RBA ACOUSTICS

25 SHELTON STREET, LONDON WC2H

Plant Noise Assessment

Reference: 10439.RP01.PNA.1
Prepared: 2 October 2020
Revision Number: 1

Official Headquarters
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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	29 September 2020	David Johnston	Russell Richardson
1	Minor amendments following design team feedback	2 October 2020	David Johnston	Russell Richardson

Terms of contract:

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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.

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1.0 INTRODUCTION

Two new condenser units have been installed in the courtyard to the rear of 25 Shelton Street, Soho, WC2H 9HW. The units are serving new gallery space occupying the ground and lower ground floors of the property. As part of the retrospective planning application, (Ref. 2020/1753/P) Camden Council requires consideration be given to atmospheric noise emissions from the proposed equipment at the nearest noise-sensitive property.

RBA Acoustics have been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emissions in accordance with Camden Council's requirements. This report presents the results of the noise measurements, associated criteria and provides the required assessment.

2.0 ENVIRONMENTAL NOISE SURVEY

2.1 Site Details

The site is shown in relation to its surroundings in the site plan in Figure 1 in Appendix E.

The courtyard is located to the rear of 25 Shelton Street and 36 – 40 Earlham Street. The courtyard is at ground floor level with residential flats rising to 5th floor level on Shelton Street to the south and 4th floor level on Earlham Street to the north. The western wall is solid brick and the eastern wall is part brick, part glazed and abuts an internal staircase for the neighbouring commercial building. Access to Earlham Street is through a gated undercroft to the northeast of the courtyard. The neighbouring properties comprise commercial and retail premises at ground floor level.

2.2 COVID-19

Guidance from the Association of Noise Consultants and the Institute of Acoustics acknowledges that whilst travel patterns and patron behaviour are abnormal during the COVID-19 pandemic there is still a need to provide robust acoustic assessments as part of, amongst other things, the planning application process. RBA Acoustics conducted a risk assessment of the noise monitoring exercise for this project and deemed it safe to continue so that noise levels could be measured. However, at the time of the monitoring exercise Central London was still operating in a stage of semi-lockdown meaning that most surrounding businesses were closed, including bars, restaurants and cafes, shops, theatres and other tourist-attracting experiences which would otherwise make the Soho area a particularly vibrant area. Use of private and public transport was also lower than normal with buses, tubes and trains operating at or less than 50% of normal operation levels. Aircraft operations are also significantly less frequent than under pre-COVID conditions. This has almost certainly contributed to lower than usual underlying background noise levels, especially considering that the courtyard is shielded from most immediate noise sources and the noise climate is made up of the ambient environment comprising mostly the surrounding road network and other transport sources. The local council has also pedestrianised many of the surrounding streets, restricting road traffic movements. We also understand that the majority of the flats above and surrounding the site have been unoccupied during lockdown.

We understand from the design team that the gate to the courtyard giving access to Earlham Street is also normally open to the street, meaning that the receptors overlooking the courtyard area are usually exposed to higher noise levels due to noise ingress from Earlham Street. During lockdown this gate has been left closed.

Although it is not possible to comment with certainty on the magnitude of the reduction to the ambient noise levels it should be noted in the context of the assessment that a greater degree of calculation tolerance is required to fairly reflect the current situation.

2.3 General

Monitoring of the prevailing background noise was undertaken from Tuesday 1 September to Wednesday 2 September 2020.

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. In any case the courtyard is largely shielded from the adverse effects of weather on noise monitoring surveys. The condenser units were off for the duration of the survey.

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

The installed Mitsubishi units were also measured in operation at full duty and in reduced noise mode. Measurements were made of the intake and discharge elements at a distance of 1m.

2.4 Measurement Location

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

Rear Courtyard

Measurements were undertaken with the microphone mounted on a 4m pole in the rear courtyard of 25 Shelton Street. This measurement position was considered as being representative of the noise climate as experienced at the closest residential receptors to the plant, overlooking the courtyard. The prevailing noise climate was noted to comprise existing plant to the west of the courtyard and road traffic noise from the surrounding road network.

The measurement position is also illustrated on the site plan in Figure 1 and photo in Figure 2, Appendix E.

2.5 Instrumentation

Details of the instrumentation used to undertake the survey are provided in Appendix B.

The sound level meter was calibrated both prior to and on completion of the survey with no significant calibration drift observed.

2.6 Environmental Noise Monitoring Results

The noise levels measured are shown as time-histories on the attached Graphs 1-2 in Appendix E.

The typical lowest L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised in Table 1.

Table 1 – Measured Environmental Noise Levels

Measurement Period	Lowest $L_{A90,15min}$ (dB)	$L_{Aeq,T}$ (dB)
Daytime (07:00 – 23:00)	42	49
Night-time (23:00 – 07:00)	42	43
Operational Hours (10:00 – 22:00)	43	50

2.7 Plant Noise Measurements

The single-figure and spectral noise levels measured with the plant operating are provided in Tables 2 and 3.

Table 2 – Measured Plant Levels

Operational Condition	Sound Pressure Level at 1m (dBA)	
	Intake	Exhaust
Full Duty	63	63
Reduced Noise Mode	55	57

Table 3 – Measured Spectral Noise Levels

Element	Sound Level (dB) at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Intake (L_p at 1m)	62	57	58	51	51	45	40	38
Exhaust (L_p at 1m)	62	61	59	54	53	47	41	36

3.0 PLANNING POLICY CONTEXT AND ASSESSMENT CRITERIA

3.1 National Planning Policy Framework

The Ministry of Housing, Communities and Local Government (2019) *National Planning Policy Framework* (NPPF), sets out the Government's planning policies for England. Paragraph 180 of the NPPF states the following:

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
>
> *a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
>
> *b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;"*

3.2 Noise Policy Statement for England

The Department for Environment Food and Rural Affairs (2010) *Noise Policy Statement for England* (NPSE) seeks to clarify the underlying principles and aims in existing policy documents, legislation and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

The statement sets out the long-term vision of the government's noise policy, which is to "*promote good health and a good quality of life through the effective management of noise within the context of policy on sustainable development*".

This long term vision is supported by three aims:

- 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 improvements of health and quality of life.

The long-term policy vision and aims are designed to enable decisions to be made regarding what is an acceptable noise burden to place on society.

The Explanatory Note within the NPSE provides further guidance on defining "significant adverse effects" and "adverse effects" using the following concepts:

- No Observed Effect Level (NOEL) – the level below which no effect can be detected. Below this level no detectable effect on health and quality of life due to noise can be established;
- Lowest Observable Adverse Effect Level (LOAEL) – the level above which adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) – the level above which significant adverse effects on health and quality of life occur.

The three aims can therefore be interpreted as follows:

- The first aim is to avoid noise levels above the SOAEL;
- The second aim considers situations where noise levels are between the LOAEL and SOAEL. In such circumstances, all reasonable steps should be taken to mitigate and minimise the effects. However, this does not mean that such adverse effects cannot occur; and
- The third aim considers situations where noise levels are between the LOAEL and NOEL. In these circumstances, where possible, reductions in noise levels should be sought through the pro-active management of noise.

The NPSE recognises that it is not possible to have single objective noise-based measures which define the SOAEL, LOAEL and NOEL and that are applicable to all sources of noise in all situations. The levels are likely to be different for different noise sources, receptors and at different times of the day.

3.3 Planning Practice Guidance (Noise)

The Ministry of Housing, Communities and Local Government (2014) *Planning Practice Guidance (Noise)* (PPG(N)) "*advises on how planning can manage potential noise impacts in new development*" and provides guidelines that are in line with the NPPF. The guidance is an online resource and was last updated on 22 July 2019.

The PPG(N) states that local planning authorities should:

> *"take account of the acoustic environment and in doing so consider:*
>
> - *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."*

The guidance uses the same concepts of adverse effect levels as the NPSE, and these are provided in full in 4 below.

The guidance recognises that the use of the word "level" does not mean that a single number value will necessarily be appropriate in determining the effects of noise exposure. Rather, factors to be considered in determining whether noise is a concern can include the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative effects.

With particular regard to mitigating noise effects on residential development the PPG(N) highlights that effects may be partially offset if residents have access to a relatively quiet façade as part of their dwelling or a relatively quiet amenity space (private, shared or public).

Table 4 – Noise Exposure Hierarchy Table from PPG(N)

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
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 Observed Adverse Effect	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; 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Table 4 continued – Noise Exposure Hierarchy Table from PPG(N)

Perception	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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 through use of appropriate mitigation whilst taking into account the social and economic benefit
Unacceptable Observed Adverse Effect Level			
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an 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 through use of appropriate mitigation

3.4 Camden Council – Camden Local Plan

The Camden Local Plan was "*adopted by Council on 3 July 2017. It replaced the Core Strategy and Camden Development Policies as the basis for planning decisions and future development in Camden.*" (from the Camden Council Website, September 2020).

Policy A4 of the Local Plan reads as follows:

> *"Policy A4 Noise and vibration – The Council will seek to ensure that noise and vibration is controlled and managed. Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:*
> *a. development likely to generate unacceptable noise and vibration impacts; or*
> *b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.*
> *We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development"*

Appendix 3 of the same document begins as follows:

> *"Three basic design criteria have been set for proposed developments, these being aimed at guiding applicants as to the degree of detailed consideration needed to be given to noise in any planning application. The design criteria outlined below are defined in the corresponding noise tables. The values will vary depending on the context, type of noise and sensitivity of the receptor:*
> *• Green – where noise is considered to be at an acceptable level.*
> *• Amber – where noise is observed to have an adverse effect level, but which may be considered acceptable when assessed in the context of other merits of the development.*
> *• Red – where noise is observed to have a significant adverse effect.* [...]
>
> *A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).*

Table 5 – Effect Level Categorisation from Camden Local Plan (Table C)

Existing NSR	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings	Outside window (façade)	Day	Rating level 10dB below background	Rating level between 9dB below and 5dB above background	Rating level greater than 5dB above background
Dwellings	Outside window (façade)	Night	Rating level 10dB below background	Rating level between 9dB below and 5dB above background	Rating level greater than 5dB above background

The guidance also proposes a further 5dB reduction to the effect levels if the plant is identified as having audible tonal elements.

Lastly, the guidance provides the following additional criteria:

> *"There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted Leq,5mins noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area."*

3.5 British Standard 4142:2014

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 standard is only appropriate for the assessment of external sound levels.

The assessment method described in BS4142:2014 is based on the continuous sound pressure level produced by a specific source ($L_{Aeq,Tr}$) 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 ($L_{Ar,Tr}$). 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:

a) Typically the greater this difference, the greater the magnitude of impact.
b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
d) 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.

3.6 Planning Summary

For the purposes of this assessment we therefore propose the following noise limits

Table 6 – Adopted Criteria

Existing NSR	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings	Outside window (façade)	Operational Hours	⩽ 33 dB $L_{Aeq,Tr}$	34 – 48 dB $L_{Aeq,Tr}$	⩾ 48 dB $L_{Aeq,Tr}$

4.0 ASSESSMENT

Our assessment has been based upon the following information:

4.1 Proposed Plant Items

The following plant is proposed for the scheme:

Table 7 – Plant Information

Ref.	Manufacturer/Model	Plant Type
CU1&2	Mitsubishi FDC280KXZE1	Condenser Unit

4.2 Position of Units

The units are positioned close to the eastern boundary wall of the courtyard at ground floor level. The equipment positions are indicated on the site plan in Figure 1 in Appendix E. The proposal is to house the units within a purpose-built plant room with atmospheric openings for intake and exhaust air. Preliminary proposals for the plant enclosure are provided in Figure 3 in Appendix E.

4.3 Noise Levels

The noise levels of the plant are provided in Section 2.6 above. Review of the octave band data provides no indication of any tonal characteristics associated with the proposed plant. A prediction of the NR level at 1m from the nearest noise-sensitive receptor window (NSR) is provided below which will allow for a further assessment of tonality.

4.4 Plant Enclosure

The units are to be fully enclosed within a plant room structure with atmospheric openings for intake and exhaust air. The plant room will comprise the following:

a) External wall

The external wall is to comprise a staggered-stud frame with ply and plasterboard linings on a resilient bar and mineral wool infill. We have assumed an overall sound reduction of R_w 55dB for this element, which is acoustically suitable.

b) Internal orientation

We assume that, to prevent the recirculation of exhausted hot air, the top of the units will be blanked off from the intake grilles at the sides. This is acoustically beneficial as it will minimise noise from the exhaust elements being audible through the intake ventilation openings and vice-versa.

c) Internal lining

We have assumed that an acoustically absorbent lining of minimum 50mm thickness will be applied to the inner faces of the walls and roof within the plant enclosure. The lining should achieve minimum Class C absorption.

d) Ventilation openings

We have assumed that atmospheric openings will be acoustically louvred with louvres capable of achieving the following transmission losses:

Table 8 – Acoustic Louvre Transmission Losses

Minimum Transmission Loss (dB) at Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
5	5	7	9	13	13	13	12

The openings for the intake should be on the wall facing the eastern wall of the courtyard. The openings for the discharge should also be oriented horizontally rather than being vertical discharge.

e) Additional absorption

The eastern wall of the courtyard should be treated with an acoustically absorptive lining to minimise early reflections.

All proposals for mitigation measures will need to be checked by others for their suitability in terms of non-acoustic disciplines.

4.5 Location of Nearest Residential Windows

Receptor 1 – 25 Shelton Street

The closest residential windows to the plant were observed as being at first floor level of 25 Shelton Street, overlooking the rear courtyard approximately 3m, at the nearest point, from the new plant.

Receptor 2 – 36 Earlham Street

There are also residential windows belonging to 36 Earlham Street at first floor level overlooking the rear courtyard approximately 4m, at the nearest point, from the new plant.

We consider that any noise mitigation measures designed to achieve the Local Authority requirements at Receptor 1 will also achieve the requirements at Receptor 2, due the increased distance from the plant to Receptor 2.

4.6 Operational Hours

The proposal is for the gallery to be open from 10:00 – 19:00. During these hours it is anticipated that patron volume will be low. On occasion the opening hours may extend to 22:00 to accommodate an event.

4.7 Calculation of Noise Levels at Nearest Residential Window

Our calculation method for predicting noise levels from the proposed plant at the nearest residential windows, based on the information stated above, is summarised below.

- Measured L_p at 1m
- Plant room losses
- Attenuation (louvres)
- Screening
- Distance Attenuation
- Directivity

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 9 – Predicted Noise Levels

Operating Period	Predicted Noise Level at Receptor (dBA)	
	Receptor 1 – 25 Shelton Street	Receptor 2 – 36 Earlham Street
Operational Hours (10:00 – 22:00)	41 (NR 36)	37 (NR 32)

Noise from the proposed units to the rear of the property is above the LOAEL by 8 and 4 dBA for each receptor, but beneath the SOAEL by 7 and 11 dBA.

At receptor 1 the NR 35 limit is exceeded by 1dB. At receptor 2 the NR 35 limit is expected to be achieved provided the mitigation measures proposed can be implemented.

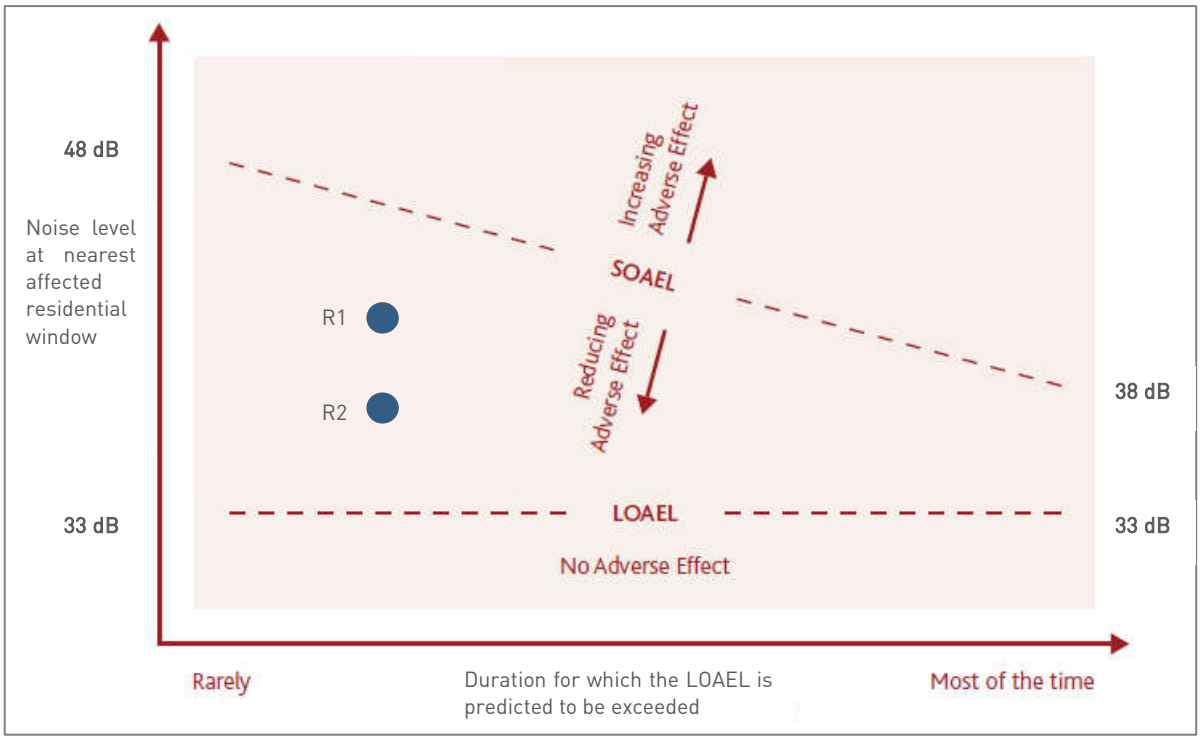
4.8 Context

In order to provide some context to the effect levels provided above we refer to guidance within the Noise Policy Statement for England (NPSE) and Planning Practice Guidance (Noise) (PPG(N)). NPSE states that in situations where noise levels are between the LOAEL and SOAEL "*all reasonable steps should be taken to mitigate and minimise the effects*". It also acknowledges that this does not mean that such adverse effects cannot occur. Significant mitigation is proposed to the units for the scheme including utilising reduced noise operating modes and the design of an acoustically attenuated enclosure to balance the need for airflow to the units and the need for noise reduction.

PPG(N) states that "*The guidance recognises that the use of the word "level" does not mean that a single number value will necessarily be appropriate in determining the effects of noise exposure. Rather, factors to be considered in determining whether noise is a concern can include the absolute noise level of the source, the existing ambient noise climate, time of day, frequency of occurrence, duration, character of the noise and cumulative effects.*"

It is appropriate therefore to consider not only the magnitude by which the LOAEL is exceeded but also how often this exceedance is likely to occur. If the exceedance was to be frequent, then the SOAEL would likely be lower than if the exceedance only occurs rarely.

The project M&E consultants have advised that full duty is likely only to be required at full capacity and in periods of warm weather. As discussed previously, daily patron volume is expected to be low, and larger capacity gatherings would be expected in the evenings when cooling is less likely to be required. Given the large thermal massing of the ground and lower ground floors, narrow streets, meaning high levels of solar shading, and prevailing climate in the UK it is considered that the LOAEL will be exceeded rarely to infrequently. This can be plotted on the graph below.



The graph demonstrates that the effect is well below of the SOAEL.

PPG(N) also states that "*With particular regard to mitigating noise effects on residential development the PPG(N) highlights that effects may be partially offset if residents have access to a relatively quiet façade as part of their dwelling or a relatively quiet amenity space (private, shared or public).*"

Earlham Street, though in central London, has light traffic flows and no external eating or drinking establishments. Shelton Street has greater traffic flow and footfall.

There is also some additional uncertainty surrounding the underlying background noise levels due to COVID-19, as discussed in Section 2.2. Although we would not anticipate the noise levels to be so different as to move the predicted noise levels from between the LOAEL and SOAEL to below the LOAEL we do consider it reasonable to assume that the numerical values for the LOAEL and SOAEL might be higher under normal conditions.

5.0 VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that condensing units be isolated from the supporting structure by means of either steel spring isolators or rubber footings. The condensers are mounted on rubber footings.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

6.0 CONCLUSION

Measurements of the existing background noise levels at 25 Shelton Street have been undertaken. The results of the measurements have been used in order to determine the required criteria for atmospheric noise emissions from plant installations. It has been noted that a reduction to the normal prevailing background noise levels is likely due to the COVID-19 pandemic, and the surrounding area therefore being unusually quiet.

The results of the assessment indicate atmospheric noise emissions from the plant are between the LOAEL and SOAEL as defined in the NPSE and PPG(N). Extensive mitigation is already proposed as part of the design by way of an attenuated enclosure and reduced noise mode. Under normal operating conditions and a return to the sorts of patron and traffic levels the surrounding area experienced pre-lockdown it is likely that the LOAEL and SOAEL would increase. It is therefore considered that the magnitude by which the predicted levels are below the SOAEL is acoustically acceptable.

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.
$L_{eq,T}$	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 – Instrumentation

The following equipment was used for the measurements

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1406262	U31212	13 March 2021
Norsonic Pre Amplifier	1209	20487		
Norsonic ½“ Microphone	1225	225566	31211	13 March 2021
Norsonic Sound Calibrator	1251	34429	U31210	13 March 2021

Appendix C – Plant calculations

A summary of the noise levels at 25 Shelton Street from the proposed plant items is provided below, together with the overall predicted level.

Unit	Exhaust	Intake	Total
Sound power level	72	70	-
Internal acoustic absorption	-7	-6	-
Attenuated Enclosure	-8	-8	-
Screening	0	0	-
Distance	-6	-6	-
Directivity (90^0)	-3	-3	-
Absorptive lining	0	-3	-
L_w to L_p	-8	-8	-
Total Received Level (dBA)	**40**	**36**	**41**

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 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.

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
Mineral wool within drywalls and linings	Skin and respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Acoustic doors - weight	Strain of neck, limbs or back	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging	Strain of neck, limbs or back.	Contractors	3	4	12	Provide sufficient manpower/ lifting gear	1	4	4
Attenuators/ Acoustic Lagging	Skin & respiratory irritation	Contractors	4	3	12	Wear gloves and mask	1	3	3
Concrete aggregate blocks - weight	Strain of neck, limbs or back	Contractors	3	3	9	Alternative drywall and lightweight block solutions have been investigated but not considered viable. All concrete blocks specified herein should be sized in accordance with HSE guidelines. Correct manual handling techniques should be employed. No employee shall carry or lift more than is comfortable for them to do so	1	3	3

L: Likelihood S: Severity R: Rating

Appendix E – Graphs and Site Plans

25 Shelton Street

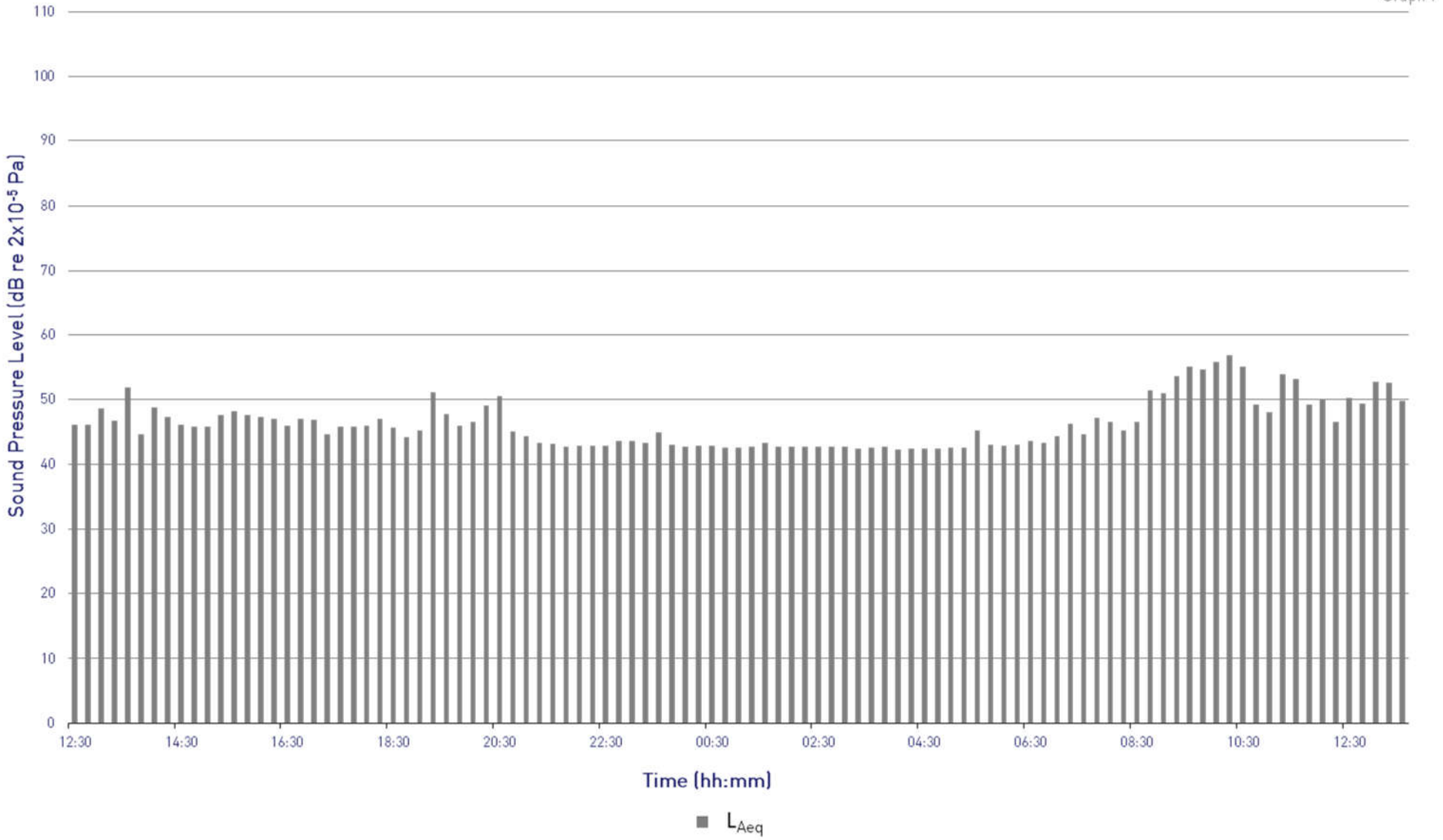
L_{Aeq} Time History

Rear Courtyard, Tuesday 1 September to Wednesday 2 September 2020

RBA ACOUSTICS

Project: 10439

Graph 1



25 Shelton Street

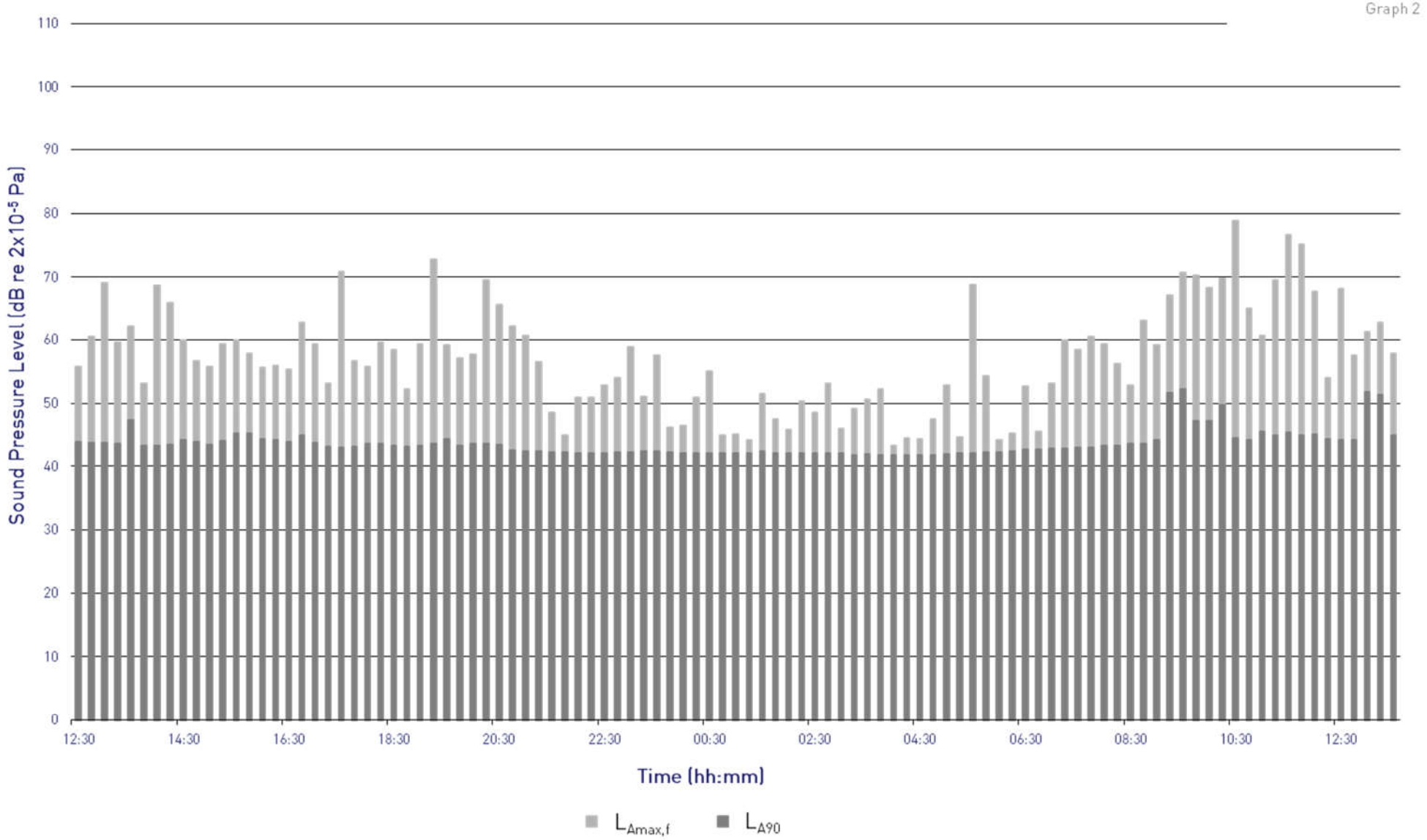
$L_{Amax,f}$ and L_{A90} Time History

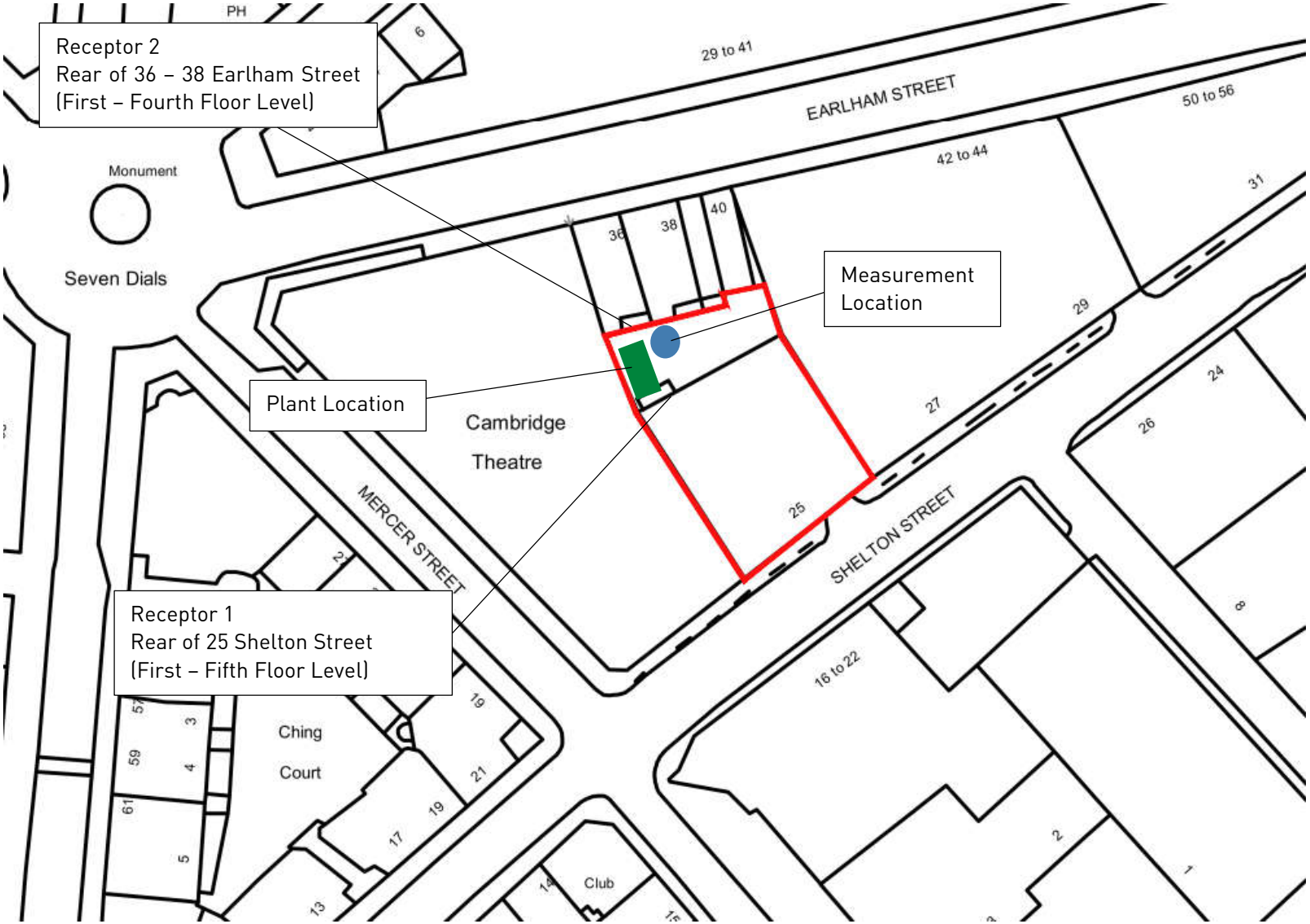
Rear Courtyard, Tuesday 1 September to Wednesday 2 September 2020

RBA ACOUSTICS

Project: 10439

Graph 2

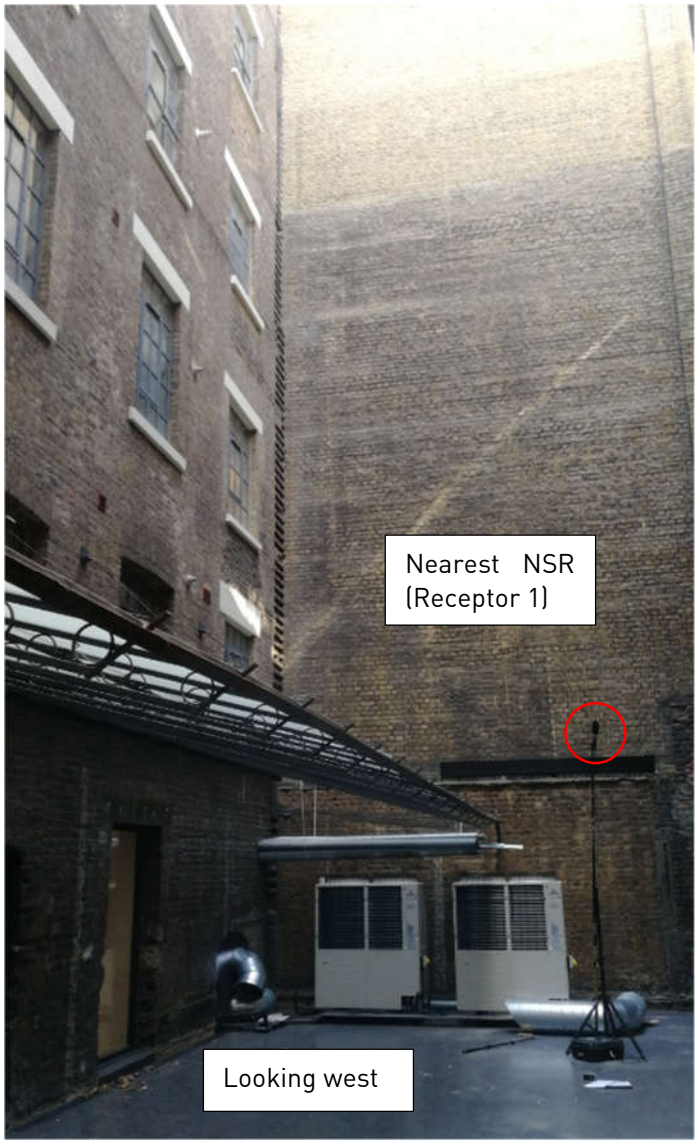


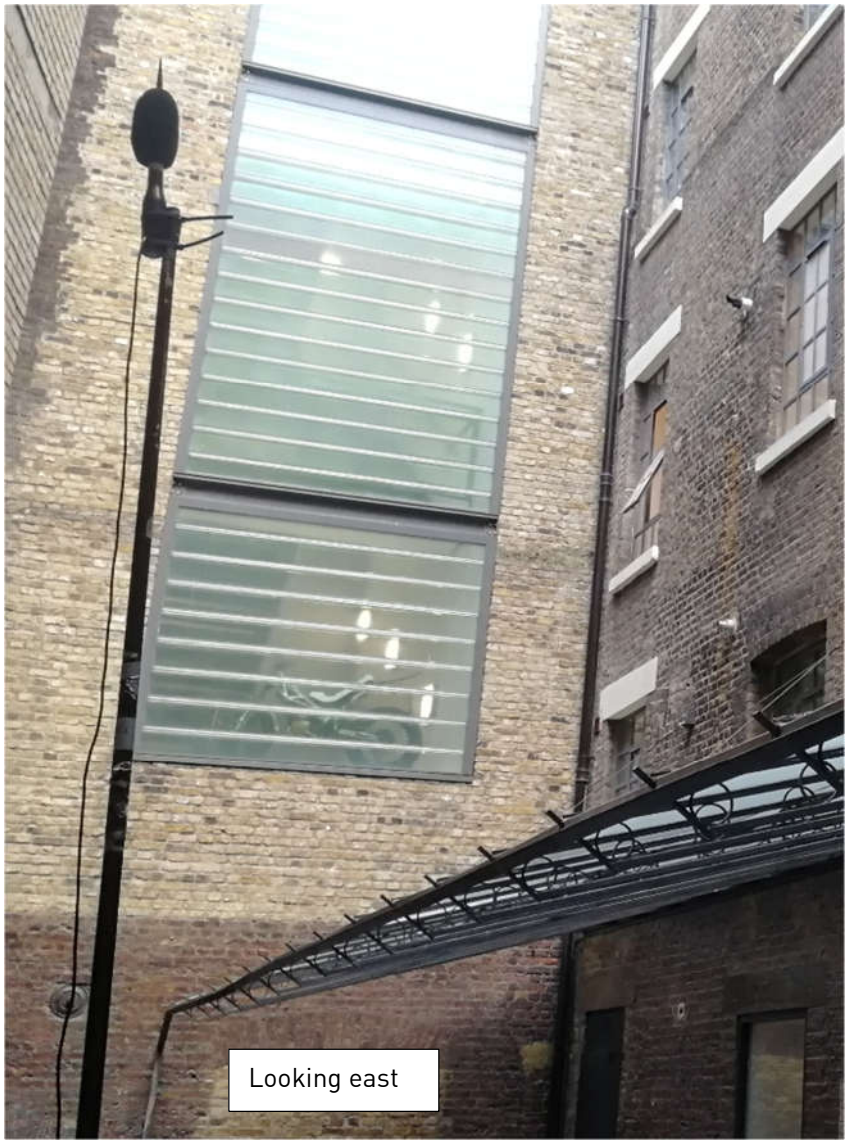


25 Shelton Street, London WC2H
Site Plan showing courtyard, plant and measurement locations
Project 10439

Figure 1
2 October 2020
Not to Scale

RBA ACOUSTICS

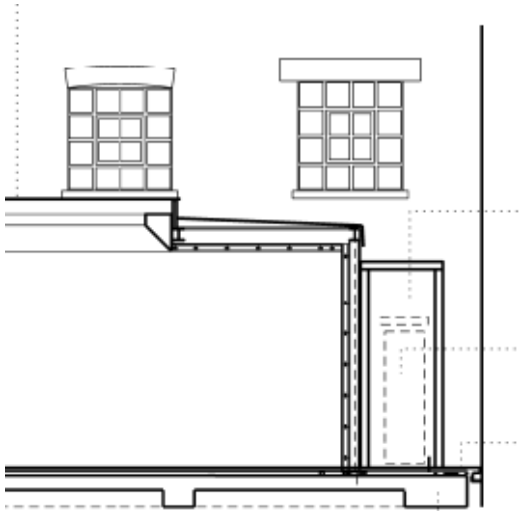


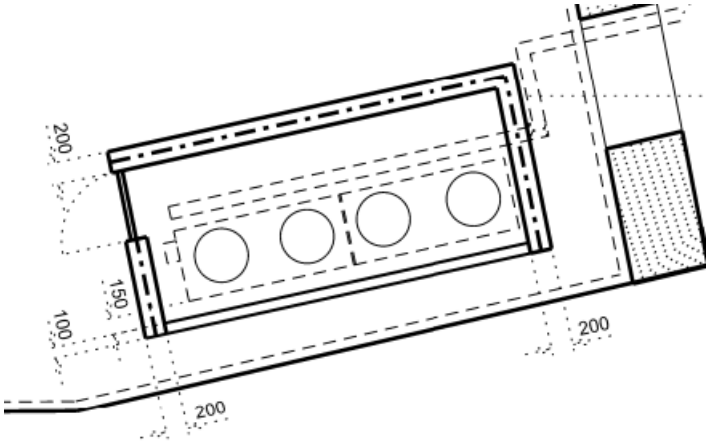


25 Shelton Street, London WC2H
Photos of measurement location
Project 10439

Figure 2
2 October 2020
Not to Scale

RBA ACOUSTICS





25 Shelton Street, London WC2H
Proposals for plant enclosure
Project 10439

Figure 3
2 October 2020
Not to Scale

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