

MECHANICAL SERVICES NOISE IMPACT ASSESSMENT

THAMES QUARTER, READING

REPORT NO. J004481-7151-RDC-02

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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.



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1.0 SUMMARY

At the request of TFT Consultants, PDA has been instructed to provide an updated noise impact assessment for the proposed external plant noise egress to nearby noise sensitive properties at the Thames Quarter development, Reading.

Our earlier mechanical services plant noise impact assessment for the site has been revised to include the plant associated with the proposed new air-handling unit.

Reverberant sound levels have been calculated due to mechanical plant within the development plant room, the car park induction ventilation fans within the car park and proposed new air handling unit. Noise break-out through the ventilation louvres and car park entrance has been calculated. Propagation to the nearest noise sensitive receiver has been calculated using Soundplan software employing the methods of ISO 9613 part 2; "Acoustics – Attenuation of Sound During Propagation Outdoors – General method of calculation."

Assessment of the development indicates a rating sound level $L_{A,r,T}$ 10dB 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. This sound level also meets the criterion of Planning Condition 38 of the planning permission for the development.

2.0 BRIEF FOR CONSULTANCY

PDA Ltd. was engaged to carry out the following:

A. Mechanical Services Noise

We will carry out a noise impact assessment of the proposed additional external plant items / louvres to neighbouring noise sensitive properties. Appropriate noise mitigation measures will be proposed where necessary to meet the plant noise emission criteria of Planning Condition 29.

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 install an additional air handling unit. This report assesses noise from the development, including the new air handling unit, in accordance with Planning Condition 38 of the Development.

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. The nearest noise sensitive residential building is The Lodge at 22 Kings Meadow Road approximately 60m north-east of the development.

4.0 ASSESSMENT CRITERIA

4.1 Local Authority Planning Condition 38

Planning Condition 38 of the development's planning permission states the following:

No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by this Council. The assessment shall be carried out in accordance with the relevant recommendations of appropriate British Standards or other recognised Codes of Good Practice. The predicted rating level, $L_{A_{r,Tf}}$ (specific sound level plus any adjustment for the characteristic features) as measured at a point 1 metre external to sensitive facades shall be at least 10dB below the existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation. The plant shall only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.

Reason: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Policy CS34 and Policy DM4

It is noted that the above condition specifies the required criterion in terms of $L_{A_{r,Tf}}$ and $L_{A90,T}$ which are the Rating Sound Level and Background Sound Level respectively when assessed in accordance with BS 4142:2014+A1:2019.

4.2 Local Authority Planning Condition 29

Planning Condition 29 of the development's planning permission states the following:

29. For the avoidance of doubt, the glazing and ventilation shall be installed in accordance with the specifications recommended within the acoustic assessment submitted with the application (Stuart Michael Associates, November 2016, 5277/NA) and retained to the standards as set out in this assessment thereafter.

Reason: to protect the amenity of future occupants of the proposed development.

Policies: CS34, DM4

Reviewing the above condition we note that the cited Stuart Michael Associates report only specifies glazing and ventilation for habitable rooms within the development. As such the proposed changes are not affected by this condition.

4.3 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 SURVEY DETAILS

The assessment method of BS 4142:2014+A1:2019 required an environmental noise survey to be carried out to establish the Background Sound Level at the nearest noise sensitive residences prior to the installation of the new source to be assessed (i.e. prior to the development).

In this case, an environmental noise survey was carried out and reported in Stuart Michael Associates report ref : 5277/NA dated November 2016, based on measurements carried out at the site between 25th and 26th September 2016.

5.1 Measured Noise Results

Measurement Position 2 was a long-term measurement located on the top (3rd floor) of the car-park previously on the development site and overlooking the railway line. The results of the survey are reproduced in Table 1 below;

Table 1 – Background noise survey results

Measurement Location	Time	Ambient Noise Level (L _{Aeq,3hr})	Maximum Noise Level (L _{Amax,T})	10 th Percentile Noise Level (L _{A10,3hr})	Background Noise Level (L _{A90, 3hr})
SLM2	1319-1419	67.5	87.9	69.9	54.7
SLM2	1419-1519	67.5	90.8	67.9	55.0
SLM2	1519-1619	67.8	86.8	69.2	57.4
SLM2	1619-1719	72.3	94.6	70.2	52.9
SLM2	1719-1819	67.1	90.9	69.2	50.1
SLM2	1819-1919	66.4	87.6	69.1	50.9
SLM2	1919-2019	68.3	88.5	68.3	48.6
SLM2	2019-2119	66.8	88.8	68.7	47.6
SLM2	2119-2219	65.3	88.7	61.0	46.3
SLM2	2219-2319	64.5	87.1	60.6	45.0
SLM2	2319-0019	64.7	90.5	62.0	42.8
SLM2	0019-0119	62.7	86.6	53.9	39.8
SLM2	0119-0219	61.7	80.5	54.2	37.7
SLM2	0219-0319	58.4	85.3	46.6	36.7
SLM2	0319-0419	60.7	86.4	46.6	35.4
SLM2	0419-0519	67.0	90.9	60.6	39.5
SLM2	0519-0619	65.2	87.0	58.4	43.1
SLM2	0619-0719	68.6	89.2	70.4	47.1
SLM2	0719-0819	69.8	92.5	70.2	55.2
SLM2	0819-0919	70.4	91.5	68.6	56.3

6.0 PROPOSED NOISE SOURCES

Noise sources associated with the original development were water booster pumps, boilers and CHP units within the building plant-room, plus ventilation fans in the car-parks at Ground Floor and First Floor level. The proposed changes will provide additional ventilation terminals in the south façade associated with the new air handling unit.

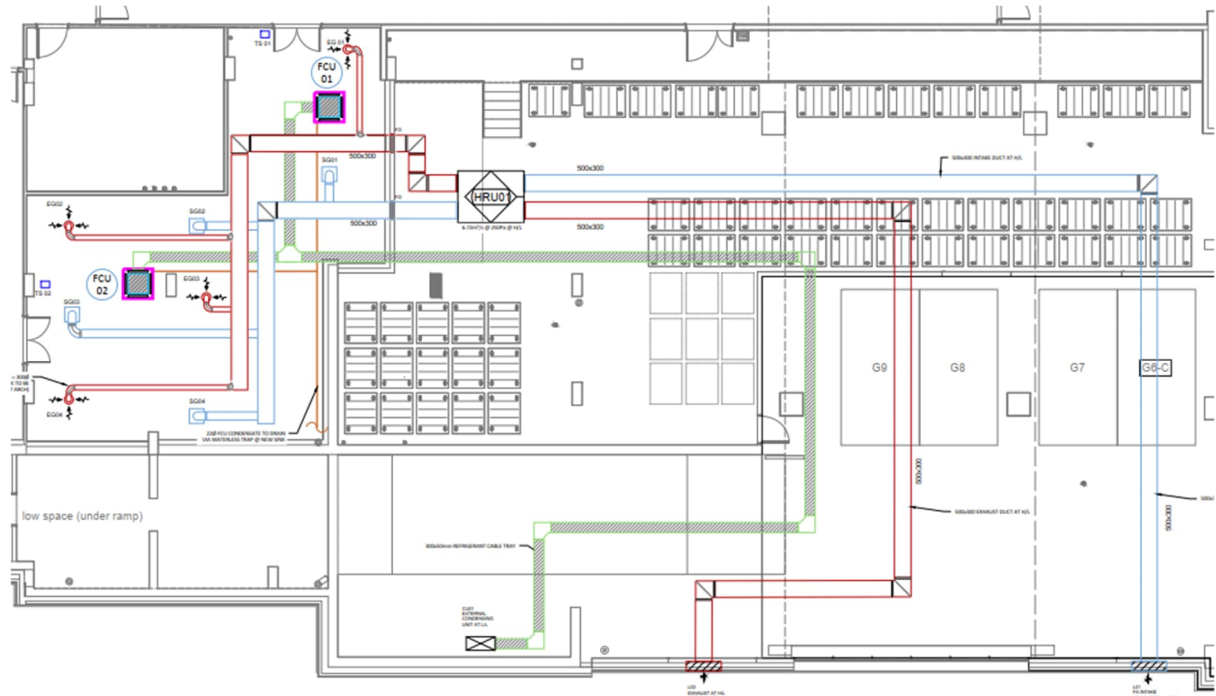


Figure 1 – Proposed new mechanical plant

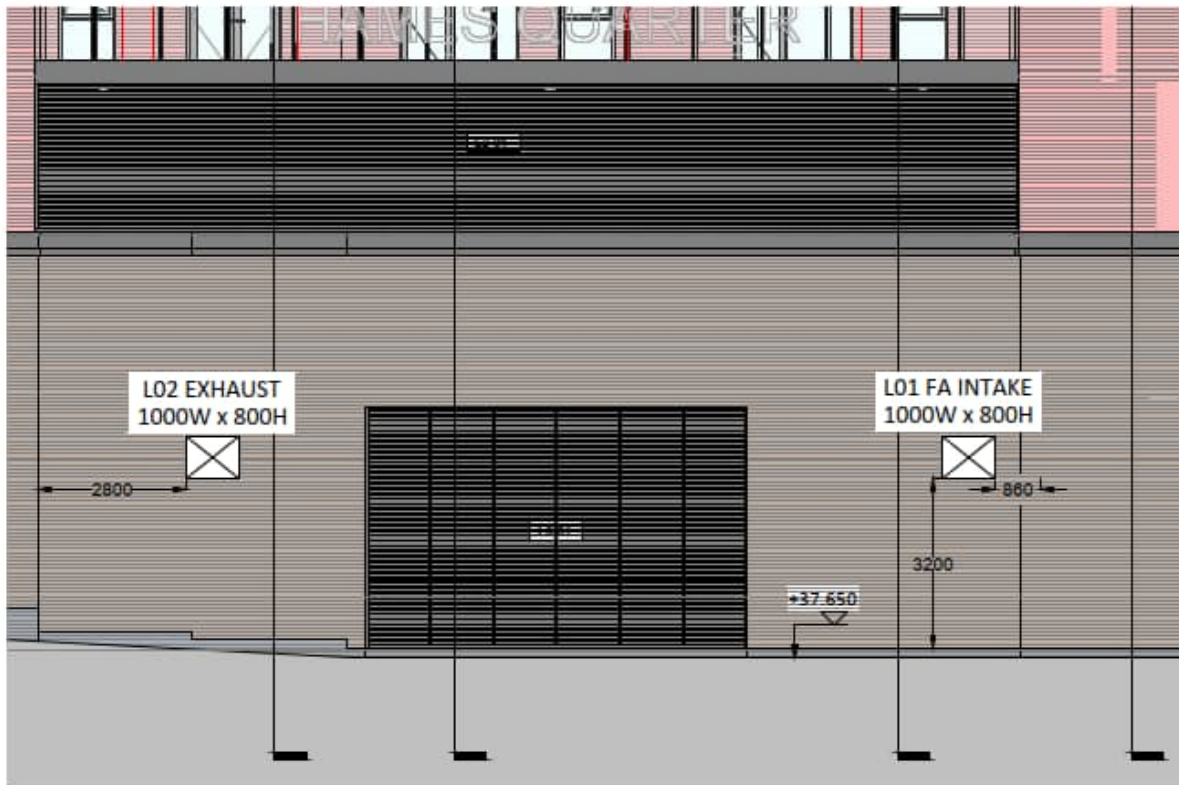


Figure 2 – Proposed new external ventilation louvres

Based on manufacturer's noise data we have calculated the sound power of the plant room, car park plant and proposed new louvres as follows:

Table 2 – Manufacturer's plant noise levels

Plant	Sound Power Level by octave frequency band [Hz] dB(A)								
	63	125	250	500	1000	2000	4000	8000	Broadband
Boiler – IMAX XTRA EL 395kW (x 3)	83	63	65	64	57	57	53	44	83
CHP	83	85	82	67	66	63	58	58	76
Water Booster Set	71	68	80	81	81	79	72	63	85
Car Park induction fans (x 13)	100	91	84	79	76	73	71	70	100
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

Notes:

1. Plant room sound powers were provided in terms of dB(A) only. Typical spectra have been taken from measurements of similar equipment and normalised to the given A-weighted sound power level.

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 in terms of the Local Authority criterion that the rating noise from the plant should not exceed 10dB below the background level. Typical background levels have been determined for the night-time period between 23:00 and 07:00.

1.1.1 Night-time

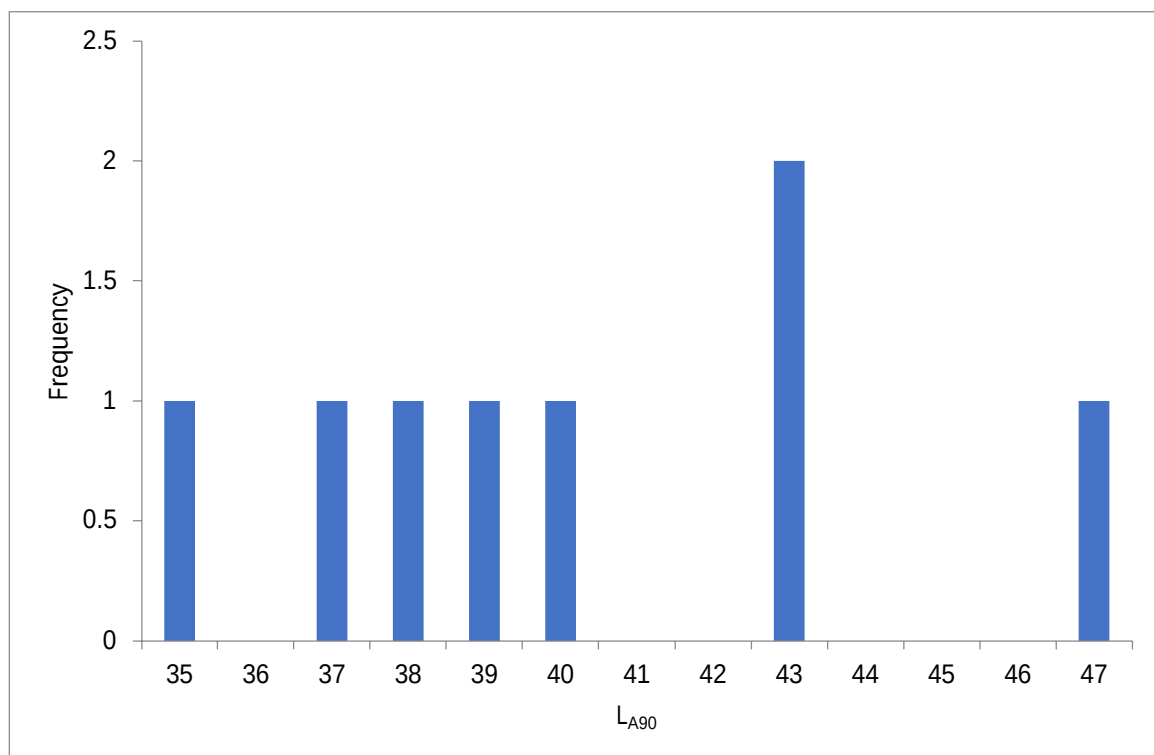


Figure 3 – Night-time background sound histogram

Typical background sound was found to be 43 dB(A) during the night-time.

7.2 Propagation Calculations

In order to calculate the noise emission from the existing building the sound power levels of the proposed new plant were corrected for the volume and reverberation of the plant room and car park respectively in order to obtain the reverberant sound pressure level in octave frequency bands in each space. The reverberation time within the plant room was assumed to be 1.5 seconds, which is judged to be

conservative for this size of room. The reverberation time within the car park was calculated using Sabine calculations and allowing for typical absorption values for the concrete finishes and proposed Rockwool soffit slab below to the underside of the apartments above. The reverberant sound pressure was used to calculate the sound power of the plant room louvre emissions and the sound power of the car park entrance and louvre emissions. For the purposes of the calculation of noise break-out from louvres, louvres were assumed to be 75% open area.

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 2.

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, the overall noise due to the new development 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.

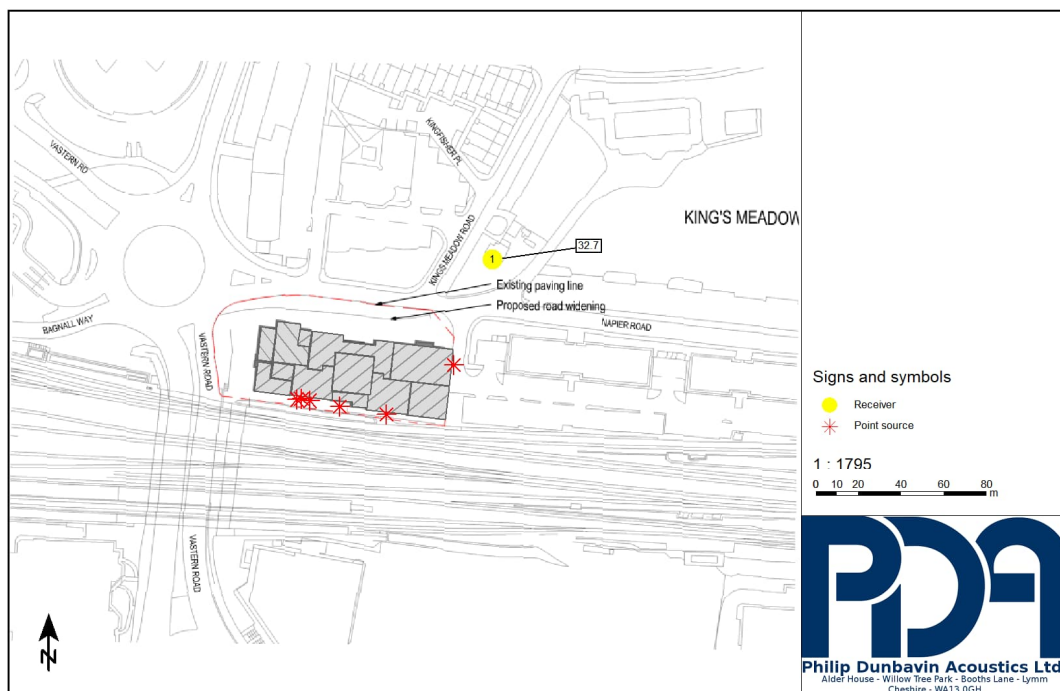


Figure 4 – Soundplan noise propagation model

Table 3 – Receiver Rating Sound Levels

Receiver	Façade rating sound level $L_{Ar,Tr}$
The Lodge, 22 Kings Meadow Road	32.7

(see Figure 4 above for location of residential receiver)

7.3 BS 4142 Assessment

The rating sound level at the nearest noise sensitive receiver is 33 dB(A). This rating level is 10 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.*” In addition the rating level meets the Local Authority criterion of Planning Condition 38 in that the rating level is 10 dB below the background sound level.

8.0 CONCLUSION

At the request of TFT Consultants, PDA has been instructed to provide an updated noise impact assessment for the proposed external plant noise egress to nearby noise sensitive properties at the Thames Quarter development, Reading.

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Assessment of the development indicates a rating sound level $L_{Ar,Tr}$ 10dB 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. This sound level also meets the criterion of Planning Condition 38 of the planning permission for the development.

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.