Haringey Civic Centre

Noise Impact Assessment

HCC-BHE-XX-XX-RP-YC-000002

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1 Introduction

1.1 Overview

Buro Happold have been commissioned by Hawkings Brown Architecture to provide acoustic consultancy services related to the proposed Hotel development located on the corner of Queensferry Street and Shandwick Place, Edinburgh, Scotland. This report is prepared to support the Planning Application for the site which is a refurbishment of multiple buildings across the site.

Buro Happold has been appointed by Hawkings Brown Architecture to provide acoustics consultancy on a proposed scheme consisting of a refurbishment of the Haringey Civic Centre and new attached Annexe at Haringey, London. The scheme is an internal refurbishment of the existing Civic Centre with a three storey high Annexe with bridge links to the existing building. The existing Civic Centre predominately consists of office space, meeting rooms, Civic Chamber, Committee Rooms alongside ancillary spaces such as water closets and comms rooms. The Annexe consists of open plan office spaces, meeting rooms and similar ancillary spaces as the Civic Centre.

1.2 Purpose of the Report

This report is prepared to support the Planning Application for the proposed development. The report:

- Evaluates the existing noise climate within the vicinity of the application site, referencing noise levels captured during an environmental noise survey
- Discusses the level of sound reduction required by the building envelope to protect occupants from excessive environmental noise ingress
- Provides limiting levels for mechanical plant to see that the occupants of nearby noise sensitive buildings are not subject to excessive plant/activity noise levels.

1.3 Content

This report covers the following elements, those being most relevant to the Spatial Coordination of the scheme:

- Pertinent acoustic criteria
- External noise levels/survey results
- 3D acoustic modelling results
- Noise break-in – façade sound insulation requirements
- Noise break-out – plant noise emission limits

Figure 1—1 Architectural render (Source: Hawkins Brown)

2 Acoustic Design Criteria

2.1 Relevant Guidance Documentation

This report is informed by the following standards and guidelines:

- The National Planning Policy Framework (NPPF)
- The Noise Policy Statement for England (NPSE)
- The London Plan 2021
- Haringey Local Plan Strategic Policies (2013) with alterations in 2017
- BS 4142:2014+A1:2019 – Methods for rating and assessing commercial and industrial sound
- British Standard (BS) 8233:2014 – Guidance on sound insulation and noise reduction for buildings

2.2 National Policy and Guidance

2.2.1 The National Planning Policy Framework (NPPF)

The NPPF is the over-arching planning policy document that applies to all new developments in England. The guidance and assessment criteria given (or referred to) in this document can therefore be applied to all other standards in terms of assessing the suitability of granting Planning permission with respect to noise impact.

The NPPF states that Planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of Conditions
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

2.2.2 The Noise Policy Statement for England (NPSE)

With specific reference to noise impact, the NPPF document refers to the Noise Policy Statement for England (NPSE). The NPSE provides guidance, which enables decisions to be made regarding the acceptable noise burden to place on society, using three key phrases – the No Observed Effect Level (NOEL), the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL).

In order to provide a consistent frame of reference (and to allow a view to be taken on the suitability of the application with reference to the relevant Planning guidance), the levels or criteria given in other relevant documents used in assessment will be re-framed in terms of the following:

- No Observed Effect Level (NOEL) - The NOEL is the level of noise impact below which no effect can be detected, and there would be no discernible negative effect on health or quality of life.
- Lowest Observed Adverse Effect Level (LOAEL) - The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than the LOAEL should see that any adverse effects on health or quality of life are negligible.
- Significant Observed Adverse Effect Level (SOAEL) - The SOAEL is the level above which significant adverse effects on health and quality of life occur. Designs should always seek to avoid a noise impact, which would be categorised as a SOAEL.

2.3 London Policy and Guidance

2.3.1 The London Plan 2021

The London Plan states the following with respect to 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

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.*

The management of noise is about encouraging the right acoustic environment, both internal and external, in the right place at the right time. This is important to promote good health and a good quality of life within the wider context of achieving sustainable development. The management of noise should be an integral part of development proposals and considered as early as possible.

Managing noise includes improving and enhancing the acoustic environment and promoting appropriate soundscapes. This can mean allowing some places or certain times to become noisier within reason, whilst others become quieter. Consideration of existing noise sensitivity within an area is important to minimise potential conflicts of uses or activities, for example in relation to internationally important nature conservation sites which contain noise sensitive wildlife species, or parks and green spaces affected by traffic noise and pollution. Boroughs, developers, businesses and other stakeholders should work collaboratively to identify the existing noise climate and other noise issues to ensure effective management and mitigation measures are achieved in new development proposals.

The management of noise also includes promoting good acoustic design of the inside of buildings. Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has produced advice, Pro:PG Planning and Noise (May 2017), that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas.

2.4 Local Planning Policy

Three relevant Planning Policy documents have been identified by the design team. The policy references relevant to noise have been identified as:

- Haringey Development Management DPD adopted July 2017

These policies provide useful commentary when considering noise in the wider context of the Local Planning Policy requirements.

These policy documents do not propose objective design targets against which noise can be assessed. As such, It is considered that where the guidance criteria identified in this report can be met, a significant adverse impact on residents should be avoided to achieve the goals of the planning policy.

2.4.1 Haringey Development Management DPD adopted July 2017 Policy DM23 Environmental Protection

DM23: Environmental Protection

> *"Noise pollution can adversely impact on the amenity and health of building occupiers as well as the wider public. The Council will seek to ensure that new developments both minimise noise pollution and appropriately manage its impact. Noise sensitive development (such as housing, schools and health facilities) should be located away or appropriately separated from major sources of noise. The Council will expect that mitigation measures are considered and incorporated into the design process prior to the submission of an application. "*
>
> *"The Council will seek to ensure that new noise sensitive development is located away from existing or planned sources of noise pollution. Proposals for potentially noisy development must suitably demonstrate that measures will be implemented to mitigate its impact."*
>
> *"A noise assessment will be required to be submitted if the proposed development is a noise sensitive development, or an activity with the potential to generate noise."*

2.5 British Standard 4142:2014+A1:2019

BS 4142:2014+A1:2019 provides methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the loading/unloading of goods and sound from mobile plant / vehicles associated with industrial / commercial premises (e.g. fork-lift trucks).

The standard utilises various descriptors to assess complaints, the impact of sound associated with proposed industrial / commercial activities on existing noise-sensitive receivers, or the impact and likely suitability of siting new noise-sensitive receivers in the vicinity of existing industrial / commercial noise sources.

The standard is specifically precluded from being used to determine likely internal sound levels arising from external noise, or from the assessment of various sound sources for which other (more relevant) guidance exists, including music/entertainment noise, person noise and construction noise.

The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receiver (*NSR*), from the 'rating level' (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).

Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific.

As a guideline, BS 4142 states that:

- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context
- A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context
- The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact
- Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on context

It should be noted that BS 4142:2014+A1:2019 draws a clear distinction between the detailed and flexible assessment methods contained within, and the more limited versions contained in the previous (1997) edition.

Above all, BS 4142:2014+A1:2019 requires qualified engineering consultants and technical planning professionals (e.g. Environmental Health Officers) to use a combination of quantitative assessment techniques and rational qualitative judgements to come to a sensible and reasonable conclusion.

2.5.1 Definitions

BS 4142 uses several specific terms to define the various levels used in assessments, as follows:

- **Specific sound** – the commercial / industrial noise source under consideration
- **Residual sound** – the sound level at the noise-sensitive receivers in the absence of the specific sound
- **Ambient sound** – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e. ambient = residual + specific)
- **Background level** - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period
- **Rating level** – the specific sound, corrected for acoustically distinguishing characteristics

2.5.2 Background level

BS 4142 emphasises that the background level ($L_{A90,T}$) is in fact a range of levels, not one absolute value. Whilst stating that the measurements of background sound should be normally not less than 15 mins, the focus is on obtaining a level for use in assessment that is representative of typical conditions at the noise-sensitive receivers.

An example methodology by which this typical value may be obtained is given in the document. In this example, monitoring of $L_{A90,15mins}$ is undertaken during periods which represent when the specific noise will be operational. After obtaining a sequence of representative contiguous or disaggregated results, it is then proposed that the modal value is representative of the 'typical' background level.

2.5.3 Specific sound

BS 4142 requires that the specific sound ($L_{Aeq,Tr}$) is obtained over a reference period of 1 hour (daytime) and 15 mins (at night). Ideally, measurements would be taken of the ambient sound and residual sound at the assessment location, with these measurements used to accurately calculate the specific sound (ambient – residual = specific).

Where the source (specific sound) is not yet operational, it is permissible to measure the specific sound elsewhere (or to use known manufacturers' or library data) and then model the impact of this against the known background level.

2.5.4 Rating level

Once the specific sound level has been determined, this must be corrected in terms of the need to consider the subjective prominence of the impact of the sound at noise-sensitive receivers, and the extent to which acoustically distinctive characteristics will attract attention.

BS 4142 states that this is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:

- ***Tonality:*** +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', and rising to +6 dB for 'highly perceptible' tones
- ***Impulsivity*** (rapidity of change and overall chance in level): +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity
- ***Intermittency:*** if the on/off-time of the specific sound is readily distinctive at the noise-sensitive receivers, +3 dB
- ***Other sound characteristics:*** (see page 14 or 20 in PDF file of 4142)

It should be noted that where one feature is clearly perceived as dominant, it may be applicable to correct for that feature only. Where multiple features are likely to affect perception and response, each should be added arithmetically.

2.6 British Standard 8233:2014

2.6.1 Acceptable Internal Ambient Noise Levels

The acoustic criteria are driven by BREEAM aspirations, which are based on guidance provided in BS 8233:2014, and supplemented as necessary for completeness by guidance from CIBSE Guide A (Environmental Design) and the British Council for Office guidance.

For all room functions, the indoor ambient noise levels should comply with design ranges given in BS 8233:2014. These design ranges are reproduced in Table 2—1.

It should be noted that the noise limits apply to steady state or quasi-steady-state sounds such as noise from air-conditioning systems and road traffic noise. It does not include noise generated by the occupants and equipment such as computers, printers and photocopiers.

Table 2—1 Internal ambient noise level requirements

Activity	Location	Design range dB $L_{Aeq,T}$
Study and work requiring concentration	Executive office	35 – 40
	Staff/meeting room, training room	35 – 45
-	Open plan office	45 – 50
Speech or telephone communications	Corridor, circulation space	45 – 55
	Cafeteria, kitchen	50 – 55

3 Site and External Noise Survey Results

3.1 Introduction

A noise survey was carried out between Tuesday 25/01/2022, and Wednesday 26/01/2022 to assess the noise climate around the development site. The purpose of the survey was to assess the following:

- To capture the noise climate of the surrounding environment and assess the potential impact of noise sources, such as those illustrated in Figure 3—1, on the proposed façades . This allows the specification of external building envelope attenuation (i.e. glazing and ventilation) to see that internal ambient noise levels within workspaces can be compliant with relevant standards and criteria
- To capture the existing background noise levels at nearby noise-sensitive (i.e. residences) receivers. This allows the specification of limiting noise levels for any externally located mechanical plant and equipment (including external terminations), to see that the installation does not negatively impact nearby noise sensitive receivers in the vicinity of the site.

3.2 Survey Details

3.2.1 Measurement Locations

Buro Happold staff visited the site on Tuesday 25 and Wednesday 26 January 2022 to obtain the required noise data. The noise survey was undertaken in free field environments at heights of approximately 1.5 metres above the local ground level.

The measurement locations are detailed below and annotated on an aerial image in Figure 3—1.

- **Location LT1** – (51.600545, -0.112295) – Long-term (unattended) noise measurement located within the site 25 m away from Trinity Rd. This measured day-time and night-time background noise levels.
- **Location ST1** – (51.600719, -0.111807) – Short-term noise measurements north-east of the development site 12 m away from the centre of the A105.
- **Location ST2** – (51.599564, -0.112312) – Short-term noise measurements south of the development site 5 m away from the centre of the A109.
- **Location BG1** –(51.600545, -0.112295) – Two short-term measurements located within the site 25 m away from Trinity Rd.
- **Location BG2** – (51.600809, -0.112334) – Two short-term measurements north of the development located 1 m from the nearest NSR façade.

3.2.2 Noise Sensitive Receivers

The following noise sensitive receivers (NSRs) have been identified, these have been marked in green in Figure 3—1:

- NSR 1 – Trinity Primary Academy to the east – located approximately 10 m east of the site
- NSR 2 – Residential dwellings on Trinity Rd – located approximately 20 m north of the site.

Figure 3—1 Site boundary with existing Haringey Civic Centre (dark red), local road network and nearest NSR highlighted (Source: Google Earth)

3.2.3 Weather Conditions

Weather conditions during the measurement periods were typically warm and dry throughout the measurement period. Wind speeds were within suitable parameters for the measurement of environmental noise (i.e. generally under 5 ms^{-1}). All microphones were protected with a windshield for the duration of the survey. Metrological conditions were not considered to unduly affect readings.

3.2.4 Instrumentation

Table 3—1 displays the noise measurement instrumentation used during the noise survey.

The measurement instruments had been calibrated and certified by an accredited laboratory not more than two years before the measurements were made, using instrumentation traceable to relevant standards. The measurement systems were field calibrated before and after the noise surveys. Calibration drift was found to be less than 0.5 dB and therefore considered generally acceptable in accordance with BS EN 61672-1:2013, BS EN 61672-2:2013+A1:2017, and BS 7445:2003.

3.2.5 Measurement parameters

The sound level meters were programmed to log various noise parameters, including $L_{Aeq,T}$ and $L_{A90,T}$ at each measurement location which are described below:

- **$L_{Aeq,T}$ – the average A-weighted sound pressure level over a period of time, T**. Typically thought of as the average ambient noise level at a particular time, and likely to be due to a combination of various noise sources, near and far
- **$L_{A90,T}$ – the A-weighted sound pressure level exceeded 90% of the measurement period**. I.e. a level which would be perceived as a constant, background noise level. Typically, largely unaffected by local traffic pass-bys or by transient events. More usually attributable to constantly running building services plant or distant road traffic. What you would hear when there is no local traffic present (or other readily identifiable noise source)

3.3 Results

3.3.1 Long term measurements

A summary of the long term measurement data is presented in Table 3—2. The values summarised are as follows:

- **$L_{Aeq,T}$** – the presented numbers are the logarithmic average of individual 15-minute $L_{Aeq,15minute}$ dB measurements undertaken at that location
- **$L_{A90,T}$** – the modal value of measured LA90,15minute values, measured during the day and night-time periods.

The noise monitoring results presented in Table 3—2 demonstrate that the daytime and night-time ambient noise levels at the measurement position, were measured to be $L_{Aeq,16hours}$ 53 dB, and $L_{Aeq,8hours}$ 49 dB respectively.

Table 3—1 Equipment schedule and serial numbers

Manufacturer	Equipment	Description	Serial Number
CEL 2	Sound level meter	Casella C633C	3921025
	Pre-amplifier	CEL 495	001773
	Microphone	CEL 251	000847
	Calibrator	CEL 120/1	2045151
Norsonic 140	Sound level meter	NOR 140	1405619
	Pre-amplifier	NOR 1209	15526
	Microphone	NOR 1225	168247
	Calibrator	NOR 1251	33827

Table 3—2 Long-term (unattended) measurement results

Time Period	Existing ambient $L_{Aeq,T}$ noise level (dB)	Notes
Daytime (07:00-23:00)	53	The first and last sections of the measurement have been removed to compensate for locking of chains and gates on the development site.
Night-time (23:00-07:00)	49	

3.3.2 Short-term attended measurements

A summary of the short-term measurement data is presented in Table 3—3. Measurements show that the existing ambient noise level ranges between $L_{Aeq,15min}$ 58 to 66 dB.

3.3.3 Background sound levels

Data analysis has been performed on the measure background sound levels to determine the typical value required for a BS 4142 assessment.

As can be seen from Figure 3—2, $L_{A90,T}$ 49 dB and 51 dB prevailed during the day. The more onerous $L_{A90,T}$ 49 dB was used to define typical daytime background sound levels at LT1. As for night-time measurements shown in Figure 3—3, the most frequent background level of $L_{A90,T}$ 38 dB was used to define typical night-time background sound levels at LT1.

3.3.4 Levels at nearby noise sensitive receivers

As previously described, a key objective of the survey is to obtain background noise levels at the nearest noise sensitive receivers (NSR). The background sound levels measured at LT1 are deemed representative for Trinity Academy Primary to the west of the site, due to its proximity to the measurement location where it will experience the same shielding from the A105 by the existing Haringey Civic Centre building.

The background sound levels at the residential dwellings to the north of the site require further analysis due to their direct sight of the A105. The only secure location to lock up unattended survey equipment was deemed to be within the existing site boundary at LT1. Therefore, the following calculation method to determine background sound levels at this NSR façade was undertaken:

- The long-term (unattended) measurement location LT1 captured daytime and night-time background levels from Tuesday 25th January to Wednesday 26th January 2022.
- Short-term measurements at BG1 and BG2 were captured to understand the effect of shielding and distance attenuation from LT1 to this NSR.
- This delta between BG1 and BG2 is then applied to the background levels measured at LT1, yielding representative background noise levels at this NSR to the north of the site.

This correction is calculated and shown in Table 3—4, indicating that an onerous 3 dB correction should be applied to measured background sound levels at LT1. A summary of the adopted background sound level at the nearest NSRs are shown in Table 3—5 Adopted background sound level at nearest NSRs .

3.4 Discussion

A summary of the noise survey results can be seen in the annotated aerial image Figure 3—4.

Predictably, the southern and eastern elevations of the site facing main roads are exposed to greater levels of noise than those which are more shielded from the existing noise sources (west and north). The dominant noise source along the other elevations is distant main road traffic and local road network traffic.

The $L_{Aeq,T}$ measurements will be used to calibrate a 3D acoustic model (Section 4), as well as calculate the façade sound insulation requirements (noise break-in) related to the BREEAM acceptable IANLs (Hea 05) and the BCO acceptable IANLs, whichever is more onerous.

The $L_{A90,T}$ values will allow for appropriate plant noise limits to be set at the nearest NSRs.

Table 3—3 Short-term (attended) measurement results

Measurement	Time-period (Tuesday 25th January)	Existing ambient $L_{Aeq,15\,min}$ noise level (dB)
ST1	15:22-15:37	65
ST2	13:48-14:03	66

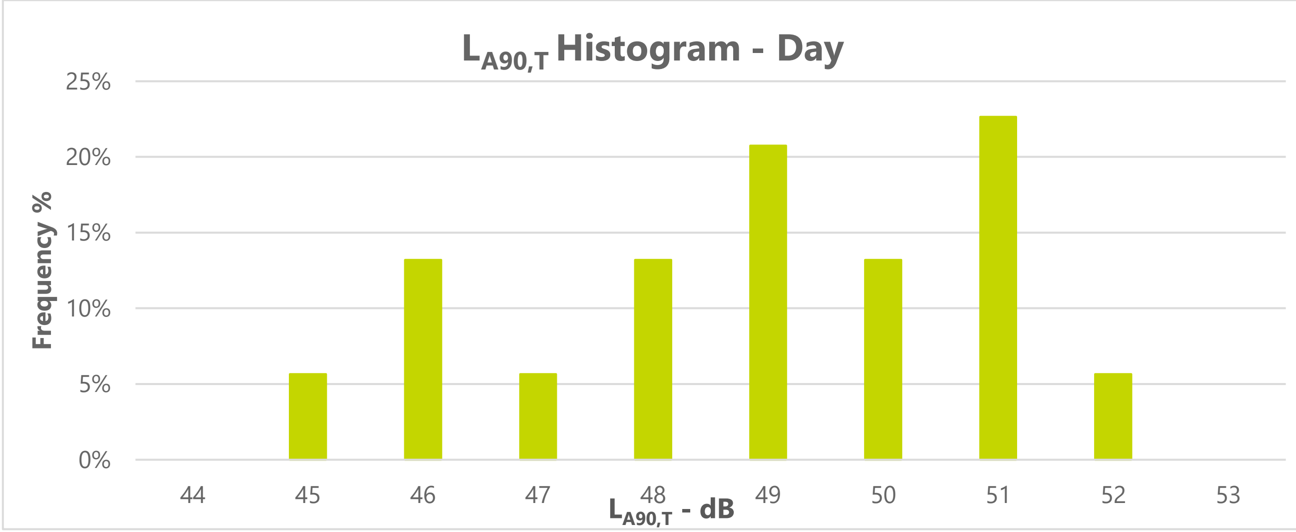


Figure 3—2 Modal analysis of daytime background levels at LT1

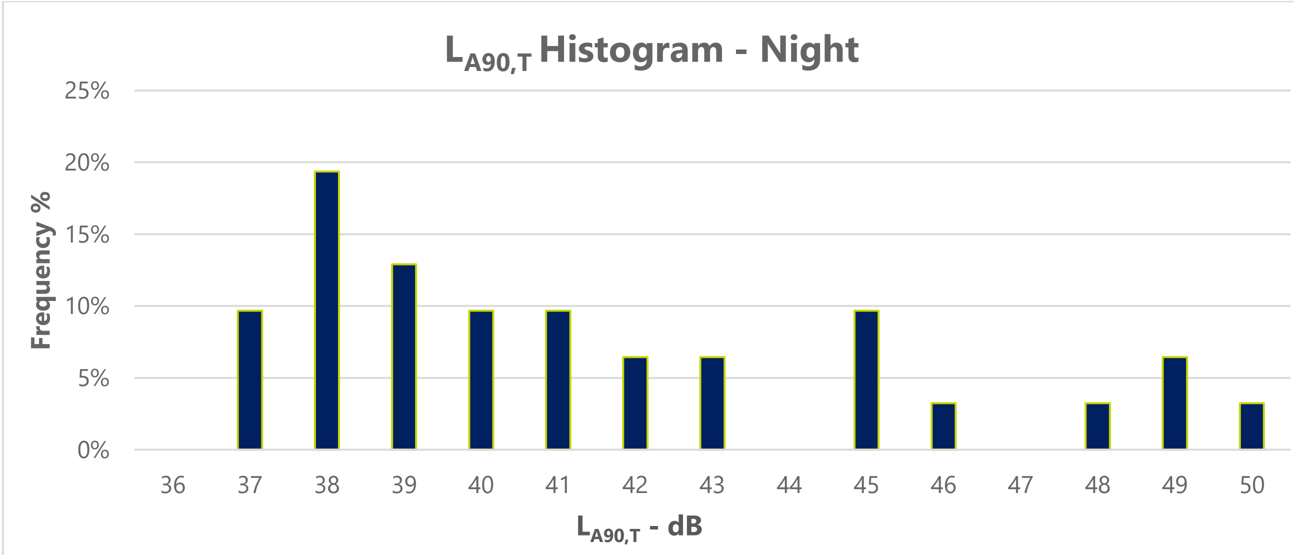


Figure 3—3 Modal analysis of night-time background levels at LT1

Table 3—4 Quantifying the road noise shielding effect at LT1 due to the existing civic centre building and surrounding foliage

Date	Measurement	Time-period	Background $L_{A90,5mins}$ sound level (dB)	Difference between BG1 and BG2 (dB)
Tuesday 25th January 2022	**BG1**	15:47-15:52	48	**2**
	BG2	15:40-15:45	50	
Wednesday 26th January 2022	**BG1**	13:34-13:39	50	**3**
	BG2	14:06-14:11	53	
Worst-case difference between BG2 (by NSR) and BG1 (by LT1 on site)				**3**

Table 3—5 Adopted background sound level at nearest NSRs

NSR	Adopted background $L_{A90,T}$ sound level (dB)	
	Daytime (07:00-23:00)	Night-time (23:00-07:00)
Trinity Academy Primary	49	38
Residential dwellings on Trinity Road	52*	41*
*Calculated by applying an onerous 3 dB correction to background sound levels measured at LT1		

Figure 3—4 Summary of noise survey results across all measurement locations (Source: Google Earth)

4 Environmental Noise Modelling

4.1 Introduction

A 3D noise modelling exercise was undertaken to calculate the façade noise level across the various elevations of the proposed development. The calculated levels are used to identify areas that can be naturally ventilated and assess the sound insulation requirements of the façade, such that the acceptable internal ambient noise levels can be achieved.

4.2 Methodology

The 3D model was created using Cadna/A version 2019 acoustic software. The noise model was constructed based upon detailed OS mapping data with local infrastructure such as roads added into the model to simulate the noise sources that were present during the on-site noise survey.

The following noise mapping assumptions have been made when producing the noise models for the proposed development:

- Buildings around the proposed development were input based on Open Street Map geodata
- The outline massing proposed for the development was introduced as currently shown in the architectural proposals
    - Site boundary:
        - Proposed Site Plan (Drawing ref.: HCC-HBA-ZZ-RF_DR-A-20001 P6)
    - Building Elevations:
        - Proposed Section CC (Ref. HCC-HBA-ZZ-ZZ-DR-A-200302 P9)
- A worst-case ground absorption coefficient of 0 has been modelled (assuming hard ground). This is likely a worst-case assessment condition
- Air temperature and relative humidity have been assumed to be at typical CadnaA input levels of 10℃ and 70%. CadnaA software calculates air absorption according to ISO 9613-1:1993
- The 3D noise model has been calibrated based on noise levels as detailed in Section 3. All noise survey data has been input into the model and calibrated to positions representative of the real-world measurement position.

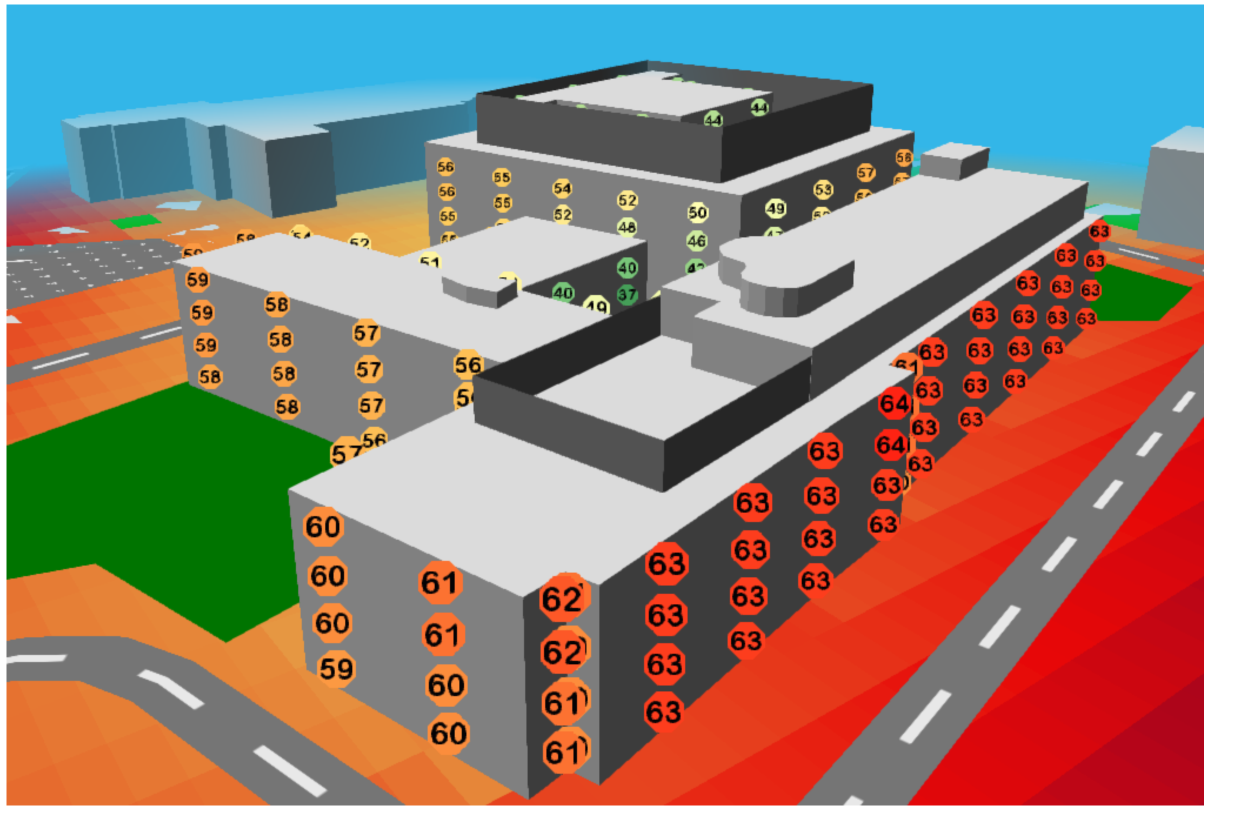


Figure 4—1 Civic Centre noise levels (south-eastern façade)

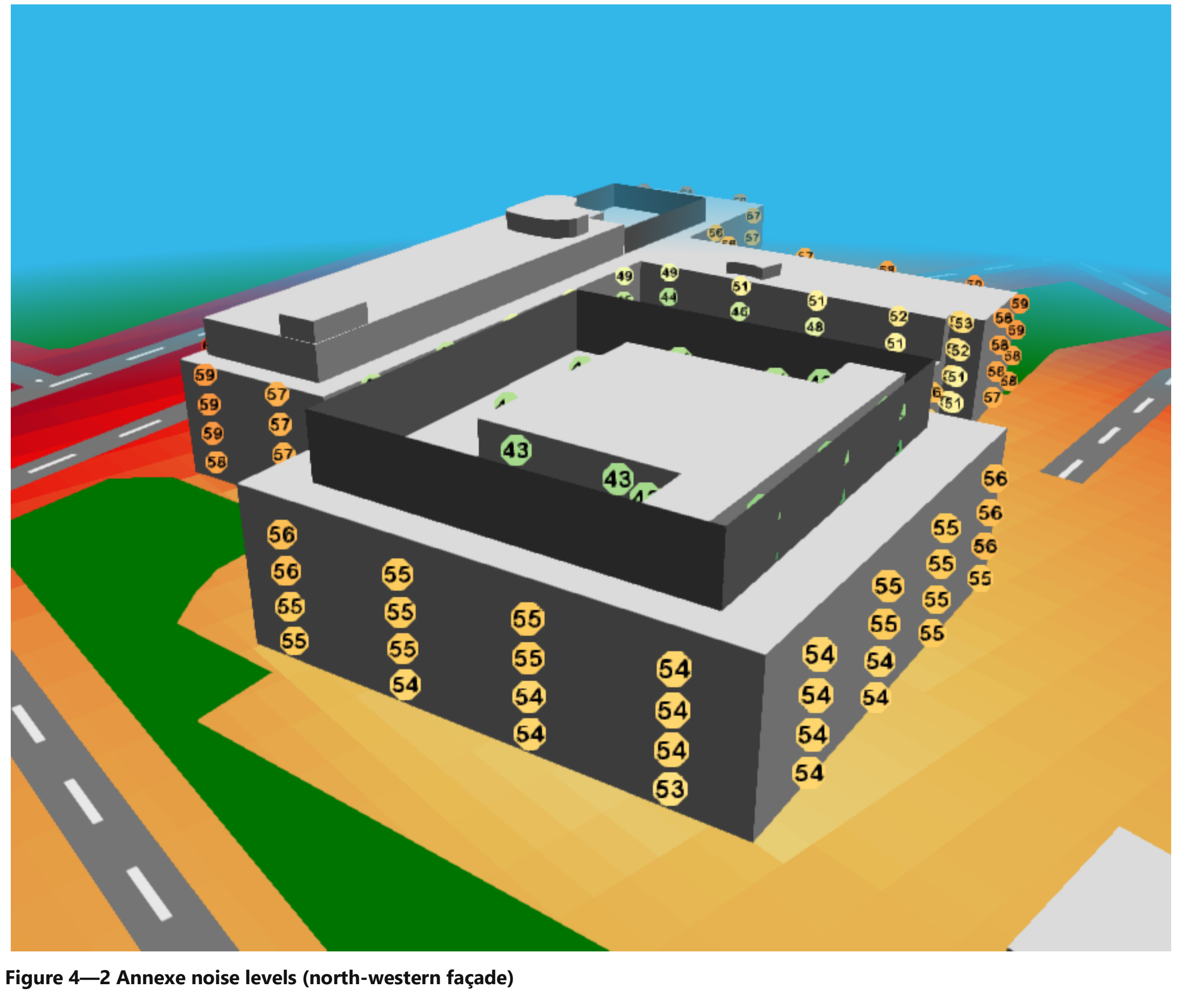


Figure 4—2 Annexe noise levels (north-western façade)

4.3 Limitations

The models have been calibrated to the noise levels measured and summarised in Section 3.3. However, this does not guarantee full accuracy of the predicted noise levels. Typically, an uncertainty within a range of approximately +/- 3 dB could be expected from computer noise modelling software. However, this uncertainty has been controlled as far as practicable by cross-referencing the levels of predicted noise impact against the spot measurements captured on site.

4.4 Results & Discussion

Figure 4—1 and Figure 4—2 highlight how noise levels across a given elevation do not vary significantly with height, except for instances where a rooftop barrier is providing shielding.

Figure 4—3 highlights how greater façade noise levels were calculated along elevations facing the A105 and A109, while quieter levels are calculated across elevations facing away from the roads. This is due to the acoustic shielding provided by the buildings.

The maximum calculated façade noise level of $L_{Aeq,T}$ 64 dB indicates that natural ventilation via operable windows without noise mitigation measures is feasible across some elevations.

Elevations with more acoustically sensitive rooms, like the civic chamber and executive office spaces, are likely to need to be mechanically ventilated to reduce environmental noise break-in. These topics are discussed in the next section.

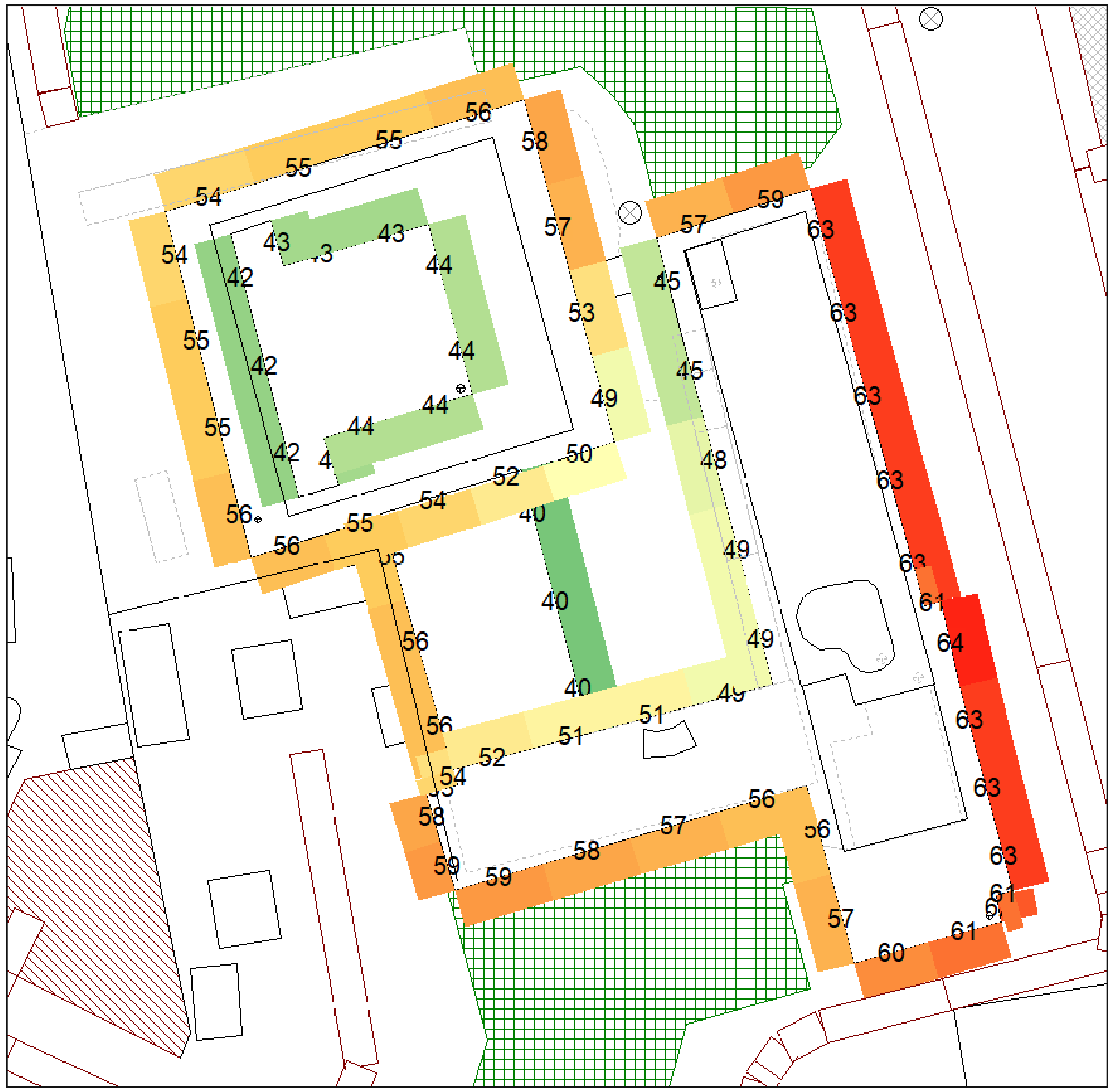


Figure 4—3 Highest Predicted Daytime Noise Levels - $L_{Aeq,T}$

5 Façade Acoustic Design & Noise Break-In

5.1 Introduction

The indoor ambient noise level (IANL) should be controlled to within acceptable noise levels to provide an acoustic environment that is suitable for the associated space.

The IANL is made up of contributions from external noise such as road traffic and airplanes, as well as internal building services noise.

The aim is to acoustically design the building such that the cumulative noise from external and internal noise sources do not exceed the IANL requirements.

The acceptable indoor ambient noise level targets are shown in Table 5—1.

5.2 Façade Design Noise Levels

Façade design noise levels are based on noise mapping calculations detailed in Section 4.4.

To simplify the façade sound insulation requirements across each building elevation, the noise levels have been broken down into "conditions" that represent a range of decibel levels.

The elevations are grouped into 2 Conditions (refer to Figure 5—1) and represent the following noise level exposures:

Condition 1: Façade exposed to noise levels of:

- Daytime: $L_{Aeq,T} \leq 59$ dB

Condition 2: Façade exposed to noise levels of:

- Daytime: $L_{Aeq,T}$ 60 - 64 dB

The greater façade noise level has then been used to calculate the façade sound insulation requirements.

Table 5—1 Acceptable indoor ambient noise levels (BS 8233:2014)

Activity	Location	Design range dB $L_{Aeq,T}$
Study and work requiring concentration	Executive office	35 – 40
	Staff/meeting room, training room	35 – 45
-	Open plan office	45 – 50
Speech or telephone communications	Corridor, circulation space	45 – 55
	Cafeteria, kitchen	50 – 55

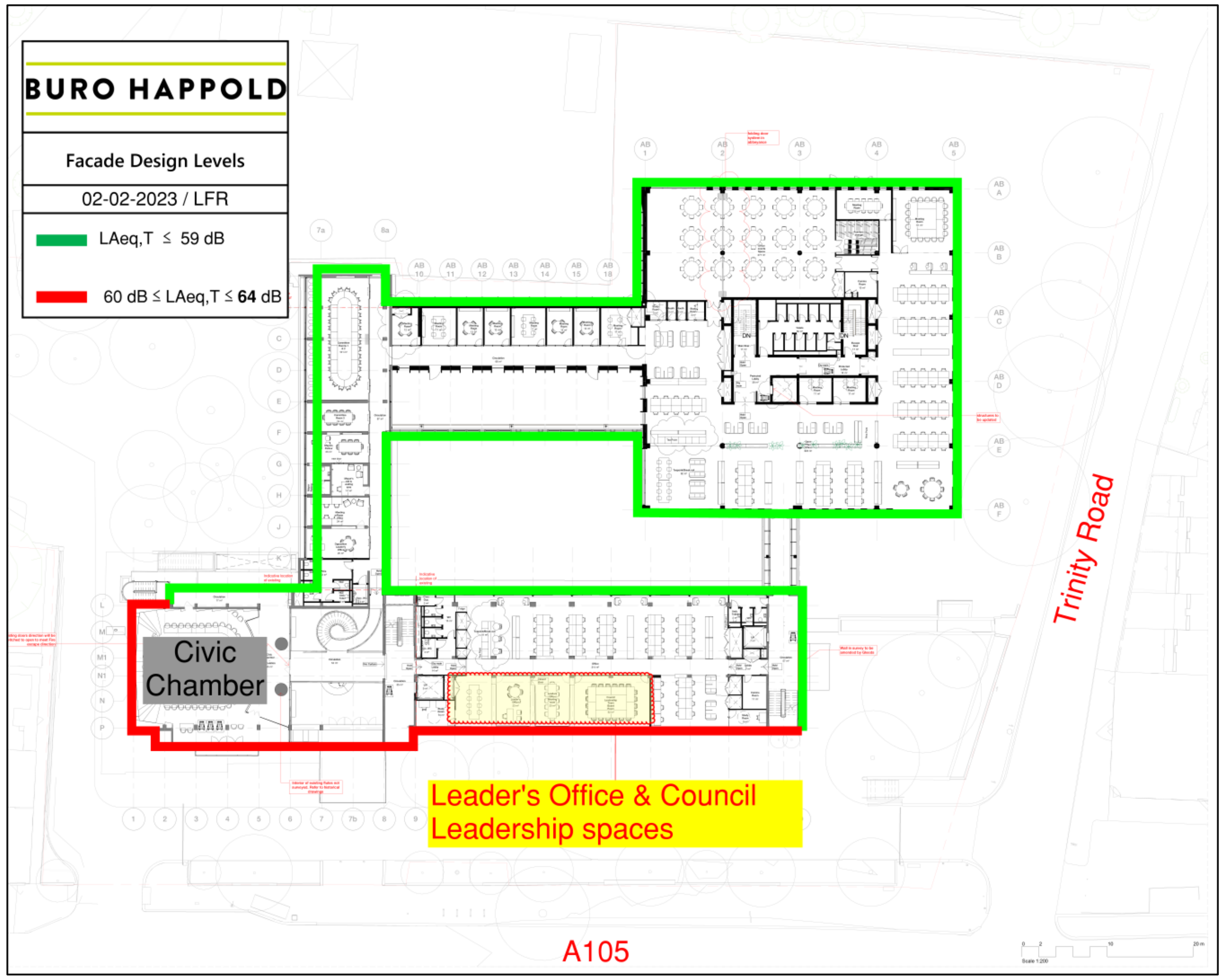


Figure 5—1 Façade design levels

5.3 Façade sound insulation requirements

5.3.1 Methodology

The façade sound insulation requirements are calculated using the façade noise levels detailed in Section 5 and the acceptable internal ambient noise levels established in Section. The façade acoustic requirements are given in terms of R, at each octave-band centre frequencies, and R_w + C_{tr}. These are defined as:

- **Sound Reduction Index, R** – is a measure of the sound insulating properties in a particular frequency band. In this case, the sound reduction index is given at each octave band centre frequency between 125 and 4000 Hz.
- **Weighted Sound Reduction Index, R_w** - is a single figure value which describes the standardised performance of partitions when measured in a laboratory.
- **Correction Traffic, C_{tr}** - is a single correction value applied which takes into account the urban traffic noise spectrum.

Calculation procedures follow the "more rigorous calculation method" outlined in BS 8233:2014, based on the equation shown across.

5.3.2 Calculation results

Noise break-in calculations have been carried out to define the minimum acoustic performance requirements of the proposed glazing and associated framing using the design noise levels and calculation methodology outlined above.

The acceptable IANL criteria can be achieved with glazing construction equal to or greater than the values given in Table 5—2.

It should be noted that the sound insulation requirements include the framing and components that make up the façade glazing system. Achievement of sound reduction requirements is paramount to see that the internal noise criteria is achieved. However, example glazing configurations have been provided for preliminary guidance only. An explanation of the build-ups is as follows:

- SGG = Saint Gobain Glass
- --/--/-- PVB interlayer = glass and air gap dimensions in mm including laminate layers e.g. 8 mm glass, 24 mm air gap, 8 mm glass with 1No. laminate layer
- Glass model = e.g. Saint-Gobain

In summary, Table 5—2 demonstrates that placing noise sensitive spaces in the Civic Centre along the eastern façade facing the A105 means an enhanced glazing specification is required.

Elsewhere, across all of the Annexe elevations and the remaining spaces within the Civic Centre, natural ventilation can be achieved with an open window and a typical double-glazed construction has been specified.

From experience on past projects, it is considered likely that the glazing construction will be thicker (thus provide greater sound insulation) than this standard build-up in order to meet other requirements such as thermal and structural performance requirements.

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ne}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

$L_{eq,ff}$	*is the equivalent continuous sound pressure level outside the room elements under consideration*[1]
A_0	*is a reference absorption area of 10 m² and is independent of frequency*
S_f	*is the total façade area in square metres (m²) of the room in question*
S_{wi}	*is the area in square metres (m²) of the windows of the room*
S_{ew}	*is the area in square metres (m²) of the external wall of the room*
S_{rr}	*is the area is square metres (m²) of the ceiling of the room*
S	*is the total area in square metres (m²) of elements through which sound enters the room, i.e $S_f + S_{rr}$*
$D_{n,e}$	*is the insulation of the trickle ventilator measured according to BS EN ISO 10140*
R_{wi}	*is the sound reduction index (octave band value) of the window*
R_{ew}	*is the sound reduction index (octave band value) of the external wall*
R_{rr}	*is the sound reduction index (octave band value) of the roof/ceiling*
A	*is the equivalent absorption area of the receiving room being considered*
3	*is a correction factor*

Table 5—2 Worst-case façade sound insulation requirement

Glazing Condition	Sound reduction indices (dB) at octave-band centre frequencies (Hz)						$R_w + C_{tr}$ – dB	Example glazing construction
	125	250	500	1K	2k	4k		
Condition 1	21	17	25	35	37	31	25	4mm / 20mm / 4mm
Condition 2	24	25	31	42	44	49	32	SGG 6mm / 12mm / 6.4mm (Stadip Silence)

[1] It is the free-field sound level (i.e. in the absence of the façade), measured or estimated at the intended position of the element under consideration. It is related to the level $L_{eq,1}$ measured within a few millimetres of the actual façade by the relation $L_{eq,ff} \approx L_{eq,1} - 6$, and to the level $L_{eq,2m}$ measured 2 m away from the façade by the relation $L_{eq,ff} \approx L_{eq,2m} - 3$As s

6 Plant Noise Break-Out

6.1 Introduction

The following section details the plant noise limits for controlling noise break-out to nearby NSRs, to see that the operation of new plant does not compromise the acoustic amenity of the surrounding area. The limits for plant noise break-out are established by the Local Planning Authority and are based on background noise level measurements at a location that is considered representative of the nearest NSR.

At this stage, specific plant selections have not been finalised. The most robust method of controlling noise output will be to set limiting noise levels for fixed plant and activity at nearby NSRs.

6.2 Noise Sensitive Receptors

The following noise-sensitive receptors have been identified:

- NSR 1 – Residential receptor located approximately 35 m north of the development site
- NSR 2 – School receptor located approximately 35 m west of the development site

6.3 Plant Noise Targets

A critical aim of local policies is to protect the acoustic amenity of existing noise-sensitive development when a new development is proposed. Concerning the NSPE, the term closely related to the Council's objective is:

- **Lowest Observed Adverse Effect Level (LOAEL)** - The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than the LOAEL should see that any adverse effects on health or quality of life are negligible.

A target design criterion that should achieve (LOAEL) at nearby NSR's is:

> *Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise-sensitive location*

BS 4142:2014+A1:2019, requires penalty corrections to the noise source for acoustically distinguishable features (rating levels). They are cumulative levels that apply to all plant items operating simultaneously – individual items may need to be attenuated to less than these values to achieve the cumulative level. Therefore, if the selections include fixed plant with tonal, impulsive, or intermittent noise features, these limits would reduce accordingly.

It should be noted that the compliance with the above should see compliance with BREEAM Pol 05 acoustic credit by default.

The typical background sound level measured at the identified NSRs, and their respective Rating Level target are shown in the following tables.

Figure 6—1 Nearby identified NSRs

Table 6—1 Plant noise limit at NSR – Day-time (07:00 – 23:00)

NSR	Typical background sound level – $L_{A90,T}$ dB	Below the typical background level $L_{A90,T}$ - dB	Rating Level – $L_{Ar,Tr}$ - dB
Trinity Primary Academy	49	-5	44
Residential dwellings on Trinity Road	53	-5	48

Table 6—2 Plant noise limit at NSR – Night-time (23:00 – 07:00)

NSR	Typical background sound level – $L_{A90,T}$ dB	Design criteria - dB	Rating Level – $L_{Ar,Tr}$
Trinity Primary Academy	38	-5	33
Residential dwellings on Trinity Road	41	-5	36

6.4 Discussion and Implications

Compliance with these limits should show that noise at nearby residential properties is likely to have a low impact, and is therefore, unlikely to generate complaints from existing residents regarding any newly-created noise associated with the development. Individual plant items may need to be designed to a lower limit such that the overall total achieves the stated criteria above.

Final plant selections have not been made; however, the following main pieces of equipment are proposed:

Annexe

- 3 x chillers - rooftop
- 2 x Air handling units - rooftop
- Various pumps – rooftop plant room

Civic Centre

- 1 x Air handling unit
- Toilet extract fans
- Heat recovery units

In addition to selecting low-noise plant items, other noise mitigation measures might be necessary to meet the proposed noise limits. These could include but are not limited to atmosphere-side attenuators and noise barriers.

Examples are shown in the figures across. The selections shall be made at the further design stages once the proposed plant is known.

Figure 6—2 Rectangular attenuator

Figure 6—3 Circular attenuator

Figure 6—4 Mechanical plant noise barriers

Figure 6—5 Chiller attenuation package

7 Conclusion

It is concluded that the proposed Harigney Civic Centre development be suitable in terms of internal acoustic conditions and the development's noise impact on sensitive receptors.

Environmental noise survey work was conducted to capture survey data on the various noise sources impacting the site. The noise survey information has been used to inform the calibration of sources within the 3D acoustic model.

The required sound insulation performance of external glazing throughout the development has been calculated from façade incident noise levels calculated in the 3D acoustic model, so that suitable internal conditions can be achieved in line with BS 8233:2014.

To reduce noise breakout from Haringey Civic Centre (associated with building services plant noise), target fixed plant noise level criteria are proposed. Noise targets have been set to control the combined noise from building services to the following Rating level:

Trinity Primary Academy

- $L_{Ar,Tr}$ 44 dB during daytime periods (07:00 – 23:00 hours)
- $L_{Ar,Tr}$ 33 dB during night-time periods (23:00 – 07:00 hours)

Residential dwellings on Trinity Road

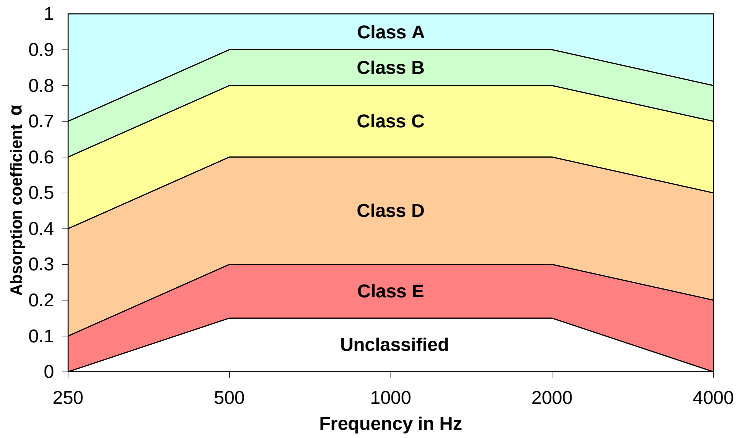
- $L_{Ar,Tr}$ 48 dB during daytime periods (07:00 – 23:00 hours)
- $L_{Ar,Tr}$ 36 dB during night-time periods (23:00 – 07:00 hours)

Based on the above, noise is not considered to form a barrier to development.

Appendix A Noise Survey Data

Appendix B Acoustic Glossary

Term	Definition
α (α_w)	Sound Absorption Coefficient (Weighted Sound Absorption Coefficient) is a measure of the effectiveness of materials as sound absorbers as defined in BS EN ISO 11654:1997. It is the ratio of the sound energy absorbed or transmitted (i.e. not reflected) by a surface to the total sound energy incident upon that surface. The value of the coefficient varies from 0 (perfect reflector) to 1 (perfect absorber).
A (A_T)	Absorption Area (Total Absorption Area) is equal to the product of multiplying the surface area of a construction (in m^2) and its Sound Absorption Coefficient (α).
Ambient Noise (as defined in BS 4142:2014+A1 2019)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.
Background Noise (as defined in BS 4142:2014+A1 2019)	A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using the Fast time weighting and quoted to the nearest whole number of decibels.
C_{tr}	Spectrum adaptation term calculated using traffic noise as described in BS EN ISO 717-1:2013. This term is provided with weighted single values such as $D_{nT,w}$ or R_w to match with particular requirements (building acoustic or traffic noise spectrum).
Decibel, dB	Decibel (dB) is a dimensionless unit commonly used to demonstrate sound levels. It is derived from the logarithm of the ratio between the measured level and the reference value. For sound pressure level (L_p) the reference value is $2x10^{-5}$ pascals. For sound power (L_w) reference value is $1x10^{-12}$ Watts.
$D_{n,f,w}$	The weighted transmission of sound energy from a source room to a receiving room via structural (vibrational) paths in the construction mainly, e.g. walls, floors, ceilings.
$D_{nT,w}$	The Weighted Standardised Level Difference ($D_{nT,w}$) is defined in BS EN ISO 140-4:1998 (superseded by BS EN ISO 16283-1:2014+A1:2017 but still cited in The Building Regulations) BS EN ISO 717-1:2013. This performance describes the installed site performance of the composite separating constructions, including the partition element performance, the flanking path transmission and the reception room reverberation time factors. $D_{nT,w}$ target leads to a selection of adequate construction elements and methods to build the partition that are rated using weighted sound reduction index R_w. It is typically standardised to a reverberation time (T_0) of 0.5 seconds. In the instance of testing in schools, T_0 is taken as the room's T_{mf}.
D_w	Weighted Level Difference: Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions
Flanking Noise	The transmission of sound around the perimeter or through holes within partitions (or barriers) that reduces the otherwise obtained sound transmission loss of a partition. Examples of flanking paths within buildings are ceiling plenum above partitions or raised floor cavities, ductwork, piping, and electrical conduit penetrations through partitions, back to back electrical boxes within partitions, window mullions, etc.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
IANL	Indoor Ambient Noise Level. For schools Table 1 in BB93 (2015) specifies the upper limit for indoor ambient noise levels within teaching areas. The design criteria is set for a 30-minute average level (i.e. $L_{Aeq,30mins}$). However, where there is negligible change in the noise level, BB93 states that a much shorter time period (e.g. $L_{Aeq,5min}$) can be used. BB93 also states that for rooms identified having limits of $L_{eq,30min}$ 35 dBA or less, the noise should not regularly exceed $L_{1,30min}$ 55 dBA.
$L_{90,T}$ ($L_{A90,T}$)	Sound pressure level exceeded for 90% of the measurement period. Referred to as background noise level.
$L_{Ar,T}$	Rating Noise Level (as defined in BS 4142:2014+A12019), the specific noise level plus any adjustment for the characteristic features of the noise.

Term	Definition
$L_{eq,T}$ ($L_{Aeq,T}$)	The equivalent continuous noise level of a time-varying noise. It is the steady noise level which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
$L_{Fmax,T}$ ($L_{AFmax,T}$)	The maximum sound pressure level measured during the measurement period T using the fast time constant.
$L'_{nT,w}$	Weighted Standardized Impact Sound Pressure Level: a single-figure value of impact sound insulation performance. This European index is described in BS EN ISO 140-7:1998 (superseded by BS EN ISO 16283-2:2015 but still cited in The Building Regulations) and BS EN ISO 717-2:2013, used for comparing and rating floors and based on the values of L'_{nT} at different frequencies. L'_{nTw} target leads to a selection of adequate construction elements and methods to build the floor that are rated using weighted normalized impact sound pressure level $L_{n,w}$. The lower the $L'_{nT,w}$ the better the performance
$L_{n,w}$	Weighted Normalized Impact Sound Pressure Level: European single figure rating for transmission loss of impact sound through building elements as described in BS EN ISO 10140-3:2010+A1:2015 and BS EN ISO 717-2:2013. The lower the $L_{n,w}$ the better the performance.
L_p	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure ($2x10^{-5}$ pascals). The reference pressure shall be explicitly stated and is defined by standard.
Noise Rating (NR)	Curves developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. These can be compared to NC curves and also can be approximated to equivalent dBA levels.
Reverberation Time (RT)	Time required for the steady sound pressure level in an enclosed space to decay by 60 dB, measured from the moment the sound source is switched off. Reverberation time is described in ISO 354:2003.
R_w (C, C_{tr})	Weighted Sound Reduction Index: Single-figure value of sound reduction according to BS EN ISO 10140-2:2010 used for rating partition systems, door-sets or glazing, based on the values of sound reduction index R at different frequencies. The higher the R_w the better the performance.
SEL (L_{AE})	Single Event Level: The sound level over one second which would have the same energy content as the whole event.
Sound absorption classes	Sound absorption performance characteristics are defined by a class. Below is a diagram of the different classes of absorption available, taken from BS EN ISO 11654:1997. The y-axis is the absorption coefficient of the material with one being total absorption and zero being no absorption. The x-axis is the frequency of the sound. 
Specific Noise Level (as defined in BS 4142:2014+A1 2019)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
T_{mf}	Mid Frequency Reverberation Time: Within BB93, the reverberation time criteria are set in terms of the averaged value of the 500 Hz, 1000 Hz and 2000 Hz frequency bands. The various levels for T_{mf} are

Term	Definition
	specified within Table 6 of BB93 (2015) and are generally upper limits. Usually the specified mid-frequency reverberation times are for 'finished but unoccupied and unfurnished rooms'.
Vibration	Force which oscillates about some specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm) or (rpm) and strokes per minute (spm). This is the number of oscillations which occurs in that time period. The amplitude is the magnitude or distance of travel of the force.
Weightings (as defined in BS EN 61672:2013):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.

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1 Introduction

1.1 Overview

Buro Happold have been commissioned by Hawkings Brown Architecture to provide acoustic consultancy services related to the proposed Hotel development located on the corner of Queensferry Street and Shandwick Place, Edinburgh, Scotland. This report is prepared to support the Planning Application for the site which is a refurbishment of multiple buildings across the site.

Buro Happold has been appointed by Hawkings Brown Architecture to provide acoustics consultancy on a proposed scheme consisting of a refurbishment of the Haringey Civic Centre and new attached Annexe at Haringey, London. The scheme is an internal refurbishment of the existing Civic Centre with a three storey high Annexe with bridge links to the existing building. The existing Civic Centre predominately consists of office space, meeting rooms, Civic Chamber, Committee Rooms alongside ancillary spaces such as water closets and comms rooms. The Annexe consists of open plan office spaces, meeting rooms and similar ancillary spaces as the Civic Centre.

Figure 1—1 Architectural render (Source: Hawkins Brown)

1.2 Purpose of the Report

This report is prepared to support the Planning Application for the proposed development. The report:

- Evaluates the existing noise climate within the vicinity of the application site, referencing noise levels captured during an environmental noise survey
- Discusses the level of sound reduction required by the building envelope to protect occupants from excessive environmental noise ingress
- Provides limiting levels for mechanical plant to see that the occupants of nearby noise sensitive buildings are not subject to excessive plant/activity noise levels.

1.3 Content

This report covers the following elements, those being most relevant to the Spatial Coordination of the scheme:

- Pertinent acoustic criteria
- External noise levels/survey results
- 3D acoustic modelling results
- Noise break-in – façade sound insulation requirements
- Noise break-out – plant noise emission limits

2 Acoustic Design Criteria

2.1 Relevant Guidance Documentation

This report is informed by the following standards and guidelines:

- The National Planning Policy Framework (NPPF)
- The Noise Policy Statement for England (NPSE)
- The London Plan 2021
- Haringey Local Plan Strategic Policies (2013) with alterations in 2017
- BS 4142:2014+A1:2019 – Methods for rating and assessing commercial and industrial sound
- British Standard (BS) 8233:2014 – Guidance on sound insulation and noise reduction for buildings

2.2 National Policy and Guidance

2.2.1 The National Planning Policy Framework (NPPF)

The NPPF is the over-arching planning policy document that applies to all new developments in England. The guidance and assessment criteria given (or referred to) in this document can therefore be applied to all other standards in terms of assessing the suitability of granting Planning permission with respect to noise impact.

The NPPF states that Planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development
- Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of Conditions
- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason

2.2.2 The Noise Policy Statement for England (NPSE)

With specific reference to noise impact, the NPPF document refers to the Noise Policy Statement for England (NPSE). The NPSE provides guidance, which enables decisions to be made regarding the acceptable noise burden to place on society, using three key phrases – the No Observed Effect Level (NOEL), the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL).

In order to provide a consistent frame of reference (and to allow a view to be taken on the suitability of the application with reference to the relevant Planning guidance), the levels or criteria given in other relevant documents used in assessment will be re-framed in terms of the following:

- No Observed Effect Level (NOEL) - The NOEL is the level of noise impact below which no effect can be detected, and there would be no discernible negative effect on health or quality of life.
- Lowest Observed Adverse Effect Level (LOAEL) - The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than the LOAEL should see that any adverse effects on health or quality of life are negligible.
- Significant Observed Adverse Effect Level (SOAEL) - The SOAEL is the level above which significant adverse effects on health and quality of life occur. Designs should always seek to avoid a noise impact, which would be categorised as a SOAEL.

2.3 London Policy and Guidance

2.3.1 The London Plan 2021

The London Plan states the following with respect to 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

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.*

The management of noise is about encouraging the right acoustic environment, both internal and external, in the right place at the right time. This is important to promote good health and a good quality of life within the wider context of achieving sustainable development. The management of noise should be an integral part of development proposals and considered as early as possible.

Managing noise includes improving and enhancing the acoustic environment and promoting appropriate soundscapes. This can mean allowing some places or certain times to become noisier within reason, whilst others become quieter. Consideration of existing noise sensitivity within an area is important to minimise potential conflicts of uses or activities, for example in relation to internationally important nature conservation sites which contain noise sensitive wildlife species, or parks and green spaces affected by traffic noise and pollution. Boroughs, developers, businesses and other stakeholders should work collaboratively to identify the existing noise climate and other noise issues to ensure effective management and mitigation measures are achieved in new development proposals.

The management of noise also includes promoting good acoustic design of the inside of buildings. Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has produced advice, Pro:PG Planning and Noise (May 2017), that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas.

2.4 Local Planning Policy

Three relevant Planning Policy documents have been identified by the design team. The policy references relevant to noise have been identified as:

- Haringey Development Management DPD adopted July 2017

These policies provide useful commentary when considering noise in the wider context of the Local Planning Policy requirements.

These policy documents do not propose objective design targets against which noise can be assessed. As such, It is considered that where the guidance criteria identified in this report can be met, a significant adverse impact on residents should be avoided to achieve the goals of the planning policy.

2.4.1 Haringey Development Management DPD adopted July 2017 Policy DM23 Environmental Protection

DM23: Environmental Protection

> *"Noise pollution can adversely impact on the amenity and health of building occupiers as well as the wider public. The Council will seek to ensure that new developments both minimise noise pollution and appropriately manage its impact. Noise sensitive development (such as housing, schools and health facilities) should be located away or appropriately separated from major sources of noise. The Council will expect that mitigation measures are considered and incorporated into the design process prior to the submission of an application. "*
>
> *"The Council will seek to ensure that new noise sensitive development is located away from existing or planned sources of noise pollution. Proposals for potentially noisy development must suitably demonstrate that measures will be implemented to mitigate its impact."*
>
> *"A noise assessment will be required to be submitted if the proposed development is a noise sensitive development, or an activity with the potential to generate noise."*

2.5 British Standard 4142:2014+A1:2019

BS 4142:2014+A1:2019 provides methods for rating and assessing sound of an industrial and/or commercial nature, which includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the loading/unloading of goods and sound from mobile plant / vehicles associated with industrial / commercial premises (e.g. fork-lift trucks).

The standard utilises various descriptors to assess complaints, the impact of sound associated with proposed industrial / commercial activities on existing noise-sensitive receivers, or the impact and likely suitability of siting new noise-sensitive receivers in the vicinity of existing industrial / commercial noise sources.

The standard is specifically precluded from being used to determine likely internal sound levels arising from external noise, or from the assessment of various sound sources for which other (more relevant) guidance exists, including music/entertainment noise, person noise and construction noise.

The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receiver (*NSR*), from the 'rating level' (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).

Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific.

As a guideline, BS 4142 states that:

- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context
- A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context
- The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact
- Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on context

It should be noted that BS 4142:2014+A1:2019 draws a clear distinction between the detailed and flexible assessment methods contained within, and the more limited versions contained in the previous (1997) edition.

Above all, BS 4142:2014+A1:2019 requires qualified engineering consultants and technical planning professionals (e.g. Environmental Health Officers) to use a combination of quantitative assessment techniques and rational qualitative judgements to come to a sensible and reasonable conclusion.

2.5.1 Definitions

BS 4142 uses several specific terms to define the various levels used in assessments, as follows:

- **Specific sound** – the commercial / industrial noise source under consideration
- **Residual sound** – the sound level at the noise-sensitive receivers in the absence of the specific sound
- **Ambient sound** – the sound level at the noise-sensitive receivers in the presence of the specific sound (i.e. ambient = residual + specific)
- **Background level** - the sound pressure level which is exceeded by the residual sound for 90% of the measurement period
- **Rating level** – the specific sound, corrected for acoustically distinguishing characteristics

2.5.2 Background level

BS 4142 emphasises that the background level ($L_{A90,T}$) is in fact a range of levels, not one absolute value. Whilst stating that the measurements of background sound should be normally not less than 15 mins, the focus is on obtaining a level for use in assessment that is representative of typical conditions at the noise-sensitive receivers.

An example methodology by which this typical value may be obtained is given in the document. In this example, monitoring of $L_{A90,15mins}$ is undertaken during periods which represent when the specific noise will be operational. After obtaining a sequence of representative contiguous or disaggregated results, it is then proposed that the modal value is representative of the 'typical' background level.

2.5.3 Specific sound

BS 4142 requires that the specific sound ($L_{Aeq,Tr}$) is obtained over a reference period of 1 hour (daytime) and 15 mins (at night). Ideally, measurements would be taken of the ambient sound and residual sound at the assessment location, with these measurements used to accurately calculate the specific sound (ambient – residual = specific).

Where the source (specific sound) is not yet operational, it is permissible to measure the specific sound elsewhere (or to use known manufacturers' or library data) and then model the impact of this against the known background level.

2.5.4 Rating level

Once the specific sound level has been determined, this must be corrected in terms of the need to consider the subjective prominence of the impact of the sound at noise-sensitive receivers, and the extent to which acoustically distinctive characteristics will attract attention.

BS 4142 states that this is normally possible to carry out a subjective assessment of characteristics, based on the following correction guidelines:

- ***Tonality:*** +2 dB for a 'just perceptible' tone, +4 dB for 'clearly perceptible', and rising to +6 dB for 'highly perceptible' tones
- ***Impulsivity*** (rapidity of change and overall chance in level): +3 dB for 'just perceptible' impulsivity, +6 dB for 'clearly perceptible', rising to +9 dB for 'highly perceptible' impulsivity
- ***Intermittency:*** if the on/off-time of the specific sound is readily distinctive at the noise-sensitive receivers, +3 dB
- ***Other sound characteristics:*** (see page 14 or 20 in PDF file of 4142)

It should be noted that where one feature is clearly perceived as dominant, it may be applicable to correct for that feature only. Where multiple features are likely to affect perception and response, each should be added arithmetically.

2.6 British Standard 8233:2014

2.6.1 Acceptable Internal Ambient Noise Levels

The acoustic criteria are driven by BREEAM aspirations, which are based on guidance provided in BS 8233:2014, and supplemented as necessary for completeness by guidance from CIBSE Guide A (Environmental Design) and the British Council for Office guidance.

For all room functions, the indoor ambient noise levels should comply with design ranges given in BS 8233:2014. These design ranges are reproduced in Table 2—1.

It should be noted that the noise limits apply to steady state or quasi-steady-state sounds such as noise from air-conditioning systems and road traffic noise. It does not include noise generated by the occupants and equipment such as computers, printers and photocopiers.

Table 2—1 Internal ambient noise level requirements

Activity	Location	Design range dB $L_{Aeq,T}$
Study and work requiring concentration	Executive office	35 – 40
	Staff/meeting room, training room	35 – 45
-	Open plan office	45 – 50
Speech or telephone communications	Corridor, circulation space	45 – 55
	Cafeteria, kitchen	50 – 55

3 Site and External Noise Survey Results

3.1 Introduction

A noise survey was carried out between Tuesday 25/01/2022, and Wednesday 26/01/2022 to assess the noise climate around the development site. The purpose of the survey was to assess the following:

- To capture the noise climate of the surrounding environment and assess the potential impact of noise sources, such as those illustrated in Figure 3—1, on the proposed façades . This allows the specification of external building envelope attenuation (i.e. glazing and ventilation) to see that internal ambient noise levels within workspaces can be compliant with relevant standards and criteria
- To capture the existing background noise levels at nearby noise-sensitive (i.e. residences) receivers. This allows the specification of limiting noise levels for any externally located mechanical plant and equipment (including external terminations), to see that the installation does not negatively impact nearby noise sensitive receivers in the vicinity of the site.

3.2 Survey Details

3.2.1 Measurement Locations

Buro Happold staff visited the site on Tuesday 25 and Wednesday 26 January 2022 to obtain the required noise data. The noise survey was undertaken in free field environments at heights of approximately 1.5 metres above the local ground level.

The measurement locations are detailed below and annotated on an aerial image in Figure 3—1.

- **Location LT1** – (51.600545, -0.112295) – Long-term (unattended) noise measurement located within the site 25 m away from Trinity Rd. This measured day-time and night-time background noise levels.
- **Location ST1** – (51.600719, -0.111807) – Short-term noise measurements north-east of the development site 12 m away from the centre of the A105.
- **Location ST2** – (51.599564, -0.112312) – Short-term noise measurements south of the development site 5 m away from the centre of the A109.
- **Location BG1** –(51.600545, -0.112295) – Two short-term measurements located within the site 25 m away from Trinity Rd.
- **Location BG2** – (51.600809, -0.112334) – Two short-term measurements north of the development located 1 m from the nearest NSR façade.

3.2.2 Noise Sensitive Receivers

The following noise sensitive receivers (NSRs) have been identified, these have been marked in green in Figure 3—1:

- NSR 1 – Trinity Primary Academy to the east – located approximately 10 m east of the site
- NSR 2 – Residential dwellings on Trinity Rd – located approximately 20 m north of the site.

Figure 3—1 Site boundary with existing Haringey Civic Centre (dark red), local road network and nearest NSR highlighted (Source: Google Earth)

3.2.3 Weather Conditions

Weather conditions during the measurement periods were typically warm and dry throughout the measurement period. Wind speeds were within suitable parameters for the measurement of environmental noise (i.e. generally under 5 ms^{-1}). All microphones were protected with a windshield for the duration of the survey. Metrological conditions were not considered to unduly affect readings.

3.2.4 Instrumentation

Table 3—1 displays the noise measurement instrumentation used during the noise survey.

The measurement instruments had been calibrated and certified by an accredited laboratory not more than two years before the measurements were made, using instrumentation traceable to relevant standards. The measurement systems were field calibrated before and after the noise surveys. Calibration drift was found to be less than 0.5 dB and therefore considered generally acceptable in accordance with BS EN 61672-1:2013, BS EN 61672-2:2013+A1:2017, and BS 7445:2003.

3.2.5 Measurement parameters

The sound level meters were programmed to log various noise parameters, including $L_{Aeq,T}$ and $L_{A90,T}$ at each measurement location which are described below:

- **$L_{Aeq,T}$ – the average A-weighted sound pressure level over a period of time, T**. Typically thought of as the average ambient noise level at a particular time, and likely to be due to a combination of various noise sources, near and far
- **$L_{A90,T}$ – the A-weighted sound pressure level exceeded 90% of the measurement period**. I.e. a level which would be perceived as a constant, background noise level. Typically, largely unaffected by local traffic pass-bys or by transient events. More usually attributable to constantly running building services plant or distant road traffic. What you would hear when there is no local traffic present (or other readily identifiable noise source)

3.3 Results

3.3.1 Long term measurements

A summary of the long term measurement data is presented in Table 3—2. The values summarised are as follows:

- **$L_{Aeq,T}$** – the presented numbers are the logarithmic average of individual 15-minute $L_{Aeq,15minute}$ dB measurements undertaken at that location
- **$L_{A90,T}$** – the modal value of measured LA90,15minute values, measured during the day and night-time periods.

The noise monitoring results presented in Table 3—2 demonstrate that the daytime and night-time ambient noise levels at the measurement position, were measured to be $L_{Aeq,16hours}$ 53 dB, and $L_{Aeq,8hours}$ 49 dB respectively.

Table 3—1 Equipment schedule and serial numbers

Manufacturer	Equipment	Description	Serial Number
CEL 2	Sound level meter	Casella C633C	3921025
	Pre-amplifier	CEL 495	001773
	Microphone	CEL 251	000847
	Calibrator	CEL 120/1	2045151
Norsonic 140	Sound level meter	NOR 140	1405619
	Pre-amplifier	NOR 1209	15526
	Microphone	NOR 1225	168247
	Calibrator	NOR 1251	33827

Table 3—2 Long-term (unattended) measurement results

Time Period	Existing ambient $L_{Aeq,T}$ noise level (dB)	Notes
Daytime (07:00-23:00)	53	The first and last sections of the measurement have been removed to compensate for locking of chains and gates on the development site.
Night-time (23:00-07:00)	49	

3.3.2 Short-term attended measurements

A summary of the short-term measurement data is presented in Table 3—3. Measurements show that the existing ambient noise level ranges between $L_{Aeq,15min}$ 58 to 66 dB.

3.3.3 Background sound levels

Data analysis has been performed on the measure background sound levels to determine the typical value required for a BS 4142 assessment.

As can be seen from Figure 3—2, $L_{A90,T}$ 49 dB and 51 dB prevailed during the day. The more onerous $L_{A90,T}$ 49 dB was used to define typical daytime background sound levels at LT1. As for night-time measurements shown in Figure 3—3, the most frequent background level of $L_{A90,T}$ 38 dB was used to define typical night-time background sound levels at LT1.

3.3.4 Levels at nearby noise sensitive receivers

As previously described, a key objective of the survey is to obtain background noise levels at the nearest noise sensitive receivers (NSR). The background sound levels measured at LT1 are deemed representative for Trinity Academy Primary to the west of the site, due to its proximity to the measurement location where it will experience the same shielding from the A105 by the existing Haringey Civic Centre building.

The background sound levels at the residential dwellings to the north of the site require further analysis due to their direct sight of the A105. The only secure location to lock up unattended survey equipment was deemed to be within the existing site boundary at LT1. Therefore, the following calculation method to determine background sound levels at this NSR façade was undertaken:

- The long-term (unattended) measurement location LT1 captured daytime and night-time background levels from Tuesday 25th January to Wednesday 26th January 2022.
- Short-term measurements at BG1 and BG2 were captured to understand the effect of shielding and distance attenuation from LT1 to this NSR.
- This delta between BG1 and BG2 is then applied to the background levels measured at LT1, yielding representative background noise levels at this NSR to the north of the site.

This correction is calculated and shown in Table 3—4, indicating that an onerous 3 dB correction should be applied to measured background sound levels at LT1. A summary of the adopted background sound level at the nearest NSRs are shown in Table 3—5 Adopted background sound level at nearest NSRs .

3.4 Discussion

A summary of the noise survey results can be seen in the annotated aerial image Figure 3—4.

Predictably, the southern and eastern elevations of the site facing main roads are exposed to greater levels of noise than those which are more shielded from the existing noise sources (west and north). The dominant noise source along the other elevations is distant main road traffic and local road network traffic.

The $L_{Aeq,T}$ measurements will be used to calibrate a 3D acoustic model (Section 4), as well as calculate the façade sound insulation requirements (noise break-in) related to the BREEAM acceptable IANLs (Hea 05) and the BCO acceptable IANLs, whichever is more onerous.

The $L_{A90,T}$ values will allow for appropriate plant noise limits to be set at the nearest NSRs.

Table 3—3 Short-term (attended) measurement results

Measurement	Time-period (Tuesday 25th January)	Existing ambient $L_{Aeq,15\,min}$ noise level (dB)
ST1	15:22-15:37	65
ST2	13:48-14:03	66

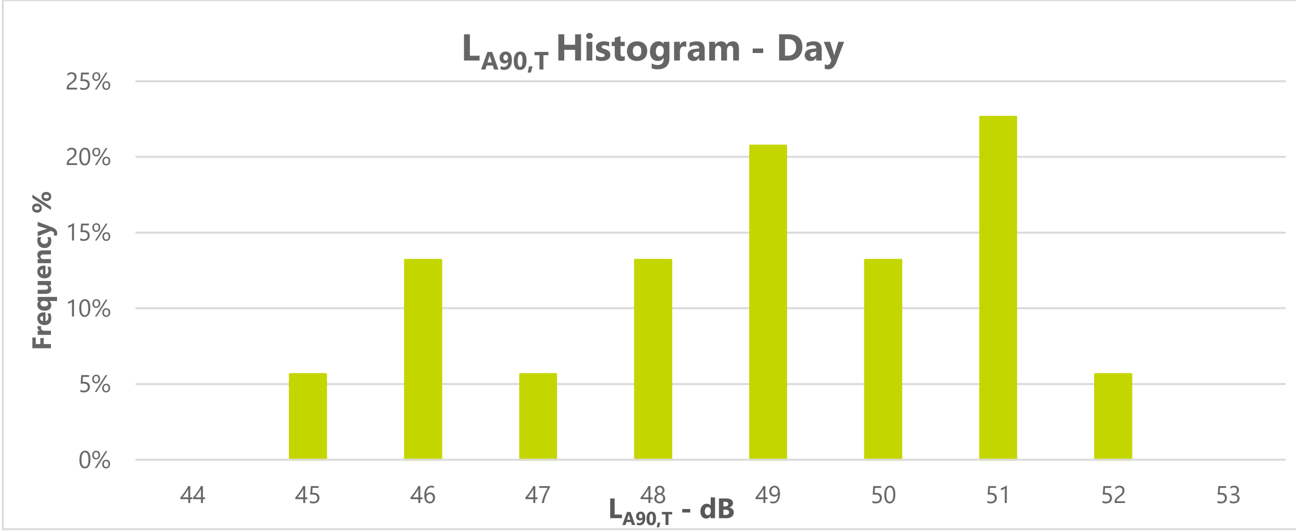


Figure 3—2 Modal analysis of daytime background levels at LT1

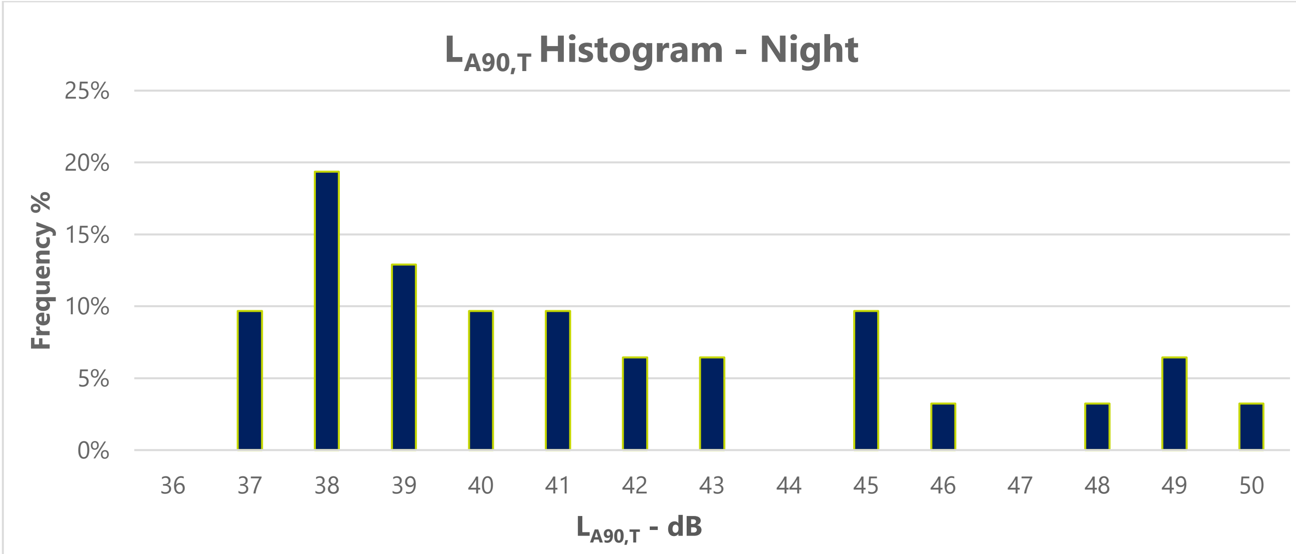


Figure 3—3 Modal analysis of night-time background levels at LT1

Table 3—4 Quantifying the road noise shielding effect at LT1 due to the existing civic centre building and surrounding foliage

Date	Measurement	Time-period	Background $L_{A90,5mins}$ sound level (dB)	Difference between BG1 and BG2 (dB)
Tuesday 25th January 2022	**BG1**	15:47-15:52	48	**2**
	BG2	15:40-15:45	50	
Wednesday 26th January 2022	**BG1**	13:34-13:39	50	**3**
	BG2	14:06-14:11	53	
Worst-case difference between BG2 (by NSR) and BG1 (by LT1 on site)				**3**

Table 3—5 Adopted background sound level at nearest NSRs

NSR	Adopted background $L_{A90,T}$ sound level (dB)	
	Daytime (07:00-23:00)	**Night-time (23:00-07:00)**
Trinity Academy Primary	49	38
Residential dwellings on Trinity Road	52*	41*
*Calculated by applying an onerous 3 dB correction to background sound levels measured at LT1		

Figure 3—4 Summary of noise survey results across all measurement locations (Source: Google Earth)

4 Environmental Noise Modelling

4.1 Introduction

A 3D noise modelling exercise was undertaken to calculate the façade noise level across the various elevations of the proposed development. The calculated levels are used to identify areas that can be naturally ventilated and assess the sound insulation requirements of the façade, such that the acceptable internal ambient noise levels can be achieved.

4.2 Methodology

The 3D model was created using Cadna/A version 2019 acoustic software. The noise model was constructed based upon detailed OS mapping data with local infrastructure such as roads added into the model to simulate the noise sources that were present during the on-site noise survey.

The following noise mapping assumptions have been made when producing the noise models for the proposed development:

- Buildings around the proposed development were input based on Open Street Map geodata
- The outline massing proposed for the development was introduced as currently shown in the architectural proposals
    - Site boundary:
        - Proposed Site Plan (Drawing ref.: HCC-HBA-ZZ-RF_DR-A-20001 P6)
    - Building Elevations:
        - Proposed Section CC (Ref. HCC-HBA-ZZ-ZZ-DR-A-200302 P9)
- A worst-case ground absorption coefficient of 0 has been modelled (assuming hard ground). This is likely a worst-case assessment condition
- Air temperature and relative humidity have been assumed to be at typical CadnaA input levels of 10℃ and 70%. CadnaA software calculates air absorption according to ISO 9613-1:1993
- The 3D noise model has been calibrated based on noise levels as detailed in Section 3. All noise survey data has been input into the model and calibrated to positions representative of the real-world measurement position.

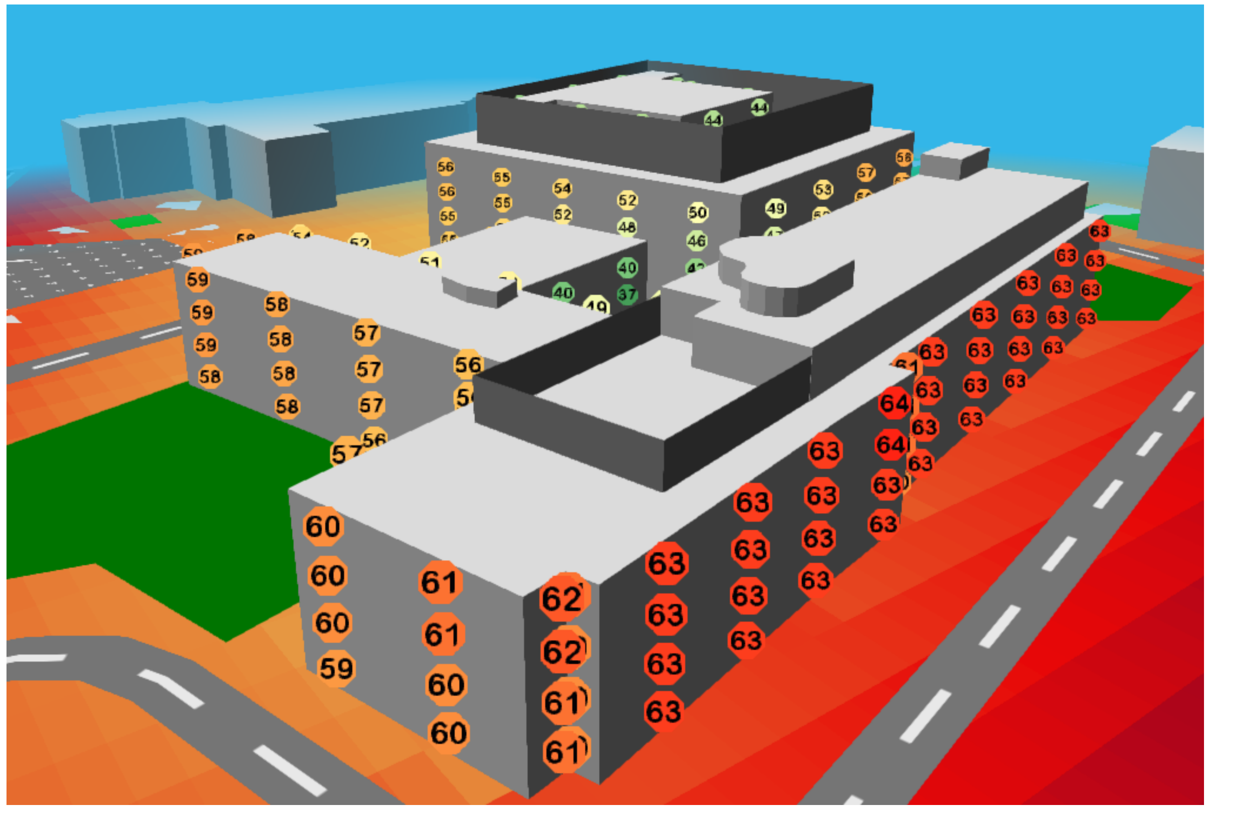


Figure 4—1 Civic Centre noise levels (south-eastern façade)

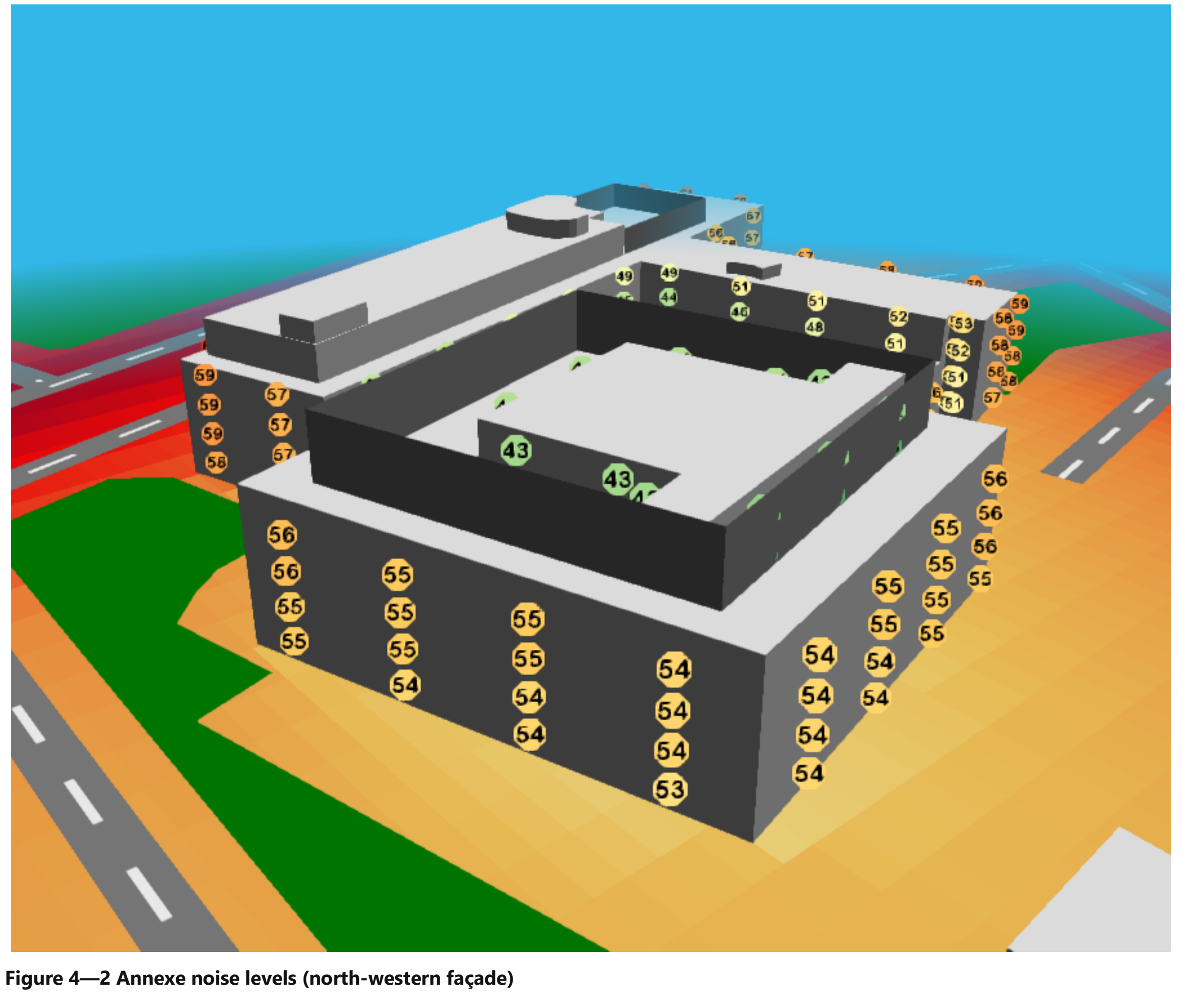


Figure 4—2 Annexe noise levels (north-western façade)

4.3 Limitations

The models have been calibrated to the noise levels measured and summarised in Section 3.3. However, this does not guarantee full accuracy of the predicted noise levels. Typically, an uncertainty within a range of approximately +/- 3 dB could be expected from computer noise modelling software. However, this uncertainty has been controlled as far as practicable by cross-referencing the levels of predicted noise impact against the spot measurements captured on site.

4.4 Results & Discussion

Figure 4—1 and Figure 4—2 highlight how noise levels across a given elevation do not vary significantly with height, except for instances where a rooftop barrier is providing shielding.

Figure 4—3 highlights how greater façade noise levels were calculated along elevations facing the A105 and A109, while quieter levels are calculated across elevations facing away from the roads. This is due to the acoustic shielding provided by the buildings.

The maximum calculated façade noise level of $L_{Aeq,T}$ 64 dB indicates that natural ventilation via operable windows without noise mitigation measures is feasible across some elevations.

Elevations with more acoustically sensitive rooms, like the civic chamber and executive office spaces, are likely to need to be mechanically ventilated to reduce environmental noise break-in. These topics are discussed in the next section.

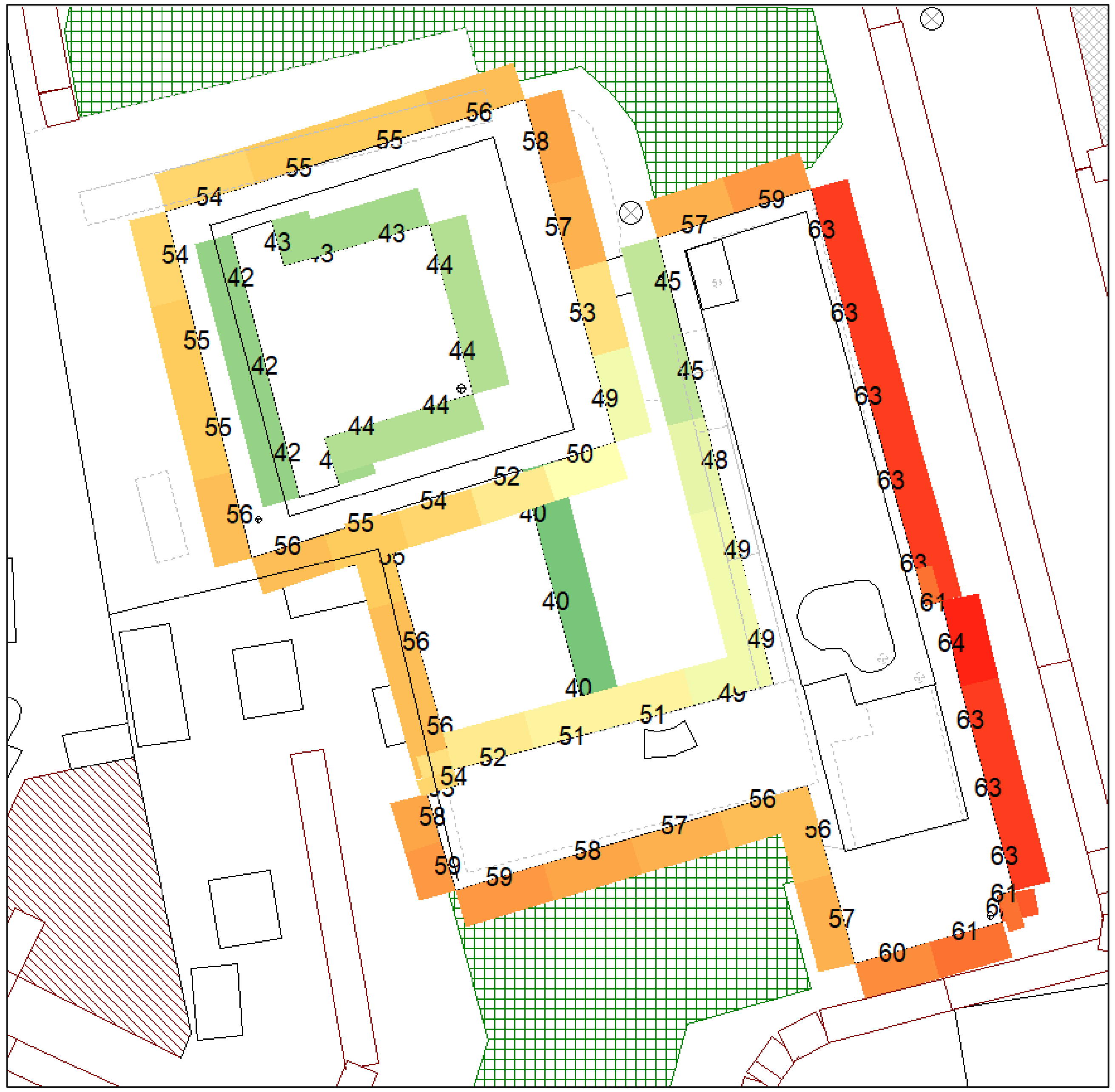


Figure 4—3 Highest Predicted Daytime Noise Levels - $L_{Aeq,T}$

5 Façade Acoustic Design & Noise Break-In

5.1 Introduction

The indoor ambient noise level (IANL) should be controlled to within acceptable noise levels to provide an acoustic environment that is suitable for the associated space.

The IANL is made up of contributions from external noise such as road traffic and airplanes, as well as internal building services noise.

The aim is to acoustically design the building such that the cumulative noise from external and internal noise sources do not exceed the IANL requirements.

The acceptable indoor ambient noise level targets are shown in Table 5—1.

5.2 Façade Design Noise Levels

Façade design noise levels are based on noise mapping calculations detailed in Section 4.4.

To simplify the façade sound insulation requirements across each building elevation, the noise levels have been broken down into "conditions" that represent a range of decibel levels.

The elevations are grouped into 2 Conditions (refer to Figure 5—1) and represent the following noise level exposures:

Condition 1: Façade exposed to noise levels of:

- Daytime: $L_{Aeq,T} \leq 59$ dB

Condition 2: Façade exposed to noise levels of:

- Daytime: $L_{Aeq,T}$ 60 - 64 dB

The greater façade noise level has then been used to calculate the façade sound insulation requirements.

Table 5—1 Acceptable indoor ambient noise levels (BS 8233:2014)

Activity	Location	Design range dB $L_{Aeq,T}$
Study and work requiring concentration	Executive office	35 – 40
	Staff/meeting room, training room	35 – 45
-	Open plan office	45 – 50
Speech or telephone communications	Corridor, circulation space	45 – 55
	Cafeteria, kitchen	50 – 55

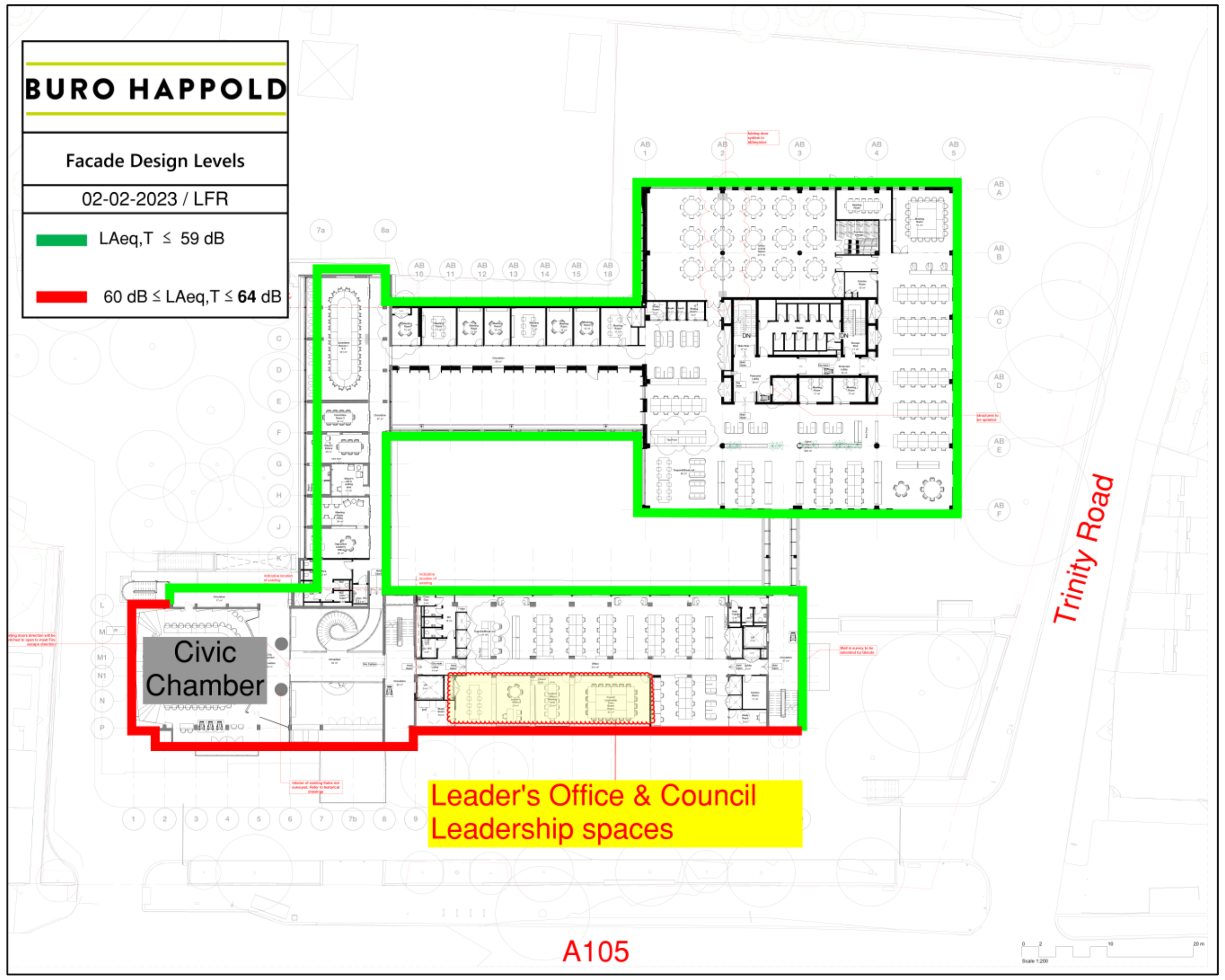


Figure 5—1 Façade design levels

5.3 Façade sound insulation requirements

5.3.1 Methodology

The façade sound insulation requirements are calculated using the façade noise levels detailed in Section 5 and the acceptable internal ambient noise levels established in Section. The façade acoustic requirements are given in terms of R, at each octave-band centre frequencies, and $R_w + C_{tr}$. These are defined as:

- **Sound Reduction Index, R** – is a measure of the sound insulating properties in a particular frequency band. In this case, the sound reduction index is given at each octave band centre frequency between 125 and 4000 Hz.
- **Weighted Sound Reduction Index, R_w** - is a single figure value which describes the standardised performance of partitions when measured in a laboratory.
- **Correction Traffic, C_{tr}** - is a single correction value applied which takes into account the urban traffic noise spectrum.

Calculation procedures follow the "more rigorous calculation method" outlined in BS 8233:2014, based on the equation shown across.

5.3.2 Calculation results

Noise break-in calculations have been carried out to define the minimum acoustic performance requirements of the proposed glazing and associated framing using the design noise levels and calculation methodology outlined above.

The acceptable IANL criteria can be achieved with glazing construction equal to or greater than the values given in Table 5—2.

It should be noted that the sound insulation requirements include the framing and components that make up the façade glazing system. Achievement of sound reduction requirements is paramount to see that the internal noise criteria is achieved. However, example glazing configurations have been provided for preliminary guidance only. An explanation of the build-ups is as follows:

- SGG = Saint Gobain Glass
- --/--/-- PVB interlayer = glass and air gap dimensions in mm including laminate layers e.g. 8 mm glass, 24 mm air gap, 8 mm glass with 1No. laminate layer
- Glass model = e.g. Saint-Gobain

In summary, Table 5—2 demonstrates that placing noise sensitive spaces in the Civic Centre along the eastern façade facing the A105 means an enhanced glazing specification is required.

Elsewhere, across all of the Annexe elevations and the remaining spaces within the Civic Centre, natural ventilation can be achieved with an open window and a typical double-glazed construction has been specified.

From experience on past projects, it is considered likely that the glazing construction will be thicker (thus provide greater sound insulation) than this standard build-up in order to meet other requirements such as thermal and structural performance requirements.

$$L_{eq,2} = L_{eq,ff} + 10\log_{10}\left(\frac{A_0}{S}10^{\frac{-D_{ne}}{10}} + \frac{S_{wi}}{S}10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S}10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S}10^{\frac{-R_{rr}}{10}}\right) + 10\log_{10}\left(\frac{S}{A}\right) + 3$$

$L_{eq,ff}$	*is the equivalent continuous sound pressure level outside the room elements under consideration*[1]
A_0	*is a reference absorption area of 10 m² and is independent of frequency*
S_f	*is the total façade area in square metres (m²) of the room in question*
S_{wi}	*is the area in square metres (m²) of the windows of the room*
S_{ew}	*is the area in square metres (m²) of the external wall of the room*
S_{rr}	*is the area is square metres (m²) of the ceiling of the room*
S	*is the total area in square metres (m²) of elements through which sound enters the room, i.e $S_f + S_{rr}$*
$D_{n,e}$	*is the insulation of the trickle ventilator measured according to BS EN ISO 10140*
R_{wi}	*is the sound reduction index (octave band value) of the window*
R_{ew}	*is the sound reduction index (octave band value) of the external wall*
R_{rr}	*is the sound reduction index (octave band value) of the roof/ceiling*
A	*is the equivalent absorption area of the receiving room being considered*
3	*is a correction factor*

Table 5—2 Worst-case façade sound insulation requirement

Glazing Condition	Sound reduction indices (dB) at octave-band centre frequencies (Hz)						$R_w + C_{tr}$ – dB	Example glazing construction
	125	250	500	1K	2k	4k		
Condition 1	21	17	25	35	37	31	25	4mm / 20mm / 4mm
Condition 2	24	25	31	42	44	49	32	SGG 6mm / 12mm / 6.4mm (Stadip Silence)

[1] It is the free-field sound level (i.e. in the absence of the façade), measured or estimated at the intended position of the element under consideration. It is related to the level $L_{eq,1}$ measured within a few millimetres of the actual façade by the relation $L_{eq,ff} \approx L_{eq,1} - 6$, and to the level $L_{eq,2m}$ measured 2 m away from the façade by the relation $L_{eq,ff} \approx L_{eq,2m} - 3$As s

6 Plant Noise Break-Out

6.1 Introduction

The following section details the plant noise limits for controlling noise break-out to nearby NSRs, to see that the operation of new plant does not compromise the acoustic amenity of the surrounding area. The limits for plant noise break-out are established by the Local Planning Authority and are based on background noise level measurements at a location that is considered representative of the nearest NSR.

At this stage, specific plant selections have not been finalised. The most robust method of controlling noise output will be to set limiting noise levels for fixed plant and activity at nearby NSRs.

6.2 Noise Sensitive Receptors

The following noise-sensitive receptors have been identified:

- NSR 1 – Residential receptor located approximately 35 m north of the development site
- NSR 2 – School receptor located approximately 35 m west of the development site

6.3 Plant Noise Targets

A critical aim of local policies is to protect the acoustic amenity of existing noise-sensitive development when a new development is proposed. Concerning the NSPE, the term closely related to the Council's objective is:

- **Lowest Observed Adverse Effect Level (LOAEL)** - The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than the LOAEL should see that any adverse effects on health or quality of life are negligible.

A target design criterion that should achieve (LOAEL) at nearby NSR's is:

> *Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise-sensitive location*

BS 4142:2014+A1:2019, requires penalty corrections to the noise source for acoustically distinguishable features (rating levels). They are cumulative levels that apply to all plant items operating simultaneously – individual items may need to be attenuated to less than these values to achieve the cumulative level. Therefore, if the selections include fixed plant with tonal, impulsive, or intermittent noise features, these limits would reduce accordingly.

It should be noted that the compliance with the above should see compliance with BREEAM Pol 05 acoustic credit by default.

The typical background sound level measured at the identified NSRs, and their respective Rating Level target are shown in the following tables.

Figure 6—1 Nearby identified NSRs

Table 6—1 Plant noise limit at NSR – Day-time (07:00 – 23:00)

NSR	Typical background sound level – $L_{A90,T}$ dB	Below the typical background level $L_{A90,T}$ - dB	Rating Level – $L_{Ar,Tr}$ - dB
Trinity Primary Academy	49	-5	44
Residential dwellings on Trinity Road	53	-5	48

Table 6—2 Plant noise limit at NSR – Night-time (23:00 – 07:00)

NSR	Typical background sound level – $L_{A90,T}$ dB	Design criteria - dB	Rating Level – $L_{Ar,Tr}$
Trinity Primary Academy	38	-5	33
Residential dwellings on Trinity Road	41	-5	36

6.4 Discussion and Implications

Compliance with these limits should show that noise at nearby residential properties is likely to have a low impact, and is therefore, unlikely to generate complaints from existing residents regarding any newly-created noise associated with the development. Individual plant items may need to be designed to a lower limit such that the overall total achieves the stated criteria above.

Final plant selections have not been made; however, the following main pieces of equipment are proposed:

Annexe

- 3 x chillers - rooftop
- 2 x Air handling units - rooftop
- Various pumps – rooftop plant room

Civic Centre

- 1 x Air handling unit
- Toilet extract fans
- Heat recovery units

In addition to selecting low-noise plant items, other noise mitigation measures might be necessary to meet the proposed noise limits. These could include but are not limited to atmosphere-side attenuators and noise barriers.

Examples are shown in the figures across. The selections shall be made at the further design stages once the proposed plant is known.

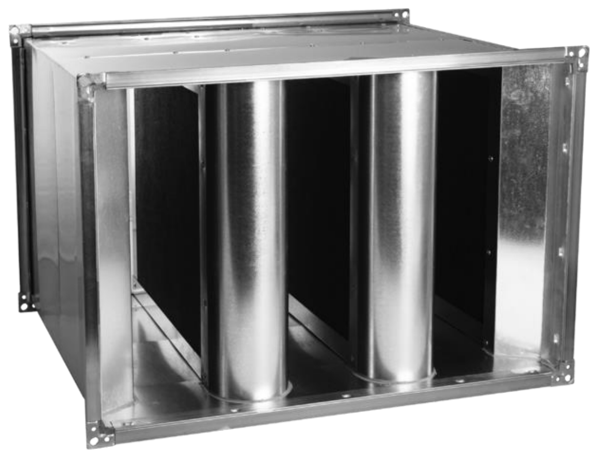


Figure 6—2 Rectangular attenuator

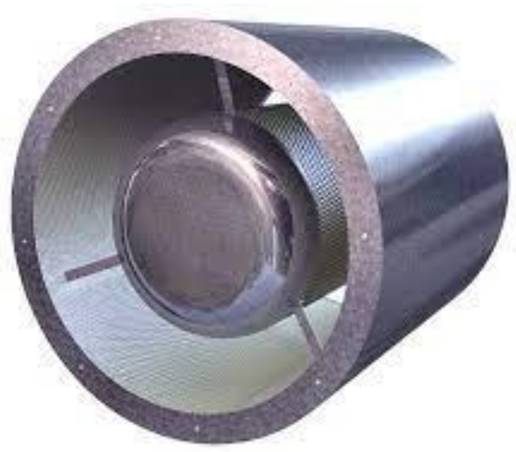


Figure 6—3 Circular attenuator

Figure 6—4 Mechanical plant noise barriers

Figure 6—5 Chiller attenuation package

7 Conclusion

It is concluded that the proposed Harigney Civic Centre development be suitable in terms of internal acoustic conditions and the development's noise impact on sensitive receptors.

Environmental noise survey work was conducted to capture survey data on the various noise sources impacting the site. The noise survey information has been used to inform the calibration of sources within the 3D acoustic model.

The required sound insulation performance of external glazing throughout the development has been calculated from façade incident noise levels calculated in the 3D acoustic model, so that suitable internal conditions can be achieved in line with BS 8233:2014.

To reduce noise breakout from Haringey Civic Centre (associated with building services plant noise), target fixed plant noise level criteria are proposed. Noise targets have been set to control the combined noise from building services to the following Rating level:

Trinity Primary Academy

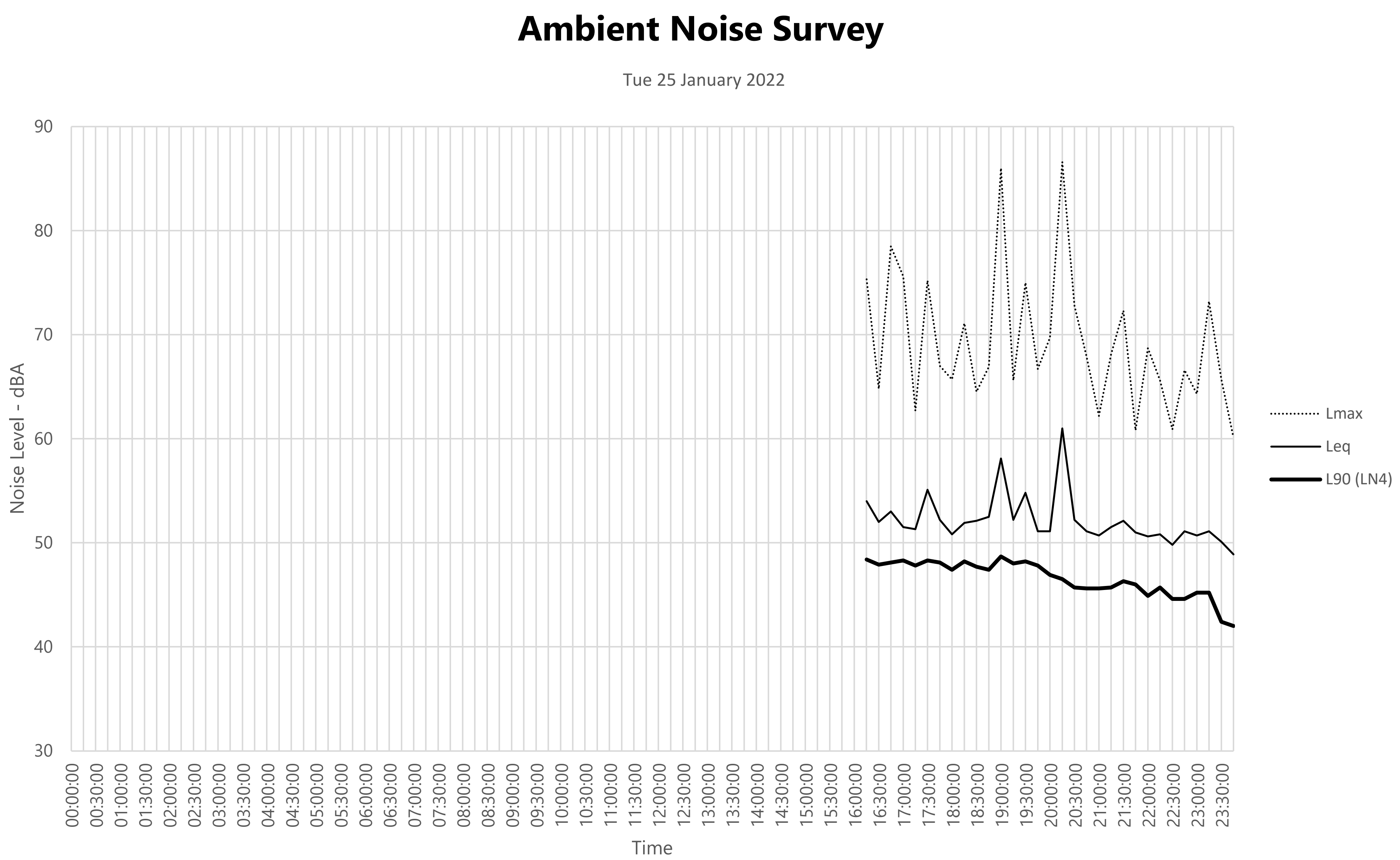
- $L_{Ar,Tr}$ 44 dB during daytime periods (07:00 – 23:00 hours)
- $L_{Ar,Tr}$ 33 dB during night-time periods (23:00 – 07:00 hours)

Residential dwellings on Trinity Road

- $L_{Ar,Tr}$ 48 dB during daytime periods (07:00 – 23:00 hours)
- $L_{Ar,Tr}$ 36 dB during night-time periods (23:00 – 07:00 hours)

Based on the above, noise is not considered to form a barrier to development.

Appendix A Noise Survey Data


Ambient Noise Survey
Tue 25 January 2022
Noise Level - dBA
90
80
70
60
50
40
30
Time
00:00:00
00:30:00
01:00:00
01:30:00
02:00:00
02:30:00
03:00:00
03:30:00
04:00:00
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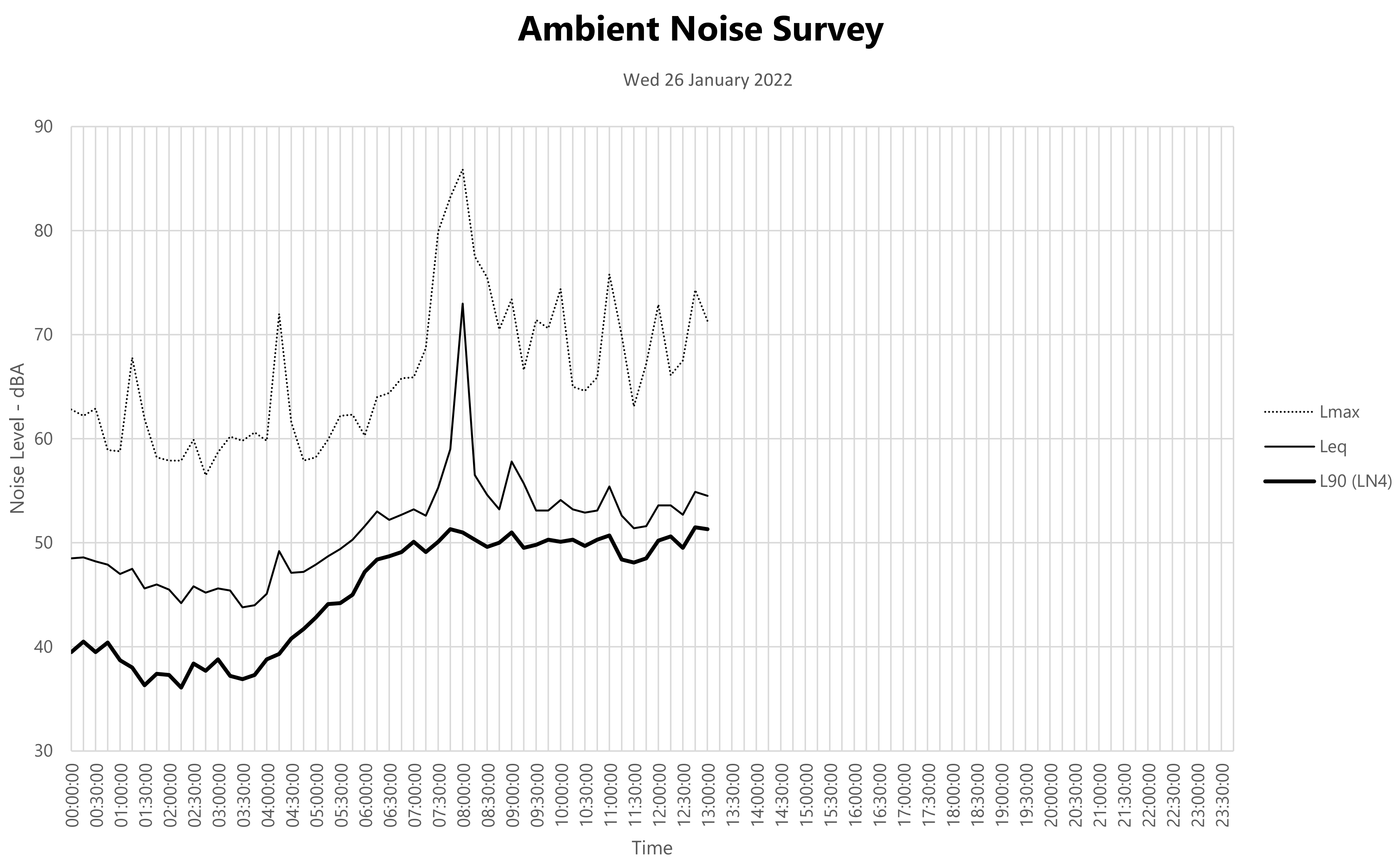
23:30:00
Lmax
Leq
L90 (LN4)



Ambient Noise Survey
Wed 26 January 2022
90
80
70
60
50
40
30
Noise Level - dBA
Time
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01:00:00
01:30:00
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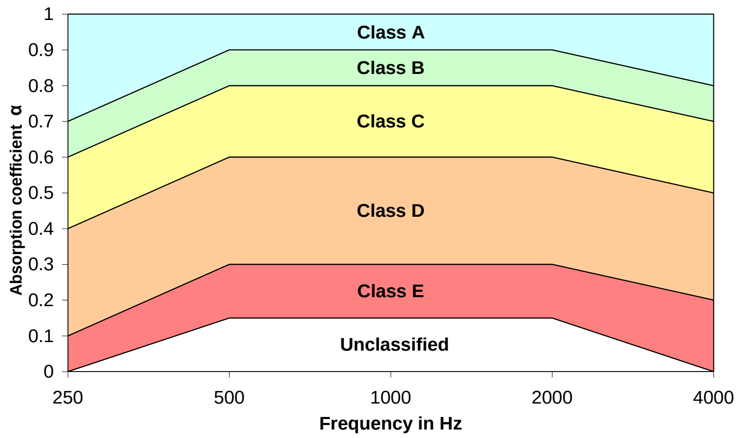
23:30:00
Lmax
Leq
L90 (LN4)

Appendix B Acoustic Glossary

Term	Definition
α (α_w)	Sound Absorption Coefficient (Weighted Sound Absorption Coefficient) is a measure of the effectiveness of materials as sound absorbers as defined in BS EN ISO 11654:1997. It is the ratio of the sound energy absorbed or transmitted (i.e. not reflected) by a surface to the total sound energy incident upon that surface. The value of the coefficient varies from 0 (perfect reflector) to 1 (perfect absorber).
A (A_T)	Absorption Area (Total Absorption Area) is equal to the product of multiplying the surface area of a construction (in m^2) and its Sound Absorption Coefficient (α).
Ambient Noise (as defined in BS 4142:2014+A1 2019)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.
Background Noise (as defined in BS 4142:2014+A1 2019)	A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using the Fast time weighting and quoted to the nearest whole number of decibels.
C_{tr}	Spectrum adaptation term calculated using traffic noise as described in BS EN ISO 717-1:2013. This term is provided with weighted single values such as $D_{nT,w}$ or R_w to match with particular requirements (building acoustic or traffic noise spectrum).
Decibel, dB	Decibel (dB) is a dimensionless unit commonly used to demonstrate sound levels. It is derived from the logarithm of the ratio between the measured level and the reference value. For sound pressure level (L_p) the reference value is $2x10^{-5}$ pascals. For sound power (L_w) reference value is $1x10^{-12}$ Watts.
$D_{n,f,w}$	The weighted transmission of sound energy from a source room to a receiving room via structural (vibrational) paths in the construction mainly, e.g. walls, floors, ceilings.
$D_{nT,w}$	The Weighted Standardised Level Difference ($D_{nT,w}$) is defined in BS EN ISO 140-4:1998 (superseded by BS EN ISO 16283-1:2014+A1:2017 but still cited in The Building Regulations) BS EN ISO 717-1:2013. This performance describes the installed site performance of the composite separating constructions, including the partition element performance, the flanking path transmission and the reception room reverberation time factors. $D_{nT,w}$ target leads to a selection of adequate construction elements and methods to build the partition that are rated using weighted sound reduction index R_w. It is typically standardised to a reverberation time (T_0) of 0.5 seconds. In the instance of testing in schools, T_0 is taken as the room's T_{mf}.
D_w	Weighted Level Difference: Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions
Flanking Noise	The transmission of sound around the perimeter or through holes within partitions (or barriers) that reduces the otherwise obtained sound transmission loss of a partition. Examples of flanking paths within buildings are ceiling plenum above partitions or raised floor cavities, ductwork, piping, and electrical conduit penetrations through partitions, back to back electrical boxes within partitions, window mullions, etc.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
IANL	Indoor Ambient Noise Level. For schools Table 1 in BB93 (2015) specifies the upper limit for indoor ambient noise levels within teaching areas. The design criteria is set for a 30-minute average level (i.e. $L_{Aeq,30mins}$). However, where there is negligible change in the noise level, BB93 states that a much shorter time period (e.g. $L_{Aeq,5min}$) can be used. BB93 also states that for rooms identified having limits of $L_{eq,30min}$ 35 dBA or less, the noise should not regularly exceed $L_{1,30min}$ 55 dBA.
$L_{90,T}$ ($L_{A90,T}$)	Sound pressure level exceeded for 90% of the measurement period. Referred to as background noise level.
$L_{Ar,T}$	Rating Noise Level (as defined in BS 4142:2014+A12019), the specific noise level plus any adjustment for the characteristic features of the noise.
$L_{eq,T}$ ($L_{Aeq,T}$)	The equivalent continuous noise level of a time-varying noise. It is the steady noise level which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
$L_{Fmax,T}$ ($L_{AFmax,T}$)	The maximum sound pressure level measured during the measurement period T using the fast time constant.
$L'_{nT,w}$	Weighted Standardized Impact Sound Pressure Level: a single-figure value of impact sound insulation performance. This European index is described in BS EN ISO 140-7:1998 (superseded by BS EN ISO 16283-2:2015 but still cited in The Building Regulations) and BS EN ISO 717-2:2013, used for comparing and rating floors and based on the values of L'_{nT} at different frequencies. L'_{nTw} target leads to a selection of adequate construction elements and methods to build the floor that are rated using weighted normalized impact sound pressure level $L_{n,w}$. The lower the $L'_{nT,w}$ the better the performance
$L_{n,w}$	Weighted Normalized Impact Sound Pressure Level: European single figure rating for transmission loss of impact sound through building elements as described in BS EN ISO 10140-3:2010+A1:2015 and BS EN ISO 717-2:2013. The lower the $L_{n,w}$ the better the performance.
L_p	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure ($2x10^{-5}$ pascals). The reference pressure shall be explicitly stated and is defined by standard.
Noise Rating (NR)	Curves developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. These can be compared to NC curves and also can be approximated to equivalent dBA levels.
Reverberation Time (RT)	Time required for the steady sound pressure level in an enclosed space to decay by 60 dB, measured from the moment the sound source is switched off. Reverberation time is described in ISO 354:2003.
R_w (C, C_{tr})	Weighted Sound Reduction Index: Single-figure value of sound reduction according to BS EN ISO 10140-2:2010 used for rating partition systems, door-sets or glazing, based on the values of sound reduction index R at different frequencies. The higher the R_w the better the performance.
SEL (L_{AE})	Single Event Level: The sound level over one second which would have the same energy content as the whole event.
Sound absorption classes	Sound absorption performance characteristics are defined by a class. Below is a diagram of the different classes of absorption available, taken from BS EN ISO 11654:1997. The y-axis is the absorption coefficient of the material with one being total absorption and zero being no absorption. The x-axis is the frequency of the sound. 
Specific Noise Level (as defined in BS 4142:2014+A1 2019)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
T_{mf}	Mid Frequency Reverberation Time: Within BB93, the reverberation time criteria are set in terms of the averaged value of the 500 Hz, 1000 Hz and 2000 Hz frequency bands. The various levels for T_{mf} are

Term	Definition
	specified within Table 6 of BB93 (2015) and are generally upper limits. Usually the specified mid-frequency reverberation times are for 'finished but unoccupied and unfurnished rooms'.
Vibration	Force which oscillates about some specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm) or (rpm) and strokes per minute (spm). This is the number of oscillations which occurs in that time period. The amplitude is the magnitude or distance of travel of the force.
Weightings (as defined in BS EN 61672:2013):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.

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