

Project:

Gym at Reading Link Retail Park

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Limitations			
This report has been prepared for the titled project and client in accordance with our agreed scope of work, document reference: PA-01132/SC1, dated 28 November 2023.			
This report should not be used or relied upon for any other project or purpose without the written authorisation of Pulsar Acoustics Ltd. Pulsar Acoustics Ltd accepts no responsibility or liability for the consequences of this document if it is used for a purpose other than for the project to which it was intended. The findings and opinions included herein are based on measurements and information gathered prior to the date the report was issued. If additional information becomes available which may affect our comments, recommendations or conclusions, then Pulsar Acoustic Ltd should be informed. We then reserve the right to review the information, assess any new potential concerns, and modify our advice accordingly.			



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1.0 - Introduction

A new building is proposed to comprise a gym at Reading Link Retail Park, Rose Kiln Lane, Reading. The planning application number is 231077.

The Council has indicated that a noise impact assessment has not been undertaken which considers the noise from building services plant, or the potential noise impact from music played from a sound system.

Pulsar Acoustics has therefore been commissioned to undertake an environmental noise survey to determine the existing noise climate, assess the proposals at planning stage, comment on its acceptability with reference to standard Council planning policy and industry guidance, and recommend acoustic mitigation measures where possible.

2.0 - Site Description

The approximate building location is outlined red on the Google Map aerial photo below.

To the north is the existing retail units and the associated car parking spaces. We would not suggest this to be noise sensitive property, especially as their customer entrance doors open and close regularly all day letting in traffic noise.

To the west is open land and residential properties. We would suggest the residential property to be the nearest noise sensitive buildings.

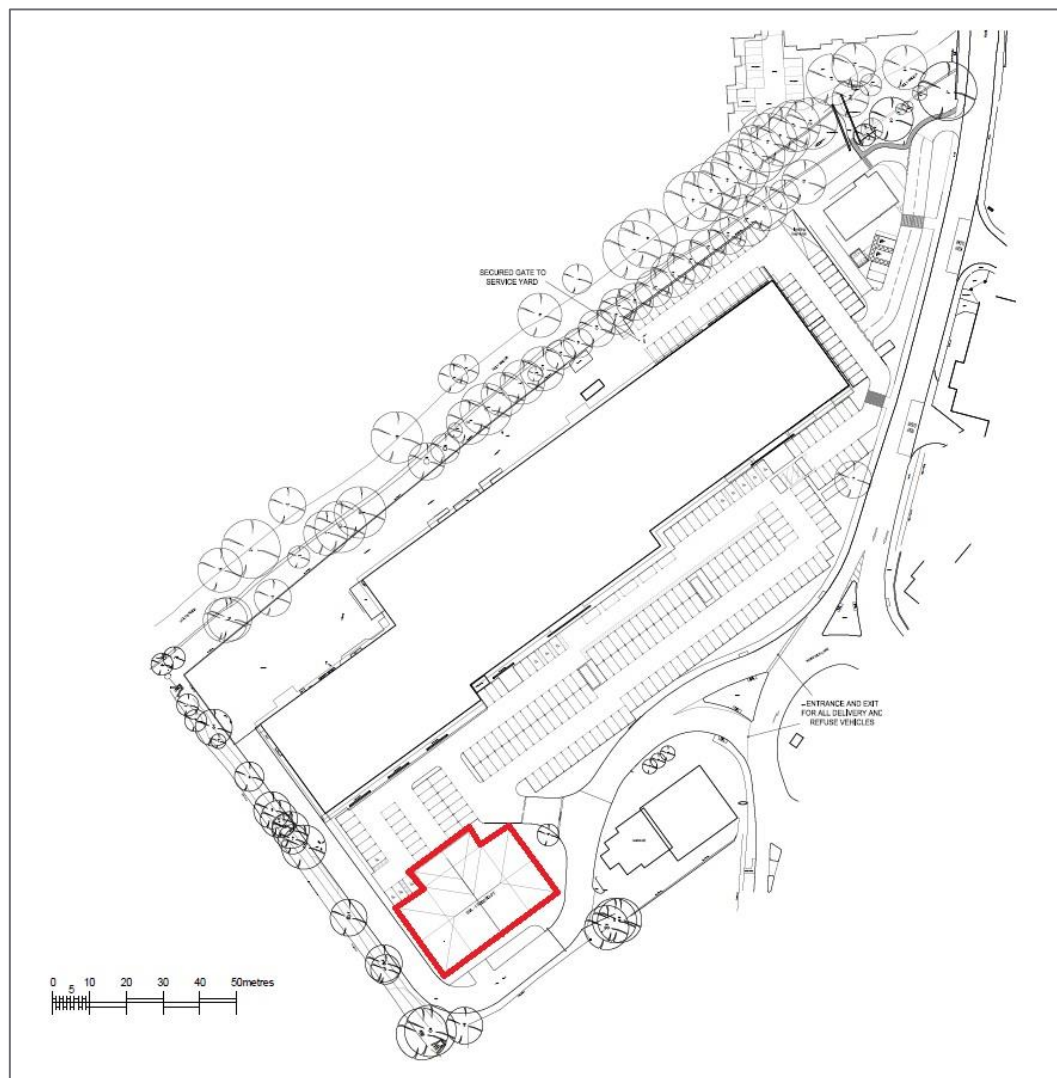
To the south is a casino and other industrial/commercial units. We would not suggest this to be noise sensitive property.

To the east is a petrol station, the busy A33 road, and more commercial/retail/industrial buildings. We would not suggest this to be noise sensitive property.



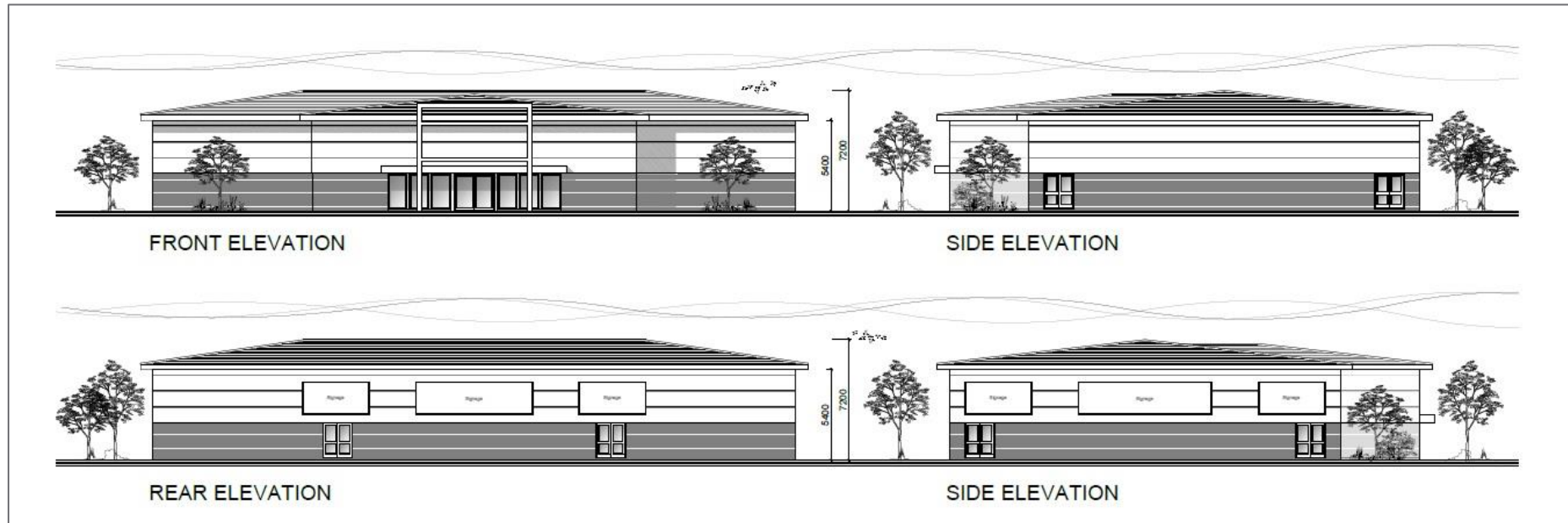


The approximate building outline has been outlined red on the architectural drawing presented below.



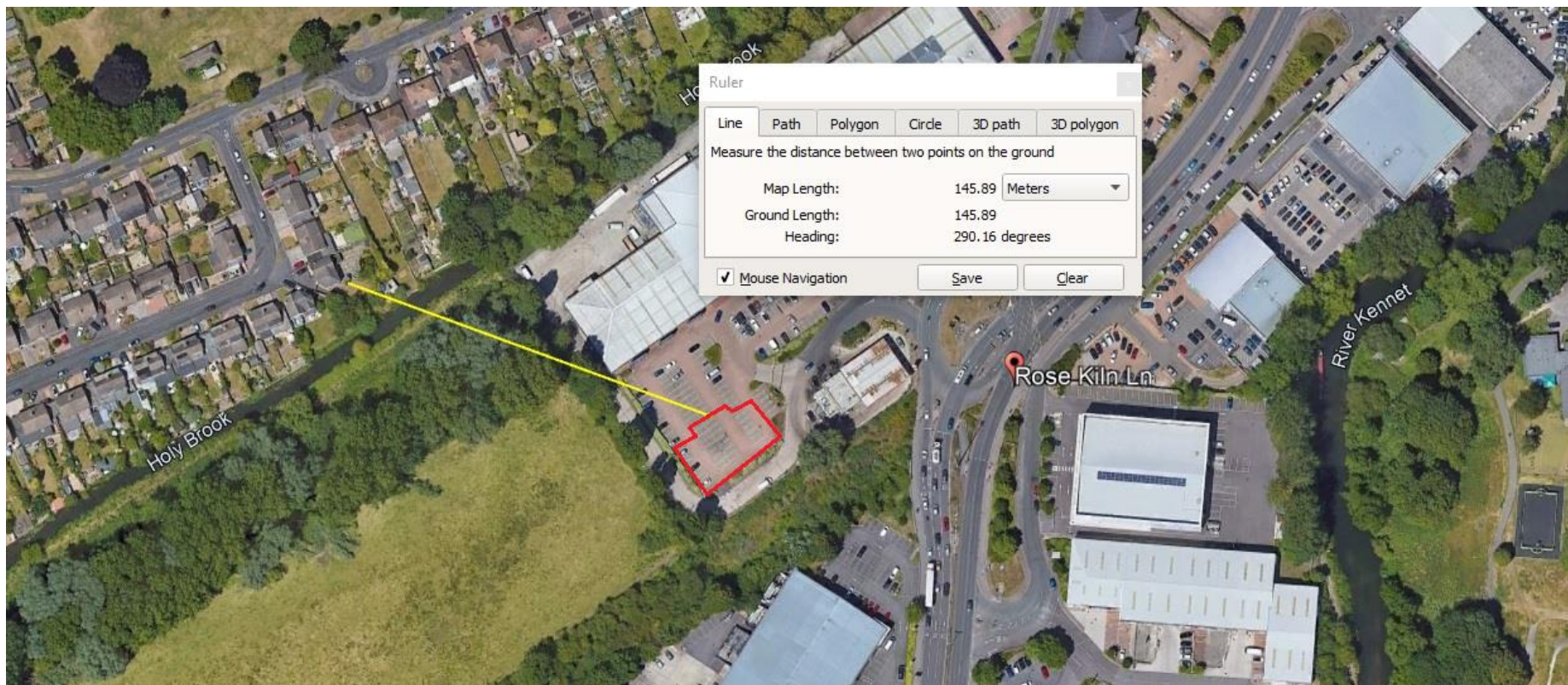


The architectural elevation drawings below indicate the façade has minimal glazing/doors/windows proposed. We would suggest a modern building by default is likely to have quite good thermal and acoustic properties.





The building is proposed to be approximately 145m away from the nearest residential property to the west as indicated on the Google Maps plan below.





3.0 - Guidance & Criteria

3.1 - Council Planning

The Council Environmental Health Officer has made the following comments in their consultation response.

“Noise generating development – air conditioning and music

Applications which include noise generating plant when there are nearby noise sensitive receptors should be accompanied by an acoustic assessment carried out in accordance with BS4142:2014+A1:2019 methodology.

A noise assessment has not been submitted with the application and therefore I cannot determine the likely noise impact of the proposal and whether the proposals are acceptable. I therefore recommend refusal unless a noise assessment can be submitted and considered by us before the application is determined.

Alternatively the following condition could be attached to consent, however it is possible that the criteria would be met with the plant specifications proposed in this application and a new application may need to be made at a later date for alternative plant / location.

- N2 MECHANICAL PLANT (NOISE ASSESSMENT REQUIRED)

No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority. The assessment shall be carried out for in accordance with BS4142:2014+A1:2019 methodology.

The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-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 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-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 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 CC8 and EN17 of the Reading Borough Local Plan 2019.*

In addition to plant noise similar concern is raised regarding music noise as follows:

“Music noise

The gym is likely to generate noise from amplified [music] which may emanate from the building, to impact on nearby residents particularly at night. It will need to be confirmed that the structure of the building will be sufficiently acoustically insulated to contain this noise and therefore in the absence of this information, the proposal should be refused or a suitable condition applied.”

3.2 - BS4142

When setting plant noise emission criteria reference is often made to the guidance of British Standard - BS4142 *“Methods for rating and assessing industrial and commercial sound”*.

The procedure contained in BS 4142 provides an assessment of the likely effects of sound on people, when comparing the specific noise levels from the plant noise source to representative background noise levels. Where the noise contains a specific characteristic then various corrections can be added to the source noise level to obtain the “rating level”.

BS 4142 states that: *“The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs”*.

An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:

- *“Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5dB 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 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."*

BS4142 also suggests:

"In using the background sound level in the method for rating and assessing industrial and commercial sound, it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."

With reference to Section 3.1 above and consideration for BS4142, the Council has essentially provided two options to determine plant noise emission criteria:

- 1) *"The predicted specific sound level ($LA_{eq,TR}$) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-existing background sound level, $LA_{90,T}$ when all plant/equipment (or any part of it) is in operation."*

or

- 2) *"The predicted rating level, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound) as measured at a point 1 metre external to the nearest noise-sensitive facade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, $LA_{90,T}$ when all plant/equipment (or any part of it) is in operation."*

Until the building services items and layout are established it is not possible to determine the characteristic features or required adjustment. Therefore it is not possible to calculate the 'Rating Level' or propose criteria in relation to Option 2.

We will therefore determine the plant noise emission criteria with reference to Option 1 as discussed later in this report.

The reality being Option 1 is probably slightly pessimistic by comparison to Option 2, however given the nearest noise sensitive residential receptor is around 145m away the difference in building design terms will be negligible.



4.0 - Site Survey

4.1 - Methodology

Sound level measurements were undertaken to determine the existing noise climate on site towards the existing residential property to the north west.

A fixed position sound level meter was set up from around 12:30 hours on Monday 04 December 2023 to Wednesday 11:15 hours on 06 December 2023.

The sound level meter was set to log various acoustic parameters, including dBA L_{max}, Leq_T, and L90 in 15-minute intervals for comparison to industry standard guidance and Council policy.

The following equipment was used to undertake the survey.

Position	Item	Make	Model	Serial Number
1	Sound Level Meter - Class 1	Larson Davis	LD-LXT	0003615
	Preamplifier - Class 1	Larson Davis	PRMLXT1L	027681
	Microphone - Class 1	Larson Davis	PCB377B02	W133370
	Hand Held Calibrator - Class 1	G.R.A.S.	GRAS-42AG	280968

The equipment calibration was spot checked using the hand-held calibrator before and after the survey and no significant change was found. (No more than 0.1dB). The equipment used complies with Type 1 (Class 1) measurement accuracy in accordance with IEC 60942 and IEC61672. The equipment has been calibrated to traceable ISO/IEC standards.

The sound level meter was located in a lockable weather proof Pelicase. The microphone was attached via an extension cable and attached protruding high up above the fence at the rear of the existing shops. The microphone height was approximately 2.5m above ground level.



The approximate measurement Position 1 is indicated on the site plan below.

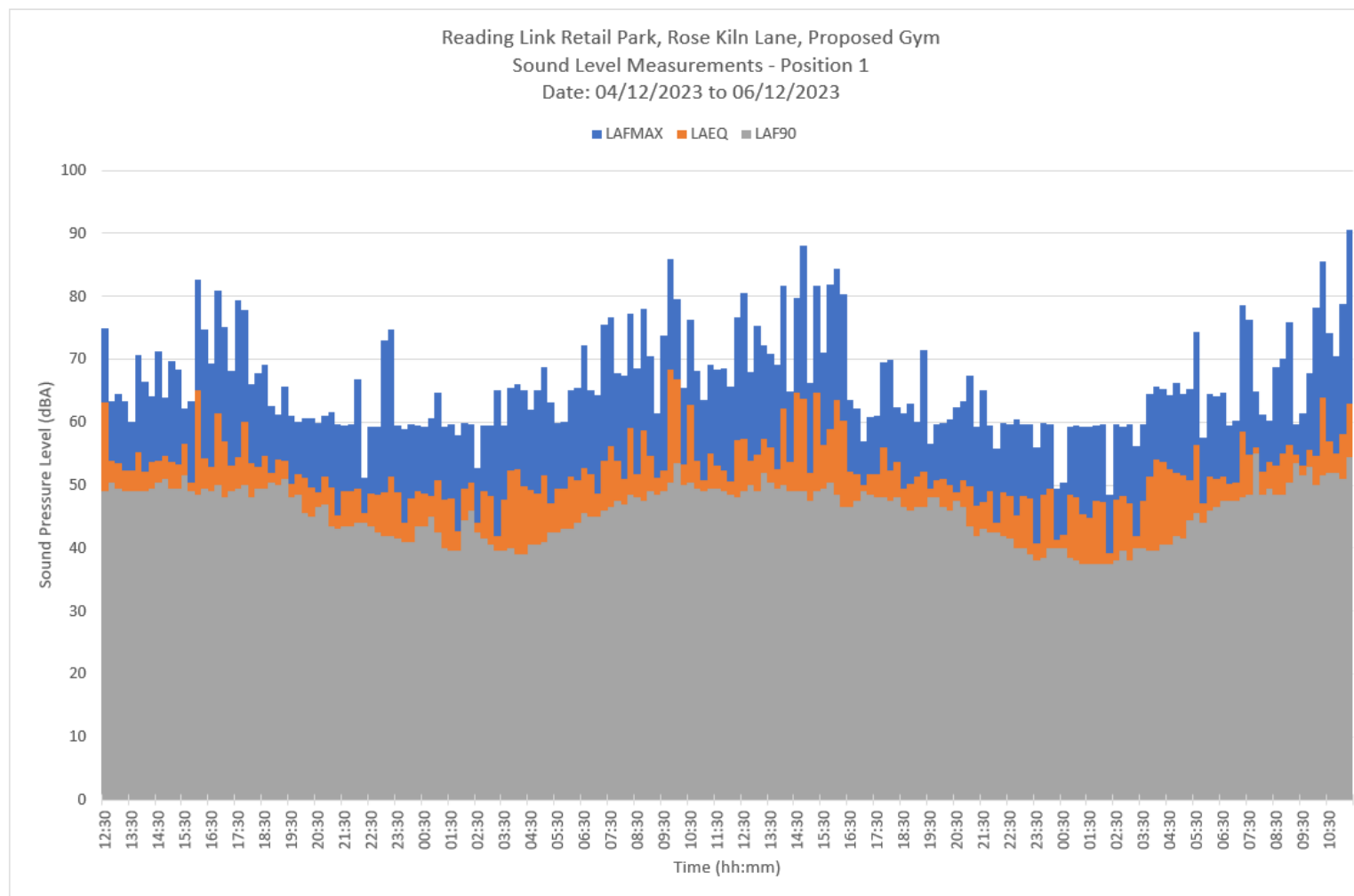


The existing dominant noise climate in the area comprises a majority of traffic noise, and existing building services from neighbouring retail/commercial/industrial buildings.



4.2 –Measurement Data

The dBA L_{max}, L_{eq,T} and L₉₀ sound level data has been plotted on the time history graph below.





The data has been analysed across multiple days to determine the ambient background by establishing the statistical L90 values as summarised in the table below.

Time	Ambient Background Statistical Values			
	Mean dBA L90	Modal dBA L90	Median dBA L90	Minimum dBA L90
Daytime (07:00 to 23:00 hours)	48	49	49	40
Night-time (23:00 to 07:00 Hours)	42	40	41	38

Figure 4 of BS4142 provides a statistical analysis example to determine an ambient background sound level. It suggests for that distribution of data the modal value was considered to be representative as it was the most commonly occurring value during the time period of interest.

The gym is proposed to operate 24 hours a day and as such we will consider the modal night-time value of 40dBA as the representative background noise.

As described in the proposed planning condition, the predicted plant noise level required at a point 1 metre external to the nearest noise sensitive façade, should be 10dBA below the existing L90 background sound level.

Therefore the design criteria for the cumulative building services noise output is 30dBA Leq,T at 1m away from the nearest residential noise sensitive façade approximately 145m away from the building.



5.0 - Limiting Noise Levels

5.1 - Plant noise

Over a distance of 145m noise should attenuate by around 43dBA. The design target is 30dBA at 1m from the residential façade and as such the building services will need to be designed so that their cumulative level does not exceed approximately 73dBA if measured around 1m away from the gym building. Of course the reality being not all plant will be located in the same position, however this figure gives us a feel for what to expect from the design.

Many modern outdoor air-conditioning units are typically around 60dBA each at 1m. Assuming there is only 1-2 outdoor units required they are unlikely to need any additional acoustic mitigation measures at this distance. However, if additional attenuation is required during the design for an outdoor AC unit, it is relatively straight forward to determine and provide a barrier/screen or enclosure to be installed that provides sufficient attenuation.

In a gym there will be toilets and changing room facilities which will of course need ventilation systems. Sometimes there are saunas, steam rooms and possibly a café on site, and if so they would also require a ventilation system.

There could be a single large ventilation system in a central location, or multiple smaller units located in multiple positions. Until the exact systems and layouts are determined it is not possible to propose acoustic specifications for each to control their noise output.

However, if acoustic attenuation is required for a ventilation system it is usually relatively easy to determine and provide inline duct mounted acoustic attenuators in the system, such that any intake or discharge noise is suitably reduced before leaving the building through a ventilation grille/louver.

For all items of external and internal building services, consideration should be made for resilient anti-vibration mounts/hangers to reduce the transfer of vibration and avoid detrimental structureborne sound radiating from a structure.

Most building services manufacturers can provide suitable off-the-shelf anti-vibration mounts/hangers. For best practice it is recommended that the building services systems and anti-vibration products should be selected and installed as per CIBSE guidance.



5.2 - Music System

Until more detailed design of the building is determined it is not possible to set specific acoustic specifications for the sound system, however, at this time we can provide some preliminary advice as follows.

If we consider the same design target as the plant noise emissions and aim for 30dBA at 145m away from the gym building, we can work backwards with some assumptions to give us a feel for restricting music noise and determine if it likely to be feasible.

The attenuation over 145m is around 43dBA. The inside to outside sound insulation of a modern thermally insulated building is likely to be at least R_w 30dBA provided no windows are open. Therefore in simple terms the music noise inside the building would need to be restricted to a level of approximately 103dBA L_{max} .

We would suggest that music at 103dBA L_{max} inside a gym is likely to be deemed far too loud. A music level of 103dBA L_{max} is similar to inside a nightclub, and the only gyms that we have witnessed that desire this high level of music are more niche activities like Boomcycle or Kobox, which are essentially spinning classes and boxing classes held in a loud nightclub environment, with flashing lights and a shouting instructors.

- <https://boomcycle.co.uk/>
- <https://kobox.co.uk/>

Most open plan retail park gyms require some background music. In our experience levels of around 80dBA are often deemed satisfactory. At around 80dBA L_{max} customers can benefit from some 'energy' in the room but do not need overly raised voices to communicate, and others who wish to use their own personal headphones can do so without too much intrusion.

Where music is desired it will be necessary during the detailed design stages to establish limiting octave band frequency (Hz) levels based on the sound insulation of the known building elements of construction.

In addition the ventilation system will also need to be considered in parallel with the sound system, to avoid the risk of any significant music noise escaping through the ventilation paths.



In granting permission we would expect the Council to provide a planning condition to limit the music noise. For example:

“A scheme of noise mitigation to control amplified music must be submitted to and approved in writing by the Local Planning Authority prior to first use, to avoid potential noise disturbance at the nearest noise sensitive receptors. The scheme should identify the exact details of the proposed system, including amplification equipment, speakers and their locations, and any noise limiting devices or control measures implemented, to ensure the music noise does not increase the existing ambient background octave band frequencies at the noise sensitive receptors.”

6.0 - Conclusion

A new building is proposed to comprise a gym at Reading Link Retail Park, Rose Kiln Lane, Reading. The planning application number is 231077.

Pulsar Acoustics has undertaken an environmental noise survey on site to determine the existing noise climate, and have reviewed the Council comments regarding the potential for noise from building services plant and music played from a sound system.

We have identified the neighbouring noise sensitive properties and from our measurement data have established the existing ambient background noise levels.

The gym is currently proposing to operate 24 hours a day, therefore based on the Council comments and BS4142 we have proposed suitable noise criteria to be achieved at all times.

We have reviewed the preliminary drawings for planning purposes and provided a general high-level overview of likely acoustic mitigation measures, potential restrictions, and limiting levels to control noise from building services and music.

Given the location of the proposed building and our initial overview of the project, we would suggest the acoustic design requirements are not likely to be particularly onerous to protect the noise sensitive residential dwellings from noise from the gym.

With suitably considered planning conditions and implemented design we see no acoustic reasons why planning would be refused.



APPENDIX A - Acoustic Terminology

The following is an explanation for some of the acoustic parameters used in this report to describe the measurements and mitigation.

- **dB** The decibel is used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level. This approach is advantageous for handling sound levels, where the ratio of the highest to lowest sound which humans could encounter, can be as high as 1,000,000 : 1. The ratio is considered with respect to the quietest and loudest sound we can hear. This is the threshold of hearing at the frequency of 1000Hz, which is taken as $20\mu\text{Pa}$ ($2 \times 10^{-5} \text{ Pa}$) of pressure for the average person. (A decibel is simply a ratio and is used in many other industries too, but most commonly in acoustic or electrical signal analysis.)
- **dBA** The human ear is more susceptible to mid-frequency noise than to higher and lower frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds to the overall level of perception by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted frequency spectrum (Hz). The measured or calculated 'A' weighted noise level is known as the dBA level.
- **$L_{eq,T}$** The equivalent continuous sound level in decibels, equivalent to the total sound energy measured over a stated period of time and is also known as the time-averaged sound level.
- **dBA $L_{eq,T}$** The A-weighted equivalent continuous sound level in decibels measured over a stated period of time 'T', and is sometimes written dB $L_{Aeq,T}$.
- **L90** This parameter is the noise level exceeded for 90% of the period T (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.
- **dBA L_{max}** The maximum dBA noise level recorded during the measurement interval period.

When discussing sound levels as decibels we use a logarithmic scale, therefore the dBA values do not follow a linear relationship. When discussing similar noises, a change of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible by a human, but is a doubling/halving of sound energy. (i.e. $50\text{dBA} + 50\text{dBA} = 53\text{dBA}$).

If you require a more detailed explanation for any of the acoustic principles or parameters discussed in this report please do not hesitate to ask.