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Wrexham Tennis Centre

Assessment of the proposed refurbished
Tennis Centre including Padel Courts.

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1.0 SUMMARY

The existing noise climate is dominated at all times by general traffic on the surrounding roads and occasional trains. The tennis games on the existing courts are audible – mainly voices and the racket/ball impacts, but in no way would they be described as intrusive and the games had little impact on the overall measured levels.

Based on a somewhat extreme assumption of all current and proposed courts in full use, right up until the evening closing time, and all mechanical equipment running together, the predicted levels are below the current general noise levels and impact is likely to be low – audible certainly, but in no way intrusive.

Some basic mitigation is discussed for the mechanical equipment which can easily be built into planning conditions if necessary.



A R Raymond



P J Durell

2.0 INTRODUCTION

ADC was asked to carry out an independent assessment of the plant area of the proposed refurbished Tennis Centre and Padel Courts and predict the overall impact at the nearest noise-sensitive positions.

This report begins by discussing the various assessment criteria applicable to this situation. We follow by describing in simple terms our basic approach to calculations and modelling.

After a brief statement of survey details we discuss basic results and the resulting assessment. The impact is discussed along with any recommendations for mitigation.

3.0 ASSESSMENT STANDARDS

3.1 Technical Advice Note (Wales), Noise

This document provides general advice on how to minimise the impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.

Development Control

The following extracts are from TAN 11:-

Development Control

Noise generating development

8. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.

9. Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities. Advice on assessing noise and on factors to consider in relation to the major noise sources including roads, railways, airports, industrial and recreational noise and their measurement is given in Annex B.

Noise-sensitive development

10. Local planning authorities should consider whether proposals for new noise-sensitive development would be incompatible with existing activities, taking into account the likely level of noise exposure at the time of the application and any increase that may reasonably be expected in the foreseeable future. Such development should not normally be permitted in areas which are, or are expected to become, subject to unacceptably high levels of noise and should not normally be permitted where high levels of noise will continue throughout the night.

For Residential Development, TAN 11 sets out Noise Exposure Categories (NECs) in Annex A as follows:-

TABLE 1: NOISE EXPOSURE CATEGORIES	
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 2: RECOMMENDED NOISE EXPOSURE CATEGORIES FOR NEW DWELLINGS NEAR EXISTING NOISE SOURCES					
Noise Levels ⁽¹⁾ corresponding to the Noise Exposure Categories for New Dwellings $L_{Aeq,T}dB$					
Noise Source		Noise Exposure Category			
		A	B	C	D
road traffic	0700-2300	<55	55-63	63-72	>72
	2300-0700 ⁽²⁾	<45	45-57	57-66	>66
rail traffic	0700-2300	<55	55-66	66-74	>74
	2300-0700 ⁽²⁾	<45	45-59	59-66	>66
air traffic ⁽³⁾	0700-2300	<57	57-66	66-72	>72
	2300-0700 ⁽²⁾	<48	48-57	57-66	>66
mixed sources ⁽⁴⁾	0700-2300	<55	55-63	63-72	>72
	2300-0700 ⁽²⁾	<45	45-57	57-66	>66
Notes ⁽¹⁾ Noise levels: the noise level(s) ($L_{Aeq,T}$) used when deciding the NEC of a site should be representatives of typical conditions. ⁽²⁾ Night-time noise levels (2300-0700): sites where individual noise events regularly exceed $82dB_{LAmax}$ (5 time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D). ⁽³⁾ Aircraft noise: daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2 dB(A) higher than those of other sources because of ground reflection effects. ⁽⁴⁾ Mixed sources: this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NECs should only be used where no individual noise source is dominant. To check if any individual noise source is dominant (for the purposes of this assessment) the noise level from the individual sources should be determined and then combined by decibel addition (remembering first to subtract 2 dB(A) from any aircraft noise contour values). If the level of any one source then lies within 2 dB(A) of the calculated combined value, that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the "mixed source" NECs. If the dominant source is industrial noise see paragraph B17 of Annex B. If the contribution of the individual noise sources to the overall noise level cannot be determined by measurement and/or calculation, then the overall measured level should be used and the site assessed against the NECs for "mixed sources".					

The document emphasises that the NECs are to be used for noise-sensitive development such as dwellings, not noise-producing development such as industrial and commercial.

3.2 Mechanical Equipment

BS 4142 was updated in November 2014. The standard is very complicated but, basically, it 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
- 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 forklift trucks, or that from train or ship movements on or around an industrial and/or commercial site.

The methods described in this British Standard use outdoor sound levels 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.

Note that it is not suitable for the assessment of the “recreational activities” but is used here for the assessment of the mechanical equipment.

Characteristics and Context

Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, we need to add a character correction to the specific sound level to obtain the rating level.

These features can include tonality, impulsivity and intermittency with corrections typically ranging potentially from 0dB to 9 dB. Corrections at the higher end would represent characteristics which are highly perceptible in the context of the ambient noise as a whole. Corrections at the lower end would represent characteristics which are just perceptible in the presence of the ambient noise as a whole,

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. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

Assessment

We obtain an *initial estimate* of the impact of the specific sound by subtracting the measured background sound level from the rating level and considering 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.

Where the initial estimate of the impact needs to be modified due to the context, pertinent factors need to be taken into consideration, including the following.

- 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.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

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

We need to consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the

way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

- 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.

3.3 Tennis and Padel

We are aware of no guidance specifically for the assessment of Tennis or Padel. However, we would suggest that useful inferences can be drawn from Sport England Artificial Grass Pitch (AGP) Acoustics – Planning Implications. Note that we have not been able to find a similar document for Wales, but the principles should be equally applicable.

The document is not explicitly for outdoor tennis courts, but the sources can be considered broadly similar, ie. balls hit with rackets and bats (as opposed to feet), rebounding off court sides in the case of padel, shouts, etc.). Indeed we would suggest that a typical AGP would normally be associated mainly with football which we would suggest is potentially more disturbing in character.

The document cites the WHO Guidelines for Community Noise, and quotes it as follows:-

“Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs”

It suggests a criterion of 50 dB L_{Aeq} in gardens and outside the windows of habitable rooms, with an assessment window of 1 hour.

In addition, and depending on the circumstances, the guidance also suggests a “comparative” approach, whereby the new/proposed noise climate is compared with the existing noise climate. Where the new/proposed noise climate is no greater than the existing noise climate then the impact is described as “slight”. In fact similar guidance would describe this as “imperceptible”.

4.0 **BASIC APPROACH TO MODELLING**

We have used the well-established CadnaA modelling software which calculates noise propagation based on the processes of *ISO 9613 : Acoustics – Attenuation of sound during propagation outdoors*. Obviously, modelling software is reliant on the inputs and assumptions. The keys ones are:-

1. The ground is mainly reflective (coefficient of 0.2 very cautiously assumed).
2. Calculations are based on two orders of reflections.
3. The proposed site buildings and the surrounding buildings are assumed to be mainly reflective (0.5 dB loss on reflection assumed).
4. The surrounding trees and vegetation will provide a small degree of absorption but this has been neglected.
5. Where acoustic fences are used, they are also assumed to be reflective the same as the buildings, unless specified otherwise.
6. In the case of mechanical equipment the source data is based on manufacturers' literature and/or discussions with the mechanical services engineer. This is entered into the model along with the conditions under which the data was established (eg. free field, over hard ground, etc.) and tested to ensure the manufacturers' figures are faithfully reproduced in the model. For the external units these were entered as point sources. For the ventilation louvres these were entered as vertical area sources.
7. All units are assumed to run continuously on full load.
8. In the case of the Padel Courts, source data was difficult to come by as it is very much an up and coming sport. However, we have located a previous assessment carried out by Clarke Saunders and used the data from that. We have also used similar data for the existing tennis courts, and the proposed extra tennis courts. The sources were entered into the modelling as a series of point sources. The source levels of each of the point sources were placed within a court area (in the case of Padel Courts this was within the proposed enclosed areas) and adjusted as necessary to match the Clarke Saunders measurements exactly.

5.0 SURVEY DETAILS

5.1 Site Times and Personnel

The existing noise climate at the nearby residential locations was surveyed by Mark Pickering of ADC Acoustics from shortly before 20:30 through to shortly after 21:30, as well as general reencountering of the area before and after. The times were chosen to represent evening opening times of the Tennis Centre, when the potential for disturbance is at its greatest.

5.2 Instrumentation

Instrumentation used was two Rion NL-52 Class I sound level meters which hold current calibration certificates and which were field-calibrated as necessary with no drift noted. The meters were set up to measure continuous 5 minute samples of the noise climate.

All measurements have been gathered in terms of dB Leq, dB Lmax and dB L90 in overall A-weighted terms, and in octave bands across the frequency range. See Definition of Acoustic Terms in Appendix 1.

5.3 Measurement Positions

The main measurement positions were as shown on the following plan.



The position was chosen to represent the nearby residential locations most likely to be affected by the proposed redevelopment.

The microphone was 1.3 m above ground and well away from other reflecting surfaces.

5.4 Survey Conditions

Weather conditions were as follows :-

Rain	:	none, dry roads
Cloud	:	0%
Temperature	:	22 to 24 Celsius
Wind	:	negligible

The general noise climate appeared to be normal and representative.

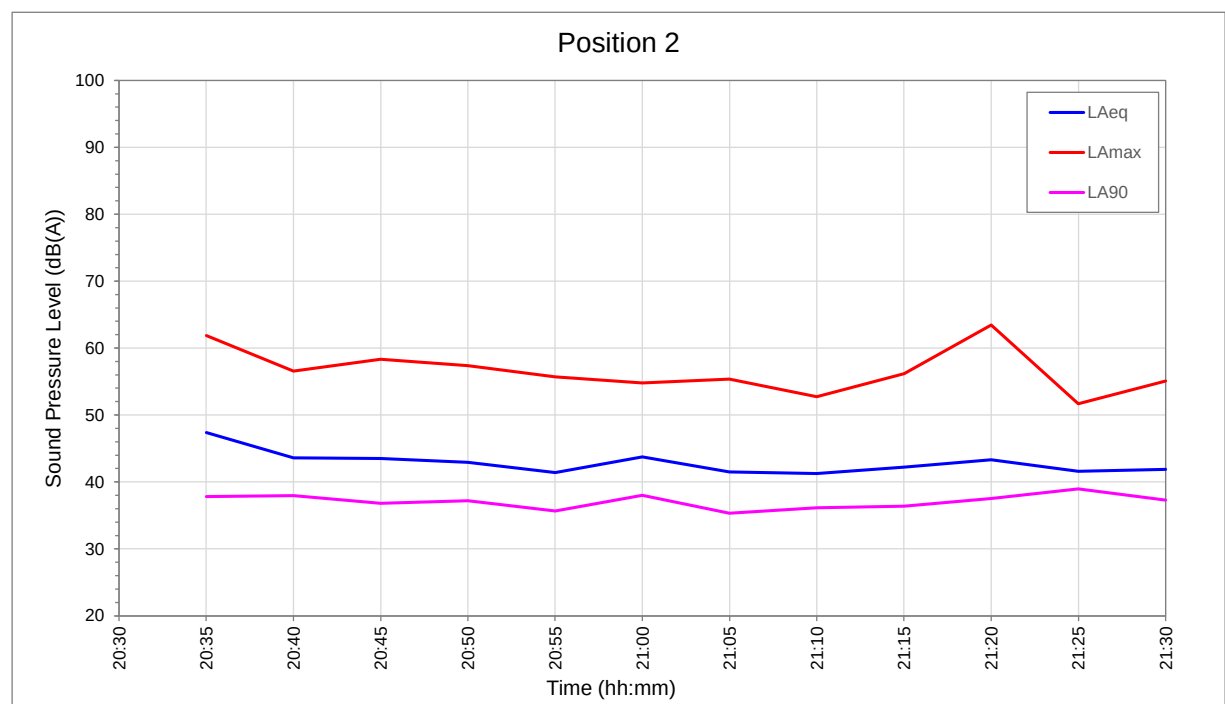
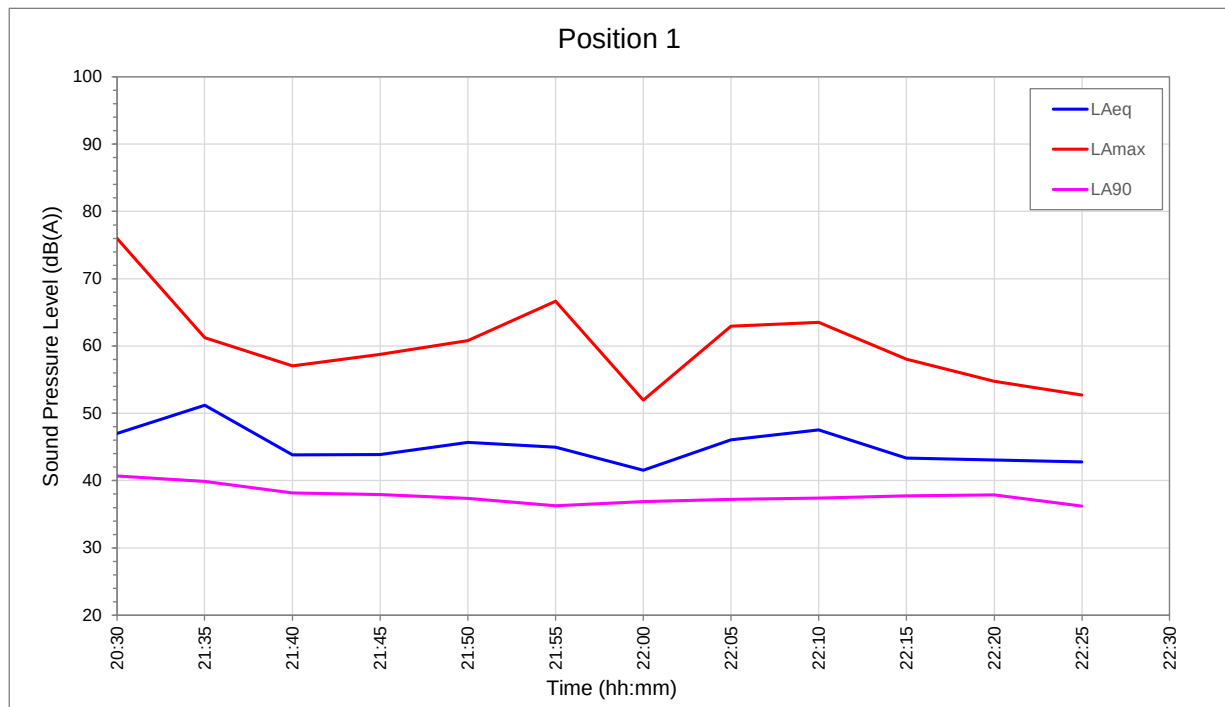
6.0 RESULTS AND DISCUSSIONS

6.1 Existing Noise Climate

The noise was dominated at all times by general traffic on the surrounding roads. Occasional trains were also affected Position 2.

There were three courts in use during the period. One was the closest court to Position 1, and the other two were the closest courts to Position 2. Voices from the games were audible, as were the racket/ball impacts, but in no way would they be described as intrusive and the games had little impact on the overall measured levels.

Full results are shown in Appendix 2. They are summarised graphically below.



We have used the lowest 15 minute periods for the evening and night time measurements in the assessments. No Standards require us to use the lowest periods but it is a means mitigating against potential

uncertainty of varying conditions, for instance on different days of the week. The levels for these periods are as follows:-

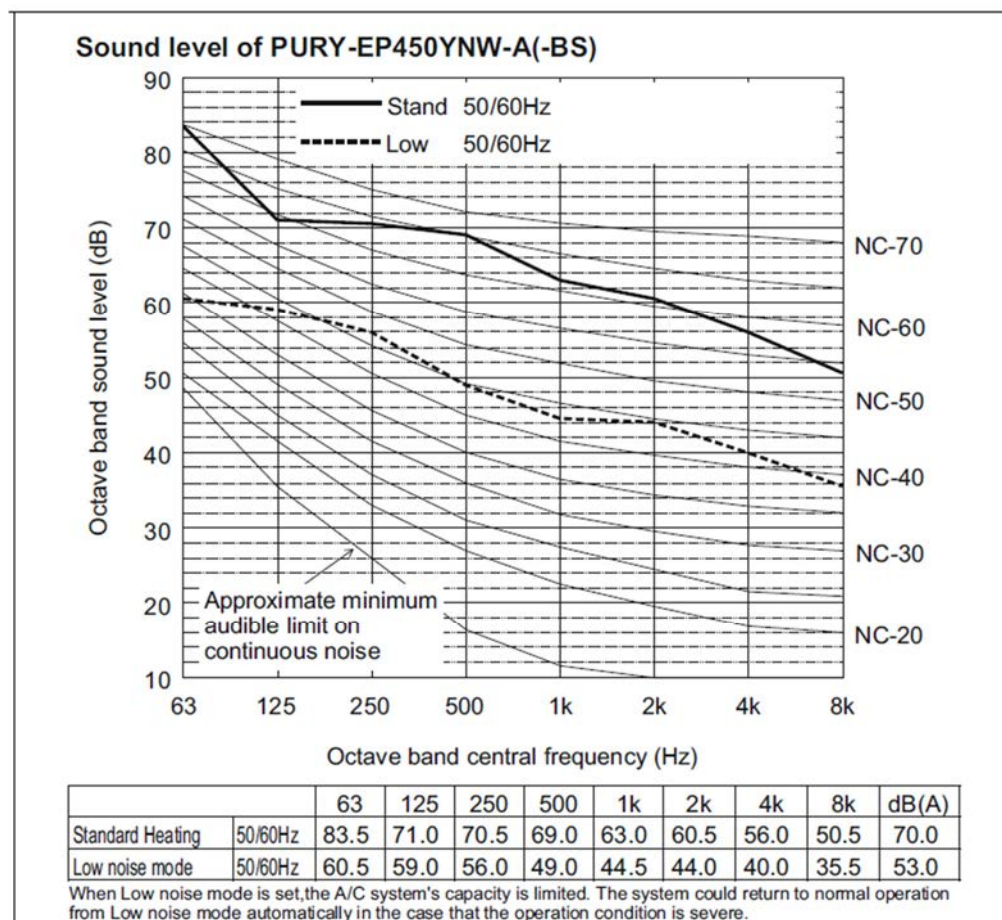
Position 1	Index	dB(A)
Lowest 15 Minutes	Leq	46
	Lmax	66
	L90	37

Position 2	Index	dB(A)
Lowest 15 Minutes	Leq	43
	Lmax	58
	L90	36

6.2 Mechanical Equipment

At this stage, exact details of mechanical equipment are not known. However, we have been provided with estimated requirements as follows:-

- 2 no. VRF condensers such as the Mitsubishi PURY-P350YNW-A2. These are also to be located in the plant compound.



- 2 no. AHU condensers such as the Daikin ERQ250AW1. These are also to be located in the plant compound.

Specifications Table for ERQ-AW1

			ERQ125A7W1B	ERQ200A7W1B	ERQ250A7W1B
Sound pressure level	Nimell.	dBA	54	57	58
Standard Accessories	Installation manual		1	1	1
	Operation manual		1	1	1
	Connection pipes		4	4	4
Refrigerant	Refrigerant—Charge—	TCO2Eq	12.9	16.1	17.5
	TCO2Eq				
	GWP		2,087.5	2,087.5	2,087.5
	Charge	kg	6.2	7.7	8.4
Operation range	Type		R-410A	R-410A	R-410A
	Cooling	Max.	*CDB 43	43	43
		Min.	*CDB -5	-5	-5
	Heating	Max.	*CWB 15	15	15
		Min.	*CWB -20	-20	-20
Cooling capacity	Nom.	kW	14.0 (1)	22.4 (1)	28.0 (1)
Piping connections	Liquid	OD mm	9.52	9.52	9.52
		Type	Braze connection	Braze connection	Braze connection
	Gas	OD mm	15.9	19.1	22.2
		Type	Braze connection	Braze connection	Braze connection
Power input	Cooling	Nom. kW	3.52 (1)	5.22 (1)	7.42 (1)
Sound power level	Nom.	dBA	72	78	78

- There may also be another air con condenser located beneath the external steps near the meeting rooms and viewing areas. This is likely to be a Mitsubishi PUMY-P-R410A or similar.

Air Conditioning

Product Information

PUMY-P R410A
Inverter Heat Pump
(12.5-22.4kW)





PUMY-P OUTDOOR UNITS		PUMY-P112VKM5	PUMY-P112YKM4	PUMY-P125VKM5	PUMY-P125YKM4	PUMY-P140VKM5	PUMY-P140YKM4	PUMY-P200YKM2
NUMBER OF CONNECTABLE INDOOR UNITS	Branch box / Mixed ¹	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 10	8 / 11
CAPACITY (kW)	Heating (nominal)	14.0	14.0	16.0	16.0	18.0	18.0	25.0
	Cooling (nominal)	12.5	12.5	14.0	14.0	15.5	15.5	22.4
	Heating (UK)	13.9	13.9	15.8	15.8	17.8	17.8	24.8
	Cooling (UK)	10.0	10.0	11.2	11.2	12.4	12.4	17.9
COP / EER (nominal)		4.61 / 4.48	4.61 / 4.48	4.28 / 4.05	4.28 / 4.05	4.03 / 3.43	4.03 / 3.43	4.28 / 3.70
SCOP / SEER ²		-	-	-	-	-	-	-
MAX AIRFLOW (m ³ /min)	Heating / Cooling	110	110	110	110	110	110	141
SOUND PRESSURE LEVEL (dBA)		49	49	50	50	51	51	56
SOUND POWER LEVEL (dBA)	Cooling	69	69	70	70	71	71	75

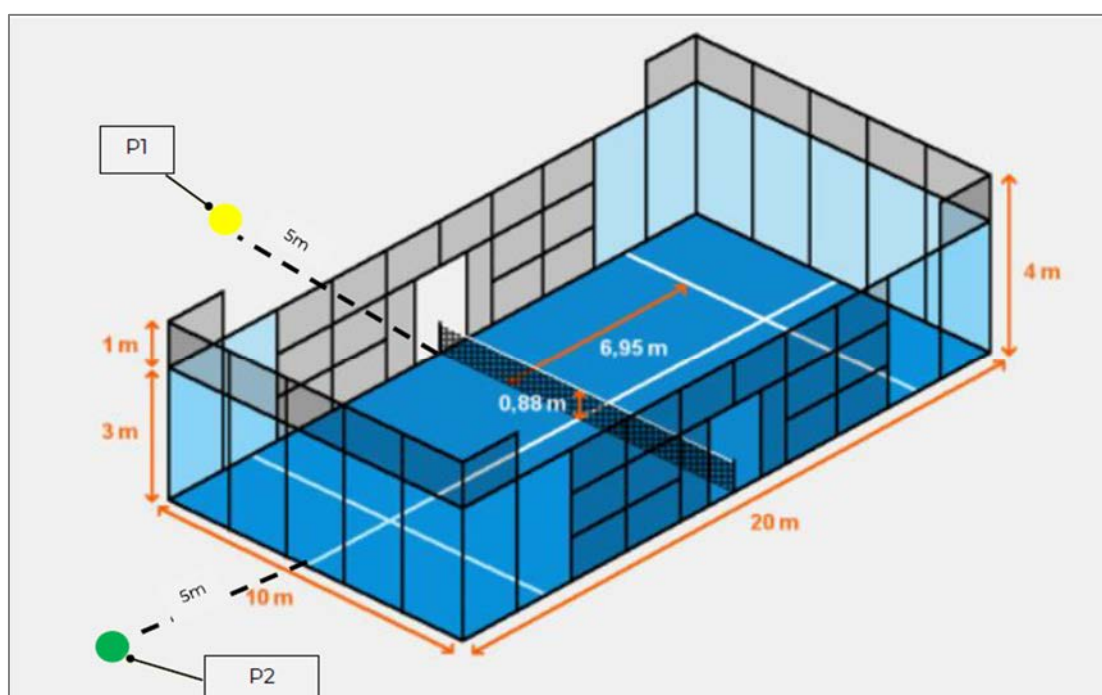
- There is a large number of ventilation louvres serving the MVHR units. These cannot be predicted at this stage, and so we have used an assumption of 63 dB L_{Aeq} at 1 m based on previous projects. Meeting this level will simply be a matter of silencer selection at the detailed design stage.

- There will be the kitchen extract fan. Again a specification of 63 dB L_{Aeq} at 1 m would be a simple matter of silencer selection at the detailed design stage.

6.3 Tennis and Padel

We have referenced a public domain report by Clarke Saunders for East Dorset Lawn Tennis and Croquet Club, Poole, dated 31st May 2022¹. It is a specific assessment of proposed Padel Tennis facilities. We have looked carefully at the methods and processes and we agree with the approach taken and conclusions derived. In fact it is almost identical to the way we would have approached it ourselves if a suitable facility could have been found in the timescales. Extracts are as follows:-

Measurement Positions

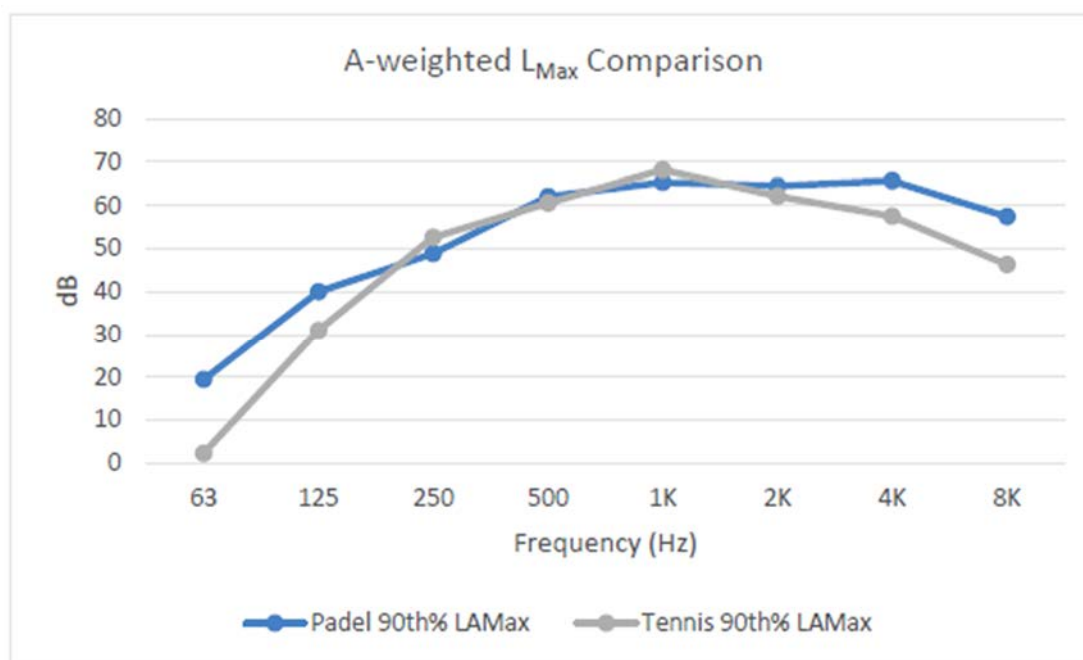
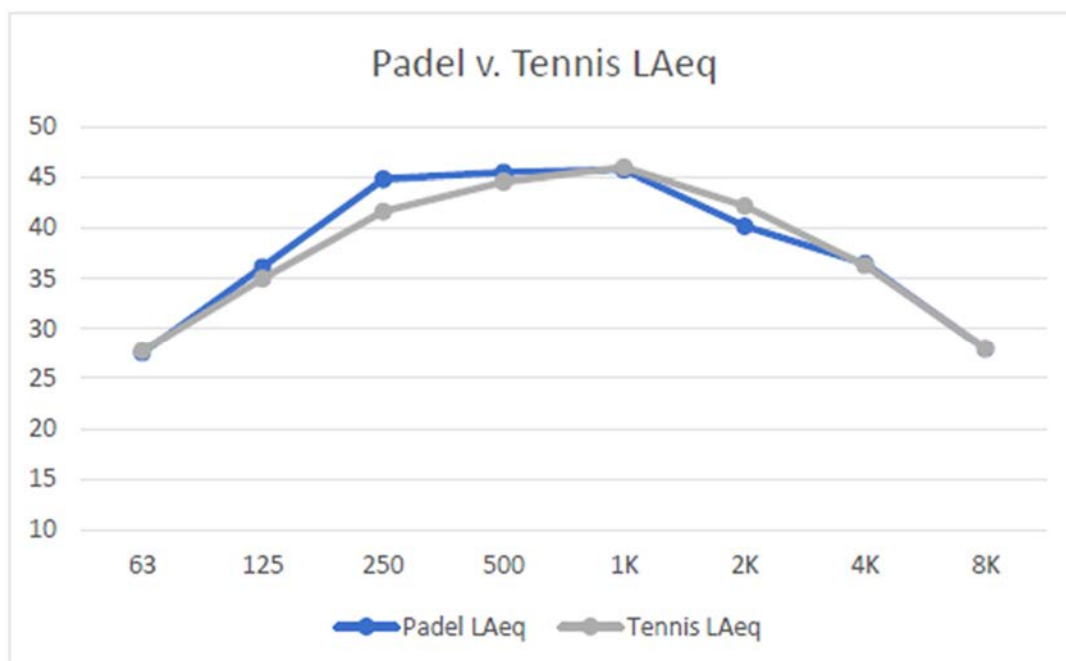


Basic Results

SOURCE	AVERAGE $L_{Aeq,T}$	90 TH PERCENTILE L_{MAX}
P1 Centre line	52 dB	81 dB
P2 Baseline end	51 dB	70 dB
Tennis Baseline end	49 dB	70 dB

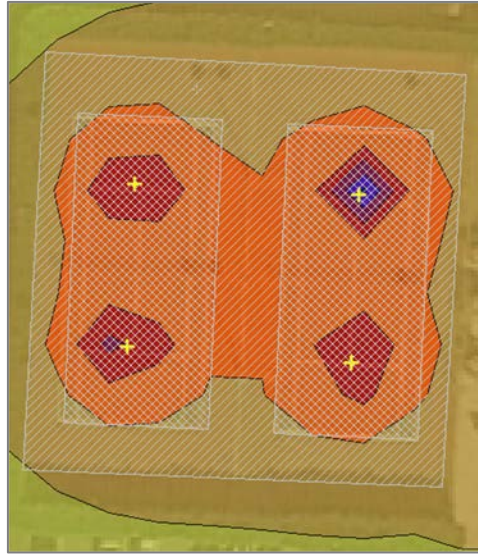
Table 5.1 Measured noise levels [dB ref. 20μPa.]

¹ Planning reference APP/23/00374/F at BCP Council.

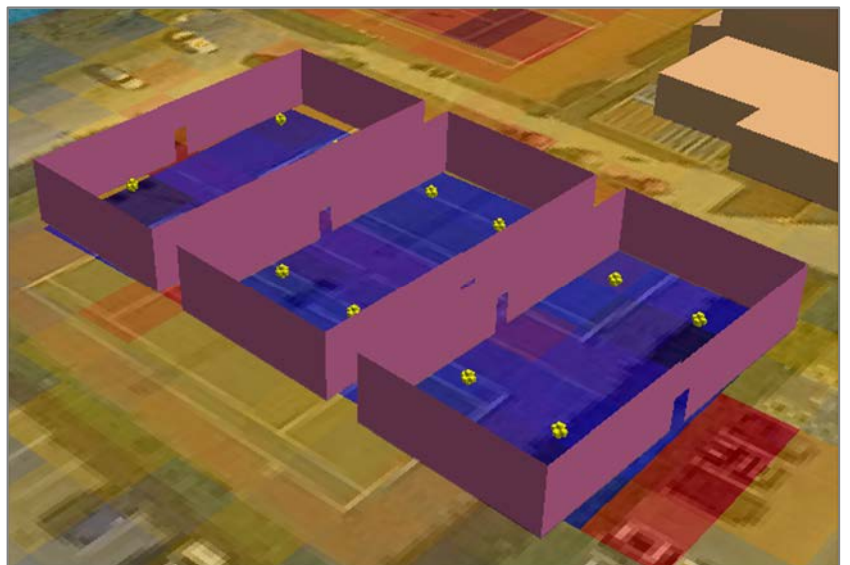


These levels were set up within our modelling for an individual padel court and individual tennis court. The sources were then entered at 4 positions within the padel court enclosures and two positions on the tennis court. The sources were then adjusted to match the above measured results exactly. These models were then applied to the actual site as existing and proposed.

Existing Tennis Courts Model



Proposed Padel Courts Model



6.4 Overall Predicted Levels

Based on all courts in use, current and proposed, and all mechanical equipment running at the same time, modelled noise climate is as follows:-



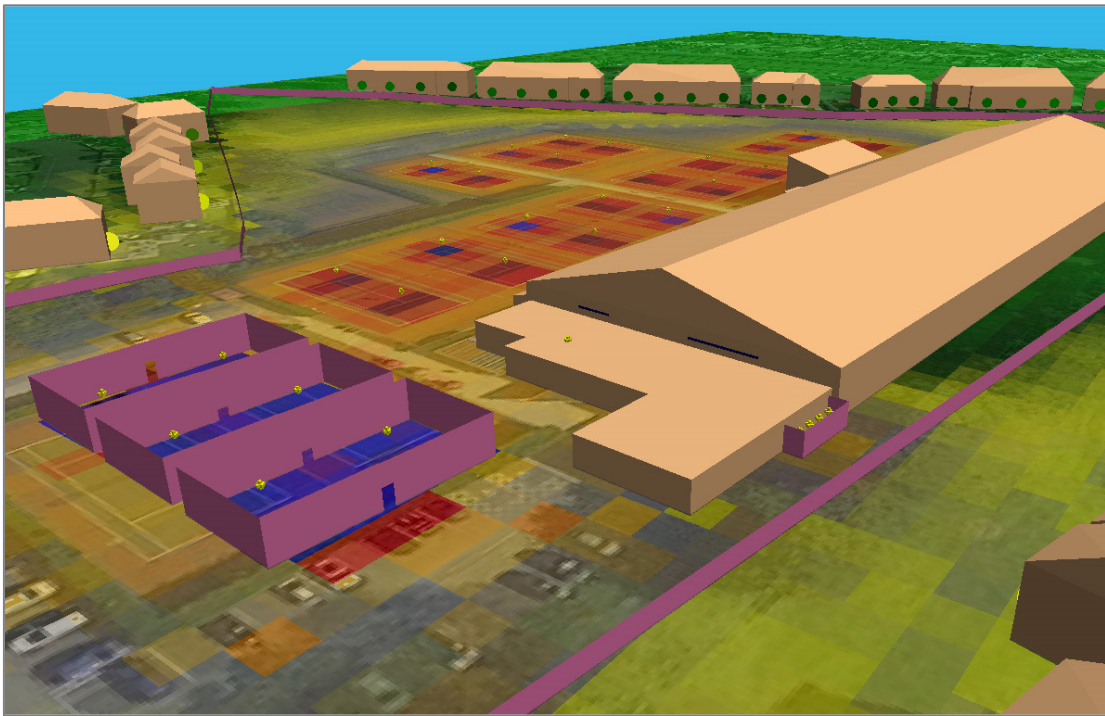
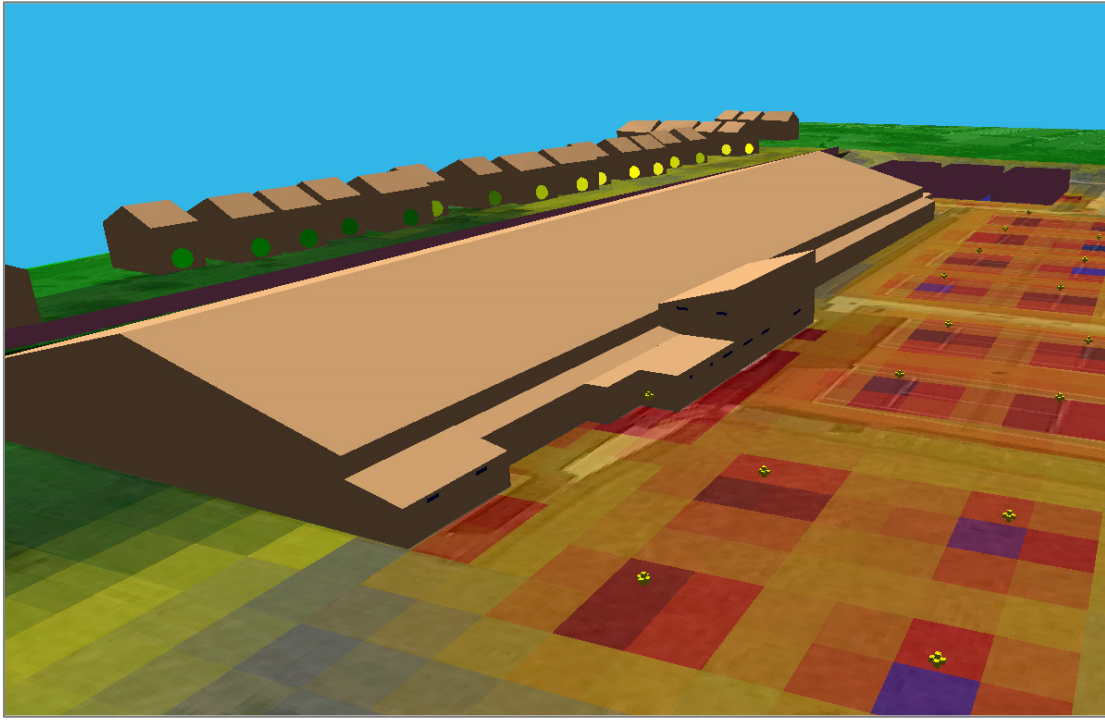
Note that:-

- The beige shapes are surrounding buildings and the application site building in its proposed form.
- The magenta lines are fences and screens.
- The yellow crosses are the point sources of the tennis and mechanical equipment external units.
- The blue lines are the vertical area sources of the MVHR louvres. They are difficult to see in the plan view but easier to see in the 3D and Zoomed Views below.
- The coloured numbers are the noise levels at the residential facades. Zoomed views of the most affected houses are shown below.
- Note that the noise contours are shown for guidance as to how the noise propagates. The contours are at a height of 1.5 m.

The following imaged Zoom in on the most affected residential locations.



The following 3D views should help to visualise the model.



In summary, with all courts in use (existing and proposed) and all mechanical equipment running, the predicted levels are up to 45 dB L_{Aeq} to the NW and SW. This is significantly below the Sport England basic criterion of 50 dB L_{Aeq} and below the existing levels for Position 1 of 46 dB L_{Aeq} , which was dominated by traffic, with tennis matches audible but not intrusive.. Predicted levels to the East are up to 40 dB L_{Aeq} . Again this is substantially below the Sport England criterion of 50 dB L_{Aeq} and also below the existing levels at Position 2 of 43 dB L_{Aeq} , which again was dominated by traffic with tennis matches audible but not intrusive.

6.5 Proposed Tennis Only

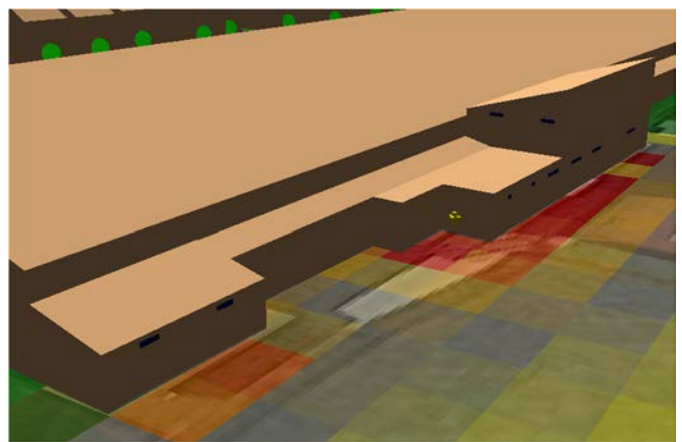
The same modelling can be used to predict the impact of the proposed tennis, ie. the padel courts and two extra tennis courts, without the impact of the existing courts and the mechanical equipment.



This gives levels of up to 44 dB L_{Aeq} to the NW and SW and up to 37 dB L_{Aeq} to the east.

6.6 Proposed Mechanical Equipment Only

Again the modelling can be used to single out just the proposed mechanical equipment without any tennis.



This gives levels of up to 35 dB L_{Aeq} to the SW, up to 28 dB L_{Aeq} to the NW and up to 29 dB L_{Aeq} to the east. These figures are below even the lowest single 5 minute measurement of the background level of 36 dB L_{A90} . And significantly below the respective levels for the two main positions.

It is clear that the impact will be negligible but, for completeness a BS 4142 assessment at the residential locations to the SW is as follows:-

Specific Sound Level:	35 dB L _{Aeq}
Feature Corrections ²	
tonality:	0 dB L _{Aeq}
impulsivity:	0 dB L _{Aeq}
intermittency:	0 dB L _{Aeq}
other:	0 dB L _{Aeq}
Rating Level:	35 dB L _{Ar}
Background Sound Level:	37 dB L _{A90}
Rating Level Excess re. Background	-2 dB

This is below what a BS 4142 “*Initial estimate*” rates as “*low impact depending on the context*”.

The context of course is an established tennis centre. Also important is the fact that we assume that all units will run at full load all of the time which unlikely ever to happen. We would suggest that the impact of the mechanical equipment will be negligible.

6.7 Mitigation

The above modelling assumes a 2.5 m fence around the plant area to the south side. The fence does not need to be particularly high-spec. Theoretically, a barrier which is required to provide a 10 dB reduction only needs a density of 3 kg/m² which would be equivalent to around 6 mm thick timber. Of course the fence would be far thicker than this for structural purposes. The important point is that there are no gaps, including allowance for shrinkage and warping. An overlapping 18 mm fence would be a typical example of a simple acoustic fence. This could be controlled by a condition requiring details to be submitted and approved.

More generally, the mechanical equipment is speculative at this stage and subject to detailed design. However, we are advised that it is representative of what will be specified. The MVHR vents and kitchen extracts are assumed to have a specification of 63 dB L_{Aeq} at 1m (horizontally and/or in the direction of the houses). This should be readily achievable with normal silencers. This could be controlled by a condition requiring details to be submitted and approved.

No mitigation should be required for the tennis and padel courts activities.

² The units are extremely unlikely to be tonal or impulsive. They may be intermittent to a degree at source but, at the receiver position, the intermittency is extremely unlikely to be “*readily distinctive against the residual acoustic environment*”, as BS 4142 describes it. Also the equipment tends to ramp up and down rather than abruptly cut in and out, and of course all the units will do so at different times, each masking the effect of the others. In any case, the noise is likely to be barely audible at the receiver positions and so no character corrections apply.

6.6 Discussion of Uncertainty

For the mechanical equipment, BS4142 requires us to

“Consider the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, take reasonably practicable steps to reduce the level of uncertainty”.

The measurements of Background/Residual Sound were taken at times regarded as representing what are likely to be the worst case (quietest) parts of the opening times. We have no reason to believe that the conditions were anything other than representative of normal conditions. BS 4142 does not state what would be a representative background noise but there is certainly no suggestion that it should be the lowest. However, in order to allow for the possibility of variation in levels, we have used the lowest 15 minute period.

Source data is assumed to be reliable. Where uncertainty may exist for this we have mitigated it by assuming that all equipment is running on full load all of the time, which would in our experience would rarely occur, if ever.

Calculations are based on the processes of *ISO 9613 : Acoustics – Attenuation of sound during propagation outdoors*. We know of no concerns within our industry as to the basic reliability of these methods and it is cited in BS 4142 as “*a validated method of calculating sound levels*”. The CadnaA software uses this standard and the input assumptions err on the side of caution and are stated in Section 4.

Varying meteorological conditions are unlikely to have a significant impact on results as the distances involved are small.

7.0 CONCLUSIONS/RECOMMENDATIONS

The existing noise climate is dominated at all times by general traffic on the surrounding roads and occasional trains. The tennis games on the existing courts are audible – mainly voices and the racket/ball impacts, but in no way would they be described as intrusive and the games had little impact on the overall measured levels.

Based on a somewhat extreme assumption of all current and proposed courts in full use, right up until the evening closing time, and all mechanical equipment running together, the predicted levels are below the current general noise levels and impact is likely to be low – audible certainly, but in no way intrusive.

Some basic mitigation is discussed for the mechanical equipment which can easily be built into planning conditions if necessary.

Our only other recommendation is that you issue this report to planners and that Officers are encouraged to contact us directly with any queries.

Appendix 1

Definition of Acoustic Terms

The Decibel

The decibel is the basic unit of noise measurement and is denoted dB. Technically, it is a means of expressing the difference in noise level between the measured noise and a standard level of noise. Most often the threshold of human hearing is used as the standard reference but it really should be stated. The threshold of human hearing is a sound pressure of $20\mu\text{Pa}$ or a sound power of 1pW .

A sound pressure level or SPL should be expressed in dB(re. $20\mu\text{Pa}$). A sound power level or SWL should be expressed in dB(re. 1pW). If the reference levels are omitted, it will often (but not always) be safe to assume that they are referenced to the threshold of human hearing.

A-Weighting and dB(A)

The human hearing system responds differently to different frequencies. The A-weighting system takes account of this by emphasising mid and high frequencies more than low frequencies to give an overall level. An A-Weighted noise level, therefore, reflects the way normal, healthy hearing would perceive the overall level of the noise. The basic unit is dB(A), although other systems of expressing an A-weighted levels are discussed below.

Other weighting systems, such as C-Weighting, denoted dB(C), reflect the human hearing system's response at higher noise levels.

NR and NC Levels

NR curves and NC curves are a series of curves representing noise levels across the frequency range. A given noise climate has an NR level or NC level if it equals a point on the curve at any frequency. They are particularly, although by no means exclusively, used as a means of specifying noise limits in an indoor environment, for instance from mechanical services or traffic noise break-in from the outside. They are typically expressed as NR or NC followed by a number, e.g. NR40, NC55, etc.

Equivalent Continuous Sound Level, L_{eq}

This can be simplistically described as a way of expressing the average noise level.

The unit is dB L_{eq} . For A-weighted levels the unit is dB(A) L_{eq} or, in more modern units, dB L_{Aeq} .

Maximum Level, $L_{\max}$

This is the maximum level reached (usually for a fraction of a second) in the measurement period.

The unit is dB $L_{\max}$. For A-weighted levels the unit is dB(A) $L_{\max}$ or, in more modern units, dB $L_{A\max}$.

Statistical (Percentile) Levels, L_n

During a measurement of fluctuating noise, it is often useful to establish the levels exceed for a percentage of the time. L_n is the index representing the level exceeded for $n\%$ of the measurement period.

The unit is dB L_n . For A-weighted levels, the unit is dB(A) L_n or, in more modern units, dB L_{An} .

Common examples are as follows :-

dB L_{A90} is the A-weighted level exceeded for 90% of the time and is often used to describe the underlying background noise.

dB L_{A50} is the A-weighted level exceeded for 50% of the time. Mathematically, it is the median, another kind of average.

dB L_{A10} is the A-weighted level exceeded for 10% of the time and has traditionally been used to describe the intermittent highs in the noise climate such as passing cars or aircraft.

Frequency Analysis

Here the audible frequency range is divided up into bands and the noise level is expressed in each frequency band from low pitches to high pitches.

Octave Band analysis is where the frequency range is divided into 8 bands from 63 Hz to 8kHz, or sometimes into 10 bands from 31.5 Hz to 16kHz.

1/3 Octave Band analysis provides more detailed subdivision into 24 bands from 50 Hz to 10kHz, or sometimes into 30 bands from 20Hz to 20kHz.

Narrow Band analysis takes this further with the possibility of many thousands of bands, possibly only 1Hz wide, or even less.

In all types of frequency analysis, the level in each band can be expressed in terms of L_{eq} , $L_{\max}$, L_n , etc. as defined above.

Sound Insulation

Sound insulation is best expressed across the frequency range in octave bands or third octave bands. Often, however, in known environments such as domestic sound insulation and speech privacy, it is simpler to express the sound insulation as a single figure. A higher value means better sound insulation.

The most common ways are $\text{dB } D_{nTw}$, $\text{dB } R_w$ and $\text{dB}_{(\text{mean } 100-3150\text{Hz})}$. The first two are ways of expressing average sound insulation, weighted to account for speech frequencies. The third is simply an un-weighted mean value.

The Building Regulations Approved Document E (ADE) routinely refer to $D_{nTw} + C_{tr}$. The C_{tr} term is a negative number which is used to modify the D_{nTw} value for the insulation properties at lower frequencies.

ADE also uses the L_{nTw} index for impact sound transmission. It is a measure of the level of noise in the room below a room in which a standard tapping machine is being used. It represents the impact sound transfer such as footfall noise, scraping chairs, washing machines, etc. A lower value means better insulation.

Reverberation Time

The most common measure of Reverberation Time is, effectively the time taken for sound from a steady source to decay by 60 dB after it has been abruptly cut off. In practice it is often difficult to measure a 60 dB decay and so decays of 30 dB, 20 dB, or even 10 dB are often used and adjusted pro rata, although the exact measure is not quite the same.

Reverberation Time is generally expressed as RT in seconds. We may, if we are being precise, add subscripts 60, 30, etc to show whether the basis of the measure is 60 dB decay, 30 dB decay, etc. E.g. the $RT_{60} = 0.52\text{s}$, the $RT_{30} = 0.49\text{s}$, etc.

RT can be expressed in octave bands or 1/3 octave bands across the frequency range, or at central frequencies such as 500 Hz or 1kHz.