



QUIET WATERS,
ROUNDSTONE LANE,
ANGMERING

External Building
Fabric Assessment

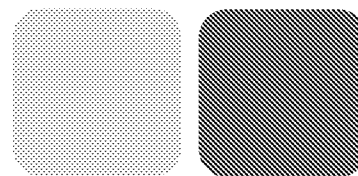
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External Building Fabric Assessment



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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	14 May 2018	Joe Allen	Robert Barlow

Terms of contract:

RBA Acoustics Ltd has prepared this report in accordance with our Scope of Work 8689.ACB01.0 dated 3 May 2018. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and again will need to be developed in to full working drawings by the lead designer to incorporate all other design disciplines

In line with our Environmental Policy, up to two hard copies of the report will be provided upon request. Additional copies of the report, or further hard copies of revised reports, would be subject to an administrative cost of £20.00 (+VAT) per copy.



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1.0 INTRODUCTION

A new residential development is proposed at the former Quiet Waters site, Roundstone Lane, Angmering. The development consists of 30 new residential units.

A Planning Condition has been attached to the permission (A/132/17/OUT) requiring that the scheme be designed such that external noise levels are suitably controlled and acceptable internal living conditions are achieved.

An assessment has therefore been carried out in relation to the noise levels likely to be incident on the proposed building façades so as to provide acoustic performance specifications such that the acceptable internal noise criteria can be achieved.

This report details the results of the noise survey and sets out the acoustic performance requirements of the external building fabric elements suitable for submission to Arun District Council for discharge of the Planning Condition.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following 24 hour period:

Wednesday 9 May to Thursday 10 May 2018.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period, however the based on observations during the site visits, and weather reports for the area, it was generally considered suitable for obtaining representative noise measurements, it being predominantly dry with little wind.

Measurements were made of the L_{A90} , L_{Amax} and L_{Aeq} noise levels over sample periods of 15 minutes duration.

2.2 Measurement Locations

To determine the existing noise climate around the site measurements were undertaken at the following two location:

Position 1

The microphone was positioned in free-field conditions at a height of 3m above ground and approximately 8m from the nearest roadside kerb of Roundstone Lane. This position is therefore considered to be representative of noise levels on the façades of the future dwellings. A correction is required to be made to the noise levels to account for barrier screening by the site hoardings.

Position 2

The microphone was positioned in free-field conditions at a height of 2m above ground to the east of the development site. This position is therefore considered to be representative of noise levels due to commercial activity associated with the Haskins Garden Centre to the east of the site.

The measurement positions are also illustrated on the site plan attached in Figure 1, and accompanying photo in Figure 2.

The prevailing noise climate was predominantly affected by road traffic along Roundstone Lane.

2.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix C.

The sound level meters were calibrated both prior to and on completion of the survey with no significant calibration drifts observed.

2.4 Results

The noise levels measured are shown as time-histories on the attached Graphs 1-4.

In order to ensure a worst case assessment the lowest background L_{A95} noise levels measured have been used in our analyses. The period averaged L_{Aeq} noise levels measured are summarised in Table 1, along with the lowest period L_{A95} and the typical L_{AFmax} levels measured during the night time.

Table 1 – Measured Levels

Position	Measurement Period	Measured Sound Pressure Level		
		L_{Aeq} [dBA]	L_{A95} [dBA]	Typical L_{AFmax} [dBA]
Position 1	Daytime (07:00 – 23:00)	62.0	40.8	-
	Night-time (23:00 – 07:00)	54.6	36.0	75.2
Position 2	Daytime (07:00 – 23:00)	51.7	46.8	-
	Night-time (23:00 – 07:00)	39.3	30.6	60.4

A brief explanation of the acoustic terminology used in this report is shown within Appendix A.

QUINT WATERS, ROUNDSTONE LANE, ANGMERING / External Building Fabric Assessment

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The standard advises internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties as set out in Table 2. A brief explanation of the acoustic terminology used in this report is shown in Appendix A attached.

Table 2 – BS 8233:2014 Residential Criteria

Room	07:00 to 23:00	23:00 to 07:00
Living Rooms	35 dB $L_{Aeq,16hour}$	--
Dining Room/area	40 dB $L_{Aeq,16hour}$	--
Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

3.3 World Health Organisation: Guidelines for Community Noise

The document describes guideline levels that are “essentially values for the onset of health effects from noise exposure”.

A table of guideline values is included, relating to adverse health effects, referred to as any temporary or long term deterioration in physical, psychological, or social functioning that is associated with noise exposure. Table 3 sets out the guidance from *Table 4.1: Guideline values for community noise in specific environments*, as stated in the document.

Table 3 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	L_{Amax} (dB)
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-times	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

With reference to maximum noise levels the following guidance is provided within the WHO guidance:

“For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10-15 times per night (Vallet & Vernet 1991) and most studies show an increase in the percentage of awakenings at SEL values of 55-60 dBA (Passchier-Vermeer 1993; Finegold et al. 1994; Pearsons et al. 1995). For intermittent events that approximate aircraft noise, with an effective duration of 10-30s, SEL values of 55-60 corresponds to a L_{Amax} value of 45dB. Ten to 15 of these events during an 8 hour night-time implies a $L_{Aeq, 8h}$ of 20-25dB. This is 10-15dB below the $L_{Aeq, 8h}$ or 30dB for continuous night-time noise exposure, and shows that intermittent character of noise must be taken into account when setting night-time noise limits for noise exposure. For example, this can be achieved by considering the number of noise events and the difference between the maximum sound pressure level and the background of these events.”

Therefore the frequency of occurrence of maximum noise events should not typically exceed 10-15 times in any night.

3.4 British Standard 4142

BS4142:2014 Methods for rating and assessing industrial and commercial sound describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

- sound from industrial and manufacturing processes;
- sound from fixed installations which comprise mechanical and electrical plant and equipment;
- sound from the loading and unloading of goods and materials at industrial and/or commercial premises;
- sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described within BS4142:2014 use outdoor sound levels 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 standard is also applicable to determine rating levels for sound of an industrial or commercial nature at proposed new dwellings or premises used for residential premises.

The assessment method described in BS4142:2014 is based on the continuous sound pressure level produced by a specific source ($L_{Aeq,T}$) at the assessment location. Appropriate corrections allowing for any tonality, impulsivity, other characteristics or intermittency of the specific sound source are then applied to derive the rating level ($L_{A,r,T}$). The rating level is then compared to the background sound level ($L_{A90,T}$) to produce the relative difference, or excess of rating level over background sound level. BS4142:2014 quantifies the estimated impact from the excess as:

Typically the greater this difference, the greater the magnitude of impact:

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

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

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.

In the context of this development, it is considered that the primary source of noise is that of road traffic along Roundstone Lane and not and nearby industrial activity and therefore the criteria outlined in BS8233 and WHO are the most appropriate.

3.5 Summary

The project criteria adopted are therefore as follows:

Bedroom	Night-time (23:00-07:00)	30dB L_{Aeq} 45dB $L_{Amax,T}$
Living Rooms	Daytime (07:00-23:00)	35dB L_{Aeq}

4.0 EXTERNAL BUILDING FABRIC ASSESSMENT

4.1 Background

Analyses of the external building fabric have been undertaken in order to ascertain the required acoustic performance of the glazing and other external fabric elements to achieve the project criteria.

4.2 Assumptions

Our external building fabric analyses have assumed the following:

(a) Drawings

The assessment has been based on the information provided in the following drawings:

- Bedaro Proposed Site Layout dated May 2018

(b) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 2.4.

(c) Room Absorption

The bedrooms are assumed to be acoustically "soft" with carpets, curtains and other soft furnishings. For the purposes of our analyses we have assumed the absorption coefficients detailed in Tables 4 and 5.

Table 4 – Bedroom Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.25	0.27	0.31	0.32	0.32	0.32

The living rooms are assumed to be less acoustically absorptive (with a hard floor finish, although with furnishings). For the purposes of our analyses we have assumed the following absorption coefficients.

Table 5– Living Room Absorption Coefficients

Absorption Coefficient (α) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
0.15	0.18	0.20	0.22	0.22	0.22	0.23	0.27

(d) External Wall

External non-glazed areas are to comprise the following:

- External Brickwork
- Thermal insulation and cavity
- Blockwork

As such, we have assumed the following sound reduction indices (equating to an overall R_w of 52dB) for all non-glazed façade areas comprising the above construction:

Table 6-- Non-Glazed SRIs

Assumed Sound Reduction Index [dB] at Octave Band Centre Frequency [Hz]							
63	125	250	500	1k	2k	4k	8k
36	41	45	45	54	58	58	58

Should the proposals for non-glazed areas change, it is critical we are informed at the earliest opportunity as this could have a significant impact on the sound insulation performance requirements of the glazing systems.

(e) Ventilation

It is understood the chosen strategy is natural ventilation via trickle ventilators. These have also been assessed and the acoustic performance specification for such trickle ventilators is detailed below.

It should be noted the trickle ventilators provide background trickle ventilation only and that windows are to generally be openable to provide rapid ventilation. During those periods where windows are opened for purge/rapid ventilation, noise levels will naturally be increased internally.

4.3 Specification & Guidance Constructions

Appendix B details the sound reduction performance specification for glazed elements of the external building fabric. The glazing performance specifications apply to the glazing package as a whole inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seals, etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc.

For guidance purposes we would typically expect the following glazing configurations detailed below to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix B.

Please note – The glazing configurations described in Table 7 and ventilator types described in Table 8 are given for costing purposes only. All window systems should be capable of meeting the performance specifications shown in Appendix B, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a window configuration will meet the performance specification.

Table 7-- Glazing Guidance Constructions

Glazing Type	Glazing Configuration
G1	Medium spec double glazing e.g. 10mm glass / 12mm cavity / 4mm glass
G2	Standard thermal double glazing (preferably with differing pane thicknesses) e.g. 4mm glass / 12mm cavity / 6mm glass

For guidance purposes we would typically expect the following trickle ventilator types to prove commensurate with achieving the sound insulation performance specifications detailed within Appendix B.

Table 8-- Guidance Trickle Ventilator Types

Ventilator Type	Example Ventilator Type
V1	An acoustically rated "through-the-frame" type trickle ventilator
V2	Any standard "through-the-frame" type trickle ventilator with direct air path

4.4 Applicable Zoning

Due to the differences in the prevailing noise climate around the site and the types of rooms at each floor level, two primary glazing zones have been defined, as indicated on the façade zoning plan provided in Figure 2 in Appendix E.

- | | | | | |
|------|--------|---|------------------|----|
| (i) | Zone 1 | – | Glazing Type: | G1 |
| | | | Ventilator Type: | V1 |
| (ii) | Zone 2 | – | Glazing Type: | G2 |
| | | | Ventilator Type: | V2 |

5.0 AMENITY SPACE

With reference to the measured levels reported in Table 1, it can be seen that noise levels to the rear of the site away from Roundstone Lane are within the upper limit for amenity space as referred to in BS8233 and WHO (L_{eq} 55 dBA).

Similarly, gardens associated with the houses affronting Roundstone Lane are located to the rear of the buildings and so, once screening from the future buildings is accounted for, noise levels will also be within the 55 dBA upper limit.

6.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at Quiet Waters, Roundstone Lane, Angmering. The measured noise levels are presented within this report. The resultant noise levels have been used in the assessment of the glazing requirements to ensure suitable internal noise levels are achieved at the proposed development with reference to BS 8233 and WHO and Planning Condition 5.

General guidance configurations have been suggested for the glazing constructions that should be capable of achieving the required specifications detailed within Appendix B.

Appendix A - Acoustic Terminology

dB	Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.
dB(A)	The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level. Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.
L_{eq}	L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (1 hour).
L_{Aeq}	The level of notional steady sound which, over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measured over that period.
L_n (e.g. L_{A10} , L_{A90})	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time, hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the average minimum level and is often used to describe the background noise.
$L_{max,T}$	The instantaneous maximum sound pressure level which occurred during the measurement period, T. It is commonly used to measure the effect of very short duration bursts of noise, such as for example sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the general level of, say, traffic noise, but because of their very short duration, maybe only a very small fraction of a second, may not have any effect on the L_{eq} value.

Appendix B – External Building Fabric Acoustic Specification

1.0 Window Sound Insulation Performance

Glazed units (inclusive of glazing, louvres, timber panels, spandrel panels, infill panels, framing, opening lights, balcony/terrace doors, seals, etc. as appropriate) should achieve the following minimum sound reduction indices as tested in general accordance with BS EN ISO 10140-2:2010:

Type	Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R _w (dB)
	63	125	250	500	1k	2k	4k	8k	
G1	21	25	22	33	40	43	44	44	36
G2	19	23	24	23	32	38	35	35	31

Note: R_w is the "overall weighted sound reduction index" tested in a laboratory.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency-specific performance levels may ultimately prove acoustically acceptable. Test data for representative samples of all glazing systems shall be submitted to RBA Acoustics for approval to demonstrate compliance with the above performance specifications.

2.0 Trickle Ventilator Sound Insulation Performance

Trickle ventilators (in their open state) should achieve the following minimum element-normalised level differences as tested in accordance with BS EN 20140-10:1992:

Type	Minimum Recommended D _{n,w} (dB) at Octave Band Centre Frequency (Hz)								D _{n,e,w} (dB)
	63	125	250	500	1k	2k	4k	8k	
V1	30	34	38	43	42	34	34	34	39
V2	31	35	35	34	36	34	34	34	35

Note: D_{n,e,w} is the "overall weighted element normalised level difference" tested in a laboratory.

Please note the above specification(s) assumes one trickle ventilator will be installed per room, i.e. a continuous mechanical extract system (ADF System 3) will be utilised. The specification(s) should be increased by a factor of 10Log(N) should N ventilators be required per room, i.e. increase by +3dB or +5dB respectively should two or three ventilators be required per room.

N.B. as the internal noise criteria are expressed in dBA terms, other frequency specific performance levels may ultimately prove acoustically acceptable. Test data for the trickle vents in their open state shall be submitted to RBA Acoustics for approval.

Appendix C - Instrumentation

The following equipment was used for the measurements

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Expiry Date
Norsonic Type 1 Sound Level Meter	Nor140	1406116	U23172	24 November 2018
Norsonic Pre Amplifier	1209	20295		
Norsonic ½" Microphone	1225	215486	23171	24 November 2018
Norsonic Sound Calibrator	1251	34307	U23170	24 November 2018
Norsonic Type 1 Sound Level Meter	Nor140	1406258	U25097	23 March 2019
Norsonic Pre Amplifier	1209	20490		
Norsonic ½" Microphone	1225	225526	25096	23 March 2019
Norsonic Sound Calibrator	1251	34397	U25095	23 March 2019

Appendix D – CDM Considerations

The likelihood the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

- 1 – Remote (almost never)
- 2 – Unlikely (occurs rarely)
- 3 – Possible (could occur, but uncommon)
- 4 – Likely (recurrent but not frequent)
- 5 – Very likely (occurs frequently)

The severity of harm can be assessed by applying an indicative score (from 1 to 5) as follows:

- 1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
- 2 – Minor (e.g. small cut, abrasion, basic first aid need)
- 3 – Moderate (e.g. strain, sprain, incapacitation > 3 days)
- 4 – Serious (e.g. fracture, hospitalisation > 24 hrs, incapacitation > 4 weeks)
- 5 – Fatal (single or multiple)

The rating value is obtained by multiply the two scores and is then used to determine the course of action.

Rating Bands (Severity x Likelihood)		
Low Risk [1 – 8]	Medium Risk [9 – 12]	High Risk [15 – 25]
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Acoustic glazing - weight	Strain of neck, limbs or back. Fall from height.	Contractors	3	5	15	Provide sufficient manpower, lifting gear and structural support	1	5	5

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Site Plans

Quiet Waters, Angmering

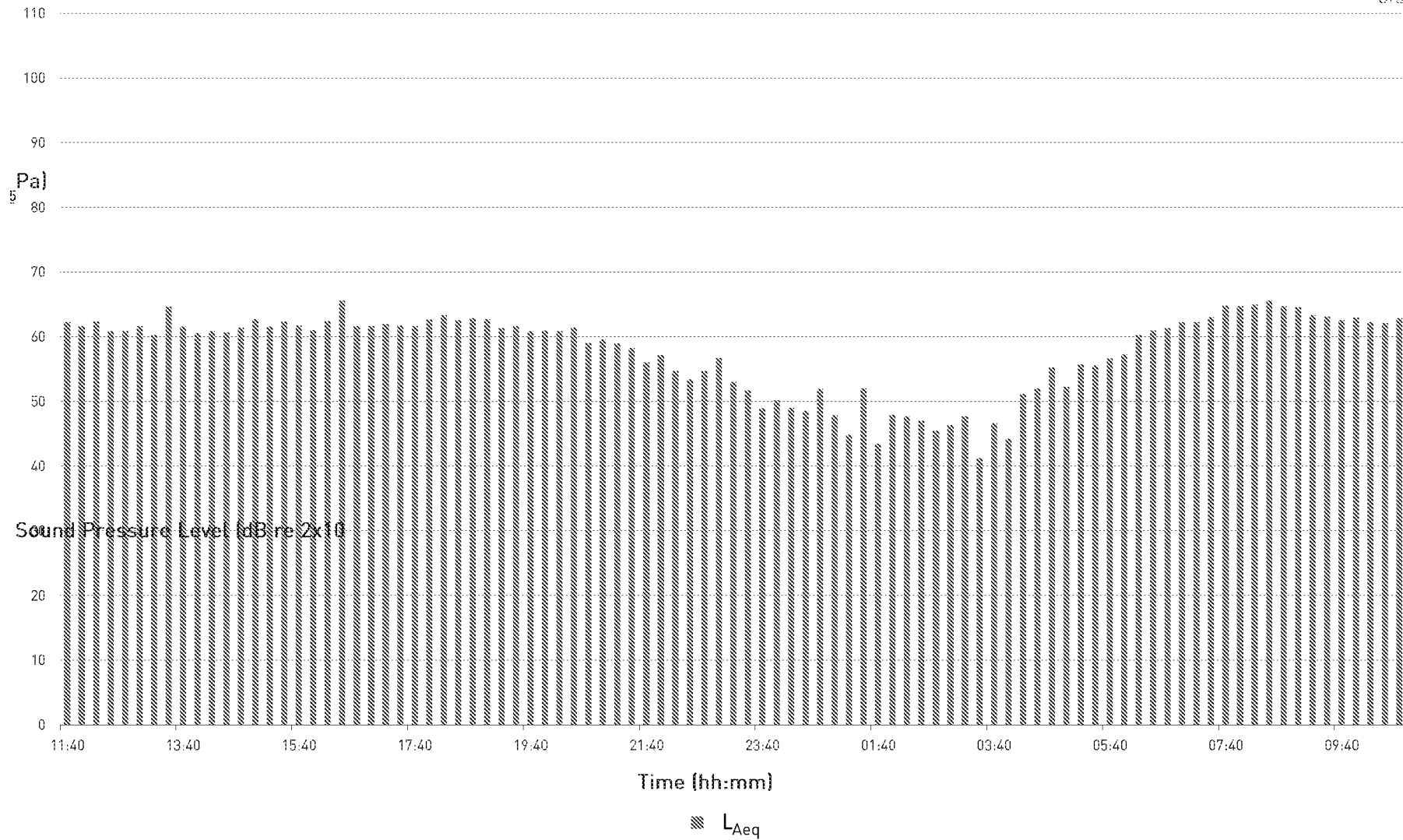
L_{Aeq} Time History

Roundstone Lane



Project: 8689

Graph 1

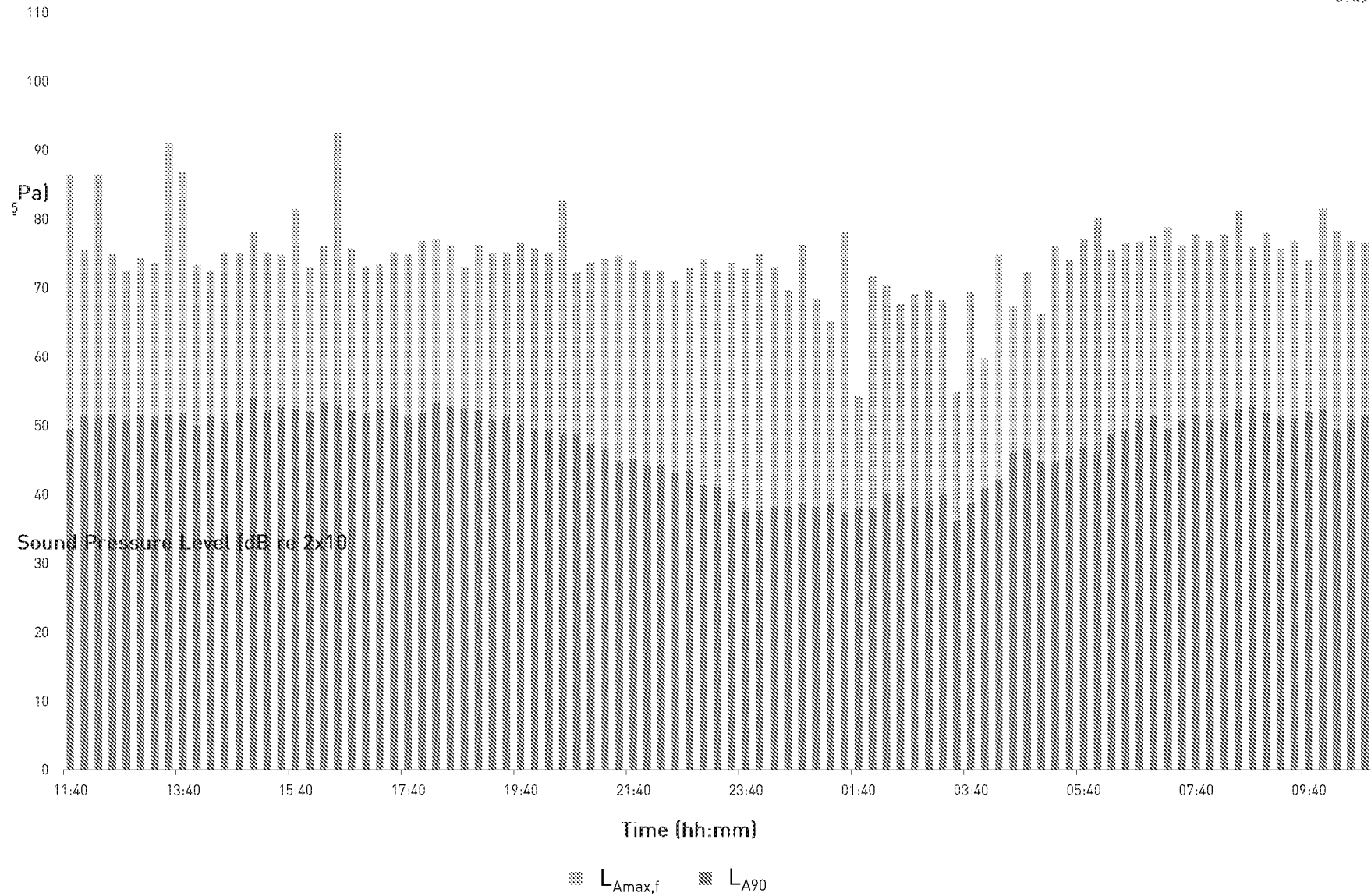


Quiet Waters, Angmering
 $L_{Amax,f}$ and L_{A90} Time History
 Roundstone Lane



Project: 8659

Graph 2



Quiet Waters, Angmering

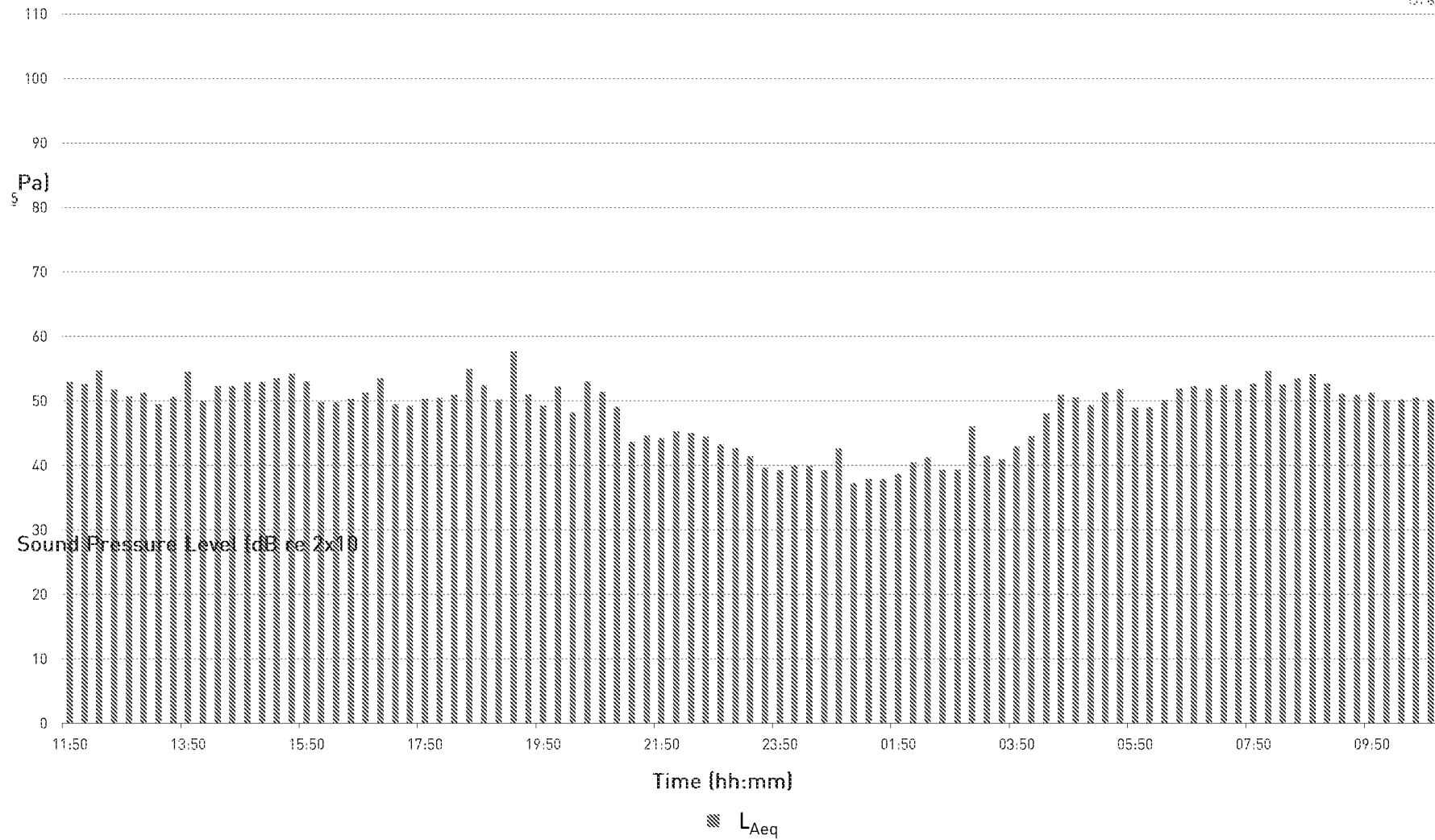
L_{Aeq} Time History

Garden Centre

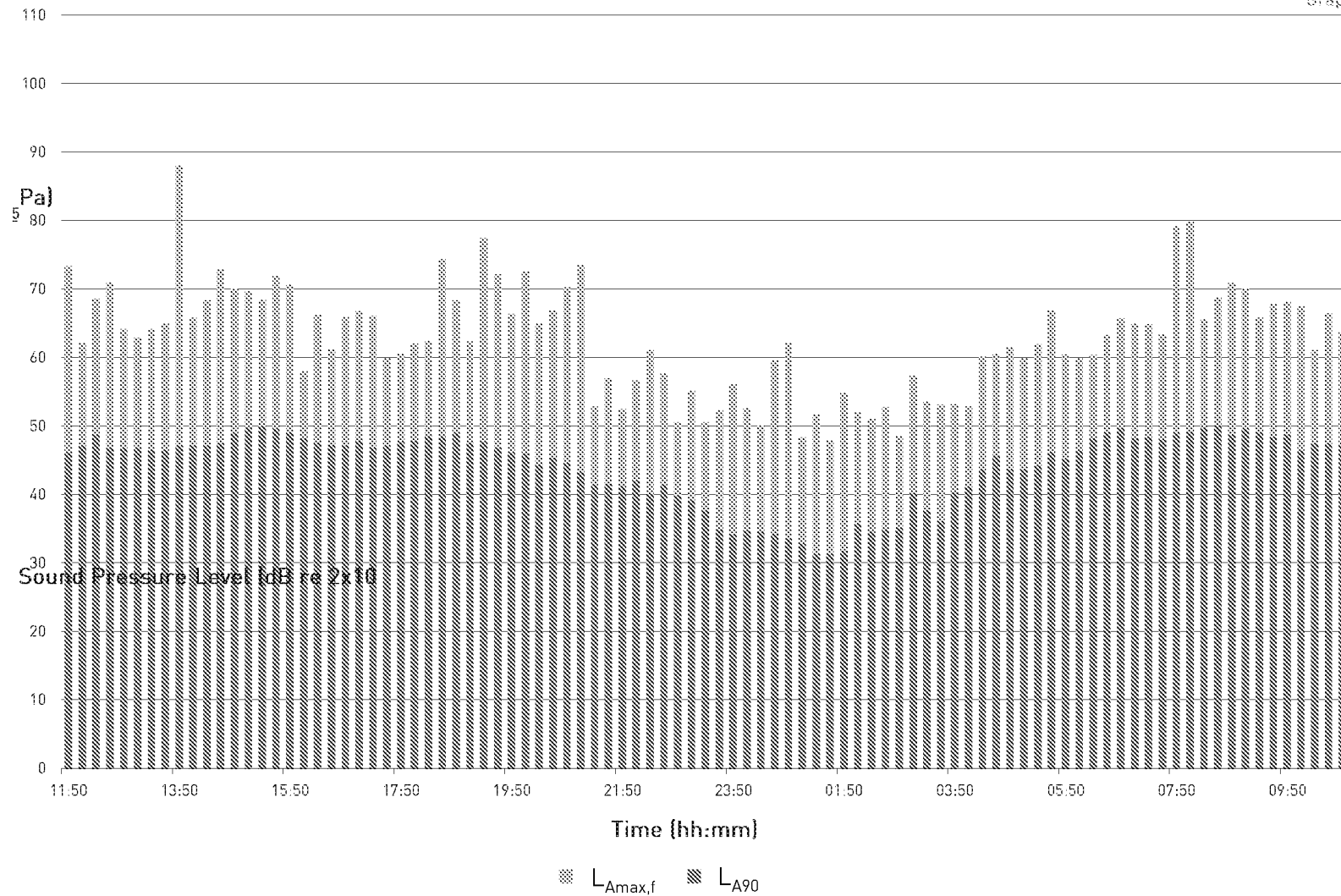


Project: 8699

Graph 3



Quiet Waters, Angmering
 $L_{Amax,f}$ and L_{A90} Time History
Garden Centre





QUIET WATERS, ROUNDSTONE LANE, ANGMERING
Measurement Positions
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Figure 1
14 May 2018
Not to Scale





QUIET WATERS, ROUNDSTONE LANE, ANGMERING
Measurement Position 1
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Figure 2
14 May 2018
Not to Scale





QUIET WATERS, ROUNDSTONE LANE, ANGMERING
Measurement Position 2
Project 8689

Figure 3
14 May 2018
Not to Scale



