102-106 City Road, Cardiff

Noise Assessment for Licensing

1st September 2021

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1. INTRODUCTION

1.1. Overview

inacoustic has been commissioned to assess the impact of potential music noise breakout during recorded music events held at 102-106 City Road, Cardiff, upon existing residential receptors in the area.

The following technical noise assessment has been produced in order to support a licensing application to Cardiff City Council and is based on a series of noise measurements and predictions.

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

1.2. Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at the Site;
- A detailed assessment of the noise effects arising from on-site activities, in accordance with relevant standards in respect of sound from the existing sources; and
- Recommendation of noise management measures, where necessary.

2. Assessment Criteria

2.1. IOA Good Practice Guide on the Control of Noise from Pubs and Clubs

The IOA Good Practice Guide on the Control of Noise from Pubs and Clubs (2003)[1] provides guidance for the assessment and control of noise affecting noise-sensitive properties, from the public and private use of public houses, clubs, hotels, discotheques, restaurants, cafes, community or village halls and other similar premises. The main sources of noise considered are music; singing; public address (PA) systems; children's play areas; beer gardens; people in general; car parks and access roads; deliveries; collections; materials handling; plant and machinery; and skittle alleys.

The guide goes on to suggest that music, singing and speech, both amplified and non-amplified, are common sources of noise disturbance arising from the types of premises mentioned above and, that noise from such sources is a common cause of complaints, the majority of which arise because music and associated noise is audible in nearby or adjoining noise-sensitive property, gardens and amenity areas.

The guide goes on to suggest that some of the reasons why disturbance arises from these sources are as follows:

- Music and associated noise usually occurs from mid-evening until either late evening or early morning when residents in adjacent properties may be attempting to go to sleep or are sleeping;
- Music and associated noise levels generally increase as an event progresses, whilst ambient noise levels fall, particularly in the evening and night. This can make the noise more noticeable and hence increase the likelihood of complaint;
- Music sources frequently contain a significant low frequency (bass) component that is less well attenuated by building structures than the higher frequency components. This can result in disturbing bass beat effects in or at nearby noise-sensitive properties, particularly if they are structurally attached;
- Noise problems associated with these sources can be exacerbated in the summer when windows and doors may be open for ventilation purposes, or when residents are outside, enjoying their gardens or amenity areas; and
- Noise problems can also occur when music events are held in acoustically weak structures.

As such, it is suggested that appropriate, objective noise criteria should be developed to ensure the following:

- Within premises where entertainment takes place on a regular basis, music and associated sources should not be audible inside noise-sensitive properties at any time; and
- Within premises where entertainment takes place less frequently, music and associated sources should not be audible inside noise-sensitive property between 23:00 and 07:00 hours. For other times, appropriate criteria need to be developed which balance the rights of those seeking and providing entertainment, with those who may be disturbed by noise.

The guide goes on to suggest that noise may be considered inaudible when it is at a low enough level, such that it is not recognisable as emanating from the source in question and, it does not alter the perception of the ambient noise environment that would prevail in the absence of the source in question.

The guide also suggests that appropriate planning and good management can minimise the potential for noise disturbance and complaint, thereby reducing the likelihood of neighbour conflict and avoiding licensing problems. It also suggests that those having management responsibility for a

[1] Good Practice Guide on the Control of Noise from Pubs and Clubs. Institute of Acoustics. 2003

business have a statutory duty to prevent excessive noise and, failure to do so can lead to prosecution.

Further to the above, it is also suggested that the implementation of procedures for noise control should be an essential part of the business management and, that it will generally be of benefit to hold discussions with the local authority on these matters, particularly in relation to enforcement policies.

The guide also suggests that at the design stage, when planning the refurbishment of existing premises, or when noise disturbance is occurring from existing premises, the following measures should be considered:

- The determination of an appropriate level of sound insulation, based on realistic source and reception levels;
- The construction of cavity masonry walls or the addition of sound insulating, independent wall linings to enhance the containment and attenuation of sound;
- The provision of lobbies with automatic door-closers for building entrances and exits. Where possible, the distance between the inner and outer doors should be sufficient to ensure that one door set is normally closed as people pass through the lobby;
- The provision of well-sealed acoustic doors on emergency exits;
- The provision of acoustically insulated glazing;
- The provision of mechanical ventilation or air conditioning systems that will enable windows and doors to be kept closed, hence reducing noise breakout;
- The installation of visual, manual or audible alarms, to alert staff that doors or windows which should be kept closed, are open;
- The control of music noise at source, either by reducing the overall sound level of the music, or by reducing the sound level at individual frequencies which are causing, or have the potential to cause, disturbance;
- The playing of more calming types of music towards the end of an event;
- The use of an approval system for DJs and other performers;
- The installation of sound level regulatory devices (noise limiters), connected to all permanent music and public address equipment and all available mains power sockets within the area around a stage, within a performance area, or near to a control desk. However, in very noise-sensitive situations, it may be found that such devices have to be set to low that music events are not viable; and
- Alterations to the number and mounting of loudspeakers, so that internal music levels can be kept as low as possible and the transmission of structure-borne noise is minimised.

3. Site Description

3.1. Site and Surrounding Area

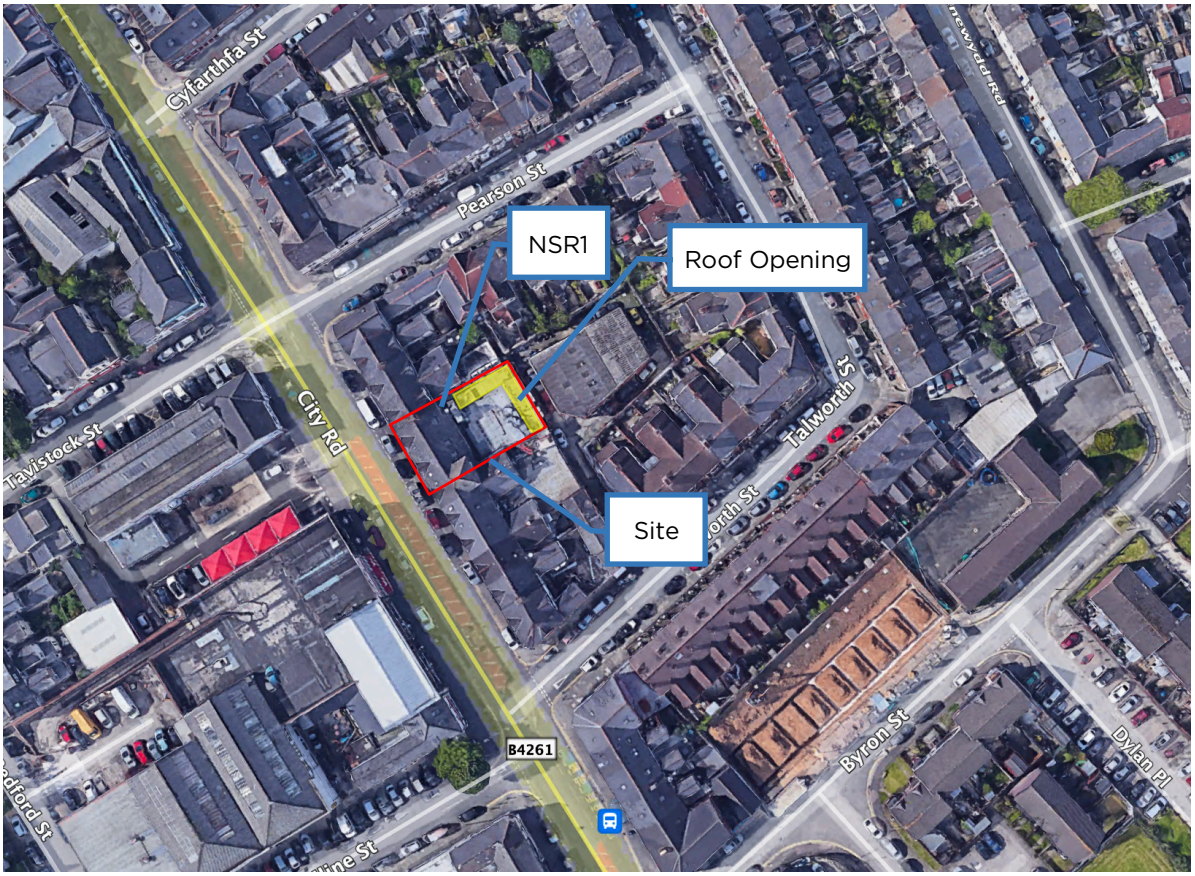
The site currently comprises an existing Shisha Bar, located on the ground floor of 102-106 City Road.

Residential properties are located directly above the venue. To the rear of the property, the flat roof has been partially removed (as can be seen below in yellow) to provide sufficient open area to allow for smoking of Shisha within the building. The closest residential receptors to the roof opening are situated 3 meters away and have been indicated as NSR1.

The site location can be seen in Figure 1, below, in the context of the surrounding area.

The ambient sound environment throughout the area comprises road traffic noise, arising from vehicles travelling along the nearby roads, as well as plant noise arising from the nearby commercial units.

Figure 1: Site and Surrounding Area



3.2. Proposed Operation

The current opening hours are from 12:00 to 02:00, 7-Days a week.

It is proposed to operate recorded music during these hours, whilst serving hot food and Shisha.

The premises will comprise an in-built music system and a DJ-led PA system. All the DJ equipment will be run through a limiter, which will be stored within a locked cupboard, which is only openable by senior management. The limiter will be set such that the internal noise limit within the venue cannot be exceeded.

4. MEASUREMENT

4.1. General

The prevailing noise conditions in the area have been determined by an attended noise survey conducted on Wednesday 25th August 2021. Measurements were undertaken at a location representative of the nearest noise sensitive receptor, whilst synchronised measurements were also undertaken inside the venue to determine the relationship with the noise level within the venue. Measurements were also taken within the flats directly above the venue.

4.2. Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445[2]. All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[3]. A full inventory of this equipment is shown in Table 1 below.

TABLE 1: INVENTORY OF SOUND MEASUREMENT EQUIPMENT

Measurement	Make, Model & Description	Serial Number
MP1B And MP2	Rion NL-52 Sound Level Meter	00965159
	Rion NH-25 Preamplifier	65386
	Rion UC-59 Microphone	10288
MP1A and MP3	Rion NL-52 Sound Level Meter	01009671
	Rion NH-25 Preamplifier	09976
	Rion UC-59 Microphone	18146
All	Cirrus CR:515 Acoustic Calibrator	72886

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.1 dB in the field calibration was found to have occurred on all sound level meters.

The weather conditions during the survey were dry with low wind speeds throughout the entire measurement period.

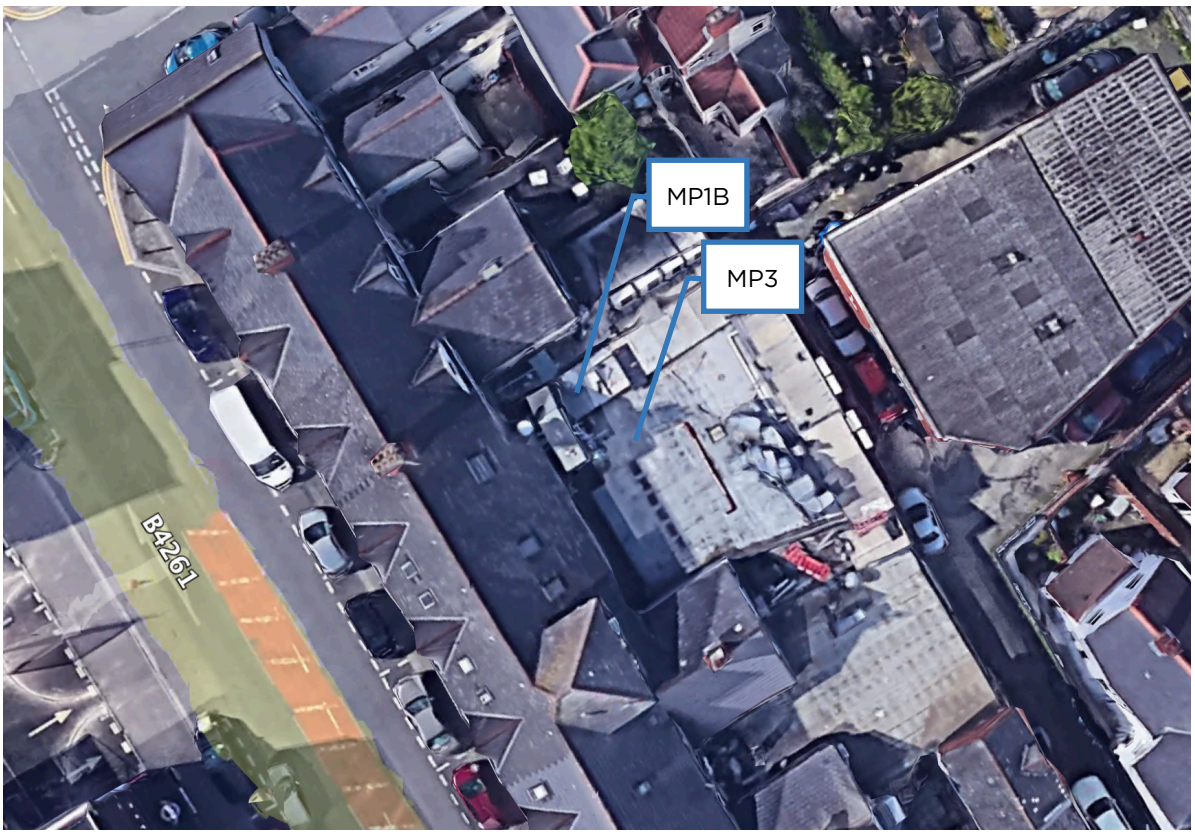
The microphones were fitted with protective windshields for the measurements, which are described in Table 2 with a plan indicating their respective locations shown in Figure 2.

[2] British Standard 7445: 2003: Description and measurement of environmental noise. BSI
[3] British Standard 61672: 2013: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

Table 2: Measurement Position Descriptions

Measurement Position	Description
MP1A and MP1B	A series of attended measurements within the ground floor bar, with the installed PA used to generate an internal reverberant music noise level within the internal space. The music chosen was deemed to be typical of the style played within the bar, with a reasonable bass component.
MP2	An attended measurement of sound within a bedroom of the flat on the first floor, directly above the bar. The measurement was taken to determine the noise transfer between the ground and first floor, whilst the music was operating.
MP3	A series of attended propagation test measurements, on the external roof to the rear of the building and representative of NSR1. The exercise comprised measurements of background/residual sound and ambient sound with the music on and off. Measurements were undertaken at a distance of 3 metres from the roof opening where the music prominently emanates from. The microphone was located at a height of 1.5 metres above the roof level and measurements were taken under free-field conditions.

Figure 2: External Measurement Positions



The summarised results of the on-site noise measurements are presented in Table 3.

TABLE 3: SUMMARY OF NOISE MEASUREMENT RESULTS

Position / Description	Period	Noise Level, dB
		$L_{Aeq,T}$
MP1A – Within the Venue (in Sync with MP2)	Music On	71.7
MP1B – Within the Venue (in sync with MP3)	Music On	70.2
MP2 -Within the Flat above the venue	Music On	29.9
MP3 – 3m from roof top opening	Music On	55.0
	Music Off	48.3

5. Noise Assessment

5.1. General

A series of measurements have been undertaken at the nearest noise sensitive receptor locations, to determine the potential acoustic impacts, associated with music played within the venue. The assessment identifies the required noise limits within the venue, to reduce the sound to an acceptable level, such that noise breakout does not significantly impact the nearby residents.

The predictions consider the residential receptor properties directly above the venue, as well as the properties to the north-west, as identified in Figure 1 and indicated as NSR1.

It is considered that achieving NR25 between the daytime hours of 12:00 to 23:00 and NR20 during the night-time hours of 23:00 to 02:00 within habitable rooms of the nearest noise sensitive dwellings would be suitable to ensure the risk of noise complaints being mitigated and accords with the method accepted throughout the UK.

5.1.1. Methodology

In order to determine the level of impact of nightclub noise on the nearest noise-sensitive receptors, a measurement exercise has been carried out by considering typical sound levels within the nightclub and measuring the noise breakout through the roof opening to the rear of the venue, which provides a specific sound level at the nearest noise sensitive façade. The internal noise level has then been calculated within the habitable rooms and has been assessed against the NR criteria.

Noise ingress within the habitable dwellings has been calculated by considering the typical reduction through a partially openable window; thus considering a robust scenario, where residents may open their windows to provide comfort cooling, whilst the music is operating within the venue.

Measurements have also been taken in both the venue and the bedroom of the flat directly above the music generating areas, to determine the noise transfer through the floor.

Appropriate music noise level limits have been set within the venue to ensure that the previously mentioned internal noise level criteria within habitable dwellings can be achieved.

5.2. Results

5.2.1. Measurements Within the Venue

The octave band, internal reverberant sound pressure level has been measured and outlined in Table 4.

TABLE 4: REVERBERANT SOUND PRESSURE LEVEL WITHIN THE PREMISES MP1B

Source	Z-Weighted Octave Band Sound Pressure Level, Hz (dB)								
	dBA	63	125	250	500	1000	2000	4000	8000
Reverberant Sound Pressure Level within the Venue – MP1B	70.2	79.0	68.1	70.8	67.7	63.4	60.7	58.5	61.6

It should be noted that the measurements were taken to the side of the DJ area, underneath the roof opening, as a reference point.

5.2.2. Specific Sound Level at Nearest Receptor from Nightclub – Noise Breakout

The measured specific sound level at the nearest noise-sensitive receptor, on the basis of the operational noise levels set out within Table 4 are shown in Table 5. The distance from the roof opening to the receiver has been measured to be approximately 3 metres.

The coincident internal sound level, after accounting for noise breakout losses from roof opening and sound transfer through a partially open window, can be found in Table 6.

TABLE 5: SPECIFIC SOUND LEVEL CALCULATIONS FOR NIGHT CLUB AT NSR1

Source	Z-Weighted Octave Band Sound Level, Hz (dB)								
	dB(A)	63	125	250	500	1000	2000	4000	8000
Ambient Sound Level 3m from roof opening of venue – Music On	55.0	73.3	62.5	56.1	52.3	46.1	42.1	38.5	36.2
Residual Sound Level 3m from roof opening of venue – Music Off	48.3	57.0	57.9	49.7	45.6	42.2	38.1	33.4	27.0
Specific Sound Level 3m from roof opening of music venue	53.7	73.2	60.7	55.0	51.3	43.8	39.9	36.9	35.6

TABLE 6: INTERNAL SOUND LEVELS WITHIN NSR1

Source	Z-Weighted Octave Band Sound Level, Hz (dB)								
	dB(A)	63	125	250	500	1000	2000	4000	8000
Specific Sound Level at Facade	53.7	73.2	60.7	55.0	51.3	43.8	39.9	36.9	35.6
Reduction through openable window	-15	-15	-15	-15	-15	-15	-15	-15	-15
Internal Ambient Noise Level	38.7	58.2	45.7	40.0	36.3	28.8	24.9	21.9	20.6

The resultant Noise Rating level within the flat is therefore NR 32. In order to reduce the music noise level to an acceptable level within the daytime/evening hours (12:00-23:00), it is required to reduce the noise level within the venue, from that measured by 7dB(A) and during the night-time opening hours (23:00-02:00), the operating level needs to be reduced by 12dB(A).

5.2.3. Noise Transfer through Internal Floor

The measured internal sound levels within both the music venue and the bedroom located above the music area can be seen below. Measurements of the music noise within the venue were taken directly below the bedroom used in this assessment.

TABLE 7: INTERNAL SOUND LEVELS WITHIN NSR1

Source	Z-Weighted Octave Band Sound Level, Hz (dB)								
	dB(A)	63	125	250	500	1000	2000	4000	8000
Reverberant Sound Pressure Level within the Venue – MP1A	71.7	78.8	68.0	64.7	67.0	66.4	63.8	60.8	64.9
Internal Ambient Noise Level within First Floor Bedroom	29.9	50.3	39.1	26.7	25.0	21.1	19.7	16.8	17.9

The resultant NR Rating within the bedroom is therefore NR 25, which complies with the adopted noise rating requirement for the daytime period (12:00-23:00).

In order to achieve NR 20 within residential dwellings during the night-time period (23:00-02:00), it is required reduce the operating noise level within the venue by 5dB(A), from that measured.

6. Noise Limits Within the Venue

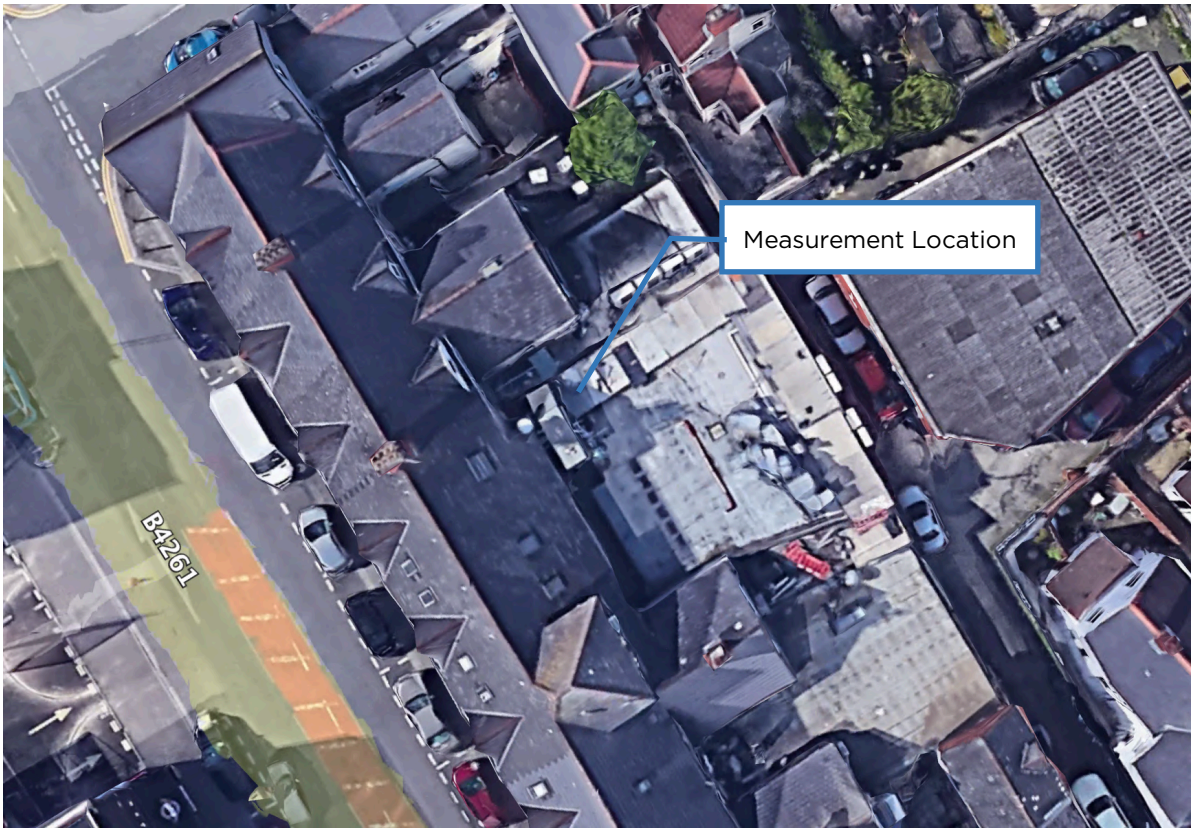
Based on the findings from the measurement exercise as discussed in section 5.2, It is suggested that the following noise limits are set within the bar to ensure that the internal noise level criteria of NR25 between the daytime/evening hours of 12:00 to 23:00 and NR20 during the night-time hours of 23:00 to 02:00 within habitable rooms of the nearest noise sensitive dwellings can be achieved.

The noise limits are to be measured at the side of the DJ area, underneath the roof opening, as specified in Figure 3. Measurements should be undertaken at least 1 metre away from any reflective surfaces.

Table 8: Music Noise Level Limits within the Venue

Time Period	Music Noise Limits Within the Venue $L_{Aeq,\ 5\ minutes}$
Daytime/Evening hours (12:00-23:00)	63
Night-time hours (23:00-02:00)	58

Figure 3: Location of Measurement Location for Music Noise Limits



7. Noise Management Plan

The following mitigation measures are recommended for inclusion into the Noise Management Plan, regarding events within the venue:

- Music Noise limits to be monitored at the specified location throughout periods when music is being played.
- A limiter is installed within a locked cupboard, which will be locked at all times. The limiter will be set to ensure that the music noise generated cannot exceed the noise limits set out within this report.
- Music should not be played outside of the operational hours of 12:00-02:00.

8. Conclusion

inacoustic has been commissioned to assess the impact of potential music noise breakout during recorded music events at 102-106 City Road, Cardiff, upon existing residential receptors in the area.

This technical noise assessment has been produced in order to support a licensing application to Cardiff City Council and is based on a series of noise measurements and predictions.

The assessment considers the potential effects of music noise generated at the premises; both within and around the venue to determine the impact of noise at the nearest residential properties.

Consequently, a series of noise limits have been proposed that can be incorporated into a Noise Management Plan and will ensure that the amenity of neighbouring receptor properties is not unduly affected.

9. APPENDICES

9.1. Appendix A – Definition of Terms

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE 9: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

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