



24 STONE STREET,
GRAVESEND

Acoustic Assessment Report

Reference: 12973.RP01.AAR.1

Prepared: 13 November 2023

Revision Number: 1

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Acoustic Assessment Report



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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	13 September 2023	Matt Wildman	Torben Andersen
1	Revised ventilation strategy and internal building fabric recommendations	13 November 2023	Matt Wildman	Martin Raisborough

Terms of contract:

RBA Acoustics Ltd have prepared this report in accordance with our Scope of Work 12973.ACB01.0 dated 21 August 2023. 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 will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.



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1.0 INTRODUCTION

It is proposed to renovate the existing building at 24 Stone Street, Gravesend to form a new House of Multiple Occupancy consisting of 8 bedrooms over three storeys, with possible commercial or amenity uses at ground floor level. The building has previously served as a pub at ground floor level with residential uses at first and second floor levels, although the building has been derelict for several years.

To assist with the planning application, an assessment has been carried out in relation to the noise levels likely to be incident on the proposed building façades and to provide acoustic performance specifications such that 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.

This report also sets out recommendations relating to the internal building fabric elements considering the limitations posed by the listed nature of the building.

A summary of acoustic terminology is included in Appendix A.

2.0 SITE DESCRIPTION

24 Stone Street is a three-storey building located in the centre of Gravesend, on the corner of the junction between Athboy Road and Stone Street. The upper floors of the building overlook the town centre and the railway lines serving Gravesend train station, which is approximately 10m to the north of the site. To the east of the site is a large plaza with outdoor seating which is subject to high pedestrianised traffic. Gravesend Community Centre is also located to the east of the site. The southern boundary of the property is adjoined to Il Padrino Restaurant. To the west the property overlooks Athboy Road leading down towards the train station itself.

The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix F).

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken by Matt Wildman (BSc, AMIOA) of RBA Acoustics over the following 24-hour period:

- 12:00 Wednesday 30th August to 12:00 Thursday 31st August 2023.

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

3.2 Measurement Locations

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

Measurement Position 1 – Athboy Road

The microphone was mounted on an A-Frame out of a second-floor window overlooking Athboy Road and the railway lines, approximately 6m above ground level. The microphone of the sound level meter was 1 metre from the building façade.

The noise climate at this location mainly consisted of traffic from the surrounding road network and trains on the nearby railway lines. L_{Aeq} measurements from the microphone are thought to be subject to reflection effects from the closed window, and have therefore been corrected in our analysis.

Measurement Position 2 – Stone Street

The microphone was mounted on an A-Frame out of a second-floor window overlooking Stone Street and the plaza opposite the site, approximately 6m above ground level. The microphone of the sound level meter was 1 metre from the building façade.

The noise climate at this location mainly consisted of traffic from the surrounding road network and trains on the nearby railway lines. L_{Aeq} measurements from the microphone are thought to be subject to reflection effects from the closed window and have therefore been corrected in our analysis.

The measurement positions are also illustrated on the site plan attached in Figure 1 and photos in Figure 2 (Appendix F).

3.3 Instrumentation

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

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

3.4 Results

The full results of the noise levels measured during the surveys are presented as time-histories on the attached Graphs 1-4 (Appendix F).

The lowest L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised in Table 1, along with the 'typical maximum' L_{AFmax} noise levels measured during the night-time, which is the 90th percentile of all $L_{AFmax,5min}$ noise levels measured.

Table 1 – Measured Level

Position	Lowest Background Noise Level, $L_{A90,15min}$ (dB)		Time-Averaged Noise Level, L_{Aeq} (dB)		Typical Maximum Noise Level, $L_{AFmax,5min}$ (dB)
	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Daytime (07:00-23:00)	Night-time (23:00-07:00)	Night-time (23:00-07:00)
Athboy Road	48	39	64	59	77
Stone Street	44	34	62	56	75

4.0 EXTERNAL BUILDING FABRIC CRITERIA

This section outlines typical assessment criteria in terms of the relevant standards.

4.1 British Standard 8233:2014

British Standards Institution (2014) *BS 8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings* draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions.

The noise level values given are in terms of an average (L_{Aeq}) level.

The standard advises internal ambient noise levels for achieving suitable resting and sleeping conditions within residential properties as set out in Table 2.

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 $L_{Aeq,8hour}$

4.2 World Health Organisation Guidelines

WHO (2018) *Environmental Noise Guidelines for the European Region* sets out to define “recommended exposure levels for environmental noise in order to protect population health”. The guidance document relates specifically to external noise levels, and recommends that “all CNG [WHO (1999) *Guidelines for Community Noise*] indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid”. RBA therefore make reference to Guidelines for Community Noise for recommendations on internal noise levels.

Guidelines for Community Noise 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, defined as any temporary or long-term deterioration in physical, psychological, or social functioning that is associated with noise exposure. The following is an extract from Table 4.1: Guideline values for community noise in specific environments, as stated in the WHO document.

Table 3 – Guideline Values for Community Noise

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (hours)	$L_{Amax,f}$ (dB)
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.

4.3 Summary

The project criteria adopted are therefore as follows:

Bedrooms	Night-time (23:00-07:00)	30 dB L_{Aeq} 45 dB $L_{Amax,f}$ (not normally exceeded)
Living Rooms	Daytime (07:00-23:00)	35 dB L_{Aeq}

5.0 EXTERNAL BUILDING FABRIC ASSESSMENT

5.1 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.

5.2 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:

Drawing no: 3580/P/11	Drawing Title: Proposed Floor Plans
Drawing no: 3580/P/12	Drawing Title: Proposed Elevations

(b) Noise Levels

The assessment has been based on the measured noise levels as detailed in Section 3.4.

(c) Room Absorption

The calculations assume that bedrooms are acoustically 'soft' with carpets, curtains and other soft furnishings. The communal kitchens are assumed to be less acoustically absorptive (with a hard floor finish, although with furnishings).

Details of the absorption coefficients assumed in the calculations are provided in Appendix B.

(d) External Wall

External non-glazed areas are to comprise the following:

- 215mm brickwork walls

As such, RBA have assumed the following sound reduction indices (equating to an overall R_w of 58 dB) for all non-glazed façade areas:

Table 4 – Sound Reduction Indices of Non-Glazed Elements

Assumed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
35	42	48	53	63	70	74	74

Should the proposals for non-glazed areas change, it is critical RBA 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 for ventilation of all dwellings is mechanical ventilation with heat recovery.

We understand windows are to be openable to provide purge ventilation and cooling during overheating. During those periods where windows are opened for purge/rapid ventilation, noise levels will naturally be increased internally.

5.3 Specification & Guidance Constructions

Appendix C details the sound reduction performance specification for the 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.

Please note – All window systems should be capable of meeting the performance specifications shown in Appendix C, 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.

The preferred glazing strategy is to retain the single glazed sash windows that form the existing external building fabric. This glazing configuration should prove commensurate with achieving the sound insulation performance specifications detailed within Appendix C.

It should be noted that due to the non-acoustic reasons (security, thermal or structural purposes), the specifications may exceed those stated above in some locations.

6.0 GENERAL INTERNAL BUILDING FABRIC CONSIDERATIONS

A summary of the various requirements of the development in terms of Approved Document E (2003 edition incorporating 2004, 2010 and 2015 amendments) of the Building Regulations is included as follows.

6.1 Separating Walls and Floors

The following are the levels of sound insulation that separating walls and floors (and stairs) must achieve in developments formed by material change of use. It is worth noting that HMO properties do not necessarily need to comply with requirement E1 of Approved Document E and it is often at the discretion of Building Control as to what specific sound insulation requirements apply, however, we would recommend that the following performance standards are targeted:

Airborne

A minimum weighted standardized level difference plus spectrum adaptation term ($D_{nT,w} + C_{tr}$) of 43dB.

Impact (Floors only)

A maximum weighted standardized impact sound pressure level ($L'_{nT,w}$) of 64dB.

It is recommended to target an improvement to the basic Building Regulations requirements of 5-10 dB for separating floors between commercial users and residential dwellings, which would apply to the separating floor buildup between ground floor and first floor.

6.2 Historic Buildings

It is understood that the existing building is listed.

It is recognised within Approved Document E that in the case of historic buildings undergoing a material change of use it may not be practical to improve the sound insulation to the required standards due to the need to conserve special characteristics of the building. In these instances, the aim should be to improve the sound insulation to the extent that it is practically possible.

6.3 Flat Entrance Doors

Entrance doors to bedrooms off common areas should be at least 25kg/m² or alternatively should be capable of achieving a minimum laboratory acoustic performance of R_w 29dB. We suggest the doors comprise 44mm thick solid core timber doors fitted within rebated frames with neoprene compressible bulb type acoustic seals to head and jambs. Gaps at the threshold should be minimised and ideally an automatic drop-down threshold seal installed.

7.0 WALL CONSTRUCTIONS

The recommended constructions for the separating walls and internal walls are discussed below.

7.1 Separating Walls

Existing masonry walls of at least 200mm thickness will be retained and are considered acoustically acceptable as separating walls.

Existing studwork walls will be retained and upgraded with an additional independent stud frame to one side with 2 x 15mm dense plasterboard (minimum 12.5kg/m²) lining with plaster skim finish and 50mm mineral wool between the studs.

New separating walls will comprise the following construction with an overall thickness of 210mm:

2 layers of 15mm dense plasterboard (minimum 12.5kg/m²)
Studwork
Nominal 'independence' gap between frames
50mm mineral wool lining down the centre
Studwork
2 layers of 15mm dense plasterboard (minimum 12.5kg/m²)

8.0 FLOOR CONSTRUCTIONS

The requirements for the separating floors throughout the development are discussed below.

8.1 Separating Floors

Sound insulation testing was carried out between the ground floor, first floor and second floor in order to assess the existing performance against requirements of Approved Document E shown in Section 6.1. Results showed that the measured separating floor construction in some areas fell marginally short of the requirements.

Due to the listed nature of the building, it is preferable not to introduce additional treatment to the underside of the existing ceiling where decorative original plaster details are present.

Considering the limited options to treat the existing construction, it is advised to introduce a minimum of 100mm of mineral wool in between the existing timber joists between ground floor, first floor and second floor.

9.0 CONCLUSION

RBA Acoustics have undertaken noise monitoring at the proposed development site at 24 Stone Street, Gravesend. 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 8233:2014 and WHO Guidelines.

Suitable separating constructions capable of achieving the sound insulation requirements specified in Approved Document E as well as recommendations to adequately improve the sound insulation performance of the existing separating floor buildup as far as reasonably possible have also been proposed, however, it is acknowledged that there is not necessarily a requirement for the scheme to adhere to the requirements of Approved Document E, and consultation with Building Control should be carried out in order to determine the necessary acoustic requirements.

Appendix A – Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
$D_{n,e,w}$	A single number weighted quantity which characterises the airborne sound insulation through a specified small element. A higher numerical quantity represents a better performance.
$L_{eq,T}$	The level of a notional steady sound which, over a stated period of time, T , would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, T , would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
L_{An} (e.g. L_{A10} , L_{A90})	The sound level exceeded for n% of the time. E.g. L_{A10} is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, L_{A90} is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise.
$L_{Amax,T}$	The instantaneous maximum A-weighted 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, e.g. sudden bangs, shouts, car horns, emergency sirens etc. which audibly stand out from the ambient level.
Octave band	A frequency band in which the upper limit of the band is twice the frequency of the lower limit.
1/3 Octave band	A frequency band which is one-third of an octave band.
R_w	A single number quantity which characterises the airborne sound insulation of a material or building element in a laboratory test.

Appendix B – Room Absorption Coefficients

For the purposes of the analyses RBA have assumed the absorption coefficients detailed in Table B1 for bedrooms and Table B2 for living rooms.

Table B1 – 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

Table B2 – 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

Appendix C – External Building Fabric Acoustic Specification

External facade constructions and components, such as brise soleil, grilles, ventilators, curtain walling systems or other architectural features, are not to give rise to intrusive whistling, creaking, rattling or other noises as a result of wind or other climatic effects.

The Contractor shall take reasonable precautions to avoid unwanted noise including creaking, rattling and whistling being generated by the Contractors works when subject to environmental conditions (including wind) and thermal expansion over the life of the façade.

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 10140-2:2021:

Minimum Recommended Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)								R_w (dB)
63	125	250	500	1k	2k	4k	8k	
16	23	25	27	26	26	29	25	27

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

N.B. as the internal noise criteria are expressed in overall 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.

Appendix D – Instrumentation

The following equipment was used for the measurements.

Table D1 – Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1407793	4712338926	9 December 2023
Norsonic Pre Amplifier	1209	23228		
Norsonic ½" Microphone	1225	468954		3 December 2023
Norsonic Sound Calibrator	1255	125525796	Cal 022-2021-14779	8 December 2023

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1407794	4712332270	9 December 2023
Norsonic Pre Amplifier	1209	23229		
Norsonic ½" Microphone	1225	468970		3 December 2023
Norsonic Sound Calibrator	1255	125525795	Cal 022-2021-14778	8 December 2023

Appendix E – 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 for more than 3 days)
- 4 – Serious (e.g. fracture, hospitalisation for more than 24 hours, incapacitation for more than 4 weeks)
- 5 – Fatal (single or multiple)

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

Table E1 – Risk Ratings

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:

Table E2 – Risk Assessment

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
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

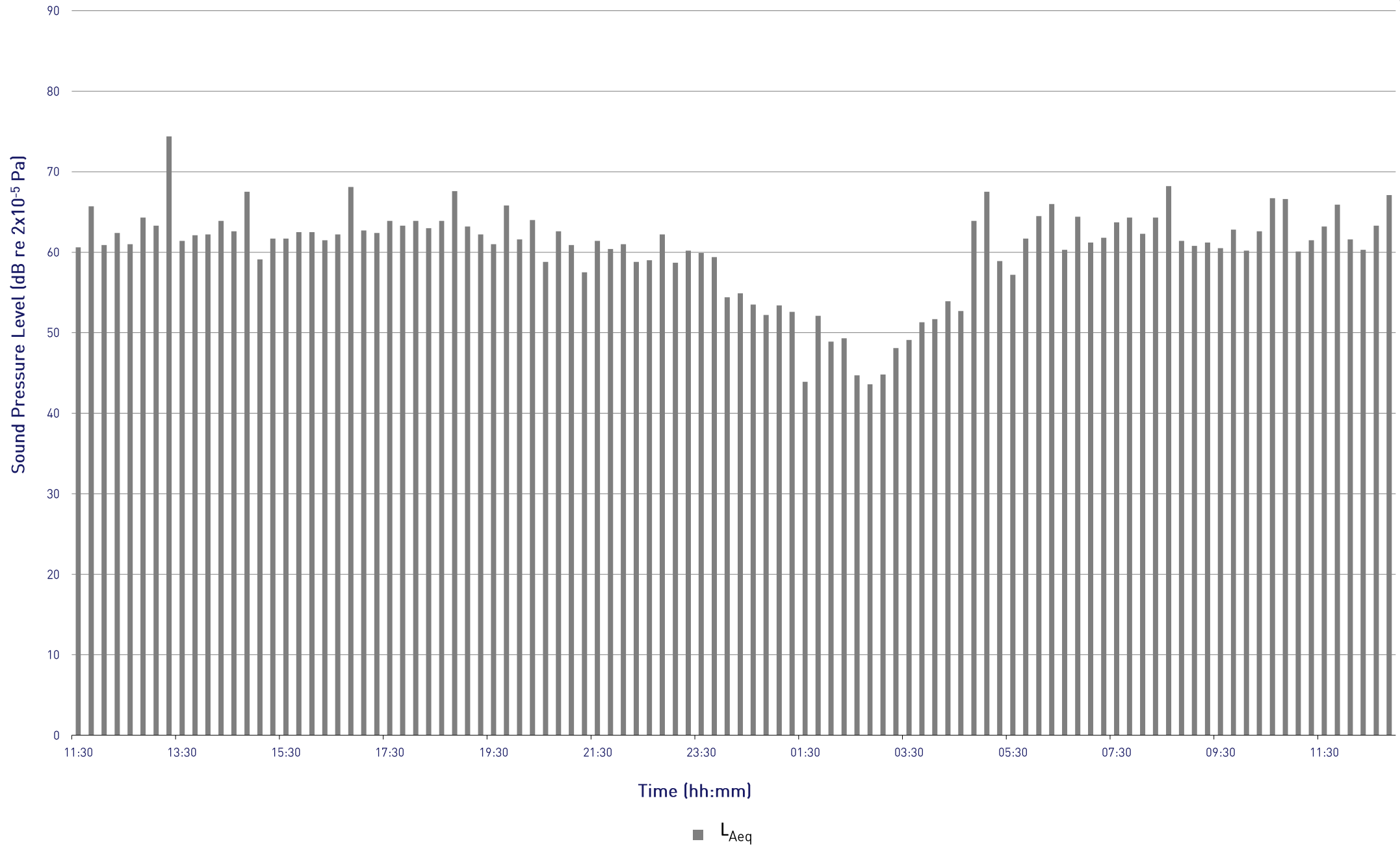
L: Likelihood S: Severity R: Rating

Appendix F – Graphs and Site Plans

24 Stone Street, Gravesend

L_{Aeq} Time History

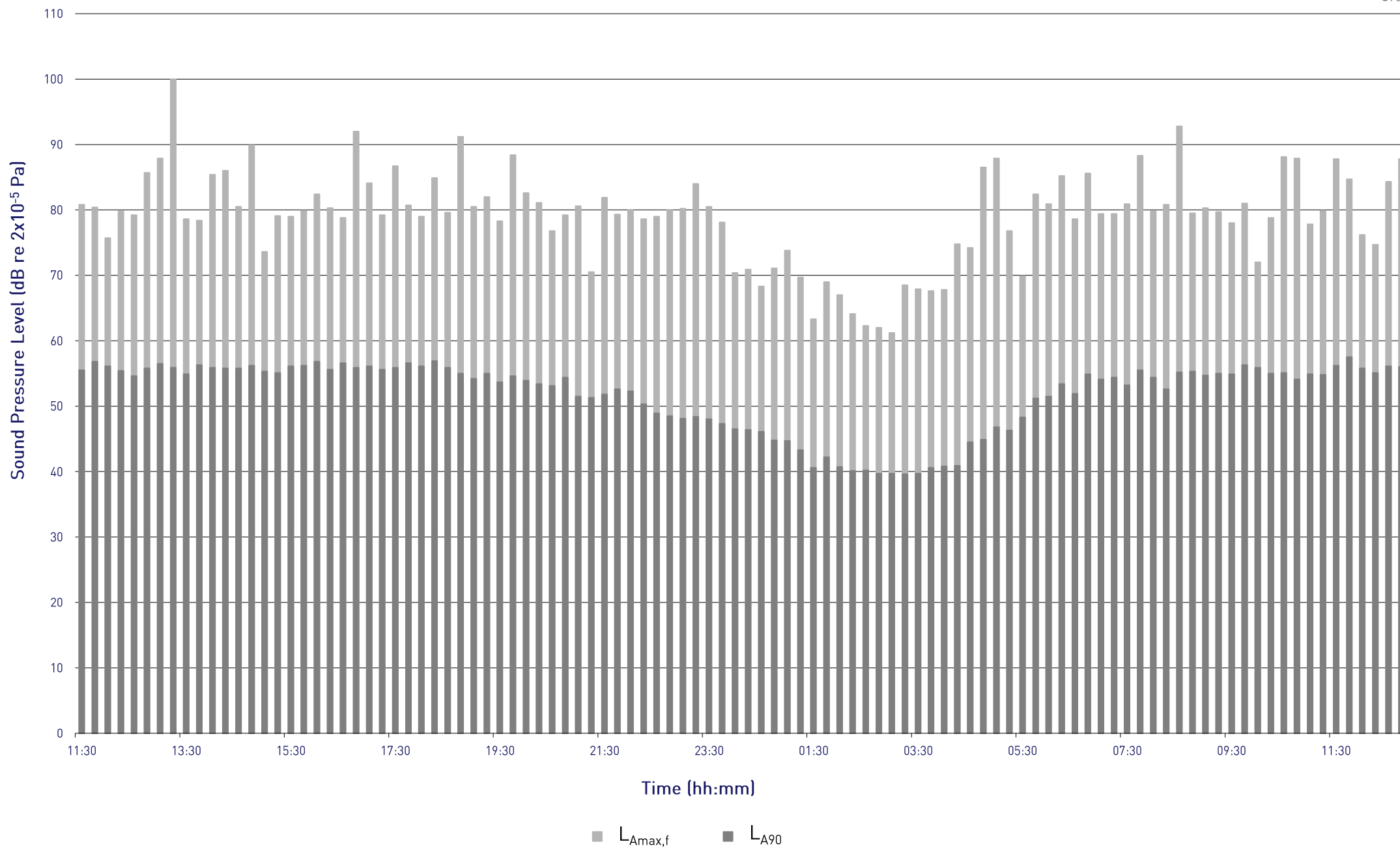
Position 1, Athboy Road - Wednesday 30th August to Thursday 31 August 2023



24 Stone Street, Gravesend

$L_{Amax,f}$ and L_{A90} Time History

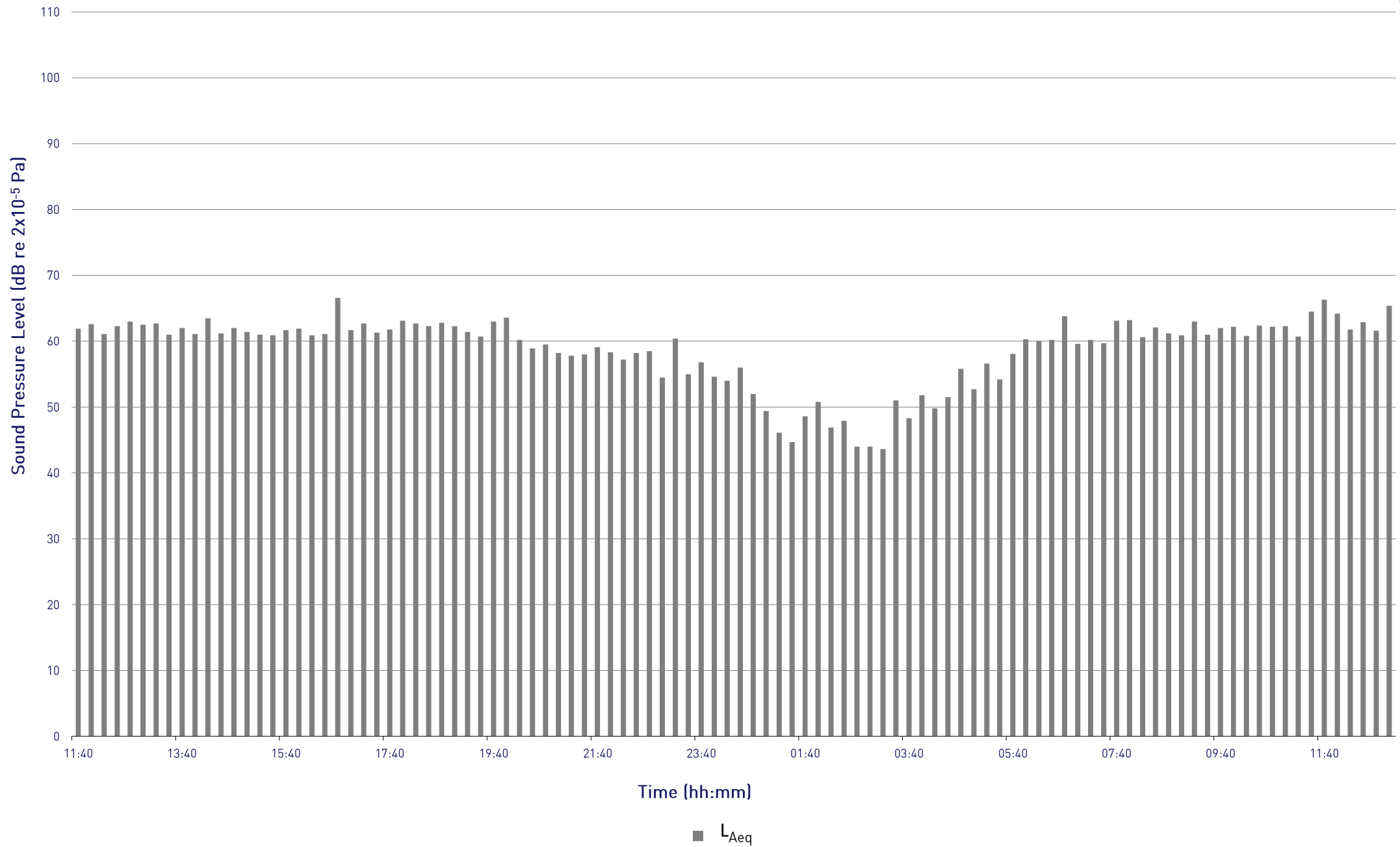
Position 1, Athboy Road - Wednesday 30th August to Thursday 31 August 2023



24 Stone Street, Gravesend

L_{Aeq} Time History

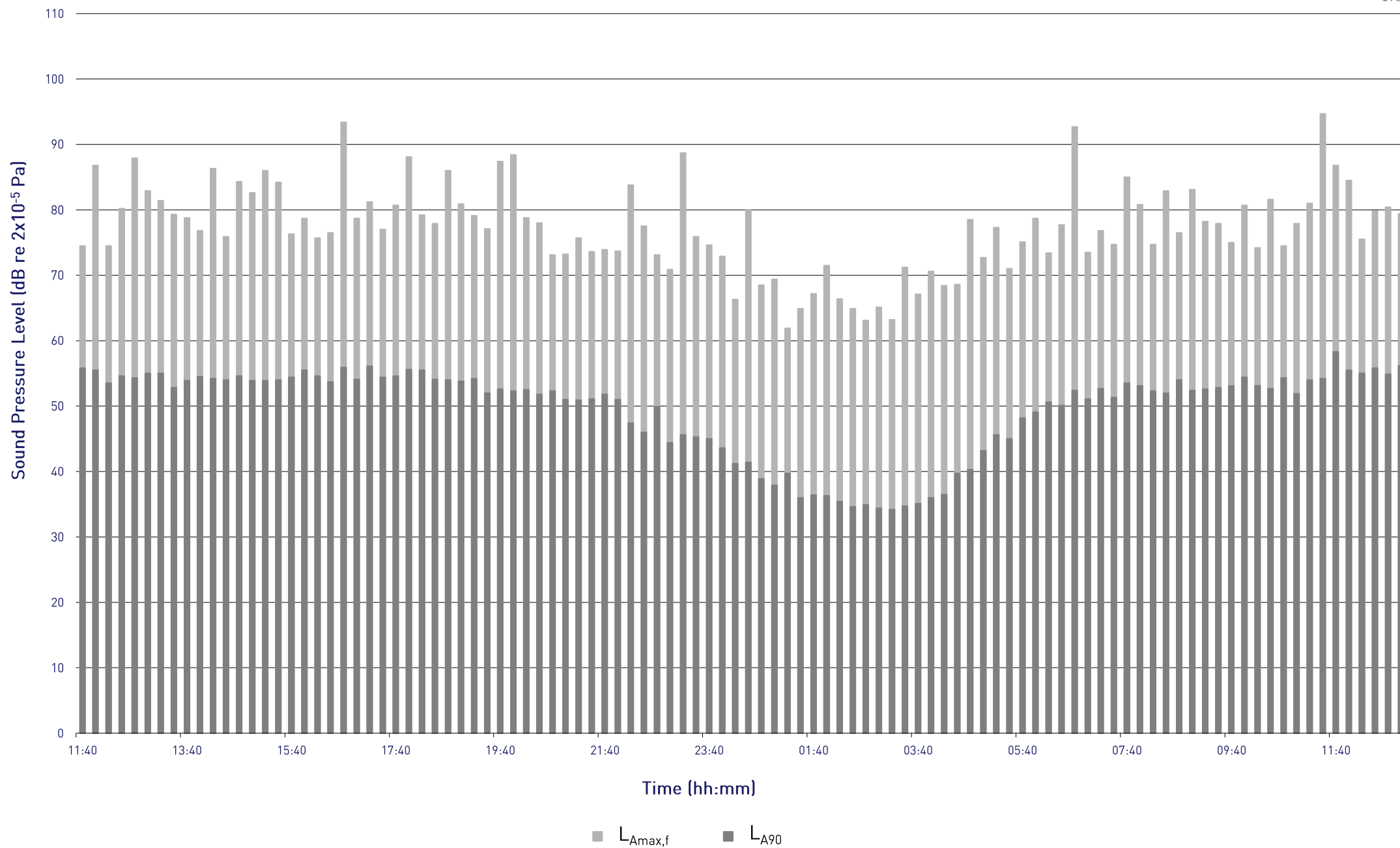
Position 2, Stone Street - Thursday 30th August to Friday 31st August 2023

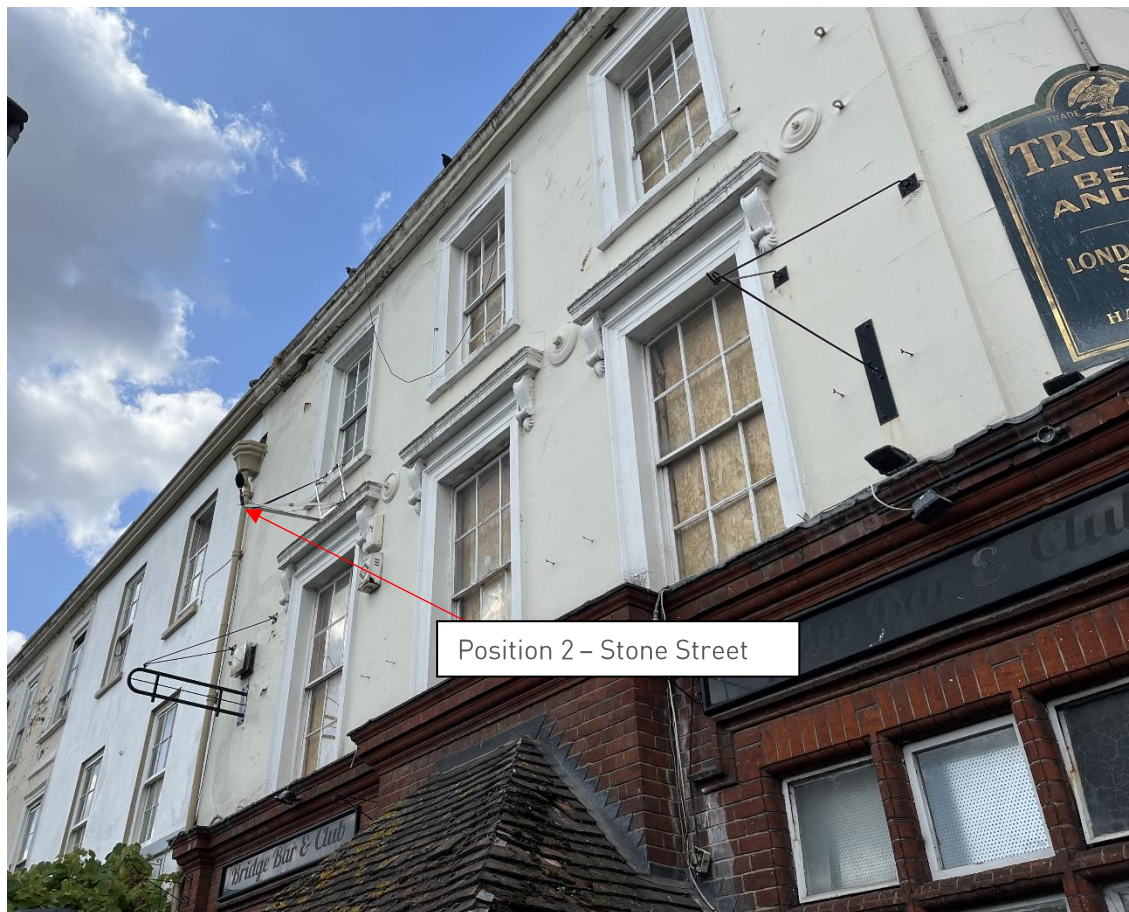


24 Stone Street, Gravesend

$L_{Amax,f}$ and L_{A90} Time History

Position 2, Stone Street - Thursday 30th August to Friday 31st August 2023





24 Stone Street, Gravesend
 Photos Of Measurement Locations
 Project 12973

Figure 2
 13 November 2023
 Not to Scale



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