Noise Assessment

Ringer's Road – Bromley

LUSTRE
CONSULTING

Non-Technical Summary

What is Proposed?	Demolition of existing buildings and construction of a mixed-use development comprising residential units, ancillary residents' facilities (including co-working space) and commercial floor space (Use Class E) across two blocks (Blocks A and B), along with associated hard and soft landscaping, amenity spaces, cycle and refuse storage.
What is the Problem?	The future noise climate at the site is considered to be dominated by noise from air traffic. Noise from the adjacent Salvation Army Church also has the potential to affect future residents. In addition to the above, noise egress from plant associated with the proposal could have an effect on noise-sensitive receptors in the area.
What is the Result?	The noise assessment has shown that suitable acoustic conditions within the proposed dwellings can be achieved provided windows are kept closed and the building envelope is suitably specified to resist noise. Through the inclusion of an acoustic screen, noise egress due to proposed plant items on the roof, can also be suitably controlled
What are the Next Steps?	This report should be submitted to the local planning authority to support the planning application. To mitigate the above identified noise impacts, the following elements will need to be implemented during the detailed design stage: ▶ Acoustic glazing with acoustically attenuated ventilation. ▶ Rooftop acoustic screen ▶ Sound insulation between Block B commercial and residential unit(s)

Report Record

Project Name	Ringers Road – Bromley
Client	Ringers Road Properties Ltd
Report Type	Noise Assessment
Report Ref	3606_AC_2.0
Issue Date	December 2022
Author	Stephan Booi, Principal Acoustic Consultant – PgD AMIOA
Reviewer	Simon Stoate, Principal – BEng (Hons) MSc MCIWEM C.WEM

Report Revisions

Revision Ref	Date	Author	Details
2.0	12/12/2022	SB	First Issue

Contents

Figures

Tables

Appendices

2nd Floor North Fitted Rigging House, The Historic Dockyard, Chatham, Kent, ME4 4TZ
e: info@lustreconsulting.com t: 01634 757 705
www.lustreconsulting.com

1.0 Introduction

1.1 The proposed Ringers Road development consists of the redevelopment of land between Ethelbert Road and Ringers Road in Bromley, to include a multi-storey residential development with commercial units at lower levels. The development is being proposed by Ringers Road Properties Ltd (Client).

1.2 Being close to the Bromley city centre, the Ringers Road development is likely to be exposed to elevated levels of noise, thus potentially affecting future residents of the development. There is also the potential that both the commercial and residential elements of the development would introduce new noise sources into the area which could have a detrimental effect if not adequately considered as part of the design process.

1.3 A noise assessment report in support of the projects Planning Application was completed in 2021 (ref. *3606\NL\January 2021\NA&NM*, revision 1.4, and dated 09/21). Following the submission of the Planning Application, comments from the London Borough of Bromley (LBB) and the Greater London Authority (GLA) with regard to the noise assessment were received.

1.4 To address LBB's and the GLA's comments, an updated noise assessment has been prepared by Lustre Consulting to further assess the project's potential noise effects and evaluate potential acoustic constraints. The updated noise assessment includes additional baseline noise monitoring and subsequent evaluation as well as high level consideration of potential internal sound transmission. This report presents the combined findings of the initial and updated Noise Assessment.

What is a Noise Assessment?

1.5 A Noise Assessment will determine if and to what extent existing or future noise sources could affect noise-sensitive receptors, and importantly, if those noise sources could have an adverse impact. If the Noise Assessment finds that the level of risk or impact is unacceptable, mitigation measures will need to be applied to the development.

1.6 The Noise Assessment will consider the prevailing sound environment to determine potential noise sources including traffic, aircraft or other noise generating activities, such as

mechanical plant, generators etc. The report will provide an impact assessment and give actionable recommendations. Recommendations may include solutions involving changes to design, layout and construction methods, so that the impacts from noise can be reduced to acceptable levels. Often these mitigation measures can be incorporated into standard construction practices. Find out more about how we undertake Noise Assessments including FAQ here.

1.7 Understanding and reducing the impacts ensures that you have a safe and compliant site. When dealing with planning, the National Planning Policy Framework (NPPF) and associated policies require an appropriate noise assessment at the initial planning stage, whilst the ProPG: Planning & Noise Professional Practice Guidance on Planning & Noise New Residential Development May 2017 requires delivery of sustainable development by promoting good health and wellbeing through the effective management of noise.

The Subject Site

Table 1 Site Details	
Address	Ringer's Road, Bromley, BR1 1HT
Eastings, Northings	540241, 168909
Local Planning Authority	London Borough of Bromley

1.8 The site, irregular in plan, is centred at National Grid Reference 540241, 168909, and occupies an approximate area of 0.11ha. The site area and existing layout is shown below in Figure 1.

1.9 The site currently comprises a mix of commercial and residential use. Fronting onto Ringers Road is the commercial unit which is occupied by a shisha/grill bar. At the northern boundary, fronting onto Ethelbert Road, there is a residential property and the rear of the commercial property.

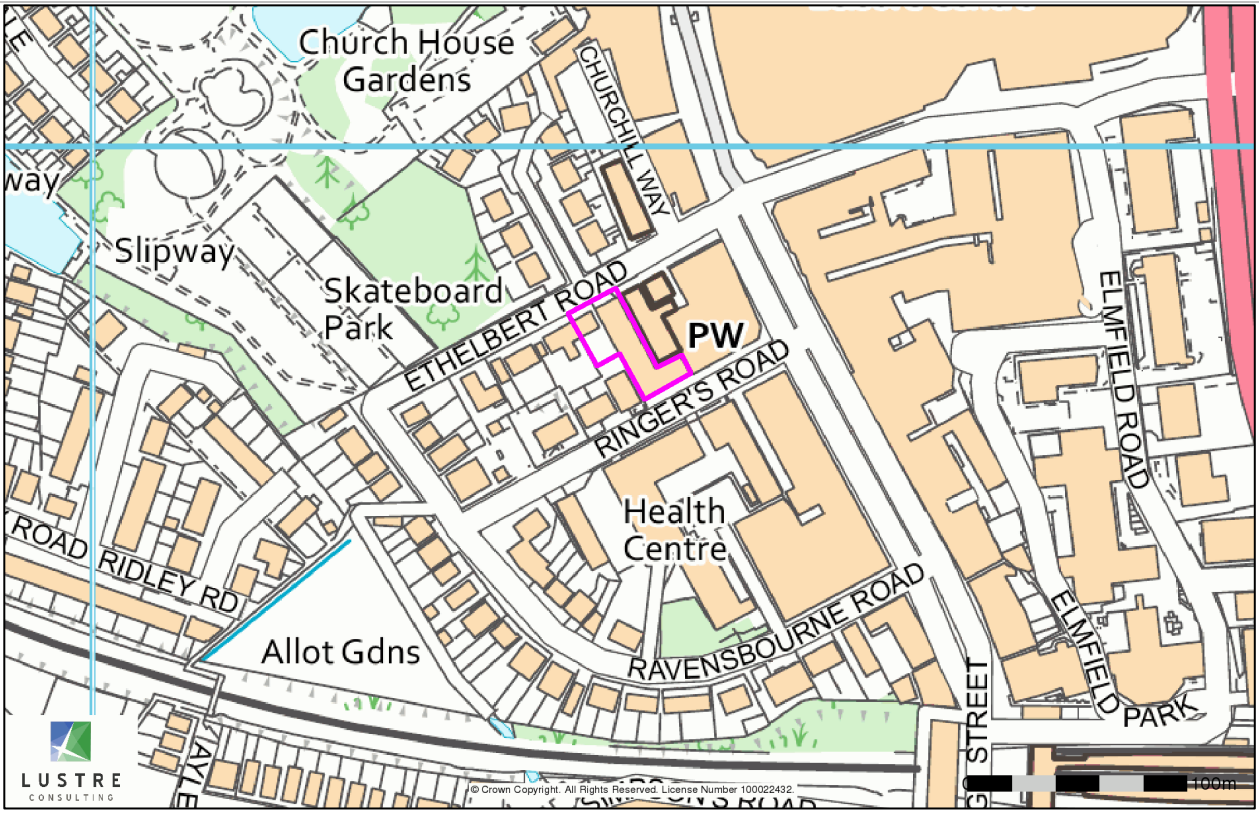


Figure 1 Site Location

1.10 The site is surrounded primarily by residential properties. On its eastern boundary, a small part of the site is bound by large retail unit with the remainder of the eastern boundary bound by the Bromley Salvation Army Church.

1.11 It is understood that the application site falls within areas suitable for development in the Bromley Town Centre Area Action Plan 2010

The Proposed Development

1.12 Proposals for re-development works at the site are to involve the clearance of the site and construction of two multi-storey residential blocks, Block A and Block B, both with communal/commercial units at lower levels.

1.13 The proposed development will comprise two blocks of residential apartments with communal open space. Figure 2 illustrates the proposed development scheme.

Figure 2 Proposed Development

The Objectives

1.14 The scope of works adopted in this Noise Assessment will address the following potential issues:

- Potential for noise from road, rail and air traffic.
- Potential for noise from static point sources – this may include nearby generators, air conditioning units.
- Potential for noisy environments such as active commercial or industrial sites, schools etc.

1.15 The objective of this Noise Assessment is therefore to determine the extent and impact of external noise sources that have the potential to affect the site and its proposals, as well as to provide guidance on a scheme of sound insulation to mitigate those impacts. This report presents the methodology and results of the survey, in which proposed mitigation measures are based upon.

Report Structure, Limitations & Changes

1.16 The report structure generally follows the pollution linkage approach described above. Chapter 2 of the report sets out the assessment methodology. Chapter 3 discusses the baseline noise conditions, and Chapter 4 details the noise modelling approach. Noise design appraisal – a scheme of acoustic mitigation – is set out in Chapter 5 and the report conclusions and recommendations are presented in Chapter 6.

1.17 There are a lot of technical terms in this report and definitions are provided in Appendix A. Appendix B details some of the relevant guidance that this assessment is based on as well as acoustic criteria/thresholds. Extracts of survey data and analysis are provided in Appendix C. Details of the indicative plant are presented in Appendix D whereas Appendix E shows the noise model predictions and a 3D screenshot of the noise model.

1.18 This assessment has been undertaken in accordance with our Terms & Conditions. Full details on limitations and reliance are provided in those Terms. Third party information which has been reviewed and used to inform the assessments presented herein, including public records held by various regulatory authorities and environmental database data has been assumed to be true and accurate.

1.19 This assessment has been carried out to determine the potential risks posed to future end users, along with other key receptors, based on the current development. Should revisions in the development proposals result in a change in any assessment parameters detailed in this report, a re-assessment of the risk should be carried out.

2.0 Assessment Methodology

Introduction

2.1 This chapter lists the target noise sources identified from a review of Google Earth / Street View, from any client or regulator information and from observations made during deployment of monitoring equipment / site visits. In addition, this section details the methodology for the noise monitoring equipment deployment and survey standards.

Relevant Policy, Guidance and Acoustic Criteria

2.2 Appendix B details some of the relevant national Planning policy guidance on noise. Local policy and relevant noise guidance is discussed below.

The London Plan 2021

2.3 The London Plan sets out an integrated economic, environmental, transport and social framework for the development of London and provides the framework to address the key planning issues

2.4 Noise is widely covered in the London Plan and a key consideration in respect of policy on design. Policies D13 and D14, as reproduced below, are included in the London Plan to reduce, manage and mitigate noise.

Policy D13 Agent of Change

A The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-generating uses in a sensitive manner when new development is proposed nearby.

B Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.

C New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.

D Development proposals should manage noise and other potential nuisances by:

1) ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area
2) exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations
3) separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.

E Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed.

Policy D14 Noise

A In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:

1) avoiding significant adverse noise impacts on health and quality of life
2) reflecting the Agent of Change principle as set out in Policy D13 Agent of Change
3) mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses
4) improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)

5) separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation

6) where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles

7) promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.

B Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations.

Local Policy

2.5 The London Borough of Bromley Local Plan (2019), provides some guidance with respect to acoustic criteria for new development in the borough as outline in Policy 119 below:

Policy 119

Noise Pollution

In order to minimise adverse impacts on noise sensitive receptors, proposed developments likely to generate noise and or vibration will require a full noise/ vibration assessment to identify issues and appropriate mitigation measures.

In most cases where there is a risk of cumulative impact on background level over time or where an area is already subject to an unsatisfactory noise environment, applicants will be required to ensure that the absolute measured or predicted level of any new noise source is 10dB below the existing typical background LA90 noise level when measured at any sensitive receptor.

New noise sensitive development should be located away from existing noise emitting uses unless it can be demonstrated that satisfactory living and working standards can be achieved and that there will be no adverse impacts on the continued operation of the existing use.

The design and layout of new development should ensure that noise sensitive areas and rooms are located away from parts of the site most exposed to noise wherever practicable. External amenity areas should incorporate acoustic mitigation measures such as barriers and sound absorption where this is necessary and will assist in achieving a reasonable external noise environment.

In mixed use buildings, conversions and changes of use which increase internal noise should incorporate measures to minimise the transfer of noise between different parts of the building. An airborne sound insulation of at least 55dB D'nT,w + Ctr will usually be expected in separating partitions between residential dwellings and non-residential noise generating uses. A higher standard may sometimes be necessary depending on the nature of the development.

2.6 The Local Plan also makes reference to both BS 8233:2014 and BS 4142:2014 in the supporting text to Policy 119.

BS 8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

2.7 BS8233 'Guidance on sound insulation and noise reduction for buildings' provides guidance on indoor ambient noise levels for various situations. The relevant desirable guideline limits for dwellings are shown in Table 2 below.

Table 2 BS 8233 Indoor Ambient Noise Levels for Dwellings

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living room	35 dB $L_{Aeq,16h}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

2.8 It is important to note that the above guideline noise level limits are applicable to 'anonymous' noise sources such as steady traffic and general distant urban noise.

2.9 In terms of the guideline noise limits, BS 8233 guidance does state that a 5 dB relaxation may be applied where a development is necessary or desirable:

> *Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.*

2.10 In terms of outdoor amenity spaces, BS 8233:2014 offers the following guidance:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB LAeq, with an upper guideline value of 55dB LAeq which would be acceptable in noisier environments. However, it is also recognised that these 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."*

Professional Practice Guidance on Planning & Noise (ProPG) – New Residential Development

2.11 Professional Practice Guidance on Planning & Noise (ProPG) is guidance for new residential development that aims to protect people from noise through encouraging better acoustic design. The guidance has been jointly prepared by the Institute of Acoustics (IOA), Chartered Institute of Environmental Health (CIEH), and the Association of Noise Consultants (ANC).

2.12 ProPG draws upon legislation and other guidance and standards such as WHO, BS 4142:2014 and BS 8233:2014 (discussed above). In terms of the BS 8233:2014 guidance, ProPG provides supplementary advice with respect to night-time maximum noise levels stating:

> *"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 LAmax,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"*

BS 4142:2014 – 'Methods for Rating and Assessing Industrial and Commercial Sound'

2.13 BS 4142:2014 describes methods for assessing the likelihood of adverse comment arising as a result of commercial or industrial noise. The methodology requires the determination of the 'noise rating level' (or $L_{Ar,Tr}$) for the noise source(s) being assessed, which is the noise of the plant plus corrections for acoustic characteristics which attract attention, e.g. tonality, impulsivity, intermittency, etc.

2.14 The noise rating level is then compared against the prevailing 'background sound level' (or $L_{A90,T}$) at the noise-sensitive receptor considering the following guidance:

- Typically, the greater the difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and

2.15 The lower the rating 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. When 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.

Greater London Authority Comments

2.16 In the GLA's Planning report (ref. GLA/2022/0167/S1/01, dated 4 April 2022), comments have been made with regard to noise from the bus stop and the church adjacent to the site. The relevant comments are copied below:

> 19. The site is adjacent to a church, and potential noise impacts on future residents are a consideration. The northern elevation of the Ringer's Road building and the eastern elevation of the Ethelbert Road building could be impacted by noise from the church; however, this is not addressed in the applicant's Noise Assessment. This requires further investigation and is likely to require mitigation through both the layout of homes (the location of bedrooms) and enhanced sound insulation. Given the adjacency to coach/bus stands/stops, further consideration should also be given to the residential design and layout to minimise the impact of noise and other disturbance from coach and bus operations on residents. The proposals are not therefore in accordance with London Plan Policy D13.

2.17 Whilst not explicitly stated in the previous noise report, the 2020 baseline noise measurements do cover noise from the bus stop.

2.18 In terms of church noise, there appeared to be no evidence of excessive noise egress from the church based on the baseline noise survey data. However, as there is potentially some uncertainty in this area, additional baseline noise monitoring has been undertaken, see Section 3.0 of this report.

Local Authority Liaison

2.19 Contact was made with Bromley's EHO on 31 October 2022 via email, proposing a monitoring location along the eastern boundary of the site for the additional baseline noise survey to better assess potential noise from the adjacent church. In addition, clarification to previous comments/queries from the Local Authority regarding the proposed scheme were also provided.

2.20 A response form the Local Authority was received on 02 November 2022 via email, confirming that the proposed noise survey location is acceptable but that consideration should be given to whether windows of the church are openable and the potential effect if windows were open.

2.21 Additionally, it was requested for the updated noise assessment to provide consideration to internal sound insulation, particularly in relation to potential noise transmission between habitable rooms and the proposed commercial unit in Block B as well as the plant room in Block A (and any other relevant areas).

Adopted Acoustic Criteria

2.22 This section sets out the proposed acoustic design criteria in respect of external noise break-in, taking into consideration the policy, guidance and liaison with the Local Authority discussed above.

2.23 The principles of ProPG and BS 8233:2014 guidance are followed for assessing whether the proposed development would be viable in terms of noise. This is reflected in the acoustic design targets, shown in Table 3 below, for 'general' noise conditions.

2.24 However, it is clear that church noise affecting parts of the proposed development, as further discussed below in Section 3.0 of this report, would not be 'anonymous'. The noise also repeatedly occurs on Sunday mornings (and potentially at other times of the week), when future residents may still be resting, potentially increasing the likelihood of adverse comment.

2.25 It is therefore proposed for a 10 dB penalty to be applied to the daytime BS 8233:2014 noise limits and the assessment period reduced to one hour. In terms of worst-case church noise for short periods, a 5 dB penalty is proposed.

Table 3 Proposed Acoustic Criteria for Noise Break-in

Noise source	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
General Noise	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$ 45 dB $L_{AF,max}$[1]
	Living room	35 dB $L_{Aeq,16h}$	—
Church Noise General	Bedroom	25 dB $L_{Aeq,1h}$	N/A
	Living room		
Church Noise Worst Case	Bedroom	30 dB L_{Aeq} 40 dB $L_{AF,max}$	N/A
	Living room		

Notes to Table 3: [1] value to not normally be exceeded more than 10 times a night

Baseline Noise Survey

Methodology

2.26 The initial long-term unattended baseline noise survey was undertaken from Thursday 23/10/2020 to Wednesday 28/10/2020. Noise monitoring was carried out at two free-field locations; one at the site boundary with Ringers Road (NMP1), approximately 3 m above roof level (about 1 m above the parapet wall), representative of the Block A façade, and the other on the second-floor roof (about 1.5 m above roof level) at the northern site boundary

with Ethelbert Road (NMP2) representative of the Block B façade. Both sound level meters were fitted with their proprietary environmental weather kits.

2.27 Both sound level meters were set to record broadband and spectral ambient and maximum noise levels in 15-minute contiguous periods. Statistical L_{10} and L_{90} noise indices were also captured.

2.28 In addition to the 2020 baseline noise survey, another baseline noise survey has been undertaken with the primary goal of establishing noise levels associated with the operation of the Salvation Army Church adjacent to the site. The unattended noise survey was undertaken over a prolonged 10-day period from Thursday 22/11/2022 to Monday 28/11/2022, to ensure two weekend periods were captured.

2.29 The sound level meter was set up approximately 1.2 m above first-floor roof level at the site boundary with the church (NMP3). This position was selected as it is roughly representative of the nearest proposed façade. This monitoring position is also opposite a window towards the southern end of the church hall where the brass band plays, thus can be expected to be worst-case in terms of noise egress from the church.

2.30 Similar to the initial noise survey, both broadband and spectral noise levels were captured at NMP3. The sound level meter was set to measure sound levels in 5-minute contiguous periods but 1-second interval data was also obtained for post-processing. Along with the sound level measurements, audio data for source identification was also recorded.

2.31 The approximate noise monitoring positions are shown in Figure 3 below.

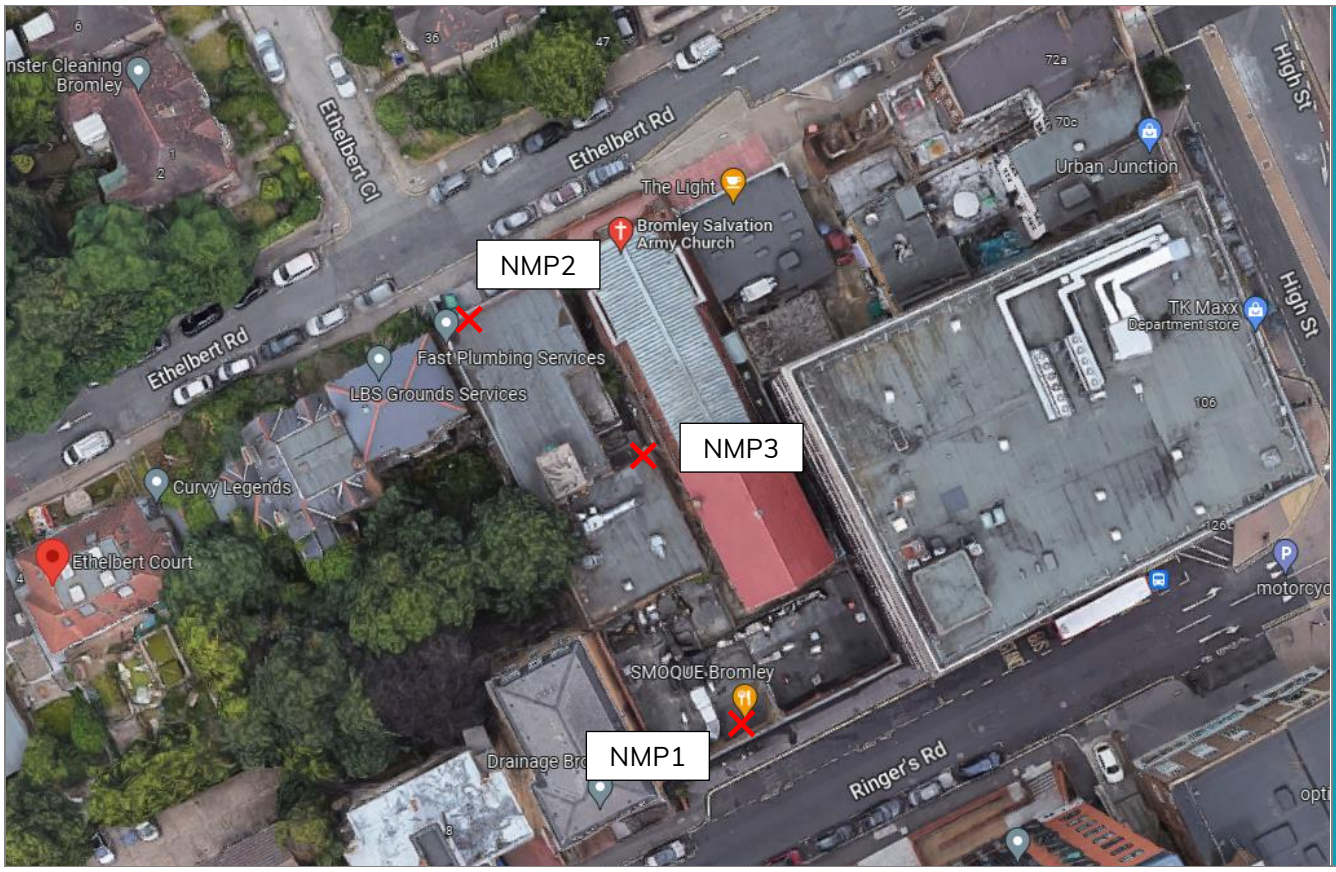


Figure 3 Approximate Noise Survey Locations

2.32 Pre- and post-survey calibration checks were carried out for all the noise surveys, which confirmed that no significant drift had occurred.

2.33 Details of the equipment used for the noise surveys is summarised in the table below.

Table 4 Noise Survey Equipment

Item	Make	Location	Serial No.
Sound level meter	Norsonic Nor140	NMP1	1405197
Sound level meter	Norsonic Nor140	NMP2	1404543
Sound level meter	NTi XL2	NMP3	A2A-08116-E0
Field calibrator	Norsonic Nor1255	n/a	125525497

2.34 Acoustic measurement equipment used during the survey conforms to relevant British Standards, namely BS EN 61672-3:' *Electroacoustics: Sound level meters Periodic tests*' and BS EN 60942:2003.' *Electroacoustics: Sound calibrators*'. The calibration certificates are available upon request.

Meteorological Conditions

2.35 Meteorological conditions during the initial noise measurement period were generally in line with recommendations for environmental noise surveys, with minimal wind (<5m/s) during the survey. Meteorological data referred to at the time, showed some periods with rain. However, this does not appear to have affected the noise measurement results, see Appendix C, presumably due to road traffic noise (which tends to increase during wet conditions) not being the main source affecting the site. As such, for the purpose of this assessment, the full data set was used.

2.36 For the NMP3 survey, conditions were generally also in line with recommendations for environmental noise surveys but was variable at times. As such, some periods which were clearly affected have been omitted from the results, as detailed in Appendix C

Noise Model Predictions

2.37 To assess the potential impact of noise from the proposed plant items and noise egress from the Salvation Army Church, a three-dimensional acoustic model of the site and its immediate surroundings has been created using Datakustik CadnaA noise modelling software (version 2022).

2.38 For the noise model calculations, ISO 9613[1] calculation settings were used along with the following inputs/settings:

- Ground absorption coefficient of 0 (hard)
- General building and barrier absorption coefficient of 0.2
- Three orders of reflection
- DEFRA 1m LiDAR DTM data used

[1] ISO 9613-2:1996 '*Attenuation of sound during propagation outdoors- Part 2: General method of calculation*

- Building heights based on information provided (elevation drawings). Where no information was available, heights have been estimated from Google Street View.
- Receptor height at 1.5 m for ground floor with 2.5 m added for each floor level
- Spectral plant noise level data, see Appendix D

2.39 The noise model predictions for church noise were calibrated to match data captured at location NMP3.

3.0 Baseline Noise Survey Results

Existing Noise Environment

3.1 The main noise on site was observed to be noise from existing mechanical services plant on the roof, which are understood to service the ground floor bar/restaurant (Smoque). When the plant were not operating, aircraft noise and general plant noise were observed to be the main contributors to the noise environment. Occasional traffic noise and distant noise from the High Street could also be observed at times. No particular noise from busses was noted.

3.2 It understood that the existing mechanical services plant items on site generally operate from 11:00 to 23:00. However, these plant items would not be present with the proposed scheme in place.

3.3 The noise environment at the measurement position, when the onsite mechanical services plant are not operating, is considered reasonably representative of the surrounding area.

Survey Results Summary

2020 Baseline Noise Survey

3.4 Table 5 provides a summary of the 2020 baseline noise level measurement results and derived values for positions NMP1 and NMP2. An overview of the survey in both tabular and graphical format is also available in Appendix C, with full data available upon request.

Table 5 Summary of Measured Noise Levels – NMP1 and NMP2

Period	Noise Levels (dB)					
	Ambient, L_{Aeq} [1]		Background, L_{A90} [2]		Maximum, $L_{AF,max}$	
	NMP1	NMP2	NMP1	NMP2	NMP1	NMP2
Daytime (07:00 – 23:00)	58	57	57	53	59 - 93	59 - 94
Without mechanical services noise (07:00 – 11:00 approx.)	52	52	47	49	59 - 81	59 - 80
Night-time (23:00 - 07:00)	47	46	40	42	65[3]	67[3]

Notes to Table 5:
[1] Logarithmic average, [2] Most occurring L_{A90} value, [3] 90th percentile $L_{AFmax,15min}$

3.5 As can be seen from the above results, the daytime (07:00 – 23:00) weekday ambient noise levels of around 58 dB L_{Aeq} were measured at locations NMP1 and NMP2. However, as discussed before, this noise level includes dominant noise contribution from the onsite mechanical services plant, which would not be present if the proposed scheme were to progress.

3.6 As such, the NMP1 and NMP2 noise levels of 52 dB L_{Aeq} during the daytime period prior to the restaurant fan(s) being switched on are considered more representative of the daytime noise levels the proposed scheme would be exposed to.

3.7 Representative background sound levels of 47 and 49 dB L_{A90} were captured at positions NMP1 and NMP2 respectively, see Appendix C for background sound level analysis graphs.

3.8 The measurements show that ambient night-time noise levels of around 47 dB L_{Aeq} can be expected, with maximum noise levels around 67 dB $L_{AF,max}$. Night-time background sound levels of 40 and 42 dB L_{A90} were captured at positions NMP1 and NMP2 respectively.

3.9 From the results it can be seen that the noise levels at NMP1 and NMP2 are very similar.

3.10 Note that for the daytime ambient and background noise measurement results, there is a slight risk that the morning noise level measurements would not have captured potential variations in the afternoon noise environment.

2022 Baseline Noise Survey

3.11 The results of the latest 2022 baseline noise survey at position NMP3 are shown below in Table 6. As with NMP1 and NMP2, an overview of the survey in both tabular and graphical format is presented in Appendix C, with full data available upon request.

Table 6 Summary of Measured Noise Levels – NMP3			
Period	Noise Levels (dB)		
	Ambient, L_{Aeq} [1]	Background, L_{A90} [2]	Maximum, $L_{AF,max}$
Daytime (07:00 – 23:00)	67	69	51 - 89
Without restaurant fan noise (07:00 – 10:30)	53	47	53 - 81
Night-time (23:00 – 07:00)	47	43	60 - 67 (64[3])

Notes to Table 6:
[1] Logarithmic average, [2] Most occurring $L_{A90,5min}$, [3] Arithmetic average of 10th highest $L_{AFmax,5min}$ per night

3.12 Similar to the initial noise survey, mechanical services plant noise was the main contributor to the noise environment at NMP3, thus the daytime (07:00 to 23:00) period is not considered representative of future conditions.

3.13 Without noise from the existing mechanical services plant, ambient noise levels range from 51 dB to 54 dB with an average of 53 dB L_{Aeq}. The representative daytime background level at NMP3 is 47 dB L_{A90} .

3.14 The overall night-time ambient noise level was found to be in the region of 47 dB L_{Aeq} whilst the maximum noise level is 64 dB L_{AFmax}. The representative background sound levels at NMP3 is 43 dB L_{A90}.

3.15 The overall results from the latest 2022 baseline noise survey are very similar to the results of NMP1 and NMP2. As NMP3 is mostly shielded from the road, this seems to suggest that traffic noise from Ringers Road and Ethelbert Road is not as a significant contributor at the proposed site, which tallies with the latest onsite observations, audio recording and further analysis indicating that aircraft noise is the main contributor.

3.16 Heathrow WebTrak My Neighbourhood flight path data, see Figure 4 below, also demonstrates that the site is situated within a major flightpath supporting the observation of aircraft flyovers being a common occurrence and contributor to the noise environment.

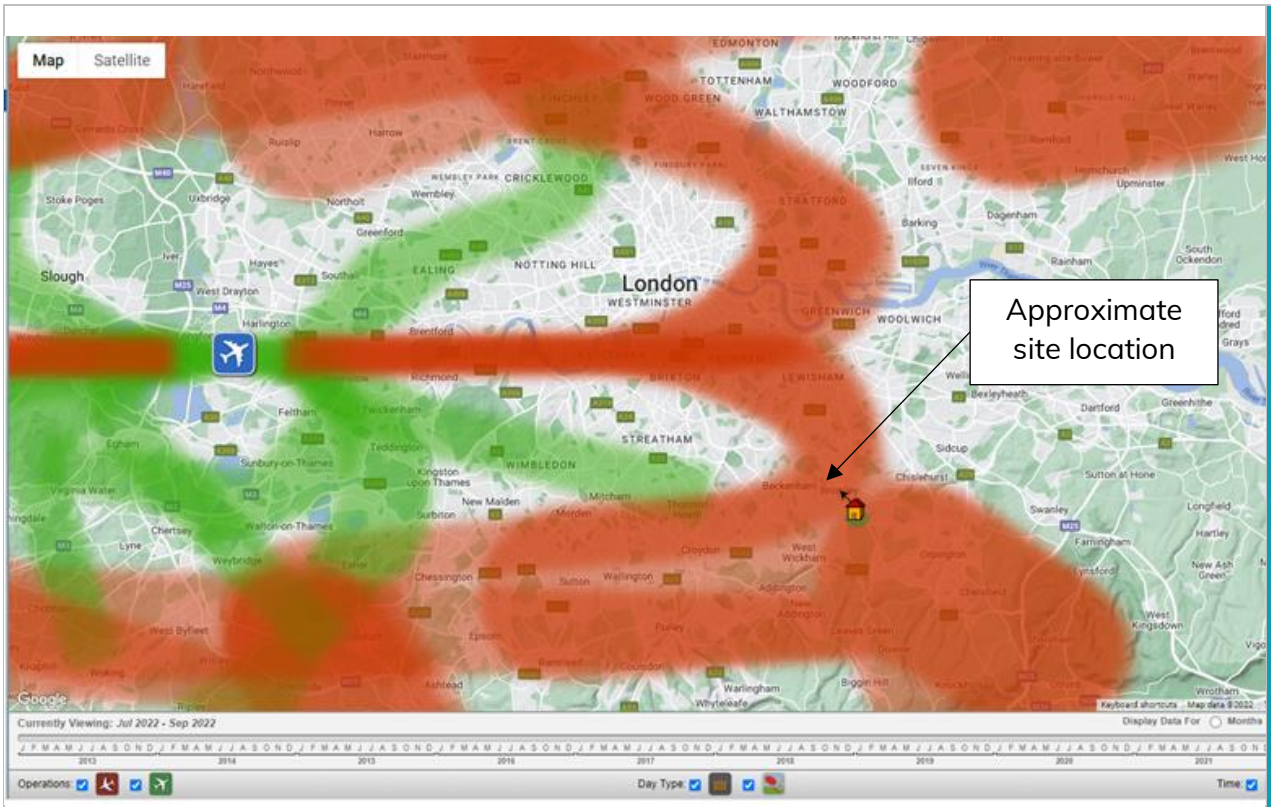


Figure 4 Heathrow Flight Path Data

3.17 Based on these findings of the updated noise survey and the fact that wet conditions do not appear to have (significantly) affected noise levels, traffic noise appears to have less of a bearing on the existing noise climate and may have been overestimated in the previous assessment. As such, the results of the noise model developed for the previous noise assessment have been omitted from this assessment. However, note that this does not materially change the noise levels used for informing the design appraisal.

Salvation Army Church Noise

3.18 As mentioned previously, one of the main reasons for undertaking the NMP3 noise survey was to ascertain potential noise levels associated with the operation of the Salvation Army Church adjacent to the proposed development. The survey results specific to church noise are presented in Table 7 below.

Table 7 Church Noise Levels – NMP3		
Period	Noise Levels (dB)	
	Ambient, L_{Aeq}	Maximum, $L_{AF,max}$
Sunday service (10:00 – 11:30, 20th Nov)	63	80
Sunday service (10:00 – 11:30, 27th Nov)	53	67
Worst-case, music (brass and drums)	72	80

3.19 As can be seen from the measurement results above, noise levels during Sunday service at the Salvation Army Church of 63 dB L_{Aeq} and 53 dB L_{Aeq} were measured during the 20th and 27th November services respectively.

3.20 Analysis of the audio recordings (also refer to the marked-up church service noise level graphs in Appendix C) clearly shows that church noise is present on Sunday 27th November but that the periods of elevated church noise are comparable or slightly higher when compared against periods of aircraft noise. It is therefore not surprising that the overall ambient noise level during this period is similar to the general ambient noise level (without mechanical services noise) shown in Table 6.

3.21 Noise levels during the Sunday 20th November church service on the other hand are, at 63 L_{Aeq}, significantly higher than the general ambient noise level of 53 L_{Aeq}, thereby demonstrating that church noise was the dominant source during this period. Even higher worst-case ambient noise levels were measured during church service; 72 L_{Aeq}, albeit over a relatively short three-minute period.

3.22 From these results it is clear that church noise has the potential to be significantly higher than the overall daytime ambient noise levels. Moreover, as the noise would not be 'anonymous' and also anticipated to occur, it could attract attention and potentially elicit an adverse response from future residents if not dealt with in an adequate way (also see Section 5.0 – Acoustic Design Statement).

3.23 Based on the worst-case noise level of 72 dB L_{Aeq} at NMP3 and taking into account point source propagation attenuation due to the distance between the microphone to the nearest church hall window (at the end of the hall where the church band performs), it is estimated that the sound power representative of the acoustic energy transmitted via the window would have been in the region of 90 dB(A).

3.24 Sound levels associated with brass instruments can reach roughly 90 – 100 dB close to the performer[2]. Sound insulation provided by double glazing, as installed at the church, would be at least 30 dB R_w.

3.25 When considering the above, it is likely that the window(s) of the church hall would have been open during the 20th November church service. As such, the noise level of 72 L_{Aeq}, is considered to be reasonably representative of worst-case church noise conditions.

[2] Sound Exposure of Symphony Orchestra Musicians, Hvass Schmidt et al, August 2011

4.0 Noise Model Predictions

4.1 An overview of the noise model predictions are shown in the figures below. Worst-case and general combined church and plant noise contours are shown.

4.2 Predicted noise levels per floor are also shown in Appendix E.

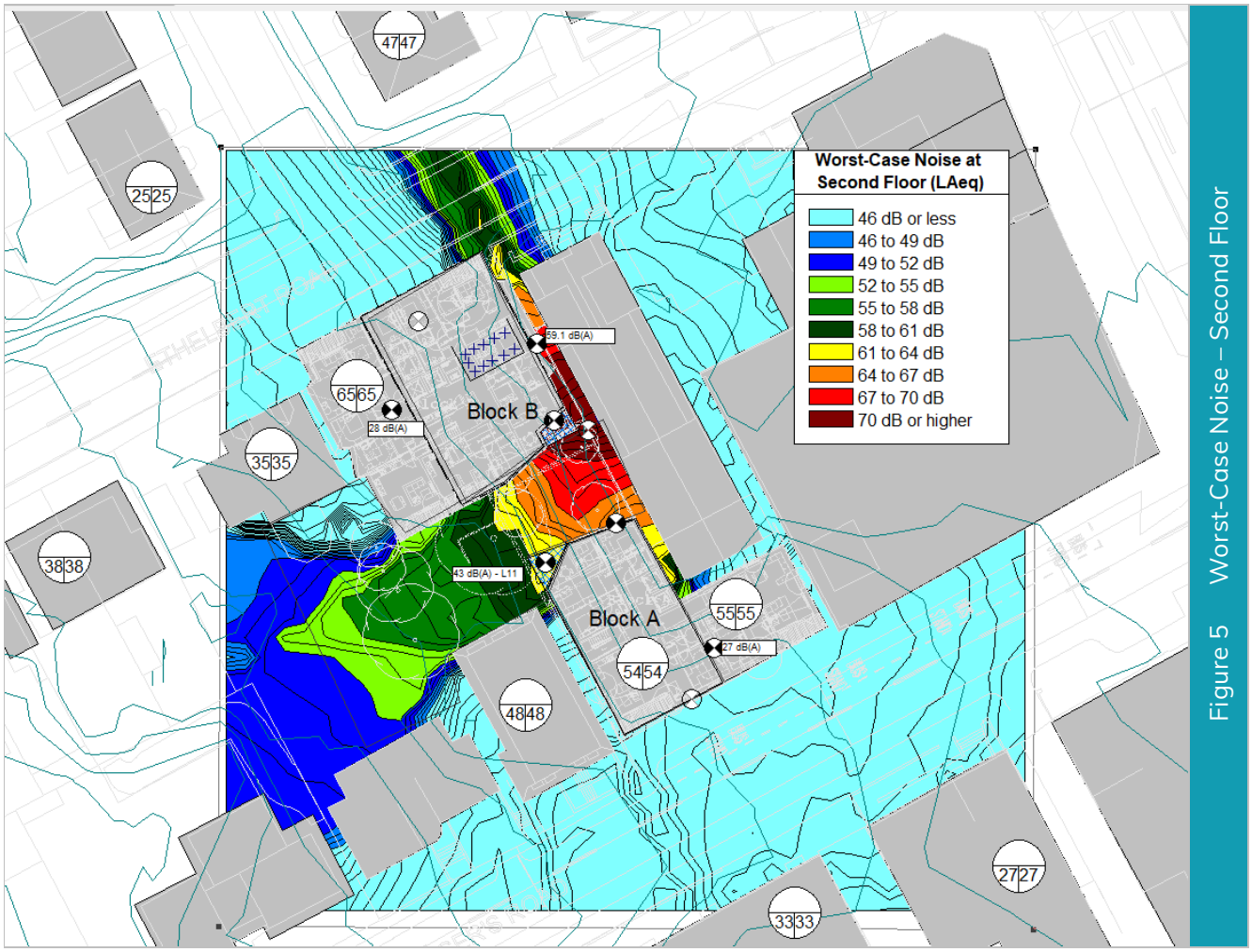


Figure 5 Worst-Case Noise – Second Floor

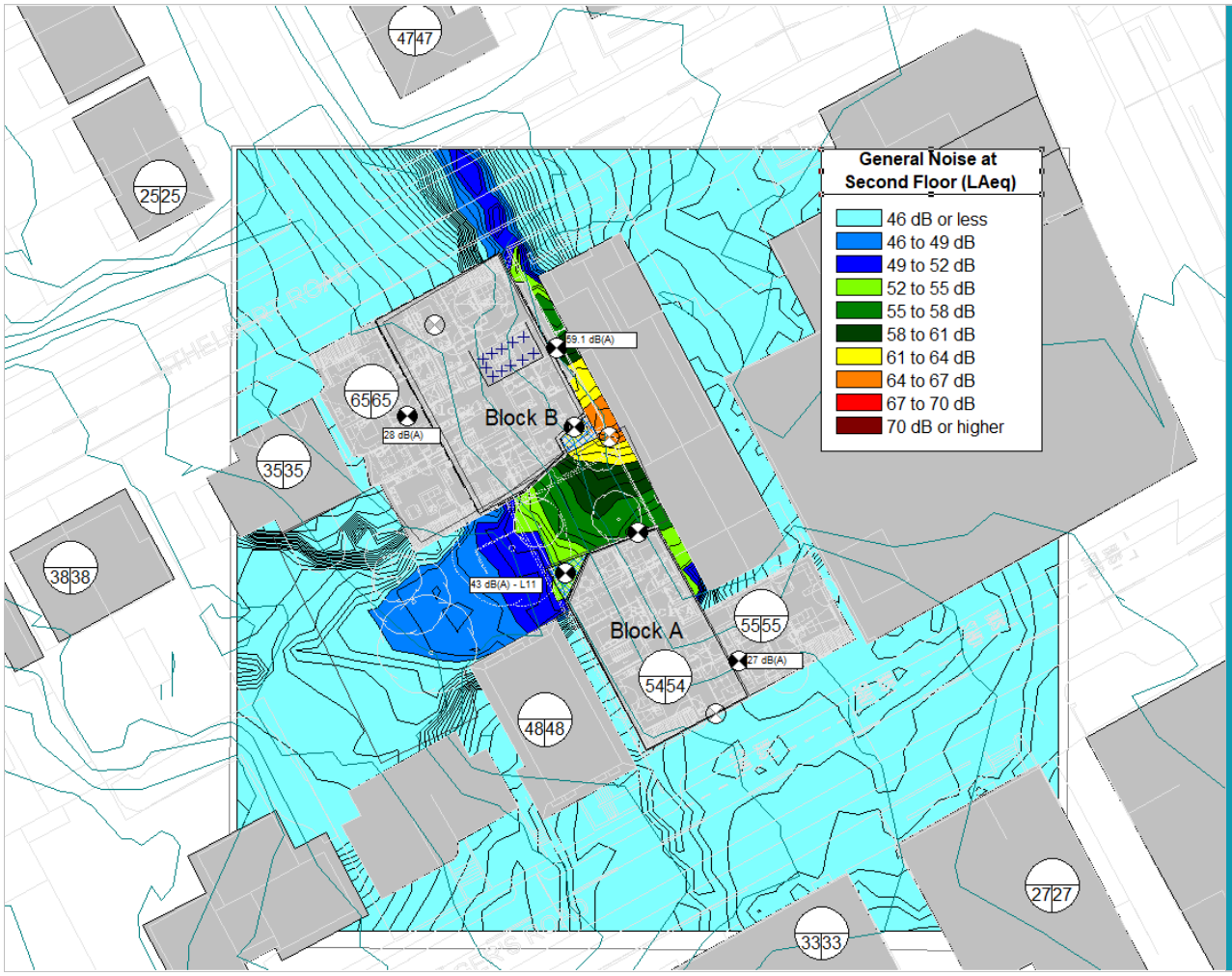


Figure 6 General Noise – Second Floor

4.3 By using the results of the noise model and further calculations, a design appraisal of the building envelope has been undertaken. The results of this exercise are discussed in the following chapter.

5.0 Acoustic Design Statement

5.1 This chapter sets out the minimum acoustic mitigation measures which will be required to ensure that the site is compliant with the acoustic design criteria.

5.2 The project is still at an early design stage and therefore it is expected that the design will be developed accordingly through the various RIBA stages. This assessment is therefore considered preliminary in this regard.

Building Envelope Assessment

5.3 This section sets out the octave spectrum data, interpreted from the measured noise levels detailed in Chapter 3, noise modelling, and the resultant recommended building exterior make-up or external building envelope specification to mitigate the observed noise levels.

5.4 The information in this Chapter regarding mitigation represents both the preliminary and minimum building envelope specification, i.e. the minimum design criteria for glazing, walls and roof build-ups.

Design Assumptions

5.5 Noting the stage of the design process, several assumptions and industry standard values and parameters have been used as the basis of this appraisal. Indicative façade, roof build-ups and bedroom sizes have been adopted in environmental noise break-in calculations based on the plan drawings provided, as detailed in the table below.

Table 8 Calculation Parameters for Assessment		
Element	Properties/Parameters	
Façade Wall	Outer masonry (brick) layer, Metsec frame with lightweight internal wall lining.	
Roof	Concrete slab with suspended ceiling	
Floor Area	Bedroom	13 m^2 (Approximate)
	Living Room	30 m^2 (Approximate)
Glazing Area	Bedroom	3 m^2 (incl. spandrel)
	Living Room	14 m^2
Ventilation	Bedroom	MVHR
	Living Room	MVHR
Reverberation Time	Bedroom	0.5 s
	Living Room	0.8 s

5.6 Mechanical ventilation heat recovery (MVHR) is proposed for both the residential and non-residential portions of the development. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way. Having an MVHR system for ventilation is beneficial in terms of noise break-in as direct noise transmission via the ventilation system into the dwelling is avoided.

Design Appraisal Noise Data

5.7 Spectral L_{eq} day and night noise levels along with the night L_{Amax} data used for the building envelope calculations are presented in Table 9. These values are considered representative of 'general' conditions

Table 9	Spectral Noise Data for Building Envelope Assessment							
Period	Noise level (dB) per octave band centre frequency (Hz)							Overall, dB(A)
	63	125	250	500	1k	2k	4k	
Day L_{eq}	61	57	55	51	48	42	35	53
Night L_{eq}	56	52	51	45	40	34	29	47
Night L_{max}	73	70	68	66	61	56	52	67

5.8 In addition to the above, consideration has been given to noise associated with the church adjacent to the proposed site. Table 10 details the spectral noise levels associated with the operation of the Salvation Army Church, at the worst affected rooms.

Table 10	Spectral Noise Data for Building Envelope Assessment – Church Noise								
Location	Period	Noise level (dB) per octave band centre frequency (Hz)							Overall, dB(A)
		63	125	250	500	1k	2k	4k	
Bedroom	General, L_{eq}	53	55	60	60	53	46	36	59
	Worst-case, L_{eq}	53	60	69	69	62	53	40	69
	Worst-case, L_{Fmax}	75	80	84	80	71	66	59	80
Living Room	General, L_{eq}	57	59	63	62	55	48	38	61
	Worst-case, L_{eq}	53	60	69	69	62	53	40	71
	Worst-case, L_{Fmax}	75	81	85	82	73	68	61	82

5.9 Note that the data in Table 10 have been derived via noise modelling using NMP3 noise data as the input.

Building Envelope Recommendations

5.10 A partially open window is generally taken to provide around 13 dB sound reduction against external noise. When considering the above and the noise levels in Table 9, day and night internal ambient noise levels in the region of 40 dB and 34 dB L_{Aeq} can be expected respectively.

5.11 In terms of night-time maximum noise levels, internal noise levels of 54 dB $L_{AF,max}$ are expected to occur on more than 10 occasions per night.

5.12 This shows that both the maximum and ambient noise levels for 'general' conditions would exceed the BS 8233:2014 (see Table 2) and ProPG guideline noise targets, albeit with the ambient noise exceedances falling within the 5 dB relaxation for 'reasonable' acoustic conditions. Maximum noise levels would on average exceed the 45 dB limit by a larger 9 dB margin. Taking into account these noise level exceedances, windows across the development would have to remain closed to achieve satisfactory acoustic conditions.

5.13 In addition to the 'general' noise discussed above, noise levels during church service would at the façades with direct line of sight to the open church window(s) be higher than for general daytime conditions. A further complication could be that such noise would not be 'anonymous' and a regular recurrence thus having the potential of a greater adverse noise effect. Therefore, more stringent noise limits have been considered where church noise contribution is significant (also refer to Table 3).

5.14 Noise break-in calculations in line with the 'more rigorous' BS 8233:2014 methodology and taking into consideration the proposed design indicate that despite the elevated external noise levels desirable internal noise levels should be achievable within the proposed dwellings. To achieve this, however, windows would generally have to remain closed and suitable building envelope specifications used.

5.15 The following table illustrates the initial example façade specifications to provide sufficient resistance against external noise. Alternative build-ups could be considered but they should meet the recommended minimum performance requirements as detailed in this report.

5.16 Acoustic specifications for the façade types are shown below in Table 11.

Table 11 Preliminary Building Envelope Specification									
Façade type	Element	Minimum sound insulation (dB) per octave band centre frequency (Hz)							Overall sound Insulation
		63	125	250	500	1k	2k	4k	
Type A	Fenestration, all habitable spaces	19	20	20	30	40	35	44	32 (-5) dB $R_w(C_{tr})$
	Walls	Standard wall construction should comfortably provide sufficient sound insulation							
Type B	Fenestration, bedrooms	28	27	37	41	39	67	67	43 (-5) dB $R_w(C_{tr})$
	Fenestration, living rooms	25	31	38	43	44	49	62	46 (-5) dB R_w (C_{tr})
	Walls, all habitable spaces	29	49	60	53	60	60	60	58 (-2) dB $R_w(C_{tr})$

5.17 The acoustic specifications are divided into two groups and colour coded as shown in the figure below. Note that the specifications include a 3 dB allowance as a general margin and for mechanical services noise contribution.

Figure 7 Acoustic façade types

5.18 It shall be noted that the acoustic specification values for the glazing elements apply to the combined glass pane, window/door frame, spandrels (where applicable) and the like.

5.19 The acoustic specifications are only applicable to habitable spaces such as bedrooms and living rooms (including open-plan kitchens).

5.20 Where façades have not been acoustically classified in the figure above, or for acoustically non-sensitive rooms, i.e. kitchens, bathrooms, utility rooms, etc., either no minimum sound insulation requirements apply or standard specifications would be comfortably sufficient.

5.21 Suitable example double glazing specifications would include:

- Type A – 6 / 16 / 6
- Type B - Bedrooms – 12 / 16 (Argon) / 8.8
- Type B – Living Rooms – 12 / 16 (Argon) / 16.8

5.22 Notwithstanding the above, alternative glazing and wall specifications may also be acoustically feasible and can be considered as part of the detailed design process. Any updated acoustic specifications should be forwarded to Lustre Consulting for review to ensure they are acoustically suitable.

5.23 Also, as shown from the noise modelling results in Appendix E, the contribution of church noise reduces rapidly at higher floor levels, around 10 dB from the 8th floor, or more where the balconies provide additional screening. The acoustic specifications in Table 11 could, therefore, be reduced as part of the detailed design process.

5.24 However, it is important to note that at higher levels there are a number of rooms with larger windows than the calculation parameters used for this assessment (see Table 8). As such, the fenestration specifications may need to be adjusted to take the larger area into account.

5.25 Note that the external masonry wall and roof constructions have been assumed to provide reasonably high levels of sound attenuation, in excess of 50 dB R_w. Whilst this should be easily achievable given the proposed construction, it should be checked as part of the detailed design process.

5.26 It is also important to note that the recommendations above are intended to demonstrate compliance with relevant guidance only. Further analysis may be required during the project design stage, for example, to verify potential changes to the design, ensuring proposed build-ups and products used (including ventilation) meet the acoustic requirements, etc.

Ventilation

5.27 Approved Document F of the Building Regulations stipulates the requirement for rapid intermittent ventilation for occupants to have the ability to quickly expel fumes in dwellings.

5.28 Whilst windows would have to remain closed to ensure adequate acoustic conditions, the use of open windows for rapid ventilation is considered acceptable as any increase in noise would be for a short period only and expected by the occupant. The overall exposure to noise would therefore be relatively small.

Overheating Considerations

5.29 The requirement for having closed windows to achieve satisfactory acoustic conditions could have ramifications on other aspects of the design. The interdependent nature of acoustics, ventilation and overheating may necessitate these to be considered in an integrated approach during the project design stage.

5.30 It is recommended reference is made to Part O of the Building Regulations and, where required, also the Acoustics Ventilation and Overheating – Residential Design Guide document.

5.31 The site is exposed to elevated noise levels. Due to these noise levels, there is the potential for the noise level limits in Part O (paragraph 3.3), at which windows are likely to be closed during sleeping hours, to be exceeded. However, the potential for exceedance is borderline, which may be a factor when further considering overheating and thermal comfort as part of the detailed design process.

Internal Sound Insulation

Internal Floors and Partitions

5.32 The London Borough of Bromley's Local Plan makes reference to minimum acoustic separation of 55 dB $D_{nT,w}$ + C_{tr} between residential areas and areas containing noise generating activities of mixed-use developments.

5.33 Given the proposed concrete frame construction, the 55 dB, or higher, sound insulation requirement should be relatively easy to achieve.

5.34 Whilst the requirement appears to be aimed at mixed-use developments or conversions, it is considered a reasonable target for some of the other elements of the proposed development, e.g. the separating floor between the ground floor plant rooms and dwellings above.

5.35 As it is not known at this stage what the commercial use in Block B will entail, there is a potential high risk of adverse sound transmission from the commercial unit and the above/adjacent bedroom. This particular arrangement is highlighted in the figure below.

5.36 It is recommended that, where feasible, the arrangement is amended so that a less noise-sensitive room(s) (bathroom, storage, utilities, etc.) shares the separating wall with the commercial unit to provide a 'buffer' zone. Alternatively, noise within the commercial unit can be controlled via operating noise limits in the tenancy agreement but this may limit the unit's use type.

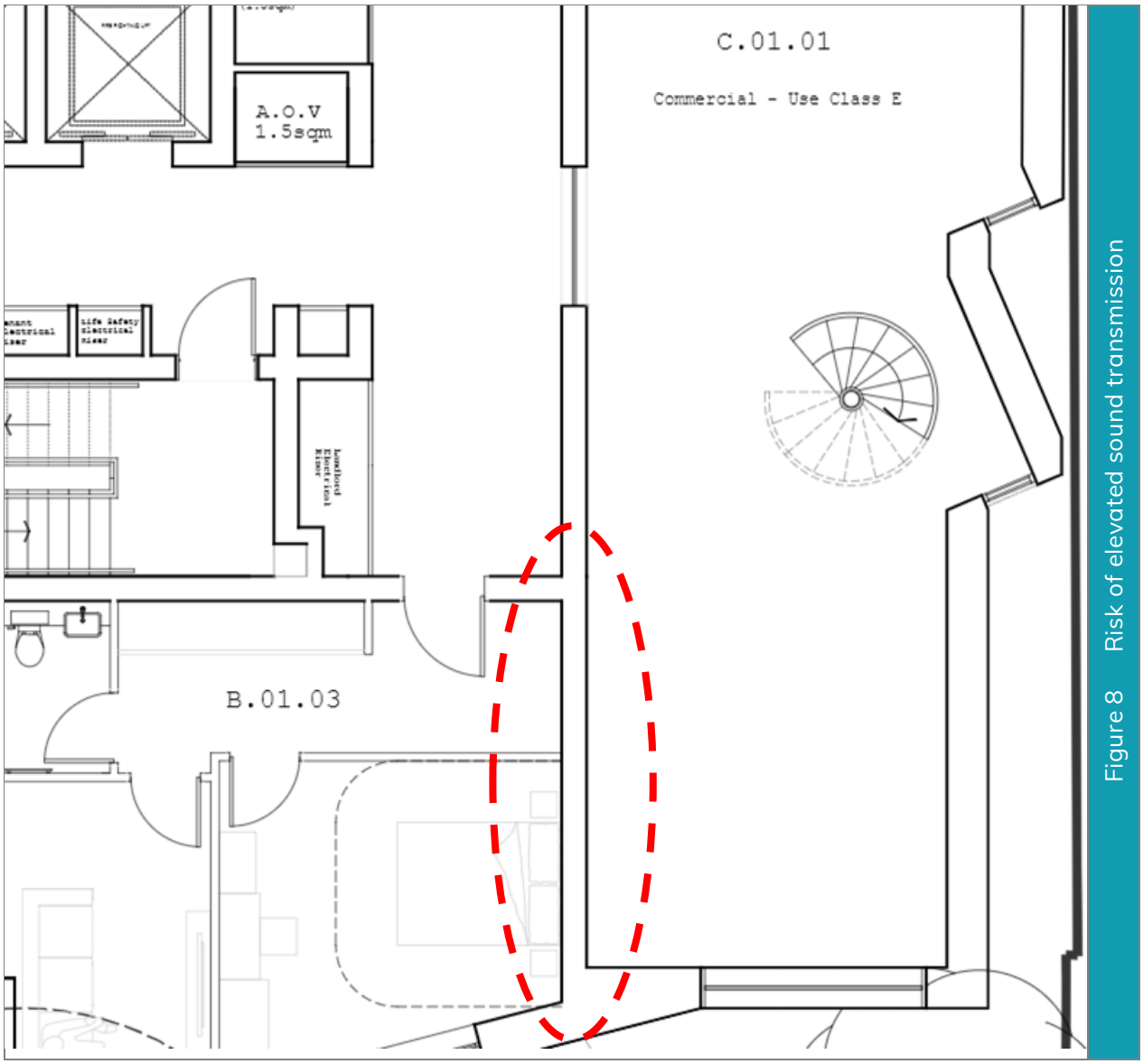


Figure 8 Risk of elevated sound transmission

5.37 Given the potential for noise disturbance from the plant room and commercial unit(s), it is recommended that the acoustic separation for these areas is carefully considered as part of the detailed design stage, including any junction detailing which can be a critical sound insulation factor.

Structure-borne Transmission Rooftop Plant

5.38 Besides the potential for sound transmission from noisy internal areas to dwellings, structure-borne noise/vibration from (rooftop) plant could also affect nearby noise-sensitive rooms and areas.

5.39 Given the high mass construction (concrete frame), adequate control of structure-borne noise/vibration transmission should be feasible with suitable anti-vibration mountings. Nevertheless, it is recommended that this is considered as part of the detailed design.

Noise within External Amenity Areas

5.40 Consideration to noise levels within the private amenity areas has been given by way of not exceeding the upper 55 dB(A) BS 8233:2014 guideline value.

5.41 As can be seen from the baseline noise levels in Tables 5 and 6, as well as considering proposed plant noise mitigation (discussed below), conditions compliant with BS 8233:2014 upper limit can be expected.

5.42 Once the building is in place, it is also expected that some of the balconies may benefit from screening which would further reduce the noise levels.

Plant Noise Limits – Internal

5.43 Internal noise limits for mechanical services are set out in the *Building Services Stage 2* report. For ease of reference, Table 8 from this report, which sets out the proposed noise limits, has been copied below.

Table 8: Noise conditions

Area	Noise level
Living room	NR30
Kitchen	NR40
Bedroom	NR25
Bathroom	NR40
Corridor/Lobby	NR40
Bicycle Cafe	NR40-45

External and internal noise level criteria shall be in line with CIBSE Guides, BS 8233:2014, World Health Organisation's guidelines and in compliance with the acoustic report of the development.

5.44 The above noise level limits for internal mechanical services are considered appropriate, and compliant with LBB's requirements.

5.45 However, where dwellings are intended to be marketed as 'premium', it is recommended that all the relevant noise level limits are reduced by 5 dB or more, e.g. the noise contribution limit for bedrooms would be NR20 Leq.

5.46 Also, it is important to note that these noise limits shall be applicable to the combined noise from mechanical services, including contribution due to structure-borne transmission, and shall be free of acoustic characteristics which attract attention. Examples of acoustic characteristics are, but not limited to, hums, tones, modulation, etc.

5.47 The acoustic properties of internal (non-separating) walls may need to be considered in more detail as part of the detailed design process to ensure mechanical services noise is adequately controlled.

Plant Noise – External

5.48 As part of the proposed development, a number of potentially noisy items of plant would be included, with the following preliminary items/areas identified:

- Plant within the ground floor plant rooms
- Substation – Block A ground floor
- Plant associated with Class E commercial space
- 11 no. Air Source Heat Pumps – Block B roof

5.49 Of the above, noise from the substation and plant within dedicated plant rooms is considered low risk in terms of affecting existing noise-sensitive receptors in the area. Plant associated with the commercial element and the external air source heat pumps (ASHP) would have a higher noise pollution potential.

5.50 Given the preliminary stage of the design, plant details are very limited, particularly for the commercial element as the tenant is not known. However, through the allocation of space in the plant rooms and also the shared residential/commercial rooftop ASHP area, suitable control of plant noise from the commercial units should not be problematic to achieve.

5.51 With regard to noise from the ASHPs, noise modelling has been undertaken to determine whether the proposed location (Block B roof) is feasible. The noise model predictions have shown that, even with no mitigation in place and worst-case operational conditions, i.e. all ASHPs operating concurrently at nominal design duty, noise contribution from these plant items would comply with the LBB noise criterion, i.e. more than 10 dB below day and night background sound levels, at all existing noise-sensitive receptors.

5.52 However, to reduce noise levels affecting some parts of the proposed development, a 3 m high acoustic screen is proposed as indicated by the blue lines in the figure below.

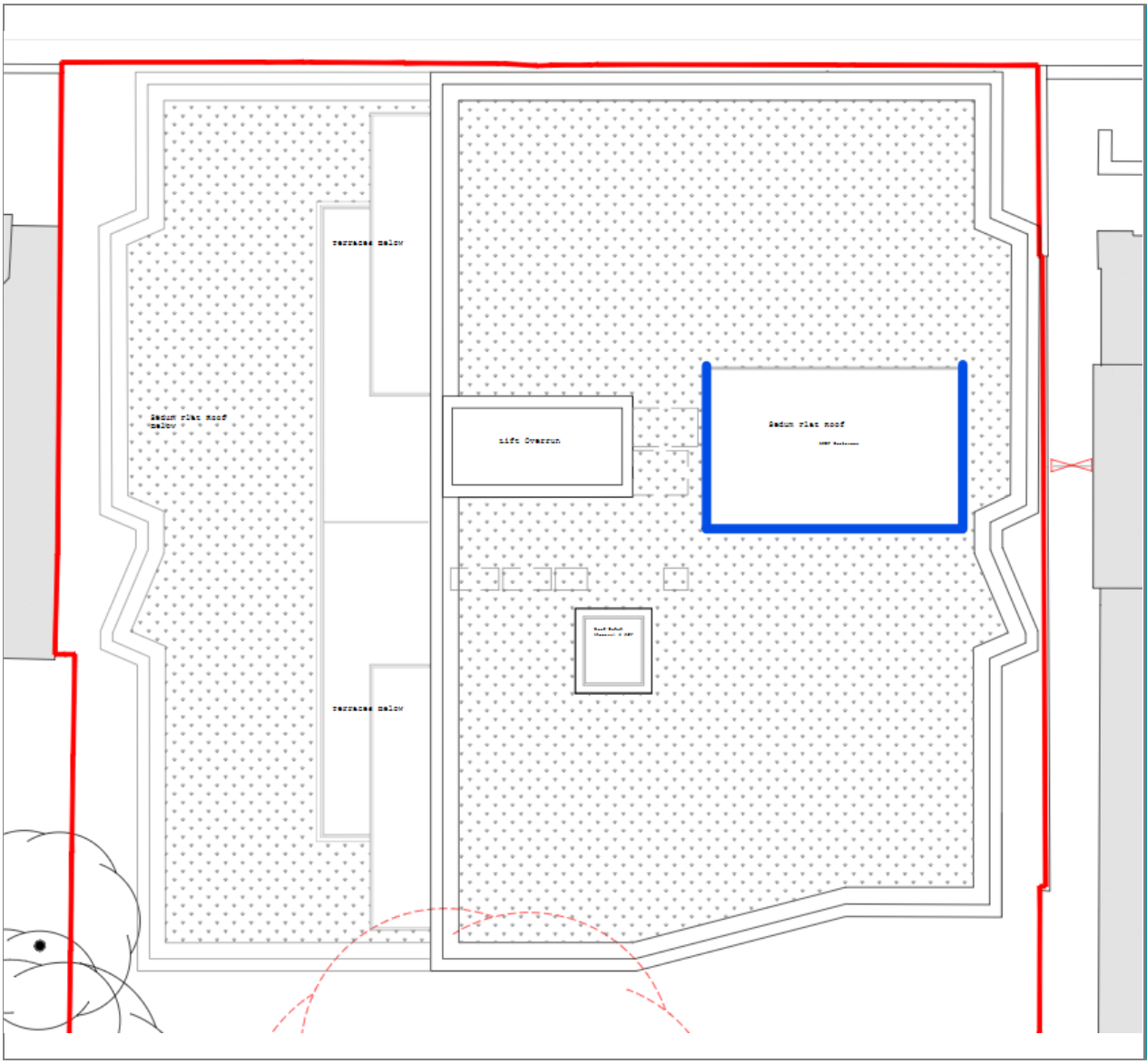


Figure 9 Block B acoustic barrier

5.53 In terms of the commercial units, it is understood that the proposal is for the shell only. Future tenants may require noisy plant however. Should this be the case, the 'noise rating level' associated with the operation of the plant, and determined in line with BS 4142:2014, should not exceed existing background sound levels at noise-sensitive receptors to avoid complaints.

5.54 It is noted, however, that the Local Planning Authority requires a more site/plant-specific target requirement, presumably, to prevent background noise 'creep'. As such, the combined

plant 'noise rating level(s)' associated with the operation of the commercial units are required to be 10 dB below the prevailing background sound levels:

- Daytime: 47 dB L_{A90}
- Night-time: 43 dB L_{A90}

5.55 It is important to keep in mind that the above background sound levels, particularly for the daytime period, do not include noise contribution from the existing on-site restaurant's mechanical services plant. Given this context, the above limits could be considered too onerous and a higher limit may be more appropriate. Additional baseline noise surveys at the existing noise-sensitive receptors may therefore be of benefit if consent were to be given for the proposed scheme.

6.0 Conclusions & Next Steps

6.1 This report has presented the findings of a Noise Assessment, which identified key sources of noise, monitored noise levels, assessed conditions against Local and British guidance, and outlined suitable methods of mitigation, where needed.

6.2 Assessment of prevailing environmental noise levels has been undertaken over what is deemed to have been a typical period. Additional noise monitoring to determine noise from the Salvation Army Church adjacent to the proposed site has also been undertaken.

6.3 The main noise sources at the proposed development site were observed to be mechanical services noise and air traffic noise. Occasional road traffic noise was also noted. In terms of the future noise conditions, the existing bar/restaurant would be replaced, thus air traffic noise would become the main general noise source with general plant noise also contributing.

6.4 The additional baseline noise survey also showed that parts of the site could be exposed to elevated levels of noise due to the church, albeit for relatively short periods, when the church's windows facing the proposed development are open.

6.5 This assessment has considered the above noise sources and has shown that with suitably specified façade constructions, internal noise levels in line with Local and British guidance limits can be achieved. Noise levels within the proposed private amenity spaces would also be in compliance with the relevant guidance.

6.6 Further to the above, to protect parts of the proposed development, an acoustic screen for the rooftop plant items is proposed.

6.7 As the plant details for the commercial element of the proposed development are not known at this stage, noise limits are proposed. However, as noted in this report, the noise level limits may have to be adjusted (via additional monitoring) to take into consideration noise contribution from the existing plant on site, as the background sound data in this report do not include contribution from the existing Smoque bar/restaurant.

6.8 High level consideration has also been given to internal sound transmission, particularly from the potentially noisier areas of the proposed development to adjacent habitable spaces. In general, due to the proposed high mass concrete frame construction, high levels of sound insulation should be achievable with relatively standard constructions, which significantly reduces this risk.

6.9 Having said that, as part of the detailed design, it may be worthwhile for the arrangement to be tweaked and a buffer zone introduced (e.g. via non-sensitive rooms/spaces) to reduce the risk of potentially problematic sound transfer between the commercial and residential units which share a separating wall in Block B.

6.10 Alternatively, the risk could be managed via a suitable tenancy agreement but this may not be desirable as it may limit the type of tenant that could use the commercial space without upgrading the existing partitions.

Planning Considerations & Next Steps

6.11 The information in this report should be used to ensure the proposed building envelope specifications meet the recommended specifications. Once this has been checked, the report can be submitted to the Local Planning Authority in support of the Application.

6.12 The preliminary façade specification is considered to be standard construction for the majority of external wall, fenestration and roofs. However, windows would have to remain closed to ensure adequate acoustic conditions. As such, an alternative form of ventilation will be required, understood to be an MVHR system, to provide a compliant building façade.

6.13 For parts of the proposed façade, there is also a risk of elevated noise due to operation of the church. To reduce the risk of adverse comment from future residents, uprated acoustic glazing is proposed.

6.14 And as mentioned above, an acoustic screen is proposed for the rooftop plant area to offer some protection to parts of the proposed development (noise mitigation not required for existing noise-sensitive receptors).

6.15 In summary, the following elements will need to be considered/implemented in the design and construction of the building:

- Acoustic glazing
- Acoustic vents (MVHR)
- Rooftop acoustic screen
- Block B acoustic separation between commercial and residential unit(s)
- Plant noise limits for commercial element

6.16 It should be noted that the above mitigation measures and considerations are based on the indicative design. Once the design process has advanced through the RIBA design stages, the Acoustic Design Statement should be checked and updated to ensure compliance with the final building design.

Next Steps following Planning Approval

6.17 As the proposed scheme entails residential development, the design will need to be compliant with the minimum acoustic criteria as set out in Approved Document E (ADE) of the Building Regulations. For the acoustic separation between the residential and commercial element, it is likely that an uplift over ADE sound insulation requirement would be needed, e.g. 10 dB or more.

6.18 Whilst compliance with ADE does not fall under the remit of the Local Planning Authority, the ADE design requirements will have to be integrated with acoustic design recommendations in this report, should the scheme progress further.

6.19 The Local Planning Authority may also impose noise-related Conditions, e.g. to control plant noise and/or demonstrate compliance with the relevant acoustic design criteria.

6.20 Lustre Consulting's dedicated acoustic consultants can help you navigate these next steps in the design.

APPENDIX A: Acoustic Terminology

Parameter	Description
Sound	A sound wave can be viewed as small pressure fluctuations in an elastic medium such as air. When the frequencies of the pressure fluctuations are within the audible range, the human ear responds to sound waves which produces the sensation of hearing. There are two basic characteristics of sound: amplitude and frequency. Amplitude relates to the perceived loudness of a sound whereas the pitch of a sound corresponds to the frequency.
Noise	Noise, a subjective term, is essentially unwanted sound. It is very much dependent on the receptor's perception of the sound.
Decibel (dB)	The sound pressure is measured in Pascals. The human ear responds to a wide range of sound pressures, from 0.00002 to 20 Pascals. Given this wide range of values, it is convenient to express these in a logarithmic scale, the decibel (dB). The decibel is a logarithmic scale representing the measurement unit of sound pressure levels or noise levels relative to the threshold of hearing ($20x10^{-6}$ Pascals). Zero decibel represents the threshold of hearing. The higher the value the louder the sound, with the value around 110 decibel being the level at which hearing becomes uncomfortable. Around 130 decibel is the threshold of pain at which hearing becomes painful.
Frequency (Hz)	The pitch of a sound relates to the frequency, which is expressed in Hertz (Hz). The audible range for human hearing typically ranges from 20 Hz to 20 kHz, but this tends to decrease with age. A pure tone, e.g. as produced by a tuning fork, contains sound of a single frequency (440 Hz). In real life, most sound consists of complex waves containing sound waves of multiple frequencies.
A-weighting	Human hearing is not linear, i.e. the perceived loudness of sound varies with both frequency and amplitude. To better represent the human hearing response, frequency 'weightings' are applied to sound. There are various weighting networks best suited to specific conditions. However, in practice, the A-weighting network has become the generally accepted 'correction' for representing loudness. When a weighting filter has been applied to a value, the weighting type is added to the descriptor, L_{Aeq}, L_{pA}, etc, or just after the decibel, dBA or dB(A)

Parameter	Description
Octave Bands or 1/3-Octave Bands	Whilst single figure values are useful, often spectral data is required for analysis and/or acoustic specification. To represent the frequency content, sound level or acoustic properties are presented in specific frequency bands, also known as octave bands. The frequencies of octave bands have been internationally standardised. For example, the 500 Hz octave band (500 Hz being the centre frequency) has a range from 354 Hz to 707 Hz. Where finer spectral detail is required, 1/3-octave band data can be used. Each octave band is divided into three 1/3-octave bands.
Sound Pressure Level (SPL or L_p)	The sound pressure level is indicative of the sound wave strength and has good correlation with perceived loudness. Sound pressure is expressed in Pacals and, for convenience, is expressed
Sound Power Level (SWL or L_w)	The sound power is the overall acoustic energy radiated by a source over a specific period and is expressed in Watts. It is an inherent property of the source and, unlike sound pressure, does not depend on the distance to the source. As sound power values vary greatly, it is convenient to express these as a level in decibels, the sound power level, SWL or L_w (referenced to 10^{-12} Watts).
$L_{Aeq,T}$	The A-weighted equivalent continuous sound level over the period T. Often also referred to as the ambient noise level. This is the sound level that is equivalent to the total average energy of noise recorded over a given period.
L_{Amax}	The A-weighted maximum instantaneous noise level.
L_{A10}	The A-weighted statistical sound level which is exceeded 10% of the given measurement period. In the UK, this level is usually used to describe road traffic noise.
L_{A90}	The A-weighted statistical sound level which is exceeded 90% of the given measurement period. This level is usually synonymous with the background sound level and generally describes the underlying level of sound that is experienced when specific events are not taking place.
R_w	The weighted (w) sound reduction index (R), a single figure rating of the laboratory airborne sound insulation performance of a construction, usually measured across the frequency range 100-3150Hz. The higher the value, the greater the sound insulation, and the more onerous the requirement.

Parameter	Description
$D_{nT,w}$	The weighted (w) sound insulation (*D*), a single figure rating of the in-situ airborne sound insulation performance of a construction. The sound insulation value is standardised (n*T*) to a reference reverberation time for typical conditions. The higher the value, the greater the sound insulation.
$L'_{nT,w}$	The weighted (w) impact sound pressure level (*L*), a single figure rating of the in-situ impact sound insulation performance of a construction. The sound insulation value is standardised (n*T*) to a reference reverberation time for typical conditions. The lower the value, the greater the sound insulation.
C or C_{tr}	These are spectrum adaptation terms for taking into account the effect of different sound spectra. C and C_{tr} are corrections for pink noise and traffic noise respectively and are added to single figure quantities, e.g. $R_w + C_{tr}$
$D_{n,ew}$	The weighted (w) element (e) normalised (n) level difference (D), an indicator of the ability of a small building element (such as a trickle ventilator) to reduce sound in a particular frequency band. The higher the value, the greater the sound reduction, and vice versa.
Reverberation Time (RT60 or T60)	Reverberation time relates to the echoing decay of sound in a room. More specifically, the reverberation time (RT60) is the time it takes for the sound pressure level to drop by 60 dB after excitation. The value is expressed in seconds. In many situations, conditions do not allow for the entire 60 dB decay time to be measured. Where this is the case, a reduced part of the decay can be measured and the results extrapolated; typically these are the T20 or T30. The higher the value, the more reverberant a space is.

APPENDIX B: Planning Policy and Guidance

NATIONAL PLANNING POLICY FRAMEWORK, 2021 (NPPF)

The National Planning Policy Framework (NPPF) includes the following statements relating to noise and the requirement to take it into account in the planning process.

Section 15, paragraph 170 (e) of NPPF states:

- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.*

Section 16, paragraph 180 of NPPF states:

- *(a) mitigate and reduce to a minimum potential adverse impact 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;*

Paragraph 182 of NPPF further elaborates on the consideration of existing businesses, as follows:

- *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 NPPF does not provide absolute limits on noise that are acceptable or unacceptable in a given situation. It does, however, set out the "need to ensure that developments do not give rise to significant adverse impacts on health and the quality of life". In addition, the operations of existing businesses are also protected, with reference to ensuring new developments do not have an adverse effect on their operations.

NOISE POLICY STATEMENT FOR ENGLAND, 2010 (NPSE)

The Noise Policy Statement for England (NPSE) applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise but does not apply to noise in the workplace. The Government recognizes that the effective management of noise requires a coordinated and long-term approach that encompasses many aspects of modern society.

The long-term vision of Government noise policy is set out to promote good health and a good quality of life through the effective management of noise within the context of Government 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 improvement of health and quality of life.

The NPSE introduces the concept of NOEL, LOAEL and SOAELs, which are described below:

- NOEL – No Observed Effect Level – This is the level below which no observable effect can be detected.
- LOAEL – Lowest Observed Adverse Effect Level – This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant effects on health and quality of life can be detected.

PLANNING POLICY GUIDANCE – NOISE, 2014

This guidance is provided online within the UK Government Planning System. The guidance expands upon the concepts of Observed Effect Levels and the following table is provided.

Planning Policy Guidance - Noise exposure hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Outcome
No Observed Effect Level			
Not Noticeable	No Effect	No Observable Effect	No specific measures required
Noticeable but 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
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
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

ProPG: PLANNING & NOISE PROFESSIONAL PRACTICE GUIDANCE ON PLANNING & NOISE NEW RESIDENTIAL DEVELOPMENT MAY 2017

The primary goal of ProPG is to assist the delivery of sustainable development by promoting good health and wellbeing through the effective management of noise. It seeks to do that through encouraging a good acoustic design process in and around proposed new residential development having regard to national policy on planning and noise.

ProPG advocates a systematic, proportionate, risk based, 2-stage, approach. The approach encourages early consideration of noise issues, facilitates straightforward accelerated decision making for lower risk sites, and assists proper consideration of noise issues where the acoustic environment is challenging. It is envisaged that following the guidance contained in this document will increase the likelihood of success of planning applications for new residential development, yet it also provides a clear basis for recommending refusal of new housing development on noise grounds where necessary.

Stage 1: Initial Site Noise Risk Assessment

An initial noise risk assessment of the proposed development site should be conducted by a competent noise practitioner at the earliest opportunity, before any planning application is submitted. The noise risk assessment should provide an indication of the likely risk of adverse effects from noise were no subsequent mitigation to be included as part of the development proposal. It should indicate whether the proposed site is considered to pose a negligible, low, medium or high risk from a noise perspective.

Stage 2: Full Assessment – the four key elements

- Element 1 – Good Acoustic Design Process Stage 2:
- Element 2 – Internal Noise Level Guidelines Stage 2:
- Element 3 – External Amenity Area Noise Assessment Stage 2:
- Element 4 – Assessment of Other Relevant Issues

Figure: Summary plan for ProPG planning advice

NOISE RISK ASSESSMENT	POTENTIAL EFFECT WITHOUT NOISE MITIGATION	PRE-PLANNING APPLICATION ADVICE
Indicative Daytime Noise Levels $L_{Aeq,16hr}$ / Indicative Night-time Noise Levels $L_{Aeq,8hr}$  	Increasing risk of adverse effect	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. This risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice. As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised, and which clearly demonstrate that a significant adverse noise impact will be avoided in the finished development. At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development.
	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.

The following British Standards and Building Regulations have been considered for this assessment.

BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

This standard provides information and guidance on sound insulation and noise reduction for buildings. It deals with the control of external noise and outlines recommendations for occupied rooms.

The following table is taken from the document outlining requirements for internal noise levels in residential accommodation.

Indoor Ambient Noise Levels for Dwellings (BS 8233:2014)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35dB $L_{Aeq,16Hr}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16Hr}$	-
Sleeping	Bedroom	35dB $L_{Aeq,16Hr}$	30dB $L_{Aeq,8Hr}$

The noise levels presented are based on existing WHO guideline values. The document further recommends that guideline value may be set in terms of SEL or $L_{Amax,F,}$ if systematic individual noise events are happening. The values are depending on the character and number of events per night. Sporadic noise events could require separate values. In this instance a target value of 45 dB L_{Amax} has been established as the average L_{Amax} level not to be exceeded in bedrooms at night.

External Amenity Space

BS 8233:2014 offers the following guidance regarding outdoor amenity space:

> *"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB LAeq, with an upper guideline value of 55dB LAeq which would be acceptable in noisier environments. However, it is also recognised that these 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."*

BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'

BS 4142:2014 describes methods for determining and assessing noise levels from noise sources with a view to determining the likelihood of adverse impact.

The document has been developed for the purposes of:

- Investigating complaints,
- Assessing sound from proposed new, modified or additional sources of sound of an industrial and / or commercial nature; and
- Assessing sound at proposed new dwellings or premises used for residential purposes.

The document is now suitable for the determination of noise nuisance. Furthermore, that standard is not intended to apply to the following sources of noise:

- recreational activities, including all forms of motorsport;
- music or other entertainment;
- shooting grounds;
- construction and demolition;
- domestic animals;
- people;
- public address systems for speech;
- other sources falling within the scopes of other standards or guidance.

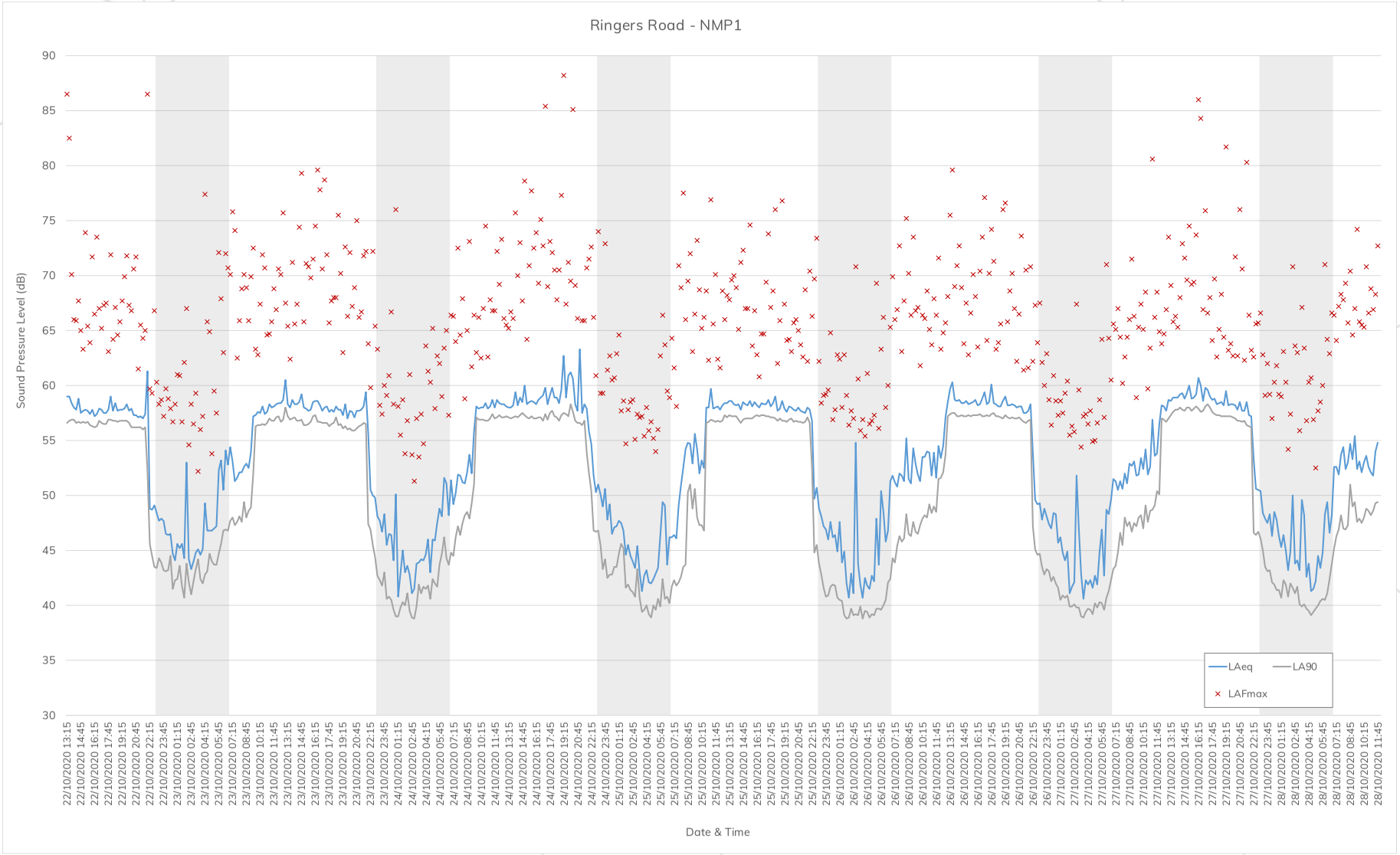
The methodology requires the determination of the specific sound level, corrected for characteristic feature in order to produce a rating level. The rating level is then compared against the background noise level (expressed as $L_{A90,T}$), thereby producing an 'excess of Rating over background sound level' figure. This figure is then used for assessment of likelihood of adverse impact.

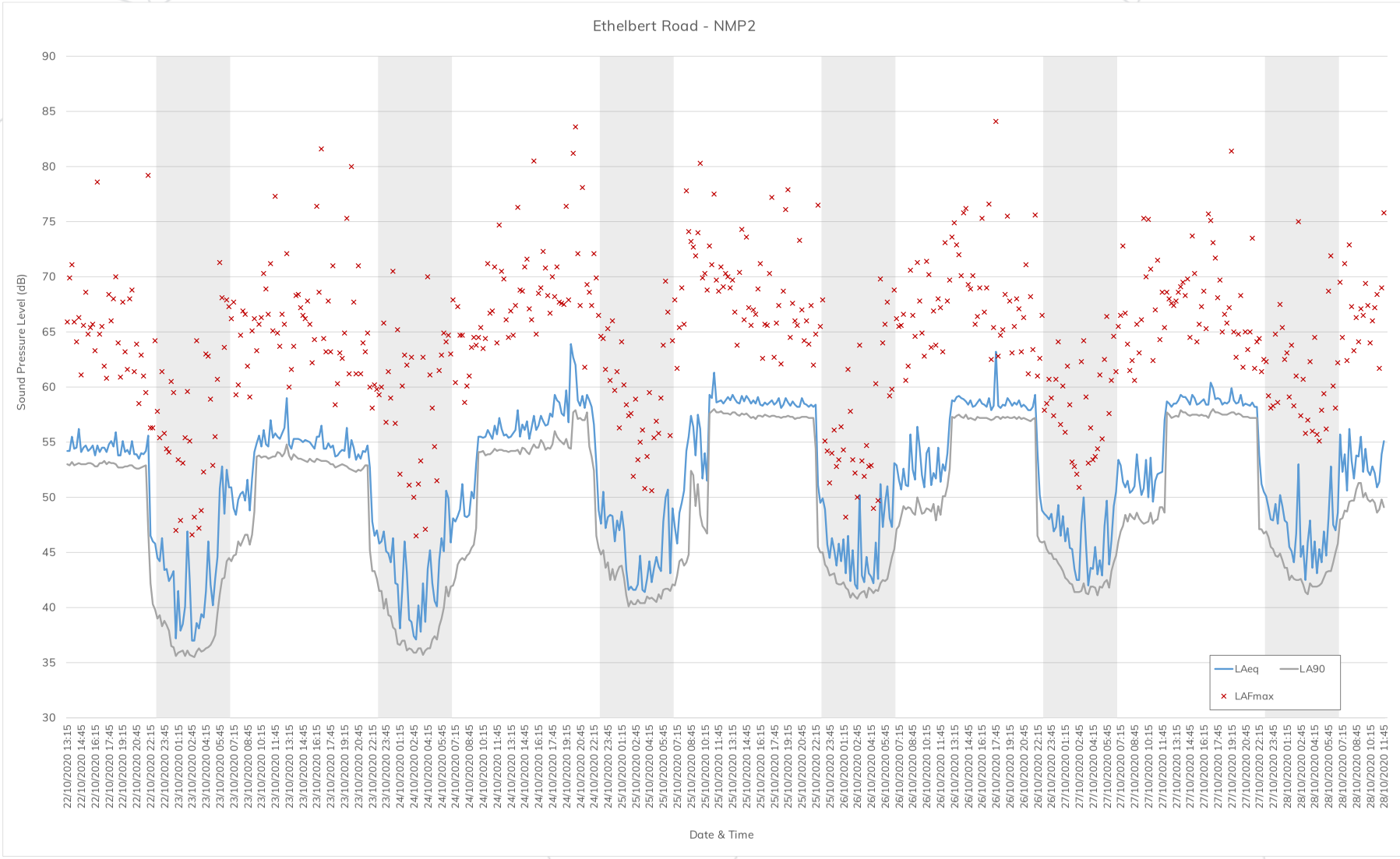
The standard places great emphasis on the context of the sound environment that is being assessed and the development overall. This is an essential part of the assessment process, particularly when predicting likelihood of adverse impact. However, for guidance the following is included in the standard:

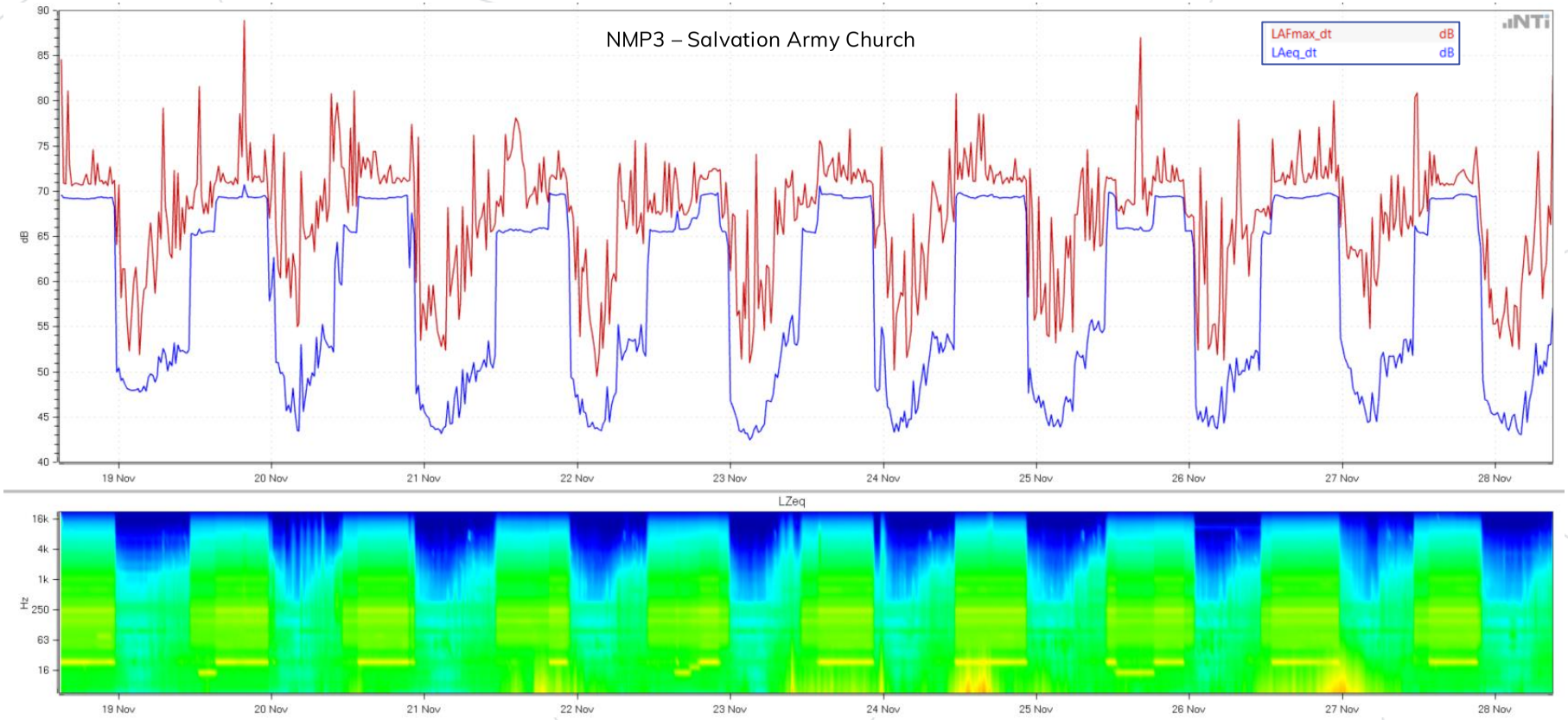
- Typically, the greater the difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;

- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating 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. When 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.

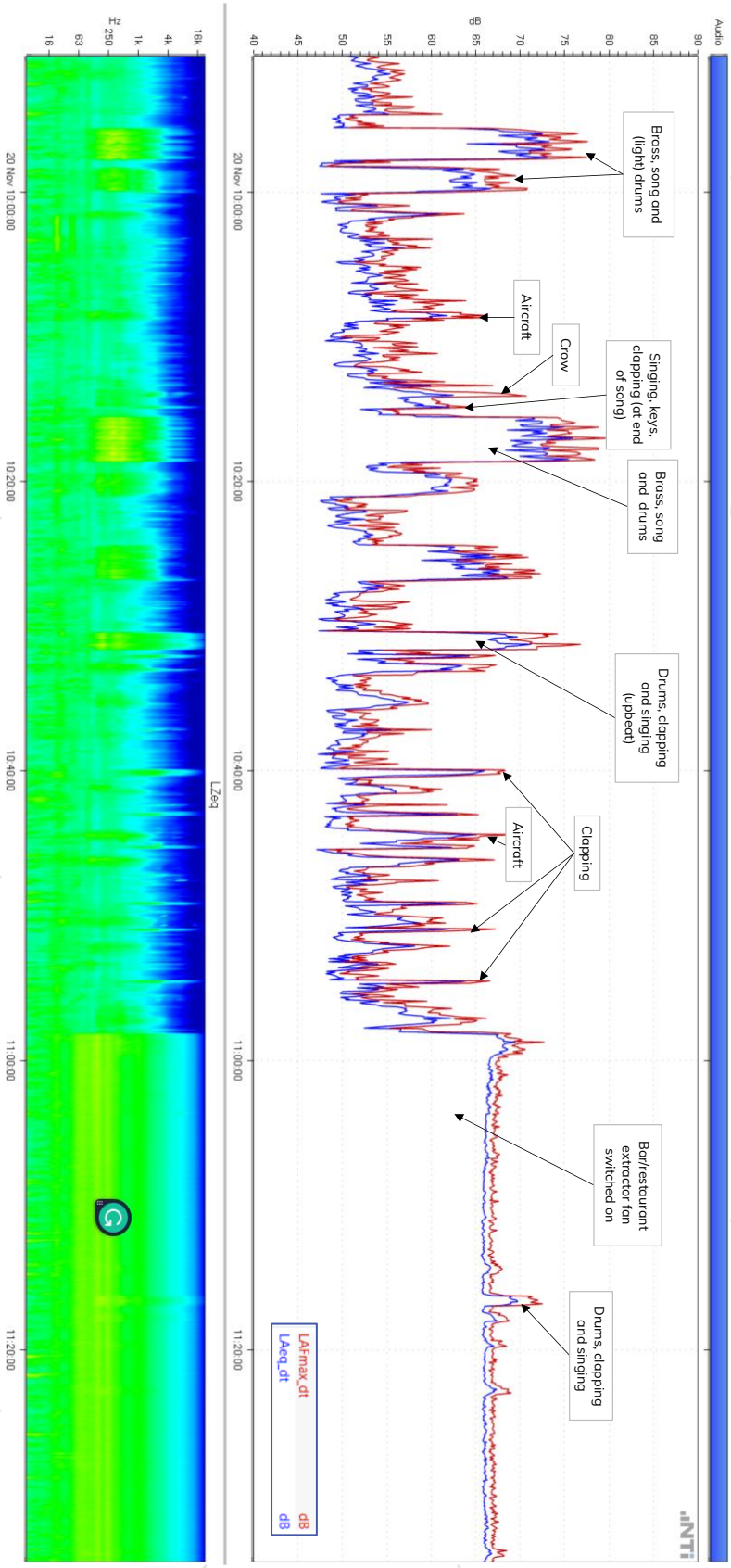
APPENDIX C: Survey Data and Analysis


Ringers Road - NMP1
Sound Pressure Level (dB)
90
85
80
75
70
65
60
55
50
45
40
35
30
LAeq
LA90
LAFmax
Date & Time
22/10/2020 13:15
22/10/2020 14:45
22/10/2020 16:15
22/10/2020 17:45
22/10/2020 19:15
22/10/2020 20:45
22/10/2020 22:15
22/10/2020 23:45
23/10/2020 01:15
23/10/2020 02:45
23/10/2020 04:15
23/10/2020 05:45
23/10/2020 07:15
23/10/2020 08:45
23/10/2020 10:15
23/10/2020 11:45
23/10/2020 13:15
23/10/2020 14:45
23/10/2020 16:15
23/10/2020 17:45
23/10/2020 19:15
23/10/2020 20:45
23/10/2020 22:15
23/10/2020 23:45
24/10/2020 01:15
24/10/2020 02:45
24/10/2020 04:15
24/10/2020 05:45
24/10/2020 07:15
24/10/2020 08:45
24/10/2020 10:15
24/10/2020 11:45
24/10/2020 13:15
24/10/2020 14:45
24/10/2020 16:15
24/10/2020 17:45
24/10/2020 19:15
24/10/2020 20:45
24/10/2020 22:15
24/10/2020 23:45
25/10/2020 01:15
25/10/2020 02:45
25/10/2020 04:15
25/10/2020 05:45
25/10/2020 07:15
25/10/2020 08:45
25/10/2020 10:15
25/10/2020 11:45
25/10/2020 13:15
25/10/2020 14:45
25/10/2020 16:15
25/10/2020 17:45
25/10/2020 19:15
25/10/2020 20:45
25/10/2020 22:15
25/10/2020 23:45
26/10/2020 01:15
26/10/2020 02:45
26/10/2020 04:15
26/10/2020 05:45
26/10/2020 07:15
26/10/2020 08:45
26/10/2020 10:15
26/10/2020 11:45
26/10/2020 13:15
26/10/2020 14:45
26/10/2020 16:15
26/10/2020 17:45
26/10/2020 19:15
26/10/2020 20:45
26/10/2020 22:15
26/10/2020 23:45
27/10/2020 01:15
27/10/2020 02:45
27/10/2020 04:15
27/10/2020 05:45
27/10/2020 07:15
27/10/2020 08:45
27/10/2020 10:15
27/10/2020 11:45
27/10/2020 13:15
27/10/2020 14:45
27/10/2020 16:15
27/10/2020 17:45
27/10/2020 19:15
27/10/2020 20:45
27/10/2020 22:15
27/10/2020 23:45
28/10/2020 01:15
28/10/2020 02:45
28/10/2020 04:15
28/10/2020 05:45
28/10/2020 07:15
28/10/2020 08:45
28/10/2020 10:15
28/10/2020 11:45

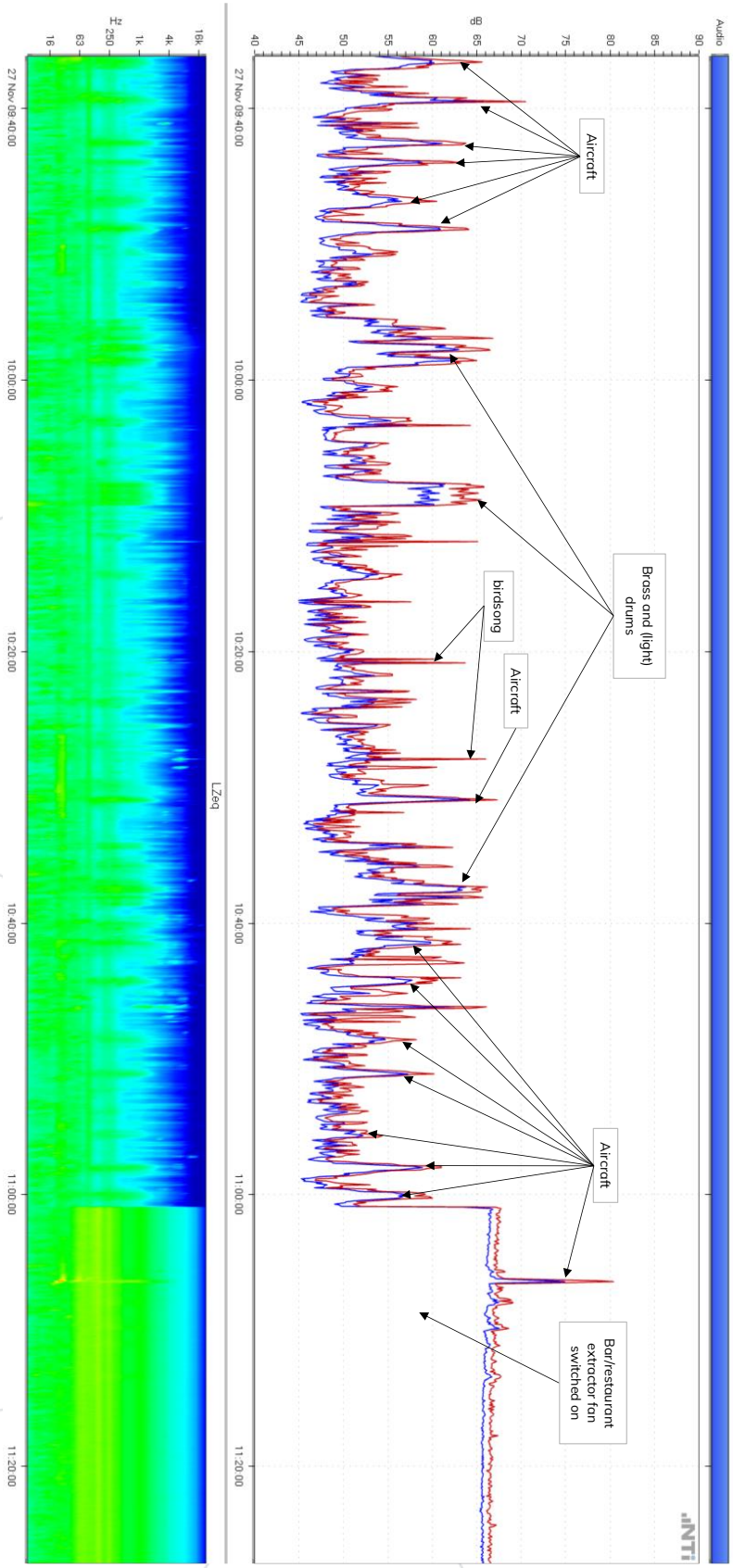

Ethelbert Road - NMP2
Sound Pressure Level (dB)
90
85
80
75
70
65
60
55
50
45
40
35
30
LAeq
LA90
LAFmax
Date & Time


NMP3 – Salvation Army Church
LAFmax_dt dB
LAeq_dt dB
dB
90
85
80
75
70
65
60
55
50
45
40
19 Nov
20 Nov
21 Nov
22 Nov
23 Nov
24 Nov
25 Nov
26 Nov
27 Nov
28 Nov
LZeq
Hz
16k
4k
1k
250
63
16

NMP3 – Sunday Morning 20th November



NMP3 – Sunday Morning 27th November



NMP1 and NMP2 – Noise Data

		Ambient, Leq		Maximum, LAF,max		Background, L90 (average)	
		NMP1	NMP2	NMP1	NMP2	NMP1	NMP2
22/10/2020	13:00 to 23:00	58	54	59 - 87	56 - 79	56	52
23/10/2020	Daytime (07:00 - 23:00)	57	54	60 - 80	58 - 82	55	51
	07:00 to 09:30	53	50	63 - 76	59 - 68	48	46
24/10/2020	Daytime (07:00 - 23:00)	58	57	59 - 93	59 - 94	55	53
	07:00 to 09:45	52	50	59 - 73	59 - 68	47	45
25/10/2020	Daytime (07:00 - 23:00)	58	58	59 - 93	62 - 80	55	54
	07:00 to 10:30	52	54	59 - 73	62 - 80	47	47
26/10/2020	Daytime (07:00 - 23:00)	57	57	61 - 80	61 - 84	53	54
	07:00 to 12:30	53	53	62 - 75	61 - 73	48	49
27/10/2020	Daytime (07:00 - 23:00)	57	57	59 - 86	61 - 81	54	54
	07:00 to 12:00	53	52	59 - 81	61 - 75	47	48
28/10/2020	07:00 to 12:00	53	53	64 - 74	62 - 76	48	50
Average	Daytime (07:00 - 23:00)	58	57	-	-	54	53
	Pre-restaurant fan noise	52	52	-	-	48	47

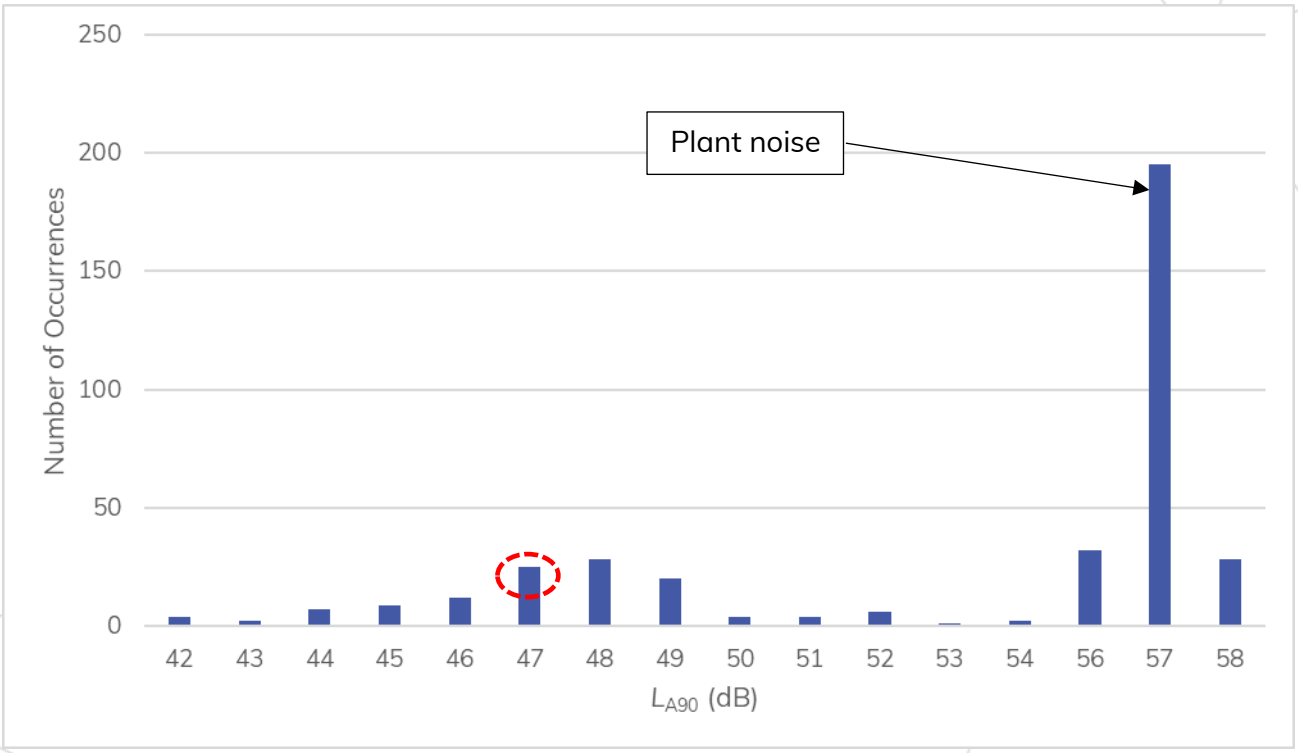
		Ambient, Leq		Maximum, LAF,max		Background, L90 (average)	
		NMP1	NMP2	NMP1	NMP2	NMP1	NMP2
23/10/2020	Night-time (23:00 - 07:00)	48	46	70	68	43	38
24/10/2020	Night-time (23:00 - 07:00)	47	44	65	67	41	38
25/10/2020	Night-time (23:00 - 07:00)	47	46	65	67	41	42
26/10/2020	Night-time (23:00 - 07:00)	47	47	65	67	40	42
27/10/2020	Night-time (23:00 - 07:00)	46	47	64	66	41	43
28/10/2020	Night-time (23:00 - 07:00)	53	48	63	69	48	43
	Night-time (23:00 - 07:00)	47	46	65	67	43	41

NMP3 – Noise Data

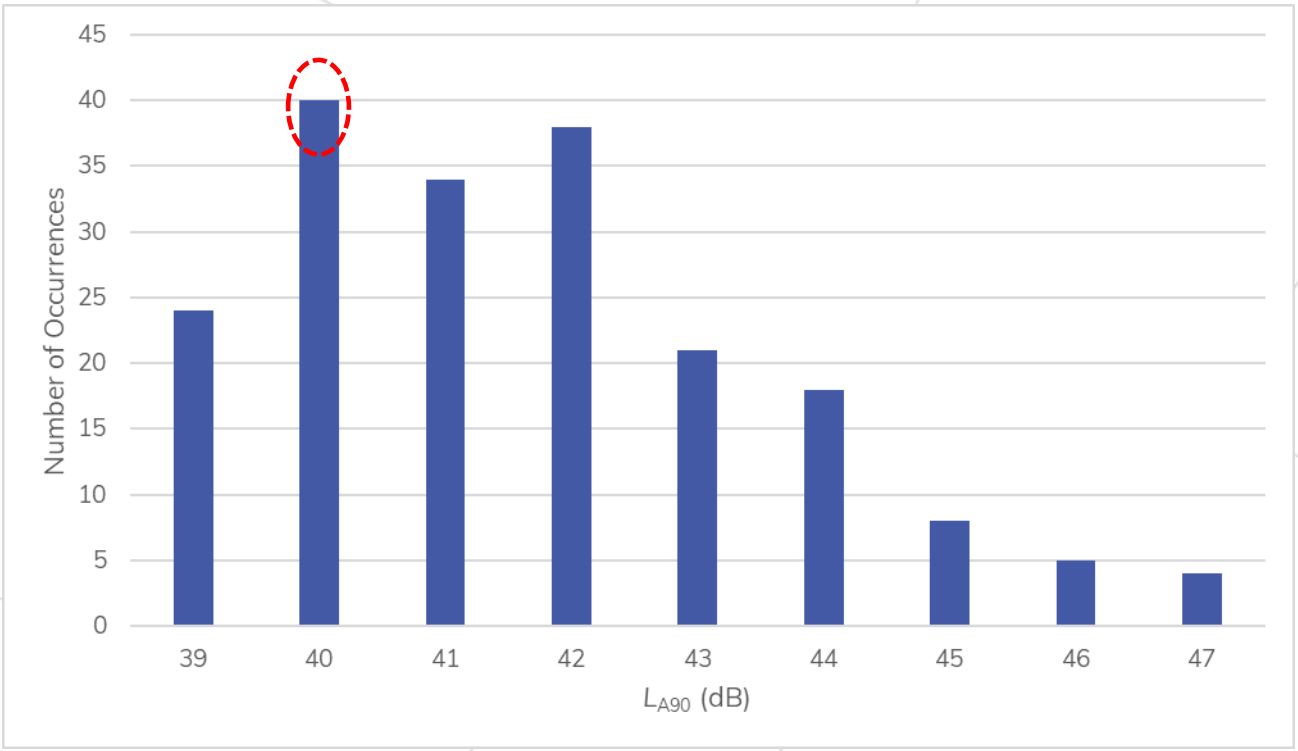
Type	Start	Duration	LAFmax [dB]	LAeq [dB]	Comment
07:00-10:30	19/11/2022 07:00	3:30:00	72	52	-
07:00-10:30	20/11/2022 07:00	3:30:00	81	58	-
07:00-10:30	21/11/2022 07:00	3:30:00	76	51	-
07:00-10:30	22/11/2022 07:00	3:30:00	76	53	-
07:00-10:30	23/11/2022 07:00	00:38:00	69	53	Periods of rain removed
07:00-10:30	24/11/2022 07:00	3:30:00	75	53	-
07:00-10:30	25/11/2022 07:00	3:30:00	75	54	-
07:00-10:30	26/11/2022 07:00	3:30:00	78	51	-
07:00-10:30	27/11/2022 07:00	3:30:00	72	52	-
07:00-10:30	28/11/2022 07:00	1:49:55	83	53	-
Night	18/11/2022 23:00	07:40:25	79	49	Fan noise operating past 23:00 removed
Night	19/11/2022 23:00	3:06:00	70	47	-
Night	20/11/2022 23:00	8:00:00	68	46	-
Night	21/11/2022 23:00	8:00:00	73	48	-
Night	22/11/2022 23:00	07:26:35	74	45	Fan noise operating past 23:00 removed
Night	23/11/2022 23:00	7:07:00	68	47	-
Night	24/11/2022 23:00	8:00:00	72	48	-
Night	25/11/2022 23:00	5:37:40	73	48	Fan noise operating past 23:00 removed
Night	26/11/2022 23:00	3:34:00	73	59	Rain, do not use
Night	27/11/2022 23:00	8:00:00	74	47	-

Background Noise Data Analysis

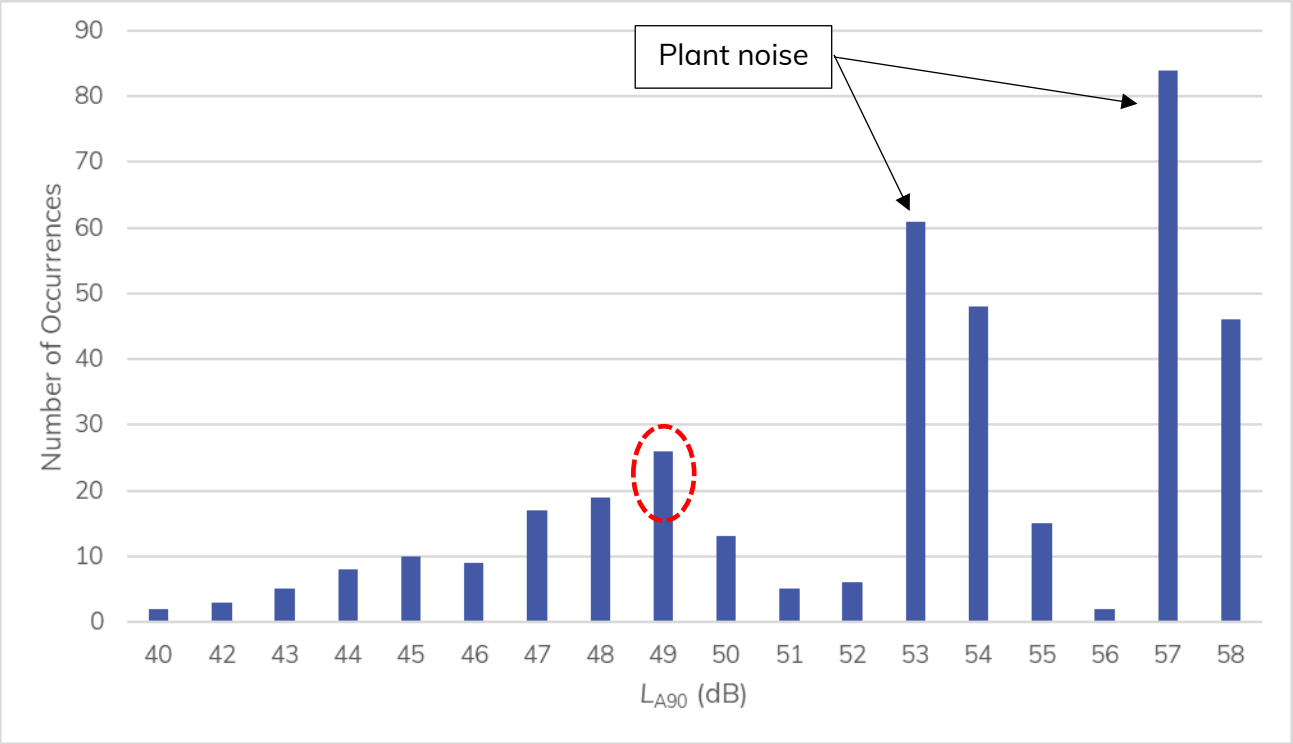
Daytime – NMP1



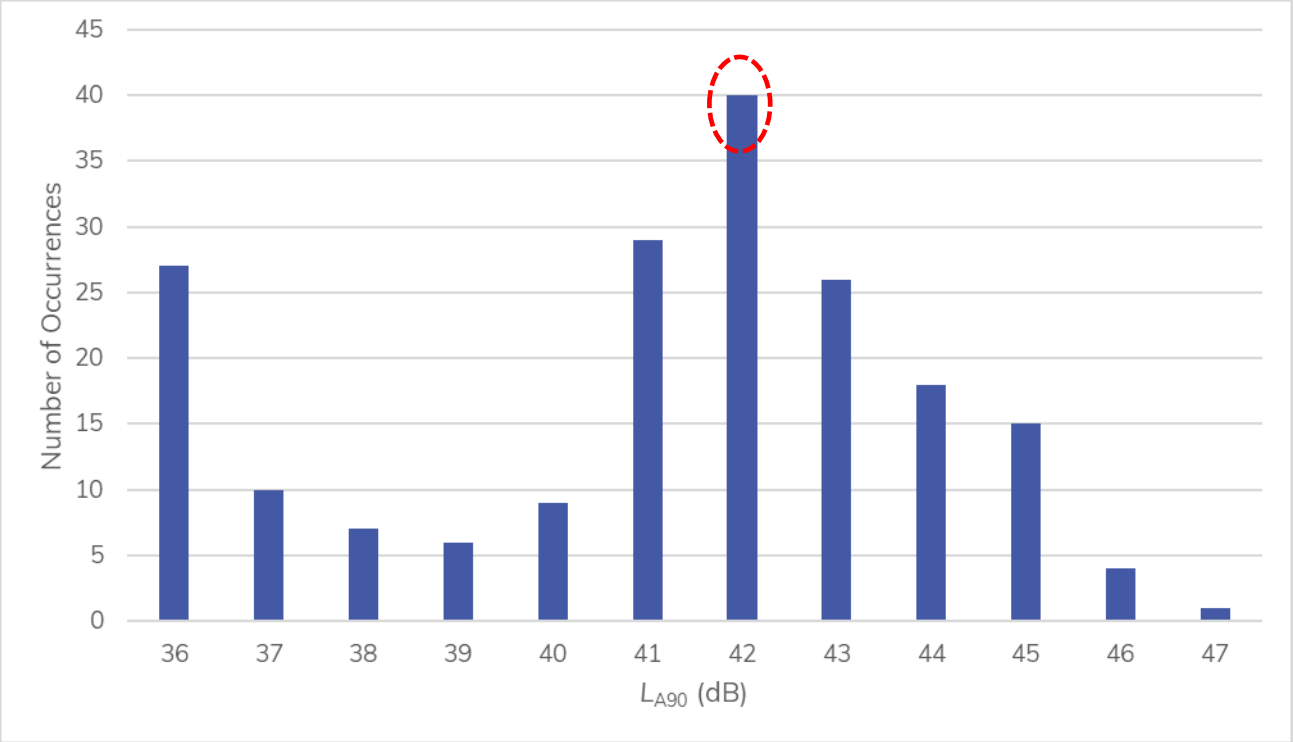
Night-time – NMP1



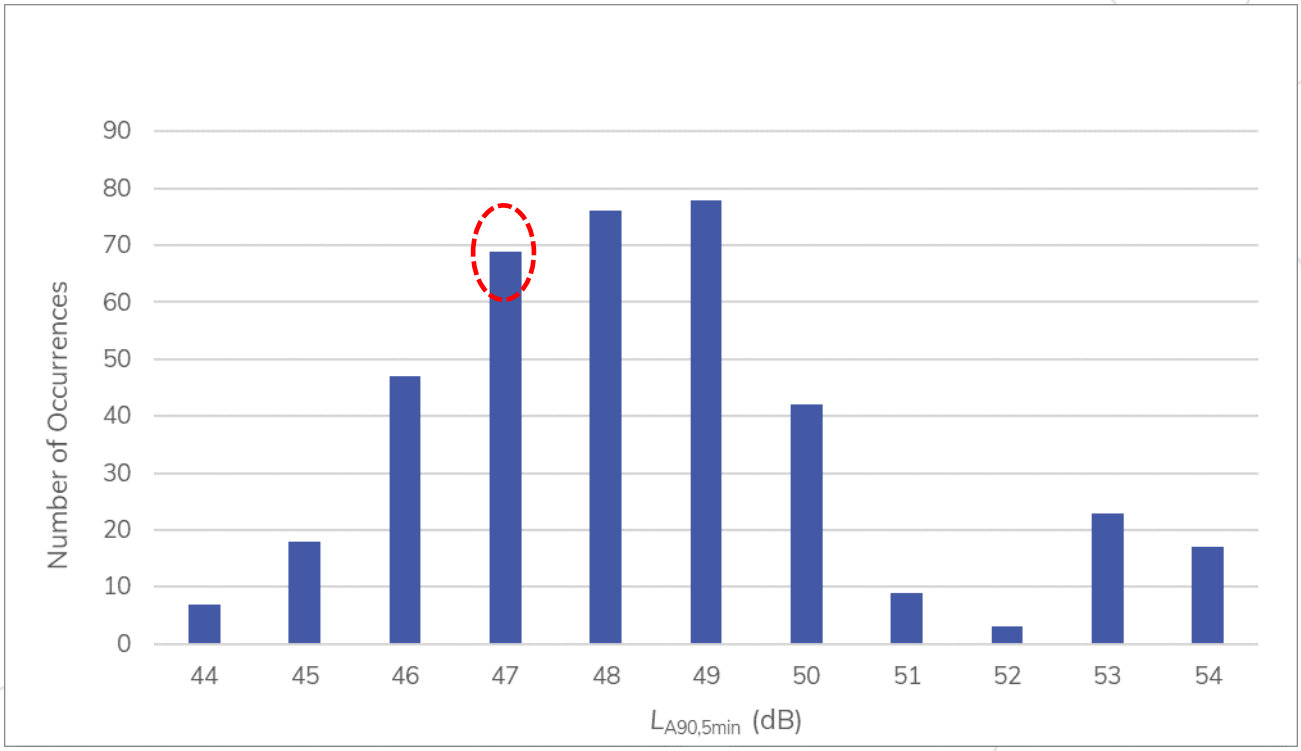
Daytime – NMP2



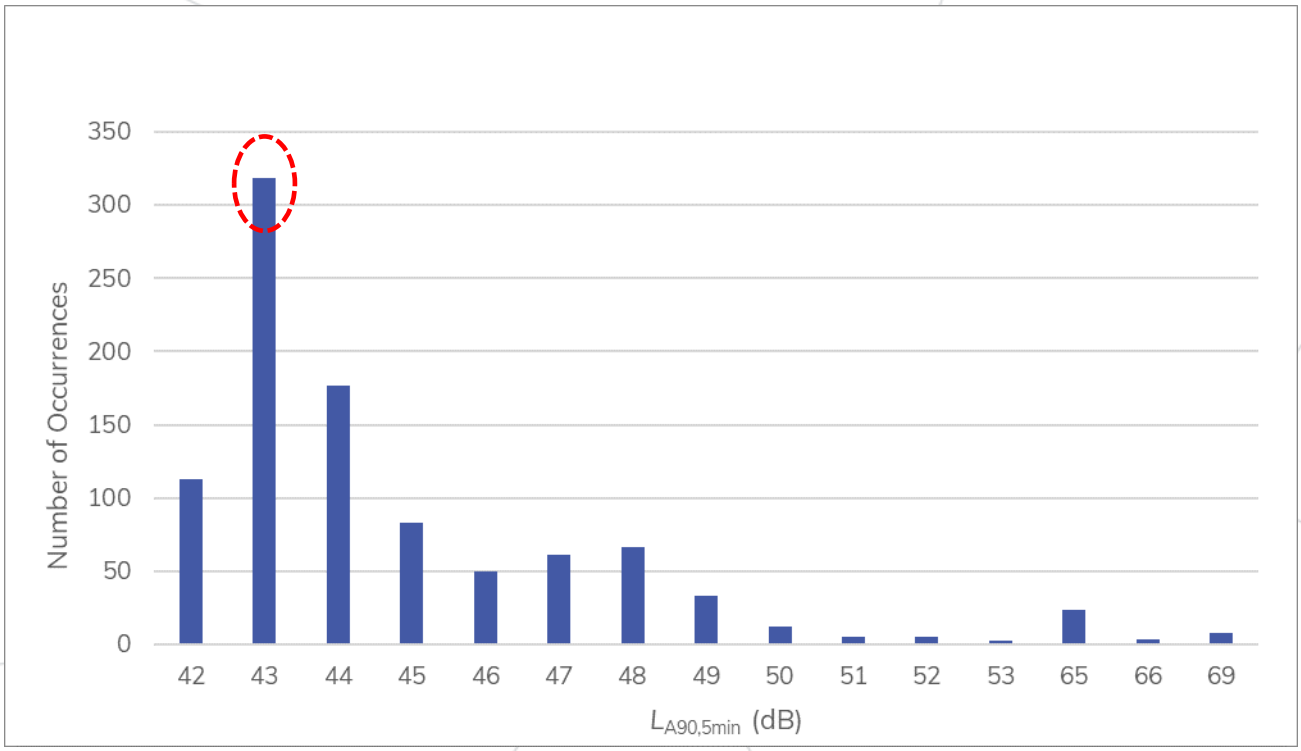
Night-time – NMP2



Daytime (07:00 to 10:30) – NMP3



Night-time – NMP3



APPENDIX D: Plant Noise Data

MCS
CERTIFIED

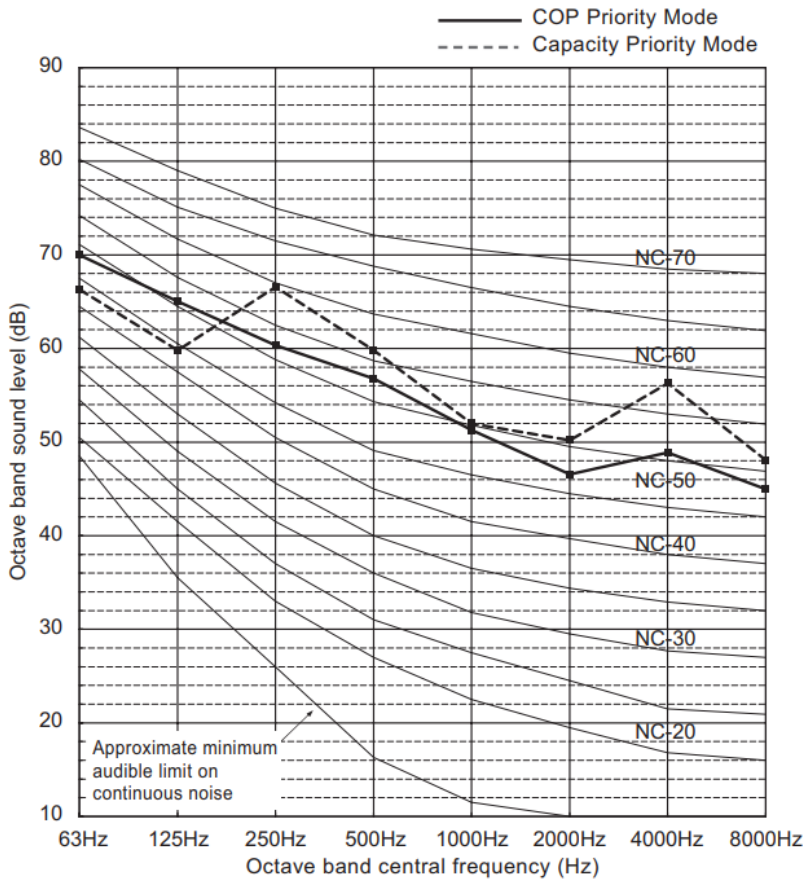
Certificate Number: MCS HP0002
Product Type: Heat Pumps
Product Reference: CAHV-P500YB-HPB

OUTDOOR UNIT		CAHV-P500YB-HPB
HEAT PUMP SPACE HEATER - 55℃	ErP Rating	A++
	η_s	125%
	SCOP	3.19
HEAT PUMP SPACE HEATER - 35℃	ErP Rating	A+
	η_s	139%
	SCOP	3.54
HEATING*1 (A-3/W35)	Capacity (kW)	42.6
	Power Input (kW)	15.2
	COP	2.80
OPERATING AMBIENT TEMPERATURE (°C DB)		-20~+40°C
SOUND PRESSURE LEVEL AT 1M (dBA)*2*3		59
LOW NOISE MODE (dBA)*2		Variable
FLOW RATE (l/min)		126
WATER PRESSURE DROP (kPa)		18
DIMENSIONS (mm)	Width	1978
	Depth	759
	Height	1710 (1650 without legs)
WEIGHT (kg)		526
ELECTRICAL SUPPLY		380-415v, 50Hz
PHASE		3
NOMINAL RUNNING CURRENT [MAX] (A)		17.6 [52.9]
FUSE RATING - MCB SIZES (A)*4		63
REFRIGERANT CHARGE (kg) / CO_2 EQUIVALENT (t)	R407C (GWP 1774)	11 / 19.5

*1 Under normal heating conditions at outdoor temp: -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C *2 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511
*3 Sound power level of the CAHV-P500YB-HPB is 70.7dBA. Tested to BS EN12102 *4 MCB Sizes BS EN60898-2 & BS EN60947-2
η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

Sound Pressure Level: 59.0 / 63.0 dB (COP Priority Mode / Capacity Priority Mode)

Opetation condition… Spring, Autumn: Outdoor temp.: 16°CDB/12°CWB, Inlet water temp.: 40°C, Outlet water temp.: 45°C
Winter: Outdoor temp.: 7°CDB/ 6 °CWB, Inlet water temp.: 65°C, Outlet water temp.: 70°C



APPENDIX E: Noise Model Screenshot and Predicted Noise Levels

Noise Model Receptor (Façade) Location	Predicted Noise Level, L_{Aeq} (dB)		
	Church Noise		Plant (ASHP)
	Worst Case	General	
Block B roof - amenity	34	28	27
Block A roof - amenity	36	27	17
Block B - bedroom 2nd	69	59	22
Block B - bedroom 3rd	67	57	22
Block B - bedroom 4th	65	55	25
Block B - bedroom 5th	63	54	29
Block B - bedroom 6th	62	53	25
Block B - bedroom 7th	61	51	24
Block B - bedroom 8th	60	50	26
Block B - bedroom 9th	59	49	28
Block B - bedroom 10th	58	49	33
Block B - bedroom 11th	58	49	37
Block B - living room 2nd	71	61	32
Block B - living room 3rd	61	52	33
Block B - living room 4th	59	49	22
Block B - living room 5th	57	48	21
Block B - living room 6th	56	47	23
Block B - living room 7th	53	44	28
Block B - living room 8th	52	43	25
Block B - living room 9th	52	43	27
Block B - living room 10th	51	42	29
Block B - living room 11th	50	41	31
Block A - bedroom 2nd	63	54	17
Block A - bedroom 3rd	62	53	18
Block A - bedroom 4th	61	52	19
Block A - bedroom 5th	60	51	19
Block A - bedroom 6th	59	50	20
Block A - bedroom 7th	58	49	22
Block A - bedroom 8th	57	48	23
Block A - bedroom 9th	56	47	24
Block A - bedroom 10th	55	46	26
Block A - bedroom 11th	55	45	29

LUSTRE
CONSULTING

2nd Floor North, Fitted Rigging House,
The Historic Dockyard, Chatham, Kent, ME4 4TZ
e: info@lustreconsulting.com | t: 01634 757 705
www.lustreconsulting.com