



ACOUSTIC CONSULTANTS LTD
noise and acoustic specialists since 1987

Environmental Noise Assessment

**Proposed Residential Development
Skewen Snooker Club, Neath**

**Reference: 8254/SL
Date: 17 February 2020**

Proposed Residential Development Skewen Snooker Club, Neath



ACOUSTIC CONSULTANTS LTD
noise and acoustic specialists since 1987

T: 0117 986 2956 | E: mail@acoustic-ltd.co.uk

Client:	Acoustic Consultant:
 CASTELL GROUP Property Development Specialists	 ACOUSTIC CONSULTANTS LTD noise and acoustic specialists since 1987

Document Control

Version	Revision Description	Date	Author:	Reviewed by:
1.0	First Issue	17/02/20	Samuel Lawrence	Blake Lucas

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the external noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.



Table of Contents

1.	Introduction	4
2.	The Site and Proposals	5
3.	Assessment Criteria	6
4.	Site Noise Monitoring	11
5.	Noise Modelling	14
6.	Internal Ambient Noise Levels	17
7.	Summary and Conclusions	20
8.	Appendix 1 – Glossary of Acoustic Terminology	21
9.	Appendix 2 – Calculation to Worst-Case Rooms	24



1. Introduction

Castell Group Ltd appointed Acoustic Consultants Ltd to undertake an environmental noise assessment for the proposed residential development at the plot of land containing the former Skewen Snooker Club in Neath.

The purpose of this report is to assess the suitability of the site for residential use in terms of noise, and outline any required mitigation measures to achieve internal noise levels compliant with British Standard 8233:2014.

A site noise survey has been undertaken, the results of which are summarised in this report. The noise survey data and site plans have been used to create a computer noise model to predict the propagation of railway noise to the proposed dwellings across the site. Noise mitigation measures have been specified for the more noise sensitive façades in the proposed layout.

The noise impact assessment has been undertaken in accordance with the guidance in the Planning Policy Wales (PPW), Technical Advice Note (Wales) 11 (TAN11) and British Standard 8233:2104 (BS8233).

The author of this report is an Associate Member of the Institute of Acoustics and has three years' experience in the field of noise, and is considered suitably qualified to undertake this noise impact assessment. This report has been checked by a director of the company with over twelve years' experience in the industry.

2. The Site and Proposals

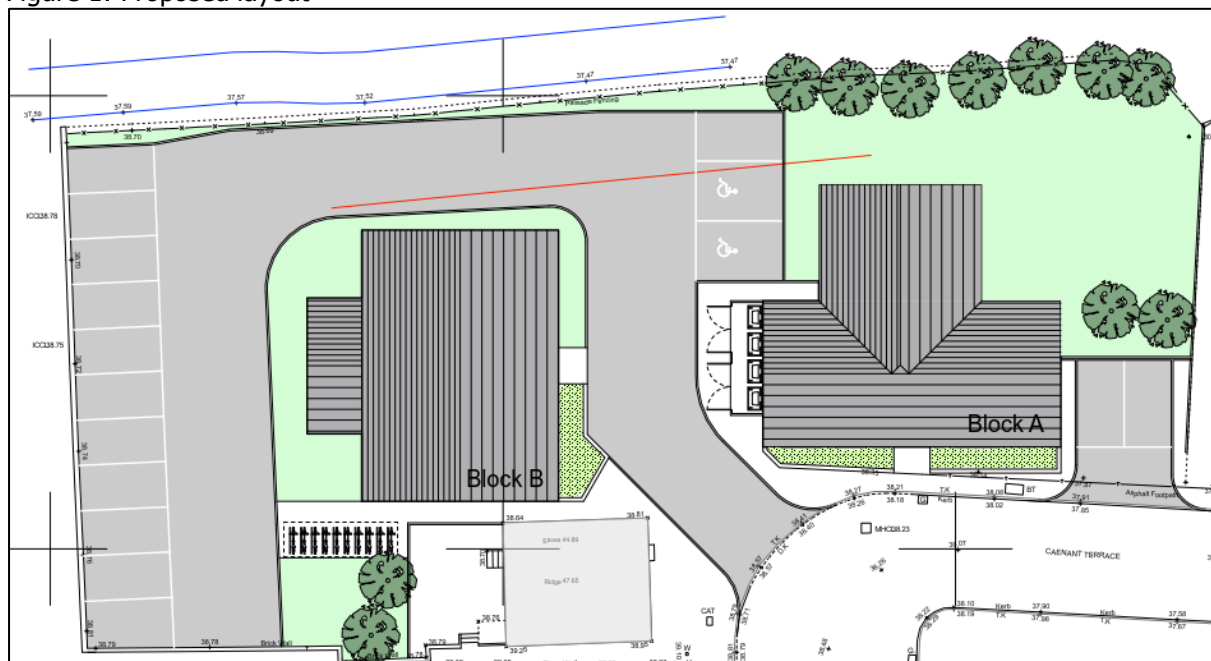
The site is a plot of land currently housing the now vacant Skewen Snooker Club. It is located in a residential area, Caenant Terrace, Neath SA10 6UP; south of the railway line running between Skewen and Neath railway stations.

It is proposed to demolish the existing snooker hall building and construct two, two-storey blocks of flats comprising a total of ten apartments with associated parking.

Railway traffic is considered the primary source of noise affecting the site and will determine any noise mitigation measures necessary to address external noise intrusion.

The proposed site layout is shown below.

Figure 1: Proposed layout





3. Assessment Criteria

3.1. Planning Policy Wales

Planning Policy Wales (PPW) Edition 10 dated December 2018 sets out the land use planning policies of the Welsh Government. Section 1 states:

"1.1 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. PPW, the TANs¹, MTANs² and policy clarification letters comprise national planning policy. "

The most relevant statements for noise affecting a residential use are provided in Section 6.7 and summarised below:

"6.7.1 Clean air and an appropriate soundscape, contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible."

6.7.4 The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

6.7.5 In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change.



In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

6.7.6 In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- not create areas of poor air quality or inappropriate soundscape; and*
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.*

6.7.7 To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.

6.7.8 Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:

- traffic management and road safety;*
- ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- supporting low or zero emissions public transport;*
- providing active travel infrastructure; and*
- incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.*

6.7.14 Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur. In circumstances where impacts are unacceptable, for example where adequate mitigation is unlikely to be sufficient to safeguard local amenity in terms of air quality and the acoustic environment it will be appropriate to refuse permission. Location of Commercial, Industrial and other Potentially Polluting Development.



6.7.19 The health imperative of good air quality and appropriate soundscapes in contributing to the overall character and quality of places and the health and well-being of people and wildlife should be fully recognised. It will not be appropriate to locate sensitive uses, such as hospitals, schools, care homes and housing adjacent to busy roads or other transport routes, where there are no connectivity benefits to be gained and where health and amenity impacts associated with increased exposure of people to pollution will be unacceptable. Whilst some uses may be appropriate with the aid of good design air quality and soundscape considerations can be overriding factors, especially for sensitive uses, if they cannot be adequately mitigated and impacts minimised.

6.7.20 Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements.

6.7.21 Regard should be paid to current air quality and noise levels and the quality of the existing soundscape and account taken of any relevant local air quality action plan, noise action plan and/ or local or regional air quality strategy as part of development strategies and proposals in development plans and before determining planning applications. Soundscapes and Compatibility of Uses

6.7.24 The potential impacts of noise pollution arising from existing development, be this commercial, industrial, transport related or cultural venues (such as music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity and any necessary measures and controls should be incorporated as part of the proposed new development. This will help to prevent the risk of restrictions or possible closure of existing premises or adverse impacts on transport infrastructure due to noise and other complaints from occupiers of new developments. It will be important that the most appropriate level of information is provided and assessment undertaken."

PPW does not provide any quantifiable criteria and directs you to the Technical Advice Notes (TAN 11).

3.2. Technical Advice Note (Wales) - Noise

Planning Policy Wales (PPW) Edition 9 dated November 2016 sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes.

The relevant planning criteria for proposed residential development is in Technical Advice Note (Wales) 11 entitled "Noise" which was published in October 1997. The introduction states: *"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources"*.

Table 1 provides Noise Exposure Categories, which relate to proposed residential developments near to a transportation noise source. Noise Exposure Categories, (NEC's) in relation to railway noise are addressed in ranges according to the free-field equivalent noise levels ($L_{Aeq,T}$) measured at the position of the proposed dwellings.

Table 1: TAN 11 Noise Exposure Categories

NOISE SOURCE	NOISE EXPOSURE CATEGORY			
	A	B	C	D
Railway Traffic				
07.00 - 23.00 hrs	<55	55 – 63	63 – 72	>72
23.00 - 07.00 hrs	<45	45 – 57	57 – 66	>66

The Technical Advice Note (Wales) 11 gives advice to Local Planning Authorities on assessing proposals for residential developments near a source of noise, depending upon which of the four Noise Exposure Categories the proposed site falls into:

NEC 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.*

NEC B. *Noise should be taken into account when determining planning applications and where appropriate, conditions imposed to ensure an adequate level of protection.*

NEC 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.*

NEC D. *Planning permission should normally be refused.*

In addition, it states: *Night-time noise levels (23.000 - 07.00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S 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).*"

Any façade of the scheme that falls into NEC B or above mitigation is required to achieve acceptable levels which are detailed below.

3.3. British Standard 8233:2014

For internal noise levels TAN11 refers directly to BS 8233:1999 entitled "Sound insulation and noise reduction for buildings – Code of Practice" which provides design criteria as a result of road traffic noise. British Standard 8233:1999 has now been withdrawn and replaced with British Standard 8233:2014, providing advice for all types of buildings. We would consider that the current British Standard 8233:2014 is the appropriate standard for assessing the noise impact from external sources.

Table 4 from BS 8233:2014 provides internal ambient noise levels (IANLs) for different types of rooms affected by noise sources 'without a specific character' and are based on existing guidelines issued by the World Health Organisation, 1999. The British Standard guideline states that noise levels should not exceed those as noted in the table below:

Table 2: British Standard 8233:2014 Internal Ambient Noise Level Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16\text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hour}}$	30 dB $L_{Aeq,8\text{ hour}}$

3.4. World Health Organisation Guidelines

Applicable to this development, section 3.4 of the WHO Guidance states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)"*.

As such, maximum noise levels would be considered acceptable if they do not exceed 45 dB $L_{Amax,F}$ no more than 10 to 15 times during the night-time period.

4. Site Noise Monitoring

A 24-hour noise survey was undertaken at the site from 14:15 hours on the 6th February 2020 to determine the noise climate affecting the proposed dwellings.

4.1. Monitoring Equipment

Sound Pressure Levels were measured using a Class 1 sound level meter with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, Cirrus Research, CR:171C	G080650	04/06/19	271343
Microphone, Cirrus Research, MK224	210551D	04/06/19	129446
Calibrator, Cirrus Research, CR:515	84377	04/06/19	129444

The measurement system was checked before and after use with the noted calibrator and no drift was detected.

4.2. Monitoring Procedure

The microphone was mounted on a pole raised through a vent on the north facing façade of the existing Skewen Snooker Club building, overlooking the nearby railway line. The microphone was located at a height of approximately 4.5 metres above the ground and was considered to be in a façade position (i.e. influenced by sound reflections from the façade of the building).

The most prominent noise events at the site were due to passing trains and the background sound level was influenced by the flowing of a nearby stream.

The monitoring location is illustrated on Figure 2 below.

Figure 2: Monitoring location with approximate site boundary marked in red



4.3. Weather Conditions

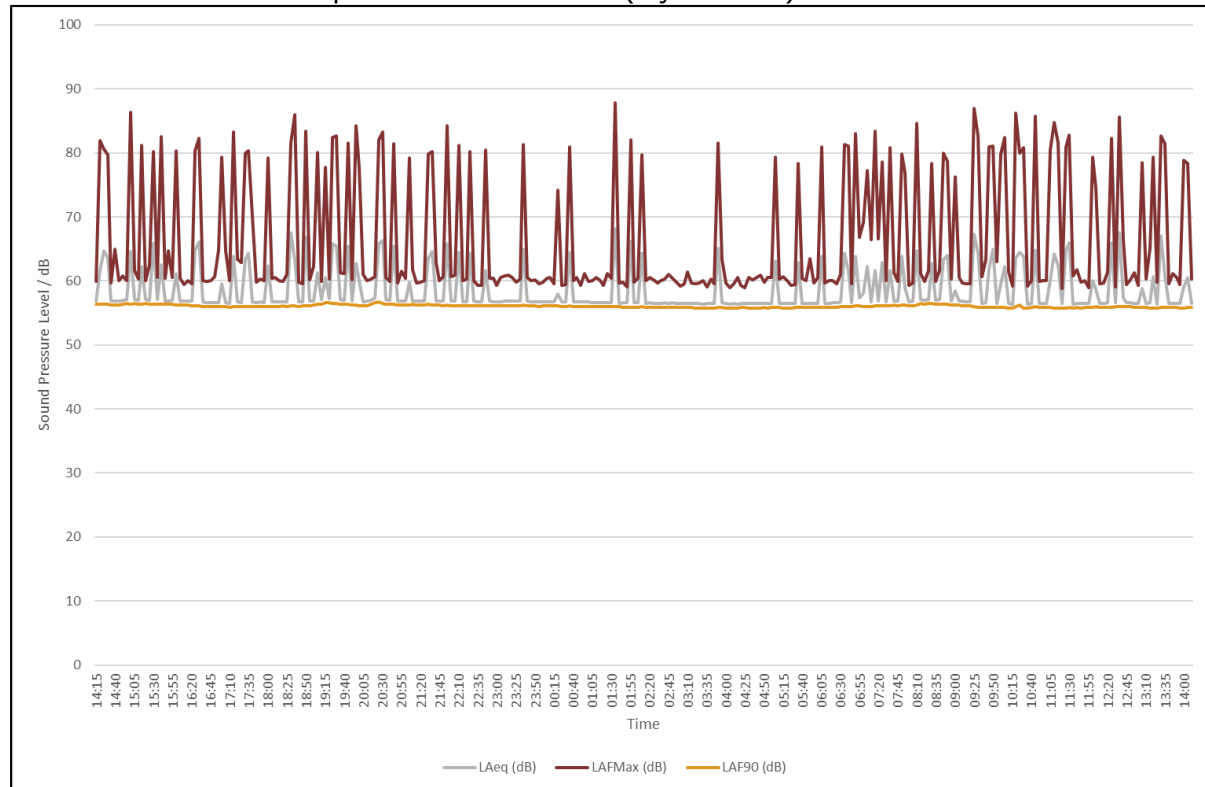
During the measurement the weather was dry with an average temperature of approximately 8 degrees Celsius, and wind speeds not exceeding 5 metres per second and no precipitation. The weather conditions are not expected to have affected the measured noise data.

4.4. Measured Noise Levels

The measured data for the baseline noise survey consists of the Equivalent Noise Level ($L_{Aeq,5min}$), Background Noise Level ($L_{A90,5min}$) and Maximum Noise Level (L_{AFmax}) in dB(A). The consistent level of the $L_{A90,5min}$ is due to the constant flow of the nearby stream. Mitigation measures will nevertheless be determined by the maximum noise events so the noise of the stream is not considered to influence the outcome of the assessment.

These results are displayed in Chart 1.

Chart 1: Variation in sound pressure level over time (façade levels)



The relevant spectral measured data over the 24 hours is summarised below in Table 4.

Table 4: Measured façade noise levels

Period	Parameter	Sound Pressure Level per Octave Band / dB								dB(A)
		63	125	250	500	1000	2000	4000	8000	
Day	Leq16hr	59.9	59.5	54.0	55.5	57.6	54.0	50.0	45.6	61
Night	Leq8hr	56.8	54.9	53.0	53.0	55.4	52.7	48.6	42.9	59
	LFmax	77.0	71.1	71.5	73.0	76.0	72.7	68.4	60.4	79



5. Noise Modelling

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured railway noise data noted above. The software predicts railway noise propagation using the method of 'Calculation of Railway Noise 1995', and a verification model has been created to ensure the measured and predicted levels are comparable. This model is available upon request.

5.1. Modelling Parameters

The noise predictions have been undertaken using supplied plans of the proposed site and the following general modelling parameters:

- The noise model has been calibrated to match the data measured at the monitoring location noted in Section 4.4 (corrected to free-field levels).
- The site and surrounding area have been modelled according to satellite imagery of the area and the proposed site layout and elevations provided by the client.
- The ground is considered reflective in the surrounding fields and gardens.
- Reflections have been determined via the correction method (+1.5 dB), as per the methodology of CRN (1995).
- The noise maps predict noise levels across the site from the noted noise sources at a height of 4.5 metres above the ground.
- Noise levels have been predicted to the façades containing windows only, based the glazing locations shown on the supplied elevations. For night-time predictions, the levels predicted are shown only at façades to bedrooms that contain windows.
- The topography of the site and surrounding area was modelled using open source online Lidar data (1x1m grid).

5.2. Noise Modelling Results

Predicted noise emission maps for equivalent noise levels during the daytime ($L_{Aeq,16hour}$) and night-time ($L_{Aeq,8hour}$), and maximum noise events (L_{AFmax}) during the night-time are provided below in the figures below.



Figure 3: Daytime $L_{Aeq}(16\text{hour})$ noise prediction map (noise map and building evaluation at 4.5 metres)

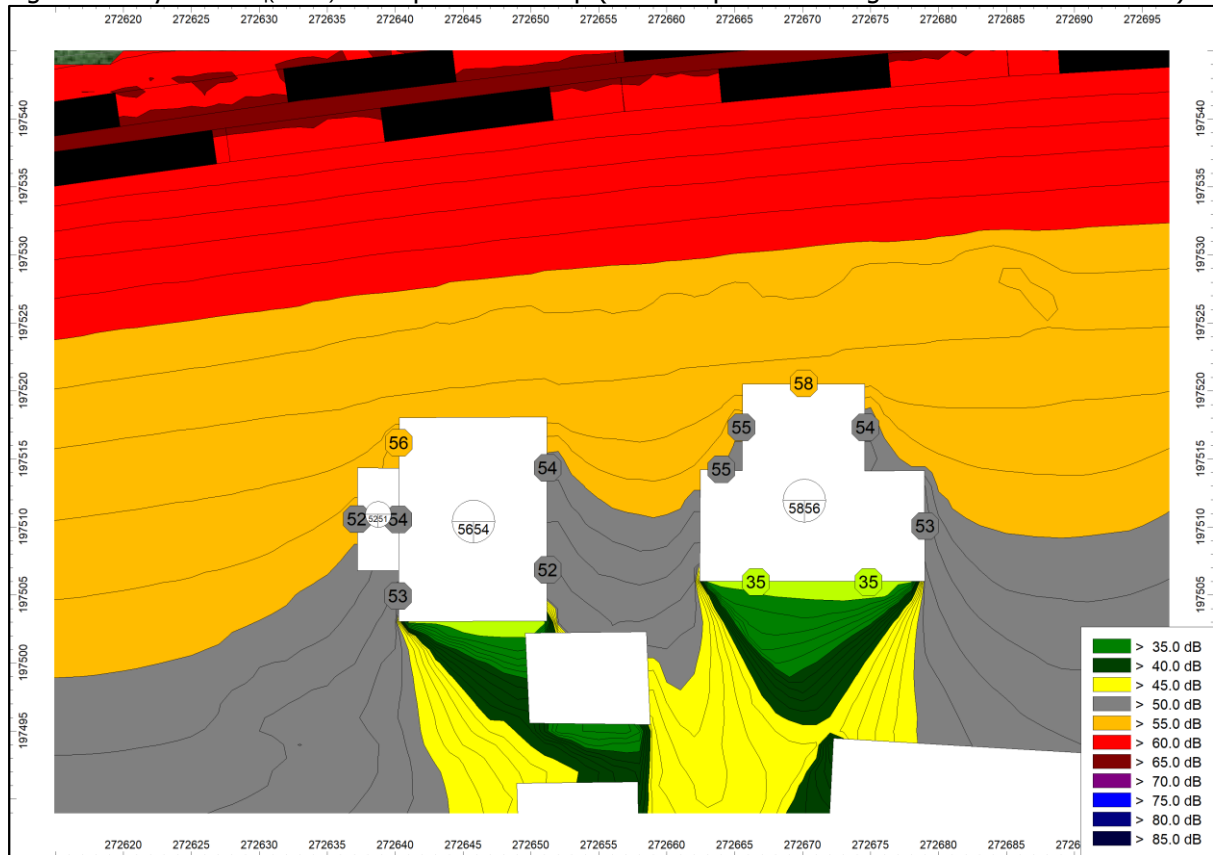
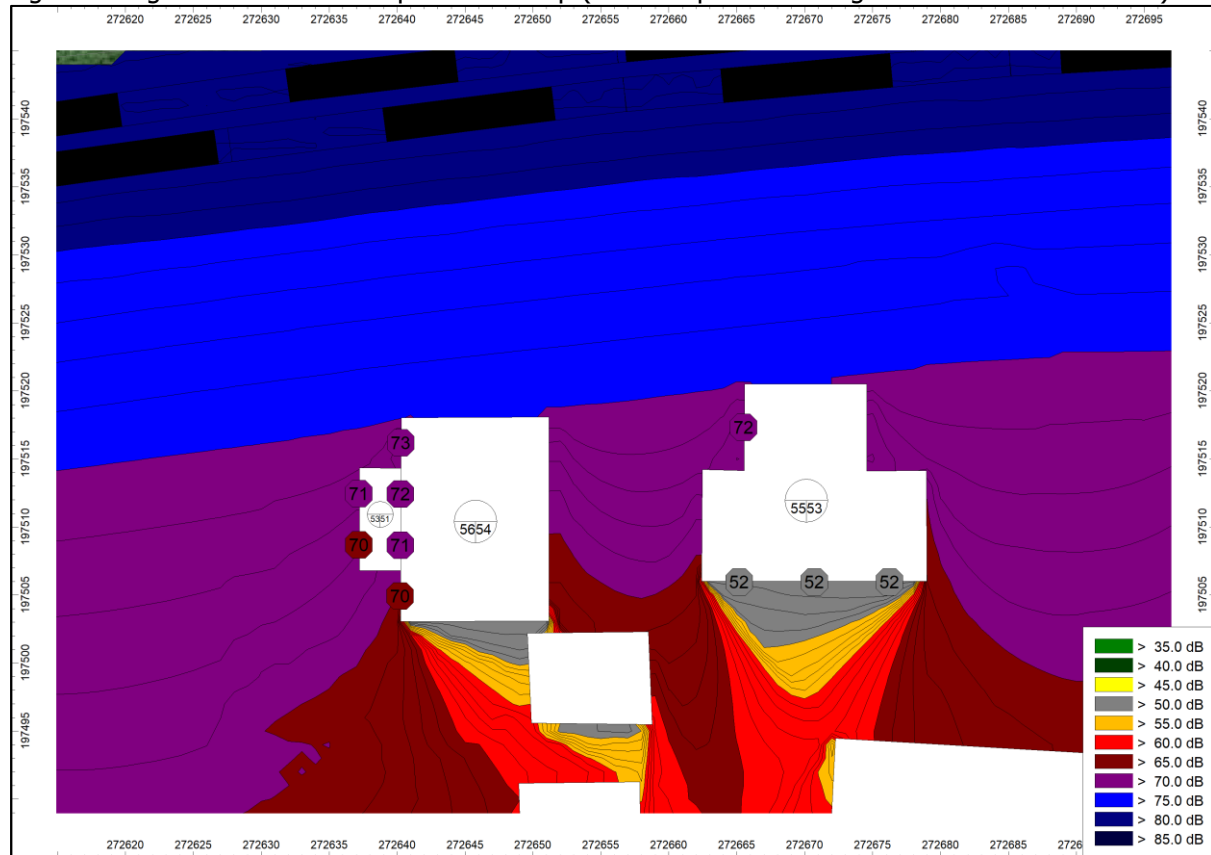


Figure 4: Night-time $L_{Aeq}(8\text{hour})$ noise prediction map (noise map and building evaluation at 4.5 metres)



Figure 5: Night-time L_{AFmax} noise prediction map (noise map and building evaluation at 4.5 metres)



5.3. Noise Exposure Category

In terms of equivalent noise levels, the proposed site falls into NEC B during the daytime and night-time periods, with worst-case levels of 58 dB $L_{Aeq,16hour}$ and 56 dB $L_{Aeq,8hour}$ respectively. The assessment of maximum noise events does not alter the Noise Exposure Category as no façades are predicted to be regularly exposed to noise events exceeding 82 dB L_{ASmax} (above shows a worst-case typical noise event of 73 dB L_{AFmax} at the proposed façade, and the L_{ASmax} parameter is typically lower than L_{AFmax}).

While the site only falls into NEC B, we would consider that façade noise mitigation measures are required to achieve appropriate internal conditions.

6. Internal Ambient Noise Levels

6.1. Calculation Method

Calculations for the internal ambient noise levels have been undertaken using the calculation method provided by Annex G of British Standard 8233:2014. The calculations have been undertaken using the building façade constructions below and building evaluation single figure values noted in Figure 3 to Figure 5 above.

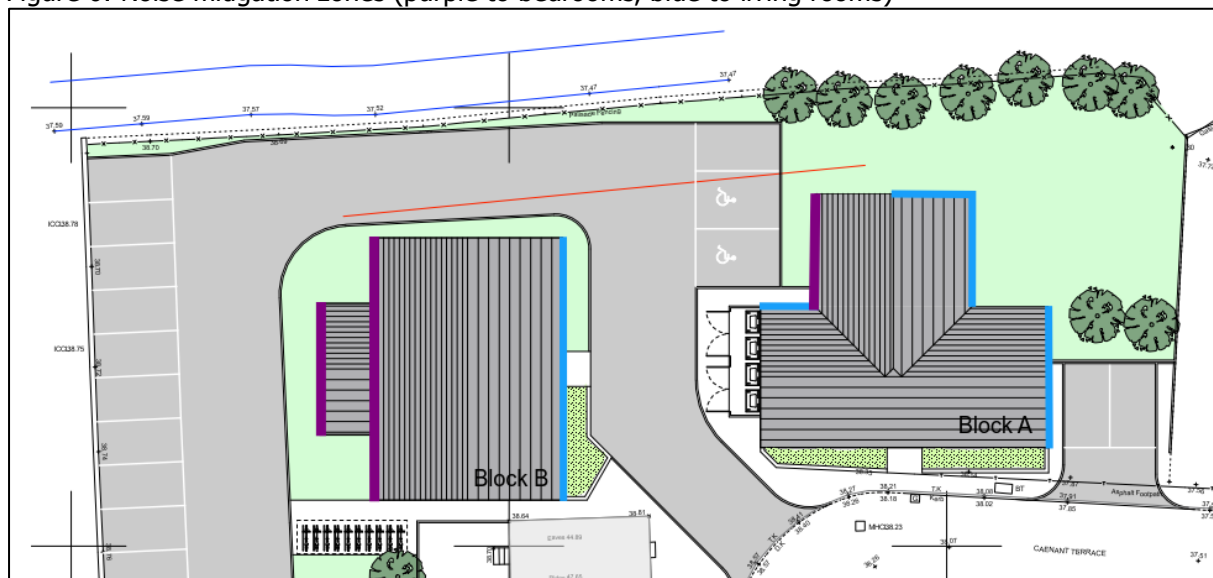
The worst-case dimensions for bedrooms and living rooms have been taken from the Kennedy James Griffiths 'Block A' and 'Block B Floor Plan' drawings dated 11.02.2020.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the BS 8233:2014 recommended internal ambient noise level criteria.

6.2. Mitigation Locations

Specific mitigation measures are required to most living rooms and bedrooms in the proposed development, as shown on the figure below. Façades with windows to sensitive rooms have been marked with a colour code indicating purple to bedrooms and blue to living rooms. The south facing façade is shielded from the railway and therefore requires no specific noise mitigation measures. The required noise mitigation measures are based on the results of the survey in Section 4.4 12of this report and the noise modelling in Section 5.2.

Figure 6: Noise mitigation zones (purple to bedrooms, blue to living rooms)



6.3. External Wall Construction

Across the entire development, the external walls can be of a conventional construction comprising either masonry or light weight metal/timber frame.

- The masonry construction could comprise of at least two skins of block (one of density 1880 Kg/m³, 100mm cavity, 100mm block (density of 400 Kg/m³). Room side of the block work would be plastered or have plaster on dabs.
- The light weight construction could comprise of a single frame (minimum 100mm) construction with one skin of block, brick slips, or two layers of board each side of the stud (minimum mass per side 20 Kg/m²) and 50 millimetre of mineral wool insulation within the cavity.

The above constructions are expected to achieve the following sound reduction indices:

Table 5: Required minimum sound insulation performance of external walls

Location	Sound Reduction Index / dB per Octave Band (Hz)								R _w (dB)
	63	125	250	500	1k	2k	4k	8k	
Whole Development	31	38	46	45	55	66	77	70	52

6.4. Roof Construction

Across the whole development, the dwellings could have a roof constructed using traditional techniques, such as a timber construction with concrete/slate tiles (minimum mass per unit area of 30 Kg/m²) with a loft space and a plasterboard ceiling above the habitable rooms.

The above constructions are expected to achieve the following sound reduction indices:

Table 6: Required minimum sound insulation performance of roof

Location	Sound Reduction Index / dB per Octave Band (Hz)								R _w (dB)
	63	125	250	500	1k	2k	4k	8k	
Whole Development	25	39	47	53	58	56	60	55	56

6.5. Window Construction

The windows on all elevations could be openable; however, should be sealed airtight in the blue and purple zones shown in Figure 6 to control external noise, with alternative means of ventilation provided. The windows should be constructed from a standard double-glazed construction housed in sturdy good quality frames with airtight compression seals, of which the exact specifications required are described below.

The sound insulation performance for the windows should achieve the following as a minimum. The supplier should confirm these are achievable with the chosen systems.

Table 7: Required minimum sound insulation of windows

Location	Room Type	Typical Construction	Sound Reduction Index, dB per Octave Band, Hz								R _w (dB)
			63	125	250	500	1k	2k	4k	8k	
Purple	Bedroom	10/12/6	21	26	27	34	40	38	46	46	37
Blue	Living Room	4/12/4	20	24	20	25	35	38	35	36	31

6.6. Ventilation Provisions

The habitable rooms falling in the Blue and Purple Zones as shown in Figure 6 will need to be ventilated via attenuated means. The ventilation should be located on these façades only and should include the necessary sound attenuation in order that the ingress of external noise is controlled to be compatible with the building fabric.

We have assumed one vent per habitable room. The minimum normalised level difference ($D_{n,e}$) performance for the vents in the open position is provided below. The supplier should provide test data confirming ventilation meets the below performance in the open position.

Table 8: Required minimum sound insulation performance of ventilation

Zone	Room Type	Element Normalised Level Difference, $D_{n,e}$ per Octave Band, Hz								$D_{n,e,w}$ (dB)
		63	125	250	500	1k	2k	4k	8k	
Purple	Bedroom	32	32	37	37	36	36	35	40	37
Blue	Living Room	30	35	35	36	34	29	33	34	32

6.7. Effect of Mitigation Measures

With the mitigation measures installed to habitable rooms of the dwellings in the rooms noted above, the predicted internal noise levels are below British Standard 8233:2014 and WHO (1999) criteria and, on this basis, we would consider noise ingress to be suitably controlled.

The predictions for the worst-case room are shown in more detail in Appendix 2.



7. Summary and Conclusions

Castell Group Ltd appointed Acoustic Consultants Ltd to undertake an environmental noise assessment for the proposed residential development at the plot of land housing the former Skewen Snooker Club in Neath.

The purpose of this report was to assess the suitability of the site for residential use in terms of noise, and outline required mitigation measures to achieve internal noise levels compliant with British Standard 8233:2014.

Noise modelling, based on noise data measured on site, was undertaken in Cadna:A to determine a TAN11 Noise Exposure Category for the site of the proposed development. The site is considered to fall into NEC B.

In order to achieve acceptable internal acoustic condition in accordance with British Standard 8233:2014 and WHO 1999, we have provided noise mitigation measures in terms of façade insulation and ventilation provisions in the areas most exposed to railway noise.



8. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \log_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.



Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,T_r}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, L_{Ar,T_r} – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T_{20} (time taken for a 20 dB decay multiplied by three) and T_{30} (time taken for a 30 dB decay multiplied by two).



Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, eVDV – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).

9. Appendix 2 – Calculation to Worst-Case Rooms

Figure 7: Predictions for internal ambient noise levels to worst-case bedroom

Site Name:		Skewen Snooker Club, Neath								
Date:		14/02/2020								
Room Type/Location		Bedroom								
Criteria		35 dB LAeq(16hr), 30 dB LAeq(8hr), 45 dB LAFmax								
Room Dimensions										
Room Height (m)		2.4	Room Volume		0.16*Volume					
Length (m)		3.2	27.648		4.42368					
Width (m)		3.6								
Frequency		63	125	250	500	1000	2000	4000	8000	T _{ref}
Reverberation Time		0.48	0.48	0.64	0.82	0.97	0.59	0.45	0.45	0.8
Free Field Level at Façade										
Octave Band		63	125	250	500	1000	2000	4000	8000	dBA
Day, L _{eq} (16 hour)		56	57	51	52	55	51	47	44	58
Night L _{eq} (8hour)		54	52	50	50	52	50	46	40	56
Night-time L _{max} (fast)		71	65	65	67	70	67	62	54	73
Building Façade Construction										
External Element		63	125	250	500	1000	2000	4000	8000	
Acoustic Trickle Vent - Trimvent 4000 - 37 Dnew		D _{ne}	31.5	32	36.5	37.1	36.4	36.1	34.8	40.1
		Number of	1	0	0	0	0	0	0	0
			0.00022	0.00020	0.00007	0.00006	0.00007	0.00008	0.00010	0.00003
2x100mm block plastered/render both sides 100mm void, 1880 Kg/m3 + 400 kg/m3 - 52 Rw			31	38	46	45	55	66	77	70
		Area	17	0	0	0	0	0	0	0
			0.00041	0.00008	0.00001	0.00002	0.00000	0.00000	0.00000	0.00000
Double Glazed: 10/12/6 - 37 Rw			21	26	27	34	40	38	46	46
		Area	2	0	0	0	0	0	0	0
			0.00037	0.00012	0.00009	0.00002	0.00000	0.00001	0.00000	0.00000
Pitched Roof - 56 Rw			25	39	47	53	58	56	60	55
		Area	14	0	0	0	0	0	0	0
			0.001383	5.51E-05	8.73E-06	2.19E-06	6.93E-07	1.1E-06	4.38E-07	1.38E-06
Calculations to BS EN 12354										
		63	125	250	500	1000	2000	4000	8000	
Sum		0.00238665	0.000452	0.000185	9.81E-05	7.86E-05	8.54E-05	0.000105	3.32E-05	
10log sum		-26.222119	-33.4513	-37.3243	-40.0837	-41.0457	-40.6871	-39.7838	-44.795	
10log S/A		5.44298825	5.442988	6.622289	7.729171	8.479028	6.331686	5.161008	5.161008	
correction factor +3		3	3	3	3	3	3	3	3	
Octave Band		63	125	250	500	1000	2000	4000	8000	dBA
Day, L _{eq} (16 hour)		38	32	23	23	25	20	15	7	28
Night L _{eq} (8hour)		36	27	22	21	23	18	14	3	26
Night-time L _{max} (fast)		53	40	38	38	40	35	31	18	43



ACOUSTIC CONSULTANTS LTD
noise and acoustic specialists since 1987

Head Office: 194 West Street, Bedminster, Bristol, BS3 3NB

T: 0117 986 2956

www.acoustic-ltd.co.uk

Bristol | Swansea | Manchester

Registered Office: 194 West St, Bristol, BS3 3NB Registered No: 8544901