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Confirmatory Plant Noise Impact Assessment Report to Address Planning Condition

Sunlight House, Quay Street, Manchester

Report Reference 22656.PNIA-RPT.02

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1 INTRODUCTION

ES Acoustics Ltd have been commissioned by Hybrid Planning & Development Ltd to undertake a confirmatory noise impact assessment in accordance with BS 4142:2014+A1:2019 for the installation of juice preparation area extraction equipment to serve the ground floor juice bar at Sunlight House, Quay Street, Manchester, to address the requirements of part b & c of the noise related Planning Condition, which reads as follows:

"b. Prior to the first operation of the louvre, plant, equipment or servicing, a verification report, which will include post-completion testing, shall be submitted to and be approved in writing by the Local Planning Authority to validate that the louvre, plant, equipment or servicing achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.

c. In the event of non-conformity with a rating level of 5dB (LAeq) below the typical background (LA90) level in each octave band, then any measures/changes required to achieve conformity shall be carried out. Any required measures/changes and verification shall continue until conformity has been achieved and agreed in writing by the Local Planning Authority, before operation of the louvre, plant, equipment or servicing can commence.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site. Pursuant to policies SP1 and DM1 of the Core Strategy and saved policy DC26 of the UDP."

The purpose of this report is to;

- Review relevant national planning policy and guidance, and the scenario under assessment;
- Present the results of a post-installation confirmatory noise survey undertaken on site to determine specific noise levels of the operating plant;
- Undertake noise propagation calculations and a noise impact assessment in accordance with BS 4142:2014+A1:2019 of the proposed external building services plant to the closest noise sensitive receptors and the previously measured background noise levels;
- Determine noise impacts on the closest noise sensitive receivers in relation to any relevant Local Planning requirements; and,
- Outline mitigation advice to ensure a low likelihood of adverse impact on the nearby noise sensitive receptors if required.

2 SITE CONTEXT AND BACKGROUND INFORMATION

2.1 Background Context

The installation and operation of juice preparation area extraction equipment has been installed to serve the juice bar, *Joe & The Juice,* at Sunlight House, Manchester. As such, measurements of the noise emissions have been undertaken to confirm that the noise emissions meet the requirements of MCC.

2.2 Site Description and Proposal

The site is situated in on Quay Street in Manchester, under the jurisdiction of Manchester City Council. The juice bar, *Joe & The Juice,* is proposed on the ground floor of the building, with offices above.

The proposal is for the proposed juice preparation area intake plant to be ducted to the southern façade, with the extract ducted onto the eastern facade.

The site location is presented in Figure 1, which shows the application site, plant unit installation location, and the closest receptor windows relative to the plant location:

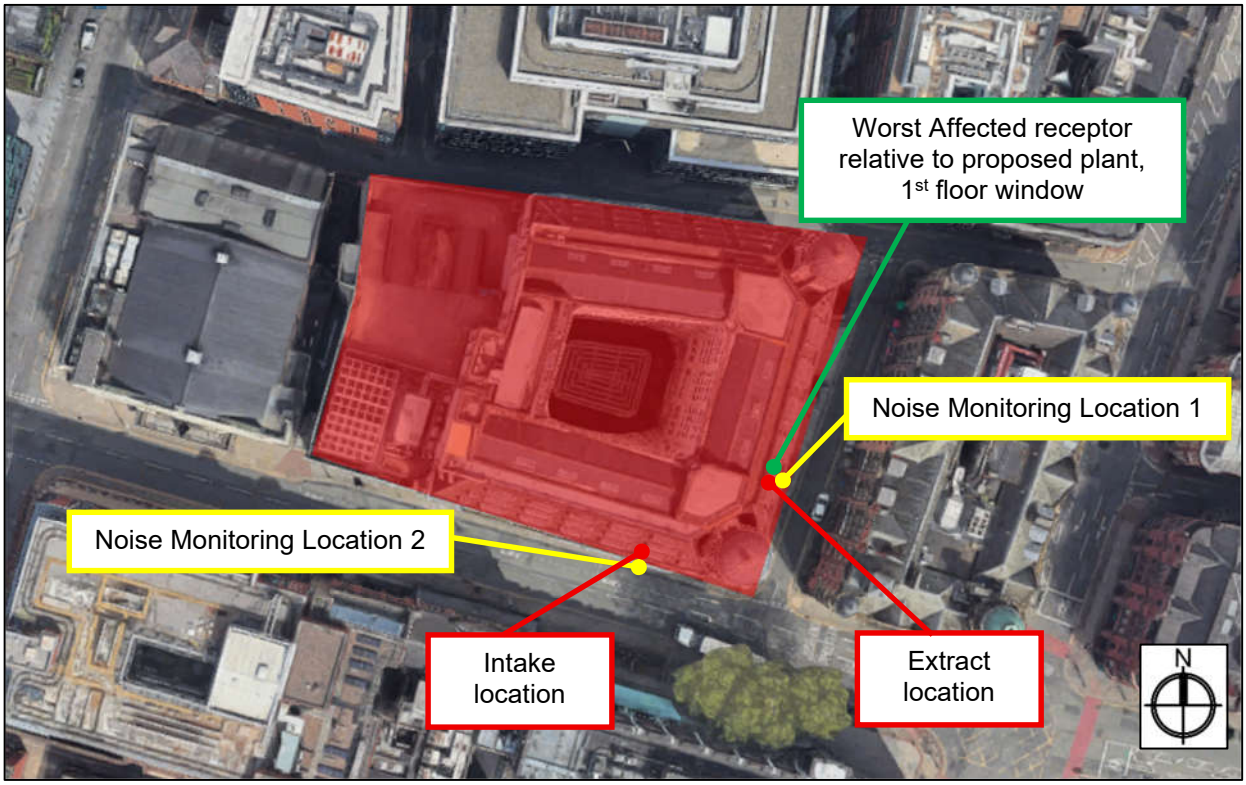


Figure 1 Site location plan (Ref: Google Maps)

A review of the satellite imagery of the site and surrounding area shows that all of the closest buildings to the proposed development are offices. The Planning Condition specifies that the assessment be conducted to the 'nearest noise sensitive location'. On this basis, the offices directly above the intake and extract louvres have been considered as the nearest noise sensitive locations for this assessment.

The buildings to the south are the *Cornerblock* office building and a building with Tesco on the ground floor and offices above. For these locations, there is Quay Street between them and the intake louvre location. The road traffic noise from Quay Street would mask the building services noise at this location

and the distance from the intake louvre to the would also attenuate the noise further. As such, these buildings cannot be considered as the ‘nearest noise sensitive location’ as stated in the Planning Condition. Assessing the building services noise emissions to the nearest office window above the intake and extract louvres would be considered a ‘worst case’ assessment and be the only locations that fulfill the requirement of the ‘nearest noise sensitive location’ as per the planning condition.

3 PLANNING CONDITION AND RELEVANT NOISE IMPACT ASSESSMENT GUIDANCE

The planning condition for which this report is prepared is as follows:

"b. Prior to the first operation of the louvre, plant, equipment or servicing, a verification report, which will include post-completion testing, shall be submitted to and be approved in writing by the Local Planning Authority to validate that the louvre, plant, equipment or servicing achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.

c. In the event of non-conformity with a rating level of 5dB (LAeq) below the typical background (LA90) level in each octave band, then any measures/changes required to achieve conformity shall be carried out. Any required measures/changes and verification shall continue until conformity has been achieved and agreed in writing by the Local Planning Authority, before operation of the louvre, plant, equipment or servicing can commence.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site. Pursuant to policies SP1 and DM1 of the Core Strategy and saved policy DC26 of the UDP."

A full review of relevant guidance has been undertaken, as outlined in Appendix B. For ease of reference, the following documentation has been reviewed:

- *BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'*
- *Manchester City Council 'Planning and Noise – Technical Guidance' October 2022*

4 ENVIRONMENTAL NOISE SURVEY

4.1 Measurement Location and Procedure

A noise survey was undertaken on site at the locations shown in Figure 1. The microphones of the noise monitoring equipment were placed 1m from the intake and extract louvres on an extendable pole for both monitoring locations.

These locations were chosen as the noise emissions from the intake and extract systems were not audible at the noise sensitive receptor. At these locations, the noise emissions from the intake and extract systems were barely audible.

The measurement procedure complied with ISO 1996-2:2017 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels'*, with attended monitoring undertaken between 14:00 and 15:00 on 11th August 2026.

The key acoustic descriptors measured for this assessment are as follows:

- $L_{Aeq,T}$ *(the continuous equivalent A-weighted noise level over a given time period, T); and*
- $L_{A90,T}$ *(the noise level exceeded for 90% of the measurement period T, referred to as the 'background' noise level).*

4.2 Measurement Equipment

The table below presents the equipment used for the baseline noise survey. The equipment calibration was verified before and after use, and no significant drift/deviation was observed.

Equipment	Make and Model	Serial Number
Sound Level Meter	Svantek 977 Class 1 Sound Level Meter	34191
Microphone Capsule	ACO Pacific 7052E	77747
Microphone Preamplifier	Svantek SV 12L	32446
Calibrator	Svantek SV33 Class 1 Calibrator	125829

Table 1 Noise survey equipment

4.3 Weather Conditions

Weather conditions at the time of the site visits were observed to be suitable for environmental noise measurement, with light winds and dry weather. Wind speeds were lower than 4 m/s, with temperatures approximately 27ºC.

4.4 Survey Results

Measurements were taken at both monitoring locations with and without the intake and extract system operating. All measurements were at least five minutes in duration to ensure that the specific noise levels of the plant noise emissions could be captured.

At both noise monitoring locations, the noise emissions from the building services were not audible. Noise levels were dominated by the noise emissions from passers by, road traffic on Quay Street and distant road traffic and plant.

Table 2 shows the measured noise levels, as well as the typical background noise level spectrum. The typical background noise level was measured and calculated in ES Acoustics previous report, 22656.PNIA-RPT.01 Rev B, dated 4th August 2026.

Measurement Location and Condition	Overall Noise Level	Unweighted Octave Band Noise Level Spectrum							
		63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
Location 1 (dB $L_{Aeq,T}$) Plant Operating	61	65	63	63	60	56	51	50	40
Location 1 (dB $L_{Aeq,T}$) Plant Not Operating	61	65	63	62	59	56	51	49	39
Location 2 (dB $L_{Aeq,T}$) Plant Operating	67	73	67	65	61	59	54	46	44
Location 2 (dB $L_{Aeq,T}$) Plant Not Operating	67	73	66	64	60	57	53	43	42
Daytime Background Noise Level (dB $L_{A90,T}$) (07:00-23:00)	54	46	46	46	45	45	45	46	50
Night-time Background Noise Level (dB $L_{A90,T}$) (23:00-07:00)	49	49	52	49	46	44	40	38	36

Table 2 Measured Noise Levels

5 NOISE IMPACT ASSESSMENT

5.1 Predicted Noise Levels at Closest Noise Sensitive Receptor

To calculate the specific noise level of the intake and extract equipment, the logarithmic difference between the measurements with the plant operating and without the plant operating was calculated.

The Specific Sound Level of the extraction equipment has been then assessed to the closest noise sensitive windows. These calculations consider various factors such as attenuation over distance. With the additional consideration of BS 4142:2014 correction factors, the Plant Noise Rating Level at the noise sensitive receptor can be determined.

For the purposes of this assessment, no BS4142:2014 correction factors have been applied. The noise emissions are broadband so do not warrant any tonality corrections. When operating, they will operate consistently for the full assessment period, so no intermittency or impulsivity corrections are warranted.

The Plant Noise Rating Level calculated at the receptor are summarised in the table below. Manchester City Council have informed ES Acoustics that some of the offices in the surrounding area operate during the night, therefore a night-time assessment is required.

Period	Noise Level	Octave Band Noise Level Spectrum								Overall Noise Level
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Daytime (07:00-23:00)	Plant Noise Rating level (dB $L_{Ar,Tr}$)	36	38	40	38	37	33	33	29	42
	Typical Background Noise Level (dB $L_{A90,T}$)	46	46	46	45	45	45	46	50	54
	Difference	-10	-8	-6	-7	-8	-12	-13	-21	-12
	Compliant with Planning Condition?	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Night-time (23:00 – 07:00)	Plant Noise Rating level (dB $L_{Ar,Tr}$)	36	38	40	38	37	33	33	29	42
	Typical Background Noise Level (dB $L_{A90,T}$)	49	52	49	46	44	40	38	36	49
	Difference	-13	-14	-9	-8	-7	-7	-5	-5	-7
	Compliant with Planning Condition?	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**

Table 3 Predicted Plant Noise Rating Levels at receptor

Table 3 shows that the noise emissions from the installed intake and extract systems meet the requirements of MCC. On this basis, the planning condition can be discharged.

5.2 Assessment Context

As outlined in the BS 4241:2014+A1:2019 guidance presented in Appendix B, the three types of context which should be considered are:

- *aspects of the absolute level;*
- *aspects of character; and*
- *aspects of the receptor, including physical measures designed to reduce noise.*

With respect to the absolute level, the Plant Noise Rating Level outside the residential window would fall below the recommended external noise level recommended by WHO of 45 dB $L_{Aeq,T}$ to facilitate good resting conditions.

With regards to aspects of character of noise at the noise sensitive receiver properties, the existing noise profile of the area is dominated by noise from background road traffic noise, in addition to other low level plant in the area as evidenced by the environmental noise survey. As the received noise levels are so low as to be effectively inaudible during daytime hours, the addition of this noise source would not be expected to present a significant impact on the acoustic character of the area.

With regards to aspects of the receptor properties, the receiver properties are all office premises. As such, the primary source of cooling would be internal climate control. With this in consideration, the external building fabric can remain closed whilst maintaining suitable internal noise levels, and this would typically be the preference to prevent noise ingress from existing road traffic noise, which the plant noise from the proposed extraction equipment inherently falls below.

5.3 Assessment of Impacts

Considering the calculated Rating Level compared to the background sound level and the context in which the sound occurs, we would conclude that the plant installation would present a low likelihood of adverse impact when assessed in accordance with BS 4142:2014+A1:2019.

6 CONCLUSION

Confirmatory noise measurements have been undertaken at Sunlight House, Quay Street, Manchester to confirm that the noise emissions from the installed intake and extract system meet the requirements of the planning condition imposed on the site by Manchester City Council.

Using the measurements taken and previously measured background noise levels, calculations of noise emissions from the plant installation have been undertaken in respect to the requirements of an imposed Planning Condition.

It has been concluded that noise emissions from the plant would meet the requirements of the Planning Condition. The assessment indicated that the plant noise rating level is sufficiently below the background sound level to be considered as a low likelihood of adverse impact in accordance with BS 4142:2014+A1:2019.

No further remedial measures would be expected to be required to maintain a low likelihood of adverse impact, and it can be confirmed that the requirements of the Planning Condition can be achieved.

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel scale - dB

The decibel (dB) is a relative unit of measurement used in acoustics. The dB is a logarithmic ratio between a measured level and a reference level of 0 dB (i.e the threshold of human hearing). Simply put, the decibel compresses the wide range of sounds we hear into more manageable numbers.

Addition of noise from several sources

Sound produced by multiple sound sources are added logarithmically e.g. power ratio of 2 = 3dB, power ratio of 10 = 10dB. Therefore, two equally intense sound sources operating simultaneously produce a sound level which is 3dB higher than a single source e.g. 60dB + 60dB = 63dB.

Subjective impression of noise

Human response to sound is highly individualized and often based on psychological factors such as emotion and expectation. Sensitivity to sound typically depends on the loudness, pitch, duration of the occurrence, and time of occurrence (e.g. a sound source could cause annoyance during the night where it would not during the day). The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level	Change in perceived loudness
1 dB	Imperceptible
3 dB	Just barely perceptible
6 dB	Clearly noticeable
10 dB	About twice as loud

'A' Weighted Frequency Filter - dB(A)

The human ear is not equally sensitive in all frequencies. The A-weighting filter was devised to take this into account when undertaking noise measurements and allows a sound level meter to replicate the human ears response to sound.

$L_{Aeq, T}$

Sound can fluctuate widely over a given period. L_{Aeq} is the A-weighted equivalent continuous sound level, with T denoting the time period over which the fluctuating sound levels were averaged e.g. $L_{Aeq,16h}$ is the equivalent continuous noise level over an 16 hour period.

L_{A90}

A-weighted sound level exceeded for 90% of the measurement period, calculated via statistical analysis. The L_{A90} descriptor is typically used to establish background sound levels for noise impact assessments

L_{A10}

A-weighted sound level exceeded for 10% of the measurement period, calculated via statistical analysis.

L_{AFmax}

A-weighted sound level maximum sound pressure level that has been measured over a given time period

APPENDIX A

GLOSSARY OF ACOUSTIC TERMINOLOGY

Octave Bands

The audio or frequency spectrum of the human ear is in the range of 20Hz to 20 kHz. The spectrum tells how the energy of the sound signal is distributed in frequency. Octave bands divides the audio spectrum into 10 equal parts. The International Standards Organisation defines the centre frequency of these bands as 31.5Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1kHz, 2kHz, 4kHz, 8kHz and 16kHz.

Noise Rating (NR) Curves

A method of rating noise using a set of curves relating octave band sound pressure levels. Typically used for building services systems within offices

Airborne sound

Sound radiated from a source into the surrounding air e.g. musical instruments, tv/radio, machinery/equipment. Airborne sound insulation refers to the reduction or attenuation of airborne sound, usually via a solid partition between a source and receiver.

Impact sound

Sound resulting from the impact between colliding objects, e.g. footfall impact upon a floor. Impact sound insulation refers to the resistance of a floor to the transmission of impact sound, typically via the installation of a ‘resilient layer’

Flanking sound

The transmission of airborne sound between two adjacent rooms by paths other than via the separating partition between the rooms, e.g. the abutment point of a wall and floor.

Structure-borne noise

Noise caused by the vibration of elements of a structure. This can result in reradiated noise, whereby the vibrating element transmits airborne sound into a space e.g. vibration caused by mechanical plant installed within a plant room which is not adequately isolated from the structure, or construction/demolition work in an adjacent building.

Reverberant sound

Sound in an enclosed space (usually a room), which results from repeated reflections at the boundaries. Reverberation time is the time taken for a steady sound level in an enclosed space to decay by 60dB, measured from the moment the sound source is switched off. A example of a typically reverberant space would be a classic church. Absorptive materials can be used to reduce reflections and reverberation times.

APPENDIX B

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

1 NATIONAL POLICY

1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) covers issues relating to noise and planning in England.

The paragraphs relating to noise state:

187. Planning policies and decisions should contribute to and enhance the natural and local environment by; […]

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans

198. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; […]

200. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

1.2 Noise Policy Statement for England (NPSE)

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The long-term vision of the Government noise policy is to '*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development*.'

The NPSE vision noted above is supported by the following 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 NPSE outlines observed effect levels relating to the above, as follows:

- *No observed effect level (NOEL): this is the level of noise exposure below which no effect at all on health or quality of life can be detected;*
- *Lowest observed adverse effect level (LOAEL): this is the level of noise exposure above which adverse effects on health and quality of life can be detected;*
- *Significant observed adverse effect level (SOAEL): This is the level of noise exposure above which significant adverse effects on health and quality of life occur;*

Noise effect levels are not set at absolute noise level targets, but instead vary depending on the context and character of the noise and site-specific factors which may impact on the severity of the effect. The NPSE states:

'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. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.'

1.3 National Planning Practice Guidance (NPPG)

The NPPG provides practical guidance on how the NPPF should be applied as well as and guidance on the factors influencing whether noise may be a concern at the planning stage and how adverse effects can be mitigated. The table below summarises the effect levels presented within the NPSE, as follows:

Response	Examples of Outcomes	Increasing Effect Level	Action
Not present	No Effect	No Observed Effect	No specific measures required
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific Measures required
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate & reduce to a minimum

APPENDIX B

PLANNING POLICY AND RELEVANT ACOUSTIC GUIDANCE REVIEW

Response	Examples of Outcomes	Increasing Effect Level	Action
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1 Noise exposure hierachy

2 REGIONAL POLICY

2.1 Manchester City Council – Planning and Noise Technical Guidance

Published in October 2022, Manchester City Council's supplementary planning document, '*Planning and Noise Technical Guidance*', provides planners with acceptable noise criteria for a wide range of developments.

Section 3.7 states the following:

3.7 MCC assessment criteria In the context of government policy, the Council require that developments aim for:

1. A noise level between the No Observed Effect Level (this is the level of noise exposure below which no effect at all on health or quality of life can be detected) and the Lowest Observed Adverse Effect Level (this is the level of noise exposure above which adverse effects on health and quality of life can be detected). Conditions may be attached. If point 1 cannot be achieved, then:

2. If the assessment results in a level between the Lowest Observed Adverse Effect Level and the Significant Observed Adverse Effect Level (this is the level of noise exposure above which significant adverse effects on health and quality of life occur), mitigation will be necessary to reduce the level and thus conditions will be attached. If points 1 & 2 cannot be achieved, then:

3. If the assessment results in a Significant Observed Adverse Effect Level after mitigation, the application will be recommended for refusal.

3.7.1 MCC guidance

The NPPF, NSPE and NPPG do not present absolute noise level criteria which define SOAEL, LOAEL and NOAEL which is applicable to all sources of noise in all situations in a planning context. One of the aims of this document, therefore, is to address this ambiguity and provide a suite of noise level design targets for typical developments (which are in accordance with current policies and standards). Where certain developments are not specifically covered, the applicant/consultant is encouraged to contact us with a view of discussing the best that can be achieved for the given situation (in the context of the scenarios listed in section 3.6).

3.7.1.1 Residential Developments

The Council has adopted the following noise limits for residential properties:

- ***Bedrooms (night time - 23.00 - 07.00) 30 dB $L_{Aeq,T}$ (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 10 times)***
- ***Living Rooms (daytime - 07.00 - 23.00) 35 dB $L_{Aeq,T}$***
- ***Gardens and terraces (daytime) 55 dB $L_{Aeq,T}$***

These criteria have been adopted for the following reasons:

- *BS 8233: 2014 recognises these levels as a good standard for resting/sleeping conditions.*
- *The WHO document 'Guidelines for Community Noise' recommends an internal LAeq of 30dB for optimal sleep conditions (and no more than 35dB for internal rooms during daytime).*
- *The performance of acoustic insulation schemes can often be below that specified, according to the quality of installation, materials, noise spectrum and deterioration / wear and tear of building elements. A high design specification introduces a 'safety margin' should building elements not perform as well as expected ('on-site' performance).*
- *Performance specification for glazing does not usually take into account the detrimental effect of vents on the sound insulation. Even 'acoustic' vents will reduce the performance of the facade insulation, as they will inherently contain a free open area for air exchange.*
- *There is a general increase in urban noise levels, which can in the future be reasonably accommodated by these standards.*
- *The standards support the Local Authority corporate objective to prevent ill-health and improve local peoples' health and well being.*

3.7.1.2 Entertainment Venues

Noise from entertainment venues, e.g. noise from recorded music, live bands, or karaoke, can be particularly annoying for local residents and businesses if not adequately contained within the venue.

When considering the potential impact of a proposal for an entertainment venue, consultants should consider the overall noise level (L_{Aeq}) and the 63 Hz and 125 Hz octave band noise levels (L_{eq}). Music noise in the 63 Hz and 125 Hz octave bands, often described as 'bass noise', is particularly difficult to contain and the impulsive and non-steady character of low frequency music noise is particularly disturbing for local residents exposed to it.

Applicants and consultants should note that, although a particular business model may require a 'chilled out' or 'acoustic' venue, planning approval for an entertainment venue will remain in place as long as the development exists. Subsequent owners or tenants may wish to provide louder entertainment in the future. For this reason, applicants and consultants should predict the noise impact of a proposed

entertainment venue using noise levels representative of those found in 'typical' venues of the kind being applied for. Consultants should provide their rationale for using particular noise levels and reference the source of the noise levels used during their predictions.

A lively city centre bar can operate around 95dB L_{Aeq} and nightclubs can be even higher at 105dB L_{Aeq}. The range of levels at 63Hz and 125Hz octave bands is wider than the A weighted levels and can be up to 115dB L_{eq} and 110dB L_{eq} respectively (Davies et al 2005).

There is a lack of consensus on an assessment method for noise levels within habitable rooms with regard to entertainment noise. The design aim, however, should be to design to 'inaudible'. The building structure is therefore key and will usually involve a high performing solution in loud music venues.*

Existing noise standards/criteria are not appropriate for evaluating low frequency noise; in almost all other situations the established noise descriptors are based on the A-weighted sound level (dBA), which effectively filters out low frequency sounds (Moorhouse et al 2011).

When dealing with noise control, especially at the lower frequencies, it is usual to look at the octave band data as a Z-weighting (linear) and not the A-weighting, due in main to the amount you have to 'take off', resulting in meaningless data (-26.2dB at 63Hz), and also with respect to the sound insulation performance of various constructions materials.

Rather than just A-weighted levels being assessed, e.g. internal noise levels as per BS 8233: 2014, a low frequency band analysis should be carried out (McCullough et al 2004).

For the assessment of low frequency music noise, it is more practical to consider the 63 Hz and 125 Hz octave bands. The Noise Council's Code of Practice (1995) on 'Environmental Noise Control at Concerts' suggests limits on both these octave bands.

The DEFRA report 'Noise from Pubs and Clubs – Phase 1' suggests limits on 1/3 octave bands. However the problem with this particular suggestion, and one of the reasons it is not widely used, is due to the difficulty in obtaining 1/3 octave band sound insulation performance data for various construction materials.

With regards to assessing music noise, the 63 Hz and 125 Hz octave band levels as shown in Figure 1 have been plotted against the NR 15 curve as shown in Figure 2, and a good correlation at low frequencies is evident (the octave bands were calculated from the 'Moorhouse curve' by logarithmically adding the adjacent 1/3 octave bands).

However, the NR curve may be too stringent at mid and higher frequencies and may be lower than background noise levels in habitable spaces. Furthermore, the NR curve is most commonly used to set limits for mechanical services noise in buildings, i.e. steady, continuous noise sources. Music noise has different characteristics and as such can be described as unsteady and non-continuous in comparison.

Even though the Moorhouse curve does not specifically relate to entertainment noise (as per the caveat in the revised edition) these levels provide a good practical basis to assess low frequency music noise.

They also provide a workable prediction for planning applications and a measurement method and assessment for in-situ low frequency issues in existing habitable spaces.

Therefore, a criterion that would achieve a condition of 'inaudible' / 'virtually inaudible' which is applicable for new residential developments that are structurally connected to entertainment venues (or vice versa) would be:

'Music noise levels in the 63Hz and 125Hz octave centre frequency bands (L_{eq}) should be controlled so as not to exceed (in habitable rooms) 47dB and 41dB ($L_{eq,5min}$), respectively'.

This criterion may also be applicable for new residential developments that are structurally separate from an existing entertainment venue.

A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:

*'**Entertainment noise ($L_{Aeq,5min}$) should be controlled to 5dB below the typical background noise level ($L_{A90,T}$) in each octave band at the nearest noise sensitive location'**.*

Depending on the circumstances it could be that both the above criteria are applicable for the same development (new entertainment venue). In order to control music noise levels so as not to exceed any agreed maximum permissible operating levels, as a last resort, a suitable noise limiting device may be necessary to install, in addition to structural acoustic treatments such as uprated lobby systems and size, location and fixing of loudspeakers.

3.7.1.3 Mixed Use Developments

Where a planning application includes a proposal to contain a potentially noisy development within the same building as a noise sensitive use or vice versa the noise survey should consider the transfer of noise between the noisy and noise sensitive uses. An example of where this should be considered would be a proposal for a bar or club within the same building as residential properties (see section 3.6.1.2).

Consultants should demonstrate that the structure of the development will be sufficient to adequately contain the noise generated within the development. In doing so consultants should consider:

- *flanking noise;*
- *structure borne noise;*
- *the overall level of noise (L_{Aeq}) generated by the use in question and any tonal or impulsive characteristics that the noise may contain; and*
- *the acoustic properties of the development (including the construction of party floors and/or walls, windows and doors, ventilation systems, and structural columns.)*

3.7.1.4 Construction / demolition phases

Noise from construction or demolition works as part of a development can be intrusive or disruptive to local businesses and/or noise sensitive land uses. For this reason, construction or demolition activities should be restricted to daytime periods and have finite start and finish times.

All noisy works (i.e. those that are audible beyond the site boundary) should be restricted to the following hours to minimise disruption:

- *Monday - Friday: 7.30am - 6pm*
- *Saturday: 8.30am - 2pm*
- *Sunday / Bank holidays: No work*

These restrictions apply to deliveries/collections to the site.

By utilising set working hours for activities on site as well as deliveries to the site, respite is provided for local residents and businesses near to the development. Noise and disruption to local residents will occur during development works, so it is important to remember that local residents may not necessarily be in favour of the development or all aspects of it. By keeping an open dialogue and attempting to placate any complaints or grievances, the development is likely to progress more efficiently.

For larger developments or developments that are likely to progress over a long period of time, it may be worth considering a 'Considerate Contractors Scheme'. These schemes suggest guidelines to minimise disruption to local residents and businesses and provide a code of conduct for employees on site so that their work does not unduly upset local residents and/or businesses. These schemes include noise as well as many other elements such as dust suppression, deliveries, working hours, behaviour on site, approved delivery routes, etc.

A Construction Management Plan (CMP) shall be submitted to and approved by the Council for large schemes. This should contain a Noise & Vibration section that bases the assessment on BS 5228 (see section 3.5), with reference to other relevant standards. It should also contain a community consultation strategy which includes how and when local businesses and residents will be consulted on matters such out of hours works.

3.7.1.5 Industrial / commercial developments

BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises (section 3.5). One of the indications of the impact of a BS 4142 assessment is 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.

The Council consider that new developments should contribute and enhance the area in which they are located and where possible i.e. prevent 'noise creep', contribute to the improvement of people's health and quality of life as per the NPSE. With this in mind, the design objective should be:

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'The development should be designed so as to achieve a rating level of 5dB ($L_{Aeq,T}$) below the typical background ($L_{A90,T}$) level at the nearest noise sensitive location.'

Where this criterion cannot be achieved, the various noise control measures considered as part of the assessment should be fully explained (i.e. relocation of noise sources, use of quieter equipment, enclosures, screening, restriction of the hours of operation) and the achievable noise level should be identified. This information will allow a judgement to be made concerning the application and its likely impact on the surrounding area.

In addition to the above, maximum noise levels should also be adequately controlled. Where particular uses generate high noise levels of a short duration (e.g. loud bangs) on a regular basis, these should aim to be controlled so as not to exceed 60 dB (LAmax) at the façade of noise sensitive premises nearby in accordance with the recommendations of the WHO (section 3.6).

Deliveries and collections are usually controlled by restricting operational hours but depending on the extent of these activities, a Noise Management Plan (NMP) may be requested, which would include an assessment of noise. This would usually involve assessing the noise upon arrival, loading/unloading period and then departure.

The NMP may also need to include controls such as acoustically sealed delivery bays, and restrictions on vehicle mounted refrigeration units and audible alarm systems. Where applicable, the noise assessment will take account of multiple noise sources operating simultaneously and report the cumulative impact.

Noise and vibration from fixed plant / equipment

Noise from fixed plant, equipment or machinery can be very annoying and disruptive to people living nearby particularly where that item involved emits a noise with impulsive or tonal characteristics.

Many of the complaints Environmental Health receive about noise from plant, equipment and machinery specifically concern the character of the noise emitted. Any noise assessment needs to consider not only the overall level of noise emitted, but also its particular characteristics. The noise assessment should be based on BS 4142, and any application for fixed plant, equipment or machinery must demonstrate 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 of 5dB ($L_{Aeq,T}$) below the typical background ($L_{A90,T}$) level at the nearest noise sensitive location'.

By designing the sound pressure level of any plant items to generate a noise impact of at least 5dB below the existing background level, any plant noise impact should be of a negligible level which should not give rise to complaints from users or occupiers of existing noise-sensitive usages. See Appendix A with regards to the expectation of how to calculate a 'typical' background level.

Past experience has shown that this criterion can be readily achieved. Where available, product specification data for new items should be submitted with the acoustic report. Consultants should be

using these to compare with data from the noise survey and propose mitigation where the levels are above those specified in the criterion. Where this information is not available a consultant may choose to measure the noise, levels generated by the equipment in question where the equipment has already been installed elsewhere (and in accordance with BS 4142).

Where fixed plant, equipment or machinery is attached to a building the vibration caused by it can pass through the building structure and cause structure borne noise elsewhere in the building. Where it is to be installed in or on a building containing a noise sensitive use structure borne noise should be considered in the noise assessment and adequate control measures should be proposed. An example of where this would be required is where there is a proposal to install ventilation equipment on the roof of a residential apartment block or it could be an air source heat pump attached to the side of a building.

3.7.1.6 Other potentially noisy activities

The following types of development proposals or applications may have additional specific guidance published to review noise impacts or may otherwise be a potential source of noise. It is recommended that pre-application discussions are held with the Environmental Protection Team at www.manchester.gov.uk if any of the following application types are to be submitted:

- *Motor car/bike tracks/speedways*
- *BMX, skateboard, scooter, mountain bike tracks*
- *MUGAs*
- *Sport stadia*
- *B2 Use Class developments*
- *Wind Turbines*
- *Gymnasia*

The above list is far from exhaustive, however it highlights some of the applications that have been considered with particular attention to noise in the past.

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3 BEST PRACTICE AND GUIDANCE

3.1.1 World Health Organization (WHO) Guidelines

WHO Guidelines for Community Noise (1999) provides guideline values for community noise in specific environments. This has since been supplemented by WHO Environmental Noise Guidelines for European Region (WHO, Regional office for Europe, 2018).

The WHO guideline values most relevant to new residential development are outlined in the table below:

Specific Environment	Critical Health Effects	$L_{Aeq,\ T}$ [dB]	L_{Afmax} [dB]	Time Base
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	n/a	07:00-23:00
	Sleep disturbance night-time	30	45	23:00-07:00
Dwelling, outdoors	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00
Outdoor living area	Serious annoyance, daytime and evening	55	n/a	07:00-23:00
	Moderate annoyance, daytime and evening	50	n/a	07:00-23:00

Table 2 Guideline Values from WHO Guidelines for Community Noise (1999)

The effects of noise in dwellings are typically sleep disturbance, annoyance and speech interference. For bedrooms the critical effect is sleep disturbance. Indoor guideline values for bedrooms at night are 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for single sound events, but the guidance also notes that lower noise levels may be disturbing depending on the nature of the noise source.

3.2 BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

Table 4 of BS 8233:2014 (reproduced below) provides guidance on recommended internal ambient noise levels in residential spaces based on World Health Organization (WHO) research.

Room	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Living Room	≤ 35 dB $L_{Aeq,16hr}$	N/A
Dining Room	≤ 40 dB $L_{Aeq,16hr}$	N/A
Bedroom	≤ 35 dB $L_{Aeq,16hr}$	≤ 30 dB $L_{Aeq,8hr}$

Table 3 BS 8233:2014 indoor ambient noise levels for dwellings

The following notes should be considered alongside the levels presented above:

- *The levels presented above are for steady external noise sources without a specific character. Noise is considered to have a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate*
- *The levels are based on annual average data and do not have to be achieved in all circumstances e.g. it is normal to exclude occasional events, such as fireworks night or New Year's Eve*

- *Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved*
- *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*
- *The levels outlined above are not applicable under "purge ventilation" conditions as defined by Approved Document F of the Building Regulations, as this should only occur occasionally e.g. to remove odour from painting or burnt food). However, the levels above should be achieved whilst providing sufficient background ventilation, either via passive or mechanical methods*

It should be noted that the 2014 version of BS 8233:2014 does not include any specific requirement for maximum instantaneous noise levels (L_{max}) within dwellings. However, methodology for the assessment of maximum noise levels is included in ProPG and referenced in WHO guidelines.

Section 7.7.3.2 of BS 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'* presents desirable guideline levels for amenity areas. The section is presented in its entirety below:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space."

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3.3 ProPG: Professional Practice Guidance on Planning and Noise

ProPG was published to provide practitioners with guidance and a recommended approach for the assessment of noise impact on residential developments during the planning stage.

The guidance can be seen as the missing link between the current NPPF and its predecessor, PPG24 (Planning Policy Guidance 24: Planning and Noise), which provided a prescriptive method for assessing sites for residential development but without the nuance of the key elements described in ProPG.

The guidance seeks to assist in the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise and encourage a good acoustic design in and around proposed new residential development whilst considering national policy on planning and noise.

The recommend approach for assessment is summarised below:

- *Stage 1 – an initial noise risk assessment of the proposed development site*
- *Stage 2 – a systematic consideration of four key elements:*
    - *Element 1 – Demonstrating a "Good Acoustic Design Process" (including feasibility of reducing or relocating existing noise sources, site orientation and building layout and appropriate constructions methods to meet performance requirements);*
    - *Element 2 – Observing internal "Noise Level Guidelines" (as presented in Section 3.3.1 of this report, with additional consideration of individual noise events which should normally not exceed L_{AFmax} 45 dB more than 10 times in bedrooms at night);*
    - *Element 3 – Undertaking an "External Amenity Area Noise Assessment" (ProPG aligns with BS 8233:2014 and suggests that noise levels in external amenity areas should ideally not be above $L_{Aeq,16hr}$ 50-55dB. However, there is an acceptance that these guideline values may not be achievable in all circumstances where development might be desirable, and in such situations, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited.); and*
    - *Element 4 – Consideration of "other relevant issues" (including compliance with national and local policy, acoustic design vs unintended adverse consequences, acoustic design vs wider planning objectives)*

To help consider noise at a site at an early stage an initial noise risk assessment should assess the Noise Risk Category of the site to help provide an indication of the likely suitability of the site for new residential development from a noise perspective. The table below sets out the indicative noise levels for the Noise Risk Categories and a description of the potential effect of noise where no further noise mitigation is to take place as well as additional guidance.

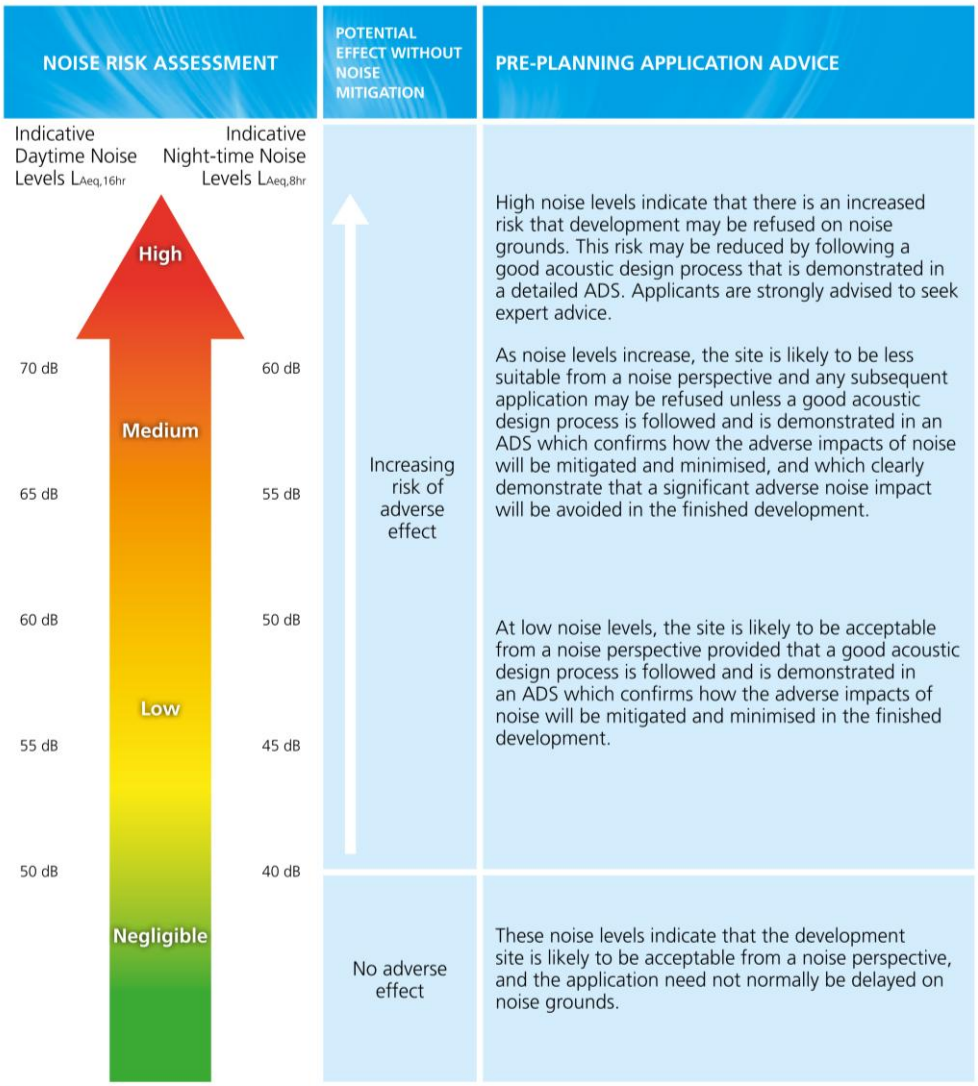


Figure 1. Stage 1– Initial Site Noise Risk Assessment

ProPG Planning & Noise: New Residential Development • May 2017

3.3.1 Possible Options for the Identification of SOAELs and LOAELs in Support of the NPSE (2014)

Commissioned by Defra and developed through research conducted by AECOM, the study titled "Possible Options for the Identification of SOAELs and LOAELs in Support of the NPSE" explores potential numerical values for SOAELs and LOAELs, which are concepts introduced within the Noise Policy Statement for England (NPSE). Following the revocation of PPG24: Planning and Noise in 2012, which previously outlined Noise Exposure Categories with defined numerical thresholds, the NPSE faced criticism for lacking specific quantitative guidance. Although both the NPSE and the National Planning Policy Framework (NPPF) advocate for context-driven,

location-specific noise criteria, the absence of numerical benchmarks posed challenges in applying the NPSE effectively.

To address this, the research project proposes indicative values and potential value ranges for SOAELs and LOAELs across various noise sources, with the findings summarised in Table 4.

Source	Effect	LOAEL	SOAEL
Road	Annoyance (Daytime)	**56** (53-59)	**66** (64-68)
	Sleep (Night-time)	**46** (43-52)	**56** (51-64)
Rail	Annoyance (Daytime)	**63** (61-66)	**72** (70-74)
	Sleep (Night-time)	**55** (52-63)	**68** (61-77)
Air	Annoyance (Daytime)	**52** (50-54)	**60** (58-62)
	Sleep (Night-time)	**41** (40-49)	**53** (47-60)

Table 4 Possible Value & Ranges of Values for LOAEL & SOAEL

3.3.2 Approved Document O: Overheating

Approved Document O took effect on 15 June 2022 with the aim to protect the health and welfare of occupants of a building by reducing the occurrence of high indoor temperatures with residential buildings.

Paragraph 3.3 covers the noise consideration and is presented below:

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am).

Following the adoption of ADO, the 'Approved Document O Noise Guide' has been published by the Institute of Acoustics and Association of Noise Consultants to provide guidance for practitioners when implementing the standards within ADO relating to noise.

Requirement O1 requires reasonable provision for limiting unwanted solar gain as well as providing an adequate means of removing excess heat from the indoor environment. Compliance with Requirement O1 can be demonstrated via a simplified method or via dynamic thermal modelling.

The simplified method presents minimum free areas for bedrooms as a percentage of the floor area for high and medium risk locations, which are 13% and 4% respectively. The ADO Noise Guide clarifies the following external noise levels above which the simplified method cannot be used:

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Parameter	High Risk Location	Moderate Risk Location
$L_{Aeq,8h}$ averaged over 8 hours (between 11pm and 7am)	45 dB	50 dB
L_{AFmax} more than 10 times a night (between 11pm and 7am)	60 dB	65 dB

Table 5 External noise levels above which the simplified method cannot be used (Ref: ADO Noise Guide)

Note that these values do not account for façade elements in front of the window (e.g. balconies).

The thermal modelling method requires a CIBSE TM59 assessment and consideration of acceptable strategies for reducing overheating risk via limiting solar gains and removing excess heat from the building.

Paragraphs 2.7 and 2.10 are presented below:

2.7 Solar gains in summer should be limited by any of the following means.

a. Fixed shading devices, comprising any of the following.

- *i. Shutters, ii. External blinds, iii. Overhangs, iv. Awnings.*

b. Glazing design, involving any of the following solutions.

- *i. Size, ii. Orientation, iii. g-value, iv. Depth of the window reveal.*

c. Building design – for example, the placement of balconies.

d. Shading provided by adjacent permanent buildings, structures, or landscaping.

2.10 Excess heat should be removed from the residential building by any of the following means.

a. Opening windows (the effectiveness of this method is improved by cross-ventilation).

b. Ventilation louvres in external walls.

c. A mechanical ventilation system.

d. A mechanical cooling system

In meeting the obligations noted above, consideration must be given to noise during night, pollution, security, protection from falling and protection from entrapment.

The ADO Noise Guide suggests that in the case of dynamic thermal modelling (when noise and air quality are not a constraint), the primary approach to remove excess heat should be via an open window. From the established external noise exposure at each bedroom window, the outside to inside level difference should be calculated, and then the target Equivalent Area should be predicted using the following equations (depending on whether the required level difference is free-field or façade):

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Equation 1[8]

$$EA\ based\ on\ façade\ level\ difference = V \times 10^{\left(\frac{-(D_{2m,nT}+5)}{10}\right)}$$

Where

$D_{2m,nT}$ is the is the façade level difference between the A-weighted level 2m in front of the façade ($L_{1,2m}$), and the standardised internal A-weighted level ($L_{eq,2,nT}$). In the absence of any better alternative method, the same principle can be applied to L_{AFmax}.

V is the room volume (m^3)

EA is the Equivalent Area of the open window (m^2)

Equation 2[8]

$$EA\ based\ on\ freefield\ level\ difference = V \times 10^{\left(\frac{-(D_{nT}+8)}{10}\right)}$$

The total maximum Equivalent Area for each bedroom to meet the required standardised level difference should then be communicated to the dynamic thermal modelling consultant to verify whether or not the building is still at risk of overheating with the Equivalent Areas calculated.

In the case where openable windows are not suitable and a mechanical ventilation system is required, the following noise limits should be observed:

Parameter	Bedrooms
Mechanical ventilation or mechanical cooling system noise	$L_{Aeq,T}$ 30 (±5) dB

Table 6 Recommended noise level for mechanical ventilation or mechanical cooling systems

Higher noise levels than those in Table 2, e.g. by up to 10 dBA, may be appropriate in some operating scenarios, where rapid changes to the cooling or ventilation rates quickly improve the thermal comfort of the occupant. Equally, lower noise levels may be appropriate for some types of residential development.

The ADO Noise Guide suggests the following assessment steps:

To determine if an open window can be used for removing excess heat, it is recommended that the acoustic consultant adopts the following process:

1. *Establish the night-time noise exposure at all bedroom windows as advised in this document;*
2. *Determine the outside to inside sound insulation for each bedroom window required to meet the noise threshold;*
3. *Determine the Equivalent Area to achieve the required outside to inside sound insulation as determined in 2) above; and*
4. *Communicate the required total maximum night-time Equivalent Area via an open window for the dynamic thermal modeller to use.*

For bedrooms that cannot rely on an open window to remove excess heat at night due to noise constraints, the thermal modeller should identify the solution to remove excess heat. The acoustic consultant can then advise the acoustic requirements for any proposed provisions.

One clear way of communicating the advice is to provide a mark-up showing the required performance at each façade / window.

The dynamic thermal modelling report should contain sufficient reference to any associated noise assessment, the required sound insulation performance and maximum night-time Equivalent Area and the basis for defining these.

3.4 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

BS 4142:2014+A1:2019 provides a methodology for rating and assessing the impacts of industrial and commercial sound at noise sensitive receptors. In the context of this report, this guidance would be relevant for any new fixed plant installations that might be installed for the scheme.

The methodology involves comparing the Rating Noise Level due to the sound source/s under assessment with the existing background sound level (L_{A90}) when the noise source is not operating to estimate the initial impact, as follows (Typically, the greater this difference, the greater the magnitude of the impact):

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

b) *A difference of around +5 dB could be an indication of an adverse impact, depending on the context*

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

The standard notes that a noise source under assessment will have a 'low impact' when the 'rating level' of a noise source is less than the existing background sound. It is also important to note that any quantitative assessment results are assessed considering the context in which the sound occurs.

The standard notes three types of context within Clause 11, which are:

1) *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

   Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

   Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound*

source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as i. facade insulation treatment, ii. ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation, and iii. acoustic screening.*

The definitions noted above are described below:

- ***Specific sound*** *– sound source being assessed ($L_s = L_{Aeq,\ Tr}$)*
- ***Residual sound*** *– Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound ($L_r = L_{Aeq,\ T}$)*
- ***Ambient sound*** *– totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far ($L_a = L_{Aeq,\ T}$)*
- ***Background level*** *– sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval ($L_{A90,\ T}$)*
- ***Rating level*** *– specific sound level plus any adjustment for the characteristic features of the sound ($L_{Ar,Tr}$)*

With regards to background sound levels, BS 4142:2014+A1:2019 notes:

"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

With regards to the 'rating level', the adjustments for the characteristic features of the sound are outlined below:

- *Tonality – +2 dB for a tone which is 'just perceptible' at the noise receptor, +4 dB where it is 'clearly perceptible', and +6 dB where it is 'highly perceptible'*
- *Impulsivity – +3 dB for a tone which is 'just perceptible' at the noise receptor, +6 dB where it is 'clearly perceptible', and +9 dB where it is 'highly perceptible'*
- *Intermittency – +3 dB if the intermittency is readily distinctive against the residual acoustic environment*
- *Other sound characteristics – where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.*

It must be noted that as the rating level is determined at the closest noise sensitive receptor, the acoustic feature corrections should be applied based on the level at receptor location, not at source. This is particularly relevant when noise propagation characteristics cause differences in sound reduction at various frequency bands.

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Note that the assessment reference periods that should be considered for daytime and night-time, as defined within the standard, are:

- *One hour period for a sound source operating during daytime hours (07:00-23:00 hours)*
- *Fifteen-minute period for a sound source operating during the night-time (23:00-07:00 hours)*

ES Acoustics Notes regarding Context:

The notes presented below are informed by the BS 4142:2014+A1:2019 Technical Note prepared by the Association of Noise Consultant Good Practice Working Group. Assessment context is often misunderstood or applied incorrectly, and the notes are therefore presented to provide a clear picture on what aspects of context should be considered when assessing the overall impact of a particular scenario:

Subclause 11(1)

The second paragraph notes that absolute levels may be as, or more, important than relative outcomes where background and rating levels are low. It is important to note that both background and rating levels would need to be low for this particular caveat to apply.

BS 4142 does not indicate how the initial estimate of impact should be adjusted when background and rating levels are low, only that the absolute levels may be more important than the difference between the two values. It is likely that where the background and rating levels are low, the absolute levels might suggest a more acceptable outcome than would otherwise be suggested by the difference between the values. For example, a situation might be considered acceptable where a rating level of 30dB is 10dB above a background sound level of 20dB, i.e. an initial estimate of a significant adverse impact is modified by the low rating and background sound levels. However, there may be situations where the opposite is true, and it is for the assessor to justify any modifications to the initial estimate of impact.

BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$. We would consider that similar values would not be unreasonable in the context of the current edition of BS 4142.

The third paragraph states that "where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts".

In the ordinary application of BS 4142 the residual sound level is not compared with the background sound level to determine the level of impact. The third paragraph is therefore taken to mean that the level of impact caused by the residual level has been determined by professional judgement or with reference to another document, such as the Noise Insulation Regulations 1975 (as amended 1988). Where professional judgement is used, it should be appropriately justified.

Where the residual sound levels are very high, a significant adverse impact might be declared in a situation where the rating level exceeds the background sound level by, say, 4dB, i.e. since the residual sound levels are already considered to cause a significant impact, any worsening of the situation would be considered a significant adverse

impact, even if the difference between the rating level and background sound level would not suggest this to be the case.

Subclause 11(2)

The second aspect of context described in BS 4142 relates to the character and level of the specific sound. In essence, whether or not the character of the sound is distinguishable from the character of the ambient or residual acoustic environment or is incongruous.

BS 4142 does not provide instruction as to how to treat the assessment outcomes in these circumstances, nor does it explain how to distinguish between this contextual consideration and the process for applying rating penalties. The latter is itself informed by the distinctive characteristics of the specific sound in the context of the residual sound environment.

Where character-based contextual matters are taken into account, the assessor should make it clear how these matters are distinct from those that informed the rating level corrections, and what the implications of these further character assessments should be. For example; new deliveries on an estate entailing rating penalties for reversing alarms and impulsive noise but these types of noise are already present at other existing premises, so contextually the impact is reduced. Conversely, where the residual level is largely comprised of natural sounds, such as the sea or birdsong, so the impact from the specific source might be increased.

Subclause 11(3)

The third contextual matter described in Clause 11 relates to the receptor itself. It is important to note that the reference at the start of this section of BS 4142 to 'the sensitivity of the receptor' refers to a generic receptor type, i.e. a dwelling, and not to the particular attitudes or responses of a particular person (although if the residential receptor type is specific it may have a bearing e.g. student accommodation).

The ANC working group notes that this part of BS 4142 allows the internal noise environment to be considered, despite BS 4142 excluding such matters from its Scope (Subclauses 1.1, 1.2 and 1.3). The working group considers that the consideration of the internal noise environment is only valid in a BS 4142 assessment where it relates to the contextual elements of the assessment.

APPENDIX C

PLANT NOISE EMISSION CALCULATIONS

Confirmatory BS 4142:2014 Assessment - Sunlight House	Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Location 1 - Plant operating	65	63	63	60	56	51	50	40	
Location 1 - Plant not operating	65	63	62	59	56	51	49	39	
Logarithmic Difference	45	45	45	43	30	34	36	32	
Location 2 - Plant operating	73	67	65	60	58	54	46	44	
Location 2 - Plant not operating	73	66	64	59	57	53	43	42	
Logarithmic Difference	37	43	48	46	47	42	41	37	
Distance Attenuation 20log(3/1)	-10	-10	-10	-10	-10	-10	-10	-10	
Location 1 with distance attenuation	35	36	36	34	20	24	27	22	
Location 2 with distance attenuation	27	34	39	37	37	32	32	28	
Sum Location 1 & 2	36	38	40	38	37	33	33	29	
BS4142 Acoustic Feature Corrections									
Tonality									0
Intermittency									0
Impulsivity									0
Total Rating Noise Level at NSR 1 Receptor Window, dB									**42**