ACOUSTIC CONSULTANTS LTD

Environmental Noise Assessment

Proposed Residential Development
Former HSBC, Melksham

Reference: 10443/SL

Client:
Nicholas H Wood

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

Nicholas H Wood appointed Acoustic Consultants Limited to carry out a noise assessment for the proposed dwelling to be located at the site of the former HSBC, Melksham.

This assessment considers the impact of noise from the surrounding road network, commercial noise and adjacent public house. A noise survey was conducted to establish environmental noise levels at the façade of the proposed dwelling. It was also agreed with both the client and public house to test the internal sound insulation between the public house and dwelling to inform the acoustic advice.

Internal noise levels due to external noise ingress have been predicted and assessed based on the measured external survey data. Where guideline noise levels are predicted to be exceeded internally due to external noise ingress, noise mitigation measures have been set out in this report. We have also provided commentary on internal sound transmission from the public house to the proposed dwelling based on the known information.

The noise assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 8233:2014 (BS8233), WHO (1999) and local authority guidance.

The application site was granted prior approval for the proposals by Wiltshire Council on 10th November 2022 (Application Number PL/2022/05692), subject to the condition, as stated in Section 3.

2. The Site & Proposals

The site is the former HSBC building in Melksham, Wiltshire. It is currently being used as an artist's studio and it is proposed to construct a flat upon the mezzanine floor to provide an associated dwelling above.

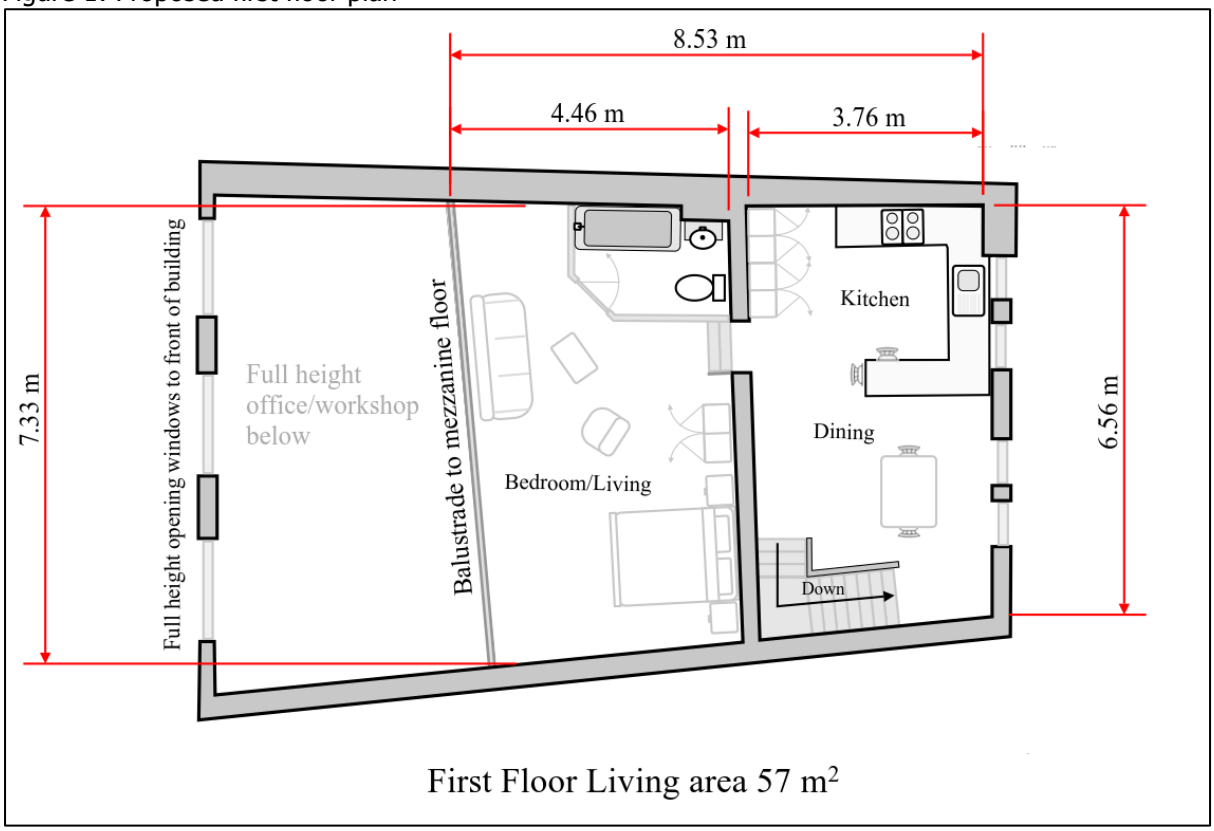
The proposals see the introduction of bedroom/living space and kitchen/dining area upon the mezzanine floor. These are understood to be open plan in nature and also overlook the artist's studio below.

The site is located off the roundabout connecting High Street, Lowbourne and Bank Street and there is a public house at the Parsons Noses directly neighbouring the site to the south which shares a party wall with the proposed dwelling.

The Parsons Nose is open until 02:00 hours on Fridays and Saturday nights and is understood to host live music events. Noise transfer through the party wall, noise of the public house's beer garden to the rear of the site and noise from pub patrons congregating on the surrounding roads to the front of site all has the potential to affect the proposed dwellings.

The proposed site location is shown below:

Figure 1: Proposed first floor plan



3. Planning Condition

The application site was granted prior approval for the proposals by Wiltshire Council on 10th November 2022 (Application Number PL/2022/05692), subject to the following condition:

> *"Prior to commencement of development an acoustic report shall be submitted to the LPA for approval in writing prior to implementation. The report shall demonstrate that the internal and external amenity standards of BS8233:2014 Guidance on sound insulation and noise reduction for buildings (or any subsequent version) and WHO Guidelines for Community Noise (1999) can be achieved within the development. The report must include full details of any scheme of mitigation required to achieve this which if approved must be implemented in full and maintained in that way in perpetuity.*
>
> *REASON: To ensure a satisfactory standard of amenity for incoming occupiers."*

Therefore, where the development is designed to achieve the acoustic requirements set out above, the requirements of the conditional prior approval granted by Wiltshire Council can be met.

4. Assessment Methodology

4.1. British Standard 8233:2014

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)".*

4.2. Noise from Events with Amplified Music

The planning condition refers only to BS8233:2014 and WHO 1999 which typically are used to address sources such as road traffic and general community noise.

This may not sufficiently control music noise. As such we propose an alternative criterion of NR20 for events with live or amplified music.

The criterion of NR20 is a more onerous criterion than British Standard 8233:2014 criteria for daytime and night-time rooms, and places more emphasis on low frequency noise, which is often the most prominent aspect of amplified music.

We would therefore consider this a suitable criterion for structure borne transfer of amplified music noise from the adjacent public house.

5. Baseline Noise Monitoring

Between 8th-11th September 2023, a partially attended long-term noise survey was undertaken at the site to determine environmental noise levels which could affect the proposed dwelling.

5.1. 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 and calibration information

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-13617-E0	30/03/2022	40614
Pre-Amp, NTI, MA220	7727	30/03/2022	40614
Microphone, NTI, MC230A	A16151	30/03/2022	40613
Calibrator, Larson Davis, CAL200	12605	07/07/2023	44797
SLM, NTI, XL2	A2A-11041-E0	07/07/2023	44799
Pre-Amp, NTI, MA220	1822	07/07/2023	44799
Microphone, NTI, MC230	9583	07/07/2023	44799
Calibrator, Larson Davis, CAL200	18273	30/01/2023	43115
SLM, NTI, XL3	A3A-00416-D1	28/11/2022	UK-22-122
Pre-Amp, NTI, MA220	11239	28/11/2022	UK-22-122
Microphone, NTI, MC230A	A23729	28/11/2022	UK-22-122
CEL-284/2	3/02716829	01/12/2022	24902

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

5.2. Monitoring Procedure

A survey methodology was devised prior to the survey and agreed with the client and public house. Sound level meters would be installed on the front and rear façades to determine environmental noise levels over the duration of a weekend survey, while a sound insulation test would be undertaken between the public house and proposed dwelling in order to both establish the existing sound insulation performance and identify the primary paths of sound transmission from the pub into the proposed dwelling.

The pub were reluctant to provide access for the sound insulation testing but agreed following correspondence from us via the client stating the importance of investigative testing in identifying paths of sound transmission and quantifying the sound insulation performance across the frequency spectrum.

When our consultant arrived on site at the agreed time in order to carry out tests, the landlord of the public house refused access to facilitate the sound insulation testing. As a result, it was not possible to evaluate the sound insulation performance of the separating wall nor identify paths of flanking sound transmission.

In order to capture some data with which to assess sound transfer from the public house, an additional sound level meter was installed internally within the centre of the open plan room.

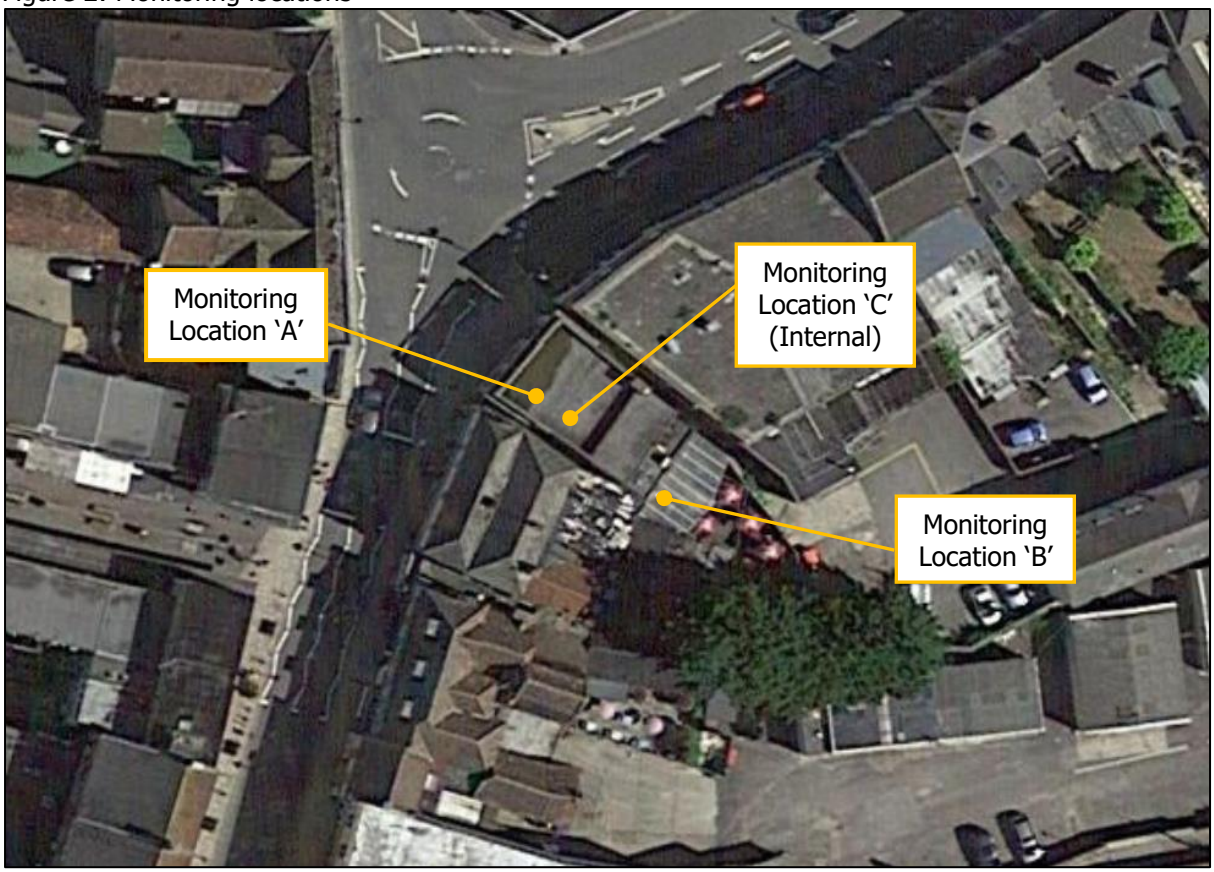
The sound level meter at Monitoring Location 'A' was located in a façade position, with the microphone elevated through a first-floor window on the north-western façade overlooking High Street. The purpose of this measurement was to determine environmental noise levels due to road traffic and pedestrians on High Street, Bank Street and Lowbourne.

The sound level meter at Monitoring Location 'B' was in a façade position with the microphone elevated through the first-floor window on the south-eastern façade overlooking the beer garden to the rear of the Parsons Nose public house.

The additional sound level meter left internally at Monitoring Location 'C' was in a reverberant position in the centre of the room and was intended to provide guidance on the internal noise levels associated with the use of the adjacent public house. The partially open windows at Monitoring Locations 'A' and 'B' meant that this monitoring position was also influenced by noise break in from the front and rear of the building.

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

Figure 2: Monitoring locations



5.3. Weather Conditions

As follows are summarised the weather conditions throughout the survey; these are not considered to have had any adverse effect on the measured data.

Table 3: Weather conditions at the site during the survey.

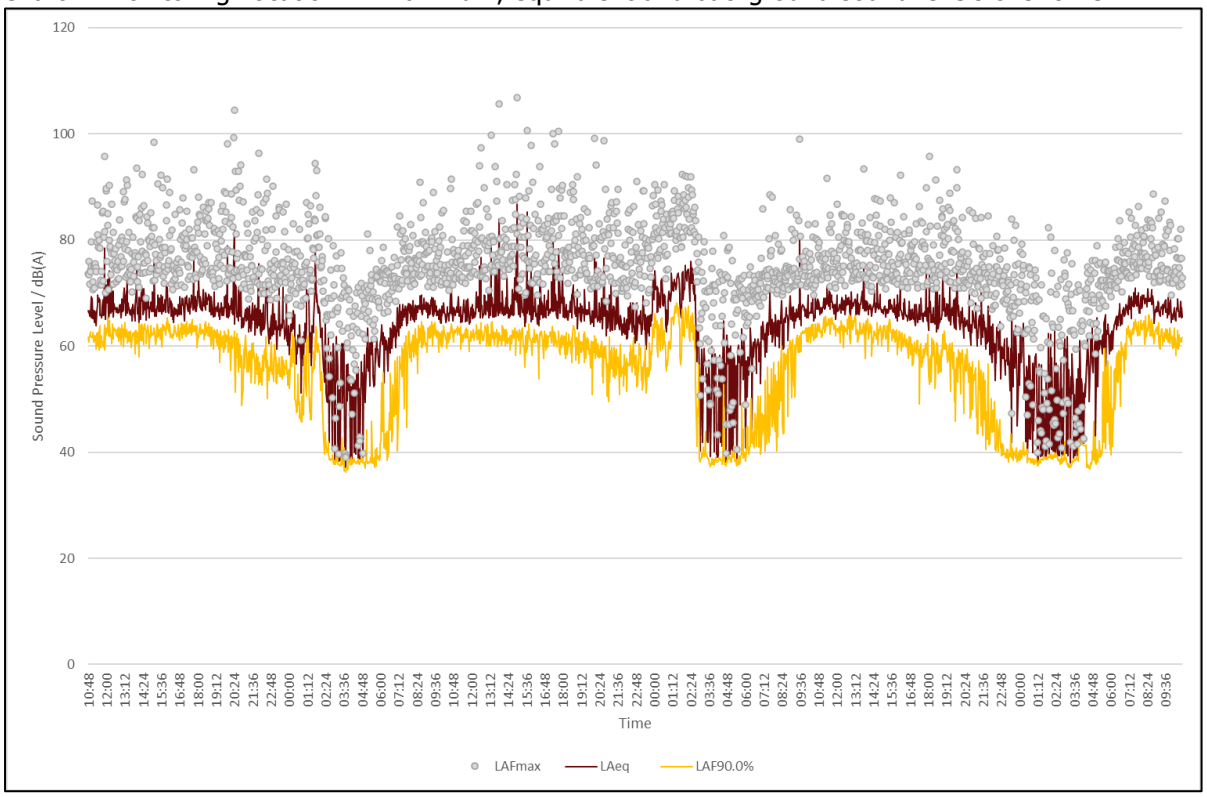
Date	Wind Speed (m/s)	Prevailing Wind Direction	Average Air Temperature (°C)	Precipitation (time/hrs)
08/09/2023	1	S	25	0
09/09/2023	2	SW	25	0
10/09/2023	3	E	22	0.25
11/09/2023	4	SW	19	0

5.4. Noise Survey Data

5.4.1. Monitoring Location 'A'

As follows is the measured data from the long-term noise measurements at Monitoring Location 'A' overlooking High Street. The chart below shows the maximum noise events (L_{AFmax}), equivalent noise levels (L_{Aeq}) and statistical background noise levels (L_{A90}) (façade levels).

Chart 1: Monitoring Location 'A' maximum, equivalent and background sound levels over time



As follows are the design worst-case typical equivalent noise and maximum noise spectra determined at Monitoring Location 'A':

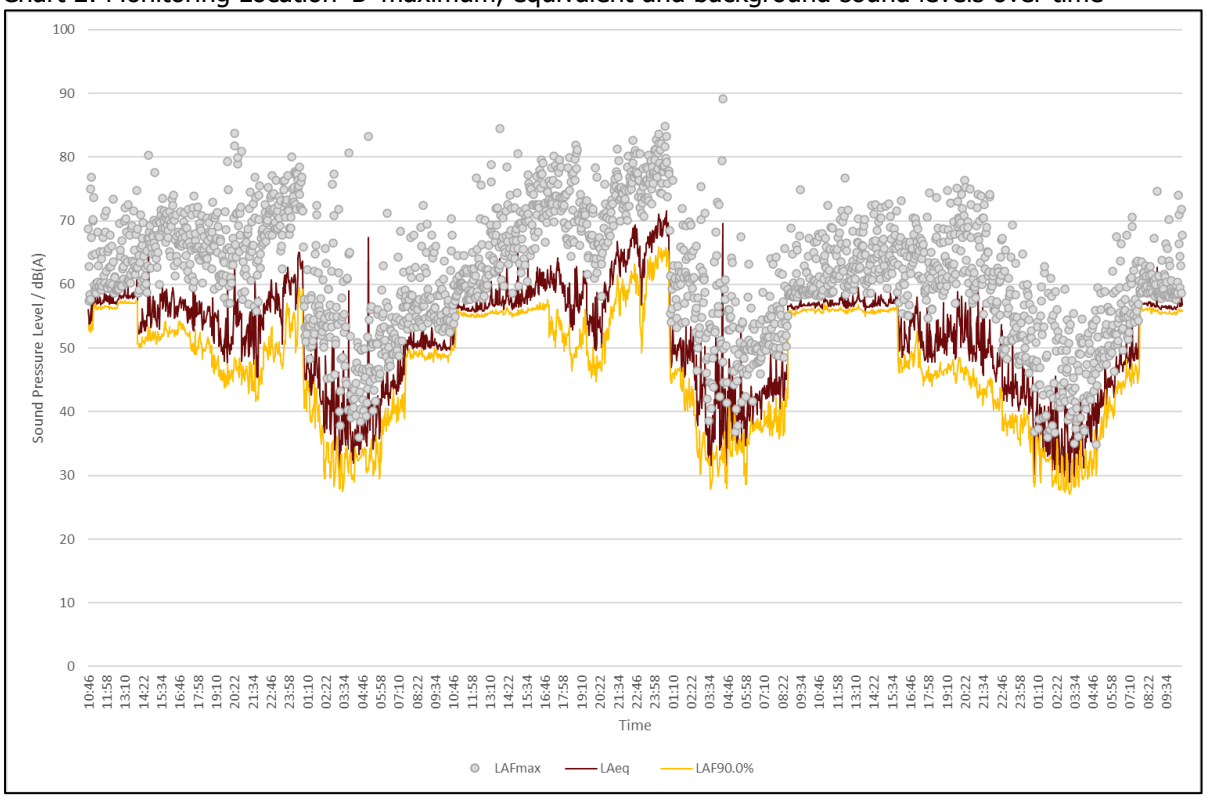
Table 4: Equivalent and maximum noise levels at Monitoring Location 'A' (free-field levels)

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
$L_{eq,16hour}$	74	70	64	63	62	59	51	46	66
$L_{eq,8hour}$	65	60	58	62	61	56	47	40	64
L_{Fmax}	86	68	72	80	80	77	62	59	86

5.4.2. **Monitoring Location 'B'**

As follows is the measured data from the long-term noise measurements at Monitoring Location 'A' overlooking the Parsons Nose pub garden to the rear. The chart below shows the maximum noise events (L_{AFmax}), equivalent noise levels (L_{Aeq}) and statistical background noise levels (L_{A90}) (façade levels).

Chart 2: Monitoring Location 'B' maximum, equivalent and background sound levels over time



As follows are the design worst-case typical equivalent noise and maximum noise spectra determined at Monitoring Location 'B':

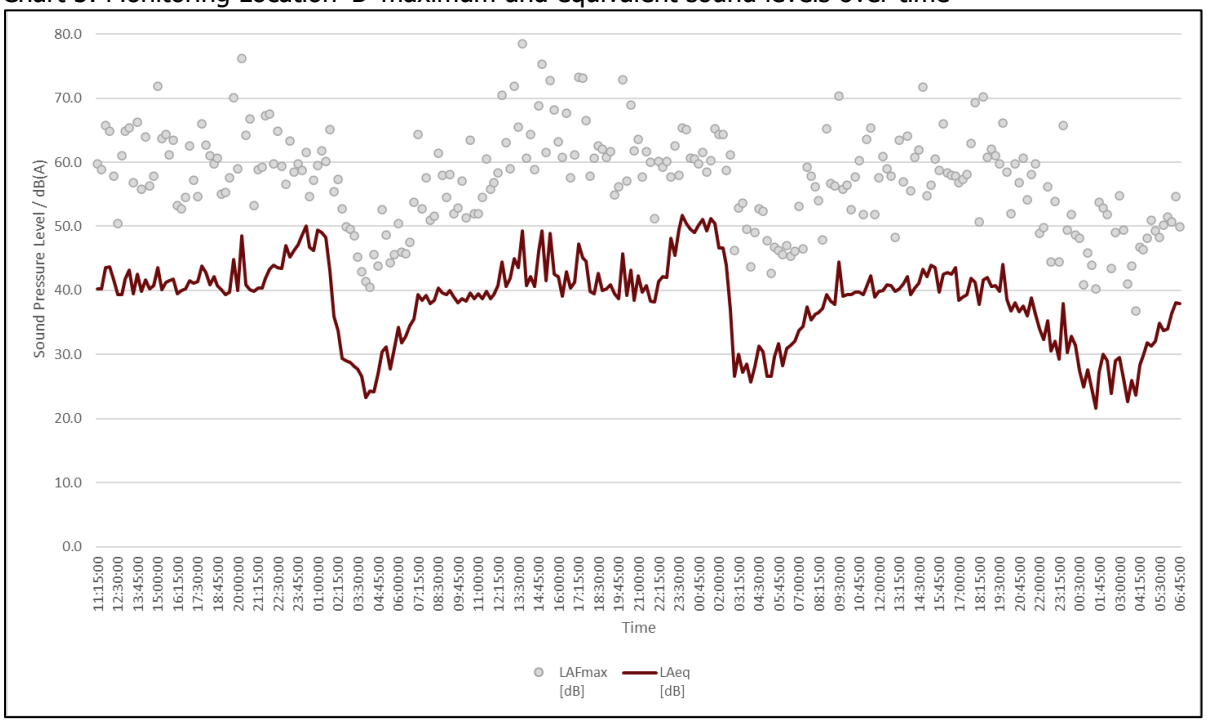
Table 5: Equivalent and maximum noise levels at Monitoring Location 'B' (free-field levels)

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
$L_{eq,16hour}$	59	57	54	55	52	47	39	30	57
$L_{eq,8hour}$	55	52	51	58	55	50	43	32	59
L_{Fmax}	68	69	68	75	79	73	60	49	81

5.4.3. **Monitoring Location 'C'**

As follows is shown the measured data from the long-term noise measurements of the noise climate at Monitoring Location 'C'. The chart below shows the maximum noise events (L_{AFmax}) and equivalent noise levels (L_{Aeq}).

Chart 3: Monitoring Location 'B' maximum and equivalent sound levels over time



As follows are the worst-case typical equivalent noise and maximum noise spectra determined at Monitoring Location 'C':

Table 6: Equivalent and maximum noise levels at Monitoring Location 'C' (internal reverberant levels)

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
	63	125	250	500	1000	2000	4000	8000	
$L_{eq,16hour}$	53	49	43	40	37	33	26	18	42
$L_{eq,8hour}$	54	52	50	45	39	33	23	14	46
L_{Fmax}	47	40	40	52	64	53	44	25	64

Chart 3 above clearly shows where amplified music noise from the public house affected the levels measured internally at Monitoring Location 'C'. The data was post-processed and the periods of music noise analysed to establish a design internal music noise level which comprises the worst-case level measured over the full survey in each octave band (during music noise). This spectrum may also have been influenced by noise ingress via the open windows. The design music noise spectrum is as follows:

Table 7: Design amplified music noise spectrum determined internally at Monitoring Location 'C'

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)	NR
	63	125	250	500	1000	2000	4000	8000		
$L_{eq,15min}$	61	59	57	50	44	38	29	22	52	48

6. External Noise Control

Based on the results of the external noise survey, it will be necessary to design the building fabric of the dwelling to control the levels of environmental noise internally to within the requirements of BS8233:2014 and WHO 1999 as required by the prior approval planning condition.

The following sections set out the noise mitigation measures that would be required to achieve guideline internal ambient noise levels due to external noise ingress.

6.1. 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 survey data at Monitoring Locations 'A' and 'B' is representative of the noise incident on the north-western and south-eastern facades of the building respectively. As follows are set out mitigation measures determined to control external ingress noise through the building façade at these locations.

The calculations have been undertaken using dimensions of the proposed flat, the building façade constructions set out below and the octave band noise levels measured during the noise survey.

Alternative constructions to those noted below could potentially be used but may need to be reassessed to ensure they control external noise to within BS8233:2014 and WHO 1999 criteria.

6.2. External Wall Construction

The existing external wall specification is understood to be of an unknown masonry construction. We have worked on the assumption that the external wall consists of the following:

- Masonry construction comprised of a minimum of 215mm brick, fairfaced, assumed mass per unit area of 355kg/m^2.

In order to control the ingress of external noise, the habitable rooms should be lined internally with an system such as British Gypsum Gyplyner Universal to comprise:

- GL1 Lining Channel to form 35mm cavity.
- 25mm mineral wool (APR 1200) in the cavity.
- 2 layers of 12.5mm Wallboard plasterboard (total surface mass 16 kg/m^2).

This construction is expected to achieve the following sound reduction indices:

Table 8: Assumed minimum sound insulation performance of external walls (with internal lining)

Construction	Sound Reduction Index / dB per Octave Band (Hz)							R_w
	63	125	250	500	1k	2k	4k	
Masonry, lined internally	35	40	52	60	68	74	79	**62**

Any alternative constructions must achieve the above noted performance. Please advise if the density or construction of the external wall differs from the assumptions stated above.

Please note, the external walls could also require lining to control flanking noise transmission from the public house. It was not possible to determine the extent of flanking noise present in the external walls during the site visit as the pub landlord refused to facilitate a sound transmission test being undertaken.

6.3. Roof Construction

The exact specification of the roof is unknown. We have worked on the basis of a flat roof construction with tiles/external finish of minimum surface mass 30 kg/m^2, a timber frame with mineral wool insulation in the cavity and a plasterboard ceiling fixed to the joists. We have also considered the full correction for barrier attenuation set out in ISO-9613 to sound reaching the roof.

The construction above would be expected to achieve the following sound reduction indices:

Table 9: Assumed minimum sound reduction indices of roof

Location	Sound Reduction Index 'R' (dB) per Octave Band Frequency								R_w
	63	125	250	500	1k	2k	4k	8k	
All Habitable Rooms	15	27	41	49	54	56	57	57	**51**

Any alternative constructions should achieve the above noted performance. Please advise if the construction differs significantly from the above.

Please note the above only considers external noise ingress. More robust measures may be required to address structure borne noise passing through the roof – this is discussed in Section 0 below but is not possible to quantify due to pub refusing access for the sound insulation testing.

6.4. Window Construction

It will be required to install secondary glazing to all windows across the scheme in order to control the ingress of environmental noise (road traffic, beer garden noise and patrons outside the front of the public house). Without secondary glazing, it is not considered possible to achieve the internal noise criteria set out in the prior approval planning condition.

The secondary glazing panes should be constructed from sturdy good quality frames with airtight compression seals to control noise. The windows could be openable (for purge ventilation for example) with background ventilation provided via alternative attenuated means.

The minimum sound reduction indices that would be required of the secondary glazed windows are as follows:

Table 10: Required sound reduction indices of windows

Room	Sound Reduction Index / dB per Octave Band (Hz)								R_w (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
All Habitable Rooms	30	35	46	46	46	56	65	60	**49**	10/200/6

Any alternative constructions must achieve the above noted performance. The above assumes the existing glazing is 6-millimetres thick. We recommend that the secondary glazing supplier confirms the performance above can be achieved with their system when installed internally to the existing panes. All panes must be well sealed in order to achieve the performance above.

6.5. Ventilation Provisions

There will be a need for suitable attenuated ventilation provisions to the proposed open plan mezzanine flat to control external noise. A mechanical ventilation system should be installed and the sound level difference to 'habitable rooms' through the system should be, at a minimum, as set out per zone below in Table 11. This is the difference between the external façade level and the level inside a furnished room at one-and-a-half metres from the vent.

Table 11: Minimum required atmosphere-to-room sound level difference for MVHR, if applicable

Location	Minimum Sound Level Difference (dB)							
	63	125	250	500	1k	2k	4k	8k
Atmosphere to open plan habitable rooms	37	42	44	48	53	57	68	65

6.6. Effect of Noise Control Measures

Based on our calculations, the predicted internal noise levels within the proposed dwellings could achieve the recommended music noise criterion of NR20 and 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 (as required in the planning condition) with the noise mitigation measures set out above.

The calculations for the bedroom area is provided below:

Figure 3: Calculation for predicted noise levels within dwelling (external noise ingress only)

Free Field Level at Façade

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq16\ hour}$	74	70	64	63	62	59	51	46	66
Night $L_{eq\ (8hour)}$	65	60	58	62	61	56	47	40	64
Night-time $L_{max(fast)}$	89	70	74	83	83	80	65	61	86

Building Façade Construction

External Element		63	125	250	500	1000	2000	4000	8000
215mm concrete block, fairfaced, 355kgm2, 1470kgm3 - 52 Rw		40	40	42	45	56	66	73	73
	Area	42							
		0.00004	0.00004	0.00002	0.00001	0.00000	0.00000	0.00000	0.00000
Secondary Glazing : Separate panes 10/200/6 - 49 Rw		30	35	46	46	46	56	65	60
	Area	8.71							
		0.00008	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Roof: User Defined		35	47	61	69	74	76	77	77
(+20 dB for barrier)	Area	58							
		0.000162108	1.02283E-05	4.07197E-07	6.45363E-08	2.04082E-08	1.28767E-08	1.02283E-08	1.02283E-08
Double Glazed: 10/12/6.4 - 39 Rw	R	22	27	29	36	41	42	52	50
door	Area	4.20							
		0.000234059	7.40161E-05	4.6701E-05	9.31807E-06	2.94663E-06	2.34059E-06	2.34059E-07	3.70959E-07

Calculations to BS EN 12354

	63	125	250	500	1000	2000	4000	8000
Sum	0.00051043	0.000145906	7.2597E-05	2.31212E-05	5.83723E-06	2.64049E-06	2.87327E-07	0.00000
10log sum	-32.9206243	-38.35926362	-41.39081368	-46.35990141	-52.33793168	-55.78315501	-65.41624122	-63.21637425
10log S/A	3.26411173	3.264111728	4.236376905	5.258038167	6.389665065	5.451241851	4.808843655	4.808843655
correction factor +3	3	3	3	3	3	3	3	3

Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, $L_{eq16\ hour}$	47.6	37.5	30.1	24.7	19.1	12.0	-6.3	-8.9	28
Night $L_{eq\ (8hour)}$	38.2	28.0	23.4	24.1	18.1	8.8	-10.4	-15.7	24
Night-time $L_{max(fast)}$	62.1	38.3	40.0	44.8	40.0	32.5	7.1	5.9	45

7. Structure Borne Noise

The mitigation set out above addresses noise ingress through the building façade based on the survey data obtained at Monitoring Locations 'A' and 'B'. A third sound level meter was set up within the proposed artist's studio / dwelling at Monitoring Location 'C'. The purpose of the internal measurement was to determine the typical level of noise internally due to the operation of the neighbouring public house.

The worst-case music noise levels were established to form the design noise levels for structural noise transfer into the proposed dwellings:

Table 12: Design amplified music noise spectrum determined internally at Monitoring Location 'C'

Parameter	Sound Pressure Level per Octave Band / dB								dB(A)	NR
	63	125	250	500	1000	2000	4000	8000		
$L_{eq,15min}$	61	59	57	50	44	38	29	22	52	48

The measured amplified music noise within the proposed dwelling caused the 30 dB $L_{Aeq,8hour}$ local authority requirement to be exceeded within the proposed dwelling and also significantly exceeds NR20.

It is likely that structure borne noise is contributing to the resultant amplified music noise levels observed within the proposed dwelling, but it is not clear if this is passing into the dwelling via paths in addition to the party wall (i.e. whether sound is also present in the floor, external wall, mezzanine structure, roof, or a combination of all).

Further work would be needed to establish the nature and extent of mitigation required to suitably address structure borne noise. This would require cooperation from the public house.

It is possible that measures such as a new floor structure isolated from the building with proprietary mounts, lining the flanking walls, a mass barrier ceiling, amongst others may be required. It is not possible to comment more specifically without further investigative sound insulation testing works.

7.1. Party Wall

At a minimum, to address the requirements of planning, we advise that the party wall is independently lined on the dwelling/studio side to comprise the following construction:

- Existing masonry walls (unknown specification).
- New cavity of at least 200 millimetres.
- Minimum of 100 millimetres of mineral wool insulation (33 kg/m^3 e.g. APR 1200).
- Independent wall liner (not fixed to the party wall) such as Gyplyner IWL with stud channels formed at maximum of 400-millimetre centres.
- Two layers of staggered and sealed Soundbloc plasterboard (minimum total surface mass 25 kg/m^2).

The independent wall liner should be installed across the full height of the party wall.

Please note that lining the party wall does not guarantee that flanking sound will be addressed. Below we comment on potential paths of flanking noise but we cannot advise on mitigating these without further work on site, which would require access to be allowed by the public house.

7.2. Flanking Through External Walls

The external wall lining we have recommended in Section 6.2 is to address the ingress of external noise only. It was possible to evaluate the extent of sound transmission from the pub via the external flanking walls and therefore it is not possible to comment on the control of flanking noise through the recommended lining for the external walls in Section 6.2 above.

7.3. Flanking Through Mezzanine Floor

The junction detail between the mezzanine structure and party wall/external walls is unknown and it was not possible to conduct the sound insulation test from the pub due to no access.

Therefore, the behaviour of structure borne sound as it passes into the mezzanine is unknown and it is not possible to comment on measures to control structure borne noise here. If flanking noise is significant within the mezzanine structure, it might be necessary to remove it and construct a new mezzanine upon resilient mounts and which are not structurally fixed to the party wall. It is not possible to advise without further work, however, this would likely require the input from a specialist vibration company such as Mason UK or similar.

7.4. Flanking Through Ground Floor

It is unknown if the ground floor slab is continuous between the site and adjacent public house and the flanking detail with the party wall is also not known. As the dwelling overlooks the ground floor art studio, flanking noise radiating up from the ground floor slab could affect noise levels observed within the living areas on the mezzanine floor.

Should music noise be passing into the dwelling via the floor structure, it is likely that some form of raised floor system could be necessary. For example, these types of system could include lightweight sprung floors or batten systems upon resilient mounts but without observation made during investigative sound testing, it is not possible to assess if these approaches would be successful and we are not able to advise further. Further work may be needed and may require the input from a specialist vibration company such as Mason UK or similar.

7.5. Flanking Through Ceiling/Roof

The construction of the roof and ceiling below are not known and the junction detail with the party wall is also unknown. If flanking noise is passing into the roof, it is likely that a mass barrier ceiling of some sort would be required.

Without having been able to test the sound insulation on site and observe flanking through the ceiling, it is not possible to comment on the specific requirements of the mass barrier ceiling and further work may be needed to determine this.

8. Summary and Conclusions

Nicholas H Wood appointed Acoustic Consultants Limited to carry out an environmental noise assessment for the proposed dwelling to be located at the site of the former HSBC, Melksham.

A noise survey was carried out to determine environmental noise levels at the site due to both road traffic and amplified music. An investigative sound insulation test was also agreed and arranged with the neighbouring public house in order to assess structure borne noise passing into the dwelling. The public house nevertheless refused access to our consultant on the day despite having been informed of the importance of the testing.

Noise mitigation measures are required to meet the relevant noise guidance in British Standard 8233:2014 and WHO (1999) due to external noise ingress within the open plan living areas upon the mezzanine floor. Noise mitigation advice is provided in this report in the form of wall lining and secondary glazing constructions, as well as ventilation provisions, to achieve the planning requirements for noise ingress through the building façade.

Measures for addressing structure borne noise are discussed in outline above. We have recommended, at a minimum, that the party wall is independently lined but cannot advise specifically on the effectiveness of flanking noise mitigation measures due to the public house denying access.

With the noted external noise mitigation measures, it is considered that noise ingress can be controlled to within the planning condition requirements. Further work is needed to establish the nature and extent of mitigation required to suitably address structure borne noise. These measures could be conditioned as part of the planning permission and addressed at the detailed design stage.

9. 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).

10. Appendix 2 - Detailing, Workmanship & Verification

Noise control predictions have been based on the constructions as listed in this report with no allowance made for weak points. Small weaknesses in the fabric design and/or installation are likely to significantly reduce the predicted noise control performance. Predictions are based upon the best available information with regards to the performance of the building materials and systems.

It is therefore necessary to ensure that all detailing is carefully designed so that there are no weak points present. All brick and blockwork joints should be completely in-filled with mortar. It is also necessary to provide comprehensive site construction checks to ensure that the installation matches the design intent. In general terms it should also be noted that there should be no gaps in the constructions and that all components should be carefully sealed airtight using suitable dense non-setting mastics (NOT FOAM) where appropriate. All walls, unless noted otherwise, should run the full height up to the slab soffit or underside of the roof. The details at these joins will require careful consideration.

All the elements should be constructed in accordance with the manufacturer's recommendations.

In terms of achieving the acoustic requirements of particular elements as noted in this report, the only contractual link is between the Contractor (the Builder) and Supplier. As such, it is very important that all purchase contracts include for the particular elements to comply with the acoustic requirements as noted in this report. The verification should be in accordance with the appropriate British Standard or International Standards Organisation Standards. Weighted sound reduction indices (R_w) should be measured in accordance with British Standard EN ISO 140-3:1995 and rated in accordance with British Standard EN International Standards Organisation 717-1:1997. Sound absorption coefficients should be in accordance with International Standards Organisation 354 and rated in accordance with British Standard EN ISO 11654.1997.



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