VANGUARDIA

A BURO HAPPOLD COMPANY

Substation Noise Assessment

Wrexham University Substation

0065004-BHE-0001

0065004

5 August 2025

Revision P01

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Revision	Description	Issued by	Date	Checked
P01	Draft for comment	VP	05/08/2025	CG

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1 Introduction

Vanguardia has been commissioned by Wrexham Association Football Club to undertake a noise assessment for the installation of a substation and switch room on Wrexham University grounds. This assessment is written to discharge Condition 4 of planning permission WRR P/2023/0291 granted in 2023 by Wrexham County Borough Council (WCBC). The text from the planning condition is reproduced below:

> *Prior to the first use of any electricity substation installed in connection with the development hereby approved, an acoustic report assessing its impact upon amenity shall be submitted to, and approved in writing by, the Local Planning Authority. The report shall address the issue of noise (including low frequency noise) and vibration from the station to ensure that there is no loss of amenity to residential or commercial properties. The measures as are approved shall be fully implemented in strict accordance with the scheme prior to first use of the development and shall thereafter be retained as such.*

In order to discharge this planning condition, Vanguardia have. in absence of a specific methodology of assessment stated by WCBC, referred to national policy and guidance when considering the noise impact of the substation.

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2 Proposals and Guidance

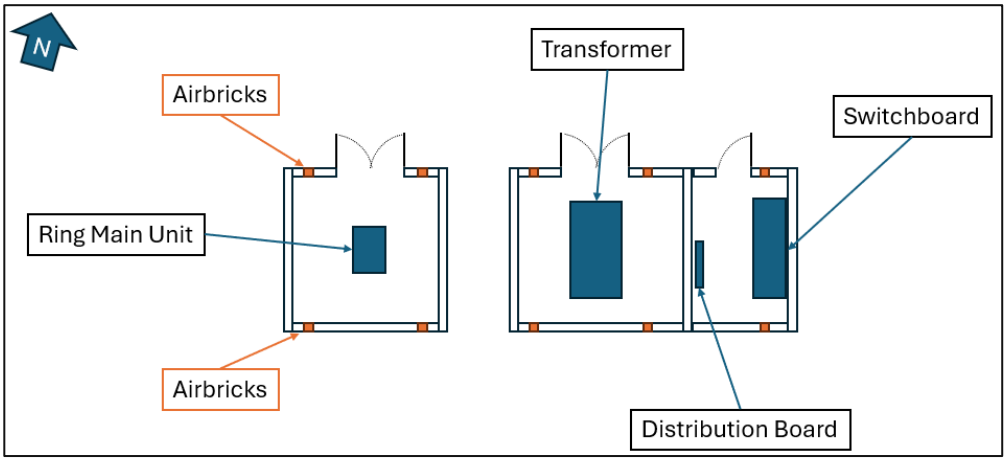
2.1 Substation Specifications

The development is made up of a Scottish Power Mains substation, along with a University Transformer & Switch Room. The buildings are to replace existing provision which is currently situated in the location of the proposed new Wrexham Football Club Kop Stand. As such, they are a direct replacement of the existing buildings, as detailed in the planning application.

The substation building will be made up of a concrete base and ceiling with supporting cavity walls and appropriately specified doors. Ventilation to the buildings will be airbricks positioned on the front and rear facades of the buildings. These airbricks, while appropriately specified for the building, will be the acoustically weakest points of the structure. As a result, predictions in this report are based on the noise break out from these elements only.

Figure 1 below presents the indicative layout of the plant rooms, with the key elements in each building.

Figure 1 Noise sources in each building



The dominant noise source in the buildings will be the distribution transformer. The transformer from the existing building will be moved to the new structure and is understood to be a model Schneider 500kVA 11/.433kV ONAN Distribution Transformer. To account for worst case, the source data from the transformer will be used as the main internal noise source for each building. Acoustic details of this unit are set out in the following sections and the propagation of noise from this unit are considered at the local receptors.

2.2 Relevant Guidance

BS 4142:2014+A1:2019 methods of rating and assessing industrial and commercial sound

BS 4142:2014+A1:2019 provides a method of rating and assessing sound of an industrial or commercial nature to determine the level of impact of the source at the receiver locations.

The standard indicates that certain features can increase the impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are discernible at the assessment location, a character correction should be added to the specific sound level to obtain the rating level.

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Once the specific sound level is corrected to the rating level, the representative background sound level is subtracted from the rating level to provide an initial estimate of the impact. The greater the difference, the greater the magnitude of the impact. The standard states that:

> A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
>
> A difference of around +5 dB is likely to be an indication of an adverse impact, dependant on the context.
>
> 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.
>
> 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.

The standard indicates that, while the difference between the rating level and the background sound level provides an initial estimate of the impact, the absolute noise levels should also be considered, as should the character and the level of the specific sound compared to that of the residual sound, and the façade sound insulation of the receptor.

Defra Research Report NANR45

As referred to in BS4142:2014+A1:2019 as reference to the assessment of low frequency noise, the Defra Research Report NANR45 (Procedure for the assessment of low frequency noise complaints) has been considered in relation to the potential noise impact from the substation. This document, published in 2011, provides a reference criterion curve that is typically referenced to indicate if low frequency impacts are likely to be an issue. As it is a guide to be used when considering potential nuisance it is not typically intended to be used at the planning stage, but has been referenced as an indicator.

NANR45 provides the following reference 1/3 octave band internal levels (known as the reference criterion curve) that are suggested thresholds to not exceed to be measured within receptors properties. These levels are also presented in 1/1 octave bands to match up to align with the proceeding assessment. These levels are presented in Table 1 below.

Table 1 Reference criterion curve from NANR45

Frequency, Hz	**10**	**12.5**	**16**	**20**	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
NANR45 1/3 Octave band Internal level, dB	92	87	83	74	64	56	49	43	42	40	38	36	34
Frequency, Hz		**16**			**31.5**			**63**			**125**		
Derived 1/1 Octave band NANR45 Internal level, dB		89			65			47			41		

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In anticipation of the limitations in gathering very low frequency 1/3 octave data, NANR45 presents a range of maximum C weighted levels below which the measurement of third octave band may not be required, the lowest Maximum L_c limit from Table 2 below (54dB(C)) has been considered in this assessment due to a lack of low frequency third octave band source data at that low frequency level.

Table 2 Overall 'C' weighted levels (LC) below which the given 1/3 octave band is not required

Maximum L_C	**76dB(C)**	**71dB(C)**	**66dB(C)**	**60dB(C)**	**54dB(C)**
1/3 Octave band not required	10Hz	12.5Hz	16Hz	20Hz	25Hz

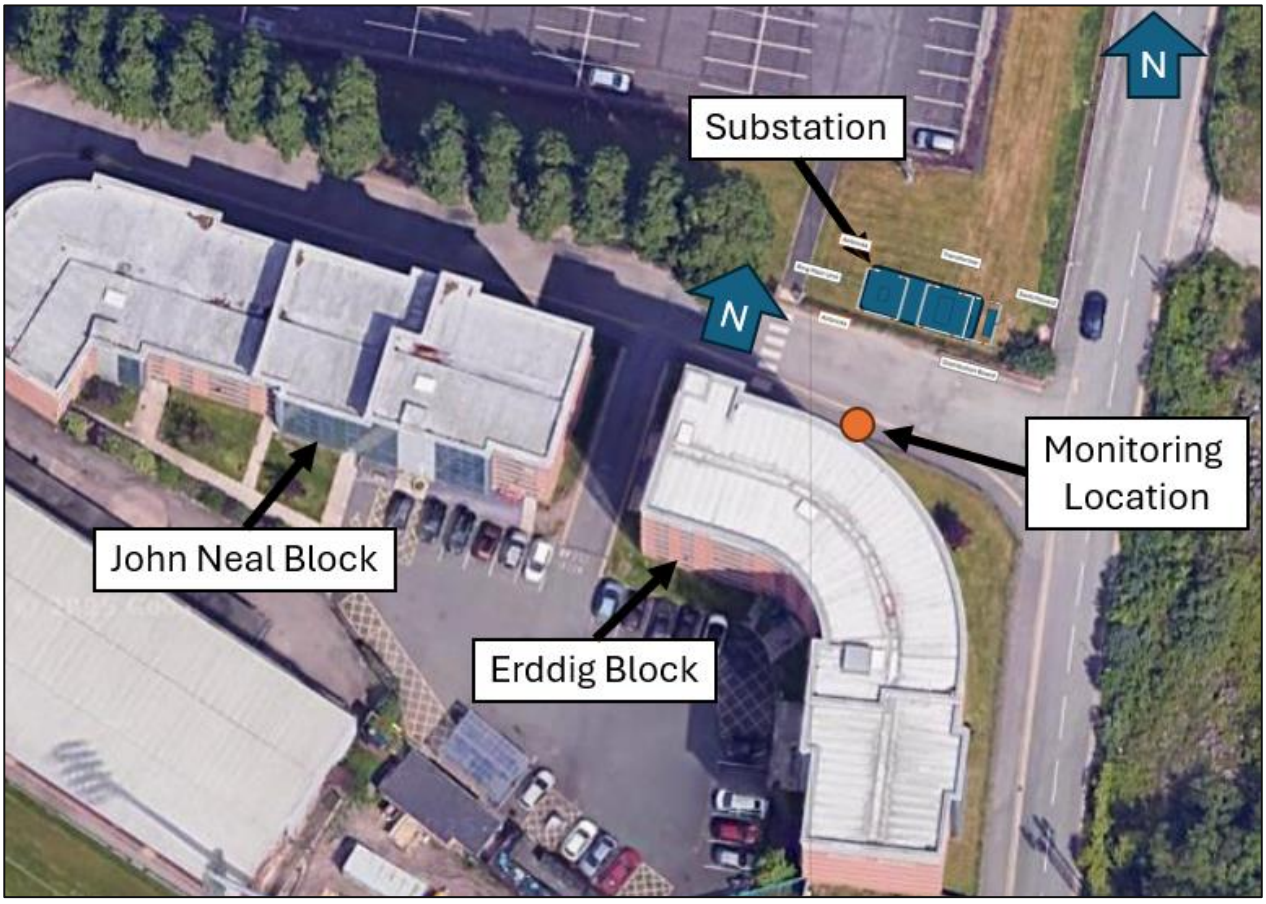
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3 Survey and Assessment

3.1 Receptors

The location of the substation is in close proximity to existing student accommodation from Wrexham University. There are two buildings known as the Erddig Block, which is eight storeys high, and the John Neal Block which is seven storeys high. At its closest, the substation is approximately 20 m from the Erddig Block and 30 m from the John Neal Block. A site plan highlighting the proximity of the university buildings to the substation is presented in Figure 2 below:

Figure 2 Site location plan relative to nearest sensitive receptors



3.2 Survey Details

To cater for a likely worse case baseline noise environment, a short baseline survey was undertaken in the early hours of the morning on Friday 1st August 2025. The survey took place between 01:00 and 02:00 outside the northern façade of the Wrexham University Erddig Block residence, see Figure 2 above. This time was chosen to represent the likely lowest background levels.

A Class 1 sound level meter was deployed on the roadside at an approximate height of 1.8 m from the ground in a free field position, with no significant shift in calibration noted before or after the measurement.

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The dominant noise source noted from the survey was a small number of road traffic sources on Mold Road with other sources including a wind in vegetation and some aircraft noise towards the end of the hour.

Table 3 below presents the measured data from the survey including the ambient (LAeq), background (LA90) and low frequency data.

Table 3 Measured survey data

Date	Start time	$L_{Aeq, 15\ mins}$ dB	$L_{A90, 15\ mins}$ dB	31.5Hz $L_{Zeq, 15\ mins}$ dB	63Hz $L_{Zeq, 15\ mins}$ dB
01/08/2025	01:00	45	38	57	53
	01:15	45	38	58	54
	01:30	47	37	61	56
	01:45	47	40	58	56

3.3 Noise Source

The source most likely to generate the highest noise level is the transformer housed in one of the two buildings. To cater for a worst case, this assessment this source has been considered the main noise source in both buildings. The transformer is understood to be a model Schneider 500kVA 11/.433kV ONAN from the previous substation; the datasheet provided for this unit this has a broadband sound power level of 62dBA. In absence of 1/3 or 1/1 octave band data, a reference spectra from another transformer (Schneider Electric DCU 4032 Transformer) has been uplifted to the 62dBA sound power level of the unit to be installed. This level is presented below in Table 4.

Table 4 Reference sound power levels

Frequency, Hz	63Hz	125Hz	250Hz	500Hz	1KHz	2KHz	4KHz	8KHz	Broadband dBA	Broadband dBC
Reference sound Power Level (dB) (spectrum based on Schneider DCU 4032)	51	57	55	62	56	51	44	44	62	65

The breakout noise level from the substation buildings has been calculated and the resultant noise level has been predicted using a 3D acoustic model. Area sources have been allocated in the model at the locations representative of the acoustically weakest part of the building that are closest to the nearest receptor. The airbricks to the rear of the substation are the location of acoustic breakout from the substation buildings and the propagation of this noise to the receptors has been calculated using the methodology set out in ISO 9613:2024.

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3.4 Noise Assessment

Predictions

The noise level from the substation based on the assumptions previously stated has been predicted at the nearest receptor and at various heights representative of the building storeys. These are presented below in Table 5.

Table 5 Noise Predictions

	Predicted level (dB)		
Floor Height	**A Weighted**	**C Weighted**	**Low Frequency (63Hz)**
Ground Floor (1.5m)	19	23	12
First Floor (4.5m)	19	23	12
Second Floor (7.5m)	19	22	11
Third Floor (10.5m)	18	21	10

Comparison to background

When considering the predicted noise impact of the proposed substation (Table 5) compared to the existing likely worst case background noise level from the survey data (Table 3), it can be seen the noise impact is significantly below the background level. At its worst, the predicted A weighted noise level from the substation is 19dB below background level, which is unlikely to be audible. According to BS 4142, this is an indication of the specific sound source having a low impact, depending on the context.

Low Frequency

As highlighted in Section 2, consideration has been given to the potential low frequency noise from the substation. The lowest predicted 1/1 octave band frequency (63Hz) noise level predictions from Table 5 are significantly below (35dB below) the derived 1/1 octave band internal reference criterion curve level from Table 1, and the overall C weighted levels from the substation are 31dB(C) below the lowest C weighted level stated in Table 2.

The low frequency (63Hz) predicted levels from Table 5 are also significantly below (44dB) the existing low frequency levels from the survey data presented in Table 3, so are not predicted to be audible.

Vibration

The units housed in the substation are unlikely to generate any significant ground borne vibration based on the component pieces of that equipment. Furthermore, given the receptor's proximity to the rail line which are typically a primary source of ground borne vibration, in the unlikely event any vibration was generated by the substation, this would likely be below the existing baseline environment.

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4 Conclusion

Vanguardia has been commissioned by Wrexham Association Football Club to undertake a noise assessment of the installation of a substation and switch room on Wrexham University grounds. This assessment is written to discharge Condition 4 of planning permission WRR P/2023/0291 granted in 2023 by Wrexham County Borough Council.

Condition 4 doesn't refer to any guidance or reference material to undertake this assessment; in absence of this, national guidance and published documents have been referred to, to consider the impact

To support the assessment, a short baseline noise survey was undertaken on the 1st August 2025 to ascertain the existing noise level at the likely quietest period of the day (01:00 – 02:00).

Predictions have been calculated based on reference source data considering both the likely impact to the existing noise environment and the likelihood for complaint from low frequency noise.

Assessment of the predicted noise levels demonstrates that the specific sound source will have a low impact. Additionally, the low frequency levels are predicted to be significantly below the reference criterion curve used for the assessment.

It is unlikely that any vibration from the substation buildings would be perceptible at the receptor locations, predominantly based on the equipment housed in the buildings.

This report shows that the substation complies with condition 4 of planning permission ref WRR P/2023/0291, demonstrating that there is no loss of amenity to residential or commercial properties and so the condition can be discharged.

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