

SANDY BROWN

Consultants in Acoustics, Noise & Vibration

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86-87a Broad Street, Reading

Acoustic planning report

London, Manchester, Edinburgh, Birmingham, Belfast

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Version	Date	Comments	Author	Reviewer
A	9 Feb 21		Artem Khodov	Robert Conetta
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C	12 Sep 21	Update following comments from team	Artem Khodov	Robert Conetta

Summary

Sandy Brown has been commissioned by Bankfoot APAM to provide an assessment of noise in relation to the proposed development at 86-87a Broad Street, Reading.

The proposal comprises:

“Redevelopment behind retained facade to provide a part-four, part-five storey building to provide Class E at ground floor and C3 residential above, together with associated works, landscaping arrangements and external plant.”

An environmental noise survey has been carried out at the site between 13 January 2021 and 20 January 2021.

Due to the Covid 19 lockdown, travel restrictions and closure of many commercial premises, noise levels during the survey may be lower than those under normal conditions. As such, a review of historical noise surveys close to the site has also been undertaken to establish appropriate baseline noise conditions.

The assessment undertaken provides a robust estimate of the environmental noise climate and is in line with the *“Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments”* produced by the Association of Noise Consultants and the Institute of Acoustics.

It is estimated that representative background sound levels under normal conditions would be:

- $L_{A90,5min}$ 54 dB during the daytime and $L_{A90,5min}$ 41 dB at night at front of site
- $L_{A90,5min}$ 48 dB during the daytime and $L_{A90,5min}$ 41 dB at night at the rear of the site

Based on the requirements of Reading Borough Council and on the results of the noise survey, all plant must be designed such that the cumulative noise level at 1 m from the worst affected windows of the nearby noise sensitive premises does not exceed:

- L_{Aeq} 44 dB during the daytime and L_{Aeq} 31 dB during the night at the front of site
- L_{Aeq} 41 dB during the daytime and L_{Aeq} 34 dB at night at the rear of the site

The average ambient noise levels incident on the facade during normal conditions are expected to be:

- $L_{Aeq,16h}$ 62 dB during the daytime and $L_{Aeq,8h}$ 56 dB at night at the front of the site
- $L_{Aeq,16h}$ 52 dB during the daytime and $L_{Aeq,8h}$ 47 dB at night at the rear of the site

An initial assessment has been carried out to determine required acoustic performances for the facades. Based on the highest ambient noise levels the facade sound insulation performance requirements range from $R'_w + C_{tr}$ 25 – 28 dB, which can be achieved with most double-glazing systems.

A Level 1 overheating assessment has been undertaken in-line with guidance set-out in the AVOG. It is recommended that a Level 2 overheating assessment is undertaken for dwellings at the front of the site in order to minimise the risk of noise nuisance in an overheating condition.

Noise levels at the terraces, during daytime and nighttime hours, are not expected to exceed the upper guideline value of L_{Aeq} 55 dB given in BS 8233:2014.

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1 Introduction

Sandy Brown has been commissioned by Bankfoot APAM to provide an assessment of noise in relation to the proposed development at 86-87a Broad Street, Reading.

An environmental noise survey has been carried out to establish:

- background sound levels around the site and by nearby noise sensitive premises
- ambient and maximum noise levels at the site.

The background sound levels measured during the survey are used as the basis for setting limits for noise emission from proposed building services plant. These limits are set in accordance with the requirements of Reading Borough Council.

Ambient and maximum noise levels are used to assess building envelope sound insulation requirements to achieve appropriate internal noise levels for residences. These follow standards set in accordance with Reading Borough Council guidelines.

This report provides details of the noise survey, including measurement results, and provides recommendations.

2 Development proposals

The proposal comprises:

“Redevelopment behind retained facade to provide a part-four, part-five storey building to provide Class E at ground floor and C3 residential above, together with associated works, landscaping arrangements and external plant.”

3 Site description

3.1 The site and its surroundings

The site location in relation to its surroundings is shown in red Figure 1. The site is located on Broad Street, which is the pedestrianised retail and commercial high street. St Mary's Butts – a busy road lies to the west of the site.

The rear of the site is facing a shared courtyard, and a car park.



Figure 1 Aerial view of site (courtesy of Google Earth Pro)

3.2 Adjacent premises

The site is located in a predominantly commercial area. The commercial buildings are shown in blue on Figure 1.

Premises at 83 Broad street, 85 Broad Street, 61 St Mary's Butts have commercial premises on the ground floor and residential premises on the top floors. 59 St Mary's Butts is a residential building. These are highlighted in yellow in Figure 1.

4 Assessment criteria

4.1 NPPF and NPSE

The National Planning Policy Framework, July 2021 (NPPF) sets out the UK government's planning policies for England. It supersedes previous guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers.

The NPPF states:

'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:

- *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.*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'*

and

'Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.'

The NPSE states that its aims are as follows:

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

- *Avoid significant adverse impacts on health and quality of life*
- *Mitigate and minimise adverse impacts on health and quality of life and*
- *Where possible, contribute to the improvement of health and quality of life.'*

As such, neither document sets out specific acoustic criteria for new residential developments, but they require consideration of the effect of existing noise on the new development and the effect of noise from the development on the surroundings.

4.2 ProPG

ProPG *Planning & Noise (Professional Practice Guidance on Planning & Noise), New Residential Development, 2017* provides guidance to the management of noise within the planning system in England. It is restricted to consideration of new residential developments that will be exposed predominantly to airborne noise from transport sources.

The two stages of the approach are given below

- Stage 1 – Initial noise risk assessment of the proposed development site
- Stage 2 – Systematic consideration of four key elements
 - Element 1 – Demonstrating a “Good Acoustic Design Process”
 - Element 2 – Observing internal “Noise Level Guidelines”
 - Element 3 – Undertaking an “External Amenity Area Noise Assessment”
 - Element 4 – Consideration of “Other Relevant Issues”.

Following this approach, there are four possible recommendations, the choice of recommendation is as follows:

- Grant without conditions
- Grant with conditions
- Avoid
- Prevent

Guidance provided in ProPG has been used to assess the proposed development site and recommend mitigation measures to reduce noise levels.

4.3 Noise egress

4.3.1 Standard guidance

BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS 4142) provides a method for assessing noise from items such as building services plant against the existing background sound levels at the nearest noise sensitive premises.

BS 4142 suggests that if the noise level is 10 dB or more higher than the existing background sound level, it is likely to be an indication of a significant adverse impact. If the level is 5 dB above the existing background sound level, it is likely to be an indication of an adverse impact. If the level does not exceed the background level, it is an indication of having a low impact.

If the noise contains ‘attention catching features’ such as tones, bangs etc, a penalty, based on the type and impact of those features, is applied.

4.3.2 Local Authority criteria

In relation to mechanical plant noise egress, Reading Borough Council Local Plan (Adopted November 2019) states:

Where noise generating equipment is proposed, the noise source specific level (plant noise level) should be at least 10 dBA below the existing background level as measured at the nearest noise sensitive receptor.

4.4 Noise ingress

4.4.1 Local Authority requirements

Reading Borough Council Local Plan (Adopted November 2019) does not have any specific criteria for noise ingress.

4.4.2 British Standard guidance

Guidance on acceptable internal noise levels in residential dwellings is given in BS 8233:2014 *Sound insulation and noise reduction for buildings*. The guidance limits are shown in Table 1.

These internal levels are based on annual average data and do not have to be achieved in all circumstances. It is normal to exclude occasional events, such as fireworks night or New Year's Eve.

Table 1 Internal noise criteria for sleeping/resting

Internal space	Indoor ambient noise level, L_{Aeq} (dB)	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Living rooms	35	-
Dining room	40	-
Bedrooms	35	30 ¹

[1] BS 8233 notes that individual noise events can cause sleep disturbance, and that a guideline value may be set depending on the character and number of events per night, although no specific limit is provided. For regular events, such as scheduled aircraft or passing trains, a guideline value may be set in terms of SEL or $L_{Amax,F}$. Sporadic noise events could require separate values.

The standard states that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

For external amenity areas, such as gardens and patios, the standard states:

'it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'

4.4.3 ProPG

Internal noise ingress criteria in ProPG are the same as in BS 8233:2014 but additional guidance is provided. In relation to regular individual noise events the following additional guidance is provided:

'In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events.'

4.4.4 Acoustics, ventilation and overheating

Guidance on external noise levels from transport noise sources and the assessment of risk in an overheating condition is given in the Association of Noise Consultants *Acoustics Ventilation and Overheating, Residential Design Guide* (AVOG).

A Level 1 assessment comprises assessing the external free-field noise levels to guideline thresholds. External noise levels and the associated risk categories for a Level 1 assessment are adapted and summarised in Table 2, though consideration also has to be given the duration and frequency of any overheating periods.

Table 2 Guidance for Level 1 assessment of noise from transport sources relating to overheating condition

Risk category for Level 1 assessment	External free-field noise level	
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)
Negligible	$L_{Aeq} \leq 52$ dB	$L_{Aeq} \leq 47$ dB
Low	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 57$ dB	$L_{Aeq} > 47$ dB and $L_{Aeq} \leq 52$ dB
Medium	$L_{Aeq} > 57$ dB and $L_{Aeq} \leq 62$ dB	$L_{Aeq} > 52$ dB and $L_{Aeq} \leq 55$ dB
High	$L_{Aeq} > 62$ dB	$L_{Aeq} > 55$ dB

If a Level 1 assessment finds that the development falls into a 'Medium' or 'High' risk category a Level 2 assessment should be carried out, assessing the expected internal noise levels for an overheating condition and the associated risk of adverse effect. The Level 2 assessment would consider the following:

- Duration of period where additional ventilative cooling is required (to be assessed by others, typically part of a CIBSE TM59 assessment)
- How wide the external windows would need to be open to control overheating (to be assessed by others, typically part of a CIBSE TM59 assessment).

The guidance for suitable internal noise levels in order that noise ingress can be suitably controlled for an overheating condition are provided in AVOG. These are adapted and summarised in Table 3, though are not supposed to be taken as limits, rather guidelines to be assessed while also considering the adverse effect of any overheating (duration and severity).

The lowest observed affect level (LOAEL) and the significant observed affect level (SOAEL) for increased noise levels associated with controlling overheating are specific to each project as these depend on the magnitude of the increased internal noise levels and the duration for which they occur.

Table 3 Guidance for Level 2 assessment of noise from transport sources relating to overheating condition

Effect level	Internal noise level from transport sources		
	Daytime (07:00 – 23:00)	Night (23:00 – 07:00)	
LOAEL (noise can be heard, but does not cause any change in behaviour)	$L_{Aeq} \leq 35$ dB	$L_{Aeq} \leq 30$ dB	L_{AFmax} 45 dB not normally exceeded
SOAEL upper limit for longer overheating durations	$L_{Aeq} > 35$ dB and $L_{Aeq} \leq 40$ dB	$L_{Aeq} > 30$ dB and $L_{Aeq} \leq 35$ dB	-
SOAEL upper limit for shorter overheating durations	$L_{Aeq} > 40$ dB and $L_{Aeq} \leq 50$ dB	$L_{Aeq} > 35$ dB and $L_{Aeq} \leq 42$ dB	-
Exceeds SOAEL (noise causes a material change in behaviour)	$L_{Aeq} > 50$ dB	$L_{Aeq} > 42$ dB	L_{AFmax} 65 dB normally exceeded

The AVOG illustrates that there is a link between adverse effects, increasing internal ambient noise levels and the duration of exposure to noise for an overheating condition. These are indicated in Figure 2.

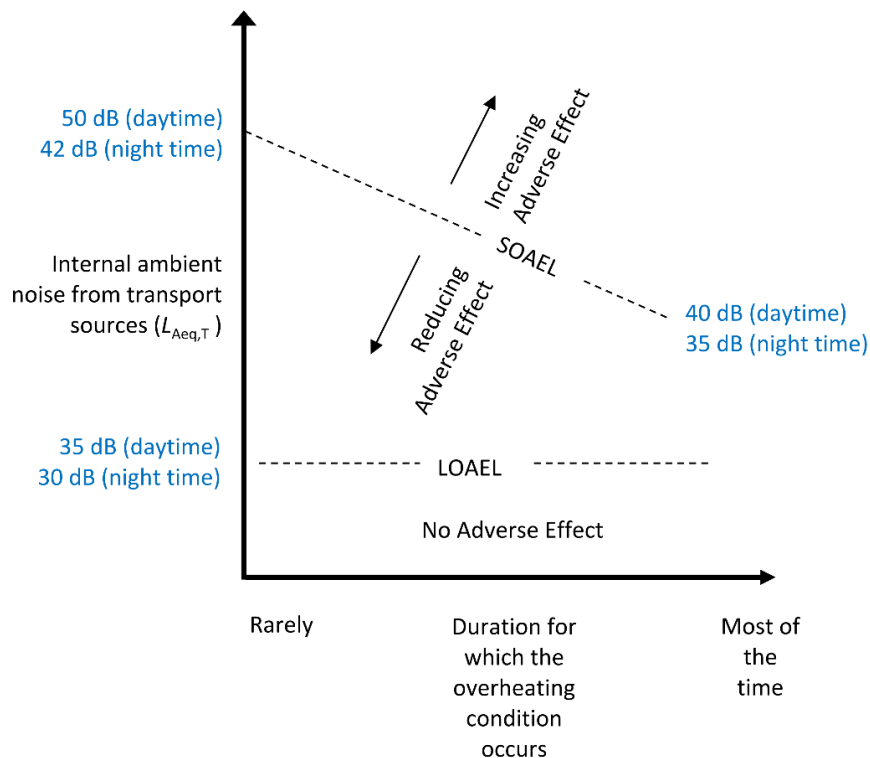


Figure 2 Internal ambient noise levels and increasing adverse effects for an overheating condition

When internal noise levels are above Significant Observed Adverse Effect Level (SOAEL), it is likely that there will be a high potential for an adverse outcome. These adverse outcomes will include:

- Material change in behaviour and/or attitude, eg 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 and difficulty in getting back to sleep
- Quality of life diminished.

As illustrated, the potential for adverse risk increases with the duration of exposure to noise, ie, a shorter exposure will result in a lower risk of adverse outcomes.

5 Noise survey

5.1 Method

Unattended noise monitoring was undertaken at the site over 8 days.

Details of the equipment used and the noise indices measured are provided in Appendix A.

The unattended measurements at position A were taken over 5-minute periods between 14:45 on 13 January 2021 and 09:45 on 19 January 2021. The unattended measurements at position B were taken over 5-minute periods between 15:15 on 13 January 2021 and 13:00 on 20 January 2021. The equipment was installed by Artem Khodov and collected by Patrick Smith.

The measurement positions used during the survey are indicated in Figure 1, denoted by letters 'A' and 'B'. Photographs showing the measurement locations are provided in Figure 3 and Figure 4. These locations were chosen to be reasonably representative of noise levels at the site and outside the nearest noise sensitive premises.

Measurements at position A are considered to be at the facade. Measurements at position B are considered to be free-field.



Figure 3 Logger installed on site at position A



Figure 4 Logger installed on site at position B

5.2 Weather conditions

Weather conditions during the survey are described in Appendix A.

5.3 Observations

The dominant noise sources observed at the front site during the survey were occasional pedestrians on Broad St and from road traffic on St Mary's Butts.

The dominant noise sources observed at the rear site during the survey were items of external plant located on adjacent buildings.

Less significant noise sources included distant traffic.

5.4 Results at position A

A graph showing the results of the unattended measurements is provided in Appendix B.

Measurements at position A are considered to be at the facade.

Day and night-time ambient noise levels measured during the unattended survey are presented in Table 4.

Table 4 Ambient noise levels measured during the unattended survey at position A

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Wednesday 13 January 2021	N/A ^[1]	59
Thursday 14 January 2021	59	55
Friday 15 January 2021	59	54
Saturday 16 January 2021	60	48
Sunday 17 January 2021	57	52
Monday 18 January 2021	58	52
Tuesday 19 January 2021	N/A ^[1]	N/A
Average	59	53

^[1] Measurement not made over full period due to monitoring start and end time (the measurement on 13 January 2021 was over 8 hours, and on 19 January 2021 over 3 hours); not included in the average.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and night time statistical analysis of representative values for the site are given in Figure 5 and Figure 6.

From this analysis, the representative background sound levels measured during the survey were $L_{A90,5 \text{ min}}$ 51 dB during the daytime and $L_{A90,5 \text{ min}}$ 38 dB at night.

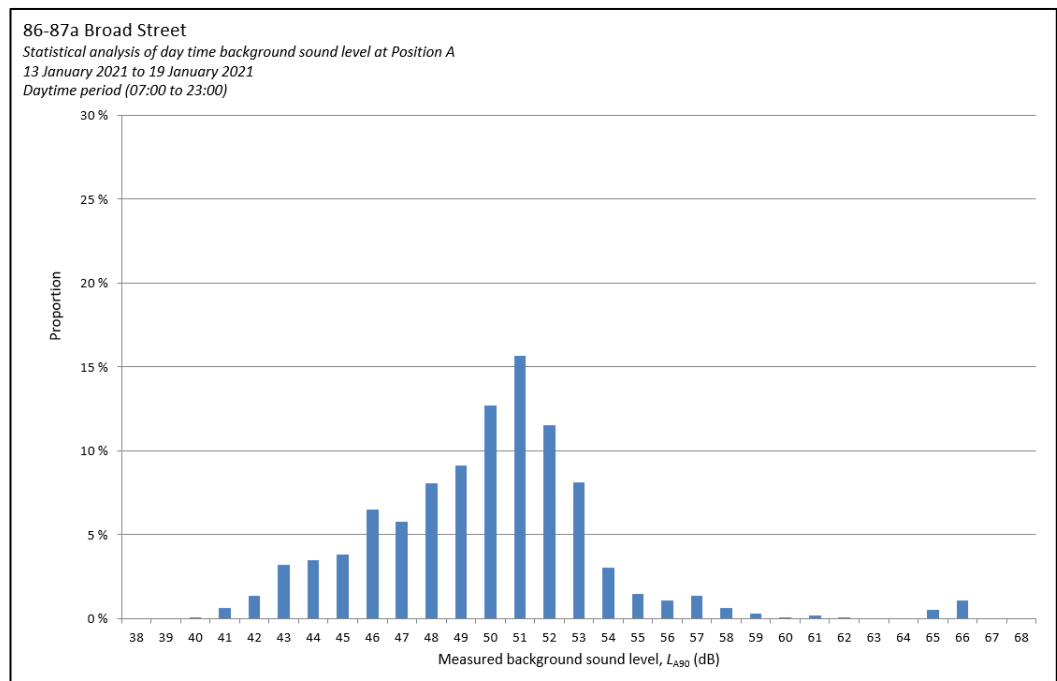


Figure 5 Position A daytime statistical analysis

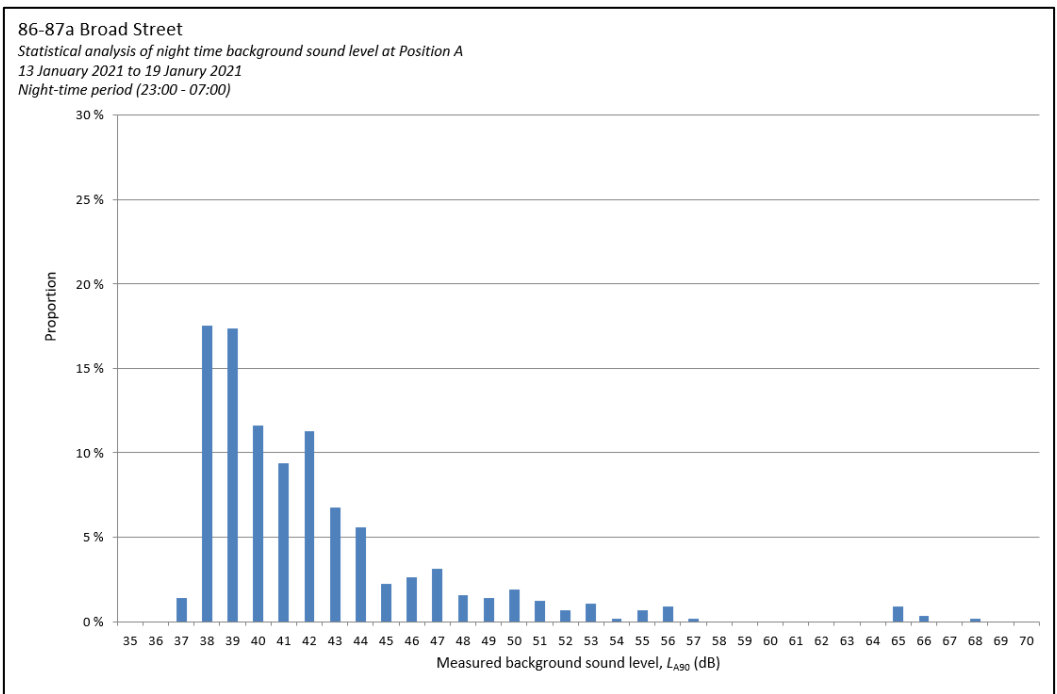


Figure 6 Position A night-time statistical analysis

5.5 Results at position B

A graph showing the results of the unattended measurements is provided in Appendix C.

Measurements at position B are considered to be free-field. Day and night-time ambient noise levels measured during the unattended survey are presented in Table 4.

Table 5 Ambient noise levels measured during the unattended survey at position B

Date	Daytime (07:00 – 23:00) $L_{Aeq,16h}$ (dB)	Night (23:00 – 07:00) $L_{Aeq,8h}$ (dB)
Wednesday 13 January 2021	N/A ^[1]	46
Thursday 14 January 2021	52	50
Friday 15 January 2021	52	47
Saturday 16 January 2021	51	44
Sunday 17 January 2021	50	47
Monday 18 January 2021	52	50
Tuesday 19 January 2021	53	48
Wednesday 20 January 2021	N/A ^[1]	N/A
Average	52	47

^[1] Measurement not made over full period due to monitoring start and end time (the measurement on 13 January 2021 was over 8 hours, and on 20 January 2021 over 6 hours); not included in the average.

In line with BS 4142:2014+A1:2019, representative background sound levels have been determined using statistical analysis of the continuous measurements.

Daytime and nighttime statistical analysis of representative values for the site are given in Figure 7 and Figure 8.

From this analysis, the representative background sound levels measured during the survey were $L_{A90,5\min}$ 48 dB during the daytime and $L_{A90,5\min}$ 41 dB at night at the rear of the site.

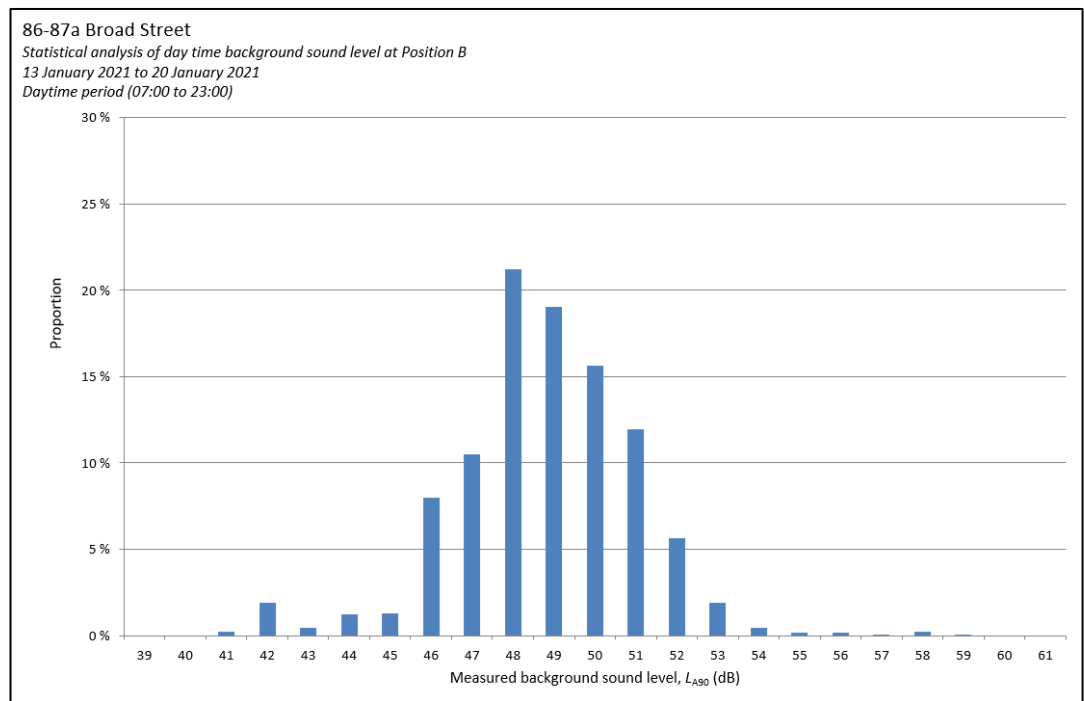


Figure 7 Position B daytime statistical analysis

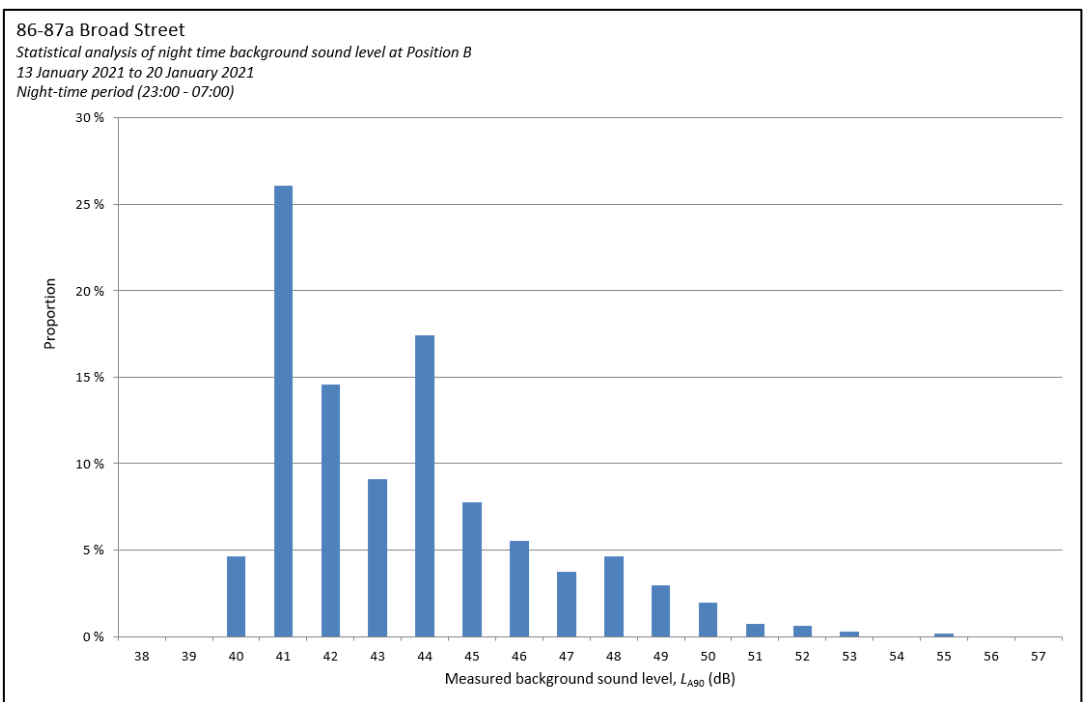


Figure 8 Position B night-time statistical analysis

6 Correction of the survey results due to the impact of COVID-19 pandemic

The measurements were undertaken during the national lockdown, caused by COVID-19 pandemic. As a result of this, traffic and pedestrian flows are reduced significantly compared to the normal conditions.

Following the guidance released by Institute of Acoustics and Association of Noise Consultants on 15 January 2021, noise surveys should continue. However, appropriate corrections need to be applied to mathematically estimate the expected noise level at the measured locations during normal conditions. To estimate the local conditions a review of previous planning applications available on Reading Borough Council's website has been conducted, as well as a road traffic noise assessment to estimate normal traffic noise from St Mary's Butts.

6.1 Review of historical environmental noise surveys

A review of historical environmental noise surveys undertaken for previously approved planning applications in the locality of the proposed development has been conducted. Surveys from the following applications have been reviewed:

- *Application 151221 116-117&119 Broad Street and 19-22 Minster Street Reading RG1 2BE (Received on 13 July 2015)*
- *Application 190182 'Unit 4' Broad Street Mall (received on 1 February 2019)*

Following the review of these planning applications, it was determined that the noise levels measured at the front of the site are approximately 3 dB lower than during normal conditions. As such it is recommended that a +3 dB correction is applied to the measurement results recorded at position A.

No correction is recommended for the measurement results recorded at the rear of the site (position B). As a result, the representative background noise levels are expected to be:

- L_{A90} 54 dB at the front of site during daytime (facade level)
- L_{A90} 41 dB at the front of site at night (facade level)
- L_{A90} 48 dB at the rear of site during daytime (free-field level)
- L_{A90} 41 dB at the rear of site at night (free-field level)

And representative ambient noise levels are expected to be:

- L_{Aeq} 62 dB at the front of site during daytime (facade level)
- L_{Aeq} 56 dB at the front of site at night (facade level)
- L_{Aeq} 52 dB at the rear of site during daytime (free-field level)
- L_{Aeq} 47 dB at the rear of site at night (free-field level)

7 Control of plant noise egress

7.1 Basic limits

Based on the above criteria and the measurement results, the cumulative noise level from the operation of all new plant should not exceed the limits set out in Table 6.

The limits apply at 1 m from the worst affected windows of the nearest noise sensitive premises and are presented as facade levels. These have been corrected relative to the measured free-field background noise levels by the addition of 3 dB. In this case these limits would apply at 83 Broad Street (front of site), 85 Broad Street (front of site), 59 St Mary's Butts (rear of site) and 61 St Mary's Butts (rear of site).

Table 6 Plant noise limits at 1 m from the nearest noise sensitive premises at front of site

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,5min}$ (dB)
Daytime (07:00-23:00)	44
Night-time (23:00-07:00)	31

Table 7 Plant noise limits at 1 m from the nearest noise sensitive premises at rear of site

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises, $L_{Aeq,5min}$ (dB)
Daytime (07:00-23:00)	41
Night-time (23:00-07:00)	34

The limits set out in Table 6 do not include any attention catching features. The penalty corrections for attention catching features may be significant, and will need to be considered as the building services design progresses. This is discussed in Appendix D.

7.2 Plant noise assessment

All building services plant will be designed to achieve the noise limits set out above, including any corrections for attention catching features. At this stage, no information is available in relation to the proposed plant. This will need to be assessed as the design progresses.

8 Facade sound insulation – noise ingress

This section describes an assessment of facade sound insulation to control noise ingress. The required facade specification largely depends on the external noise levels and the internal noise criteria.

The following assessment is based on achieving the internal noise levels recommended in BS 8233:2014, which are set out in Section 4.4.

8.1 External noise levels

Predicted external noise levels at the facades of the proposed development are shown in Figure 9.

During the worst-case night of the survey, the L_{AFmax} levels measured at the site were:

- between L_{AFmax} 55-75 dB at the front of the site
- between L_{AFmax} 52-65 dB at the rear of the site

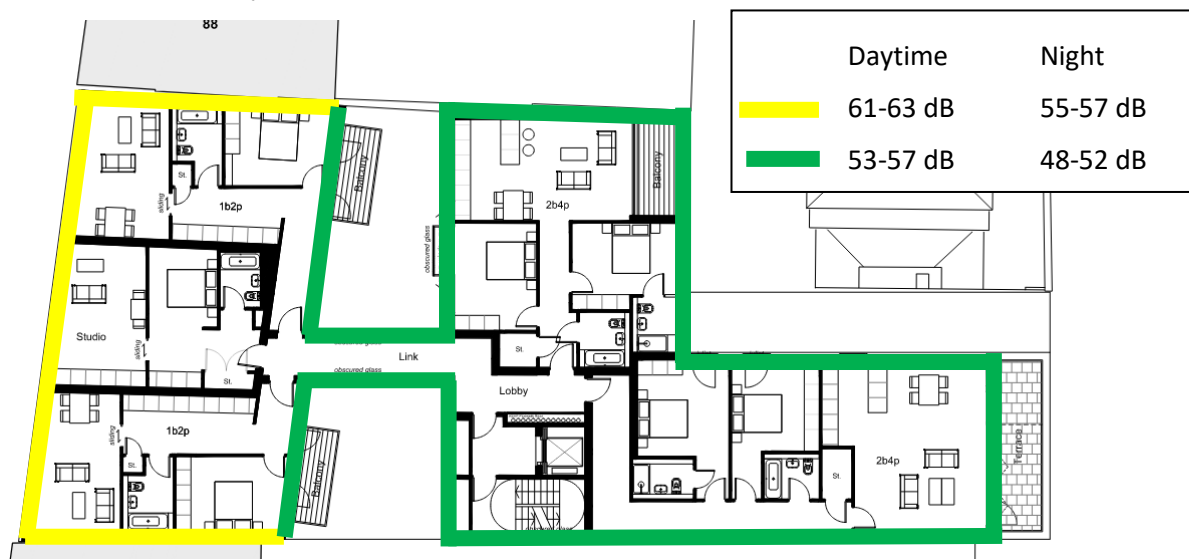


Figure 9 Expected noise levels incident on the facade

8.2 Facade sound insulation

Minimum facade sound insulation requirements for the facades are given in Table 8. These have been determined to achieve the internal noise criteria for bedrooms and living areas using predicted external noise levels at the facades.

At this site, the facade performance requirements are driven by night-time ambient noise levels incident at the development facade. This specification will also ensure that $L_{AFmax\ 15\ min}$ criteria is exceeded on no more than 10 occasions based on the worst affected night during the survey.

Table 8 Facade sound insulation performance requirements

Facade	Overall sound insulation performance, R'_w+C_{tr} (dB)
	28
	25

The performance required by each element will depend on the relative areas of glazed and non-glazed elements, and the ventilation strategy. If applicable, this includes the acoustic performance of trickle ventilators and the number of ventilators per room. As a guide, for a mechanically ventilated room with a 50% glazed facade, the glazing sound insulation requirement would typically be 3 dB lower than the overall facade sound insulation requirement. This is provided the non-glazed external wall elements provide at least 10 dB more sound insulation than the glazed elements.

8.3 Guidance on facade construction, glazing, and ventilation strategy

The glazing sound insulation performance requirements can generally be achieved with most standard double-glazing systems. Table 9 sets out some examples of glazing configurations and ventilation strategies that could achieve the required sound insulation performances.

Table 9 Example glazing configurations and ventilation strategies for overall facade sound insulation

Overall facade sound insulation, R'_w+C_{tr} (dB)	Example glazing configuration	Ventilation strategy
15 – 27	6 mm glass/16 mm cavity/6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)
28 – 29	6.8 mm acoustic laminate/16 mm cavity /6 mm glass	Acoustically attenuated passive ventilation (eg, trickle vents)

The performance required by each element will depend on the relative areas of glazed and non-glazed elements, and the ventilation strategy. If applicable, this includes the acoustic

performance of trickle ventilators and the number of ventilators per room. As a guide, for a mechanically ventilated room with a 50% glazed facade, the glazing sound insulation requirement would typically be 3 dB lower than the overall facade sound insulation requirement. This is provided the non-glazed external wall elements provide at least 10 dB more sound insulation than the glazed elements.

A more detailed facade assessment will be needed as the design develops to ensure the overall performance requirements are met.

8.4 Overheating assessment

Based on the results of the survey and review of historical survey data, the expected external free-field noise levels are:

- L_{Aeq} 59 dB at the front of site during daytime
- L_{Aeq} 53 dB at the front of site at night
- L_{Aeq} 52 dB at the rear of site during daytime
- L_{Aeq} 47 dB at the rear of site at night

A Level 1 assessment has been undertaken as described in Section 4.4.4.

The outcome of the assessment indicates the development falls into the following risk categories:

- 'Medium' – for dwellings at the front of the site
- 'Negligible' – for dwellings at the rear of the site

For dwellings which fall into the 'Medium' risk category, a Level 2 assessment should be carried out. This should assess the expected internal noise levels for an overheating condition and the associated risk of adverse effect.

Further details of a Level 2 assessment can be found in Section 4.4.4.

8.5 External amenity areas

There are a number of terraces proposed at the rear of the site. Based on their location, noise levels at the terraces, during daytime and night time hours, are not expected to exceed the upper guideline value of L_{Aeq} 55 dB given in BS 8233:2014.

9 Conclusion

The representative predicted background sound levels during normal conditions are:

- $L_{A90,5min}$ 54 dB during the day, and $L_{A90,5min}$ 41 dB during the night at front of the site
- $L_{A90,5min}$ 48 dB during the day, and $L_{A90,5min}$ 41 dB during the night at the rear of the site

Based on the requirements of Reading Borough Council, the relevant plant noise limits at the worst affected existing noise sensitive premises are:

- L_{Aeq} 44 dB during the day, and L_{Aeq} 31 dB during the night at front of the site
- L_{Aeq} 41 dB during the day, and L_{Aeq} 34 dB during the night at the rear of the site

These limits are cumulative and apply with all plant operating under normal conditions. If plant items contain tonal or attention catching features, the limits will be more stringent.

An initial assessment has been carried out to determine required acoustic performances for the facades. Based on the highest ambient noise levels the facade sound insulation performance requirements range from $R'_w + C_{tr}$ 25 – 28 dB. Which can be achieved with most double-glazing systems.

A Level 1 overheating assessment has been undertaken in-line with guidance set-out in the AVOG. It is recommended that a Level 2 overheating assessment is undertaken for dwellings at the front of the site in order to minimise the risk of noise nuisance in an overheating condition.

Noise levels at the terraces, during daytime and nighttime hours, are not expected to exceed the upper guideline value of L_{Aeq} 55 dB given in BS 8233:2014.

Appendix A - Survey details

Equipment

The unattended noise measurements were taken using two Rion NI-52 sound level meters.

Calibration details for the equipment used during the survey are provided in Table A1.

Table A1 Equipment calibration data

Equipment description	Type/serial number	Manufacturer	Calibration expiry	Calibration certification number
Sound level meter	NL-52/00320633	Rion	2 Jun 22	TCRT20/1263
Microphone	UC-59/12576	Rion	2 Jun 22	TCRT20/1263
Pre-amp	NH-25/10641	Rion	2 Jun 22	TCRT20/1263
Calibrator	N7-74/34125430	Rion	29 May 22	TCRT20/1262
Sound level meter	NL-52/00375679	Rion	9 Jul 21	TCRT19/1541
Microphone	UC-59/11168	Rion	9 Jul 21	TCRT19/1541
Pre-amp	NH-25/65806	Rion	9 Jul 21	TCRT19/1541
Calibrator	SV30A/10576	Svan	9 Jul 21	TCRT19/1539

Calibration of the meters used for the measurements is traceable to national standards. Calibration certificates for the sound level meters used in this survey are available upon request.

Calibration checks were carried out on the meters and their measurement chains at the beginning and end of the survey. No significant calibration deviation occurred.

Noise indices

Noise indices recorded included the following:

- $L_{Aeq,T}$ The A-weighted equivalent continuous sound pressure level over a period of time, T.
- $L_{AFmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a fast time weighting.
- $L_{ASmax,T}$ The A-weighted maximum sound pressure level that occurred during a given period, T, with a slow time weighting.
- $L_{A90,T}$ The A-weighted sound pressure level exceeded for 90% of the measurement period. Indicative of the background sound level.

Sound pressure level measurements are normally taken with an A-weighting (denoted by a subscript 'A', eg L_{A90}) to approximate the frequency response of the human ear.

A more detailed explanation of these quantities can be found in BS7445: Part 1: 2003 *Description and measurement of environmental noise, Part 1. Guide to quantities and procedures*.

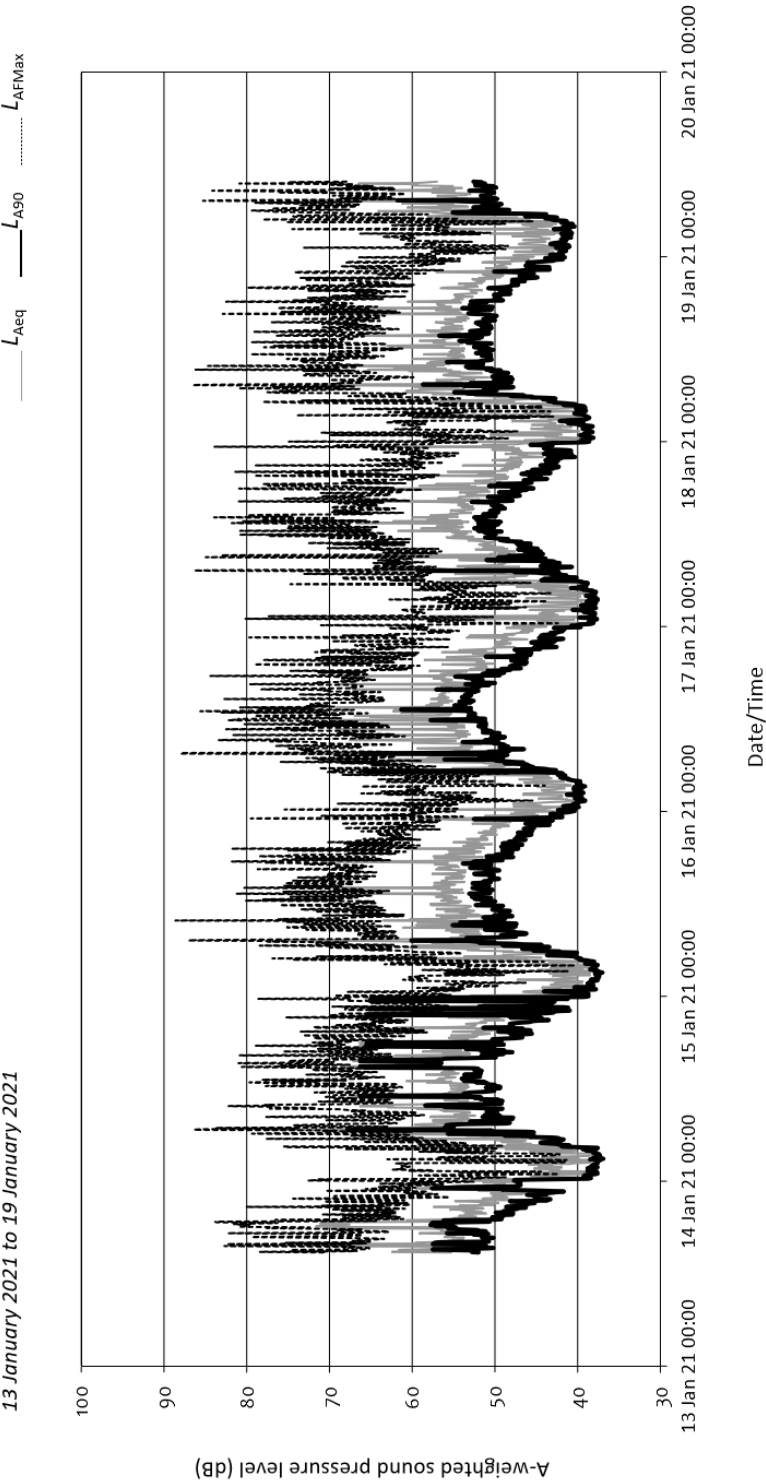
Weather conditions

During the unattended noise measurements, weather reports for the area indicated that temperatures varied between 0°C at night and 10°C during the day, and the wind speed was less than 5 m/s.

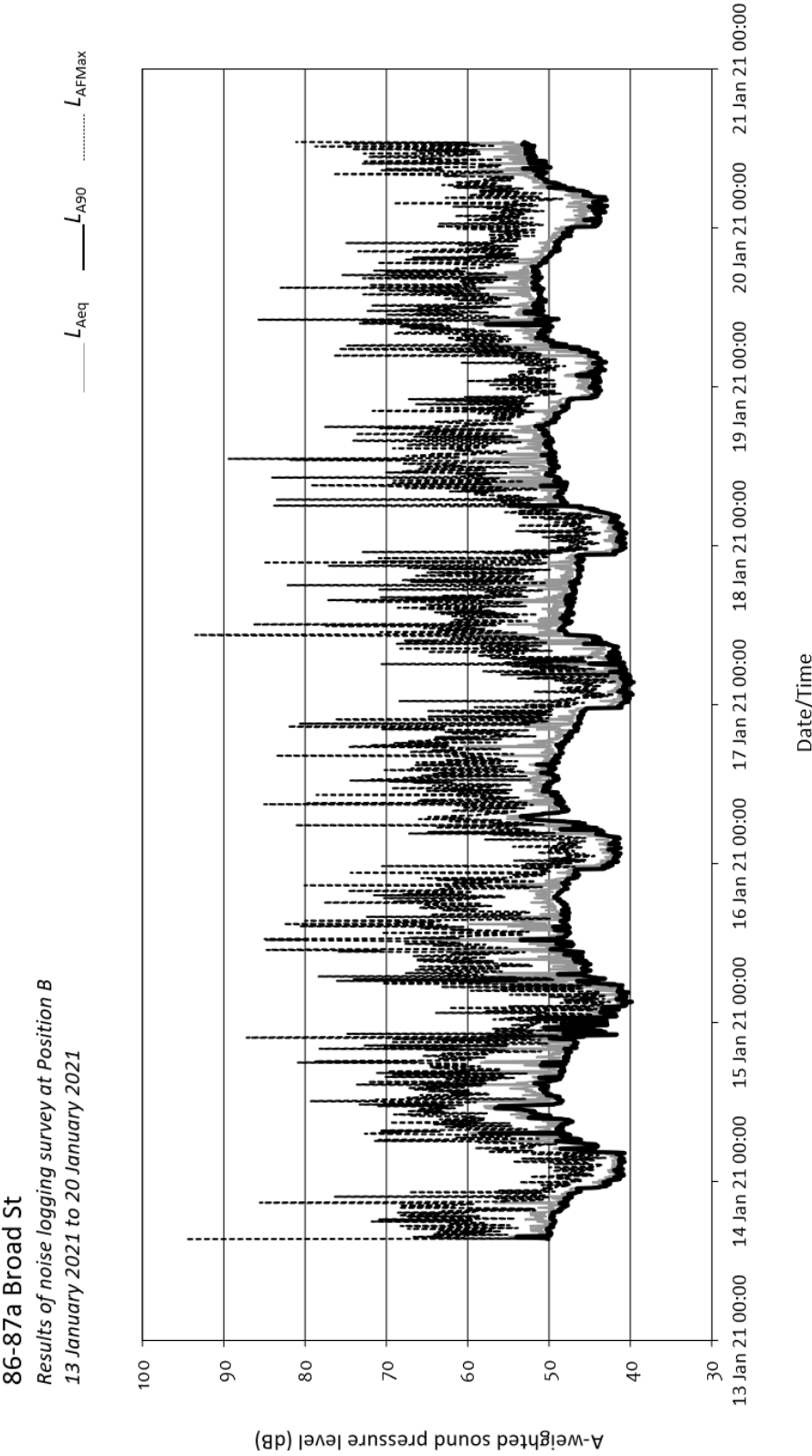
These weather conditions are considered suitable for obtaining representative measurements.

Appendix B - Results of unattended measurements at position A

86-87a Broad Street
Results of noise logging survey at Position A
13 January 2021 to 19 January 2021



Appendix C - Results of unattended measurements at position B



Appendix D - BS 4142 corrections for attention catching features

The following applies where plant noise is assessed in accordance with BS 4142:2014+A1:2019.

If the proposed plant noise contains attention catching features (such as tonal elements, whines, whistles, bangs etc), penalty corrections should be applied based on the type and impact of the features.

If appropriate, a subjective assessment of the plant features can be adopted. Where the plant noise contains tonal elements, the following corrections can be made depending on how perceptible the tone is at the noise receptor:

- 0 dB where the tone is not perceptible
- 2 dB where the tone is just perceptible
- 4 dB where the tone is clearly perceptible
- 6 dB where the tone is highly perceptible.

Where the plant noise is impulsive, the following corrections can be made depending on how perceptible the impulsivity is at the noise receptor:

- 0 dB where the impulse is not perceptible
- 3 dB where the impulse is just perceptible
- 6 dB where the impulse is clearly perceptible
- 9 dB where the impulse is highly perceptible.

For noise which is equally both impulsive and tonal, then both features can be accounted for by linearly summing the corrections for both characteristics.

If the plant has other distinctive characteristics, such as intermittency, then a 3 dB correction can be made.

If a subjective assessment of tonality is not appropriate, an objective assessment can be made by analysis of time-averaged, third-octave band sound pressure levels. A noise source is deemed to be tonal if the level in a third-octave band exceeds the level in adjacent third-octave bands by the level differences given below:

- 15 dB in the low frequency third-octave bands (25 Hz to 125 Hz)
- 8 dB in the mid frequency third-octave bands (160 Hz to 400 Hz)
- 5 dB in the high frequency third-octave bands (500 Hz to 10000 Hz).

If an objective assessment identifies the plant noise to be tonal then a 6 dB correction must be made.