HOARE LEA

UoM Zochonis. Manchester. University of Manchester.

ACOUSTICS

ENVIRONMENTAL NOISE SURVEY REPORT

REVISION 00 – 17 AUGUST 2023

Audit sheet.

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Executive summary

Hoare Lea have been appointed to provide acoustic advice for the proposed refurbishment scheme at the University of Manchester's Zochonis Building. The site is located within the jurisdiction of Manchester City Council.

An environmental noise survey has been carried out between 4 August and 9 August 2023.

The representative background noise levels measured during the survey were $L_{A90,15min}$ 49 dB during the daytime (07:00 to 23:00 hrs) and $L_{A90,15min}$ 47 dB at night-time (23:00 to 07:00 hrs).

Based on Manchester City Council and BS4142:2014 guidance, all plant, equipment and machinery associated with the development shall be controlled to ensure that the overall sound pressure levels at 1 m from the façade of the nearest noise sensitive premises do not exceed:

- Outside the dwellings on Upper Brook Street - $L_{Ar,T}$ 44 dB during the daytime (07:00 to 23:00 hrs) and $L_{Ar,T}$ 42 dB during the night (23:00 to 07:00 hrs).
- Outside the George Kenyon Halls of Residence - $L_{Ar,T}$ 38 dB during the daytime (07:00 to 23:00 hrs) and $L_{Ar,T}$ 36 dB during the night (23:00 to 07:00 hrs).

If the plant contains any tonal characteristics a further correction will be required.

The plant design is not sufficiently progressed to comment on specific attenuation requirements. However, given the high existing background noise levels measured and distance to the nearest sensitive premises, it is expected that the noise limits set out can be achieved without requiring onerous measures.

1. Introduction.

Hoare Lea have been appointed to provide acoustic advice for the proposed refurbishment scheme at the University of Manchester Zochonis Building.

An environmental noise survey has been carried out on site over 5 days commencing on Friday 4 August 2023. The aim of the survey was to determine the existing noise levels around the site, with the purpose of establishing the prevalent ambient and representative background noise levels to set maximum noise egress limits for the plant and machinery associated with the development.

This report presents the findings of the noise survey and sets out the permissible maximum plant noise egress limits in accordance with BS 4142:2014 guidance.

2. Site and development details.

2.1 Site location and proposals.

The proposed scheme comprises refurbishment works to the Zochonis Building which will include the installation of a new rooftop plant, including new air source heat pumps.

The building is located at the junction of Dover Street and Rumford Street within the University of Manchester site. Other university buildings are located in the immediate vicinity, with the nearest sensitive receptors identified as the George Kenyon Halls of Residence within the University of Manchester site and dwelling houses located on Upper Brook Street.

The location of the site is indicated in Figure 1 alongside the identified noise sensitive receptors.

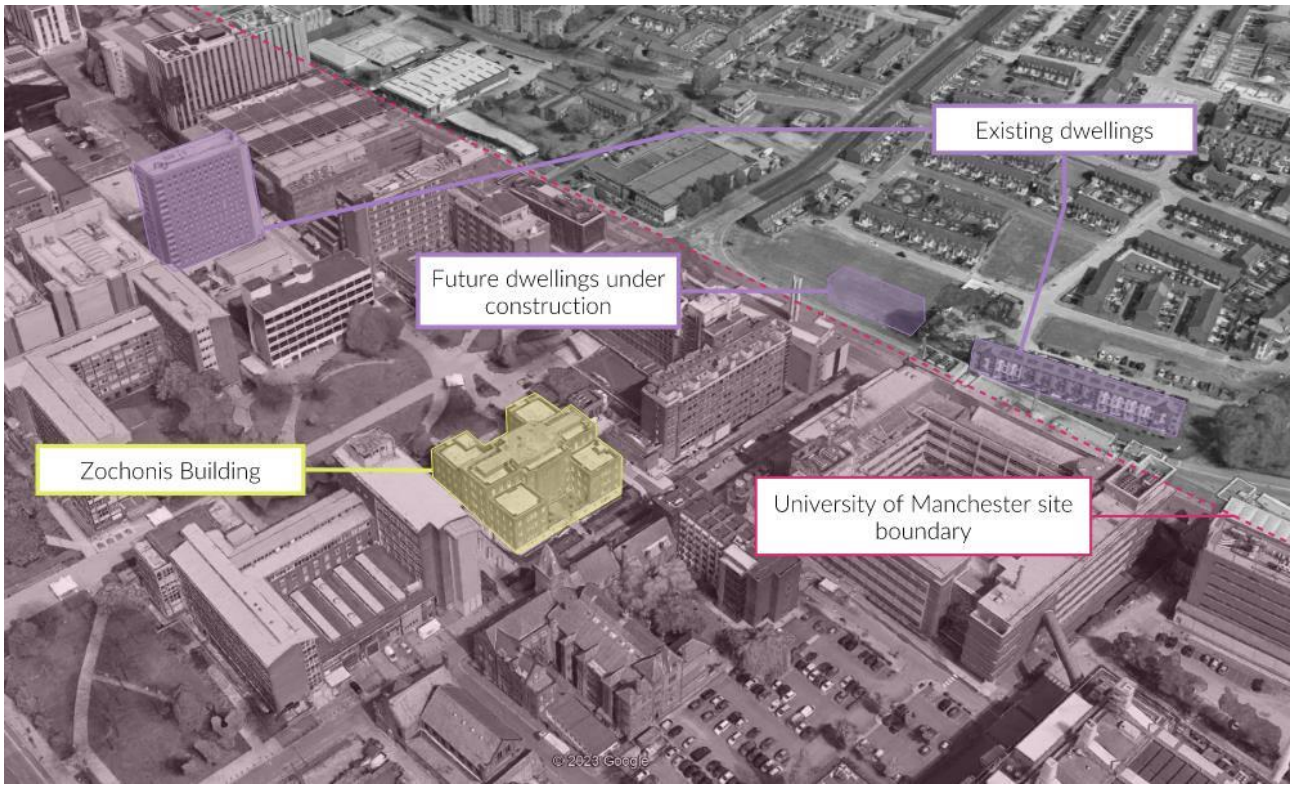


Figure 1 Annotated 3D rendered image showing development location and context (courtesy of Google Earth)

2.2 Surrounding area.

The building to be refurbished is located within the University of Manchester site in between Oxford Road and Upper Brook Street. The immediate surroundings are therefore primarily formed from educational and science/research buildings. Beyond Upper Brook Street is a residential area formed from an estate of dwelling houses.

3. Acoustic criteria.

A full review of pertinent national and local planning policy is provided in Appendix A.

3.1 Local Authority planning guidance.

Criteria for plant noise egress are provided in the Manchester City Council (MCC) "Planning & Noise Technical Guidance (October 2022)" document.

With regards to noise from fixed plant/equipment, MCC refers to BS 4142:2014 and also states the following:

"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}) below the typical background (L_{A90}) level at the nearest noise sensitive location."

A brief summary of the standard guidance is presented below for reference.

3.2 BS 4142:2014.

Noise egress from any plant and machinery associated with the development should not cause disturbance at nearby sensitive premises.

The rating level for all new plant and machinery should be no more than equal to the existing representative background noise levels.

Further corrections should be applied if the plant noise contains tonal and/or impulsive characteristics. The magnitude of these corrections is dependent upon the subjective perceptibility of the tones/impulses present.

Where the Rating Level exceeds the background, the level of impact increases as shown below.

Table 1 BS4142 assessment criteria

Comparison with background	Assessment
+0 dB or below measured background	Low impact
+ 5 dB	Adverse impact
+ 10 dB or more above measured background	Significant adverse impact

4. Environmental noise survey.

An environmental noise survey was carried out on site over a period of 5 days between 4 August 2023 and 9 August 2023. During this time, long-term unattended measurements were carried out. Full details of the equipment used, as well as weather information are provided in Appendix B. Detailed survey results are presented in Appendix C.

The survey measurement position and key noise sources are indicated on the annotated aerial photography presented in Figure 2.

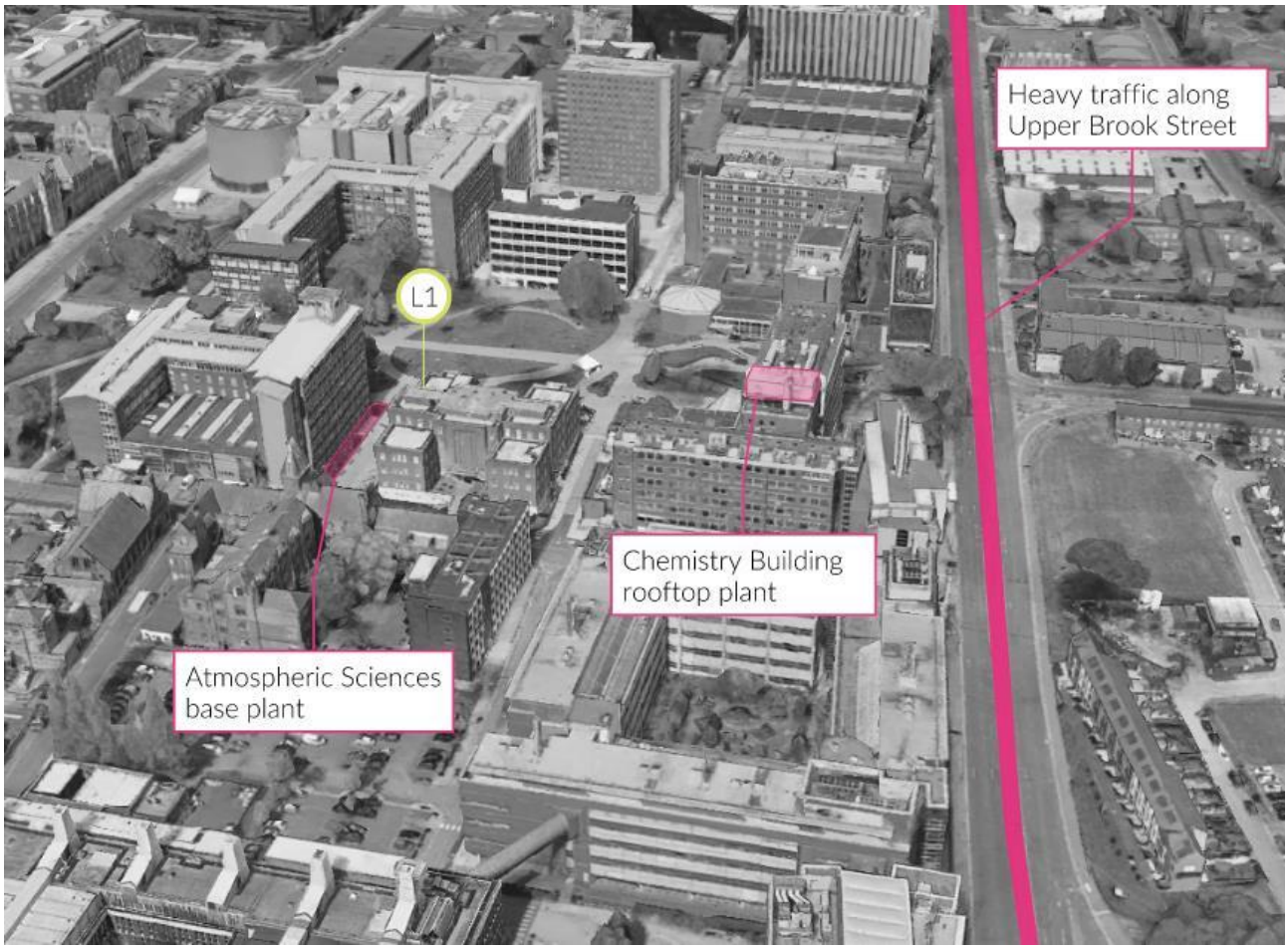


Figure 2 Aerial photograph indicating measurement position (courtesy of Google Earth)

In line with BS 4142:2014, for the purpose of analysis and establishing representative background sound levels during the periods of interest, the background sound levels have been quantified using statistical analysis from the continuous logging measurements. These are presented in Appendix D.

From the analysis carried out, the representative background sound levels measured during the survey were respectively $L_{A90,15min}$ 49 dB during the daytime period, and $L_{A90,15min}$ 47 dB during the night-time period.

4.1 Observations.

There was substantial rooftop plant located on the University of Manchester Chemistry Building which provided clearly audible continuous background noise at the noise monitoring location. Due to the significant size of the plant, there was direct line of sight to it at street level, with the associating noise clearly audible along Dover Street and Rumford Street.

Plant was also located at the base of the University of Manchester Centre for Atmospheric Sciences. While the noise monitoring equipment was being set up this provided no audible background noise at the measurement location. However, upon retrieval of the equipment there was audible continuous background noise provided. It appears that this plant does not operate continuously, and as such has not affected the background noise levels taken as representative.

As the Chemistry Building rooftop plant was located approximately the same distance to Position L1 as to the nearby dwellings on Upper Brook Street, it is deemed that the noise levels due to the plant as measured at L1 are representative of the levels experienced outside the dwellings.

Outside of the nearby dwellings along Upper Brook Street, the plant noise was masked by heavy traffic flow along Upper Brook Street (A34). Traffic noise from Upper Brook Street was also contributing to noise levels at monitoring position L1, but to a much lesser degree due to the screening and distance attenuation provided from the road.

It is therefore considered likely that the overall background noise level at the dwellings is slightly higher than measured at L1 due to increased traffic noise contributions. However, the use of noise levels measured at position L1 provides a suitable conservative indication of noise at the dwellings from existing continuous plant for the purposes of setting noise limits for new plant.

The George Kenyon Halls of Residence are located approximately twice the distance from the Chemistry Building compared to the noise monitoring position. It is therefore considered appropriate to apply a distance correction of -6 dB to account for the additional distance attenuation that would occur to this receptor. The representative background at this location is therefore considered to be $L_{A90,15min}$ 43 dB during the daytime period and $L_{A90,15min}$ 41 dB during the night.

5. Plant noise egress.

5.1 Plant noise limits.

Base on the criteria set out in Section 3 and the survey results, the cumulative maximum sound pressure levels for fixed plant, equipment and machinery associated with the development shall not exceed the levels present in Table 2 at 1 m from the nearest noise sensitive premises.

Table 2 Maximum permissible sound pressure levels at 1m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1m from the nearest noise sensitive premises ($L_{Ar,T}$, dB) *
Outside dwellings on Upper Brook Street	
07:00 to 23:00 hours	44
23:00 to 07:00 hours	42
Outside George Kenyon Halls of Residence	
07:00 to 23:00 hours	38
23:00 to 07:00 hours	36

*If plant noise contains any tonal or impulsive characteristics, a further correction shall be applied to the levels set out above in accordance with BS4142:2014.

5.2 Attenuation measures.

All noise generating plant and equipment associated with the development will be designed to ensure that the noise egress limits specified above are achieved.

The plant design is not yet sufficiently progressed to comment on specific attenuation measures. However, such measures would typically include in-duct attenuation, acoustic screening or enclosure, low noise equipment, and acoustically rated louvres.

Given the high existing background noise levels measured and distance to the nearest sensitive premises, it is expected that the noise limits set out can be achieved without requiring onerous measures.

Appendix A: Policy and guidance.

National policy.

Noise Policy Statement for England.

The *Noise Policy Statement for England* (NPSE) advises that noise impacts should be assessed on the basis of adverse and significant adverse effects but does not provide any specific guidance on assessment methods or noise limits.

The NPSE introduces the concepts summarised in Table 3 that can be applied when considering the significance of noise impacts, which are applied by the World Health Organization.

The document advises that it is not possible to have '*a single objective noise based measure.... that is applicable to all sources of noise in all situations*'. It further advises that the sound level at which an adverse effect occurs is likely to be different for different noise sources, for different receptors at different times.

Effect Level 1	Description
No Observed Effect Level (NOEL)	This is the noise level below which no effect can be detected. In simple terms, below this level of noise, there is no detectable effect on health and quality of life due to the noise being assessed.
Lowest Observed Adverse Effect Level (LOAEL)	This is the level of noise 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 above which significant adverse effects on health and quality of life occur.

Table 3: NPSE observed effect levels.

National Planning Policy Framework.

National Planning Policy Framework (NPPF) sets out the Government's planning policies and how these are expected to be applied. In relation to noise and vibration, NPPF section 15 paragraphs 170, 180 and 182 are presented below:

'*170. Planning policies and decisions should contribute to and enhance the natural and local environment by:*

e. 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'

'*180. 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:*

1. *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;*
2. *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;*

and

3. *limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

'*182. 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.'

Planning Practice Guidance.
Online Planning Practice Guidance (PPG) has been published to provide greater details in relation to the relevance of noise to the planning process following the introduction of the NPPF and NPSE.

This guidance states, under the heading *'How to Determine the Noise Impact'*, that the following should be considered by Local Authorities:

- *'whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.'*

In line with NPSE, this includes identifying where noise exposure is above or below the significant observed adverse effect level and the lowest observed adverse effect level for a given situation during the operation of the Proposed Development.

Further guidance on each of the various observed effect levels set out in the NPSE is provided in the table detailed in the section headed 'How to Recognise when Noise could be a concern?' which is reproduced in Table 4.

It is important to note that no specific noise parameters are defined in the text or target noise levels provided. Under the heading 'What factors influence whether noise could be a Concern?', the subjective nature of noise is discussed. It is stated that there is no simple relationship between noise levels and the impact on those affected. This depends on how various factors combine in particular situations.

In respect of mixed-use developments, the following guidance is provided:

'When proposed developments could include activities that would be covered by the licensing regime, local planning authorities should consider whether the potential for adverse noise impacts will be addressed through licensing controls (including license conditions). Local planning authorities should not however presume that license conditions will provide for noise management in all instances and should liaise with the licensing authority.'

Perception	Example of outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not Intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.		No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and Intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. 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 Level	Avoid
Noticeable and disruptive	Extensive and regular changes in behaviour and/or inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

Table 4: PPG observed effects.

Local policy.

Manchester Core Strategy.

Manchester's Local Development Framework Core Strategy Development Plan Document was adopted in 2012. The document outlines the Council's vision for Manchester in 2027 and includes planning policies to be followed within the Manchester City Council area. The document includes two policies relating to noise and this development. The key paragraphs are presented below:

Policy SP1
The key spatial principles which will guide the strategic development of Manchester to 2027 are:

- *The City is covered by regeneration areas including the City Centre. All development should have regard to the character, issues and strategy for each regeneration area as described in the North, East, Central and South Manchester and Wythenshawe Strategic Regeneration Frameworks and the Manchester City Centre Strategic Plan.*

Development in all parts of the City should make a positive contribution to neighbourhoods of choice including:

- *creating well designed places that enhance or create character.*
- *making a positive contribution to the health, safety and wellbeing of residents*
- *considering the needs of all members of the community regardless of age, gender, disability, sexuality, religion, culture, ethnicity or income.*
- *protect and enhance the built and natural environment.*

Policy DM1
All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:

- *Impact on the surrounding areas in terms of the design, scale and appearance of the proposed development. Development should have regard to the character of the surrounding area.*
- *Effects on amenity, including privacy, light, noise, vibration, air quality, odours, litter, vermin, birds, road safety and traffic generation. This could also include proposals which would be sensitive to existing environmental conditions, such as noise.*
- *Design for health.*

Unitary Development Plan for the City of Manchester.
Although the Unitary Development Plan for the City of Manchester (1995) has been superseded by the Manchester Core Strategy, some policies have been retained. One saved policy relates to noise and the key paragraphs are presented below:

Policy DC26
The Council intends to use the development control process to reduce the impact of noise on people living and working in, or visiting, the City. In giving effect to this intention, the Council will consider both:

a. the effect of new development proposals which are likely to be generators of noise; and

b. the implications of new development being exposed to existing noise sources which are effectively outside planning control.

Developments likely to result in unacceptably high levels of noises will not be permitted:

a. in residential areas;

b. near schools, hospitals, nursing homes and similar institutions;

c. near open land used frequently for recreational purposes.

The Council will control noise levels by requiring, where necessary, high levels of noise insulation in new development as well as noise barriers where this is appropriate.

Manchester City Council Noise and Planning Technical Guidance.
The Manchester City Council have produced supplementary technical guidance on noise and planning, released in 2022. This considered assessment methodologies and criteria for various aspects of noise within planning. The key paragraphs in relation to the proposed development are presented below:

3.6.1.5.1 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 noise 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: 2014 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 (LAeq) below the typical background (LA90) 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.

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 the guidance in 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 fixed plant or equipment on the roof of a residential apartment block.

5.1.2 Noise generated within the development

The existing and expected noise source/s should first be identified and the following procedures should be applied:

1) select metrics to use for measuring or predicting noise levels (e.g. LAeq,T)

2) assess effects of topography and other features, such as noise screens or reflecting surfaces.

3) measure or predict noise levels at strategic points. In some complex situations it might be beneficial to produce a contour map of external noise levels.

4) if appropriate, assess noise levels due to user activities around the development.

The levels of existing noise and noise expected in the foreseeable future should be based on measurement where practicable, or may be predicted if there is reliable information.

5.2 Assessing noise

The following information MUST be included in all acoustic reports:

- *A statement of the reason for and scope of the report.*
- *Details of the proposed development to which the report relates.*
- *A location and development plan.*
- *A description of the area and environment surrounding the development site*
- *The methodology used to carry out the noise survey including the location of any noise monitoring locations, the equipment used and details of its last accredited calibration, and the weather conditions at the time the survey was carried out*
- *Full table of results.*
- *Assessment of the results in accordance to the relevant standards and policies.*
- *Recommendations for noise control measures if needed.*

• Full calculations of the noise reductions expected to support any suggested noise control measures.

5.3.1.4 Plant and Equipment

Noise from external plant, equipment or servicing items are assessed when determining planning applications. Typical equipment in both commercial and residential developments includes items such as air conditioning plant, retail refrigeration plant or lift motors.

Industrial developments are much more varied with the types of plant and equipment being entirely related to the industry in question.

The design aim here should be to meet the criterion in section 3.6.1.5.1. Consideration should initially be given to selecting the most low noise emitting models of plant and equipment possible. If this is not feasible, then it may be advisable to consider relocating noisy plant and equipment to a less noise sensitive area of the site and/or away from multiple reflecting surfaces.

It may also be possible to erect acoustic shielding around any necessary plant and equipment to contain noise and prevent it causing problems off-site. Some equipment may require additional acoustic mitigation measures to control the impacts from tonal noise or intermittent operation.

The use of any plant and equipment overnight usually causes an increase in noise sensitivity, so it may be advisable to limit use during night time periods if possible.

Consideration of the above measures at an early stage of the planning process is likely to progress an application more swiftly.

Recognised guidance.

British Standard 4142.

Current Government advice to Local Planning Authorities in both England and Wales refers to British Standard 4142:2014 (BS 4142) as being the appropriate guidance for assessing commercial operations and fixed building services plant noise. The British Standard provides an objective method for rating the significance of impact from industrial and commercial operations. It describes a means of determining sound levels from fixed plant installations and determining the background sound levels that prevail on a site.

The assessment of the impacts is based on the subtraction of the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods"*.

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB(A)), impulsivity (up to +9 dB(A)), intermittency (+3 dB(A)) and other sound characteristics (+3 dB(A)) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level. The following is considered when evaluating the potential impact:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context.

It also states '*where background sound levels and rating levels are low, absolute levels might be as, or more, relevant that the margin by which the rating level exceeds the background. This is especially true at night.*'.

Appendix B: Survey and equipment details.

Equipment details.
The details of the equipment used during the environmental noise survey.

All equipment used was within dates of calibration and calibration certificates are available on request.

Table 5 Equipment used during environmental noise survey.

Description	Serial Number	Calibration Date
Rion - Sound Level Meter: NL-52 Rion - Microphone: UC-59 Rion - Pre-amplifier: NH-25	00297868 14887 88079	14/04/2023

Weather information
Weather reports for the area indicate that temperatures ranged between approximately 10 °C and 19 °C. Wind speeds were low, and periods of rain were not substantial to have affected the background measurement results.

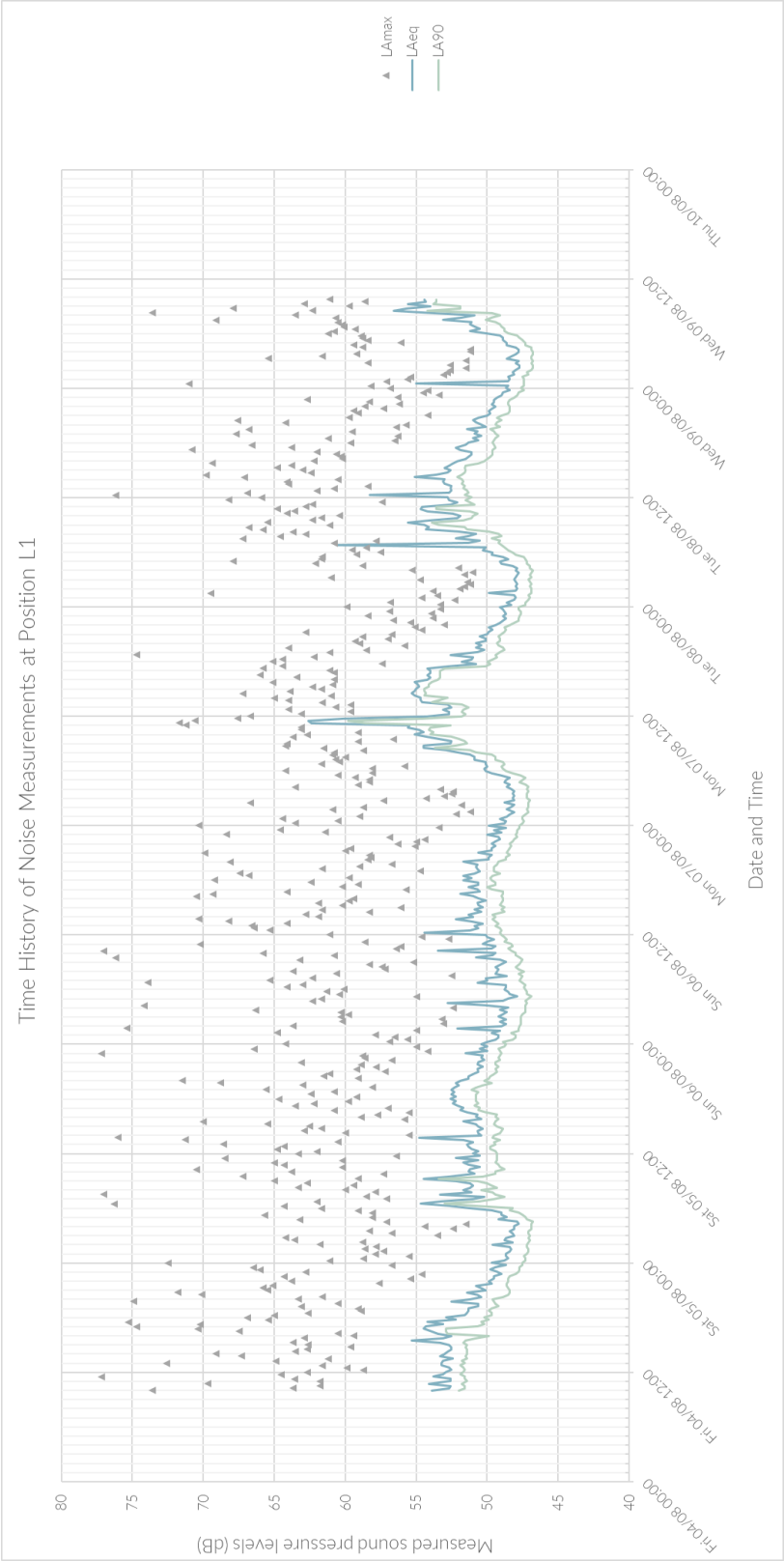
The measured data is therefore considered suitable as being representative of typical conditions.

Appendix C: Detailed survey results.

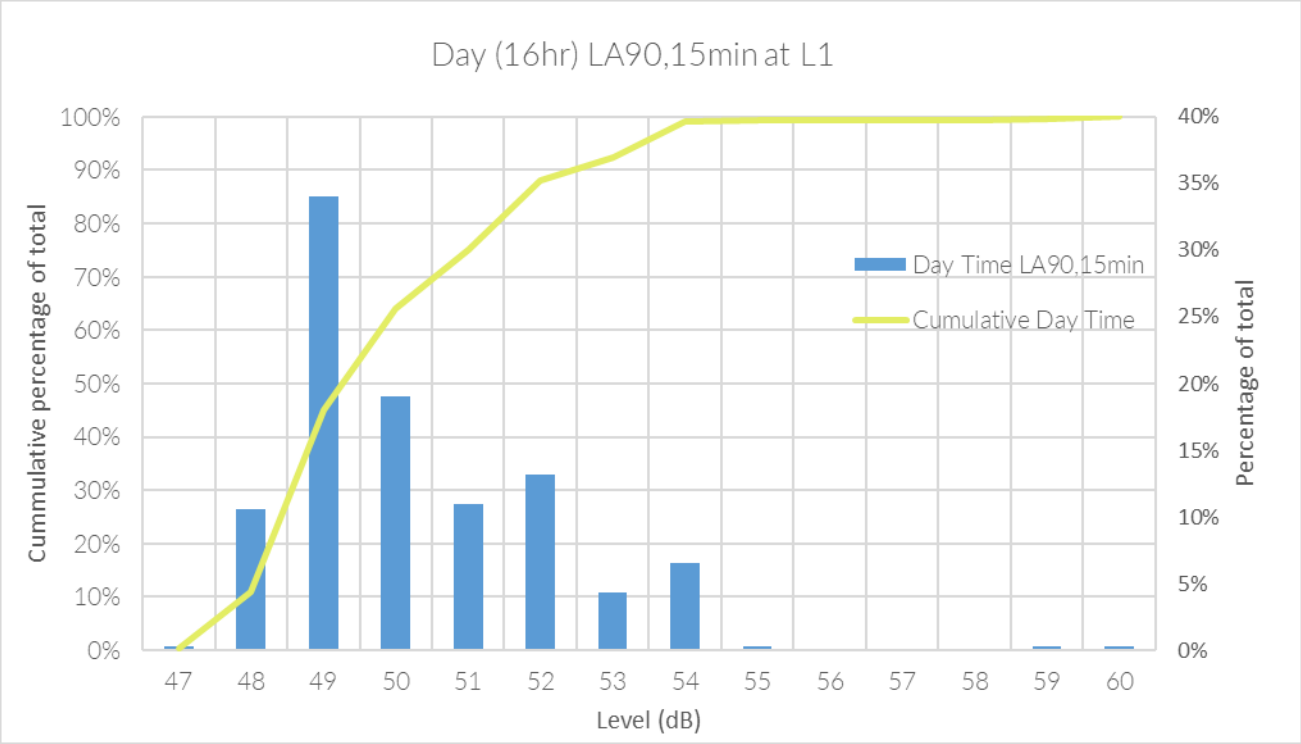
Results.
Table C1 Ambient noise levels measured during unattended measurements.

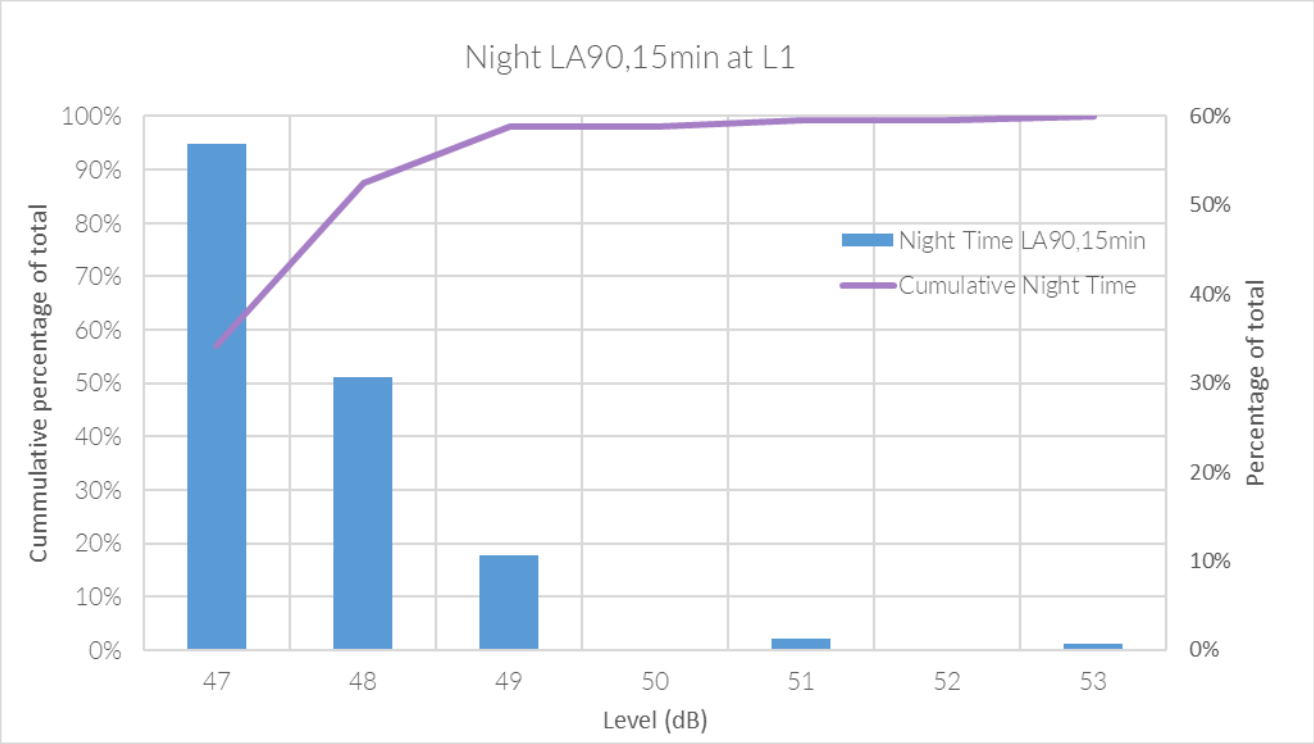
Date	Day time (07:00-23:00)	Night time (23:00 - 07:00)
	$L_{Aeq,16hr}$ (dB)	$L_{Aeq,8hr}$ (dB)
04/08/2023	52	50
05/08/2023	52	50
06/08/2023	51	49
07/08/2023	54	50
08/08/2023	52	49
09/08/2023	54	#N/A

Time history graph at unattended position L1.



Appendix D: Statistical analysis of background levels measured.





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