



BAM CONSTRUCTION LIMITED

ADULT AND OLDER PERSONS MENTAL HEALTH UNIT – GLAN CLWYD HOSPITAL

NOISE ASSESSMENT FOR PLANNING PURPOSES

09 February 2023

AEC REPORT: P4114/R3/DMT

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1.0 INTRODUCTION

General

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by BAM Construction Limited to undertake a baseline noise survey and noise assessment for planning purposes, in relation to the proposed Adult and Older Persons Mental Health Unit at Glan Clwyd Hospital, Rhyl, Wales.
- 1.2 This noise assessment report provides the following:
- noise criteria for external plant noise emissions and guidance on internal noise level limits;
 - the findings of a baseline noise measurement survey;
 - an assessment of building services plant noise limits;
 - assessment of external noise levels and site suitability, and;
 - outline mitigation measures where appropriate.
- 1.3 Meeting the proposed criteria for internal noise levels and external plant noise emissions would also satisfy the requirements of BREEAM, if the associated credits are being sought. This would be developed during the design stages and is not discussed further in this report.
- 1.4 Acoustic terminology is discussed in brief in Appendix A.

CDM Regulations

- 1.5 It should be noted that AEC does not make recommendations on specific products to be used, although the report may make reference to products that could meet the relevant acoustic parameters. It is assumed that the health and safety requirements for any inferred products are confirmed and adhered to prior to use.

2.0 BACKGROUND AND SITE DESCRIPTION

- 2.1 The proposed development scheme is located to the north-west corner of the hospital site and is bound by existing hospital buildings to the south (Pathology Building) and east, and grasslands to the north and west, as indicated on the attached Figure 1, below.
- 2.2 Further south of the scheme, beyond the Pathology Building, and further north of the scheme beyond the grasslands, are the residences on Ffordd Parc Castell and the Faenol Fawr Country House & Manor Hotel, respectively. These are the nearest noise sensitive receptors (NNSR) to the scheme. Also indicated on Figure 1.
- 2.3 The proposals are to construct a new three storey mental health unit building with several plant rooms on the roof of building, as indicated on Figures 2 and 3, below. The building includes, single bed wards/rooms assessment rooms, therapies, care rooms, offices, pharmacy and other spaces including external gardens.

3.0 BASIS OF ASSESSMENT

Policy and Guidance

- 3.1 The Planning Policy Wales (PPW)¹, repeatedly states the need for noise pollution to be considered and mitigated, during both construction and operational phases. This is to minimise or avoid adverse effects on individuals and communities due to noise emissions.
- 3.2 The PPW is supplemented by a series of Technical Advice Notes (TANs). TAN-11 – ‘Noise’², provides more detailed guidance on noise and how adverse impacts of noise can be minimised without placing unreasonable restrictions on development or adding unduly to the costs or administrative burdens of business.
- 3.3 Paragraph 8 of TAN-11 states that “*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*”.
- 3.4 TAN-11 acknowledges the need to consider the acoustic character of the noise source in question as this can affect the assessment of the effects. Further to this, Appendix B.17 of TAN-11 refers to BS4142:1990 (superseded by the 2019 edition), which presents a method for assessing noise from industrial and commercial developments. This would be the industry standard guidance for assessing noise from external building services plant, such as that proposed on the roof of the proposed development.
- 3.5 As indicated above, one important point inferred from the PPW and TAN-11 guidance is that, whilst noise can override other planning concerns, it should not be considered in isolation from the economic, social and other environmental dimensions of any proposed development.

¹ PPW, published, December 2018

² TAN-11 ‘Noise’, published, October 1997

External Building Services Plant

- 3.6 External noise from building service plant is typically assessed to the guidance in BS 4142-2014+A1-2019 'Methods for rating and assessing industrial and commercial sound' (BS4142).
- 3.7 In BS4142, noise impacts are assessed by comparing the calculated 'rating level' from the external plant against the existing baseline background sound level, as assessed at the nearest noise sensitive receptor(s).
- 3.8 A 'rating level' ($dB_{L_{Ar,Tr}}$) is obtained by applying a character correction to the 'specific noise level' ($dB_{Aeq,Tr}$) of a noise source (e.g. plant noise). The correction is applied if the noise has a defined acoustic character such as being tonal, impulsive, distinctive or intermittent in nature.
- 3.9 The magnitude of the correction is dependent on the character of the noise source and its level of perceptibility at the receiver. A correction of between 0 to +6dB and 0 to +9dB can be applied if the noise source is tonal or impulsive, respectively. Where the specific sound has characteristics, which are neither tonal nor impulsive but are distinctive against the residual sound climate, a +3dB penalty can be applied. A +3dB penalty can also be applied if the specific sound is intermittent in nature.
- 3.10 When assessing the potential noise impacts, 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. BS4142 states that:
- A difference of around +10dB or more is likely to be indicative of a significant adverse impact, depending on context.
 - A difference of around +5dB or more is likely to be indicative of an adverse impact, depending on context.
 - The lower the rating level relative to the background level, the less likely it is that the specific sound source will have an 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.
- 3.11 Based on the above, it is proposed that **the rating noise level from the proposed development is controlled to -5dB below the existing background noise level at the nearest noise sensitive receptors**. This would give a strong indication that the specific sound would have a low impact. Achieving this limit would be in-line with the aims of PPW and should satisfy any Local Authority requirements.

Site Suitability (HTM 08-01)

- 3.12 In terms of acoustics for healthcare buildings, and the suitability of the site, appropriate design advice is included in the Department of Health’s Special Services ‘*Health Technical Memorandum 08-01: Acoustics*’ (HTM 08-01). To comply with HTM 08-01, the noise limits detailed in Table 3.1, below, for noise breaking in from external sources, and mechanical services plant, should not be exceeded.

Table 3.1 – Maximum Allowable Internal Noise Levels (HTM 08-01)

Room type		External Sources, dBL _{Aeq,1h}	Mechanical services noise (NR)
Single bed ward	Day (0700 to 2300h)	40	30
	Night (2300 to 0700h)	35 (& 45dBL _{AFmax})	
Multi bed ward	Day (0700 to 2300h)	45	
	Night (2300 to 0700h)	35 (& 45dBL _{AFmax})	
Operating theatres		40	40
Small offices and meeting rooms (<i>e.g. consulting, private office, small treatment, interview, small seminar</i>)		40	35
En-suite toilet and shower		45	40
Public Areas (<i>waiting, dining, playroom</i>)		50	40
Public and staff toilet and shower		55	45

- 3.13 With regard to the night-time maximum noise level limits for the wards, this is based on typical sources of noise, not occasional events (e.g. vehicle horns and helicopters – subject to agreement from the hospital trust).
- 3.14 HTM-08-01 does not stipulate noise level limits in external amenity areas (gardens). However, based on AEC’s professional experience, noise levels in garden areas on a hospital site would ideally be less than 55dBL_{Aeq,T}.

4.0 BASELINE NOISE SURVEY

- 4.1 AEC attended site on Thursday 6 and Friday 7 May 2021 to undertake external noise level measurements. Daytime measurements were undertaken on Thursday between approximately 1730 and 1830h and on Friday between approximately 0930 and 1230h. Night-time measurements were undertaken between Thursday 2300h and 0115h on Friday.
- 4.2 The noise measurement survey was undertaken in general accordance with BS:7445-1: 2003 “*Description and measurement of environmental noise*” (BS7445-1) and HTM 08-01.
- 4.3 The full measurement procedure is presented in Appendix B and the measured data is presented in Tables B1 and B2.
- 4.4 Both daytime and night-time noise measurements were undertaken at three locations around the development site identified as A to C on the attached Figure 1.
- 4.5 Locations A and C were representative of the NNSR’s at Faenol Fawr Country House & Manor Hotel and Ffordd Parc Castell, respectively. Location B was chosen to represent baseline noise level affecting the proposed development.
- 4.6 The noise climate at locations A, B and C was dominated by constant mechanical building services noise associated with the existing hospital buildings and distant road traffic noise.
- 4.7 A summary of the measured free-field daytime and night-time noise levels measured at each of the locations is presented in Table 4.1, below.

Table 4.1 - Summary of Free-field Noise Levels

Location	Measure Noise Level, dB			
	Day (0700-2300)		Night (2300-0700)	
	L _{Aeq,15mins}	L _{A90,15mins}	L _{Aeq,15mins}	L _{A90,15mins}
A	51	44	40	38
B	48	46	45	44
C	47	45	44	43

- 4.8 Noise from existing ambulance sirens and helicopters is not included in this assessment. Ambulances were not using their sirens on-site during the noise survey. It is understood that occasional noise from these sources would be a site management issue.
- 4.9 It should be noted that while the noise measurements were taken during the Covid-19 restrictions, it is anticipated that the measured noise levels are representative due to activities in and around hospitals remaining unaffected during the restrictions. Any minor changes to the noise levels during ‘normal’ conditions are not expected to have any material effect on the advice given in this report.

5.0 ASSESSMENT OF BUILDING SERVICES PLANT

- 5.1 It is understood that the mechanical services plant serving the proposed development could be operational 24 hours a day, seven days a week. The building services plant will be located in plant rooms, as shown on Figure 3.
- 5.2 The nearest noise sensitive receptor would be the Faenol Fawr Country House & Manor Hotel, which is approximately 200m to the north of the proposed scheme.
- 5.3 At this stage AEC has not been provided with the exact make and model, or technical data, of the different internal and external plant items to be installed.
- 5.4 Therefore, based on the arithmetic average of the measured night-time background noise level of $38\text{dB}_{\text{LA90,15mins}}$ representative of the Faenol Fawr Country House & Manor, the free-field total rating level from all building services plant combined should be controlled to **no greater than $33\text{dB}_{\text{Ar,Tr}}$ external to the hotel** to comply with the proposed planning noise limit.
- 5.5 As an example, based on a clear line of sight and a distance of 200m, from the nearest part of the proposed development to the NNSR, all plant would need to be limited to around $69\text{dB}_{\text{Aeq,T}}$ at 3 metres.
- 5.6 This limit is indicative only and should not be applied to individual plant items, as lower limits would be required from individual noise sources. Higher limits could also be acceptable where there is acoustic screening, or an enclosure. This will require further development.
- 5.7 It is assumed that the rating level would not require any acoustic character correction. This is because the noise source is not expected to be tonal or intermittent in nature and should be barely perceptible at the NNSR.
- 5.8 Achieving the above noise level limit should not be particularly onerous. However, it will likely require standard design/mitigation measures to be incorporated, including: selection of quiet plant items; atmosphere side attenuation to air handling plant, and potentially other mitigation measures e.g. acoustic louvers to plant rooms.
- 5.9 It should be noted that noise from the building services plant will also need to be controlled to meet appropriate noise levels inside adjacent hospital buildings and inside the noise sensitive areas of the proposed development itself. This will not be overly onerous but will require further consideration as the design develops.

6.0 ASSESSMENT OF SITE SUITABILITY

6.1 Although this is not thought to be a strict planning requirement, an outline assessment of site suitability is provided below.

External Levels in Garden Areas

6.2 Based on the measured noise levels presented in Table 4.1 and the fact that some of the proposed garden areas are fully or partially screened from the existing building services plant of the pathology building, noise level in the proposed garden areas will be significantly below $55\text{dB}_{\text{L}_{\text{Aeq,T}}}$, provided building service noise from the proposed development is suitably controlled.

6.3 Therefore, based on the measured baseline noise levels and proposed layout, external noise levels in the garden areas will be suitable for the intended use.

Internal Noise Levels

5.1 A partially open window for ventilation provides up to 15dB attenuation from outside to inside. Therefore, to meet the HTM08-01 internal noise levels detailed in Table 2.1 above, external noise levels should not typically exceed the following limits:

- Single Wards / Bedrooms - Daytime: $55\text{dB}_{\text{L}_{\text{Aeq,T}}}$
- Single Wards / Bedrooms - Night-time: $50\text{dB}_{\text{L}_{\text{Aeq,T}}}$
- Single Wards / Bedrooms - Night-time: $60\text{dB}_{\text{L}_{\text{Amax,F}}}$

6.4 Based on the findings of the baseline noise measurement survey, if desirable, all elevations could be ventilated naturally, by means of a partially open window. Suitable internal noise levels (compliant with HTM 08-01) will be achieved with a standard thermal double glazing with a performance of around $30\text{dB}_{\text{R}_w} / 25\text{dB}_{\text{R}_w+\text{C}_{\text{tr}}}$.

6.5 However, this may require further consideration as the design develops and building services plant noise, associated with the development, is assessed in detail.

6.6 Other façade elements would need to achieve a performance of 10dB higher than the glazing i.e. approximately $40\text{R}'_w$. This would be achieved by most standard building envelope constructions and would not be particularly onerous. However, this will be developed with an acoustician at the design development stages.

6.7 Where there is new building services plant proposed on the roof, suitable acoustic design advice will ensure the noise levels are controlled to other areas of the development and that the roof structure is suitable for the control of noise ingress.

6.8 Therefore, in terms of noise, the site is considered suitable for development of noise sensitive uses, including offices and assessment rooms.

7.0 CONCLUSION

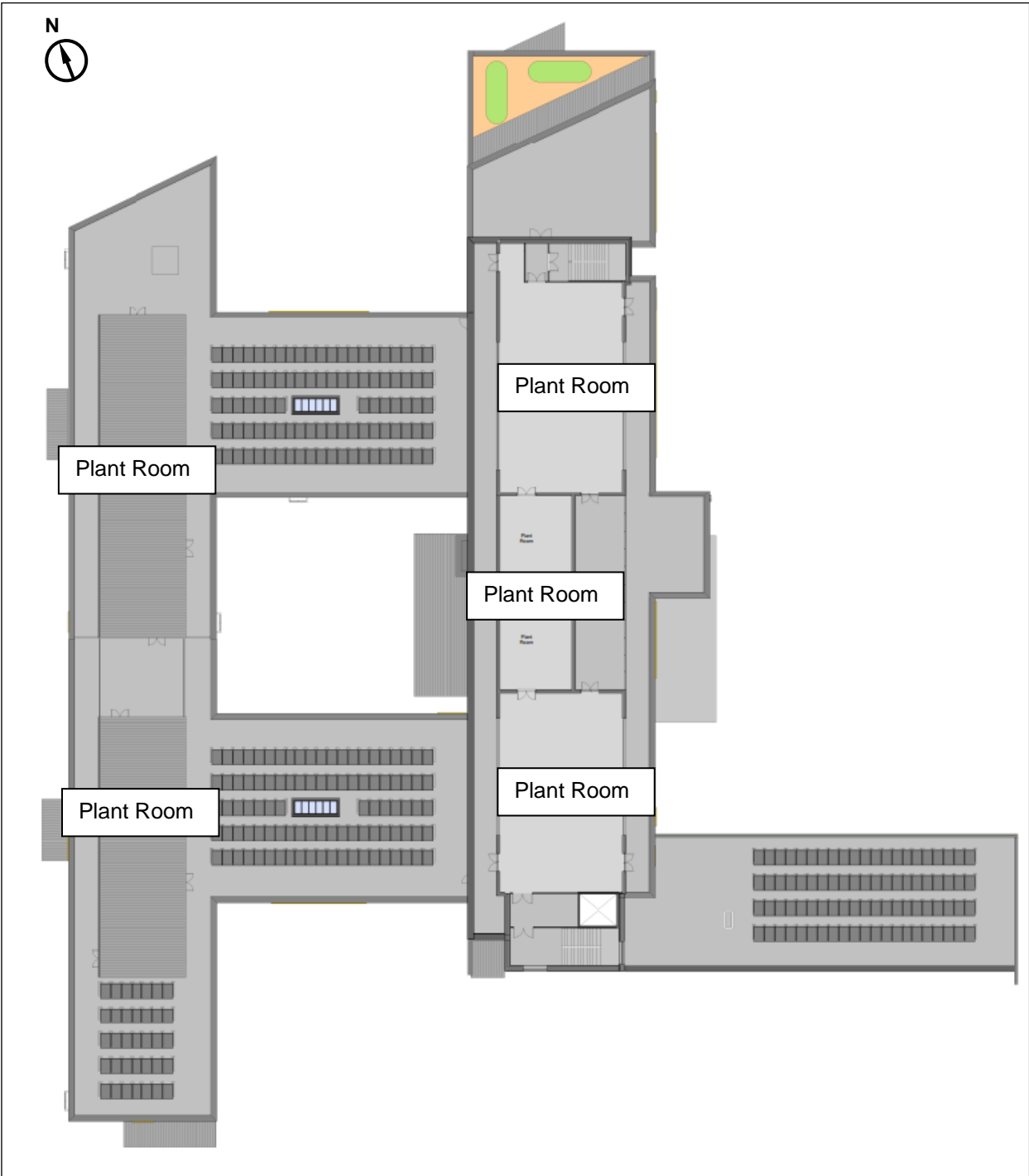
- 7.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by BAM Construction Limited to undertake a baseline noise survey and noise assessment for planning purposes, in relation to the proposed Adult and Older Persons Mental Health Unit at Glan Clwyd Hospital, Rhyl, Wales.
- 7.2 The nearest noise sensitive receptor (NNSR) would be the Faenol Fawr Country House & Manor Hotel, which is about 200m to the north of the proposed scheme.
- 7.3 The noise assessment has been based on guidance provided in BS 4142-2014+A1-2019 '*Methods for rating and assessing industrial and commercial sound*' (BS4142) and Department of Health's Special Services '*Health Technical Memorandum 08-01: Acoustics*' (HTM 08-01).
- 7.4 AEC measured a daytime and night-time background noise level of around 44dB_{LA90,15mins} and 38dB_{LA90,15mins}, respectively, representative of the NNSR.
- 7.5 Based on the arithmetic average of the measured night-time background noise levels, it is recommended that the free-field rating level from all new building services plant associated with the development should be controlled to no greater than 33dB_{LAr,Tr} external to the windows of the existing NNSR (Faenol Fawr Country House & Manor Hotel) to comply with the proposed planning noise limit.
- 7.6 Achieving this plant noise limit would give an indication of a low impact on the noise sensitive receptor, in accordance with BS4142 and it should not be particularly onerous to meet this limit. However, it will likely require standard design/mitigation measures to be incorporated.
- 7.7 In terms of the site suitability, although not strictly a planning requirement, the proposed development site has been surveyed and, in terms of noise, it is considered suitable for development of the proposed noise sensitive uses, including offices and assessment rooms.
- 7.8 Based on Table 4.1, the AEC proposed external noise level limit in the garden areas can be comfortably achieved. The building can be ventilated via open windows on all elevations and with standard acoustic glazing the required internal noise limits can also be achieved.
- 7.9 Based on the above assessment, and the implementation of the standard noise mitigation measures, noise should not be considered a determining factor in relation to the planning permission being sought for the proposed development.

FIGURE 1 – Existing Site Showing Monitoring Locations



Imagery ©2021 Bluesky, Infoterra Ltd & COWI A/S, Getmapping plc, Maxar Technologies, Map data ©2021 United Kingdom

FIGURE 3 – Proposed Site Layout showing Roof top Plant Rooms



APPENDIX A – Acoustic Terminology in Brief

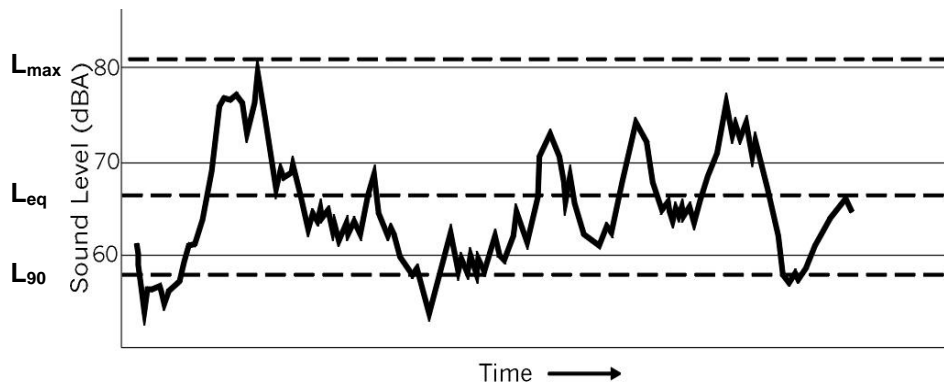
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most sound is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The *dBA* weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a *dB* descriptor in the report e.g. $L_{Aeq,T}$ could be written $dB_{L_{Aeq,T}}$



Example of Sound Level Varying With Time

$L_{Aeq,T}$ The equivalent continuous (A-weighted) sound level. It may be thought of as the “average” sound level over a given time, *T*. It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the “ambient” noise level.

$L_{A10,T}$ The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise.

$L_{A90,T}$ The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.

L_{Amax}	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
Façade Level	This refers to the sound level measured outside, at 1m from a hard reflecting surface, typically 3dB greater than the free-field level.

Other Acoustics Units

R_w	Single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
R_w + C_{tr}	Single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element (normally windows) over a range of frequencies, typically 100-3150Hz, adjusted to adjusted by a spectrum adaptation to provide the reduction of traffic noise.
RT	The RT (Reverberation Time) of a space is defined as the time it takes for the sound pressure level to reduce by 60dB. It is not always possible to measure the full 60dB decay, so the first 20dB decay (T ₂₀) or 30dB decay (T ₃₀) is used to approximate the reverberation time (T ₆₀)
D_{n,e,w}	Weighted element-normalised level difference. Single number rating used to describe the sound insulation performance.

APPENDIX B – Noise Survey Details

Date & Time of Survey:	Thursday 6 May 2021, 1730 to 1830h. Thursday 6 May 2021, 2300h to 0115h, Friday 7 May 2021. Friday 7 May 2021, 0930 to 1230h.					
Personnel:	Naveen Ramesh Simha (AEC).					
Equipment Used:	Cirrus CR:171B Real Time Analyser (AEC Kit 3).					
Calibration:	The sound level analysers, which conforms to BS EN 61672-1: 2013 ' <i>Electroacoustics – Sound level meters - Part 1 Specifications</i> ' for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request.					
Weather Conditions:	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	06/05/2021	Day	Dry	8°C	North-Westward and 4 m/s	70%
	06/05/2021	Night	Dry	5°C	Westward and 3 m/s	90%
	07/05/2021	Day	Dry	9°C	North-Westward and 3 m/s	70%
Measurement Locations:	Measurements were undertaken at three locations around the development site. Identified as A to C on Figure 1 and described below. A – To the north-east of the helipad. B – To the south-western boundary of the Site. C – To the south of the Site representing residences on Ffordd Parc Castell.					
Measurement Details:	Measurements were undertaken over various periods in terms of L_{eq} , L_{10} , L_{90} , and L_{max} .					
Façade / Free-Field:	A to C - free-field.					
	Full results for the attended measurements are given in Tables B1 and B2.					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					

TABLE B1 – Measured Daytime Noise Levels

Location	Date	Period, h	Noise Level, dB				Comments
			L _{Aeq}	L _{A10}	L _{A90}	L _{Amax, F}	
A	06/05/2021	1737 – 1752	52.0	48.2	43.5	77.5	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to car pass by on the Hotel Road.
	07/05/2021	0948 – 1003	48.9	47.7	44.3	72.7	
	07/05/2021	1042 – 1057	51.4	49.1	43.3	78.4	
B	06/05/2021	1756 – 1811	47.7	48.5	46.8	59.6	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to hospital activity.
	07/05/2021	1005 – 1020	48.2	49.0	45.9	66.0	
	07/05/2021	1100 – 1115	46.7	47.7	44.9	56.9	
C	06/05/2021	1816 – 1831	47.2	48.6	45.6	55.3	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to hospital activity.
	07/05/2021	1023 – 1038	47.4	48.8	45.5	60.6	
	07/05/2021	1117 – 1132	46.3	47.7	44.2	60.5	

TABLE B2 – Measured Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L _{Aeq}	L _{A90}	L _{Amax, F}	
A	2300 – 2315	40.6	38.8	47.5	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to car pass by on the Hotel Road.
	2351 – 0006	41.4	39.2	53.3	
	0040 – 0055	38.8	37.3	50.2	
B	2316 – 2331	45.1	44.3	54.7	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to hospital activity.
	0007 – 0022	44.3	43.4	58.5	
	0056 – 0111	44.8	44.0	51.5	
C	2333 – 2348	44.0	42.8	58.5	Ambient noise level due to distant road traffic noise and plant noise from existing hospital buildings. Maximum noise level due to hospital activity.
	0023 – 0038	44.3	43.1	56.2	