



Jacksons Corner, Reading

Acoustic Report

April 2016

For

SG Capital

International House

1-6 Yarmouth Place

London

W1J 7BU

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EXECUTIVE SUMMARY

A new development is proposed at Jacksons Corner in Reading. The new development will include 34 residential apartments and three food & beverage units and will involve the refurbishment of an existing building and construction of a new building.

Reading Borough Council has requirements in relation to external noise intrusion into the new apartments, building services noise emissions affecting the new and existing dwellings, and potential noise break-out from the proposed food & beverage units.

A noise survey has been undertaken to determine ambient and background noise levels within and around the proposed development site.

Based on the noise survey results, calculations have been undertaken to determine the acoustic requirements of the residential façades, so as to achieve the Reading Borough Council requirements. It was concluded that the requirements could be achieved in the worst-case using suitably-selected acoustic double glazing. The sound reduction requirements are lower in quieter parts of the site. A detailed acoustic specification for all of the proposed development façades will be produced during the project design stage.

Noise limits for new building services plant have been proposed, based on the results of the noise survey and Reading Borough Council's requirements. Noise mitigation measures have been discussed, which will be refined during the project design stage and by the food & beverage tenant teams.

An assessment of noise break-out from the proposed food & beverage units to the residential dwellings has also been undertaken, with suitable mitigation measures proposed so as to achieve Reading Borough Council's requirements.

1.0 Introduction

A new development is proposed at Jacksons Corner in Reading. The development will include 34 residential apartments and three food & beverage units and will involve the refurbishment of an existing building and construction of a new building.

Reading Borough Council has requirements in relation to external noise intrusion into the new apartments, building services noise emissions affecting the new and existing dwellings, and potential noise break-out from the proposed food & beverage units.

This report presents the methodology and results of a noise survey to determine ambient and background noise levels within and around the site, as well as subsequent assessments to address Reading Borough Council's requirements.

2.0 Description of Site and Proposals

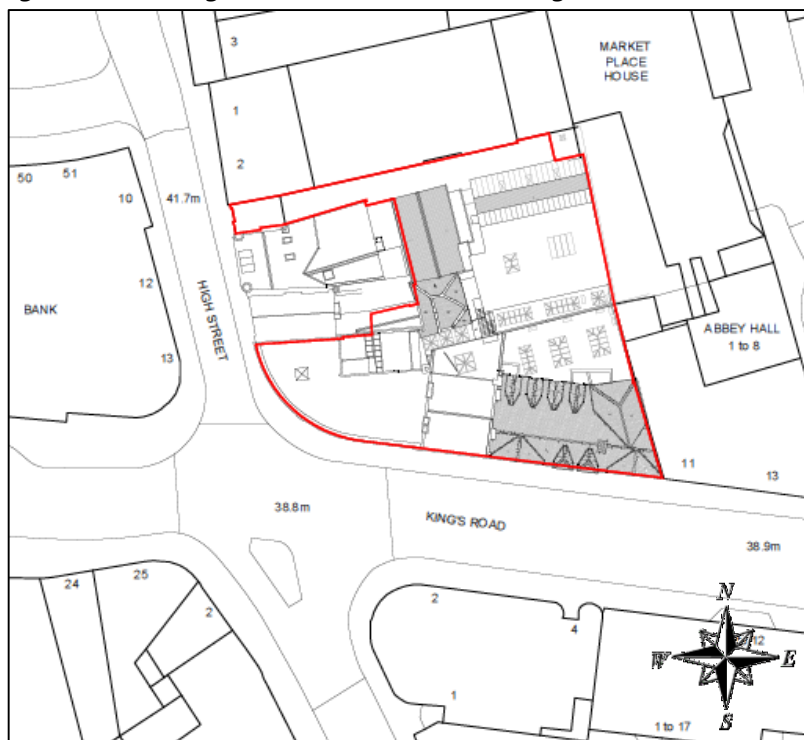
The proposed development site is at a location known as Jacksons Corner at 1-9 King's Road in the centre of Reading. The site is bounded by King's Road to the south and High Street to the west.

The majority of the site is currently occupied by a vacant retail property, with a small number of vacant residential units on the uppermost floors.

The area surrounding the site is made up of predominantly commercial uses (retail and office properties), although a residential dwelling was noted adjacent to the site within 11 King's Road to the east.

Figure 2.1 shows the existing site extent in **red** and the surrounding properties.

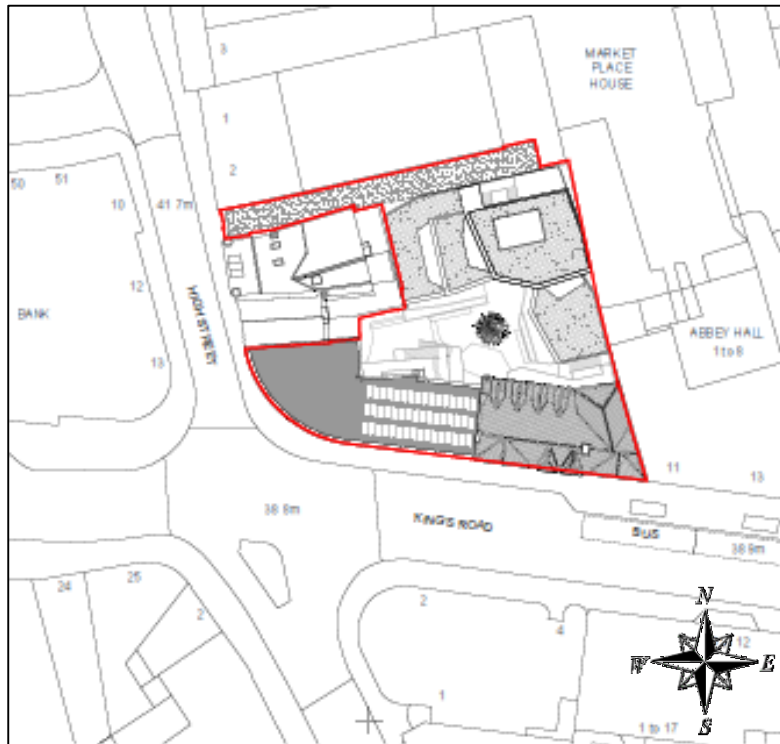
Figure 2.1 Existing Site Extent and Surroundings



It is proposed to refurbish the main southern corner building fronting onto King's Road to provide 18 apartments at first, second and third floor levels, with three food & beverage units at ground floor level. A new building is to be constructed to the north/rear of the site, involving 16 apartments arranged from ground to sixth floor level. A communal courtyard will occupy the centre of the site and the newly-built apartments will be equipped with balconies.

Figure 2.2 shows the proposed site arrangement in red.

Figure 2.2 Proposed Site Arrangement



3.0 Reading Borough Council Requirements

Reading Borough Council has confirmed the acoustic criteria shown in Table 3.1.

Table 3.1 Reading Borough Council Acoustic Criteria

Element	Criterion
External Noise Intrusion	Achieve acceptable internal noise levels in the residential dwellings, as specified in BS 8233: 2014 and WHO Guidelines
External Building Services Plant Noise Emissions	Limit building services noise to a level 10 dB less than the lowest background (L_{A90}) noise level
Internal Noise Break-out from Food & Beverage Units	Limit noise break-out to a level 10 dB less than the BS 8233/WHO internal noise levels

4.0 Noise Survey Methodology

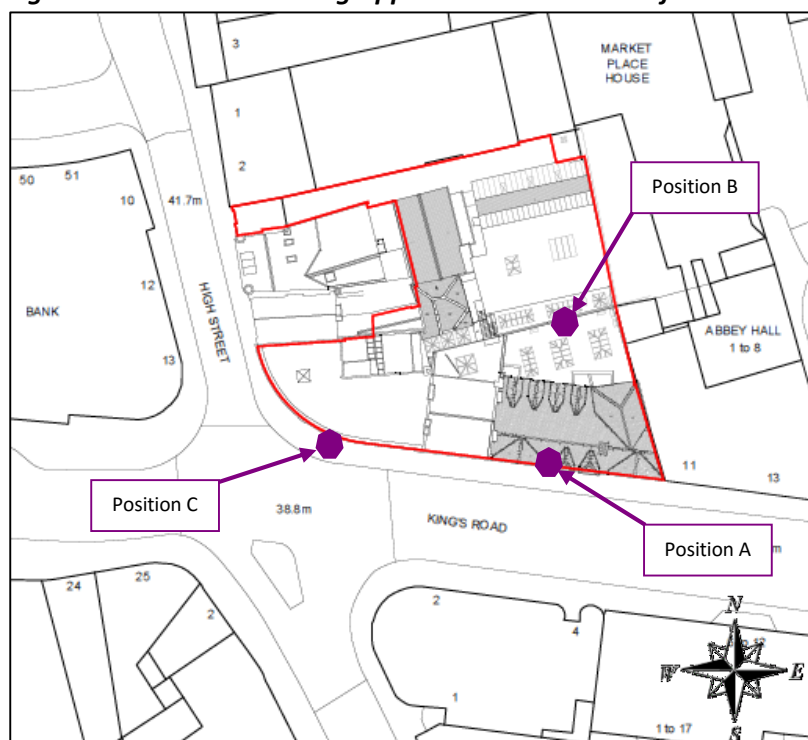
An unmanned environmental noise survey was undertaken over approximately 4 days between Thursday 17 March 2016 and Monday 21 March 2016. This survey period was selected to determine typical ambient and background noise levels during the proposed periods when the residential elements will be occupied and the commercial elements operational.

The measurement positions are described in Table 4.1 and indicated in **purple** on Figure 4.1.

Table 4.1 Description of Measurement Positions

Position	Description
A	Protruding from a window at first floor level at the southern boundary of the site overlooking King's Road
B	Fixed to a railing on a first floor level roof area in the centre of the site
C	Mounted on a tripod at a height of approximately 1.5m above pavement level at the south western corner of the site, at the intersection of King's Road and High Street

Figure 4.1 Site Plan Showing Approximate Locations of Measurement Positions



Measurement position A was selected as a worst-case location to assess noise levels affecting the proposed development site. Measurement position B was selected as being representative of background noise levels at the nearest existing noise sensitive properties.

A short manned noise survey was undertaken at position C to assess any variation in noise between the southern boundary of the site and the south western corner at the junction of King's Road and High Street.

The equipment used for the noise survey is summarised in Table 4.2.

Table 4.2 Description of Equipment used for Noise Survey

Measurement Position	Item	Make & Model	Serial Number
A	Type 1 automated logging sound level meter	01 dB Duo	10522
	Type 1 ½" external microphone	GRAS 40CD	136978
	Calibrator	01 dB CAL 21	01120237
B and C	Type 1 automated logging sound level meter	01 dB Cube	10511
	Type 1 ½" external microphone	GRAS 40CD	144879
	Calibrator	01 dB CAL 21	01120237

L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels were measured throughout the noise survey over contiguous 1 second intervals.

Due to the nature of the noise survey, i.e. unmanned, we are unable to comment on the weather conditions throughout the entire noise survey period. However, at the beginning and end of the survey period, there was noted to be no rainfall, a clear sky and only light wind. These conditions are understood to be representative of the survey period and are considered appropriate for undertaking environmental noise measurements.

The noise monitoring equipment was calibrated before and after the noise survey period. No significant change was found. Equipment calibration certificates can be provided upon request.

5.0 Noise Survey Results

Appendix B presents time history graphs showing the L_{Amax} , L_{Aeq} and L_{A90} sound pressure levels measured throughout the noise survey at the unmanned measurement positions. Due to measurement position A being near to the facade of the existing building, the measured noise levels have been reduced by 2 dB to more closely resemble "free-field" conditions (in accordance with guidance from BS 8233: 2014).

We would consider the levels measured to be reasonable, considering the location of the measurement positions and the dominant nearby noise sources.

Due to the nature of the unmanned noise survey we are unable to comment on the exact noise climate throughout the entire survey period. However, at the beginning and end of the survey period the

daytime noise climate at position A was noted to be affected by noise from road traffic and buses using King's Road and High Street. We anticipate that this would also be true of night-time periods.

At position B, the daytime noise climate was noted to be affected by road traffic noise using surrounding roads (e.g. High Street, King's Road), which we expect would also be true of night-time periods.

It was found that at position C, noise levels were generally 2 dB greater than at position A, and this has been taken into account in subsequent assessments.

6.0 External Noise Intrusion

This section assesses noise intrusion within the proposed development due to external sources, in relation to Reading Borough Council's requirements.

6.1 Layout of Proposed Development

The proposed development layout has been configured to minimise the number of sensitive rooms that directly face the principal surrounding sources of noise. The existing building is to be reconfigured so that dual-aspect apartments are constructed, with mainly living rooms facing 'out' of the site and bedrooms facing 'in' towards the sheltered central courtyard. Only a small number of bedrooms are proposed in the façades facing High Street/King's Road, with the remainder being living rooms.

The central courtyard, new residential building and new balconies will all benefit acoustically from the screening provided by the retained refurbished building around the site's boundary.

6.2 Measured External Noise Levels

Table 6.1 presents the noise levels measured at the south western corner of the site (worst-case) and within the site, derived from the manned and unmanned measurement results.

Table 6.1 Measured Noise Levels

Measurement Position	Daytime L_{Aeq} (16 hour) (dB)	Night-time L_{Aeq} (8 hour) (dB)
South Western Corner	68	62
Centre of Site	51	43

In addition, typically night-time L_{Amax} noise levels at the south western corner of the site were in the order of 82 dB.

6.3 Internal Noise Level Limits

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" recommends acceptable internal noise limits for residential dwellings, as presented in Table 6.2.

Table 6.2 BS 8233: 2014 Internal Noise Limits

Activity	Location	07:00 – 23:00 hours	23:00 – 07:00 hours
Resting	Living room	35 dB $L_{Aeq, 16 \text{ hr}}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16 \text{ hr}}$	-
Sleeping / daytime resting	Bedroom	35 dB $L_{Aeq, 16 \text{ hr}}$	30 dB $L_{Aeq, 8 \text{ hr}}$

In addition, the World Health Organisation (WHO) document “*Guidelines for Community Noise*” (1999) advises the following:

“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)”

Our assessment of external noise intrusion has considered both the BS 8233: 2014 and WHO guidance presented above.

6.4 External Façade Acoustic Requirements

Our calculations indicate that the BS 8233/WHO internal noise level limits could be achieved in the worst-case development façade at the south western corner of the site through the use of laminated acoustic double glazing achieving a sound reduction performance of at least R_w 40 dB. For the small number of bedrooms in this façade, higher-rated acoustic double glazing would be required (R_w 45 dB).

Any background ventilation in this façade would need to be acoustically attenuated i.e. high performance acoustic trickle ventilators or acoustic through-wall ventilators (assuming an open area of no greater than 2,500mm²).

For the quieter façades of the development facing into the centre of the site, conventional non-acoustic double glazing and trickle ventilators should be acoustically sufficient.

In general, the internal noise criteria would be exceeded if windows are opened.

Further analysis will be undertaken during the project design stage to refine the glazing specifications for each façade of the new and refurbished buildings.

7.0 Building Services Plant Noise Emissions

7.1 External Noise Limits

The lowest measured background noise levels are shown in Table 7.1.

Table 7.1 Lowest Measured Background Noise Levels

Noise Sensitive Property	Lowest Measured L_{A90} Background Noise Level (dB)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
South of Site	39	32
Within the Site	35	32

Reading Borough Council typically requires building services plant noise emissions to be limited to a level 10 dB less than the lowest background noise levels. However, given the very low background noise levels presented in Table 7.1, we would propose that building services plant noise emissions are limited to a maximum of 30 dB L_{Aeq} at the nearest existing or proposed noise sensitive property.

We would consider this to be an acceptable limit given:

- (a) The predominantly commercial nature of the area around the site
- (b) The advice given in both the current and previous versions of BS 4142 (which suggest suitable absolute noise level limits in quiet areas)
- (c) That 30 dB L_{Aeq} external to any residential property is less than the 45 dB L_{Aeq} threshold recommended by the WHO outside bedrooms with windows open.

The noise limit is to be achieved when measured 1m external to the nearest noise sensitive property and applies to the total cumulative noise level with all relevant plant operating simultaneously.

7.2 Control of Noise Emissions

At this stage in the design process it is considered that the plant design is sufficiently flexible to ensure that suitably quiet, non-tonal plant can be procured and where necessary mitigation options can be included (e.g. plant location, enclosures, screening) to ensure the noise limits are not exceeded.

The building services design is at an early stage and will depend largely on the food & beverage unit operators, but likely plant items and mitigation measures are as follows:

- Condensers units may be proposed on the roof of the new building at the rear of the site, serving the proposed food & beverage units. Low-noise plant items could be selected with night set-back settings and an acoustic screen could be constructed around the perimeter of the plant area (which would also provide visual screening). Where necessary, the condenser units could also be fitted with proprietary acoustic enclosures.
- Ventilation plant (e.g. toilet extract fans, fresh air supply fans, flue dilution fans) are likely to be located within the food & beverage unit demises, so casing noise break-out is likely to be sufficiently controlled. In addition, where ductwork connects with external grilles/louvres, suitable in-duct acoustic attenuators could be included in the design.
- Noise break-out from the substation within the new building at the rear of the site will be controlled via the appropriate design of the surrounding structure (walls and floors), which will be considered in detail during the design stage of the project.

8.0 Noise Break-Out from Food & Beverage Units

Control of noise break-out will be achieved via a combination of the following :

- This is discussed in the following sections.

A new floor construction is proposed between the food & beverage units, located at ground floor level, and the proposed residential apartments, at first floor level above. The floor is to consist of a 250mm thick dense concrete slab (2,300kg/m³), plus residential floor finishes above and tenant's decorative ceiling below.

Overall, this construction is likely to be capable of achieving airborne sound insulation at least 5 dB in excess of the standard required by Approved Document E 2003 of the Building Regulations.

Based on this floor construction, we have undertaken noise break-out calculations for several typical modern restaurants, of the sort that may occupy the proposed food & beverage units. Our calculations are shown in Tables 8.1 to 8.4.

Table 8.1 Food & Beverage Unit Noise Break-Out Calculations – Family Restaurant

Element	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Typical Restaurant Noise Level (L_{eq} , dB)	63	65	67	67	67	67	67	67
Sound Reduction of Separating Floor Construction (dB)	-35	-42	-46	-50	-57	-60	-65	-65
Correction for Floor Area and Receive Room Absorption (dB)	+9	+10	+9	+9	+11	+12	+12	+12
Predicted Noise Break-Out Level (dB)	37	33	30	26	21	19	14	14

Table 8.2 Food & Beverage Unit Noise Break-Out Calculations – Mediterranean Restaurant

Element	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
Typical Restaurant Noise Level (L_{eq} , dB)	61	63	63	66	62	59	58	51	
Sound Reduction of Separating Floor Construction (dB)	-35	-42	-46	-50	-57	-60	-65	-65	
Correction for Floor Area and Receive Room Absorption (dB)	+9	+10	+9	+9	+11	+12	+12	+12	L_{Aeq}
Predicted Noise Break-Out Level (dB)	35	31	26	25	16	11	5	<0	25

Table 8.3 Food & Beverage Unit Noise Break-Out Calculations – Pizza Restaurant

Element	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
Typical Restaurant Noise Level (L_{eq} , dB)	63	63	65	65	64	61	57	51	
Sound Reduction of Separating Floor Construction (dB)	-35	-42	-46	-50	-57	-60	-65	-65	
Correction for Floor Area and Receive Room Absorption (dB)	+9	+10	+9	+9	+11	+12	+12	+12	L_{Aeq}
Predicted Noise Break-Out Level (dB)	37	31	28	24	18	13	4	<0	25

Table 8.4 Food & Beverage Unit Noise Break-Out Calculations – Oriental Restaurant

Element	Octave Band Centre Frequency (Hz)								
	63	125	250	500	1k	2k	4k	8k	
Typical Restaurant Noise Level (L_{eq} , dB)	64	65	69	74	73	69	63	56	
Sound Reduction of Separating Floor Construction (dB)	-35	-42	-46	-50	-57	-60	-65	-65	
Correction for Floor Area and Receive Room Absorption (dB)	+9	+10	+9	+9	+11	+12	+12	+12	L_{Aeq}
Predicted Noise Break-Out Level (dB)	38	33	32	33	27	21	10	<0	33

It can be seen that the level of restaurant noise and noise break-out varies according to the tenant.

As mentioned in Section 3, Reading Borough Council require noise break-out to be limited to a level 10 dB less than the BS 8233/WHO levels, which are shown in Table 6.2. During daytime periods (07:00 – 23:00 hours), when the food & beverage units will be operational, this equates to a noise break-out limit of 25 dB L_{Aeq} .

For the examples above, it can be seen some achieve the noise limit and some do not, which reinforces the need to control operational noise at source via a tenancy agreement.

8.2 Tenancy Agreement

Appendix C presents typical wording that could be included in a tenancy agreement, which we have used successfully on numerous developments in the past.

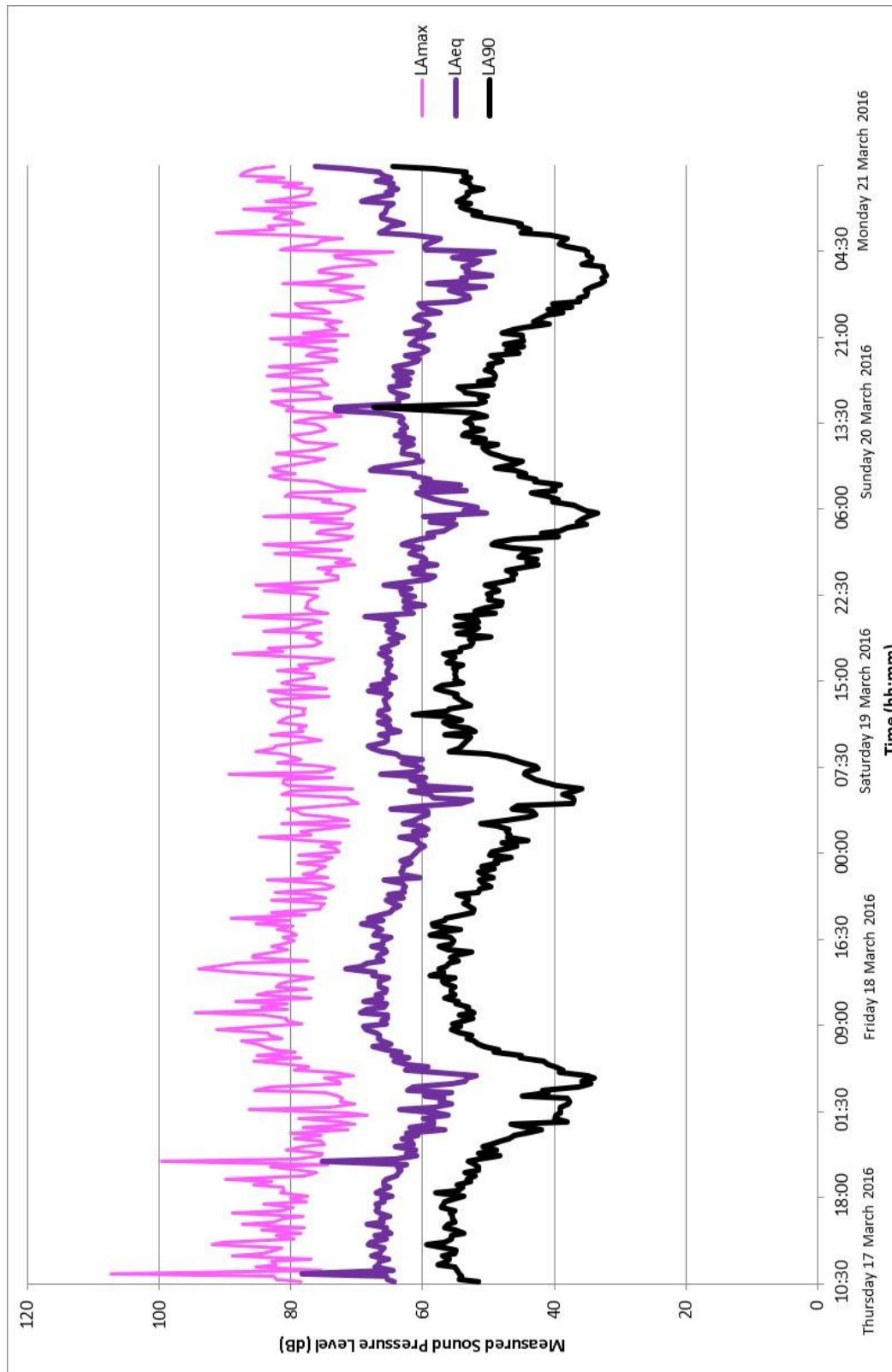
Typically, the tenant would be required to produce a technical assessment of their likely operational noise levels (e.g. based on similar operational sites) and undertake calculations, based on the proposed site conditions, to predict noise break-out levels. If the predicted levels exceed the proposed limits, then the tenant would be required to include noise mitigation measures in their design (e.g. upgraded acoustic ceiling, noise limiters on music), and present these measures to the landlord for review and approval.

Appendix A – Acoustic Terminology

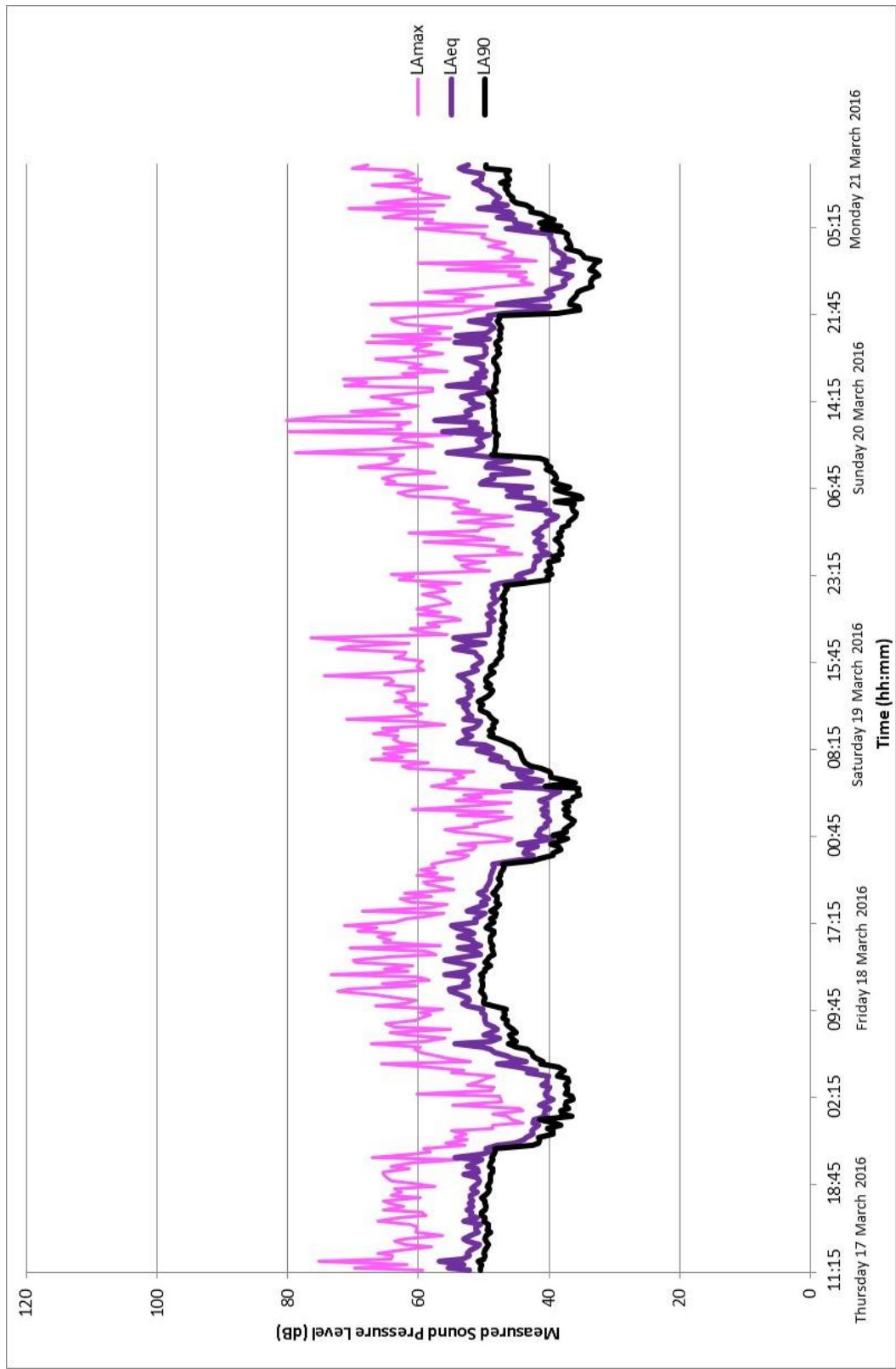
Parameter	Description
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing (20×10^{-6} Pascals).
Sound Pressure Level (L_p)	The sound pressure level is the sound pressure fluctuation caused by vibrating objects relative to the threshold of hearing.
A-weighting (L_A or dBA)	The sound level in dB with a filter applied to increase certain frequencies and decrease others to correspond with the average human response to sound.
$L_{Aeq,T}$	The A-weighted equivalent continuous noise level over the time period T (typically T= 16 hours for daytime periods, T = 8 hours for night-time periods). This is the sound level that is equivalent to the average energy of noise recorded over a given period.
L_{A90} (15 min)	The noise level exceeded for 90% of the time (also referred to as the background noise level), measured over a 15 minute period

Appendix B – Time History Graphs

Position A



Position B



Appendix C – Typical Tenancy Agreement Wording

1.0 General

Noise and vibration due to the Tenant's operations, activities and building services plant shall be designed, installed and maintained such that:

- (a) it does not cause constitute a noise nuisance
- and
- (b) it achieves any Local Authority planning/Environmental Health/Building Control requirements
- and
- (c) noise break-out to the first floor dwellings does not exceed 25 dB L_{Aeq}

2.0 Noise due to Operations

Noise due to operations is expected to include activity noise within the demise, as well as noise due to any building services plant or plant rooms within the Tenant's demise.

2.1 Internal

So as to comply with the general requirements given in Section 1.0, it is suggested that the Tenant limits noise levels in his demise to those shown in Table 1.

Table 1. Suggested Noise Limits in Demise

Parameter	Maximum Sound Pressure Level (dB re 2 x 10 ⁻⁵ Pa) @							
	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
L _{eq} (1 hour)	70	68	65	62	60	60	60	60

Should the Tenant wish to operate at greater noise levels than those shown in Table 1, additional sound insulation measures may be necessary as part of the Tenant's fit-out. As a minimum, this would be expected to include a plasterboard ceiling throughout the Tenant's demise.

Any additional measures shall be proposed by the Tenant to the Landlord. The design proposal shall include, as appropriate, calculations and manufacturer's sound insulation test results for any proprietary systems.

The base-build floor construction separating the ground floor and first floor levels can be assumed to provide the sound reduction indices given in Table 2, in the absence of any additional measures (e.g. suspended ceiling) in the ground floor demise.

Table 2. Sound Reduction Indices for Floor Construction Separating Ground and First Floor Levels

Sound Reduction Index (dB) @							
Octave Band Centre Frequency (Hz)							
63	125	250	500	1k	2k	4k	8k
35	42	46	50	57	60	65	65

Additionally, measures may be required in order to minimise the transfer of structureborne sound e.g. resilient mounting of loudspeakers in the ground floor demise.

2.2 External

Noise break-out from the ground floor demise to external areas shall be limited so as to comply with the requirements of the Local Authority (this may require an environmental noise survey to be undertaken to establish background noise levels).

In addition, noise break-out to public circulation areas shall be limited to a maximum of 55 dB L_{Aeq} (1 hour) during daytime periods (07:00 – 23:00 hours), when measured at any position 2m from the external façade of the demise and at least 1.5m above ground level.

3.0 Building Services Plant Noise and Vibration

3.1 Internal

Noise due to any internal plant within or serving the Tenant's demise shall be limited so as to comply with the general requirements given in Section 1. For any plant rooms within the Tenant's demise, noise levels therein should not exceed the suggested noise limits given in Table 2.

Should the Tenant wish to operate at greater noise levels than those shown in Table 2, additional sound insulation and noise control measures may be necessary as part of the Tenant's fit-out.

Vibration emitted by any internal plant within or serving the Tenant's demise shall not exceed $0.01m/s^2$ peak acceleration within any other demises of the building, as defined in Clause 3.3 of BS 6472-1: 2008.

3.2 External

External noise emissions from building services plant shall be limited so as to comply with the requirements of the Local Authority. Based on background noise levels measured in March 2016, it is suggested that the Tenant should limit cumulative noise emissions from the demise to the levels shown in Table 3.

Table 3. Maximum External Noise Emissions for Demise

Noise Sensitive Property	External $L_{Aeq,T}$ Noise Limit during Plant Operating Period (dB)	
	Daytime (07:00 – 23:00 hours)	Night-time (23:00 – 07:00 hours)
South and West of Site	25	25
North and East of Site	25	25
Within the Site	25	25

The noise limits in Table 3 are to be achieved during the specified plant operating period when measured 1m external to the nearest noise sensitive property and apply to the total cumulative noise level with all relevant plant operating simultaneously.

In addition, building services plant noise emissions to public circulation areas shall be limited to a maximum of 55 dB L_{Aeq} (1 hour) during the period 07:00 – 23:00 hours, when measured at any position 2m from the external façade of the demise and at least 1.5m above ground level.

3.3 General

Noise from the Tenant's plant should not exhibit any tonal content. Where any tonal content is apparent, the noise limits shall be reduced by 5 dB.

All Tenant plant shall be appropriately vibration isolated.

The Tenant shall be responsible for maintaining the plant to ensure that worn or damaged components do not increase the noise or vibration output.

The Tenant shall submit to the Landlord details of plant noise and vibration emissions and a scheme for attenuation/control thereof so as to comply with the specified limits, prior to commencing any installation.

The plant is likely to be subject to manufacturer's tolerances. The Tenant team should allow for this in their proposals.

4.0 Submission of Proposals

The Tenant's proposals to control noise and vibration to within the specified limits shall be submitted to the Landlord and shall include:

- Description of likely activities within the Tenant's demise
- Predicted operational noise levels within the Tenant's demise
- Predicted operational noise break-out levels within the first floor level office area
- Details of any additional sound insulation measures that are deemed necessary
- Manufacturer's noise emission data for any building services plant
- Manufacturer's noise reduction data for any plant noise attenuation (attenuators, etc.)
- Predicted noise levels within any plant rooms in the Tenant's demise
- Predicted plant room noise break-out levels to the first floor level office area
- Predicted external noise emissions from the Tenant's building services plant
- Details of the Tenant's proposed vibration isolation measures