ACOUSTIC CONSULTANTS LTD

Environmental Noise Assessment

Proposed Residential Development
3 Druids Hill, Stoke Bishop

Reference: 10564/BL

Client:

spec recruitment
Your Bristol, Your Agency

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

Spec Recruitment appointed Acoustic Consultants Limited to carry out an environmental noise assessment for the proposed residential development to be located at 3 Druids Hill, Stoke Bishop, Bristol which has been approved, (application reference 22/04805) with a noise related condition (condition 2).

This assessment takes into account the impact of noise from the surrounding commercial plant. A noise survey was conducted at the site to establish environmental noise levels at the site.

The noise assessment has been undertaken in accordance with the guidance in ProPG, British Standard 8233:2014 (BS8233) and WHO (1999).

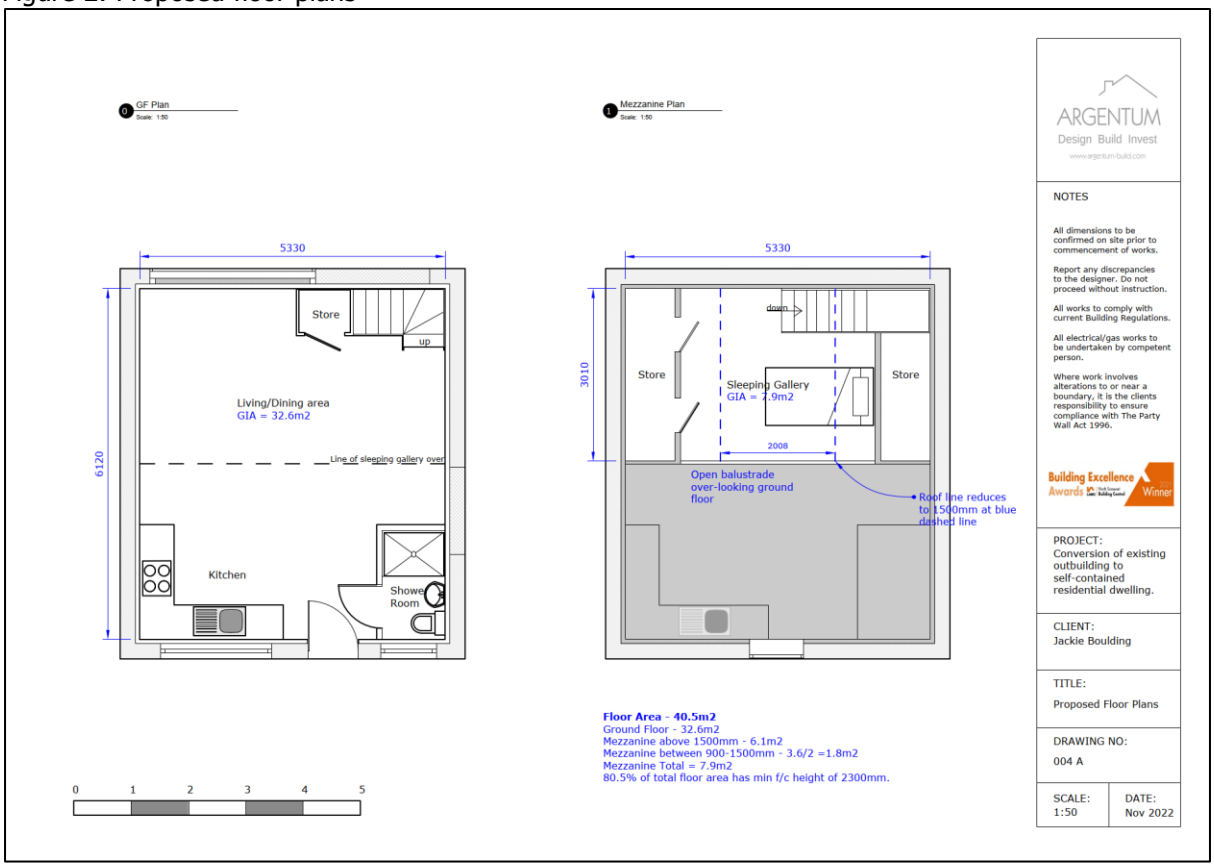
2. The Site & Proposals

The site is located to the rear of the garden of 3 Druids Hill, Stoke Bishop. It is proposed to redevelop the existing garage structure into a self-contained maisonette dwelling with vehicular access and associated works. The site is located next to a Welcome Co Op store that has commercial plant near the proposed dwelling.

The proposed site layout plan and floorplans are shown below.

Figure 1: Proposed site Location

Figure 2: Proposed floor plans



3. Assessment Methodology

3.1. Planning Condition 2

Planning Condition 2 states:

"Noise Sensitive Premises Assessment No commencement of use shall take place until a noise risk assessment with regards to noise from neighbouring commercial units, including noise from external plant and equipment, has been submitted to and approved in writing by the Local Planning Authority. The assessment shall be in accordance with ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise New Residential Development (May 2017). The noise assessment shall be carried out by a suitably qualified acoustic consultant/engineer and if necessary shall include a scheme of noise insulation measures. Any approved scheme of insulation measures shall be implemented prior to the commencement of the use and be permanently maintained thereafter.

Reason: In order to safeguard the amenities of nearby occupiers. The details are needed prior to the start of work as the acoustic report may require changes to the design details."

It should be noted that ProPG is not intended for commercial noise but has been considered here as requested by the EHO.

3.2. ProPG Stage 1: Initial Site Noise Risk Assessment

2.7 An initial noise risk assessment of the proposed development site should be conducted by a competent noise practitioner at the earliest opportunity before any planning application is submitted. The noise risk assessment should provide an indication of the likely risk of adverse effect from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

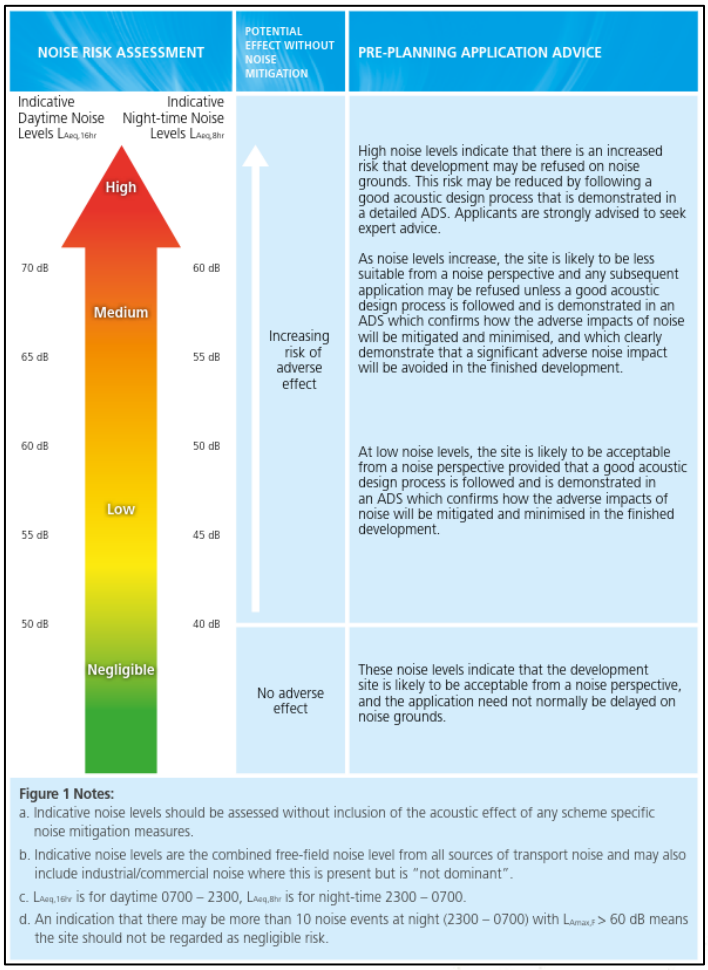
2.8 The risk assessment should not include the impact of any new or additional mitigation measures that may subsequently be included in development proposals for the site and proposed as part of a subsequent planning application. In other words, the risk assessment should include the acoustic effect of any existing site features that will remain (e.g. retained buildings, changes in ground level) and exclude the acoustic effect of any site features that will not remain) e.g. buildings to be demolished, fences and barriers to be removes) if development proceeds.

2.9 The noise risk assessment may be based on measurement or prediction (or a combination) as appropriate, and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future.

It may often be useful to liaise with the LPA regarding the most appropriate typical worst case scenario for the particular site. Care should be taken so that the risk assessment includes the combined free-field noise level from all relevant sources of transport noise that affect the site. The assessment may also include industrial/commercial noise where this is present but is "not dominant" (see below).

2.10 Figure 1 summarises the Stage 1 Initial Site Noise Risk Assessment. The figure illustrates how an initial noise risk assessment is linked with an increasing risk of adverse effect from noise and how this in turn is broadly associated indicative noise levels derived from current guidance and experience. The indicative noise levels derived from current guidance and experience. The indicative noise levels are intended to provide a sense of the noise challenge at a potential residential development site and should be interpreted flexibly having regard to the locality, the project and the wider context. In the final column, the initial noise risk assessment is aligned with pre-planning application guidance that highlights the increasing importance of good acoustic design as the noise risk increases.

2.11 The overall Stage 1 approach is considered to support wider Government planning and noise policy and guidance at the date of publication of this document, including the NPPF, NPSE and PPG-Noise.



3.3. Pro PG Stage 2: British Standard 8233:2014

ProPG Planning and Noise guidance refers to British Standard 8233:2014 criteria for the acoustic design required to control internal ambient noise levels and external noise. The relevant sections of this British Standard are provided below.

British Standard 8233:2014 entitled 'Guidance on sound insulation and noise reduction for buildings', Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources 'without a specific character' and these are based on existing guidelines issued by the World Health Organisation in 1999. The British Standard guideline states that noise levels should not exceed those as noted in Table 4 of the British Standard, and this is summarised below:

Table 1: British Standard 8233:2014 Internal Noise Criteria

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

The British Standard does not provide any internal noise criteria for maximum noise levels. Section 3.4 of the WHO Guidelines state *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)".*

4. Noise Survey

A noise survey was undertaken between 9th to 13th November 2023 to establish environmental noise levels at the nearest façade to the commercial plant.

4.1. Monitoring Equipment

Sound Pressure Levels were measured using a Class 1 Sound Level Meter with a half-inch condenser microphone using the "fast" setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 2: Monitoring Equipment

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-13561-E0	17/11/2021	39498
Pre-Amp, NTI, MA220	7606	17/11/2021	39498
Microphone, NTI, MC230A	A17955	17/11/2021	39497
Calibrator, Larson Davis, CAL200	15064	08/12/2022	42729

The measurement system was checked for calibration before and after the tests, and no significant drift was detected.

4.2. Monitoring Locations

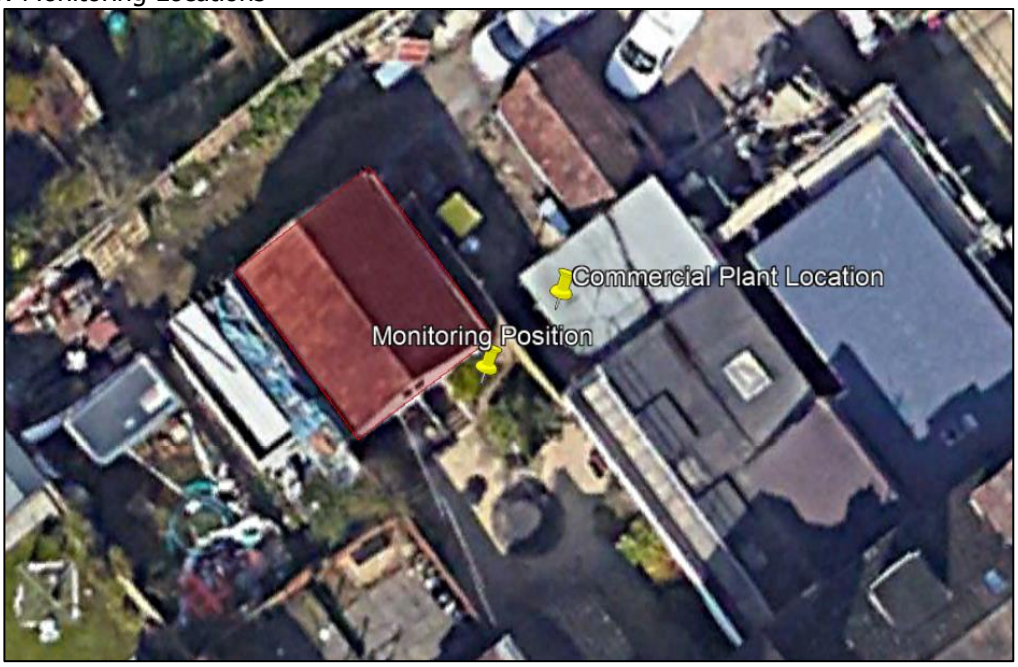
A partially attended long-term noise survey was undertaken at the site to determine environmental noise levels which could affect the dwellings (i.e. road traffic and plant noise).

The sound level meter at Monitoring Location 'A' was located in a façade position, with the microphone 1.5 metres above the ground. The purpose of this measurement was to determine the noise levels at the façade nearest to the commercial plant.

Attended measurement was also taken at the same location to establish plant noise levels from the commercial plant during set up. Five of the units were running intermittently in various combinations for the duration of the attended measurements and three were not running at all.

The monitoring locations are shown on the satellite image of the site below:

Figure 3: Monitoring Locations



4.3. Weather Conditions

Weather conditions were generally calm and clement over the duration of the survey with wind speeds typically not exceeding 5 m/s.

4.4. Measured Noise Levels

4.4.1. Unattended Long Term Noise Levels

As follows are the measured equivalent noise and maximum noise spectra:

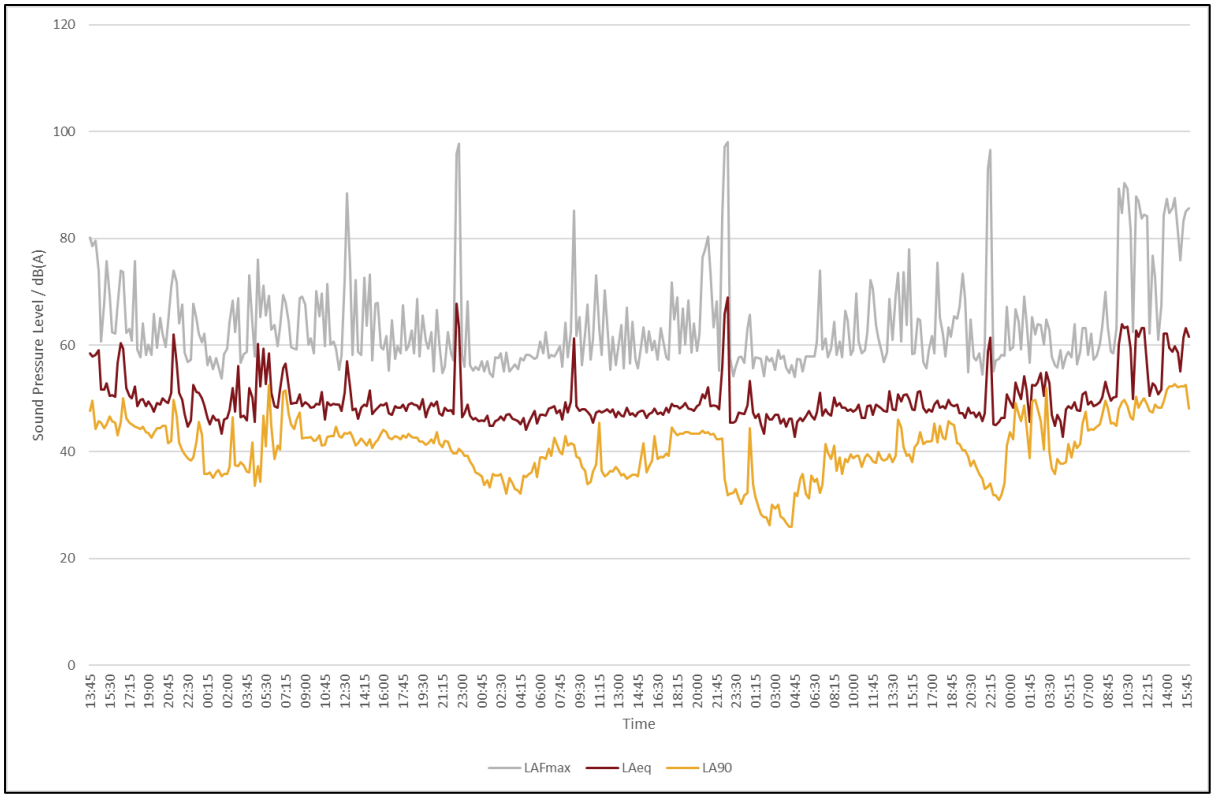
Table 3: Equivalent and maximum noise levels at Monitoring Location

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
$L_{eq,16hour}$	56.8	61.4	54.7	48.1	47.2	46.7	47.1	46.6	55
$L_{eq,8hour}$	54.0	60.0	52.6	41.8	41.1	42.4	41.1	37.2	50
L_{Fmax}	64.9	70.7	63.2	59.2	61.7	64.2	62.4	58.5	69

*11th highest maximum noise event at night based on WHO (1999) guidance

The chart below shows the maximum noise events (L_{AFmax}), equivalent noise levels (L_{Aeq}) and statistical background noise levels (L_{A90}) with time:

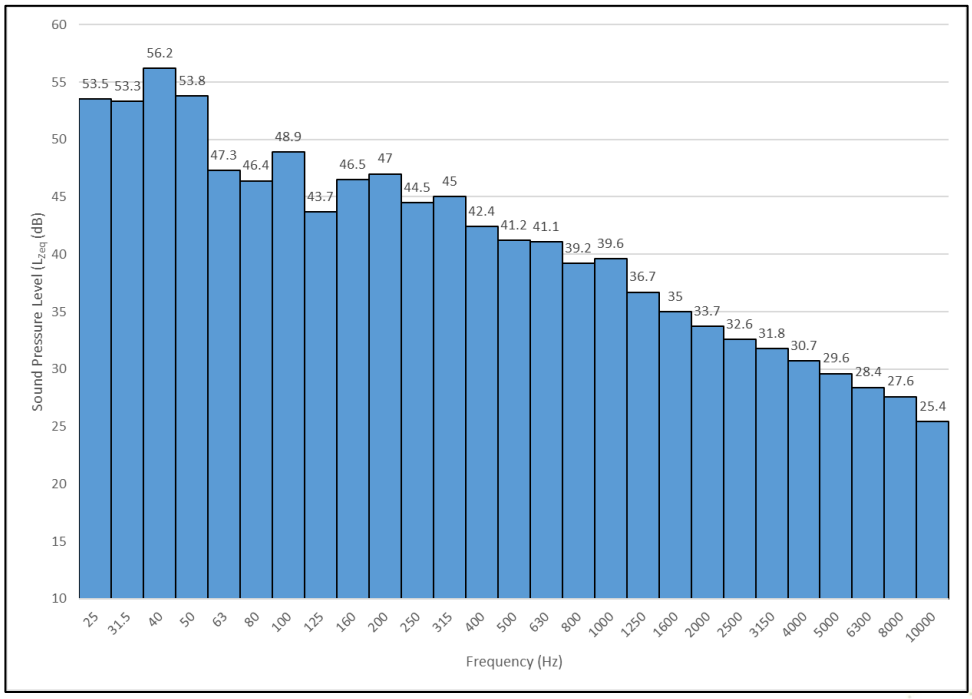
Chart 1: Measured Noise Levels over Time



4.4.2. **Attended Noise Levels**

The attended measurement of plant noise level is shown in the chart below, the plant noise levels were 49 dB $L_{Aeq(T)}$. The plant was not tonal but was intermittent in nature.

Chart 2: Measured Noise Levels over Time



5. Internal Noise Assessment

It will be necessary to design the building fabric of the dwelling to control the levels of plant noise as per Pro PG and planning Condtion 2.

5.1. Calculation Method

Calculations for the internal ambient noise levels have been undertaken using the calculation method provided in Annex G of British Standard 8233:2014.

The calculations have been undertaken using the building façade constructions set out below, octave band equivalent noise levels measured during the long term noise survey and noise modelling results.

The calculations are based on room and façade dimensions set out in the proposed plans issued by the client.

5.2. External Wall Construction

The external walls could comprise either a masonry or light weight timber / metal frame construction.

- The masonry construction could comprise at least two skins of block (one of density 1850 Kg/m^3, 100mm cavity, 100mm block (density of 400 Kg/m^3). The inner skin of block would be plastered.

Or,

- The timber/metal frame construction could comprise a single frame construction with an external leaf of 100mm brick or block (density 1600 kg/m^3), 100mm timber/metal stud with 50 millimetre of mineral wool insulation within the cavity and inner lining comprising two layers of dense plasterboard (minimum total surface mass 16 kg/m^2).

The constructions above are expected to achieve the following minimum sound reduction indices:

Table 4: Required minimum sound reduction indices of external wall

Frequency (Hz)	**Sound Reduction Index 'R' (dB) per Octave Band Frequency**								**R_w**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	
Masonry	31	38	46	45	55	66	77	70	**52**
Lightweight	25	40	45	46	53	60	60	60	

Any alternative constructions must achieve the above noted performance.

5.3. Roof Construction

The roof should therefore be constructed as follows:

- Concrete or slate tiles (minimum density 30 Kg/m^2)
- 100-millimetre timber joists
- 50 millimetres of mineral wool in the cavity (minimum 10 kg/m^3)
- 2 x 12.5mm Wallboard plasterboard (total surface mass 16 kg/m^2)

This construction is expected to achieve the following sound reduction indices as calculated in the proprietary software INSUL:

Table 5: Required minimum sound reduction indices of roof

Frequency (Hz)	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
Roof	17	22	37	42	50	57	57	57	44

Any alternative roof constructions should achieve the above noted performance.

5.4. Windows Construction

The windows on all elevations can be openable, at occupier discretion for purge ventilation for example. The windows should be constructed from sturdy good quality frames with airtight compression seals. The minimum sound reduction indices required of the windows are as follows:

Table 6: Required sound reduction indices of windows

Frequency (Hz)	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
Roof	20	24	20	25	35	38	35	36	31

The window supplier should provide test data to confirm the chosen system provides the required performance. Any alternative constructions must meet the minimum requirements above.

5.5. Door Construction

The door should be constructed from sturdy good quality frames with airtight compression seals. The minimum sound reduction indices required of the door is as follows:

Table 7: Required sound reduction indices of door

Frequency (Hz)	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
Door	14	17	22	26	29	28	36	36	29

The door supplier should provide test data to confirm the chosen system provides the required performance. Any alternative constructions must meet the minimum requirements above.

5.6. Ventilation Provisions

There will be a need for suitable attenuated ventilation provisions. For typical background ventilation this could be achieved via window-fitted acoustic trickle vents. We have worked on the basis of 4 vents to the space. This should be confirmed by the client.

As follows are summarised the element normalised level differences ($D_{,n,e,}$) (in the open position) required for trickle vents to habitable rooms across the development.

Table 8: Required minimum element normalised level difference of ventilation (in the open position)

Required Vent Sound Insulation Performance, $D_{n,e}$ per Octave Band (Hz)								**$D_{n,e,w}$ (dB)**	**Typical Construction**
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**		
30	38	38	33	36	47	49	57	**39**	Acoustic Trickle vent

The ventilation supplier should confirm the above performance is achievable when tested to the current British Standards.

5.7. Effect of Noise Control Measures

With the noted building fabric construction, and suitable ventilation provisions, the predicted internal noise levels within the proposed dwellings are within the criteria of British Standard 8233:2014 of 35 dB $L_{Aeq,16hour}$ in the daytime rooms, and 30 dB $L_{Aeq,8hour}$ and 45 dB $L_{Amax,F}$ in the night-time rooms.

The calculation is provided below:

Figure 4: Noise ingress calculation

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq,16hour}$	57	61	55	48	47	47	47	47	55
Night $L_{eq,8hour}$	54	60	53	42	41	42	41	37	50
Night-time $L_{max(fast)}$	65	71	63	59	62	64	62	59	69

Building Façade Construction

External Element		63	125	250	500	1000	2000	4000	8000
SF X V50 / SFSA C25 (open) – 39 Dnew	D_{nw}	30	38	38	33	36	47	49	57
	Number of	4							
		0	0	0	0	0	0	0	0
Wall: User Defined		25	40	45	46	53	60	60	60
	Area	39							
		0	0	0	0	0	0	0	0
Double Glazed: 4/12/4 - 31 Rw		20	24	20	25	35	38	35	36
	Area	5							
		0	0	0	0	0	0	0	0
Flat, timber-joist roof, asphalt on boarding. 12mm plasterboard ceiling, thermal insulation - 44 Rw		17	22	37	42	50	57	57	57
	Area	33							
		0	0	0	0	0	0	0	0
Door - 29dB Rw	R	14	17	22	26	29	28	36	36
	Area	2							
		0	0	0	0	0	0	0	0

Calculations to BS EN 12354

	63	125	250	500	1000	2000	4000	8000
Sum	0.01209	0.003547692	0.001017944	0.000547165	0.000178854	6.21074E-05	3.50715E-05	2.5607E-05
10log sum	-19.17521876	-24.50054152	-29.92276239	-32.61881635	-37.4750026	-42.06856815	-44.5504571	-45.91641375
10log S/A	3.287942549	3.287942549	3.287942549	3.287942549	3.287942549	3.287942549	3.287942549	3.287942549
correction factor +3	3	3	3	3	3	3	3	3

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq,16hour}$	44	43	31	22	16	11	9	7	**29**
Night $L_{eq,8hour}$	41	42	29	15	10	7	3	-2	**27**
Night-time $L_{max(fast)}$	52	52	40	33	31	28	24	19	**40**

6. Summary and Conclusions

Spec Recruitment appointed Acoustic Consultants Limited to carry out an environmental noise assessment for the proposed residential development to be located at 3 Druids Hill, Stoke Bishop, Bristol which has been approved (application reference 22/04805) with a noise related condition (condition 2).

This assessment takes into account the impact of noise from the surrounding commercial plant. A noise survey was conducted at the site to establish environmental noise levels at the site.

The noise assessment has been undertaken in accordance with the guidance in ProPG, British Standard 8233:2014 (BS8233) and WHO (1999).

With the proposed fabric construction and suitable ventilation provisions set out in this report, the predicted internal equivalent noise levels due to external noise are within the British Standard 8233:2014 and WHO (1999) criteria for good internal noise conditions.

The proposals and recommended mitigation measures set in this report achieve the aims of Pro PG as required in the planning condition.

7. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure pA – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$L_{pA} = 10 \log_{10} (p_A/p_0)^2$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
p_0 is the reference sound pressure (20 µPa)

Background sound level, $L_{A90,T}$– A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t2 – t1, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{AeqT} = 10\lg_{10}\left\{(1/T)\int_{t_1}^{t_2}[p_A(t)^2/p_0^2]dt\right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 µPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

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