Paragon
Acoustic Consultants

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Opinions included herein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations, Paragon Acoustic Consultants Ltd reserves the right to review the information, reassess any new potential concerns and modify our opinions accordingly.

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1 Introduction

On 14 September 2020, Outline Planning Permission (`OPP') was granted for the redevelopment of the whole Barnes Hospital campus (ref. 18/3642/OUT), which comprised three development plots: (1) the residential plot, (2) the Special Educational Needs (SEN) School and (3) the health centre.

Whilst all three parts are still being delivered, it is now proposed that these will be brought forward on an individual site basis rather than through one outline permission and subsequent reserved matters.

This planning application therefore relates only to the residential plot of the wider campus..

Paragon Acoustic Consultants Ltd (PACL) has been commissioned by Flatt Consulting to conduct environmental noise and groundborne vibration surveys to obtain statistical data characterising the existing background and ambient climate at the site. This information shall be used to provide the basis for stipulating performance targets for façade sound insulation in the context of controlling external noise ingress, the setting of noise limits for new mechanical plant that may be installed as part of the scheme and for providing outline guidance regarding any foundation isolation measures that may be required to mitigate groundborne vibration.

2 Site Description

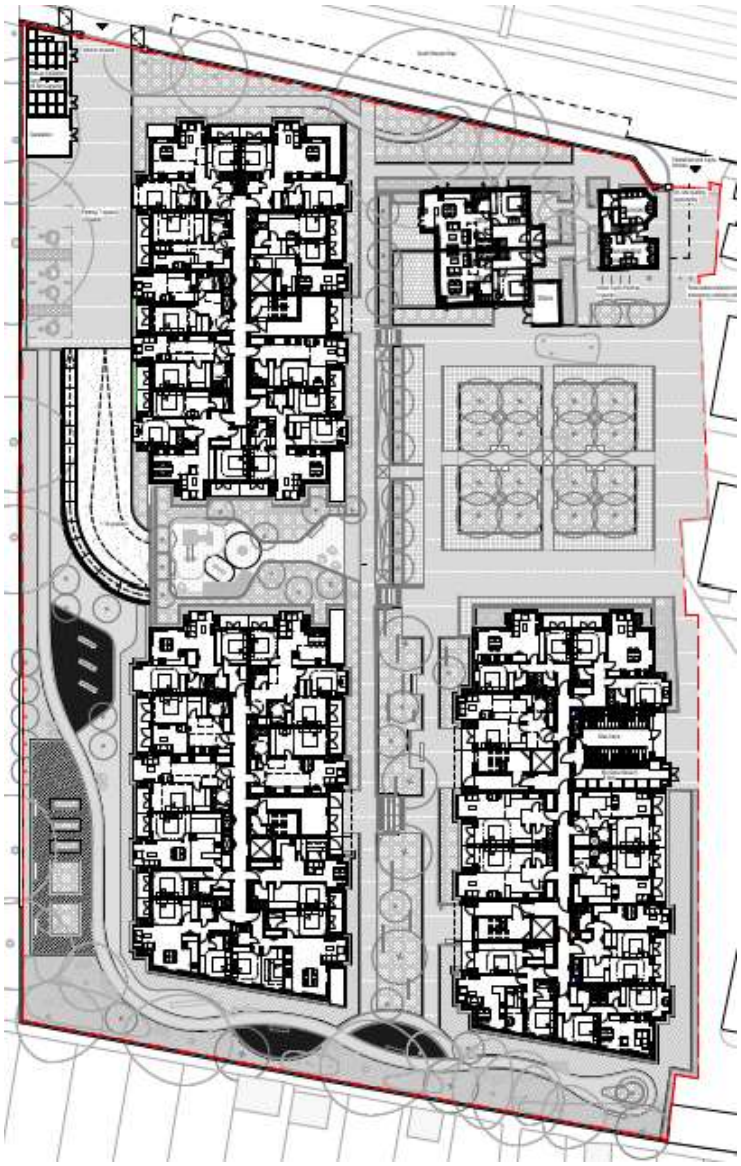
The site is located on the south side of South Worple Way, East Sheen, approximately 1 km southwest of Barnes High Street. Access to Plot A will be occur via South Worple Way.

To the north of the site is an overground railway service operated by South Western Railway. Mortlake station lies approximately 680m to the west, with Barnes station being located around 1 km to the east.

Immediately to the west of the site is the Old Mortlake Burial Ground, whilst the residential dwellings of South Worple Avenue are apparent to the east.

The site is within the administrative boundary of the London Borough of Richmond and the application red line is shown in Figure 1 below.

Figure 1: Site extents (red line)



3 Guidance on the Assessment of Noise

3.1 BS 8233:2014: Guidance on sound insulation and noise reduction for buildings

This British Standard came into effect on 28 February 2014 and superseded BS 8233:1999, which was withdrawn.

The standard draws on the results of research and experience to provide information on the design of buildings that have internal acoustic environments appropriate to their functions. It deals with control of noise from outside the building, noise from plant and services within it, and room acoustics for non-critical situations. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

Indoor ambient noise levels for dwellings are set out at Section 7.7.2, Table 4, reproduced below.

Table 1: Indoor ambient noise levels for dwellings (from BS 8233:2014, Table 4)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

A series of notes provide context to the guideline values of Table 4. Note 1 advises that the indoor ambient noise levels are *"the sum total of structure-borne and airborne noise sources. Groundborne noise is assessed separately and is not included as part of these targets, as human response to groundborne noise varies with many factors such as level, character, timing, occupant expectation and sensitivity."*

Note 3 states *"These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year's Eve."*

Note 4 deals with individual events and advises that *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values*".

Note 5 states that if relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation arrangement that does not compromise the façade insulation or the resulting noise level.

Note 7 provides a rider to the guideline values of Table 4, *"Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved"*.

For outdoor areas (i.e., balconies), BS 8233:2014 recommends 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 $L_{Aeq,T}$". However, the standard acknowledges that that these guideline values are not achievable in all circumstances and in higher noise areas, a compromise might be warranted. In such circumstances, development should be designed to achieve the lowest practicable levels in these external amenity spaces.

3.2 World Health Organisation

The World Health Organisation (WHO) document "Guidelines for Community Noise" provided a review of the effects of noise and a description of the principles of health criteria.

Table 1 of the document presents guideline values arranged according to specific environments and critical health effects. Noise indices to be adopted and the accompanying time base to be used for the assessment are also presented.

The guideline values consider all health effects for a specific environment. An adverse health effect refers to any temporary or long-term impairment of physical, psychological or social functioning associated with noise exposure. The specific noise limits were set for each health "using the lowest noise level that produces an adverse health effect"

Table 2: WHO Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	L_{Aeq} [dB]	Time base [hours]	L_{Amax} fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	50	16	
	Moderate annoyance, daytime and evening	55	16	
Dwelling, indoors	Speech intelligibility & moderate annoyance daytime & evening	35	16	
	Sleep disturbance, night time	30	8	45

For the daytime level, the WHO Guidelines for Community Noise identifies guideline values to assess typical community annoyance with 50 or 55 dB L_{Aeq} [outdoor noise level] representing *"daytime levels below which a majority of the adult population will be protected from becoming moderately or seriously annoyed, respectively."* On this last matter, page 144 of the Community Noise guidelines states that *"Available data indicate that daytime sound pressure levels of less than 50 dB L_{Aeq} cause little or no serious annoyance in the community"*. The dose response curves on page 100 of the document suggest about 5% of the population is annoyed at 55 dB - i.e., the majority referred to in the annoyance guideline value is about 95% of the population.

For noise events, the guideline value was set at 45 dB L_{Amax}, with research cited in the text advising that this value should not be exceeded by more than 10 to 15 times per night to ensure "good sleep".

3.3 BS 4142:2014+A1:2019. Methods for Rating and Assessing Industrial and Commercial Sound

British Standard BS 4142:2019 supersedes BS 4142:2014, which is withdrawn. The main aim of the standard is to provide an assessment and rating method that is proportionate, sufficiently flexible and suitable for use by practitioners to inform professional judgement.

The standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

a) sound from industrial and manufacturing processes;

b) sound from fixed installations which comprise mechanical and electrical plant and equipment;

c) sound from the loading and unloading of goods and materials at industrial and/or commercial premises; and

d) sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes, such as that from fork-lift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The Scope of the Standard is explicit in that its methods can be used to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. By definition, the methods are not therefore applicable to the assessment of the effects of sound on users of commercial, industrial or similar types of "non-residential" premises.

An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level. Typically, the greater this difference, the greater the magnitude of the impact. The standard advises that:

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

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

c) 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."

Note 2 to Clause 11 advises that:

> *"Adverse impacts may include but not be limited to annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

When the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be considered which may include:

1. The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

   Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

2. The character and level of the residual sound compared to the character and level of the specific sound.

3. The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) facade insulation treatment;
ii) ventilation and/or cooling; and
iii) acoustic screening.

As noted at point 1 above, the initial estimate of impact can be modified depending on the absolute level of the sound. On this point, guidance on absolute sound levels both within buildings and at outdoor amenity areas is given in BS 8233:2014, which is referred to in the examples of Annex A of the standard. It is important to understand that there is no limit to how much contextual considerations can alter the numerical outcomes of the initial assessment.

3.4 Local Authority Mechanical Plant Noise Policy

The development is located within the administrative jurisdiction of the London Borough of Richmond upon Thames (Richmond).

The London Borough of Richmond Upon Thames Supplementary Planning Document (SPD) Development Control for Noise Generating and Noise Sensitive Development to address noise issues affecting the Borough and assist in providing a consistent approach to development where noise is an issue. It addresses policy context, aims and objectives and provides guidance on the technical aspects of acoustic design for noise sensitive and noise generating development.

Section 6 of the SPD covers new noise generating industrial and commercial development and advises that

> *"All industrial and commercial development with the potential to generate noise will be assessed and, where relevant, controlled by planning conditions in order to protect residential amenity. Conditions may be used, for example, to restrict noise levels and to control hours of operation. The most relevant standard for assessing new industrial and commercial development is BS4142:2014."*

Table 2 of Section 6.2 of the SPD sets out a matrix for gauging noise significance risk against a BS 4142 assessment outcome together with accompanying planning advice, reproduced below. It goes on to say that *"As a general rule, the Borough will seek to achieve the external noise standards detailed in Table 2"*.

Noise Significance Risk	BS4142 Outcome	Planning Advice
Minimal	$L_{A,Tr} - L_{A90,T} \leq -5$	Where the rating level of noise is below the background noise level by at least 5dB, this indicates that the proposed NGD is likely to be acceptable from a noise perspective. The Borough will seek this level of compliance in most noise sensitive areas and/or where there is a requirement to mitigate creeping background effects.
Low	$L_{A,Tr} - L_{A90,T}$ is > -5 & ≤ 0	Where the rating level of noise is equal to, or below the background noise level by up to 5dB, this indicates that the proposed NGD may be acceptable from a noise perspective but will be more context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally). Compliance within this range is more applicable to less sensitive sites or where there is no requirement to mitigate creeping background effects.
Medium	$L_{A,Tr} - L_{A90,T}$ is > 0 & $\leq +5$	Where the rating level of noise is equal to, or above the background noise level by up to 5dB, this indicates that the proposed NGD is less likely to be acceptable from a noise perspective and will be context dependent, i.e. extent and effect on noise sensitive receivers (externally and internally). Compliance within this range is typically only applicable to non-sensitive sites or where there are overriding other reasons why development should be considered. It will typically be necessary for the applicant to confirm how adverse impacts from the NGD will be mitigated and minimised. It is less likely that planning consent will be granted.
High	$L_{A,Tr} - L_{A90,T} > +5$	Where the rating level of noise is above the background noise level by more than 5dB, this indicates that the proposed NGD is unlikely to be acceptable from a noise perspective and planning consent is likely to be refused on noise grounds.

4 Guidance on the Assessment of Vibration

British Standard BS 6472: Part 1:2008 *Guide to the evaluation of human exposure to vibration in buildings - Part 1: Vibration sources other than blasting* is the main guidance document utilised for this vibration assessment. It provides guidance for measuring and evaluating human exposure to vibration where the source of vibration does not arise from blasting activities.

Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2. The weighting used is W_b. A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 s.

Table 3 below summarises the levels of vibration dose values (VDV) and the corresponding probability of adverse comments.

Table 3: Vibration dose values which might result in various probabilities of adverse comment within residential buildings (source: BS 6472, Part 1, 2008)

Place and time	Low probability of adverse comment $m \cdot s^{-1.75}$ 1)	Adverse comment possible $m \cdot s^{-1.75}$	Adverse comment probable $m \cdot s^{-1.75}$ 2)
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

NOTE For offices and workshops, multiplying factors of 2 and 4 respectively should be applied to the above vibration dose value ranges for a 16 h day.

For vibration exposure below the lowest value of the range corresponding to “Low probability of adverse comment” the standard advises that “adverse comment is not expected”.

5 Environmental Noise Surveys

5.1 Survey Procedure

In order to characterise the existing noise climate, a detailed survey has been carried out at the development site.

Monitoring was undertaken between 01 August 2019 and 05 August 2019 at the location described below and illustrated by Figure 2.

- MP1: northern boundary of the site adjacent to the western site entrance (approx. 51° 28' 3"N, 0°-15' -23"W).

Figure 2: Noise monitoring position

The sound level meter was installed such that the microphone diaphragm was located 3m above ground level with line of site to the railway lines to the north

The measurements were obtained using the instrumentation scheduled below, which complies with the Type 1 specification of IEC 60651 and IEC 60804, Class 1 specification of IEC 61260 and IEC 61672 and Class 1 of IEC 60942 as applicable.

Table 4: Equipment Details

Equipment Description and Serial Number	Manufacturer	Model Number	Calibration certificate number	Calibration expiry date
Real-time sound level analyser, serial no. 56213	SVANTEK	SVAN 971	14011217-2	23/11/2020
Microphone, serial no. 65483	ACO	7052E	14011217-2	23/11/2020
Preamplifier, serial no. 57308	SVANTEK	SV18	14011217-2	23/11/2020
Acoustic Calibrator, serial no. 58011	SVANTEK	SV33A	14011217-1	23/11/2020
Microphone outdoor protection kit	SVANTEK	SA271	n/a	n/a

Field calibration checks were made at the beginning and end of the measurement session. No significant drift was encountered, calibration level with matched calibrator 114 dB(A) (± 0.15dB @ 1000 Hz).

Various statistical broad-band and spectral sound pressure level measurements were obtained during the survey. A measurement time interval T_m = 5 minutes was used for sampling.

The quantities recorded included:

- $L_{eq,T}$: 1/1 octave band Z-weighted and broadband (A-weighted) values of the equivalent continuous sound pressure level over the measurement period, T;
- L_{Fmax}: 1/1 octave band Z-weighted and broadband (A-weighted) values of the maximum sound pressure level for the measurement period, T;
- $L_{AF90\%,T}$: Broadband (A-weighted) value of the sound pressure level exceeded for 90% of the measurement period, T.

Weather conditions[1] during the survey were typically as per Table 5 below.

Table 5: Typical weather data during survey periods

Day and Date	Temperature		Average Humidity	Average wind speed	Precipitation
	Min	Max			
01/08/2019	14 °C	27 °C	67 %	0.0 ms^{-1}	0.0 mm
02/08/2019	14 °C	27 °C	67 %	0.0 ms^{-1}	0.0 mm
03/08/2019	14 °C	27 °C	69 %	0.1 ms^{-1}	7.6 mm
04/08/2019	14 °C	27 °C	70 %	0.1 ms^{-1}	0.0 mm
05/08/2019	16 °C	26 °C	68 %	0.3 ms^{-1}	0.0 mm

5.2 Results

The measured survey data is summarised in Table 3 below and illustrated by Figures 3 to 6.

Table 6: Summary of measured sound levels

Start Date	Ambient Sound Level			Background Sound Level			
	Day (0700-2300)	Night (2300-0700)		Day $L_{AF90,5min}$ (0700-2300)		Night $L_{AF90,5min}$ (2300-0700)	
	$L_{Aeq,16h}$	$L_{Aeq,8h}$	L_{AFmax}[2]	Range	Mode	Range	Mode
01/08/19	61 dB	57 dB	77 dB	34-51 dB	44 dB	28-50 dB	30 dB
02/08/19	63 dB	57 dB	77 dB	36-50 dB	44 dB	29-39 dB	32 dB
03/08/19	59 dB	56 dB	76 dB	31-47 dB	36 dB	31-50 dB	32 dB
04/08/19	64 dB	60 dB	79 dB	32-64 dB	44 dB	28-70 dB	29 dB
05/08/19	61 dB	n/a	n/a	42-47 dB	45 dB	n/a	n/a

[1] St Margarets - ITWICKEN25 (51.459° N, -0.326° W)

[2] 10th highest value, see Section 3.2 for supporting commentary.

Figure 3: Day ambient sound levels

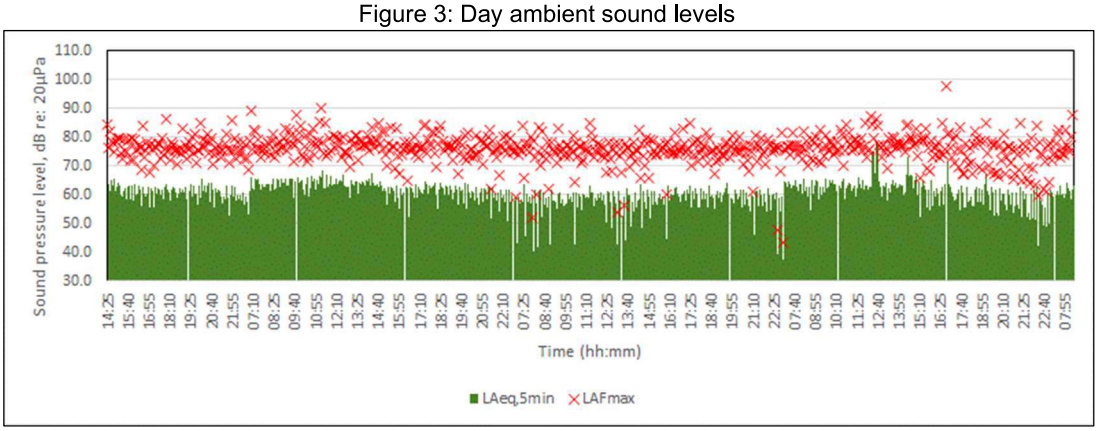


Figure 4: Night ambient sound levels

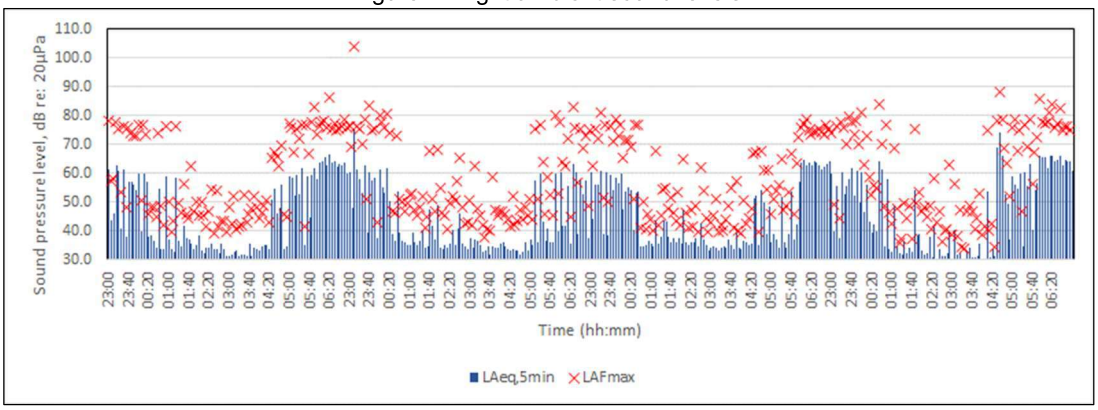


Figure 5: Day background sound levels

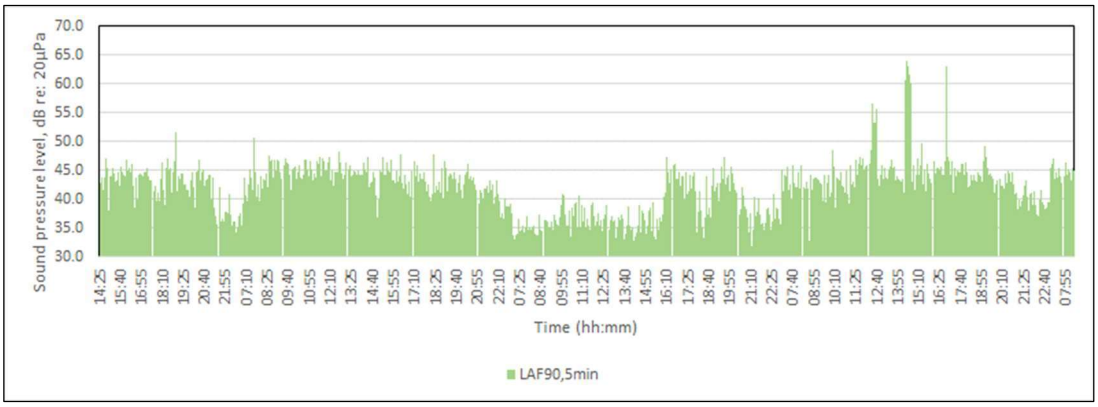
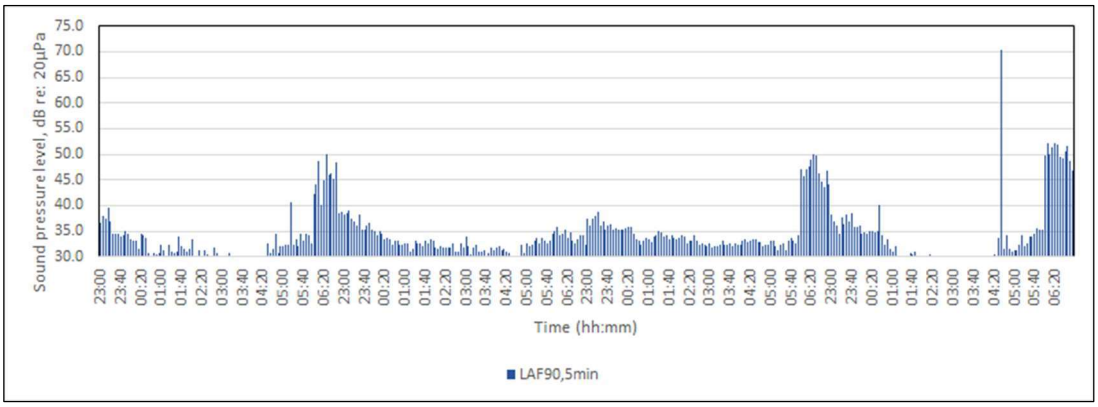


Figure 6: Night background sound levels



6 Groundborne Vibration Surveys

6.1 Procedure

Monitoring was undertaken between 01 August 2019 and 05 August 2019 at the location described below, see also Figure 2 above.

- MP1: northern boundary of the site adjacent to the western site entrance (approx. 51° 28' 3"N, 0°-15' -23"W).

Measurements were undertaken using the following instrumentation

Table 7: Equipment Details

Equipment Description and Serial Number	Manufacturer	Model Number	Calibration certificate number	Calibration expiry date
Real-time vibration meter, serial no. 14627	Svantek	SVAN958	TCRT18/1453	22 May 2020
Tri-axial accelerometer, serial no. 328	Dytran	3233A	TCRT18/1453	22 May 2020

The accelerometer was affixed to a steel inertia block using a method as described in Section 5.3.5 of BS ISO 5348:1998. The steel block was placed in direct contact with a section of concrete paving. The transducer was positioned with axes at the following alignment:

- X-axis: north (towards railway);
- Y-axis: west (parallel with South Worple Way);
- Z-axis: vertical.

6.2 Results

The measured survey data is summarised in Tables 8 and 9 below and compared against the likelihood of adverse comment as outlined in Table 1 of BS 6472. The data are also illustrated as a time series in Figures 7 to 9.

Table 8: Measured day vibration dose values and corresponding assessment outcomes

Starting Day	X Axis	Y Axis	Z Axis	$VDV_{b/d,day}$	Assessment Outcome
	$VDV_{d,day}$	$VDV_{d,day}$	$VDV_{b,day}$		
01/08/19	0.01	0.02	0.07	0.07	Below "low probability of adverse comment"
02/08/19	0.01	0.02	0.19	0.19	Below "low probability of adverse comment"
03/08/19	0.01	0.02	0.10	0.10	Below "low probability of adverse comment"
04/08/19	0.01	0.02	0.10	0.10	Below "low probability of adverse comment"
05/08/19	0.01	0.01	0.05	0.05	Below "low probability of adverse comment"

Table 9: Measured night vibration dose values and corresponding assessment outcomes

Starting Day	X Axis $VDV_{d,day}$	Y Axis $VDV_{d,day}$	Z Axis $VDV_{b,day}$	$VDV_{b/d,day}$	Assessment Outcome
01/08/19	0.01	0.01	0.05	0.05	Below “low probability of adverse comment”
02/08/19	0.01	0.01	0.04	0.04	Below “low probability of adverse comment”
03/08/19	0.01	0.01	0.04	0.04	Below “low probability of adverse comment”
04/08/19	0.01	0.01	0.05	0.05	Below “low probability of adverse comment”

Figure 7: Measured x-axis vibration dose values (VDV $ms^{-1.75}$)

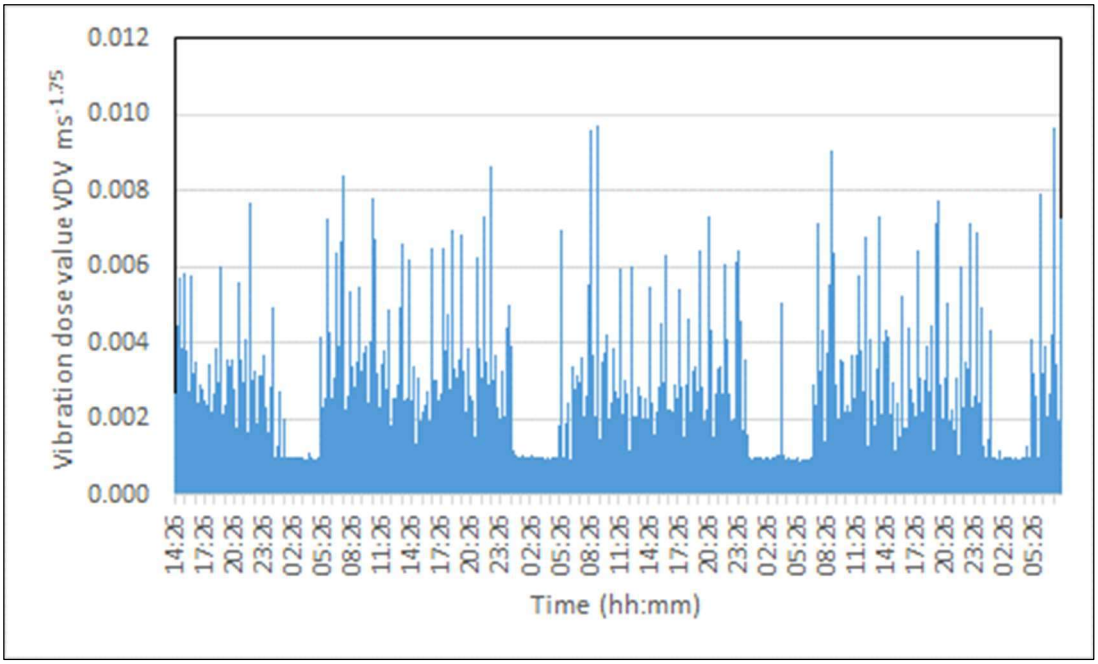


Figure 8: Measured y-axis vibration dose values (VDV $ms^{-1.75}$)

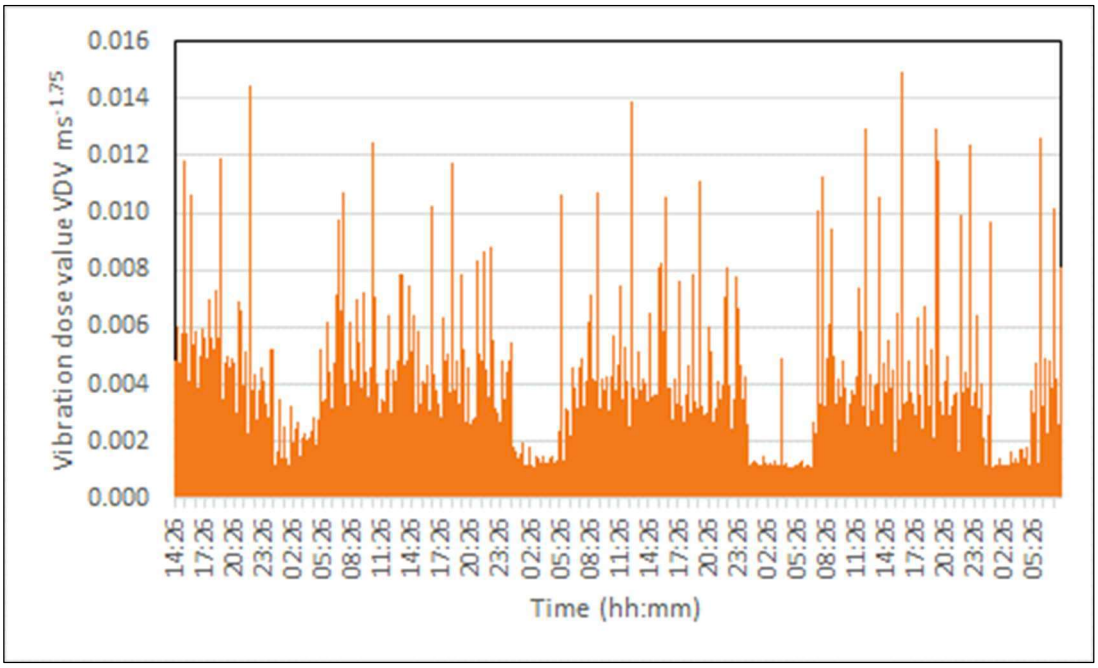
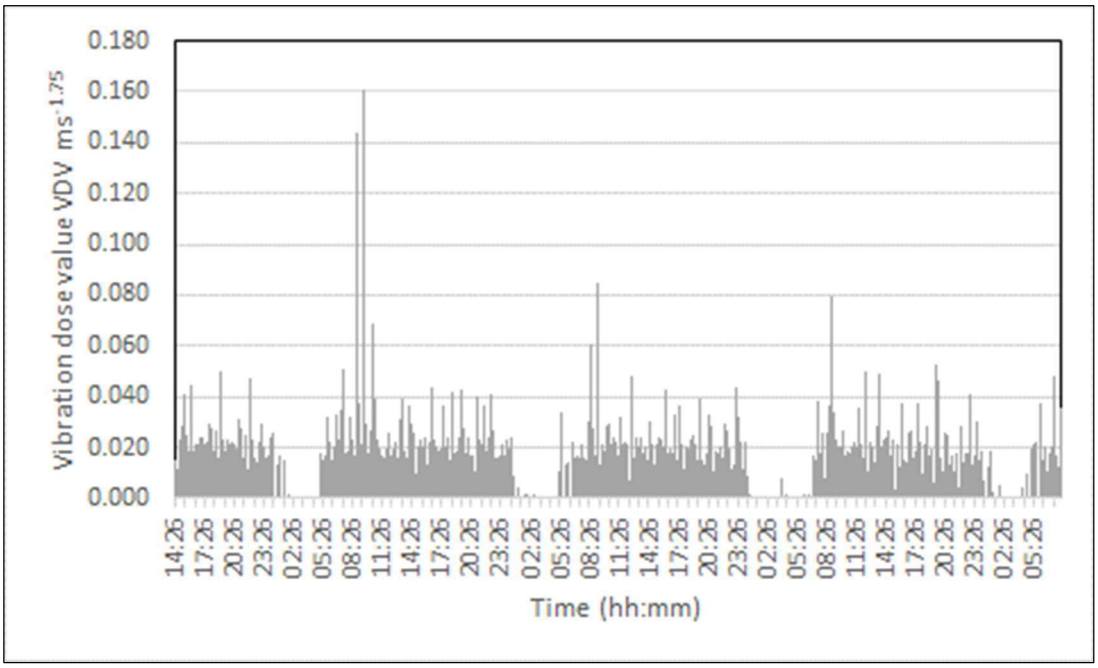


Figure 9: Measured z-axis vibration dose values (VDV $ms^{-1.75}$)



7 Mechanical Plant

7.2 Derived Criteria for Residential Premises

As noted above, the Richmond SPD requires new plant to be assessed in accordance with BS 4142:2014[3]+A1:2019. Based on Table 2, Section 6.2 of the SPD, it is proposed that a rating level be set 5 dB below the typical (modal) background sound level.

The derived external noise criteria at residential receptors are summarised in Table 10:

Table 10: External Noise Design Criteria

Plant location	Receptor	Design Criterion	
		Daytime (07:00-23:00)	Night-time (23:00-07:00)
Any location on site	1m from third party residential windows, or at a height of 1.2m above ground level at any adjacent residential garden, terrace, balcony or patio	39 dB $L_{Ar,Tr}$	30 dB $L_{Ar,Tr}$ See Note 1

Notes

1 To achieve a target rating level $L_{Ar,Tr}$ 5 dB below background at night would require that plant L_{Aeq} noise levels would need to be no more than 28 dB. An absolute sound level of this magnitude would fall below the no observed effect level (NOEL) derived from the WHO Night Noise Guidelines for Europe and would therefore be deemed unnecessarily onerous. The proposed night noise criterion in Table 2 has therefore been set as numerically equal to the NOEL value and this approach follows the philosophy of Clause 11 of BS 4142:2014+A1:2019.

Consideration may in principle need to be given to whether acoustic features are present at an assessment location. Features such as tones or impulses will be quantified using, for example, the procedures in Annex C and Annex E of BS 4142:2014 respectively. Where such features are present at an assessment location, the character corrections set out in Clause 9 of BS 4142 shall be applied as applicable.

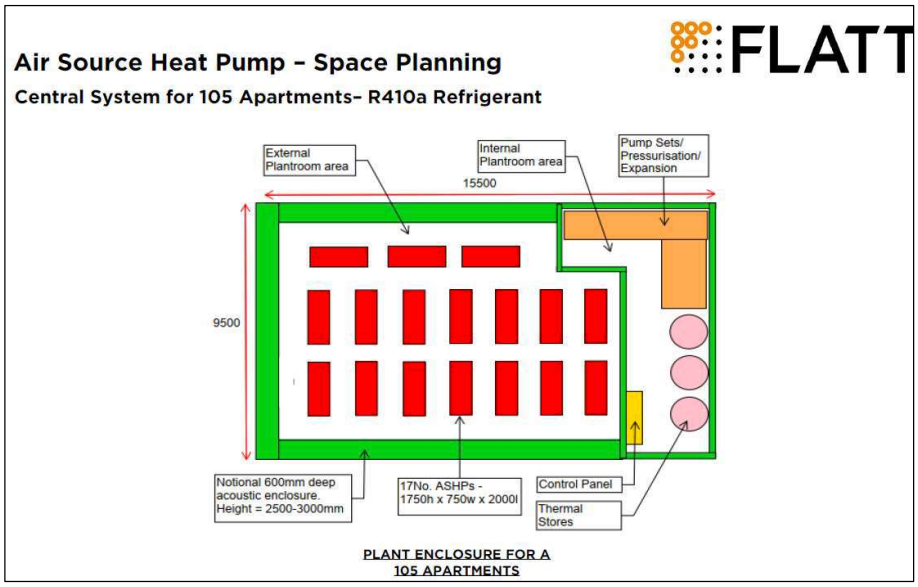
Note that the limiting noise criteria apply with all mechanical plant operating.

7.2 Plant Installation

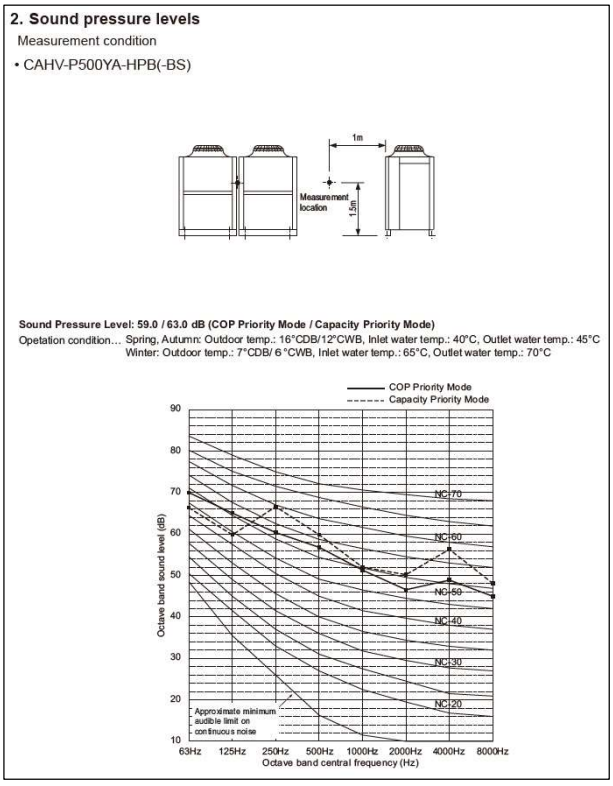
It is proposed that 17 number air source heat pumps be installed in a purpose-built enclosure on the roof of Bloc A, as per Figure 10 below.

[3] BS 4142:2014 has been withdrawn and is replaced by BS 4142:2014+A1:2019+A1:2019. The current edition of the standard will be used for the assessment set out herein.

Figure 10: Proposed roof plant installation



The heat pumps are to comprise Mitsubishi CAHV-P500YA-HPB units. Manufacturer's noise emission data is as follows:



7.1 Predicted Plant Noise Levels

Calculations have been carried out using the data presented earlier within this report to predict the resultant sound pressure levels due to airborne transmitted noise outside the nearest exposed noise assessment positions. For this purpose, a detailed three-dimensional computer model of the locality has been constructed using CADNA A

software, which implements the procedures contained in a number of pertinent documents including ISO 9613-2: Acoustics to Abatement of sound propagation outdoors, Part 2: General method of calculation.

For the purposes of this analysis, it has been assumed that 3.0m imperforate screening to the roof level plant compound. The following noise levels are predicted.

Table 11: Predicted noise level at nearest affected premises

Plant	Receiver	Predicted Level $L_{Ar,Tr}$	Target Criterion $L_{Ar,Tr}$		Excess	
			Day	Night	Day	Night
Block A, 17 No. air source heat pumps	Block A	41 dB	39 dB	30 dB	+2 dB	+11 dB
	Block B	44 dB	39 dB	30 dB	+5 dB	+14 dB
	Block C	40 dB	39 dB	30 dB	+1 dB	+10 dB

As can be seen from Table 11, a noise excesses is calculated assuming provision of a 3.0m screen and additional mitigation will be required.

A further assessment has been carried out to determine the effectiveness of additional potential mitigation options. For example, housing the units in purpose-built enclosures achieving the insertion loss values set out in Table 12.

Table 12: Insertion loss values for enclosures to outdoor units

Plant Item(s)	Enclosure Insertion loss (IL dB) at 1/1 octave band centre frequency (Hz)							
	63	125	250	500	1k0	2k0	4k0	8k0
17 No. heat pumps	14	16	23	30	37	39	38	39

Calculations indicate that mitigation achieving the provisional insertion loss values in Table 12 in conjunction with the proposed 3.0m screen should comfortably bring about compliance with the atmosphere criteria detailed herein, i.e., a rating level of 30 dB $L_{Ar,Tr}$ dB. A detailed review of the plant installation will be carried out at the appropriate RIBA plan of work stage.

8 Conclusions

A detailed environmental noise survey has been undertaken to determine the underlying ambient and background noise climate at the development site.

The data reported herein may have been used to establish external noise criteria in accordance with Local Authority noise policy and a review of current outline proposals for mechanical plant has been undertaken. The principles of a noise mitigation scheme necessary to meet Local Authority policy requirements are presented accordingly. The measurement results detailed herein will be used for the purposes of identifying numerical façade sound insulation performance targets in the context of controlling external noise ingress at an appropriate stage of the project's development, e.g., at RIBA Stage 3 and 4.

As regards groundborne vibration, the data reported in Section 6 lie below the point marking "low probability of adverse comment" for the day and night periods, according to the guidance given in BS 6472:2008. Whilst certain individual events maybe perceptible, the standard advises that adverse comment would not be expected, for vibration exposure of the magnitude reported herein.