



Project:	Queen Anne's School, 6 Henley Rd, Reading RG4 6DX			
Client:	Boddingtons Planning			
Report Title:	AGP Noise Impact Assessment			
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Revision:	A			
Report Status:	First Draft			
Reference:	20190416_4375_AGPNA.docx			

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1 Introduction

This noise assessment has been prepared by Paragon Acoustic Consultants Ltd (PACL) on behalf of Boddingtons Planning in support of a planning application for development of an artificial grass pitch (AGP) to be located on the existing playing field at Queen Anne's School, 6 Henley Rd, Reading RG4 6DX.

It is proposed that the facility will be available for use by the school and other third party stakeholders with sporting activity until 21:00 hours.

This noise assessment considers the potential impacts and effects of noise upon the proposed development and, where necessary, its mitigation, in order to demonstrate the suitability of the site development in the context of National and Local Planning Policy and Guidance and other relevant sources of guidance.

The assessment contained within this report is based upon the principles and recommendations contained within the following documents:

- National Planning Policy Framework;
- National Policy Statement for England;
- World Health Organisation, Guidelines for Community Noise, 1999;
- BS8233: 2014: Guidance on sound insulation and noise reduction for buildings;
- Sport England Artificial Grass Pitch Acoustics – Planning Implications.

2 Site Description

The artificial grass pitch (AGP) is to be located to the west of the existing tennis courts and is shown by plan in Figure 1 below. The perimeter of the AGP will be situated approximately 43m from the nearest residential receptors to the northwest and 84m distant from the nearest residential receptors to the east.

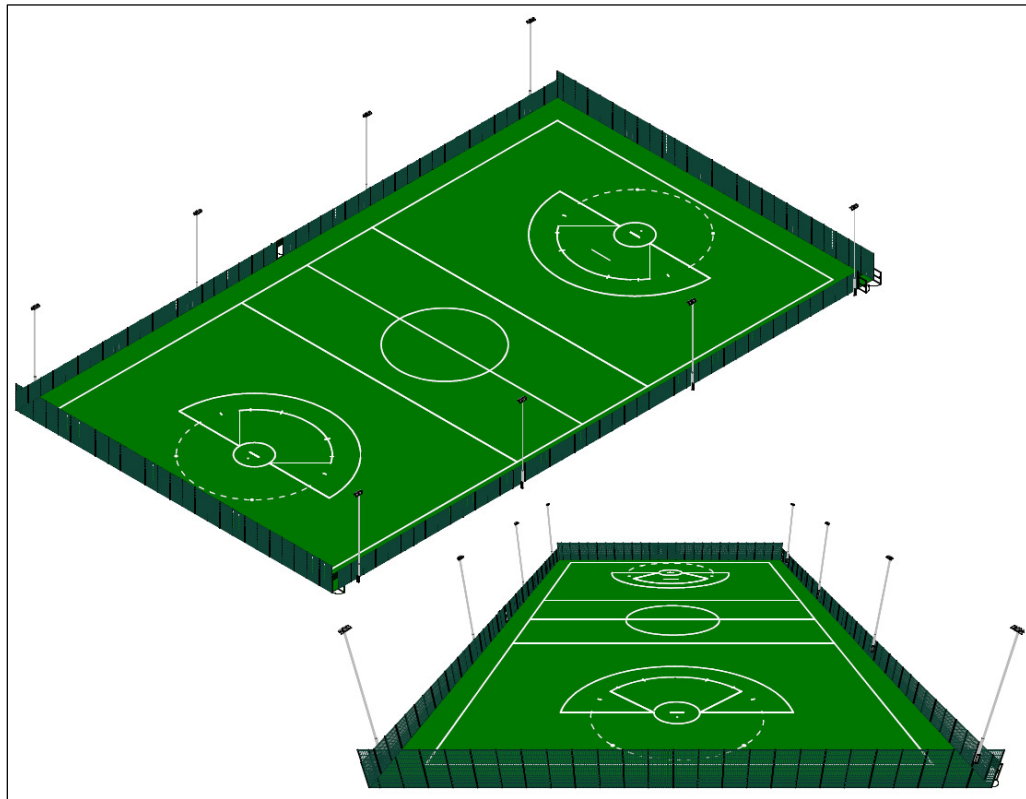
The facility will be bounded on all sides by weldmesh type fencing, generally as per Figure 2, and resilient fixings will be incorporated. Side boards will not be included as part of the perimeter treatment.

Under the proposals the northern most 7 tennis courts will be floodlit.

Figure 1: Site Layout and location of nearest noise sensitive receptors



Figure 2: Site Isometric showing principles of perimeter treatment



3 Planning Policy Context and Guidance on the Assessment of Noise

3.1 National Planning Policy Framework 2019

The [NPPF](#)¹ sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced.

There are a number of paragraphs in the NPPF that directly mention noise.

Paragraph 170 states that planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability

Paragraph 180 states that planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life²;
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.3 Noise Policy Statement for England 2010

The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy, which is to:

“Promote good health and a good quality of life through the management of noise within the context of Government policy on sustainable development”.

This long term vision is supported by the following aims:

“Through the effective management of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality; and*

¹

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf

² See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).

- *where possible, contribute to the improvement of health and quality of life.*

When discussing the meaning of “significant adverse” and “adverse”, within an Explanatory Note the NPSE states:

“There are two established concepts from toxicology that are currently being applied to noise impacts for example, by the World Health Organisation. They are

NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.”

For the purposes of the NPSE, the Government added the following related concept:

“SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.”

It is also noted that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different sources, for different receptors and at different times.

3.4 BS 8233:2014: Guidance on sound insulation and noise reduction for buildings

This British Standard came into effect on 28 February 2014 and superseded BS 8233:1999, which was withdrawn.

Target indoor ambient noise levels for dwellings are set out at Section 7.7.2, Table 4, reproduced below.

Table 1: Indoor ambient noise levels for dwellings (from BS 8233:2014, Table 4)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	—
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	—
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

A series of notes provide context to the guideline values of Table 4.

Note 3 states *“These levels are based on annual average data and do not have to be achieved in all circumstances. For example, it is normal to exclude occasional events, such as fireworks night or New Year’s Eve.”*

Note 7 provides a rider to the guideline values of Table 4, *“Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved”.*

For outdoor areas (i.e. balconies), BS 8233:2014 recommends that “it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ ”.

3.5 IEMA Guidelines for Environmental Noise Impact Assessment

The Institute of Environmental Management and Assessment published guidelines for noise impact assessment in October 2014. The guidelines set out key principles for noise impact assessment relevant to all types of project regardless of size.

Absolute levels such as those set out in WHO Guidelines are considered and the Guidelines suggest that a change in noise levels in an area where the existing levels are above WHO Guidelines should be considered as having more of an adverse effect than a change in noise levels in an area where existing levels are well below.

The Guidelines contain effect descriptors for changes in noise levels and for noise effect levels. These are summarised below:

Effect Descriptors	
Very substantial	Greater than 10 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise
Substantial	Greater than 5 dB L_{Aeq} change in sound level at a noise sensitive receptor, or a 5 to 9.9 dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise
Moderate	A 3 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5dB L_{Aeq} change in sound level at a receptor of some sensitivity
Slight	A 3 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity
None/Not Significant	Less than 2.9 dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

Noise Effect Level		
Time	Lowest Observed Adverse Effect Level	Significant Observed Adverse Effect Level
07:00 hrs to 23:00hrs	50 dB $L_{Aeq,16h}$	60 dB $L_{Aeq,16h}$

The Guidelines are not prescriptive as to how a noise impact assessment should be carried out, and allow assessors to take into account factors such as frequency spectra, days and times of operation, frequency of operation and any other factor which allows the noise to be assessed in context.

3.6 Design Guidance Note, Artificial Grass Pitch (AGP) Acoustics

Sport England published this Design Guidance Note in August 2015. The document refers to WHO Guidelines for Community Noise but suggests that the assessment time period for AGPs should be 1 hour rather than 16 hours as this is typically the time period for a community sports session on an AGP.

It recommends a limit in external living areas of residential properties of 50 dB $L_{Aeq,1hour}$.

The document used a study of football, hockey and rugby games on AGPs and found that the most significant noise levels were found to be the voices from players. It gave a typical free-field noise level of 58 dB $L_{Aeq,1hour}$ measured at 10m from the side-line halfway marking. It also states that for a site in an open location, this noise can be achieved at a distance of 40m, assuming area source propagation which considers noise generated from all areas of an AGP.

4 Activity Noise Modelling

In order to accurately assess propagation of noise across the site from the AGP and tennis courts, a 3-d acoustic model has been created using CADNAA noise prediction software, which is a leading application for calculation, presentation, assessment and prediction of environmental noise.

4.1 Representative Noise Emission Levels

Paragon Acoustic Consultants Ltd (PACL) holds a significant library of data for a range of sport activities. The following data have been used as input values to the CADNAA model to calculate immission levels at surrounding noise sensitive receptors. For the purposes of this assessment it has been taken that four tennis courts each holding a doubles match will occur in parallel with use of the AGP.

Table 2: Representative source emission values

Noise Source	Source Emission Value	Propagation Model
Lacrosse/Hockey	102 dB L_{wA} (derived from 58 dB L_{Aeq} at 10m corrected for AGP area)	Area source (AGP 101m × 63m)
Tennis	79 dB L_{wA}	16 × point sources (4 sources per court)

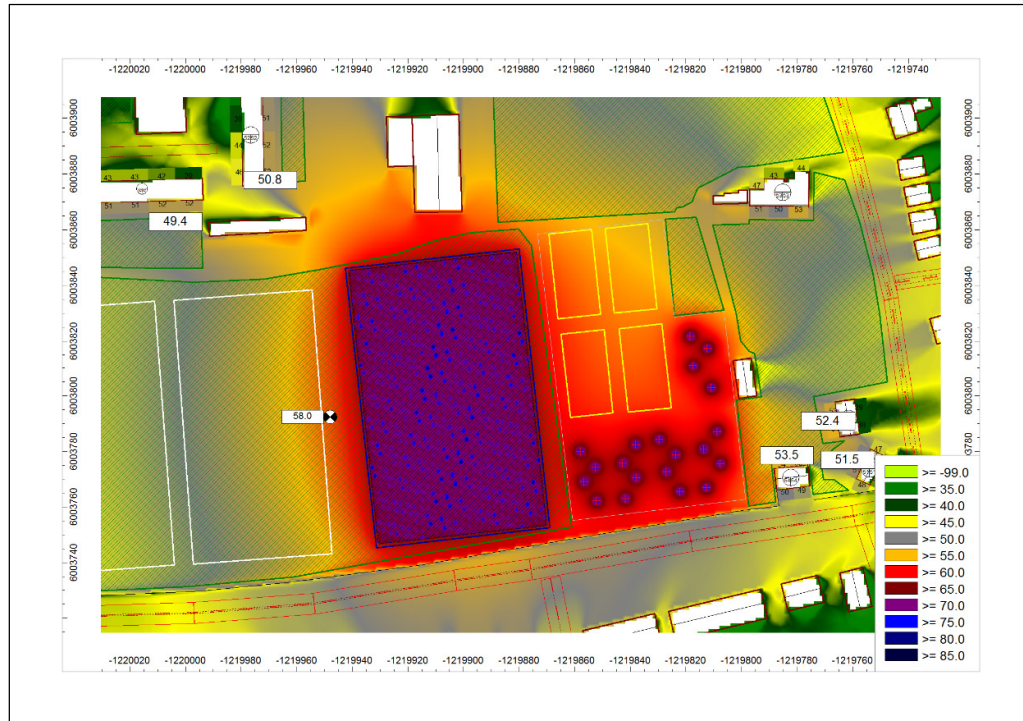
The noise model has been calibrated to represent a 60 minute time interval and thus represents the equivalent sound energy from the games areas within an hour period. This approach has been adopted to account for the intermittent nature of noise associated with sporting activity, in-line with Sport England guidance.

The model has assumed source heights of 1.5m and has allowed for three orders of reflection to adequately quantify the contribution from image sources.

5 Noise Impact Assessment

Predicted noise immission levels at surrounding noise sensitive receptors are shown in Figure 3 below.

Figure 3: Predicted $L_{Aeq,1h}$ noise levels from the AGP and Tennis Courts



Based on the guidance reviewed in Section 3.6, noise levels with gardens and amenity areas should not normally exceed 50 dB $L_{Aeq,1h}$ during the day (07:00 to 23:00 hours).

The noise map shown in Figure 3 shows that the Sport England criterion would typically be achieved at the receptors to the northwest of the proposed AGP. A nominal excess of 0.8 dB is calculated in one location, however this is considered to be a negligible margin following the IEMA effect descriptors reviewed at Section 3.5.

The worst case outdoor amenity area noise level to the east of the scheme is calculated to be 54 dB $L_{Aeq,1h}$ when rounded to the nearest integer value. Whilst this would not be considered as a particularly significant excess above the Sport England criterion and would still meet the upper range of values for outdoor spaces set out in BS 8233:2014, it is nonetheless considered that proportionate mitigation should be considered.

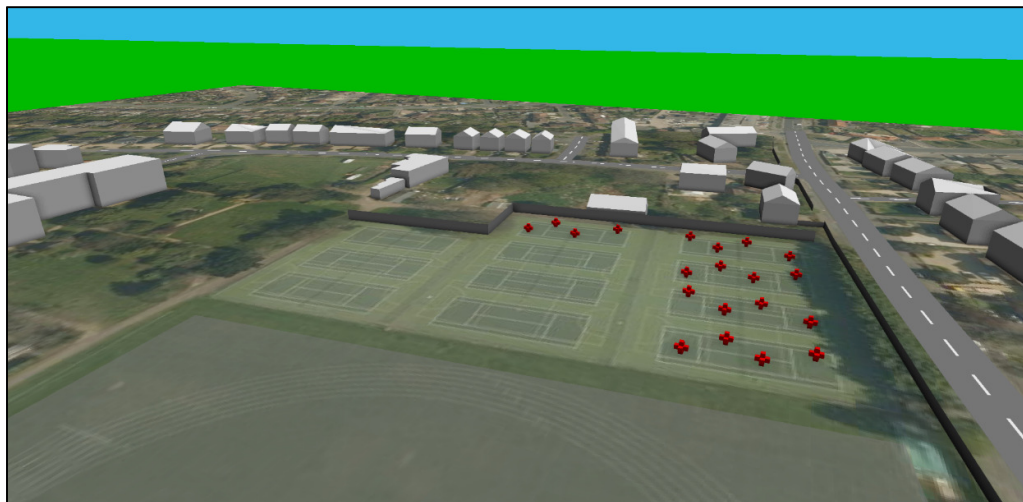
5.1 Acoustic Screening

To bring about a reduction in outdoor amenity space noise levels at the receptors to the east of the sports area, the CADNA A model has been re-run assuming provision of a 2.0m high acoustic screen following the east boundary line of the tennis courts, illustrated below in Figures 4 and 5 below.

Figure 4: Extent of proposed 2.0m acoustic screen



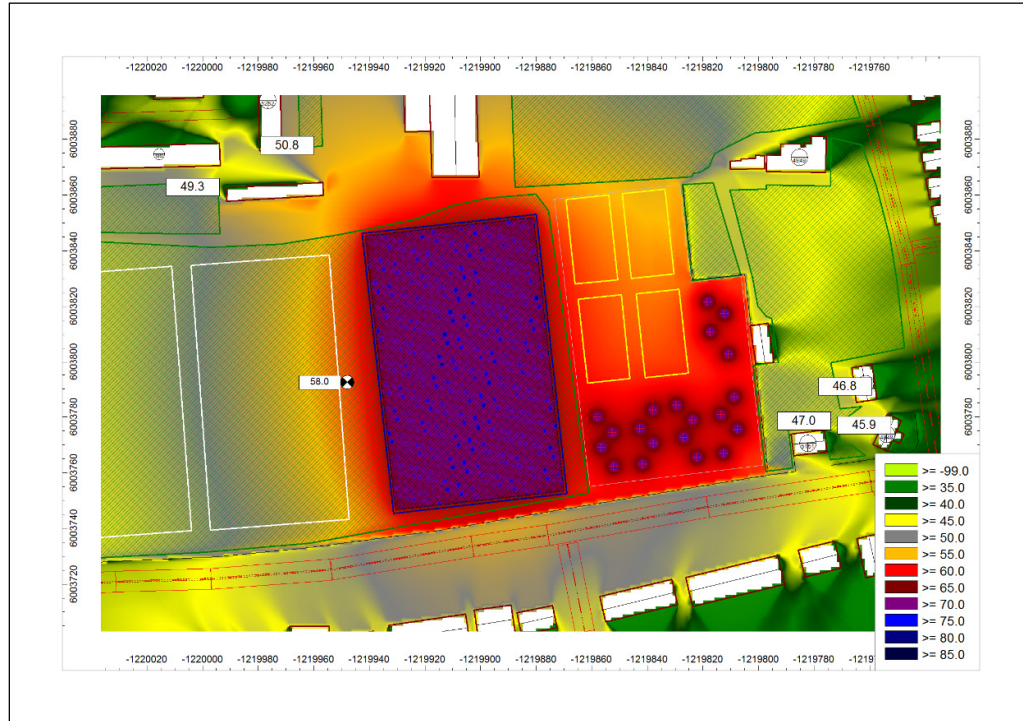
Figure 5: Extent of proposed 2.0m acoustic screen (aerial view from the west)



Predicted $L_{Aeq,1h}$ noise levels assuming provision of the boundary screening are shown in Figure 6 below. As can be seen, outdoor amenity noise levels at the receptors to the east of the tennis courts are typically around 47 dB(A) and hence below the Sport England criterion. Comparison of these noise levels against the concomitant unmitigated values

illustrated in Figure 3 shows that the screen would afford a reduction in noise of up to 7 dB(A) which is considered to be a substantial difference.

Figure 6: Predicted $L_{Aeq,1h}$ noise levels from the AGP and Tennis Courts with mitigation



To ensure that sound transmission through the proposed screen would be minimal as compared with the contribution from diffracted paths, it is suggested that the construction should be capable of attaining a minimum airborne sound insulation performance value of DL_R 20 dB, determined as per BS EN 1793-2:2018³. This standard is strictly applicable to road traffic noise reducing devices, but provides relevant guidance that may be used in the absence of a particular standard applicable to noise from sport activity.

The quantity DL_R is quantity is determined by:

$$DL_R = -10 \lg \left| \frac{\sum_{i=1}^{18} 10^{0.1 L_i} 10^{-0.1 R_i}}{\sum_{i=1}^{18} 10^{0.1 L_i}} \right| \quad [1]$$

³ BS EN 1793-2:2018: Road traffic noise reducing devices - Test method for determining the acoustic performance. Part 2: Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions.

Where:

DL_R is the single-number rating of airborne sound insulation performance expressed as a difference of A weighted sound pressure levels, in decibels;

R_i is the sound reduction index in the i th one-third octave band;

L_i is the normalized A weighted sound pressure level, in decibels, of traffic noise in the i th one-third octave band defined in EN 1793-3.

Guidance regarding materials that can be used for the construction of acoustic fences is given in the Design Manual for Roads and Bridges, Volume 10 Environmental Design Section 5 Environmental Barriers, HA 66/95, Part 2. Section 7.2 of the DMRB describes use of timber as a barrier material and it is proposed that this be used.

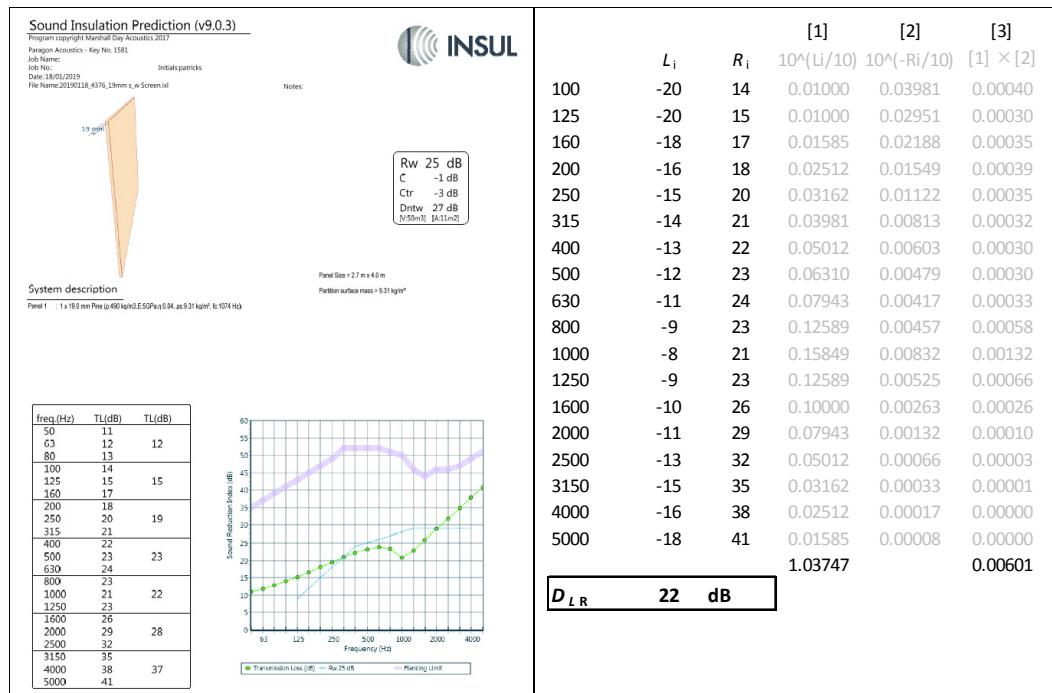
To determine the thickness of a timber screen sufficient to attain a DL_R of 20 dB, calculations have been carried out using Insul v9.0.3 prediction software. The model output shows that 19mm solid softwood of minimum density 490 kg/m³ would attain a sound insulation value of $R_w (C;C_{tr})$ 25 (-1;-3) dB, as below.

The 1/3 octave band sound reduction indices have been processed using equation [1] and a DL_R value of 22 dB results. The following points should also be implemented:

- The fence shall form an imperforate structure using timber without defects such as knots, twist or warping. The timber fence shall not have a gap at the base.
- The timber shall be a minimum 19 mm thick in all parts of the fence and shall be of minimum density 490 kg/m³.
- Timber boards shall overlap by a minimum 25mm to allow for the movement of the timber due to environmental factors, both short term and over a period of time;
- Supports may be of steel universal beam sections (other materials may be used provided they are cost effective and fit for the purpose of supporting an environmental barrier) as these to provide a convenient means of supporting acoustic screen panels – see Sections 6.11 and 6.12 of HA 66/95, Part 2.

All other design considerations such as wind loading, aerodynamic loading, other dynamic loads, maintenance and service life shall be considered by others, as required.

Table 3: Prediction of sound insulation of 19mm softwood barrier material and calculation of single number rating



5.2 Other Mitigation Measures

As noted above, the design of the AGP will be such that there will be no side boards this preventing generation of impulsive noise components from hockey ball impacts, for example. In addition, it is proposed that the weld mesh fencing arrangement shall incorporate damping material in the posts and that neoprene isolators shall be incorporated to separate panels from the posts.

6 Conclusions

A detailed appraisal has been undertaken to determine potential noise impacts associated with development of a proposed AGP at Queen Anne's school, Reading. The noise contribution of the proposed AGP together with use of four tennis courts has been calculated over a 60 minute period using CADNA A software. Assessments have been benchmarked against guide line values set out in BS 8233: 2014 and Sport England guidance.

Where there is potential for an adverse effect of noise, appropriate outline mitigation measures have been identified in the form of acoustic screening to the east boundary of the existing tennis court area. The adoption of such principles is considered to conform to the requirements of National Planning Policy in avoiding or reducing to a minimum, any adverse effects on any sensitive external spaces, within the context of sustainable development and accords with the principles of good design.

It is considered that sufficient information has been presented to address any acoustic queries that the Local Planning Authority may have.