DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

53Two Watson Street Arches

Acoustic Planning Report

dBx Acoustics Ltd
Beehive Mill, Jersey Street
Manchester M4 6JG

19070 53Two Watson Street R01

16 September 2019

Client: 53Two

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Contents

Contents 1

Introduction 2

Assessment Criteria 3

Noise Survey 6

Noise Impact Assessment – Noise Emissions 8

Noise Intrusion 10

Plant Noise Assessment 10

Conclusions 12

Appendix A – Glossary of Acoustic Terminology 13

Revision	Date	Revision Details	Author	Checked
R01	16 Sep 2019	Original Issue	DocuSigned by: Susan Witterick 3E69257DCFC14C6... Susan Witterick BSc MIOA	DocuSigned by: Ben Tomlin 2DD2C00AF12B454... Ben Tomlin BSc MIOA

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Introduction

dBx Acoustics Ltd has been appointed by 53Two to provide acoustic consultancy services to support a planning application for their proposed theatre and bar development within Arches 18 (theatre) and 19 (bar) on Watson Street, Manchester.

There will be a mezzanine plant deck above the backstage area in Arch 18, with air intake and discharge louvres on the Watson Street facade. The main entrance will be on Watson Street with a secondary entrance to the bar and theatre on Great Bridgewater Street.

A glossary of acoustic terminology has been supplied in Appendix A in order to assist the reader.

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Assessment Criteria

Manchester City Council – Planning & Noise Technical Guidance (December 2015)

This document sets out Manchester City Council's requirements with regard to current guidance and policy, with the aspiration that new developments achieve the highest standards without compromising the health and wellbeing of residents. The guidance refers to the NPPF and NPSE as described below.

The following requirements are considered relevant to this project;

> *"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a BS 4142 rating level (see below) of 5 dB L_{Aeq} below the typical background L_{A90} level at the nearest noise sensitive location. "*

> *"Where entertainment noise is proposed the L_{Aeq} (entertainment noise) shall be controlled to 10 dB below the L_{A90} (without entertainment noise) in each octave band at the façade of the nearest noise sensitive location, and internal noise levels at structurally adjoined residential properties in the 63 Hz and 125 Hz octave frequency bands shall be controlled so as not to exceed (in habitable rooms) 47 dB and 41 dB respectively."*

Noise Policy Statement for England (NPSE)

NPPF affirms that National Policy Statements form part of the overall framework of national planning policy, and should be a material consideration in decisions on planning applications. The Noise Policy Statement for England came into force in 2010 and states:

This Noise Policy Statement for England (NPSE) should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. The NPSE does not apply to noise in the workplace (occupational noise).

Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*

The NPPF noise aims widely reflect those in NPSE. The NPSE does however include some context within the explanatory note to assessing noise impact and uses established concepts from toxicology currently being applied to noise impacts, these include:

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

- ***NOEL*** *– No Observed Effect Level.* This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- ***SOAEL*** *– Significant Observed Adverse Effect Level.* This is the level above which significant adverse effects on health and quality of life occur.
- ***LOAEL*** *– Lowest Observed Adverse Effect Level.* This is the level above which adverse effects on health and quality of life can be detected.
- However, it is clear that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

The table on the following page is extracted from the Government's Planning Practice Guidance on noise[1]. It summarises the noise exposure hierarchy, based on the likely average response.

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'

BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating is determined and compared with the existing local Background Sound Level.

The Rating Level ($dBL_{Ar,T}$) is evaluated from the Specific Noise Level by including several, cumulative corrections to account for factors such as distinguishable tone, impulse, intermittency or other readily distinguishable sound characteristics.

The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Table 1: Noise Exposure Hierarchy

Perception	Examples of outcomes	Increasing effect level	Action
Not noticeable	No effect	No observed effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life	No observed adverse effect	No specific measures required
		Lowest observed adverse effect level (LOAEL)	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude. E.g. turning up the volume of the television; speaking more loudly; where there is no alternative ventilation, having to close windows are some of the time because of the noise. Potential for some reportedly disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
		Significant observed adverse effect level (SOAEL)	
Noticeable and disruptive	The noise causes material change in behaviour and/or attitude e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep the windows closed most of the time because of the noise. Potential for sleep disturbance result in difficulty in getting to sleep. Premature awakening and difficulty getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or psychological effects e.g. regular sleep deprivation/awakening; loss of appetite; significant, medically definable harm e.g. auditoria and non-auditory	Unacceptable adverse effect	Prevent

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Noise Survey

A noise survey was carried out at the site by dBx Acoustics on Sunday 8th September 2019 between approximately 2100hrs and 2330hrs, and on Wednesday 11th September 2019 between approximately 1245hrs and 1500hrs.

The nearest noise sensitive properties to the site have been identified as the Hilton Hotel / Beetham Tower on Great Bridgwater Street which is approximately 60m from the site, and apartments at the Great Northern Tower on Watson Street approximately 140m away. The premises opposite the site on Watson Street is a multi-storey car park which is not considered noise sensitive.

Measurements were made at three locations as shown on Figure 1 below.

Figure 1: Site Location and Measurement Positions



- Location A (free-field measurement) free field measurement at Great Northern Tower representing noise sensitive receptors.
- Location B (façade measurement) on Watson Street representing the façade of the proposed development.
- Location C (free field measurement) representing noise sensitive receptor at Beetham Tower.

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

The noise monitoring equipment used was a Cirrus 171c Type 1 Sound Level Meter with serial number G300656. On site calibration checks were performed before and after the measurements using a Cirrus 515 sound calibrator, serial number 87921, and were found to be within the permitted tolerance of BS EN 61672-1:2013. All equipment had a valid calibration certificate at the time of the survey and the microphone was fitted with a windshield to prevent wind noise from affecting the measurements.

For all measurements, the microphone was located 1.3m above ground / floor level and for the free-field measurements was approximately 3m away from any other reflective surface. Measurements were all of 15 minutes' duration.

Measurements were undertaken in accordance with BS 7445-1:2003 *Description and Measurement of Environmental Noise*.

The weather during the measurements was warm (12°C at night and 16°C during the day), still and dry, with around 10% cloud cover. Little to no wind was present during the survey. There was heavy rain on the morning of September 11th but this cleared before the survey commenced and there was no standing water on the road surfaces.

The measured noise levels are presented in Table 1, below;

Table 1: Measured Noise Levels

Location	Date and Time	L_{Aeq} (dB)	L_{A90} (dB)	L_{Amax},(dB)	L_{A10} (dB)
A	8 Sep 2109hrs	81	52	84	59
	8 Sep 2156hrs	81	52	81	60
	8 Sep 2249hrs	72	52	72	58
	11 Sep 1303hrs	70	58	89	72
	11 Sep 1402 hrs	64	57	78	67
B	8 Sep 2126hrs	61	54	79	65
	8 Sep 2213hrs	59	55	76	61
	8 Sep 2307hrs	59	55	78	59
	11 Sep 1230hrs	73	60	97	73
	11 Sep 1319hrs	68	60	84	71
	11 Sep 1330hrs	66	57	79	70
	11 Sep 1419hrs	66	59	78	70
	11 Sep 1431hrs	67	58	84	70
C	8 Sep 2140hrs	65	49	89	68
	8 Sep 2230hrs	58	47	80	61
	8 Sep 2323hrs	59	47	74	63
	11 Sep 1246hrs	67	60	85	70
	11 Sep 1345hrs	67	58	88	70

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

At locations B and C, the dominant source of noise was road traffic, with background noise caused by road traffic on the surrounding road network. At location A (Great Northern Tower), the sound climate was dominated by mechanical services plant.

The relevant octave band background sound levels (dBL_{90}) from this survey used in the assessment of building services plant and entertainment noise emissions are shown in Table 2, below;

Table 2: External Background Noise Levels L90

Measurement Location	Background sound levels in octave bands, L90 (dB)								
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dBA
Location A Great Northern Tower	60	54	54	52	52	48	40	33	**52**
Location C Beetham Tower	63	57	54	54	53	51	44	36	**47**

It can be seen that the Beetham Tower can be taken as the nearest noise sensitive receptor both due to its proximity (60m) to the site and the lower background noise levels measured at night.

Noise Impact Assessment – Noise Emissions

The acoustic design of the bar is based on an acoustically 'worst case' use as a busy bar, with live or amplified music.

MCC requirements are that "*where entertainment noise is proposed the L_{Aeq} (entertainment noise) shall be controlled to 10 dB below the L_{A90} (without entertainment noise) in each octave band at the façade of the nearest noise sensitive location.*"

In order to determine the minimum required sound insulation performance of the glazing at the proposed site, noise break out calculations have been undertaken.

The calculation assumes a level of $91dBL_{Aeq,T}$ within the bar unit. This is based on measurements made by dBx Acoustics Ltd at similar sized city centre bars with amplified music and can be considered to represent a worst-case basis for noise impact.

It is likely that the doors to the proposed development will be opened frequently, and so a door with relatively low sound insulation performance was used within our calculations to reflect this. In the calculation, a door with a sound insulation performance of $26dBR_w$ was used. The proposed glazing is a 6/16/6mm argon filled double glazed unit with a sound insulation performance of $35dBR_w$ and $31dBR_w+C_{tr}$.

The noise break-out calculation is presented as Calculation 1, below;

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Calculation 1: Noise Break-Out Calculation

Room to Exterior

Date: 13-Sep-19
Job No:
Project: 53Two
Title: Noise Break Out

Frequency	63	125	250	500	1k	2k	4k	8k	A	NR
Room Lp	83	83	81	85	90	81	73	67	91	90
Wall SRI	17	21	23	28	34	33	32	36		

Wall dimensions length: 5.00 m
height: 5.00 m

Distance from wall to receive: 60.0 m

Directivity index of location (0, 3, 6 or 9): 3

0 = free space
3 = junction with surface
5 = junction of two surfaces
6 = junction of three surfaces

Frequency	63	125	250	500	1k	2k	4k	8k	A	NR
Receive Lp	31.8	27.4	23.8	22.2	21.8	13.4	6.3	-3.6	25.0	21.8
Limit	53	47	44	44	43	41	34	26	**10dB below lowest measured**	
Difference	-21.2	-19.6	-20.2	-21.8	-21.2	-27.6	-27.7	-29.6		

As shown by Calculation 1, the requirements set out by Manchester City Council (MCC) can be easily achieved with the proposed sound insulation performances of the glazing (35dBR_w, *and* 31dBR_w+C_{tr}) and doors (26 dBR_w) and a level of 91 dB$L_{Aeq,T}$ within the commercial unit.

In fact, the predicted noise emissions received at the Beetham Tower are significantly below the measured background sound level in each octave band – as such even if noise levels within the development were in excess of 100dBL_{Aeq} (which would be subjectively uncomfortable for occupants and unlikely to occur), the requirements of MCC would be met.

The theatre is located towards the rear of the arch and is separated from the building frontage by the backstage area. It is therefore unlikely that noise emissions from the theatre would be audible externally to the building. However, as with potential noise emissions from the bar, an exceptionally high noise level would need to occur within the theatre before the limits set by MCC would be exceeded.

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Noise Intrusion

Using the daytime survey data from Location B, immediately outside the proposed development, the CRTN shortened methodology can be used to derive the daytime (16 hour) $L_{Aeq,16hour}$ affecting the building façade.

The logarithmic average of the dBL_{A10} values provides the 3-hour average, $dBL_{A10,3hour}$. This is converted to the 18-hour $dBL_{A10,18hour}$ value by subtracting 1dB. This is then converted to the 16-hour ambient noise level, $dBL_{Aeq,16hour}$, by subtracting a further 2dB. The resulting daytime level is therefore **$68dBL_{Aeq,16hr.}$**

A break-in calculation based on the façade and glazing as detailed above indicates that the resultant traffic noise level within the bar will be around $34dBL_{Aeq,T}$. This is compatible with the proposed use of both the bar and backstage areas and appropriate for the proposed use.

Plant Noise Assessment

Manchester City Council requires that externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level $L_{Ar,T}$ of 5 dB below the typical background L_{A90} level at the nearest noise sensitive location.

The measurements taken at locations A and C can be considered as representative of the noise levels at the nearest noise sensitive locations. To recap, the background noise levels at these locations are $52dBL_{A90}$ at Location A, Great Northern Tower, and $47dBL_{A90}$ at Location C, Beetham Tower.

The proposed plant comprises 2no. air handling units (Nuaire XBC85) and 4no. Mitsubishi PUMY-P200YKM2 condensing units.

The Mitsubishi units have a sound power level of 75 dBA according to the manufacturers' literature.

For the air handling units, given that the plant mezzanine is separated from the street only by louvres, the manufacturers' quoted sound power levels for the unit casing, fresh air inlet, and exhaust, have been summed which gives a sound power level of $83dBL_{WA}$. *This includes Nuaire XBC85 silencers on both the inlet and exhaust.*

Assuming constant use of all units, the cumulative sound power of the plant is $87dBL_{WA}$. This was then converted to sound pressure and corrected for distance to the nearest noise sensitive location the Beetham Tower at approximately 60m. This then determined the specific noise level. The BS4142 assessment is presented as

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Table 3, below.

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Table 3: BS4142 Assessment

Item	Calculation	Relevant Clause	Comments
Measured background sound level	47 dB $L_{A90, 15mins}$	8.3	The lowest background sound level measured during the night-time period.
Specific sound level	40 dB $L_{Aeq,T}$	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the night time period so reference period is 15 minutes		7.2	-
Acoustic feature correction	0 dB	9.2	The plant does not exhibit any acoustically distinctive characteristics
Rating Level	40 dB $L_{Ar,T}$	9.2	The predicted Rating Level during the night-time period.
Background sound level	47 dB $L_{A90, 1hr}$	8	The typical background sound level measured.
Excess of Rating Level over background sound level	-7dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level does not exceed the lowest measured background level. This is an indication of the development having a low impact.
Uncertainty of the assessment	Minor	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

The predicted rating level of plant is 7dB below the lowest measured night-time background sound level at the nearest noise sensitive location. This is compatible with MCC requirements and a positive indication that plant noise will not cause disturbance to occupants.

Conclusions

This report presents an assessment of potential noise emissions from the bar and theatre within Arches 18 and 19 at Watson Street, Manchester.

A noise survey has been carried out at the site which informs the noise impact assessment. Given the orientation of the building and proximity, the Beetham Tower, at a distance of approximately 60m, has been identified as the nearest noise sensitive location.

Based on the proposed glazing and typical noise levels measured in a lively city centre bar with amplified music, it is demonstrated that the requirements of Manchester City Council with regard to entertainment noise emissions will be readily achieved.

A BS4142 assessment of the proposed air handling and condenser units has been undertaken, and it is demonstrated that the proposed plant has a low likelihood of adverse impact and is compliant with MCC requirements.

A noise break-in assessment was undertaken to confirm the potential impact of environmental noise on the bar and theatre use of the site, and no concerns are apparent.

Noise should therefore not be a limiting factor in any planning application.

DocuSign Envelope ID: 398E8B73-1594-453B-95B9-8F50EB43C7DF

Appendix A – Glossary of Acoustic Terminology

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is $2x10^{-5}$ N/m^2. The sound pressure level existing when microphone measured pressure is $2x10^{-5}$ N/m^2 is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during time, T.
$L_{Amax,T}$	The instantaneous maximum A weighted sound pressure level which occurred during time, T.