Sustainable Acoustics

Richard Witcher

47 BROAD STREET, ALRESFORD

Noise Impact Assessment

Report No. 23-0083-0 R02

♦ PROTECT ♦ ENHANCE ♦ CONNECT

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Noise Impact Assessment

Report No.:	23-0083-0 R02
Date:	07 September 20233

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CONTENTS

1 INTRODUCTION 5
2 SITE CONTEXT 5
3 POLICY AND GUIDANCE ON NOISE 8
3.1 National Policy 8
3.2 British Standard BS 4142 8
3.3 Local Policy 9
4 METHODOLOGY 11
4.1 Survey 11
4.2 Weather 11
4.3 Instrumentation 12
5 RESULTS 13
6 ASSESSMENT 16
6.1 Proposed Plant 16
6.2 Target 16
6.3 Assessment 16
7 MITIGATION 18
8 SUMMARY AND RECOMENDATION 19
APPENDIX 1 POLICY AND GUIDANCE ON NOISE I
APPENDIX 2 INSTRUMENTATION VIII
APPENDIX 3 ACOUSTIC TERMINOLOGY X

TABLES

Table 1 – Instrumentation 12
Table 2 – Overall Acoustic Parameters at monitor during the survey 13
Table 3 – Proposed unit acoustic information 16
Table 4 - BS 4142:2014 Table for plant noise assessment 17
Table 5 – Anticipated plant noise level with a noise barrier implemented. 18

FIGURES

Figure 1 – Satellite view of 47 Broad Street, Alresford 5
Figure 2 – Proposed position of Air Source Heat Pumps (ASHPs) 6
Figure 3 – Proposed position of ASHPs in context 6
Figure 4 – Receiver window photograph, in context 7
Figure 5 – Garage door photograph, in context 7
Figure 6 – Monitoring Location 11
Figure 7 – Acoustic parameters at monitoring location 13
Figure 8 – Statistcal analysis of background noise levels during night hours 14
Figure 9 - Statistcal analysis of background noise levels during evening hours 15
Figure 10 – Hypothetical pergola area for horizontal noise barrier 18

1 INTRODUCTION

The property at 47 Broad Street, Alresford is requesting planning application to install 2 Air Source Heat Pump units within a garage at the rear of the building.

As part of the application, it is required by the City of Winchester to submit a report detailing an impact assessment on anticipated noise levels at the closest noise-sensitive property.

This report details the acoustic study undertaken for this purpose.

2 SITE CONTEXT

The site is located in the centre of the village of Alresford as shown below in Figure 1.

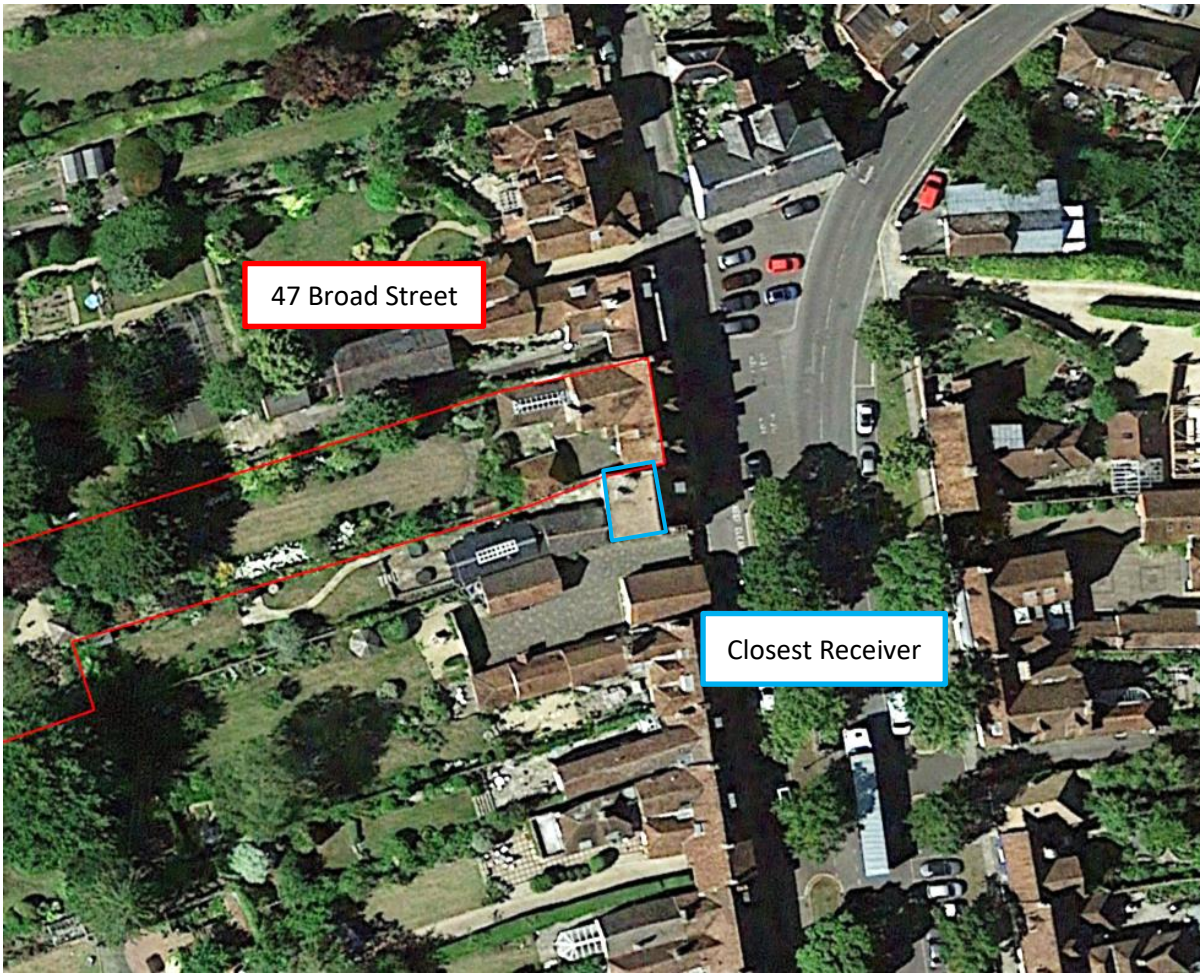


Figure 1 – Satellite view of 47 Broad Street, Alresford

The immediate surrounding area of Broad Street is a mix of residential and commercial properties, in the same vein as the rest of the village. The neighbouring buildings on either side are residential properties. Broad Street is frequently trafficked during the day, though activity drops steeply going into the night.

The location of the proposed Air Source Heat Pumps is within the front area of the garage at the rear of the property as show in Figure 2. Figure 3 shows the plan in the context of the surrounding area, with an approximate overlay with the satellite view.

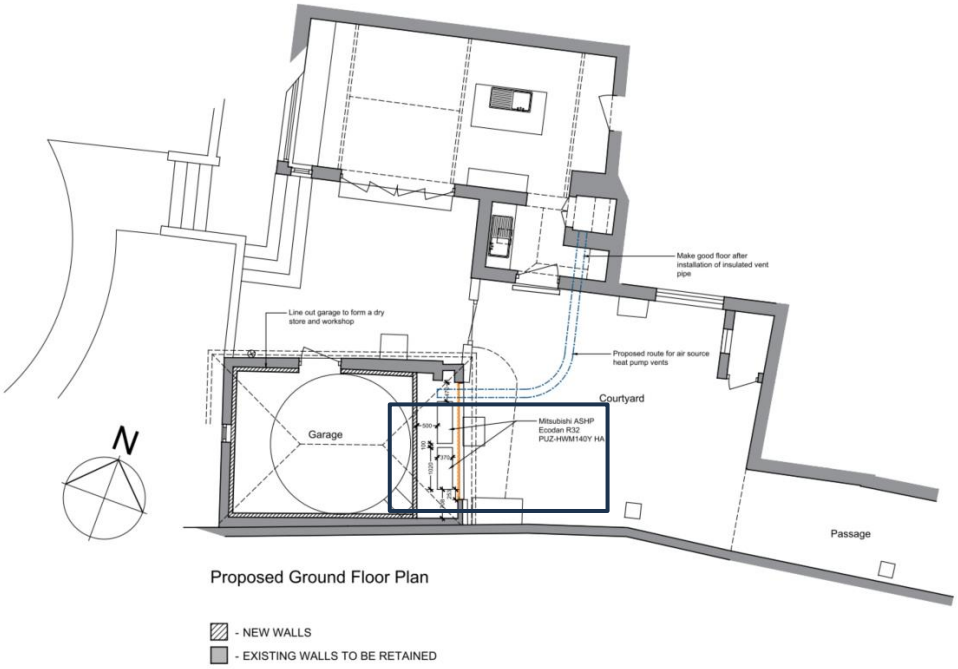


Figure 2 – Proposed position of Air Source Heat Pumps (ASHPs)

Figure 3 – Proposed position of ASHPs in context

The closest noise sensitive residential window is approximately 6m away from the garage door. Figure 4 shows the context of the distance between proposed source location and receiver; Figure 5 depicts the garage door.

Figure 4 – Receiver window photograph, in context

Figure 5 – Garage door photograph, in context

3 POLICY AND GUIDANCE ON NOISE

3.1 National Policy

National planning policy is provided in the National Planning Policy Framework (NPPF). Policy on noise implications is to *avoid* significant adverse impacts, *mitigate* and reduce other adverse impacts and to *recognise* the need for development. This is further qualified in the Noise Policy Statement for England (NPSE).

Commercial and industrial noise sources (including plant and ventilation) should normally be assessed using the methodology in BS4142: 2014, which compares the rating noise from the source with the existing background noise level to determine the likelihood of adverse impact.

Further information on the national policy and guidance is provided in Appendix 1 of this report.

3.2 British Standard BS 4142

The British Standard BS 4142: 2014, *Methods for rating and assessing industrial and commercial sound* is an update of the previous edition of the standard, and describes methods for rating and assessing sound of an industrial and/or commercial nature, to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The sound from the industrial/commercial source is rated by taking into account the sound level of the source, known as the specific sound level, and its characteristics, such as tonal, impulsive or intermittency of the source, and applying an appropriate correction to give the rating level of the sound source. To gain an initial estimate of the potential impacts of the sound source, it is compared to the background noise level, and the level by which the rating level exceeds the background noise level indicates the following potential impacts:

Difference	**Assessment**
Around 10 dB or more	Likely to be an indication of a significant adverse impact, depending on the context
Around 5 dB	Likely to be an indication of an adverse impact, depending on the context
0 dB or less	An indication of the specific sound source having a low impact, depending on the context

The standard states that "*where an initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following:*

1) *The absolute level of the sound*

2) *The character and level of the residual sound compared to the character and level of the specific sound*

3) *The sensitivity of the receptor*

The current edition of the standard also requires that the potential impact of uncertainty should be reported, and practicable steps are taken to reduce the level of uncertainty.

3.3 Local Policy

Winchester City Council – Planning Condition

Winchester City Council have provided the following planning condition:

Prior to the commencement of development, a full acoustic report shall be submitted to and approved in writing by the Local Planning Authority. The report shall ensure, with identified mitigation where appropriate, that upon completion of the development:

i. Any vehicles, machinery or equipment associated with the use of the proposed development will not have unacceptable noise or vibration impacts upon existing noise sensitive premises.

Development must then continue in accordance with the approved details. Any mitigation measures identified in the acoustic report must be in operation prior to the occupation or use of the development hereby approved.

Reason

To ensure acceptable noise levels within noise sensitive premises are maintained.

Sustainable Acoustics Ltd consider that undertaking a BS 4142 Noise Impact Assessment constitutes an appropriate methodology to produce such a report.

Winchester City Council – Technical Guidance for Noise

A relevant excerpt is copied below:

"Part 2 of the Local Plan (adopted in April 2017) forms part of the district development framework which guides future planning decisions in the Winchester district.

The main aim of Part 2 is to allocate land to help deliver the development strategy for new housing, economic growth and diversification for the period to 2031. The policy of most relevance to noise is DM20, which states: Development which generates noise pollution or is sensitive to it will only be permitted where it accords with the Development Plan and does not have an unacceptable impact on human health or quality of life. A noise generating or noise sensitive development should include an assessment to demonstrate how it prevents, or minimises to an acceptable level, all adverse noise impacts.

Assessment of these impacts should have regard to the advice contained within the Department for Environment Food and Rural Affairs (DEFRA) Noise Policy Statement for England (NPSE), March 2010, or its recognised replacement. Development will not be permitted where levels above the Significant Observed Adverse Effect Level (SOAEL) exist, and mitigation measures have not been proposed that

will reduce impacts to as near to the Lowest Observed Effect Level (LOAEL) as is reasonably possible. Mitigation measures should not render the design and amenity spaces unacceptable."

Liaison with Environmental Health

Due to the very low background noise level monitored during night-hours, Sustainable Acoustics Ltd contacted Winchester City Council Environmental Health Officer Sara Hayes-Arter to discuss whether an absolute target (as opposed to a relative target, as would normally be imposed using 4142 methodology) might be more suitable.

SAL suggested that from an external rating level of 35 dB L_{Aeq}, one might expect internal levels of 20 dB L_{Aeq} (allowing for 15 dB attenuation through an open window, as per BS 8233 Annex G). This would yield a level 10 dB below the recommended level for night-time bedroom resting as outlined in BS 8233. On 7th September 2023, Environmental Health alluded to this being a sensible target, having recently been discussed by CIEH and IOA (Chartered Institute of Environmental Health, and the Institute of Acoustics).

4 METHODOLOGY

4.1 Survey

An unattended noise survey was undertaken to gather data for background and ambient sound levels at the site between the 19th July and the 25th July 2023. The Class 1 data-logging sound level meter was installed at the rear of the site, at approximately first floor height, as marked on Figure 6 below. The meter was set to record acoustic parameters in intervals of 15 minutes and 1 minute.

The position was chosen to represent the background and ambient levels at the nearby receiver as closely as possible and was screened from road traffic noise to the same extent as the receiver.

Figure 6 – Monitoring Location

4.2 Weather

Weather during the period was warm, with temperatures ranging between 11°C and 21°C during daytimes and 11°C and 16°C during night-times. Wind direction was generally from the south-west and speeds were generally low, although occasionally exceeding 5m/s during afternoons of the 22nd and 23rd July, although not to a point where any observable adverse effect can be seen. Some light rainfall occurred on the 22nd and 24th; although, similarly, this has not affected overall levels.

4.3 Instrumentation

Instrumentation detail is provided in Table 1 below. Equipment was calibrator prior to and on completion of the survey; no noticeable drift in calibration was noted.

Equipment	Type	Serial Number	Calibration	
			Date	Certificate no
Sound Level Meter				
Svantek Class 1 Sound and Vibration Analyser	958A	59140	04/11/22	1503768-1S
Microphone	MK 255	12582	04/11/22	1503768-1S
Preamplifier	SV 12L	57964	04/11/22	1503768-1S
Calibrator				
Svantek SV33	SV33	58228	11/08/22	1503139-1

Table 1 – Instrumentation

5 RESULTS

Figure 7 provides the variation in acoustic parameters over the survey at the monitoring location.

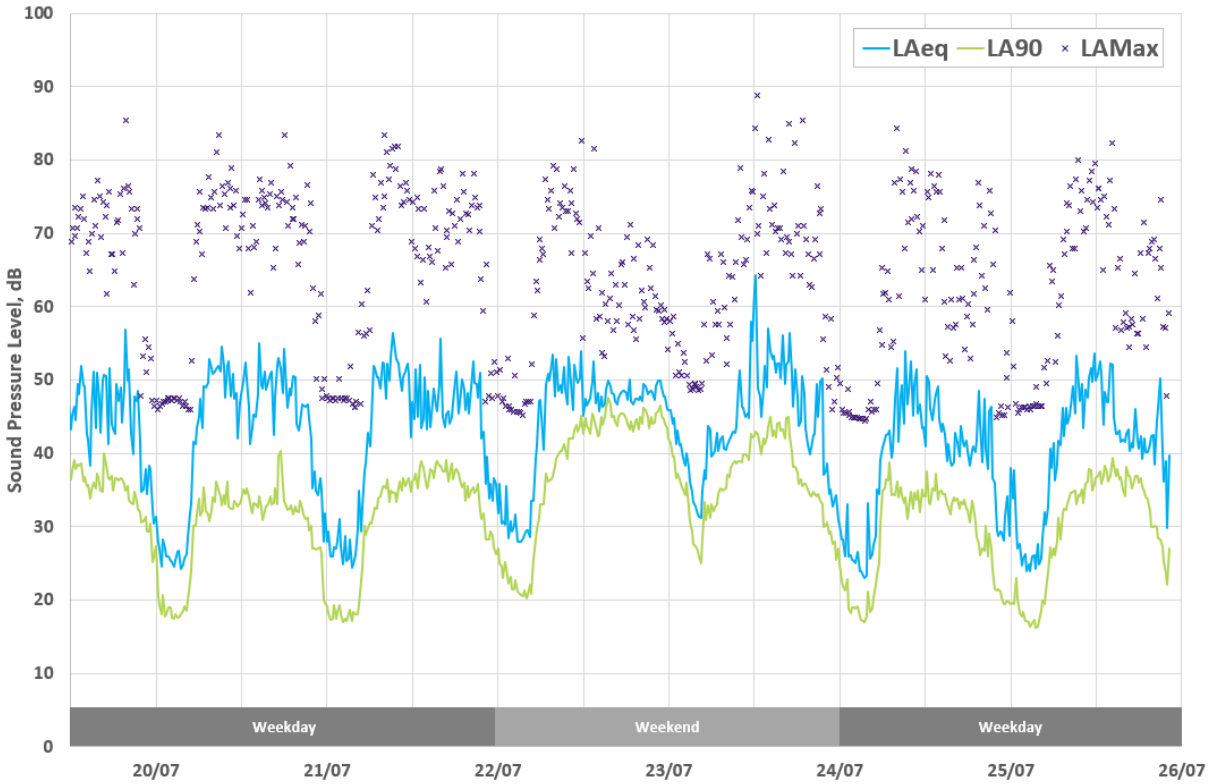


Figure 7 – Acoustic parameters at monitoring location

Table 2 below summarises these parameters over the duration of the survey, showing overall daytime, evening, and night-time noise levels measured at the long-term monitor.

	L_{Aeq}		L_{A90}		L_{AMax}	
	Range (15min)	**Average**	**Range (15min)**	**Modal**	**Range (15min)**	**Modal**
0700 – 2300 16hr daytime period	29 – 64	**49**	20 – 48	**35**	45 – 89	69
0700 – 1900 12hr daytime period	38 – 64	**50**	28 – 48	**35**	52 – 89	74
1900 – 2300 4hr evening period	29 – 57	**46**	20 – 47	**34**	45 – 86	69
2300 - 0700 8hr night-time period	23 – 52	**40**	16 – 45	**18**	45 – 78	48

Table 2 – Overall Acoustic Parameters at monitor during the survey

Calculated noise levels need to be assessed against the residual background. It is important to look at the background noise levels in context, as the lowest occurring background noise level may not be typical of the environment (overly stringent), and background noise level that occurs most often (modal) may not allow for worst-case scenarios (not stringent enough).

When considering night-time noise in this instance, as shown by Figure 8, the modal background noise level of 18 dB L_{A90}, represents a typical worst-case level, where levels are at or above this for 80% of night-time measurements.

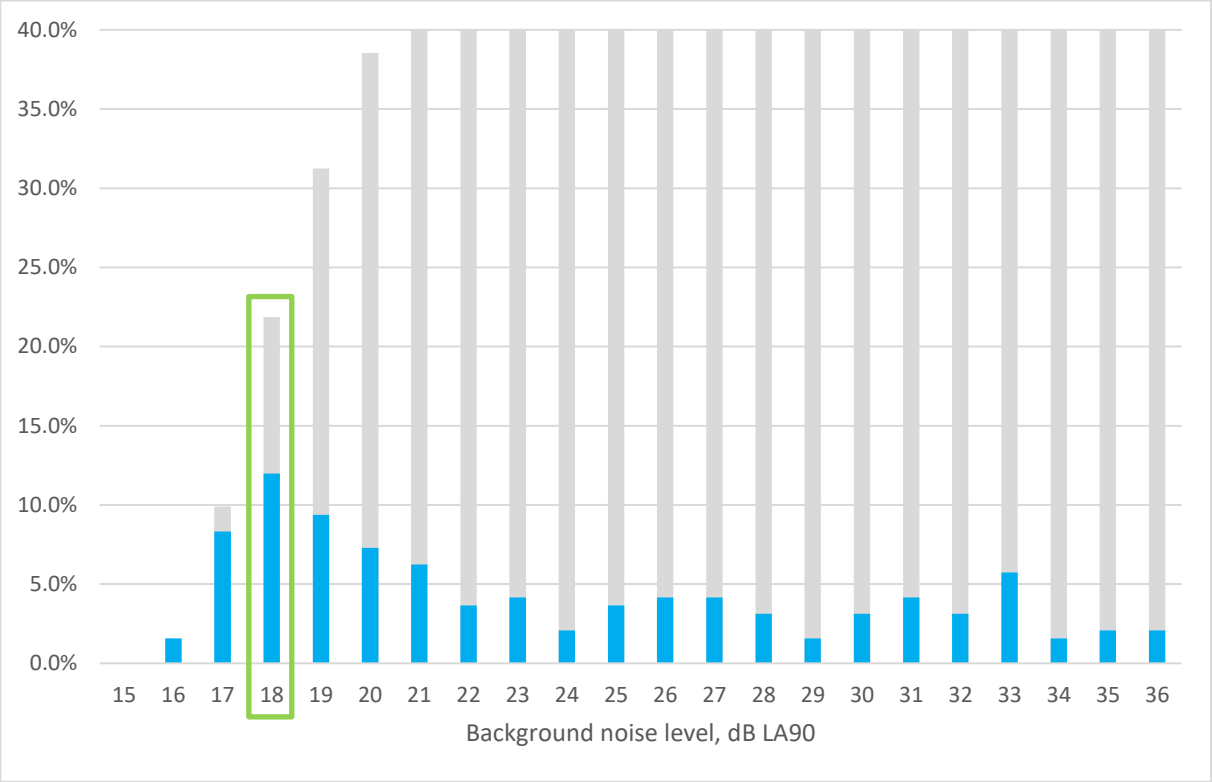


Figure 8 – Statistcal analysis of background noise levels during night hours

Figure 9 below shows the same analysis done on the evening levels (between 19:00 and 23:00). Whilst the modal background noise level is 34 dB, it is considered more appropriate to consider a more sensitive case; 80% of all evening background levels measured are above 27 dB L_{A90}.

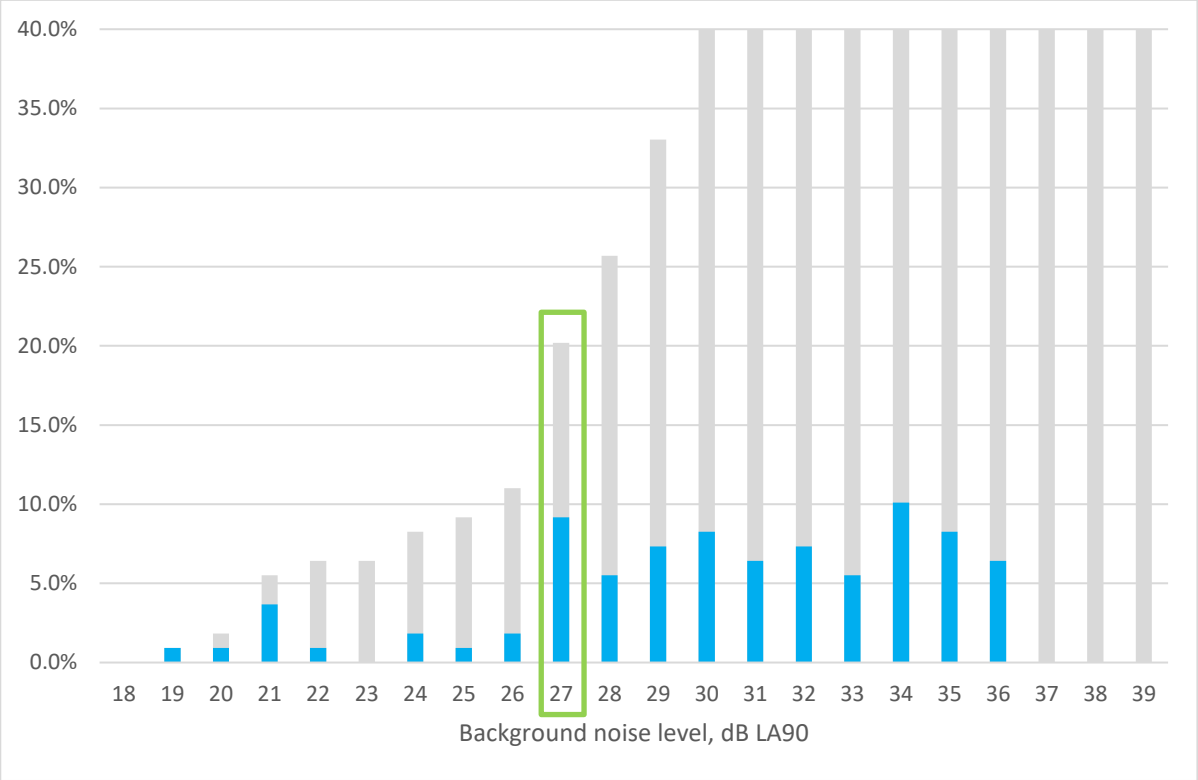


Figure 9 - Statistcal analysis of background noise levels during evening hours

6 ASSESSMENT

6.1 Proposed Plant

It is proposed to install 2 Air Source Heat Pump units within the garage area; Mitsubishi Ecodan R32 PUZ-HWM140Y HA. It is understood the ASHP are selected as external units, which sit outside the garage area (garage alterations are shown on Figure 3), and therefore open to the atmosphere overhead and to the front of the ASHPs

The Sound Power Level has been provided in manufacturers technical data sheets, and the spectral data has been estimated using data from a similar unit, calibrated to the sound power level.

Unit	A	SPL (dB) in Octave Band centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Pressure Level at 1m, dB	53	53	48	45	46	51	45	43	35
Sound Power Level, dB	67	67	62	59	60	65	59	57	49

Table 3 – Proposed unit acoustic information

6.2 Target

The background noise level during night hours is extremely low, and it is therefore considered that reaching this level may present a challenge.

Achieving a rating level of +0 dB in line with a BS 4142 methodology would normally be considered indicative of having a low impact considering the context; though as discussed in section 3.3 of this report, it is considered that a target **rating** level (taking into account any penalties as deemed necessary from a 4142 assessment) of 35 dB L_{Aeq} externally may be more appropriate; as this would likely achieve internal levels 10 dB below the criteria deemed suitable in BS 8233 for night-time resting within bedrooms

6.3 Assessment

The following assumptions are made in the following assessment:

- The distance between source (ASHPs) and nearest receiver (taken as the window at first floor as seen in Figure 4) is of the order of 6 metres.
- The wall behind the units is taken as reflective and propagation is quarter-spherical.
- Both units operate simultaneously…
- At their typical running capacity as stated in the manufacturer's datasheet. It is likely that the units will have nighttime set- back, but may go into anti-frost mode during nighttime hours, and be running on full capacity during early morning periods.
- The existing garden/boundary wall is approximately 2m in height, and approximately halfway between source and receiver.

With these assumptions, level outside the receiver window from operation of both units would be of the order of **42 dB $L_{Aeq,T}$** .

A BS 4142 assessment is completed in Table 4 below.

Results		Relevant BS4142 clause	Commentary
Specific sound power level of <u>one</u> unit	67 dB	7.3.4	Calculated by removing residual noise from the measured plant noise. *As manufacturer data is available, no correction has been considered.*
Specific sound level at receiver	≈ 42 dB (39 dB from each unit)	7.3.4	Calculated level at the closest residential window assuming quarter-spherical spreading from **two** point-sources over ≈6m with partial screening
Background sound level	18 dB L_{A90}	8.3	Typical lowest 15-minute background sound level measured during periods when proposed plant would be running.
Acoustic feature correction	+3 dB	9.2	These types of units can be tonal; though would commonly be considered distinctive against the residual acoustic environment, which is considered likely in this context*
Rating level	45 dB	9.2	Sound level at windows of façade calculated from propagation calculations with additional character penalty.
Excess of rating over background sound level	**+ 27 dB**	11	
Uncertainty of the assessment	*+1/- 3 dB*	*10*	*Uncertainty has been determined from variability in plant noise operating capacity, existing background noise levels, assumptions used in calculations and variation in façade level over the building.*

Table 4 - BS 4142:2014 Table for plant noise assessment

*Context : the residual acoustic environment is a quiet garden in a well-screened suburban village.

A BS 4142 rating level of +27 dB would normally be considered to have a significant adverse impact in this context, and it is therefore considered that mitigation measures are undertaken.

7 MITIGATION

When considering potential mitigation options, it has been assumed that there is no scope to move the units or change their hours of operation.

10 dB of attenuation would be required to achieve a level outside the window of 32 dB L_{Aeq}, which is considered to reach a rating level of 35 dB L_{Aeq} allowing for a penalty due to the type of noise being readily distinctive against the residual background.

It is recommended that the additional mitigation is achieved through the use of a barrier to screen the units.

The location of the barrier could either be as an extension to the existing wall (vertical) or as a "lip" or pergola (horizontal) as shown in Figure 10 below. In either case, it is assumed the barrier will block the line-of-sight to the window by a minimum distance (perpendicular to the propagation path between source and receiver) of **1.2m**.

A barrier can be made of a number of materials but should be solid and continuous over its area and sealed properly at the perimeter, with a surface mass of not less than 10 kg /m^2 (such as that which is achieved with marine plywood).

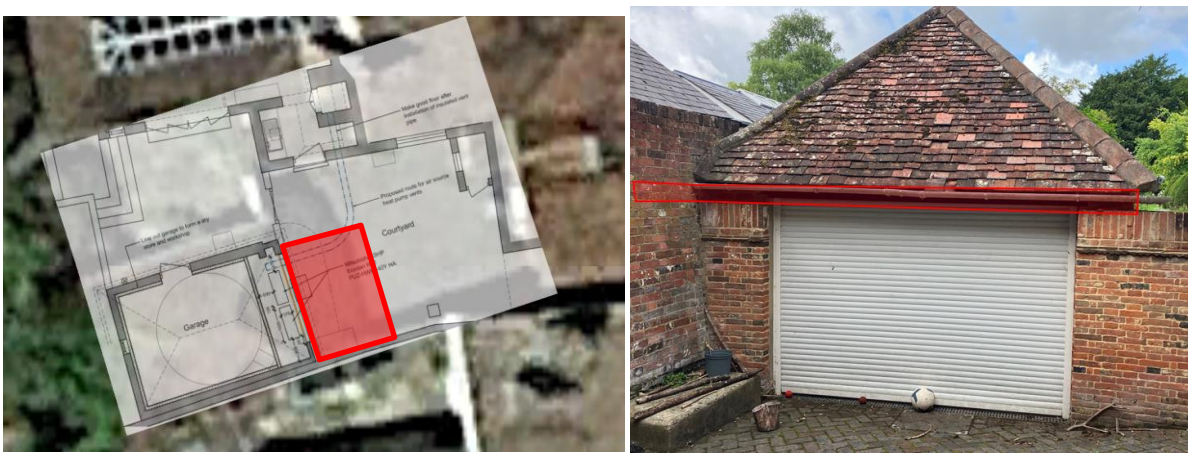


Figure 10 – Hypothetical pergola area for horizontal noise barrier

Unit	A	SPL (dB) in Octave Band centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Sound Power	70	70	65	62	63	68	62	60	52
Distance Attenuation (6m)		21	21	21	21	21	21	21	21
Barrier Attenuation		8	10	12	15	18	21	24	24
Level at Receiver	32	41	34	29	27	29	20	15	7

Table 5 – Anticipated plant noise level with a noise barrier implemented.

8 SUMMARY AND RECOMENDATION

A noise impact assessment has been carried out at the site on 47 Broad Street, Alresford as part of a study to accompany the planning application for new plant units at the rear of the garage.

Without mitigation, these units present the risk of significant adverse impact at the closest neighbouring, noise-sensitive window; should they run throughout the night.

To achieve a level of plant noise similar to the existing background, extensive mitigation would be required, which is considered overly onerous due to the very low existing background noise levels.

Following liaison with Environmental Health, it is considered that a low internal noise level can be achieved at the neighbouring window that would satisfy the requirements for night-time resting as outlined in BS 8233 with a higher external level (which would be considered a low level, in absolute terms).

Using an external rating level of 35 dB L_{Aeq} as a target, then less onerous mitigation is required, and it is determined that this can be achieved using a noise barrier that significantly blocks line of sight between source and receiver.

In conclusion, it is considered that the proposed installation can be executed with sufficient mitigation to achieve the NPSE and the NPPF requirements.

APPENDIX 1 Policy and Guidance on Noise

A1.1 National Planning Policy Framework

Current planning policy is based on the National Planning Policy Framework (NPPF), revised in July 2021, which supports a presumption in favour of sustainable development, unless the adverse impacts of that development would outweigh the benefits when assessed against the policies in the Framework, taken as a whole.

The noise implications of development are recognised at paragraph 185, where it is stated that planning policies and decisions should:

- *"mitigate and reduce to a minimum potential adverse impacts from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[1]"*
- *"Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*

The Government's objective is to significantly boost the supply of homes, but puts in place protections for existing business in paragraph 187:

> *"Planning policies and decisions should ensure that new development can be integrated effectively with existing business and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses 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."*

A1.2 Noise Policy Statement for England

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England[2] (NPSE). This document sets out a policy vision to

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

To achieve this vision the Statement sets the following three aims:

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

- *avoid significant adverse impacts on health and quality of life*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.*
- The following descriptive terms are implemented in the NPSE:

[1] See Explanatory Note to the Noise Policy Statement for England.
[2] Department for Environment, Food and Rural Affairs, *Noise Policy Statement for England,* London, 2010

- 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.

A1.3 National Planning Policy Guidance on Noise (July 2019)

This guidance is consistent with the policy within NPSE. The newly refreshed guidance says *"Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset".*

It also say noise can override other planning concerns, where justified, "*although it is important to look at noise in the context of the wider characteristics of a development proposal".*

It makes clear that "*As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy".*

The guidance provides the following "Noise Exposure Hierarchy Table":

Response	Examples of outcomes	Increasing effect level	Action
NO OBSERVED EFFECT LEVEL			
Not present	No Effect	No Observed Effect	No specific measures required
NO OBSERVED ADVERSE EFFECT LEVEL			
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
LOWEST OBSERVED ADVERSE EFFECT LEVEL			
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 and reduce to a minimum
SIGNIFICANT OBSERVED ADVERSE EFFECT LEVEL			
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

A1.4 ProPG

Professional Practice Guidance on Planning & Noise: New Residential Development, published May 2017 by a Working Group of the Institute of Acoustics, Association of Noise Consultants and Chartered Institute of Environmental Health to provide guidance on the approach to the management of noise within the planning system in England. Whilst it is not an official government code of practice, it is endorsed by the appropriate professional bodies and reflects the NPSE, NPPF and Planning Practice Guidance. It is restricted primarily to the consideration of new residential development that will be exposed to transportation noise sources.

ProPG advocates consideration of noise at an early stage and good acoustic design to produce sustainable development. Design target noise levels are based on BS 8233: 2014 with additional guidance on individual noise events at night, how windows and ventilation should be assessed and how the assessment should be considered where target noise levels may be difficult to achieve.

The criteria for the ProPG Stage 1: Initial Site Risk Assessment are reproduced overleaf.

Note also that Appendix A para A.19: "A site should be regarded as high risk where the $L_{Amax,\,f}$ exceeds or is likely to exceed 80 dB more than 20 times per night."

As an additional note to the final comment at the bottom of Figure 1; NOTE 4 in Figure 2 with ProPG guidance gives the following advice in relation to maximum noise levels: *"In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night."*

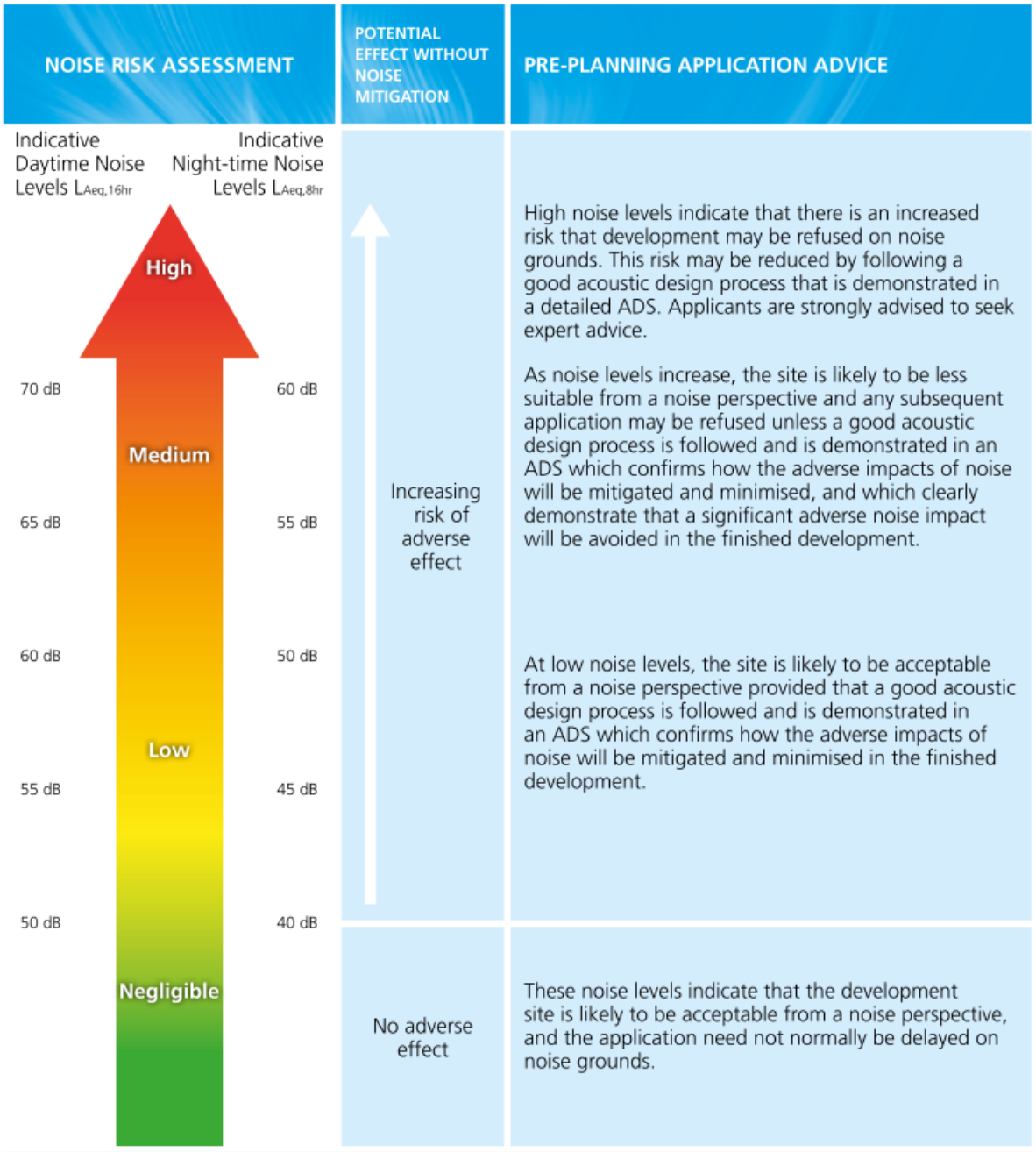


Figure 1. Stage 1– Initial Site Noise Risk Assessment

A1.5 BS 8233: 2014

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

Activity	**Location**	**07:00 to 23:00**	**23:00 to 07:00**
Resting	Living room	35 dB $L_{Aeq,\ 16\ hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,\ 16\ hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$

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

BS 8233 states that regular induvial noise events can cause sleep disturbance and that a guideline value in terms of SEL or $L_{Amax,\ F}$ may be set depending on the character and number of events. *ProPG adds to these criteria with the advice that good acoustic design should aim limit individual events to not more than 45 dB $L_{Amax,\ F}$ more than 10 times per night (inside bedrooms).*

Where development is considered necessary or desirable, despite external noise level above WHO guidelines, it is noted in BS 8233 that the above target levels may be relaxed by up to 5 dB. *ProPG expands on this stating that the more often internal noise levels exceed the target by more than 5 dB, the more likely they are to be regarded as unreasonable and it should be demonstrated how these will be kept to a minimum. Where internal target levels are exceeded by more than 10 dB they are highly likely to be regarded as unacceptable and should be prevented.*

APPENDIX 2 Instrumentation

Equipment	Type	Serial Number	Calibration	
			Date	Certificate no
Internal Monitoring				
Svantek Class 1 Sound and Vibration Analyser	958A	59140	19/10/20	14016196-1
Microphone	MK 255	12582	19/10/20	14016196-1
Preamplifier	SV 12L	57964	19/10/20	14016196-1
Calibrator				
Svantek SV33	SV33	58228	11/08/22	1503139-1

APPENDIX 3 Acoustic Terminology

Environmental Noise

Environmental noise is normally described in terms of the single figure A-weighted sound pressure level, in decibels (dB). The A-weighting corresponds to the frequency sensitivity of the ear and, therefore, provides an approximation to the subjective response to sound at different frequencies. When a sound level is expressed in this way, the units can be denoted dB(A).

When sound is time varying, it is convenient to express the sound level using an indicator, or descriptor that takes account of this variation. Two types of indicator are in common use, the equivalent continuous sound level and the statistical indicators.

Equivalent continuous sound level

$L_{Aeq, T}$: This indicator provides the overall noise exposure to time varying sound and is the energy average of the sound over a specified time period. It is the notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound over the same period. It is denoted $L_{eq, T}$, or, if A-weighted, $L_{Aeq, T}$, where T is the time period of interest.

Statistical indicators

The statistical indicators are also single figure descriptors, but provide additional information on the temporal variation of the noise level with time. The indicators are expressed as the sound level exceeded for a specified percentage of the time period of interest and the most commonly used are described below:

$L_{A90, T}$: the A-weighted noise level exceeded for 90% of the time period T. This indicator is representative of the noise level occurring in the absence of short-term events and is used in the UK to represent the background noise level.

$L_{A10, T}$: the A-weighted noise level exceeded for 10% of the time period T. This indicator is used in the UK to define traffic noise, although in PPG 24 the $L_{Aeq, T}$ is used. For freely flowing continuous traffic, the $L_{Aeq, T}$ is approximately 3 dB lower than the $L_{A10, T}$.

$L_{A1, T}$: the A-weighted noise level exceeded for 1% of the time period T. This indicator is representative of any short-term peaks that occur in the time period.

$L_{Amax, T}$: the maximum A-weighted noise level that occurred during the time period T. It usually includes an additional subscript, slow (s) or fast (f), ie $L_{Amax, slow, T}$ or $L_{Amax, fast, T}$ which denotes the response time used in the analysis algorithm. The fast response tracks the maximum level of a rapidly changing sound more accurately than the slow response and the value is generally higher for impulsive or transient sounds.

$L_{Amin, T}$: the minimum A-weighted sound level occurring in the time period T, expressed in a similar way to the $L_{Amax, T}$.

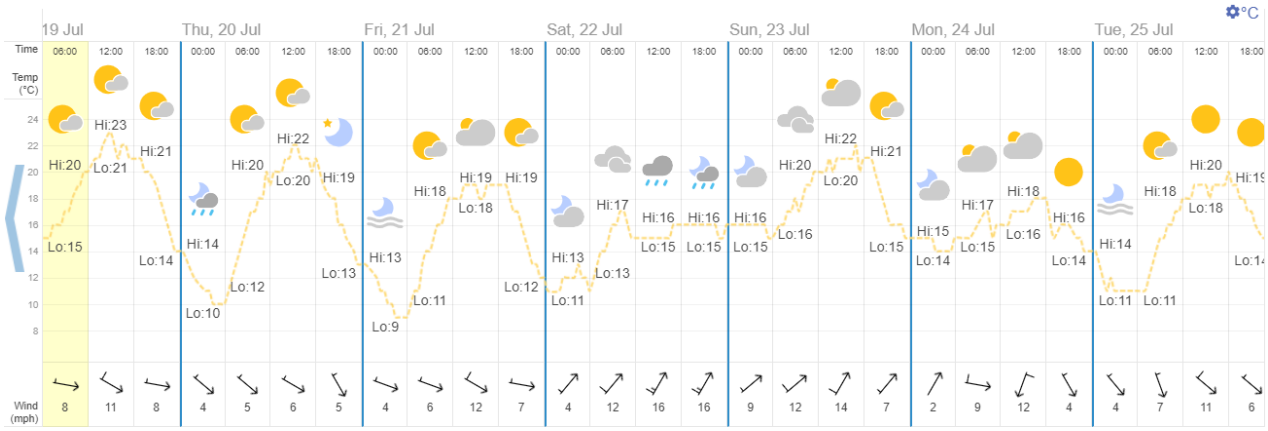
Sound Insulation

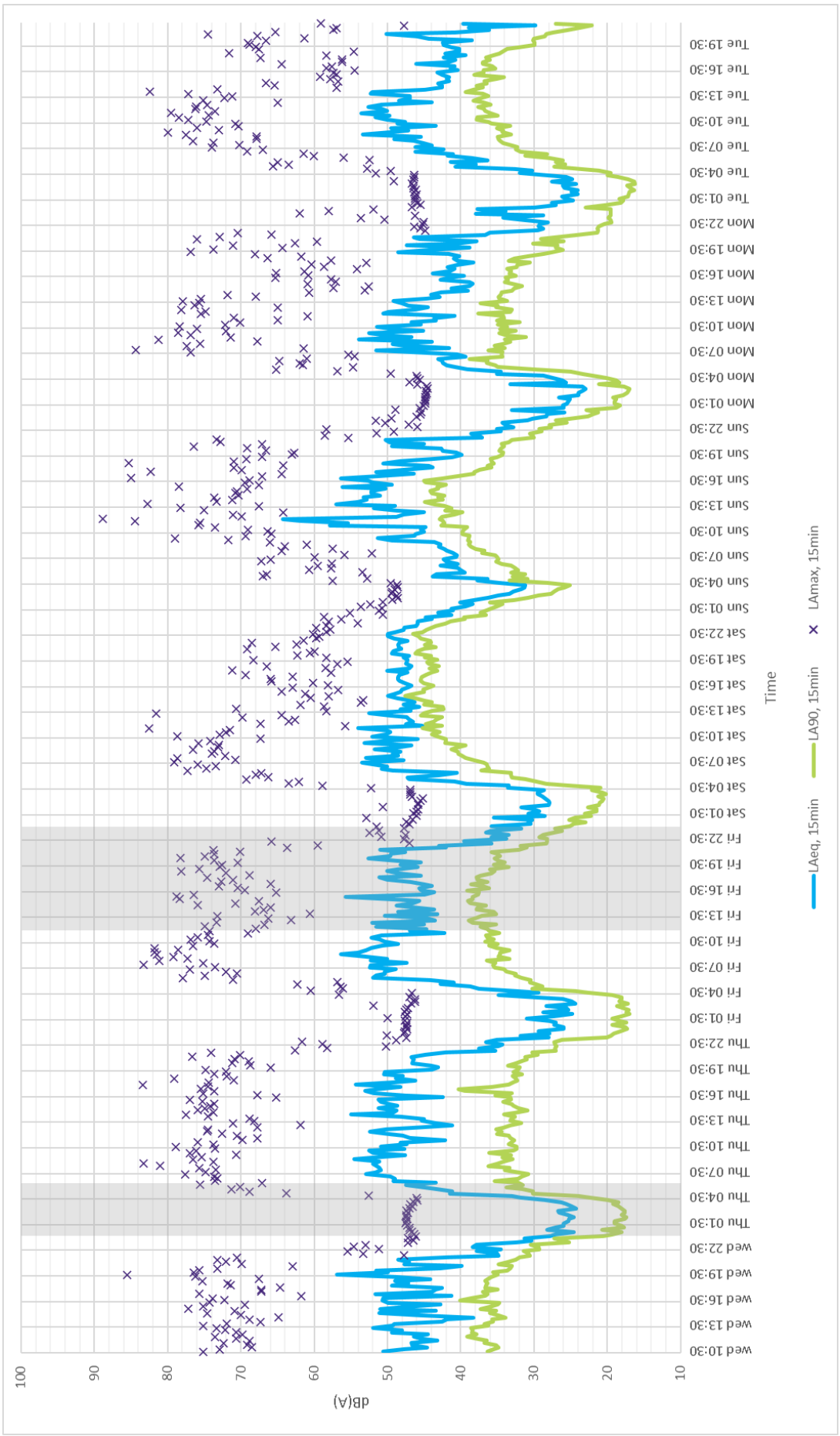
When specifying the level of sound insulation required for a given building element the following descriptors may be used:

R_w: the 'weighted sound reduction index'. This represents the level of sound reduction measured in a laboratory for a given building element. The w denotes 'weighting' and takes account of the deviations in sound reduction at a range of frequency bands when compared with a reference curve to determine the single figure value. Note this does not represent the in-situ performance of an installed element. Manufacturers should quote the R_w performance for their products.

R_{Tra}: This is the A-Weighted sound reduction of road traffic noise and is sometimes quoted by window manufacturers. This takes account of a standard road traffic noise spectrum, which has a bias towards low frequency. For a typical domestic room, the R_{Tra} can be subtracted from the A-weighted free-field external noise level to obtain the approximate internal noise level. Note this is not valid for other situations, such as a relatively large window area, a small room volume, or a highly reverberant room.

D_{new}: This is a way to represent the sound insulation provided by a small building element, such as a ventilation opening. The 'D' denotes the sound level difference measured across the installed element 'e' and is normalised 'n' to take account of the receiving room properties in which it was measured, and weighted 'w' by comparing the level difference across a range of frequency bands and comparing with a standard reference curve to provide a single figure value. Manufacturers of small building elements such as ventilation openings should state the D_{new} performance of their products.




dB(A)
100
90
80
70
60
50
40
30
20
10
Time
wed 10:30
wed 13:30
wed 16:30
wed 19:30
wed 22:30
Thu 01:30
Thu 04:30
Thu 07:30
Thu 10:30
Thu 13:30
Thu 16:30
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Sun 04:30
Sun 07:30
Sun 10:30
Sun 13:30
Sun 16:30
Sun 19:30
Sun 22:30
Mon 01:30
Mon 04:30
Mon 07:30
Mon 10:30
Mon 13:30
Mon 16:30
Mon 19:30
Mon 22:30
Tue 01:30
Tue 04:30
Tue 07:30
Tue 10:30
Tue 13:30
Tue 16:30
Tue 19:30
LAeq, 15min
LA90, 15min
LAmax, 15min

Winchester City council refers to the Environmental Protection Act 1990 when evaluating what can be done about noise nuisance:

Abatement notice in respect of noise in street.

(1)In the case of a statutory nuisance within section 79(1)(ga) above that—

(a)has not yet occurred, or

(b)arises from noise emitted from or caused by an unattended vehicle or unattended machinery or equipment,

the abatement notice shall be served in accordance with subsection (2) below.

(2)The notice shall be served—

(a)where the person responsible for the vehicle, machinery or equipment can be found, on that person;

(b)where that person cannot be found or where the local authority determines that this paragraph should apply, by fixing the notice to the vehicle, machinery or equipment.

(3)Where—

(a)an abatement notice is served in accordance with subsection (2)(b) above by virtue of a determination of the local authority, and

(b)the person responsible for the vehicle, machinery or equipment can be found and served with a copy of the notice within an hour of the notice being fixed to the vehicle, machinery or equipment,

a copy of the notice shall be served on that person accordingly.

(4)Where an abatement notice is served in accordance with subsection (2)(b) above by virtue of a determination of the local authority, the notice shall state that, if a copy of the notice is subsequently served under subsection (3) above, the time specified in the notice as the time within which its requirements are to be complied with is extended by such further period as is specified in the notice.

(5)Where an abatement notice is served in accordance with subsection (2)(b) above, the person responsible for the vehicle, machinery or equipment may appeal against the notice under section 80(3) above as if he had been served with the notice on the date on which it was fixed to the vehicle, machinery or equipment.

(6)Section 80(4) above shall apply in relation to a person on whom a copy of an abatement notice is served under subsection (3) above as if the copy were the notice itself.

(7)A person who removes or interferes with a notice fixed to a vehicle, machinery or equipment in accordance with subsection (2)(b) above shall be guilty of an offence, unless he is the person responsible for the vehicle, machinery or equipment or he does so with the authority of that person.

(8)A person who commits an offence under subsection (7) above shall be liable on summary conviction to a fine not exceeding level 3 on the standard scale.]