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Carnell Warren Associates

Caxton House – Overheating Condition

Rev A
11/17/2020

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1. Cover Statement

The attached appendix documents address the following planning condition:

“No flat hereby approved shall be occupied unless and until a scheme of noise mitigation measures has been submitted to and approved by the Local Planning

Authority to meet the recommended standards in respect of external noise source set out in table 4 of BS 8233:2014 and the night time LAmax level recommended in the WHO's Night Noise Guidelines for Europe (2009). Where windows need to remain closed to meet this criteria, whole house ventilation is required to ensure thermal comfort can be managed inside the dwellings during the summer months. Reason: In the interests of the amenity of future occupiers in view of the fact that the site is adjacent to business uses and to comply with policies 15 and 34 of the Adur Local Plan”

Two reports/studies are attached in the appendix of this document, firstly an acoustic survey, and secondly an thermal comfort analysis

The condition outlined above has been mitigated in the following ways

- Improved building fabric
- Provision of solar control glass with a g-value of 0.53 to all façades
- Provision of openable windows and doors to all habitable rooms
- Specification of System 1 extract ventilation (reference thermal comfort report), with additional extract to the bedrooms
- Cold radiation from the thermal mass
- Concrete internal floors
- Medium dense blocks to party walls and corridors
- Medium dense blocks to external walls

As the bedroom are prone to overheating and also due to the requirement for the windows in the bedrooms to be closed at night (see acoustic survey) We have allowed for surface mounted extract units for all bedroom to allow 35l/s (D150TW Specification included in appendix) of air to be circulated with the windows closed.

The thermal comfort report calculates this rate to be sufficient to avoid overheating.

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APPENDIX



Thermal Comfort Analysis

Caxton House, Ham Road, Shoreham-by-Sea BN43 6QD

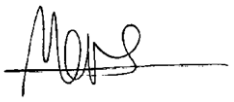
November 2020

E & S Bristol Ltd
info@eandsbristol.co.uk
www.eandsbristol.co.uk

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Document Control

Prepared By:	Marcus Eves	Signed:	
Checked By:	Graham Suttill	Signed:	

Revision History

Revision	Date	Details
-	13/11/2020	First issue

Disclaimer

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This report estimates the thermal behaviour of the Caxton House development using detailed thermal modelling methods. Assumptions are made within this process, which may not occur in practice. Whilst E & S Bristol take great care in assembling simulations which provide an accurate depiction of reality, certain variables are difficult to predict, in particular the weather. As such, the data contained within this report is purely advisory and for the purposes of satisfying CIBSE TM52 and TM59 overheating metric requirements only. Higher or lower temperatures than those simulated may occur if weather conditions or internal behaviours deviate sufficiently from those modelled.

1. Executive Summary

1.1 This report details the results of the thermal comfort analysis completed on the proposed new residential development; Caxton House, Ham Road, Shore-by-Sea The assessment has been carried out in order to demonstrate the building complies with CIBSE TM59: Design methodology for the assessment of overheating risk in homes.

1.2 2no. flats out of the 14no. proposed flats have been used as a representative sample of the dwellings. These apartments have been identified as the dwellings with the highest risk of overheating within the development. The apartments have been selected due to the inclusion of a mix of the following characteristics in each:

a. most southerly orientations;
b. single aspect;
c. topmost floors;
d. high ratio of southerly facing glazing;
e. limited external shading opportunities;
f. limited opening windows

1.3 A full dynamic thermal model was carried out on the 2 apartments. The dynamic thermal model was created using IES Virtual Environment 2019 in accordance with CIBSE AM11: Building Energy and Environmental Modelling. The model has been created using detailed drawings and information supplied by Dunn Architects and Carnell Warren Associates Ltd.

1.4 The modelling has incorporated inputs provided within the TM59 methodology guidance and information provided by the architect which includes:

a. Building construction type and thermal performance;
b. Occupancy, lighting, equipment heat gains and profiles;
c. Infiltration and mechanical ventilation designed strategy;
d. Passive ventilation strategy through openable windows and doors;
e. External air speed assumptions.

1.5 The dwellings have been assessed against Criteria (a) and Criteria (b) of CIBSE TM59.

1.6 The results indicate using a mixture of a mechanical and passive design strategy the building is fully compliant with the requirement of CIBSE TM59 against weather data file Gatwick DSY1 2020s, high emissions, 50% percentile scenario.

1.7 The report concludes overheating risk is considered not significant.

2. Introduction

2.1 A dynamic thermal simulation of the proposed residential development; Caxton House, Shoreham-by-Sea has been undertaken using IES Virtual Environment software. The simulation is based upon data provided by a number of sources including Dunn Architects and Carnell Warren Associates. Suitable interpretations and assumptions have been used where required and detailed in the report.

2.2 The purpose of the analysis is to establish whether the internal temperatures simulated within the model achieve the requirements of the CIBSE thermal comfort metric TM59. The CIBSE TM59 overheating metric is aimed specifically at residential buildings.

2.3 The code adopts Criterion 1 (hours of exceedance) of CIBSE TM52 as a principle definition of overheating. This criterion establishes the amount of time that a room is assessed to be above an established maximum comfort temperature, where the maximum comfort temperature is based upon an equation taking into account the weighted running mean of outdoor air temperatures.

2.4 In addition, the code requires that for bedrooms only, the temperature shall not exceed 26°C for more than 1% of annual hours during the time range 10pm -7am. The CIBSE TM59 code also requires that corridor spaces are tested against an overheating metric, which deems a corridor to overheat should it incur temperatures >28°C for more than 3% of annual hours. However, it is not mandatory under the code for this level of performance to be met, it is simply an advisory.

2.5 As the access corridors are small, they have not been considered in this assessment.

2.6 Any occupied room that fails Criterion 1 and any bedroom which fails the second criteria of the above is potentially at risk of overheating.

2.7 In order to reduce overheating and reliance on air conditioning, the design of the development has followed the Cooling Hierarchy;

1) Minimise internal heat generation through energy efficient design;
2) Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and walls;
3) Manage the heat within the building through exposed internal thermal mass and high ceilings;
4) Passive ventilation;
5) Mechanical ventilation;
6) Active cooling systems.

3. Overheating Background

3.1 The project team has considered overheating risk at an early stage to ensure that when the end users occupy the building, thermal comfort levels are maximised. Thermal comfort is important within modern buildings. If temperature exceeds 28^{o}C, dissatisfaction can occur for occupants, resulting in poor productivity. For prolonged periods of time, high temperatures can also impact on occupant's health and wellbeing.

3.2 Inhabitants may feel hot, uncomfortable and show lower productivity when temperatures reach between 24-28°C. Indoor temperatures that stay at or over 28°C for long periods of time could cause occupant dissatisfaction. This can be expressed as the occupant experiencing thermal discomfort and, in some cases, thermal stress. Thermal discomfort is where occupants feel uncomfortable as they are too hot. Thermal stress is where the thermal environment will cause potentially harmful medical conditions such as dehydration or heat exhaustion. Vulnerable people, such as the elderly are particularly susceptible to health problems due to overheating.

3.3 Traditional construction within the UK has predominately comprised of heavyweight materials, resulting in a 'high' thermal mass. The level of thermal mass will affect the internal temperature. If too high, elements will absorb heat more readily, and displace the heat within a room. If too low, then elements will not easily absorb heat, resulting in sustained high temperatures in rooms.

3.4 Modern buildings are usually constructed from lightweight materials, are highly insulated and have been built to high standards of air tightness. This results in more heat being retained within the building which cannot be absorbed by the lightweight fabric.

3.5 Buildings also have overheating issues when large glazed façades are designed. South facing façades will receive the highest amount of direct sunlight, and adjoining rooms will therefore be subject to intense solar gains.

3.6 There are also other sources of 'internal gains' that can lead to overheating, and occupant dissatisfaction. Internal gains occur from lighting, people, computers and many other sources typically in the variable building fabric. Internal gains have been modelled with the dynamic simulation using TM59 benchmark figures to account for heat gains.

4. CIBSE TM59 Overheating Criteria

4.1 Overheating in dwellings is assessed using CIBSE TM59:2017, Design methodology for the assessment of overheating risk in homes. The following two criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe.

4.2 This is a standardised approach to predict overheating risk for residential building designs using a dynamic thermal analysis. It provides a baseline which includes specific weather files, defined internal gains and a set of profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk.

4.3 Table 1 below provides a summary of the assessment criteria outlined in CIBSE TM59. For the purposes of this analysis, the building has been assessed against all three criteria.

Scenario	CIBSE TM59 Compliance Requirement's
Predominantly Naturally Ventilated Dwelling	Criteria (a) for living rooms, kitchen and bedrooms: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: Hours of exceedance, which is the number of hours during which the difference between the actual operative temperature and maximum acceptable temperature); Criteria (b) for bedrooms only: to guarantee comfort during sleeping hours the operative temperature in the bedroom from 22:00 to 07:00 shall not exceed 26 °C for more than 1% of annual hours. (Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, therefore 33 or more hours above 26 °C will be recorded as a fail); Note: Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both (a) and (b) above must be passed for all relevant rooms.
Predominantly Mechanically Ventilated Dwelling	CIBSE Guide A Temperature Test: Occupied spaces should not exceed operative temperature of 26°C for more than 3% of annual occupied hours.
Communal Corridors (Where communal heating present)	CIBSE Guide A fixed temperature test: a) Where corridors should not exceed operative temperature of 28°C for total annual hours (262 hours or less)

Table 1: CIBSE TM59 Compliance Requirements

5. Dynamic Simulation Model

5.1 CIBSE has undertaken considerable research on the impact of climate change on the indoor environment and weather data. CIBSE Guide A, Approved Document Part L, Approved Document Part F and the National Calculation Methodology (NCM) Modelling Guide provides data on maximum average temperatures, ventilation rates and overheating criteria.

5.2 DSM building analysis is based on the CIBSE admittance method. This method uses idealised (sinusoidal) weather and thermal response factors (admittance, decrement factor and surface factor) that are based on a 24-hour frequency.

5.3 IESVE v.2019.0.1.0 has been used to carry out a dynamic simulation to analyse any potential overheating risks of the building, which is in accordance with CIBSE AM11: Building Energy and Environmental Modelling.

5.4 The full dynamic simulation is in accordance with CIBSE TM59:2017: Environmental Design that combines the effects of:

- CIBSE Design Summer Year1 (DSY1) weather data, (projected climate change environment)
- Equipment, lighting and people heat gains
- Fresh air supply
- Occupancy and variation
- Building fabric
- Solar heat gains and shading

5.5 CIBSE weather data has been used based on geographical location of the site. CIBSE TM59 requires that simulations be tested using DSY1 2020 High 50th Percentile weather data. CIBSE DSY1 represents a moderately warm summer.

5.6 This simulation has been used the London_GTW_DSY1_2020High50.epw weather file.

6. Building Model

6.1 CIBSE TM59 provides guidance for overheating risk assessment. In line with this methodology a representative sample dwelling of the building has been taken.

6.2 These apartments have been identified as the dwellings with the highest risk of overheating within the development due to the inclusion of a number of the following characteristics: a) southerly orientation; b) single aspect; c) topmost floors; d) high ratio of southerly facing glazing; and e) limited external shading opportunities.

6.3 The sections below include the location, internal layout of the sample dwellings selected, and further explanation why they are the most appropriate units for this study in line with guidance within TM59 methodology. The building only has windows to the east and west orientations, therefore none with full southerly window is shown in the selection.

6.4 2no. dwellings located across the site were selected for the assessment. The assessed areas can be seen in Appendix B.

Unit Reference	Glazing Orientations	Details
Flat 05	South	Single aspect, large area South facing glazing, no shading
Flat 13	South	Predominately single aspect, large area South facing glazing, no shading

Table 2: Sample Dwellings

6.5 Shown below are screenshots of the building geometry from within the IES software. The assessed dwellings and adjacent dwellings are shown in blue. The unassessed adjacent spaces are shown in pink, whilst the green area is the local shading (balconies).

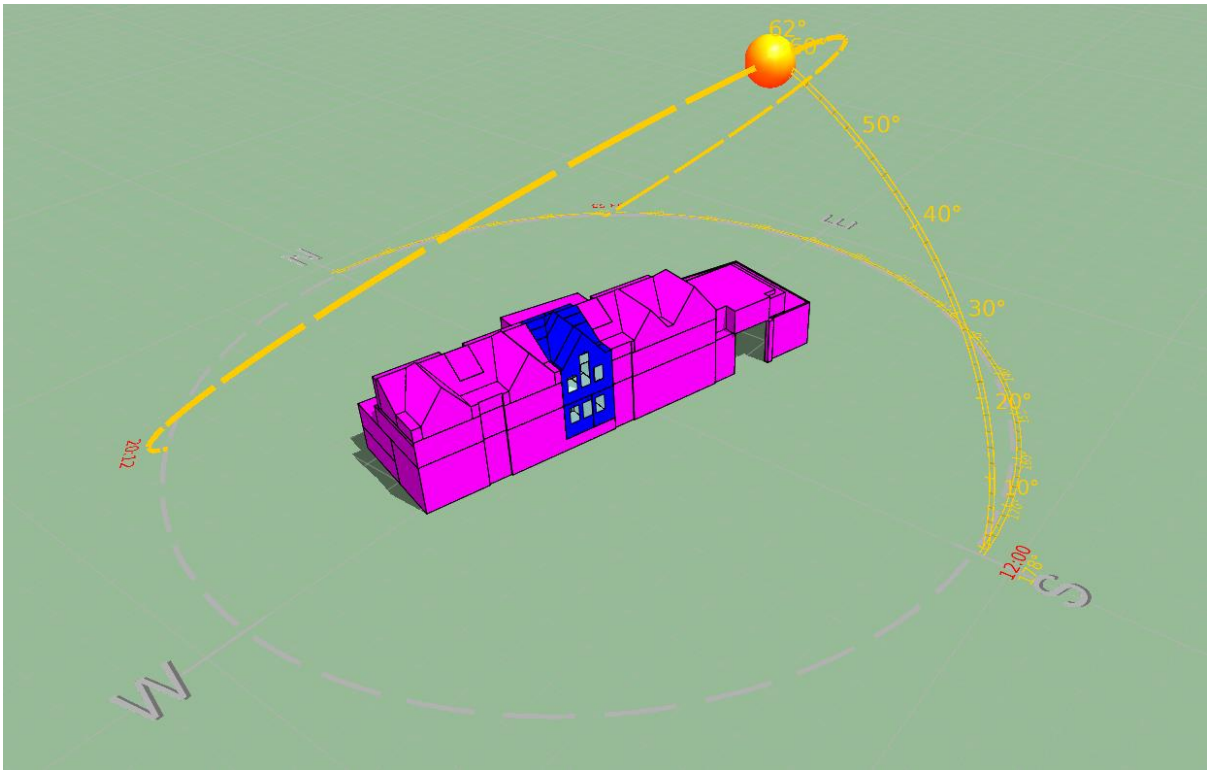


Figure 1: IES Model of Site viewed from South West

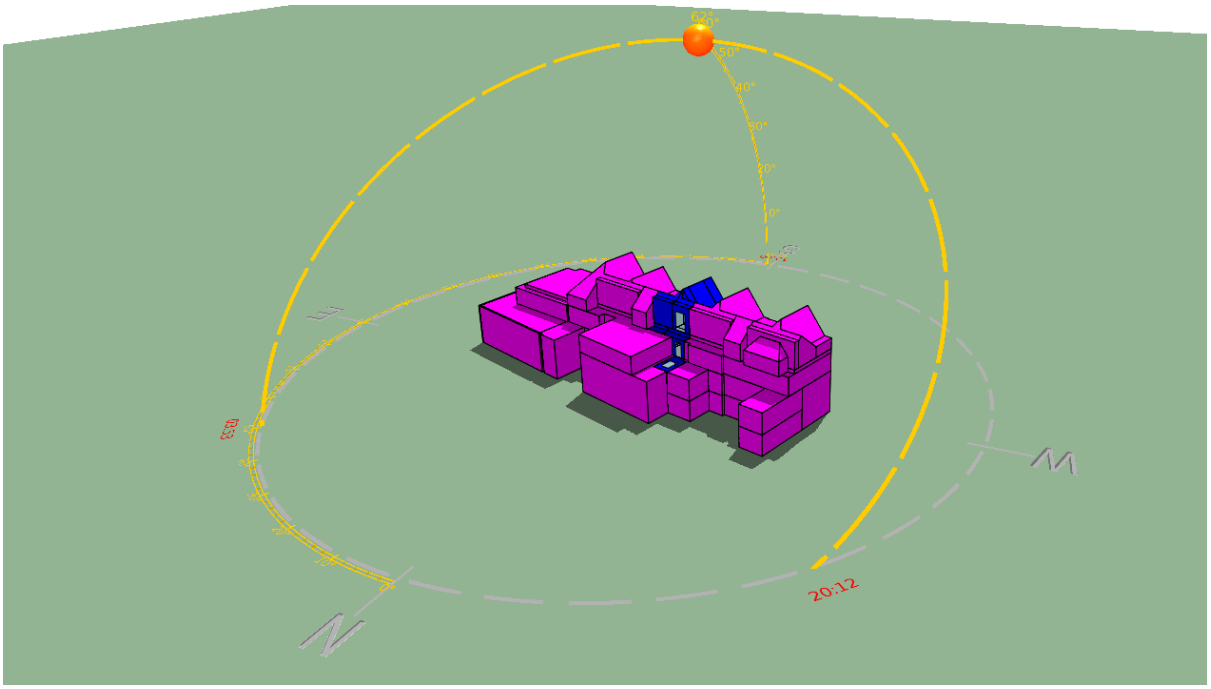


Figure 2: IES Model of Site viewed from North West

7. Model Specification

7.1 Construction Fabric

7.1.1 The following modelling inputs (Table 3 & 4) have been set up in the baseline dynamic thermal simulation, in line with SAP calculation inputs. CIBSE TM59 Guidance has been used for all occupancy rates and internal heat gain assumptions which will contribute to the risk of overheating.

Element	Construction	U-Value ($W/m^2.K$)	Thermal Mass $KJ/(m^2.K)$
Ground Floor	Beam and Block	0.11	160
Intermediate Floors	Concrete Floors	-	12
External Walls - Cavity	Stone/Brick, Block work,125mm cavity with 115mm Kingspan K106, 15mm doat and dab, 15mm Plasterboard	0.16	108
External Walls - Timber	25mm Timber Cladding, batten cavity, 100mm Kooltherm K7 between timbers, 12mm Plywood 62.5mm Kooltherm K118 Insulated Plasterboard, 15mm Gyproc	0.16	18
Wall to Corridor	15mm Gyproc, 15mm dot and dab, 100mm blockwork, 75mm Isover, 100mm blockwork, 15mm dot and dab, 15mm Gyproc,	0.17	17.5
Internal Walls in Flats	Lightweight Timber	-	8.75
Warm Pitch Roof	Breather Membrane, 90mm Kingspan Kooltherm K107 above rafters, 90mm Kingspan Kooltherm K107 between rafters, timber battens, 195mm rafters, 2 x 12.5mm Plasterboard	0.11	18

Table 3: Thermal Envelope U-Values

Glazing	U-Value ($W/m^2.K$)	Frame factor	G-value	LT-value
Windows	1.40	20%	0.53	0.72
Fully Glazed Doors	1.40	20%	0.53	0.72
Rooflights	1.40	20%	0.53	0.72
Doors to flats	1.60	N/A	N/A	N/A

Table 4: Opening Parameters

7.2 Occupancy and Equipment

7.2.1 These are the gains associated with humans in the space. Based on CIBSE Guide A (2015a), a maximum sensible heat gain of 75 W/person and a maximum latent heat gain of 55 W/person are assumed in the living spaces. An allowance of 30% reduced gain during sleeping is based on Addendum G to ANSI/ASHRAE Standard 55-2010, Table 5.2.1.2 'Metabolic rates for typical tasks. The values used are summarised in Table 5 below

Space	Maximum Sensible Gain (W/Person)	Maximum Latent Gain (W/Person)
Occupied Spaces	75	55

Table 5: Occupancy Heat Gains

7.2.2 Table 6 shows the occupancy and equipment levels in each room. The profiles used to describe when the occupants will be present are shown in Appendix A were extracted from TM59 methodology.

Unit/Room Type	Occupancy	Equipment load
Studio	2 People at all times	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
1-Bed Apartment Kitchen / Living / Dining	1 person from 9am to 10pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
2-Bed Apartment Kitchen / Living / Dining	2 people from 9am to 10pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
3-Bed Apartment Kitchen / Living / Dining	3 people from 9am to 10pm; room is unoccupied for the rest of the day	Peak load of 450 W from 6 pm to 8 pm 200 W from 8 pm to 10 pm 110 W from 9 am to 6 pm and from 10 pm to 12 pm Base load of 85 W for the rest of the day
Double Bedroom	2 people at 70% gains from 11pm to 8am; 2 people at full gains from 8am to 9am and from 10pm to 11pm; 1 person at full gain from 9am to 10pm.	Peak load of 80 W from 8 am to 11 pm Base load of 10 W during sleeping hours

Table 6: Occupancy and equipment gain description

7.2.3 The communal spaces have been considered in the model as heated spaces. However no specific heat loss or gains from the space have been accounted for.

7.3 Lighting Gains

7.3.1 Following CIBSE TM59 methodology, an internal lighting gain of 2.0 W/m² from 6pm to 11pm has been assumed to the living / dining / kitchen rooms and bedrooms, as acceptable daylight levels are available to these dwellings.

7.4 Ventilation

7.4.1 The model has been based on all dwellings using the openable windows to achieve adequate ventilation levels to avoid overheating. Due to the proximity to Shoreham by Sea railway station, the bedroom windows are modelled as openable during the day time, however, are modelled as closed during the hours of midnight and 8am.

7.4.2 The windows are considered to be open when the internal dry bulb temperature exceeds 22°C and the room is occupied, in line with TM59 methodology. The openable angle for the top hung casement windows has been input to be a maximum of 10°.

7.4.3 The secure terrace doors are assumed to be fully open during daytime hours when the internal dry bulb temperature exceeds 22°C but closed during the night. The rooflight in the flat roof has also been input as openable.

7.4.4 All internal doors have been included and left open in the model in the daytime but have been assumed to be closed when the occupants are sleeping.

7.4.5 The building will use System 1 Ventilation; Intermittent extract fans and background ventilators. Additional mechanical extract ventilation will be provided to the bedrooms to assist with heat dissipation during the night time, when the windows are closed. The fans will have an extract rate of 35 L/s.

7.4.6 A summary of the window and door opening profile can be found in Appendix C.

7.5 Infiltration

7.5.1 The building has been simulated using an air permeability of $5m^3/hm^2$ at 50Pa. The corresponding infiltration rate for the dwellings has been derived from CIBSE Guide A (2015a) Table 4.24 as outlined in the following Table 7. This infiltration rate is the average, assuming air leakage on each apartment is pressure tested separately.

Built Form	Air Changes per Hour
Apartments (storeys 1–5)	0.35 ACH

Table 7: Infiltration Rates

7.6 Internal Shading

7.6.1 TM59 methodology prescribes that internal blinds can be included for the analysis only if specifically included in the design, provided in the base build and explained within the associated home user guide. In addition, blinds should not be used if they clash with the opening of windows.

7.6.2 No Internal shading has been modelled in the assessment.

8. Results

8.1 The following tables show the results of the thermal modelling study using the design specification and assumptions detailed in this report. The air speed has been set at 0.1m/s in line with CIBSE TM59 requirements. Whilst the occupancy tables show reduced occupancy in line with CIBSE TM59, the results are based on a 24-hour frequency.

8.2 Results Summary

8.2.1 Table 9 below shows a summary of how the assessed living rooms and bedrooms have performed against CIBSE TM59 for each weather scenario.

Design Summer Year 1			
Room name	**Criterion (a) result**	**Criterion (b) result**	**Overall TM59 result**
Flat 05 - Bedroom 1	Pass	Pass	Pass
Flat 05 - Bedroom 2	Pass	Pass	Pass
Flat 05 - Dining	Pass	N/A	Pass
Flat 05 - Living Room	Pass	N/A	Pass
Flat 09 - Bedroom 1	Pass	Pass	Pass
Flat 09 - Bedroom 2	Pass	Pass	Pass
Flat 09 - Living/Kitchen	Pass	N/A	Pass
Flat 09 - Study	Pass	N/A	Pass

Table 8: TM59 Criterion (a) and (b) Results

8.2.2 Table 8 shows that all assessed bedroom and living spaces comply with both Criterion (a) and Criterion (b) of CIBSE TM59 in the 2020 scenario. This demonstrates the building is fully compliant with the CIBSE targets and risk of overheating is considered not significant.

8.3 Criterion (a) Results

8.3.1 Table 9 below shows a summary of how the assessed bedrooms and living rooms have performed against CIBSE Criterion (a) for all 3 weather scenarios. Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1°K from May to September shall not exceed 3% of occupied hours.

Room	Occupied Hours	No. hours ΔT ≥ 1°K	% Occupied hours ΔT ≥ 1°K	Result
Flat 05 - Bedroom 1	3671	17	0.5	Pass
Flat 05 - Bedroom 2	3671	13	0.4	Pass
Flat 05 - Dining	1989	0	0	Pass
Flat 05 - Living Room	1989	18	0.9	Pass
Flat 13 - Bedroom 1	3671	5	0.1	Pass
Flat 13 - Bedroom 2	3671	13	0.4	Pass
Flat 13 - Living/Kitchen	1989	19	1	Pass
Flat 13 - Study	3671	28	0.8	Pass

Table 9: TM59 Criterion (a) Overheating Results

8.3.2 Table 9 demonstrates that for the DSY 1 scenario, all occupied rooms will meet overheating metric.

8.4 Criterion (b) Results

8.4.1 Table 10 below shows a summary of how the assessed bedrooms rooms have performed against CIBSE Criterion (b). Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26^{o}C for more than 1% of annual hours (33 hours is therefore recorded as a fail).

Room Name	Total hours > 26^{o}C	Pass/Fail
Flat 05 - Bedroom 1	17	Pass
Flat 05 - Bedroom 2	18	Pass
Flat 05 - Dining	NA	NA
Flat 05 - Living Room	NA	NA
Flat 13 - Bedroom 1	8	Pass
Flat 13 - Bedroom 2	30	Pass
Flat 13 - Living/Kitchen	NA	NA
Flat 13 - Study	NA	NA

Table 10: TM59 Criterion (b) Overheating Results

8.4.2 Table 10 shows that for the DSY 1 2020 scenarios, the bedrooms are within the overheating targets and do not exceed 26°C for more than 1% of the annual hours overnight (32 hours over the course of a year between the hours of 10pm and 7am). Therefore, nighttime overheating risk is considered not significant.

9. Conclusion

9.1 This report provides a summary of the overheating risk assessment undertaken on a sample of dwellings at Caxton House, Shore-by-Sea.

9.2 The assessment has been undertaken using approved IES software. The model carried out in accordance with CISE AM11 incorporated inputs in line with the TM59 methodology guidance, and also based on information provided by the architects and mechanical and electrical consultants. All inputs and assumptions have been outlined within this report.

9.3 This overheating assessment demonstrates that the development at Caxton House has demonstrated compliance with:

- Methodology as set out in CIBSE TM59 and complies with the overheating criteria

9.4 It is not considered occupiers of building will be vulnerable or of any particular concern, therefore compliance with these more extreme scenarios is not required or sought at this time

9.5 The building design and building services design have maximised all available measures to minimise heat generation within the dwellings, reduce the amount of heat entering the building, and use a passive ventilation strategy to the dwellings in line with the cooling hierarchy.

9.6 The risk of overheating in the building has been minimised to within acceptable levels as the following measures will be implemented upon construction.

- Improved building fabric
- Provision of solar control glass with a g-value of 0.53 to all façades
- Provision of openable windows and doors to all habitable rooms
- Specification of System 1 extract ventilation, with additional extract to the bedrooms
- Cold radiation from the thermal mass
  - Concrete internal floors
  - Medium dense blocks to party walls and corridors
  - Medium dense blocks to external walls

9.7 The building is fully compliant against the mandatory criteria set out in CIBSE TM59. The building will benefit from openable windows to all habitable rooms. However it is assumed due to acoustic issues, the bedroom windows will remain closed during the night time.

9.8 Data set consideration must be made to the variation profiles assumed within the analysis for occupancy, lighting and equipment that is detailed within this report. Changing any of the inputs within the thermal model will impact on overall results.

APPENDIX A

CIBSE TM59 Profiles

Figure 1 Heat gain profile

Number of people	Description	Peak load (W)		Period																						
		Sensible	Latent	00–01	01–02	02–03	03–04	04–05	05–06	06–07	07–08	08–09	09–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	21–22	22–23	23–24
				Hour-ending																							
				1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
1	Single bedroom occupancy	75	55	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.7
2	Double bedroom occupancy	150	110	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.7
2	Studio occupancy	150	110	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1-bed: living/kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
1	1-bed: living occupancy	75	55	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
1	1-bed: kitchen occupancy	75	55	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
2	2-bed: living/kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
2	2-bed: living occupancy	150	110	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
2	2-bed: kitchen occupancy	150	110	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
3	3-bed: living/kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
3	3-bed: living occupancy	225	165	0	0	0	0	0	0	0	0	0	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0	0
3	3-bed: kitchen occupancy	225	165	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0
	Single bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Double bedroom equipment	80		0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.13
	Studio equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living/kitchen equipment	450		0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1	1	0.44	0.44	0.24	0.24
	Living equipment	150		0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	1	1	1	1	0.4	0.4
	Kitchen equipment	300		0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	1	1	0.17	0.17	0.17	0.17
	Lighting profile	2 (W/m2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0

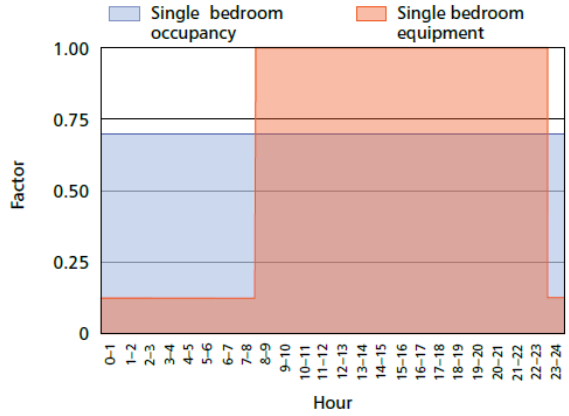


Figure 2 Heat gain profile: single bedroom

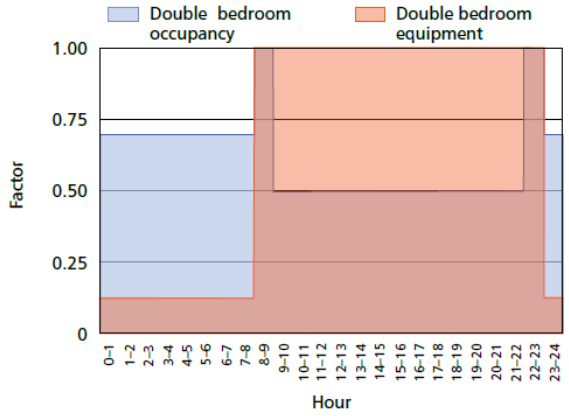


Figure 3 Heat gain profile: double bedroom

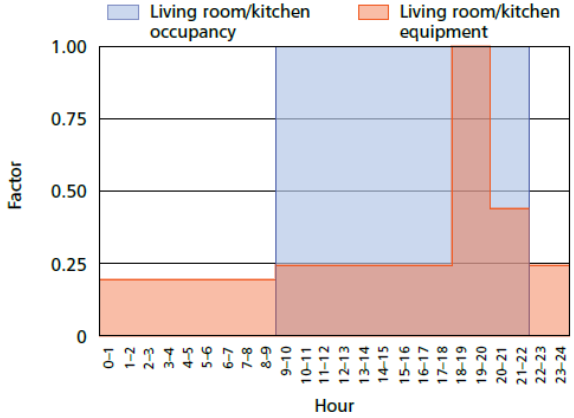


Figure 4 Heat gain profile: combined living room/kitchen

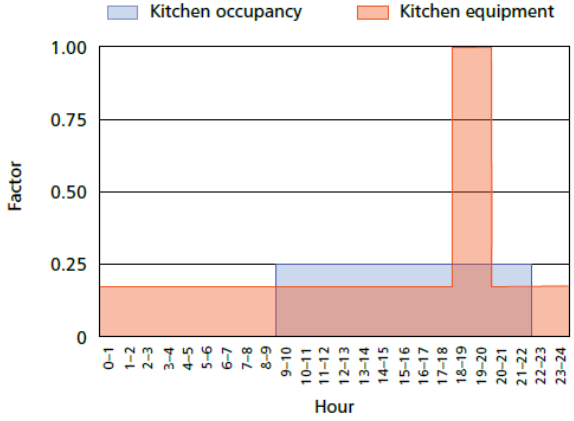


Figure 6 Heat gain profile: kitchen

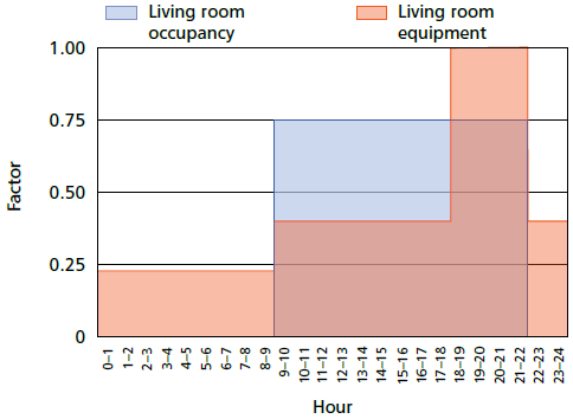


Figure 5 Heat gain profile: living room

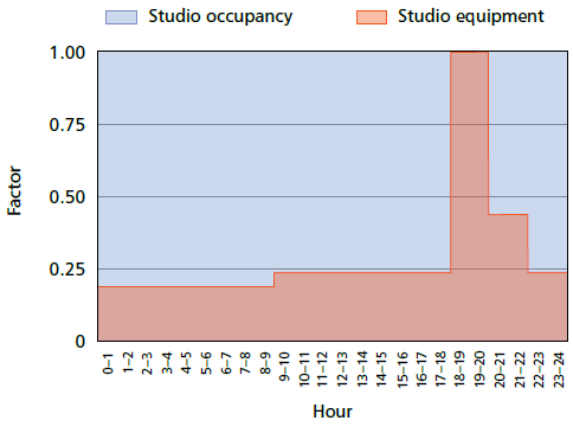


Figure 7 Heat gain profile: studio

APPENDIX B

Assessed Units Ground Floor

Flat 5 in Red

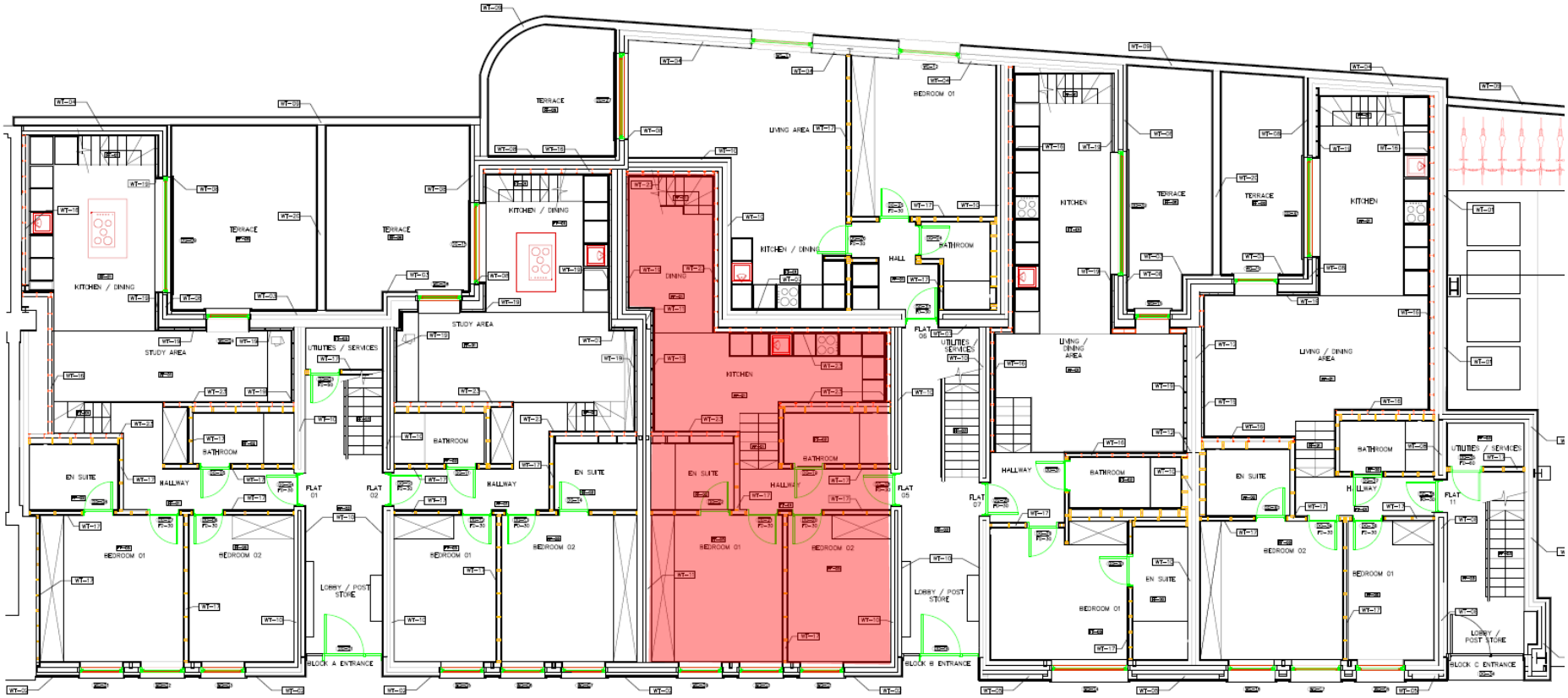


Figure 3 Assessed Flats Ground Floor

Assessed Units Mezzanine Floor

Flat 5 in Red

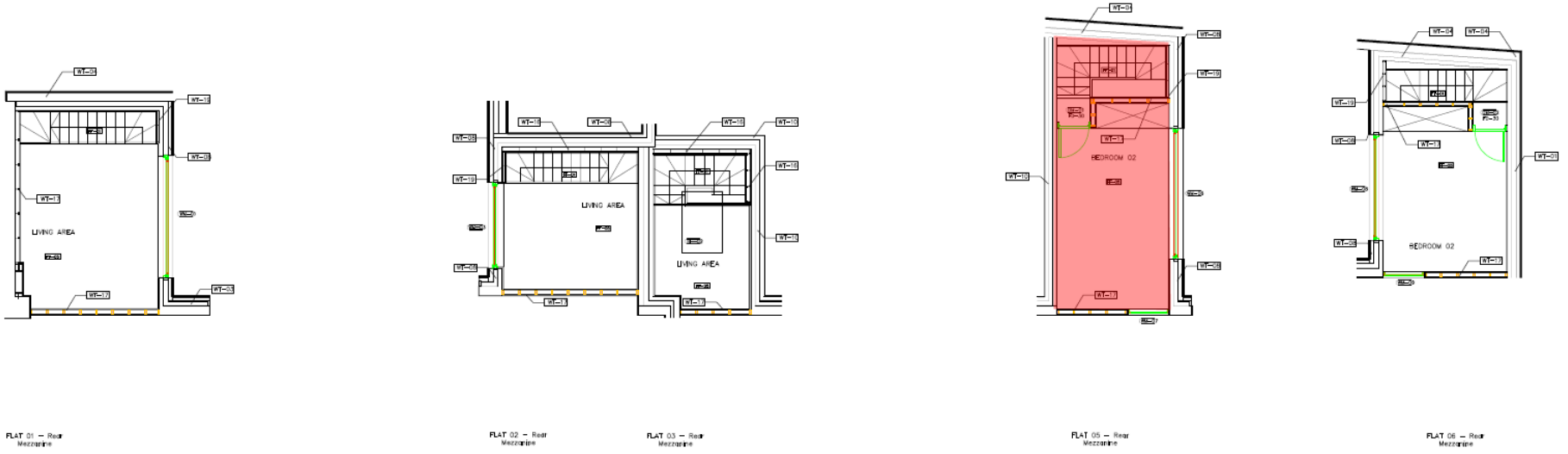


Figure 4 Assessed Flats Mezzanine

Assessed Units First Floor

Flat 09 in Green



Figure 5 Assessed Flats First Floor

Assessed Units Second Floor

Flat 09 in Green



Figure 6 Assessed Flats Second Floor

APPENDIX C

Natural Ventilation and Air Movement



Figure 7: Natural Ventilation Opening Types East Elevation

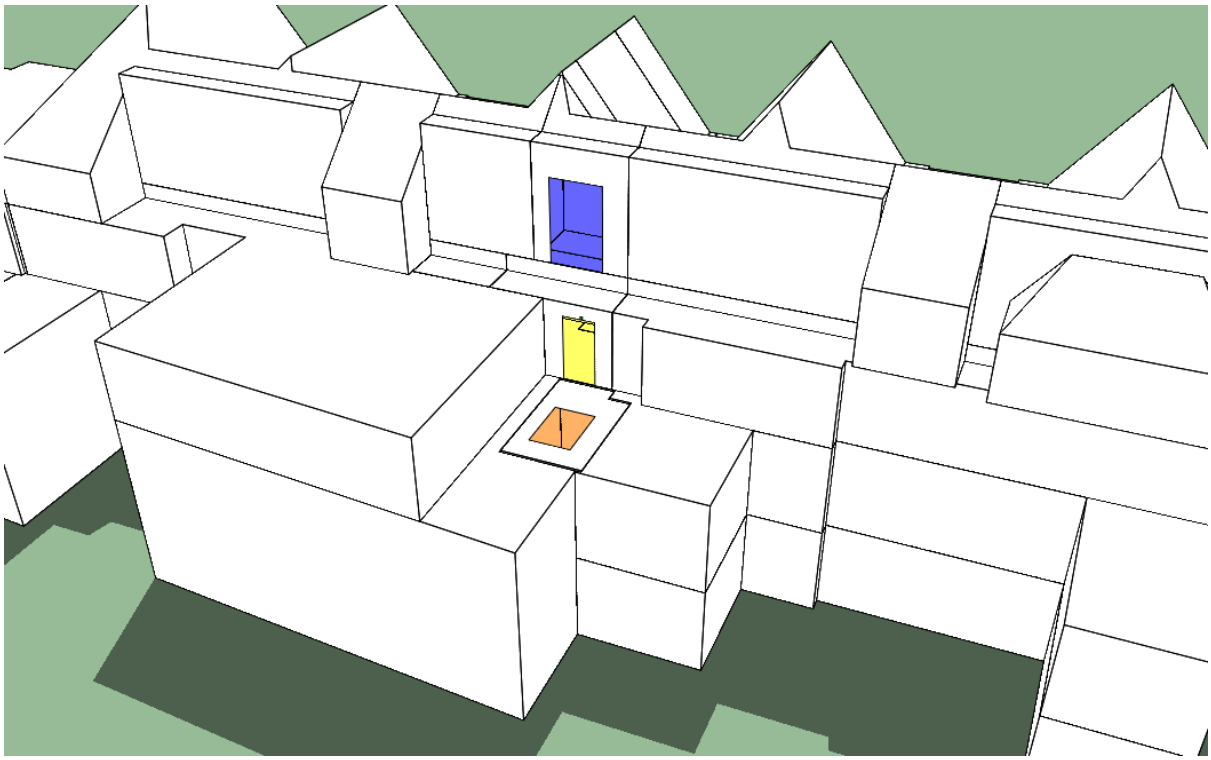
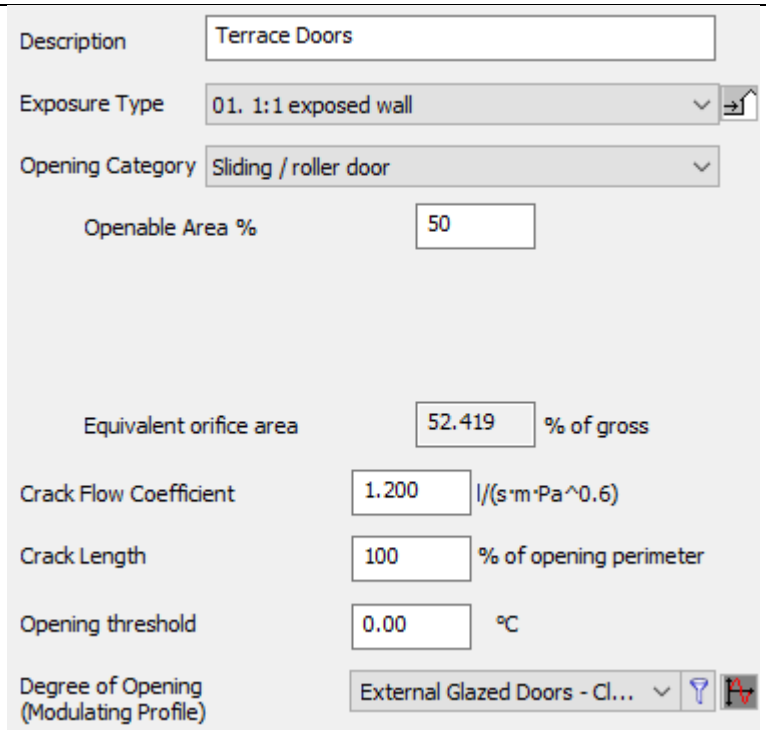
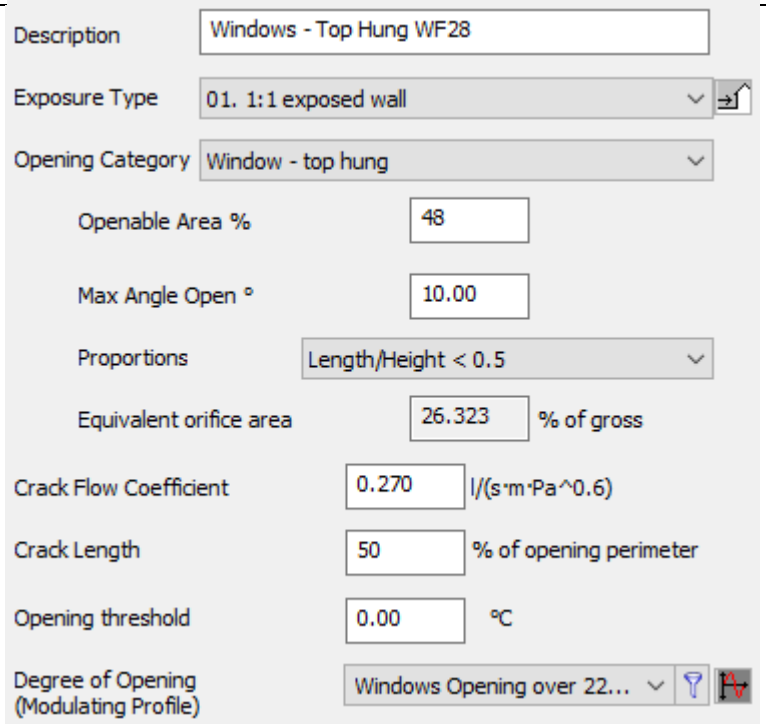


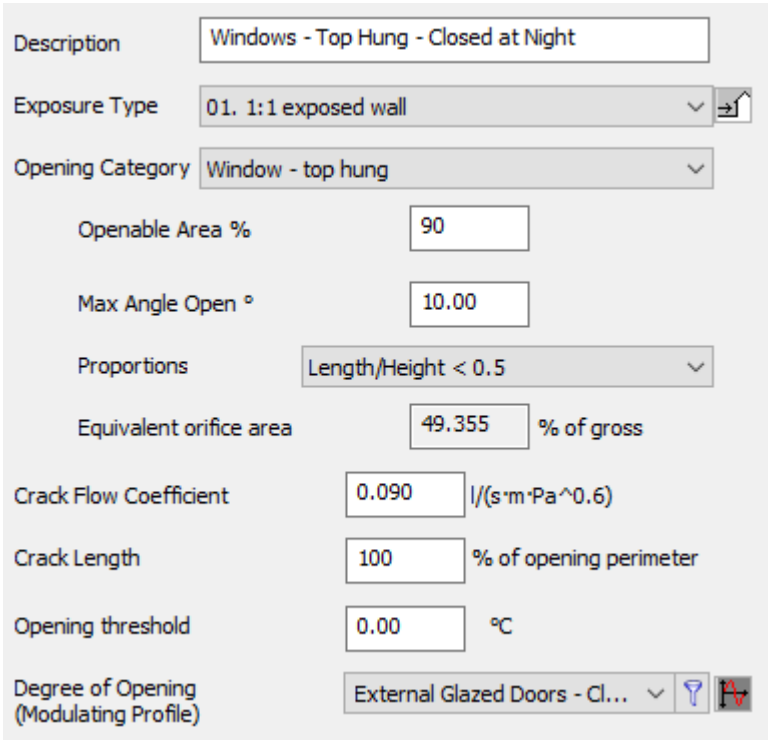
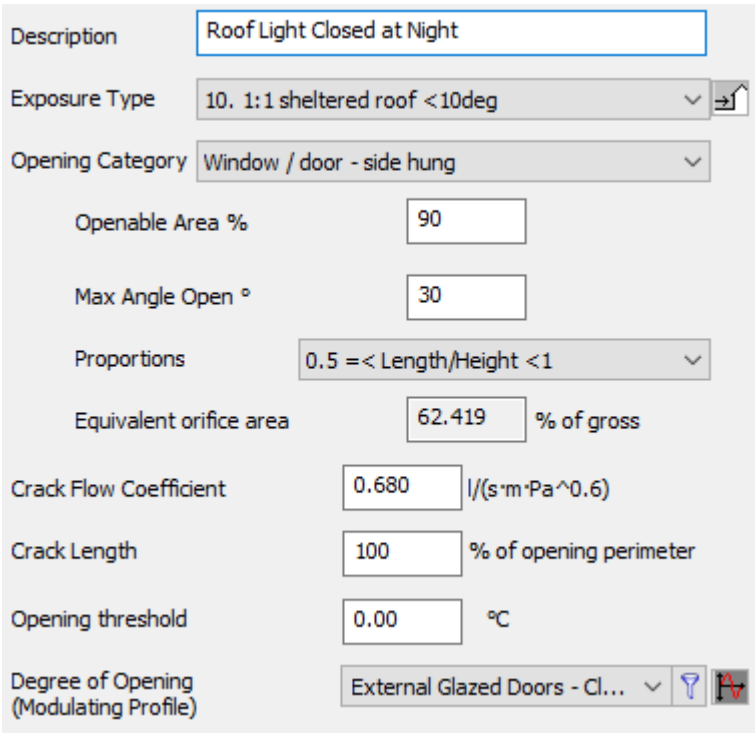
Figure 8: Natural Ventilation Opening Types West Elevation



Figure 9 Opening Types Legend

Opening Type Name	Opening Details	Operation Profile
Windows	Description: Windows Fully Closed Exposure Type: 05. 1:1 semi-exposed wall Opening Category: Custom / sharp edge orifice Openable Area %: 0 Equivalent orifice area: 0 % of gross Crack Flow Coefficient: 0.150 l/(s·m·Pa^0.6) Crack Length: 0 % of opening perimeter Opening threshold: 0.00 °C Degree of Opening (Modulating Profile): off continuously	A
Internal Doors	Description: Internal Doors Exposure Type: 00. Internal Opening Category: Window / door - side hung Openable Area %: 90 Max Angle Open °: 90.00 Proportions: Length/Height < 0.5 Equivalent orifice area: 92.903 % of gross Crack Flow Coefficient: 1.300 l/(s·m·Pa^0.6) Crack Length: 100 % of opening perimeter	B

Terrace Doors		C
Windows - Top Hung WF28		D

Top Hung Windows		C
Roof Light		C

Operation Profiles

Reference	Details	Operation Profile
A	Fixed Pane windows and doors	Closed 100% of the time
B	Internal Doors	All internal doors fully open during the day between 07:00-23:00. Closed during the night when occupants are sleeping
C	Windows, doors & rooflights	Window begins to open when internal temperature exceeds 22°C, becoming fully open when internal temperature reaches 27°C Operation accessible between 07:00-23:00 Closed outside these hours overnight
D	Manual Windows Opening Profile 24/7	Window begins to open when internal temperature exceeds 22°C, becoming fully open when internal temperature reaches 27°C Operation accessible 24/7.

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Caxton House
Shoreham By Sea

Environmental Noise Survey and Acoustic Design Statement Report

28024/ADS1

1 October 2020

For:
Carnell Warren



Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

Head Office: Duke House, 1-2 Duke Street, Woking, Surrey, GU21 5BA (t) +44 (0) 1483 770 595
Manchester Office: First Floor, 346 Deansgate, Manchester, M3 4LY (t) +44 (0) 161 832 7041
(w) hanntucker.co.uk (e) enquiries@hanntucker.co.uk

Hann Tucker Associates

Environmental Noise Survey and Acoustic Design Statement Report
28024/ADS1

Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	01/10/2020	-		
			Daniel Stuart Consultant BSc(Hons), AMIOA	John Gibbs Director MIOA, MSEE, CEnv

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Hann Tucker Associates

Environmental Noise Survey and Acoustic Design Statement Report
28024/ADS1

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Attachments

Appendix A – Acoustic Terminology

1.0 Introduction

A residential development is proposed at Caxton House, Shoreham By Sea.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey and noise impact assessment in order to assess the suitability of the site for residential use.

This report presents the methodology and findings of our noise survey and assessment in the context of national planning policies and the policy of the Local Authority.

2.0 Objectives

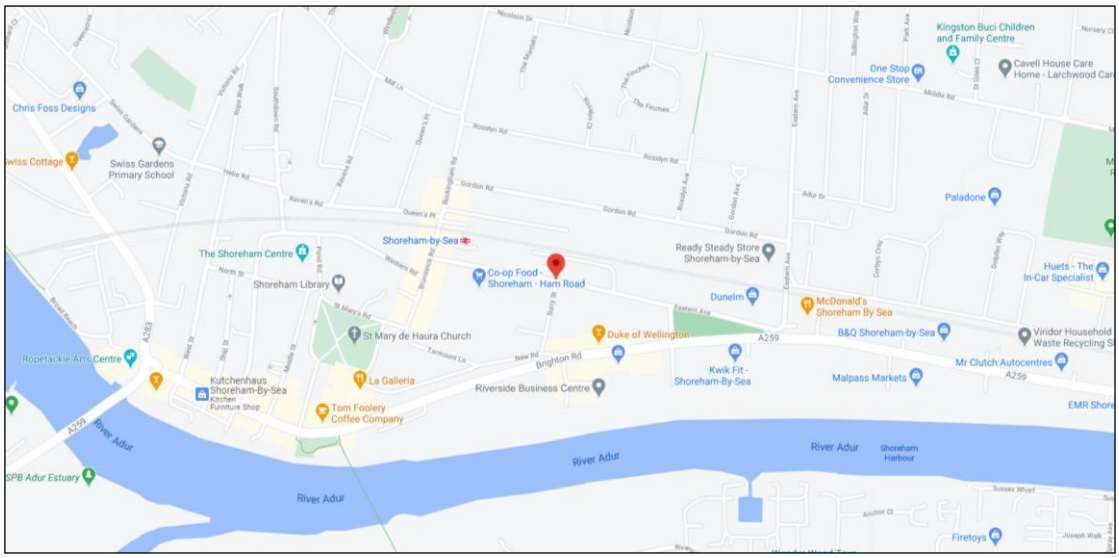
To undertake an environmental noise survey to establish the existing L_{Amax}, L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at selected accessible positions.

Based on the results of the survey, to undertake a noise assessment to assess the suitability of the site for residential use in accordance with the Noise Policy Statement for England (NPSE), National Planning Policy Framework (NPPF), Planning Practice Guidance (ProPG), British Standard BS8233:2014 and Local Authority requirements.

3.0 Site Description

3.1 Location

The site is located at Caxton House, Ham Road, Shoreham By Sea. The location is shown in the Location Map below.



Location Map (Map Data © 2020 Google)

The site falls within the jurisdiction of Adur District Council.

3.2 Description

The site is located on Ham Road, Shoreham By Sea and consists of mostly residential buildings. Most buildings are approximately 2No. storeys in height. Shoreham By Sea train station is located approximately 15m to the north of the site and a car park.

The site is shown in the Site Plan below.



Location Map (Imagery © 2020 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky, Map Data © 2020 Google.)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Methodology

The survey was undertaken by Daniel Stuart BSc(Hons) AMIOA.

5.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 14:30 hours on 24 September 2020 to 14:30 hours on 25 September 2020.

During the periods we were on site the wind conditions were light. The sky was generally overcast. We understand that generally throughout the survey period the weather conditions were similar with some rain. These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

5.1.1 Measurement Positions

The noise level measurements were undertaken at 2No. positions as described in the table below.

Position No	Description
1	The sound level meter was located on the first floor of the development. The microphone was placed on a pole 1m from the north façade (train station side) of the site.
2	The sound level meter was located on the first floor of the development. The microphone was placed on a pole 1m from the south façade (Ham Road) of the site.

The positions are shown on the plan below.



Plan Showing Measurement Positions (Imagery © 2020 Bluesky, DigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky, Map Data © 2020 Google.)

5.2 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3444	09/10/2019
Type 1 ½" Condenser Microphone	PCB	377B02	139312	09/10/2019
Type 1 Calibrator	Bruel & Kjaer	4231	2205779	02/09/2020
Type 1 Data Logging Sound Level Meter	Larson Davis	824	3443	09/10/2019
Type 1 ½" Condenser Microphone	PCB	377B02	122885	09/10/2019

Each sound level meter, including the extension cable, was calibrated prior to and on completion of the surveys. No significant changes were found to have occurred.

Each sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable. Each microphone was fitted with a windshield.

6.0 Results

The results have been plotted on Time History Graphs 00000/TH1 to 00000/TH2 enclosed presenting the 15 minute A-weighted (dBA) L_{90}, L_{eq} and L_{max} levels at each measurement

position throughout the duration of the survey.

6.1 L_{eq} Noise Levels

In order to compare the results of our survey with the relevant guidelines it is necessary to convert the measured $L_{Aeq(15\ minute)}$ noise levels into single figure daytime $L_{Aeq(16\text{-}hour)}$ (07:00-23:00 hours) and night-time $L_{Aeq(8\text{-}hour)}$ (23:00-07:00 hours) levels. There were some periods of construction noise throughout the survey period which have been discounted from the daytime noise levels presented.

The daytime $L_{Aeq(16\text{-}hour)}$ and night-time $L_{Aeq(8\text{-}hour)}$ noise levels for each position are presented in the tables below.

Position	Daytime $L_{Aeq(16\text{-}hour)}$	Night-Time $L_{Aeq(8\text{-}hour)}$
1	61 dB	56 dB
2	64 dB	54 dB

The above levels are as measured at the measurement positions and include local reflections

6.2 Night-time L_{max} Results

During the night-time period 23:00 hours – 07:00 hours the recorded L_{Amax} events are as follows

- Position 1 - range from 46dB to 89dB and the 10th highest L_{Amax} event recorded was 73dB.
- Position 2 – range from 47dB to 87dB and the 10th highest L_{Amax} event recorded was 73dB.

7.0 Discussion of Noise Climate

During the periods we were on site the dominant noise sources were from road traffic from Ham Road and the surrounding road network, trains to the north of the site and local construction noise throughout some periods during the day time.

8.0 Relevant Planning Policies and Guidance

8.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010. The NPSE is

the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

That vision is supported by the following aims of the revised NPPF (see section 8.2 below).

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledge in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three aims listed in paragraph (b) above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active

management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

8.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised February 2019):

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

8.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on noise although, like the NPPF and NPSE the PPG does not provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	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.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	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 acoustic character of the area.	Significant Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

8.4 Planning Condition

We have received the following planning condition from Adur District Council:

"No flat hereby approved shall be occupied unless and until a scheme of noise mitigation measures has been submitted to and approved by the Local Planning Authority to meet the recommended standards in respect of external noise source set out in table 4 of BS 8233:2014 and the night time L_{Amax} level recommended in the WHO's Night Noise Guidelines for Europe (2009). Where windows need to remain closed to meet this criteria, whole house ventilation is required to ensure thermal comfort can be managed inside the dwellings during the summer months.

Reason: In the interests of the amenity of future occupiers in view of the fact that the site is adjacent to business uses and to comply with policies 15 and 34 of the Adur Local Plan"

8.5 World Health Organisation

The current Environmental Noise Guidelines 2018 for the European Region (ENG) supersede the Guidelines for Community Noise from 1999 (CNG). Nevertheless, the ENG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) remain valid.

A summary of the guidance from the ENG and CNG is shown in the table below.

Source	CNG guideline indoors all sources	ENG guideline outdoors noise from specific source only
Road traffic noise	35 $L_{Aeq, 16h}$	53 dB L_{den}
	30 $L_{Aeq, 8h}$	45 dB L_{night}
Railway noise	35 $L_{Aeq, 16h}$	54 dB L_{den}
	30 $L_{Aeq, 8h}$	44 dB L_{night}
Aircraft noise	35 $L_{Aeq, 16h}$	45 dB L_{den}
	30 $L_{Aeq, 8h}$	40 dB L_{night}

With regard to single-event noise indicators, Section 2.2.2 of the WHO Environmental Noise Guidelines 2018 state:

"In many situations, average noise levels like the L_{den} or L_{night} indicators may not be the best to explain a particular noise effect. Single-event noise indicators – such as the maximum sound pressure level ($L_{A,max}$) and its frequency distribution – are warranted in specific situations, such

as in the context of night-time railway or aircraft noise events that can clearly elicit awakenings and other physiological reactions that are mostly determined by $L_{A,max}$. Nevertheless, the assessment of the relationship between different types of single-event noise indicators and long-term health outcomes at the population level remains tentative. The guidelines therefore make no recommendations for single-event noise indicators."

8.6 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

8.6.1 Internal Areas

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	*Location*	*Desirable Internal Ambient Criteria*	
		07:00 – 23:00	*23:00 to 07:00*
Resting	*Living Rooms*	*35 dB $L_{Aeq,16hour}$*	-
Dining	*Dining Room/Area*	*40 dB $L_{Aeq,16hour}$*	-
Sleeping (Daytime Resting)	*Bedroom*	*35 dB $L_{Aeq,16hour}$*	*30 dB $L_{Aeq,8hour}$*

Note 1 The above table provides recommended levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

Note 2 The levels shown in the above table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in the above table.

Note 3 These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks nigh or News Year's Eve.

Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and

number of events per night. Sporadic noise events could require separate values.

Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

Note 6 Attention is drawn to the Building Regulations.

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

8.7 ProPG : Planning & Noise : 2017

8.7.1 The primary goal of the ProPG is to assist the delivery of sustainable development by promoting good health and well-being through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise. It is applicable to noise from existing transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise). The recommended approach is also considered suitable where some industrial or commercial noise contributes to the acoustic environment provided that is "not dominant".

8.7.2 This ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging.

8.7.3 The two sequential stages of the overall approach are:

- Stage 1 – an initial noise risk assessment of the proposed development site; and
- Stage 2 – a systematic consideration of four key elements.

8.7.4 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1 – demonstrating a "Good Acoustic Design Process";
- Element 2 – observing internal "Noise Level Guidelines";
- Element 3 – undertaking an "External Amenity Area Noise Assessment"; and

- Element 4 – consideration of "Other Relevant Issues".

8.7.5 The ProPG considers suitable guidance on internal noise levels found in "BS8233:2014: Guidance on sound insulation and noise reduction for buildings". Table 4 in Section 7.7.2 of the standard suggests that "in general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values". The standard states (Section 7.7.1) that "occupants are usually more tolerant of noise without a specific character" and only noise without such character is considered in Table 4 of the standard.

Activity	Location	07:00 – 23:00 Hours	23:00 – 07:00 Hours
Resting	Living Room	35dB $L_{Aeq,16hr}$	-
Dining	Dining Room / Area	40dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hr}$	30dB $L_{Aeq,8hr}$ 45dB $L_{Amax,F}$

NOTE 1 the Table provides recommended internal L_{Aeq} target levels for overall noise in the design of a building. These are the sum total of structure-borne and airborne noise sources. Ground-borne noise is assessed separately and is not included as part of these targets, as human response to ground-borne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity.

NOTE 2 The internal L_{Aeq} target levels shown in the Table are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g. 1 hour, may be used, but the level should be selected to ensure consistency with the L_{Aeq} target levels recommended in the Table.

NOTE 3 These internal L_{Aeq} target levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve.

NOTE 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline

then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).

NOTE 5 Designing the site layout and the dwellings so that the internal target levels can be achieved with open windows in as many properties as possible demonstrates good acoustic design. Where it is not possible to meet internal target levels with windows open, internal noise levels can be assessed with windows closed, however any façade openings used to provide whole dwelling ventilation (e.g. trickle ventilators) should be assessed in the "open" position and, in this scenario, the internal L_{Aeq} target levels should not normally be exceeded, subject to the further advice in Note 7.

NOTE 6 Attention is drawn to the requirements of the Building Regulations.

NOTE 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5dB, the more that most people are likely to regard them as "unreasonable". Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10dB, they are likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing "unacceptable" noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form (See Section 3.D).

Figure 2. ProPG Internal Noise Level Guidelines (additions to BS8233:2014 shown in blue).

9.0 Proposed Design Target Internal Noise Levels

On the basis of the planning condition, BS8233:2014 and WHO Guidance we propose the following internal noise levels be adopted as design targets in the proposed habitable rooms:

Activity	Location	Desirable Internal Ambient Criteria	
		07:00 – 23:00	23:00 to 07:00
Resting	Living Rooms	35 dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hr}$ 45dB $L_{Amax,F}$

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target noise levels may be relaxed (subject to the requirements of any planning conditions) by up to 5 dB and reasonable internal conditions still achieved.

10.0 Achievable Internal Noise Levels

We have predicted the levels that would be achievable in the worst-case dwellings with windows partially opened and also with windows closed.

10.1 Windows Partially Open

It is generally accepted that the typical noise reduction achieved with partially opened windows is around 15dBA (ref. BS 8233:2014 Annex G.1). This value is the difference between dBA levels measured outside and inside typical dwellings, therefore 3dBA should be added to free field noise levels to determine outside levels.

A simple assessment thus indicates the following noise levels may be expected within the proposed worst case habitable rooms with partially opened windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Partially Opened					
	Position 1			Position 2		
	Daytime $L_{Aeq(16\text{-}hour)}$	Night-time $L_{Aeq(8\text{-}hour)}$	Night-time $L_{Amax,fast}$	Daytime $L_{Aeq(16\text{-}hour)}$	Night-time $L_{Aeq(8\text{-}hour)}$	Night-time $L_{Amax,fast}$
Façade noise level	61 dBA	56 dBA	73 dBA	64 dBA	54 dBA	73 dBA
Noise reduction for conventional thermal double glazing	-15dBA	-15dBA	-15dBA	-15dBA	-15dBA	-15dBA
Predicted internal noise levels	46 dBA	41 dBA	58 dBA	49 dBA	39 dBA	58 dBA

10.2 Windows Closed

Provision exists to provide appropriate sound insulation solutions as required including, where necessary, suitably specified glazing and attenuated ventilators. We have undertaken calculations to determine the likely façade sound insulation performance requirements for the worst affected (east) facade. Our calculation methods follow those outlined in BS 8233:2014. Our calculations are based on the following assumptions:

- Conventional brick/block cavity external wall or equivalent;

- Typical furnishings including beds, sofas, chairs etc;
- Double glazing comprising 4/16/4 or equivalent having an R_w of 32dB;
- Hit-and-miss ventilator having an $D_{ne,w}$ of 31dB.

The above achieves a noise reduction of 30dBA from free field levels (without reflections). The measurement positions in the survey were measured at the façade and therefore include reflections off the façade and are therefore approximately 3dBA greater than the free field levels. Therefore the noise reduction of the above configuration is approximately equivalent of 33dBA from façade noise levels as measured in the survey.

The following table summarises our assessment of achievable noise levels within the proposed worst case habitable rooms with closed windows.

Description	Predicted Worst Case Internal Noise Levels with Windows Closed					
	Position 1			Position 2		
	Daytime $L_{Aeq(16\text{-}hour)}$	Night-time $L_{Aeq(8\text{-}hour)}$	Night-time $L_{Amax,fast}$	Daytime $L_{Aeq(16\text{-}hour)}$	Night-time $L_{Aeq(8\text{-}hour)}$	Night-time $L_{Amax,fast}$
Façade noise level	61 dBA	56 dBA	73 dBA	64 dBA	54 dBA	73 dBA
Noise reduction for closed windows	-33dBA	-33dBA	-33dBA	-33dBA	-33dBA	-33dBA
Predicted internal noise levels	28 dBA	23dBA	40 dBA	31 dBA	21 dBA	40 dBA

11.0 Mitigation Measures

The predicted worst case internal noise levels with windows closed meet the proposed criteria. It is thus demonstrated that acceptable internal noise levels are achievable with conventional double glazing.

The predicted worst case internal noise levels with windows partially opened exceed the proposed target levels (as is often the case). The minimum mitigation available to future occupants would be to close their window.

Therefore as noise levels does not meet the acoustic criteria with windows open, the Local Authority planning condition requires "*Where windows need to remain closed to meet this criteria, whole house ventilation is required to ensure thermal comfort can be managed inside the dwellings during the summer months.".* It may be acceptable to give residents the option to use open windows for thermal comfort for very short periods occasionally throughout the year.

12.0 Conclusions

A detailed environmental noise survey has been undertaken in order to establish the currently prevailing environmental noise climate around the site.

The environmental noise impact upon the proposed dwellings has been assessed in the context of national and local planning policies.

Appropriate target internal noise levels have been proposed. These are achievable using conventional mitigation measures and closed windows

The predicted worst case internal noise levels with windows partially opened exceed the proposed target levels (as is often the case). The minimum mitigation available to future occupants would be to close their window.

The assessment shows the site, subject to appropriate mitigation measures, is suitable for residential development in terms of noise.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

L_p — Sound Pressure Level (SPL) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

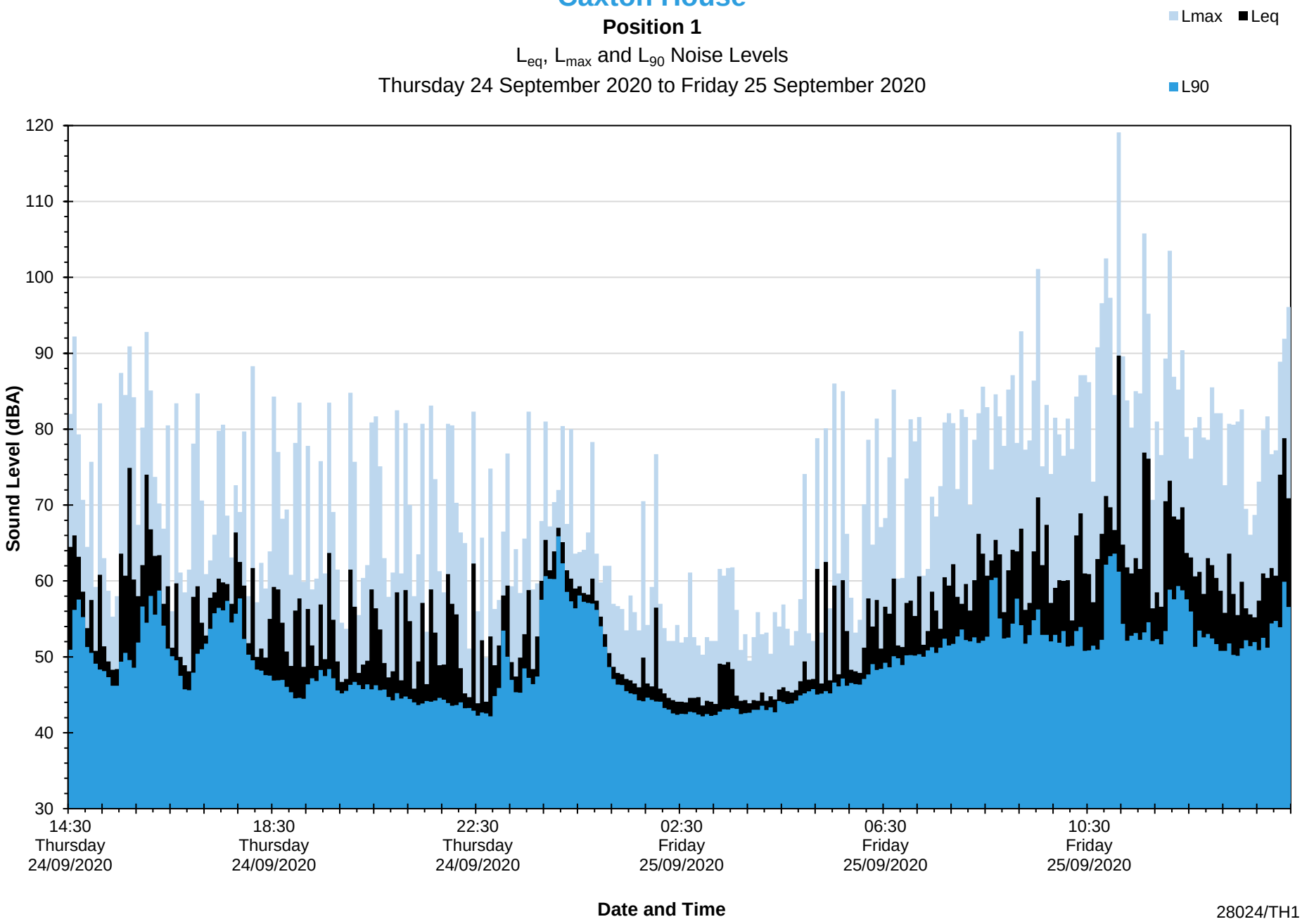
L_w — Sound Power Level (SWL) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

Caxton House

Position 1

L_{eq}, L_{max} and L_{90} Noise Levels

Thursday 24 September 2020 to Friday 25 September 2020



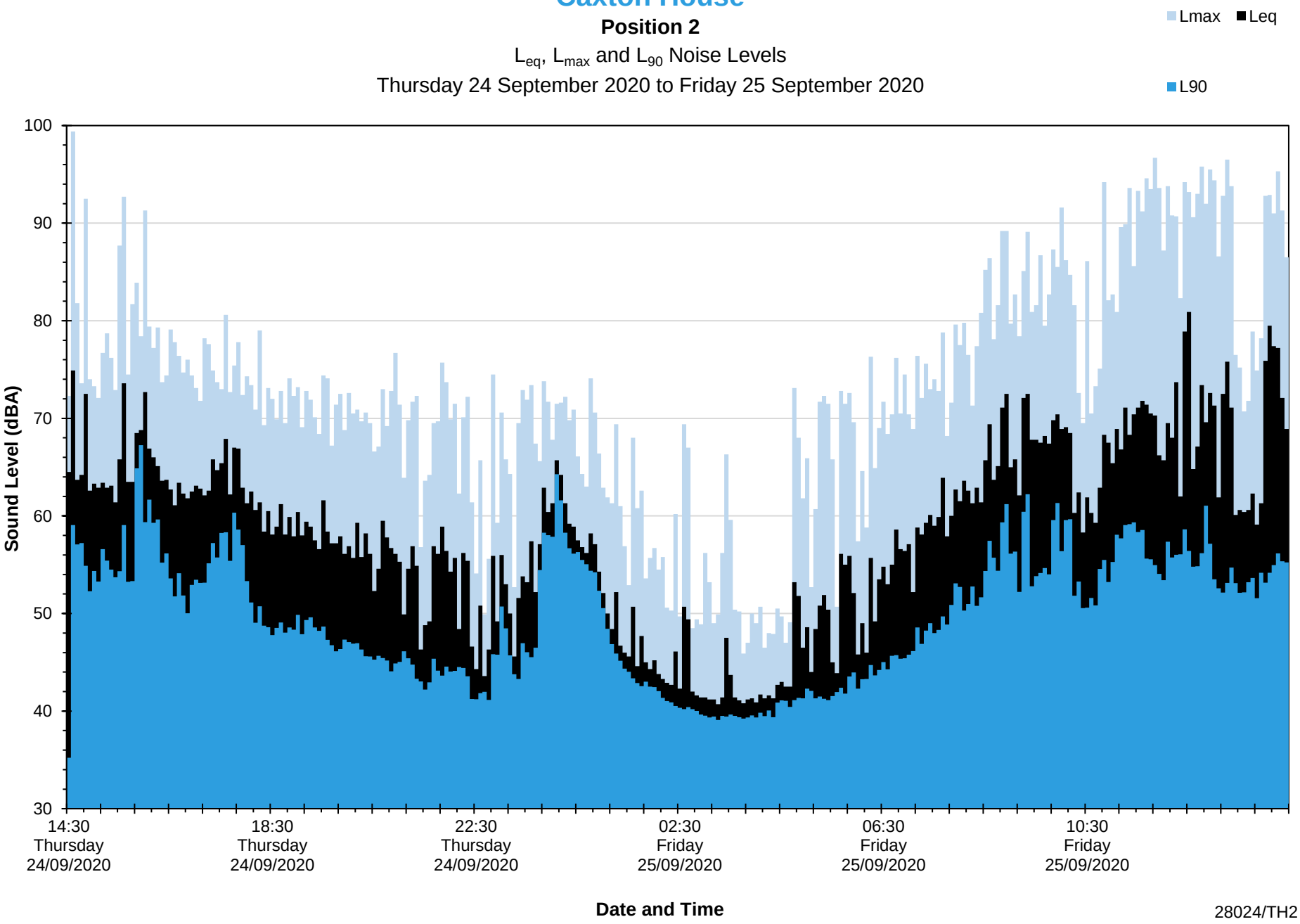
28024/TH1

Caxton House

Position 2

L_{eq}, L_{max} and L_{90} Noise Levels

Thursday 24 September 2020 to Friday 25 September 2020



28024/TH2

Affresco Discreet
Wall Fans (100, 125 & 150mm)



Basic or Timer controls options

Easy to install

Suitable for bathroom zones 1, 2 & 3

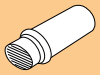
Low profile

Accessories

ED1/ED150
Easyfix ducting plastic wall liner with integral screw-fixing channels.



FF100
Fast fix wall duct system. Comprises 100mm PVC duct with external wall duct seal and external grille. Available in white or brown.



EG1/EG2
Fixed blade louvred grille in semi-matt ABS plastic. Available in white or brown.

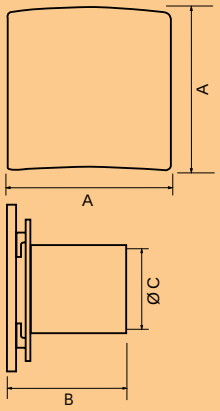


Physical Specifications

Weight:
100mm – 0.7kg
125mm – 0.61kg
150mm – 1.05kg

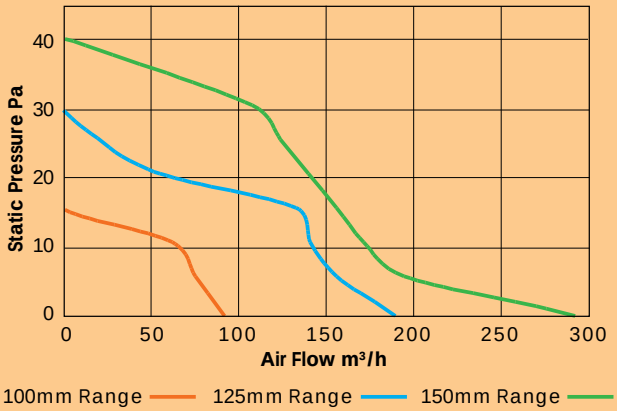
Material: ABS plastic

Dimensions



	100mm	125mm	150mm
A	150	180	220
B	135	150	160
C	98	115	150

Performance Graph



Electrical Specifications

230V~50Hz Class II

Consumption: 100mm Fan – 13W
125mm Fan – 20W
150mm Fan – 22W

Cabling: 1.5mm² max.

Data Table

	Performance to BS 848 Pt1 in free air m^3/h^{-1}	$l.s^{-1}$	Sound Pressure level @ 3m dB(A)	IP Rating	Operation	Features
D100BW	90	25	33	24	Single speed	100mm induct wall fan with plain white front cover
D100TW	90	25	33	24	Single speed	100mm induct wall fan with timer and plain white front cover
D125BW	185	51	39	24	Single speed	125mm induct wall fan with plain white front cover
D125TW	185	51	39	24	Single speed	125mm induct wall fan with timer and plain white front cover
D150BW	280	78	40	24	Single speed	150mm induct wall fan with plain white front cover
D150TW	280	78	40	24	Single speed	150mm induct wall fan with timer and plain white front cover

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Bathroom Extractor Fans

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Shower Seats

Grab Rails

Shower Curtains

Toilet Brushes

Bathroom Cleaning Products

Wall Mounted Bathroom Accessories

- Robe Hooks
- Bathroom Tumblers
- Toilet Roll Holders
- Soap Dishes
- Towel Rings
- Shower Caddies

Bathroom Mirrors

- Standard Bathroom Mirrors
- LED Bathroom Mirrors
- Shaving Mirrors

plumbworld

Big brands, small prices.