



Loreto Sixth Form College

ASHP Noise Impact Assessment

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REVISION HISTORY

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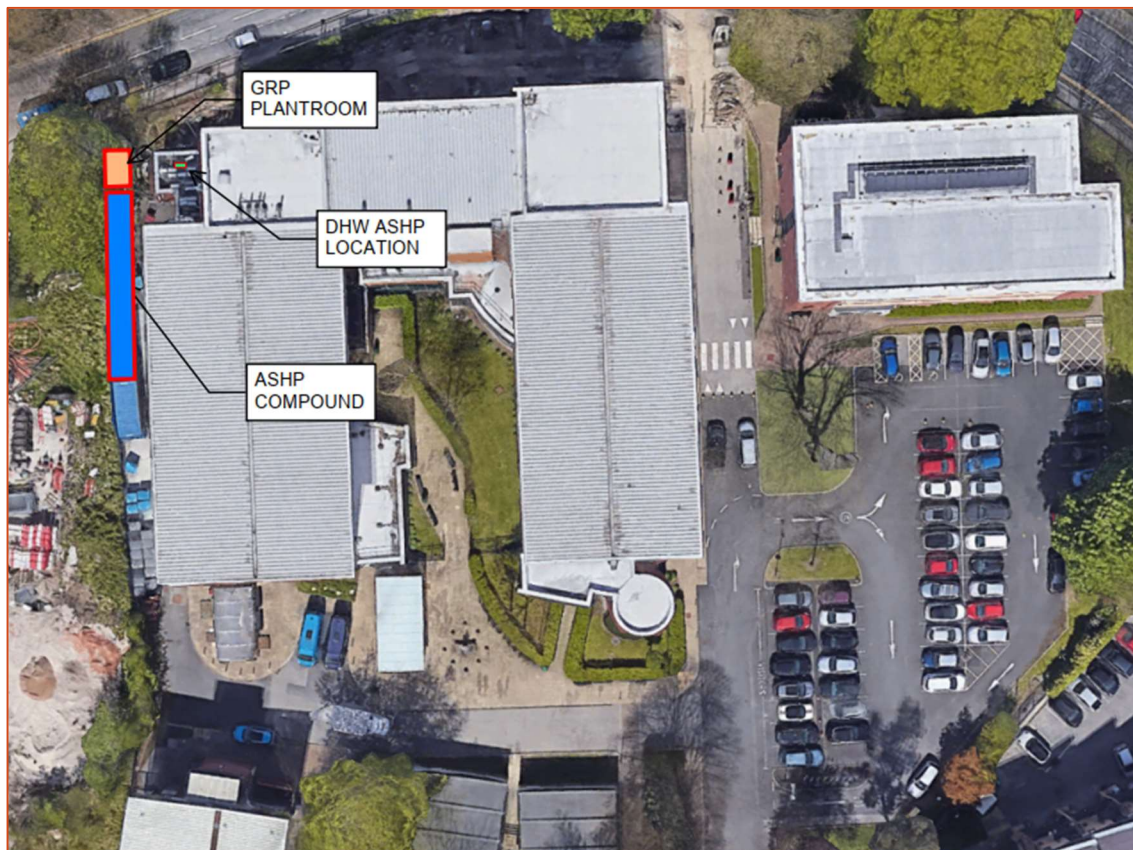
1 INTRODUCTION

- 1.1 dBx Acoustics has been appointed by Loreto Sixth Form College to carry out a noise survey and noise impact assessment for the proposed installation of 6 no. air source heat pumps (ASHP) at Loreto Sixth Form College, Chichester Rd South, Manchester M15 5PB.
- 1.2 This report presents the results of a noise survey carried out at the site, and an assessment of the noise impact from the proposed units.
- 1.3 The Local Authority is Manchester City Council (MCC).
- 1.4 A glossary of acoustic terminology is provided in Appendix A to assist the reader.

2 SITE DESCRIPTION

- 2.1 Five Strebel S-ASX-VP90 air source heat pumps (ASHP) are proposed to be installed within the area marked 'ASHP compound' on Figure 1, below. A sixth domestic hot water ASHP will be installed at roof level (Strebel S-ASX-VP60) in the location marked 'DHW ASHP Location'.

Figure 1: Proposed ASHP Location



- 2.2 The nearest noise sensitive receptors (NSRs) are residential houses on Drayton Street approximately 80m to the west.
- 2.3 There are teaching spaces at first floor level which overlook the proposed ASHP compound.

3 ACOUSTIC DESIGN CRITERIA

Local Authority Requirements

- 3.1 The Local Authority is Manchester City Council (MCC).
- 3.2 MCC's document *Planning and Noise*, last updated in October 2022, requires that BS412 should be used to assess the likely impact of noise from new items of plant. Specifically, it is required that:

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

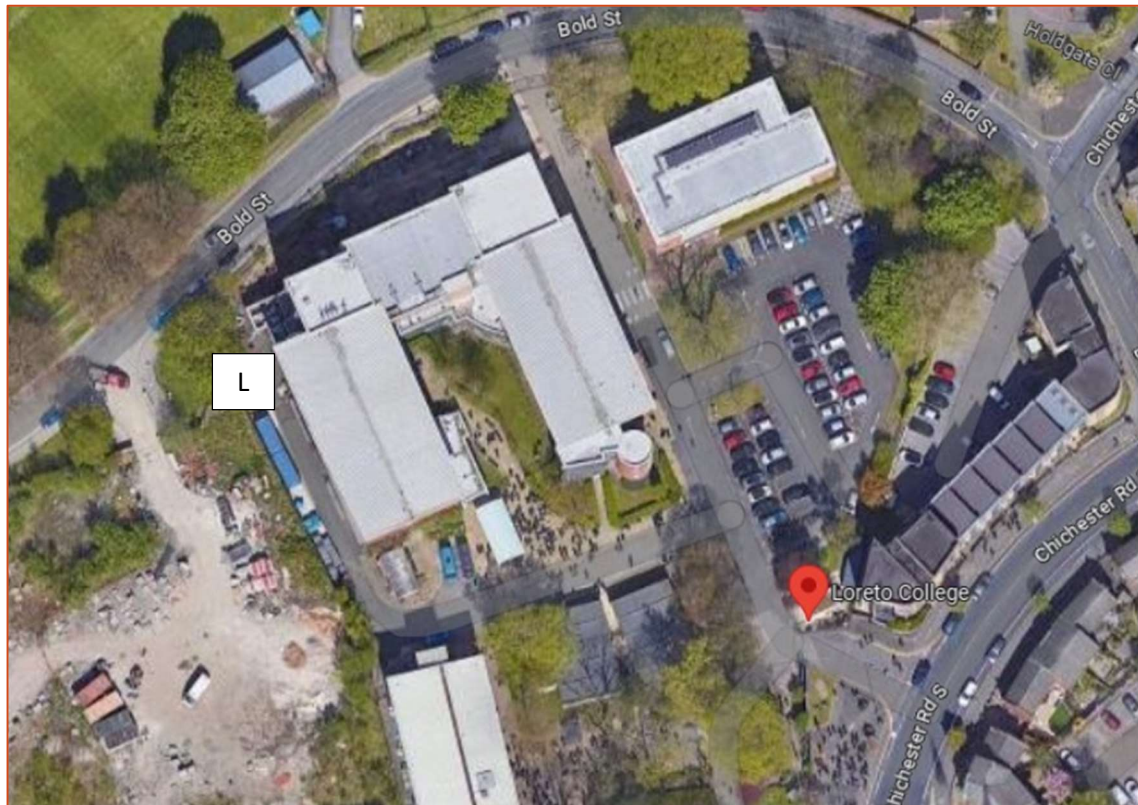
BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'

- 3.1 BS 4142:2014 sets out a procedure for assessing noise impact whereby a Noise Rating Level is determined and compared with the existing local Background Sound Level.
- 3.2 The Rating Level ($dB_{L_{Ar,Tr}}$) is evaluated from the Specific Noise Level by including cumulative corrections to account for factors such as distinguishable tone, impulsivity, intermittency or other readily distinguishable sound characteristics.
- 3.3 The assessment of the impact depends upon the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level. An initial estimate of the impact of the specific sound is made by subtracting the Background Sound Level from the Rating Level, while considering the following points:
- a) Typically, the greater this difference, the greater the magnitude of the impact.
 - b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5dB 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.

4 NOISE SURVEY

- 4.1 An unattended noise survey was carried out between 15:00h on Wednesday 3rd May and 15:00h Thursday 4th May. Measurements were made continuously throughout this period at the site boundary, at the location marked 'L' in Figure 2, below.
- 4.2 This monitoring location was selected to be representative of noise levels affecting both the nearby teaching spaces and the nearby noise sensitive receptors.

Figure 1: Noise Monitoring Location



- 4.3 The key noise sources during the survey were traffic on the surrounding road network, and existing plant located at ground floor level at the building exterior.
- 4.4 Measurements were undertaken in accordance with BS 7445-1:2003 *Description and Measurement of Environmental Noise*, with the microphone located approximately 1.5 metres above the local ground level and at least 3.5 metres away from reflective surfaces other than the ground; i.e. in free field conditions.

Weather Conditions

- 4.6 Weather conditions during the measurement period were dry and sunny with temperatures ranging between 6°C and 16°C.
- 4.7 Wind speeds were within suitable parameters for the measurement of environmental noise (i.e. generally under 5 ms⁻¹). The microphone was protected with a windshield for the duration of the survey.

Equipment

- 4.8 The equipment used during the environmental noise survey is detailed in Table 1, below.

Table 1: Equipment Used

Kit Reference	Equipment	Manufacturer & Part No.	Serial Number	Calibration Date	Certificate Number
Kit 4 - Cirrus	Meter	CR:171C	G300656	13/10/2022	181506
	Pre-Amp	MV:200F	9136F		
	Microphone	MK:224	215619A		
	Calibrator	CR:515	87921	18/01/2023	06083/3

- 4.9 The sound level meter was calibrated before and after measurements, with no significant drift recorded. An accredited laboratory calibrated the equipment not more than two years prior to the measurements being made, with the exception of the calibrator, which had been calibrated not more than one year prior to the survey.

5 ENVIRONMENTAL NOISE SURVEY RESULTS

- 5.1 The noise levels measured during the environmental noise survey are summarised in Table 2, below. Full measurement data are available on request.

Table 3: Continuous Noise Monitor Results, Location L

Period	Ambient Noise Level, $\text{dBL}_{\text{Aeq,T}}$	Background Noise Level, $\text{dBL}_{\text{A90,T}}$
Daytime (07:00h-23:00h)	57	50
Night-Time (23:00h-07:00h)	48	42

- 5.2 Using the statistical analysis methodology described in BS 4142:2014 '*Methods for Rating and Assessing Industrial and Commercial Sound*' (BS4142), the typical daytime and night-time background noise levels to be used for this assessment have been determined to be $50\text{dBL}_{\text{A90,1hr}}$ and $42\text{dBL}_{\text{A90,15mins}}$, respectively.

6 PLANT NOISE IMPACT ASSESSMENT

- 6.1 Five Strebel S-ASX-VP90 air source heat pumps will be installed within a compound to the west of the existing buildings. A single Strebel S-ASX-VP60 unit will be installed on a nearby rooftop as shown in Figure 1.
- 6.2 The manufacturer's noise data for these units are presented in Figure 3, below.

Figure 2: Manufacturer's Noise Data

2.4.1 THE CURRENT NOISE LEVELS OF THE S-ASX-VP													
Model	Sound power levels [dB] By octave bands [Hz]								Sound Power Level		Sound Pressure Level		
											At 1 Metre	At 5 Metres	At 10 Metres
	63	125	250	500	1000	2000	4000	8000	[dB]	[dB(A)]	[dB(A)]	[dB(A)]	[dB(A)]
VP 60	81.4	79.3	77.6	73.9	70.4	66.2	60.5	53.0	85	76	59	49	44
VP 70	81.9	79.8	78.1	74.4	70.9	66.7	61.0	53.5	86	77	59	50	45
VP 80	82.3	80.2	78.5	74.8	71.3	67.1	61.4	53.9	86	77	60	50	45
VP 90	82.9	80.8	79.1	75.4	71.9	67.7	62.0	54.5	87	78	60	51	46
VP 100	83.8	81.7	80.0	76.3	72.8	68.6	62.9	55.4	87	78	61	52	47

Reference Conditions:
 Performances referred to units operating in heating mode at nominal conditions A7W35.
 Unit placed in free field on reflecting surface (directional factor equal to 2).
 The sound power level is measured according to ISO 3744 standard.
 The sound pressure level is calculated according to ISO 3744 at various distance from the external surface of the unit.

- 6.3 A noise model has been created using the Soundplan 8.2 software package, based on the manufacturer's data for the proposed ASHP units, to predict the specific sound level arising at the noise sensitive receptors from the operation of these units.
- 6.4 The predicted specific sound level is 37dB_{L_{Aeq,T}} when assessed at the residential properties at Drayton Street.
- 6.5 Table 4, below, presents a BS4142 assessment of noise impact to the residential receptors during the night time period (23:00h-07:00h).

Table 4: BS4142 Assessment – Drayton Street (Night-Time)

Item	Calculation	Relevant Clause	Comments
Measured background sound level – night-time	42dBL _{A90,15min}	8.3	The typical background sound level measured during the night-time period.
Specific sound level	37dBL _{Aeq,15min}	7.3.3	A prediction made using the methodology outlined above, includes all sources, screening and distance corrections.
Assessment made during the night-time period so reference period is 15 minutes		7.2	-
Acoustic feature correction	0dB	9.2	9.2
Rating Level	37dBL _{A_r,Tr}	9.2	The predicted Rating Level during the night-time period.
Excess of Rating Level over background sound level	-5dB	11	-
Assessment indicates low likelihood of adverse impact		11	Predicted Rating Level does not exceed the lowest measured background level. This is an indication of the development having a low impact.
Uncertainty of the assessment	Minor	10	Background sound level based on repeatable measurements. The predicted Rating Level is based on established prediction methodologies.

- 6.6 The BS4142 assessment detailed above indicates that plant noise from the proposed ASHP when assessed at the nearest noise sensitive receptors will be no greater than the measured background noise levels in both the day and night-time periods.
- 6.7 This therefore indicates no adverse impact at these receptors is like, and that the noise egress is compliant with the requirements of Manchester City Council.
- 6.8 Noise to teaching spaces within the College itself must also be considered, although this is not a planning issue. Observations on site indicated that the nearest window to the ASHP compound directly overlooks the proposed plant location at first floor level.
- 6.9 Calculations indicate that the specific sound level received at the teaching façade will be 59dBL_{Aeq,T}. Allowing a typical external to internal level difference of 15dB through an open window, the plant level arising within the teaching space would be around 44dBL_{Aeq,T}. This is comparable with the guidance given in BB93 for naturally ventilated Design and Technology teaching rooms (45dBL_{Aeq,T}), and would therefore not be expected to have an adverse impact on teaching activity.

7 CONCLUSION

- 7.1 dBx Acoustics has been appointed by Loreto Sixth Form College, Manchester, to carry out a noise survey and noise impact assessment for the proposed installation of 7 no. air source heat pumps (ASHP) at their site on Chichester Road South, Manchester M15 5PB.
- 7.2 A day and night-time noise survey has been undertaken at the site, representative of the typical background noise levels at both the nearest noise sensitive receptor (residential properties on Drayton Street), and teaching spaces on the western façade of the College.
- 7.3 Based upon the manufacturers data for the plant intended for the development, an assessment of operational plant noise levels at the nearest sensitive receptors has been undertaken.
- 7.4 The predicted cumulative plant noise rating level when assessed at the noise sensitive receptors is 5dB lower than the measured night-time background noise levels. This indicates that no adverse noise impact is anticipated and meets the requirements of Manchester City Council.
- 7.5 An assessment of noise to the teaching façade indicates that, with windows open for ventilation, noise levels internally would be within appropriate limits for teaching and learning.
- 7.6 Taking the above into account, noise should not be a limiting factor in any planning application.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

Decibel, dB	A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure level (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when microphone measured pressure is 2×10^{-5} N/m ² is 0 dB, the threshold of hearing.
L	Instantaneous value of Sound Pressure Level (L_p) or Sound Power Level (L_w).
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
A-weighting	Arithmetic corrections applied to values of L_p according to frequency. When logarithmically summed for all frequencies, the resulting single "A weighted value" becomes comparable with other such values from which a comparative loudness judgement can be made, then, without knowledge of frequency content of the source.
$L_{eq,T}$	Equivalent continuous level of sound pressure which, if it actually existed for the integration time period T of the measurement, would possess the same energy as the constantly varying values of L_p actually measured.
$L_{Aeq,T}$	Equivalent continuous level of A weighted sound pressure which, if it actually existed for the integration time period, T, of the measurement would possess the same energy as the constantly varying values of L_p actually measured.
$L_{n,T}$	L_p which was exceeded for n% of time, T.
$L_{An,T}$	Level in dBA which was exceeded for n% of time, T.
L_{Fmax}	The instantaneous maximum sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
L_{AFmax}	The instantaneous maximum A weighted sound pressure level which occurred during the measurement. F indicates that the fast time-weighting is used.
$L_{Ar,Tr}$	The rating level: the equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise.
Reverberation Time, T	The time that would be required for the sound pressure level to decrease by 60 dB after the sound source has stopped. The descriptor T, often includes other nomenclature to describe the type of reverberation time measurement or if the reverberation time is an average taken for specific frequencies. For example, a T_{mf} is the mid-frequency reverberation time.
Absorption Coefficient, α	The fraction of reverberant sound energy absorbed by a material. It is expressed as a value between 1.0 which equates to perfect absorption and 0 which equates to zero absorption.
Acoustic Class, A - E	Classification of sound absorbers into Sound Absorption Classes A-E, according to BS EN ISO 11654, including frequencies 200-5000 Hz
NRC	A single-number rating system used to compare the sound-absorbing characteristics of building materials. A measurement of the acoustical absorption performance of a material, calculated by averaging its Sound Absorption Coefficients at 250, 500, 1000 and 2000 Hz
STI	Speech Transmission Index , Metric ranging between 0 and 1 representing the transmission quality of speech with respect to intelligibility by a speech transmission channel
R	Sound Reduction Index , the laboratory measured sound insulation properties of a material or building element in octave or third octave bands.
R_w	Weighted Sound Reduction Index , a single number which represents the sound reduction of a material. It is derived by plotting the sound reduction index against a set of reference curves. The curves are shifted until a best-fit is established and the curve which best fits the sound reduction spectrum is used to represent the single figure value.
D_w	Weighted Level Difference , the weighted level difference between a pair of rooms, stated as a single figure.

D_{nT}	Standardised Level Difference, a frequency-dependent measurement of airborne sound insulation, calculated using the following formula: $D_{nT} = L_1 - L_2 + 10\log(T/T_0)$ dB Where: L_1 is the energy-averaged sound pressure level due to the pink noise source measured in the source room using a sweep technique. L_2 is the energy-averaged sound pressure level measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (= 0.5s for dwellings).
$D_{nT,w}$	Weighted Standardised Level Difference, a single-figure value of airborne sound insulation performance, derived according to procedures in BS EN ISO 717-1, based on the D_{nT} values at different frequencies (100-3150 Hz third octave bands).
$D_{n,F,w}$	Weighted, Normalised Flanking Level Difference, the normalised, weighted difference in sound level between a pair of rooms via a flanking element, such as mullion or ceiling detail. The level difference in octave bands is first normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
D_{ne}	Normalised Element Level Difference. The normalised difference in sound level between a pair of rooms via a small element such as a trickle ventilator. The level difference in octave bands is normalized to a reference amount of absorption.
$D_{n,e,w}$	Weighted, Normalised Element Level Difference. The normalised, weighted difference in sound level between a pair of rooms via a small element such as a trickle ventilator, stated as a single figure. The level difference in octave bands is normalized to a reference amount of absorption and then plotted against a set of reference curves to establish a single figure value.
C_{tr}	Spectrum Adaptation Term, a correction term applied to the sound insulation single-number values (R_w, D_w, and $D_{nT,w}$) in accordance with BS EN ISO 717-1. Applying the C_{tr} penalises a construction's performance if its low frequency performance is poor in relation its performance at higher frequencies.
Impact Sound	The noise generated by an impact on a structure. This is normally used to describe the noise created by people walking or moving furniture on a floor structure.
L_{nT}	Standardised Impact Sound Pressure Level, a frequency dependent measurement of impact sound insulation, calculated using the following formula: $L_{nT} = L_1 + 10\log(T/T_0)$ dB Where: L_1 is the mean sound pressure level due to the tapping machine measured in the receiving room using a sweep technique. T is the mean receiving room reverberation time (derived from T_{30} measured in seconds). T_0 is the reference reverberation time (0.5s for dwellings)
$L'_{nT,w}$	Weighted Standardised Impact Sound Pressure Level, a single-figure value (@ 500 Hz) of impact sound insulation, performance, derived according to BS EN ISO 717-2, based on the L_{nT} values at different frequencies (100Hz- 3150 Hz third octave bands).
Insertion Loss, IL	The reduction of noise level due to the presence of a noise control device such as an attenuator, excluding any regeneration noise created by its presence.
NR	The Noise Rating level. This is a single figure value derived by plotting a noise spectrum against a set of curves. The curve under which the spectrum fits is the resulting NR level.

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