
TECHNICAL MEMO

Our Ref: 4977_001m_1-0_ps



To: Ruth Harness / Matt Swanton
Re-format Architects

From: Pau Santamaria
Principal Acoustic Consultant
Anderson Acoustics Limited. Unit 9 Baden Place, Crosby Row, London SE1 1YW
E: pau@andersonacoustics.co.uk
T: 07803 624 910

Date: 5 November 2020

BREWERY HOUSE, SOUTHSEA – PLANT NOISE ASSESSMENT

1 INTRODUCTION

Anderson Acoustics Ltd was commissioned by Re-format Architects in October 2020 to provide acoustic consultancy services during the detailed design stages of the Brewery House redevelopment, located on Hambrook Street, Southsea. The conversion will provide 17 apartments over a basement and 3 floors above, the upper floor being an extension to the existing building.

This technical memo provides a noise impact assessment of the proposed 3 air source heat pump units (ASHP) that will be installed on the roof of the building providing hot water and heating to the scheme.

2 ACOUSTIC TERMINOLOGY

2.1 Noise metrics

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

- | | |
|---------------------------|--|
| 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_{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. |
| 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. |

3 ASSESSMENT CRITERIA

3.1 British Standard 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound*

BS 4142:2014 provides guidance on rating and assessing the likely effects of sound of an industrial and/or commercial nature including from fixed plant installations. This standard provides a procedure for the measurement and rating of noise levels outside dwellings in mixed residential and industrial areas. A methodology for predicting the likelihood of adverse impact is also provided in this document although the assessment of nuisance explicitly falls outside the scope of this British Standard.

BS 4142 describes methods for determining the 'rating level' $L_{A,r,T}$ of the sound source being assessed (known as the 'specific sound source') outside premises used for residential purposes. The rating level may be based on a measured or predicted 'specific sound level' L_s with additional corrections applied to account for any characteristic features of the sound which could increase the significance of impact. Adjustments of between 0 and +6 dB can be applied for tonal sources and 0 to +9 dB for impulsive sources. Additional corrections of +3 dB can be made for other characteristics such as intermittency.

The method for assessing the significance of the specific sound source is based on the difference between its rating level and the background sound level $L_{A90,T}$ as well as the context in which it occurs. The standard states that:

- 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 BS4142: 2014 standard also looks at the local acoustic environment and context into which the sound sources are being introduced.

3.2 Adopted criteria

Given the proposed development was granted planning permission when the ASHP units were not envisaged as part of the design, a retrospective assessment is now deemed necessary to address their noise emissions. Generally, a background noise survey would be undertaken to determine the typical baseline noise conditions of a site and surrounding noise-sensitive receptors. However, due to the retrospective character of this assessment and the current Covid19 lockdown restrictions, which may affect typical ambient noise conditions at the development; the present assessment does not include background noise data measured at the site. As such, suitable criteria have been determined in accordance with the guidance in BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' [9] and BS8233 for both the nearest noise-sensitive residents to the scheme and the future residents of the building itself; which are shown in Table 3.1 below. The adopted criteria, which is described below, are considered worst-case and therefore not totally dependant on typical background sound levels at residential receptors surrounding the development.

Table 3.1: Adopted plant noise criteria for dwellings

Premises type	Assessment period and location(s)	Adopted noise criterion/criteria
Residential where opening windows is relied upon for cooling	Daytime (07-23) Whichever is the nearest/worst case of (where present): <ul style="list-style-type: none"> • within existing outdoor amenity area (e.g. rear garden) (nearest to the source), 1.5 m above ground/floor level; or • 1 m outside existing window (midway of window height). 	The rating level ($L_{Ar,Tr}$) ^{1,2} should be no more than whichever is the highest of: <ul style="list-style-type: none"> • background sound level ($L_{A90,T}$) minus 10 dB³; or • 40 dB (daytime) and 35 dB (night-time)⁴.
	Night-time (23-07) <ul style="list-style-type: none"> • 1 m outside existing bedroom window(s) (midway of window height). 	
Residential where opening windows is <u>not</u> relied upon for cooling (and where there is no external amenity space)	Daytime (07-23) <ul style="list-style-type: none"> • 1 m outside existing window (midway of window height). 	The rating level ($L_{Ar,Tr}$) ^{1,2} should be no more than: <ul style="list-style-type: none"> • 50 dB⁵.
	Night-time (23-07) <ul style="list-style-type: none"> • 1 m outside existing bedroom window(s) (midway of window height). 	The rating level ($L_{Ar,Tr}$) ^{1,2} should be no more than: <ul style="list-style-type: none"> • 45 dB⁶.

1 The reference time period, T_r , should be 1 hour during the day and 15 minutes at night.

2 The rating level and background sound level should be determined in accordance with BS 4142.

3 Indication of no impact on nearest noise sensitive receptors outside the development.

4 Rating levels at these levels or below are considered very low, since the equivalent levels inside a property (even considering an open window) would be well below the BS 8233 internal noise criteria.

5 This is based on 35 dB (BS 8233 internal target) plus 25 dB (façade performance) minus 10 dB (for competing sources).

6 This is based on 30 dB (BS 8233 internal target) plus 25 dB (façade performance) minus 10 dB (for competing sources).

As a worst-case assessment, since it is unknown whether the nearest noise-sensitive receptors to the proposed ASHP units may use opening windows for cooling or not, a night-time level of 35 dB $L_{Ar,Tr}$ has been targeted for both existing neighbouring residents as well as future occupants of the building itself. This is considered to be the most onerous criteria from all the included above.

4 SITE DESCRIPTION

The Brewery House building is located in a residential area in Southsea; bound by Hambrook Street to the south, Little Hambrook Street to the west, Copper Street to the north and a 3-storey residential building immediately to the east (see Figure 4.1 below for context).

The building is located in a residential-led area, with local, fairly narrow streets surrounding it; so road traffic flows are considered to be low, mostly for access to private properties in the area. The noise climate is not expected to be heavily dominated by road traffic from Hambrook Street or surrounding roads. Road traffic noise in busier, distant roads (such as Jubilee Terrace located 100m west) may be dominating the noise climate at the Brewery House.

The nearest residential receptors to the proposed plant are the residents on the building immediately to the east of Brewery House (St George's Court), located at a distance of approximately 12 metres from the proposed ASHPs. There are also other residential receptors in close proximity to the proposed plant, such as the residents on the 22-32 Hambrook Street building (18 metres away to the west) and on the 1-6 Cooper Street building (approximately 22 metres north-west).

Figure 4.1: Map showing location of the site (blue), nearest noise-sensitive receptors and ASHP locations (yellow)



Please note that the Figure 4.1 above shows the proposed plant overlaid onto an image of the existing building, which is approximately 9 metres high when measured from street level to the flat roof areas on the sides, and approximately 11m high when measured to the central pitched roof area. The new floor addition to the existing building will raise the flat roof areas of the building to 12m from street level (so it will be approximately 3 metres higher than before). The three ASHP units will sit in a central flat area on the flat roof of the new floor, at a height of approximately 10.5 metres above street level (see Figures 4.2 and 4.3 below).

Figure 4.2: Indicative location of the ASHPs (blue) on the roof (section BB through building, flat roof not shown)

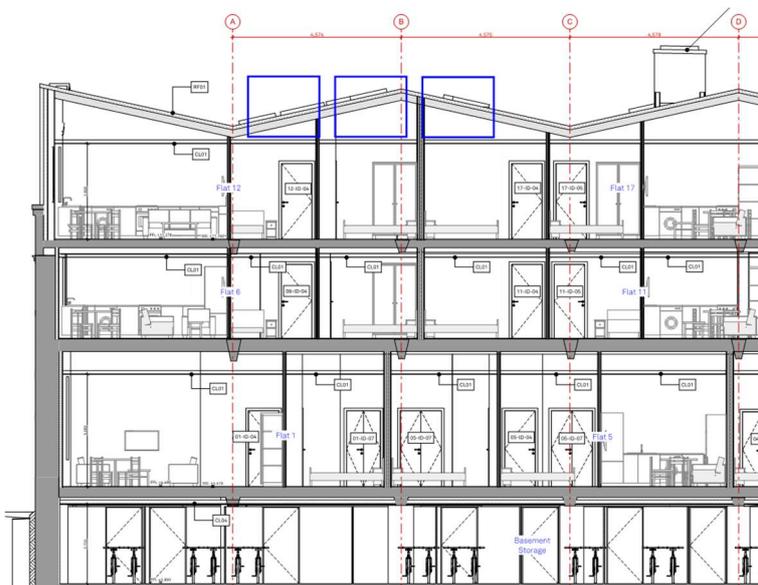
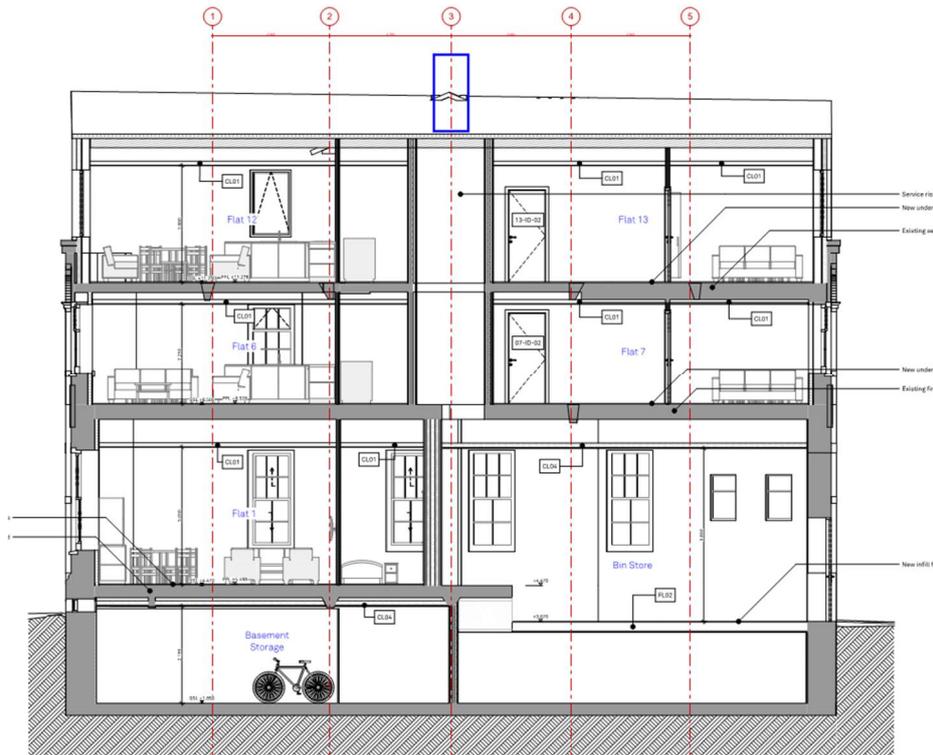


Figure 4.3: Indicative location of the ASHPs (blue) on the roof (section DD across building)



4.1 Proposed plant

3 no. Mitsubishi CAHV-P500YA-HPB (-BS) ASHP units have been proposed on the new roof of the Brewery House building. The sound power levels of each unit are shown in Table 4.1 below. It has been assumed that any unit may be able to operate any time of the week (so we have assumed 24x7 operations as a worst-case).

Table 4.1: Plant noise emissions of the proposed ASHP Mitsubishi CAHV-P500YA-HPB (-BS) ASHPs

63	125	250	500	1k	2k	4k	8k	Overall level
78	73	69	65	60	55	57	53	67 dB L _{WA}

5 NOISE IMPACT ASSESSMENT

As outlined in Section 3.2, the rating level of the proposed plant will need to be controlled to 35 dB L_{A_r,Tr} at the nearest noise sensitive properties during the night-time period. As the plant is likely run for 24-hours a day, ensuring that the night-time criterion is not exceeded will also ensure that the daytime criterion is achieved.

5.1 Noise modelling

In order to assess the potential impact of the ASHP units described above, a detailed 3D noise model has been built using the noise modelling software CadnaA 2019 to estimate the façade incident noise levels at neighbouring and future proposed residential receptors. Figures 5.1 to 5.3 below show 3D views of the noise model used in our predictions.

CadnaA is designed in accordance with ISO 9613 prediction methodologies, which allow consideration of the effects of the acoustic screening provided by the future roof edges of the Brewery House. The model also considers the effects of the topographical conditions throughout the area, ground absorption, atmospheric absorption, acoustic reflections and acoustic screening, as well as applying a light downwind propagation correction to represent a worst-case.

The ASHP units have been modelled in CadnaA as point sources, at a height of 1.5 metres above roof level (based on manufacturer’s measured noise data at that height); with the model having a maximum order of reflections of 2, all buildings set out as slightly reflective (absorption coefficient of 0.21) and ground adjusted to be fully reflective (concrete surface, i.e. $G=0$).

Figure 5.1: South-western view of Brewery House, proposed ASHPs (blue) and predicted free-field levels at the nearest noise-sensitive receptors

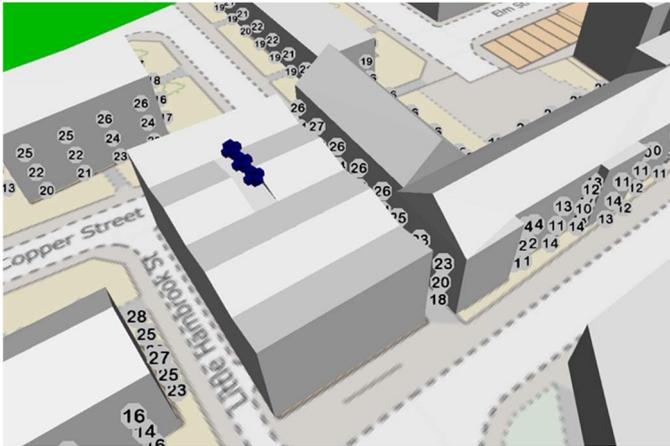


Figure 5.2: South-eastern view of Brewery House, proposed ASHPs (blue) and predicted free-field levels at the nearest noise-sensitive receptors

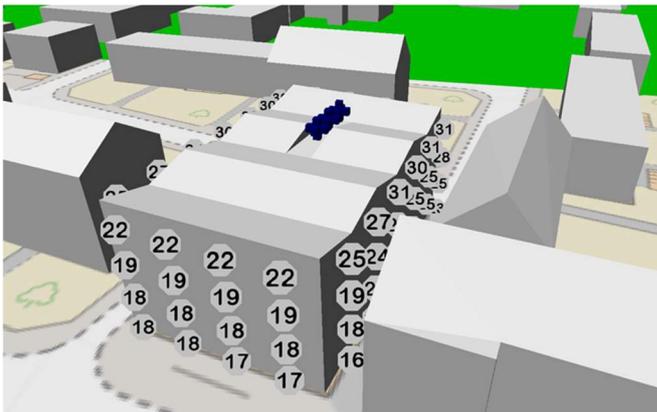
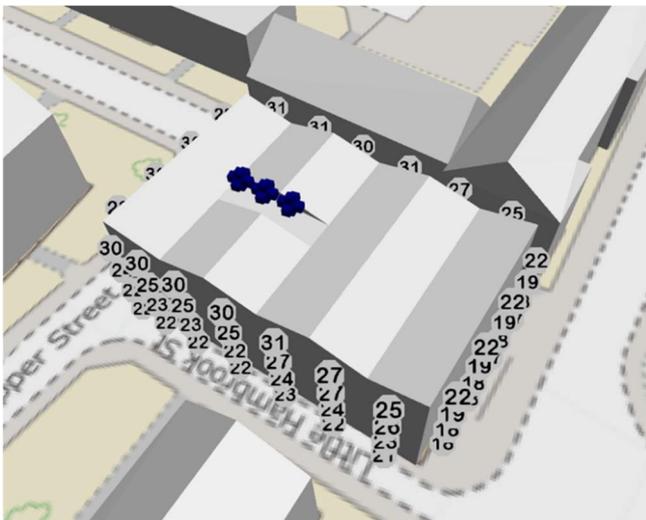


Figure 5.3: Western view of Brewery House, proposed ASHPs (blue) and predicted free-field levels at the receptors of the building itself



5.2 Results

The worst-case predicted specific noise levels at the nearest residential receptors due to the operation of the proposed plant are shown in Table 5.1 below, assessed in line with BS4142 guidance. The predicted levels at the proposed receptors do not show any tonal acoustic feature. Intermittent or other acoustic feature corrections sufficient to attract attention are not deemed applicable to the proposed plant, therefore no character corrections have been applied.

Table 5.1: BS4142 assessment

Description	Predicted noise level at receptor, dB			
	St George's House (2F)	22-32 Hambrook St (2F)	1-6 Cooper St (2F)	Brewery House (2F)
Predicted Specific Noise Level (L_s) – free-field	27	28	26	31
Façade correction	+3	+3	+3	+3
Acoustic Character Correction	0	0	0	0
Rating Level ($L_{Ar, Tr}$)	30	31	29	34
Adopted Plant Noise Emissions Criterion	35	35	35	35
Rating Level ($L_{Ar, Tr}$) vs Adopted Criterion	-5	-4	-6	-1

Based on the above assessment, the proposed plant is likely to comply with the adopted 35 dB L_{Aeq} at both external and Brewery House noise-sensitive receptors; therefore the operation of the plant should not impact on the internal living conditions of the surrounding residents. **As such, mitigation measures are not required, and the proposed plant should be considered acceptable with regard to noise emissions and planning permission should not be rejected on noise grounds.**

5.3 Noise transfer via the new roof to dwellings below

The new roof construction at Brewery House will be based on a 150mm concrete slab. All ASHP units will be built on Big Foot anti-vibration mounts, therefore airborne noise transfer from the proposed units to the dwellings below is not considered to be a concern. The specific anti-vibration mount model for the proposed ASHP units should be confirmed with the manufacturer.