



Luke Smith
JPM Acoustics Ltd

Manchester City Council
Environmental Health (Noise)

20th February 2025

To Whom It May Concern,

SUBJECT: LAND BOUNDED BY PARKHILL AVENUE (139946/FO/2024)

JPM Acoustics Ltd is providing ongoing noise services for the proposed development at the Land Bounded By Parkhill Avenue (planning reference: 139946/FO/2024).

The applicant has received planning consent subject to the satisfaction of a number of planning conditions. This letter refers specifically to Condition 12a, which is reproduced, below, for reference:

"Prior to above groundworks commencing a scheme for acoustically insulating the proposed residential accommodation against noise from Parkhill Avenue, Delaunays Road and Cleveland Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises.

The potential for overheating shall also be assessed and the noise insulation scheme shall take this into account. The approved noise insulation and ventilation scheme shall be completed before any of the dwelling units are occupied.

Noise survey data shall include measurements taken during a rush-hour period and night time to determine the appropriate sound insulation measures necessary. The following noise criteria shall be required to be achieved when providing adequate ventilation as defined by Approved Document F of the Building Regulations (whole dwelling ventilation):

Bedrooms (night time - 23.00 - 07.00): 30 dB LAeq (individual noise events shall not exceed 45dB L_{Amax,F} by more than 10 times)

Living Rooms (daytime - 07.00 - 23.00): 35 dB LAeq

Gardens and terraces (daytime): 55 dB LAeq

Higher internal noise levels than those specified above may be allowed when higher rates of ventilation are required in relation to the overheating condition."

Detailed Noise Impact (report reference: 0112024, July 2024) and Overheating (report reference: 0112024_OH_002, April 2024) Assessment Reports were submitted as part of the consented planning application, along with a supplementary Technical Note (dated 02/07/2024) regarding the noise impact assessment.

The contents of these detailed Assessment Reports and the supplementary Technical Note address the requirements set out in Condition 12a in full, and no further evidence is considered to be required in order to satisfy Condition 12a. The Reports and the Technical Note are appended to this letter for convenience.

I trust that the above is clear and satisfactory, however, please do get in touch if you wish to discuss further.

Yours sincerely,



Luke Smith
Associate // JPM Acoustics Ltd

Attachments:

Parkhill Avenue, Crumpsall - Noise Impact Assessment (JPM Acoustics Ltd, 02nd July 2024)

Parkhill Avenue – Technical Note (JPM Acoustics Ltd, 02nd July 2024)

Parkhill Avenue, Crumpsall - Approved Document O: Overheating Assessment (JPM Acoustics Ltd, 29th April 2024)

JPM ACOUSTICS

PARKHILL AVENUE, CRUMPSALL

NOISE IMPACT ASSESSMENT

JULY 2024





DOCUMENT VERSION RECORD

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1.0. INTRODUCTION

1.1. OVERVIEW

- 1.1.1. JPM Acoustics Ltd has been appointed to undertake a noise impact assessment to support a planning application for the proposed residential development at Parkhill Avenue, Crumpsall.
- 1.1.2. This report considers the potential impact of road traffic noise and industrial/commercial noise on proposed noise sensitive properties within the development site. The assessment has been undertaken with due regard to relevant planning policies, British Standards, and technical guidance documents relating to noise.
- 1.1.3. This report is necessarily technical in nature. Therefore, to assist the reader, a glossary of acoustic terminology is provided in **Appendix A**.

1.2. SITE LOCATION AND PROPOSED DEVELOPMENT

- 1.2.1. At present, the site comprises open land which is located in a mixed-use area of Crumpsall. Immediately to the north lies Cleveland Road, with the premises of British Cables Company approximately 60 m further north; to the east lies Delaunays Road; to the south are residential properties along Delaunays Road and Parkhill Avenue; and to the west lies Parkhill Avenue.
- 1.2.2. The site location is presented in **Figure 1.1**.

Figure 1.1: Site location plan



- 1.2.3. The development proposals include for 9 no. properties with private gardens and 15 no. apartments with an associated shared garden space. **Figure 1.2** shows the Proposed Site Layout Plan.

Figure 1.2: Proposed site layout plan



Source: Triangle Architects. Drawing reference: 21-041 02, April 2024

2.0. STANDARDS AND GUIDANCE

2.1. BS 8233:2014: GUIDANCE ON SOUND INSULATION AND NOISE REDUCTION FOR BUILDINGS (BS 8233)

- 2.1.1. BS 8233 provides guidance for the control of noise in and around buildings. The guidance provided within the document is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.
- 2.1.2. The Standard includes recommended internal and external guideline noise levels which are applicable to dwellings for steady external noise sources. The Standard states that it is desirable that the internal ambient noise levels do not exceed the criteria set out in **Table 2.1**.

Table 2.1: Desirable internal guideline values from BS 8233

Activity	Location	Period	
		07:00 to 23:00 (Daytime)	23:00 to 07:00 (Night-Time)
Resting	Living Room	35 dB $L_{Aeq, 16h}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq, 16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16h}$	30 dB $L_{Aeq, 8h}$

- 2.1.3. Whilst BS 8233 recognises that a guideline value may be set in terms of SEL or L_{AFmax} for the assessment of regular individual noise events that can cause sleep disturbance during the night-time, a specific criterion is not stipulated.
- 2.1.4. It is common practice, however, to adopt 45 dB L_{AFmax} as a criterion for typical events at night, based on the guidance from the World Health Organisation 'Guidelines for Community Noise' (WHO Guidelines).
- 2.1.5. With respect to external amenity spaces such as gardens and patios, it is stated that it is desirable that the noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. It is then confirmed that higher external noise criteria may be appropriate under certain circumstances such as within city centres, urban areas, and locations adjoining the strategic transportation network, where it may be necessary to compromise between elevated noise levels and other factors such as convenience of living, and efficient use of land resource.

- 2.1.6. Regarding external noise levels for balconies, BS 8233 states that the specification of noise limits is not necessarily appropriate. The Standard states that small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these spaces. However, the general guidance on noise in amenity spaces is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas but should be achievable in some areas.

3.0. BASELINE NOISE SURVEY

3.1. OVERVIEW

- 3.1.1. A baseline noise survey has been undertaken to determine the prevailing noise climate across the site. A short summary of the baseline noise survey methodology and relevant results is included below.

3.2. MEASUREMENT LOCATIONS

- 3.2.1. Measurements were undertaken at three locations during the survey. The adopted measurement locations are presented in **Figure 3.1**.

Figure 3.1: Baseline noise survey measurement locations



Measurement Location 1 (ML1)

- 3.2.2. Unattended measurements were undertaken at ML1 between 23:00 on 28th February 2024 and 23:00 on 29th February 2024.
- 3.2.3. The equipment at ML1 was installed in free-field conditions at a height of 1.5 m above local ground level and 4.5 m from the nearest kerb of Parkhill Avenue. The noise climate at ML1 was dominated by road traffic on Parkhill Avenue.

Measurement Location 2 (ML2)

- 3.2.4. Unattended measurements were undertaken at ML2 between 23:00 on 28th February 2024 and 23:00 on 29th February 2024.
- 3.2.5. The equipment at ML2 was installed in free-field conditions at a height of 2.5 m above the road level of Delaunays Road, and 8 m from the nearest kerb of Delaunays Road. The noise climate at ML2 was dominated by road traffic on Delaunays Road.

Measurement Location 3 (ML3)

- 3.2.6. Unattended measurements were undertaken at ML3 between 23:00 on 28th February 2024 and 23:00 on 29th February 2024.
- 3.2.7. The equipment at ML3 was installed in free-field conditions at a height of 1.5 m above local ground level and 10 m from Cleveland Road. The noise climate at ML3 was dominated by road traffic on Cleveland Road. Whilst on site, no noise was perceptible from the British Cables Company premises to the northeast.

3.3. EQUIPMENT

- 3.3.1. The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3.1**. The measurement equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed.
- 3.3.2. The sound level meter, pre-amplifier and microphone were calibrated to traceable standards within 24 months prior to the measurements. The portable calibrator was calibrated within 12 months prior to the measurements.

Table 3.1: Equipment details

Location	Equipment	Make and Model	Serial Number	Calibration due Date
ML1	Sound Level Meter	Svantek 971	60745	06/09/2025
	Microphone	Aco Pacific 7052E	64535	
	Preamplifier	Svantek SV18	66815	
ML2	Sound Level Meter	Svantek 971	80344	26/05/2024
	Microphone	Aco Pacific 7052E	69566	

Location	Equipment	Make and Model	Serial Number	Calibration due Date
	Preamplifier	Svantek SV18	71577	
ML3	Sound Level Meter	Svantek 971	80342	10/11/2024
	Microphone	Aco Pacific 7052E	71683	
	Preamplifier	Svantek SV18	71576	
ML1,2 and 3	Calibrator	01dB-Stell Cal 21	34675335	06/09/2024

3.4. WEATHER CONDITIONS

- 3.4.1. Weather conditions during the survey were conducive to the measurement of environmental noise, it being dry with low wind speeds ($<5 \text{ ms}^{-1}$).

3.5. RESULTS

- 3.5.1. Summaries of the equivalent continuous ($L_{Aeq,T}$), background sound ($L_{A90,T}$), and maximum noise ($L_{AFmax,T}$) levels at each measurement location are presented in **Table 3.2** to **Table 3.7**, below, and presented graphically in **Appendix B**.

Table 3.2: Summary of measured sound pressure levels at ML1

Date and Start time	Period	Measured Sound Pressure Levels		
		dB $L_{Aeq,T}$	dB $L_{A90,T}^1$	dB $L_{AFmax,T}^2$
28/02/24 23:00	Night-time	52	42	67
29/02/24 07:00	Daytime	54	48	-
<p>¹ - Taken to be the lower of the mean and modal values from the measured $L_{A90,15min}$ values during relevant period</p> <p>² - Taken to be the 10th highest of the measured $L_{AFmax,5min}$ values during the night-time period</p>				

Table 3.3: Measured octave band sound pressure levels at ML1

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Night-time	55	47	43	41	44	47	45	40	52
Daytime	62	55	51	47	50	47	45	40	54

Table 3.4: Summary of measured sound pressure levels at ML2

Date and Start time	Period	Measured Sound Pressure Levels		
		dB $L_{Aeq,T}$	dB $L_{A90,T}^1$	dB $L_{AFmax,T}^2$
28/02/24 23:00	Night-time	60	41	78
29/02/24 07:00	Daytime	65	51	-
¹ - Taken to be the lower of the mean and modal values from the measured $L_{A90,15min}$ values during relevant period ² - Taken to be the 10th highest of the measured $L_{AFmax,5min}$ values during the night-time period				

Table 3.5: Measured octave band sound pressure levels at ML2

Period	Octave Band Sound Pressure Levels (L_{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Night-time	59	52	49	50	55	54	51	47	60
Daytime	67	60	57	57	62	59	52	47	65

Table 3.6: Summary of measured sound pressure levels at ML3

Date and Start time	Period	Measured Sound Pressure Levels		
		dB L _{Aeq,T}	dB L _{A90,T} ¹	dB L _{AFmax,T} ²
28/02/24 23:00	Night-time	52	44	68
29/02/24 07:00	Daytime	56	48	-
¹ - Taken to be the lower of the mean and modal values from the measured L _{A90,15min} values during relevant period ² - Taken to be the 10th highest of the measured L _{AFmax,5min} values during the night-time period				

Table 3.7: Measured octave band sound pressure levels at ML3

Period	Octave Band Sound Pressure Levels (L _{eq} dB)								dB(A)
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	
Night-time	55	50	46	42	45	46	46	42	52
Daytime	63	58	55	48	51	50	46	42	56

4.0. ASSESSMENT

4.1. OVERVIEW

- 4.1.1. This section presents an assessment of the suitability of the site for residential use, which considers the potential impact from road traffic noise, based on the Proposed Site Layout Plan (see **Figure 1.2**). This assessment is informed by the results of the noise survey, outlined in Section 3.
- 4.1.2. With respect to noise from the British Cables Company premises, located northeast of the site, no noise was perceptible during installation or collection of the measurement equipment. Additionally, the survey data at ML3 (i.e. the location nearest to the premises) does not indicate the presence of noise from the premises when compared with the measurement data at ML1 and ML2, which are both dominated by road traffic. Therefore, noise from the premises is not deemed to be of significance and has not been considered further in this assessment.

4.2. ACOUSTIC MODEL

- 4.2.1. In order to predict the ambient noise levels across the site during the daytime and night-time periods, a 3D acoustic model of the site and surrounding area has been generated using the acoustic modelling software CadnaA®. The model was generated applying the following methodology:
- The model was set to apply the prediction methodology from the Department for Transport document Calculation of Road Traffic Noise (CRTN) for road traffic noise sources (L_{Aeq}).
 - L_{AFmax} noise levels have been predicted with a simplified model of a 6 dB reduction per doubling of distance from the nearside kerb edge of the road.
 - The model included the Proposed Site Layout, which is shown in **Figure 1.2**.
 - Topographical data for the ground levels across the site and surrounding area, obtained from LIDAR data of 1 m resolution, publicly available from the Department for Environment Food and Rural Affairs (DEFRA) was included.
 - The model was set to include second order reflected noise from solid structures. All buildings were set to be acoustically reflective.
 - The heights of proposed properties within the model have been set at 8 m and the heights of existing buildings surrounding the site have been determined using online mapping sources.
 - Ground cover has been assumed to have an absorption coefficient of 0.5 to account for the varied absorptive and reflective conditions across the site and surrounding area.
 - For the prediction of noise levels during the daytime, receptor points within the model have been set at 1.5 m above local ground level. For the night-time, receptor points have been set at 4 m, to be representative of bedrooms at first floor level.

- Embedded mitigation in the form of perimeter garden fencing has been included in the model at a standard height of 1.8 m.

4.2.2. In order to calibrate the acoustic model, receptor points have been set within the model which are representative of the height and locations of ML1, ML2 and ML3. The road sources have then been calibrated at those receptor points until the modelled ambient noise levels for the daytime and night-time periods equalled those measured at ML1, ML2 and ML3.

EXTERNAL NOISE LEVELS

4.2.3. **Figure 4.1** presents the predicted ambient noise levels from road traffic across the site during the daytime ($L_{Aeq,16h}$).

4.2.1. **Figure 4.1** indicates that noise levels during the daytime are predicted to meet or fall below the recommended upper guideline value of 55 dB $L_{Aeq,16h}$ in all external amenity spaces (i.e. private gardens and the shared garden space) demarked in the Proposed Site Layout Plan.

4.2.2. For balcony spaces at the apartment building, the predicted $L_{Aeq,16h}$ levels range from 54 to 57 dB within those located on the north-western façade, away from Delaunays Road; and between 62 to 63 dB within the balconies located at the south-west and north-eastern facades, overlooking Delaunays Road.

4.2.3. Whilst noise levels in the majority of these spaces are predicted to exceed the recommended upper guideline limit, BS 8233, states the following with respect to balcony spaces:

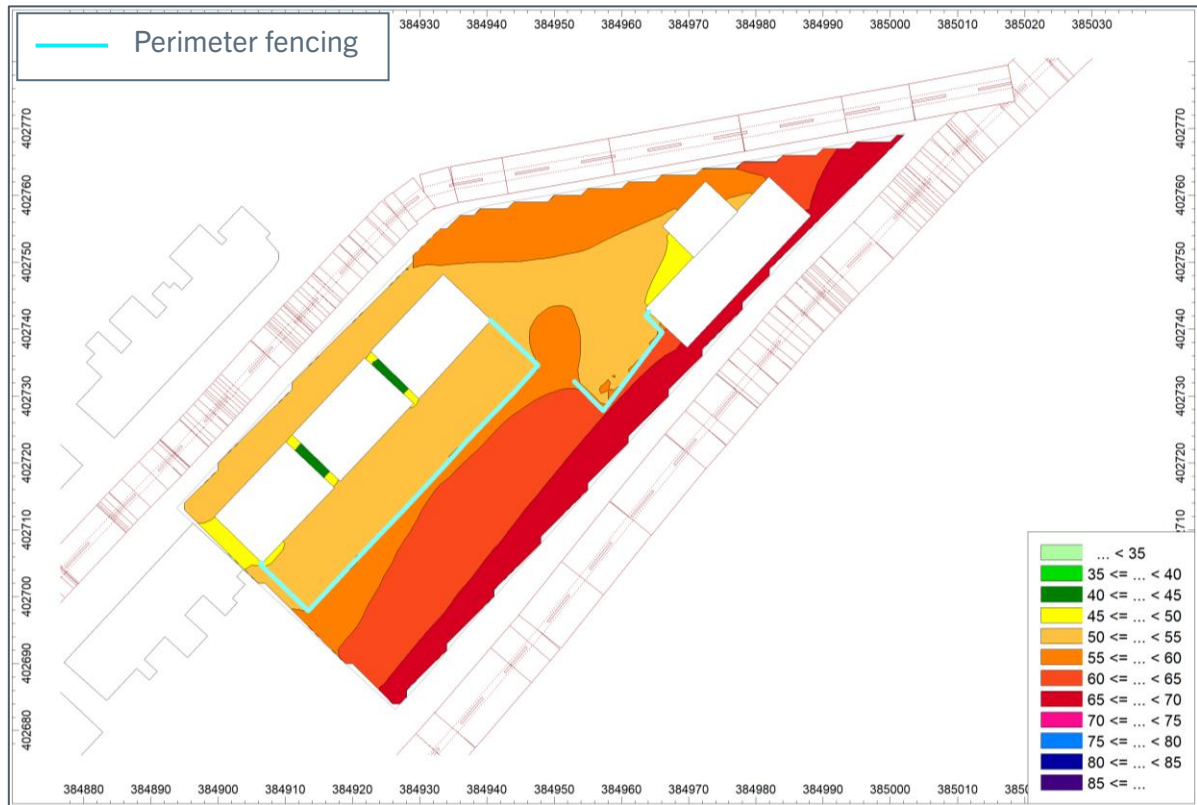
“Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate.”

4.2.4. Furthermore, the Planning Practice Guidance for noise¹ advises that noise impacts may be partially offset if (future) residents have access to a ‘relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings’. A space which meets this criterion has been included as part of the design at ground floor level. This is the shared garden space, in which noise levels are predicted to meet or fall below the recommended upper guideline threshold of 55 dB.

4.2.5. Given that noise limits are not necessarily required in balcony spaces, as stated in BS 8233, and on the basis that occupants have an alternative external amenity provision where noise levels meet or fall below the recommended upper guideline threshold, it is considered that no further forms of mitigation are required to reduce noise levels within balcony spaces.

¹ Department for Levelling Up, Housing and Communities, Ministry of Housing, Communities & Local Government. (2019). Planning Practice Guidance: Noise. Paragraph: 011 Reference ID: 30-011-20190722

Figure 4.1: Daytime ambient noise levels ($L_{Aeq,16h}$) at 1.5 m above ground



INTERNAL NOISE LEVELS

- 4.2.6. For the assessment of road traffic noise levels within sensitive internal spaces during the daytime, consideration must be given to the ambient noise level ($L_{Aeq,16h}$). For the night-time, consideration must be given to both the ambient noise level ($L_{Aeq,8h}$), and the maximum noise level from individual, or distinctive noise events (L_{AFmax}).
- 4.2.7. Based on the adopted internal ambient noise level criterion of 35 dB $L_{Aeq,16h}$ for the daytime, the equivalent external level, assuming an open window provides 15 dB noise attenuation, is 50 dB $L_{Aeq,16h}$.
- 4.2.8. Based on the adopted internal ambient noise level criterion of 30 dB $L_{Aeq,8h}$ for the night-time, and 45 dB L_{AFmax} for maximum noise levels, the equivalent external levels, assuming an open window provides 15 dB noise attenuation, are 45 dB $L_{Aeq,8h}$ and 60 dB L_{AFmax} , respectively.
- 4.2.9. **Table 4.1** presents the range of predicted external noise levels at the proposed houses and the apartment block during the daytime and night-time.

Table 4.1: Predicted noise levels during the daytime and night-time

Property	Predicted Ambient Noise Levels, dB $L_{Aeq,T}$		Predicted Maximum Noise Levels, dB $L_{AFmax,5min}$
	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Night-time (23:00-07:00)
Houses	43 - 54	42 - 53	62 - 66
Apartment Block	49 - 67	45 - 62	63 - 80

4.2.10. **Table 4.1** indicates that noise levels at the worst affected facades of the houses and the apartment block are predicted to exceed the daytime and night-time ambient noise level criteria and the night-time maximum noise level criterion. Therefore, consideration is given to forms of mitigation to reduce internal noise levels in the following section.

5.0. MITIGATION

5.1. OVERVIEW

- 5.1.1. The assessment of potential noise impacts from road traffic local to the site has indicated that noise levels within some sensitive internal spaces of the development are likely to exceed the 'desirable' guideline values from BS 8233.
- 5.1.2. This section presents the acoustic performance requirements relating to the sound insulation of the facades such that internal ambient and maximum noise levels within sensitive internal spaces comply with the guideline values from BS 8233. The predictions have been undertaken in accordance with the 'More rigorous calculation' methodology from BS 8233.

5.2. MITIGATION ASSESSMENT

- 5.2.1. The following assumptions have made for the assessment of the sound insulation requirements of the facades:
- The predictions assume good quality workmanship, for example that windows, doors and opening lights are well sealed. Poor workmanship or low-quality seals may result in predicted internal noise levels being exceeded.
 - External walls are assumed to be of brick construction.
 - Bedrooms are assumed to have a single trickle ventilator.
 - Living rooms are assumed to have two trickle ventilators.
 - All rooms are assumed to have a reverberation time of 0.5 s in the frequency bands of interest.
 - Room and glazing dimensions have been based on drawings provided by Triangle Architects.
 - Based on the results of the overheating assessment, prepared by JPM Acoustics (report reference: *0112024_OH_002, April 2024*), mechanical ventilation and heat recovery (ADF System 4) has been recommended for all apartments. This has been taken into account in the subsequent sound insulation calculations for the apartment block.
- 5.2.2. Based on the results of the above predictions, details of the recommended acoustic performance requirements of the glazing and ventilation systems are given in **Table 5.1**.

Table 5.1: Summary of the recommended glazing and ventilation systems

Key colour in Appendix C	Window System	Ventilation Strategy
	36 dB $R_w + C_{tr}$ Example configuration: 10 mm glass/12 mm air gap/8.8 mm acoustic laminated glass or similar	ADF System 4 Mechanical Ventilation and Heat Recovery
	33 dB $R_w + C_{tr}$ Example configuration: 6 mm glass/12 mm air gap/8.8 mm acoustic laminated glass or similar	ADF System 4 Mechanical Ventilation and Heat Recovery
	27 dB $R_w + C_{tr}$ Example configuration: 4 mm glass/12 mm air gap/4 mm glass or similar	ADF System 1 Background ventilators and intermittent extract fans with a minimum performance of 29 dB $D_{n,e,w} + C_{tr}$
<p>“ADF System” is the name given to various ventilation strategies set out in Approved Document F (ADF) – Means of Ventilation, 2010 Edition.</p>		

- 5.2.3. Accounting for the glazing and ventilation performances from Table 5.1 the desirable guideline values from BS 8233 and, the 45 dB L_{AFmax} criterion during the night-time, would be predicted to be achieved with windows closed and ventilators open.
- 5.2.4. Note that windows can still be opened at the occupier’s discretion and when purge ventilation is required for the rapid removal/dispersal of odour or pollutants (e.g. water vapour, burnt toast, paint vapours).

6.0. CONCLUSION

- 6.1.1. JPM Acoustics Ltd has been appointed to undertake a noise impact assessment to support a planning application for the proposed residential development at Parkhill Avenue, Crumpsall
- 6.1.2. An assessment has been undertaken in accordance with relevant British Standards and has been informed by a baseline noise survey.
- 6.1.3. With respect to noise levels within external amenity spaces, the assessment indicates that the recommended upper guideline value from BS 8233 can be achieved in all private and shared garden spaces without the need for specific forms of mitigation.
- 6.1.4. The assessment indicates that desirable internal noise levels are unlikely to be achieved at the worst affected facades with windows open. Therefore, recommendations have been made regarding suitable glazing and ventilation acoustic performances, which, if adopted, indicate that desirable internal noise levels can be achieved.
- 6.1.5. In summary, with the proposed forms of mitigation in place, desirable internal noise levels are achievable. Consequently, noise need not be a significant factor in the determination of this application.

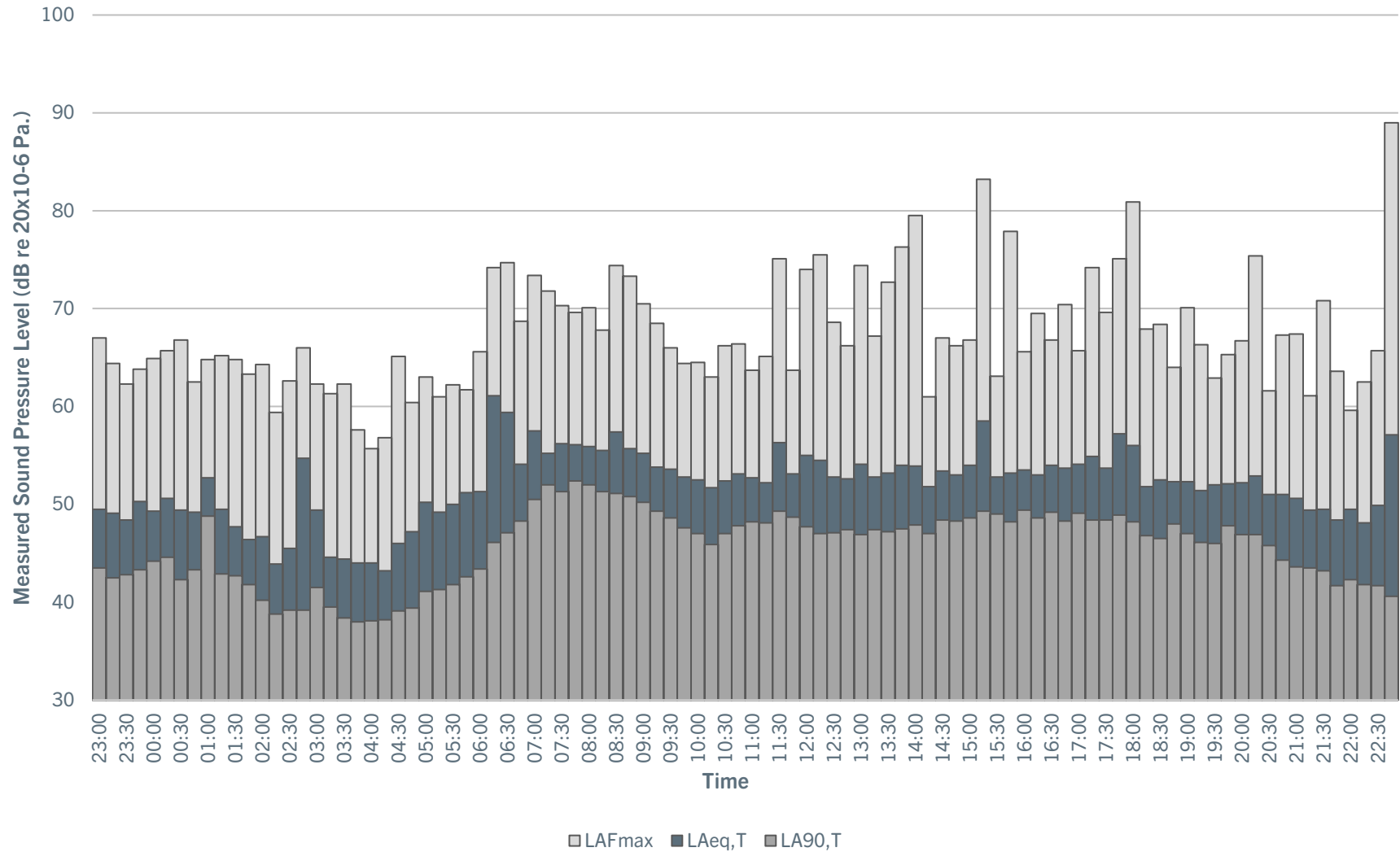
APPENDIX A: GLOSSARY

Table A.2: Acoustic terminology

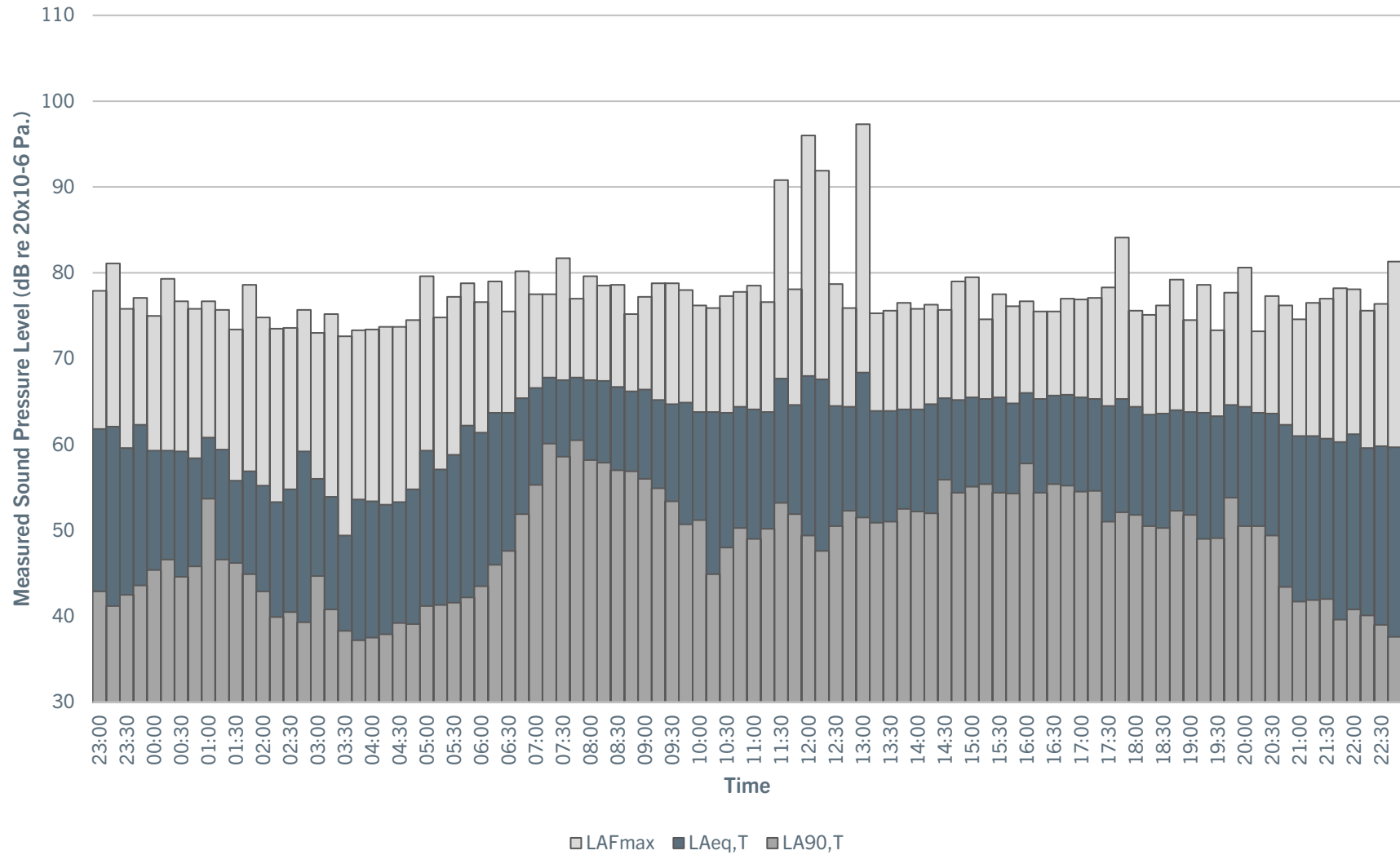
Terminology	Description
A-weighting, dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Decibel, (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1/s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 Pa.
Façade	At a distance of 1 m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting (F)	Averaging time constant used in sound level meters and commonly used in the measurement of environmental noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period, T. L_{90} may be thought of as the "average minimum" noise level. Generally used to describe background noise.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period, T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period, T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure. Measured in pascals (Pa).
Sound Pressure Level (Sound Level), L_p	The sound level is the sound pressure on a decibel scale, relative to a reference value of 20×10^{-6} Pascals.

APPENDIX B: SURVEY RESULTS

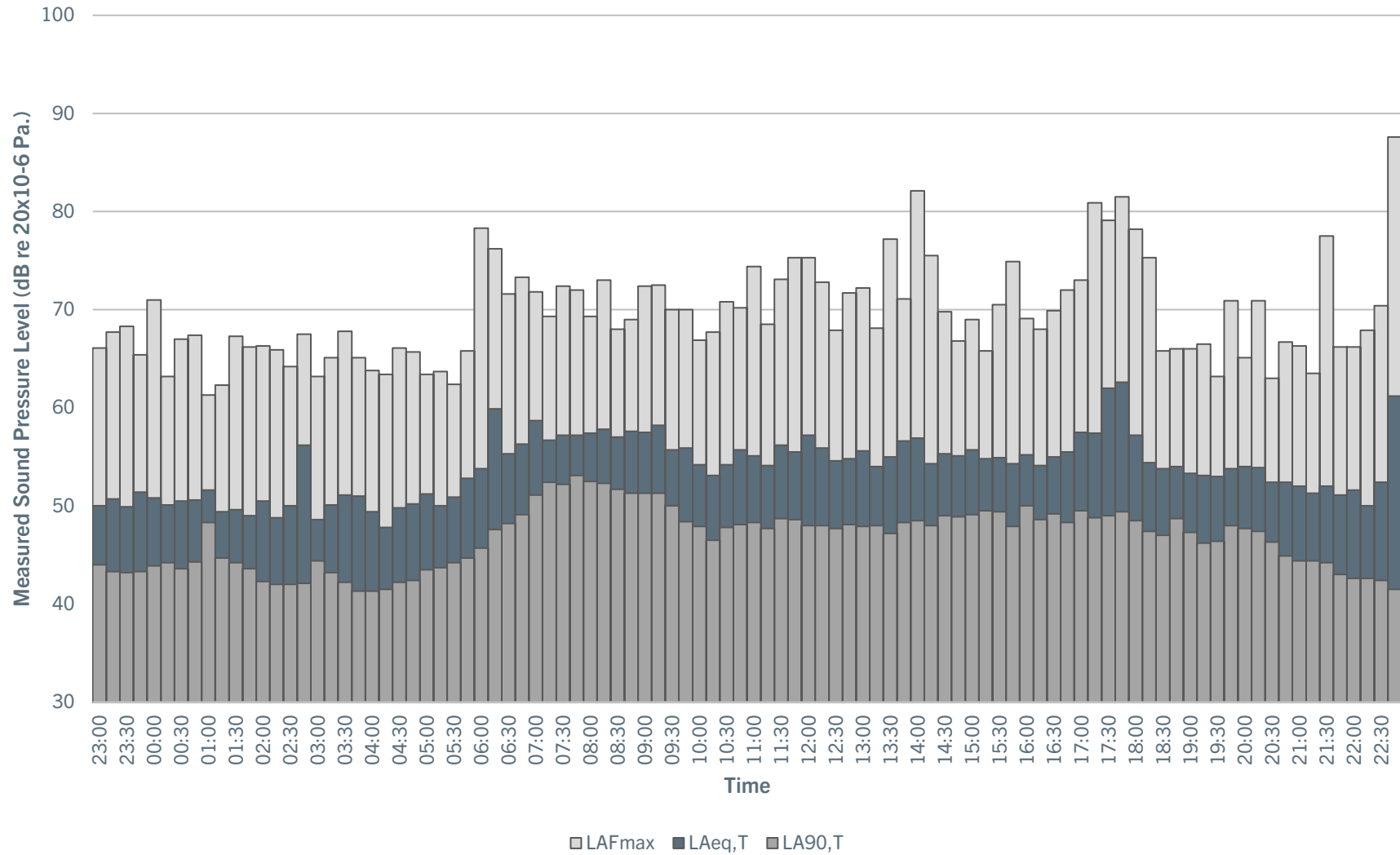
Parkhill Avenue - ML1
Environmental Noise Monitoring Survey Results
LAeq, LAFmax & LA90 Measured Noise Levels
12/02/2024 - 13/02/2024



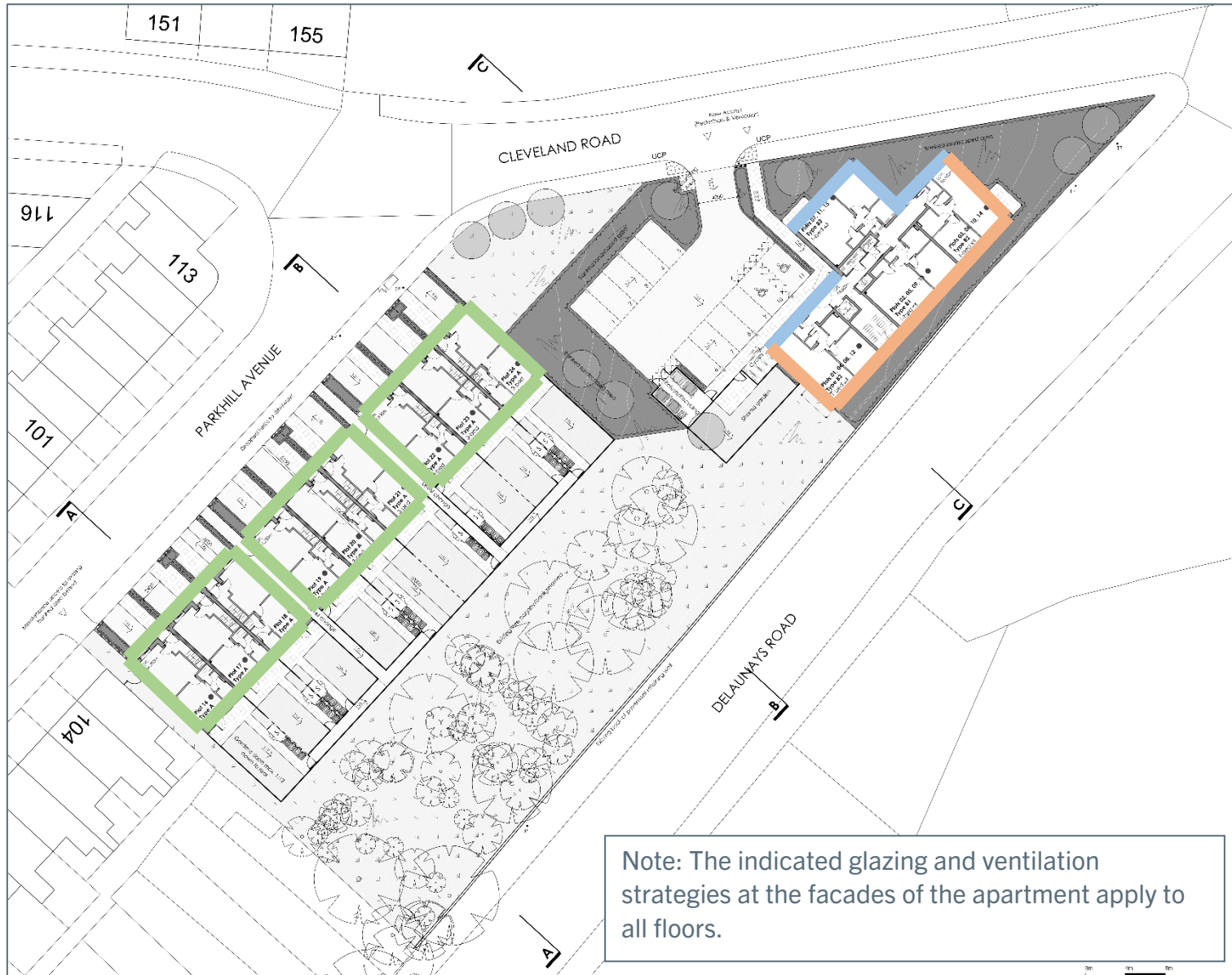
Parkhill Avenue - ML2
Environmental Noise Monitoring Survey Results
LAeq, LAFmax & LA90 Measured Noise Levels
12/02/2024 - 13/02/2024



Parkhill Avenue - ML3
Environmental Noise Monitoring Survey Results
LAeq, LAFmax & LA90 Measured Noise Levels
12/02/2024 - 13/02/2024



APPENDIX C: GLAZING AND VENTILATION



JPM ACOUSTICS // TECHNICAL NOTE

TO:	Manchester City Council: Environmental Health
FROM:	Luke Smith (JPM Acoustics)
SUBJECT:	Parkhill Avenue – Noise Impact Assessment
DATE:	02/07/2024

INTRODUCTION

JPM Acoustics has previously submitted a Noise Impact Assessment (report reference: *0112024, April 2024*) (April 2024 NIA) for the proposed residential development

Comments have been received in response to the report from the Environmental Health (EH) Department at Manchester City Council (MCC), which are addressed below. Each comment is reproduced below in full, followed by responses from JPM Acoustics.

ENVIRONMENTAL HEALTH COMMENTS

“No mention of AVO assessment or justification why this has not been done.”

A separate, detailed assessment of overheating has been provided by JPM Acoustics (report reference *0112024_OH_002, April 2024*) as part of the planning application. The April 2024 NIA indicated that external noise levels are such that windows should generally be kept closed (although it would be acceptable to open them at the occupier’s discretion and for the purposes of purge ventilation). The detailed overheating assessment then makes recommendations for mitigation measures to control overheating. On this basis, the matter of overheating is considered to have been addressed.

“Garden/ balcony dB levels not given.”

The assessment of garden spaces has been provided in the April 2024 NIA, in which noise levels are presented graphically and are stated as being below 55 dB in paragraph 4.2.1. An updated noise impact assessment report (report reference: *0112024, July 2024*) (July 2024 NIA) has been prepared in which further consideration is given to noise across balcony spaces.

“It is not clear from the different colouring systems what windows are getting what glazing.”

The colours set out in Table 5.1 of the April 2024 NIA correspond with the Figure provided in Appendix C of the report.

“An open window provided 13dB of attenuation not 15dB.”

It is assumed that the suggested 13 dB value has been taken from The Acoustics Ventilation and Overheating Guide (AVOG). The guidance in AVOG is based on laboratory and field studies of sound insulation performances from windows of various types and degrees of opening angle. The

Napier University study¹ prepared for DEFRA, which is referenced in AVOG, estimates a 13 dB sound insulation performance for sash windows, which are generally considered to be 'acoustically weak' in performance terms. However, the windows for the proposed properties will be the more commonly installed hinged variety, which, the study indicated, performed 1-2 dB higher than sash windows. On this basis, a value of 15 dB is reasonable for the type of open window which is proposed. This notwithstanding, the April 2024 NIA indicates that windows should be closed, which would significantly increase the sound insulation of the façades whether accepted as 13 dB or 15 dB with windows opened.

"It is not clear what an ADF system 1 is? Environmental Health look at this from a comfort point of view, Building Control regulations are not something that would be commented on."

ADF (Approved Document F) and ADF system 1 are frequently referred to in AVOG, the document referenced for use by EH in its comments (although referred to as 'AVO'), so it is assumed that there would be some familiarity with them. It is appropriate to include ADF system 1 in the April 2024 NIA and for EH to acknowledge its inclusion, as it is a ventilation system, which has a clear bearing on the noise assessment.

It has been noted, however, that the April 2024 NIA had not been updated to include for the Mechanical Ventilation and Heat Recovery (MVHR) system (ADF system 4) which is recommended for the apartments in the subsequent overheating assessment. This has been rectified in the updated July 2024 NIA.

END

¹ Department of Environment, Food & Rural Affairs (2007). NANR116: 'Open/Closed Window Research' Sound Insulation Through Ventilated Domestic Windows



JPM ACOUSTICS

PARKHILL AVENUE, CRUMPSALL

APPROVED DOCUMENT O: OVERHEATING ASSESSMENT

APRIL 2024



DOCUMENT VERSION RECORD

	1	2	3
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APPROVED DOCUMENT O: OVERHEATING ASSESSMENT COMPLIANCE REPORT

EXECUTIVE SUMMARY

JPM Acoustics has been appointed to undertake an assessment of overheating risk for 24x proposed dwellings at Parkhill Avenue, Crumpsall. The proposed development comprises 9x semi-detached dwellings, and 15x flats.

Furthermore, JPM Acoustics has also been appointed to undertake a noise impact assessment to support a planning application for the proposed development. The results of the noise impact assessment (report reference 0112024) identified that internal noise levels would be acceptable in the proposed 9x dwelling-houses with windows open for ventilation or comfort cooling. However, in the 15x flats, openable windows should not be relied upon at night-time (23:00 – 07:00) for ventilation or comfort cooling.

An assessment of overheating risk has been undertaken, which draws on information provided by the design team, which aligns with the provisional SAP calculations for the proposed dwelling-houses and flats. The resultant Approved Document O: Overheating Compliance Report for the proposed dwellings is included in Appendix A.

The assessment has found a low residual risk of overheating in all dwellings across the site, provided the mitigation measures outlined in this document are incorporated into the scheme design; principally a scheme of Mechanical Ventilation with Heat Recovery in the 15x proposed flats where openable windows are prohibited at night due to high external noise levels. Details of the required MVHR system for in the 15x flats, and the assumed natural scheme of ventilation in the dwelling / houses are presented in this report. A glazing g-value of 0.40 for the proposed flats, and 0.5 for the dwelling-houses has been assumed .

A summary of measures that form the overheating mitigating strategy include:

- Natural ventilation via window openings as per the architectural drawings (where noise restrictions allow)
- Window openings to be opened to maximal permissible opening angles in accordance with Approved Document K (safeguarding measures may be required)
- Glazing solar performance (g value) of 0.4 for flats and 0.5 for the dwelling-houses.
- Mechanical ventilation with Heat Recovery to the flats.
- Decentralised Mechanical Extract ventilation to the houses (system 3).
- Internal doors to be left open when possible
- Window trickle ventilators meeting minimum Approved Document F requirements.

1.0. INTRODUCTION

1.1. OVERVIEW

- 1.1.1. JPM Acoustics has been appointed to undertake an assessment of overheating risk for 24x proposed dwellings at Parkhill Avenue, Crumpsall. The proposed development comprises 9x semi-detached dwellings, and 15x flats.
- 1.1.2. The results of this study are intended to inform and verify the design proposals, thereby providing the basis for mitigating overheating risk, and producing dwellings which provide comfortable environmental conditions for future occupants.
- 1.1.3. In addition, this Overheating Assessment is intended to support a Planning Application for the development, and demonstrates that the proposed development complies with the relevant current guidance (i.e. CIBSE TM59: Design Methodology for the Assessment of Overheating Risk in Homes 2017 (TM59), and the requirements of dynamic thermal modelling outlined in Approved Document O: Overheating Mitigation (ADO) of the Building Regulations).
- 1.1.4. It should be noted that with any modelling exercise relies in part on assumptions and approximations. As far as possible, details of all assumptions and approximations are provided within this report. Assumptions and approximations are predominantly informed by information provided by design team, but should be reviewed carefully by the design team to ensure they are appropriate.
- 1.1.5. Furthermore, all results based on the output from computer modelling software should be taken as an indication of the likely final situation. The predicted conditions cannot, however, be guaranteed.

1.2. SITE LOCATION AND PROPOSED DEVELOPMENT

- 1.2.1. The proposed development site comprises open land which is located in a mixed-use area of Crumpsall. Immediately to the north lies Cleveland Road, with the premises of British Cables Company approximately 60 m further north; to the east lies Delaunays Road; to the south are residential properties along Delaunays Road and Parkhill Avenue; and to the west lies Parkhill Avenue.
- 1.2.2. The site location is presented in **Figure 1.1**.

Figure 1.1: Site location plan

1.2.3. The development proposals include for 9x dwelling-houses with private gardens and 15x flats with an associated shared garden space. **Figure 1.2** shows the proposed development layout.

Figure 1.2: Proposed Development Layout

2.0. OVERHEATING ASSESSMENT CRITERIA

- 2.1.1. TM59 sets separate overheating compliance criteria for homes that are predominantly naturally ventilated and those that are predominantly mechanically ventilated.
- 2.1.2. For homes that are predominantly naturally ventilated, two criterion should be used to assess overheating. The first overheating criterion, which applies to both living rooms/kitchens and bedrooms, is an adaptive criterion. The second overheating criterion is a fixed temperature parameter which applies only to bedrooms. Both criteria must be met for all spaces for compliance to be achieved.
- 2.1.3. For mechanically ventilated homes, a fixed temperature method with a single criterion should be adopted. This single criterion must be met for all spaces (living rooms/kitchens and bedrooms) for compliance to be achieved
- 2.1.4. The TM59 criteria for naturally and mechanically ventilated homes are summarised in **Table 2.1**.

Table 2.1: Overheating Assessment Criteria

Assessment Type	Assessment Criteria	Applicable Rooms	Occupied Hours	Naturally Ventilated Homes (open windows)	Mechanically Ventilated Homes (closed windows)
Predominantly Natural Ventilation	Criterion 1	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	The number of hours during which external and internal temperature difference 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.	Not applicable
	Criterion 2	Bedrooms only	Bedrooms – 24-hour occupancy	The operative temperature in the bedroom from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours. 33 or more hours above 26°C will be a fail	Not applicable
Predominantly Mechanical Ventilation	Criterion 1	Living rooms, kitchens and bedrooms	Living / Kitchen / Dining rooms – 9am to 10pm (13 hours/day) Bedrooms – 24-hour occupancy	Not applicable	The operative temperature in occupied all occupied rooms should not exceed 26°C for more than 3% of the annual occupied annual hours. 143 or more hours above 26°C for living rooms and kitchens will be a fail. 263 or more hours above 26 °C for bedrooms will be a fail

3.0. DESIGN PRINCIPLES

3.1. OVERVIEW

- 3.1.1. In order to demonstrate compliance with Requirement O1 from ADO, this assessment has adopted the Dynamic Thermal Modelling Approach.
- 3.1.2. To demonstrate compliance using the dynamic thermal modelling method, all of the following have been considered:
- (a) CIBSE TM59 methodology for predicting overheating risk;
 - (b) limits on the use of CIBSE TM59 methodology set out below; and
 - (c) acceptable strategies for reducing overheating risk

3.2. LIMITS OF CIBSE TM59 MODELLING

- 3.2.1. All of the following limits of CIBSE's TM59, section 3.3 shall apply:
- a) When a room is occupied during the day (08:00 – 23:00), openings should be modelled as follows:
 - i) Start to open when the internal temperature exceeds 22°C
 - ii) Be fully open when the internal temperature exceeds 26°C
 - iii) Start to close when internal temperature falls below 26°C
 - iv) Be fully closed when the internal temperature falls below 22°C
 - b) At night (23:00 – 08:00), openings should be modelled as fully open (in naturally ventilated spaces) if both of the following apply:
 - i) The opening is on the first floor or above and not easily accessible
 - ii) The internal temperature exceeds 23°C at 11pm.
 - c) When a ground floor or easily accessible room is unoccupied, both of the following apply:
 - i) In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely.
 - ii) At night, windows, patio doors and balcony doors should be modelled as closed.
 - d) An entrance door should be included, which should be shut all the time.
 - e) Acceptable strategies for reducing overheating risk should be employed.

3.3. LIMITING SOLAR GAINS

3.3.1. Solar gains in summer should be limited by any of the following means:

- a) Fixed shading devices, comprising any of the following.
 - i) Shutters
 - ii) External blinds
 - iii) Overhangs
 - iv) Awnings
- b) Glazing design, involving any of the following solutions:
 - i) Size
 - ii) Orientation
 - iii) g-value
 - iv) Depth of the window reveal
- c) Building design – for example, the placement of balconies.
- d) Shading provided by adjacent permanent buildings, structures, or landscaping.

3.4. REMOVING EXCESS HEAT

3.4.1. Excess heat should be removed by any of the following means:

- a) Opening windows (the effectiveness of this method is improved by cross-ventilation)
- b) Ventilation louvres in external walls
- c) A mechanical ventilation system
- d) A mechanical cooling system

4.0. DESIGN CRITERIA

4.1.1. The following general criteria have been adopted in the simulation.

4.2. AIR PERMEABILITY

4.2.1. An air infiltration rate of 0.15ACH has been applied to all plots based on Table 4.24 of CIBSE Guide A for an air permeability target of 3 m³/(h.m²).

4.3. EXTERNAL ENVELOPE

4.3.1. The U-values in **Table 4.1** have been assumed.

Table 4.1: Assumed U-Values

Element	Proposed U-value (W/m ² K)	Part L1A U-value (W/m ² K)
External Walls	0.19	0.18
Exposed floor	0.11	0.13
Roof	0.15	0.11
Glazing	1.20	1.40
Patio Doors	1.20	1.40
Doors	1.20	1.00

4.4. GLAZING SPECIFICATION

4.4.1. The glazing is based on a G-value of 0.40 for the apartments and 0.50 for the houses.

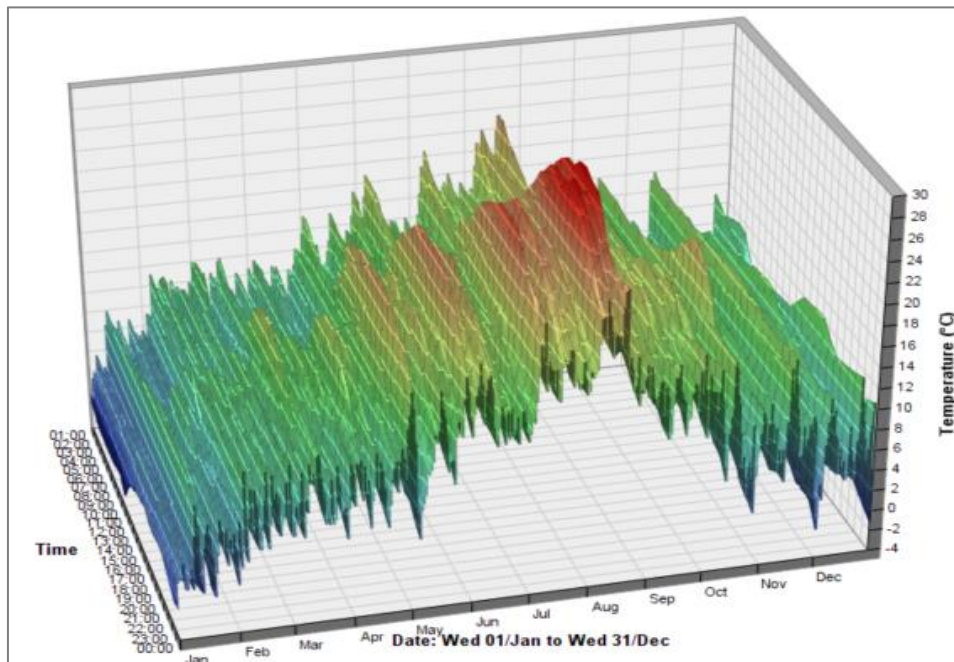
4.5. INTERNAL WINDOW BLINDS

4.5.1. Internal blinds have been not included in the calculations

4.6. WEATHER

4.6.1. The development site is located in Crumpsall, Manchester. Weather file used in the calculation:- Manchester_DSY1_2020High50_.epw. The peak summer temperature is 30°C (see **Figure 4.1**).

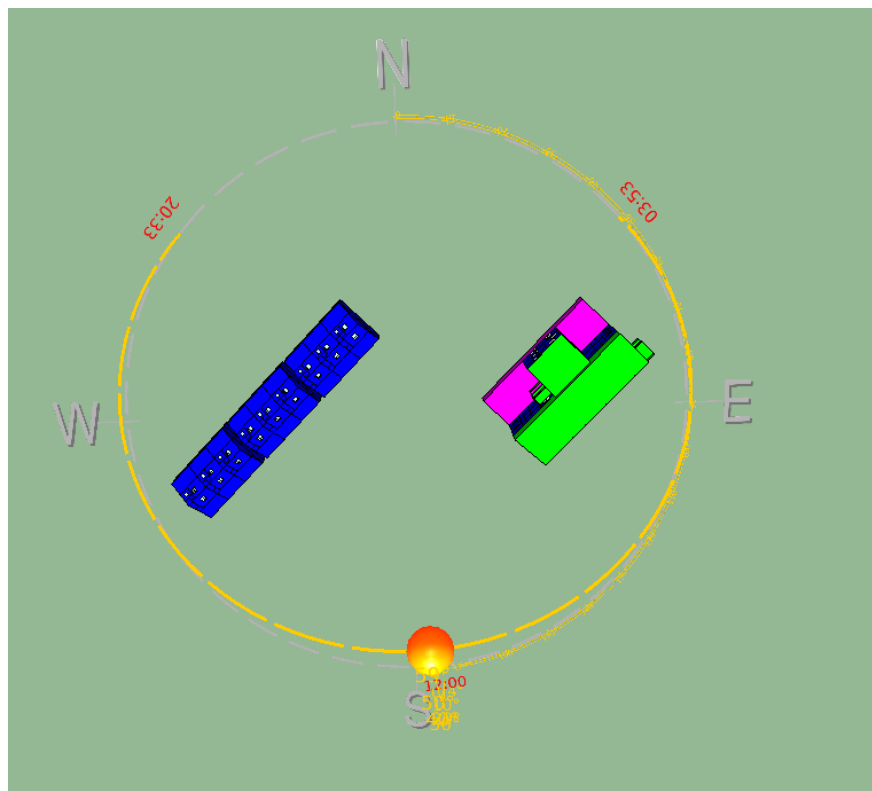
Figure 4.1: Annual dry-bulb temperature graph of modelled weather file



4.7. SITE ORIENTATION

- 4.7.1. The dwelling has been modelled in its correct orientation as per the Site Plan Drawing (see **Figure 4.2**)

Figure 4.2: Development Orientation



5.0. REFERENCE DATA

5.1. ARCHITRECTORAL DRAWINGS

- 5.1.1. The modelling on which this assessment is based has adopted scheme layout plans detailed in drawings provided by the project Architects.

6.0. INTERNAL GAINS

6.1. OVERVIEW

- 6.1.1. Internal gains adopted throughout the simulations are detailed in this section. No differences between weekdays and weekends are considered. Bedrooms are have been assumed to have a 24-hour occupancy profile which means that one person is always assumed to be present in each bedroom during the daytime, and two people in each double bedroom at night. Kitchen/living rooms are assumed to be unoccupied during sleeping hours and occupied during the rest of the day. Occupied periods are totaled at 3672 hours per year for bedrooms (24/7 May to September) and 1989 hours for living areas (13 hours per day May to September).

6.2. OCCUPANCY

- 6.2.1. Based on CIBSE Guide A (2015a), a maximum sensible heat gain of 75W per person is assumed in living spaces. An allowance for 30% reduced gain during sleeping is based on Addendum g to ANSI/ASHRAE Standard 55-2010.

Table 6.1: Assumed Occupancy Gains

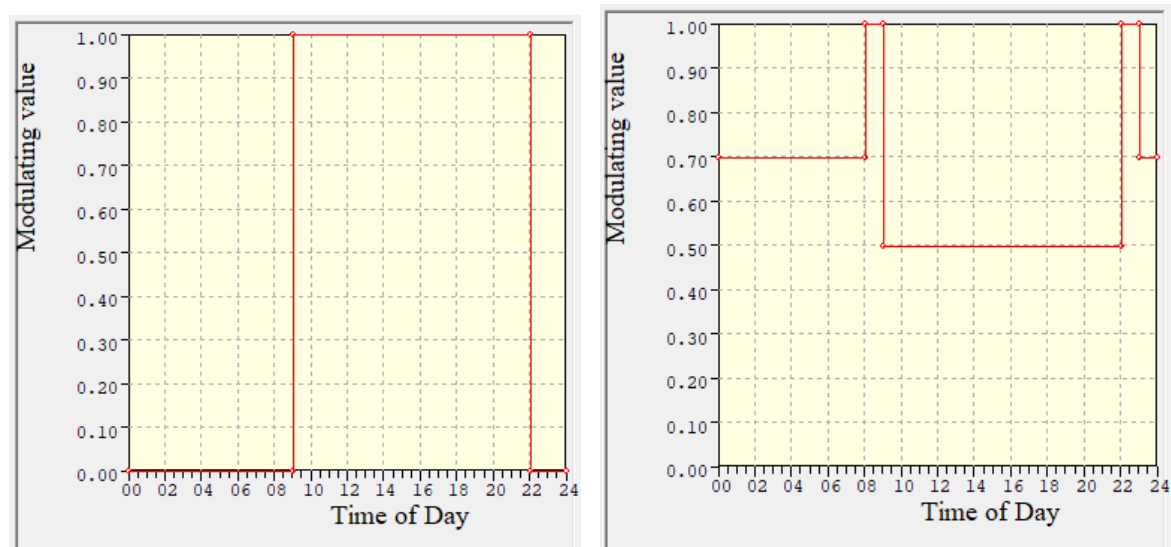
Activity	Sensible Heat Gain per Person (W)
Standard	75
Sleeping	55

Table 6.2: Assumed Occupancy

Unit / Room Type	Occupancy
1 bed living/kitchen	1 person from 9am to 10pm room is unoccupied for the rest of the day
2 bed living/kitchen	2 people from 9am to 10pm room is unoccupied for the rest of the day
3 bed living/kitchen	3 people from 9am to 10pm room is unoccupied for the rest of the day

Unit / Room Type	Occupancy
Double bedroom	2 people at 70% gain from 11pm to 8am 2 people at full gain from 8am to 9am and from 10pm to 11pm 1 person at full gain from 9am to 10pm
Single bedroom	1 person at 70% gain from 11pm to 8am 1 person at full gain from 8am to 11pm

Figure 6.1: Typical living / Kitchen Occupancy Profile (left image), Typical double bedroom occupancy profile (right image)



6.3. LIGHTING

- 6.3.1. Lighting energy is assumed to be proportional to floor area. A default value of 2 w/m² is applied to all occupied areas from 18:00 until 23:00.

Table 6.3: Assumed Lighting Gains

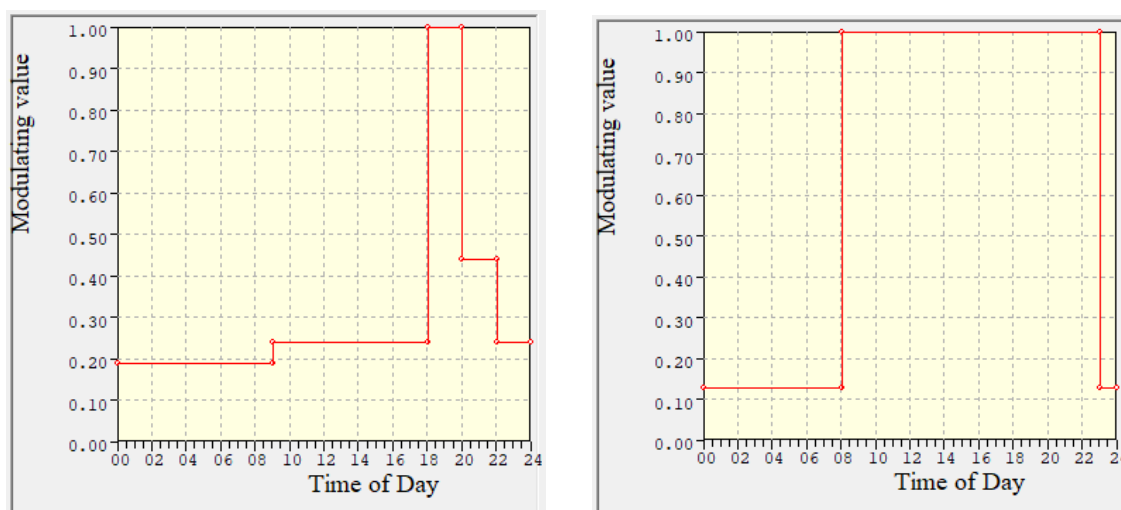
Zone Type	Gain (W)
Living / kitchen / dining area	2
Bedroom	0

6.4. EQUIPMENT

- 6.4.1. Assumed equipment gains per room type are detailed in **Table 6.4**.

Table 6.4: Assumed Equipment Gains

Activity	Sensible Heat Gain per Person (W)
1 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
2 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
3 bed living/kitchen	Peak load of 450W from 6pm to 8pm 200W from 8pm to 10pm 110W from 9am to 6pm and 10pm to 12pm Base load of 85W for the rest of the day
Double bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Single bedroom	Peak load of 80W from 8am to 11pm Base load of 10W during sleeping hours
Communal corridors	Assumed to be zero

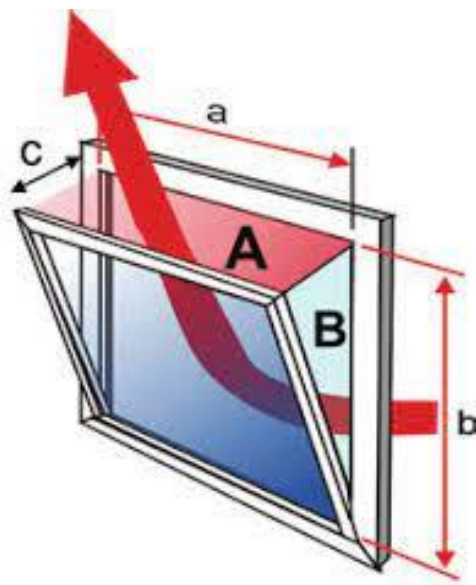
Figure 6.2: Typical Living / Kitchen Equipment Gain Profile (left image), Typical Double Bedroom Equipment Gain Profile (right image)

7.0. VENTILATION

7.1. NATURAL VENTILATION

- 7.1.1. The windows of the development have been modelled using an opening profile that simulates the occupants within the rooms opening the windows when the internal air temperature reaches 22°C, as stipulated by ADO. The same procedure operates in reverse as the air temperature cools.
- 7.1.2. The free area is a way of measuring what the equivalent completely open area is for a glazing assembly. Sufficient free area to the opening windows in a dwelling is vital to the overheating mitigation strategy and can be calculated using the combined areas of **A+B** (in m²), as identified in **Figure 7.1**.

Figure 7.1: Illustration of Window Opening for Natural Ventilation



- 7.1.3. Opening angle is the degree of opening of area **B** in **Figure 7.1**. Windows have been modelled to be either top or side hung as shown on the architectural drawings.
- 7.1.4. Dimension **C** refers to the opening length that windows reach when opened. As referenced in ADO section 3.9, if the maximum opening angle (**B**) exceeds 100 mm of dimension length **C** then the following three criteria must be met:
- a) Window handles on windows that open outwards are not more than 650 mm from the inside face of the wall when the window is at its maximum openable angle.
 - b) Guarding meets the minimum standards in Table 3.1
 - c) Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

7.2. INTERNAL DOORS

- 7.2.1. It is recommended for dwelling occupants to keep internal doors open at all times where possible so to allow air movement between rooms. Openable windows in non-habitable spaces such as landings / halls and bathrooms have been modelled, and can contribute to the overall natural ventilation strategy for the dwelling.
- 7.2.2. ADO stipulates bedroom doors must be modelled to be closed during sleeping hours, however there are no constraints during the day and are therefore modelled as open. All non-bedroom doors are considered open on a 24/7 basis.

7.3. WINDOW OPENING SCHEDULE

- 7.3.1. Figures below identify the assumed window opening schedule in the thermal model.

Opening Type	
■	XTRN0000 (Window / Door Closed)
■	XTRN0002 (Internal Doors Living)
■	XTRN0003 (Internal Doors Bedroom)
■	XTRN0004 (Patio Doors (Section 26a))
■	XTRN0009 (Top Hung (Section 26a))
■	XTRN0011 (Top Hung (Section 26ab))

- Window/Door Closed: Fixed pane, unopenable
- Patio Doors section 2.6a (day) – Patio Doors: Day Open, Night Closed
- Top Hung section 2.6a (day) – Window: Day Open, Night Closed
- Top Hung section 2.6a+b (day & night) Window: Day Open, Night Open

Figure 7.2: Allocation of Window Types Across the Dwelling Houses on the Site

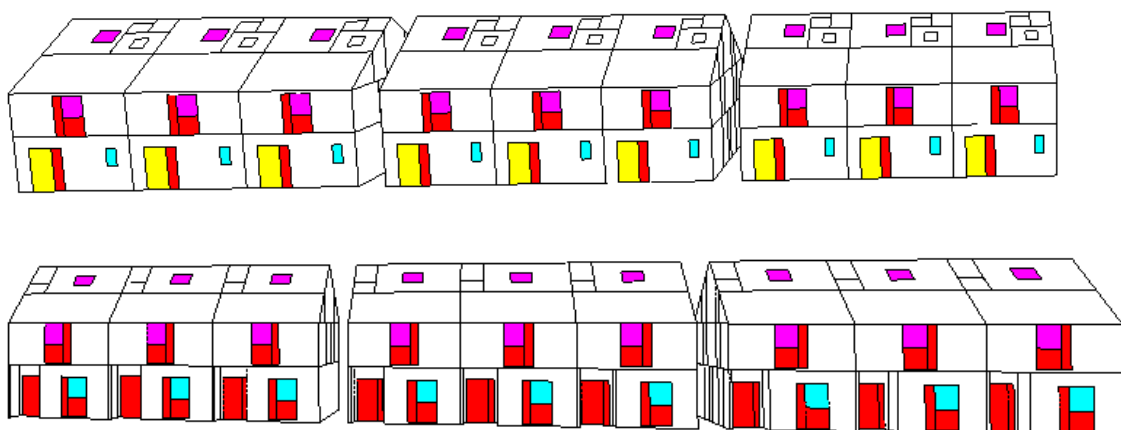
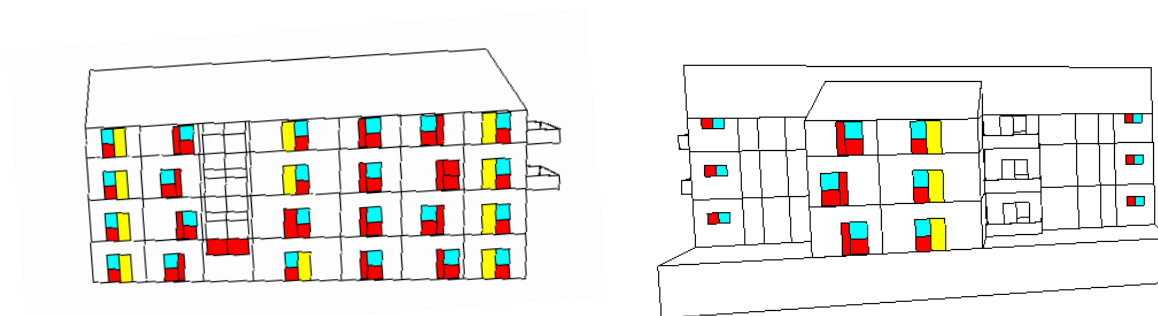


Figure 7.3: Allocation of Window Types Across the Flats on the Site



7.4. TRICKLE VENTILATORS

7.4.1. As per section 1.64 of Approved Document F: Ventilation (ADF) of the Building Regulations, where intermittent extract ventilation is present, supply / replacement air is to be provided by trickle ventilators in windows to meet the following conditions:

- a) Not to be installed in wet rooms
- b) Provide a minimum equivalent area of 4000 mm² for each habitable room in the dwelling
- c) Provide a minimum total number of ventilators that is the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom dwelling should have three background ventilators, a two bedroom dwelling should have four background ventilators, etc.)

Figure 7.4: Reproduction of Table 1.1 from ADF

Table 1.1 Minimum extract ventilation rates for intermittent extract systems	
Room	Intermittent extract rate (l/s)
Kitchen (cooker hood extracting to the outside) ^[1]	30
Kitchen (no cooker hood or cooker hood does not extract to the outside) ^[2]	60
Utility room	30
Bathroom	15
Sanitary accommodation ^[3]	6
NOTES:	
1. See Diagram 1.1.	
2. See Diagram 1.2.	
3. As an alternative for sanitary accommodation, the purge ventilation guidance may be used.	

8.0. MECAHNICAL VENTILATION WITH HEAT RECOVERY

8.1. OVERVIEW

- 8.1.1. Mechanical Ventilation with Heat Recovery (MVHR) is proposed in flats where environmental noise levels require that windows remain closed at night.
- 8.1.2. MVHR is a low energy, continuous mechanical ventilation system designed to replace conventional extract ventilation systems (such as intermittent systems) by drawing moisture laden air out of the kitchen and wet rooms (bathrooms and utility) while supplying fresh air to habitable rooms such as Bedrooms and Living spaces.
- 8.1.3. An additional benefit is an air pathway is also formed drawing warm air out of habitable spaces and evacuated from the dwelling, with the makeup air being provided by mechanically supplied air from the unit in addition to any windows in habitable spaces (when opened).
- 8.1.4. The minimum whole house ventilation rates are presented in Table 1.3 of ADF, as reproduced in **Figure 8.1** below.

Figure 8.1: Reproduction of Table 1.3 from ADF, Minimum Whole Dwelling Ventilation Rates

Table 1.3 Minimum whole dwelling ventilation rates determined by the number of bedrooms	
Number of bedrooms ⁽¹⁾⁽²⁾	Minimum ventilation rate by number of bedrooms (l/s)
1	19
2	25
3	31
4	37
5	43
NOTES:	
1. If the dwelling only has one habitable room, a minimum ventilation rate of 13l/s should be used.	
2. For each additional bedroom, add 6l/s to the values in Table 1.3.	

- 8.1.5. The required supply rates for TM59 compliance in habitable rooms are as follows:

- Bedrooms: 10l/s (boosted to 25 l/s)
- Kitchen/Dining/Living: 10l/s (boosted to 25 l/s)

- 8.1.6. A “boost mode” has been assumed to operate when internal temperatures exceed 22°C.

9.0. ENSURING THE OVERHEATING STRATEGY IS USEABLE

9.1. OVERVIEW

- 9.1.1. ADO lists a number of measures to ensure the overheating mitigation strategy can be feasibly implemented, as well as complying with overlapping building codes. The full literature can be found in Section 3: Ensuring the Overheating Mitigation Strategy is Usable of ADO. A summary of the key constraints is presented below.

9.2. NOISE

- 9.2.1. In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (23:00 – 07:00).
- 9.2.2. Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits: A) 40dB $L_{Aeq,T}$, averaged over 8 hours (between 23:00 – 07:00). & b) 55 dB L_{AFmax} , more than 10 times a night (between 23:00 – 07:00).
- 9.2.3. As outlined previously in this report, external noise levels incident on the proposed flats are predicted to exceed 40 dB $L_{Aeq,8hrs}$ overnight. As such, it has been assumed that windows will remain closed at night.

9.3. POLLUTION

- 9.3.1. Buildings located near to significant local pollution sources should be designed to minimise the intake of external air pollutants. Guidance is given in Section 2 of Approved Document F, Volume 1: Dwellings.

9.4. SECURITY

- 9.4.1. When determining the free area available for ventilation during sleeping hours, only the proportion of openings that can be opened securely should be considered to provide useful ventilation. This particularly applies in the following locations, where openings may be vulnerable to intrusion by a casual or opportunistic burglar:
- a) Ground floor bedrooms
 - b) Easily accessible bedrooms

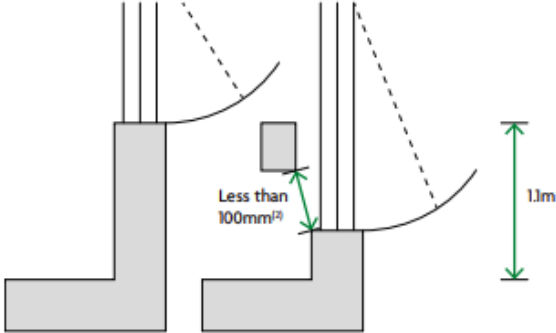
9.5. PROTECTION FROM FALLING

- 9.5.1. Openings which are intended to be open for long periods to reduce overheating risk might pose a higher risk of falls from height.

- 9.5.2. Only the proportion of openings which can be opened with a very low risk of occupants falling from height should be considered to form part of the overheating mitigation strategy.
- 9.5.3. Openings that can be opened wider than 100mm may form part of the overheating mitigation strategy where they meet all of the following conditions:
- Window handles on windows that open outwards are not more than 650mm from the inside face of the wall when the window is at its maximum openable angle.
 - Guarding meets the minimum standards in Table 3.1
 - Guarding does not allow children to easily climb it. For example, horizontal bars should generally be avoided.

Figure 9.1: Reproduction of Table 3.1 from ADF

Table 3.1 Guarding heights	
Change in floor level between inside and outside	Guarding height ⁽¹⁾
Less than 600mm	See Approved Document K
More than 600mm	1.1m



NOTES:

1. This approved document has increased levels of protection from falling compared to Approved Document K. Where applicable, the higher standard applies.
2. Guarding should be sized to prevent the passage of a 100mm sphere.

10.0. RESULTS SUMMARY

10.1.1. Table 11.1 below presents a summary results table detailing the overheating assessment findings.

House Type	Description	Orientation	Overheating Strategy Summary	TM59 / Part O Compliance	Results
House Type C.1 House Type C.2 House Type C.3	1 Bed 2 Person Apartment	North West/South East	Natural ventilation from unrestricted windows (windows closed during the night).	☑	Appendix A
			0.4 G value		
			MVHR		
House Type D	3 Bed 6 Person House	North West/South East	Natural ventilation from unrestricted windows (windows open during the day and night)	☑	Appendix A
			0.5 G value		
			Extract ventilation in wet rooms		

11.0. ASSESMENT SUMMARY

- 11.1.1. The assessment has found a low residual risk of overheating in all dwellings across the site, provided the mitigation measures outlined in this document are incorporated into the scheme design; principally a scheme of Mechanical Ventilation with Heat Recovery in the 15x proposed flats where openable windows are prohibited at night due to high external noise levels. Details of the required MVHR system for in the 15x flats, and the assumed natural scheme of ventilation in the dwelling / houses are presented in this report.
- 11.1.2. A summary of the assumed mitigation measures adopted in the overheating assessment is provided below:
- Natural ventilation via window openings as per the architectural drawings.
 - Window openings to be opened to maximal permissible opening angles in accordance with Approved Document K (safeguarding measures may be required)
 - Glazing solar performance (g value) of 0.40 for apartments and 0.5 for the houses.
 - Mechanical ventilation with Heat Recovery to the apartments.
 - Decentralised Mechanical Extract ventilation to the house (system 3).
 - Internal doors to be left open when possible.
 - Window trickle ventilators meeting minimum ADF requirements.
- 11.1.3. With the above measures implemented, the modelling found all spaces in the assessed dwellings to pass the overheating criteria and comply with ADO building regulations.
- 11.1.4. It should be noted that while the regulations do not permit the use of blinds and curtains in the calculations, if the sun shines directly into a living space, the occupant should consider closing the curtains or blinds to limit solar gains and try and keep rooms as cool as possible.
- 11.1.5. During periods where the intern temperature is below the external temperature, it is advised that occupants should keep their windows closed, to prevent bringing warm air in. If it reaches a point where the temperature inside the house is equal to that outside, then the occupant should open the windows, keeping the curtains closed.

12.0. MODELLING DISCLAIMER

- 12.1.1. The calculations produced by JPM Acoustics have been carried out with due care and draw on information provided by others to determine whether the thermal model of the proposed building can achieve compliance, at design stage, with the stated criteria within this report.
- 12.1.2. It should be noted that the data generated by this work is obtained using computer simulations. These simulations are the best means of predicting the performance of the building at this stage. Full certainty can only be achieved by measuring the performance of the building and associated systems after a period of use.
- 12.1.3. The actual operative temperatures within the building once occupied may vary from the calculated values within this report. These differences will occur due to a number of variable parameters between the modelled building and the actual building. Such differences will include the hours, levels of occupancy, equipment, how the windows are used etc.
- 12.1.4. Whilst the simulations have been undertaken in good faith using reasonable skill and care, JPM Acoustics can take no responsibility for differences between the computer simulations and the actual performance of the completed development due to the inherent complexity and variability of the physics in a building and its environment.

APPROVED DOCUMENT O: OVERHEATING ASSESSMENT COMPLIANCE REPORT

Approved Document O report
Overheating risk in residential buildings
for
Parkhill Avenue

Parkhill Avenue

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Building details

Project name: Parkhill Avenue	Date: 17-04-2024 12:16:21
Location: Manchester Ap, United Kingdom	
Address: Parkhill Avenue, Crumpsall, Manchester	
Building use: Residential	
Are there any security, noise, or pollution issues: Apartment windows to remain shut during the night	

Designer's details

Designer's name:
Designer's organisation:
Designer's address:

Dynamic thermal model

Software: IESVE version 2023.4.1.0	
Weather file: Manchester_DSY1_2020High50_.epw	
Results file: Parkhill Ave.aps	
Number of rooms analysed: 66	
TM59: summer elevated air speed: 0.1	
TM59: occupant category: Category II (normal)	
Overheating mitigation strategy:	
Has the building construction proposal been modelled accurately?	YES
Have the analysed rooms passed the assessment for Approved Doc O Dynamic Thermal Modelling Method (CIBSE TM 59)?	YES
Designer's signature:	

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Summary

CIBSE TM59 overheating methodology for predominantly naturally ventilated rooms assesses against two criteria, (a) and (b) (for Category I occupancy, T_{max} is reduced by 1K):

- Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours
- Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Approved document O applies limits to CIBSE TM59 section 3.3 (openings); these requirements are applied by appropriate assignment of MacroFlo types / scripted profiles in the model (see Modelled Openings Section).

CIBSE TM59 overheating methodology for predominantly mechanically ventilated rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

CIBSE TM59 also states that the inclusion of corridors in the overheating analysis is mandatory where community heating pipework runs through them. While there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of the total annual hours this should be identified as a significant risk.

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
LGF - Type C2 - Kitchen / Living	Pass	-	-	-
LGF - Type C2 - Bedroom	Pass	-	-	-
LGF - Type C1 - Bedroom	Pass	Pass	-	-
LGF - Type C1 - Kitchen / Living	Pass	N/A	-	-
LGF - Type C2 - Kitchen / Living	Pass	N/A	-	-
LGF - Type C2 - Bedroom	Pass	Pass	-	-
LGF - Type C3 - Bedroom	Pass	-	-	-
LGF - Type C3 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Bedroom	Pass	-	-	-
GF - Type C1 - Bedroom	Pass	-	-	-
GF - Type C1 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Bedroom	Pass	-	-	-
LGF - Type C3 - Bedroom	Pass	-	-	-
LGF - Type C3 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Bedroom	Pass	-	-	-
GF - Type C1 - Bedroom	Pass	-	-	-
GF - Type C1 - Kitchen / Living	Pass	-	-	-

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Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
GF - Type C2 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Bedroom	Pass	-	-	-
LGF - Type C3 - Bedroom	Pass	Pass	-	-
LGF - Type C3 - Kitchen / Living	Pass	N/A	-	-
GF - Type C2 - Kitchen / Living	Pass	-	-	-
GF - Type C2 - Bedroom	Pass	-	-	-
GF - Type C1 - Bedroom	Pass	Pass	-	-
GF - Type C1 - Kitchen / Living	Pass	N/A	-	-
GF - Type C2 - Kitchen / Living	Pass	N/A	-	-
GF - Type C2 - Bedroom	Pass	Pass	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (Mid) - Double Bedroom	Pass	-	-	-
FF - Type D (Mid) - Single Bedroom	Pass	-	-	-
SF - Type D (Mid) - Twin Bedroom	Pass	-	-	-
GF - Type D (End) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (End) - Double Bedroom	Pass	-	-	-
FF - Type D (End) - Single Bedroom	Pass	-	-	-
SF - Type D (End) - Twin Bedroom	Pass	-	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (Mid) - Double Bedroom	Pass	-	-	-
FF - Type D (Mid) - Single Bedroom	Pass	-	-	-
SF - Type D (Mid) - Twin Bedroom	Pass	-	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (Mid) - Double Bedroom	Pass	-	-	-
FF - Type D (Mid) - Single Bedroom	Pass	-	-	-

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Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
SF - Type D (Mid) - Twin Bedroom	Pass	-	-	-
GF - Type D (End) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (End) - Double Bedroom	Pass	-	-	-
FF - Type D (End) - Single Bedroom	Pass	-	-	-
SF - Type D (End) - Twin Bedroom	Pass	-	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (Mid) - Double Bedroom	Pass	-	-	-
FF - Type D (Mid) - Single Bedroom	Pass	-	-	-
SF - Type D (Mid) - Twin Bedroom	Pass	-	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	-	-	-
FF - Type D (Mid) - Double Bedroom	Pass	-	-	-
FF - Type D (Mid) - Single Bedroom	Pass	-	-	-
SF - Type D (Mid) - Twin Bedroom	Pass	-	-	-
GF - Type D (End) - Kitchen / Living / Dining	Pass	N/A	-	-
FF - Type D (End) - Double Bedroom	Pass	Pass	-	-
FF - Type D (End) - Single Bedroom	Pass	Pass	-	-
SF - Type D (End) - Twin Bedroom	Pass	Pass	-	-
GF - Type D (Mid) - Kitchen / Living / Dining	Pass	N/A	-	-
FF - Type D (Mid) - Double Bedroom	Pass	Pass	-	-
FF - Type D (Mid) - Single Bedroom	Pass	Pass	-	-
SF - Type D (End) - Twin Bedroom	Pass	Pass	-	-

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Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
LGF - Type C2 - Kitchen / Living	1989	1	0.1	Pass
LGF - Type C2 - Bedroom	3672	3	0.1	Pass
LGF - Type C1 - Bedroom	3672	0	0.0	Pass
LGF - Type C1 - Kitchen / Living	1989	0	0.0	Pass
LGF - Type C2 - Kitchen / Living	1989	0	0.0	Pass
LGF - Type C2 - Bedroom	3672	0	0.0	Pass
LGF - Type C3 - Bedroom	3672	0	0.0	Pass
LGF - Type C3 - Kitchen / Living	1989	0	0.0	Pass
GF - Type C2 - Kitchen / Living	1989	1	0.1	Pass
GF - Type C2 - Bedroom	3672	3	0.1	Pass
GF - Type C1 - Bedroom	3672	0	0.0	Pass
GF - Type C1 - Kitchen / Living	1989	0	0.0	Pass
GF - Type C2 - Kitchen / Living	1989	5	0.3	Pass
GF - Type C2 - Bedroom	3672	3	0.1	Pass
LGF - Type C3 - Bedroom	3672	0	0.0	Pass
LGF - Type C3 - Kitchen / Living	1989	0	0.0	Pass
GF - Type C2 - Kitchen / Living	1989	1	0.1	Pass
GF - Type C2 - Bedroom	3672	0	0.0	Pass
GF - Type C1 - Bedroom	3672	0	0.0	Pass
GF - Type C1 - Kitchen / Living	1989	0	0.0	Pass
GF - Type C2 - Kitchen / Living	1989	5	0.3	Pass
GF - Type C2 - Bedroom	3672	3	0.1	Pass
LGF - Type C3 - Bedroom	3672	0	0.0	Pass
LGF - Type C3 - Kitchen / Living	1989	0	0.0	Pass
GF - Type C2 - Kitchen / Living	1989	1	0.1	Pass
GF - Type C2 - Bedroom	3672	3	0.1	Pass
GF - Type C1 - Bedroom	3672	0	0.0	Pass

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Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
GF - Type C1 - Kitchen / Living	1989	1	0.1	Pass
GF - Type C2 - Kitchen / Living	1989	7	0.4	Pass
GF - Type C2 - Bedroom	3672	3	0.1	Pass
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	1	0.0	Pass
GF - Type D (End) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (End) - Double Bedroom	3672	2	0.1	Pass
FF - Type D (End) - Single Bedroom	3672	3	0.1	Pass
SF - Type D (End) - Twin Bedroom	3672	2	0.1	Pass
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	0	0.0	Pass
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	1	0.0	Pass
GF - Type D (End) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (End) - Double Bedroom	3672	2	0.1	Pass
FF - Type D (End) - Single Bedroom	3672	3	0.1	Pass
SF - Type D (End) - Twin Bedroom	3672	2	0.1	Pass

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Room name	Occupied hours	No. hours $\Delta T \geq 1^\circ\text{K}$	% Occupied hours $\Delta T \geq 1^\circ\text{K}$	Criterion a check
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	0	0.0	Pass
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	1	0.0	Pass
GF - Type D (End) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (End) - Double Bedroom	3672	2	0.1	Pass
FF - Type D (End) - Single Bedroom	3672	4	0.1	Pass
SF - Type D (End) - Twin Bedroom	3672	2	0.1	Pass
GF - Type D (Mid) - Kitchen / Living / Dining	1989	1	0.1	Pass
FF - Type D (Mid) - Double Bedroom	3672	0	0.0	Pass
FF - Type D (Mid) - Single Bedroom	3672	1	0.0	Pass
SF - Type D (Mid) - Twin Bedroom	3672	0	0.0	Pass

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Naturally ventilated rooms – criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
LGF - Type C2 - Kitchen / Living	N/A	N/A	N/A	N/A
LGF - Type C2 - Bedroom	12	13	25	Pass
LGF - Type C1 - Bedroom	9	8	17	Pass
LGF - Type C1 - Kitchen / Living	N/A	N/A	N/A	N/A
LGF - Type C3 - Bedroom	9	7	16	Pass
LGF - Type C3 - Kitchen / Living	N/A	N/A	N/A	N/A
GF - Type C2 - Kitchen / Living	N/A	N/A	N/A	N/A
GF - Type C2 - Bedroom	9	15	24	Pass
GF - Type C1 - Bedroom	13	11	24	Pass
GF - Type C1 - Kitchen / Living	N/A	N/A	N/A	N/A
GF - Type D (Mid) - Kitchen / Living / Dining	N/A	N/A	N/A	N/A
FF - Type D (Mid) - Double Bedroom	1	0	1	Pass
FF - Type D (Mid) - Single Bedroom	3	0	3	Pass
SF - Type D (Mid) - Twin Bedroom	0	0	0	Pass
GF - Type D (End) - Kitchen / Living / Dining	N/A	N/A	N/A	N/A
FF - Type D (End) - Double Bedroom	2	0	2	Pass
FF - Type D (End) - Single Bedroom	3	0	3	Pass
SF - Type D (End) - Twin Bedroom	0	0	0	Pass

Mechanically ventilated rooms

CIBSE TM59 overheating methodology for predominantly mech. vent. rooms states the operative temperature of all rooms shall not exceed 26°C for more than 3% of annual occupied hours.

Room name	No. hours > 26°C	% Annual hours > 26°C	Mechanically ventilated check
No mech vent rooms	N/A	N/A	N/A

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Communal corridors

CIBSE TM59 states that whilst there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of annual hours, then this should be identified as a significant risk within the TM59 overheating report.

Room name	No. hours > 28°C	% Annual hours > 28°C	Corridor overheating risk check
No corridors	N/A	N/A	N/A

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Modelled details & overheating mitigation strategy

Approved document O: Providing Information & Appendix B requires information about the model and the overheating mitigation strategy. The following tables detail the modelling method and mitigation strategies applied to each analysed room. Where multiple active openings per space (windows & louvres) exist they are all listed. Occupancy, equipment and lighting profiles for occupied rooms comply with TM59 section 5.

Modelled occupancy

Room name	Floor area m ²	Thermal template	Occupancy profile	Equipment profile	Lighting profile
LGF - Type C2 - Kitchen / Living	29.36	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
LGF - Type C2 - Bedroom	16.43	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C1 - Bedroom	16.4	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C1 - Kitchen / Living	32.77	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
LGF - Type C2 - Kitchen / Living	29.58	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
LGF - Type C2 - Bedroom	17.12	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Bedroom	15.77	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Kitchen / Living	31.83	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Kitchen / Living	29.36	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	16.43	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Bedroom	16.4	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Kitchen / Living	32.77	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Kitchen / Living	29.58	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	17.12	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Bedroom	15.77	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Kitchen / Living	31.83	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h

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Room name	Floor area m ²	Thermal template	Occupancy profile	Equipment profile	Lighting profile
GF - Type C2 - Kitchen / Living	29.36	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	16.43	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Bedroom	16.4	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Kitchen / Living	32.77	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Kitchen / Living	29.58	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	17.12	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Bedroom	15.77	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
LGF - Type C3 - Kitchen / Living	31.83	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Kitchen / Living	29.36	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	16.43	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Bedroom	16.4	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type C1 - Kitchen / Living	32.77	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Kitchen / Living	29.58	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
GF - Type C2 - Bedroom	17.12	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (End) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h

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Room name	Floor area m ²	Thermal template	Occupancy profile	Equipment profile	Lighting profile
FF - Type D (End) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (End) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (End) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (End) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (End) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (End) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (End) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h

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Room name	Floor area m ²	Thermal template	Occupancy profile	Equipment profile	Lighting profile
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (End) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (End) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (End) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (End) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
GF - Type D (Mid) - Kitchen / Living / Dining	44.59	TM59 - 2 Bedroom - Living / Kitchen	Living / Kitchen Occupancy	Living / Kitchen Equipment	18-23h
FF - Type D (Mid) - Double Bedroom	16.41	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
FF - Type D (Mid) - Single Bedroom	16.15	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h
SF - Type D (Mid) - Twin Bedroom	19.39	TM59 - Double Bedroom	Double Bedroom Occupancy	Double Bedroom Equipment	18-23h

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Modelled openings

Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
LGF - Type C2 - Kitchen / Living	17.52	0.3987, 0.3987	1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87	98.33999633789062, 98.33999633789062, 0.0, 56.599998474121094, 98.33999633789062, 0.0, 56.599998474121094	20.74	on continuously, off continuously, ADO.Section_26a
LGF - Type C2 - Bedroom	23.12	0.3987	1.91, 0.82, 0.86, 0.95	98.33999633789062, 0.0, 0.0, 56.599998474121094	14.7	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
LGF - Type C1 - Bedroom	23.17	0.3987	1.91, 0.86, 0.95, 0.82	98.33999633789062, 0.0, 56.599998474121094, 0.0	14.73	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
LGF - Type C1 - Kitchen / Living	19.23	0.3987	1.91, 1.64, 0.77, 0.87, 1.91	98.33999633789062, 98.33999633789062, 0.0, 56.599998474121094, 98.33999633789062	17.89	on continuously, off continuously, ADO.Section_26a
LGF - Type C2 - Kitchen / Living	8.74	0.3987	1.91, 1.64, 0.77, 0.87	98.33999633789062, 98.33999633789062, 0.0, 56.599998474121094	13.47	on continuously, off continuously, ADO.Section_26a
LGF - Type C2 - Bedroom	22.32	0.3987	1.91, 0.86, 0.82, 0.95	98.33999633789062, 0.0, 0.0, 56.599998474121094	14.11	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
LGF - Type C3 - Bedroom	10.69	0.3987	0.82, 0.86, 0.95, 1.91	0.0, 0.0, 56.599998474121094, 98.33999633789062	15.32	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
LGF - Type C3 - Kitchen / Living	9.13	0.3987	0.77, 0.87, 1.64, 1.91, 1.91	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 98.339996337 89062	18.42	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Kitchen / Living	16.22	0.3987, 0.3987, 0.3987	1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87, 0.4, 0.4	98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56.59999847412 1094, 0.0, 56.59999847412 1094	21.51	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Bedroom	23.12	0.3987	1.91, 0.86, 0.82, 0.95	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	14.7	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
GF - Type C1 - Bedroom	23.17	0.3987	1.91, 0.86, 0.95, 0.82	98.339996337 89062, 0.0, 56.59999847412 1094, 0.0	14.73	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
GF - Type C1 - Kitchen / Living	19.23	0.3987	1.91, 0.77, 0.87, 1.64, 1.91	98.339996337 89062, 0.0, 56.59999847412 1094, 0.0, 98.33999633789 062	12.97	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Kitchen / Living	16.15	0.3987, 0.3987, 0.3987	0.4, 0.4, 1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56.59999847412 1094	21.35	on continuously, off continuously, ADO.Section_26a

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
GF - Type C2 - Bedroom	22.32	0.3987	1.91, 0.82, 0.86, 0.95	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	14.11	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
LGF - Type C3 - Bedroom	10.69	0.3987	0.82, 0.86, 0.95, 1.91	0.0, 0.0, 56.59 99984741210 94, 98.339996 33789062	15.32	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
LGF - Type C3 - Kitchen / Living	9.13	0.3987	0.77, 0.87, 1.64, 1.91, 1.91	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 98.339996337 89062	18.42	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Kitchen / Living	16.22	0.3987, 0.3987, 0.3987	1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87, 0.4, 0.4	98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56.59999847412 1094, 0.0, 56.59999847412 1094	21.51	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Bedroom	23.12	0.3987	1.91, 0.82, 0.86, 0.95	98.339996337 89062, 0.0, 0.0, 0.0	11.43	Internal Doors Bedroom Weekly, off continuously
GF - Type C1 - Bedroom	23.17	0.3987	1.91, 0.86, 0.95, 0.82	98.339996337 89062, 0.0, 56.59999847412 1094, 0.0	14.73	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
GF - Type C1 - Kitchen / Living	19.23	0.3987	1.91, 0.77, 0.87, 1.64, 1.91	98.339996337 89062, 0.0, 56.59999847412 1094, 98.3399 9633789062, 98.339996337 89062	17.89	on continuously, off continuously, ADO.Section_26a

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
GF - Type C2 - Kitchen / Living	16.15	0.3987, 0.3987, 0.3987	0.4, 0.4, 1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56 .59999847412 1094	21.35	on continuously, off continuously, ADO.Section_ 26a
GF - Type C2 - Bedroom	22.32	0.3987	1.91, 0.82, 0.86, 0.95	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	14.11	Internal Doors Bedroom Weekly, off continuously, ADO.Section_ 26a
LGF - Type C3 - Bedroom	15.27	0.3987	0.82, 0.86, 0.95, 1.91	0.0, 0.0, 56.59 99984741210 94, 98.339996 33789062	15.32	Internal Doors Bedroom Weekly, off continuously, ADO.Section_ 26a
LGF - Type C3 - Kitchen / Living	13.05	0.3987	0.77, 0.87, 1.64, 1.91, 1.91	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 98.339996337 89062	18.42	on continuously, off continuously, ADO.Section_ 26a
GF - Type C2 - Kitchen / Living	23.09	0.3987, 0.3987, 0.3987	1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87, 0.38, 0.38	98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56 .59999847412 1094, 0.0, 56. 59999847412 1094	21.47	on continuously, off continuously, ADO.Section_ 26a
GF - Type C2 - Bedroom	33.02	0.3987	1.91, 0.86, 0.82, 0.95	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	14.7	Internal Doors Bedroom Weekly, off continuously, ADO.Section_ 26a

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
GF - Type C1 - Bedroom	33.1	0.3987	1.91, 0.86, 0.95, 0.82	98.339996337 89062, 0.0, 56 .59999847412 1094, 0.0	14.73	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
GF - Type C1 - Kitchen / Living	27.47	0.3987	1.91, 0.77, 0.87, 1.64, 1.91	98.339996337 89062, 0.0, 56 .59999847412 1094, 98.3399 9633789062, 98.339996337 89062	17.89	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Kitchen / Living	23.0	0.3987, 0.3987, 0.3987	0.38, 0.38, 1.91, 1.64, 0.77, 0.87, 1.64, 0.77, 0.87	0.0, 56.59999 8474121094, 98.339996337 89062, 98.339 99633789062, 0.0, 56.59999 8474121094, 98.339996337 89062, 0.0, 56 .59999847412 1094	21.31	on continuously, off continuously, ADO.Section_26a
GF - Type C2 - Bedroom	31.89	0.3987	1.91, 0.82, 0.86, 0.95	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	14.11	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
GF - Type D (Mid) - Kitchen / Living / Dining	15.24	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.339996337 89062, 0.0, 56 .59999847412 1094, 0.0, 0.0, 56.599998474 121094, 0.0, 9 8.3399963378 9062	10.79	on continuously, off continuously, ADO.Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59 99984741210 94, 98.339996 33789062, 98. 33999633789 062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (Mid) - Single Bedroom	17.08	0.5	1.91, 0.76, 0.9, 1.04	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
SF - Type D (Mid) - Twin Bedroom	N/A	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.599998474121094, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (End) - Kitchen / Living / Dining	19.44	0.5, 0.871, 0.5	2.15, 0.95, 0.41, 1.13, 1.22, 0.66, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	on continuously, off continuously, ADO. Section_26a
FF - Type D (End) - Double Bedroom	23.61	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.599998474121094, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (End) - Single Bedroom	24.34	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO. Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (End) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.599998474121094, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (Mid) - Kitchen / Living / Dining	11.02	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO. Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.599998474121094, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
FF - Type D (Mid) - Single Bedroom	14.5	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (Mid) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.599998474121094, 98.33999633789062, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (Mid) - Kitchen / Living / Dining	15.24	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.599998474121094, 98.33999633789062, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (Mid) - Single Bedroom	17.08	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (Mid) - Twin Bedroom	N/A	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.599998474121094, 98.33999633789062, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (End) - Kitchen / Living / Dining	19.44	0.5, 0.871, 0.5	2.15, 0.95, 0.41, 1.13, 1.22, 0.66, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
FF - Type D (End) - Double Bedroom	23.61	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59 99984741210 94, 98.339996 33789062, 98. 33999633789 062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (End) - Single Bedroom	24.34	0.5	1.91, 0.76, 0.9, 1.04	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (End) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474 121094, 56.59 99984741210 94, 98.339996 33789062, 98. 33999633789 062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (Mid) - Kitchen / Living / Dining	11.02	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.339996337 89062, 0.0, 56 .59999847412 1094, 0.0, 0.0, 56.599998474 121094, 0.0, 9 8.3399963378 9062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59 99984741210 94, 98.339996 33789062, 98. 33999633789 062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (Mid) - Single Bedroom	14.5	0.5	1.91, 0.76, 0.9, 1.04	98.339996337 89062, 0.0, 0.0, 56.59999 8474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (Mid) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474 121094, 56.59 99984741210 94, 98.339996 33789062, 98. 33999633789 062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
GF - Type D (Mid) - Kitchen / Living / Dining	15.24	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59998474121094, 98.33999633789062, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (Mid) - Single Bedroom	17.08	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (Mid) - Twin Bedroom	N/A	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.59998474121094, 98.33999633789062, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (End) - Kitchen / Living / Dining	19.44	0.5, 0.871, 0.5	2.15, 0.94, 0.41, 1.13, 1.22, 0.66, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO.Section_26a
FF - Type D (End) - Double Bedroom	23.61	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59998474121094, 98.33999633789062, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (End) - Single Bedroom	24.34	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO.Section_26ab, Internal Doors Bedroom Weekly, off continuously

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Room name	Window to wall ratio %	Window g-value (EN 410)	Opening gross area m ²	Opening free area (avg) %	Opening free area / floor area ratio %	Opening profile(s)
SF - Type D (End) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.59998474121094, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab
GF - Type D (Mid) - Kitchen / Living / Dining	11.02	0.5, 0.5	2.15, 0.95, 0.41, 0.76, 0.9, 1.04, 1.91, 1.91	98.33999633789062, 0.0, 56.599998474121094, 0.0, 0.0, 56.599998474121094, 0.0, 98.33999633789062	10.79	Internal Doors Bedroom Weekly, off continuously, ADO. Section_26a
FF - Type D (Mid) - Double Bedroom	14.87	0.5	0.76, 0.88, 0.97, 1.91, 1.91	0.0, 0.0, 56.59998474121094, 98.33999633789062, 98.33999633789062	26.24	Internal Doors Bedroom Weekly, ADO. Section_26ab, off continuously
FF - Type D (Mid) - Single Bedroom	14.5	0.5	1.91, 0.76, 0.9, 1.04	98.33999633789062, 0.0, 0.0, 56.599998474121094	15.28	ADO. Section_26ab, Internal Doors Bedroom Weekly, off continuously
SF - Type D (Mid) - Twin Bedroom	0.0	0.5044, 0.5044	1.02, 1.02, 1.65, 1.76	56.599998474121094, 56.59998474121094, 98.33999633789062, 98.33999633789062	23.25	Internal Doors Bedroom Weekly, ADO. Section_26ab

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Modelled ventilation

Room name	Infiltration rate ACH	Mech vent flow rate ACH
LGF - Type C2 - Kitchen / Living	0.15	1.02
LGF - Type C2 - Bedroom	0.15	1.83
LGF - Type C1 - Bedroom	0.15	1.83
LGF - Type C1 - Kitchen / Living	0.15	0.92
LGF - Type C2 - Kitchen / Living	0.15	1.01
LGF - Type C2 - Bedroom	0.15	1.75
LGF - Type C3 - Bedroom	0.15	1.9
LGF - Type C3 - Kitchen / Living	0.15	0.94
GF - Type C2 - Kitchen / Living	0.15	1.02
GF - Type C2 - Bedroom	0.15	1.83
GF - Type C1 - Bedroom	0.15	1.83
GF - Type C1 - Kitchen / Living	0.15	0.92
GF - Type C2 - Kitchen / Living	0.15	1.01
GF - Type C2 - Bedroom	0.15	1.75
LGF - Type C3 - Bedroom	0.15	1.9
LGF - Type C3 - Kitchen / Living	0.15	0.94
GF - Type C2 - Kitchen / Living	0.15	1.02
GF - Type C2 - Bedroom	0.15	1.83
GF - Type C1 - Bedroom	0.15	1.83
GF - Type C1 - Kitchen / Living	0.15	0.92
GF - Type C2 - Kitchen / Living	0.15	1.01
GF - Type C2 - Bedroom	0.15	1.75
LGF - Type C3 - Bedroom	0.15	2.72
LGF - Type C3 - Kitchen / Living	0.15	1.35
GF - Type C2 - Kitchen / Living	0.15	1.46
GF - Type C2 - Bedroom	0.15	2.61
GF - Type C1 - Bedroom	0.15	2.61
GF - Type C1 - Kitchen / Living	0.15	1.31
GF - Type C2 - Kitchen / Living	0.15	1.45
GF - Type C2 - Bedroom	0.15	2.5
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0
GF - Type D (End) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (End) - Double Bedroom	0.15	0.0
FF - Type D (End) - Single Bedroom	0.15	0.0
SF - Type D (End) - Twin Bedroom	0.15	0.0
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0

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Room name	Infiltration rate ACH	Mech vent flow rate ACH
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0
GF - Type D (End) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (End) - Double Bedroom	0.15	0.0
FF - Type D (End) - Single Bedroom	0.15	0.0
SF - Type D (End) - Twin Bedroom	0.15	0.0
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0
GF - Type D (End) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (End) - Double Bedroom	0.15	0.0
FF - Type D (End) - Single Bedroom	0.15	0.0
SF - Type D (End) - Twin Bedroom	0.15	0.0
GF - Type D (Mid) - Kitchen / Living / Dining	0.15	0.39
FF - Type D (Mid) - Double Bedroom	0.15	0.0
FF - Type D (Mid) - Single Bedroom	0.15	0.0
SF - Type D (Mid) - Twin Bedroom	0.15	0.0