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ACOUSTICS

READING GATEWAY – VOLVO CAR SHOWROOM

Plant Noise Break Out Assessment

Kier



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1.0 INTRODUCTION

MACH Acoustics has been appointed by Kier to undertake an external plant noise assessment for the proposed site of Reading Gateway, Volvo Car Showroom, Reading.

The following subsection describes the purpose of the plant noise break out assessment.

1.1 Plant Noise Break-Out Assessment

The purpose of the assessment is to determine the existing ambient background noise level representative of the worst affected dwellings to the proposed development. Based on this level, the likelihood of complaints as a result of the proposed development can be assessed. Where non-compliance is indicated, appropriate noise mitigation can be specified.

In order to assess noise emissions from the proposed site, the assessment has been benchmarked against a noise survey carried out by Peter Brett Associates LLP (PBA) previously between 21/01/2015 to 28/01/2015. The methodology has been carried out in accordance with BS 4142: 2014 “*Methods for rating and assessing industrial and commercial sound*” and the planning conditions stated within Section 1.1.1

1.1.1 Planning Conditions

The Volvo Car Showroom has the following planning conditions imposed by the local authority;

“17. No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved in writing by this council. The assessment shall be carried for in accordance with BS 4142: 2014 methodology. The predicted specific sound level (LAeq, TR) as measured at a point 1 meter external to sensitive facades shall be at least 10 dB below the existing background sound level, LA90, T when all plant/equipment (or any part of it is in operation). The predicted rating level, LAr, Tr (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 meter external to sensitive facades shall not exceed the existing background sound level, LA90, T when all plant/equipment (or any part of it) is in operation. The plant shall thereafter only be installed in accordance with the assessment.

Reason: To safeguard the amenities of the adjoining premises and the area generally, in accordance with Core Strategy Policy CS34 and sites and Detailed Policies Document Policy DM4”

2.0 BS 4142: 2014 CRITERIA

BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level.

BS 4142 states that one should ‘*obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:*

- a) *Typically, the greater this difference, the greater the magnitude of the impact.*
- b) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c) *A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.*
- d) *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if ‘*a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources.*’ To summarise, BS4142 section 9.2 advises the following with regards to corrections for acoustic characteristics:

- **Tonality** – *for sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.*
- **Impulsivity** – *A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level., Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.*
- **Other sound characteristics** – *Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied*
- **Intermittency** – *When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.*

3.0 ENVIRONMENTAL NOISE ASSESSMENT

Peter Brett Associates LLP (PBA) previously carried out an environmental noise assessment for the Reading Gateway Premier Inn development between 21/01/15 to 28/01/2015. MACH Acoustics have used the survey data within the Peter Brett Associates report to inform the acoustic design.

PBA notes that the dominant noise sources in the area are vehicles along the A33, Basingstoke Road, Imperial Way, and the M4. It is therefore considered that measurement position 2 is more representative for the ambient day time noise climate at the proposed location of the Volvo Car Showroom. Please note, noise levels at the façade is likely to be lower than the noise levels at P2, therefore, using this measurement is most robust.

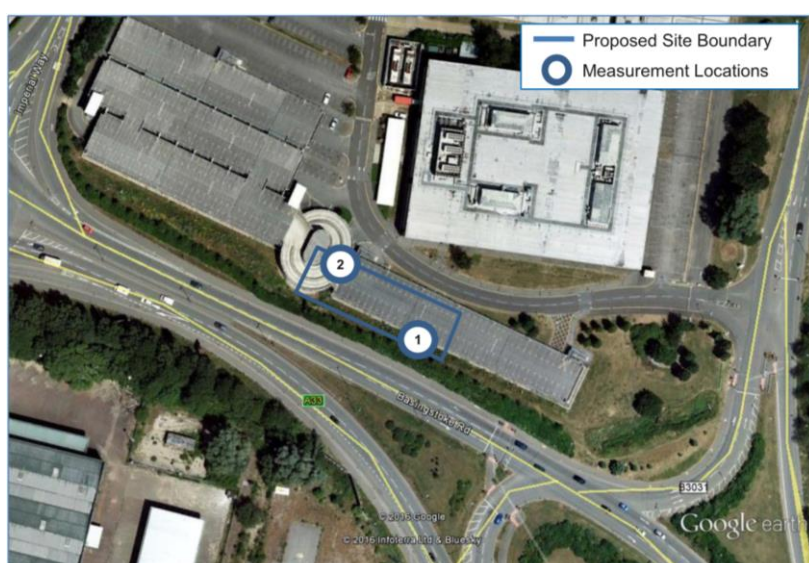


Figure 1: Satellite Image Showing the Measurement Positions (Image © 2015 Infoterra Ltd. And Bluesky. Aerial Photo Images Reproduced from a Licenced Copy of Google Earth Pro)

Figure 3.1: Excerpt from report by PBA showing measurement locations

The table below provides a summary of the noise levels measured by Peter Brett Associates.

		Position 1	Position 2
Daytime (07:00 – 23:00)	Highest $L_{Aeq,1hr}$	71 dB	68 dB
Night time (23:00 – 07:00)	Highest $L_{Aeq,1hr}$	68 dB	66 dB

Table 3.1: Summary of PBA Fixed Position Measurements

Further details of the environmental noise levels and assessment can be found within Peter Brett Associates LLP's report; "32618_PADR_20102016_MLB_LWT_DW_rev1".

Note; MACH Acoustics does not accept any responsibility for the contents within the report by Peter Brett Associates LLP. The methodology of the noise survey has been assumed to be conducted in accordance with BS 7445.

4.0 EXTERNAL PLANT NOISE BREAK-OUT

4.1 Nearest Noise Sensitive Receiver

The nearest noise sensitive receptor to this development is the Nissan Car Showroom at a distance of approximately 22m from the proposed development.

4.2 Plant Noise Limits

For the purposes of assessment, MACH Acoustics has taken the minimum L_{A90} occurring during the survey by Peter Brett Associates LLP (PBA).

Time Period	L_{A90} (dB)
Day Time (07:00 – 23:00)	52

Table 4.1: Assessment Background Noise Levels

As the exact balance between relative noise contributions from the A33 and the M4 is unknown, the A33 has been taken as the dominant noise source, to give the most robust noise level targets for noise break out from plant associated with the development.

Noise rating levels are to be assessed against the stated criteria given in Section 1.1.1, when compared against the existing background noise levels, L_{A90} , which are been presented above. The table below presents these values with the maximum noise rating level which must not be exceeded at the noise sensitive receptor.

Note; The proposed plant is to only run during the day time, therefore, no night time plant noise limits have been specified.

Assessment Period	Assessed Background Noise Level (dB, L_{A90})	Noise Rating Design Criteria	Plant Noise At Nearest Noise Sensitive Receiver (dB L_{Aeq})
Daytime (07:00 – 23:00)	52	- 10 dB	42

Table 4.2: Maximum Rating Level Targets at Nearest Receivers

4.3 Proposed Mechanical Equipment

A list of the proposed plant equipment is provided in Table 4.3 below. This indicates the sound power of each unit and the expected period the equipment is operational. Locations of the proposed equipment are shown in Appendix A and Manufactures data is provided in Appendix B.

Equipment	Frequency (Hz)							SPL (dBA)	Maximum Operational Hours
	63	125	250	500	1k	2k	4k		
AC09 Small Condenser – Casing Breakout	53	51	52	44	42	38	33	48	Day Time (07:00 – 23:00)
EC01 Large Condenser – Casing Breakout	77	72	68	65	59	51	46	66	

Table 4.3: Plant Equipment

4.4 Predicted Plant Noise Levels at Nearest Receivers

Table 4.4 provides the expected plant noise levels at the nearest noise sensitive receivers should be considered in this project. These have been established through calculation. Corrections for tonality, impulsivity, intermittency or any other sound characteristics has not been included within the calculation.

Receiver	Measurement Period	Target Plant Limit at nearest noise sensitive receiver (dB, L_{Aeq})	Predicted Plant Noise Level Limit at nearest noise sensitive receiver (dB, L_{Aeq})	Pass/Fail
Nearest Noise Sensitive Receiver	Day Time 07:00 – 23:00	42	42	Pass

Table 4.4: Predicted plant noise levels at nearest receptors

As demonstrated in the table above, the proposed plant meets the target plant noise limit at the nearest noise sensitive receiver (Nissan Car Showroom), no additional mitigation measures are required to meet this target. Please see Appendix C for the plant noise breakout calculations

4.4.1 Predicted Plant Noise Levels at the development

A noise break in calculation has been conducted from the plant on the ground floor to the nearest room within the development. It is seen that the noise break in from the plant to the workshop area is lower than the proposed internal ambient noise limits and therefore, there are no concerns over noise break in to the development.

ACOUSTIC TERMINOLOGY

Absorption Classes	The sound absorption of a material is rated from Class A to Class E, where Class A materials provide the highest levels of sound absorption.
Ambient Noise Levels	Noise levels measured in the absence of noise requiring control, frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel. The logarithmic unit of sound level.
dBA	A-weighted decibel. The A-weighting approximates the response of the human ear.
$D_{nT,w}$	Weighted standardized level difference. A single number quantity of the sound level difference between two rooms. $D_{nT,w}$ is typically used to measure the on-site sound insulation performance of a building element such as a wall, floor or ceiling. Measured in accordance with BS EN ISO 16283-1 and weighted in accordance with BS EN ISO 717-1.
$D_{n,e,w}$	The weighted element-normalized level difference. A single number rating of the sound reduction provided by a sound passing through an individual element. $D_{n,e,w}$ is typically used to define the sound insulation provided by ventilators. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1.
Flanking	Transmission of sound energy through paths adjacent to the building element being considered. For example, sound may be transmitted around a wall by travelling up into the ceiling space and then down into the adjacent room.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4kHz, roughly equal to the range of frequencies on a piano.
Impact Sound	Sound produced by an object impacting directly on a building structure, such as footfall noise or chairs scrapping on a floor.
$L_{Aeq,t}$	The equivalent continuous sound level measured in dBA. This is commonly referred to as the average noise level. “t” is the interval time for the measurement which is most often 30 minutes when demonstrating compliance with BB93.
$L_{A90,t}$	The noise level exceeded for 90% of the measurement period, measured in dBA. This is commonly referred to as the background noise level.
$L'_{nT,w}$	Weighted, standardized impact sound pressure level. A single number rating of the impact sound insulation of a floor/ceiling when impacted on by a standard ‘tapper’ machine. The lower the $L'_{nT,w}$ the better the acoustic performance. Measured in accordance with BBS EN ISO 140-7 and rated in accordance with BS EN ISO 717-2.
NR	Noise Rating. A single number rating which is based on the sound level in the octave bands 31.5Hz – 8kHz inclusive, generally used to assess noise from mechanical services in buildings.
Octave band	Frequencies are often grouped together into octaves for analysis. Octave bands are labelled by their centre frequency which are: 63Hz, 125Hz, 250Hz, 500Hz 1kHz, 2kHz and 4kHz.
Reverberation time (T_{mf})	Reverberation time is used for assessing the acoustic qualities of a space. It is defined as the time it takes for an impulse to decay by 60dB. T_{mf} is the arithmetic average of the reverberation time in the mid frequency bands (500Hz, 1k Hz and 2 kHz).
R_w	Weighted sound reduction index. A single number rating of the sound insulation performance of a specific building element. R_w is measured in a laboratory. R_w is commonly used by manufacturers to describe the sound insulation performance of building elements such as plasterboard and concrete. Measured in accordance with BS EN ISO 10140-2:2010 and rated in accordance with BS EN ISO 717-1
Sound Absorption	When sound hits a surface, some of the sound energy is absorbed by the surface material. Sound absorption refers to the ability of a material to absorb sound, rated from 0, complete reflection, to 1, complete absorption.
Sound Insulation	When sound hits a surface, some of the sound energy travels through the material. ‘Sound insulation’ refers to the ability of a material to prevent the travel of sound.
Structure-borne transmission	Transmission of sound energy as vibrations via the structure of a building.

APPENDIX A – PLANT LOCATIONS



APPENDIX B – PLANT NOISE DATA

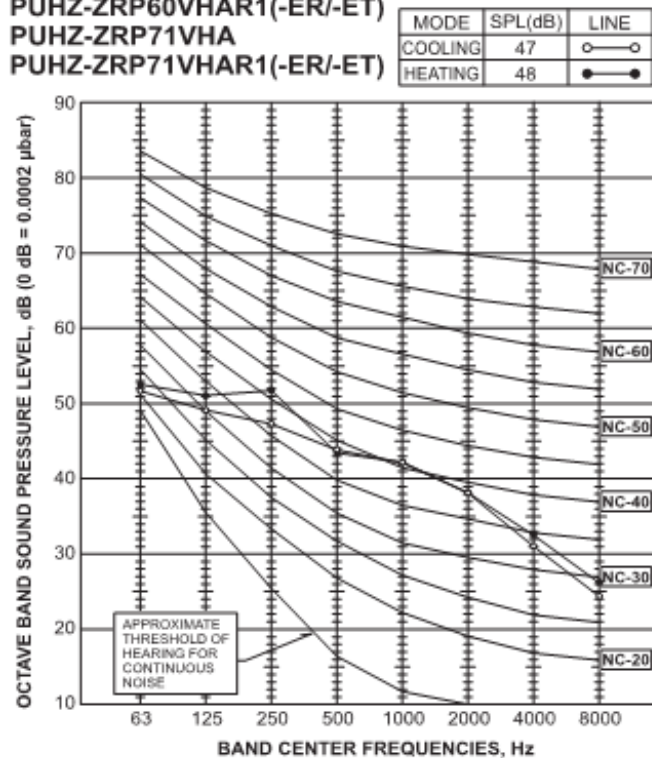
AC09 Small Condenser

PUHZ-ZRP60VHA

PUHZ-ZRP60VHAR1(-ER/-ET)

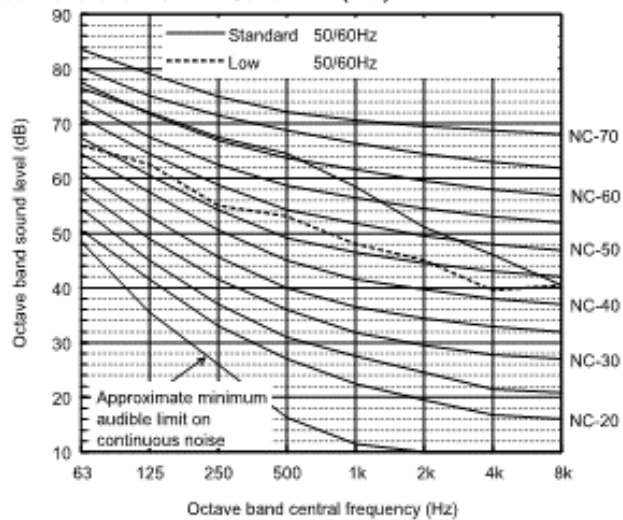
PUHZ-ZRP71VHA

PUHZ-ZRP71VHAR1(-ER/-ET)



EC01 Large Condenser

Sound level of PURY-P750YSLM-A1(-BS)



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard	50/60Hz	76.5	72.0	67.5	64.5	58.5	51.0	46.0	40.5	65.5
Low noise mode	50/60Hz	66.0	62.5	55.0	53.0	48.0	45.0	39.5	40.5	55.0

When Low noise mode is set, the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

APPENDIX C - PLANT NOISE BREAK OUT CALCULATIONS

Source		Receiver								Include?	
AC09 - PUHZ-ZRP60VHA		Breakout	Nearest Residential Property								Yes
		Octave Band Centre Frequencies, Hz									
		63	125	250	500	1000	2000	4000	dB(A)		
Measured	SPL	52.5	51	52	43.5	42	38	32.5	48.0		
Number of Units	1										
Radiation Directivity	Q = 2										
@ Distance (m)	1m										
Sound Power Level (SWL) radiating from unit		60	59	60	51	50	46	40	55.9		
Directivity Factor	Q = 4	+6	+6	+6	+6	+6	+6	+6			
Distance to Noise Sensitive Receptor	23m	-38	-38	-38	-38	-38	-38	-38			
Sound Pressure Level (SPL) at Noise Sensitive Receptor		29	27	28	20	18	14	9	24.0		

Source		Receiver								Include?	
EC01 - PURY-P750YSLM-A1(-BS)		Breakout	Nearest Residential Property								Yes
		Octave Band Centre Frequencies, Hz									
		63	125	250	500	1000	2000	4000	dB(A)		
Measured	SPL	76.5	72	67.5	64.5	58.5	51	46	65.5		
Number of Units	1										
Radiation Directivity	Q = 2										
@ Distance (m)	1m										
Sound Power Level (SWL) radiating from unit		84	80	75	72	66	59	54	73.5		
Directivity Factor	Q = 4	+6	+6	+6	+6	+6	+6	+6			
Distance to Noise Sensitive Receptor	22m	-38	-38	-38	-38	-38	-38	-38			
Sound Pressure Level (SPL) at Noise Sensitive Receptor		53	48	44	41	35	27	22	41.5		

		63	125	250	500	1000	2000	4000	dB(A)
Total SPL at Noise Sensitive Receptor		53	48	44	41	35	27	22	42