



BAM CONSTRUCTION LIMITED

NUCLEAR MEDICINE – GLAN CLWYD HOSPITAL

NOISE ASSESSMENT FOR PLANNING PURPOSES

2 May 2023

AEC REPORT: P4858/R1/NRS

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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 Nuclear Medicine building at Glan Clwyd Hospital, Wales.
- 1.2 The proposed Nuclear Medicine building will include a gamma camera and PET CT scan facility with associated ancillary rooms. The external building services plant will be located on the roof.
- 1.3 This noise assessment report provides the following:
 - Noise criteria for external plant noise emissions;
 - Guidance on internal noise level limits;
 - Findings of a baseline noise measurement survey;
 - Assessment of building services plant noise limits, and
 - Site suitability assessment.
- 1.4 Acoustic terminology is discussed in brief in Appendix A.

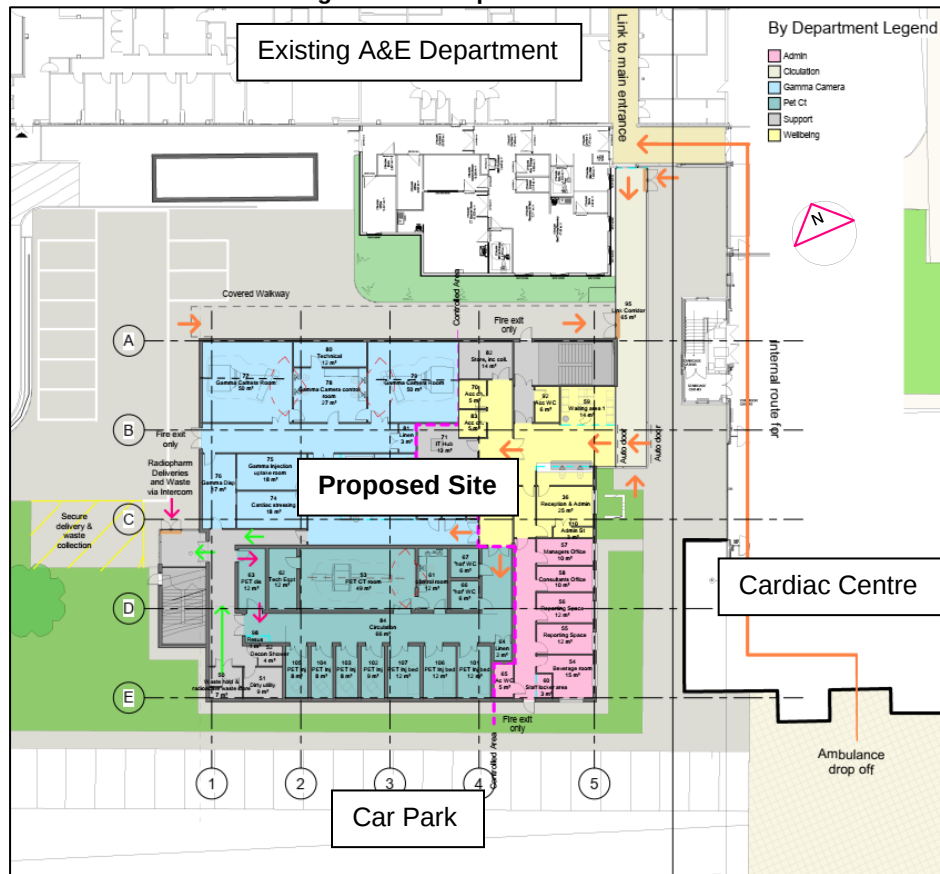
CDM Regulations

- 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 is bound by the existing A&E building to the north, cardiac centre to the east, car park to the south and access way (to the A&E) to the west. A proposed site plan is presented in Figure 2.1, below.
- 2.2 The nearest noise sensitive receptors (NNSR) to the site are located about 95m and 110m to the south-west of the site on Rhodfa Flint.
- 2.3 As mentioned above, the proposals are to construct a single storey Nuclear Medicine building which will house a gamma camera and PET CT scan facilities along with their associated ancillary rooms. There is a plant room and external plant compound located on the roof.

Figure 2.1 – Proposed Site Plan



3.0 BASIS OF ASSESSMENT

Policy and Guidance

- 3.1 The Planning Policy Wales, 2021 (PPW), 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’, Oct 1997, 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.

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' ($dB_{L_{A,T,r}}$) is obtained by applying a character correction to the 'specific noise level' ($dB_{Aeq,T,r}$) 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.

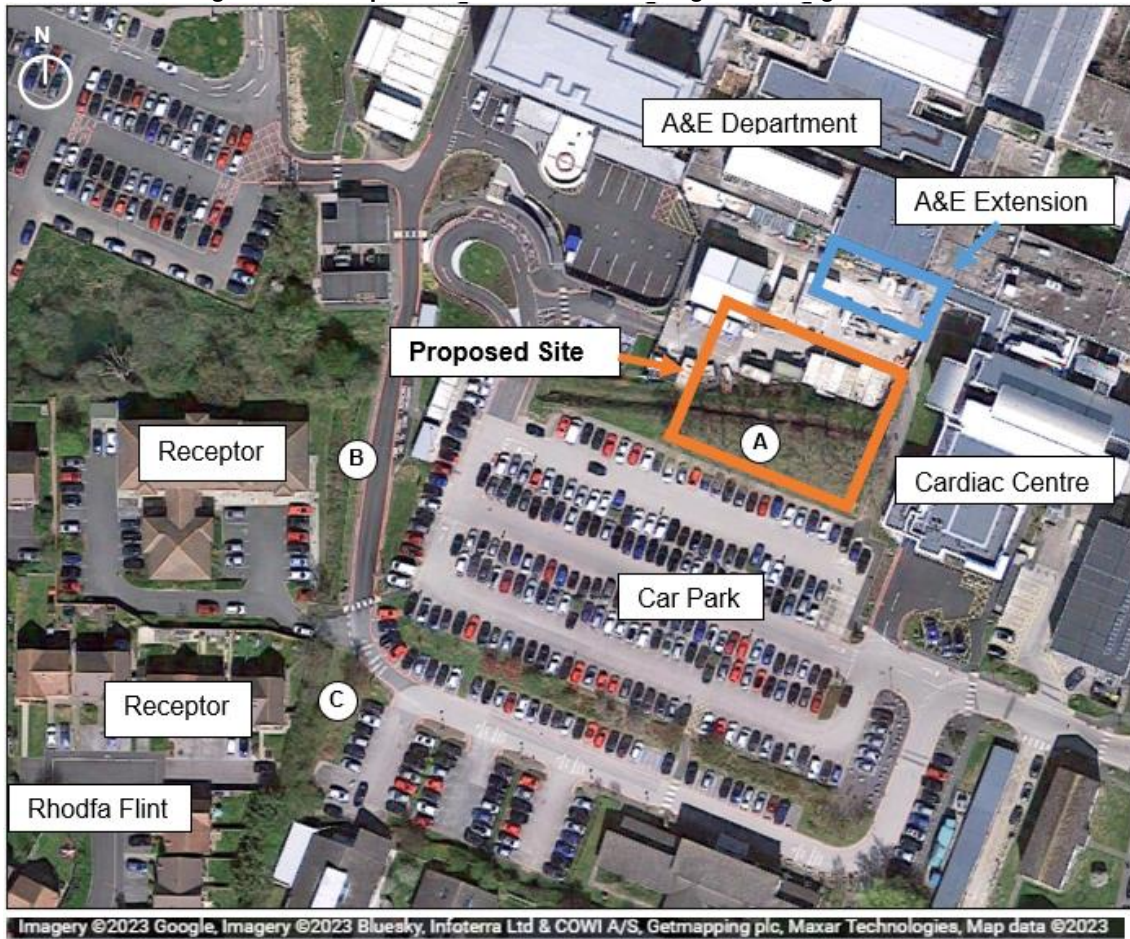
Table 3.1 – Maximum Allowable Internal Noise Levels (HTM 08-01)

Room type	External Sources, dBL _{Aeq,1h}	Mechanical services noise (NR)
Operating theatres (<i>For various scanning rooms, excluding noise from the operation of the scanners</i>)	40	40
Small offices and meeting rooms (<i>e.g. consulting, private office, small treatment, interview, small seminar</i>)	40	35
Public Areas (<i>waiting, dining, playroom</i>)	50	40
Public and staff toilet and shower	55	45

4.0 BASELINE NOISE SURVEY

- 4.1 AEC attended site on Monday 27 and Tuesday 28 March 2023 to undertake external noise level measurements. Daytime measurements were undertaken on Monday between approximately 1430 and 1700h. Night-time measurements were undertaken on Monday 27 March 2023, from 2300h until 0100h on Tuesday 28 March 2023.
- 4.2 All measurements were undertaken under free-field conditions and in general accordance with BS7445-1: 2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*' and HTM 08-01. A full measurement procedure for the survey is presented in Table B.1 of Appendix B and the measured data is presented in Tables B.2 and B.3.
- 4.3 Both daytime and night-time noise measurements were undertaken at three locations around the development site identified as A to C on Figure 4.1, below.
- 4.4 Locations B and C were representative of the NNSR's at Rhodfa Flint, whereas Location A was chosen to represent baseline noise level affecting the proposed development.

Figure 4.1 – Proposed Site Location Showing Monitoring Locations



- 4.5 The noise climate at locations A, B and C was dominated by constant mechanical building services noise associated with the existing hospital buildings and noise from cars entering and leaving the car park.
- 4.6 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

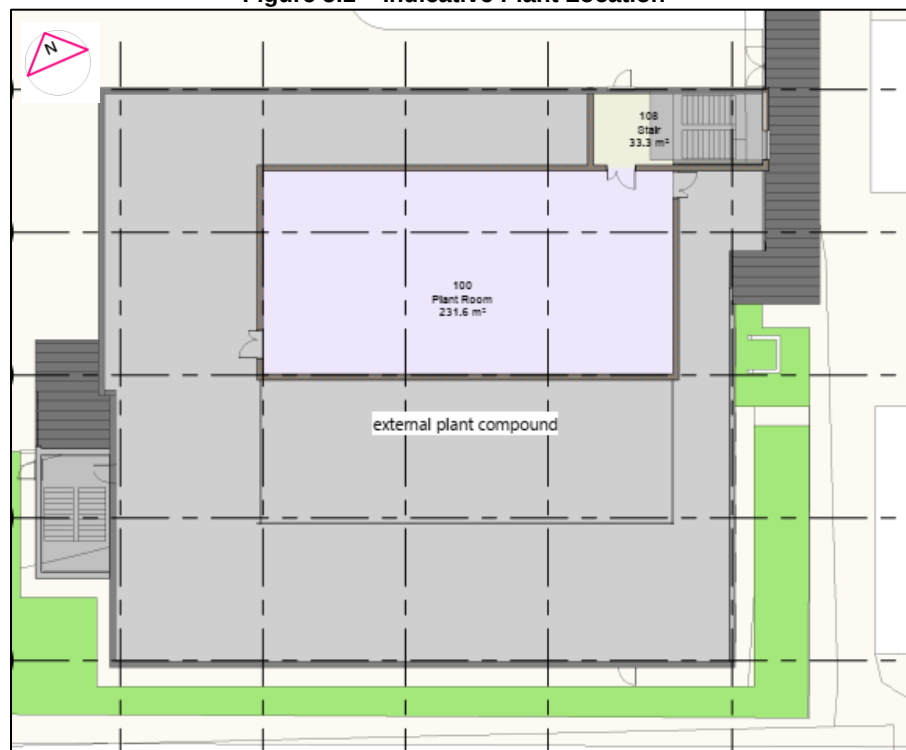
Location	Measure Noise Level, dB			
	Day (0700-2300)		Night (2300-0700)	
	L _{Aeq,15mins}	L _{A90,15mins}	L _{Aeq,15mins}	L _{A90,15mins}
A	47	43	48	44
B	48	44	48	44
C	47	42	47	43

- 4.7 The average noise levels have been determined from the above to represent the daytime and night-time ambient (dB_{LAeq}) noise levels affecting the proposed site. However, the lowest measured background values have been taken to represent the background noise levels in the night-time period at the nearest noise sensitive receptors.
- 4.8 Noise from existing ambulance sirens 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.

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 a plant room and external plant compound located on the roof, as indicated on Figure 5.1, below.

Figure 5.1 – Indicative Plant Location



- 5.2 The nearest noise sensitive receptors would be the residences on Rhodfa Flint, which are approximately 95m to 110m to the south-west 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 external plant items to be installed.

- 5.4 Therefore, based on the lowest measured background noise level of $42\text{dBL}_{\text{A90,15mins}}$ representative of the residences on Rhodfa Flint, the free-field total rating level from all building services plant combined should be controlled to **no greater than $37\text{dBL}_{\text{Ar,Tr}}$ external to the residence** to comply with the proposed planning noise limit.
- 5.5 As an indicative example, based on a clear line of sight and a distance of 95m, from the nearest part of the proposed development to the NNSR, rating noise from all plant items combined would need to be limited to around $67\text{dBL}_{\text{Ar,Tr}}$ at 3 metres.
- 5.6 This limit is indicative only and should not be applied to individual plant items, as lower limits could be required from individual noise sources. Higher limits could also be acceptable for specific noise sources where there is additional attenuation due to distance, acoustic screening i.e. from the building, or an enclosure etc. This will require further development.
- 5.7 It is assumed that the rating level would not require any acoustic character correction. This is based on the plant noise being relatively consistent, broadband, and similar to the existing plant noise from the hospital site.
- 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 cardiac center and inside the noise sensitive areas of the proposed development itself. This will not be overly onerous and should be acceptable based on not exceeding the above limit, 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 in terms of internal noise levels is provided below.
- 6.2 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 3.1 above, external noise levels should not typically exceed $55\text{dBL}_{\text{Aeq,T}}$ from external sources.
- 6.3 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. However, it is likely that internal areas will be mechanically ventilated, therefore, suitable internal noise levels (compliant with HTM 08-01) will be achieved with a standard thermal double glazing with a sound insulation performance of around $30\text{dBR}_w / 25\text{dBR}_{w+C_{tr}}$.
- 6.4 This may require further consideration as the design develops and building services plant noise associated with the development, is assessed in detail.

- 6.5 With respect to noise from building services plant affecting the noise sensitive rooms of the proposed building, 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.
- 6.6 Therefore, in terms of noise, the site is considered suitable for development of noise sensitive uses, including scanning facilities and associated ancillary rooms.

7.0 SUMMARY & CONCLUSIONS

- 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 Nuclear Medicine building at Glan Clwyd Hospital, Wales.
- 7.2 The nearest noise sensitive receptors (NNSR) to the site are located about 95m and 110m to the south-west of the site on Rhodfa Flint.
- 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 background noise levels in the range of 42-46dB_{LA90,15mins}, representative of the NNSR throughout the day and night-time periods.
- 7.5 Based on the lowest measured 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 37dB_{LA_r,Tr} external to the windows of the NNSR 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 scanning facilities and associated ancillary rooms.
- 7.8 The building can be ventilated via partially open windows on all elevations, if required, however, assuming mechanical ventilation throughout, then standard thermal double-glazed windows would be sufficient to meet the internal noise limits.
- 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.

APPENDIX A – Acoustic Terminology in Brief

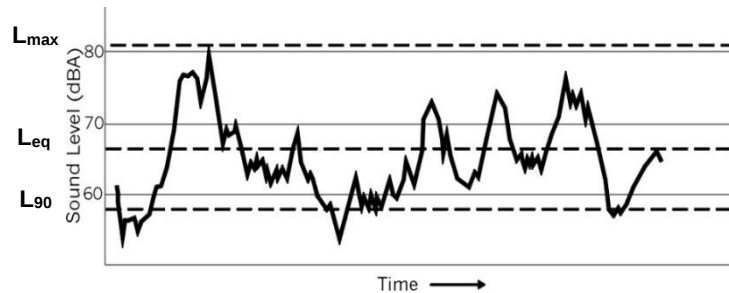
General

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 noise 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 emphasizes or reduces the importance of certain frequencies within the audible range

Sound / Noise Units

The figure below shows an example of sound level varying with time. Because of this variation over time the same period of noise can be described by several different levels. The most common of these are described below.



Commonly Used Descriptors for Sound / Noise

$L_{Amax,F/S}$	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
$L_{Aeq,T}$	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. It can be considered as the "ambient" noise level.
$L_{A90,T}$	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe the "background" noise.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.

Other Common Acoustics Descriptors

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.
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R'_w	Apparent sound reduction index - Single number rating used to describe the sound reduction index of an on-site construction over a range of frequencies, typically 100-3150Hz.
C_{tr}	A road traffic spectrum adaptation term which is used to describe the low frequency sound insulation performance of building elements.
BS4142 Descriptors	
Ambient Sound Level, L_{Aeq, T}	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.
Background Sound Level, L_{A90}	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.
Rating Level, L_{Ar, Tr}	Specific sound level plus any adjustment for the characteristic features of the sound
Residual Sound, L_{Aeq, T}	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Specific Sound Level, L_{Aeq, Tr}	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, <i>r</i> .

APPENDIX B – Noise Survey Details

Table B.1 – Measurement Procedure

Date & Time of Survey:	1430 to 1700h on Monday 27 March 2023. Monday 27 March 2023, 2300h till 0100h, Tuesday 28 March 2023.					
Personnel:	Naveen Ramesh Simha (AEC).					
Equipment Used:	B&K 2260 Real Time Analyser (AEC Kit 2).					
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
	27/03/2023	Day	Dry	8°C	North-westerly and 2 m/s	65%
		Night	Dry	6°C	Southerly and 2 m/s	95%
Measurement Locations:	Measurements were undertaken at three locations around the development site. Identified as A to C on Figure 1 and described below. A – Representative of the Southern Façade of the Development. B & C – Representative of the Nearest Noise Sensitive Receptors.					
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 B.2 and B.3.					
Measured Data:	Full octave band centre frequency data was obtained for all measurements.					

Table B.2 – Measured Daytime Noise Levels

Location	Period, h	Noise Level, dB				Comments
		L _{Aeq}	L _{A10}	L _{A90}	L _{Amax, F}	
A	1430 – 1445	46.5	48.3	42.6	64.2	Ambient noise level due noise from car park and plant noise from existing hospital buildings.
	1522 – 1537	48.2	49.3	44.5	63.5	
	1612 – 1627	45.8	46.3	42.2	64.9	
B	1447 – 1502	48.1	47.2	43.7	68.7	
	1538 – 1553	46.6	48.1	44.4	62.3	
	1629 – 1644	48.0	48.1	44.4	67.7	
C	1505 – 1520	47.3	50.1	42.1	60.4	
	1555 – 1610	45.2	47.5	41.8	56.5	
	1645 – 1700	47.2	49.2	41.7	63.0	

Table B.3 – Measured Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L _{Aeq}	L _{A90}	L _{Amax, F}	
A	2300 – 2315	48.8	45.7	64.2	Ambient noise level due noise from car park and plant noise from existing hospital buildings. Maximum noise level due to car entering / leaving the car park.
	2343 – 2358	48.1	43.9	60.3	
	0026 – 0041	47.5	44.7	57.8	
B	2316 – 2331	48.6	45.3	59.0	
	2359 – 0014	49.2	44.2	68.4	
	0042 – 0057	45.7	41.5	56.3	
C	2332 – 2342	47.7	43.6	56.9	
	0015 – 0025	47.9	44.3	60.9	
	0058 – 0103	48.1	44.6	56.1	