011	71.2	17.9	49	6	1 & 2 & 3
1F OFFICE 08	GF00001D	71.2	13.6	41	6	1 & 2 & 3
1F OFFICE 09	GF00001C	71.2	14.3	44	6	1 & 2 & 3
1F OFFICE 10	GF00002D	71.2	8.3	39	6	1 & 2 & 3
2F OFFICE 01	GF00002F	71.2	6.5	33	6	1 & 2 & 3
2F OFFICE 02	GF000030	71.2	18.7	52	7	1 & 2 & 3
2F OFFICE 03	GF000031	71.2	10.9	44	7	1 & 2 & 3
2F OFFICE 04	GF000034	71.2	17.1	50	6	1 & 2 & 3
2F OFFICE 05	GF000036	71.2	9.3	40	6	1 & 2 & 3
2F OFFICE 06	GF000033	71.2	17.5	49	6	1 & 2 & 3
3F OFFICE 01	GF00003D	71.2	6.8	32	5	1 & 2 & 3
3F OFFICE 02	GF000029	71.2	20.1	58	6	1 & 2 & 3
3F OFFICE 03	GF00002A	71.2	12.2	45	6	1 & 2 & 3
3F OFFICE 04	GF00002C	71.2	11.1	42	6	1 & 2 & 3
GF OFFICE 01	GF000001	71.2	19.6	51	7	1 & 2 & 3
GF OFFICE 02	GF000002	71.2	12.8	48	7	1 & 2 & 3
GF OFFICE 03	GF000003	71.2	13.5	46	6	1 & 2 & 3
GF OFFICE 04	GF000005	71.2	16.7	48	6	1 & 2 & 3
GF OFFICE 05	GF000000	71.2	16	49	6	1 & 2 & 3
GF TEA	GF00000E	71.2	12.8	38	5	1 & 2 & 3

6 CONCLUSION

This report summarises the result of an overheating assessment to assess whether the cooling is required for the proposed refurbishment at 30 Lincoln's Field., London.

The assessment has identified that the existing building's offices areas will overheat during summer months at all 3 scenarios of window opening angles.

The assessment assumes that the middle pane of each window profile is fully openable till max 90 Degree angle. Due to lack of Building Fabrics and Elevation drawings, the building fabrics have been assumed based on building's age, appearance and building regulations applicable then.

The office is assumed with internal gains suitable for the existing office room types and use.

From the results, it appears that to its current use, the offices will overheat during summer months, and it is recommended to consider provided energy efficient cooling system if refurbished.