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Noise Impact Assessment

Church Lane, Moston, Manchester, M9 4HW

Client Name: HAD & Co Property Consultants Ltd.

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1. Introduction

1.1 Overview

AVAL Consulting Group Limited has been commissioned to carry out a Noise Impact Assessment for the proposed development at Church Lane, Moston, Manchester, M9 4HW. The proposal is for the construction of a 28-unit residential apartment complex with an amenity area for recreational purposes, on currently disused land; alteration to external elevations, involving installation of windows and door-to-side elevation; parking, cycle and refuse storage.

Detailed site drawings are presented in Appendix B.

1.2 Objective

The planning process requires evidence from a noise impact assessment that mitigation measures can ensure that noise will remain within acceptable levels on the premises. BS:8233 guidance suggests that prior to developing a scheme, details of the measures should be considered so that internal sound levels within all habitable rooms do not exceed 35 dB(A) $L_{Aeq,16hours}$ (07:00- 23:00); and internal sound levels within all bedrooms that do not exceed 30 dB(A) $L_{Aeq, 8hours}$ (23:00-07:00).

The purpose of the noise impact assessment is to ensure that the proposed scheme and its usage are suitable for habitation in relation to the prevailing noise in the surrounding area's environment. If needed, mitigation measures to accompany the planning application will be provided.

1.3 Site Location

Figures 1.1 and 1.2 below highlight the site location. The site for the proposed construction of a residential apartment complex is located on Church Lane between Thorntree Close and Glenwood Drive. The surrounding area is predominantly residential dwellings, with a nursery and non-residential storage in the vicinity.

The closest and most predominant sources of noise are considered to be from:

- The Nursery
- The non-residential storage/ commercial building
- Traffic on Church Lane

Figure 1.1: Site location (image source: Google Maps)

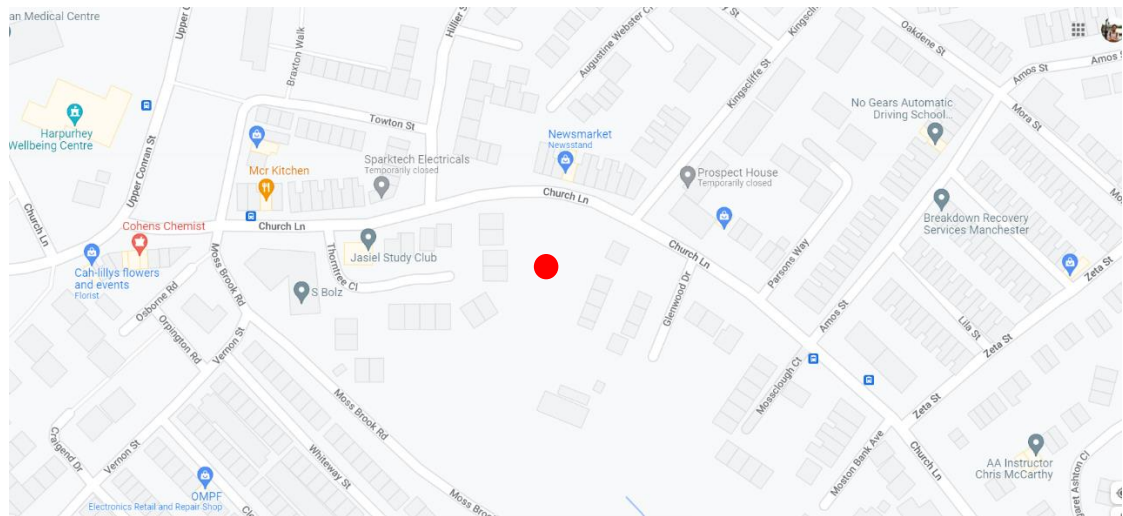


Figure 1.2: Site location (image source: Google Earth Pro)



2. Relevant Noise Standards

This section summarises all legislation, policy, statutory and non-statutory guidelines relevant to the proposed development. Furthermore, the latest regional and local planning policy guidance specifically applicable to the proposed development has been reviewed.

New residential developments are typically assessed in accordance with BS8233:2014 which incorporates world Health Organisation (WHO) Guidelines.

2.1 The 'National Planning Policy Framework (NPPF)

The updated 2021 version of the 'National Planning Policy Framework (NPPF)'¹ contains information and general guidance to Local Authorities in relation to considering and taking into account noise. The National Planning Policy Framework (NPPF) guidance reinforces that noise should be taken into account considering planning policies and decisions. Some of the guidance contained within the 'National Planning Policy Framework (NPPF)' includes the following:

- Paragraph 174e: *"...preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability..."*
- Paragraph 185a,b: *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
 - (a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life...*
 - (b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;..."*
- Paragraph 187: *Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues, and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.*

In conjunction with the 'National Planning Policy Framework (NPPF)', 'The Noise Policy Statement for England (NPSE)'², dated March 2010, states the following regarding a long-term vision of government noise policy:

¹ The National Planning Policy Framework (2021) <https://www.gov.uk/guidance/national-planning-policy-framework>

² Noise Policy Statement for England (NPSE) <https://www.gov.uk/government/publications/noise-policy-statement-for-england>

“Noise Policy Statement for England Aims:

The first aim of the NPSE:

Avoid significant adverse impacts on health and quality of life from environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development.

The second aim of the NPSE:

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development.

The third aim of the NPSE:

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development.”

In terms of the NPSE, the impact of noise can be categorised by the following terms:

- NOEL – No Observed Effect Level – The level where no effect can be detected
- LOAEL – Lowest Observed Adverse Effect Level – The level where adverse effects on health and quality of life can be detected
- SOAEL – Significant Observed Adverse Effect Level – The level where significant adverse effects on health and quality of life may occur.

The NPSE further states that:

“It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors, and at different times.”

No specific guidance is detailed or given in the ‘National Planning Policy Framework (NPPF)’, or ‘The Noise Policy Statement for England (NPSE)’ in terms of acceptable acoustic criteria/noise criteria in order to achieve the ‘NOEL, LOAEL or SOAEL’. Therefore, it is considered necessary to refer to alternate national guidance, preferably standardised or regulated such as an appropriate British Standard (BS), or in the absence of this, alternate World Health Organisation (WHO) guidelines, etc.

2.2 WHO ‘Guidelines for Community Noise’

Where noise is assessed against the ‘Absolute Level’, then this can be split into separate daytime and night-time legislation. The WHO ‘Guidelines for Community Noise’ state in 4.2.7 “Annoyance Responses” that:

“During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10 dB lower than during the day....”

The guidance goes on to provide a daytime³ internal acoustic criteria relative to critical health effect(s) that of 35 dB $L_{Aeq,16\text{ hour}}$, and a night-time⁴ level of 30 dB $L_{Aeq,8\text{ hour}}$ / 45 dB L_{AFmax} linked with dwelling indoors. Therefore, assuming a maximum external noise level of 50 dB $L_{Aeq,t}$ during the daytime, (considering a 15 dB reduction in noise via a partially open window) an internal noise level of 35 dB $L_{Aeq,t}$ should be achieved.

During the night-time periods, a further publication; WHO Night Noise Guidelines For Europe⁵ published in 2009 states that:

“Below the level of 30 dB $L_{night,outside}$, no effects on sleep are observed except for a slight increase in the frequency of body movements during sleep due to night noise. There is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night,outside}$ are harmful to health. However, adverse health effects are observed at the level above 40 dB $L_{night,outside}$, such as self-reported sleep disturbance, environmental insomnia, and increased use of somnifacient drugs and sedatives. Therefore, 40 dB $L_{night,outside}$ is equivalent to the LOAEL for night noise..... The LOAEL of night noise, 40 dB $L_{night,outside}$, can be considered a health-based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.”

Therefore, where absolute levels need to be referenced, a maximum daytime noise limit of 50 dB $L_{Aeq,t}$ can be considered, with the LOAEL for night of 40 dB $L_{night,outside}$ being considered.

2.3 IEMA (Institute of Environmental Management & Assessment)

IEMA also defines the sensitivity of receptors according to the table below

Very Substantial	Greater than 10 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise
Substantial	Greater than 5 dB L_{Aeq} change in sound level at a noise-sensitive receptor, or a 5 to 9.9 dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise
Moderate	A 3 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5 dB L_{Aeq} change in sound level at a receptor of some sensitivity
Slight	A 3 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity
None/Not Significant	Less than 2.9 dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

Table 2.1 Effect Descriptors (Guidelines For Environmental Noise Assessment, 2014)

2.4 The British Standard 8233: Sound Insulation and Noise Reduction for Buildings/Code of Practice

BS 8233: Sound Insulation and Noise Reduction for Buildings/Code of Practice provides the acceptable noise levels. Table 4 of British Standard BS 8233 reproduced below (Table 2.1) provides appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

³ daytime is typically between 07:00 h and 23:00 h.

⁴ night-time is between 23:00 h and 07:00 h.

Activity	Location	07:00 to 23:00 (Day Time)	23:00 to 07:00 (Night Time)
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ hour}}$	-
Dinning	Dining Room/area	40 dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$

Table 2.2: British Standard recommended indoor noise levels for dwellings (Source: British Standard BS: 8233)

In addition, the WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009 makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax} . The number of individual noise events should also be taken into account and the WHO guidelines suggest that indoor noise levels from such events should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night. The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces, and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq} .

BS 8233 further states that “The noise level in any hotel bedroom, with windows closed, from all external sources, including road, rail and air traffic and noise from activities outside the hotel and any adjacent premises, are to be within the range of average noise levels in Table H3.

Table H.3 Indoor ambient noise level ranges for hotel bedrooms

Period	Noise level
Daytime (07:00 – 23:00 hrs)	30 – 40 dB $L_{Aeq, 1 \text{ hour}}$
Night-time (23:00 – 07:00 hrs)	25 – 35 dB $L_{Aeq, 1 \text{ hour}}$
Night-time (23.00 – 07.00 hrs)	45 – 55 dB L_{Amax}

3. Noise Surveys

3.1 Overview

This section provides the details of the methodological approach taken to assess the prevailing acoustic environment at the site where new noise-sensitive receptors (residential units) will be introduced. To establish the current acoustic environment and the monitoring of noise levels at the site, the noise key indicators namely L_{Aeq} , L_{A90} , L_{Amax} , have been used where appropriate and are described in Appendix A.

3.2 Noise Monitoring Location

Background noise was monitored at the locations shown in Figure 3.1, positioned 2 meters from the fencing walls. These locations were chosen for monitoring as they capture ambient noise from Church lane, as well as the commercial space south of the site and nursery on the east façade and accurately represent the prevailing noise levels in the area.

These monitors were placed at least 3.5m meters from any surrounding objects, so the devices were considered to be in a free-field configuration. All measurements were carried out in conjunction with BS7445 parts1 & 2.

Figure 3.1 Noise Monitoring Location (Image source: Google Earth Pro)



3.3 Noise Survey Periods

The noise survey was carried out for a period of 24 hours in 1 second intervals, capturing the prevailing noise environment for a full day-time and night-time period.

Table 3.2 Noise Survey Periods

Measurement Location	Start Date	Start Time	End Date	End Time
1	18/05/22	10:55	19/05/22	11:54
2	18/05/22	11:04	19/05/22	12:09

3.4 Details of Noise Monitoring Equipment

The details of the equipment used for noise monitoring have been tabulated below. The sound level meter used for this survey is a Class 1 device which has been laboratory calibrated, as well as field calibrated on site before and after monitoring (no calibration drift was recorded). Calibration certificates are attached in Appendix E.

Table 3.3 Noise Equipment Details

Equipment	Serial Number	Calibration Certificate Issued
BSWA Class 1 308 Sound level meter	580273	02.01.22
BSWA Class 1 308 Sound level meter	570134	20.01.22
BSWA Class 1 CA111 Calibrator (UKAS)	550282	23.07.21

3.5 Weather Conditions

The weather conditions throughout this survey period are suitable for the measurement of environmental noise in accordance with BS7445: Description and Measurement of Environmental Noise.

Table 3.4 Meteorological conditions during the survey (Source: Worldweatheronline Southall)

Variable	Condition
Wind	5.0 m/s Maximum
Cloud cover	67% Average
Precipitation	1.7 mm

Temperature	20C Max 9C Min
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4. Noise Survey Results

4.1 Ambient noise results

Daytime noise levels between 07:00 – 20:00 were relatively consistent and as expected for the location, with levels gradually dropping off into the later evening hours. The lowest noise levels were observed between 01:00 and 04:00.

A full graph of the results (presented in 5-minute intervals) is presented in Figure 4.2 and Figure 4.3, with the night-time LA_{Fmax} values (presented in 1-minute 'event' intervals) isolated in Figure 4.3 and Figure 4.4.

A summary of the single-figure day-time and night-time survey levels can be seen below.

Table 4.1 Summary of Noise Results

	MONITOR 1		MONITOR 2	
Indicator	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)
L_{Aeq}	56.4	48.9	55.7	47.7
L_{A90}	55.0	51.9	58.7	50.8
L_{A10}	43.3	33.3	46.2	37.0
L_{AFmax}	80.5	77.8	83.0	72.1

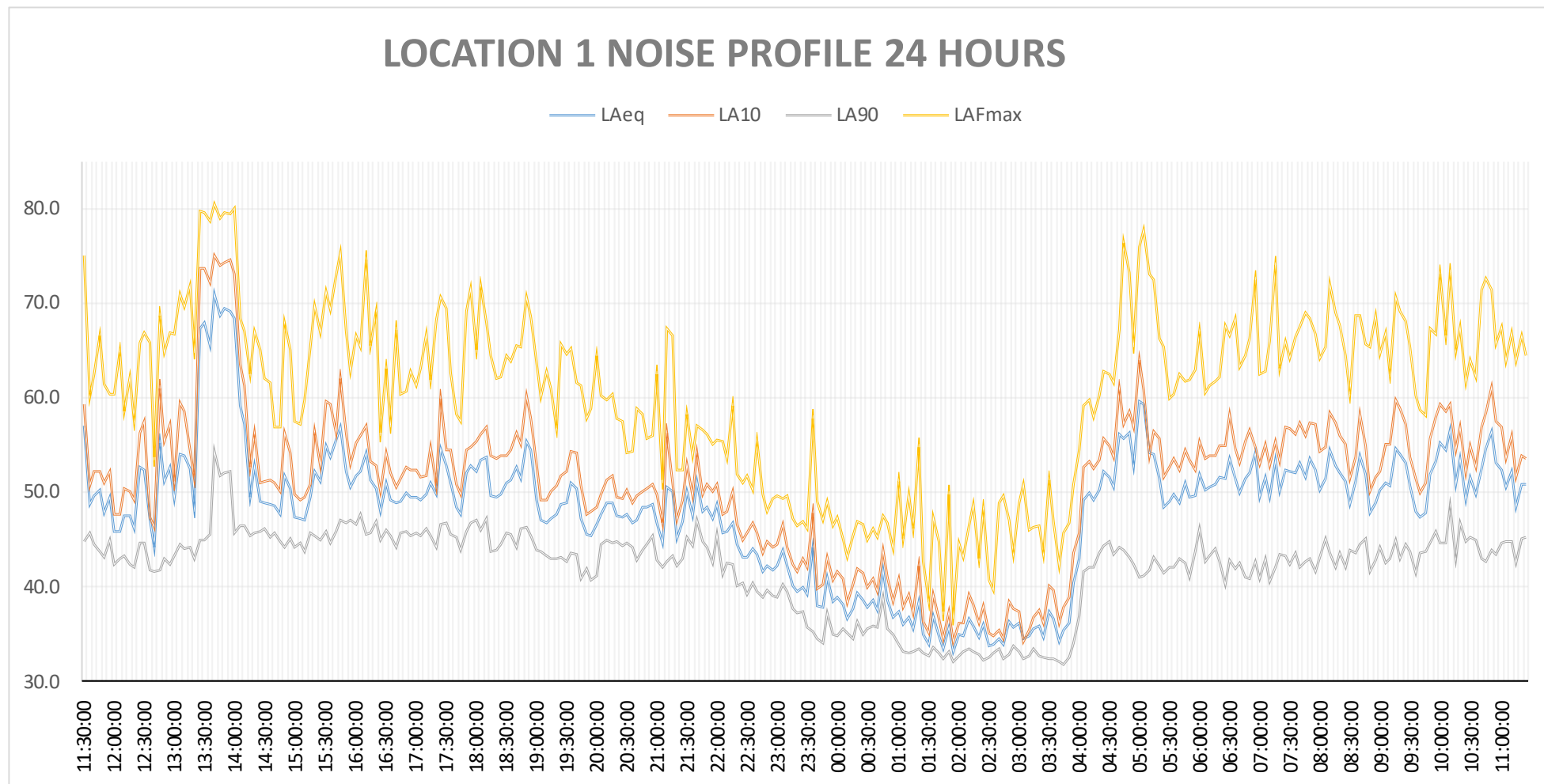


Figure 4.2 Location 1 Noise profile 24 hours, 5 min intervals

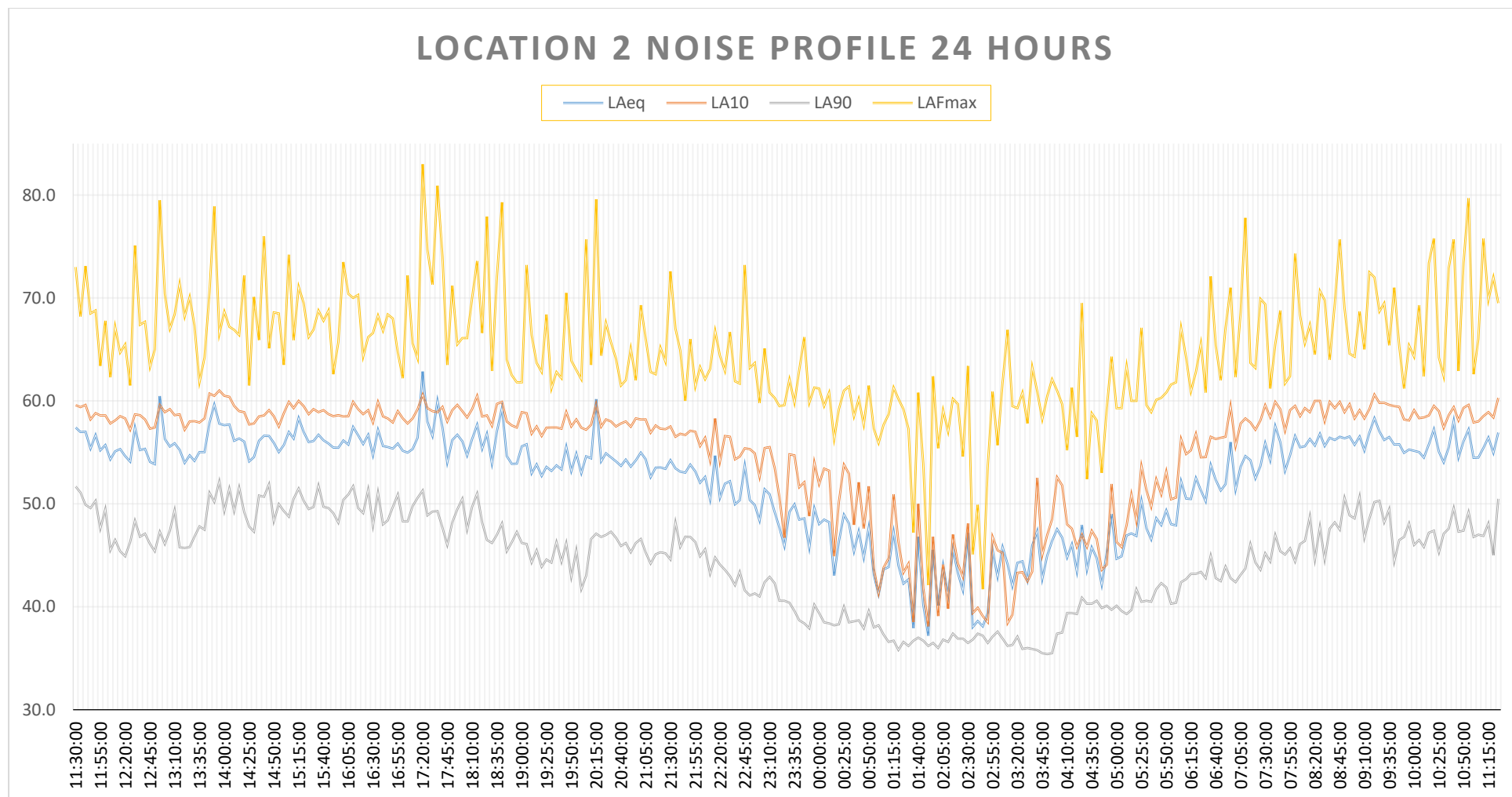


Figure 4.3 Location 2 Noise profile 24 hours, 5 min intervals

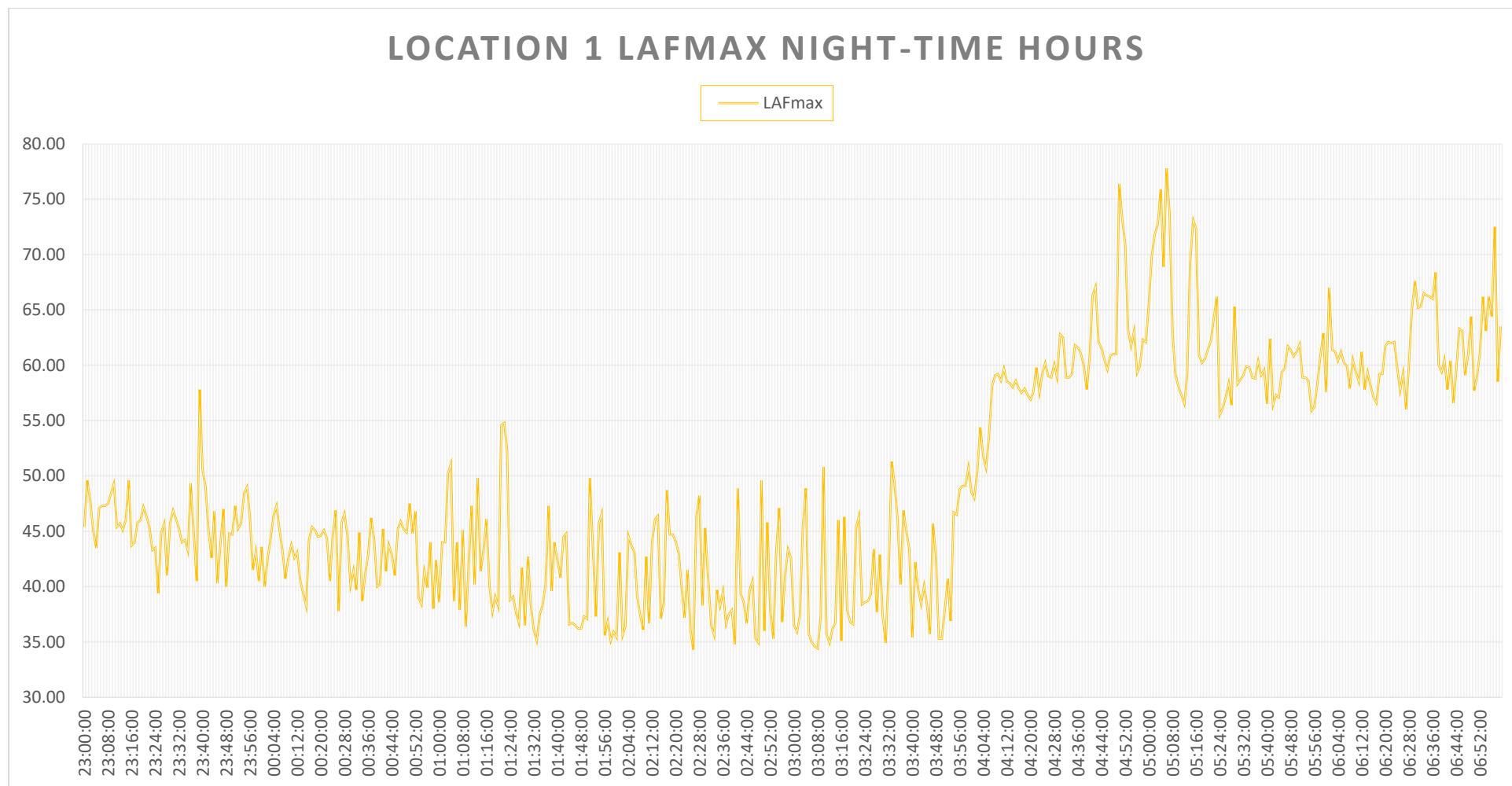


Figure 4.4 Location 1 Night-time Noise profile LAFmax values 1 minute 'event' interval

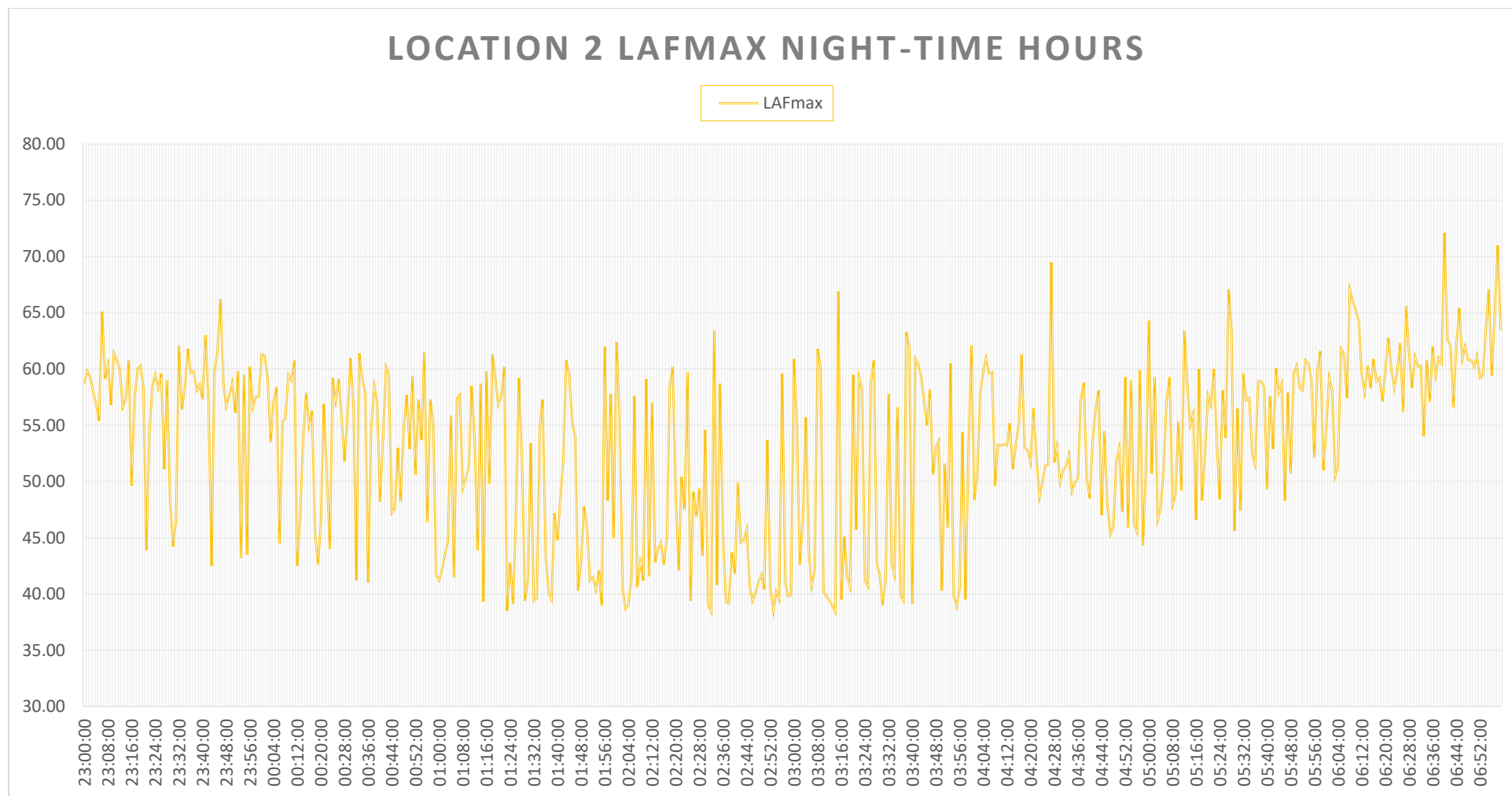


Figure 4.5 Location 2 Night-time Noise profile LAFmax values 1 minute 'event' interval

5. Noise Impact Assessment

The predicted external noise levels have been compared with the WHO, BS:8233 to derive the required noise reduction of façade/windows.

The internal target levels for bedrooms are based on guidelines laid out by BS:8233

- Day-time (07.00-23.00 hrs): 35dB(A)
- Night-time (23.00-07.00 hrs): 30dB(A)

5.1 Noise Impact of External Noise (South side/ Monitor 1)

Referring to Section 4 of this Report and considering the nature of the noise from the external surroundings, it was deemed appropriate to compare the target values mentioned above to the L_{Aeq} (Daytime), L_{Aeq} (Night-time), and L_{Amax} (Night-time) values.

It was found that a minimum attenuation level of $56.4 - 35 = 21.4$ dB is required during daytime and a minimum attenuation of $48.9 - 30 = 18.9$ dB during the night- time.

ProPG and the WHO community noise guidelines also recommend that the peak noise in bedrooms should not exceed 45 dB L_{Amax} more than 15 times per night. Pro PG mentions that "A site should be regarded as high risk if the $L_{Amax,F}$ exceeds, or is likely to exceed 80 dB more than 20 times a night. It further states that behavioural awakening (sleep disturbance) is likely to occur where the maximum sound level at the façade of a building with partially open windows is above

- 85 dB $L_{Amax,F}$ (where the number of events exceeding this value is ≤ 20); or
- 80 dB $L_{Amax,F}$ (where the number of events exceeding this value is > 20).

Based on the L_{Amax} graph showing individual 1 minute events (refer to Section 4.1 of this report), it can be determined that the maximum night-time values and number of occurrences referred to by the Pro PG (80 - 85 dB) have been not been exceeded. Based on the full night of data, it is unlikely that these levels would be exceeded more than 15-20 times per night and as such would not be deemed high risk.

Based on the night-time L_{AFmax} value recorded (refer to L_{AFmax} graph in Section 4), it was found that a minimum attenuation level of $77.8 - 45 = 32.8$ dB is required to meet these criteria.

Therefore, on the overall, a minimum noise attenuation of 32.8 dB(A) is required to account for a worst-case scenario.

To ensure robust mitigation, it is proposed that all of the proposed building facades and windows on the South facade should have a minimum acoustic performance of 32.8 dB (A).

5.2 Noise Impact of External Noise (North side/ Monitor 2)

It was found that a minimum attenuation level of $55.7 - 35 = 20.7$ dB is required during daytime and a minimum attenuation of $47.7 - 30 = 17.7$ dB during the night- time.

Based on the night-time L_{AFmax} value recorded (refer to L_{AFmax} graph in Section 4), it was found that a minimum attenuation level of $72.1 - 45 = 27.1$ dB is required to meet these criteria.

To ensure robust mitigation, it is proposed that all of the proposed building facades and windows on the North and East facade should have a minimum acoustic performance of 27.1 dB (A).

5.3 Noise Impact on Outdoor Amenity Areas (Gardens)

BS 8223 states that "For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited".

Based on the monitored data in Section 4 of this report, it was found that the prevailing daytime noise levels were 57dB (accounts for a worst-case scenario). BS8233 states sets an upper limit of 55dB for outdoor amenity areas. Based on the recorded values, it was found that the prevailing noise levels is 2dB over the recommended limits. However, based on IEMA and NPSE guidelines, this can be considered as insignificant and categorised as NOEL, (no observed adverse effect). Therefore no additional mitigation measures have been recommended.

6. Proposed Mitigation Measures

Mitigation measures need to be in place to minimise the potential negative impacts in order to ensure that the internal noise limits are achieved, we would recommend the following scheme of mitigation measures as outlined below.

6.1 Non-Glazed Elements

It is currently understood that non-glazed building façade elements of the proposed development are comprised of masonry and will be retained.

As deduced in section 5 of this report and to ensure robust mitigation, it is proposed that all external non-glazed elements of the building façade should be able to provide a sound reduction performance of at least **33 dB**.

This should be easily achieved as part of the Building Regulations 2010 requirements (see Appendix D), which require a **minimum performance of 43 dB ($D_{nT,w} + C_{tr}$)** for external facades.

6.2 Glazed Elements

6.2.1 Façade facing South

It is proposed that any glazed element located on the building facades facing South should have an acoustic performance of at least **33 dB(A)**. Examples of glazing configurations to achieve this performance are included in Appendix C.

6.2.2 Façade facing North

It is proposed that all glazed elements on the building facades facing North should have an acoustic performance of at least **27 dB(A)**. Examples of glazing configurations to achieve this performance are included in Appendix C.

6.3 Separating Floors

In order to protect the amenity of occupiers between the ground and first-floor units, the separating floor/ceiling/wall structures including the communal entrance should be enhanced 5 dB above the recommended Building Regulations 2010 requirements for Purpose Building Dwelling-Houses and Flats. This will require a minimum airborne acoustic performance of **48 dB ($D_{nT,w} + C_{tr}$)** and a maximum impact insulation performance of **54 dB ($L'_{nT,w}$)**. It is understood that the above-mentioned requirements will be achieved with the proposed separating floor design (refer to Appendix C).

6.4 Ventilation Strategy

From the findings in the noise survey, the prevailing L_{Aeq} levels were measured as below.

Table 6.1 L_{Aeq} levels at the noise monitoring location

	LOCATION 1		LOCATION 2	
Indicator	Daytime dB(A)	Night-time dB(A)	Daytime dB(A)	Night-time dB(A)
L_{Aeq}	56.4	48.9	55.7	47.7

In reference to Table 3.2 of The “Acoustics Ventilation and Overheating Residential Design Guide” (See Appendix E), it was found that the risk category (for a level 1 assessment) is **low during the daytime and medium during the night-time**.

It is to be noted that, as per BS 8233, “If partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB, resulting in

the target levels being exceeded. However, windows may still be openable for rapid or purge ventilation, or occupant's choice."

It is therefore recommended that **acoustic trickle vents that have attenuation characteristics ≥ 33 dB, $D_{n,e,w}$** (see Appendix C for examples) should form part of the design for continuous ventilation and rapid purge can still be achieved through open windows as the predicted internal levels with open windows would be 33dB, which is 3dB above and considered as only having a slight adverse effect (see Section 2 of this report)

6.5 Construction Phase Mitigation Measures

6.5.2 Noise

The effects of noise can vary from a person to person. The negative impacts include a sensation of loudness, potential interference with speech communication, disturbance of work or leisure, and disturbance of sleep. It should be noted that within any neighbourhood, some individuals will be more sensitive to noise than others.

In order to assess instantaneous noise levels at any time, the instantaneous A-weighted sound pressure level, L_pA can be used. This will give an indication of the loudness and degree of speech interference from noise.

The most commonly used descriptor, however, is the equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$. The time period involved should always be stated as the figure is a mathematical average of all individual contributions of various sources during the reference period T. When assessing noise from individual events that may not always be present during a longer period L_{Aeq} , it can be useful to use a short reference period (e.g. 5min). As an alternative descriptor, the maximum sound pressure level, $L_{A(max)}$, or the one percentile level, L_{A01} , may be used.

Concerning noise levels, it is proposed that the absolute limit would be determined in accordance with BS5228-1:2009 and would be subject to an overall daytime noise limit of 75dB L_{Aeq} .

6.5.3 Vibration

The sensitivity of the human frame to vibration varies according to the axis of vibration relative to the human body (e.g. x, y, or z-axis) and the frequency of vibration. In general, except at very low frequencies, sensitivity is greater in the z-axis (i.e. head to foot). When setting vibration control targets it is reasonable to assume that people will normally be sitting or standing during the day and lying down during the night.

With an impulsive source of vibration, it is usual to measure the peak value attained from the beginning to the end of a drive. It is also usual to measure in terms of peak particle velocity (P.P.V) if the risk of damage to the building is the primary concern and there is also an interest in human reaction. If the concern is purely for human tolerance, then acceleration is the preferred parameter.

Vibrations, even of very low magnitude, may be perceptible to people and can interfere with the satisfactory conduct of certain delicate activities, e.g. operating theatres, use of very sensitive laboratory weighing equipment, etc.

Nuisance from vibration is frequently associated with the assumption that, if vibrations can be felt, then damage is consequently inevitable; however, considerably greater levels of vibration

are required to cause damage to buildings and structures than to be perceived by the human body.

Vibrations from site activities to the neighbourhood may, therefore, cause anxiety as well as annoyance and can disturb sleep, work, or leisure activities. As with noise, in any neighbourhood, some individuals will be more sensitive to vibration than others.

6.5.4 Noise and Vibration Monitoring Technology

The following factors are typically used to assess the likelihood of disturbance caused by noise and vibration generating activities.

- Site location

The relative location of a site in relation to noise or vibration-sensitive receivers will be a determining factor. The closer a site is to sensitive premises, the higher the likelihood of complaints due to noise and vibration emanating from the site.

- Ambient noise and vibration levels

It is understood that the site surrounding is generally representative of a typical busy urban mixed-use adjacent to an 'A' road. The ambient noise and vibration are predominantly related to the existing road traffic movement.

- Duration of site operations

In general, the longer the duration of all on-site operations, the more likely it is that noise or vibration from the site will potentially be an issue. In this respect, good public relations are very important. Local residents may be willing to accept a new status of noise and vibration if they know and understand the source and the duration of all operations. Therefore, all site operations are to be carried out according to a stated schedule. Changes are to be notified to the local authority in advance.

- Hours of work

For any noise-sensitive premises, some periods of the day will be more sensitive than others. Times of site operation outside normal weekday working hours will also need consideration.

Noise control targets for the evening period in such cases will need to be stricter than those for the daytime and, when noise limits are set, the evening limit may have to be as low as 10 dB(A) below the daytime limit. Very strict noise control targets should be applied to any site which is to operate at night.

Ealing Council have stated any associated activities audible beyond the site boundary are to be restricted to 0800 – 1800 hrs Monday to Friday, 0800 – 1300 Saturday (no work on Sunday or public holidays).

- Site Operation

People's attitudes to noise are always influenced by their attitudes to the noise source itself. Noise and vibration generated from a site will tend to be accepted more willingly by local residents if they consider that the site operator is adopting the best practicable means to avoid unnecessary noise.

- Noise and vibration characteristics

In many cases, the particular identity of noise and vibration will affect people's judgement and appreciation of the signal itself. For example, the presence of a high-amplitude impulsive noise, accompanied by a vibration sensation would render the overall assessment slightly more onerous as "penalties" would need to be employed. These would comprise weightings to signals (e.g. 5dB (A) to a highly tonal or intermittent noise source).

6.5.5 Proposed Control Measures for Construction Noise

The contractor to ensure The Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974) will be used to reduce noise and vibration levels at all times. Where practicable the control measures set out in BS 5228:2009 + A1:2014 Part 1 & Part 2, Section 8 will also be implemented.

The following noise and vibration control measures to be included as a minimum:

- Choice of methodology/technique for operations (including site layout) will be considered in order to eliminate or reduce emissions at sensitive locations;
- Fixed items of construction plant will be electrically powered in preference to diesel or petrol-driven;
- If any specialist fabrication is required, this will be undertaken off-site if possible;
- Noisy plant will be kept as far away as possible from sensitive areas;
- Each item of the plant used will comply with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 where reasonably available;
- Equipment will be well-maintained and will be used in the mode of operation that minimises noise and shut down when not in use;
- Vehicles shall not wait or queue on the public highway with engines running (unless the engine is required to power the operation of the vehicle e.g. concrete wagon);
- Where possible deliveries will be arranged on a just-in-time basis to prevent vehicles from queuing outside of the site and
- All materials will be handled in a manner that minimizes noise.

6.5.6 Temporary Noise Barrier or Noise Insulation

Table E2 of BS 5228-1:2009+A1:2014 provides an example of time periods, averaging times, and noise levels associated with the determination of eligibility for noise insulation.

Noise insulation, or the reasonable costs thereof, will be offered by the developer or promoter to owners, where applied for by owners or occupiers, subject to meeting the other requirements of the proposed scheme, where the construction of the development causes, or is expected to cause, a measured or predicted airborne construction noise level that exceeds either of the following at property lawfully occupied as a permanent dwelling: the noise insulation trigger levels presented in Table E.2 for the corresponding times of day; and a noise level 5 dB or more above the existing pre-construction ambient noise level for the corresponding times of day; whichever is the higher; and for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months."

7 Conclusions

An environmental noise impact assessment has been undertaken for the proposed construction on Land at Church Lane, Moston, Manchester, M9 4HW, based on the daytime and night-time levels likely to be experienced by the proposed residential units and amenity spaces.

Predicted noise levels allowed a robust noise insulation proposal to be made to comply with a minimum value for required attenuation, which would, in turn, provide internal noise levels for all residential environments of the development commensurate to the relevant design standard.

The attenuation requirement for external facades will be adequately met by the minimum requirements of Building Regulations 2010. Mitigation measures have been advised for windows, ventilation, separating walls, and separating floor. Measures have also been included for the construction phase as per BS5228.

Following the implementation of measures outlined in section 6 of this report, it can, therefore, be concluded that the proposed development is not considered to conflict with any national, regional, or local noise planning policy.

Appendices

- Appendix A: Noise Indicators and Acoustic Terminology
- Appendix B: Site plans
- Appendix C: Proposed mitigation
- Appendix D: Building Regulations 2010 Internal acoustic performance standards
- Appendix E: Overheating Ventilation Risk Assessment
- Appendix F: Calibration Certificates

Appendix A: Noise Indicators and Acoustic Terminology

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Reference Time Interval, T

The specified time interval over which an equivalent continuous A-weighted sound pressure level is determined.

$L_{Aeq,T}$

The A-weighted equivalent continuous sound level. This is the sound level of a notionally steady sound having the same energy as the fluctuating sound over a specified measurement period, T.

$L_{A10,T}$

The A-weighted sound level exceeded for 10% of the specified measurement period, T.

L_{Amax}

The highest short duration A-weighted sound level recorded during a noise event.

L_{den}

The L_{den} (Day Evening Night Sound Level) or CNEL (Community Noise Equivalent Level) is the average sound level over a 24 hour period, with a penalty of 5 dB added for the evening hours or 19:00 to 22:00, and a penalty of 10 dB added for the nighttime hours of 22:00 to 07:00.

L_{night}

The A-weighted, L_{eq} (equivalent noise level) over the 8 hour night period of 23:00 to 07:00 hours, also known as the night noise indicator.

L_{A90}

The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources, there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbers, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance

Appendix B: Site plans

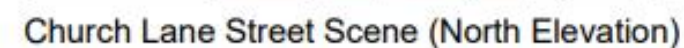
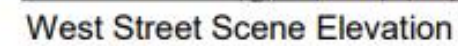
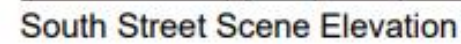
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Revisions: 1.00



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File: Program/Division	Issue: 00
Issue: History/Program/Div	Issue: 00
Issue: Issue Date	Page: 01
Issuing/Re: Main/Div/Div	Issue: 1-100
Revision:	





10) the work is to be reported to the latest reasonable standards (Code of Practice and the Health and Safety Commission)

11) all events were conducted in compliance with Health and Safety legislation

12) all arrangements are in place to ensure safety of the public

The contractor should consult and notify all stakeholders and event producers and notify the event of any changes

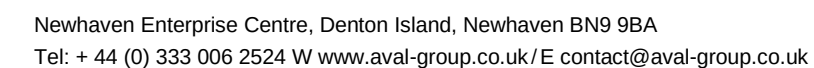
The main focus of the strategy is to ensure that:

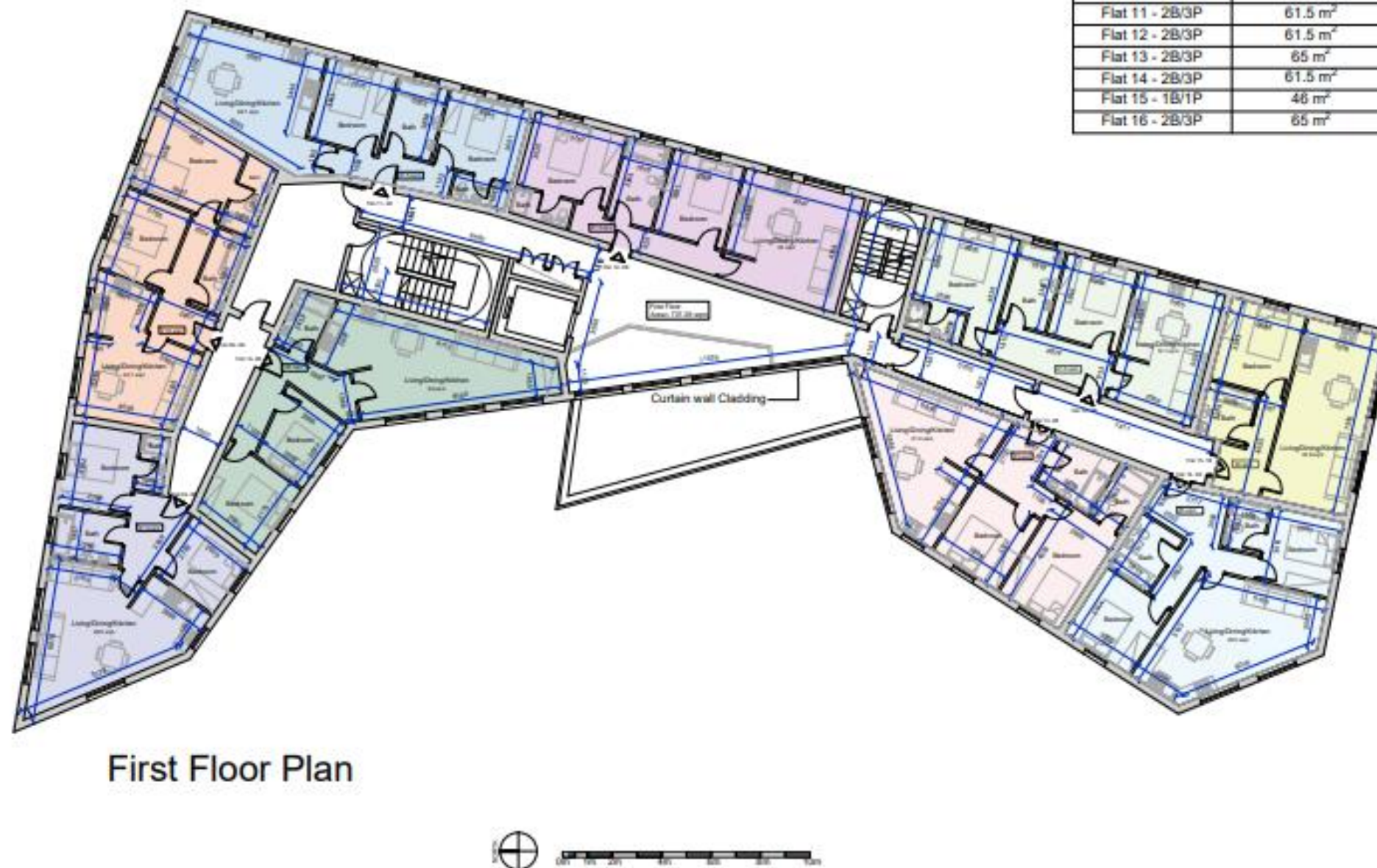
- 1) All A-level events have all key events covered by the contractor
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MARK: Specialty Properties III	MARKED: SO
DATE: 01-01-2000	PIPING: 01
ISSUING: 01-01-2000 (01-01-2000)	SCALE: 1:1000
PROJECT:	

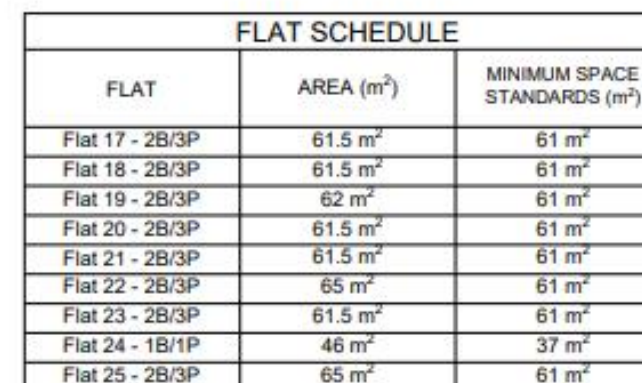




FLAT SCHEDULE		
FLAT	AREA (m ²)	MINIMUM SPACE STANDARDS (m ²)
Flat 08 - 2B/3P	61.5 m ²	61 m ²
Flat 09 - 2B/3P	61.5 m ²	61 m ²
Flat 10 - 2B/3P	62 m ²	61 m ²
Flat 11 - 2B/3P	61.5 m ²	61 m ²
Flat 12 - 2B/3P	61.5 m ²	61 m ²
Flat 13 - 2B/3P	65 m ²	61 m ²
Flat 14 - 2B/3P	61.5 m ²	61 m ²
Flat 15 - 1B/1P	46 m ²	37 m ²
Flat 16 - 2B/3P	65 m ²	61 m ²

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Second Floor Plan

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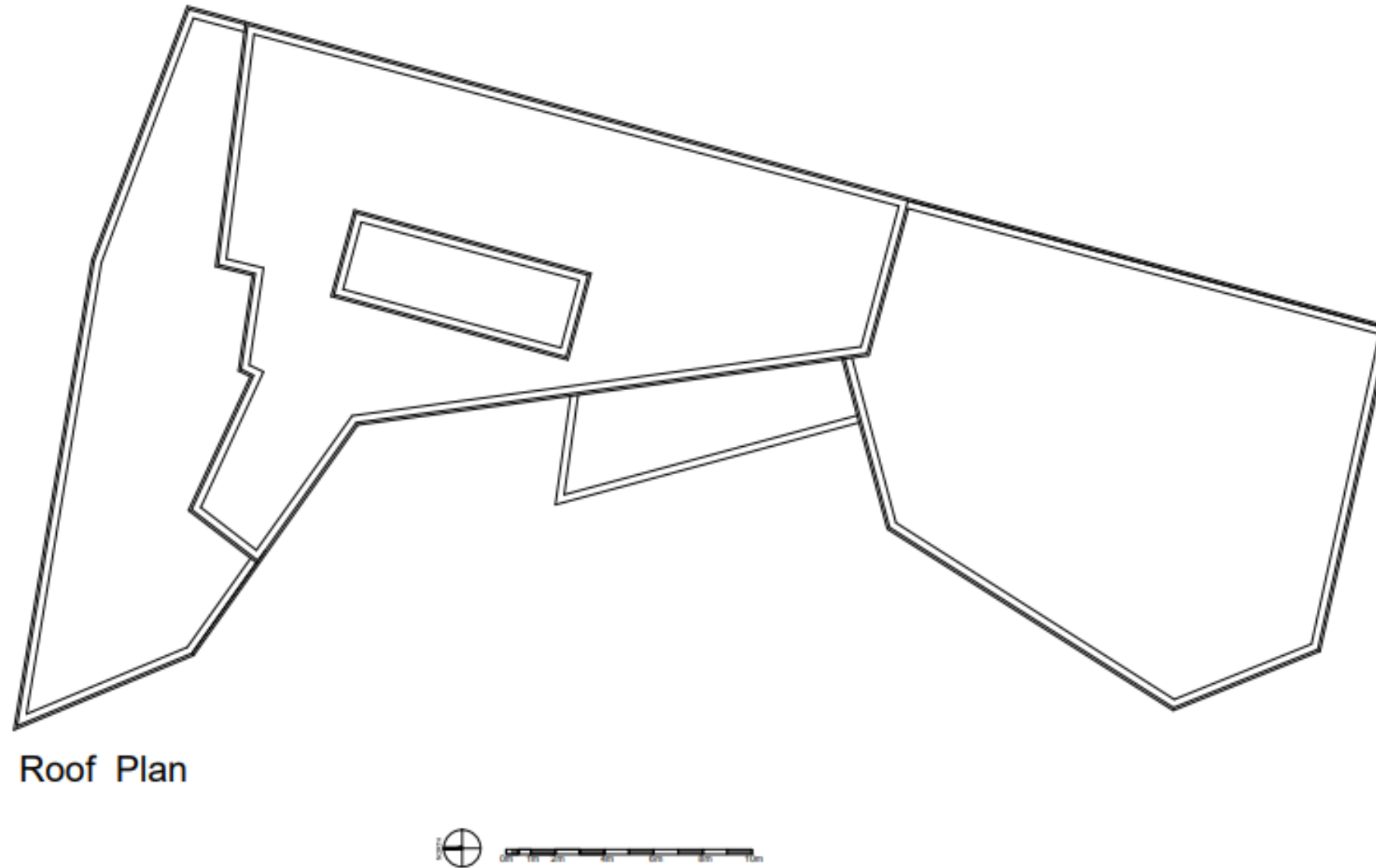


Address: 1000 4th Street Denver Colorado Telephone: (303) 733-1111 Fax: (303) 733-1111	
1999 Proposed Project/Activities:	Project ID:
State Library, Project ID:	Library ID:
State ID Number:	Project A-Z
Planning ID Number:	State ID:
Branch:	

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All work is to be carried out to the latest current British standards/Codes of Practice and recognised working practices.

All work and materials should comply with health and safety legislation.

All dimensions are in millimetres unless
where explicitly shown otherwise.

The contractor should check and verify all dimensions as work progresses and verify the extent of any discrepancies.

Do not scale off the drawings, if it should suit.

H&D & Co. are not liable for any work undertaken prior to Full Planning Consent and/or Building Regulations approval.

CDD REGULATIONS 2011
The client must abide by the Construction Design and Management Regulations 2011.
The client must appoint a contractor, if more than one contractor is to be involved, the client will need to appoint (in writing) a principal designer (to plan, manage and coordinate the planning and design work) and a principal contractor (to plan, manage and coordinate the construction and ensure there are arrangements in place for managing and organising the project).

Domestic clients
The domestic client is to appoint a principal designer and a principal contractor when there is more than one contractor. If not your status will automatically transferred to the contractor or principal contractor. The designer can take on the duties, provided there is a written agreement between you and the designer to do so.

The Health and Safety Executive is to be notified as soon as possible before construction work starts if the works:

- (a) last longer than 30 working days or have more than 50 workers working simultaneously at any point in the project or
- (b) Exceeds 50 person days.

PARTY WALL ACT
The owner should first decide to do as under the requirements of the Party Wall Act 1996, has a duty to serve a Party Structure Notice on any adjoining owner if building work on, or near an existing Party Wall involves any of

- Support of injury
- Initiation of ATP through wall
- Raising a wall or cutting off projections
- Detachment and rejoining
- Underpinning
- Insertion of new footlines

- Foundation within a footprint of an existing structure where the new foundations will go deeper than adjoining foundations, or within a footprint of an existing structure where the new foundations are within a 1/2 diameter line of the adjoining foundations.
- Party Wall Agreement is to be in place prior to start of work on site.

THERMAL BRIDGING
Care shall be taken to limit the occurrence of thermal bridging in the insulation layers caused by gaps within the thermal element (i.e. around windows and door openings). Reasonable provision shall also be made to ensure the attention is concentrated to minimize unwanted air leakage through the new building fabric.

get.TED@aol.com or 02046464000.
All works are to be carried out in a
workmanlike manner. All materials and
workmanship must comply with Regulation 7
of the Building Regulations, all relevant
British Standards, European Standards,
Agreement Certificates, Product Certificates
or Technical (EN) Standards etc. Products
conforming to a European technical standard
or harmonised European product should
have a CE marking.

Revised June 1, 2016

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Appendix C: Proposed mitigation

Separating floors

Timber floor - Treatment laid on sub-floor

Refurbishment/conversion timber separating floor

CELLECTA ScreedBoard® 28 laid on timber sub-floor
Existing timber joists
New ceiling fixed to resilient bars

Floating floor treatment	CELLECTA ScreedBoard® 28 (See Table 2RF.06a for full details)
Floor decking	15mm thick (min) wood based board, density 600kg/m³ (min) or existing floor boards (with all gaps sealed with suitable flexible mastic)
Joists	200mm (min) solid timber joists
Absorbing material	• 50mm CELLECTA FIBREfon® Micro 50 • 100mm (min) mineral wool (45kg/m³)
Ceiling	See Table 2RF.06b for ceiling treatment

Fig. 2RF.06

FASTRACKCAD ARCHITECTURAL CAD DATABASES

NBSPlus

Table 2RF.06a

Installation Details

Resilient overlay platform floor system

- ScreedBoard® 28** High density acoustic overlay board
Dimensions: 28mm x 600mm x 1200mm
Weight: 24kg/m² / 18.72kg/board
- CELLECTA Pro Adhesive**
ScreedBoard joint adhesive
Bottle size: 1L / 30m² coverage
- YELOfon® F550**
Perforated flanking strip:
6mm x 50mm x 30mm x 2m

Additional Products for this application:

- 50mm CELLECTA FIBREfon Micro 50 non-fib polyester quilt
- 100mm (min) mineral wool 45kg/m³

Install **RUBBERfon® TSS** (Threshold Support Strip) at door thresholds or where square edge boards meet, reducing excessive flex, whilst maintaining acoustic performance.
Composition: 100% recycled re-bonded rubber
Size: 8mm x 75mm x 1000mm

Provide an 5-10mm expansion gap between the hubtable and communal area treatments

Remove a 40mm section of resilient layer off each edge to accommodate a Threshold Support Strip (TSS)

Table 2RF.06b

Ceiling Treatment Options

Ceiling boards must not penetrate or touch joists

- 16mm (min) metal resilient bars mounted at right angles to the joists at 400mm (max) centres
- 30mm CELLECTA HP30 resilient bars mounted at right angles to the joists at 600mm (max) centres

Ceiling treatment:
Two layers of gypsum-board board, composed of 15mm (nominal 12.5kg/m²) fixed with 25mm screws and a second layer of 15mm (nominal 12.5kg/m²) fixed with 42mm screws, with all joints staggered.

Standard resilient bars set at 450mm (max) centres

HP30 resilient bars set at 600mm (max) centres

+3 dB $R_w + C_w$ ⁽¹⁾
+2 dB $L_{n,w}$ ⁽²⁾

⁽¹⁾ Typical dB improvement of HP30 over 16mm resilient bars.

Acoustic Performance

Airborne: 52dB $R_w + C_w$
Impact: 54dB $L_{n,w}$

Performance values quoted were achieved using 50 x 235mm solid timber and 16mm resilient bar at Sound Research laboratories, Sudbury in accordance with Approved Document E: Annex B: Procedures for sound insulation testing.
Airborne results tested in accordance with BS EN ISO 140-3:1995
Impact results tested in accordance with BS EN ISO 140-6:1998

Third Party Accreditation and Approvals

CLASS 00, S1
BS EN13501-1

SRL Performance Tested

2015

Environmental Credentials

GWP <5

100% Recycled Polymer

zero ODP

76

01634 29-66-77

collecta.co.uk

technical@collecta.co.uk

Newhaven Enterprise Centre, Denton Island, Newhaven BN9 9BA
Tel: + 44 (0) 333 006 2524 W www.aval-group.co.uk / E contact@aval-group.co.uk

35

Acoustic Glass Options



For environments where a sound barrier would be beneficial, we advise specifying acoustic glass.

What level of noise reduction is required?

25 dB	Low to normal speech can be overheard and interpreted easily
30 dB	Standard to loud speech can be overheard and discriminated easily
35 dB	Loud speech can be distinguished and interpreted under normal background levels
40 dB	Loud speech can be heard but not easily distinguished
45 dB	Loud speech can be heard but not distinguished
50 dB	Very loud speech or shouting can be heard but not distinguished

Overview of single skin glass types to be used to achieve particular dB ratings

32 dB	6 mm toughened
35 dB	6.8 mm acoustic laminate 10.8 mm PVB laminated
40 dB	14.8 mm acoustic laminate
45 dB	See double glazed skin options
50 dB	See double glazed skin options

Overview of double skin options to be used to achieve particular dB ratings

Thickness of pane	Gap between panes					
	30mm	50mm	75mm	100mm	200mm	250mm
6mm	32 dB	33 dB	35 dB	36 dB	39 dB	40 dB
8mm	34 dB	35 dB	37 dB	39 dB	42 dB	44 dB
10mm	36 dB	37 dB	39 dB	41 dB	45 dB	46 dB
12mm	38 dB	40 dB	42 dB	44 dB	48 dB	49 dB

(Sound reduction can be achieved when both pieces of glass are of the same thickness. dB rating varies according to air gap between the two panels.)

Products, Processes and Applications



Optional features

- Sound reduction
- Fire resistant
- Low iron • Mirrored
- Tinted
- Satin finish • Ritec coating
- ESG Switchable Privacy Glass

Processes

- Drilling • Sandblasting
- Notching • Cut outs
- Toughening
- Corner mitring
- Polishing • Laminating

Applications

- External walkways
- Internal corridors
- Meeting rooms
- Office space
- Privacy screening
- Shop fittings
- Smoking areas

Quality Standards

Toughened Glass: manufactured in accordance with the latest standard 'Glass in building – thermal toughened soda lime silicate safety glass BS EN 12150 : (Parts 1 & 2) : 2000, incorporating 'Glass in building – impact test BS EN 12600 : 2002' and 'Glass in building – four point bending test BS EN 1288-3 : 2000'.

Laminating: conducted in accordance with 'Glass in building – Laminated glass and laminated safety glass – BS EN 12543 (Parts 1-6:1998 and BS EN 14449:2005). The EVA interlayer is manufactured in accordance with 'UNI EN ISO 12543-4:2000' and is certified by the manufacturer.

Safety: ESG TuffLam satisfies all safety glazing requirements of BS 6262 : Part 4 : Safety related to human impact, Regulation 14 of the Health and Safety at Work Act as well as Approved Document N of the Building Regulations. It is particularly suited to areas where enhanced performance is required.



Essex Safety Glass Ltd, Units 1-3 Moss Road, Witham, Essex CM8 3UQ
Tel: 01376 520061 Fax: 01376 521176 Web: www.esguk.co.uk Email: sales@esguk.co.uk

2500EA / 5000EA

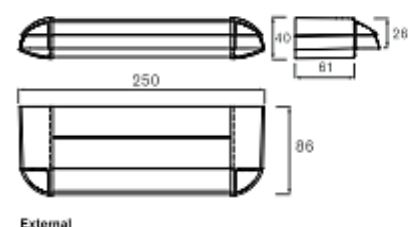
Acoustic window ventilator

Physical specification

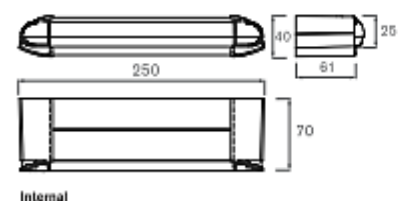
All measurements in millimetres unless otherwise indicated

Materials: Aluminium Alloy

2500EA Acoustic



External



Internal

2500EA Acoustic slot size

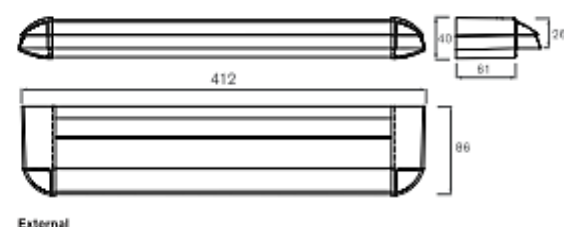
Height: 13mm

Length
192mm

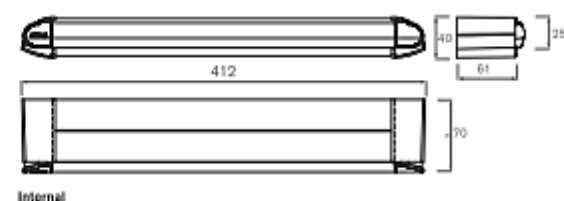
Installation

1. Prepare the window frame with the correct slot sizes.
2. Use the self tapping screws to install the acoustic parts.
3. Use standard pyramid vent screws to install the canopy and vent.

5000EA Acoustic



External



Internal

5000EA Acoustic slot size

Height: 13mm

Length	Central gap	Length
172mm	10mm	172mm

Acoustic Ventilation 7



The best of both worlds... achieves Building Regulations' EA requirements along with fantastic acoustic performances up to 45dB(A)

Features and benefits

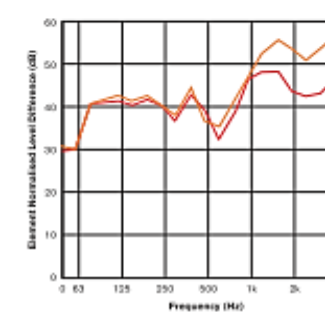
- ▶ Smallest acoustic window vents providing 2500mm² or 5000mm² equivalent area ventilation on the market
- ▶ Achieves the best acoustic performance for window ventilators available within the UK – up to 45dB(A)
- ▶ A simple, yet adaptable, solution to meet required specification/ Building Regulation requirements incorporating both high levels of equivalent area ventilation and acoustic noise reduction
- ▶ Modularity of acoustic sets provides flexibility for installation and acoustic performance
- ▶ Aesthetically pleasing design which is easy to open and control by the homeowner
- ▶ Excellent airtightness performance with upward air deflection to reduce the risk of draughts
- ▶ May require add on section in some window installations

Sets comprise of:

- 1 EA vent + 1 external acoustic module** – providing noise reduction with discreet internal aesthetics.
- 1 EA vent + 2 acoustic modules** (for internal and external install) – providing maximum noise reduction.

Performance

2500EA acoustic performance

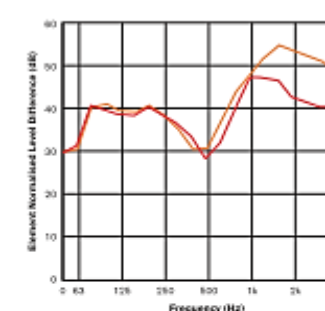


Key

2500EAW.AC1

2500EAW.AC2

5000EA acoustic performance



Key

5000EAW.AC1

5000EAW.AC2

Models, control options and key data

Product code	Description	Controls	Acoustic performance			Equivalent area mm ²	Colour
			Dn,e,w	Dn,e,w (C)	Dn,e,w (Ct)		
2500EAW.AC1 *	Vent + 1 Acoustic External Module	Front	42dB(A)	41dB	40dB	2570	White
2500EAW.AC2 *	Vent + 2 Acoustic Modules	Front	45dB(A)	43dB	42dB	2570	White
5000EAW.AC1 *	Vent + 1 Acoustic External Module	Front	39dB(A)	38dB	37dB	5350	White
5000EAW.AC2 *	Vent + 2 Acoustic Modules	Front	42dB(A)	40dB	39dB	5350	White

* Pricing is variable depending on quantity ordered - please call for details

Call: 01276 605800 Email: orders@greenwood.co.uk Visit: www.greenwood.co.uk Twitter: follow us @greenwoodairvac

Appendix D: Building Regulations 2010 Internal acoustic performance standards

Table 0.1a Dwelling-houses and flats – performance standards for separating walls, separating floors, and stairs that have a separating function

	Airborne sound insulation sound insulation $D_{nT,w} + C_{tr}$ dB (Minimum values)	Impact sound insulation $L'_{nT,w}$ dB (Maximum values)
Purpose built dwelling-houses and flats		
Walls	45	-
Floors and stairs	45	62
Dwelling-houses and flats formed by material change of use		
Walls	43	-
Floors and stairs	43	64

Table 0.1b Rooms for residential purposes – performance standards for separating walls, separating floors, and stairs that have a separating function

	Airborne sound insulation sound insulation $D_{nT,w} + C_{tr}$ dB (Minimum values)	Impact sound insulation $L'_{nT,w}$ dB (Maximum values)
Purpose built rooms for residential purposes		
Walls	43	-
Floors and stairs	45	62
Rooms for residential purposes formed by material change of use		
Walls	43	-
Floors and stairs	43	64

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources ^[Note 1] relating to overheating condition

Newhaven Enterprise Centre, Denton Island, Newhaven BN9 9BA
Tel: + 44 (0) 333 006 2524 W www.aval-group.co.uk / E contact@aval-group.co.uk

Appendix F: Calibration Certificates

Certificate of Calibration Class 1

BSWA-IV-C021-09-P0274

BSWA TECH

CERTIFICATE OF CALIBRATION

Class 1

TYPE: BSWA 308

S/N: 580276

京制01020122号

1. APPEARANCE

Pass

2. CALIBRATION (sound)

Calibrator: BK4231

Sound Level: 93.8 dB

Frequency: 1000 Hz

Microphone Model / SN: MP231 / 580293

3. FREQUENCY WEIGHTINGS (sound & electrical)

Z-weighting (sound & electrical); A/C-weighting (electrical, plus Z-weighting error)

Frequency [Hz]	A	C	Z
10	-69.0	-14.3	0.0
20	-50.4	-6.2	0.0
31.5	-39.5	-3.1	0.0
63	-26.2	-0.8	0.0
125	-16.1	-0.2	0.0
250	-8.7	0.0	0.0
500	-3.3	0.0	0.0
1000	0.2	0.2	0.2
2000	1.5	0.1	0.3
4000	1.2	-0.6	0.3
8000	-1.0	-2.9	0.6
16000	-12.1	-14.2	0.5
20000	-26.1	-28.0	-1.4

4. LEVEL LINEARITY (electrical)

Filter=A; Fsin=1kHz

Nominal[dB]	20	21	22	23	24	25	30	40	50	60	70	80	89
Indication[dB]	19.9	21.0	22.0	23.0	24.0	25.0	30.0	40.0	50.0	60.0	70.0	80.0	89.0
Error[dB]	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Nominal[dB]	90	91	92	93	94	95	96	97	98	99	100	110	120
Indication[dB]	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0	99.0	100.0	110.0	120.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Nominal[dB]	129	130	131	132	133	134
Indication[dB]	129.0	130.0	131.0	132.0	133.0	134.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0

5. SELF-GENERATED NOISE LEVEL (sound)

Measured in anechoic chamber with microphone; Backlight Off; Electrical noise please refer user manual

Filter	A	C	Z
Indication[dB]	~ 18	~ 23	~ 31

6. TIME WEIGHTINGS (electrical)

Filter=A; Fsin=4kHz; Steady Level=132dBA

Detector	F	S
Rate of Decay[dB/s]	34.4	4.4
Delta of F/S[dB]	0.0	

7. TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A = 132.0 dB

Tone Burst Duration [ms]	$L_{Amax} - L_A$	$L_{ASmax} - L_A$	$L_{AE} - L_A$
500	-0.1	-4.1	-3.1
200	-1.0	-7.5	-7.1
50	-4.9	-13.2	-13.1
10	-11.2	-20.1	-20.1

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v1.2

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Certificate of Calibration Class 1

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8. REPEATED TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A = 132.0 dB

Tone Burst Duration [ms]	Tone Burst Interval [ms]	Response[dB]
500	2000	$L_{Aavg} - L_A$
200	800	-7.0
50	200	-7.0
10	40	-7.0

9. OVERLOAD INDICATION (electrical)

Filter=A; Fsin=1000Hz

Nominal[dB]	Steady	Error[dB]	Delta of Positive and Negative[dB]
134.1	0.1	0.2	0.0

10. C-WEIGHTED PEAK SOUND LEVEL (electrical)

Filter=C; Peak; Fsin=500Hz

Steady Signal Level	Single Cycle	Positive Half Cycle	Negative Half Cycle
4dB Below Top	3.6	2.3	2.3
Middle	3.6	2.3	2.3
1dB Above Floor	3.7	2.5	2.3

CONDITIONS

Temperature	18	°C
Relative Humidity	36	%
Static Pressure	101.4	kPa

TEST EQUIPMENT

Item	Manufacturer	Model	S/N	Description
1	B&K	4231	3008422	Sound Calibrator
2	Agilent	33220A	MY44038043	Signal Generator
3	Agilent	34401A	SG47000236	Digital Multimeter
4	NJZY	ZY5142D	0425	Step Attenuator
5	B&K	4180	2412874	Standard Microphone

TEST PROCEDURES IN ACCORDANCE WITH

IEC 61672-3:2013

Class 1 Performance Verified.

Test Qualified.

DATE: 2021 Y 2 M 1 D

TEST (sig.):

APVD (sig.):

QC 05

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Calibration Certificate

With UKAS Results

Issued By: Castle Group Ltd

Date Of Issue : 03/08/21

Certificate No : 550282/79553

Page 1 of 3



All instruments are tested to check compliance with particular specifications. These may be an appropriate British or International Standard, or if the instrument was not originally designed to meet any such Standard, or when the instrument was originally manufactured a relevant Standard did not exist, the instrument will be tested to the manufacturer's original specification.

The measurements reported in the attached certificate were carried out using equipment whose values are traceable to National Standards and verified by equipment traceable whose values are traceable to a National Standards Laboratory. The applicable reference for the calibration of the test equipment is shown below.

The performance of the instrument was determined by comparison with the manufacturers' specification as found in the instrument handbook or other technical publication. Any significant uncertainty of the measuring system will also be included.

The instrument was allowed to stabilise for a period of 30 minutes prior to measurements made.

The ambient temperature and relative humidity throughout verification were 24 ±2 °C and 40% RH respectively.

Instruments used to carry out this calibration are as follows: -
Multifunction Calibrator 4226 Serial No: 3290080
Applicable Reference: CDK2101873.
Sound Level Meter 2260 Serial No: 1875415
Applicable Reference: 08277

Subject of Calibration: CA111
Instrument: Sound Level Calibrator
Serial No: 550282

Supplied Barometer Data (If applicable)
Barometer Type: —
Barometer Serial No: —

UKAS Reference: 0653
UKAS Certificate: UCRT21/1913

Basis Of Test: Compliance to Manufacturer's Original Specification

Checked By:
M. Mann
(Approved Signatory)
Date of Calibration: 23 Jul 2021
Date of Verification: 02 Aug 2021

Client: Aval Consulting Group Ltd
Address: Unit 33 Newhaven Enterprise Centre
Denton Island
Newhaven
Sussex
BN9 9BA

Client Reference:

— Indicates item or information not available
Castle Group Ltd
Salter Road, Scarborough Business Park, Scarborough, North Yorkshire YO11 3UZ United Kingdom
t: +44 (0)1723 584250 f: +44 (0)1723 583728 e: sales@castlegroup.co.uk
www.castlegroup.co.uk