Aval Consulting Group.

Noise Impact Assessment

52 Avenue Road, St. Johns Wood, London, NW8 6HS

Client Name: 52 Avenue Road Limited

April 2022

Project Information

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A	27 April 2022	Christopher Murphy DipHE IOA CCENM 2021	Nuvin Boyjonauth MSc, IOA Dip. 2021	Ayan Chakravartty MSc MPhil IOA CCENM 2019 IOA Dip. 2021	Draft

Disclaimer

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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 52 Avenue Road, St. Johns Wood, London. The proposal involves:

- 12no townhouses
- Communal health and wellness spa
- Private and communal gardens

Detailed site drawings for the proposed scheme are attached in Appendix B.

1.2 Objective

The planning process requires evidence from a noise impact assessment that mitigation measures can ensure that noise can be reduced to acceptable levels within 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} (07:00-23:00); and internal sound levels within all bedrooms that do not exceed 30 dB(A) L_{Aeq} (23:00-07:00).

Mechanical equipment related to the proposed scheme will also be assessed following BS:4142 and local council guidance, whereby noise levels must be 10 dB(A) below the ambient background level at the nearest noise-sensitive receptors, which in this instance is the proposed townhouses.

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, as well as noise introduced from new mechanical equipment. If needed, mitigation measures to accompany the planning application will be provided.

1.3 Site Location

Figure 1.1 shows the proposed site location. The site is bounded by Avenue Road to the west and Elsworthy Road to the north. The area is predominantly residential in nature, with a moderate-high amount of vehicle activity on Avenue Road. There are no other notable permanent noise sources.

Figure 1.1: Proposed site location (image source: Google Maps)

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. BS4142 has also been considered with regards to the proposed communal Health and Wellness Spa.

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 (NSPE) 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 daytime[3] internal acoustic criteria relative to critical health effect(s) that of 35 dB $L_{Aeq,16\ hour}$, and a night-time[4] level of 30 dB $L_{Aeq,8\ hour}$ / 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 Europe' 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 $L_{Aeq,\ 16\ hour}$	-
Dinning	Dining Room/area	40 dB $L_{Aeq,\ 16\ hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$

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 $L_{Aeq,1hour}$
Night-time (23:00 – 07:00 hrs)	25 – 35 dB $L_{Aeq,1hour}$
Night-time (23.00 – 07.00 hrs)	45 – 55 dB L_{Amax}

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

In terms of industrial/commercial development, guidance is set out in BS 4142: 2014, 'Methods for rating and assessing industrial and commercial sound'. BS 4142 requires the noise from the process/equipment (in LA_{eq}) to be compared with the background sound level (LA_{90}) in conjunction with the new noise source.

BS 4142 states that if the rated noise level exceeds the LA_{90} background sound level by around +10 dB or more, then it is likely that the resultant noise may have a significant adverse

impact, a difference of around +5 dB over the background sound level is likely to have an adverse impact, and where the rating level does not exceed the background sound level it is an indication that the resultant noise is likely to have a low adverse impact.

BS 4142: 2014 provides a method for assessing whether an industrial or commercial sound source (e.g. fixed mechanical plant) is likely to cause a disturbance to persons living near to the sound source.

The 2014 document introduces three main acoustic features:

- **Tonality:** Defined as more sound in the 1/3 octave band than those nearby 1/3 octave bands or more sound in a given frequency than in those nearby frequencies. The tonality feature correction +6dB and can be applied using subjective method or an objective method using 1/3 octave bands.
- **Impulsivity:** defined as sound that increases by a rate of at least 10dB per second, regardless of its duration. The impulsivity feature correction range from 0-9 dB and can be applied using a subjective method or an objective method using a sound level meter capable of sampling sound at either once every 0.01s interval or once every 0.025s interval.
- **Intermittency:** Defined as sound that can be identified as being on/off during the measurement period in which case the correction factor that is applied to the specific sound source (e.g. fume extraction system) is +3 DB.

BS 4142 assesses potential significant effect by comparing the source noise (extractor duct vent noise) with the measured background noise level (LA90). The standard provides a penalty (correction factor) for acoustic features for instance bangs or tonal qualities that can increase the likelihood of noise complaints and in these cases, the standard requires a correction to be added to the source noise level. The source noise level along with the correction factor is referred to as the 'rating level'. The rating level is then compared with the background level (La90). BS 4142:2014 advocates the use of LAeq,T - a level, which is directly measurable and termed the Specific Sound Level.

- Subjectively the Specific Sound Level may be corrected as follows:

The Specific Sound Level is subject to a correction for tonality between 0dB to +6dB for sound ranging from not tonal to prominently tonal. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6dB where it is highly perceptible.

The Specific Sound Level may be also corrected to impulsivity. A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of +3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible.

Other sound characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, can have a penalty of 3dB applied.

Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Further corrections may be applied due to intermittency. When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time

period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.

If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, BS4142:2014 suggests using the one-third octave method and/or the reference methods, as appropriate.

The one-third octave method tests for the presence of a prominent, discrete-frequency spectral component (tone) typically compares the LZeq,T sound pressure level averaged over the time when the tone is present in a one-third-octave band with the time-average linear sound pressure levels in the adjacent one-third-octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference. The level differences between adjacent one-third-octave bands that identify a tone are:

• 15 dB in the low-frequency one-third-octave bands (25Hz to 125Hz);

• 8 dB in the middle-frequency one-third-octave bands (160Hz to 400Hz); and

• 5 dB in the high-frequency one-third-octave bands (500Hz to 10,000Hz).

- The reference (objective) method.

If the presence of audible tones is in dispute, a special measurement procedure can be used to verify their presence. Based on the prominence of the tones this procedure also provides recommended level adjustments. The aim of the reference method is to assess the prominence of tones in the same way as listeners do on average. The method is based on the psychoacoustic concept of critical bands, which are defined so that sound outside a critical band does not contribute significantly to the audibility of tones inside that critical band. The method includes procedures for steady and varying tones, narrow-band sound and low-frequency tones, and the result is a graduated 0dB to 6dB adjustment. It is known as the Joint Nordic Method 2 and is to be found in ISO 1996-2. The reference method is also described in BS4142:2014.

Specific Sound Level with (or without) added contentions is termed the Rating Level. When used to assess industrial or commercial sound, the Rating Level is determined and the LA90 background level is subtracted from it. Typically, the greater this difference, the greater the magnitude of the impact.

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

A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

In addition to above, based on the Guidance of Control of Odour and Noise from Commercial Kitchen Exhaust Systems (2018), there are two fundamental categories of noise source are of relevance. The first is the noise produced by the fan, which is a function of the type of fan (axial, centrifugal, mixed flow, etc), the rate of the airflow and the pressure drop. For these calculations, the octave band sound power from the fan is required. This can normally be obtained from the manufacturer.

The second category of noise is generated by turbulence as the air passes within the ducts or through the exit grille or louvre. In this case, the amount of noise is determined by the design of duct, grille, or louvre, the pressure drop across terminations, the velocity of the air (this can be variable across the duct, grille, or louvre) and the area of the duct or opening. The problem with this form of noise, especially at terminations, is that in most situations it can only be controlled at its source. For example, at the feature that is generating the noise as there is no further length of duct in which to install noise control equipment.

In some situations, a third source may need to be considered. This is where noise generated within the building breaks into the ductwork and is radiated from the outlet. The area of the duct walls, the acoustic properties of the duct walls, and the area of any inlets determine the amount of break-in noise. Once this noise has broken into the ducts it can be treated as if it were an additional component of the fan noise. However, the nature of this additional noise is such that it usually contains a relatively high level of low-frequency sound which can be difficult to attenuate.

The attenuation of fan noise (and break-in noise) provided by the ductwork is determined by the length of the ducts, the presence of any bends, changes in cross-section, the presence of any plenum chambers and termination effects (including sound-attenuating louvres if present and the attenuation provided by any change in cross-section). A balance has to be struck between the acoustic benefit of bends and louvres etc and the pressure drop that these create, possibly requiring a larger fan.

The sound energy components arising from fan noise, turbulence within the duct and at outlets, and from noise break-in, combine to produce an acoustic source at the outlet. The energy will then propagate away from the outlet in a manner determined by the nature and geometry of surrounding buildings and terrain. The nature, temporal characteristic and level of the resultant sound that reaches the ears of people in the vicinity (usually quantified by considering the noise at façades), and its level relative to the background noise, all contribute to its potential to cause disturbance and complaint. These factors should be taken into account at the planning stage as a matter of course. They form the basis of BS 4142 “Rating industrial noise affecting mixed residential and industrial areas” which is also used by Local Authority as support to the issue of a Noise Abatement Notice under the Environmental Protection Act.

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},and L_{Amax}, have been used where appropriate and are described in Appendix A.

3.2 Noise Monitoring Location

Noise monitoring was carried out at the location shown in Figure 3.1 below. This location was deemed appropriate to give an accurate assessment of the prevailing levels of noise that are likely to be experienced by the proposed development, including both the boundary roads.

The noise monitor was positioned 1.3 m above ground level and > 3.5 m away from all reflective surfaces. As such, the readings obtained are considered to be in free-field conditions as per BS 7445.

Figure 3.1 Noise Monitoring Location (image source: Google Maps)

Figure 3.2 Background noise monitoring location (image source: Aval Consulting Group Ltd)

3.3 Noise Survey Periods

The noise survey was carried out for 46 hours at 1 second intervals. The time periods have been outlined below.

Measurement Location	Start Date	Start Time	End Date	End Time
1	09/11/21	14:11	11/11/21	12:11

Table 3.2 Noise Survey Periods

3.4 Details of Noise Monitoring Equipment

The details of the equipment used for all noise monitoring have been tabulated below. The sound level meter used for this survey was 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 B.

Location	Equipment	Serial Number	Last Calibrated
1	BSWA 308 Class 1 Sound level meter	580273	01/02/21
3	BSWA CA111 Class 1 Calibrator (UKAS)	550282	23/07/21

Table 3.3 Noise Equipment Details

3.5 Weather Conditions

During the background survey, conditions were mostly overcast with low-moderate winds, and some light rain noted on the morning of the 11th November. 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.

Variable	Condition
Wind	4 m/s Maximum
Humidity	70% Average
Cloud cover	77% Average
Precipitation	0.6 mm
Temperature	15C Max 10C Min

Table 3.4 Meteorological conditions during survey period (Source: Worldweatheronline St Johns Wood)

4. Noise Survey Results

4.1 Ambient noise results

A summary of the noise results can be seen below in Table 4.1. A full graph of the results is presented below in Figure 4.2, with the night-time LAFmax figures isolated in Figure 4.3.

Indicator	Daytime (07:00-23:00) All values in dB(A)	Night-time (23:00-07:00) All values in dB(A)
L_{Aeq}	61.8	45.6
L_{A90}	49.9	40.7
L_{A10}	60.9	52.2
L_{Amax}	88.3	74.2

Table 4.1 Summary of Noise Results

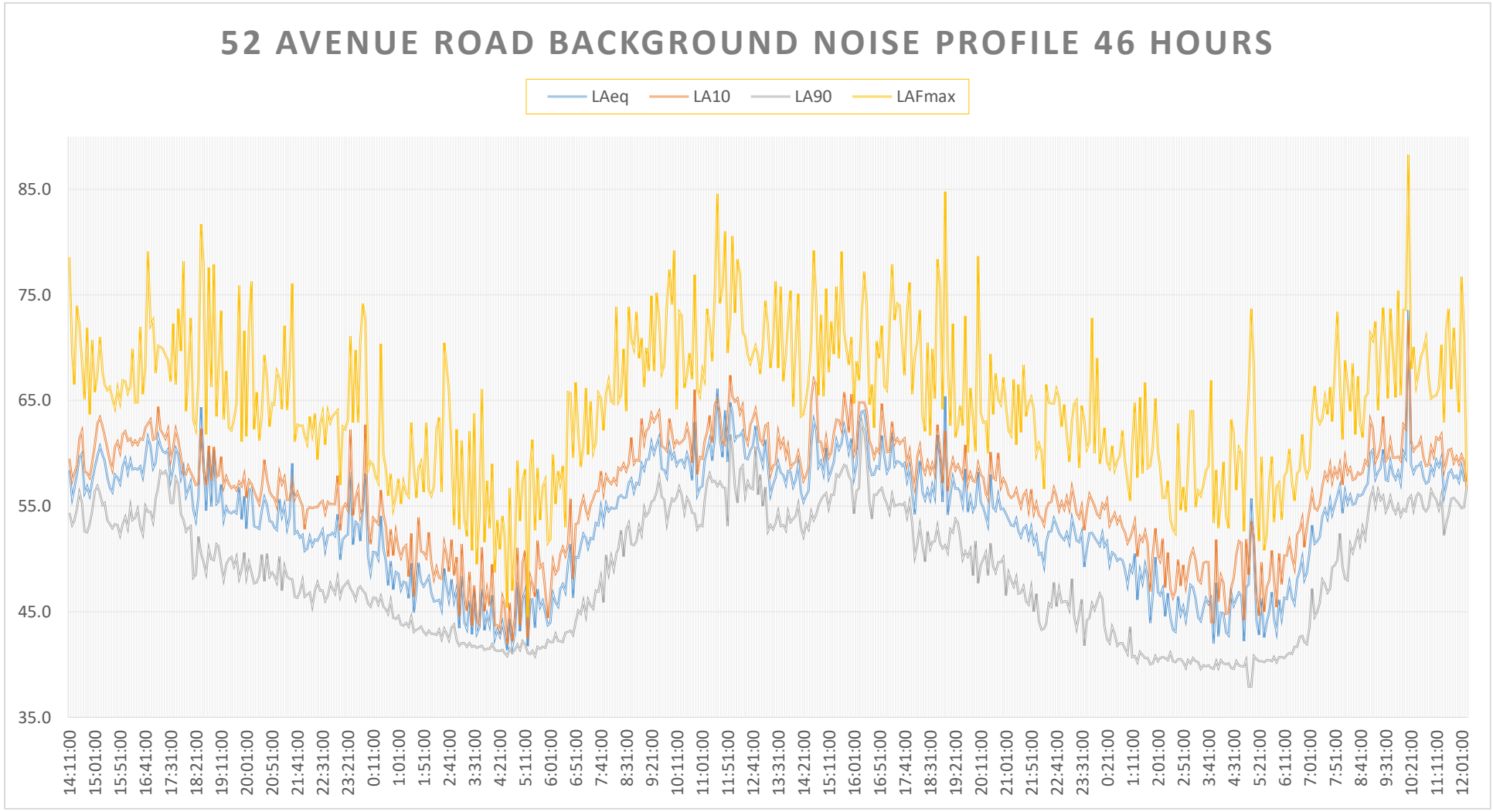

Figure 4.2 Noise profile 46 hours, presented in 5 minute intervals – 52 Avenue Road

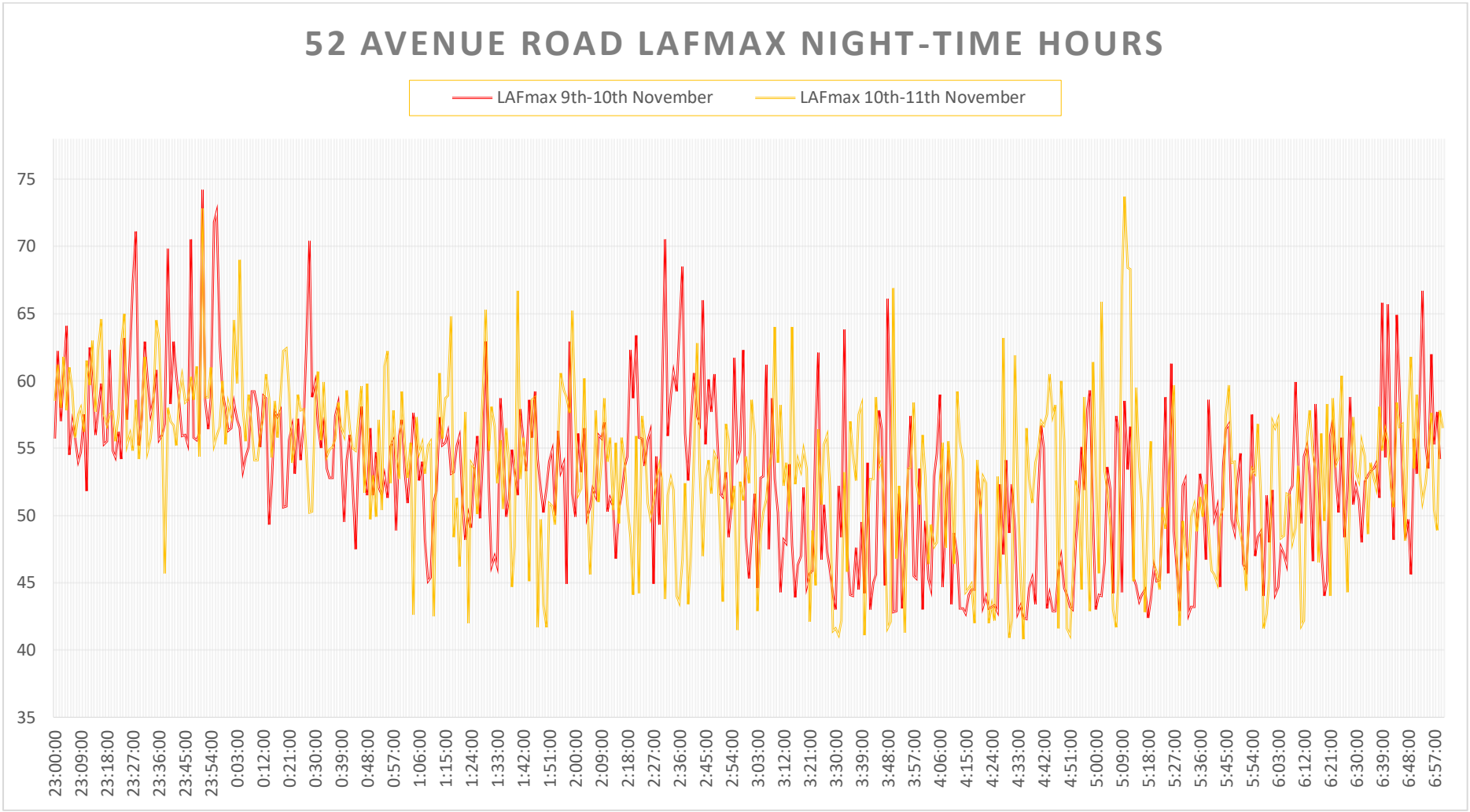

Figure 4.3 LAFmax night-time exceedances, presented in 1 minute intervals between 23:00 – 07:00 – 52 Avenue Road

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 Prevailing External Noise

It was found that a minimum attenuation level of **61.8 – 35 = 26.8 dB** is required during daytime and a minimum attenuation of **45.8 – 30 = 31.8 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 peak 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 not been exceeded, and are not likely to be exceeded at any point in time.

Based on the night-time L_{AFmax} values recorded (refer to L_{AFmax} graph in Section 4), it was observed that the highest L_{AFmax} value over 2 nights was 74.2 dB, and this is deemed to be a a fair representation of the worst-case peak noise level to be expected throughout the night. It was found that a minimum attenuation level of **74.2 – 45 = 29.2 dB** is required to meet these criteria.

Therefore, on the overall, a minimum noise attenuation of 32 dB(A) is required to account for a worst-case scenario based on the night-time LAeq levels. To ensure robust mitigation, it is proposed that all building facades and windows should have a minimum acoustic performance of **32 dB (A).**

5.2 Noise Impact on Amenity areas

BS 8233 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".

In reference to Section 4 of this report, the prevailing noise levels were recorded as having an L_{Aeq} of 61.8 dB. This exceeds the upper guideline of 55 dB as outlined in BS8233. However, the proposed site is in a location that sees relatively high traffic levels of vehicle traffic connecting Regents Park and Swiss Cottage, so this is to be expected for the area.

The communal garden is situated in the centre of the site and will be surrounded by the proposed buildings, so this figure is likely to be lower in the final development as the townhouses will block some of the road noise. No mitigation measures are deemed necessary.

5.3 Communal Health and Wellness Spa

The proposed health and wellness spa is to be located underground and will not be adjoined to any noise sensitive rooms, therefore noise from residents using this area is not considered to be a concern.

Equipment in the plant room has not yet been finalised, so target values are advised based on the lowest measured background level. Rated noise levels from any external plant equipment (e.g. relating to the pool, sauna, ventilation etc) must not exceed a level > 10 dB(A) below the prevailing daytime background level of 49.9 dB(A) and night-time level of 40.7 dB(A). This equipment is expected to be tonal in nature and will be subject to an acoustic penalty. All plant equipment must be designed and installed by suitably qualified persons so that related **noise levels should not exceed 30.7 dB 1 meter from the façade of the nearest unit** on the development as per BS4142.

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 the non-glazed building façade elements of the proposed development would be comprised of masonry. 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 32 dB. This should be easily achieved as part of the Building Regulations 2010 requirements, which require a minimum acoustic performance of 43 dB for external facades.

6.2 Glazed Elements

It is proposed that acoustically laminated double-glazed windows would be able to attenuate background noise by at least 32 dB(A). Examples of such window configurations and their specifications can be found in Appendix C.

6.3 Amenity Areas

Based on the findings in section 5.2 of this report, no mitigation measures are required for the amenity area.

6.4 Ventilation Strategy

The findings of the noise survey, the prevailing L_{Aeq} levels have been presented below.

Indicator	Daytime dB(A)	Night-time dB(A)
L_{Aeq}	61.8	45.6

Table 6.1 L_{Aeq} levels at noise monitoring location

In reference to Table 3.2 of The "*Acoustics Ventilation and Overheating Residential Design Guide*", it was found that the risk category (for a level 1 assessment) is medium during the day time and negligible during night time.

BS 8233 states that "*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*." This would also vary on the type of window used.

Based on the background survey, open windows in bedrooms would result in the daytime limit of 35 dB being exceeded by 11.8 dB, and the limit of 30 dB at night time being exceeded by 0.6 dB. In order to prevent internal noise disturbance, we recommend rapid purge ventilation along with acoustic trickle vents that have attenuation characteristics ≥ 32 dB, $D_{n,e,w.}$ (see Appendix C for example).

6.5 Communal Health and Wellness Spa

It is advised that all plant equipment is to be designed and installed by suitably qualified persons whereby noise levels do not exceed 30.7 dB 1 meter from the façade of the nearest unit on the development as per BS4142 methodology and local council guidance. Should mechanical noise exceed this level, the equipment will be mitigated directly at the source and as such will have no impact on the previous mitigation measures outlined as per BS8233.

6.6 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.

6.6.1 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 survey has been undertaken for the proposed development at 52 Avenue Road, St Johns Wood, allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

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

Acoustic attenuation for all non-glazed external facades will be sufficiently met based on external façade requirements as per Building Regulations 2010. Mitigation advise has been provided for windows and ventilation, as well as the construction phase as per BS5228.

Target noise levels have been provided for plant equipment relating to the health and wellness spa. We advise that these are verified upon completion of the design scheme to confirm whether additional mitigation measures are required as per BS4142 and local Camden noise guidance.

With regards to existing external noise intrusion as per BS8233, no further mitigation measures should be required in order to protect the proposed habitable spaces from adverse impact.

Appendices

Decibel scale - dB

Appendix A: Noise Indicators and Acoustic Terminology

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 Lden (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, Leq (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 absorbents, 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.

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Appendix B: Site Drawings

Aval Consulting Group.

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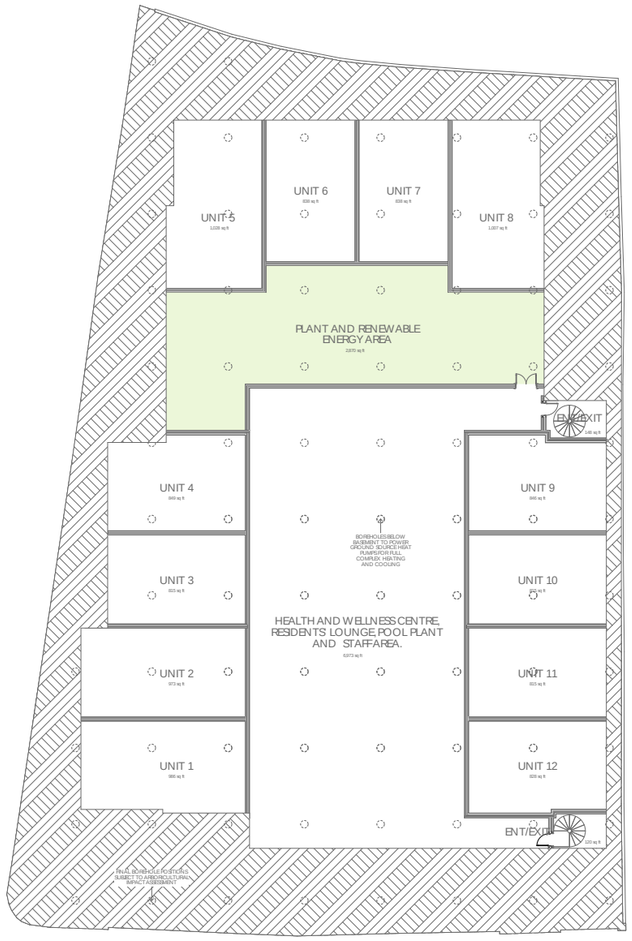

0 20M

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PROJECT:
AVENUE GARDENS

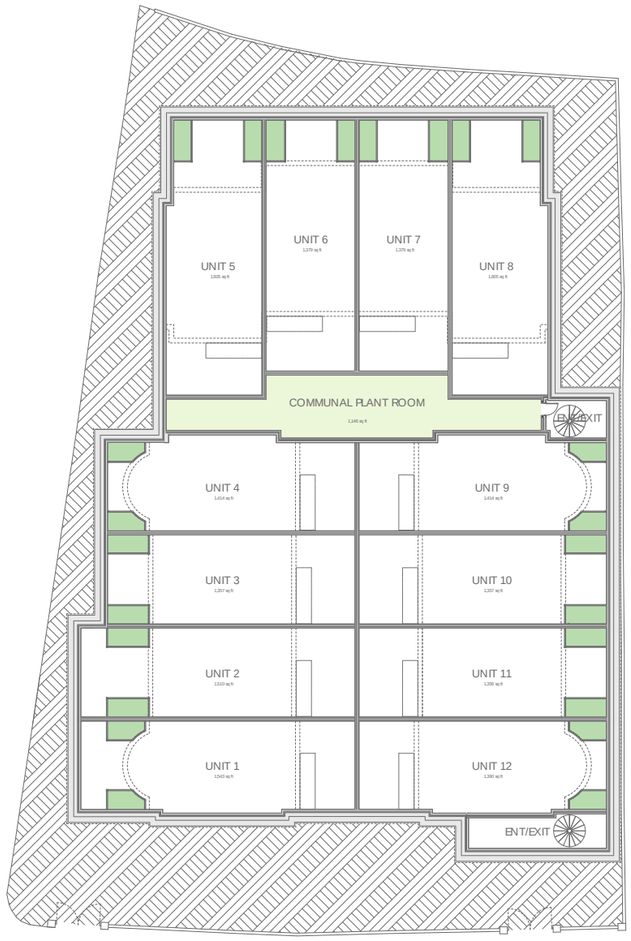
TITLE:
PROPOSED BASEMENT PLAN - 12 UNIT SCHEME

Date: APRIL 2022
Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-253

Aval Consulting Group.

N



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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED LOWER GROUND FLOOR PLAN - 12 UNIT SCHEME

Date: APRIL 2022

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DRAWING NUMBER: 208-254A

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED GROUND FLOOR PLAN

Date: APRIL 2022

Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-255A

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED FIRST FLOOR PLAN - 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:200 @A1 Drawn: SDK

DRAWING NUMBER: 208-256

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED SECOND FLOOR PLAN - 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:200 @A1 Drawn: SDK

DRAWING NUMBER: 208-257

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED ROOF PLAN - 12 UNIT SCHEME

Date: APRIL 2022
Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-258

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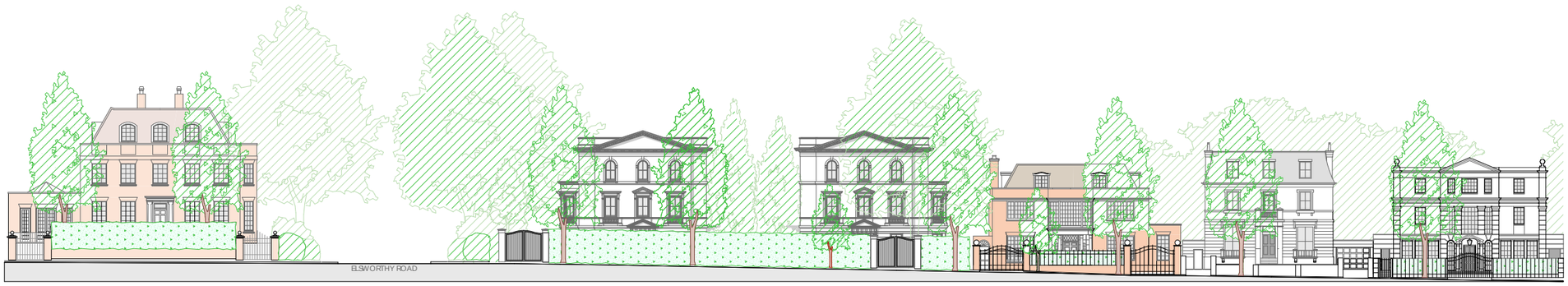

0 20M

PROPOSED AVENUE ROAD STREET ELEVATION

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED AVENUE ROAD
STREET SCENE ELEVATION
- 12 UNIT SCHEME

Date: APRIL 2022
Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-270

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0 20M

PROPOSED ELSWORTHY ROAD STREET SCENE ELEVATION

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED ELSWORTHY ROAD STREET SCENE ELEVATION - 12 UNIT SCHEME

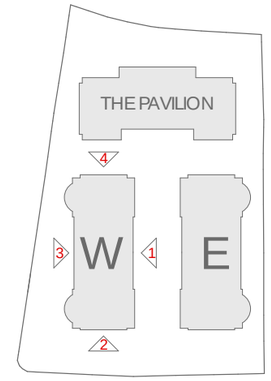
Date: APRIL 2022
Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-271B

Aval Consulting Group.

ELEVATION 1

ELEVATION 2



KEY

N

ELEVATION 3

ELEVATION 4

WEST BUILDING 1:100

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PROJECT:
AVENUE GARDENS

TITLE:
WEST BUILDING
PROPOSED ELEVATIONS
- 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:100 @ A1 Drawn: SDK

DRAWING NUMBER: 208-272A

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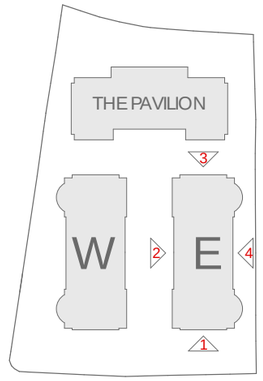
ELEVATION 1

ELEVATION 2

ELEVATION 3

ELEVATION 4

EAST BUILDING 1:100



KEY

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PROJECT:
AVENUE GARDENS

TITLE:
EAST BUILDING
PROPOSED ELEVATIONS
- 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:100 @ A1 Drawn: SDK

DRAWING NUMBER: 208-273A

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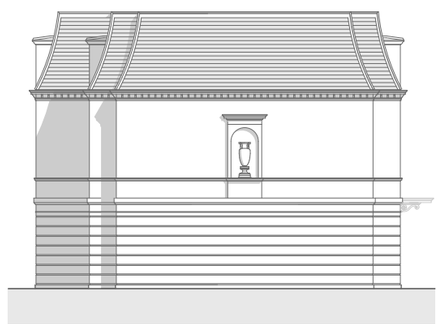
ELEVATION 1



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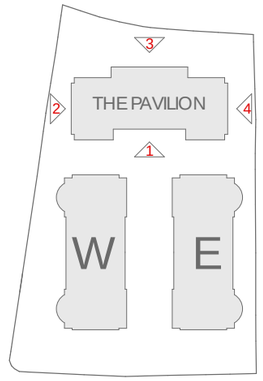

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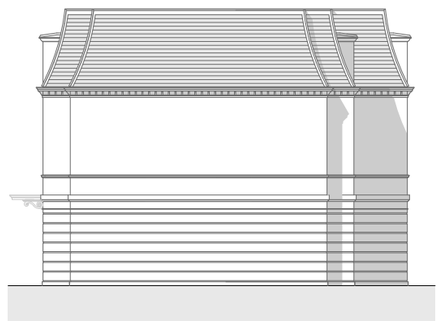

ELEVATION 4

THE PAVILION 1:100

PLANNING

DOMVS
LONDON

WWW.DOMVSLONDON.COM

PROJECT:
AVENUE GARDENS

TITLE:
THE PAVILION
PROPOSED ELEVATIONS
- 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:100 @ A1 Drawn: SDK

DRAWING NUMBER: 208-274A

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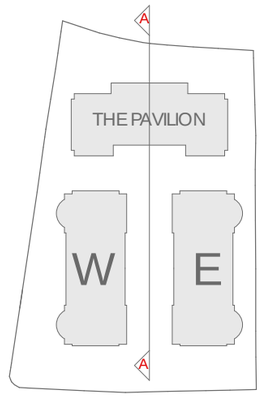

KEY

N

0 4 8 12 16 20M

PROPOSED SECTION A - A 1:200

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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED SECTION A - A
- 12 UNIT SCHEME

Date: APRIL 2022

Scale: 1:200 @ A1 Drawn: SDK

DRAWING NUMBER: 208-290A

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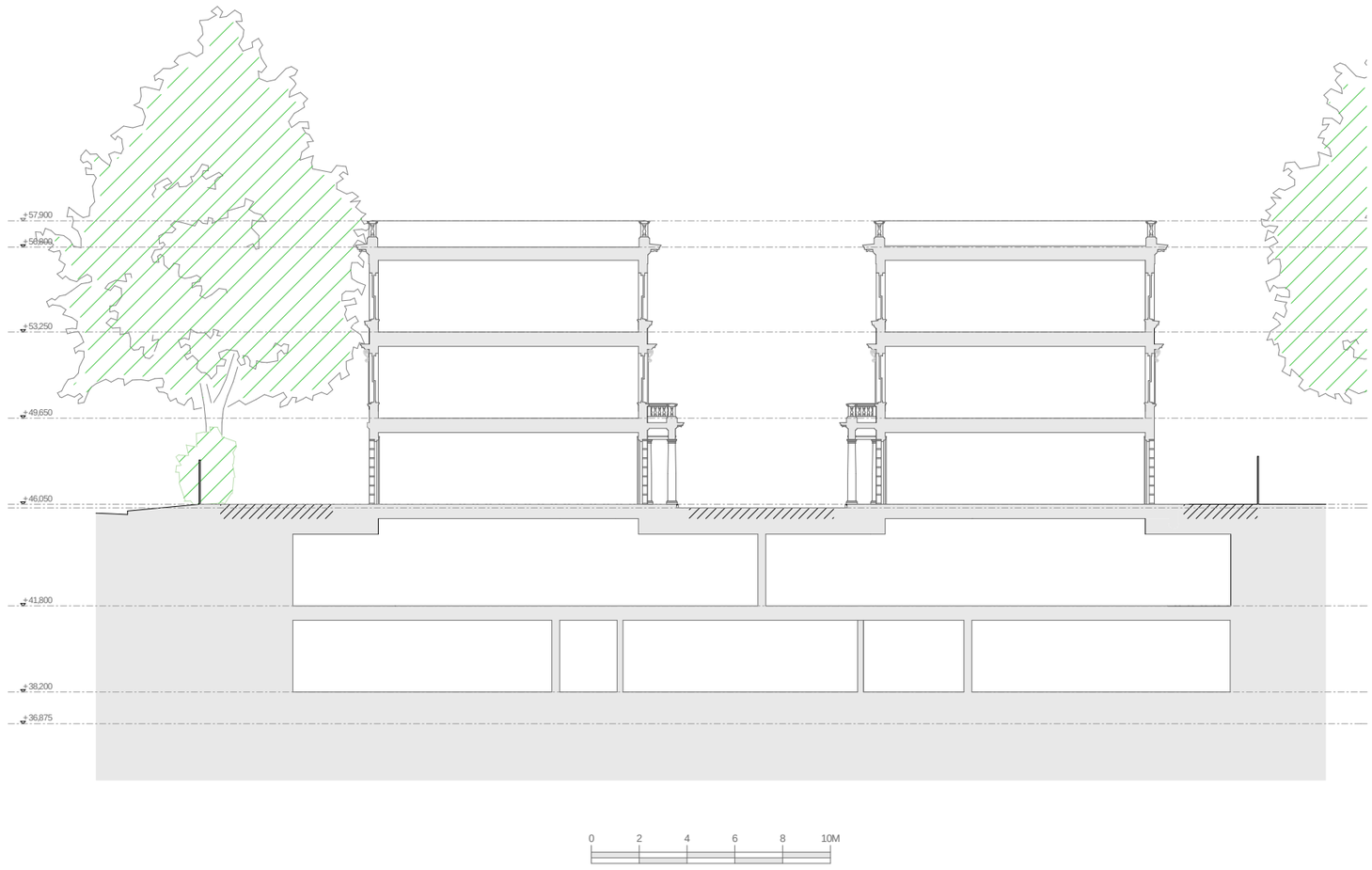
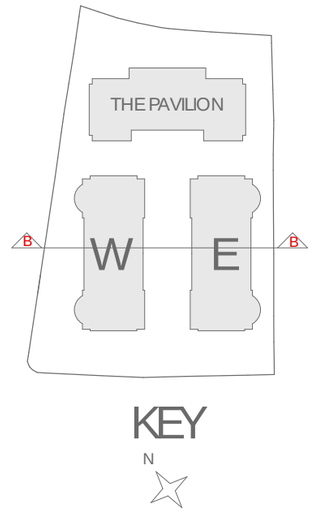


PROPOSED SECTION B - B 1:100



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PROJECT:
AVENUE GARDENS

TITLE:
PROPOSED SECTION B - B
- 12 UNIT SCHEME

Date: APRIL 2022
Scale: 1:100 @ A1 Drawn: SDK

DRAWING NUMBER: 208-291A

Appendix C: Proposed Mitigation

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

	Gap between panes					
Thickness of pane	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 mitering
- 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 sodalime 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

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2500EA / 5000EA

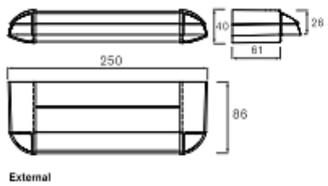
Acoustic window ventilator

Physical specification

All measurements in millimetres unless otherwise indicated

Materials: Aluminium Alloy

2500EA Acoustic



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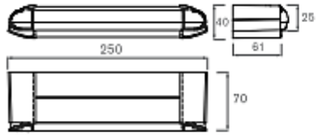
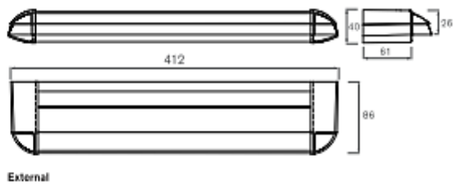


Internal

5000EA Acoustic



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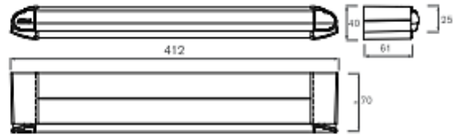


Internal

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.

2500EA Acoustic slot size

Height: 13mm

Length
192mm

5000EA Acoustic slot size

Height: 13mm

Length	Central gap	Length
172mm	10mm	172mm

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

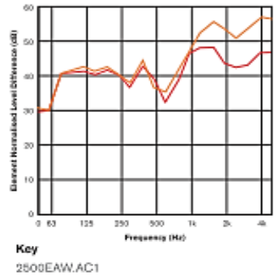
Sets comprise of:

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

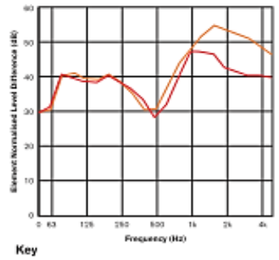


Key

2500EAW.AC1

2500EAW.AC2

5000EA acoustic performance



Key

5000EAW.AC1

5000EAW.AC2

Models, control options and key data

			Acoustic performance				
Product code	**Description**	**Controls**	**Dn,e,w**	**Dn,e,w (C)**	**Dn,e,w (Ctr)**	**Equivalent area mm²**	**Colour**
2500EAW.AC1 *	Vent + 1 Acoustic External Module	Front	42dB(A)	41dB	40dB	2670	White
2500EAW.AC2 *	Vent + 2 Acoustic Modules	Front	45dB(A)	43dB	42dB	2670	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	38dB	5350	White

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

Appendix D: Certificates

Certificate of Calibration Class 1 BSWA-IV-C021-09-P0274

CERTIFICATE OF CALIBRATION

Class 1

TYPE: BSWA 308 S/N: 580273

京制01020122号

1. APPEARANCE Pass

2. CALIBRATION (sound)

Calibrator: BK4231 Sound Level: 93.8 dB Frequency: 1000 Hz

Microphone Model / SN: MP231 /580307

Filter	Nominal[dB]	Indication[dB]	Error[dB]
A	93.8	93.8	0.0
C	93.8	93.8	0.0
Z	93.8	93.8	0.0

3. FREQUENCY WEIGHTINGS (sound & electrical)

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

Frequency	Attenuation[dB]		
[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	1.6	0.2	0.4
4000	1.3	-0.5	0.4
8000	-0.7	-2.6	0.9
16000	-11.7	-13.8	0.9
20000	-25.5	-27.5	-0.8

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]	20.0	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]	0.0	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]	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]	34.7	4.3
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	Response[dB]		
[ms]	L_{AFmax}-L_A	L_{ASmax}-L_A	L_{AE}-L_A
500	-0.1	-4.1	-3.1
200	-1.0	-7.5	-7.0
50	-4.9	-13.2	-13.1
10	-11.2	-20.1	-20.1

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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] L_{Aeq}-L_A
500	2000	-7.0
200	800	-7.0
50	200	-7.0
10	40	-7.0

9. OVERLOAD INDICATION (electrical)

Filter=A; Fsin=1000Hz

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

10. C-WEIGHTED PEAK SOUND LEVEL (electrical)

Filter=C; Peak; Fsin=500Hz

Steady Signal Level	(L_{Cpeak}-L_C)[dB]		
	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	2.6	2.3

CONDITIONS		
Temperature	18	℃
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	MY44036043	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 2M D TEST (sig.): JD 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

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Castle

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

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