Noise Survey of Residential Development

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Date:	01.02.2018

Version	1	2	3
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Date	06/02/2018	--	--
Project Number	2127PB	--	--

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Executive summary

An environmental noise survey and noise impact assessment has been undertaken at the proposed residential development 37 Liverpool Road, Manchester, Greater Manchester, M3 4NQ to assess the suitability of the site for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

The BS8233:2014 assessment of expected sound levels incident on the proposed residential dwelling shows that glazing in all living areas require a minimum attenuation of 34.1 dB R_{w+Ctr} and bedrooms require a minimum attenuation of 42.0 dB R_w. Ventilation with a minimum Dn,e,w of 42.0 dB should also be installed in habitable rooms. This will protect the amenity of the future occupants in relation to noise from the surrounding noise sources.

Outline mitigation measures have been recommended in section 6.0, including glazing, ventilation and adjoining wall construction. These recommendations should be sufficient to achieve the internal noise levels for the proposed development according to BS8233:2014 noise criteria. Written approval of the findings of this report is required from the Local Authority prior to works commencing.

1. Introduction

1.1 Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for Dr Jimmy Charro ('the Proposed Development') at 37 Liverpool Road, Manchester, M3 4NQ ('the Site').

The Applicant is preparing a planning application to be submitted ('the Application') to Manchester City Council.

Accordingly, the following technical noise assessment has been produced to accompany the Application to Manchester City Council.

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 & Objectives

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

- Ambient sound monitoring survey to evaluate the prevailing sound levels incident on the Site;
- Detailed sound modelling, acoustic calculation and analysis in accordance with ISO9613 – 1 prediction methodology to predict sound levels incident on the Site;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance in England and Wales, BS8233:2014, World Health Organisation Guidelines and other relevant standards.

2. Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

2.1 National Planning Policy Framework (2012)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2012. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 11, Conserving and enhancing the natural environment, paragraph 109, it states:

The planning system should contribute to and enhance the natural and local environment by: preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;

Paragraph 123 states and Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impact on health and quality of life arising from noise from new development, including using conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established.*

2.2 Noise Policy Statement for England

Paragraph 123 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

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

To achieve this vision the Statement identifies the following three 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;*
- *Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that "significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development".

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

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. This can be related to the third aim above, which seeks: "where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim."

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

2.3 BS8233:2014`Guidance on sound insulation and noise reduction for buildings'

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, "anonymous" noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 1.0 - BS8233 criteria for internal noise levels in dwellings

It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

3. Site Description & Background Information

3.1 Site & Surroundings

The proposed development is to convert a three storey "Garret style" building, with the ground floor previously occupied by a café, into townhouse style residential property. The site is located on Liverpool Road, in a mixed commercial/residential area in Manchester City Centre.

The area has a moderate/high level of noise typical of inner city locations, the dominant noise source in the area is road traffic generated from both small vehicles and public transport. Due to the location it is expected there will also be noise generated by late night revelers. The closest noise generating commercial property is the White Lion public house approximately 10 metres to the West of the development. This is solely a drinking establishment with no entertainment events occurring. Consequently no entertainment noise assessment will be undertaken. The rear of the property is secluded with no dominant sources of noise and is significantly quieter. The area shows a constant level of noise without a perceivable difference over day/night time and any notable difference between weekdays and weekend. Previous planning permission was granted for similar developments in neighbouring sites on Liverpool Road. An annotated site location map can be found in appendix C.

4. Environmental Noise Survey

In order to characterise the sound profile of the area of the proposed development, a 72-hour environmental sound survey was carried out from Friday 16th December 2016 to Monday 19th December 2016.

4.1 Measurement Methodology

For the long-term sound monitoring, the sound level meter was placed at 1st floor level, protruding from a window of the neighboring site No. 39- 41 Liverpool road. The microphone was positioned approximately 1m away from the building's façade. The monitoring position was chosen in order to collect representative sound levels of the area during a weekday for the day time and night time periods. The position was also representative of the highest expected sound levels at the site. The measurement position can be found in appendix C.

4.2 Measurement Equipment

Piece of Equipment	Serial No	Calibration Deviation
SVAN 977 Class 1 Sound Level Meter	34826	≤0.5
SVAN Class 1 Calibrator SV31	32569	

Table 2.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective wind shield for the entire measurements period. Calibration certificates can be provided upon request.

4.3 Weather Summary

As the environmental noise survey was carried out over a long un-manned 72-hour period no records of weather conditions were taken. However, During the set up and collection of the monitoring equipment the weather was calm with wind speeds of less than 5m/s and no precipitation. All measurements have been compared with met office weather data of the area and periods of elevated weather conditions have been excluded from the subsequent calculations.

4.4 Results

4.4.1 Summary Results

The following table shows a summary of the sound survey results; L_{Aeq}, L_{Amax}, L_{A90} and the L_{A10} for the measurement period.

Measurement Position MP1				
Measurement Time Period ('t')	**$L_{Aeq,t}$**	**$L_{Amax,t}$**	**$L_{A90,t}$**	**$L_{A10,t}$**
Day 1 (14:27 - 23:00)	**69.1**	98.2	66.4	69.5
Night 1 (23:00 – 7:00)	**68.7**	103.3	61.9	69.6

Day 2 (7:00 – 23:00)	68.0	100.3	66.0	69.2
Night 2 (23:00 – 7:00)	68.2	**105.4**	61.1	68.9
Day 3 (7:00 – 23:00)	66.2	93.9	63.2	67.6
Night 3 (23:00 – 7:00)	62.1	86.3	53.1	55.4
Day 4 (7:00 - 14:07)	68.9	95.1	66.2	70.4

Table 3.0 – Sound Survey Summary Results

Discussion

The maximum noise level measured during the night time period is 105.4 dB $L_{AMax,8hour.}$ When using maximum noise levels to assess the noise profile of an area consideration must be given to the frequency of events. As this level only occurred once per night time period a maximum level of 87.0 dB shall be used in the subsequent assessment. The value of 87.0dB $L_{AFMax,8hour}$ was exceeded 8 times on the Friday night, 5 times on the Saturday night and 0 times on the Sunday night. This is conservative and representative of the maximum noise levels and will allow a robust façade specification.

4.5 Subjective impression & Context

Whilst on site it was found that the dominant source of noise was from road traffic. The neighboring commercial premises presented no definable noise. Upon inspection the mixed source noise emissions were moderate/high as can be seen in the measurement time history in appendix D. Providing adequate mitigation is installed the amenity of the future residents can be protected.

4.6 Uncertainty

Efforts have been taken to address the uncertainty in the measurement and calculation of the level of impact. The following points have been addressed:

1) The most exposed measurement position has been chosen to ensure a robust survey.
2) The ambient sound environment during the measurement period did not vary significantly.
3) The background measurement location was within close proximity to the proposed dwelling.
4) Meteorological conditions were appropriate for the measurement of environmental noise.
5) Short measurement time intervals were used to show short term increases in ambient sound levels.
6) All figures are rounded to the nearest 0.1dB.
7) The instrumentation used is class 1 and within calibration.
8) A in depth analysis of ambient sound levels has been undertaken to ensure the figure used is consistent across the monitoring period.
9) Approved standards have been used to complete any calculations.

5. Noise Assessment

5.1 BS8233:2014 Noise Assessment

5.1.1 Internal Noise Level Assessment

The following section analyses the ambient sound levels incident on the development compared with the internal noise level criteria presented within BS8233:2014. Table 4.0 analyses the required minimum SRI required of the dwelling to achieve appropriate internal noise levels.

Measurement position	Location	Time Period	Façade Noise Level	BS8233 Criteria	Min. SRI Required (dB)
MP1	Bedroom / Living Room	Day time	69.1	35 dB $L_{Aeq,16hour}$	34.1 R_w
	Bedroom	Night time	68.7	30 dB $L_{Aeq,8hour}$	38.7 R_w
	Bedroom	Night time	87.0	45 dB $L_{Amax,8hour}$	42.0 R_w **

Table 4.0 – BS8233 Internal Noise Level Analysis

Discussion:

As can be seen by the analysis in table 4.0 the windows require glazing with an attenuation of 42.0dB Rw to protect against maximum noise events, 34.1dB Rw + Ctr to protect against average daytime noise and 38.7dB Rw + Ctr to protect against average night noise levels. This is recommended for all windows within the property.

5.1.2 Recommendations & Mitigation

Site Layout & Orientation

Where feasible bedrooms should be located to the rear elevation.

Building Envelope

The noise levels within the proposed dwellings will be dictated by the configuration, materials and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels in combination with a superior quality appropriate acoustic glazing specification.

a) Facades

The prediction of the performance of the facade is based upon a construction of 200mm brick and is calculated within INSUL software, the expected performance is shown in Table 5.0.

Frequency (Hz)	63	125	250	500	1K	2K	4K	Rw
Façade SRI	41	44	42	47	55	63	68	53

Table 5.0 – Façade SRI

Any other configuration of external walls that would achieve at least these insulation figures will be suitable for the development.

b) Roofs

If the dwelling has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. If the roof, is being utilized as a voided loft space with thermal insulation the following detailing is not required. The ceilings in the roof space should consist of 100mm 45kg/m2 fitted tightly between the 200mm roof joists and 2no. 15mm SoundBloc plasterboard fixed to resilient bars to achieve a uniform sound reduction. The expected performance as predicted within INSUL software is shown in Table 6.0.

Frequency (Hz)	63	125	250	500	1K	2K	4K	Rw
Roof SRI	33	45	52	57	60	57	61	58

Table 6.0 – Roof SRI

Any other configuration of roof that would achieve at least these insulation figures will be suitable for the development.

c) Glazing

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. To provide a robust assessment the composite SRI required for the entire building envelope will be used to provide the glazing specification.

Glazed elements installed in all the living rooms and bedrooms require a minimum sound reduction index value as shown in Table 4.0. The glazing units shown in Table 7.0 would provide a suitable sound reduction, any other window capable of providing this attenuation will be suitable. The performance is specified for the whole window unit, including frame and other design features.

Location	Glazing Configuration	Attenuation (dB)
Bedrooms Front Facade	*Double Glazing* 8mm Glass – 16mm Argon Cavity – 9.1mm Optiohon	43 R_w
Living Rooms Front Facade	*Double Glazing* 10mm Glass – 12mm Air Cavity – 6.4mm Optiphon	40 R_w
All Rooms Rear Facade	Double Glazing 4mm Glass – 12mm Air Cavity – 6.4mm	32 R_w

Table 7.0 – Glazing SRI

The glazing system above will protect the amenity of the occupants of the dwellings against the extraneous noise. The glazing specifications have been taken from the BS6262 – 2 and Pilkington's Optiphon range however any glazing providing the same attenuation can be used.

d) Ventilation

BS8233 States;

"If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

It is recommended that an alternative ventilation system is installed to fully protect the amenity of future inhabitants. As stated in BS8233:2014 section 5.4.4, having complete enclosure of the noise source or receiver is the most effective barrier of sound. An alternative ventilation strategy allows for maximum sound insulation from the noise source whilst still maintaining a sufficient level of ventilation. It is recommended that the alternative ventilation should provide the same resistance to sound as the glazed elements.

Table *8*.0 provides ventilation systems that meets the above recommendations.

Model	**Attenuation (dB)**
Titon Sonair F+	55dB $D_{n,e,w}$
Simon Acoustic Trickle Ventilation	38dB Open / 41dB Closed $D_{n,e,w}$

Table 8.0 – Ventilation Specification

If the above ventilation systems are not deemed suitable for the development then a mechanical heat-recovery ventilation (MHRV) system should be employed. It should be noted that if a MHRV system is used, the self-generating noise from the system will need to conform to the internal noise levels outlined in BS8233:2014.

6. Conclusion

An environmental noise survey and noise impact assessment has been undertaken at the proposed residential development at 37 Liverpool Road, Manchester, Greater Manchester, M3 4NQ to assess the suitability of site. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

Outline mitigation measures have been recommended in section 6.0, including glazing and ventilation. These recommendations should be sufficient to achieve the internal and external noise levels for the proposed development according to BS8233:2014 noise criteria. Written approval of the findings of this report is required from the Local Authority prior to works commencing.

Appendix A – Acoustic Terminology

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. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq 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. L90 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. L10 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.

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, BS4142:2014 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 0.125ms.

Appendix B – Location Plan



Appendix C – Environmental Sound Survey

