ROYAL FREE HOSPITAL CSB TRANSFORMER

Plant Noise Assessment

Reference: 14047.RP01.PNA.0
Prepared: 14 February 2025
Revision Number: 0

Playfords
18 Blackstone Road
Huntingdon
Cambridgeshire
PE29 6EF

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Revision	Comment	Date	Prepared By	Approved By
0	First issue of report	14 February 2025	Robert Gurney	Russell Richardson

Terms of contract:

RBA Acoustics Ltd have prepared this report in accordance with our Scope of Work 14047.SW01.0 dated 25 October 2024. RBA Acoustics Ltd shall not be responsible for any use of the report or its contents for any purpose other than that for which it was provided. Should the Client require the distribution of the report to other parties for information, the full report should be copied. No professional liability or warranty shall be extended to other parties by RBA Acoustics Ltd without written agreement from RBA Acoustics Ltd.

The recommendations within this report relate to acoustics performance only and will need to be integrated within the overall design by the lead designer to incorporate all other design disciplines such as fire, structural integrity, setting-out, etc. Similarly, any sketches appended to this report illustrate acoustic principles only and will need to be developed into full working drawings by the lead designer to incorporate all other design disciplines.

RBA ACOUSTICS

LONDON
44 Borough Road
London, SE1 0AJ
T. +44 (0) 20 7620 1950

MANCHESTER
Bloc, 17 Marble Street
Manchester, M2 3AW
T. +44 (0) 161 661 4504

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1. INTRODUCTION

It is proposed to locate new items of plant at the Royal Free Hospital (RFH), London. As part of the planning application, Camden Council requires consideration be given to atmospheric noise emissions from the proposed equipment to the nearest noise-sensitive receptors.

RBA Acoustics has been commissioned to undertake measurements of the prevailing noise conditions at the site and to determine the atmospheric noise emission limits in accordance with Camden Council's typical requirements. This report presents the results of the noise measurements and associated criteria, and provides the required assessment.

2. SITE DESCRIPTION

The site is shown in relation to its surroundings in the site plan in Figure 1 (Appendix E).

The site is an existing hospital building overlooking Rowland Hill Street, approximately 300 m south of Hampstead Heath underground station and approximately 230 m north of Belsize Park underground station. The hospital site spans approximately a 230 m radius with areas serving both medical and educational purposes. The area subject to assessment is the Royal Free Hospital School of Medicine which is located on the southwest boundary of the site.

The nearest noise-sensitive receptors (NSRs) are residential properties in Belle Vue, Hampstead, located approximately 18 m west from the RFH School of Medicine, with existing plant on the eastern boundary of the school's roof as well as on the rooftops of the adjacent hospital buildings to both the north and south.

The dominant noise source at the site was noted to be noise from existing plant servicing the hospital, with traffic noise from the surrounding road network also apparent.

3. ENVIRONMENTAL NOISE SURVEY

3.1 Survey Methodology

Monitoring of the prevailing background noise was undertaken over the following period:

- 12:00 Thursday 12 December to 11:00 Monday 16 December 2024.

As the survey was unattended it is not possible to comment with certainty regarding meteorological conditions throughout the entire survey period. However, based on observations during the site visits and weather reports for the area, conditions were generally considered suitable for obtaining representative noise measurements, being predominantly dry with little wind.

Measurements were made of the L_{A90}, L_{Amax} and L_{Aeq} noise levels over 15-minute sample periods. A summary of acoustic terminology is included in Appendix A.

3.2 Measurement Position

To determine the existing noise climate around the site measurements were undertaken at the following location:

- *Measurement Position 1 – West Façade*
  The measurement position was located approximately 19 m to the east of the nearby residential receptors. The meter was secured to the western façade of the School of Medicine building by an A-frame, 1m from the façade and approximately 0.5m below roof level. This location was chosen to obtain noise data which is representative of the noise levels at the NSR.

The measurement position is also illustrated on the site plan attached in Figure 1 and photos in Figure 2 (Appendix E).

3.3 Instrumentation

For information regarding the equipment used for the measurements please refer to Appendix B.

The sound level meter was calibrated both prior to and on completion of the survey with no significant calibration drift observed.

3.4 Survey Noise Levels

The noise levels measured are shown as time-histories on the attached Graphs 1-2 (Appendix E).

Selection of an appropriately representative background sound level is discussed in BS 4142:2014 *Methods for Rating and Assessing Industrial and Commercial Sound* as follows:

> *"In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed.*
>
> *[...] A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value."*

Graph 3 in Appendix E presents the range of background sound levels measured and, on this occasion, the lowest background level has been chosen to ensure a worst-case assessment.

The representative background L_{A90} and the period averaged L_{Aeq} noise levels measured are summarised in Table 1.

Table 1 - Measured Baseline Noise Levels

Measurement Period	Measurement Position 1 (MP1) – West Façade	
	Lowest Background Noise Level $L_{A90,15min}$ (dB)	Period-Averaged Noise Level $L_{Aeq,T}$ (dB)
Daytime (07:00 – 23:00)	53	60
Night-time (23:00 – 07:00)	52	54

4. PLANT NOISE CRITERIA

The requirements of Camden Council's Environmental Health Department regarding new building services plant are understood to be as follows.

> *"[...] it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases, a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)."*

Transformers typically exhibit tonal characteristics and we therefore consider it appropriate to impose the additional 5dB penalty required by LB Camden.

In line with the above requirements, we propose items of mechanical services be designed so that noise emissions from the plant do not exceed the following levels when assessed at the nearest noise sensitive location:

Table 2 – Plant Noise Limits at NSR

Assessment Period	Plant Noise Criteria to be achieved at 1m outside the window of the nearest Noise-Sensitive Receptor (NSR), L_{Aeq} (dB)
	NSR Belle Vue, Hampstead
Daytime (07:00 – 23:00)	38
Night-time (23:00 – 07:00)	37

It should be noted that the above requirements are applied at the nearest residential adjacencies and alternative criteria should be incorporated if there are also commercial properties affected by the proposed plant installations.

5. PLANT NOISE ASSESSMENT

This assessment has been based on the information provided to RBA Acoustics by Playfords and is described in the following sections.

5.1 Proposed Plant Items

The following plant is proposed for the scheme:

Table 3 – Proposed Plant Items

Ref.	Manufacturer/Model/Duty	Plant Type	Plant Data (L_P at 1m (dBA))
TR1	Unknown	Transformer	68

5.2 Plant Locations

The transformer is proposed to be located on the roof of the Medical School, approximately 6 m from the roof edge and approximately 24 m from the nearest noise-sensitive receptors.

The equipment positions are indicated on the site plan in Figure 1 in Appendix E.

5.3 Noise-Sensitive Receptor (NSR)

Based on observations made on site and discussions with the design team we understand the nearest noise-sensitive receptor to the proposed plant to be as follows:

- *NSR1 – Belle Vue, Hampstead*
  The nearest noise sensitive receptor to the proposed transformer is the eastern façade of the residential Belle Vue, Hampstead building. It is located approximately 24 m from the proposed transformer location.

The receptor is shown in the site plan in Figure 1 in Appendix E.

5.4 Enclosure

After correspondence with Playford's, the project building services consultants, we understand the transformer will be housed in an enclosure made of 18mm plywood encased in GRP. We have therefore included an additional insertion loss for the enclosure.

5.5 Predicted Noise Levels at NSR

Our calculation method for predicting noise levels from the proposed external plant at the nearest noise-sensitive receptors, based on the information above, is summarised below.

- Source Term SPL
- Enclosure loss
- Screening
- Distance Attenuation
    - As the transformer/enclosure is large relative to the distance to the NSR, the Rathe distance loss method is used as a worst-case assessment procedure

Calculation sheets are attached for further information in Appendix C.

The results of the calculations indicate the following noise levels at the nearest affected residential windows:

Table 4 – Predicted Plant Noise Levels

Operating Period	Noise Level (dB) at NSR – Belle Vue, Hampstead	
	Prediction	Criterion
Daytime (07:00 – 23:00)	33	38
Night-time (23:00 – 07:00)	33	37

Noise from the new transformer is predicted to be within the LB Camden criteria for both daytime and night-time periods.

6. VIBRATION CONTROL

In addition to the control of airborne noise transfer, it is also important to consider the transfer of noise as vibration to adjacent properties (as well as to any sensitive areas of the same building).

We would typically advise that transformers be isolated from the supporting structure by means of either steel spring isolators or rubber footings. For particularly sensitive locations, or when on lightweight structures the mounts should ideally be caged and be of the restrained type.

It is important the isolation is not "short-circuited" by associated pipework or conduits. To this end, any conduits should be looped and flexible connectors should be introduced between the condenser and any associated pipework. Pipework should be supported by brackets containing neoprene inserts.

7. CONCLUSION

RBA Acoustics has undertaken noise monitoring at the Royal Free Hospital and the measured noise levels are presented within this report. The resultant noise levels have been used to determine the required criteria for atmospheric noise emissions from the proposed plant installations, including corrections for tonality.

The results of the assessment indicate atmospheric noise emissions from the proposed plant are within the daytime and night-time criteria typically required by Camden Council. As such, the proposed plant installations should be considered acceptable in terms of noise impact to nearest noise-sensitive receptors.

Appendix A - Acoustic Terminology

A-weighting (e.g. dB(A))	A correction applied across the frequency bands to take into account the response of the human ear, and therefore considered to be more representative of the sound levels people hear.
DeciBel (dB)	Unit used for many different acoustic parameters. It is the logarithmic ratio of the level being assessed to a standard reference level.
L_{eq}	The level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
$L_{Aeq,T}$	The A-weighted level of a notional steady sound which, over a stated period of time, T, would have the same acoustic energy as the fluctuating noise measured over that period. Typically used to represent the average or ambient noise level.
L_{An} (e.g. L_{A10}, L_{A90})	The sound level exceeded for n% of the time. E.g. L_{A10} is the A-weighted level exceeded for 10% of the time and as such can be used to represent a typical maximum level. Similarly, L_{A90} is the level exceeded for 90% of the measurement period, and is often used to describe the underlying background noise.
NR	Noise Rating – A single figure term to describe a measured noise level which considers the frequency content of the noise, generally used for internal noise level measurements (particularly mechanical services plant).

Appendix B - Instrumentation

The following equipment was used for the acoustic measurements.

Table B1 - Equipment Calibration Details

Manufacturer	Model Type	Serial No.	Calibration	
			Certificate No.	Valid Until
Norsonic Type 1 Sound Level Meter	Nor140	1407792	U45990	17 November 2025
Norsonic Pre Amplifier	1209	23227		
Norsonic ½“ Microphone	1225	469028	45989	17 November 2025
Norsonic Sound Calibrator	1255	125525797	U45988	17 November 2025

Appendix C - Plant Calculations

Table C1 - Example Calculation – TR1

Parameter	dBA
L_P at 1m	61
Screening	0
Distance losses at 24m (Rathe)	-20
Enclosure insertion loss	-16
Noise level at receiver	33

Appendix D - CDM Considerations

The Likelihood (**L**) the harm will occur can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Remote (almost never)
2 – Unlikely (occurs rarely)
3 – Possible (could occur, but uncommon)
4 – Likely (recurrent but not frequent)
5 – Very likely (occurs frequently)

The Severity of harm (**S**) can be assessed by applying an indicative score (from 1 to 5) as follows:

1 – Trivial (e.g. discomfort, slight bruising, self-help recovery)
2 – Minor (e.g. small cut, abrasion, basic first aid need)
3 – Moderate (e.g. strain, sprain, incapacitation for more than 3 days)
4 – Serious (e.g. fracture, hospitalisation for more than 24 hours, incapacitation for more than 4 weeks)
5 – Fatal (single or multiple)

The rating value is obtained by multiplying the two scores and is then used to determine the course of action.

Table D1- Risk Ratings

Rating Bands (Likelihood x Severity)		
Low Risk (1 – 8)	Medium Risk (9 -12)	High Risk (15 – 25)
May be ignored but ensure controls remain effective	Continue, but implement additional reasonable practicable controls where possible	Avoidance action is required; therefore alternative design solutions must be examined. Activity must not proceed until risks are reduced to a low or medium level

The following hazards pertinent to our design input have been identified and control measures suggested:

Table D2 – Risk Assessment

Hazard	Risk Of	At Risk	Rating			Control Measures	Controlled		
			L	S	R		L	S	R
Vibration Isolators	Injury to hands	Contractors	3	3	9	Care needs to be taken during adjustment. Follow manufacturers guidance	1	3	3

L: Likelihood S: Severity R: Rating

Appendix E - Graphs and Site Plans

Royal Free Hospital CSB Transformer

L_{Aeq} Time History

West Façade - Thursday 12 December to Monday 16 December 2024

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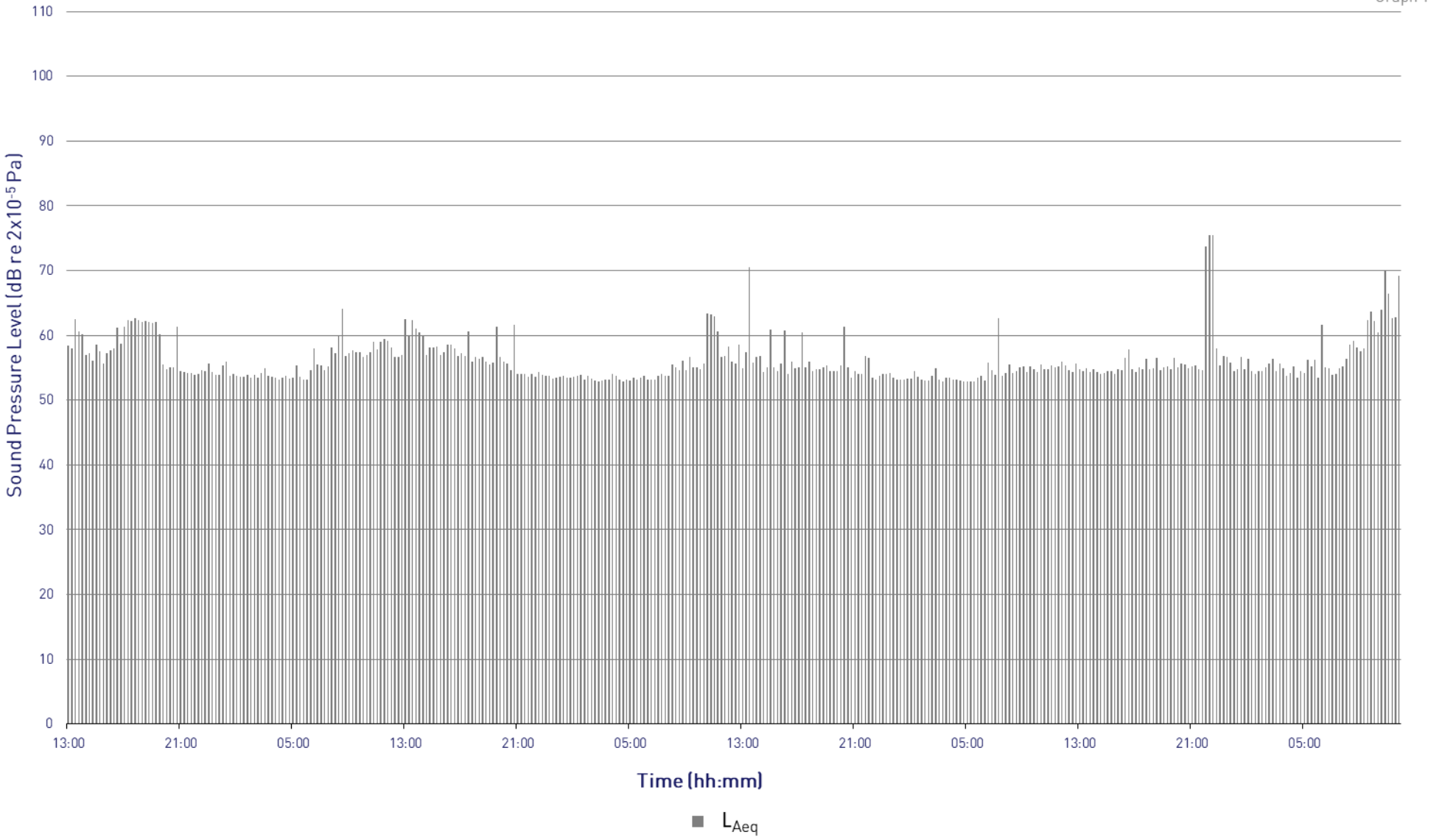
Graph 1



Royal Free Hospital CSB Transformer

$L_{Amax,f}$ and L_{A90} Time History

West Façade - Thursday 12 December to Monday 16 December 2024

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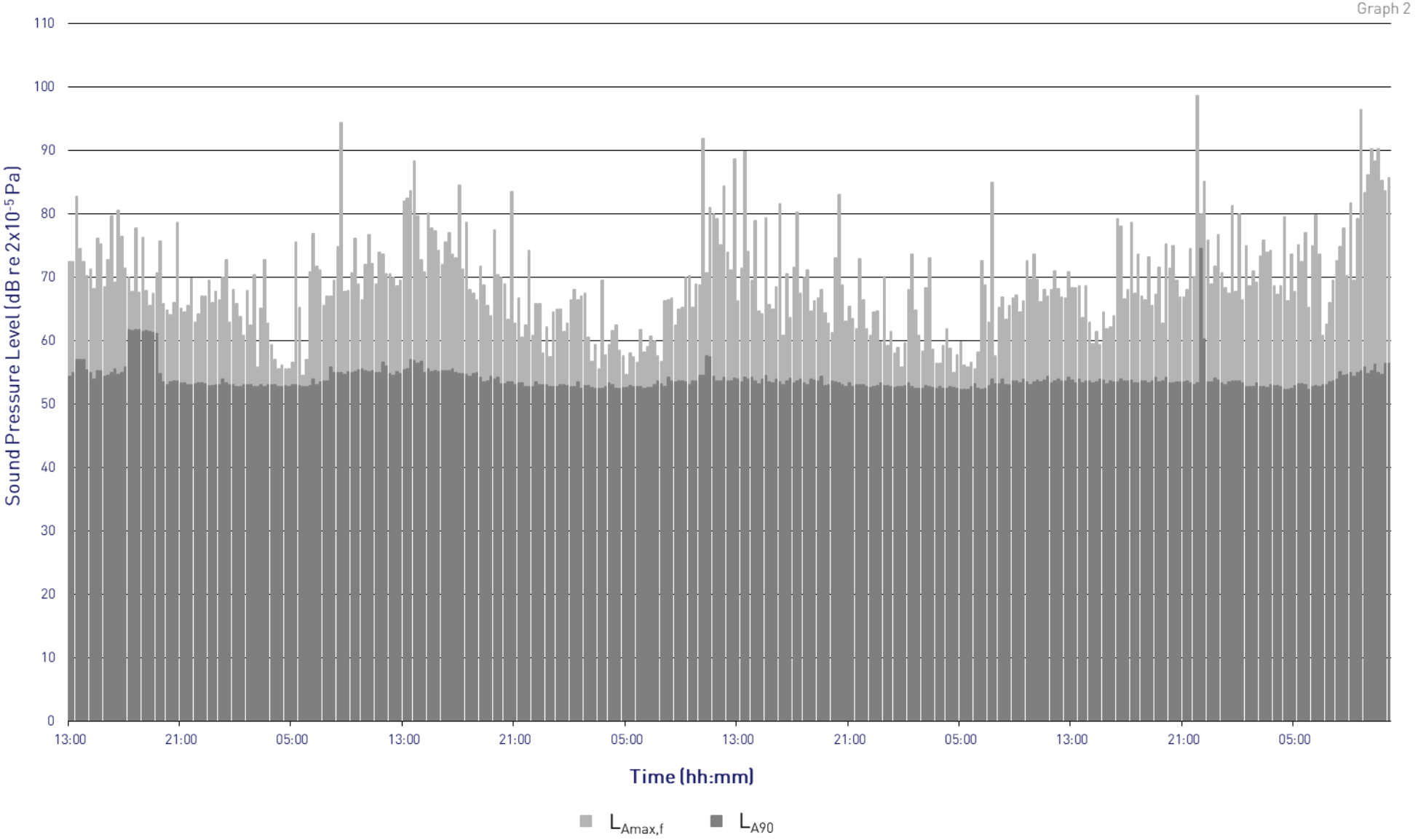
Graph 2



Royal Free Hospital CSB Transformer

$L_{A90,15\ minutes}$ Histogram

West Façade - Thursday 12 December to Monday 16 December 2024

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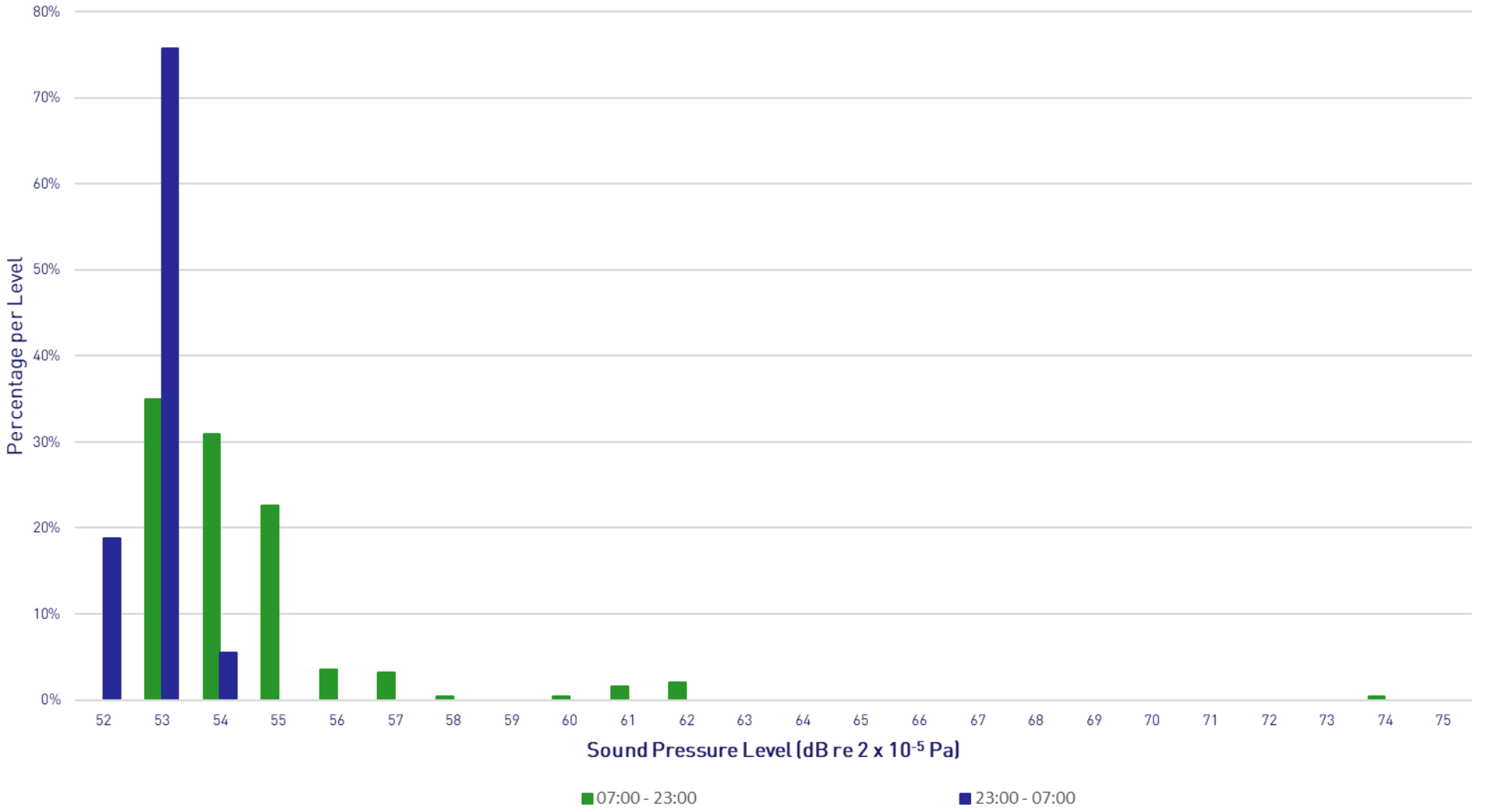
Graph 3



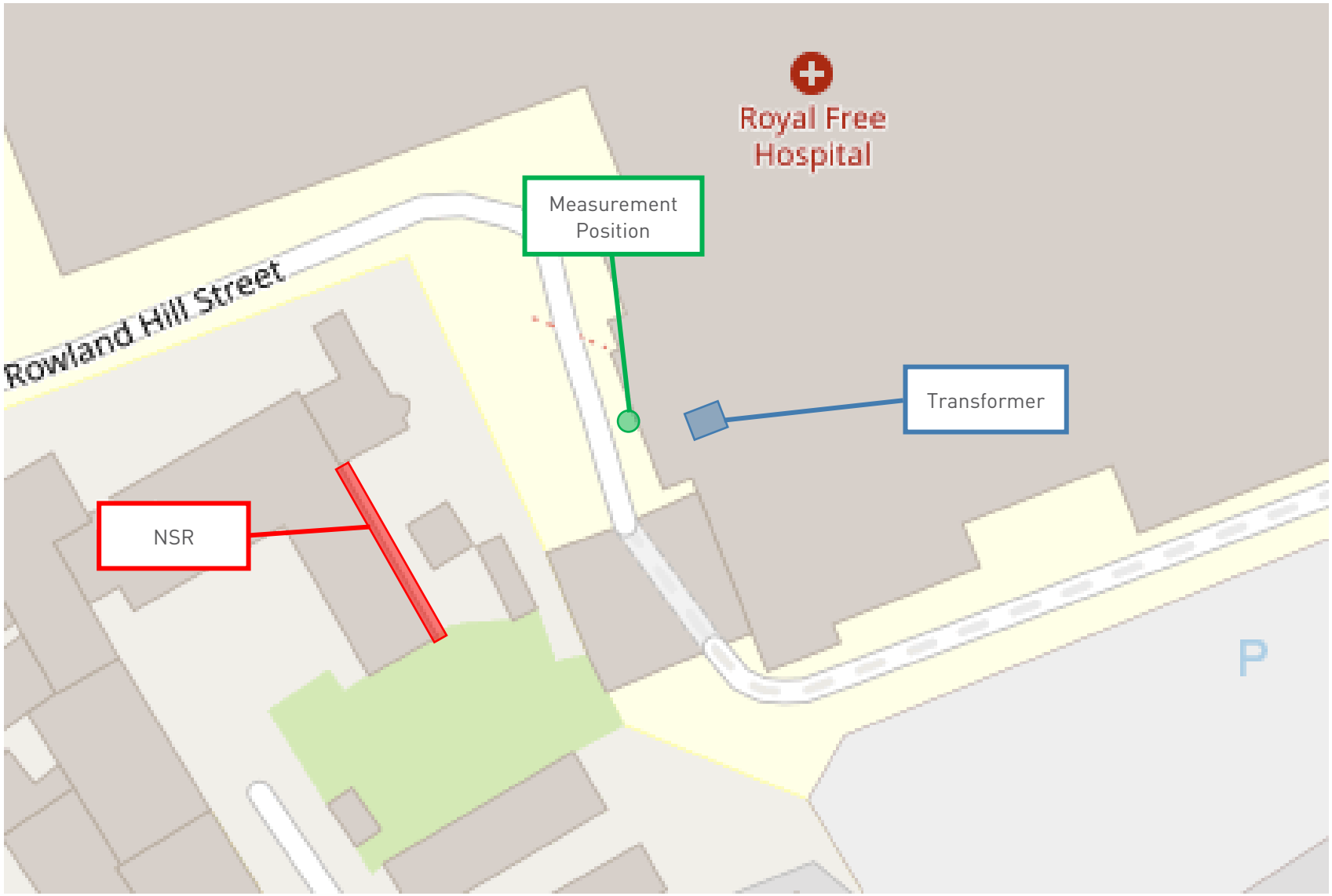


Figure 1 - Site Plan

Royal Free Hospital CSB Transformer

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Not to Scale

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Figure 2 – Photo of measurement position and NSR

Royal Free Hospital CSB Transformer

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Not to Scale

RBA ACOUSTICS

RBA ACOUSTICS
W. www.rba-acoustics.co.uk
E. info@rba-acoustics.co.uk

London:
44 Borough Road
London, SE1 0AJ
T. +44 (0) 20 7620 1950

Manchester:
Bloc, 17 Marble Street
Manchester, M2 3AW
T. +44 (0) 161 661 4504