

4 Appendix I Overheating report.

REPORT TITLE:	PROJECT NUMBER:	DATE:
Hexbox Overheating Analysis Report	1647	12/01/2024
	PROJECT NAME:	REVISION:
	Hexbox	2.0

Rev	Date of Issue	Status	Issued by	Checked by	Summary of changes
2.0	12/01/2024	Information	KS		Updated building orientation, rooflight changes & solar shading
1.0	14/12/2023	Information	KS		

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1 Introduction

The purpose of this report is to present the thermal comfort analysis of the proposed Hexbox studio theatre extension to the Hexagon theatre, Reading. The proposed building has been modelled using dynamic simulation software. Simulations of the modelled building are used to assess thermal comfort and risk of overheating on an hourly basis during the summer months, based on standard CIBSE Design Summer Year (DSY) weather files, and according to the methodology described in the document *CIBSE TM52 - The limits of thermal comfort: avoiding overheating in European buildings*. CIBSE TM52 is the industry standard for assessing the risk of summertime overheating in non-domestic buildings in the UK.

The analysis also considers the effect of warmer summers in the future by modelling against predicted future weather scenarios.

2 Overheating Analysis

2.1 Basis of design

There are various opportunities and limitations to passive design for this building due to its specific use and to site constraints:

- ✓ The predominantly exposed façade in north-east facing and therefore high solar gains should be managed in early mornings.
- ✗ Natural ventilation to the west is limited by the proximity to the A329 road.
- ✗ The Student Accommodation has a bin store to the north-west of the HexBox, limiting the potential for air intake at low level.
- ✗ Opening windows for night cooling will not be an option for security reasons.
- ✗ Due to the nature of the building, many of the spaces are acoustically sensitive, limiting the use of natural ventilation.

The Foyer is the only space proposed to be fully naturally ventilated. Natural ventilation of the auditorium has been included in the design to provide an optional alternative, and will be effective during mid-seasons. Mechanical cooling in the auditorium will be required during the warmest days. This analysis provides an indication of the extent of mechanical cooling provision. The foyer and the auditorium are the two spaces considered in this report.

The dynamic simulation software used for this analysis was EDSL Tas version 9.5.6. The model represents the building geometry and fabric build up, and includes occupancy and heat gains for each space, as well as predictions for window and vent opening.

The geometry is based on Haworth Tompkins Architects Stage 3 coordination drawings:

- HEX-HTL-ZZ-00-DR-A-00900 Rev C – Proposed Site Plan
- HEX-HTL-ZZ-00-DR-A-00100 Rev C – Proposed G+0 Plan
- HEX-HTL-ZZ-01-DR-A-00101 Rev C – Proposed G+1 Plan
- HEX-HTL-ZZ-1M-DR-A-00102 Rev C – Proposed G+1M Plan
- HEX-HTL-ZZ-02-DR-A-00103 Rev C – Proposed G+2 Plan
- HEX-HTL-ZZ-RF-DR-A-00110 Rev C – Proposed Roof Plan
- HEX-HTL-ZZ-ZZ-DR-A-00200 Rev B – Proposed Sections AA & BB
- HEX-HTL-ZZ-ZZ-DR-A-00201 Rev B – Proposed Sections CC
- HEX-HTL-ZZ-ZZ-DR-A-00202 Rev B – Proposed Sections 1-4
- HEX-HTL-ZZ-ZZ-DR-A-00300 Rev B – Proposed East & South Elevations
- HEX-HTL-ZZ-ZZ-DR-A-00301 Rev B – Proposed West & North Elevations

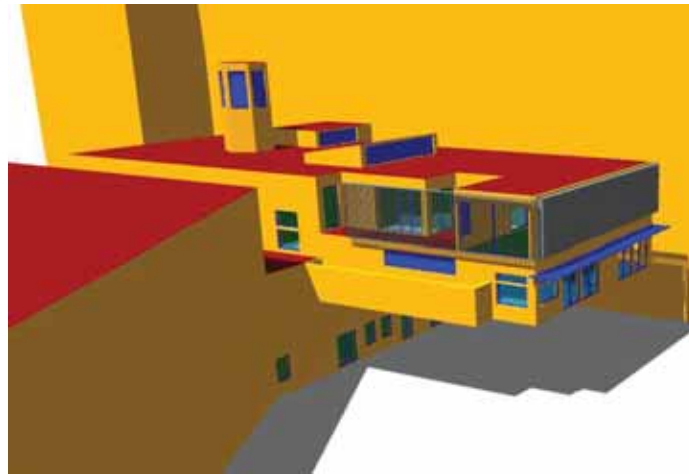


Figure 1: Extract from the Tas model

2.2 Criteria for avoidance of overheating

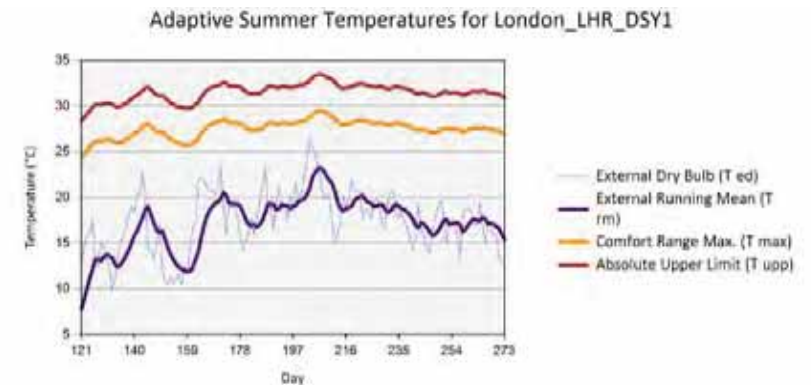
The methodology set out in *CIBSE TM52 – The limits of thermal comfort: avoiding overheating in European buildings* has been used to assess the relative likelihood of occupants overheating in the occupied spaces of the building. This analysis uses three criteria for assessing thermal comfort, which indicate when overheating is likely to be problematic. These criteria are based upon the adaptive model of thermal comfort, whereby the relationship between comfort and environment is a consequence of adaption by the subjects to the environment they normally encounter. As such, comfort is not assessed on a fixed temperature, but rather is adapted according to the running mean of temperatures over recent days.

This building is classified as Category II (Normal expectation for new buildings and renovations). For Category II buildings, the three criteria a building is assessed against are as follows:

- **Criterion 1 (Hours of Exceedance)** sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature by 1°C or more during the occupied hours of a typical non-heating season (1st of May to 30th September). This criterion should be 3% or less to pass.
- **Criterion 2 (Daily Weighted Exceedance)** considers the severity of the overheating within each day, which can be as important as its frequency, the level of which is a function of both temperature rise and duration. This criterion should be 6 degree-hours or less in any one day to pass.
- **Criterion 3 (Upper Limit Temperature)** sets an absolute maximum daily indoor operating temperature for a room, beyond which the level of overheating is unacceptable. This criterion should be 4°C over the comfort temperature, or less to pass.

A room is considered to overheat when it fails at least two of the three criteria.

It is important to note that passing TM52 does not necessarily imply that occupied spaces will not feel hot on occasion through the summer months; however, it does suggest that the frequency and intensity of these occasions will be low enough to be considered acceptable by most occupants.



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

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C 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 acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Figure 2: TM52 Summary

2.3 Model Assumptions

2.3.1 Weather data

For overheating analysis, the CIBSE Design Summer Year weather file for Heathrow (DSY) was used ('London_LHR_DSY1'). This is in accordance with CIBSE TM52 guidance on modelling for the thermal comfort and the avoidance of overheating.

The DSY (Design Summer Year) weather file consists of a single continuous year of hourly data, selected from the 20-year data sets (1983 to 2004) to represent a year with a hot, but not extreme, summer. The selection is based on the daily mean dry-bulb temperatures during the period April - September, with the third hottest year being selected. This enables designers to simulate building performance during a year with a hot, but not extreme, summer.

2.3.2 Constructions

The constructions of the different elements of the building fabric have been modelled to match the design U-values:

Element	U-Value (W/m ² K)	G-Value
Windows	1.2	0.29
Rooflights	1.2	0.29
Doors	1.2	0.29
External Wall	0.15	
Ground Floor	0.12	
Exposed Floor	0.12	
Roof	0.12	

Table 1: Building fabric thermal properties

The main foyer has been modelled with a dense plaster ceiling and wall coverings, which contribute to the thermal mass and therefore ability of building to regulate peak temperatures.

2.3.3 External shading

External shading is provided at the G+2 level and to the south facing box office window, to limit solar gain through glazing to the main foyer, box office and the community room. There is also a canopy over the main foyer entrance on the north-east façade, to reduce solar gains into the main foyer.

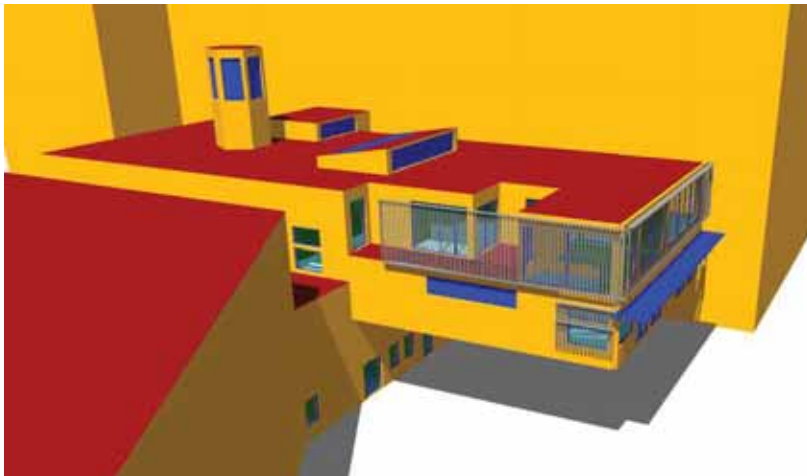


Figure 2: Solar shading at G+2 level south-east facade

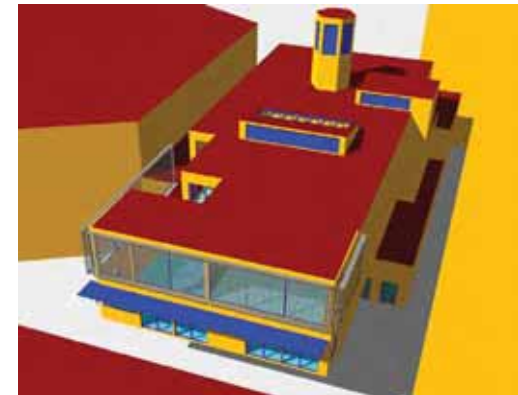


Figure 3: Solar shading at G+2 level north-east facade

Shading is proposed to be in the form of metal sheet panels that have 45% open area.

2.3.4 Internal Gains

The main purpose of this model is to assess the risk of overheating within the naturally ventilated spaces. While the main foyer is likely to be full on a winter's evening pre-performance and during the interval, for the purposes of this model, it has been assumed that on the warmest days, many people will move out onto the podium deck in front of the main foyer. This will reduce the occupancy of this space significantly, and this has been represented in the occupancy profiles for the overheating model.

It is assumed for the purposes of this model, that upper circulation spaces are not used as foyer spaces, and will therefore not be considered as occupied spaces.

Space Type	Lighting Gain	Equipment Gain	Occupancy Gain		
	(W/m²)	(W/m²)		Sensible (W/person)	Latent (W/person)
Main Foyer	6	4	9 people	90	55
Lower Foyer	6	2	4 people	90	55
Gallery foyer	6	2	3 people	90	55
G+2 circulation	6	2	1 person	90	55
Box Office	6	25	2 people	90	55
Bar/Cafe	8	30	2 people	90	55
Auditorium (including balcony)	10	25	200 people	75	35
Stage	(included in Equipment gain)	225	6 people	125	140

Table 2: Internal gains in naturally ventilated spaces

2.3.5 Thermostat

Since the purpose of this model is to assess overheating risk during the summer months, heating has been set at a low setback level. For the more transient foyer spaces the thermostat has been set to 16°C, and in the auditorium the thermostat has been set to 18°C. This ensures there is no overlap between assumed window opening schedules (which have been modelled based on internal temperatures) and provision of heating. No active cooling has been assumed in this model.

2.3.6 Ventilation

For the spaces being modelled in this analysis, ventilation is to be provided by natural ventilation. Therefore, ventilation provision is through openable vents and doors.

The main openable vents and doors are listed below. Window and door sizes have been modelled based upon the information on the Haworth Tompkins Architects Stage 3 Coordination drawings as listed in section 2.1.

Vent sizes are based upon Skelly & Couch Ltd ventilation schematic drawing 1647-SAC-00-ZZ-SM-M-U10-500 Rev P1.

Aperture location & type	Dimensions	% Free area openable	Schedule for opening
Main Foyer entrance double doors at podium level (4 no.)	As Architect drawings	100	8am-11pm Start opening 17°C/finish opening 18°C
Bar/Café vents in wall (4 no.)	4 no. 1.0m wide x 1.0m high	50	24 hrs Start opening 16°C/finish opening 17°C
Lantern over main foyer vents in wall (1 no.)	1 no. 1.0m wide x 2.0m high	50	24 hrs Start opening 16°C/finish opening 17°C
Gallery foyer vents next to rooflights (7 no.)	7 no. 1.0m wide x 1.15m high	50	24 hrs Start opening 16°C/finish opening 17°C
G+2 Terrace door	As Architect drawings	100	8am-11pm Start opening 18°C/finish opening 19°C
Roof level intake vents over auditorium (8 no.)	8 no. 1.0m wide x 1.0m high	50	24 hrs Start opening 18°C/finish opening 19°C
Chimney exhaust vents over auditorium (8 no.)	8 no. 1.05m wide x 2.0m high	50	24 hrs Start opening 18°C/finish opening 19°C

Table 3: Apertures and openings providing natural ventilation

3 Results & Discussion

3.1 Current DSY1 Weather file results

The TM52 assessment results for the fully naturally ventilated spaces are shown in *Table 4* below.

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
Auditorium	1071	32	98	14.0	7	Fail
Lower Foyer	2448	73	5	5.0	0	Pass
Foyer Main	2448	73	21	21.0	0	Pass
Bar/Cafe	2295	68	24	21.0	0	Pass
Balcony	1071	32	140	19.0	10	Fail

Table 4: TM52 analysis results (Current London_LHR_DSY1)

These results indicate that all the fully naturally ventilated occupied spaces (the main foyer spaces) pass the TM52 assessment, even though some fail Criterion 2, showing vulnerability towards sustained (6+ hours) periods of overheating on extremely warm summer days.

The auditorium and balcony spaces fail the criteria, but they have not been designed as fully naturally ventilated. It is anticipated that mechanical ventilation with cooling will be provided in these spaces. However, by interrogating the day-by-day outputs of the TM52 analysis results (refer to Appendix I), it can be seen that in the auditorium, there are 10 days from May to September when fewer than 2 of the 3 criteria are achieved. For the balcony space, there are 14 days from May to September when fewer than 2 of the 3 criteria are achieved.

Therefore, it can be assumed that for much of the year, natural ventilation would be an option in the auditorium, with mechanical ventilation with cooling being a requirement on particularly warm days.

3.2 Future Weather File Results

The analysis has also been run against *CIBSE* future projected Design Weather data to review the building performance for future weather patterns.

The future climate scenarios are based upon the medium emissions 50th percentile, climate change scenarios for 2050 and 2080, enabling an element of future-proofing against the worst-case future overheating as a result of warming climate.

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
Lower Foyer	2448	73	26	13.0	0	Pass
Foyer Main	2448	73	103	22.0	7	Fail
Bar CAfe	2295	68	110	24.0	6	Fail

Table 7 – 2050 Future weather overheating simulation

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
Lower Foyer	2448	73	41	16.0	0	Pass
Foyer Main	2448	73	134	30.0	8	Fail
Bar CAfe	2295	68	137	27.0	9	Fail

Table 6 – 2080 Future weather overheating simulation

It can be seen that the fully naturally ventilated main foyer and bar/café areas no longer achieve the TM52 criteria for the avoidance of overheating under future weather scenarios. For this reason, fan coil units are to be installed to provide cooling in the foyer space, generated from the air source heat pump.

4 Conclusion

The modelling results above demonstrate that the spaces are passing TM52 under normal occupancy conditions, but this does not necessarily imply that occupied spaces will not feel hot on occasion through the summer months. It does, however, suggest that the frequency and intensity of these occasions will be low enough to be considered acceptable by most occupants.

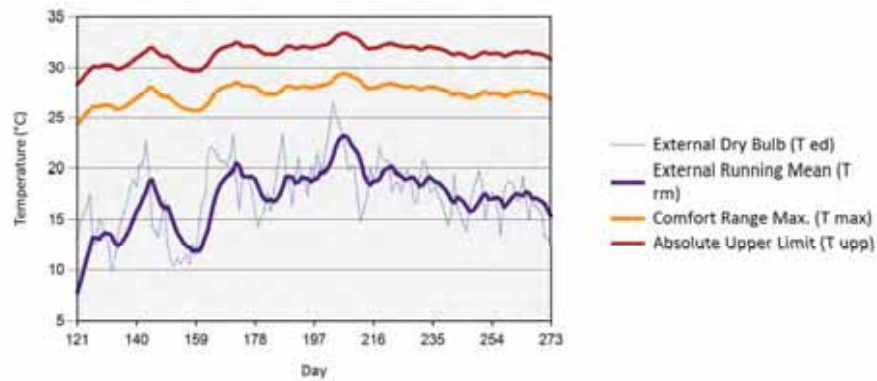
The results also show that natural ventilation will be an option for the auditorium for much of the year.

When future weather scenarios are considered, the naturally ventilated spaces will feel uncomfortably hot, and mechanical cooling is to be provided for this scenario.

5 Appendix I – Day by day TM52 results for auditorium

Adaptive Overheating Report (CIBSE TM52)

Adaptive Summer Temperatures for London_LHR_DSY1



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

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C 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 acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): Hexbox without terrace windows.tbd

Simulation Results File (.tsd): Hexbox without terrace windows.tsd

Date: 12 January 2024

Building Category: Category II

Report Criteria: TM52

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Auditorium

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
121	21.30	7	0	0	0
122	23.56	7	0	0	0
123	25.13	7	0	0	0
124	25.32	7	0	0	0
125	27.54	7	2	3	0
126	22.05	7	0	0	0
127	23.67	7	0	0	0
128	24.79	7	0	0	0
129	22.71	7	0	0	0
130	22.30	7	0	0	0
131	21.47	7	0	0	0
132	19.48	7	0	0	0
133	20.50	7	0	0	0
134	21.50	7	0	0	0
135	23.03	7	0	0	0
136	23.78	7	0	0	0
137	25.76	7	0	0	0
138	26.26	7	0	0	0
139	26.52	7	0	0	0
140	26.21	7	0	0	0
141	27.10	7	0	0	0
142	26.62	7	0	0	0
143	29.88	7	7	11	0
144	25.57	7	0	0	0
145	21.93	7	0	0	0
146	23.20	7	0	0	0
147	22.71	7	0	0	0
148	24.46	7	0	0	0
149	24.81	7	0	0	0
150	20.69	7	0	0	0
151	20.43	7	0	0	0
152	20.29	7	0	0	0
153	21.70	7	0	0	0
154	20.50	7	0	0	0
155	20.66	7	0	0	0
156	21.29	7	0	0	0
157	19.56	7	0	0	0
158	21.25	7	0	0	0
159	20.02	7	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Auditorium

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
160	22.97	7	0	0	0
161	24.05	7	0	0	0
162	24.78	7	0	0	0
163	28.05	7	6	8	0
164	28.84	7	6	9	0
165	28.87	7	5	6	0
166	28.92	7	3	3	0
167	28.70	7	1	1	0
168	29.18	7	2	2	0
169	27.53	7	0	0	0
170	28.97	7	1	1	0
171	31.00	7	7	14	0
172	25.73	7	0	0	0
173	24.91	7	0	0	0
174	27.53	7	0	0	0
175	27.22	7	0	0	0
176	27.16	7	0	0	0
177	24.55	7	0	0	0
178	22.05	7	0	0	0
179	21.16	7	0	0	0
180	23.97	7	0	0	0
181	23.92	7	0	0	0
182	24.08	7	0	0	0
183	24.26	7	0	0	0
184	24.86	7	0	0	0
185	25.96	7	0	0	0
186	28.00	7	0	0	0
187	29.45	7	6	9	0
188	25.36	7	0	0	0
189	27.56	7	0	0	0
190	23.37	7	0	0	0
191	26.84	7	0	0	0
192	28.47	7	0	0	0
193	26.21	7	0	0	0
194	26.54	7	0	0	0
195	26.49	7	0	0	0
196	29.26	7	4	4	0
197	26.26	7	0	0	0
198	29.89	7	3	5	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Auditorium

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
199	27.55	7	0	0	0
200	29.16	7	2	2	0
201	29.84	7	3	4	0
202	31.32	7	5	9	0
203	33.60	7	7	8	4
204	33.01	7	7	10	3
205	31.65	7	5	8	0
206	30.47	7	5	5	0
207	28.69	7	0	0	0
208	27.72	7	0	0	0
209	27.72	7	0	0	0
210	27.80	7	0	0	0
211	23.71	7	0	0	0
212	22.48	7	0	0	0
213	25.32	7	0	0	0
214	25.34	7	0	0	0
215	27.81	7	0	0	0
216	27.74	7	0	0	0
217	29.08	7	3	3	0
218	29.83	7	6	7	0
219	28.03	7	0	0	0
220	27.87	7	0	0	0
221	26.82	7	0	0	0
222	25.75	7	0	0	0
223	25.70	7	0	0	0
224	26.19	7	0	0	0
225	23.95	7	0	0	0
226	25.24	7	0	0	0
227	25.15	7	0	0	0
228	25.52	7	0	0	0
229	24.36	7	0	0	0
230	25.59	7	0	0	0
231	28.17	7	0	0	0
232	28.46	7	1	1	0
233	27.75	7	0	0	0
234	26.14	7	0	0	0
235	26.15	7	0	0	0
236	26.85	7	0	0	0
237	25.09	7	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Auditorium

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
238	25.05	7	0	0	0
239	22.21	7	0	0	0
240	24.02	7	0	0	0
241	23.72	7	0	0	0
242	26.48	7	0	0	0
243	23.91	7	0	0	0
244	24.64	7	0	0	0
245	22.52	7	0	0	0
246	23.20	7	0	0	0
247	24.71	7	0	0	0
248	25.91	7	0	0	0
249	27.54	7	0	0	0
250	27.89	7	1	1	0
251	24.94	7	0	0	0
252	21.36	7	0	0	0
253	23.45	7	0	0	0
254	23.23	7	0	0	0
255	24.95	7	0	0	0
256	22.97	7	0	0	0
257	21.27	7	0	0	0
258	23.34	7	0	0	0
259	24.15	7	0	0	0
260	24.14	7	0	0	0
261	24.83	7	0	0	0
262	23.43	7	0	0	0
263	24.10	7	0	0	0
264	27.10	7	0	0	0
265	22.94	7	0	0	0
266	23.99	7	0	0	0
267	25.08	7	0	0	0
268	24.68	7	0	0	0
269	24.40	7	0	0	0
270	22.84	7	0	0	0
271	21.46	7	0	0	0
272	22.22	7	0	0	0
273	21.76	7	0	0	0
Total/Peak:	33.60	1071	98	14.0	7

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Balcony

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
121	21.69	7	0	0	0
122	24.13	7	0	0	0
123	25.70	7	1	1	0
124	25.85	7	0	0	0
125	28.19	7	5	6	0
126	22.44	7	0	0	0
127	24.13	7	0	0	0
128	25.28	7	0	0	0
129	23.23	7	0	0	0
130	22.69	7	0	0	0
131	21.80	7	0	0	0
132	19.74	7	0	0	0
133	20.85	7	0	0	0
134	21.86	7	0	0	0
135	23.44	7	0	0	0
136	24.27	7	0	0	0
137	26.35	7	0	0	0
138	26.81	7	0	0	0
139	27.13	7	0	0	0
140	26.79	7	0	0	0
141	27.68	7	1	1	0
142	27.18	7	0	0	0
143	30.63	7	7	17	0
144	25.95	7	0	0	0
145	22.08	7	0	0	0
146	23.55	7	0	0	0
147	23.07	7	0	0	0
148	24.96	7	0	0	0
149	25.32	7	0	0	0
150	20.98	7	0	0	0
151	20.70	7	0	0	0
152	20.55	7	0	0	0
153	22.10	7	0	0	0
154	20.82	7	0	0	0
155	20.99	7	0	0	0
156	21.63	7	0	0	0
157	19.83	7	0	0	0
158	21.58	7	0	0	0
159	20.33	7	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Balcony

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
160	23.49	7	0	0	0
161	24.61	7	0	0	0
162	25.36	7	0	0	0
163	28.77	7	6	11	0
164	29.58	7	7	15	0
165	29.49	7	7	11	0
166	29.48	7	4	6	0
167	29.32	7	3	3	0
168	29.85	7	2	3	0
169	28.17	7	0	0	0
170	29.48	7	3	3	0
171	31.80	7	7	19	0
172	26.11	7	0	0	0
173	25.25	7	0	0	0
174	28.13	7	0	0	0
175	27.82	7	0	0	0
176	27.67	7	0	0	0
177	24.88	7	0	0	0
178	22.33	7	0	0	0
179	21.42	7	0	0	0
180	24.37	7	0	0	0
181	24.42	7	0	0	0
182	24.51	7	0	0	0
183	24.70	7	0	0	0
184	25.29	7	0	0	0
185	26.48	7	0	0	0
186	28.60	7	3	3	0
187	30.06	7	7	12	0
188	25.70	7	0	0	0
189	27.95	7	0	0	0
190	23.59	7	0	0	0
191	27.46	7	0	0	0
192	29.15	7	3	3	0
193	26.70	7	0	0	0
194	26.99	7	0	0	0
195	27.00	7	0	0	0
196	30.00	7	4	6	0
197	26.76	7	0	0	0
198	30.62	7	6	10	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Balcony

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
199	28.03	7	0	0	0
200	29.82	7	3	4	0
201	30.44	7	5	7	0
202	32.02	7	6	11	1
203	34.39	7	7	3	6
204	33.74	7	7	12	3
205	32.16	7	6	13	0
206	30.98	7	6	7	0
207	29.14	7	0	0	0
208	28.12	7	0	0	0
209	28.27	7	0	0	0
210	28.27	7	0	0	0
211	23.97	7	0	0	0
212	22.69	7	0	0	0
213	25.78	7	0	0	0
214	25.78	7	0	0	0
215	28.45	7	1	1	0
216	28.38	7	0	0	0
217	29.75	7	4	5	0
218	30.42	7	7	12	0
219	28.63	7	0	0	0
220	28.45	7	0	0	0
221	27.27	7	0	0	0
222	26.10	7	0	0	0
223	26.14	7	0	0	0
224	26.66	7	0	0	0
225	24.31	7	0	0	0
226	25.66	7	0	0	0
227	25.56	7	0	0	0
228	25.91	7	0	0	0
229	24.75	7	0	0	0
230	26.09	7	0	0	0
231	28.80	7	3	3	0
232	29.03	7	3	3	0
233	28.26	7	0	0	0
234	26.64	7	0	0	0
235	26.58	7	0	0	0
236	27.35	7	0	0	0
237	25.44	7	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Balcony

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
238	25.44	7	0	0	0
239	22.52	7	0	0	0
240	24.43	7	0	0	0
241	24.10	7	0	0	0
242	26.97	7	0	0	0
243	24.26	7	0	0	0
244	25.08	7	0	0	0
245	22.86	7	0	0	0
246	23.55	7	0	0	0
247	25.23	7	0	0	0
248	26.48	7	0	0	0
249	28.23	7	3	3	0
250	28.45	7	3	3	0
251	25.40	7	0	0	0
252	21.52	7	0	0	0
253	23.78	7	0	0	0
254	23.58	7	0	0	0
255	25.36	7	0	0	0
256	23.24	7	0	0	0
257	21.52	7	0	0	0
258	23.76	7	0	0	0
259	24.55	7	0	0	0
260	24.54	7	0	0	0
261	25.29	7	0	0	0
262	23.77	7	0	0	0
263	24.54	7	0	0	0
264	27.61	7	0	0	0
265	23.28	7	0	0	0
266	24.35	7	0	0	0
267	25.59	7	0	0	0
268	25.09	7	0	0	0
269	24.84	7	0	0	0
270	23.12	7	0	0	0
271	21.74	7	0	0	0
272	22.51	7	0	0	0
273	22.00	7	0	0	0
Total/Peak:	34.39	1071	140	19.0	10

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Bar CAfe

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
121	17.41	15	0	0	0
122	20.59	15	0	0	0
123	22.45	15	0	0	0
124	22.93	15	0	0	0
125	24.39	15	0	0	0
126	18.75	15	0	0	0
127	19.70	15	0	0	0
128	21.48	15	0	0	0
129	20.14	15	0	0	0
130	19.10	15	0	0	0
131	18.66	15	0	0	0
132	17.31	15	0	0	0
133	17.70	15	0	0	0
134	18.50	15	0	0	0
135	20.56	15	0	0	0
136	20.94	15	0	0	0
137	22.11	15	0	0	0
138	23.98	15	0	0	0
139	24.10	15	0	0	0
140	24.53	15	0	0	0
141	26.02	15	0	0	0
142	25.62	15	0	0	0
143	27.93	15	0	0	0
144	26.65	15	0	0	0
145	19.16	15	0	0	0
146	19.70	15	0	0	0
147	19.42	15	0	0	0
148	21.11	15	0	0	0
149	22.24	15	0	0	0
150	18.39	15	0	0	0
151	17.79	15	0	0	0
152	17.78	15	0	0	0
153	18.25	15	0	0	0
154	17.96	15	0	0	0
155	17.71	15	0	0	0
156	18.41	15	0	0	0
157	17.00	15	0	0	0
158	17.60	15	0	0	0
159	17.56	15	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Bar CAfe

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
160	19.35	15	0	0	0
161	21.14	15	0	0	0
162	22.90	15	0	0	0
163	26.83	15	0	0	0
164	27.22	15	0	0	0
165	26.47	15	0	0	0
166	27.11	15	0	0	0
167	26.25	15	0	0	0
168	26.76	15	0	0	0
169	26.04	15	0	0	0
170	27.63	15	0	0	0
171	28.93	15	1	1	0
172	23.25	15	0	0	0
173	20.50	15	0	0	0
174	24.35	15	0	0	0
175	24.26	15	0	0	0
176	25.25	15	0	0	0
177	22.47	15	0	0	0
178	19.67	15	0	0	0
179	18.74	15	0	0	0
180	19.64	15	0	0	0
181	20.85	15	0	0	0
182	21.09	15	0	0	0
183	20.64	15	0	0	0
184	22.98	15	0	0	0
185	24.74	15	0	0	0
186	27.59	15	0	0	0
187	28.52	15	2	2	0
188	22.02	15	0	0	0
189	23.87	15	0	0	0
190	19.27	15	0	0	0
191	23.92	15	0	0	0
192	25.58	15	0	0	0
193	22.98	15	0	0	0
194	24.19	15	0	0	0
195	22.68	15	0	0	0
196	26.46	15	0	0	0
197	24.00	15	0	0	0
198	26.93	15	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Bar CAfe

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
199	24.83	15	0	0	0
200	26.12	15	0	0	0
201	28.19	15	0	0	0
202	30.13	15	5	6	0
203	32.21	15	9	21	0
204	30.59	15	7	7	0
205	29.49	15	0	0	0
206	28.91	15	0	0	0
207	26.38	15	0	0	0
208	25.25	15	0	0	0
209	25.25	15	0	0	0
210	25.30	15	0	0	0
211	19.88	15	0	0	0
212	19.41	15	0	0	0
213	21.79	15	0	0	0
214	22.44	15	0	0	0
215	25.41	15	0	0	0
216	24.67	15	0	0	0
217	25.78	15	0	0	0
218	27.68	15	0	0	0
219	25.88	15	0	0	0
220	25.41	15	0	0	0
221	25.18	15	0	0	0
222	21.03	15	0	0	0
223	23.06	15	0	0	0
224	23.48	15	0	0	0
225	21.55	15	0	0	0
226	23.25	15	0	0	0
227	23.73	15	0	0	0
228	23.51	15	0	0	0
229	21.61	15	0	0	0
230	22.32	15	0	0	0
231	25.45	15	0	0	0
232	26.86	15	0	0	0
233	25.50	15	0	0	0
234	23.71	15	0	0	0
235	24.14	15	0	0	0
236	24.89	15	0	0	0
237	21.31	15	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Bar CAfe

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
238	21.57	15	0	0	0
239	19.30	15	0	0	0
240	19.94	15	0	0	0
241	19.60	15	0	0	0
242	24.42	15	0	0	0
243	20.51	15	0	0	0
244	20.76	15	0	0	0
245	18.84	15	0	0	0
246	19.21	15	0	0	0
247	21.18	15	0	0	0
248	22.46	15	0	0	0
249	24.88	15	0	0	0
250	25.39	15	0	0	0
251	22.56	15	0	0	0
252	18.13	15	0	0	0
253	19.88	15	0	0	0
254	19.82	15	0	0	0
255	21.31	15	0	0	0
256	19.79	15	0	0	0
257	17.48	15	0	0	0
258	20.94	15	0	0	0
259	21.20	15	0	0	0
260	21.06	15	0	0	0
261	22.64	15	0	0	0
262	21.12	15	0	0	0
263	22.04	15	0	0	0
264	25.50	15	0	0	0
265	19.75	15	0	0	0
266	19.29	15	0	0	0
267	21.57	15	0	0	0
268	22.25	15	0	0	0
269	20.29	15	0	0	0
270	18.77	15	0	0	0
271	18.10	15	0	0	0
272	18.55	15	0	0	0
273	17.79	15	0	0	0
Total/Peak:	32.21	2295	24	21.0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Foyer Main

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
121	17.61	16	0	0	0
122	20.53	16	0	0	0
123	22.34	16	0	0	0
124	22.91	16	0	0	0
125	24.32	16	0	0	0
126	18.68	16	0	0	0
127	19.81	16	0	0	0
128	21.54	16	0	0	0
129	20.53	16	0	0	0
130	19.03	16	0	0	0
131	18.78	16	0	0	0
132	17.26	16	0	0	0
133	17.67	16	0	0	0
134	18.56	16	0	0	0
135	20.72	16	0	0	0
136	20.83	16	0	0	0
137	22.06	16	0	0	0
138	24.03	16	0	0	0
139	24.08	16	0	0	0
140	24.45	16	0	0	0
141	25.81	16	0	0	0
142	25.45	16	0	0	0
143	27.72	16	0	0	0
144	26.50	16	0	0	0
145	19.35	16	0	0	0
146	19.78	16	0	0	0
147	19.44	16	0	0	0
148	21.01	16	0	0	0
149	22.32	16	0	0	0
150	18.29	16	0	0	0
151	17.77	16	0	0	0
152	17.68	16	0	0	0
153	18.20	16	0	0	0
154	17.91	16	0	0	0
155	18.06	16	0	0	0
156	18.32	16	0	0	0
157	17.20	16	0	0	0
158	17.97	16	0	0	0
159	17.72	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Foyer Main

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
160	19.66	16	0	0	0
161	21.33	16	0	0	0
162	22.93	16	0	0	0
163	26.70	16	0	0	0
164	27.18	16	0	0	0
165	26.73	16	0	0	0
166	27.07	16	0	0	0
167	26.29	16	0	0	0
168	26.80	16	0	0	0
169	25.92	16	0	0	0
170	27.48	16	0	0	0
171	28.72	16	0	0	0
172	23.35	16	0	0	0
173	20.41	16	0	0	0
174	24.21	16	0	0	0
175	24.18	16	0	0	0
176	25.18	16	0	0	0
177	22.68	16	0	0	0
178	19.77	16	0	0	0
179	18.86	16	0	0	0
180	19.45	16	0	0	0
181	21.15	16	0	0	0
182	21.31	16	0	0	0
183	20.73	16	0	0	0
184	22.96	16	0	0	0
185	24.50	16	0	0	0
186	27.17	16	0	0	0
187	28.32	16	0	0	0
188	21.89	16	0	0	0
189	23.98	16	0	0	0
190	19.26	16	0	0	0
191	23.81	16	0	0	0
192	25.43	16	0	0	0
193	23.18	16	0	0	0
194	24.18	16	0	0	0
195	22.59	16	0	0	0
196	26.33	16	0	0	0
197	23.99	16	0	0	0
198	26.83	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Foyer Main

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
199	24.80	16	0	0	0
200	26.03	16	0	0	0
201	28.19	16	0	0	0
202	29.88	16	5	5	0
203	32.23	16	9	21	0
204	30.49	16	7	7	0
205	29.58	16	0	0	0
206	28.93	16	0	0	0
207	26.38	16	0	0	0
208	25.29	16	0	0	0
209	25.22	16	0	0	0
210	25.29	16	0	0	0
211	19.76	16	0	0	0
212	19.48	16	0	0	0
213	21.75	16	0	0	0
214	22.55	16	0	0	0
215	25.37	16	0	0	0
216	24.69	16	0	0	0
217	25.76	16	0	0	0
218	27.62	16	0	0	0
219	25.94	16	0	0	0
220	25.33	16	0	0	0
221	25.29	16	0	0	0
222	21.08	16	0	0	0
223	23.08	16	0	0	0
224	23.46	16	0	0	0
225	21.65	16	0	0	0
226	23.17	16	0	0	0
227	23.71	16	0	0	0
228	23.64	16	0	0	0
229	21.91	16	0	0	0
230	22.37	16	0	0	0
231	25.32	16	0	0	0
232	26.69	16	0	0	0
233	25.28	16	0	0	0
234	23.73	16	0	0	0
235	24.05	16	0	0	0
236	24.88	16	0	0	0
237	21.25	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Foyer Main

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
238	21.54	16	0	0	0
239	19.39	16	0	0	0
240	19.97	16	0	0	0
241	19.60	16	0	0	0
242	24.22	16	0	0	0
243	20.68	16	0	0	0
244	20.67	16	0	0	0
245	18.85	16	0	0	0
246	19.23	16	0	0	0
247	21.09	16	0	0	0
248	22.28	16	0	0	0
249	24.65	16	0	0	0
250	25.26	16	0	0	0
251	22.69	16	0	0	0
252	17.84	16	0	0	0
253	19.77	16	0	0	0
254	19.63	16	0	0	0
255	21.37	16	0	0	0
256	19.64	16	0	0	0
257	17.56	16	0	0	0
258	20.84	16	0	0	0
259	21.24	16	0	0	0
260	21.11	16	0	0	0
261	22.59	16	0	0	0
262	21.15	16	0	0	0
263	21.84	16	0	0	0
264	25.22	16	0	0	0
265	19.98	16	0	0	0
266	19.18	16	0	0	0
267	21.52	16	0	0	0
268	22.13	16	0	0	0
269	20.05	16	0	0	0
270	18.90	16	0	0	0
271	17.94	16	0	0	0
272	18.62	16	0	0	0
273	17.55	16	0	0	0
Total/Peak:	32.23	2448	21	21.0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Lower Foyer

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
121	18.47	16	0	0	0
122	20.54	16	0	0	0
123	22.14	16	0	0	0
124	22.60	16	0	0	0
125	23.79	16	0	0	0
126	19.68	16	0	0	0
127	20.65	16	0	0	0
128	21.77	16	0	0	0
129	20.90	16	0	0	0
130	19.54	16	0	0	0
131	19.22	16	0	0	0
132	18.67	16	0	0	0
133	18.93	16	0	0	0
134	18.99	16	0	0	0
135	20.86	16	0	0	0
136	21.02	16	0	0	0
137	22.17	16	0	0	0
138	23.65	16	0	0	0
139	23.71	16	0	0	0
140	23.94	16	0	0	0
141	25.00	16	0	0	0
142	24.74	16	0	0	0
143	26.88	16	0	0	0
144	25.83	16	0	0	0
145	20.25	16	0	0	0
146	20.44	16	0	0	0
147	20.08	16	0	0	0
148	21.35	16	0	0	0
149	22.42	16	0	0	0
150	19.61	16	0	0	0
151	19.04	16	0	0	0
152	19.01	16	0	0	0
153	19.29	16	0	0	0
154	19.05	16	0	0	0
155	19.23	16	0	0	0
156	19.10	16	0	0	0
157	18.73	16	0	0	0
158	19.10	16	0	0	0
159	18.69	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Lower Foyer

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
160	20.02	16	0	0	0
161	21.28	16	0	0	0
162	22.57	16	0	0	0
163	25.85	16	0	0	0
164	26.18	16	0	0	0
165	25.66	16	0	0	0
166	26.18	16	0	0	0
167	25.85	16	0	0	0
168	26.02	16	0	0	0
169	25.57	16	0	0	0
170	26.66	16	0	0	0
171	27.60	16	0	0	0
172	23.53	16	0	0	0
173	21.18	16	0	0	0
174	24.27	16	0	0	0
175	24.15	16	0	0	0
176	25.10	16	0	0	0
177	22.87	16	0	0	0
178	20.38	16	0	0	0
179	20.11	16	0	0	0
180	20.29	16	0	0	0
181	21.07	16	0	0	0
182	21.28	16	0	0	0
183	21.11	16	0	0	0
184	22.91	16	0	0	0
185	24.14	16	0	0	0
186	26.15	16	0	0	0
187	27.02	16	0	0	0
188	22.54	16	0	0	0
189	23.89	16	0	0	0
190	20.43	16	0	0	0
191	23.61	16	0	0	0
192	25.07	16	0	0	0
193	23.51	16	0	0	0
194	24.44	16	0	0	0
195	23.00	16	0	0	0
196	25.56	16	0	0	0
197	24.03	16	0	0	0
198	26.07	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Lower Foyer

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
199	24.62	16	0	0	0
200	25.77	16	0	0	0
201	27.06	16	0	0	0
202	28.90	16	0	0	0
203	29.68	16	5	5	0
204	29.02	16	0	0	0
205	28.39	16	0	0	0
206	28.04	16	0	0	0
207	26.24	16	0	0	0
208	25.13	16	0	0	0
209	25.01	16	0	0	0
210	25.08	16	0	0	0
211	20.73	16	0	0	0
212	20.27	16	0	0	0
213	22.31	16	0	0	0
214	22.75	16	0	0	0
215	24.80	16	0	0	0
216	24.61	16	0	0	0
217	25.39	16	0	0	0
218	26.68	16	0	0	0
219	25.45	16	0	0	0
220	24.97	16	0	0	0
221	24.92	16	0	0	0
222	21.98	16	0	0	0
223	23.19	16	0	0	0
224	23.41	16	0	0	0
225	21.85	16	0	0	0
226	23.02	16	0	0	0
227	23.33	16	0	0	0
228	23.43	16	0	0	0
229	22.23	16	0	0	0
230	22.75	16	0	0	0
231	24.89	16	0	0	0
232	26.20	16	0	0	0
233	25.10	16	0	0	0
234	23.68	16	0	0	0
235	24.10	16	0	0	0
236	24.47	16	0	0	0
237	21.93	16	0	0	0

Adaptive Overheating Report (CIBSE TM52)

Day by Day Results for Lower Foyer

Day	Peak Operative Temperature During Occupancy	Occupied Summer Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit
238	22.03	16	0	0	0
239	20.40	16	0	0	0
240	20.77	16	0	0	0
241	20.83	16	0	0	0
242	23.96	16	0	0	0
243	21.44	16	0	0	0
244	21.22	16	0	0	0
245	19.87	16	0	0	0
246	20.05	16	0	0	0
247	21.41	16	0	0	0
248	22.44	16	0	0	0
249	24.28	16	0	0	0
250	24.72	16	0	0	0
251	22.61	16	0	0	0
252	19.30	16	0	0	0
253	20.60	16	0	0	0
254	20.41	16	0	0	0
255	21.80	16	0	0	0
256	20.54	16	0	0	0
257	19.34	16	0	0	0
258	21.29	16	0	0	0
259	21.50	16	0	0	0
260	21.43	16	0	0	0
261	22.55	16	0	0	0
262	21.70	16	0	0	0
263	22.05	16	0	0	0
264	24.74	16	0	0	0
265	20.69	16	0	0	0
266	20.37	16	0	0	0
267	21.90	16	0	0	0
268	22.32	16	0	0	0
269	20.89	16	0	0	0
270	19.81	16	0	0	0
271	19.26	16	0	0	0
272	19.57	16	0	0	0
273	19.02	16	0	0	0
Total/Peak:	29.68	2448	5	5.0	0