hepworth acoustics

DVSA DRIVING TEST CENTRE, TIGERS ROAD, SOUTH WIGSTON, LEICESTER LE18 4WS

MECHANICAL PLANT NOISE ASSESSMENT

On behalf of:

Rider Levett Bucknall UK Ltd

Report Number P23-094-R01v2
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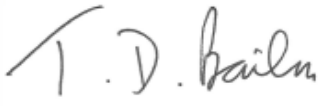
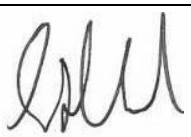
Report prepared by: Thomas Bailess MEng MIOA – Principal Consultant	
Report checked by: Graham Bowland BSc MIOA – Technical Director	

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1.0 INTRODUCTION

1.1 Hepworth Acoustics Ltd has been commissioned by Rider Levett Bucknall UK Ltd to carry out an assessment of the likely impact of noise from mechanical plant proposed for the existing DVSA Driving Test Centre, Tigers Road, South Wigston, Leicester LE18 4WS. The site location is shown in Figure 1.

1.2 This assessment has been requested in connection with the planning application for the development. This includes installing a new outdoor condenser, specifically a Daikin VRV REYA8A Outdoor Unit, on the north elevation of the existing building, in the location marked on Figure 1. The likely maximum operating hours of the condenser unit could be from 07:00 until 19:00 daily.

1.3 The purpose of this assessment is to predict the noise impact of the proposed mechanical plant associated with the development, and to recommend noise mitigation measures where needed. This assessment has included the following:

- A site inspection;
- A survey of the prevailing environmental noise levels at the site;
- Setting plant noise limits outside the nearest noise-sensitive receptors;
- Assessment of noise from the proposed mechanical plant;

1.4 The site is bounded by Tigers Road to the south. There is a commercial office building to the north, a day nursery to the northeast, and a Territorial Army centre to the west.

1.5 The nearest noise-sensitive receptor is the office building around 14 metres to the north, based on our survey on site. The nursery is around 22 metres to the northeast. The nearest residential window is at least 84 metres away, on the far side of Saffron Road.

1.6 This assessment is based on drawing 11005 - M002, Revision T2, prepared by Walmsley Engineering.

1.7 All recommendations in this report are given for acoustics reasons only. Compliance with other requirements (e.g. fire, structural, thermal, etc.) must be checked by others.

1.8 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 ACOUSTIC DESIGN CRITERIA

Residential Noise Impact

2.1 We understand that the Local Planning Authority, Oadby and Wigston Borough Council, does not stipulate specific noise limits for plant noise outside residences, but recommends assessing the plant noise impact using the guidance in British Standard 4142. The current version of British Standard 4142 is BS 4142: 2014 + A1: 2019 '*Methods for rating and assessing industrial and commercial sound'.* This standard provides methods for rating and assessing sound of an industrial and/or commercial nature. The standard will be referred to as BS 4142 for the rest of this report for brevity.

2.2 BS 4142 requires the 'rating sound level' for the new plant to be compared with the 'background (L_{A90}) sound level' measured in the absence of the plant noise being assessed, outside the nearest residential location.

2.3 The 'rating level' is derived based on the 'specific sound level' (in L_{Aeq}) attributable to the plant with an *'acoustic feature'* penalty added for any noise sources which give rise to tonal, impulsive, intermittent, or other characteristics that are readily distinctive against the residual acoustic environment, outside the residential location.

2.4 An initial estimate of the impact of the plant noise at the residential location is determined by subtracting the background sound level from the rating level. BS 4142 states that:

- Typically, the greater this difference, the greater the magnitude of the impact
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context
- The lower the rating level is relative to the measured background level, the less likely it is that the operation 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.

2.5 Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors should be taken into account, including:

- The absolute level of sound;

- The character and level of the residual sound;
- The sensitivity of the receptor and whether dwellings … will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as: i) façade insulation treatment, ii) ventilation and/or cooling, and iii) acoustic screening.

2.6 Based on the above guidance, we recommend a plant noise rating limit (dB L_{Ar}) not exceeding the background noise level (dB L_{A90}) outside the nearest residence.

Commercial Noise Impact

2.7 To determine suitable plant noise limits outside the nearby office building, we have referred to British Standard 8233: 2014 *Guidance on sound insulation and noise reduction for buildings.* This includes guidance on interior ambient noise levels within offices. The recommended indoor ambient noise levels for a selection of typical office spaces are shown in Table 1. These values refer to unoccupied spaces, i.e. excluding activity noise.

Table 1: Guidance levels for commercial office indoor ambient noise

Room	Design Range, dB $L_{Aeq,30mins}$	Source in BS8233: 2014, Section 7
Open Plan Office	45 – 50	Table 2
Meeting Rooms	35 – 45	Table 6
Executive/Cellular Offices	35 – 40	Table 6
Reception	45 – 55	Table 6

2.8 Based on the lowest values in Table 1 for a cautious approach, and a typical noise reduction of 15 dB(A) through a partly open window, we recommend a plant noise limit of 50 dB L_{Aeq} outside the nearest offices.

Nursery Noise Impact

2.9 To determine suitable plant noise limits outside the nursery, we have referred to Building Bulletin 93 *Acoustic design of schools: performance standards.* This includes guidance on interior ambient noise levels within nurseries. The recommended indoor ambient noise level for a nursery school room is 35 dB L_{Aeq}, or 40 dB L_{Aeq} if it is naturally ventilated.

2.10 Based on an internal ambient noise limit of 40 dB L_{Aeq} and a typical noise reduction of 15 dB(A) through a partly open window, we recommend a plant noise limit of 55 dB L_{Aeq} outside the adjacent nursery building.

3.0 NOISE SURVEY

3.1 Environmental noise measurements were carried out by Hepworth Acoustics at the site to determine the prevailing ambient noise climate of the area. The noise survey was carried out in a position representative of the nearest noise-sensitive receptors. The noise measurement location is marked on Figure 1.

3.2 Continuous noise monitoring was carried out between 07:00 and 19:00 on Sunday 2nd April 2023 and between 07:00 and 19:00 on Wednesday 5th April 2023 to represent a typical weekend and weekday operating hours. The noise measurements were taken in sequential 15-minute samples for the duration of the survey.

3.3 The measurement microphone was mounted on a tripod, around 1.5 metres above ground level with the microphone in 'free-field' conditions.

3.4 The weather conditions throughout the noise survey were mild, dry, and overcast, with wind speeds below 5 m/s. Wind was from the south-west. These were considered suitable conditions for the survey.

3.5 The results of the noise survey are detailed in Appendix II. The measured noise levels are summarised in Table 2.

Table 2: Environmental noise levels summary (dBA)

Time	Noise levels		
	$L_{Amax,f}$	$L_{Aeq,15mins}$	$L_{A90,15mins}$
Sunday, 07:00 to 19:00	63 – 78	48 – 53	42 – 46
Wednesday, 07:00 to 19:00	56 – 84	47 – 61	43 – 49

3.6 The noise levels measured were predominantly due to road traffic using Saffron Road. The noise climate at this location is considered suitably representative of the noise outside the nearest residences on Saffron Road.

3.7 The noise measurements were carried out using a NTi XL2 Class 1 Sound Analyser (serial no. A2A-20294-E0) fitted with a windshield.

3.8 The calibration level of the meter was checked before and after the surveys with a Brüel & Kjær Type 4231 sound calibrator (serial no. 2412667). No significant calibration deviation was observed.

4.0 ASSESSMENT

Equipment Noise Data

4.1 The manufacturer's sound pressure level data (in octave bands) of the equipment when measured at 1 metre distance are shown in Table 3.

Table 3: Equipment Octave Band Sound Pressure Level @ 1 metre, dB L_p

Equipment	Type	Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	A
AC Condenser	Daikin VRV REYA8A	59	63	61	55	51	50	45	37	58

4.2 If substitutions to the above equipment selection need to be made, for example due to supplier shortages or delays, we recommend that any alternative selection has equal or lower sound power levels than the equivalent item in Table 3. Otherwise, additional noise mitigation measures may be required.

4.3 The condenser will operate on demand and therefore will be intermittent. As such, we have applied a +3 dB acoustic feature correction for intermittency when calculating the rating level for the condenser in accordance with the guidance in BS 4142 for assessing noise impact on residences.

4.4 There will be 'distance attenuation' from the proposed plant to the nearest receptors. The formula used for attenuation of sound over distance in this context is as follows:

$$L_p = L_w - 20 \log r - 8$$

Where:

L_p = sound pressure level (dB)

L_w = sound power level (dB)

r = distance (metres)

4.5 The predict noise impacts at the nearest residence, the nearest office, and the adjacent nursery are shown in Tables 4 to 6. The calculation assumes the condenser is running at full speed to consider a worst-case scenario. Ground attenuation is taken to be negligible for a cautious approach. For residential noise impact, we have compared the sound level to the lowest measured background sound level measured during the survey.

Table 4: Predicted Condenser Noise Impact on Residences

Description	dB(A)
Condenser sound pressure level @ 1 metre (dB L_{Aeq})	58
Distance attenuation (84 metres)	-38
Façade correction	+3
Resultant specific sound level (dB $L_{Aeq,1hr}$)	23
BS 4142 penalty for intermittency	+3
Total rating sound level outside nearest residence (dB $L_{Ar,1hr}$)	26
Lowest measured background sound level, 07:00 to 19:00 (dB $L_{A90,1hr}$)	42
Comparison ($L_{Ar,1hr} - L_{A90}$)	-16

Table 5: Predicted Condenser Noise Impact on Offices

Description	dB(A)
Condenser sound pressure level @ 1 metre (dB L_{Aeq})	58
Distance attenuation (14 metres)	-23
Façade correction	+3
Resultant sound pressure level outside nearest office (dB L_{Aeq})	38
Recommended noise limit (dB L_{Aeq})	50
Comparison with noise limit	-12

Table 6: Predicted Condenser Noise Impact on Nursery

Description	dB(A)
Condenser sound pressure level @ 1 metre (dB L_{Aeq})	58
Distance attenuation (22 metres)	-27
Façade correction	+3
Resultant sound pressure level outside nursery (dB L_{Aeq})	34
Recommended noise limit (dB L_{Aeq})	55
Comparison with noise limit	-21

4.6 As shown in Tables 4 to 6, the plant noise level is well within the noise limits recommended in Section 2. On this basis, no specific noise mitigation measures are required.

5.0 CONCLUSIONS

5.1 A noise assessment of the proposed new mechanical plant associated with the existing DVSA Driving Test Centre at Tigers Road, South Wigston, Leicester LE18 4WS has been carried out.

5.2 This assessment has involved carrying out a baseline noise monitoring survey to establish the existing noise climate outside the nearest noise-sensitive premises.

5.3 Suitable plant noise limits have been determined outside the nearest noise-sensitive properties.

5.4 Using the manufacturer's noise output data for the mechanical equipment associated with the development, the likely level of plant noise has been calculated outside the nearest noise-sensitive properties.

5.5 Based on this assessment, we predict that the noise impact of the new mechanical plant associated with the development will be well within the proposed noise limits. On this basis, no specific noise mitigation measures will be required.

Figure 1 – Site Location

Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

$L_{Aeq,T}$ This is the A–weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A–weighted) energy as the real fluctuating noise, measured over the same time period, T. It is increasingly being used as the preferred parameter for all forms of environmental noise.

$L_{Amax,f}$ This is the maximum A–weighted noise level that was recorded during a sample duration, with the sound level meter on the 'fast' setting.

$L_{A90,T}$ This is the A–weighted noise level exceeded for 90% of the time period, T. L_{A90} is used as a measure of background noise.

$L_{Ar,T}$ This is the BS 4142 rating level for the time period, T.

Appendix II: Noise Survey Results

Date: Sunday 2nd April 2023

Equipment: NTi XL2 Class 1 Sound Analyser (serial no. A2A-20294-E0) fitted with a windshield

Weather: Dry, wind speed below 5 m/s

All levels in dB re 20 µPa

Start Time	Duration (h:mm:ss)	$L_{Amax,f}$	$L_{Aeq,15mins}$	$L_{A90,15mins}$
02/04/2023 07:00	0:15:00	67	48	43
02/04/2023 07:15	0:15:00	63	48	43
02/04/2023 07:30	0:15:00	66	50	43
02/04/2023 07:45	0:15:00	70	50	45
02/04/2023 08:00	0:15:00	70	50	46
02/04/2023 08:15	0:15:00	70	49	44
02/04/2023 08:30	0:15:00	67	50	45
02/04/2023 08:45	0:15:00	71	51	46
02/04/2023 09:00	0:15:00	70	50	45
02/04/2023 09:15	0:15:00	67	49	43
02/04/2023 09:30	0:15:00	64	49	44
02/04/2023 09:45	0:15:00	69	50	44
02/04/2023 10:00	0:15:00	75	51	45
02/04/2023 10:15	0:15:00	70	50	45
02/04/2023 10:30	0:15:00	69	51	45
02/04/2023 10:45	0:15:00	71	51	45
02/04/2023 11:00	0:15:00	71	49	44
02/04/2023 11:15	0:15:00	69	50	45
02/04/2023 11:30	0:15:00	70	51	45
02/04/2023 11:45	0:15:00	72	53	46
02/04/2023 12:00	0:15:00	69	50	45
02/04/2023 12:15	0:15:00	66	50	45
02/04/2023 12:30	0:15:00	67	50	45
02/04/2023 12:45	0:15:00	69	51	45
02/04/2023 13:00	0:15:00	73	50	45
02/04/2023 13:15	0:15:00	74	51	45
02/04/2023 13:30	0:15:00	72	50	45
02/04/2023 13:45	0:15:00	73	51	45
02/04/2023 14:00	0:15:00	71	50	44
02/04/2023 14:15	0:15:00	75	49	44
02/04/2023 14:30	0:15:00	70	50	45
02/04/2023 14:45	0:15:00	72	50	45
02/04/2023 15:00	0:15:00	69	50	44
02/04/2023 15:15	0:15:00	76	49	44
02/04/2023 15:30	0:15:00	75	50	45
02/04/2023 15:45	0:15:00	71	53	46
02/04/2023 16:00	0:15:00	76	52	46
02/04/2023 16:15	0:15:00	73	50	45

02/04/2023 16:30	0:15:00	77	50	45
02/04/2023 16:45	0:15:00	75	50	45
02/04/2023 17:00	0:15:00	76	50	44
02/04/2023 17:15	0:15:00	71	50	44
02/04/2023 17:30	0:15:00	72	49	44
02/04/2023 17:45	0:15:00	68	48	43
02/04/2023 18:00	0:15:00	78	51	44
02/04/2023 18:15	0:15:00	66	48	43
02/04/2023 18:30	0:15:00	73	48	42
02/04/2023 18:45	0:15:00	72	48	42

Date: Wednesday 5th April 2023

Equipment: NTi XL2 Class 1 Sound Analyser (serial no. A2A-20294-E0) fitted with a windshield

Weather: Dry, wind speed below 5 m/s

All levels in dB re 20 µPa

Start Time	Duration (h:mm:ss)	$L_{Amax,f}$	$L_{Aeq,15mins}$	$L_{A90,15mins}$
05/04/2023 07:00	0:15:00	68	49	43
05/04/2023 07:15	0:15:00	74	50	43
05/04/2023 07:30	0:15:00	72	51	43
05/04/2023 07:45	0:15:00	73	50	43
05/04/2023 08:00	0:15:00	61	52	44
05/04/2023 08:15	0:15:00	63	48	44
05/04/2023 08:30	0:15:00	65	49	44
05/04/2023 08:45	0:15:00	71	53	44
05/04/2023 09:00	0:15:00	63	48	45
05/04/2023 09:15	0:15:00	69	48	46
05/04/2023 09:30	0:15:00	61	49	45
05/04/2023 09:45	0:15:00	70	52	45
05/04/2023 10:00	0:15:00	65	50	45
05/04/2023 10:15	0:15:00	60	48	45
05/04/2023 10:30	0:15:00	67	49	45
05/04/2023 10:45	0:15:00	63	50	45
05/04/2023 11:00	0:15:00	84	57	45
05/04/2023 11:15	0:15:00	63	49	45
05/04/2023 11:30	0:15:00	65	49	45
05/04/2023 11:45	0:15:00	63	50	45
05/04/2023 12:00	0:15:00	75	61	48
05/04/2023 12:15	0:15:00	67	48	45
05/04/2023 12:30	0:15:00	65	49	45
05/04/2023 12:45	0:15:00	65	49	45
05/04/2023 13:00	0:15:00	64	47	44
05/04/2023 13:15	0:15:00	65	49	44
05/04/2023 13:30	0:15:00	65	49	44
05/04/2023 13:45	0:15:00	68	51	45
05/04/2023 14:00	0:15:00	71	51	45
05/04/2023 14:15	0:15:00	75	55	46
05/04/2023 14:30	0:15:00	66	50	46
05/04/2023 14:45	0:15:00	56	47	45
05/04/2023 15:00	0:15:00	61	48	45
05/04/2023 15:15	0:15:00	66	49	45
05/04/2023 15:30	0:15:00	74	50	45
05/04/2023 15:45	0:15:00	73	50	45
05/04/2023 16:00	0:15:00	84	53	46
05/04/2023 16:15	0:15:00	63	52	47

05/04/2023 16:30	0:15:00	75	54	47
05/04/2023 16:45	0:15:00	69	52	48
05/04/2023 17:00	0:15:00	75	53	49
05/04/2023 17:15	0:15:00	73	52	49
05/04/2023 17:30	0:15:00	71	54	49
05/04/2023 17:45	0:15:00	73	50	46
05/04/2023 18:00	0:15:00	69	52	47
05/04/2023 18:15	0:15:00	73	51	46
05/04/2023 18:30	0:15:00	75	50	45
05/04/2023 18:45	0:15:00	71	49	44