

ADDITIONAL MECHANICAL SERVICES, NOISE IMPACT ASSESSMENT

THAMES QUARTER, READING

REPORT NO. J004481-7282-RDC-01

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.



Contents

1.0 SUMMARY.....4

2.0 BRIEF FOR CONSULTANCY5

3.0 SITE DESCRIPTION5

4.0 ASSESSMENT CRITERIA.....5

5.0 NOISE SURVEY DETAILS AND RESULTS10

6.0 PROPOSED NOISE SOURCES13

7.0 IMPACT ASSESSMENT14

8.0 UNCERTAINTY16

9.0 CONCLUSION17

APPENDIX A – DEFINITION OF ACOUSTIC TERMS

APPENDIX B – FAN SOUND DATA



1.0 SUMMARY

At the request of TFT Consultants, PDA has been instructed to provide a noise impact assessment for the proposed additional external plant at the Thames Quarter development, Reading.

A survey of the environmental sound incident on the southern façade of the existing Thames Quarter development has been carried out in order to determine the Background Sound Level in accordance with BS4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound”.

Assessment of the development indicates a Rating Sound Level L_{A,r,T_r} 29dB below the Background Sound Level $L_{A90,T}$ assessed in accordance with BS BS4142:2014 + A1:2019. This is an indication of a low impact, depending on context. After consideration of context, the impact of the proposed new plant remains low, and is unlikely to be audible at the nearby receivers.

2.0 BRIEF FOR CONSULTANCY

PDA Ltd. was engaged to carry out the following:

A. Noise Survey

We will travel to the site and carry out an ambient noise survey to assess the level of noise incident on the residential uses of the southern facade. The measurement and assessment will include for noise from the adjacent rail line, installed mechanical services to the existing development, and other local noise sources.

We would propose to undertake measurements over a full night-time period and a representative portion of the daytime. Measurements would be taken by securing a sound level meter in a weatherproof enclosure located at the southern edge of one of the elevated courtyards above the parking deck.

We will carry out all noise surveys in accordance with the provisions of BS7445 “Description and Measurement of Environmental Noise”. The measurements made will include both dBA and octave band noise levels including L_{eq} , L_{max} , and L_{90} parameters. During the survey duration, we will require unrestricted access to the site.

B. Mechanical Services Noise

We will carry out a noise impact assessment of the proposed additional plant items / louvres to noise sensitive properties above. The assessment will be carried out in accordance with the methods of BS 4142:2014+A1:2019 and / or other standards as appropriate.

We will provide a technical report with details of our assessment and recommendations as required suitable for submission to the Local Authority and / or design team / contractor

3.0 SITE DESCRIPTION

The development is a residential apartment block including ancillary spaces such as shared dining room, cinema room, gym, cycle parking and car parking. It is proposed to install an additional air handling unit. This report assesses noise from the new handling unit to nearby noise sensitive dwellings.

The building occupies a site East of the Vastern Road roundabout, between King’s Meadow Road and the main-line railway lines heading into Reading railway station. The surrounding area is the railway station to the south and west of the site with largely commercial office buildings in the close vicinity of the building.

4.0 ASSESSMENT CRITERIA

4.1 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in July 2021. With regard to Noise the Framework states the following;

Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *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.*

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:

- 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;*
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

The terms 'significant adverse' and 'adverse' impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE)' which 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.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The notes also offer an explanation of the term 'adverse impacts' as follows;

... refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that 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 (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise, updated in July 2019. A summary is reproduced in Section 4.2 below, and the full document is published at <https://www.gov.uk/guidance/noise--2>. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

4.2 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL, reproduced in the table below.

Table 1 - Planning Practice noise level guidance

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

4.3 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Dwelling houses, flats and rooms in residential use

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 2 - BS8233 recommended indoor ambient noise levels

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)	Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

In addition BS 8233 suggests, '*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*'.

4.4 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable within dwellings.

Table 3 - WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours)*
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night time	30	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

In addition to the above continuous equivalent noise levels, WHO guidelines indicates that exceedances of 45 dB L_{Amax} for single sound events should be limited to no more than 10 – 15 times per night, when measured with a 'fast' time weighting.

4.5 BS 4142:2014 + A1:2019

The effect of industrial noise on the nearest noise sensitive residences will be assessed in accordance with BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'. This will include sound break-out from the mechanical services and deliveries to the proposed convenience store.

The standard describes a method of determining the level of sound of a commercial nature, together with procedures for assessing the impact of such a sound outside nearby noise sensitive areas.

The standard may be thought of as a procedure for comparing the sound from commercial sources with background sound levels in the absence of the commercial sound and determining the likely impact of the sound on noise sensitive residences.

In accordance with BS 4142 the background sound level is the typical A-weighted sound pressure level at the assessment position that is exceeded for 90% of a given time interval (L_{A90}). The specific sound level is the equivalent continuous (L_{Aeq}) sound pressure level at the assessment position produced by the commercial source over a given time interval.

Certain acoustic features can increase the impact over that expected from a simple comparison between the specific sound level and the background level. Where such features are present, these are taken into account by adding corrections to the specific sound level.

This correction is applied based on whether the following features occur, or are expected to be present. The correction values can either be determined subjectively, or by various objective measurement procedures.

- The sound contains a distinguishable, discrete, continuous tone (whine, hiss, screech, hum, etc.). 0 – 6 dB penalty
- The sound contains distinct impulses (bangs, clicks, clatters, or thumps). 0 – 9 dB penalty.
- The sound is irregular enough to attract attention. 0 – 3 dB penalty.
- Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

From the addition of the above penalties where appropriate the rating level is established, this being the value that is compared with the background noise. Note that corrections for impulsivity and tonality may be added arithmetically where both are present and likely to affect perception within the same reference period. However, if any single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics.

According to BS 4142 an initial estimate of the impact is given based on the rating level value as follows:

- a rating level 10 dB(A) or more above the background is an indication of significant adverse impact, depending on the context.
- a rating level 5 dB(A) above the background is an indication of an adverse impact, depending on the context.
- where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

BS4142 indicates that the noise source should be evaluated over the appropriate time interval which is as follows:

- 1h during the day (07:00 – 23:00)
- 15 min during the night (23:00 – 07:00)

The above initial assessment may then be modified depending on the context, to take into account;

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

- 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:
 - o Façade insulation treatment
 - o Ventilation and / or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
 - o Acoustic screening

5.0 NOISE SURVEY DETAILS AND RESULTS

An ambient noise survey has been undertaken to establish the level of ambient environmental sound incident on the noise sensitive residences including for noise from the adjacent railway, surrounding roads and other local noise sources.

1.1 Survey Times and Personnel

Measurements were conducted between 15:30 hours on Tuesday 15th August 2023 and 12:30 hours on Wednesday 16th August 2023, encompassing representative periods of the daytime and a full night-time measurement. It should be noted that assessment in accordance with BS 4142:2014+A1:2019 requires separate assessments during the night-time when it might be expected that residents are normally asleep. As such the survey results have been grouped into “day” and “night” periods in accordance with the following times:

Daytime: Between 0700 and 2300 hours

Night-time: Between 2300 and 0700 hours

5-minute sample durations were taken over the daytime and night-time measurement periods. The measurements were made and partially attended by Mr Joe Meadows of PDA Ltd.

1.2 Equipment Used

Measurements were undertaken with a Rion NL-52 sound level meter. The meter is a precision grade Class 1 sound level meter (as per BS EN 61672-1: 2002) for which current calibration certificates are held. The meter was set to A-Weighted and fast response. The meter was field calibrated directly before any measurement took place as well as immediately afterwards, and no significant drift was observed.

1.3 Weather

Weather conditions were clear with temperatures between 10°C and 23°C and windspeeds between 1 and 2m/s from the East. Conditions were conducive for sound measurements. Weather data was taken from the nearby Weather Underground IREADI199 weather station.

1.4 Measurement Locations

Measurements were undertaken at 1 no. fixed positions externally as follows:

- Position 1 – Level 3 courtyard aligned with southern façade (on mast above parapet).

The microphone was located above the parapet on the southern façade of the level 3 courtyard, representative of the noise incident on the residences on the southern façade of the development. All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. The measurement position is detailed in Figure 1 below.

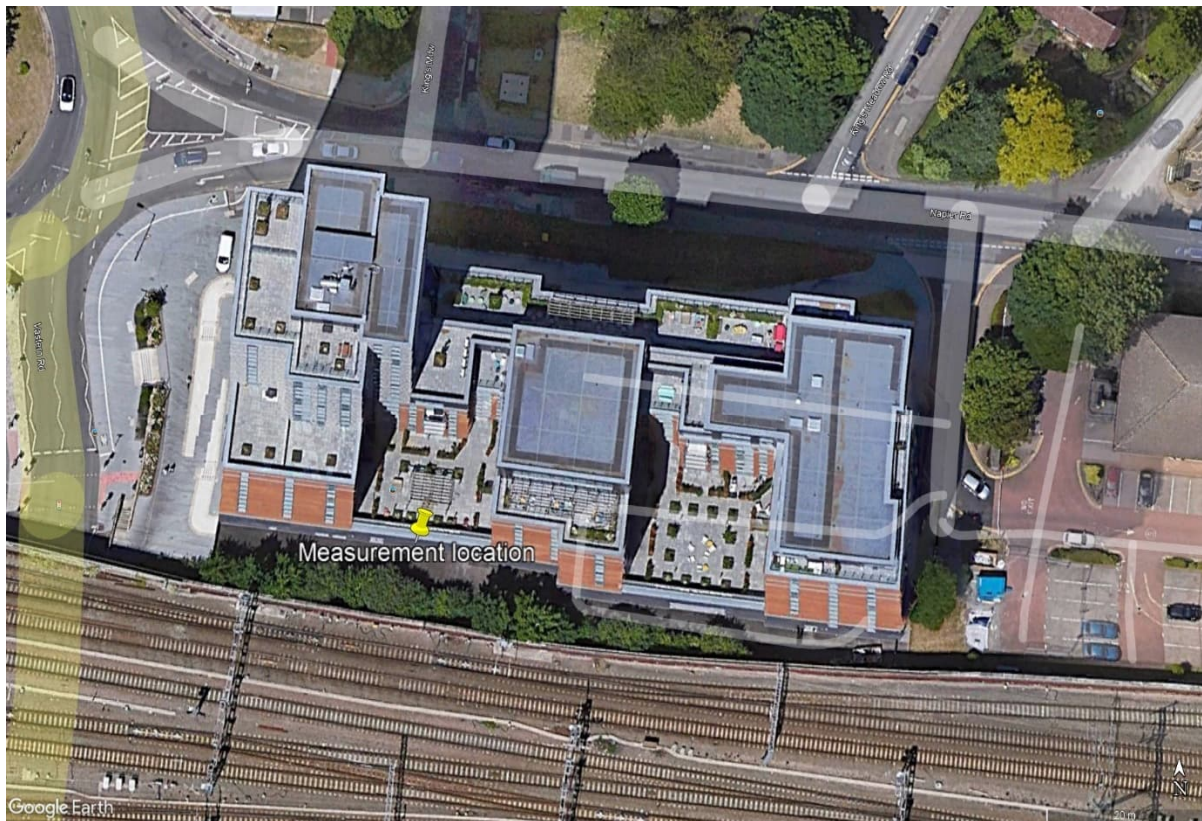


Figure 1 - Measurement Location

1.5 Description of Ambient Noise Climate

During the survey the dominant noise source was from the railway to the south of the development. In addition noise from road traffic on the surrounding roads was audible.

1.6 Measured Results

The measured sound levels are shown in Figure 2 below:

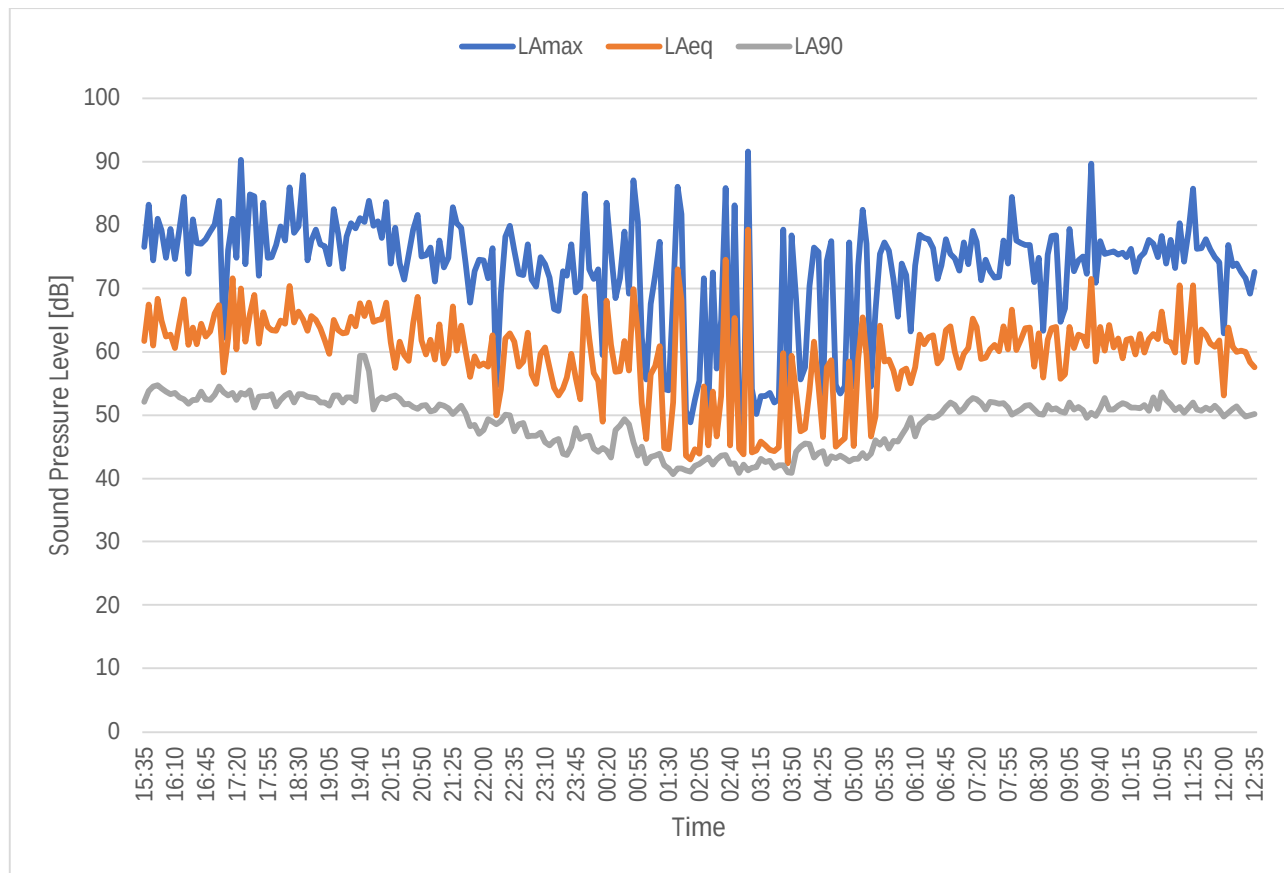


Figure 2 – Measured sound levels at location equivalent to residential façade (free-field)

The above sound level measurements are summarised in the table below.

Table 4 - Summary of environmental noise measurements

Time Period (hh:mm)	LAeq,T (dB)	Range of LAmx,5min(dB)	Range of LA90,15mins (dB)	Typical (median) LA90,15min
Day 07:00 – 23:00	64	55 – 90	47 – 54	51
Night 23:00 – 07:00	64	48 – 92	41 – 52	44

6.0 PROPOSED NOISE SOURCES

It is proposed to install a new air handling unit which will require additional ventilation terminals at 3.2m above ground level in the south facing façade (facing the railway).

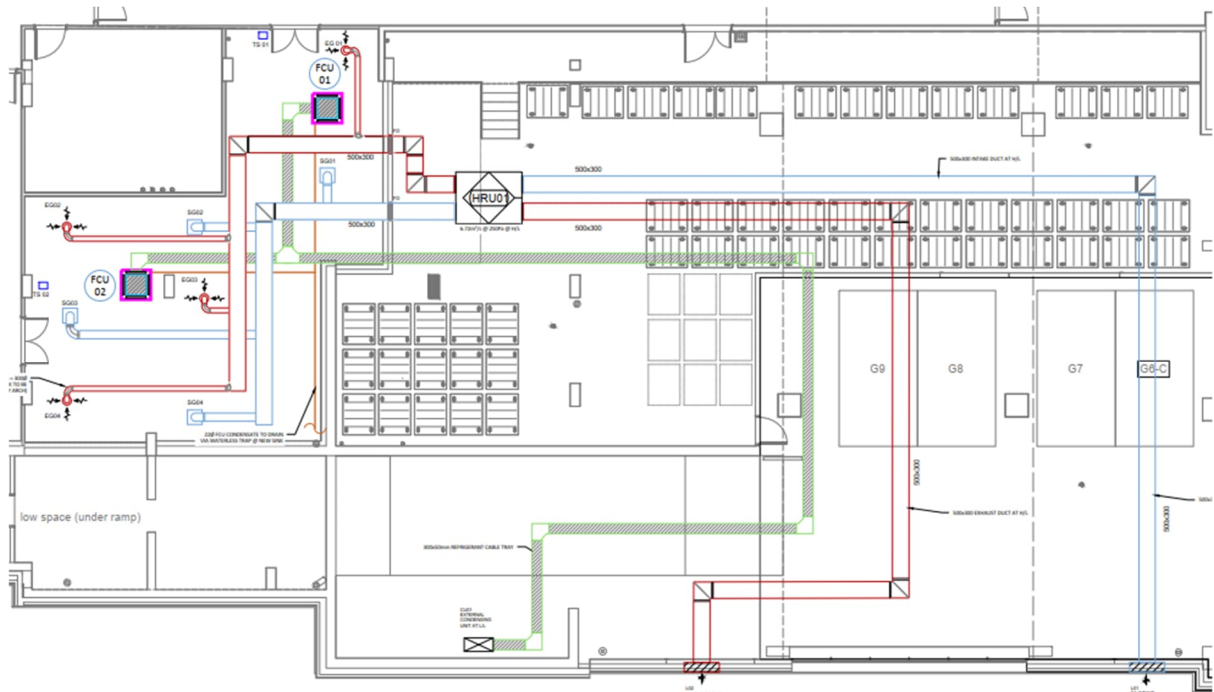


Figure 3 – Proposed new mechanical plant

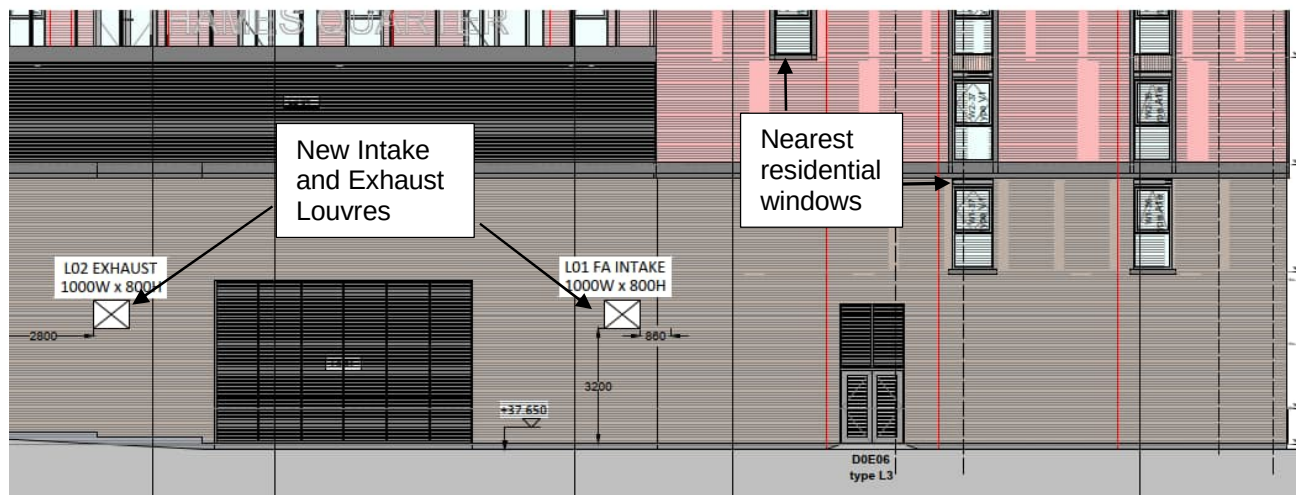


Figure 4 – Proposed new external ventilation louvres

Based on manufacturer's noise data we have calculated the sound power of the proposed new louvres as follows:

Table 5 – Louvre levels calculated from manufacturer's plant noise data

Plant	Sound Power Level by octave frequency band [Hz] dB(A)								
	63	125	250	500	1000	2000	4000	8000	Broadband
L01 new intake louvre	35	38	41	51	49	44	38	34	50
L02 new exhaust louvre	40	41	28	44	55	48	41	37	55

7.0 IMPACT ASSESSMENT

Impact of the development has been calculated with reference to BS 4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound”.

7.1 Background sound levels

BS 4142 states that background sound levels should be determined by statistical analysis of a series of background measurements taken over the period typical of the operation of the source. BS4142 also splits the assessment into daytime and night-time periods, with daytime normally taken to be 07:00 – 23:00 and night-time 23:00 – 07:00. In this case the plant may operate over the full 24 hour period and hence background noise levels during the night-time period are likely to be the limiting noise level. Typical background levels have been determined for the night-time period between 23:00 and 07:00 by taking the median of the 15 minute L_{A90} measurements over the whole 8 hour night time period. The measurements ranged from 41 – 52 dB L_{A90} with a median value of 44 dB(A).

7.2 Propagation Calculations

The sound due to the new air handling unit louvres was calculated from manufacturer's noise data. In duct sound power for the supply and exhaust ducts were corrected for attenuation due to the length of rectangular duct, number of bends, end reflection and duct area to obtain the sound power of the intake and exhaust louvres detailed within Table 5.

Sound propagation was modelled using Soundplan software and the methods of ISO 9613:2 “Acoustics – attenuation of sound during propagation outdoors – general method of calculation”, which takes into account geometric spreading, air attenuation, ground attenuation, shielding and reflections. From the model the rating noise level due to the new plant room at the residential receivers was calculated and compared with the pre-existing background sound level in accordance with the method of BS4142:2014 and the Planning Condition.

With regard to the character of the sound, in our experience plantroom equipment and fans are unlikely to be tonal or noticeably intermittent, particularly when a number of diverse sources operate simultaneously, as such the overall noise due to the new intake and exhaust louvres is unlikely to be perceptibly tonal or intermittent at the receivers. There are no impulsive sources associated with the development. As such no character correction has been applied to the predicted noise levels from the plant.

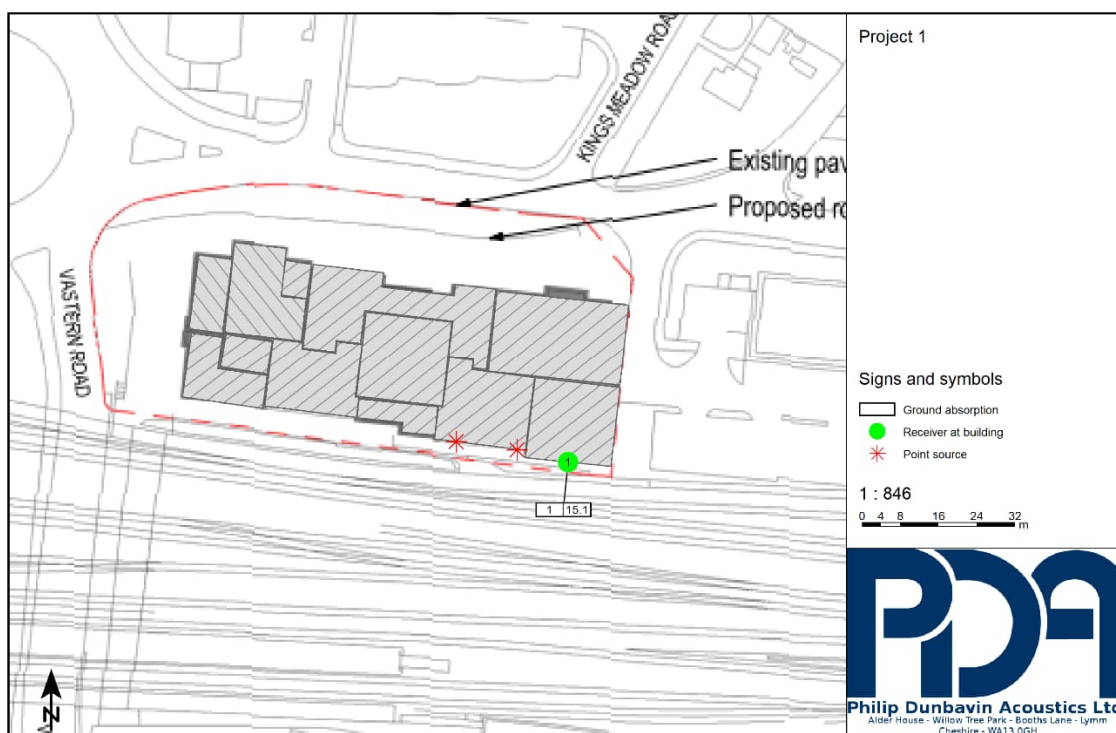


Figure 5 – Soundplan noise propagation model to nearest residential window

Table 6 – Receiver Rating Sound Levels

Receiver	Façade rating sound level $L_{A,T,r}$
Nearest residential window (south façade)	15

(see Figure 4 & Figure 5 above for location of residential receiver)

7.3 BS 4142 Assessment

The rating sound level at the nearest noise sensitive receiver is 15 dB(A). This rating level is 29 dB below the typical night-time background noise level. In accordance with BS 4142:2014, “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.” As such the initial estimate of the noise impact of the new air handling unit terminals is low and the sound is unlikely to be audible at the nearest residential windows.

7.3.1 Context

The BS4142 initial estimate is described within Section 7.3, however BS4142 indicates that this initial estimate of impact needs to be modified for context. With reference to the context BS4142 indicates that 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.

BS4142 indicates that pertinent factors that could modify context would include: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; the sensitivity of the receptor and whether dwellings or other premises used for residential purpose already incorporate design measurements that secure good internal and/or outdoor acoustic conditions.

With regards to the absolute noise levels BS4142 suggests that:

“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.”

We would note that with reference to considering context, BS 4142 repeatedly refers to the level by which the Rating Level exceeds the background level. However in this case, as the rating level is well below the background level. It is noted that the Rating Level is also well below the residual sound level and the recommended limit outside bedrooms of the WHO Guidelines, and also taking into account the mitigation to the residential façade in the form of acoustic glazing and MVHR ventilation supplied to the apartments such that windows need not be opened for background ventilation, after the consideration of context the sound impact of the new air handling unit remains low and the unit is unlikely to be significantly audible at the nearest residences.

8.0 UNCERTAINTY

BS4142 indicates that an assessment of noise impact should consider uncertainty within the assessment. This uncertainty can arise from: uncertainty in measurements; uncertainty in sound emission and sound power level; and uncertainty in calculation method.

8.1 Uncertainty in Measurements

It is noted that the instrumentation used within this assessment conforms to Class 1 accuracy in accordance with IEC 61672. In addition, the instrumentation has been calibrated to national standards and was field calibrated at the time of the measurements.

We would therefore consider that the effect of uncertainty on the measurement of background sound would be minimal and not significant in the context of the margin by which the Rating Level is below the Background Level.

8.2 Uncertainty in Sound Power Levels

We have been provided with sound power levels for the proposed plant items from manufacturers test data, including the frequency spectrum.

We would therefore consider that the effect of uncertainty in the Sound Power levels would be minimal and not significant in the context of the margin by which the Rating Level is below the Background Level.

8.3 Uncertainty in Calculation Method

It is noted that the calculations have been undertaken utilising a known prediction method and have utilised the standard ISO 9613 (as suggested in BS4142:2014+A1:2019) utilising commercial and verified prediction software. We would also note that the method of ISO 9613 calculates propagation under unfavourable meteorological conditions in regards to noise egress from the source, as such the sound levels calculated at the receiver may be regarded as a reasonably ‘worst case’ level which for more favourable propagation conditions will be reduced, leading to a lower impact than that predicted.



9.0 CONCLUSION

At the request of TFT Consultants, PDA has been instructed to provide a noise impact assessment for the proposed additional external plant at the Thames Quarter development, Reading.

A survey of the environmental sound incident on the southern façade of the existing Thames Quarter development has been carried out in order to determine the Background Sound Level in accordance with BS4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound”.

Assessment of the development indicates a Rating Sound Level L_{A,r,T_r} 29dB below the Background Sound Level $L_{A90,T}$ assessed in accordance with BS BS4142:2014 + A1:2019. This is an indication of a low impact, depending on context. After consideration of context, the impact of the proposed new plant remains low, and is unlikely to be audible at the nearby receivers.

APPENDIX A – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The “time constant”, or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. “Fast”, “Slow”, etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.

APPENDIX B – FAN SOUND DATA

XBC75 HORIZONTAL FAN - SOUND DATA

Fan Speed	Sound Power Levels (dB re 1 pW)	Frequency (Hz)								Spherical dBA@3m	Fan Speed	External Static Pressure (Pa)								Spherical dBA@3m
		63	125	250	500	1000	2000	4000	8000			63	125	250	500	1000	2000	4000	8000	
100%	Induct Intake	81	80	79	82	75	69	63	59	41	50%	66	65	64	67	60	54	48	44	26
	Induct Supply	82	78	72	79	76	66	50	50			67	63	57	64	61	51	35	35	
	Induct Discharge	85	84	79	87	86	78	71	67			70	69	64	72	71	63	56	52	
	Induct Extract	79	73	71	73	68	63	59	58			64	58	56	58	53	48	44	43	
	Casing Radiated	75	67	64	62	53	45	46	38			60	52	49	47	38	30	31	23	
75%	Induct Intake	75	74	73	76	69	63	57	53	35	25%	54	53	52	55	48	42	36	32	<20
	Induct Supply	76	72	66	73	70	60	44	44			55	51	45	52	49	39	23	23	
	Induct Discharge	79	78	73	81	80	72	65	61			58	57	52	60	59	51	44	40	
	Induct Extract	73	67	65	67	62	57	53	52			52	46	44	46	41	36	32	31	
	Casing Radiated	69	61	58	56	47	39	40	32			48	40	37	35	26	<20	<20	<20	

*Casing Radiated (Breakout).