NOISE IMPACT ASSESSMENT

SEASIDE PRIMARY SCHOOL, LANCING

ADUR & WORTHING DISTRICT COUNCILS

JULY 2022

NOISE IMPACT ASSESSMENT
SEASIDE PRIMARY SCHOOL, LANCING

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REVISION HISTORY

Version	Comments	Changes made by	Approved by
1.0	First issued version	PA	EG
2.0	Revision following update to site layout	PA	EG
3.0	Revision following revision of ventilation strategy, and proposed plant	PA	EG
4.0	Update minor correction	PA	EG

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1 INTRODUCTION

Anderson Acoustics Ltd has been commissioned by Burns Guthrie & Partners to undertake a noise assessment for Adur and Worthing District Councils (AWDC) to consider the proposed new sports hall at the Seaside Primary School, Lancing. A pre-application enquiry has been issued by Burns Guthrie (AWDC reference PREAPP/0195/21). The corresponding response requested a noise impact assessment to be supplied with the full planning application.

Accordingly, a noise survey has been undertaken to determine the existing acoustic conditions in the vicinity of the nearest dwellings to guide acoustic design criteria. This document covers the assessment of both sound emissions from proposed heating plant based on the guidance in BS 4142[1], and the potential noise breakout from the hall when in use, assessing the impact with reference to BS8233:2014[2].

The report has been revised following a minor change to the site layout (November 2021).

Following further changes to the proposed ventilation strategy, as well as a change to specified ASHP plant, and additional ventilation plant serving changing rooms and toilets, an update to the original report have been undertaken (June 2022) to assess these changes.

A glossary of terminology is presented in Appendix A.

[1] British Standard (BS) 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

[2] British Standard (BS) 8233:2014 Guidance on sound insulation and noise reduction for buildings

2 THE SITE AND NEAREST RECEPTORS

The proposed development is the construction of a new sports hall south of the main school buildings, comprising an energy efficient single storey building with associated changing, toilet and plant room. The operational hours of the sports hall will be 08:00 – 17:00 hours, Monday to Friday, with no use on weekends or bank holidays.

The site and nearest receptors (i.e. dwellings) can be seen in Figure 2-1, with the approximate proposed building footprint shown in Figure 2-2 (updated with minor relocation). Eastern and Western façade elevations are presented within Figure 2-3 and Figure 2-4 respectively. It can be seen the nearest dwellings are the bungalows on Seaside Close and Seaside Avenue, which border Seaside Primary school to the west. The closest residential receptor (conservatory of no. 4 Seaside Close) is approximately 18 m from the western façade of the proposed sports hall.

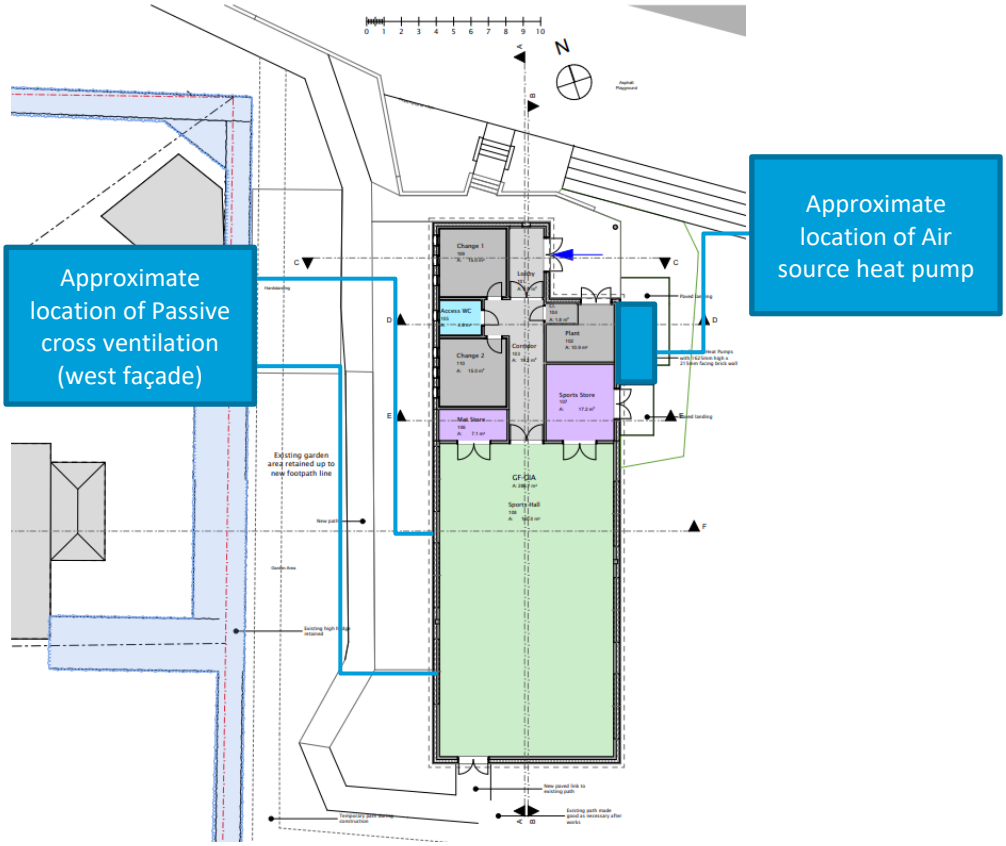
The plant room has been positioned on the eastern façade of the hall, facing away from the nearest residential receptors, and significantly acoustically screened by the sports hall building itself. Two Air Source Heat Pumps (ASHP) are proposed outside the plant room, with anticipated operational hours of between 06:00-18:00.

Figure 2-1: Site location and context



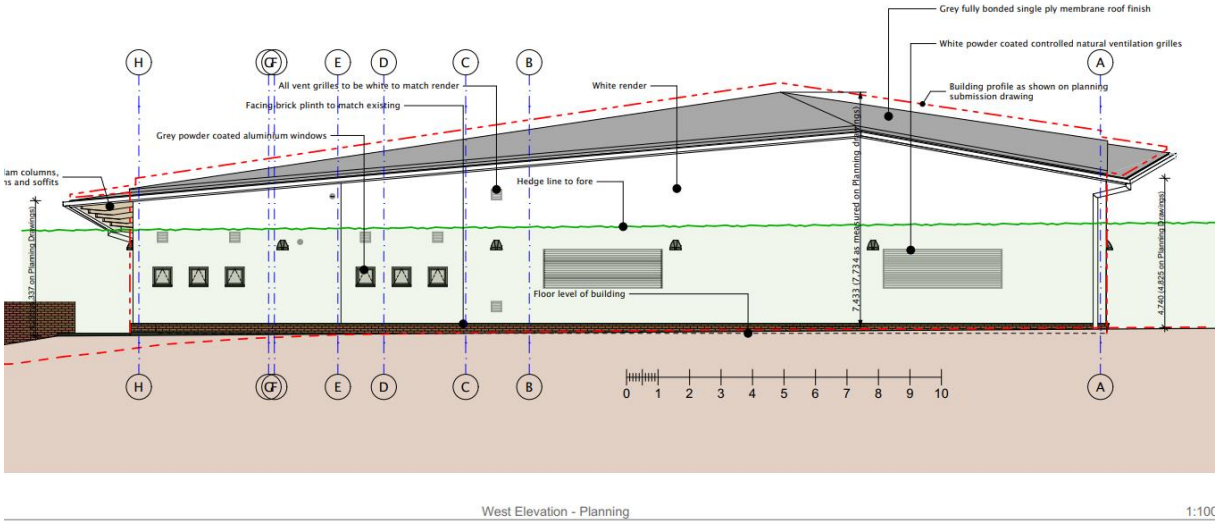
Source: Imagery 2021 Bluesky (annotated by Anderson Acoustics)

Figure 2-2: Sports hall ground floor plan



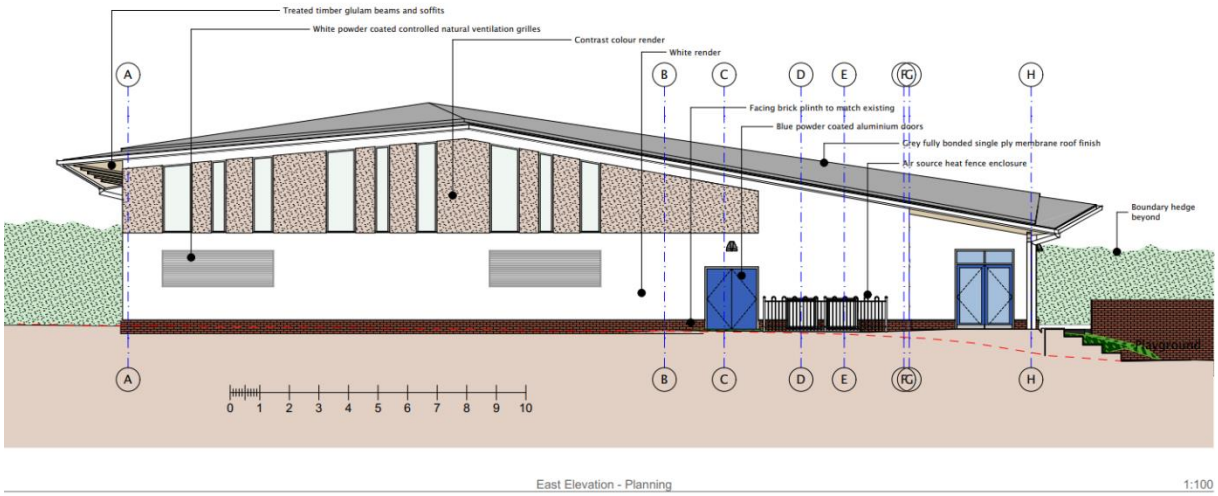
Source: Burns Guthrie and Partners (drawing number 3018/0129 v.10)

Figure 2-3: Sports hall west elevation



Source: Burns Guthrie and Partners (drawing number 3018/0279, 31/5/2022)

Figure 2-4: Sports hall east elevation



Source: Burns Guthrie and Partners (drawing number 3018/0279, 31/5/2022)

3 ASSESSMENT GUIDANCE AND CRITERIA

Noise units and national planning guidance documents in Noise Policy Statement for England (NPSE), Planning Practice Guidance–Noise (PPGN), and National Planning Policy Framework (NPPF) are detailed in Appendix B.

3.1 Relevant Policy

3.1.1 Adur and Worthing District Councils (AWDC)

AWDC use the following guidance relating to potential change to the acoustic environment when reviewing planning applications (see Appendix B for further details):

- National Planning Policy Framework (NPPF); and
- Planning Noise Advice Document: Sussex

3.1.2 Planning Noise Advice Document: Sussex (March 2021)

Section 2.0 of this document covers "Industrial and Commercial Noise Sources" which states:

> 2.2.1. "The starting point for designing any industrial/commercial development should be to minimise noise "as far as reasonably practicable". The rating level of the plant/process, when measured in accordance with BS 4142:2014, should, where practicable, be no greater than the existing background levels when measured in accordance with BS 4142:2014. There may be instances, for specific sites, where a rating level below background is deemed appropriate. This can be determined through prior discussion with the Local Planning Authority or Local Environmental Health Department. For example, a rating level of 10 dBA below background may be required in certain instances if there are specific concerns such as the potential for noise creep. It is considered that meeting these criteria would avoid adverse noise impacts, in the interests of ensuring a good standard of amenity and protecting human health. Where these criteria are not attainable, the noise report should explain why, and how best practicable means will be implemented to control noise in order to satisfy the LPA that the development is acceptable."

Appropriately, the above confirms that an assessment is required in terms of BS 4142. It is rightly identified that, assuming noise is minimised to a reasonable practicable minimum, in some instances site noise (including any correction for distinguishable features according to BS 4142 – see below) equal to the background sound level could be acceptable, but that there may be instances where lower levels may need to be considered.

Accordingly, the assessment is based on the guidance in BS 4142, as outlined below, with the potential significance of the proposed noise sources considered in the context of the site and surrounding area. The relevance and requirements of national policy are also considered further below.

3.2 BS 4142:2014 + A1:2019

The Standard provides methods for rating and assessing sound/noise of an industrial or commercial nature in relation to residential premises, hence its relevance here. The assessment methodology evaluates the "specific sound level" of each industrial or commercial sound source, corrects for distinguishable features to derive the "rating level", and compares this with the "background sound level".

An assessment, therefore, is effectively in two parts. The first part results in an initial indication of the impact, and the second part considers the impact in terms the context unique to the situation at hand. See Appendix B for further details.

3.3 British Standard 8223:2014

The core method in BS 4142 (outlined above) compares the plant noise with the background conditions (i.e. part one of an assessment). When it comes to part two – taking into account context – it is in keeping with the BS 4142 guidance to also consider the significance of the absolute level of the plant noise. This is typically done in terms of the absolute noise thresholds given in BS 8233. This provides guideline values for internal and external noise levels for dwellings.

It states that, "In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4." This table is reproduced in Table 3-1 below.

Table 3-1: BS 8233 indoor ambient noise levels for dwellings

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

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

For bedrooms during daytime operation of the site as proposed, therefore, the guideline value is 35 dB $L_{Aeq,8h}$. Assuming a partially open window providing 15 dB (during use for cooling, for example), the equivalent external level/limit would be in the order of 50 dB. This is a free-field level unaffected by any façade-reflected sound.

BS 8233 does caution that the guideline values are for sources without a specific character, and that where any such characteristics are present, "lower noise levels might be appropriate." It is likely that sound from the site will be characterful to some extent. Accordingly, some reduction in the standard values would be considered prudent. Either way, external levels of less than 45 dB – equivalent to internal levels 30 dB or less - can be seen to be low.

3.4 Summary of Assessment Criteria

It is shown above that BS 4142 is the most relevant guidance document, as referenced in the Sussex Planning Noise Advice Document; that context needs to be taken into account, whereby BS 8233 is also relevant; and that neither the local or national policy documents contain fixed thresholds.

4 BASELINE SOUND LEVELS

4.1 Introduction

To determine the baseline acoustic conditions in the vicinity of the nearest dwellings, a sound level meter was installed on the boundary of the school playing fields at no. 2 Seaside Close to measure continuously for a period of 5 days. The survey details and results are presented below.

4.2 Survey Details

Continuous unattended measurements were undertaken over four full days, including a weekend, and two-part days, between 15:30 on Wednesday 28th July and 10:30 on Monday 2nd August 2021. The area in the vicinity of the school is mainly residential, with the acoustic environment composed of sources such as local and distant road traffic. This is likely to be representative of a robust baseline case, as it does not include sound from school activities and children. It was noted that there was some distant construction noise audible, however it was not considered to have a significant influence on the measured sound levels.

The equipment details are presented in Section 4.3. The microphone was fitted with a windshield and mounted on a tripod such that this was approximately 1.5 m above the local ground and in free-field conditions (i.e. away from hard, vertical surfaces). The locations of the hall and noise monitoring equipment are shown in Figure 4-1 and Figure 4-2 below. The data gathered at this location are considered representative of those experienced at the nearest dwellings on Seaside Close and Seaside Avenue.

Figure 4-1: Survey location



Source: Imagery 2021 Google (annotated by Anderson Acoustics)

Figure 4-2: Survey location and equipment (looking south)



The measurement chain was field calibrated before the survey using an acoustic calibrator. The level was checked at the end of the survey, and no significant drift were observed. Both the sound level meter and calibrator have been calibrated by a UKAS accredited laboratory with the standard intervals of 24 months and 12 months, respectively.

The meter was set to store "A" weighted sound levels and un-weighted 1/3 octave bands between 6.3 Hz and 20 kHz every at 15-minute intervals using "fast" time weighting to capture L_{eq}, L_{max}, L_{90} and L_{10} levels have been determined. The results are presented in Section 4.4 and Appendix C.

The sources audible during attendance at site included local and distant road traffic, most notably from traffic on Old Salts Farm Road to the east. During removal of the monitoring equipment, we were informed by a neighbour that there was some audible noise understood to be associated with painting on the school premises during some days.

The weather conditions were noted regularly during the survey. There was likely influence on wind speed during Wednesday to Friday, and it is for this reason data on these days has not been used to establish baseline noise levels. For the remainder of the survey Friday to Monday wind speeds remained light (certainly below the typically adopted limit of 5 m/s for surveys). This approach will demonstrate a worst-case scenario as background ambient sound levels are, in general, lower on weekends than weekdays. This also has the effect of excluding days when it is understood painting activity was taking place on the school premises, and therefore removed the potential influence of this activity on measurements.

4.3 Survey Equipment Details

Table 4-1: Survey equipment details

Equipment (ID)	Make & Model	Serial No.	Date Laboratory Calibrated	Calibration Certification Number[1]
Sound Level Meter (AA SLM-11)	Rion NL-52	00732147	18th December 2020	UCRT20/2259
Calibrator (AA-CAL-02)	Rion NC-74	35173438	31st March 2020	UCRT21/1435
Certificates available on request				

4.4 Survey Results

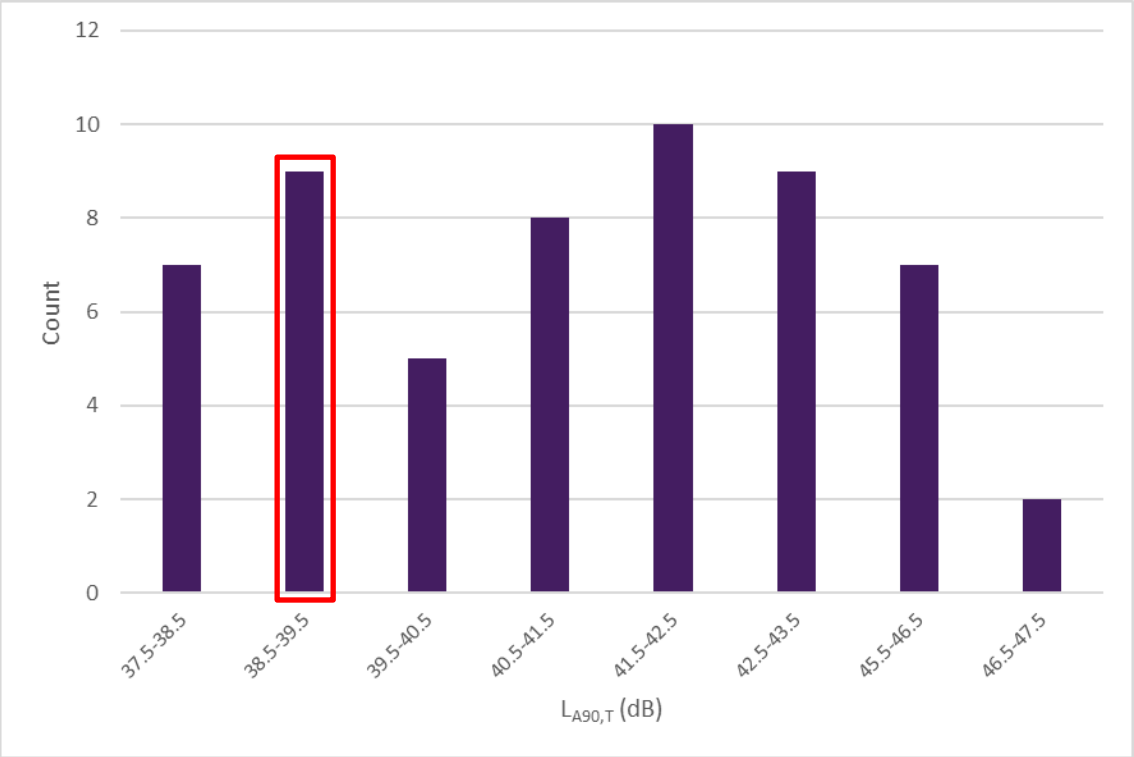
Of most interest to the assessment are the background ($L_{A90,T}$) sound levels, which are typically considered in terms of levels over a 15-minute period (BS4142 refers to a reference period of 1 hour for daytime and 15 minutes for night-time periods). The aim being to determine values that represent the typical background conditions for the period of interest e.g. early morning period. However, in order to provide context and check for atypical conditions, for example, it is appropriate to consider other standard metrics, namely L_{Aeq}, L_{Amax} and L_{A10}. The full set of 15-minute period levels are presented in the table in Appendix C. Table 4-2 presents the tabulated ambient noise levels ($L_{Aeq,T}$) and background levels ($L_{A90\ 15min}$) for the time when the plant is anticipated to operate, between 06:00 and 18:00 hours (term time Monday – Friday).

Table 4-2: Summary of ambient sound levels – free-field

Date	Measurement Period	Ambient Sound Level $L_{Aeq,T}$ (dB)	Modal Background Sound Level $L_{A90,15min}$ dB
Wednesday [1] 28th July 2021	15:45 to 18:00	52	46
Thursday 29th July 2021	06:00 to 18:00	53	39
Friday [2] 30th July 2021	06:00 to 18:00	53	47
Saturday 31st July 2021	06:00 to 18:00	49	35
Sunday 1st August 2021	06:00 to 18:00	51	33
Monday [1] 2nd August 2021	06:00 to 10:30	46	40
[1] Measurement excluded due to reduced time-period [2] Measurement excluded due to site activity/weather			

From the frequency distribution data presented in Figure 4-3, the typical background sound level during proposed hours of operation has been identified as 39 dB $L_{A90,15\ mins}$. The background sound level for this period is consistent throughout the 12 hours when the plant may be operational. It should be noted that this is likely to be representative of receptors to the west of the school, however, as later in this report it will be seen this level has also been used to assess the impact for a receptor on Old Salts Farm Road. Since the monitoring location is in a relatively secluded and therefore quieter area in comparison to Old Salts Farm Road, the use of the background level for this position is considered to represent a robust case.

Figure 4-3: $L_{A90,15min}$ frequency distribution during operational period



In order to establish the ambient acoustic conditions when the hall may be in use, the measured noise levels have also been assessed to determine the typical ambient sound levels between the hours of 06:00 and 18:00 hours. Although measured ambient noise level during Wednesday to Friday may have been influenced by the weather, these levels have been considered in the assessment of environmental noise ingress to the hall as a worst case.

The environmental ambient sound level taken to be representative outside the proposed hall is taken to be 53 dB $L_{Aeq,15min.}$ The minimum ambient sound level at the nearest noise sensitive receptor when the proposed hall will be in used for activity is taken to be 47 dB $L_{Aeq,15min}$ which would serve as a robust assessment for the impact of sports activity noise.

5 PLANT NOISE

5.1 Calculations and Modelling

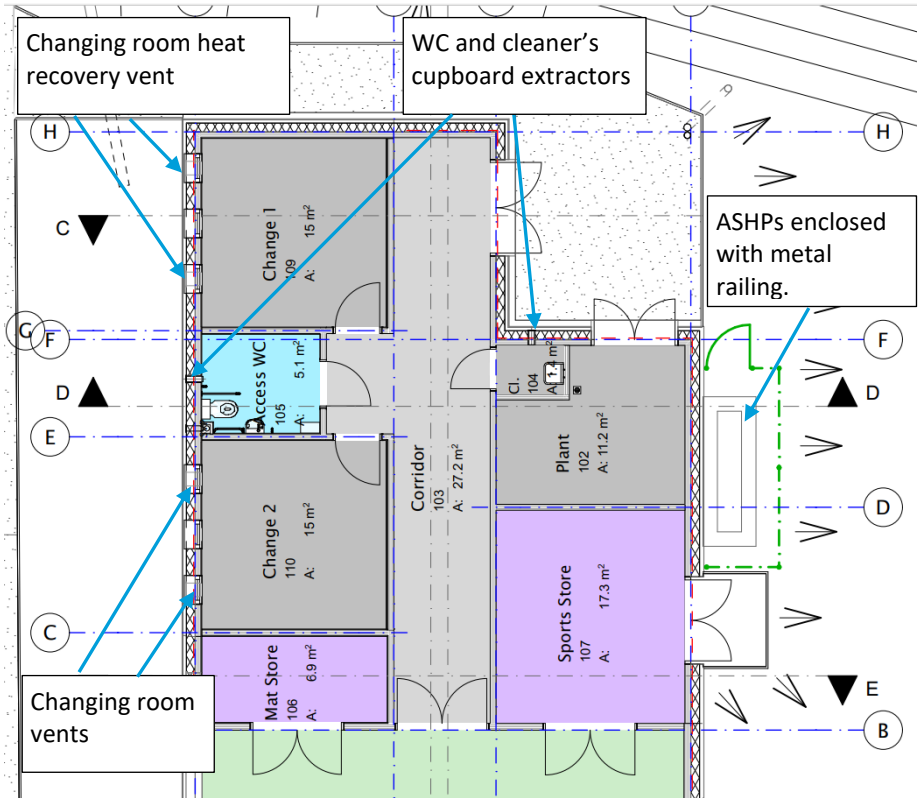
2 no. Mitsubishi PUZ-WM85VAA Air Source Heat Pumps (ASHPs) are proposed. The heat pumps will automatically operate in order to raise the internal temperature of the building in time for the start of the school day (09:00 hours). It is anticipated that the plant could potentially operate from as early as 06:00 hours and would typically operate during cooler months until approximately 18:00. In addition to the change in proposed heat pumps, ventilation extracts and heat recovery units are proposed.

The ASHPs are proposed to be located on the eastern façade of the sports hall, facing away from the nearest noise sensitive receptors to the west of the hall. This positioning also benefits from the hall itself providing substantial acoustic screening to these receptors. The units are to be located at ground level to the south of the plant room, as shown in Figure 5-1 below, highlighted in red. The plant room itself will contain low noise emission plant such as electric immersion heater, water storage vessel and control equipment; all of which will be enclosed behind louvered doors. For the purpose of this acoustic assessment, only noise arising from the operation of the ASHPs and ventilation plant is being assessed, as these will be the only significant source of plant noise. Table 5-2 presents a summary of the proposed plant details and locations. This data is from manufactures' datasheets, operating at highest duty.

Table 5-1: Summary proposed plant

Ref	Model	Sound Power level (SWL) dBA	No. units	Location
ASHP-1	PUZ-WM85VAA	58	1	External – east facade
ASHP-2	PUZ-WM85VAA	58	1	External - east facade
EF-01	OPUS40S-ESF	53.6	1	WC
EF-02	OPUS40S-ESF	53.6	1	Cleaner's cupboard
HRU-01	UNI-X360-C	64.2	1	Changing room 1
HRU-02	UNI-X360-C	64.2	1	Changing room 2

Figure 5-1: Location of Air Source Heat Pumps and other ventilation plant



Proprietary acoustic 3D modelling software (CadnaA by DataKustik) has been used to predict the sound at the nearest noise sensitive receptor (rear façade of no. 4 Seaside Close). The prediction methodology uses ISO 9613 calculation procedures.

Predicted sound levels are based upon the two Mitsubishi PUZ-WM85VAA ASHP units. Sound Power Levels (SWLs) have been taken from the respective manufacturers data sheets. The architects' drawings have been used to establish the dimensions and locations of the sports hall.

A list of assumptions used to produce the acoustic model are presented below:

- Centre of ASHPs located at 1m above ground level on the façade of the sports hall
- Plant noise emission levels are as per detailed within Table 5-1 with locations as per Figure 5-1
- Receiver located 1.5 m above ground level
- Sports hall roof at least 4.9 m above ground level
- All walls 100% acoustically reflective
- All plant assumed to be operating continuously
- Ground level is broadly flat
- All plant operating simultaneously

A screenshot from the acoustic model presenting the predicted noise levels from the proposed plant is shown in Figure 5-2 below for three locations. Predicted noise levels are summarised within Table 5-2.

Figure 5-2: Noise prediction site plan (screenshot from CadnaA acoustic model)

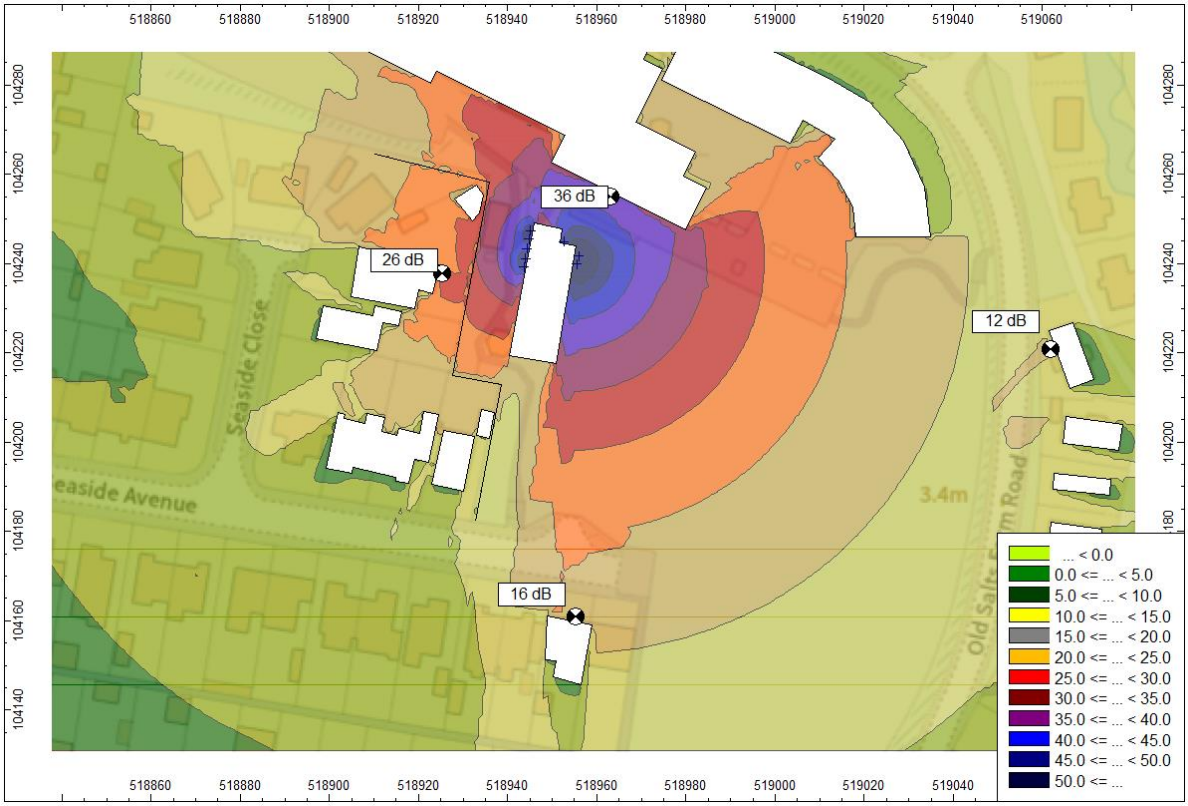


Table 5-2: Summary of predicted plant specific noise levels

Receptor location	Predicted noise level at 1m from receptor (dBA)
4 Seaside Close	26
32 Seaside Avenue	16
22 Old Salts Farm Road	12

In line with BS 4142, to account for potential acoustic character observable at the receptor a character correction has been applied to the specific noise level obtain the rating level. As it is not possible to measure the equipment to be installed, the subjective method as described within the standard has been used. As a robust assessment, a character correction of 3 dB has been applied for potential perceptible tonality, an additional correction of 2 dB has been applied for potential intermittency giving rise to a cumulative correction of 5 dB. The resulting rating levels at residential receptors are presented in Table 5-3.

Table 5-3: Summary of Rating sound levels

Receptor location	Predicted noise rating level (Specific noise level + character correction)
4 Seaside Close	31
32 Seaside Avenue	21
22 Old Salts Farm Road	17

The typical background sound level established during the operation of the plant is 39 dB $L_{A90,\ 15\ mins}$. Adur and Worthing Borough Councils refer to "*Planning Noise Advice Document: Sussex*" in relation to sources such as industrial or commercial plant, indicating that the Rating level should be no greater than the background level (ie the target maximum rating level is 39 dB). The assessment of rating level compared to background is presented within Table 5-4, which presents the predicted difference, a negative value being below background, and a positive value exceeding.

Table 5-4: Assessment of Rating level over background

Receptor location	Rating level – Background level, dB
4 Seaside Close	-8
32 Seaside Avenue	-18
22 Old Salts Farm Road	-22

The results demonstrate that the predicted plant sound emission levels are significantly below the background level, and therefore comfortably comply with Adur and Worthing Borough Council's guidance requirements of the Rating level being below background. Furthermore, BS4142 states: "*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.*" This is a positive indication that complaints arising from the operation of the proposed plant are unlikely.

Furthermore, these specific noise levels reported at 1m outside nearest residential receptors in Table 5-1 are comfortably below the maximum recommended external limit of 50 dBA, in order to meet the target BS8233 criteria for residential bedrooms with an open window during the day.

With regards to plant noise ingress to existing school buildings a free field plant noise level of 47 dBA has been predicted at 1 m from the existing school building. This predicted plant noise level is commensurate with maintaining the ideal BB93 indoor ambient noise criterion of 35dBA for based on a sound attenuation of 15 dB afforded by a partially open window.

6 ACTIVITY NOISE BREAKOUT FROM THE SPORTS HALL

6.1 Calculations

An assessment of noise breakout from the sports hall has been undertaken to establish the potential noise when in use at nearby noise sensitive receptors west of the hall. This has been calculated using typical internal reverberant sound levels measured for sports and multipurpose halls.

The breakout noise level has been calculated based on the sound propagation type and distance attenuation to the nearest residential premises, sound reduction index performance and area of each individual façade element, directivity, and screening attenuation corrections, to obtain the sound pressure level at the receiver location, $L_{p, out}$, using the following formula (with reference to BS EN ISO 10140 Part 3 and 4: 2010).

$L_{p, out} = L_{p, in} + 10 \log (S) - R - 20 \log (r) - 14$ [- directivity/screening corrections]

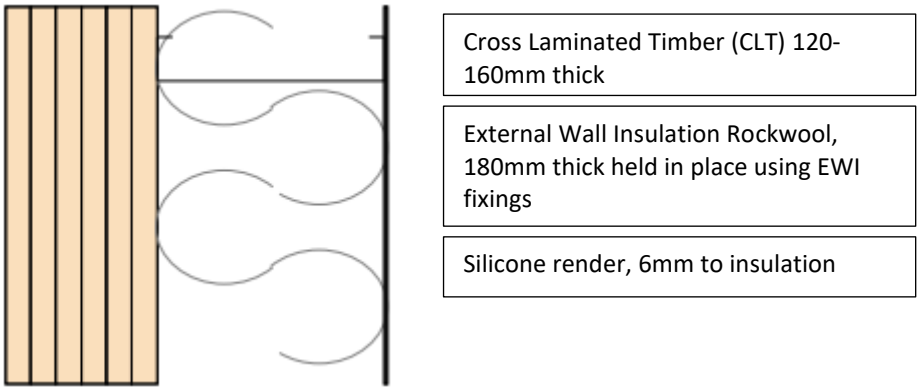
given

- The distance r (m) from a façade
- The façade Sound Reduction Index R or R' (dB)
- The internal (source room) sound pressure level $L_{p, in}$ (dB)
- The area S (m^2) of the construction element facing the receiver

This calculation assumes hemispherical sound radiation for point source, and so is valid for distances greater than three times the major source dimension (which is the case for this assessment).

The sound insulation performance of the building envelope has been estimated based on predictions undertaken with proprietary sound insulation performance software Insul, which estimates the sound reduction performance of composite structures. A section drawing showing the construction of the external walls is presented within Figure 6-1 below:

Figure 6-1 Wall construction section drawing



The predicted sound insulation performance shown in Figure 6-1 is based upon a minimum wall thickness of 120mm thick CLT. There are three closable narrow strip louvred ventilators located on the western façade of the building, opening from the hall, to provide natural cross ventilation as required. An assessment to establish the minimum required acoustic performance of the louvred ventilators has been undertaken, to ensure activity noise from the sports hall at the nearest receptor façade is no greater than the minimum existing ambient noise level experienced, or lower if practicable.

This is deemed a reasonable standard to adopt as sound experienced when the sports hall is in use would be broadly similar to when the school's sports playing fields are in use. Thus, the use of the hall would not increase

the level of sound already experienced by noise sensitive receptors. The target activity noise breakout level is therefore 47 dB $L_{Aeq,15min}$ (free- field outside the nearest residential premises) as described within Section 4 of this report.

Furthermore, it is noted that a level of 47 dB L_{Aeq} would be equivalent to 32 dB L_{Aeq} inside the residential premises, based on sound attenuation of 15 dB afforded by an open window. This is commensurate with achieving the BS8233 criteria in bedrooms and living rooms during daytime hours (35 dB $L_{Aeq,16hrs}$).

Table 6-1: Building envelope sound insulation performance

Building element	Overall performance (Rw), dB	Frequency band, unweighted Sound Insulation performance						
		63Hz	125Hz	250Hz	500Hz	1 kHz	2 kHz	4 kHz
Building envelope	56	25	34	47	56	58	66	76

The calculations are based upon the total wall area being approximately 18.0 m x 7.5 m and including 2 no. louvred ventilators of dimensions 3.7 m x 1.2 m. Detailed calculations are presented within Appendix D. To represent activity noise levels within the hall, measured sound levels within a typical school swimming pool have been use as representative of a similar highly acoustically reverberant enclosed space.

This assessment has taken a robust approach to predicted breakout during use of the hall using a worst-case reverberant source noise level. This also allows for a reasonable level of amplified music which could be anticipated for typical activities in a sports hall such as during dance classes for example. It should also be noted that this is at the limit of the internal noise level at which effective communication between pupils and teachers is possible, so in general, the typical noise levels within the hall would be lower when in use.

The results of the calculations have been used to compare the predicted levels with the ventilators with dampers in the fully open position within the façade. The calculations are based upon an, as yet, un-specified acoustically attenuated louvred ventilator model from TEK Ltd. Although the specific louvre has not been confirmed, for the purposes of this assessment the attenuation from an example model with acoustic attenuation performance at the lowest end of their range (150mm depth louvre, $D_{new + Ctr}$ 16dB) has been used in this assessment. The predicted sound level at the nearest noise sensitive receptor is 10.0 dB below the minimum ambient sound level for this lowest performing model. It is likely that the impact of activity noise breakout from the use of the sports hall would be very low and would not have any more influence on the ambient acoustic environment than the existing sports field already has. The proposed use of attenuated ventilators presents an enhanced sound insulation performance of the building envelope over the original design. A design which already satisfied the adopted guidance criterion.

7 ENVIRONMENTAL NOISE INGRESS TO THE HALL

Based on a robust external environmental ambient noise level of 53 dB $L_{Aeq,15min}$ or lower outside the hall during the proposed periods of operation, it is anticipated that the BB93 target level of 45 dB $L_{Aeq,30min}$ could be comfortably achieved using a natural cross ventilation strategy, based on the guidance provided in Building Bulletin 93 (Table 2, note 2).

8 CONSTRUCTION NOISE

Planning Noise Advisory Document: Sussex 2021 details that guidance in Annex E of BS 5228-1: 2009+A1:2014 should be followed when setting threshold noise levels for construction activities. At this stage it is not known whether a “fixed noise limit” or “noise change” method should be followed when setting potential noise significance thresholds.

Given the location of the proposed hall, should a fixed noise limit be considered suitable, a level of 75 dB at the nearest noise sensitive receiver would typically be set for all construction works between 07:00-19:00 on weekdays and 07:00-13:00 on Saturdays.

An average weekday ambient sound level of 52 dB was measured at the nearest noise sensitive premises during the daytime period. This baseline ambient noise level does not exceed the minimum threshold level detailed in method 1 (ABC method) of the "noise change" approach. Therefore, a threshold of 65 dB may be appropriate for construction activities between 07:00-19:00 on weekdays and 07:00-13:00 on Saturdays should this approach be followed.

The Local Authority may require a Construction Environmental Management Plan (CEMP), which should include details of how environmental impacts, including noise, will be managed to mitigate adverse effects to nearby sensitive receptors. It should cover the adoption of Best Practicable Means (BPM), which has been shown to reduce noise levels from construction sites typically by 5 to 10 dBA. A construction noise assessment is excluded from the current scope of works.

9 SUMMARY

Anderson Acoustics has undertaken an acoustic assessment to consider the potential noise impact for a new purpose-built sports hall at Seaside Primary School, Lancing.

A baseline sound survey was undertaken to establish the acoustic environment within the vicinity of nearby noise sensitive receptors. This data has been used to establish acoustic criteria for the plant noise assessment, as well as the noise breakout of the operation of the sports hall.

The assessment and report has been revised to reflect the minor change in the site layout, and detailed choice of proposed plant. The revised site layout and update to plant has resulted in a marginal change in predicted in impact, and there has been no material change in the results of the assessment, or findings of the report.

Predicted sound levels from the operation of the ASHPs as well additional ventilation plant are presented for several noise sensitive receptors in the vicinity of the school within Section 5 of this report, which demonstrate that the plant would comply with Adur and Worthing district council guidance at all assessed existing receptors, as well as comfortably complying with the target indoor ambient noise criteria for residential bedrooms set out in BS8233.

An assessment of sound breakout from the sports hall has been undertaken to identify the predicted sound levels at the nearest noise sensitive receptor during use of the sports hall. This has also assisted confirming the suitability of the attenuated cross ventilator performance for the proposed louvres. Based upon the calculations presented within Appendix D, the target acoustic criteria can be met with the use of performance proposed acoustically rated louvred ventilators. This presents an enhanced acoustic performance of the building envelope over the original design, which already satisfied the adopted guidance criterion.

For information, environmental noise ingress to the hall itself has been assessed to confirm that target indoor ambient noise levels within the sports hall could be achieved using the proposed natural ventilation strategy.

APPENDIX A

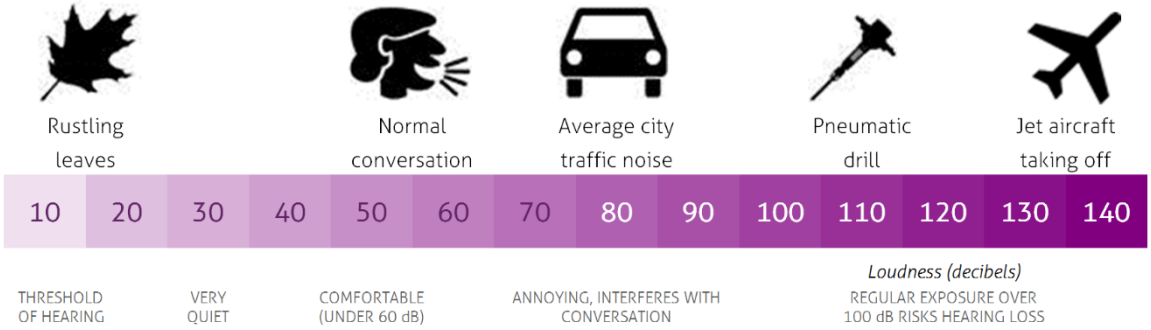
GLOSSARY OF ACOUSTICS TERMINOLOGY

There is a ten million to one ratio between the threshold of hearing and the highest tolerable sound pressure. Sound is therefore measured using a logarithmic scale, to account for this wide range, called the decibel (dB) scale. Noise is defined as unwanted sound and the range of audible sound varies from around 0 dB to 140 dB.

The human ear is capable of detecting sound over a range of frequencies from around 20 Hz to 20 kHz; however, its response varies depending on the frequency and is most sensitive to sounds in the mid frequency range of 1 kHz to 5 kHz. Instrumentation used to measure sound is therefore weighted across the frequency bands to represent the sensitivity of the ear. This is called 'A weighting' and is represented as dB(A), dBA or L_{Aeq} for example (see also below).

It is generally accepted that under normal conditions humans are capable of detecting changes in steady sound levels of 3 dB, whilst a change of 10 dB is perceived as a doubling or halving of the sound level. An indication of the range of sound levels commonly found in the environment is given below.

Figure A-1: Typical sound levels



A number of different indices are used to describe the fluctuations in sound level over certain time periods. The main indices include:

$L_{A90,T}$ This is the sound level exceeded for 90% of the measurement period and provides a measurement of relatively continuous sounds that make up quieter 'lull' periods in between sound events. It is often referred to as the background sound level, and usually measured using the 'fast' time response.

$L_{Aeq,T}$ This is the "equivalent continuous A weighted sound pressure level" and is the level of a notional steady sound which has the same acoustic energy as the fluctuating sound over a specified time period. It is often used for measuring all sources of sound in the environment, which can be referred to as the ambient sound.

$L_{Amax,F}$ This is the maximum sound pressure level measured in a given time period with the sound level meter set to 'fast' response.

Reference is often made to acoustic measurements being undertaken in 'free-field' or 'façade' locations. Free-field measurements represent a location away from vertical reflecting surfaces, normally by at least 3.5 m. A façade measurement is taken or calculated to a position 1 m from an external façade and a correction of up to 3 dB can be applied to account for the sound reflected from the façade. This latter position is often used when assessing the impact of external noise affecting residents inside properties.

In terms of the use of "sound" and "noise", strictly "sound" can be measured by a sound level meter or other measuring system, whilst "noise" is related to a human response, and is routinely described as unwanted sound, or sound that is considered undesirable or disruptive. Care has been taken in this document to use the most relevant of these terms; however, in most reference documents, and, indeed, generally, these terms are used interchangeably, with noise being used, in correctly, more often than sound, and so a mix is presented in this document. Consequently, just because the term noise is used, doesn't necessarily mean a negative effect exits or will occur, and the context of the accompanying text should be taken into account. Further definitions relating to this report are given overleaf.

Definitions

- Airborne Sound: Sound that reaches the point of interest by propagation through air.
- Ambient Sound: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.
- A-weighting, dB(A): The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
- Background sound: Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
- Calibration: The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short-term measurements, and periodically for longer term monitoring.
- Decibel (dB): A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds (s1 and s2) is given by 20 $\log_{10}$ (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 µPa.
- Façade/Façade Level: At a distance of 1 m in front of a large sound reflecting object such as a building façade. According to BS 8233:2014, "Façade level measurements of L_{pA} are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the façade." The Calculation of Road Traffic Noise (1988) uses 2.5 dB, whilst BS 5228-1:2009+A1:2014 recommends 3 dB. Owing to the latter examples, together with other historical documents, it is more usual to apply 3 dB.
- Fast time-weighting (F): Averaging time used in sound level meters. Defined in BS EN 61672-2:2013 *Electroacoustics. Sound level meters. Pattern evaluation tests*.
- Free-field/ Free-field Level: Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.
- Hertz (Hz): The unit of Frequency or Pitch of a sound. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
- $L_{A10,T}$: The A-weighted sound pressure level exceeded for 10% of the time over the period, T, measured using fast time-weighting (F), see below. It can be considered to be the "average maximum" sound level, and is generally used to describe road traffic noise.
- $L_{A90,T}$: The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the 'background' sound conditions.
- L_{Amax}: The maximum A-weighted sound pressure level during a given time period. L_{max} is sometimes used for the assessment of occasional loud sounds, which may have little effect on the overall L_{eq} noise level, but could still affect the sound environment. Unless described otherwise, it is measured using the fast time-weighting (F).
- $L_{eq,T}$: A sound level index called the equivalent continuous sound level over the time period, T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. Where the value is A-weighted, it will be presented '$L_{Aeq,T}$' or 'dBA $L_{eq,T}$', otherwise is should be an un-weighted (or linear) value.
- L_p: See Sound Pressure Level.

- ΔL_w : Reduction in weighted normalised impact sound pressure level. Used to measure the effectiveness of a resilient layer
- Octave/ octave band: Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit. For example, the 1000 Hz (1 kHz) octave band contains noise energy at all frequencies from 707 to 1414 Hz.
- Percentile Level: The sound pressure level exceeded for *N*% of a specified time interval, see $L_{A90,T}$ etc.
- R: See Sound Reduction Index.
- R_W: See Weighted Sound Reduction Index.
- Sound Absorption Class: A classification system applied to materials to describe the level of sound absorption they provide. Determined by comparing the practical sound absorption coefficient of the material with the values given in BS EN ISO 11654:1997.
- Sound Level Metrics, Indices or Parameters: Sound levels usually fluctuate over time, so it is often necessary to consider an average or statistical sound level. This can be done in several ways, so a number of different metrics have been defined, according to how the averaging or statistics are carried out.
- Sound Pressure Level (Sound Level), L_p: The sound level is the sound pressure relative to a standard reference pressure of 20 µPa ($20x10^{-6}$ Pascals) on a decibel scale.
- Sound Pressure: Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
- Sound reduction index (SRI), R: Laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.
- Weighted sound reduction index (SRI), R_W: Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies as measured in a laboratory.

APPENDIX B

NOISE POLICY AND CRITERIA

Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published by the Government in March 2010 (with no updates at the time of writing). It is the overarching statement on noise policy for England, and applies to all forms of noise other than occupational noise, setting out the long-term vision of Government noise policy, which is to:

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

Which is supported by the following noise policy aims:

"*Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *Avoid significant adverse impacts on health and quality of life;*
- *Mitigate and minimise adverse impacts on health and quality of life; and*
- *Where possible, contribute to the improvement of health and quality of life."*

When discussing the meaning of "significant adverse" and "adverse" within an Explanatory Note the NPSE states:

"*There are two established concepts from toxicology that are currently being applied to noise impacts for example, by the World Health Organisation. They are*

"*NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.*

"*LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.*"

To which the NPSE added the following related concept:

"*SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.*"

The Explanatory Note continues: "*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. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.*"

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three aims listed above. Logically, it starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL, when "*all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development.*" The final aim envisages proactive management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development.

National Planning Policy Framework

First published in 2012, and most recently updated in June 2019, the National Planning Policy Framework (NPPF) sets out the Government's planning policies for England, and how these are expected to be applied. The NPPF superseded Planning Policy Guidance Note (PPG) 24: Planning and noise (PPG 24), amongst other PPG's and Planning Policy Statements (PPSs). In contrast to these documents, the NPPF itself is generic, and reference to specific topics, e.g. noise, is limited. However, since its initial publication, the NPPF is now supported by additional guidance, which is presented subsequently below.

Noise is referenced within the NPPF as follows. These are effectively the NPPF's policies on noise.

"*170. Planning policies and decisions should contribute to and enhance the natural and local environments by:…[a number of points including]…*

e) 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. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans…"

"*180. 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[60];

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…"

Reference number 60 of the above quotation points to the Explanatory Note to the Noise Policy Statement for England (NPSE).

The following policy is also relevant to noise.

"*182. 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.*"

As mentioned above, in addition to the NPPF, the Government has published accompanying web-based planning guidance for a number of categories, including noise (see below).

Planning Practice Guidance

In March 2014, the Department for Communities and Local Government (DCLG) launched the Planning Practice Guidance web-based resource. This now forms part of the NPPF, referred to as "*relevant planning practice guidance*", which includes guidance on the category of "noise". The guidance is often referred to as PPG-Noise, PPG-N or PPG(N). It was last updated in July 2019.

In keeping with the NPSE and NPPF, no values (in dB) are presented; however, plenty of guidance is provided as to the issues to consider in assessing noise and determining suitable thresholds. Whilst, in keeping with this report, reference is made to BS 8233:2014.

A "noise exposure hierarchy table" is provided, which summarises the noise exposure hierarchy based on the likely average response of those affected and is reproduced below. It includes "examples of outcomes" relevant to the NOEL, LOAEL and SOAEL effect thresholds described in the NPSE. These outcomes are in descriptive form; there is no numerical definition of the NOEL, LOAEL and SOAEL.

Table B-1: Noise exposure hierarchy table (as per PPG-Noise)

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

It is left to other guidance documents and professional opinion to determine thresholds where required, as discussed below.

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

This Standard is referenced in the guidance used by Adur Worthing Borough Councils reference document "Planning Noise Advice Document: Sussex".

The Standard provides methods for rating and assessing sound/noise of an industrial or commercial nature in relation to residential premises, hence its relevance here. The assessment methodology evaluates the "specific sound level" of each industrial or commercial sound source, corrects for distinguishable features to derive the "rating level", and compares this with the "background sound level".

The advice is that the background sound level ($L_{A90,T}$) should be normally not less than 15 minutes, and that it should not be the lowest level, but representative of typical conditions at the noise-sensitive receiver(s) relevant to the periods of operation.

The specific sound ($L_{Aeq,T}$) is obtained over a reference period of 1 hour in terms of the daytime (07:00 to 23:00) and 15 minutes during the night-time (23:00 to 07:00).

The rating level ($L_{Ar,Tr}$) is obtained by measuring or calculating the specific sound level from the source, in terms of the $L_{Aeq,T}$ parameter, correcting for the influence from any residual sound (where applicable) and, if necessary, applying a correction factor to account for the acoustic features present in the sound in question, as experienced at the receptor, such as distinguishable, discrete, continuous note (a whine, hiss, screech or hum etc.) or distinct impulses (bangs, clatters or thumps etc.). Where no correction is warranted, the rating level is equal to the specific level.

The "subjective method" to calculate the rating level incorporates the following corrections (particularly appropriate for new sources that cannot be measured in-situ):

- Up to +6 dB due to tonality, subjectively this might be +2 for a tone that is just perceptible, +4 where it is clearly perceptible and +6 where it is highly perceptible.
- Up to+9 dB for impulsivity, subjectively this might be +3 for impulsivity that is just perceptible, +6 where it is clearly perceptible and +9 where it is highly perceptible; and
- Up to +3 dB for other acoustic features that are neither tonal nor impulsive, though readily distinctive at the receptor.

An initial estimate of the impact of the specific sound is calculated by subtracting the measured background sound level from the rating level. The following advice applies:

a) Typically, the greater this difference, the greater the magnitude of the impact.
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
d) 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.

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur.

Where the initial estimate of the impact needs to be modified due to the context, the assessment should take into account all pertinent factors, including:

- the absolute level of sound;

- the character and level of the residual sound compared to the character and level of the specific sound; and
- the sensitivity of the receptor and whether dwellings will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

Helpfully, BS 4142 includes some example assessments. In one example, it is concluded that, “Although the plant noise is somewhat different in character to the residual acoustic environment the rating level of 30 dB is low and will have little impact on residents using their patio during the evening.”

Under similar conditions it is stated: “In addition to the rating/background sound level comparison…” where “the primary concern is the potential for disturbance of residents who could be sleeping with open bedroom windows… Other guidance, such as BS 8233, might also be applicable in this instance.”

Another example concludes that, “the residual acoustic environment varies considerably with time, which also tends to mask sound from the source, reducing its relative significance…”

An assessment, therefore, is effectively in two parts. The first part results in an initial indication of the impact, which is subsequently considered in terms the context unique to the situation at hand; and where this second part may require consideration of alternative guidance and metrics. Alternatively, the context can be considered upfront and a specific threshold (or set of thresholds) determined accordingly in place of the default values presented in points a) to d) quoted above.

APPENDIX C

SURVEY DATA

Table C-1: 15-minute period survey results, dB (free-field)

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
28/07/2021 15:33	50	75	46
28/07/2021 15:48	51	71	46
28/07/2021 16:03	51	72	46
28/07/2021 16:18	49	66	46
28/07/2021 16:33	55	73	46
28/07/2021 16:48	51	81	46
28/07/2021 17:03	53	81	46
28/07/2021 17:18	52	69	46
28/07/2021 17:33	53	76	47
28/07/2021 17:48	51	66	47
28/07/2021 18:03	50	60	47
28/07/2021 18:18	50	61	46
28/07/2021 18:33	50	65	46
28/07/2021 18:48	51	67	46
28/07/2021 19:03	49	64	46
28/07/2021 19:18	50	69	46
28/07/2021 19:33	51	75	45
28/07/2021 19:48	50	74	44
28/07/2021 20:03	48	72	44
28/07/2021 20:18	47	62	44
28/07/2021 20:33	48	63	44
28/07/2021 20:48	48	62	44
28/07/2021 21:03	49	71	44
28/07/2021 21:18	47	63	44
28/07/2021 21:33	47	58	44
28/07/2021 21:48	47	61	44
28/07/2021 22:03	47	71	43
28/07/2021 22:18	47	57	43
28/07/2021 22:33	46	60	42
28/07/2021 22:48	44	54	41
28/07/2021 23:03	43	61	41
28/07/2021 23:18	44	60	41
28/07/2021 23:33	41	50	38
28/07/2021 23:48	41	56	38
29/07/2021 00:03	41	56	38
29/07/2021 00:18	39	55	37
29/07/2021 00:33	38	46	37
29/07/2021 00:48	40	51	37
29/07/2021 01:03	40	53	38
29/07/2021 01:18	41	62	39
29/07/2021 01:33	40	51	38
29/07/2021 01:48	41	51	38

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
29/07/2021 02:03	40	57	38
29/07/2021 02:18	40	48	38
29/07/2021 02:33	39	53	37
29/07/2021 02:48	40	46	38
29/07/2021 03:03	40	63	38
29/07/2021 03:18	39	55	37
29/07/2021 03:33	39	50	38
29/07/2021 03:48	40	56	38
29/07/2021 04:03	47	68	38
29/07/2021 04:18	47	66	39
29/07/2021 04:33	48	69	39
29/07/2021 04:48	49	69	38
29/07/2021 05:03	41	62	38
29/07/2021 05:18	44	69	38
29/07/2021 05:33	41	61	38
29/07/2021 05:48	52	76	38
29/07/2021 06:03	43	59	39
29/07/2021 06:18	42	61	39
29/07/2021 06:33	42	54	40
29/07/2021 06:48	41	61	39
29/07/2021 07:03	40	59	38
29/07/2021 07:18	41	58	38
29/07/2021 07:33	40	59	38
29/07/2021 07:48	42	59	39
29/07/2021 08:03	46	71	38
29/07/2021 08:18	47	71	38
29/07/2021 08:33	43	68	39
29/07/2021 08:48	57	80	40
29/07/2021 09:03	42	65	38
29/07/2021 09:18	53	73	38
29/07/2021 09:33	54	73	39
29/07/2021 09:48	43	61	39
29/07/2021 10:03	55	72	39
29/07/2021 10:18	54	71	39
29/07/2021 10:33	57	73	40
29/07/2021 10:48	56	82	40
29/07/2021 11:03	53	70	40
29/07/2021 11:18	47	68	41
29/07/2021 11:33	57	79	41
29/07/2021 11:48	47	66	42
29/07/2021 12:03	57	75	42
29/07/2021 12:18	59	82	43
29/07/2021 12:33	52	70	42

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
29/07/2021 12:48	53	69	42
29/07/2021 13:03	57	75	42
29/07/2021 13:18	46	62	42
29/07/2021 13:33	51	73	42
29/07/2021 13:48	55	75	43
29/07/2021 14:03	53	70	43
29/07/2021 14:18	55	74	42
29/07/2021 14:33	52	68	42
29/07/2021 14:48	55	74	43
29/07/2021 15:03	49	67	43
29/07/2021 15:18	52	71	43
29/07/2021 15:33	46	60	43
29/07/2021 15:48	50	67	42
29/07/2021 16:03	55	79	43
29/07/2021 16:18	51	69	43
29/07/2021 16:33	53	71	41
29/07/2021 16:48	53	63	41
29/07/2021 17:03	53	73	41
29/07/2021 17:18	50	71	41
29/07/2021 17:33	59	82	41
29/07/2021 17:48	48	67	41
29/07/2021 18:03	44	64	39
29/07/2021 18:18	45	67	39
29/07/2021 18:33	43	62	38
29/07/2021 18:48	41	65	38
29/07/2021 19:03	40	57	37
29/07/2021 19:18	40	57	37
29/07/2021 19:33	41	62	37
29/07/2021 19:48	41	72	36
29/07/2021 20:03	43	61	36
29/07/2021 20:18	46	67	35
29/07/2021 20:33	44	72	35
29/07/2021 20:48	41	64	34
29/07/2021 21:03	39	67	35
29/07/2021 21:18	39	69	35
29/07/2021 21:33	34	43	33
29/07/2021 21:48	35	46	32
29/07/2021 22:03	35	51	33
29/07/2021 22:18	37	53	32
29/07/2021 22:33	35	45	32
29/07/2021 22:48	39	56	33
29/07/2021 23:03	38	65	33
29/07/2021 23:18	36	47	33

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
29/07/2021 23:33	36	43	33
29/07/2021 23:48	41	57	35
30/07/2021 00:03	44	55	35
30/07/2021 00:18	36	52	32
30/07/2021 00:33	36	49	32
30/07/2021 00:48	40	61	33
30/07/2021 01:03	36	44	33
30/07/2021 01:18	36	46	33
30/07/2021 01:33	36	45	34
30/07/2021 01:48	36	48	34
30/07/2021 02:03	38	45	36
30/07/2021 02:18	37	45	35
30/07/2021 02:33	38	61	36
30/07/2021 02:48	37	43	35
30/07/2021 03:03	40	48	37
30/07/2021 03:18	42	60	37
30/07/2021 03:33	46	60	38
30/07/2021 03:48	46	56	42
30/07/2021 04:03	44	57	41
30/07/2021 04:18	43	57	41
30/07/2021 04:33	45	69	42
30/07/2021 04:48	48	66	43
30/07/2021 05:03	46	60	43
30/07/2021 05:18	46	67	42
30/07/2021 05:33	48	73	43
30/07/2021 05:48	45	61	42
30/07/2021 06:03	45	58	43
30/07/2021 06:18	49	70	44
30/07/2021 06:33	48	67	44
30/07/2021 06:48	51	69	45
30/07/2021 07:03	47	60	45
30/07/2021 07:18	48	68	46
30/07/2021 07:33	49	61	47
30/07/2021 07:48	50	62	47
30/07/2021 08:03	50	61	48
30/07/2021 08:18	51	62	48
30/07/2021 08:33	51	63	49
30/07/2021 08:48	52	65	50
30/07/2021 09:03	52	62	50
30/07/2021 09:18	52	67	49
30/07/2021 09:33	52	64	50
30/07/2021 09:48	53	69	49
30/07/2021 10:03	52	62	50

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
30/07/2021 10:18	53	70	50
30/07/2021 10:33	53	62	50
30/07/2021 10:48	54	66	50
30/07/2021 11:03	54	72	50
30/07/2021 11:18	54	73	50
30/07/2021 11:33	55	69	51
30/07/2021 11:48	54	66	50
30/07/2021 12:03	54	81	50
30/07/2021 12:18	55	80	50
30/07/2021 12:33	54	69	50
30/07/2021 12:48	56	82	50
30/07/2021 13:03	55	70	50
30/07/2021 13:18	54	66	51
30/07/2021 13:33	54	79	50
30/07/2021 13:48	53	67	50
30/07/2021 14:03	55	82	50
30/07/2021 14:18	54	69	50
30/07/2021 14:33	54	75	50
30/07/2021 14:48	53	81	48
30/07/2021 15:03	51	66	48
30/07/2021 15:18	51	67	48
30/07/2021 15:33	51	68	48
30/07/2021 15:48	51	62	48
30/07/2021 16:03	51	67	48
30/07/2021 16:18	50	62	48
30/07/2021 16:33	50	68	46
30/07/2021 16:48	49	59	47
30/07/2021 17:03	50	62	47
30/07/2021 17:18	57	72	42
30/07/2021 17:33	48	65	42
30/07/2021 17:48	46	63	42
30/07/2021 18:03	43	61	40
30/07/2021 18:18	45	65	40
30/07/2021 18:33	45	65	41
30/07/2021 18:48	49	70	42
30/07/2021 19:03	43	59	41
30/07/2021 19:18	43	59	41
30/07/2021 19:33	43	62	40
30/07/2021 19:48	48	71	39
30/07/2021 20:03	44	60	40
30/07/2021 20:18	44	54	41
30/07/2021 20:33	46	78	40
30/07/2021 20:48	42	58	40

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
30/07/2021 21:03	44	70	39
30/07/2021 21:18	40	65	38
30/07/2021 21:33	43	69	37
30/07/2021 21:48	39	50	37
30/07/2021 22:03	41	54	38
30/07/2021 22:18	40	52	38
30/07/2021 22:33	39	51	37
30/07/2021 22:48	44	71	37
30/07/2021 23:03	38	53	37
30/07/2021 23:18	38	48	37
30/07/2021 23:33	38	52	37
30/07/2021 23:48	37	52	36
31/07/2021 00:03	37	46	34
31/07/2021 00:18	34	44	32
31/07/2021 00:33	33	39	32
31/07/2021 00:48	34	42	32
31/07/2021 01:03	34	47	32
31/07/2021 01:18	34	51	33
31/07/2021 01:33	34	52	33
31/07/2021 01:48	33	52	32
31/07/2021 02:03	34	54	32
31/07/2021 02:18	33	44	32
31/07/2021 02:33	33	47	32
31/07/2021 02:48	33	42	31
31/07/2021 03:03	34	57	32
31/07/2021 03:18	34	52	32
31/07/2021 03:33	34	52	32
31/07/2021 03:48	34	44	32
31/07/2021 04:03	38	58	33
31/07/2021 04:18	46	65	35
31/07/2021 04:33	47	69	37
31/07/2021 04:48	42	64	36
31/07/2021 05:03	45	68	36
31/07/2021 05:18	45	71	36
31/07/2021 05:33	48	69	36
31/07/2021 05:48	44	68	36
31/07/2021 06:03	42	61	35
31/07/2021 06:18	40	58	35
31/07/2021 06:33	41	58	34
31/07/2021 06:48	41	57	35
31/07/2021 07:03	47	68	35
31/07/2021 07:18	38	52	35
31/07/2021 07:33	44	63	36

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
31/07/2021 07:48	41	56	35
31/07/2021 08:03	38	60	34
31/07/2021 08:18	44	60	35
31/07/2021 08:33	43	62	35
31/07/2021 08:48	44	74	34
31/07/2021 09:03	43	67	34
31/07/2021 09:18	47	68	34
31/07/2021 09:33	43	62	34
31/07/2021 09:48	51	71	35
31/07/2021 10:03	38	56	34
31/07/2021 10:18	40	57	33
31/07/2021 10:33	50	73	36
31/07/2021 10:48	57	73	37
31/07/2021 11:03	58	79	38
31/07/2021 11:18	51	71	38
31/07/2021 11:33	48	82	38
31/07/2021 11:48	51	70	40
31/07/2021 12:03	53	70	39
31/07/2021 12:18	43	61	38
31/07/2021 12:33	47	64	37
31/07/2021 12:48	46	64	38
31/07/2021 13:03	45	66	39
31/07/2021 13:18	52	72	39
31/07/2021 13:33	44	66	39
31/07/2021 13:48	45	62	39
31/07/2021 14:03	48	66	39
31/07/2021 14:18	46	62	39
31/07/2021 14:33	52	73	38
31/07/2021 14:48	45	62	39
31/07/2021 15:03	52	73	39
31/07/2021 15:18	50	72	40
31/07/2021 15:33	52	69	41
31/07/2021 15:48	55	76	39
31/07/2021 16:03	43	59	38
31/07/2021 16:18	46	61	40
31/07/2021 16:33	45	59	41
31/07/2021 16:48	49	68	39
31/07/2021 17:03	52	73	40
31/07/2021 17:18	50	73	39
31/07/2021 17:33	46	64	39
31/07/2021 17:48	46	60	40
31/07/2021 18:03	54	74	39
31/07/2021 18:18	41	59	38

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
31/07/2021 18:33	43	66	38
31/07/2021 18:48	42	64	38
31/07/2021 19:03	45	66	38
31/07/2021 19:18	42	63	37
31/07/2021 19:33	41	62	35
31/07/2021 19:48	42	61	36
31/07/2021 20:03	43	61	37
31/07/2021 20:18	41	57	36
31/07/2021 20:33	40	62	35
31/07/2021 20:48	44	68	35
31/07/2021 21:03	38	56	35
31/07/2021 21:18	41	66	34
31/07/2021 21:33	42	68	33
31/07/2021 21:48	42	68	32
31/07/2021 22:03	36	52	33
31/07/2021 22:18	35	47	32
31/07/2021 22:33	37	52	33
31/07/2021 22:48	38	57	32
31/07/2021 23:03	38	55	32
31/07/2021 23:18	36	68	31
31/07/2021 23:33	32	40	30
31/07/2021 23:48	31	46	29
01/08/2021 00:03	36	52	30
01/08/2021 00:18	31	37	29
01/08/2021 00:33	33	53	29
01/08/2021 00:48	30	40	28
01/08/2021 01:03	30	42	28
01/08/2021 01:18	29	38	27
01/08/2021 01:33	30	48	28
01/08/2021 01:48	30	45	28
01/08/2021 02:03	29	45	27
01/08/2021 02:18	29	45	26
01/08/2021 02:33	27	42	26
01/08/2021 02:48	28	41	26
01/08/2021 03:03	26	35	25
01/08/2021 03:18	28	45	26
01/08/2021 03:33	29	47	27
01/08/2021 03:48	29	39	27
01/08/2021 04:03	31	47	26
01/08/2021 04:18	37	57	28
01/08/2021 04:33	49	69	34
01/08/2021 04:48	46	70	31
01/08/2021 05:03	48	74	31

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
01/08/2021 05:18	45	71	32
01/08/2021 05:33	47	67	31
01/08/2021 05:48	37	60	31
01/08/2021 06:03	42	58	32
01/08/2021 06:18	43	65	31
01/08/2021 06:33	43	63	33
01/08/2021 06:48	39	60	32
01/08/2021 07:03	41	67	32
01/08/2021 07:18	44	73	32
01/08/2021 07:33	46	70	32
01/08/2021 07:48	45	69	32
01/08/2021 08:03	40	60	32
01/08/2021 08:18	43	69	32
01/08/2021 08:33	47	67	33
01/08/2021 08:48	38	55	32
01/08/2021 09:03	51	76	32
01/08/2021 09:18	58	79	45
01/08/2021 09:33	57	77	42
01/08/2021 09:48	59	83	44
01/08/2021 10:03	57	82	41
01/08/2021 10:18	50	68	39
01/08/2021 10:33	53	71	39
01/08/2021 10:48	56	81	43
01/08/2021 11:03	56	77	43
01/08/2021 11:18	55	80	38
01/08/2021 11:33	54	74	41
01/08/2021 11:48	55	74	39
01/08/2021 12:03	54	76	40
01/08/2021 12:18	58	77	36
01/08/2021 12:33	40	62	35
01/08/2021 12:48	46	69	35
01/08/2021 13:03	49	74	36
01/08/2021 13:18	51	71	35
01/08/2021 13:33	47	63	36
01/08/2021 13:48	46	64	37
01/08/2021 14:03	41	57	37
01/08/2021 14:18	46	70	37
01/08/2021 14:33	50	71	37
01/08/2021 14:48	52	70	38
01/08/2021 15:03	46	64	37
01/08/2021 15:18	43	64	38
01/08/2021 15:33	51	74	38
01/08/2021 15:48	51	72	39

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
01/08/2021 16:03	48	67	39
01/08/2021 16:18	44	65	38
01/08/2021 16:33	41	63	37
01/08/2021 16:48	48	70	38
01/08/2021 17:03	40	60	37
01/08/2021 17:18	39	59	35
01/08/2021 17:33	41	60	35
01/08/2021 17:48	38	57	35
01/08/2021 18:03	44	63	36
01/08/2021 18:18	44	63	36
01/08/2021 18:33	41	66	33
01/08/2021 18:48	43	61	33
01/08/2021 19:03	49	59	45
01/08/2021 19:18	45	56	37
01/08/2021 19:33	41	57	34
01/08/2021 19:48	37	54	30
01/08/2021 20:03	37	57	31
01/08/2021 20:18	41	64	32
01/08/2021 20:33	41	62	31
01/08/2021 20:48	36	56	30
01/08/2021 21:03	40	54	33
01/08/2021 21:18	40	68	34
01/08/2021 21:33	41	71	34
01/08/2021 21:48	41	67	33
01/08/2021 22:03	36	51	32
01/08/2021 22:18	36	47	34
01/08/2021 22:33	40	54	35
01/08/2021 22:48	36	44	34
01/08/2021 23:03	34	61	32
01/08/2021 23:18	36	50	33
01/08/2021 23:33	37	56	31
01/08/2021 23:48	33	49	29
02/08/2021 00:03	32	43	29
02/08/2021 00:18	32	43	29
02/08/2021 00:33	34	50	28
02/08/2021 00:48	34	50	29
02/08/2021 01:03	29	35	27
02/08/2021 01:18	32	41	29
02/08/2021 01:33	30	40	28
02/08/2021 01:48	30	40	28
02/08/2021 02:03	29	39	27
02/08/2021 02:18	30	40	27
02/08/2021 02:33	31	44	28

Period start	$L_{Aeq,15m}$	L_{AFmax}	$L_{A90,15m}$
02/08/2021 02:48	31	45	29
02/08/2021 03:03	31	42	29
02/08/2021 03:18	33	42	31
02/08/2021 03:33	34	53	31
02/08/2021 03:48	33	49	31
02/08/2021 04:03	35	54	31
02/08/2021 04:18	41	61	33
02/08/2021 04:33	48	70	38
02/08/2021 04:48	45	68	37
02/08/2021 05:03	44	62	38
02/08/2021 05:18	50	75	37
02/08/2021 05:33	45	64	39
02/08/2021 05:48	44	61	38
02/08/2021 06:03	45	64	39
02/08/2021 06:18	45	63	41
02/08/2021 06:33	47	69	40
02/08/2021 06:48	43	62	40
02/08/2021 07:03	42	54	40
02/08/2021 07:18	44	65	41
02/08/2021 07:33	45	69	41
02/08/2021 07:48	44	61	40
02/08/2021 08:03	44	57	41
02/08/2021 08:18	46	64	41
02/08/2021 08:33	46	62	41
02/08/2021 08:48	48	64	41
02/08/2021 09:03	47	62	41
02/08/2021 09:18	46	65	41
02/08/2021 09:33	43	63	40
02/08/2021 09:48	47	67	42
02/08/2021 10:03	45	62	40
02/08/2021 10:18	49	76	41
02/08/2021 10:33	52	76	40

APPENDIX D

NOISE BREAKOUT CALCULATIONS

Job No.	Made By	Date Created	Sheet No.
5343	PA	09/07/21	1
Job Name		Date last revised	Rev
SEASIDE PRIMARY SCHOOL, LANCING PROPOSED SPORTS HALL NOISE IMPACT ASSESSMENT		07/07/22	3

Calculation Description					Octave Band Centre Frequency							
Inside to Outside noise transfer			A	63	125	250	500	1k	2k	4k	8k
Receiver Distance from Façade in m		18.0		Source room sound pressure level Lp,in (dB)							
Source Room	Reverberant sound level within swimming pool	Lp,in (dB)	73.1	56	55	61	69	70	66	61	53
				Sound Insulation Performance R or R' (dB)							
Facade Element	Wall	Rw (dB)	56.0	25	34	47	56	58	66	76	76
+10logS											
width (m)	height (m)	Area S (m2)									
18.0	7.5	135.0		21	21	21	21	21	21	21	21
+Directivity (dB)	6			6	6	6	6	6	6	6	6
	minimum r (m)	Distance r (m)									
-20*logr-14	54.0	18.0		39	39	39	39	39	39	39	39
Receiver sound pressure level Lp,out (dB)		Lp,out (dB)	2.9	3.8	19.6	9.4	2.5	1.2	0.0	-12.1	-27.0
Weakness factor				2	8	21	30	32	40	50	50
Facade Element	2.no Large attenuated vent, 150mm deep TEK	DnEw	16.0	15	15	15	15	15	15	15	15
+10logS											
width (m)	height (m)	No.	Area S (m2)								
3.7	1.2	2	20.0	13	13	13	13	13	13	13	13
+Directivity	3			3	3	3	3	3	3	3	3
		minimum r (m)	Distance r (m)								
-20*logr-14		11.1	18.0	39	39	39	39	39	39	39	39
Receiver sound pressure level Lp,out (dB)			Lp,out (dB)	34.0	35.0	18.3	17.1	23.2	30.9	31.8	27.6	22.7
Weakness factor					4	1	0	0	0	0	0	0
Combined sound pressure level Lp,out (dB) free-field			34.0	35.0	22	18	23	31	32	28	23
Combined sound pressure level Lp,out (dB) façade			37.0	38.0	25	21	26	34	35	31	26
		Total Lp2 (dB)	38.0								
		Lp2 Target (dB)	47.0								
		Difference	-9.0								

Inside to Outside Airborne Noise transfer Version 0.02		Anderson Acoustics