# 5.0 OVERHEATING

The acoustic issues associated with overheating relate to the need to open windows to provide rapid cooling (particularly during hot weather) that is unrelated to the provision of 'background ventilation'.

### Opening Windows

Opening windows naturally compromises the sound insulation provided by the external wall, glazing and background ventilators such that higher internal noise levels would be experienced in flats; particularly those overlooking transport routes.

### Rating Exceedance

Assessing the exceedances of the target internal noise criteria in terms of occupant satisfaction is not straightforward as annoyance is highly subjective. In many cases, where the use of an open window is required as a result of occasional overheating under 'worst case scenario' times of hot weather, an increase to the internal noise level is considered to be necessary and acceptable.

It must be noted that there is no accepted guidance on internal noise levels with windows open and what is considered to be acceptable with the use of the rapid ventilation in atypical hot weather conditions. The Acoustics & Noise Consultants (ANC) association have developed a draft design guide that refers to overheating in residential developments. The following Table 10 is repeated from this draft design guide and refers to internal noise levels with windows opened.

Table 10 – ANC Draft Guidance on Overheating (Internal Noise Levels due to Transport Sources)

| Internal Ambient Noise Level | | Examples of outcomes | Risk category for Level 2 assessment |
|---|---|---|---|
| $L_{Aeq,T}$ during 07:00 – 23:00 | $L_{Aeq,T}$ during 23:00 – 07:00 | | |
| ≤ 35 dB | ≤ 30 dB | Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life. | Negligible |
| > 35 dB and ≤ 40 dB | < 30 dB and ≥ 35 dB | Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where the is no alternative ventilation, having to close windows for some of the time because of noise. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in the quality of life. | Low |
| >40 dB and ≤ 50 dB | >35 dB and ≤ 43 dB | Increasing risk of adverse effect due to impact on reliable speech communication during daytime or sleep disturbance at night. Although noise levels at the lower end of this category will cause changes in behaviour, they may still be considered suitable. Noise levels at the upper end of this category will result in more significant changes in behaviour and are only likely to be considered suitable if they occur for limited periods. | Medium |
| >50 dB | > 43 dB | The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area. | High |

With reference to the measured $L_{Aeq}$ period levels at each measurement positions the following internal noise levels are calculated within future residential dwellings with windows partially opened (reduction of 15dB applied). Also included in reference to the 'risk category' as referred to in the previous Table.

Table 12 – Predicted Internal Noise Levels Windows Open

| Measurement Position | Average $L_{Aeq, period}$ Noise Level (dB) | | | |
|---|---|---|---|---|
| | Daytime (07:00 – 23:00) | Risk Category | Night-time (23:00 – 07:00) | Risk Category |
| Position 1 (Tavistock Road) | 49 | Medium | 44 | High |
| Position 2 (Rear of Site) | 44 | Medium | 35 | Low |

Clearly, the extent to which opening windows is considered a reasonable method of avoiding overheating is heavily dependent on how often occupants are required to do so.

Overheating studies by Patrick Parsons Ltd advise the following regarding the need to open windows within the worst affected rooms:

The rooms pass the overheating criteria set out by the CIBSE guidance - *TM52: The Limits of Thermal Comfort: Avoiding Overheating in European Buildings* under the following test conditions:

- Windows are open between 07:00 – 23:00 when the room temperature exceed 25°C
- Typically bedrooms windows would be opened around 550 – 600 hours a year (6.2% - 6.85%)
- Typically Kitchen / living rooms would be opened around 850 hours a year. (9.7%)

### Summary

To summarise the information stated above, overheating issues (as defined in TM52) can be avoided by opening windows during the daytime between 07:00 – 23:00 on those occasions where internal temperatures exceed 25°C. In doing so it allows windows to be closed during the night-time between 23:00 – 07:00, which is preferable to avoid sleep disturbance and the 'high risk' category as detailed above.

Such situations are expected to occur between 7-10% of the year.

# 6.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at the COMAG Site, West Drayton. The measured noise levels are presented within this report. The resultant noise levels have been used in the assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233 and WHO.

General guidance configurations have been suggested for the glazing constructions that should be capable of achieving the required specifications detailed within Appendix B.

A worst case configuration of 10/12/6.4 double glazing is required in the worst affected bedrooms at first floor level to protect the residences from any potential noise impact. However, other areas only require more standard double glazing.

Review of the overheating assessment has been undertaken along with commentary on the implications of opening windows during the worst case test conditions on internal noise levels.

# Appendix A - Acoustic Terminology

| | |
|---|---|
| dB | Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level. |
| dB(A) | The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible. |
| $L_{eq}$ | $L_{eq}$ is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour). |
| $L_{Aeq}$ | The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period. |
| $L_{An}$ (e.g $L_{A10}$, $L_{A90}$) | If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The $L_n$ indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence $L_{10}$ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, $L_{90}$ is the average minimum level and is often used to describe the background noise. |
| $L_{max,T}$ | The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the $L_{eq}$ value. |

# Appendix B – External Building Fabric Acoustic Specification

## 1.0 Window Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2010:

| Type | Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz) | | | | | | | | $R_w$ (dB) |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| G1 | 23 | 27 | 29 | 36 | 41 | 42 | 52 | 52 | 39 |
| G2 | 19 | 23 | 22 | 27 | 38 | 40 | 41 | 41 | 33 |

Note: $R_W$ is the "overall weighted sound reduction index" tested in a laboratory.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency-specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems shall be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

## 2.0 Acoustic Flanking Specification

*Extent*

There is potential for any curtain walling or continuous system to transmit sound across the separating floors and walls, and to thus result in future sound insulation problems.

The following specification should therefore be introduced within the tender documentation in order to ensure the system components are adequately designed.

The following specifications apply to all curtain walling or continuous elements between residential units and, if applicable, between residential units and commercial areas. Between non-residential areas (e.g. commercial to commercial, etc.) it is standard practice to relax the specification to a value of 50dB $D_{n,f,w}$.

With regard to potential flanking through the panels, the specification is commensurate with relatively high sound insulation levels. Achievement of this specification will require careful consideration of the panel design, in particular the insulation type and construction make-up of the panel skin. In addition it is likely to be necessary to design the cladding such that double/twin insulated mullions and transoms are included.

*Horizontal Flanking at Separating Wall Lines*

The curtain walling/continuous system shall achieve a horizontal weighted normalised flanking level difference of 60dB $D_{n,f,w}$ when tested in general accordance with BS EN ISO 10848-2:2006 [previously BS EN 20140-9:1994] (the methodology amended accordingly).

The supplier shall demonstrate by the provision of previous test reports (and comparative calculations if required) that the specification can be achieved. The Client, however, reserve the right to insist on laboratory acoustic testing if any doubts remain in relation to the flanking performance of the system.

The curtain walling system shall provide suitable surfaces against which a good acoustic seal can be made with future separating walls.

*Vertical Flanking at Separating Floor Lines*

The curtain walling system shall achieve a vertical weighted normalised flanking level difference of 60dB $D_{n,f,w}$ when tested in general accordance with BS EN ISO 10848-2:2006 [previously BS EN 20140-9:1994] (the methodology amended accordingly).

The supplier shall demonstrate by the provision of previous test reports (and comparative calculations if required) that the specification can be achieved. The Client, however, reserve the right to insist on laboratory acoustic testing if any doubts remain in relation to the flanking performance of the system.

The curtain walling system shall provide suitable surfaces against which a good acoustic seal can be made with future separating floors.

# Appendix C - Instrumentation

The following equipment was used for the measurements

| Manufacturer | Model Type | Serial No. | Calibration | |
|---|---|---|---|---|
| | | | Certificate No. | Expiry Date |
| Norsonic Type 1 Sound Level Meter | Nor140 | 1406971 | 4715702365 | 11 September 2019 |
| Norsonic Pre Amplifier | 1209 | 21206 | | |
| Norsonic ½" Microphone | 1225 | 271059 | 4715702365 | 11 September 2019 |
| Norsonic Sound Calibrator | 1251 | 35016 | U26573 | 11 September 2019 |
| Norsonic Type 1 Sound Level Meter | Nor140 | 1406970 | 4715701644 | 11 September 2019 |
| Norsonic Pre Amplifier | 1209 | 21205 | | |
| Norsonic ½" Microphone | 1225 | 271055 | 4715701644 | 11 September 2019 |
| Norsonic Sound Calibrator | 1251 | 35020 | U26579 | 12 September 2019 |

# Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

| Rating Bands (Severity x Likelihood) | | |
|---|---|---|
| Low Risk (1 – 8) | Medium Risk (9 -12) | High Risk (15 – 25) |
| May be ignored but ensure controls remain effective | Continue, but implement additional reasonable practicable controls where possible | Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level |

The following hazards pertinent to our design input have been identified and control measures suggested:

| Hazard | Risk Of | At Risk | Rating | | | Control Measures | Controlled | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | S | R | | L | S | R |
| Mineral wool within drywalls and linings | Skin and respiratory irritation | Contractors | 4 | 3 | 12 | Wear gloves and mask | 1 | 3 | 3 |
| Acoustic glazing - weight | Strain of neck, limbs or back. Fall from height. | Contractors | 3 | 5 | 15 | Provide sufficient manpower, lifting gear and structural support | 1 | 5 | 5 |

L: Likelihood S: Severity R: Rating

# Appendix E – Graphs and Site Plans

COMAG Site, West Drayton

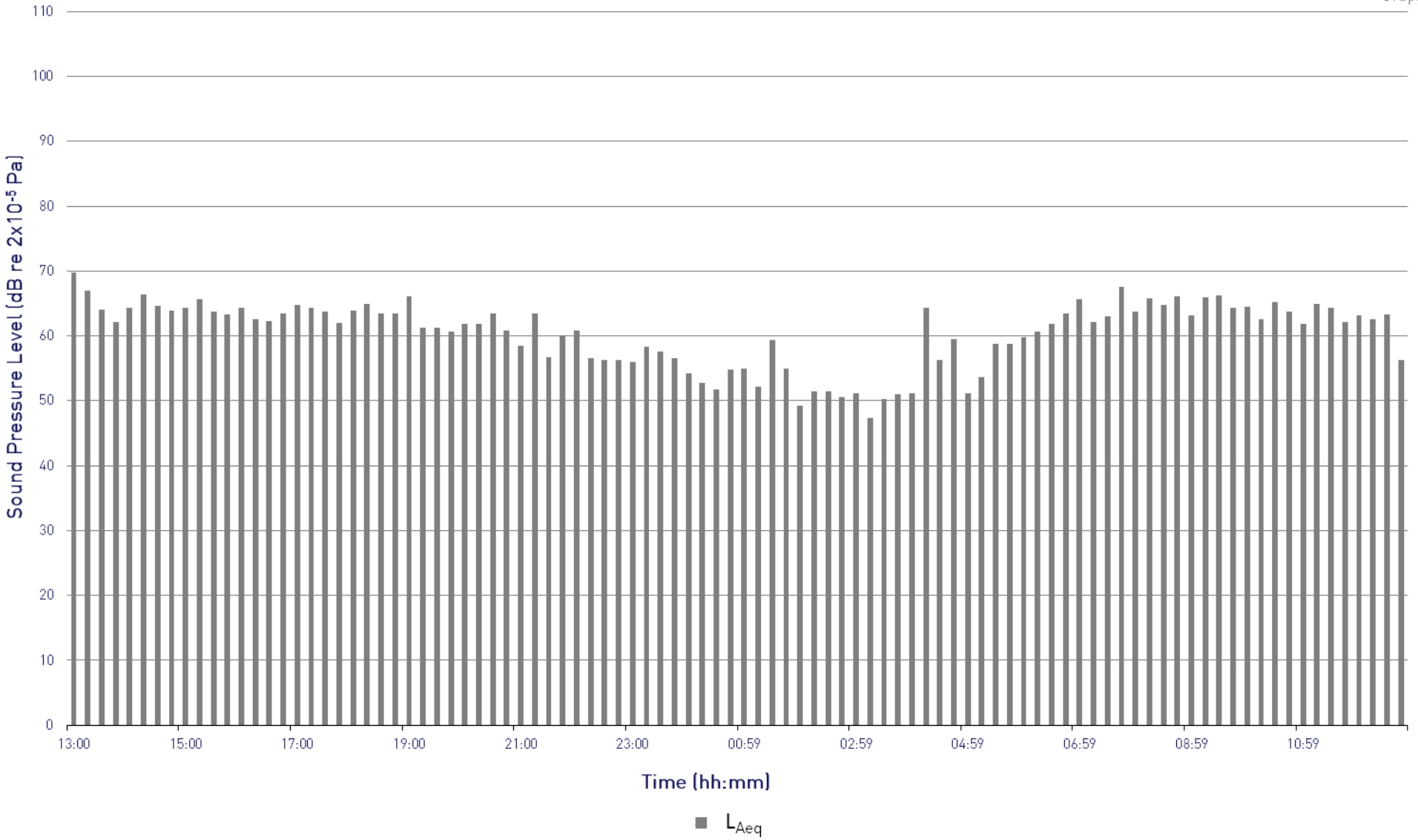
$L_{Aeq}$ Time History

Position 1 - Western Façade

RBA ACOUSTICS

Project: 8788

Graph 1



COMAG Site, West Drayton

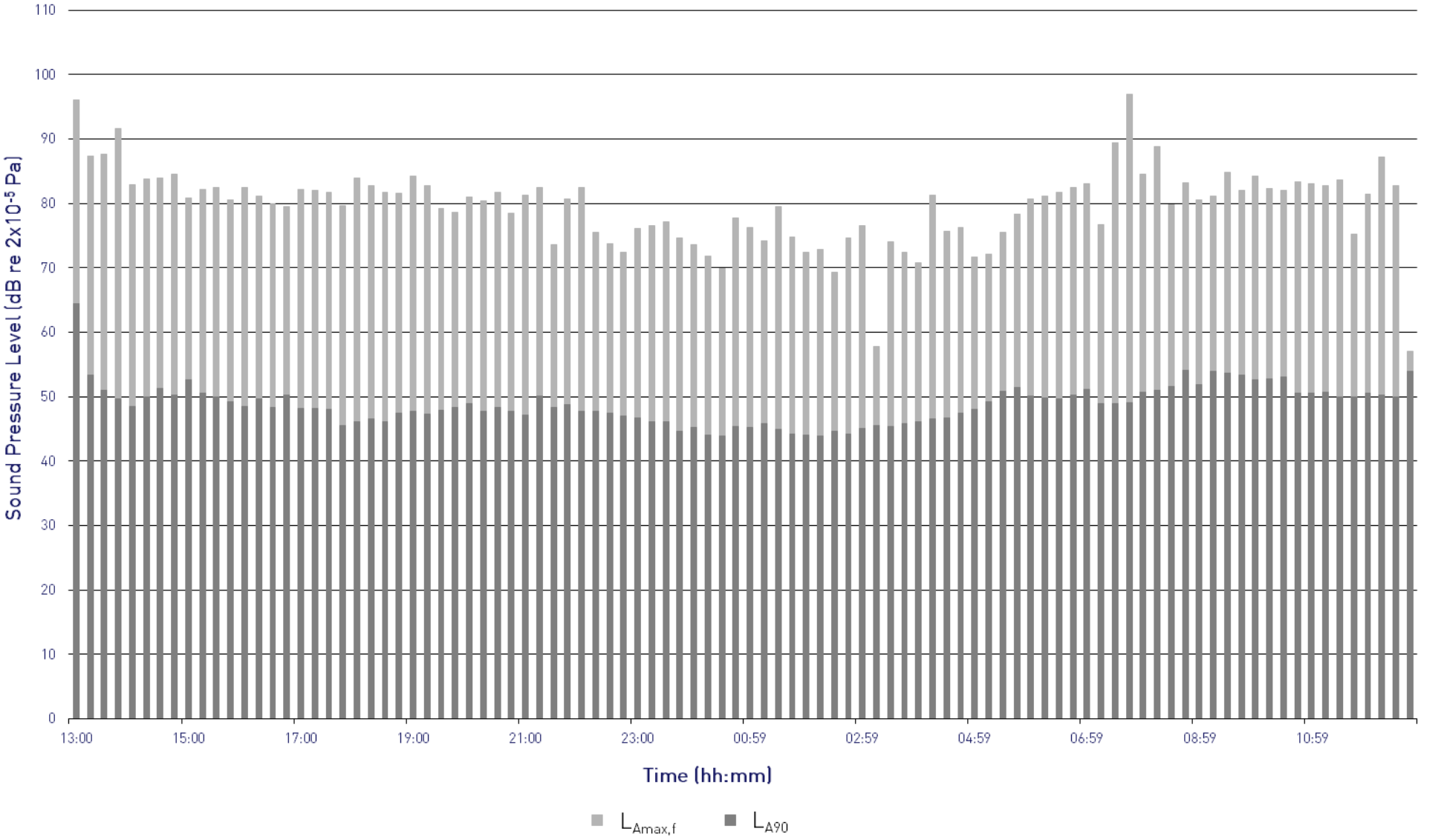
$L_{Amax,f}$ and $L_{A90}$ Time History

Position 1 - Western Façade

RBA ACOUSTICS

Project: 8788

Graph 2



COMAG Site, West Drayton

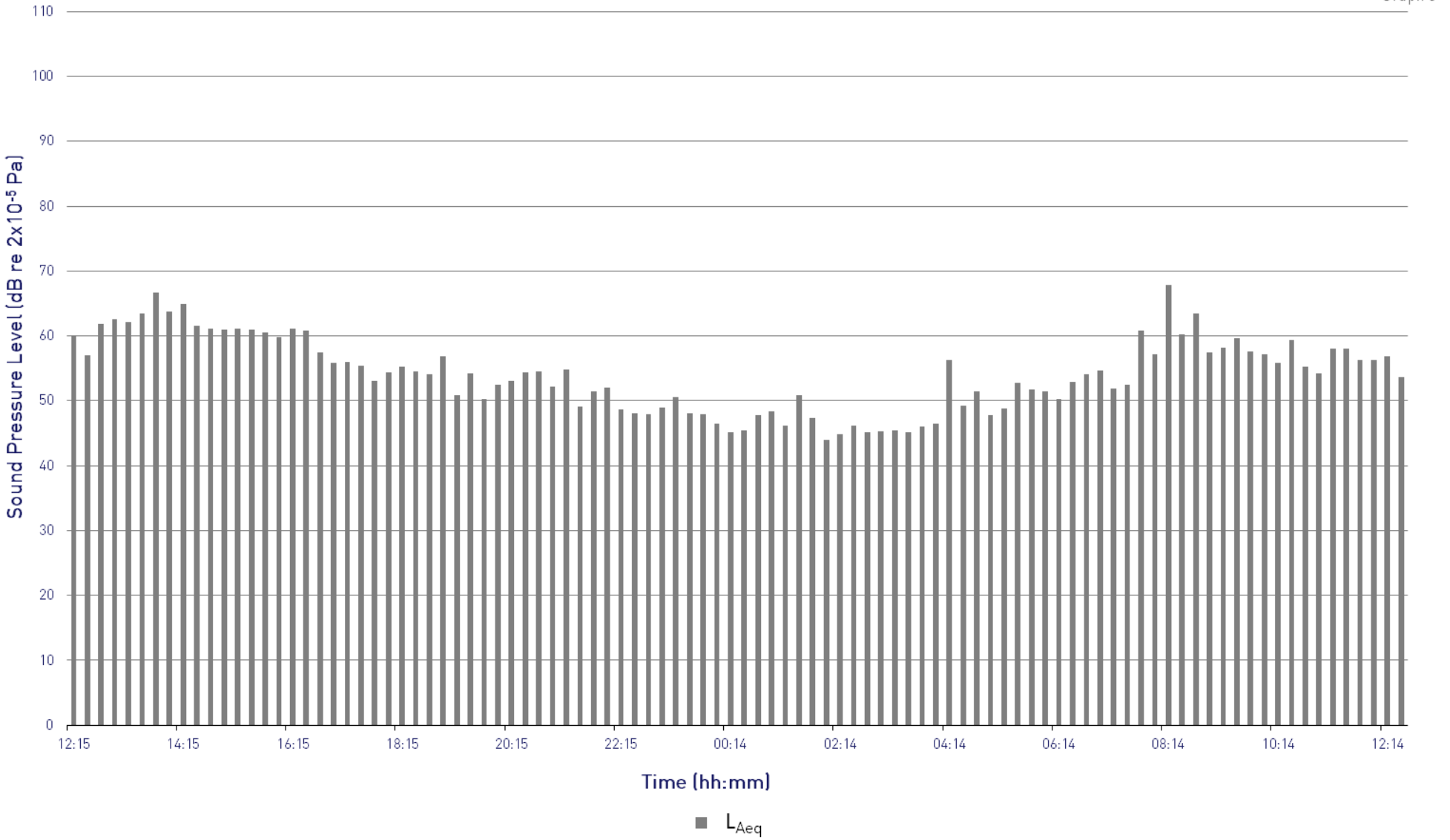
$L_{Aeq}$ Time History

Position 2 - Nothern Edge of 2nd Floor Roof

RBA ACOUSTICS

Project: 8788

Graph 3



COMAG Site, West Drayton

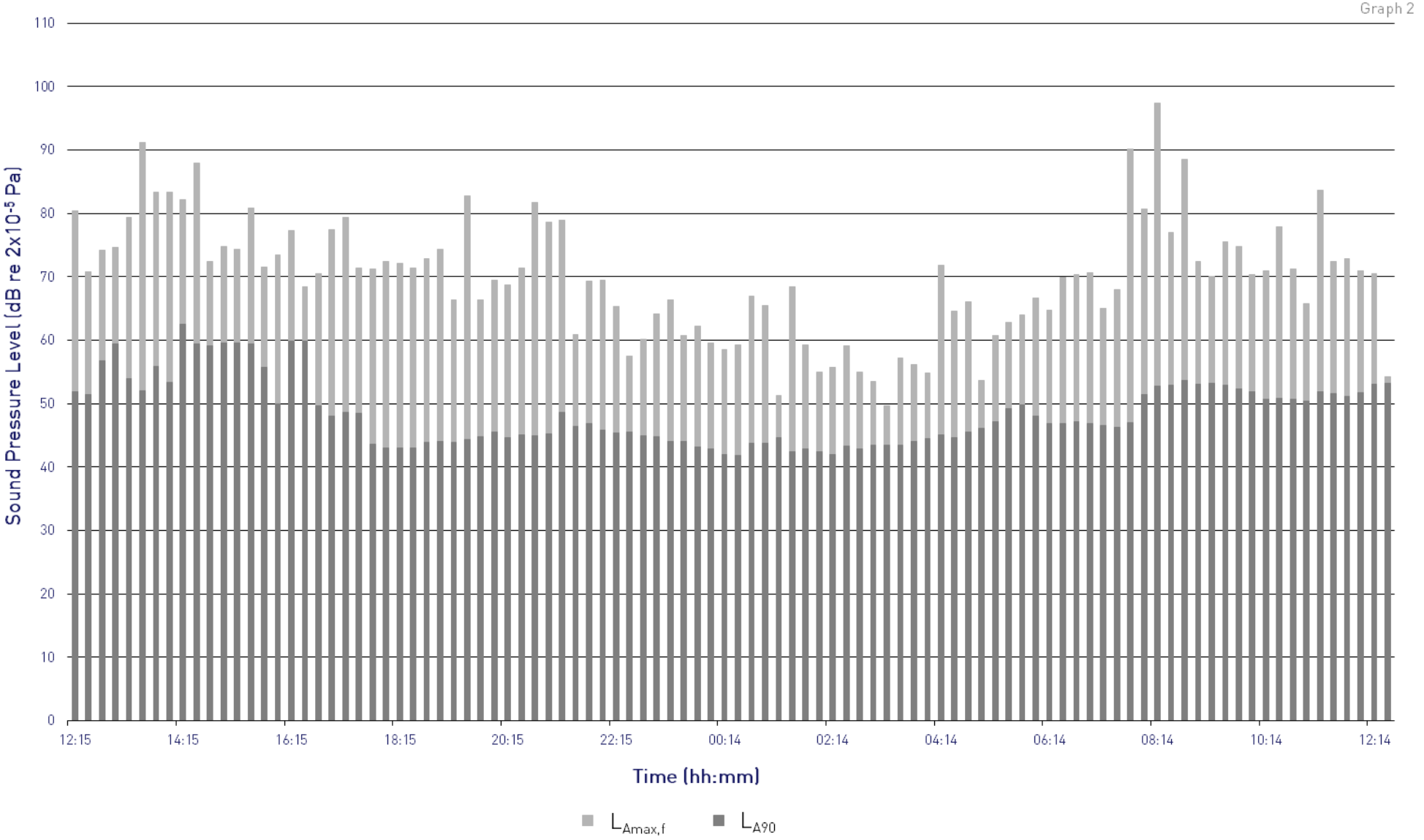
$L_{Amax,f}$ and $L_{A90}$ Time History

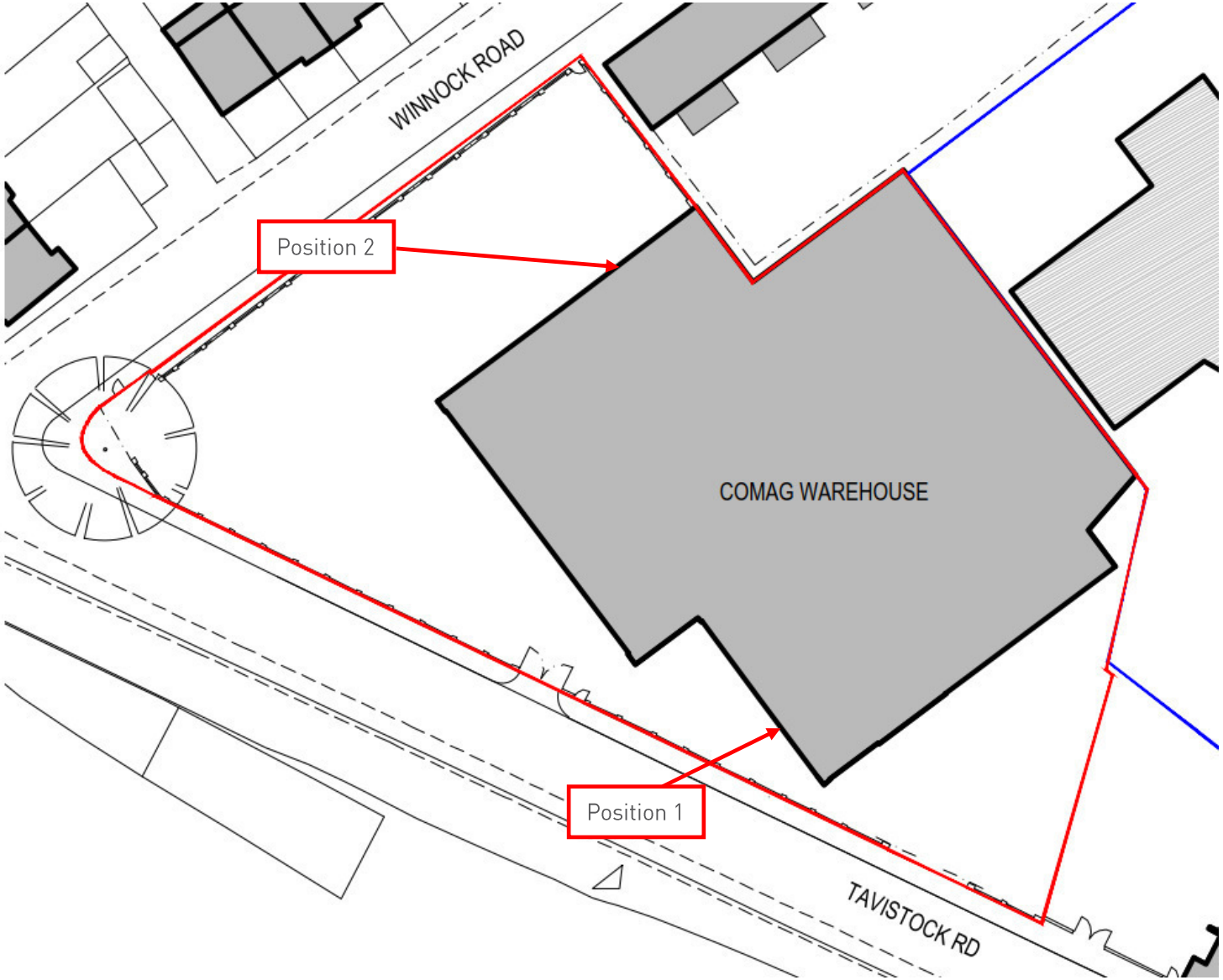
Position 2 - Nothern Edge of 2nd Floor Roof

RBA ACOUSTICS

Project: 8788

Graph 2






Comag Site, West Drayton, London
Site Plan
Project 8788

Figure 1
4 September 2018
Not to Scale

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Comag Site, West Drayton, London
Glazing Zoning Plan
Project 8788

Figure 2
4 September 2018
Not to Scale

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Comag Site, West Drayton, London
Photograph of Measurement Position 1
Project 8788

Photo 1
4 September 2018
Not to Scale

RBA ACOUSTICS




Comag Site, West Drayton, London
Photograph of Measurement Position 2
Project 8788

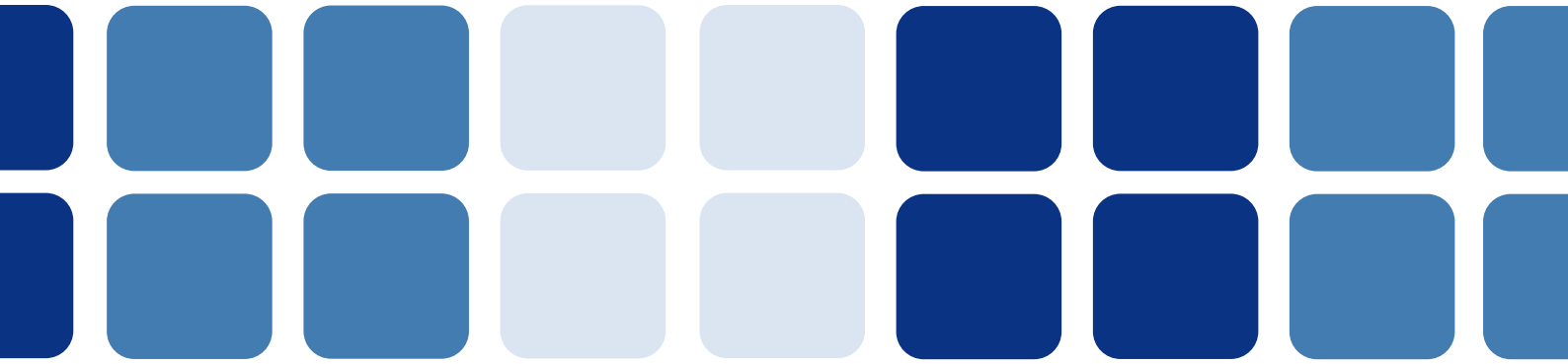
Photo 2
4 September 2018
Not to Scale

RBA ACOUSTICS

RBA ACOUSTICS
W. www.rba-acoustics.co.uk
E. info@rba-acoustics.co.uk

**London:**
44 Borough Road
London SE1 0AJ
T. +44 (0) 20 7620 1950

**Manchester:**
Lowry House, 17 Marble Street
Manchester M2 3AW
T. +44 (0) 16 1661 4504



RBA Acoustic Limited • Registered Office: Priory House Pilgrims Court Sydenham Road Guildford GU1 3RX • Registered in England No. 4480894

# Appendix F

# OVERHEATING ASSESSMENT

PATRICK PARSONS
Built environment | Engineering | Consultancy

# Overheating Assessment

COMAG
West Drayton

for

Redrow

L17035

August 2018



# Overheating Assessment

# Comag, West Drayton

# for

# Redrow

| Revision | Date of issue | Comments | Prepared By | Checked By |
|---|---|---|---|---|
| P1 | 01/08/18 | For discussion | LC/AW | EB |
| P2 | 14/08/18 | Report updated | LC | AW |
| P1 | 01/08/18 | Report updated for planning | AW | EB |
| | | | | |
| | | | | |


**Should you have any queries relating to this document please contact:**

Aled Williams BEng (Hons) LCEA LCC
Senior Mechanical Engineer
Patrick Parsons Limited
5 Saint Johns Court
Vicars Lane
Chester
CH1 1QE

T: +44 (0) 1244 902 000
E: aled.williams@patrickparsons.co.uk

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4.0 Model Information ..... 6
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6.0 Overheating Assessment Results ..... 12
7.0 Conclusion ..... 13

Appendix A Architects approved planning drawings

Appendix B Current DSY1 results

Appendix C Future 2020 DSY1, high emissions, 50% percentile results

Appendix D Further analysis results

Appendix E Openable windows analysis

## 1.0 Executive Summary

This report details the overheating assessment carried out in accordance with CIBSE Guide A: Environmental Design, CIBSE TM52 The limits of thermal comfort: avoiding overheating in European buildings and TM59 Design methodology for the assessment of overheating risk in homes. Based on the assumptions contained within the report with regard to lighting, occupancy, equipment, building operation, construction thermal properties, weather data and windows openings; mechanical cooling is required in all apartments to satisfy the criteria for assessing overheating in TM52 and TM59 should the windows at the development be closed. In accordance with the August 2017 Acoustics report carried out by WSP and submitted for planning, the windows have been modelled closed in the overheating analysis; the mechanical ventilation (MVHR) is on in the assessment.

The weather files used for the simulations are the current Design Summer Year (DSY) for London Heathrow; this has summer and winter design temperatures of 31.4° and -2.8° respectively. The model must also pass based on the Future 2020 DSY1, high emissions, 50% percentile scenario file.

The results from the thermal model demonstrate that the maximum allowable temperature of 26°C, as defined in TM59, is exceeded in all bedrooms during when the time period of 24 hours between May and September is analysed with windows closed. Should the windows be openable within bedrooms between restricted hours of 07:00 – 23:00 CIBSE TM52 satisfied.

The results from the thermal model demonstrate that the maximum allowable temperature of 26°C is exceeded in all living/kitchen areas during the occupied period (13 hours per day) between May and September is analysed with windows closed. Should the windows be openable within kitchen/living rooms comply with CIBSE TM52. Should the windows be openable within kitchen/living areas the rooms between restricted hours of 07:00 – 23:00 CIBSE TM52 satisfied.

Communal corridors have also been assessed; although some of these overheat, CIBSE TM59 states that whilst there is no mandatory target, if an operative temperature of 28°C is exceeded for more than 3% of the annual hours, these should be flagged as a significant risk within the report; it is proposed that these corridors will be mechanically ventilated.

# 2.0 Introduction

## 2.1 Background

Patrick Parsons Ltd has been appointed by Redrow to carry out the overheating assessment for the Comag development at West Drayton.

## 2.2 Aims and Objectives

The London Plan 2016 states that major development proposals should demonstrate how the design, materials, construction and operation of a development would minimise overheating and also meet its cooling needs. New developments in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

The aim of this analysis is to investigate whether the building would meet the performance standards within the internal environments with regards to summertime temperatures and the ventilation set out in CIBSE TM52 – The limits of thermal comfort: avoiding overheating in European buildings, CIBSE TM59 – Design methodology for the assessment of overheating risk in homes and CIBSE Guide A – Environmental Design. The report describes the different performance standards, then addresses how the modelling was carried out and if the building meets the performance standard.

## 2.3 Modelling

The model was constructed in IES Virtual Environments VE 2017 Version 2017.3.0.0. Analysis of the occupied spaces in a building model has been assessed in VistaPro using the weather and room variables. The assessment undertaken in preparing this report is based on the information from the design team and assumptions as stated within the report.

CIBSE TM59 states that developments should refer to the latest CIBSE design summer year (DSY) files and be required to pass using the DSY1 file most appropriate to the site location, for the 2020s, high emissions, 50% percentile scenario. A minimum requirement for passing the overheating checks is to comply with the current DSY file, with the use of additional weather files recommended to explore performance where there is particular concern.

# 3.0 Assessment Criteria

## 3.1 Introduction

The assessment of overheating is driven by the following documents:

## 3.2 London Plan (Policy 5.9)

Policy 5.9 of the London Plan 2016 requires development proposals to reduce the impact of the urban heat island effect in London. It also encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to impacts of climate change and the urban heat island effect on an area wide basis.

- Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:
- Minimise internal heat generation through energy efficient design
- Reduce the amount of heat entering the building in summer through orientation, shading albedo, fenestration, insulation and green roofs and walls
- Manage the heat within the building through exposed internal thermal mass and high ceilings
- Passive ventilation
- Mechanical ventilation
- Active cooling systems

Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New developments in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible.

Although the London Plan addresses the avoidance of overheating within buildings, it does not stipulate any document that must be followed; to assess overheating in the apartments and corridors CIBSE Guide A, CIBSE TM52 and CIBSE TM59 have been used.

## 3.3 Planning Requirement 12 – Protection from Ingress of Polluted Air

Planning requirement 12 states the following;

*Prior to commencement (other than demolition) a scheme designed to minimise the ingress of pollutes air shall be submitted for approval in writing by the Local planning Authority. The design must take into account climate change pollutants. Any suitable ventilation systems will need to address the following:*

- *Take air from a clean location or treat the air and remove pollutants;*
- *Be designed to minimise energy usage;*
- *Be sufficient to prevent summer overheating*
- *Have robust arrangements for maintenance.*
- *Minimise internal heat generation through energy efficient design*

*Thereafter and prior to occupation, the scheme shall be completed in strict accordance with the approved details and thereafter maintained for the life of the development.*

Summer overheating is assessed in line with CIBSE Guide A, CIBSE TM52 – The limits of thermal comfort: avoiding overheating in European buildings and CIBSE TM59 – Design methodology for the assessment of overheating risk in homes.

## 3.4 Requirements of CIBSE Guide A

Dwellings are required to comply with the environmental performance criteria set out in CIBSE Guide A 2015 – Environmental Design. The following section describes these requirements.

It is acknowledged that as an adaptive approach to comfort, CIBSE Guide A 2015 considers the way in which acceptable indoor conditions are related to external temperatures. For dwellings, the overheating criteria are stipulated in CIBSE Guide A 2015 as follows;

- It is desirable that bedroom temperatures at night should not exceed 26 °C unless there is some means to create air movement in the space, e.g. ceiling fans. It is stated that temperatures much above 24°C can cause thermal discomfort and affect quality of sleep.
- All occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied period.

## 3.5 Requirements of CIBSE TM52 – The limits of thermal comfort: avoiding overheating in European buildings

CIBSE TM52 2013 states the criteria based on an adaptive approach to thermal comfort; this adaptive approach to thermal comfort shows that the temperature at which the majority of people are comfortable 'tracks' the mean indoor temperature because of the correlation between indoor and outdoor temperature in free-running buildings. This means that comfort temperature also varies with outdoor temperature in buildings in free-running mode.

The following criteria are used to provide an assessment of overheating, a room or building is classed as at risk of overheating if it fails any two of the three criteria;

- 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 1K or more during the occupied hours of a typical non-heating season (1 May to 30 September)
- 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.
- The third criterion sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

The criteria stipulated by CIBSE TM52 only applies to habitable rooms (e.g. living areas, kitchens and bedrooms). The criteria are only applicable to units which have unrestricted windows openings; this is not the case for the apartments in the Phase 2 development due to acoustic concerns.

## 3.6 Requirements of CIBSE TM59 – Design methodology for the assessment of overheating risk in homes

CIBSE TM59 2017 outlines a standardised approach to predicting overheating risk for residential building designs using dynamic thermal analysis.

The methodology will;

- Allow different designs to be compared with a common approach, based on reasonable assumptions
- Support design decisions that improve comfort without cooling
- Provide consistency across the industry as all consultants will be using the same methodology for overheating risk prediction

This methodology will not;

- Guarantee that people will always be comfortable in compliant spaces, however they act
- Take into account unusual use

As identified in the WSP August 2017 Acoustics report it is stated that due to acoustic concerns, the apartments shall be restricted in terms of window openings. Under these conditions, the following compliance criteria are assessed:

- The CIBSE fixed temperature test – all occupied rooms should not exceed an operative temperature of 26°C for more than 3% of the annual occupied hours
- Whilst there is no mandatory target for corridors to meet, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours, then this should be identified as a significant risk within the report.

# 4.0 Model Information

## 4.1 Building Type & Data

### 4.1.1 Location Data

| | |
|---|---|
| Building type: | Residential |
| Infiltration: | 0.25 Air changes per hour |
| Weather File Location: | London Heathrow DSY1, current |
| | London Heathrow DSY1, 2020 high emissions, 50% percentile |

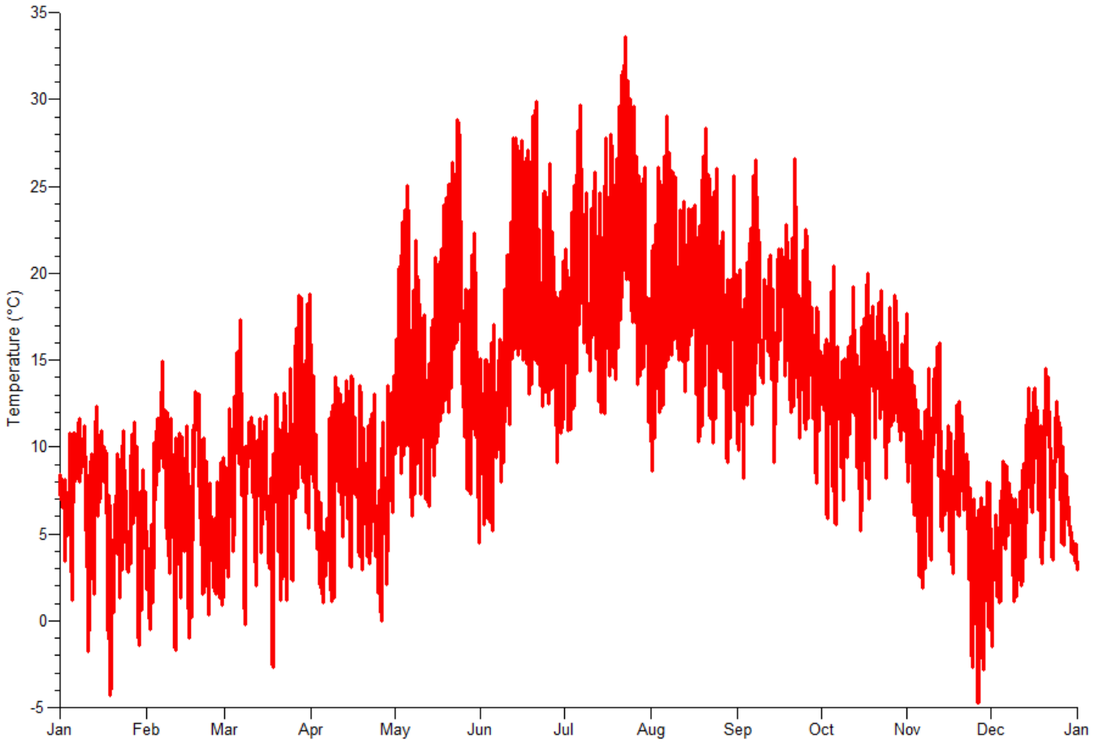



Figure 4.1 Graph of external dry bulb temperature for the London Heathrow DSY1, current weather file

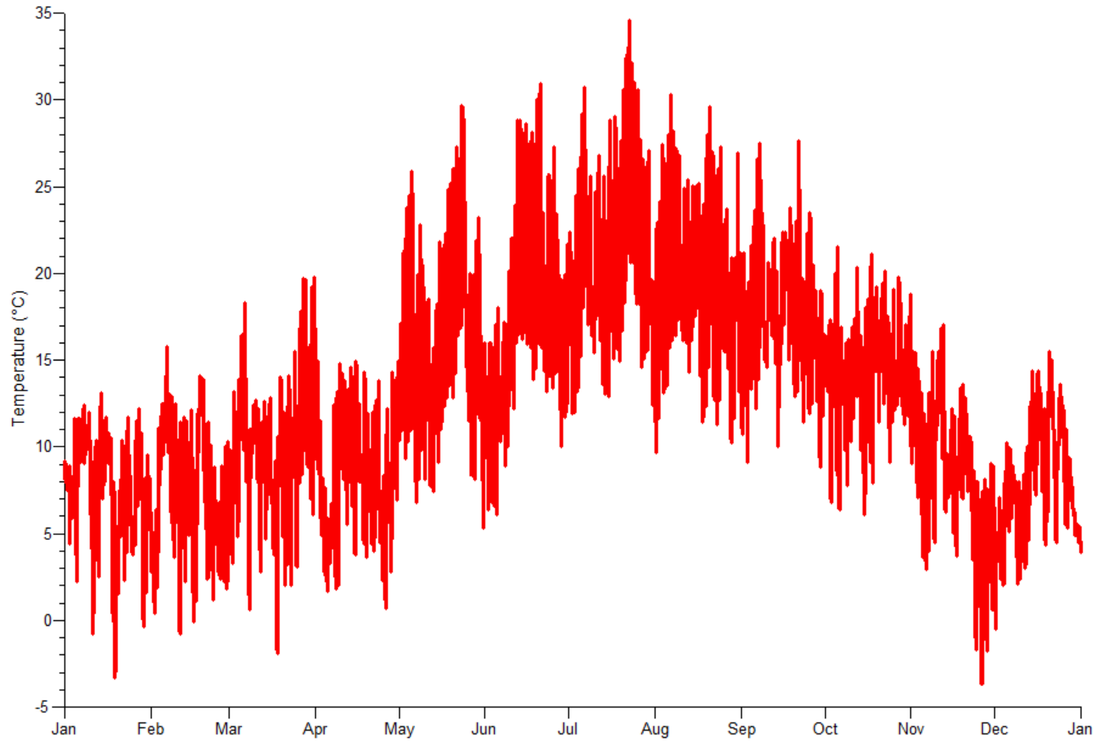



Figure 4.2 Graph of external dry bulb temperature for the London Heathrow DSY1, 2020 high emissions, 50% percentile

### 4.1.2 Building Geometry

The building has been modelled using the layout, elevations and section drawings provided by Sadler Brown Architects; see Appendix A.

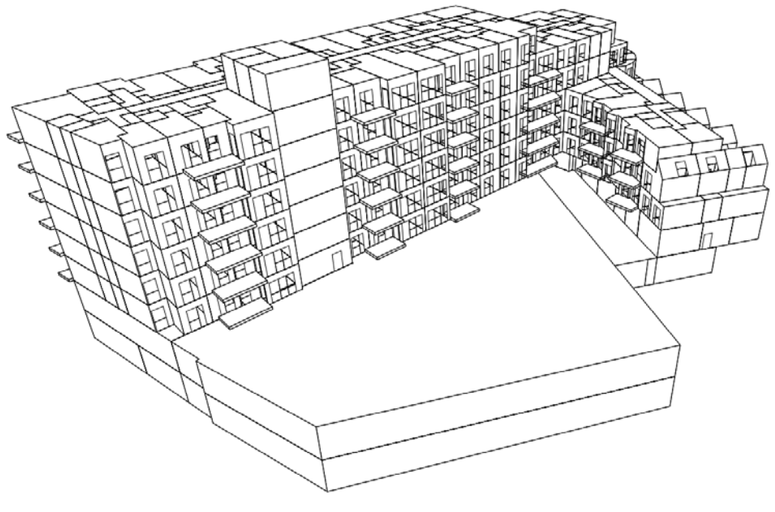


Figure 4.3 ‘Comag Dynamic Thermal Model’ isometric

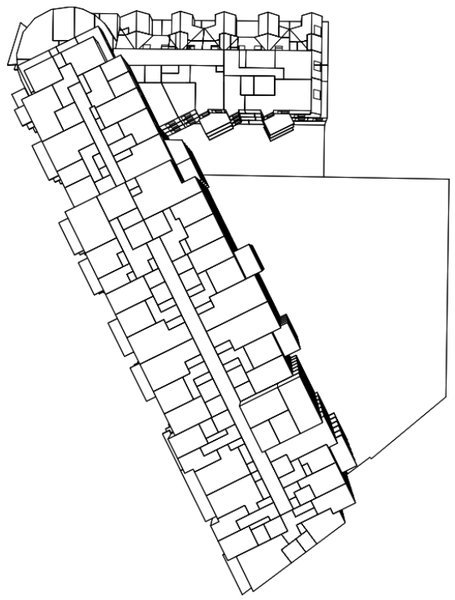


Figure 4.4 ‘Comag Dynamic Thermal Model’ plan view



Figure 4.5 ‘Comag Dynamic Thermal Model’ north elevation



Figure 4.6 ‘Comag Dynamic Thermal Model’ east elevation

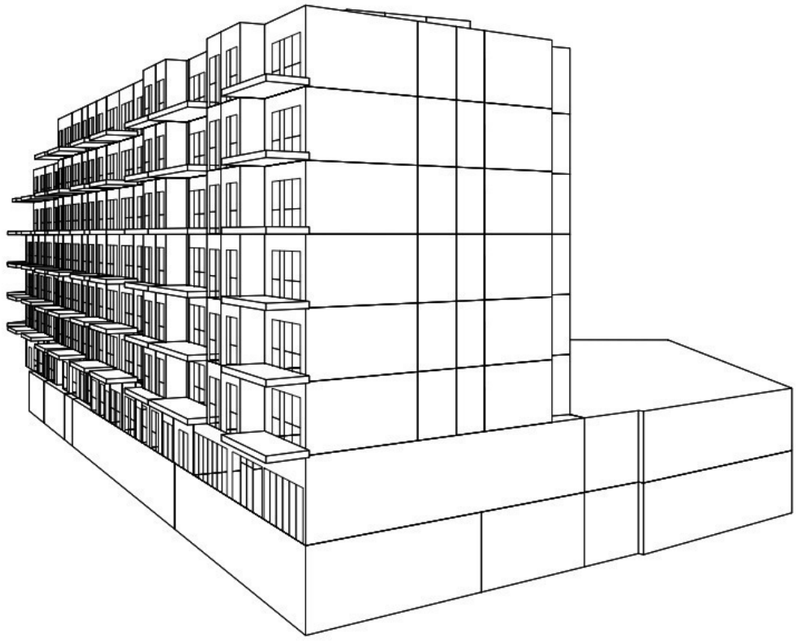


Figure 4.7 ‘Comag Dynamic Thermal Model’ south elevation



Figure 4.8 ‘Comag Dynamic Thermal Model’ west elevation

### 4.1.3 Construction Element Data

The following U-values have been used in the model

Table 4.2 Construction Element

| Construction Element | Thermal Admittance (W/m²K) | Source/Requirement |
|---|---|---|
| External wall | 0.16 | WSP Overheating Assessment January 2018 |
| Internal partition | 1.15 | WSP Overheating Assessment January 2018 |
| Floor | 0.1 | WSP Overheating Assessment January 2018 |
| Roof | 0.1 | WSP Overheating Assessment January 2018 |
| Doors | 2.2 | WSP Overheating Assessment January 2018 |

Table 4.3 Glazing Element Table

| Construction Element | Thermal Transmittance (U-value) (W/m²K) | Solar Transmittance (G-value) | Light Transmittance | Source/Requirement |
|---|---|---|---|---|
| External glazing | 1.0 | 0.35 | 0.71 | WSP Overheating Assessment January 2018 |
| Rooflights | 1.0 | 0.35 | 0.6 | WSP Overheating Assessment January 2018 |
| Application:<br>- Window exposure type: Semi exposed wall<br>- Internal shading device: light-coloured venetian blind – night time resistance 0.05 m²K/W, shading coefficient 0.61 and short-wave radiant fraction 0.3 (BRE data for typical internal blind) | | | | |

## 4.2 Occupancy, Lighting and Equipment profiles

Profiles were set up in the model to govern when occupancy, lighting and equipment heat gains occur throughout the day. These were as follows;

### 4.2.1 Occupancy Profile

The occupancy profiles set in the model are based on the recommendations as outlined in TM59:2017. A value of 75W sensible and 55W latent has been used within the apartments. Profiles are outlined in Table 4.5.

### 4.2.2 Lighting Profile

The lighting is based on a load of 2W/m²; value used for an energy efficient new-build home. It is assumed that good daylighting levels are available. For communal corridors, a value of zero has been used due to PIR sensors being present. The operating profiles for the lighting in the apartments are based on the following variation:

- 0% Load (0.00 - 18.00 & 23.00 – 24.00)
- 100% Load (18.00 – 23.00)

### 4.2.3 Equipment Profile

The equipment operating profiles are stated in Table 4.5. The overheating assessment also takes into account the distribution gains on the communal side of the Heat Interface Unit (HIU). Heat losses per metre of pipework are provided by the Domestic Building Services Compliance Guide 2013.

Table 4.4 Heat losses from pipework

| Room reference | Heat loss from pipe (W) |
|---|---|
| -1 A Circulation | 141.2 |
| 0 A Circulation | 169.4 |
| 1 A Circulation | 55.3 |
| 1 A Circulation | 494.2 |
| 2 A Circulation | 635.4 |
| 2 A Circulation | 494.2 |
| 3 A Circulation | 494.2 |
| 3 A Circulation | 494.2 |
| 4 A Circulation | 211.8 |
| 4 A Circulation | 494.2 |
| 5 A Circulation | 211.8 |
| 5 A Circulation | 494.2 |
| 6 A Circulation | 564.8 |

A pipework heat loss of 80W per room has been applied to the apartments, based on 10m of pipe modelled as 8 W/m heat loss, as per CIBSE TM59.

Table 4.5 Occupancy and equipment gain descriptions as stated in CIBSE TM59

| Unit/Room Type | Occupancy | Equipment Load |
|---|---|---|
| 1-bedroom apartment: living/kitchen | 1 person from 9am to 10pm; room is unoccupied for the rest of the day | Peak load of 450W from 6pm to 8pm<br>200W from 8pm to 10pm<br>110W from 9am to 6pm and from 10pm to 12pm<br>Base load of 85W for the rest of the day |
| 2-bedroom apartment: living/kitchen | 2 people from 9am to 10pm; room is unoccupied for the rest of the day | Peak load of 450W from 6pm to 8pm<br>200W from 8pm to 10pm<br>110W from 9am to 6pm and from 10pm to 12pm<br>Base load of 85W for the rest of the day |
| 3-bedroom apartment: living/kitchen | 3 people from 9am to 10pm; room is unoccupied for the rest of the day | Peak load of 450W from 6pm to 8pm<br>200W from 8pm to 10pm<br>110W from 9am to 6pm and from 10pm to 12pm<br>Base load of 85W for the rest of the day |
| Double/twin bedroom (inc. single room able to accommodate a double bed | 2 people at 70% gains from 11pm to 8am<br>2 people at full gains from 8am to 9am and 10pm to 11pm<br>1 person at full gains in the bedroom from 9am to 10pm | Peak load of 80W from 8am to 11pm<br>Base load of 10W during the sleeping hours |
| Communal corridor | Assumed to be zero | Pipework heat loss only; refer to Table 4.4 |

# 5.0 Mechanical Services

## 5.1 Introduction

The proposed mechanical services for the apartments and communal corridors are described below.

## 5.2 Ventilation

### 5.2.1 Natural Ventilation

All apartments in the Comag Phase 2 building have been assumed, in the overheating assessment to have restricted window openings i.e. windows to be closed in line with the WSP Acoustics Report August 2017.

### 5.2.2 Mechanical Ventilation

Mechanical ventilation to each apartment is to be provided via a heat recovery unit. Building Regulations Approved Document F stipulates the continuous ventilation rates that this type of apartment has to provide. There are 3 requirements that have to be satisfied.

Table 5.1 Requirement 1 – extract ventilation requirements for the kitchen, utility and bathroom

| | Extract ventilation rate |
|---|---|
| Kitchen | 13 l/s |
| Utility Room | 8 l/s |
| Bathroom | 8 l/s |

Table 5.2 Requirement 2 – minimum supply rate based on number of bedrooms per unit

| | Whole dwelling rate |
|---|---|
| 1B2P | 13 l/s |
| 2B4P | 21 l/s |
| 3B5P | 25 l/s |
| 3B6P | 29 l/s |

Requirement 3 – the minimum ventilation rate should not be less than 0.3 l/s per m² of internal floor area.

Communal corridors will be provided with an air change rate of 4ACH.

MVHR units shall include a summer boost facility to prevent overheating. Should the room temperature exceed 21°C the MVHR boost facility shall be enabled providing an additional 17l/s of supply air to the kitchen and bedrooms.

The building has also been modelled to include openable windows and no mechanical ventilation to determine how sensitive the building is to window openings. The following opening parameters have been set in the window opening profile:

- Internal temperature must be greater than the external temperature
- External temperature must be greater than 16°C

## 5.3 Heating

Heating to the apartments shall be provided by a heat interface unit located in the utility cupboard of each apartment. The apartments in Building A and Building B shall be heated via radiators and underfloor heating respectively. The basement energy centre shall house new high efficiency condensing gas boilers and a CHP; from the energy centre the LTHW system shall consist of a constant temperature circuit serving the heat interface units in each apartment.

## 5.4 Domestic Hot Water

The domestic hot water to the apartments shall be provided by a heat interface unit located in the utility cupboard of each apartment. The Plumbing Engineering Services Design Guide provides values for the total daily hot water demand per person for a 1-bedroom, 2-bedroom and 3-bedroom apartment of 115 litres, 75 litres and 55 litres respectively. Figure 5.1 shows the applied operation profile for the hot water usage.

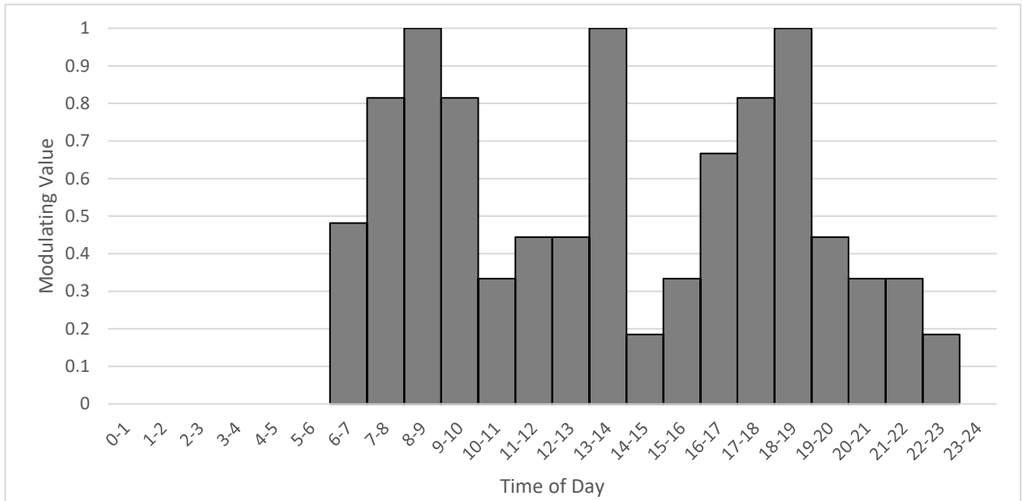



Figure 5.1 Domestic hot water operation profile

Peak hot water demand per person for the 1-bedroom, 2-bedroom and 3-bedroom apartments are 10.93 litres, 7.13 litres and 5.23 litres respectively.

# 6.0 Overheating Assessment Results

## 6.1 Assessment Software

The dynamic thermal model was created using CIBSE AM11 accredited IES Apache simulation software version 2017.3.0.0.

## 6.2 Simulation

The assessment includes all apartments as they have all been identified as dwellings at risk of overheating due to the following criteria set out in TM59:

- Large areas of glazing
- On the topmost floor
- Less shading
- Large, sun-facing windows
- Having a single aspect
- Limited opening windows

Further to the assessment of apartments; communal corridors have been assessed for overheating as they contain community heating distribution pipework.

The simulation has been carried out based on the input data as described in section 4 and 5 of this report. The results are described in the following sections.

Further to the current weather file being used to run the simulations; the building has also been run against the London Heathrow DSY1 file for the 2020, high emissions, 50% percentile scenario as required under CIBSE TM59.

The following simulations have been carried out:

- No Cooling, MVHR, Windows Closed, Blinds

For fully detailed modelling results, see Appendix B and Appendix C.

### 6.2.1 Bedroom Temperature

CIBSE Guide A states that bedroom temperatures should not exceed an absolute threshold of 26°C. Initial results, with the current DSY1 weather file for Heathrow Airport and the windows closed, show that the use of MVHR is not sufficient in maintaining the temperatures within the stipulated limits without openable windows. It can be concluded that comfort cooling is required in all bedrooms as temperatures exceed the maximum of 26°C between May and September.

### 6.2.2 Living/Kitchen Temperature

CIBSE Guide A states that bedroom temperatures should not exceed an absolute threshold of 26°C. Initial results, with the current DSY1 weather file for Heathrow Airport and the windows closed, show that the use of MVHR is not sufficient in maintaining the temperatures within the stipulated limits without openable windows. It can be concluded that comfort cooling is required in all bedrooms as temperatures exceed the maximum of 26°C between May and September.

### 6.2.3 Communal Corridor Temperature

The results demonstrate that with the mechanical ventilation rates and pipework heat losses stated in previous sections; the following communal corridors exceed 28°C for more than 3% of annual hours:

- 0 A Circulation
- 4 A Circulation
- 5 A Circulation

Although there is no mandatory target to meet, the above areas have been identified as a significant risk.

## 6.3 Further Analysis

To further interrogate the sensitivity of the model and the design parameters used; the following conditions, which were previously dismissed as they were deemed unacceptable due to planning restrictions and acoustic concerns, have been simulated to demonstrate the use of the London Plan cooling hierarchy.

Table 6.1 Modelling inputs for further overheating analysis

| | Blinds | Windows open | Windows open Restricted times | MVHR | Cooling |
|---|---|---|---|---|---|
| Simulation 1 | ✓ | ✓ | x | ✓ | x |
| Simulation 2 | ✓ | x | ✓ | ✓ | x |
| Simulation 3 | ✓ | x | x | ✓ | ✓ |

For fully detailed modelling results, see Appendix D. Following the analysis, should the windows be openable, both the bedrooms and living/kitchen areas comply with CIBSE TM52.

Should window opening time be restricted between the hours of 07.00 – 23.00, the room meet the TM52 overheating criteria.

- Windows open between 07.00 – 23.00 when the room temperatures exceeds 25°C
- Typical bedroom windows would be opened 550 – 660 hours a year (6.2% - 6.85%)
- Typical Kitchen/ Living rooms would be open around 850 hours and year (9.71%)

# 7.0 Conclusion

## 7.1 Summary

The report details the overheating assessment for the satisfaction of CIBSE Guide A, TM52 and TM59. Based on the assumptions contained within the report with regard to lighting, occupancy, equipment, building operation, construction thermal properties and window openings; mechanical cooling is required in all apartments if the windows are to remain closed as per the WSP acoustic report.

### 7.1.1 Bedroom Temperature Assessment

The results from the thermal model demonstrate that the maximum allowable temperature of 26°C is exceeded in all bedrooms during when the time period of 24 hours between May and September is analysed. Therefore, comfort cooling or openable windows are required in order to ensure the maximum temperature in the bedroom does not exceed 26°C for more than 3% of the annual occupied period.

### 7.1.2 Living/Kitchen Temperature Assessment

The results from the thermal model demonstrate that the maximum allowable temperature of 26°C is exceeded in all living/kitchen areas during the occupied period (13 hours per day) between May and September is analysed. Therefore, comfort cooling or openable windows is required in order to ensure that the maximum temperature does not exceed 26°C for more than 3% of the year.

### 7.1.3 Proposal

The results in sections 6.2.1, 6.2.2 and 6.3 demonstrate the requirement for comfort cooling or natural ventilation via openable windows is required to supplement the MVHR to pass the criteria stipulated in CIBSE Guide A, TM52 and TM59. Subject to further acoustic analysis of the site it is proposed that the site is mechanical ventilation via MVHR with summer bypass and boost facility. In addition to this window shall be openable during high summertime temperatures which is expected to occur between 7 – 10% of the year.

Appendix A

Architects approved planning drawings



3.001.3 PPL DMS

QMS ISO 14001 REGISTERED

QMS ISO 9001 REGISTERED