

Noise impact assessment

YA407.P1

Full planning application for the demolition of existing building and construction of three residential dwellings (Use Class C3), with access, landscaping and associated infrastructure

The Former Grove Public House
1515 Ashton Old Road
Manchester M11 1GR

Manchester, UK

Version 2.0

July 25, 2022

Identification

Title: Noise impact assessment: Full planning application for the demolition of existing building and construction of three residential dwellings (Use Class C3), with access, landscaping and associated infrastructure

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Client: KMM Homes

Date: July 25, 2022

Local: Manchester, UK

Version: 2.0

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Prepared for: KMM Homes

Revisions

Date	Changes / Comments	Reviser
25/07/2022	Report updated following the comments raised by the Manchester City Council (MCC) to include an assessment of external amenity areas, site survey data, Sound Level Meter (SLM) calibration certificate and update of Section 5.2.3.	LP

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Acronyms

ADF Approved Document F. [8](#), [9](#), [13](#), [23](#), [24](#)

ADO Approved Document O. [8](#), [14](#)

AVO Acoustics Ventilation And Overheating. [8](#), [10](#), [13](#), [14](#), [22](#), [24](#)

CRTN Calculation of Road Traffic Noise. [16](#)

DEFRA Department for Environment, Food and Rural Affairs. [13](#)

IANLs Internal Ambient Noise Levels. [8](#), [9](#), [12](#), [13](#), [22](#), [23](#), [24](#), [26](#)

LOAEL Lowest Observed Adverse Effect Level. [12](#), [13](#)

MCC Manchester City Council. [2](#)

NPPF National Planning Policy Framework. [10](#), [12](#), [26](#)

NPSE Noise Policy Statement for England. [10](#), [12](#), [26](#)

ProPG Professional Practice Guidance on Planning & Noise. [8](#), [12](#), [13](#)

SLM Sound Level Meter. [2](#), [17](#)

SOAEL Significant Observed Adverse Effect Level. [13](#), [14](#)

SWL Sound Power Level. [20](#)

VOCs Volatile Organic Compounds. [8](#), [9](#), [23](#), [24](#)

Glossary

C_{tr} correction term applied against the sound insulation single-number values (R_w , D_w , and $D_{nT,w}$) to provide a weighting against low frequency performance. [8](#), [9](#), [23](#)

$D_{ne,w}$ element normalized level difference of small building elements - difference of the sound pressure level produced in two rooms by a source in one room, where sound transmission is only due to a small technical element (e.g. transfer air devices, electrical cable ducts, transit sealing systems). [8](#), [9](#), [23](#)

L_{A10} A-weighted sound pressure level exceeded for 10% of the measurement period - A-weighted sound pressure level obtained using time-weighting “F”, that is exceeded for 10% of the time interval considered. [17](#), [18](#)

$L_{A10,18hr}$ A-weighted sound pressure level exceeded for 10% of the measurement period - A-weighted sound pressure level obtained using time-weighting “F”, that is exceeded for 10% of the period 06:00-24:00 hours. [17](#), [18](#)

$L_{A10,3hr}$ A-weighted sound pressure level exceeded for 10% of the measurement period - A-weighted sound pressure level obtained using time-weighting “F”, that is exceeded for 10% of a 3 hours period. [17](#), [18](#)

L_{Aeq} equivalent A-weighted sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a steady sound that has the same mean-squared sound pressure as the sound under consideration that varies with time. [10](#), [12](#), [15](#), [17](#), [24](#)

$L_{Aeq,16hr}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within the period 07:00-23:00 hours has the same mean-squared sound pressure as the sound under consideration that varies with time. [9](#), [12](#), [13](#), [17](#), [18](#), [21](#), [25](#)

$L_{Aeq,8hr}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within the period 23:00-07:00 hours has the same mean-squared sound pressure as the sound under consideration that varies with time. [12](#), [17](#), [18](#), [21](#)

$L_{Aeq,T}$ equivalent A-weighted continuous sound pressure level - value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T, has the same mean-squared sound pressure as the sound under consideration that varies with time. 9, 12, 13, 24

L_{AFmax} maximum A-weighted sound pressure level - value of the maximum A-weighted sound pressure level obtained using time-weighting “F”, during a specified time interval. 8, 9, 12, 13, 14, 15, 17, 18, 19, 23, 24

R_w weighted sound reduction index - single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. 8, 9, 23

RT reverberation time - time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. 22

Summary

YAcoustics Ltd has been commissioned to provide specialist advice in respect of a new residential development at 1515 Ashton Old Road, Manchester.

The criteria and guidelines set out in [Professional Practice Guidance on Planning & Noise \(ProPG\)](#) [11], the [Acoustics Ventilation And Overheating \(AVO\)](#) guide [14] and [Approved Document O \(ADO\)](#) [14] have been considered.

Noise affecting the proposed development has been measured during the day and night to determine noise impacts.

The primary noise sources affecting the site during both the day and night-time periods is the road traffic on Ashton Old Road (A635).

With windows open, the resulting internal ambient noise levels in the relevant internal areas of the development have the potential to cause significant adverse effects. As such, the recommended facade solutions are considered with windows closed, requiring that provisions for background ventilation and control overheating are made.

South facing Facades

Regarding south facing facades, calculations indicate that **kitchens** require glazing with a performance of 32 dB R_w+C_{tr} (e.g. 10 mm glass/16 mm cavity/6 mm glass) and that [Approved Document F \(ADF\)](#) System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 40 $D_{ne,w}+C_{tr}$.

Bedrooms require glazing and a spandrel panel with a performance of 33 dB R_w+C_{tr} (e.g. 6 mm glass/16 mm cavity/6.8 mm laminated glass), and [ADF](#) System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$.

The anticipated [Internal Ambient Noise Levels \(IANLs\)](#) with a partially open window (13 dB attenuation) would be 57 dBA during the day and 48 dBA at night, with overheating design case L_{AFmax} levels up to 78 dB, and as such opening windows **is not** considered to be a suitable solution for mitigating overheating.

Mechanical cooling is required within **bedrooms** to manage thermal comfort in conjunction with the ventilation system, in which case windows are still openable for rapid dilution of smells, water vapour and **VOCs**.

North facing Facades

As for north facing facades, calculations indicate that all spaces (i.e. living rooms and bedrooms) require glazing with a performance of 25 dB R_w+C_{tr} (e.g. 4/16/4 mm) and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 34 $D_{ne,w}+C_{tr}$.

The anticipated IANLs with a partially open window (13 dB attenuation) to control overheating would be 44 dBA during the day and 35 dBA at night, with overheating design case L_{AFmax} levels up to 63 dB.

Mechanical cooling is required within **living areas** to manage thermal comfort in conjunction with the ventilation system, in which case windows are still openable for rapid dilution of smells, water vapour and VOCs.

External amenity areas

Noise levels in all relevant amenity areas are calculated to be below the guideline upper limit of 55 dB $L_{Aeq,16hr}$, without requiring any further noise mitigation.

The proposed rear timber fencing must have no cracks or gaps, be continuous to the ground, and have a minimum surface density of 10 kg/m^2 , such as a close-board timber fence.

Further recommendations

The solutions mentioned above do not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer and as such other ADF Systems may be employed if required, in which case the proposed details should be reassessed for acoustic performance.

If mechanical ventilation systems are preferred for whole-dwelling ventilation, ADF refers that the average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following:

- a) 30dB $L_{Aeq,T}$ for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate;
- b) 45dB $L_{Aeq,T}$ in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.

Regarding overheating, the mentioned solutions are considered standard mitigation measures in controlling overheating but must be assessed by the mechanical engineer.

It is recommended that a detailed overheating assessment (e.g. dynamic modelling against CIBSE TM59 [10]) is carried out to determine possible alternative overheating mitigation solutions or to specify the capacity needed for each system.

The AVO guide recommends that mechanical noise to control overheating is limited to 30 dB L_{Aeq} for bedrooms and 35 dB L_{Aeq} for living or dining rooms. Such limits should be considered when selecting specific units.

Based on the implementation of the recommendations provided in this report, the development is considered to be suitable in line with the recommendations of the [National Planning Policy Framework \(NPPF\)](#) [12] and the [Noise Policy Statement for England \(NPSE\)](#) [5].

1 Introduction

A development consisting of three residential dwellings (Use Class C3), with access, landscaping, and associated infrastructure, is proposed at 1515 Ashton Old Road, Manchester M11 1GR.

YAcoustics Ltd has been commissioned to prepare a noise impact assessment report for the proposed development.

Thus, the relevant acoustic requirements have been identified, and suitable design solutions and recommendations have been provided accordingly.

Figure 1 shows the site location.



Figure 1 – Development location (red line)

2 Planning policy and relevant criteria

2.1 ProPG guidance

The [ProPG](#) [11] sets out criteria and guidelines for noise management concerning new residential development.

The document provides noise level limits for internal and external amenity areas that are intrinsic to the overall design.

These limits are in line with what the [NPSE](#) [5] identifies as the [Lowest Observed Adverse Effect Level \(LOAEL\)](#) and as such it is considered that by meeting these targets the aims of the [NPPF](#) [12] and the [NPSE](#) [5] are achieved (see Annex A).

The relevant criteria is presented as Table 1.

Table 1 – Internal and external ambient noise levels for dwellings (sources: BS 8233:2014 and ProPG:2017)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hr}$	-
Dinning	Dinning room/area	40 dB $L_{Aeq,16hr}$	-
Sleeping (day-time resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$
			45 ¹ dB L_{AFmax}
Leisure	Gardens and balconies	50 – 55 ² $L_{Aeq,T}$	

Note: The presented noise limits relate to steady external noise sources.

1: In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 times a night.

2: External noise level should 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.

Section 2.27 of the [ProPG](#) states the following: "Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as *"unacceptable"* by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing *"unacceptable"* noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form."

As such, [IANLs](#) more than 10 dB above the daytime and night-time values in Table 1 are

identified as the **Significant Observed Adverse Effect Level (SOAEL)**.

Appendix A of the **ProPG** states the following: "it can be concluded that at night (23:00 to 07:00 hrs), a significant effect on sleep disturbance, e.g. behavioural awakening, is likely to occur where the maximum sound level at the façade of a building **with partially open windows** is above:

- 85 dB L_{AFmax} (where the number of events exceeding this value is ≤ 20); or
- 80 dB L_{AFmax} (where the number of events exceeding this value is > 20)."

Therefore, the above L_{AFmax} values and number of events are identified as the **SOAEL** where windows are partially open.

Regarding external amenity areas, the 50-55 dB $L_{Aeq,T}$ limit identified in BS 8233 [7] is considered to be the **LOAEL** and the 66 dB $L_{Aeq,16hr}$ limit identified in the **Department for Environment, Food and Rural Affairs (DEFRA)** [8] guidance is considered to be the **SOAEL**.

2.2 AVO guidance

Section 2.4 of **ProPG** refers to the importance of providing a thermal comfort/cooling strategy to reduce potential impacts of noise on future occupants of new residential development.

The **AVO** guide [14] is intended to demonstrate good acoustics design as described in the **ProPG**, when considering **IANLs** guidelines.

The document suggests that the desirable **IANLs** as shown in Table 1 should be achieved when providing adequate ventilation as defined by **ADF** [6] whole dwelling ventilation.

However, it considers reasonable to allow higher levels of **IANLs** from transport sources when higher rates of ventilation are required in relation to the **overheating condition**.

Qualitative guidance on the combined effect of **IANLs** and duration for the overheating situation is provided in the document.

For the purpose of this assessment, the limits for **IANLs** during the overheating condition, as shown in Figures 2 and 3, have been considered. The **LOAEL** remains the same as identified in Table 1, and the **SOAEL** varies depending on the duration for which the overheating condition occurs.

For night-time periods, the L_{AFmax} value of 65 dB is identified as the SOAEL.

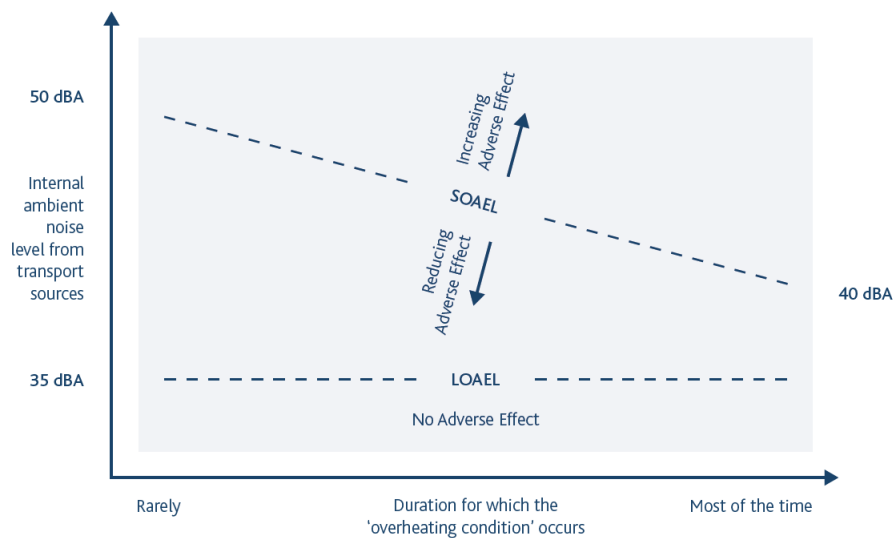


Figure 2 – AVO diagram indicating noise levels associated with adverse effects during the daytime

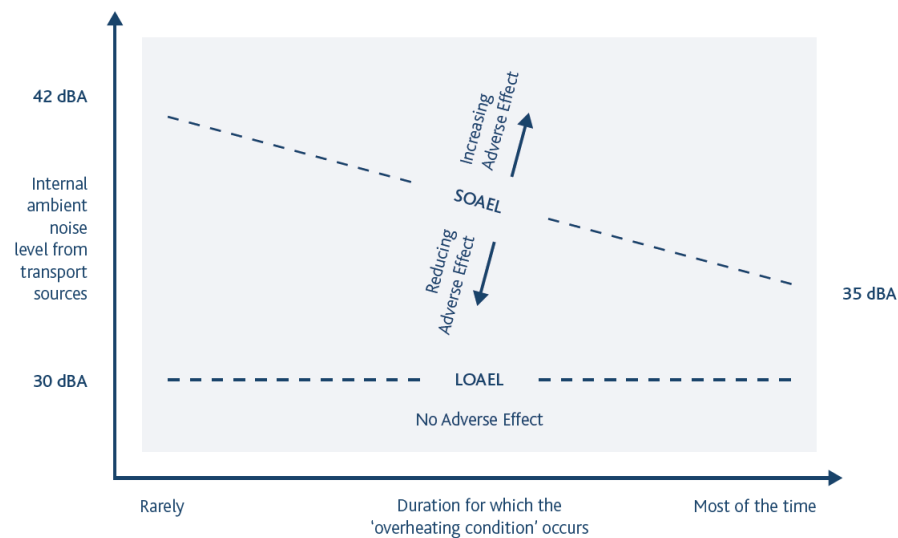


Figure 3 – AVO diagram indicating noise levels associated with adverse effects during the night-time

2.3 Approved Document O

Section 3 of Building Regulations ADO [14] mentions that in locations where external noise may be an issue, the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11 pm to 7 am).

The document also mentions that windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits:

- a) 40 dB L_{Aeq} , averaged over 8 hours (between 11 pm and 7 am);
- b) 55 dB L_{AFmax} , more than 10 times a night (between 11 pm and 7 am).

3 Site survey

3.1 Methodology

The site was initially inspected to determine the existing relevant noise sources.

No commercial noise sources were detected and it was noticeable that the main noise source affecting the proposed development during both the day and night-time is the road traffic on Ashton Old Road (A635).

To quantify its impacts, attended monitoring was carried out over three consecutive hours (from 10:00 to 13:00) on the 7th of March 2020 in line with the shortened measurement procedure included in the [Calculation of Road Traffic Noise \(CRTN\)](#) document [1].

Figure 4 illustrates the position adopted. The microphone was placed at a height of 1.5 meters above ground level and at a distance of 2 meters from the existing building.



Figure 4 – Measurement position (source: Google Maps)

The measured noise levels have been converted to the indexes $L_{A10,18hr}$, $L_{Aeq,16hr}$ and $L_{Aeq,8hr}$ in line with the guidelines for modelling traffic noise included in BS 8233 [7] and the conversion method included in TRL [4].

The procedure can be briefly described as follows:

1. Measurements of L_{A10} over any 3 consecutive hours between 10:00 and 17:00h;
2. Calculation of $L_{A10,18hr}$ as per the following equation:

$$L_{A10,18hr} = L_{A10,3hr} - 1dB \quad (3.1)$$

3. Calculation of $L_{Aeq,16hr}$ as per the following equation:

$$L_{Aeq,16hr} = L_{A10,18hr} - 2dB \quad (3.2)$$

4. Calculation of $L_{Aeq,8hr}$ for a non-motorway road as per the following equation:

$$L_{night} = 0.90 * L_{A10,18hr} - 3.77dB \quad (3.3)$$

Night time measurements have also been carried out to determine typical L_{AFmax} levels of individual events. Such measurements have been carried out for a total of 2 hour (from 23:00 to 01:00) since traffic on Ashton Old Road was noted to decrease after this time.

The microphone was placed at the same position.

The **SLM** was setup to measure L_{Aeq} values over 1 second intervals and a wind-shield was used as a precaution against interference.

The measurements were carried out in the absence of rain or wind speeds higher than $5m/s^{-1}$.

The **SLM** used meet the technical specifications of BS 7445 [2] and have current calibration certificates traceable to national standards (See Annex C). The equipment was field-calibrated before and after the measurement with no significant drift in sensitivity noted.

Table 2 – Equipment used

Equipment	Model	Serial no.
Sound Level Meter	Svantek SV307	82048
Calibrator	(with built-in calibrator)	

3.2 Results

The measured noise levels for the 3 hour period are presented as Table 3, the calculated day and night-time indexes are presented as Table 4 and the calculated daytime spectrum is presented as Table 5.

A summary of the survey data is included as Annex D.

Table 3 – Measured L_{A10} values

Period	Measured L_{A10} dB
10:00 to 11:00	76
11:00 to 12:00	75
12:00 to 13:00	76

Table 4 – Calculated day and night-time indexes

Period	Measured	Calculated		
	$L_{A10,3hr}$ dB	$L_{A10,18hr}$ dB	$L_{Aeq,16hr}$ dB	$L_{Aeq,8hr}$ dB
10:30 to 13:30 hrs	76	75	73	64

Table 5 – Daytime and night-time spectrum

Parameter	Freq. (Hz)							Total
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	
$L_{Aeq,16hr}$ dB	42	53	60	65	70	67	58	73
$L_{Aeq,8hr}$ dB	30	42	48	54	61	58	49	64

The ten highest recorded values of L_{AFmax} , associated with specific events during the night are shown in Table 6.

Table 6 – Night-time measured L_{AFmax} events

Event type	Recorded L_{AFmax}	Time
car pass	91	23:15
car pass	86	23:40
car pass	85	23:17
car pass	83	23:13
car pass	83	23:26
car pass	82	23:53
car pass	81	23:49
car pass	81	23:49
car pass	80	23:40
car pass	80	23:25

4 Facade noise

4.1 Methodology

Predictions of the noise emitted by the relevant existing noise sources at the proposed development various facades have been carried out by means of a digital geometric acoustics software.

The proprietary software Olive Tree Lab - Suite developed by the Mediterranean Acoustics Research & Development (PEMARD) has been used, in line with the methodology laid out in ISO 9613-2 [3].

The input data used and parameters used were the following:

- Site layout: Data of the site layout and model dimensions has been taken from the Architect drawings and from Google Earth;
- Surfaces absorption characteristics: All building surfaces absorption have been set as $\alpha = 0.1$ (0.5 dB reflection loss);
- Ground factor: Ground factor have been set as 0 (hard floor);
- Order of reflections: A reflection order of 3 has been used¹;

The **Sound Power Level (SWL)** of the relevant sources have been defined based on the measured noise levels.

Figure 5 shows the developed digital geometric acoustics model.

¹ A suitable reflection order has been determined based on the specific site geometry and the source-receiver positions.



Figure 5 – 3D view of the digital geometric acoustics model

4.2 Results

The calculated daytime noise levels at the proposed development facades are presented as Table 7.

Table 7 – Calculated facade noise levels (2 m from facade surface)

Façade	Parameter	Octave band mid frequency in Hz							Global
		63	125	250	500	1k	2k	4k	
South	$L_{Aeq,16hr}$ dB	42	53	60	65	70	67	58	73
	$L_{Aeq,8hr}$ dB	30	42	48	54	61	58	49	64
North	$L_{Aeq,16hr}$ dB	29	40	47	52	57	54	45	60
	$L_{Aeq,8hr}$ dB	17	29	35	41	48	45	36	51
East/West	$L_{Aeq,16hr}$ dB	38	49	56	61	66	63	54	69
	$L_{Aeq,8hr}$ dB	26	38	44	50	57	54	45	60

5 Internal ambient noise levels

5.1 Impacts with open windows

The difference between free field and internal ambient noise levels through a partially open window is approximately 13 dB [11].

Based on this assumption and the noise levels stated in Table 5, to achieve suitable IANLs, windows are required to remain closed and to provide sufficient insulation. Therefore, appropriate facade and ventilation solutions have been calculated.

5.2 Facade acoustic requirements

5.2.1 Methodology

To determine facade and ventilation solutions to achieve suitable IANLs within each relevant space, the methodology laid out in BS 8233 [7], BS EN ISO 12354-3 [9] and the guidance included in the AVO guide [14] have been considered.

The Overheating Risk – Early Stage Tool [13] produced by the Good Homes Alliance has been used to determine the proposed development risk of overheating.

The calculations have been carried out for rooms that are exposed to the highest noise levels and with the most significant ratio of glazing area to the room volume.

The dimensions and characteristics of each radiating surface (i.e. windows, external walls) and room volumes have been provided by the architect - see Annex B.

Average reverberation times RT of 0.5 and 0.8 seconds was considered adequate for bedrooms and living rooms or kitchens, respectively, due to the average room volumes and surface finishes characteristics.

Noise break-in through masonry elements is considered to be negligible.

Annex E, includes details for the calculations carried out.

5.2.2 South Facades

Ventilation design case

Calculations indicate that **kitchens** require glazing with a performance of 32 dB R_w+C_{tr} (e.g. 10 mm glass/16 mm cavity/6 mm glass) and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 40 $D_{ne,w}+C_{tr}$. The anticipated IANLs, with such solutions in place, would be 39 dBA during the day.

Bedrooms require glazing and a spandrel panel with a performance of 33 dB R_w+C_{tr} (e.g. 6 mm glass/16 mm cavity/6.8 mm laminated glass), and ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 42 $D_{ne,w}+C_{tr}$. With such solutions in place, the anticipated IANLs for the most exposed bedroom would be 35 dBA during the day, 24 dBA during the night, and 45 dBA L_{AFmax} during night-time.

Overheating design case

The Overheating Risk – Early Stage Tool indicates a high risk of overheating for south-facing facades.

The anticipated IANLs with a partially open window (13 dB attenuation) would be 57 dBA during the day and 48 dBA at night, with overheating design case L_{AFmax} levels up to 78 dB, and as such opening windows **is not** considered to be a suitable solution for mitigating overheating.

Mechanical cooling is required within **bedrooms** to manage thermal comfort in conjunction with the ventilation system, in which case windows are still openable for rapid dilution of smells, water vapour and VOCs.

5.2.3 North Facades

Ventilation design case

Calculations indicate that all spaces (i.e. living rooms and bedrooms) require glazing with a performance of 25 dB R_w+C_{tr} (e.g. 4/16/4 mm) and that ADF System 1 may be employed with a maximum of 2 trickle ventilators with a performance of 34 $D_{ne,w}+C_{tr}$. The anticipated IANLs, with such solutions in place, would vary between 30-33 dBA during the day and 20-23 dBA during the night.

Overheating design case

The anticipated **IANLs** with a partially open window (13 dB attenuation) to control overheating would be 44 dBA during the day and 35 dBA at night, with overheating design case **L_{AFmax}** levels up to 63 dB.

Mechanical cooling is required within **living areas** to manage thermal comfort in conjunction with the ventilation system, in which case windows are still openable for rapid dilution of smells, water vapour and **VOCs**.

5.2.4 Further recommendations

The solutions mentioned above do not constitute a ventilation strategy design, which is the responsibility of the mechanical engineer and as such other **ADF** Systems may be employed if required, in which case the proposed details should be reassessed for acoustic performance.

If mechanical ventilation systems are preferred for whole-dwelling ventilation, **ADF** refers that the average A-weighted sound pressure level for a ventilator operating under normal conditions and not at boost rates should not exceed both of the following:

- a) 30dB **L_{Aeq,T}** for noise-sensitive rooms (e.g. bedrooms and living rooms) when a continuous mechanical ventilation system is running on its minimum low rate;
- b) 45dB **L_{Aeq,T}** in less noise-sensitive rooms (e.g. kitchens and bathrooms) when a continuous operation system is running at the minimum high rate or an intermittent operation system is running.

Regarding overheating, the mentioned solutions are considered standard mitigation measures in controlling overheating but must be assessed by the mechanical engineer.

It is recommended that a detailed overheating assessment (e.g. dynamic modelling against CIBSE TM59 [10]) is carried out to determine possible alternative overheating mitigation solutions or to specify the capacity needed for each system.

The **AVO** guide recommends that mechanical noise to control overheating is limited to 30 dB **L_{Aeq}** for bedrooms and 35 dB **L_{Aeq}** for living or dining rooms. Such limits should be considered when selecting specific units.

6 External amenity areas

The amenity areas part of the proposed development consist of back gardens for the proposed houses.

Predictions of the noise emitted by the relevant existing noise sources during day-time at the proposed external amenity areas have been carried out by means of the same digital geometric acoustics model referred to in Section 4.1 in line with ISO 9613-2 [3].

In line with the architectural proposal, brick and timber walls with an average height of 1.8 meters have been included (See Annex B).

The same input data and parameters were used. The calculated daytime noise levels are presented as Figure ??.

The results indicate that noise levels are expected to be below 55 dB $L_{Aeq,16hr}$ for all the external amenities and as such no further mitigation solutions are required.



Figure 6 – Daytime external amenity areas noise levels

Final considerations

A detailed assessment of noise impacts on the proposed development has been carried out. Reference has been made to current national guidance, and a noise survey was carried out to determine the site's acoustics characteristics and to develop mitigation requirements necessary to achieve adequate [IANLs](#).

It has been determined that windows are required to be closed to achieve adequate [IANLs](#) within living areas. Appropriate facade and ventilation solutions and options have been provided accordingly.

It has been demonstrated that external amenity areas will be exposed to adequate noise levels, and no further mitigation is required.

Based on the implementation of the recommendations provided in this report, the development is considered to be suitable in line with the recommendations of the [NPPF](#) [12] and the [NPSE](#) [5].

Bibliography

- [1] Calculation of Road Traffic Noise (CRTN). Technical document, Department of Transport, 1988. Cited in page [16](#).
- [2] BS 7445-2:1991, Description and measurement of environmental noise - Part 2: Guide to the acquisition of data pertinent to land use. Standard, BSI, 1991. Cited in page [17](#).
- [3] ISO 9613-2:1996 Attenuation of sound during propagation outdoors - Part 2: General method of calculation. Standard, ISO, 1996. Cited 2 on pages [20](#) and [25](#).
- [4] Converting the UK Traffic Noise Index $L_{A10,18hr}$ to EU Noise Indices for Noise Mapping. Technical document, Transport Research Laboratory, 2002. Cited in page [17](#).
- [5] Noise Policy Statement for England (NPSE). Technical document, Department For Environmental, Food And Rural Affairs, 2010. Cited 4 on pages [10](#), [12](#), [26](#), and [31](#).
- [6] The Building Regulations 2010 - Approved document F: Means of ventilation. Technical document, HM Government, 2010. Cited in page [13](#).
- [7] BS 8233:2014, Guidance on sound insulation and noise reduction for buildings. Standard, 2014. Cited 3 on pages [13](#), [17](#), and [22](#).
- [8] Possible options for the identification of SOAEL and LOAEL in support of the NPSE. Technical document, AECOM & Department for Environment, Food and Rural Affairs, 2015. Cited in page [13](#).
- [9] BS EN ISO 12354-3:2017, Estimation of acoustic performance in buildings from the performance of elements - Part 3: Airborne sound insulation against outdoor sound. Standard, 2017. Cited in page [22](#).
- [10] CIBSE TM59: 2017 Design methodology for the assessment of overheating risk in homes. Technical document, CIBSE, 2017. Cited 2 on pages [10](#) and [24](#).
- [11] ProPG: Planning & Noise. Technical document, Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), 2017. Cited 3 on pages [8](#), [12](#), and [22](#).

- [12] National Planning Policy Framework. Technical document, Ministry of Housing, communities and local government, 2018. Cited 4 on pages [10](#), [12](#), [26](#), and [30](#).
- [13] Overheating in new homes - Tool and guidance for identifying and mitigating early stage overheating risks in new homes. Technical document, Good Homes Alliance, 2019. Cited in page [22](#).
- [14] Acoustics Ventilation and Overheating. Technical document, Association of Noise Consultants (ANC), 2020. Cited 4 on pages [8](#), [13](#), [14](#), and [22](#).

Annexes

ANNEX A – National Planning Policy

A.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework [12] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

In regards to noise, Paragraphs 170, 180, 204 and 205 state the following:

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

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

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

204. Planning policies should:

- g) when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction.

205. When determining planning applications, great weight should be given to the benefits of mineral extraction, including to the economy. In considering proposals for mineral extraction, minerals planning authorities should:

- c) ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties.

A.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England [5] long term vision is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development"*.

The NPSE states the three following policy aims:

First Aim:

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

Second Aim:

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

Third Aim:

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

The NPSE uses two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. These are extended to the concept of a significant observed adverse effect level as follows:

NOEL – No Observed Effect Level

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

LOAEL – Lowest Observed Adverse Effect Level

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

SOAEL – Significant Observed Adverse Effect Level

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

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development (paragraph 1.8).

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

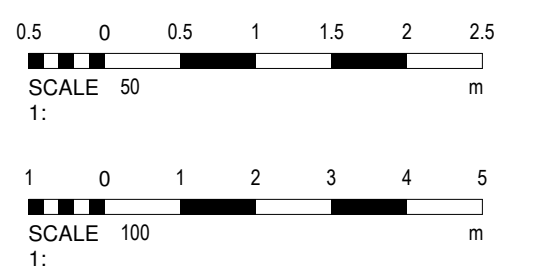
The third aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development (paragraph 1.8), recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

ANNEX B – Proposed architectural plans

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This drawing must not be scaled. Dimensions are in millimetres unless specified.



KEY:



RACHEL
M.
CREATIVE
INELL

THE GROVE SITE
Proposed Floor Plans & Elevations
0000_10400 REV P1
STATUS | PLANNING SCALE | As Indicated
DRAWN BY | RM DATE | 23.03.22
0001- RM- ZZ- ZZ- DR- A- 10400

ANNEX C – SLM Calibration certificate



CALIBRATION CERTIFICATE

Date of issue: 22-02-2021

Certificate No: 00000972-1

Page: 1/6

OBJECT OF CALIBRATION

Manufacturer: **SVANTEK**
Model: **SV307**
Serial No.: 82048
Description: Sound Level Meter

SENSOR

Manufacturer: **SVANTEK**
Model: **ST30**
Serial No.: 82588
Description: Microphone

APPLICANT

Y Acoustics
17 Newhaven Road, Brinnington SK5 8BH

ENVIRONMENTAL CONDITIONS

Temperature:	21.2 – 21.3	°C
Humidity:	46 – 47	%
Pressure:	100.2 – 100.3	kPa

DATE OF CALIBRATION

22-02-2021

APPROVED BY

B. Hunt



AcSoft Calibration | Bedford Technology Park
Thurleigh | Bedford | MK44 2YA

+44 (0) 1234 639550

www.acsoft.co.uk

Date of issue: 22-02-2021

Certificate No: 00000972-1

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CALIBRATION METHOD Method described in instruction IN-02 "Calibration of the sound level meter", issue number 11 date 27.01.2016, written on the basis of international standard EN IEC 61672-3:2013 Electroacoustics. Part 3: Periodic tests.

CALIBRATION RESULTS **The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.**
The results are presented on pages 3 to 6 of this certificate (including measurement uncertainty).

CONFORMITY WITH REQUIREMENTS On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.

UNCERTAINTY OF MEASUREMENTS Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$.

NOTES

1. The information appearing on this certificate has been compiled specifically for this instrument. This calibration certificate is produced with traceable and advanced equipment which permit comprehensive quality assurance verification of all data supplied herein.
2. The measurements in this document are traceable to GUM (Central Office of Measures), Poland
3. This calibration certificate shall not be reproduced except in full, without written permission from AcSoft Ltd.

REFERENCE EQUIPMENT

Description	Manufacturer	Model	Serial Number	Last Calibrated
Signal Generator	Svantek	SV401	124	14.09.20
Sound & Vibration Analyser	Svantek	SV912AE	15940	15.09.20
Thermo-Barometer	LAB-EL	LB-706B	912	15.09.20
Acoustical Calibrator	Svantek	SV30A	44775	15.09.20
Reference Microphone	GRAS	40AG	235709	27.08.20
Sound Intensity Calibrator	GRAS	51AB	203319	14.09.20

Date of issue: 22-02-2021

Certificate No: 00000972-1

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**CALIBRATION
RESULTS**

Calibration results are as follows:

1. Indication at the calibration check frequency

The sound level meter was calibrated in compliance with the instruction manual. During this process, the indication of this SLM was adjusted to the sound pressure level of the sound level calibrator type SV 30A, No 44775, from SVANTEK. The sound pressure level was corrected by the free-field factor.

Deviation of the acoustic pressure measurement of the A-weighted sound level using the sound calibrator type SV 30A, No 44775, from SVANTEK, was made according to the standard reference conditions: for static pressure 1003 hPa, for temperature 24 °C and for relative humidity 60 %, results:

0.0 ± 0.2 dB

The deviation was determined as a difference between the measured sound level and the sound level corrected by the free-field factor appropriate to mentioned sound calibrator.

2. Self-generated noise with microphone installed

Frequency weighting	A
The highest level of self-generated noise stated in the instruction manual [dB]	n/a
Indication [dB]	n/a

3. Self-generated noise with microphone replaced by the electrical input signal device

Frequency weighting	A	C	Z
The highest expected level of self-generated noise stated in the instruction manual [dB]	15.0	15.0	23.0
Level of self-generated noise [dB]	14.0	14.0	19.0

4. Acoustical signal tests of a frequency weighting C

Frequency	Relative frequency-weighted free-field response	Design-goal frequency weighting	The deviation of frequency weighting	Expanded uncertainty	Acceptable limits
Hz	dB	dB	dB	dB	dB
125.0	94.0	-0.2	0.2	0.3	±1.5
1000.0	94.0	0.0	0.0	0.3	±1.1
4000.0	93.4	-0.8	0.2	0.4	±1.6
8000.0	91.9	-3.0	0.9	0.4	-3.1; +2.5

Date of issue: 22-02-2021

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5. Electrical signal tests of frequency weightings

Frequency	Design-goal frequency weighting			The deviation of frequency weighting			Expanded uncertainty	Acceptable limits
	A	C	Z	A	C	Z		
Hz	dB	dB	dB	dB	dB	dB	dB	dB
63	-26,2	-0,8	0,0	0.0	0.0	0.1	0,3	±1,5
125	-16,1	-0,2	0,0	0.0	0.1	0.1	0,3	±1,5
250	-8,6	0,0	0,0	0.0	0.0	0.0	0,3	±1,4
500	-3,2	0,0	0,0	0.0	0.1	0.0	0,3	±1,4
1000	0,0	0,0	0,0	-0.1	-0.1	-0.1	0,3	±1,1
2000	1,2	-0,2	0,0	-0.1	-0.1	-0.2	0,3	±1,6
4000	1,0	-0,8	0,0	-0.1	-0.1	-0.2	0,3	±1,6
8000	-1,1	-3,0	0,0	0.0	0.0	-0.3	0,4	-3,1; +2,1
16000	-6,6	-8,5	0,0	-0.5	-0.6	-0.4	0,6	-17,0; +3,5

6. Frequency and time weightings at 1 kHz

	Sound level				Time-averaged sound level
Frequency weighting	A	A	C	Z	A
Time weighting	Fast	Slow	Fast	Fast	-
Indication [dB]	114.0	114.0	114.0	114.0	114.0
The deviation of indication from the indication of A-weighted sound level with Fast time weighting [dB]		0.0	0.0	0.0	0.0
Expanded uncertainty [dB]		0.1			
Acceptable limits[dB]		±0.3	±0.4	±0.4	±0.3

Date of issue: 22-02-2021

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7. Level linearity

Reference level range: HIGH

Expected sound level	Indication	Level linearity error	Expanded uncertainty	Acceptable limits
dB	dB	dB	dB	dB
122.0	122.0	0.0	0.2	±1.1
121.0	121.0	0.0		
120.0	120.0	0.0		
119.0	119.0	0.0		
118.0	118.0	0.0		
117.0	117.0	0.0		
116.0	116.0	0.0		
115.0	115.0	0.0		
114.0	114.0	0.0		
109.0	109.0	0.0		
104.0	104.0	0.0		
99.0	99.0	0.0		
94.0	94.0	0.0		
89.0	89.0	0.0		
84.0	84.0	0.0		
79.0	79.0	0.0		
74.0	74.0	0.0		
69.0	69.0	0.0		
64.0	64.0	0.0		
59.0	59.0	0.0		
54.0	54.0	0.0		
49.0	49.0	0.0		
44.0	43.9	-0.1		
39.0	38.9	-0.1		
34.0	33.9	-0.1		
33.0	32.9	-0.1		
32.0	31.9	-0.1		
31.0	30.9	-0.1		
30.0	29.9	-0.1		

Date of issue: 22-02-2021

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8. Toneburst response

Measurement quantity	Time weighting	Toneburst duration	The indications in response to toneburst relative to steady sound level	Reference toneburst response relative to steady sound level	Deviation of measured toneburst response from reference toneburst	Expanded uncertainty	Acceptable limits
		ms	dB	dB	dB	dB	dB
Time-weighted sound level	Fast	200	-1.0	-1.0	0.0	0.2	±0.8
		2	-18.0	-18.0	0.0		-1.8; +1.3
		0.25	-27.1	-27.0	-0.1		-3.3; +1.3
Time-weighted sound level	Slow	200	-7.5	-7.4	-0.1		±0.8
		2	-27.1	-27.0	-0.1		-1.8; +1.3
Sound exposure level	-	200	-7.0	-7.0	0.0		±0.8
		2	-27.0	-27.0	0.0		-1.8; +1.3
		0.25	-36.1	-36.0	-0.1		-3.3; +1.3

9. Peak C sound level

Numbers of cycles in test signal	Frequency of test signal	The deviation of indication	Expanded uncertainty	Acceptable limits
	Hz	dB	dB	dB
One	8000	-0.6	0.2	±2.4
Positive half-cycle	500	-0.1		±1.4
Negative half-cycle	500	-0.1		

10. Overload indication

Frequency weighting A

The difference between the levels of the positive and negative one-half-cycles input signals that first cause the displays of overload indication	Expanded uncertainty	Maximum value of the difference
dB	dB	dB
0.2	0.3	1.8

ANNEX D – Survey data

No.	Date & time	1/3 Oct LZe _q (TH) [dB]	1/3 Oct LZe _q (TH) [dB]	1/3 Oct LZe _q (TH) [dB]	1/3 Oct LZe _q (TH) [dB]
		Total A	Total C	Total Z	L10
1	08/03/2022 10:05	72.4	76.7	79.6	76
2	08/03/2022 10:10	72.4	76.6	80.7	75.5
3	08/03/2022 10:15	73.3	77.2	80.1	75.5
4	08/03/2022 10:20	73.1	77.8	81.3	75.5
5	08/03/2022 10:25	71.5	74.8	77.7	75.3
6	08/03/2022 10:30	74.2	79.3	82.4	75.3
7	08/03/2022 10:35	71.9	76.6	81.6	75.3
8	08/03/2022 10:40	73.3	78	82.8	76.3
9	08/03/2022 10:45	73.8	78.7	82.9	76.3
10	08/03/2022 10:50	73.3	79	83	76.3
11	08/03/2022 10:55	73.6	78.5	82.5	76.4
12	08/03/2022 11:00	73.1	78.1	80.3	76.4
13	08/03/2022 11:05	74	78.9	80.5	76.4
14	08/03/2022 11:10	73.1	77.8	79.5	75.6
15	08/03/2022 11:15	72.1	77.2	81.6	75.6
16	08/03/2022 11:20	72.6	77.5	81.5	75.6
17	08/03/2022 11:25	73	78	82.2	75.6
18	08/03/2022 11:30	76.2	79.4	83.6	75.6
19	08/03/2022 11:35	72.2	77.1	80.9	75.6
20	08/03/2022 11:40	72.2	76.7	78.5	75.1
21	08/03/2022 11:45	72	76.3	80.1	75.1
22	08/03/2022 11:50	72.9	77	80.2	75.1
23	08/03/2022 11:55	72.2	77.3	80.7	75.2
24	08/03/2022 12:00	72.5	77.4	81.2	75.2
25	08/03/2022 12:05	72	77.5	81.6	75.2
26	08/03/2022 12:10	72.6	78.4	83.5	75.7
27	08/03/2022 12:15	72.9	78.5	82.7	75.7
28	08/03/2022 12:20	72	77.1	81.4	75.7
29	08/03/2022 12:25	73.5	78.7	83.2	75.5
30	08/03/2022 12:30	72.8	77.9	82.4	75.5
31	08/03/2022 12:35	71.9	78.2	83.5	75.5
32	08/03/2022 12:40	73.4	79.1	82.8	75.7
33	08/03/2022 12:45	72.4	78.1	82.3	75.7
34	08/03/2022 12:50	73.8	79.5	82.5	75.7
35	08/03/2022 12:55	72.9	78.4	81.3	75.6
36	08/03/2022 13:00	73.6	78	80.6	75.6

No.	Date & time	1/3 Oct LZe _q (TH) [dB]	1/3 Oct LZe _q (TH) [dB]	1/3 Oct LZe _q (TH) [dB]
		Total A	Total C	Total Z
1	07/03/2022 23:05:00	68.7	72.4	76
2	07/03/2022 23:10:00	68.6	71.5	74.3
3	07/03/2022 23:15:00	68.8	72.8	77.4
4	07/03/2022 23:20:00	70.3	72.8	74.2
5	07/03/2022 23:25:00	73.8	76.4	79.2
6	07/03/2022 23:30:00	67.5	72.5	75.2
7	07/03/2022 23:35:00	67.7	69.3	71.7
8	07/03/2022 23:40:00	67.2	70.7	75
9	07/03/2022 23:45:00	71.5	74.8	78.3
10	07/03/2022 23:50:00	68.5	71.5	75.8
11	07/03/2022 23:55:00	68.5	71.5	74.7
12	08/03/2022 00:00:00	65.8	70.9	77.2
13	08/03/2022 00:05:00	67.5	69.7	74.6
14	08/03/2022 00:10:00	68.2	72.1	74.8
15	08/03/2022 00:15:00	64.1	66.8	71.8
16	08/03/2022 00:20:00	68.2	70.6	73.3
17	08/03/2022 00:25:00	67.5	70.6	73.2
18	08/03/2022 00:30:00	65.1	67.8	70.4
19	08/03/2022 00:35:00	69.8	73.5	75
20	08/03/2022 00:40:00	68.3	72.7	75.6
21	08/03/2022 00:45:00	68.5	73.4	76.6
22	08/03/2022 00:50:00	69.6	72.8	77.1
23	08/03/2022 00:55:00	68.8	73.8	76.5
24	08/03/2022 01:00:00	68.1	73	76.1

ANNEX E – Calculation details

ROOM DETAILS	
ID	south_fcd_kitchen
Type	Living room/dinning room
Volume (m3)	21.6
Wall (m2)	0.0
Window 1 (m2)	2.4
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.4

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	39	50	57	62	67	64	55	70
L _{Aeq} ,8hrs	External ff noise		27	39	45	51	58	55	46	61
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	4	4	4	4	4	4	4	-
10log A	10log A	-	6	6	6	6	6	6	6	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	10 mm / (6-16mm) / 6 mm	35 (-1; -3)	22	24	24	32	37	37	44	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	2500ea.ac1 (window mounted)	42 (-1;-2)	30	41	40	47	47	43	47	-
D _{ne} (Ventilator 2)	2500ea.ac1 (window mounted)	42 (-1;-2)	30	41	40	47	47	43	47	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	18	23	23	31	34	32	37	-
------------	---------------------	---	----	----	----	----	----	----	----	---

L _{Aeq} ,16hrs	IANLs	-	21	27	34	31	33	32	19	39
L _{Aeq} ,8hrs	IANLs	-	9	16	22	20	24	23	10	29

ROOM DETAILS	
ID	south_fcd_bedroom2
Type	Bedroom
Volume (m3)	24.0
Wall (m2)	0.0
Window 1 (m2)	2.4
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.4

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	39	50	57	62	67	64	55	70
L _{Aeq} ,8hrs	External ff noise		27	39	45	51	58	55	46	61
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	6 mm / 16mm argon / 6.8 mm Pilkington Optiphon	38 (-2; -5)	20	22	27	35	42	41	48	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
D _{ne} (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	17	22	25	33	37	39	45	-
------------	---------------------	---	----	----	----	----	----	----	----	---

L _{Aeq} ,16hrs	IANLs	-	20	26	29	27	28	23	8	34
L _{Aeq} ,8hrs	IANLs	-	8	15	17	16	19	14	-1	24

ROOM DETAILS	
ID	south_fcd_masterbedroom
Type	Bedroom
Volume (m3)	33.6
Wall (m2)	0.0
Window 1 (m2)	5.5
Window 2 (m2)	1.5
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	7.0

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
LAeq,16hrs	External ff noise	-	39	50	57	62	67	64	55	70
LAeq,8hrs	External ff noise		27	39	45	51	58	55	46	61
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	11	11	11	11	11	11	11	-
10log A	10log A	-	10	10	10	10	10	10	10	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	6 mm / 16mm argon / 8.8 mm Pilkington Optiphon	41 (-3; -7)	22	24	26	40	48	46	54	-
R (Window 2)	6 mm / 16mm argon / 8.8 mm Pilkington Optiphon	41 (-3; -7)	22	24	26	40	48	46	54	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
Dne (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
Dne (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	20	24	26	38	42	44	50	-
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LAeq,16hrs	IANLs	-	20	27	33	25	26	21	6	35
LAeq,8hrs	IANLs	-	8	16	21	14	17	12	-3	24

ROOM DETAILS	
ID	north_fcd_livingroom
Type	Living room
Volume (m3)	31.2
Wall (m2)	0.0
Window 1 (m2)	5.2
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	5.2

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	26	37	44	49	54	51	42	57
L _{Aeq} ,8hrs	External ff noise		14	26	32	38	45	42	33	48
RT (s)	RT (s)	-	0.8	0.8	0.8	0.8	0.8	0.8	0.8	-
Abs. Area (m2)	Abs. Area (m2)	-	6	6	6	6	6	6	6	-
10log A	10log A	-	8	8	8	8	8	8	8	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	4 mm / (6-16mm) / 4 mm	29 (-1; -4)	17	21	17	25	35	37	31	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
D _{ne} (Ventilator 2)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	16	21	17	24	29	32	28	-
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L _{Aeq} ,16hrs	IANLs	-	12	18	29	27	27	22	16	33
L _{Aeq} ,8hrs	IANLs	-	-0	7	17	16	18	13	7	23

ROOM DETAILS	
ID	north_fcd_bedroom1
Type	Bedroom
Volume (m3)	26.4
Wall (m2)	0.0
Window 1 (m2)	2.4
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.4

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	26	37	44	49	54	51	42	57
L _{Aeq} ,8hrs	External ff noise		14	26	32	38	45	42	33	48
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	4 mm / (6-16mm) / 4 mm	29 (-1; -4)	17	21	17	25	35	37	31	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
D _{ne} (Ventilator 2)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	15	20	17	23	26	29	26	-
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L _{Aeq} ,16hrs	IANLs	-	8	14	25	23	25	19	13	30
L _{Aeq} ,8hrs	IANLs	-	-4	3	13	12	16	10	4	20

ROOM DETAILS	
ID	north_fcd_bedroom3
Type	Bedroom
Volume (m3)	24.0
Wall (m2)	0.0
Window 1 (m2)	2.4
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	2.4

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	26	37	44	49	54	51	42	57
L _{Aeq} ,8hrs	External ff noise		14	26	32	38	45	42	33	48
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	4 mm / (6-16mm) / 4 mm	29 (-1; -4)	17	21	17	25	35	37	31	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
D _{ne} (Ventilator 2)	dn vent (window mounted)	37 (-1;-3)	30	39	39	37	36	39	37	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	15	20	17	23	26	29	26	-
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L _{Aeq} ,16hrs	IANLs	-	8	14	25	24	26	20	14	30
L _{Aeq} ,8hrs	IANLs	-	-4	3	13	13	17	11	5	20

ROOM DETAILS	
ID	east_fcd_bedroom3
Type	Bedroom
Volume (m3)	24.0
Wall (m2)	0.0
Window 1 (m2)	1.5
Window 2 (m2)	0.0
Roof (m2)	0.0
Wall vent (m2)	0.0
No. of passive vents	2.0
Element total area (m2)	1.5

TERM	DESCRIPTION	Rw (C;Ctr)	Octave band mid frequency in Hz							GLOBAL dB(A)
			63	125	250	500	1000	2000	4000	
L _{Aeq} ,16hrs	External ff noise	-	35	46	53	58	63	60	51	66
L _{Aeq} ,8hrs	External ff noise		23	35	41	47	54	51	42	57
RT (s)	RT (s)	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-
Abs. Area (m2)	Abs. Area (m2)	-	8	8	8	8	8	8	8	-
10log A	10log A	-	9	9	9	9	9	9	9	-

R (Wall)	n/a	-	100	100	100	100	100	100	100	-
R (Window 1)	6 mm / (6-16mm) / 4 mm	32 (-2; -4)	17	21	20	26	38	37	39	-
R (Window 2)	n/a	-	100	100	100	100	100	100	100	-
R (Roof)	n/a	-	100	100	100	100	100	100	100	-
D _{ne} (Ventilator 1)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
D _{ne} (Ventilator 2)	2500ea.ac2 (windowmounted)	45 (-2;-3)	30	42	40	46	48	53	57	-
R (Vent)	n/a	-	100	100	100	100	100	100	100	

R (Facade)	All façade elements	-	15	21	19	25	34	36	38	-
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L _{Aeq} ,16hrs	IANLs	-	16	21	29	28	25	20	9	33
L _{Aeq} ,8hrs	IANLs	-	4	10	17	17	16	11	-0	22

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