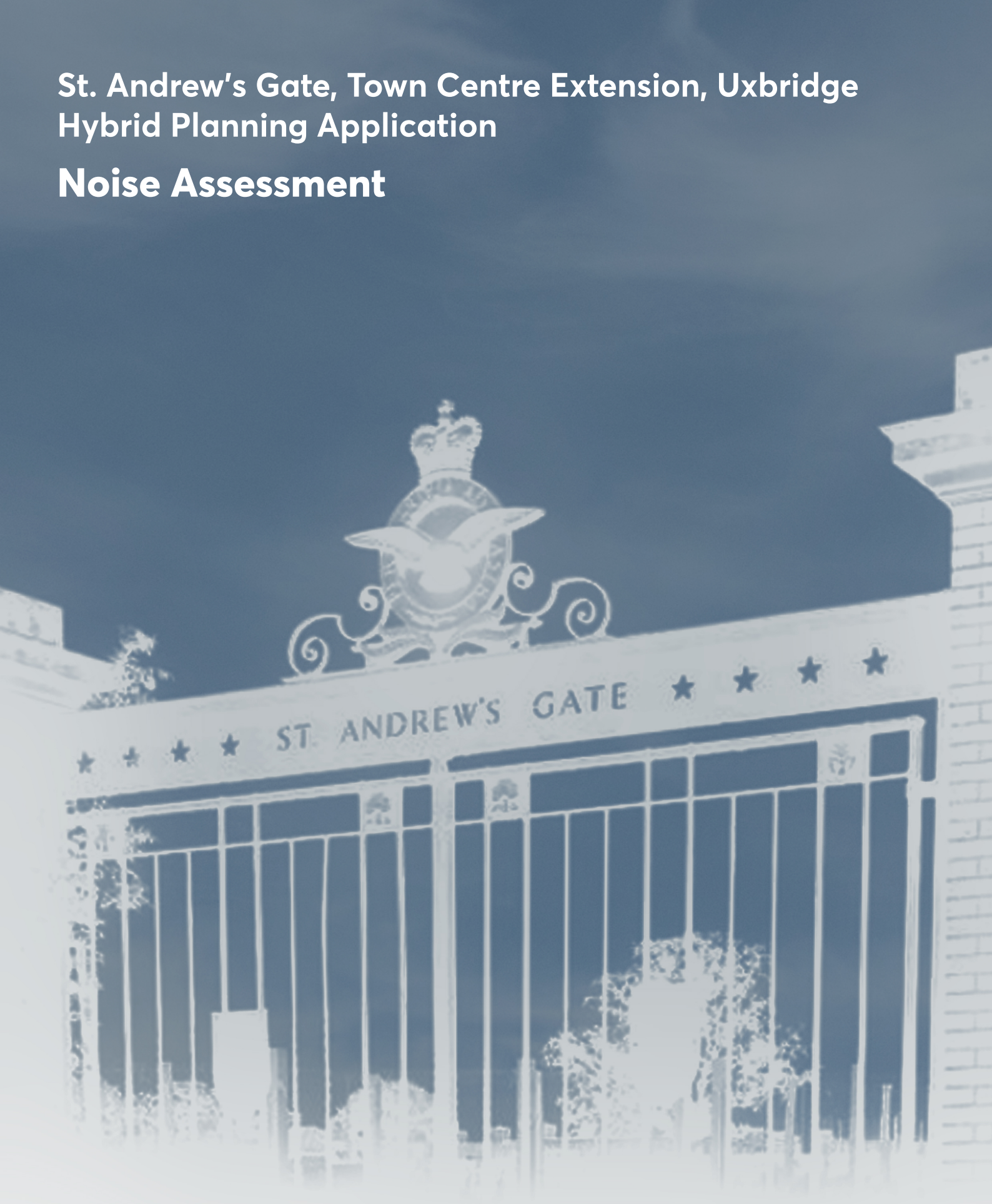
St. Andrew's Gate, Town Centre Extension, Uxbridge
Hybrid Planning Application

Noise Assessment



ST. ANDREW'S PARK
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NRG CONSULTING

St Andrew's Gate
Town Centre Extension
Uxbridge

Noise Assessment

June 2024

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1 Introduction

1.1 Overview

NRG Consulting has been commissioned to assess the impact of noise at a site referred to as **St. Andrew's Gate, Town Centre Extension, Uxbridge ('the TCE site'),** in respect of the site's suitability for residential-led mixed use development.

The proposed description of development for the hybrid planning application is:

"Outline planning permission (with all matters reserved) for residential development and commercial uses, to be occupied flexibly within Use Classes E(a), E(b), E(c), E(e), E(g)(i), E(g)(ii) and a convenience store (Use Class E(a)); plus car parking, hard and soft landscaping, and all other associated works.

Full planning permission for reinstatement of gym use (Use Class E(d)) and change of use to provide a café (Use Class E(b)) within the former cinema building; and external alterations; and associated car parking, hard and soft landscaping and all other associated works.

Masterplan to be delivered on a phased basis with Full proposals for the former cinema building to be delivered alongside Outline phases."

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

1.2 Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A baseline sound monitoring survey was undertaken at discrete locations around the TCE site;
- A detailed assessment of the suitability of the TCE site, in accordance with relevant British Standards, Policy and Guidance in respect of existing road traffic noise sources;
- Environmental Sound Criterion (ESC) determined for proposed fixed plant associated with proposed commercial elements; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Practice Guidance for England: Noise[1], BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*'[2] and BS 4142:2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*' [3].

[1] Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.
[2] British Standard Institution. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings.
[3] British Standard Institution. BS 4142:2014+A1:2019: Methods for rating and assessing industrial and commercial sound.

2 Assessment Framework

2.1 British Standard 8233:2014 'Guidance on sound insulation and noise reduction for buildings'

BS 8233:2014 draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the guideline values, as detailed below in Table 2-1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$
Resting	Living room	35 dB $L_{Aeq,16hour}$	-

***Table 2-1**:* BS 8233:2014 Indoor Ambient Noise Levels

BS 8233:2014 goes on to suggest that where development is considered necessary or desirable, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions will still be achieved.

With regard to maximum noise levels, the standard identifies that regular individual noise events (such as passing trains or scheduled aircraft etc) can cause sleep disturbance. The standard does not provide a guideline design target, but simply goes on to suggest that a guideline value may be set in terms of SEL or $L_{Amax,F}$, depending upon the character and number of events per night. It goes on to suggest that more sporadic noise events could require separate values.

In respect of external noise levels, the guidance in BS 8233:2014 suggests that *"it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments"*.

BS 8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

In respect of gardens and patios, BS 8233:2014 states;

"...it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable."

BS 8233:2014 goes on to state, for 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".

In respect of balconies, roof gardens and terraces, BS 8233:2014 states; *"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be*

necessary for these uses; however, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space".

It is clear from the narrative of BS 8233:2014, that proposed development within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels, although it acknowledges that in certain circumstance meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons.

2.2 BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

BS 4142:2014+A1:2019 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS 4142:2014+A1:2019 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

BS 4142:2014+A1:2019 states: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs"*. An estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- *"Typically, the greater this difference, the greater the magnitude of the impact."*
- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."*
- *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

During the daytime and night-time periods, the assessment is carried out over a reference time period of 1-hour and 15-minutes respectively. The periods associated with daytime or night-time, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

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

ProPG[4] advocates a systematic, proportionate, risk-based 2-stage approach. This 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 presents more challenges.

[4] ProPG: Professional Practice Guidance on Planning & Noise. ANC, IOA, CIEH, May 2017

3 Local and Regional Policy

3.1 National Planning Policy Framework

National Planning Policy Framework

The *National Planning Policy Framework* (NPPF)[5] sets out the Government's planning policies for England. Planning policy requires that applications for planning permission must be determined in accordance with the development plan, unless material considerations indicate otherwise.

The NPPF is also a material consideration in planning decisions. It sets out the Government's requirements for the planning system and how these are expected to be addressed.

Under Section 15; *Conserving and Enhancing the Natural Environment*, in Paragraph 180, the following is stated:

"Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *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".*

Paragraph 191 of the document goes on to state:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*

Paragraph 191 refers to the Noise Policy Statement for England, which is considered overleaf.

Noise Policy Statement for England, 2010

The underlying principles and aims of existing noise policy documents, legislation and guidance are clarified in *DEFRA: 2010: Noise Policy Statement for England* (NPSE)[6]. The NPSE sets out the *"Long Term Vision"* of Government noise policy as follows:

"Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development".

The NPSE outlines three aims for the effective management and control of environmental, neighbour and neighbourhood noise:

- *"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".*

[5] Department for Levelling Up, Housing & Communities (DLUHC), December 2023. National Planning Policy Framework. HMSO. London.
[6] Department for Environment, Food and Rural Affairs (DEFRA), 2010. Noise Policy Statement for England. DEFRA.

The guidance states that it is not possible to have a single objective noise-based measure that defines *"Significant Observed Adverse Effect Level (SOAEL)"* that is applicable to all sources of noise in all situations and that not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

National Planning Practice Guidance in England: Noise, 2019

Further guidance in relation to the NPPF and the NPSE has been published in the *National Planning Practice Guidance in England: Noise* (NPPG Noise)[7], which summarises the noise exposure hierarchy, based on the likely average response. The following three observed effect levels are identified below:

- Significant Observed Adverse Effect Level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur;
- Lowest Observed Adverse Effect Level: This is the level of noise exposure above which adverse effects on health and quality of life can be detected; and
- No Observed Adverse Effect Level: This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Criteria related to each of these levels are reproduced in Table 3-1.

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Noticeable and Not Intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a 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, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and Disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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
Present and Very Disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an	Unacceptable Adverse Effect	Prevent

[7] Department for Communities and Local Government (DCLG), 2019. National Planning Practice Guidance for England: Noise. DCLG.

Perception	Examples of Outcomes	Increasing Effect Level	Action
	inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.		

Table 3-1: Significance Criteria from NPPG in England: Noise

3.2 Regional Policy

The London Plan (March 2021)

The London Plan contains the following policies relating to noise, pertinent to the proposed development:

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; and
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."

3.3 Local Plan

London Borough of Hillingdon Local Plan Part 1 (2012)

The London Borough of Hillingdon Local Plan: Part 1 contains the following strategic objectives and policies relating to noise, pertinent to the proposed development:

SO10: "*Improve and protect air and water quality, reduce adverse impacts from noise including the safeguarding of quiet areas and reduce the impacts of contaminated land.*"

Policy EM8: Land, Water, Air and Noise

"*The Council will investigate Hillingdon's target areas identified in the Defra Noise Action Plans, promote the maximum possible reduction in noise levels and will minimise the number of people potentially affected. The Council will seek to identify and protect Quiet Areas in accordance with Government Policy on sustainable development and other Local Plan*

policies. The Council will seek to ensure that noise sensitive development and noise generating development are only permitted if noise impacts can be adequately controlled and mitigated.

The Council will implement Policy EM8 by Setting high standards for reducing land, water, air and noise pollution and resisting amenity and environmental impacts that affect how we enjoy the environment in which we live and work. This includes making sure developments are designed to cope with climate conditions as they change during the development's lifetime."

London Borough of Hillingdon Local Plan Part 2 (2020)

The Local Plan Part 2 Development Management Policies and Site Allocations and Designations were adopted as part of the borough's development plan at Full Council on the 16th January 2020. This replaces the Local Plan Part 2 Saved UDP Policies (2012).

The Local Plan Part 2 Development Management Policies contains multiple references to noise, but does not include any particular policy relevant to the proposed development over and above the considerations already outlined in this noise assessment report.

4 Site Description

4.1 Site and Surrounding Area

The TCE site is located to the east of Park Road (B483) and Hillingdon Road (A4020). It is bound to the north and north-east by St. Andrew's Road, to the east by the spine road, Town Centre West (TCW) phase of development and locally listed Mons building and to the south by Burton Road.

The proposed residential development, which ranges in height from three to ten storeys, is located between the TCE site and Dowding Park. Dowding Park provides a significant local amenity within a large area of urban green space, including sport pitches and play space. The John Locke Primary School is located within St. Andrew's Park, to the north of Dowding Park and is within walking distance of the TCE site. Uxbridge Underground Station and Bus Station are located within walking distance of the TCE site. St Andrew's Church is located on the opposite side of Hillingdon Road between the TCE site and town centre.

The existing TCE site comprises vacant brownfield land, the Grade II listed former cinema building and associated car park and the locally listed St Andrew's Gate. The TCE site can be seen in Figure 4-1.

Figure 4-1: *Site Location Plan*

4.2 Proposed Development Overview

Proposals include the redevelopment of the existing site to produce the following:

In outline:

- Creation of up to no. 356 residential dwellings (Class C3) within three new build blocks, of up to 10 storeys;
- Up to 1,100sqm GIA of flexible commercial space (Use Classes E(a), E(b), E(c), E(e), E(g)(i) and E(g)(ii)) at ground floor level, which will include a convenience store of up to 440sqm (GIA) located in Building Zone C and other flexible commercial floorspace at ground floor level in Building Zones B and C; and
- Associated car parking and hard and soft landscaping.

In full:

- Change of use of the former cinema building to reinstate a gym (E(d)) in the Main Hall and change of use of former squash courts to a café (E(b));
- Associated car parking and hard and soft landscaping and access alterations; and
- External alterations to the building.

5 Measurement Methodology

5.1 General

The prevailing acoustic environment within the vicinity of the TCE site has been determined by partially attended baseline sound surveys conducted during both daytime and night-time periods between 11th - 12th October 2023, and 19th - 23rd October 2023.

5.2 Measurement Details

All sound measurements were undertaken by a consultant certified as competent in environmental sound monitoring, and, in accordance with the principles of BS 7445:2003 '*Description and measurement of environmental noise*'[8].

All sound measurement equipment used during the sound surveys conformed to Type 1 specification of British Standard 61672 '*Electroacoustics. Sound level meters. Part 1 Specifications*' [9]. A full inventory of this equipment is shown in Table 5-1 below.

Unit	Make, Model & Description	Serial Number
MP1	Rion NL-52 Sound Level Meter	00965159
	Rion NH-25 Preamplifier	65386
	Rion UC-59 Microphone	18640
MP2	Brüel & Kjær 2238 Sound Level Meter	2328256
	Brüel & Kjær 4188 Microphone	171603
MP3	Rion NL-52 Sound Level Meter	00453871
	Rion NH-25 Preamplifier	43913
	Rion UC-59 Microphone	7960
All	Cirrus CR:515 Calibrator	82501

Table 5-1: *Inventory of Sound Measurement Equipment*

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.1 dB in the field calibration was found to have occurred on all sound level meters.

5.3 Weather Conditions

The weather conditions during the survey were conducive to environmental sound measurement it being dry, with low wind speeds (<5ms^{-1}). The microphones were fitted with protective windshields throughout the measurements. No periods have therefore been excluded from the dataset due to weather conditions.

[8] British Standard 7445: 2003: Description and measurement of environmental noise. BSI
[9] British Standard 61672: 2003: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

5.4 Measurement Positions

A summary of the measurement positions is presented in Table 5-2.

Measurement Position	Description
MP1	A partially attended measurement of ambient sound at the western boundary of the TCE site, closest to Park Road (B483). The measurement was undertaken under free field conditions, with the microphone located at a height of 1.5 metres above ground level. The acoustic environment was dominated by road traffic noise from Park Road (B483).
MP2	A partially attended measurement of ambient sound at the eastern boundary of the TCE site, closest to St. Andrew's Road. The measurement was undertaken under free field conditions, with the microphone located at a height of 1.5 metres above ground level. The sound environment was dominated by road traffic noise from Park Road (B483), followed by St. Andrew's Road. Occasional aircraft movements overhead.
MP3	A fully attended measurement of ambient sound at the south-eastern boundary of the TCE site, closest to the residential units under construction, adjacent to the existing cinema building. The measurement was undertaken under free field conditions, with the microphone located at a height of 1.5 metres above ground level. The sound environment was dominated by road traffic noise from Hillingdon Road.

Table 5-2: *Measurement Position Descriptions*

The measurement positions and surrounding noise sources are shown in Figure 5-1.

Figure 5-1: *Measurement Positions*

In summary, during the baseline survey the ambient sound environment across the TCE site was dominated by road traffic noise arising from Park Road (B483) and Hillingdon Road (A4020) to the west, with additional contributions from smaller surrounding roads including St Andrew's Road to the east.

5.5 Measurement Results

The parameters reported are the average Equivalent Continuous Sound Level, $L_{Aeq,T}$, the statistical index (typical) Background Sound Level, $L_{A90,T}$, as well as the and the typical Maximum Sound Pressure Level, L_{AFmax}. An explanation of the sound units presented is given in Appendix A.

The measured L_{Aeq}, L_{AFmax}, and L_{AF90} sound levels are presented as time history graphs in Appendix B for reference. The summarised results of the environmental sound measurements are presented in Table 5-3 for daytime and night-time periods, rounded to the nearest decibel.

Measurement Position	Period	Sound Pressure Level, dB			
		$L_{Aeq,T}$	90th Percentile L_{Amax}	10th Highest L_{Amax}	$L_{A90,T}$
MP1	Daytime 07:00 – 23:00	68	86	-	61*
	Night-time 23:00 - 07:00	63	79	78	51*
MP2	Daytime 07:00 – 23:00	61	82	-	53*
	Night-time 23:00 - 07:00	55	74	74	48*
MP3	Daytime 07:00 – 23:00	58	71	-	55

Table 5-3: *Summary of Sound Measurement Results*

* *Typical Background Sound Level – Calculated from Statistical Analysis. See Appendix B.*

6 Road Traffic Noise Model

6.1 Overview

The noise levels across the illustrative scheme have been predicted using the Cadna/A suite of noise modelling software. This software utilises standard acoustic principles in conjunction with approved prediction methodologies and it is a tried and tested method for accurately predicting and assessing the impact of noise from a variety of sources. Road traffic noise predictions have been carried out in accordance with the calculation methodology presented in the Calculation of Road Traffic Noise[10] (CRTN).

The noise model was calibrated to ensure that the levels predicted across the Site were an accurate reflection of real world measured noise levels during both daytime and night-time periods.

6.2 Model Assumptions

In addition to the source noise levels used in the predictions, the model also considers the effects of the existing topographical conditions throughout the area (assumed to be flat ground), ground absorption, acoustic reflections and acoustic screening. The ground factor has been set to 0.5 assuming mixed ground.

The noise model considers noise emissions from Park Road (B483)/Hillingdon Road (A4020) and St. Andrew's Road only.

[10] Calculation of Road Traffic Noise, 1988, Department of Transport Welsh Office

7 Noise Assessment

7.1 Façade Requirements – BS 8233:2014

In order to achieve appropriate noise levels within internal living spaces, in those areas where such levels will not be achieved with open windows, the dwellings themselves need to be considered with regard to the level of façade mitigation required in order to achieve internal noise levels of $L_{Aeq,16\text{-}hour}$ <35 dB in habitable rooms during the day; $L_{Aeq,8\text{-}hour}$ <30 dB and typical L_{AFMax} levels of <45 dB during the night.

The glazing and ventilation elements are typically the weakest acoustic link in the construction of a building facade. Therefore, in order to assess the acoustic performance of the proposed dwellings, it is appropriate in the first instance to explore the level of protection that will be afforded by the performance of the glazing and ventilation elements.

Windows do not reduce noise equally across the entire frequency spectrum, so the frequency content of the sound will influence the overall sound reduction performance of a given window and by extension, the resulting noise levels within the receiving room.

Many glazing manufacturers test their products under laboratory conditions using a typical road traffic noise frequency spectrum source. The resultant measured noise attenuation, in dB, gives a very useful guide to in-situ sound reduction performance of the window for situations where road traffic noise dominates. This performance index is known as the R_{TRA}, or $R_w + C_{tr}$.

The Building Regulations recommend on ventilation that habitable rooms in dwellings have 'whole-dwelling ventilation'. Internal noise levels should be considered in the context of room ventilation requirements. Where the target internal noise levels will only be achieved when windows are closed, an alternative means of ventilation will therefore be required to comply with the requirements of the Building Regulations Approved Document F.

In order to achieve the target daytime and night-time internal noise levels, it is necessary to determine the minimum acoustic performance requirements of each façade component. It is typically assumed that the default choice of glazing for the habitable rooms of the proposed development will be thermal double glazing and the default choice for ventilation will be a hit and miss, window-mounted trickle vent system (referred to as 'background ventilators' in ADF), and openable windows for purge ventilation.

Please note that this scope does not include an acoustic assessment during overheating conditions, as the residential elements are outline in nature. If, required, then an additional acoustic assessment in accordance with the ANC/IOA '*Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O*' could be undertaken at Reserved Matters stage.

To determine the glazing and ventilation requirements in order to provide an adequate level of protection against external noise intrusion, $L_{Aeq,16hour}$ daytime, $L_{Aeq,8hour}$ and typical L_{AFMax} night-time noise levels have been determined at the building façade in the noise model. Figure 7-1, Figure 7-2, and Figure 7-3 present the calculated $L_{Aeq,16hour}$ daytime, $L_{Aeq,8hour}$ and typical L_{AFMax} respectively.

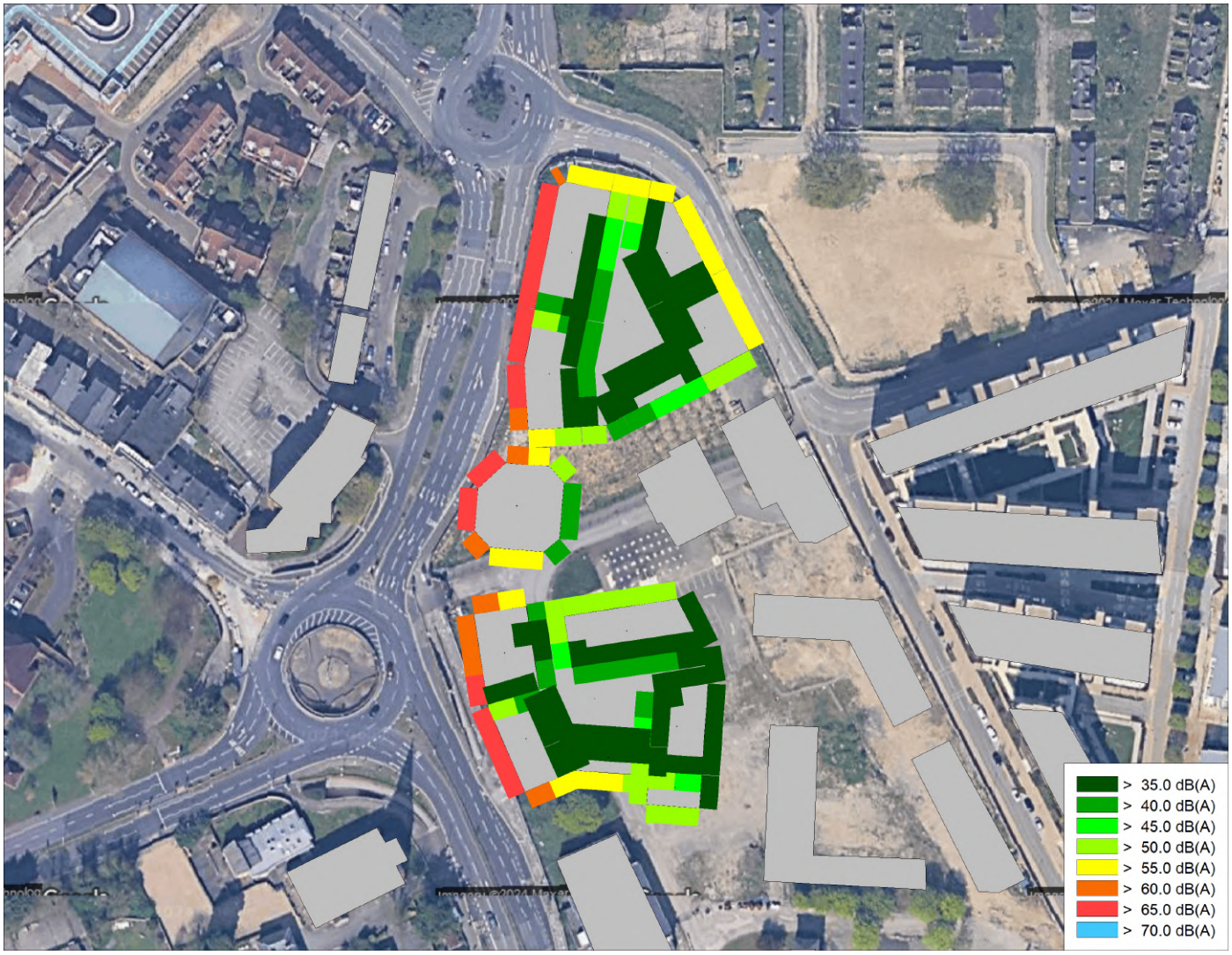


Figure 7-1: *Daytime Noise Levels, $L_{Aeq,16hr}$*

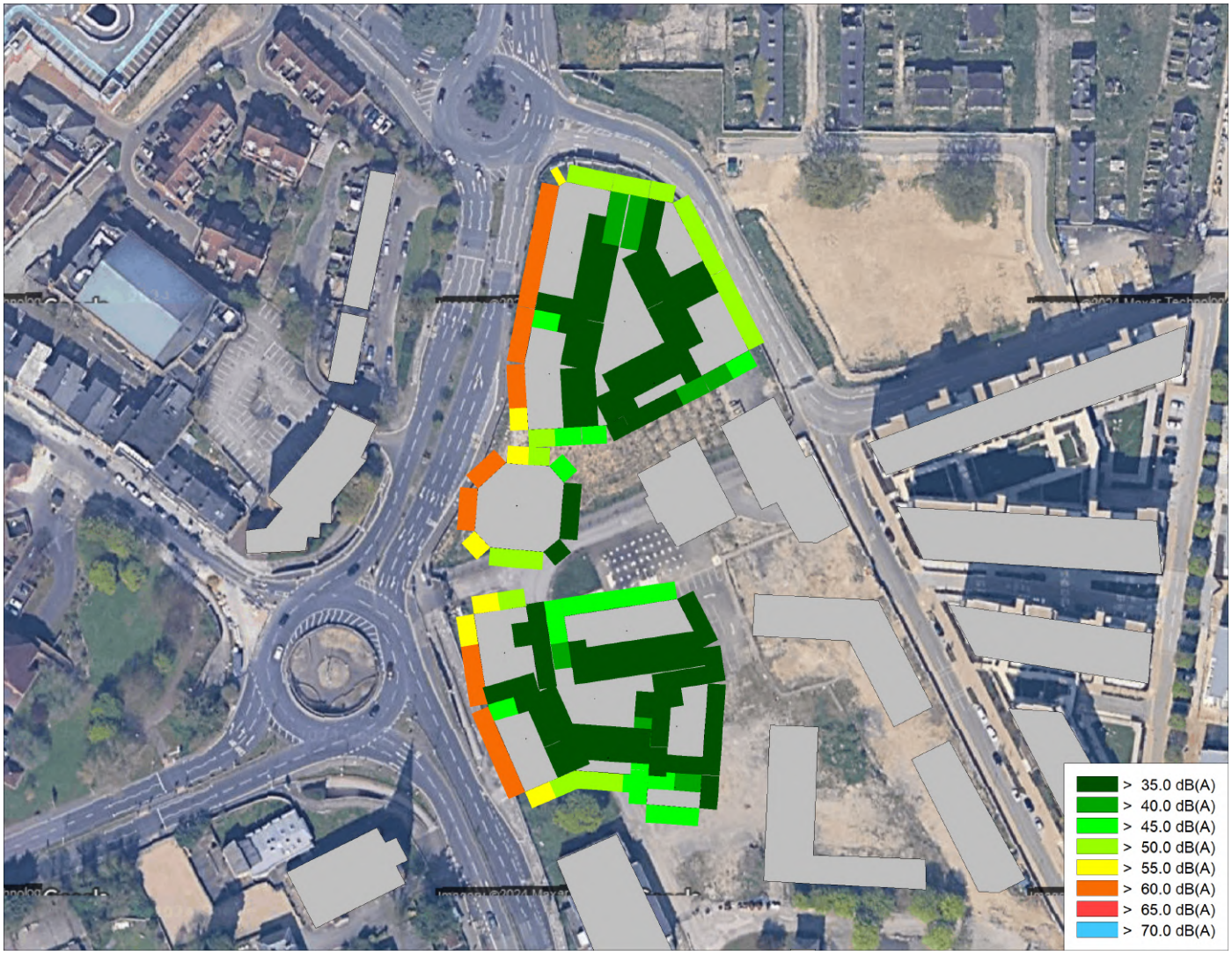


Figure 7-2: *Night Time Noise Levels, $L_{Aeq,8hr}$*

Figure 7-3: *Night-time Noise Levels, L_{Amax}*

Based on the results of the baseline sound survey and modelling exercise, an assessment of the required minimum façade mitigation for the illustrative Masterplan has been undertaken. For the purposes of this outline planning application, the assessment assumes typical rooms dimensions (12m² bedrooms and 16m² living rooms) and up to 50% of a façade being glazed. It has also been assumed that bedrooms are to be acoustically 'soft', with carpets, curtains and other soft furnishings, and living rooms to have a hard floor finish and to be less acoustically absorptive.

As already stated, in order to provide a robust assessment and a high quality living environment for future residents, providing internal noise levels of <35 dB $L_{Aeq,16\text{-hour}}$ during the daytime and <30 dB $L_{Aeq,8\text{-hour}}$ during the night-time, as well as <45 dB typical L_{AFMax} during the night, as defined in BS 8233:2014/ProPG has been adopted as the design target for the proposed development.

In this instance, the target indoor ambient noise levels can be achieved with the following façade types, as a combination of various glazing and ventilation performance as shown in Table 7-1.

External Noise Level, dB			Minimum Sound Reduction Performance, dB		
$L_{Aeq,day}$	$L_{Aeq,night}$	$L_{Amax,night}$	Mitigation Type	Glazing R_w+C_{tr}	Ventilation D_{new}
≤50	≤45	≤60	TYPE 1a	27	Partially open window
50-55	45-50	60-65	TYPE 1b	27	Partially open window *
55-60	50-55	65-70	TYPE 2	27	32
60-65	55-60	70-75	TYPE 3	33	38
65-68	60-63	75-78	TYPE 4	36	44
** Reasonable internal conditions (5dB relaxation) achieved with windows open. Otherwise, standard trickle vent will ensure compliance IANL targets.*					

Table 7-1: *Example of Suitable Façade Mitigation Options*

The mark-up with outline required performance values at each façade is presented in Figure 7-4. It is noted that, in this instance, the façade performance is driven by achieving the target L_{Amax} levels at night.

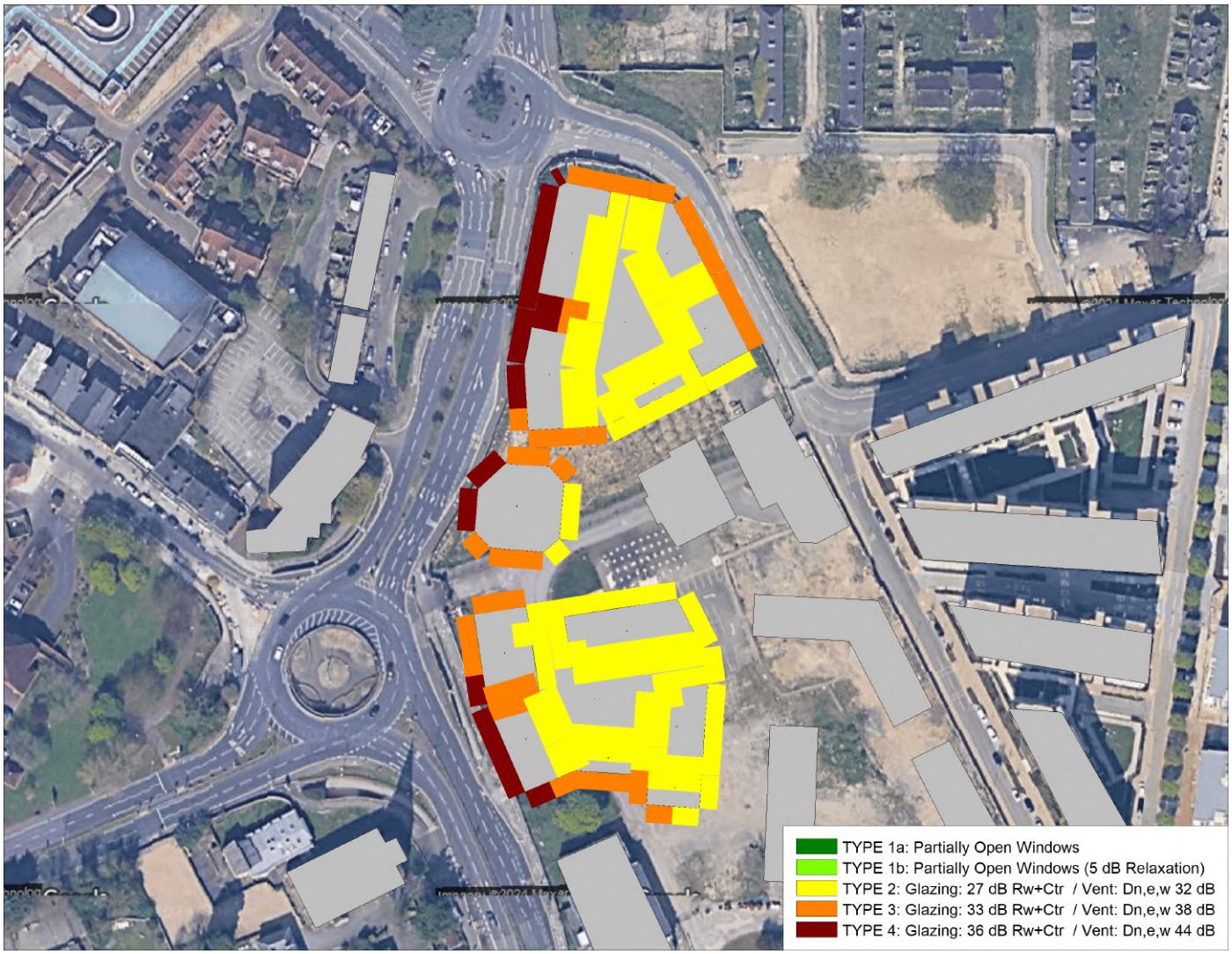


Figure 7-4: *Outline Façade Specification Map*

It is noted that the assessment with windows partially open is based on a sound reduction of 15 dB, based upon the Napier report titled NANR116: '*Open/closed window research' – Sound Insulation Through Ventilated Domestic Windows*' which has been authored for DEFRA, which demonstrates that for road traffic noise a partially openable window will achieve between 12-18 dBA. Therefore, 15dB of attenuation is the average level difference and is considered to be robust. In addition, the WHO Environmental Noise Guidelines 2018 states that '*the difference between indoor and outdoor levels are usually estimated at around 10 dB for open, 15 dB for tilted or half-open and about 25 dB for closed windows*'.

It can be seen that suitable indoor ambient noise levels can be achieved with an alternative means ventilation. When ventilation means other than partially open windows are required, windows should be closed and ventilators maintained in the open position. It should also be noted that the sound reductions detailed above apply to habitable rooms such as living rooms, dining rooms and bedrooms only. For non-habitable rooms such as kitchens, bathrooms, stairways, halls or landings, lower performance standards would be permissible, as per the guidelines given in BS8233:2014.

Glazing & Ventilation

Performance specifications are frequency specific. Overall performance values presented in Table 7-2 are given for guidance purposes only, with detailed frequency spectra and system examples provided below.

Example Glazing	Octave Band (Hz) Sound Level (dB)							
	63	125	250	500	1000	2000	4000	$R_w + C_{tr}$
	Sound Reduction Performance, R dB							
Standard Double Glazing (4mm/12mm/4mm)	19	24	20	25	34	37	35	**27**
Thermal Double Glazing (10mm/12mm/6mm)	21	26	27	34	40	38	46	**33**
Acoustic Laminated Double Glazing 8.4(lam)/12mm/10.8(lam)	23	28	29	39	44	50	61	**36**
Example Ventilation	**Octave Band (Hz) Sound Level (dB)**							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	$D_{n,e,w}$
	Sound Reduction Performance, D dB							
Hit & Miss Standard Trickle Vent	26	31	31	31	37	28	31	**32**
Acoustic Trickle Vent	25	30	33	38	37	36	36	**38**
High Performance Acoustic Trickle Vent	27	32	33	42	45	52	56	***44***
Example Walls	**Octave Band (Hz) Sound Level (dB)**							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	$R_w + C_{tr}$
	Sound Reduction Performance, R dB							
All Façades								
260kg/m^2 brick wall	31	36	40	41	45	52	52	**43**

Table 7-2: *Minimum Acoustic Performances for Glazing and Ventilation*

The 4mm/12mm/4mm notation refers to a glazing unit comprising two 4mm panes of glass separated by a 12mm air gap, and similarly for the other notations. The glazing system performance specifications detailed above apply to the glazing package as a whole, inclusive of glazing, framing, spandrel panels, etc.

Other units may be suitable and it is the responsibility of the glazing manufacturer to recommend and provide appropriate systems. The performance of the glazing systems will depend on many factors, such as the glazing configuration, size of window panels, quality of framing, quality of sealing, etc. Performance specifications are frequency specific. Overall performance values are given for guidance purposes only.

Windows may be openable for purge ventilation purposes at the user's discretion, as this is applicable only to occasional occurrences, such as to remove smoke from burnt food, and not subject to acoustic assessment.

The above façade components are conducive with those typically required for thermal insulation and represent no uplift in design beyond that required to achieve the necessary thermal standards.

It should be noted that the above represents an assessment considering a ventilation strategy sufficient to comply with the requirements of the Building Regulations Approved Document F. In the event of windows being widely open for periods of comfort cooling ventilation provision, the internal noise level criteria will be exceeded.

Consequently, the need for any additional cooling requirements to prevent overheating should be advised via an overheating assessment, in accordance with Approved Document O of the UK Building Regulations at Reserved Matters stage.

The above mitigation measures demonstrate that appropriate internal noise levels are entirely achievable through the use of suitable façade treatments, resulting in No Observed Adverse Effect.

The above analysis is provided to demonstrate that a design solution is feasible at the site for the purposes of an Outline Planning Application.

The detailed design of the proposed properties may affect both the required sound reduction performance and the appropriate selection of glazing units. The aspects of the detailed design that are important are the room dimensions, room finishes, window dimensions and the sound reduction performance of non-glazing elements.

7.2 External Amenity Areas

In respect of external noise levels, the guidance in BS 8233:2014 suggests that "*it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments*".

The calculated $L_{Aeq,16hr}$ noise levels across the TCE site are shown in Figure 7-1. Noise levels within balconies fronting onto the surrounding roads are likely to exceed the upper guideline value of 55 dB $L_{Aeq,T}$.

In order to reduce the level within the balconies, it is suggested that a solid balustrade is installed along the front of the balconies, which will reduce noise levels for a balcony user whilst seated, by screening the balconies from the local noise sources.

Regardless, BS 8233:2014 provides a much more detailed narrative on noise levels in external amenity areas and acknowledges that it may not always be necessary or feasible to ensure that noise levels remain within these guideline values.

In respect of gardens and patios, BS 8233:2014 states;

"...it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable."

BS 8233: 2014 goes on to state, for 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".

In respect of balconies, roof gardens and terraces, BS 8233:2014 states; *"Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses; however, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space".*

Based on the measured levels, the balconies on all facades may not achieve the $L_{Aeq,16\text{-}hour}$ <55 dB limit. However, it is clear from the narrative of BS 8233:2014, that proposed developments within noisy environments should be designed to ensure that the recommended internal design standards are achieved, and that noise levels in external amenity areas are designed to effectively control and reduce noise levels, although it acknowledges that in certain circumstance meeting the external design recommendations may not be feasible, or necessary, especially where the provision of such spaces is desirable for other technical, planning or policy reasons, for example that necessitate external private amenity space at each dwelling.

ProPG also advises that '*Where, despite following a good acoustic design process, significant adverse noise impacts remain on any private external amenity space (e.g. garden or balcony) then that impact may be partially off-set if the residents are provided, through the design of the development or the planning process, with access to:*

- *a relatively quiet facade (containing openable windows to habitable rooms) or a relatively quiet externally ventilated space (i.e. an enclosed balcony) as part of their dwelling; and/or*
- *a relatively quiet alternative or additional external amenity space for sole use by a household, (e.g. a garden, roof garden or large open balcony in a different, protected, location); and/or*
- *a relatively quiet, protected, nearby, external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings; and/or*
- *a relatively quiet, protected, publicly accessible, external amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking instance).'*

It is understood that residents will have access to numerous publicly accessible spaces including Roundel Place (an area of public realm to the east of the former cinema building proposed to contain a pocket park) and Squadron Square (a central area of public space), as well as Dowding Park within close walking distance.

In addition to this, the residents of the proposed development will have access to communal amenity spaces at podium level that are more sheltered from road traffic noise. Therefore, despite some private external amenity areas being above the recommended target criteria, residents are provided with some of the options above which off-set the impact.

On the basis of the above, and given the 'town centre' nature of the site, it is considered that the requirements of BS 8233:2014/WHO Guidelines, ProPG, the NPPF and National Planning Practice Guidance for England would be generally satisfied.

7.3 Environmental Sound Criterion – Fixed Plant Limits

Sound from new building services plant associated with the development will need to be controlled to limiting Environmental Sound Criterion (ESC) in line with guidance contained within BS 4142:2014+A1:2019. At this stage, although it is acknowledged that there will be sound generating plant as part of the scheme, the number and types of equipment are to be confirmed. As such, an assessment of sound associated with proposed fixed plant cannot be provided at this time.

The ESC should be achieved at a distance of 1m externally from the façade (living rooms and bedrooms only) of the nearest noise-sensitive receptor (NSR) to the fixed plant.

Location	Typical Background Sound Levels, dB L_{A90} (Daytime / Night-time*)	Maximum Rating Level for New Plant, dB $L_{Ar,Tr}$ (Daytime / Night-time*)
NSR	53/48	43/38

Table 7-3: *Environmental Sound Criterion*

*Daytime 07:00 – 23:00, Night-time 23:00 – 07:00

The rating level of 10 dB below background sound will ensure that the risk of noise creep can be reduced and shall also take into account the 'character' corrections as defined within BS 4142:2014+A1:2019.

The ESC identified in Table 7-3 should be referenced in the future design and selection of any plant. The need to control sound from fixed plant can be enforced with a suitably worded Planning Condition attached to the Decision Notice for the planning application.

It is anticipated that suitable sound emissions from fixed plant could be achieved with the following basic noise control measures:

- Select low noise equipment where possible;
- Sound Attenuators to fan intakes and exhausts;
- Localised Screening of Enclosure of air handling plant and heat rejection units if required;
- Acoustically rated louvres to plant rooms where necessary;
- Anti-Vibration mounting of all equipment; and
- Suitable sound insulation reduction of walls and roof to prevent noise breakout.

8 Conclusion

NRG Consulting has been commissioned to assess the impact of noise at a site referred to as St. Andrew's Gate, Town Centre Extension, Uxbridge ('the TCE site'), in respect of the site's suitability for residential-led development. The suitability of the site for residential development has been assessed, based on the outline development proposals and measured baseline sound levels.

Specific consideration has been given to the internal noise criteria for the proposed residential properties, as presented within BS 8233:2014, with façade mitigation measures proposed to achieve the criteria stipulated therein.

The assessment has demonstrated that standard double glazing and hit and miss trickle vents would be likely to achieve appropriate internal noise levels for the majority of proposed dwellings in the centre of the TCE site, which benefit from screening of road traffic noise associated with the adjacent roads by the outer buildings.

Standard thermal double glazing and acoustic trickle vents would be likely to achieve appropriate internal noise levels for proposed dwellings fronting onto St. Andrew's Road, and for some on the northern and southern facades of the proposed apartment blocks adjacent to Park Road (B483)/Hillingdon Road (A4020).

Areas on the western facades of the apartment blocks directly fronting onto Park Road (B483)/Hillingdon Road (A4020) are likely to require an uprated specification equivalent to Acoustic Laminated Double Glazing 8.4(lam)/12mm/10.8(lam)) and high performance acoustic trickle vents.

The assessment has found that noise levels on balconies on all facades may not achieve the desirable $L_{Aeq,16\text{-}hour}$ <55 dB limit. Noise levels should be minimised where possible through the implementation of the principles of good acoustic design, however it is understood that residents will have access to numerous publicly accessible spaces including Roundel Place (an area of public realm to the east of the former cinema building proposed to contain a pocket park) and Squadron Square (a central area of public space), which is considered will off-set the impact of potential noise at private amenity spaces in some areas of the development. Given the 'town centre' nature of this site, some exceedences in noise levels is to be expected and allowed for under BS 8233:2014, which confirms that where internal levels are achieved, there is an acknowledgement that in certain circumstances meeting the external design recommendations may not be feasible in this setting and given other competing policy requirements including for individual external private amenity space for each dwelling.

Further consideration has been given to the guidance set out in BS 4142:2014+A1:2019, to assign Environmental Sound Criterion (ESC) limits for any proposed fixed plant associated with the proposed commercial elements of the Proposed Development. The need to control sound from fixed plant can be enforced with a suitably worded Planning Condition attached to the Decision Notice for the planning application.

In light of the above, which demonstrates that the TCE site is predicted to meet the requirements of the relevant British Standard and planning guidance, it is considered that noise does not present a constraint to the development in its proposed form.

9 Appendices

9.1 Appendix A – Definition of Terms

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

Table 9-1: Typical Sound Levels found in the Environment

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq}.

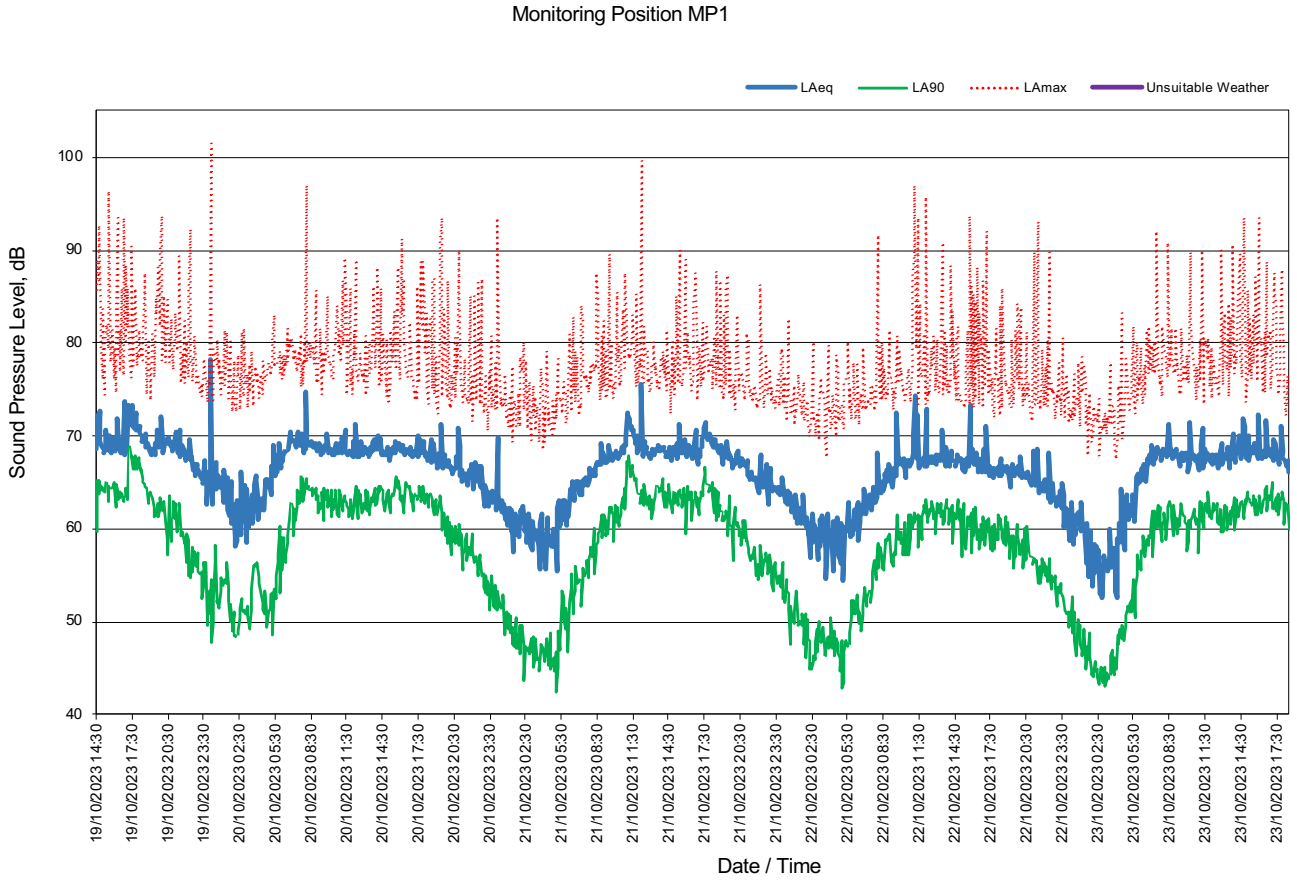
This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

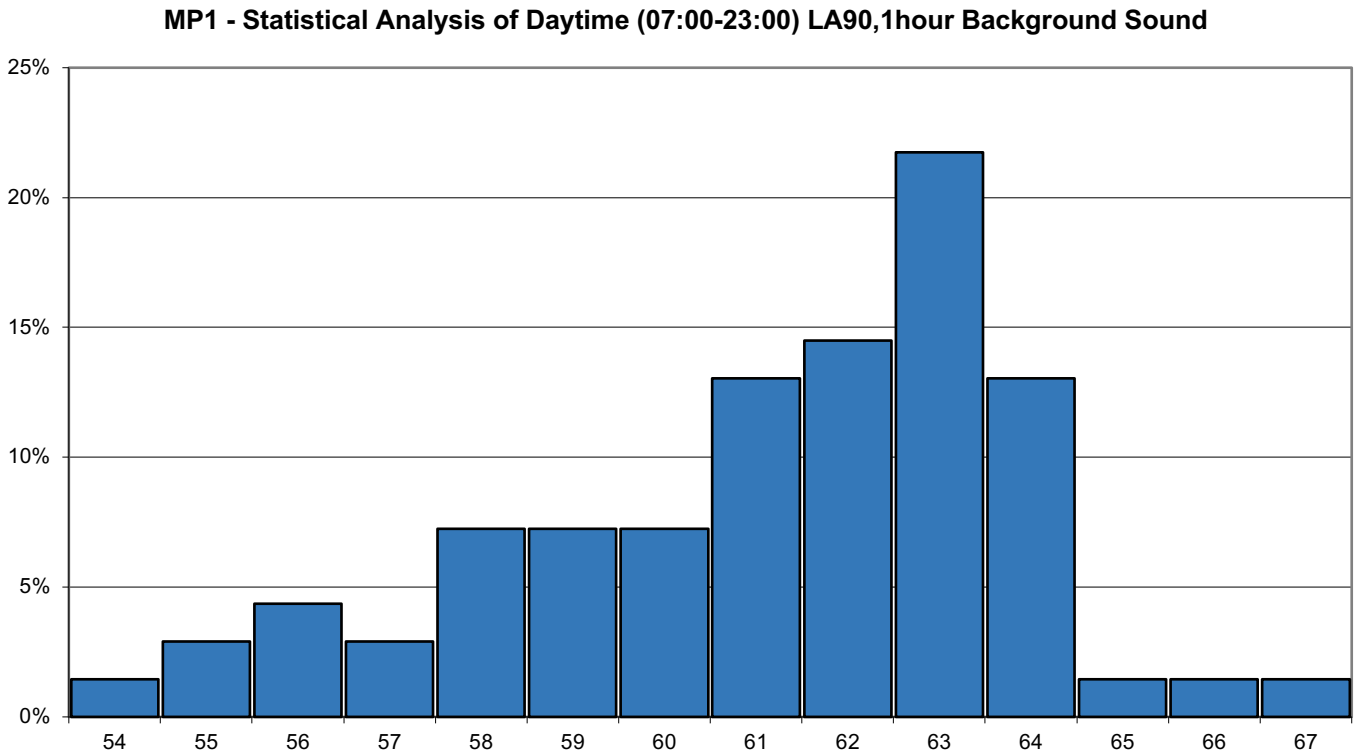
To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a

decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

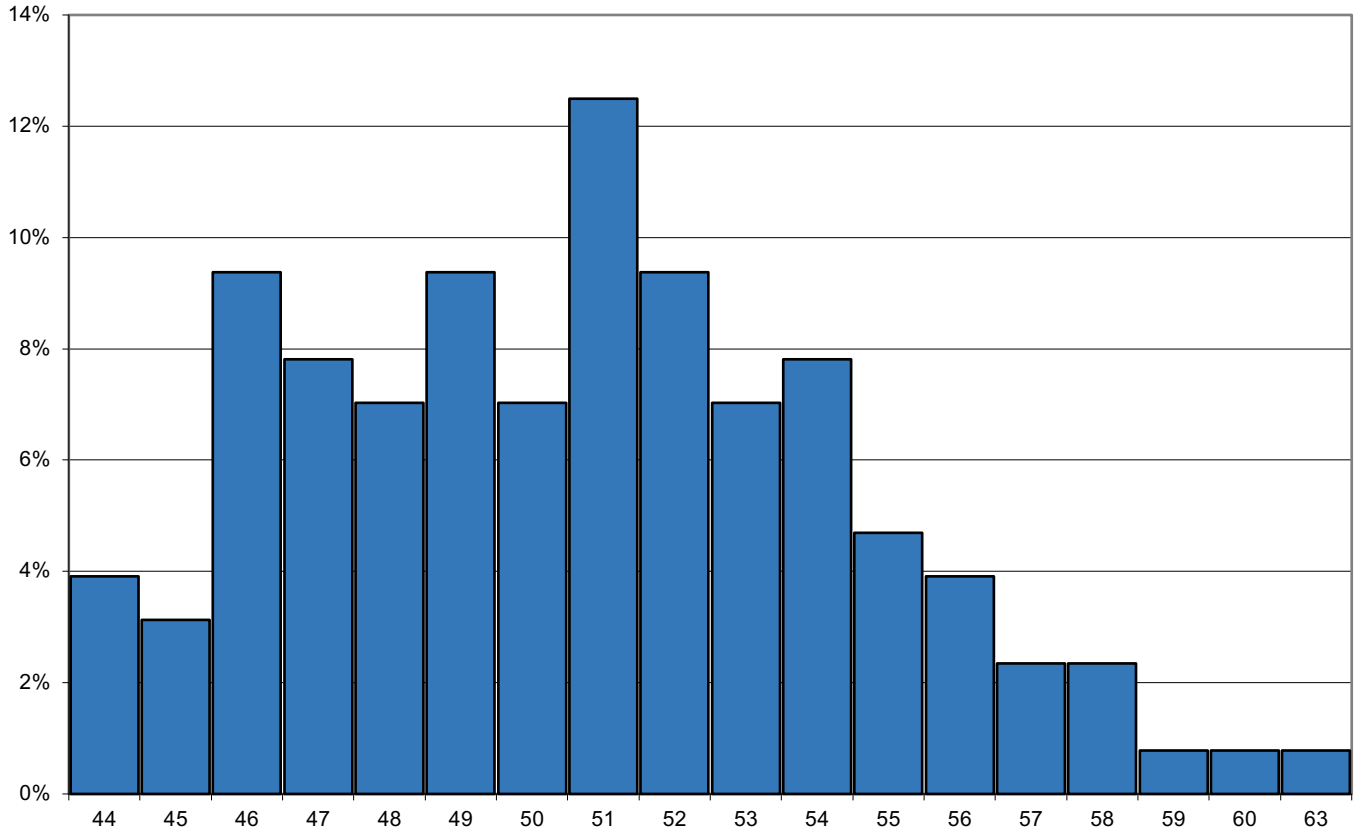
Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

9.2 Appendix B – Measurement Results

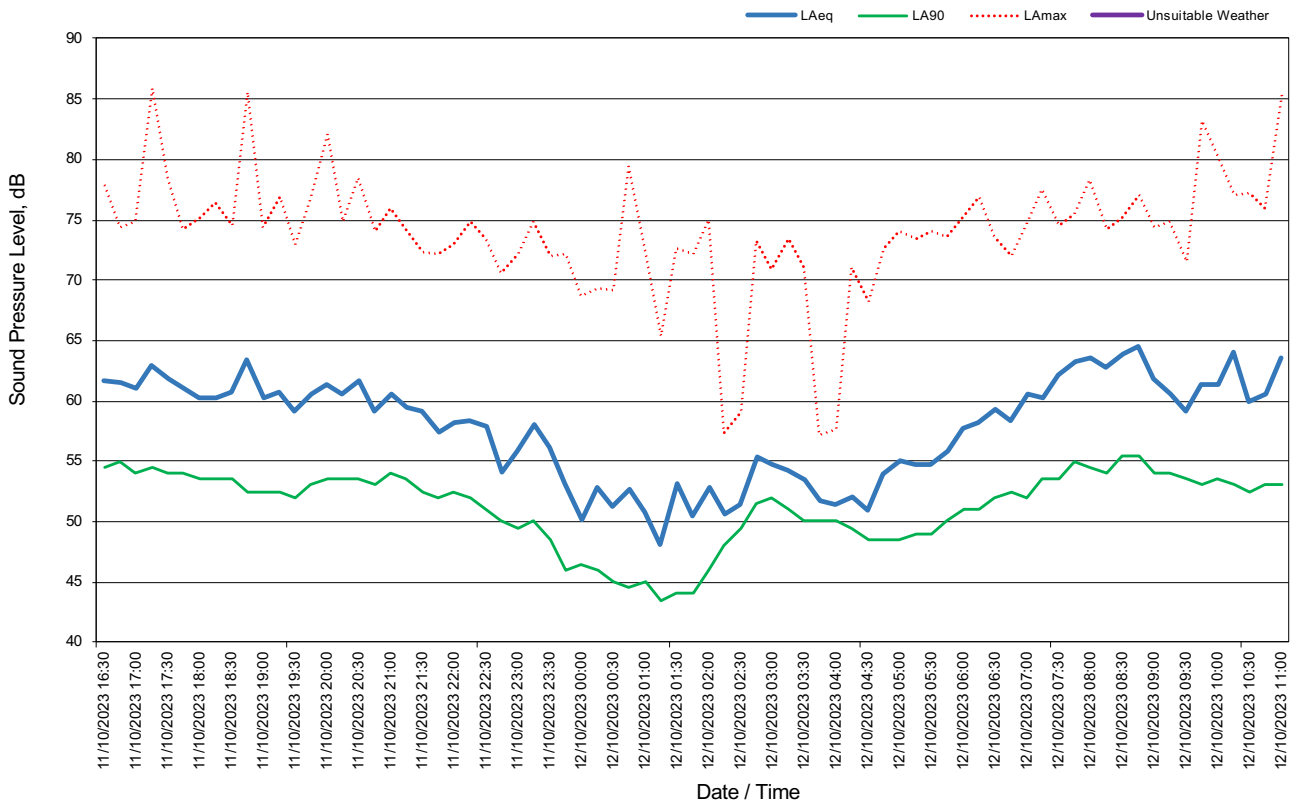




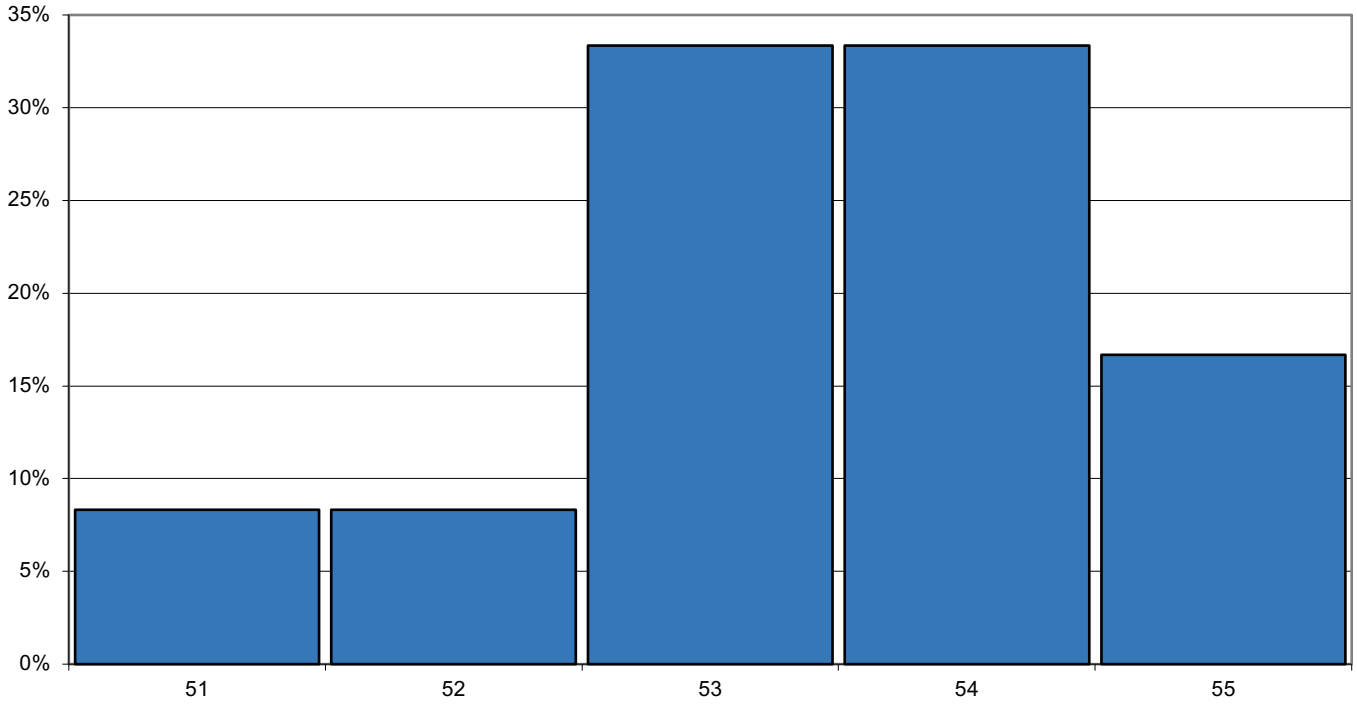
MP1 - Statistical Analysis of Night-time (23:00-07:00) LA90,15min Background Sound



Monitoring Position MP2



MP2 - Statistical Analysis of Daytime (07:00-23:00) LA90,1hour Background Sound



MP2 - Statistical Analysis of Night-time (23:00-07:00) LA90,15min Background Sound