

Proof of Evidence on Noise

Prepared by Rhys Scrivener of KR Associates (UK) Ltd
for Reading Borough Council

TOWN AND COUNTRY PLANNING ACT 1990
(AS AMENDED BY THE PLANNING AND COMPENSATION ACT 1991)

PROPOSED RESIDENTIAL DEVELOPMENT
55 VASTERN ROAD, READING

RHYS MICHAEL SCRIVENER MSC MIOA

28th September 2021

Version 1.1

Table of Contents

1. Introduction	4
2. Amendments to the Statement of Case	6
3. The Layout of the Site	8
4. Key Documents and Standards relating to RFR4	13
5. Assessment of SSE Transformer Noise (BS 4142)	25
6. Assessment of SSE Transformer Noise (NANR 45)	38
7. Conclusions and Discussions	43

(44 Pages)

0 Rhys Scrivener Experience

- 0.1 I am the founder and owner of KR Associates (UK) Ltd. I hold a Master of Science degree in Noise and Noise Control from the Open University. I am a corporate member of the Institute of Acoustics.
- 0.2 I have 25 years' experience as a noise and vibration consultant working in the UK, across Europe, the Middle East and America. Prior to creating KR Associates (UK) Ltd in 2003 I was the Technical Director of Enviro Noise Ltd for 5 years.
- 0.3 My company KR Associates (UK) Ltd has over the last 18 years prepared noise impact assessment that have supported over 6,000 planning applications including single dwellings to 1,000+ dwellings mixed use size, retail, cinema, industrial and a wide range of other uses. I have presented expert evidence relating to noise and vibration at planning appeals, public enquiries, and courts of law for a wide variety of cases.
- 0.4 I am a non-executive director of the Sound Insulation and Testing and Measurement Association (“SITMA”) and was involved in setting of a full competent person scheme to undertake sound insulation testing to show compliance with Part E of the Building Regulations 2020. I am also a non-executive director of the Building Compliance and Testing Association (“BCTA”) and have been directly involved in the creation of the Hub at the High Wycombe with an independent teaching facility with a full ISO sound transmission suite.
- 0.5 I can confirm that the advice provided within this Proof of Evidence (Noise) (“Proof”) is within my scope of expertise and experience.
- 0.6 I can confirm that I have not previously been involved in either the application nor the appeal and was initially instructed on 20th July 2021.

1. Introduction

- 1.1 This Proof has been prepared by KR Associates (UK) Ltd on behalf of Reading Borough Council in response to the appeal submitted by Berkeley Homes (Oxford and Chiltern) Ltd (“Appellant”) under section 78 of the Town and Country Planning Act 1990 (as amended) following refusal of planning application reference 200188 dated 9th of April 2021.
- 1.2 Planning application 200188 looked to demolish the existing structures and create new residential and retail floor space at 55 Vastern Road in Reading.
- “Demolition of existing structures and erection of a series of buildings ranging in height from 1 to 11 storeys, including residential dwellings (C3 use class) and retail floorspace (A3 use class), together with a new north-south pedestrian link, connecting Christchurch Bridge to Vastern Road.”*
- 1.3 24 Acoustics Ltd prepared report reference R8220-2 Rev 0 (draft) dated 17th July 2020 (Document Reference 5.15) (“Noise Report”) which was submitted to support the original application and sought to demonstrate that the existing noise from the road and the SSE Transformers could be adequately mitigated to ensure suitable internal and external living conditions for the future residents.
- 1.4 Reading Borough Council refused planning permission including reason for refusal number 4 (“RFR4”) which stated:

“The proposed development has failed to demonstrate that a suitable quality of accommodation can be provided for all future occupiers as the mitigation measures submitted would not be sufficient to minimise the impact of nearby noise pollution thereby contrary to Policies CC8, EN16 and CR6 of the Reading Borough Local Plan (2019).”

Traffic Noise from Vastern Road

- 1.5 The proposed site is located within the centre of Reading and is therefore exposed to the usual high levels of traffic noise. The guidance within paragraph 5.3.25 of the Reading Borough Local Plan adopted in 2019 provides an option to assess the internal noise levels with the windows closed. I am of the opinion that for the Appeal site the assessment of traffic noise from Vastern Road should be assessed internally with the windows closed. The proposed mitigation measures including high specification glazing and fully attenuated MVHR ventilation systems should result in internal noise levels from the traffic on Vastern Road that will provide a suitable quality of accommodation for future residents with the windows closed.

Noise from SSE Transformers

- 1.6 The proposed site is located adjacent to the large existing SSE transformer site which emits noise with a continuous low frequency 50 Hz tone and has intermittent noise from the cooling fans. I consider the SSE Generators to be an industrial and / or commercial source as defined within section 1.1.b of BS 4142 i.e., *“sound from fixed installations which comprise....electrical plant and equipment”*.
- 1.7 The assessment indicates from the external levels impacting the façade of the proposed residential buildings will have a *“significant adverse impact”* on the people who might be inside or outside of the building within the context of the site. The resultant noise levels are contrary to Policy CC8, EN16 and CR6 of the Reading Borough Local Plan and will without question result in an unacceptable quality of accommodation for future residents.

1.8 The assessment of the external sound levels impacting the proposed residential dwellings and the effects on people who might be inside or outside the building is dealt with in this Proof in the following sections:

1. Introduction to the document.
2. Amendments to the Statement of Case.
3. The Layout of the Site.
4. Key Documents and Standards relating to RFR4.
5. Assessment of SSE Transformer Noise (BS 4142).
6. Assessment of SSE Transformer Noise (NANR 45).
7. Conclusions and Discussions.

2. Amendment to the Statement of Case

Appellants Statement on Policy CR6

- 2.1 The Appellants noise consultant makes the following incorrect statement in section 2.0 of their Statement of Case regarding Policy CR6 even though it was referenced within RFR4:

*“Local Policy Reading Borough Council...CR6
...form part of the Reading Borough Local Plan (adopted November 2019) and relate to...’Accessibility and intensity of the development. As such they do not relate to noise and these aspects of reason for refusal 4 are not considered within this statement of case”*

- 2.2 Policy CR6 has three parts, the second of which states:

“Proposals for residential development within the central area will be assessed against the following criteria:

ii) Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources...have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme unless this can be mitigated.”

- 2.3 Paragraph 5.3.25 below policy CR6 provides the following guidance on the assessment of internal noise levels with the windows open or closed:

“In some cases, in order for the internal noise levels to be reasonable and not adversely affect health it would be necessary to provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather.”

- 2.4 This site is in the centre of Reading. I therefore consider it appropriate to follow the guidance at paragraph 5.3.25 of the Local Plan and in this case assess the internal noise levels from traffic with the windows closed.

Amendment to the Statement of Case

- 2.5 The following amendments need to be considered when referencing the original Statement of Case (Noise).

3. Reading Borough Council Statement of Case (Noise)

3.2 - Scope of Evidence	Remove reference to open windows
3.8 – Assessment of Traffic Levels	Remove reference to open windows
3.11 - Conclusions	Remove reference to open windows

4. Standards and Recent Appeal Decision

4.7 - ProPG Open Windows	Remove entire paragraph
4.8 – AVO Guidance	Remove entire paragraph
4.9 to 4.15 – Appeal Decisions	Remove reference to Appeal Decisions

5. Key Differences

5.3 Assessment Windows Open	Remove entire paragraph
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Opening Windows

- 2.6 I agree with the Appellants noise consultant, that should the residents of the future residential dwellings, especially those in Block A and Block BC directly facing Vastern Road open their windows contrary to section 5.3.25 of the Reading Borough Council Local Plan they will experience unacceptable internal noise levels.

3. Layout of the Site

Existing Site Layout

- 3.1 The existing site is located with a frontage onto Vastern Road to the south, the rear of the mainly terraced residential dwellings in Lynemouth Road to the west, the river Thames to the North and the residential flats at Norman Place to the East. The existing SSE site is along the eastern boundary but protrudes into the middle of the site where the two large existing transformers are located. There is a traditional multi-storey brick building along the southern boundary facing onto Vastern Road, a similar height warehouse building behind with a car park and some small outbuildings making up the rest of the site towards the river.

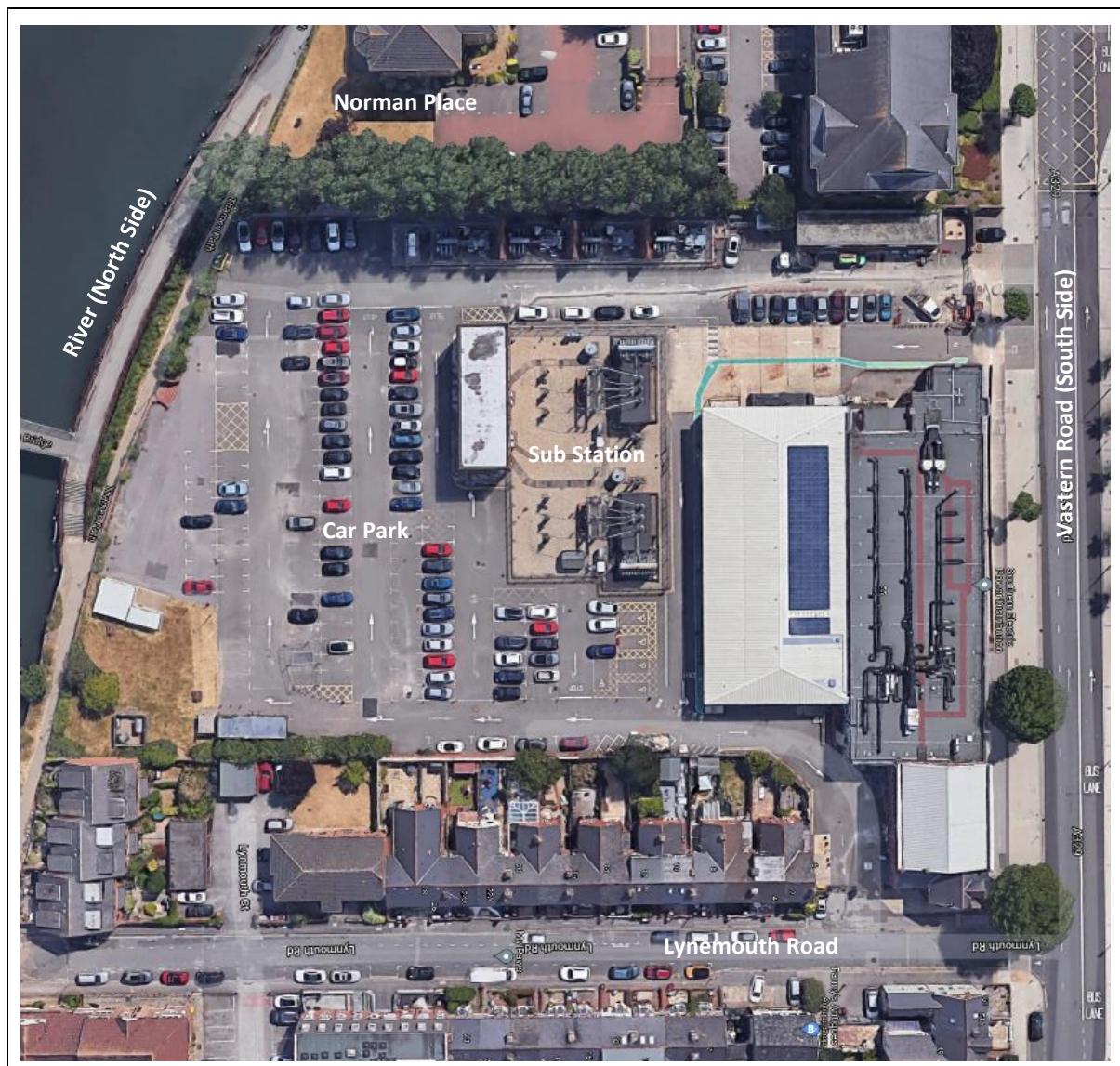


Figure 01 – Google Maps screenshot of existing layout

Proposed Site Layout

- 3.2 It is proposed to demolish the existing buildings at the front of Vastern Road and construct four blocks which consist mainly of residential dwellings. The main noise sources impacting the site are the traffic noise from Vastern Road on the south side of the site and the existing SSE transformers in the middle of the eastern boundary of the site. The river runs along the north of the site. In the 3D view below the residential facades with windows are coloured red. The following shows a simple 3D block model created of the proposed site from the Appellants drawings which will form the basis of the input to the 3D noise map and other assessments of the noise impacting the site.

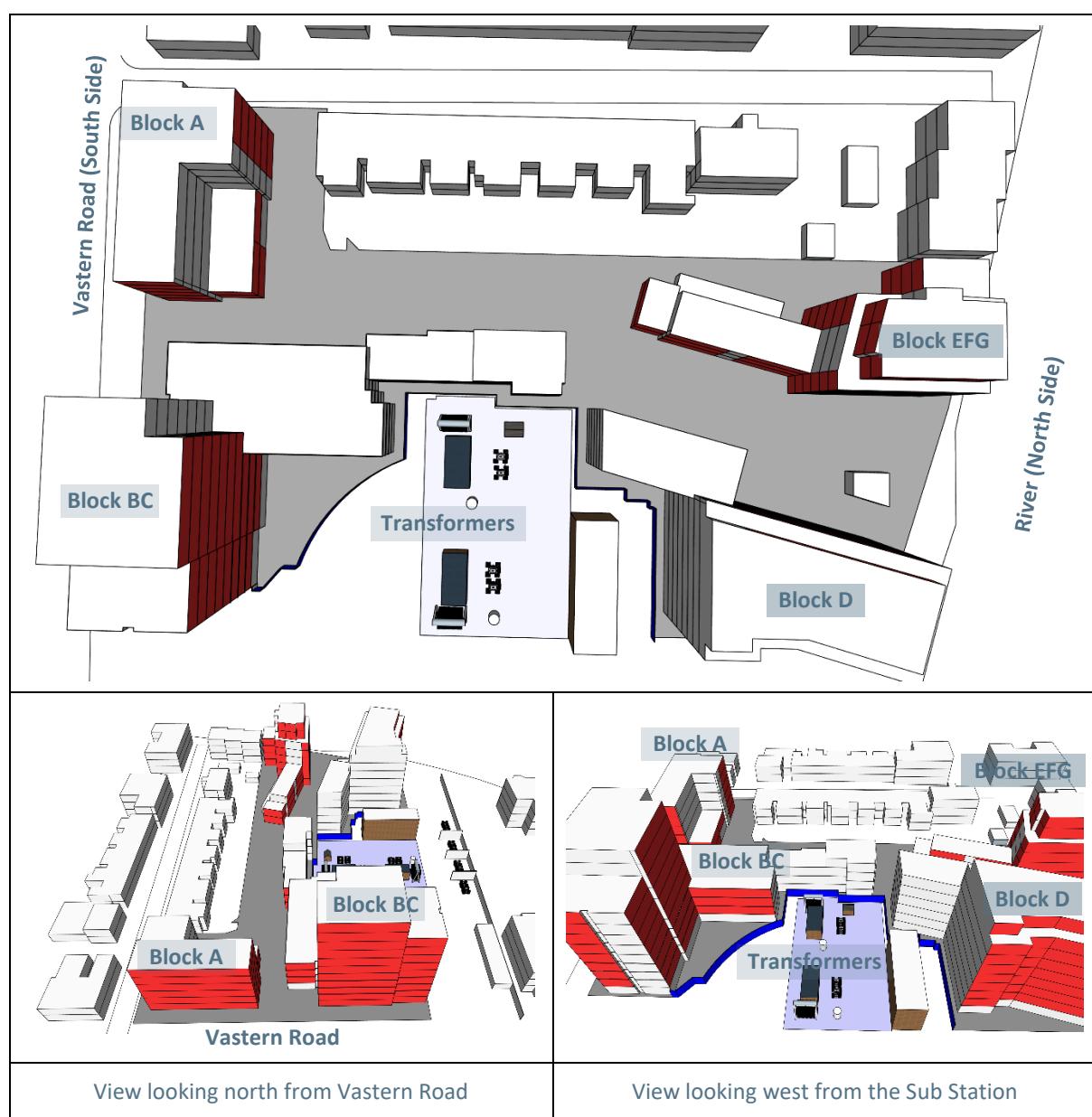


Figure 02 – 3D block model of site

Appellants Layout Drawing

- 3.3 The general site layout 5.33-BHOC.448.LA_101A Landscape General Arrangement (Masterplan) provides a good overview of the full site.

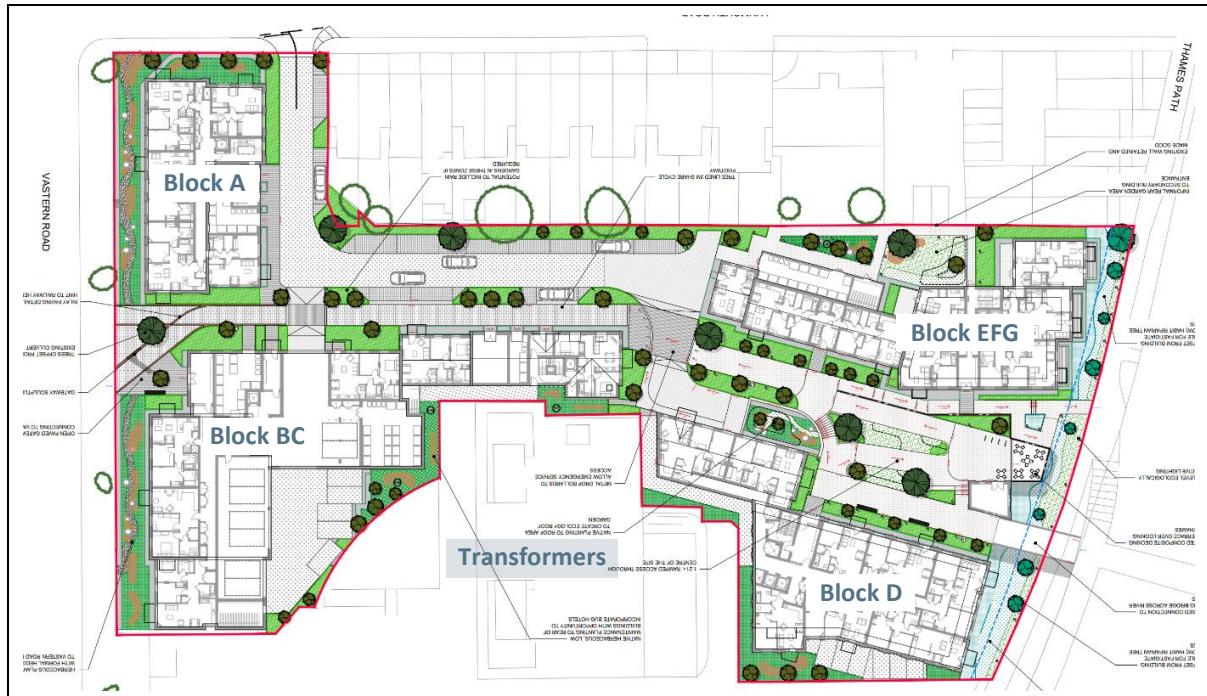


Figure 03 – Screenshot of Block Plan

- 3.4 Drawing 5.52-448.PL201.A Context Site Elevation Vastern Road shows the Vastern Road elevation and the same view within the 3D model.

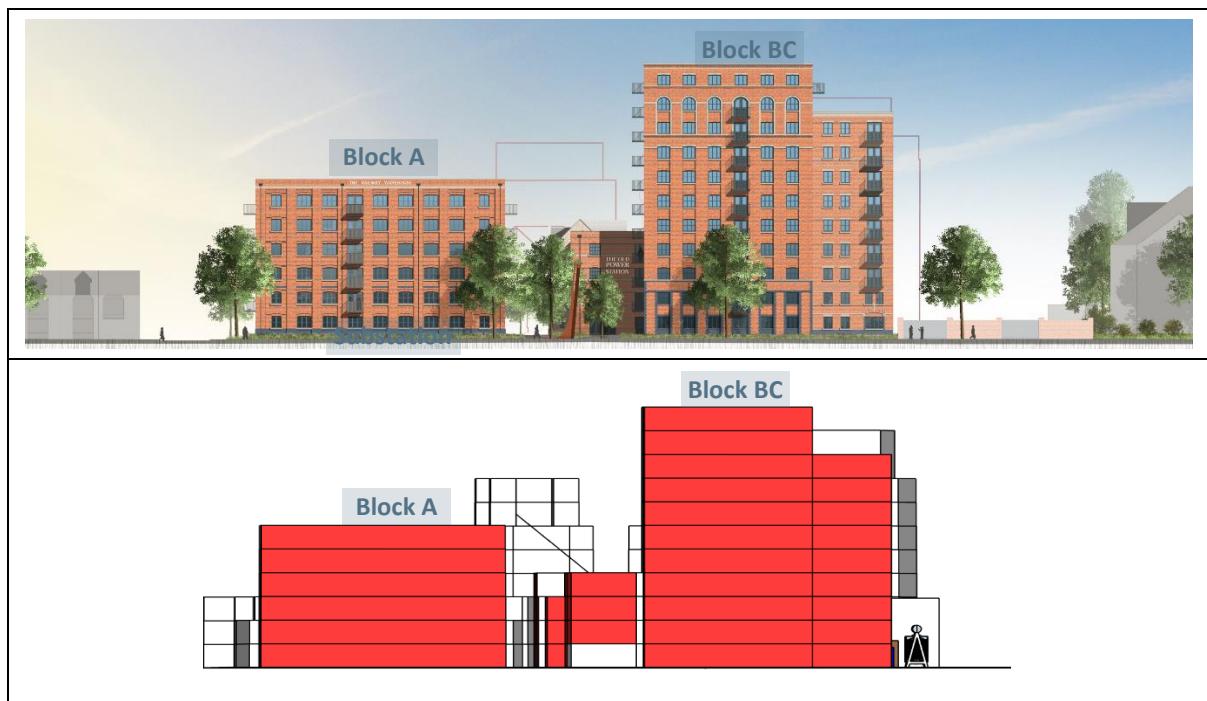


Figure 04 – Comparison between 3D Model and Appellants section

Relationship of Block BC to the SSE Transformers

- 3.5 The following view from the simple 3D model shows the relationship of the rear of Block BC to the SSE Transformers. The red coloured facades are facades that have residential windows within them.

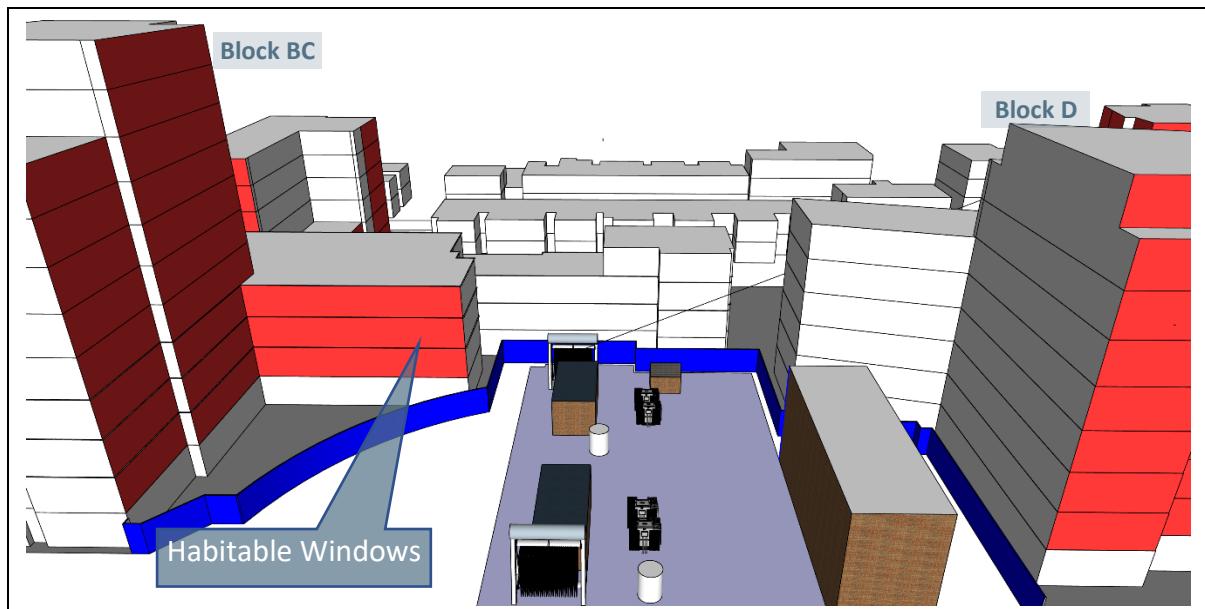


Figure 05 – 3D view from SSE Transformers looking West

- 3.6 The following exert is taken from the Appellants general arrangement plan of the 1st floor of Block BC and shows the openable windows on the rear façade facing directly to the SSE Transformers.

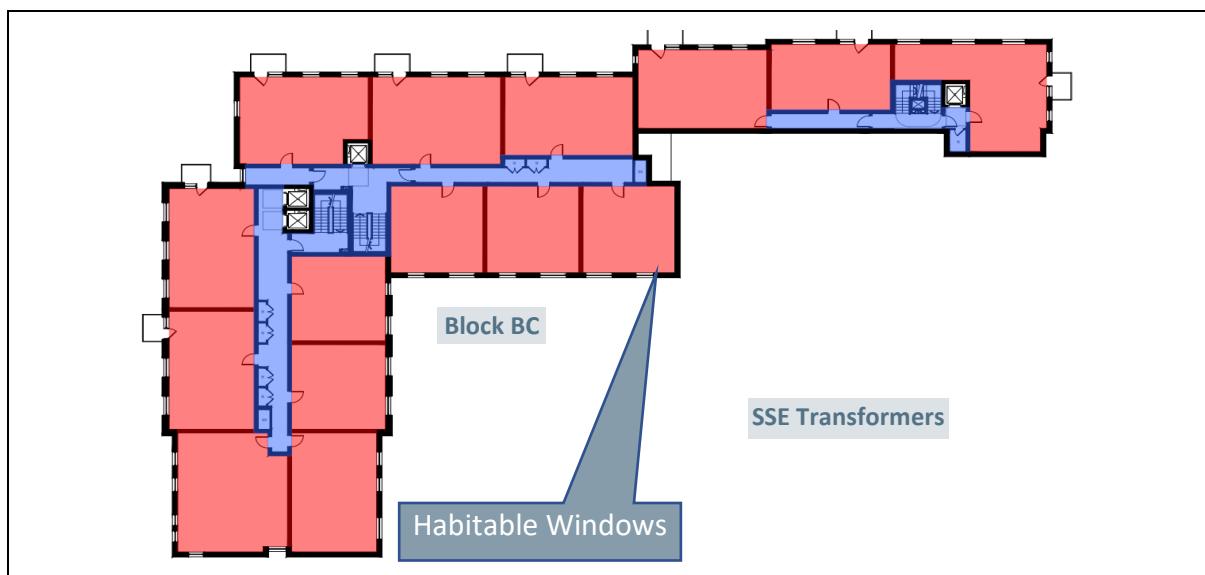


Figure 06 – Screenshot of 1st floor Block BC residential layout

4. Key Documents and Standards relating to RFR4

National Planning Policy

- 4.1 Paragraph 185 states:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should: a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life⁶⁵. ”

Note 65 refers to the Noise Policy Statement for England.

Noise Policy Statement for England

- 4.2 Defra published its document entitled “Noise Policy Statement for England” in March 2010 (“NPSE”) to clarify the long terms vision of the Government noise policy:

“Promote good health and a good quality of life through the effective management of noise within the context of Government Policy on sustainable development.”

- 4.3 NPSE provides the following three aims on the management and control of environmental noise:

*“- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.”*

MHCLG Planning Policy Guidance on Noise

- 4.4 The Ministry of Housing, Communities and Local Government last updated its online guidance on noise entitled "*Advises on how planning can manage potential noise impacts in new development*" in July 2019 ("PPG") and enhances the guidance within the NPPF and NPSE.
- 4.5 Paragraph 008 Reference ID: 30-008-20190722 entitled "*How can the risk of conflict between new development and existing businesses or facilities addressed*" of the PPG provides advice on the risk of conflict between new development and existing businesses or facilities:

"Development proposed in the vicinity of existing businesses, community facilities or other activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme.

In these circumstances the applicant (or 'agent of change') will need to clearly identify the effects of existing businesses that may cause a nuisance (including noise, but also dust, odours, vibration, and other sources of pollution) and the likelihood that they could have a significant adverse effect on new residents/users. In doing so, the agent of change will need to take into account not only the current activities that may cause a nuisance, but also those activities that businesses or other facilities are permitted to carry out, even if they are not occurring at the time of the application being made."

Local Planning Policy

4.6 The RFR4 referred to three local policies from the Reading Borough Local Plan adopted in November 2019 within RFR4: CC8, EN16 and CR6.

4.7 Policy CC8: Safeguarding Amenity

CC8: SAFEGUARDING AMENITY

Development will not cause a detrimental impact on the living environment of existing residential properties or unacceptable living conditions for new residential properties, in terms of:

- Privacy and overlooking;
- Access to sunlight and daylight;
- Visual dominance and overbearing effects of a development;
- Harm to outlook;
- Noise and disturbance;
- Artificial lighting;
- Vibration;
- Dust and fumes;
- Smell;
- Crime and safety; or
- Wind, where the proposals involve new development of more than 8 storeys.

The position of habitable rooms, windows and outdoor living spaces will be particularly important. A back-to-back distance of 20 metres between dwellings is usually appropriate, although the circumstances on individual sites may enable dwellings to be closer without a detrimental effect on privacy.

As well as immediate impacts, other aspects to which this policy applies will include matters such as hours of operation of businesses, and effects of traffic movements, particularly of heavy goods vehicles (HGVs). Proposals which would generate regular movements of HGVs on residential roads will not be acceptable.

Where an otherwise acceptable development could change its character to a use that would have a greater impact on amenity without needing planning permission, conditions will be applied to restrict such changes.

Figure 07 – Policy CC8

4.8 Paragraph 4.1.38 within the Local Plan below Policy CC8 also provides some useful guidance:

"Most tensions can be avoided by careful design, siting and orientation of buildings and spaces, paying particular attention to those aspects which are most likely to cause issues (e.g., ... noisy equipment)".

4.9 Policy EN16: Pollution and Water Resources***EN16: POLLUTION AND WATER RESOURCES***

Development will only be permitted where it would not be damaging to the environment and sensitive receptors through land, noise or light pollution; where it would result in no deterioration in, or ideally enhance, ground and surface water quality; and where adequate water resources, sewerage and wastewater treatment infrastructure will be in place to support the proposed development prior to occupation.

Proposals for development that are sensitive to the effects of noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.

Development will only be permitted on land affected by contamination where it is demonstrated that the contamination and land gas can be satisfactorily managed or remediated so that it is suitable for the proposed end use and will not impact on the groundwater environment, human health, buildings and the wider environment, during demolition and construction phases as well as during the future use of the site.

Figure 08 – Policy EN16

4.10 Paragraph 4.2.90 within the Local Plan below Policy EN16 provides some additional advice:

“It is worth noting that there is a Professional Practice Guide on Planning and Noise available⁶⁰ which provides guidance on design of residential developments to take account of noise and taking account of this from the early design stage will help to reduce noise effects on future residents.”

ProPG: Planning and Noise4.11 Reference is made in the Local Plan to the document entitled “*ProPG: Planning & Noise. Professional Practice Guidance on Planning & Noise – New Residential Development*” published in May 2017. The scope of the document at section 1.3 states:

“The scope of this ProPG is restricted to the consideration of new residential development that will be exposed predominantly (see Section 2) to airborne noise from transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise).”

4.12 Policy CR6: Living in Central Reading

CR6: LIVING IN CENTRAL READING

Proposals for residential development within the central area will be assessed against the following criteria:

- i) *All proposals for residential development within the central area will be required to contribute towards a mix of different sized units within the development. This will be measured by the number of bedrooms provided within individual units. Ideally, a mixture of one, two and three bedroom units should be provided. As a guide, in developments of 15 dwellings or more, a maximum of 40% of units should be 1-bed/studios, and a minimum of 5% of units should be at least 3-bed, unless it can be clearly demonstrated that this would render a development unviable.*
- ii) *Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated.*
- iii) *In meeting the requirement to provide affordable housing, in the central area an over-concentration of social renting for single persons will be avoided.*
- iv) *Where proposals for serviced apartments and apart-hotels fall outside the C3 use class, they will be located within the Central Core. Such proposals will not be permitted unless the duration of occupation of residents is restricted, to ensure the units are used on a short stay basis and not as residential flats, and information monitoring the implementation of this restriction is regularly supplied.*

Figure 09 – Policy CR6

4.13 Paragraph 5.3.25 below policy CR6 provides the following guidance on the assessment of internal noise levels with the windows open or closed:

“In some cases, in order for the internal noise levels to be reasonable and not adversely affect health it would be necessary to provide a system of ventilation that entirely removes the necessity to open windows, even in very hot weather.”

Appellants Description of the Noise from the SSE Transformers

- 4.14 The Appellant describes the noise from the SSE Transformers within their acoustic report:

"2.3 - ... the site is affected by noise from the neighbouring SSE transformer substation. This generates a continuous low level low frequency 'hum' from the transformers (which is more noticeable at night when background noise levels are lower) and a higher level of broadband noise from the transformer cooling fans which operate intermittently at any time."

Proposed Criterion for the Assessment of Noise from SSE Transformers

- 4.15 I consider it is appropriate to use two different standards for the assessment of noise from the SSE Transformers and how it will impact the proposed residential dwellings in terms of internal and external noise levels.
- 4.16 The first standard, British Standard 4142: 2014 + A1: 2019 takes the outdoors levels impact on the dwellings, compares it against the underlying background noise levels and then provides an initial assessment of the likely effects of sound on people who might be inside or outside the dwelling within the context of the site. The standard then provides advice on the context of the site in terms of determining if the initial impact needs to be modified to take account of all pertinent factors including the absolute level of sound, the character of the sound and the sensitivity of the receptor.
- 4.17 The second standard, NANR45 provides an absolute internal criterion to determine if the low frequency noise from the SSE Transformers, especially within the 50 Hz and 100 Hz 1/3rd octave bands is likely to give rise to complaints from the residents. The internal noise levels are calculated by taking the external noise level and calculating the internal noise levels through the respective performance of the façade, glazing and proposed ventilation system.

The First Standard – Assessment of Noise from SSE Transformers

- 4.18 British Standard 4142: 2014 + A1: 2019 entitled “*Methods for rating and assessing industrial and commercial sound*” (“BS 4142”) confirms in section 1.1.b) that the SSE Transformers emit sound that is considered to be industrial and or commercial in nature.

“Sound from fixed installations which comprise...electrical plant and equipment”

- 4.19 Section 1.1 defines the scope of BS4142.

“The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.”

- 4.20 BS 4142 provides in section 11 entitled “*Assessment of the impacts*” an initial commentary of assessing external levels and the impact it will have on the people inside or outside the building.

“The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.”

- 4.21 BS 4142 then provides an initial indication of the likely impacts on people who might be inside or outside of the dwellings from the external levels impacting the residential dwellings:

“Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level.

- a) *Typically, the greater this difference, the greater the magnitude of the impact.*
- b) *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c) *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- d) *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. 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.”*

Context of the Site

4.22 Note 2 of BS 4142 requires that you consider the context of the site and determine if the initial estimate of impact of people inside or outside the building needs to be modified due to the pertinent factors including the absolute level, character of the sound and the sensitivity of the receptors.

“1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

- i) facade insulation treatment;*
- ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) acoustic screening."*

Proposed Criterion to Comply with the Local Plan

- 4.23 I would therefore propose the following criterion to comply with Policies CC8, EN16 and CR6 of the Reading Borough Local Plan adopted in 2019 and ensure the noise from the SSE Transformers results in a suitable quality of life for the future occupiers.

Requirement	Façade Levels Day Time	Façade Levels Night Time
BS4142 - Low Impact (+0 dB Assessment)	L_{Aeq} , 1 hour 40 dB	L_{Aeq} , 15 minutes 32 dB

Figure 11 – BS 4142 assessment criterion

Appellants Proposed Noise Criterion for the SSE Transformers

- 4.24 The Appellants at section 4.1 of their Noise Report proposed the following criterion for the assessment of noise from the SSE Transformers.

“Noise levels internally in habitable rooms not to exceed 30 dB L_{Aeq, 16 hour} during the day and 30 dB L_{Aeq, 8 hour} at night...”

“Noise levels in private external amenity areas, should not exceed the prevailing representative daytime background noise level by more than 5 dBA (with a correction applied for noise character, if necessary), in accordance with the requirements of BS 4142:2014”

- 4.25 The proposed internal criterion from the Appellants ignores the advice of BS 8233 and for a reason that is not explained within the noise report applies BS 4142 to assess the external noise levels from the SSE Transformers but does not use BS 4142 to assess the internal levels. Instead, the Appellant relies on the levels within BS 8233 designed for steady states sources without character and only providing a relaxation of the day time criterion by 5 dB.

- 4.26 British Standard 8233: 2014 entitled *“Guidance on sound insulation and noise reduction for buildings”* (“BS 8233”) has a clear definition of the scope of the document at section 1:

“This British Standard provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings...”

- 4.27 Section 6 of BS 8233 is entitled *“External noise sources”* provides guidance on commons sources of noise and how to control them. Within the section 6.5 entitled *“Noise from Industry”* there is clear guidance at section 6.5.2. entitled *“Assessment of Industrial Noise”*:

“Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS 4142 should be applied. BS 4142 describes methods for determining, at the outside of a building...”

4.28 I therefore consider British Standard 4142: 2014 + A1: 2019 the appropriate standard to assess the noise levels from the SSE Transformers in terms of the outdoor sound levels and the likely effects on people who might be inside or outside of the dwellings.

4.29 Section 7 of BS 8233 entitled "*Specific types of building*" provides guidance at section 7.7.1 with a specific subclause to the external noise defined in section 6:

"This subclause applies to external noise as it affects the internal acoustic environment from sources without a specific character, previously termed "anonymous noise". Occupants are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. For simplicity, only noise without character is considered in Table 4. For dwellings, the main considerations are:

- a) for bedrooms, the acoustic effect on sleep; and*
- b) for other rooms, the acoustic effect on resting, listening and communicating."*

4.30 The note under the subclause 7.7.1 clarifies when noise has a character:

"Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate."

- 4.31 Table 4 entitled “*Internal ambient noise levels for dwellings*” provides the internal criterion within residential dwellings during the day time and night time periods for steady external noise sources without any specific character:

“In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4.”

Condition	Average Day Time	Average Night Time
Resting / Sleeping	$L_{Aeq, 16\text{ hour}}$ 35 dB	$L_{Aeq, 8\text{ hour}}$ 30 dB

Figure 10 – Table 4 within BS 8233

The Second Standard – Assessment of Noise from SSE Transformers

- 4.32 NANR45 entitled “*Procedure for the assessment of low frequency noise complaints*” published in 2011 provides the following criterion for the assessment of low frequency noise internally within dwellings:

Requirement	$1/3^{\text{rd}}$ octave band frequencies											
	12.5	16	20	25	31.5	40	50	63	80	100	125	160
NANR 45	87	83	74	64	56	49	43	42	40	38	36	34
Internal Sound Pressure Level (dB) – Reference $2 \times 10^{-5} \text{ Nm}^{-2}$												

Figure 12 – NANR45 requirements

- 4.33 The internal noise levels are calculated with the windows closed and the MVHR system in place and take account of the relative areas of the façade and glazing and the transmission loss of each element in octave bands.

5. Assessment of SSE Transformer Noise (BS 4142)

Appellants Source Noise Levels

- 5.1 24 Acoustics Ltd undertook measurements of the existing transformers and reported the overall sound power levels in table 3 of section 5.7. The main transformers each had a sound power level of $L_{W(A)}$ 95 – 96 dB(A). Further details were provided in table B1 within the Appendix of the report which detailed the sound power levels in 1/3rd octaves including $L_{W(100Hz)}$ 93 dB within the 1/3rd octave band. The Appellant did not specify which standard was used to establish the sound power levels of the transformers. British Standard 60076 – Part 10: 2016 entitled “*Power Transformers. Determination of sound level*” provides one of the approved methods of measuring noise emissions from transformers.
- 5.2 The Appellants have not detailed the type of transformers that are currently on the SSE site. Furthermore, the Appellants have not confirmed if the current works being undertaken on site are part of the works detailed on the SSE website which recently stated “*£70m upgrade over 8-years as the demand group is approaching 1m500 MW so they need to split the group*”. For the purposes of this assessment, I have assumed that the current upgrade works will not increase the overall noise emissions since the Appellants measured the original noise levels. It is assumed that both transformers are rated at 90 MVA each.
- 5.3 For the purposes of assessing the noise from the existing transformers I have assumed both transformers have the following octave band sound power levels which are derived directly from the Appellants 1/3rd octave band sound power levels provided in table B.1

Sound Power Levels	$L_{W(A)}$	Octave Band Centre Frequency (Hz)									
		16	32	63	125	250	500	1K	2K	4K	8K
A1MP	96	92	97	101	97	93	92	92	88	82	77
A2MP	95	93	99	103	97	93	93	91	87	80	76
Sound Power Level (dB) – Reference Level 1×10^{-12} watts											

Figure 13 – Appellant’s sound power levels of SSE Transformers in octave bands.

- 5.4 The following graphs show the 1/3rd octave band data for each of the SSE Transformers and the dominant tone within the 50 Hz and the secondary tone within the 100 Hz 1/3rd octave bands.

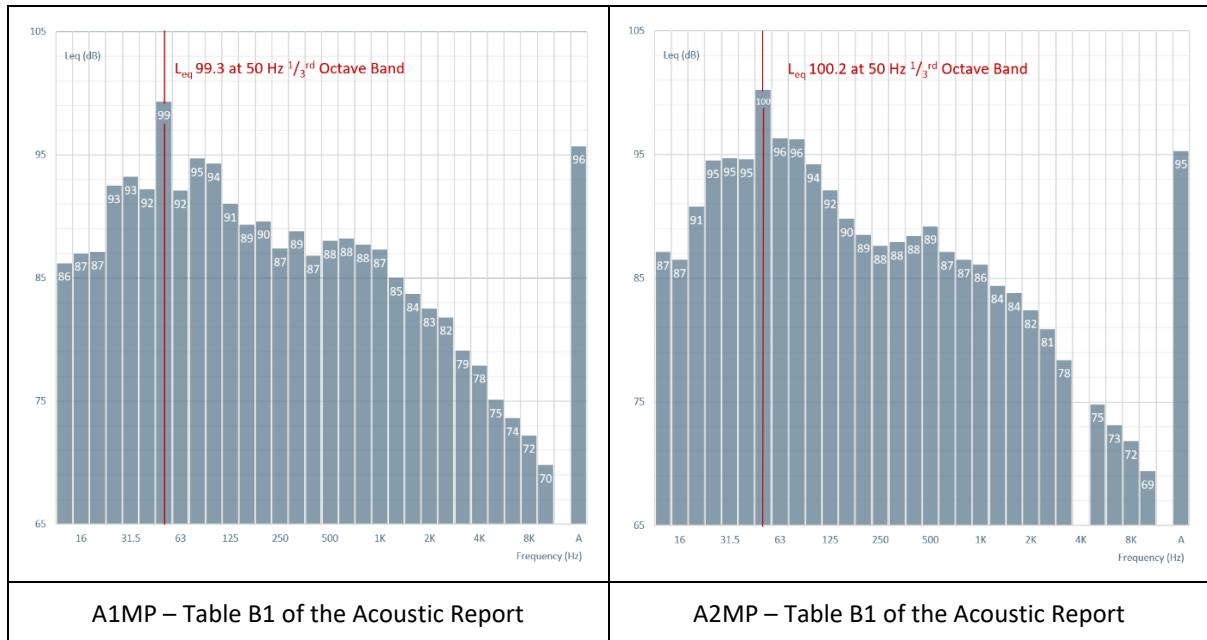


Figure 14 – Frequency graphs of appellants sound power levels of SSE Transformers

- 5.5 The Appellant within their Noise report only identifies at the 100 Hz tone and does not refer to the 50 Hz. The incoming supply to the SSE substations is likely to be 132 KV with the National Grid having a licence obligation to maintain a system frequency of 50 Hz +- 1% i.e., 49.5 Hz to 50.5 Hz.

3D Noise Map of Transformer Noise Levels

- 5.6 The Appellants noise report did not provide a 3D noise map of the transformer noise levels and how they impact the facades of the four main buildings. However, the Appellant did provide “Drawing Number Figure 4” on page 21 of the report which showed a 3D noise map with the overall A-weighted generator levels that were over LAeq 41 dB in red and that were below L_{Aeq} 41 dB in green. 3D noise maps provide a useful visual tool to fully understand and appreciate how noise interacts with complex arrangements of buildings at different heights and angles to the noise source.

5.7 To provide a comparison with the Appellants noise map I calculated the same noise map assuming each building façade was constructed from brick and glass.

5.8 The following noise maps show a good correlation between the Appellants 3D noise map and the noise map which I am using to calculate the overall noise levels.

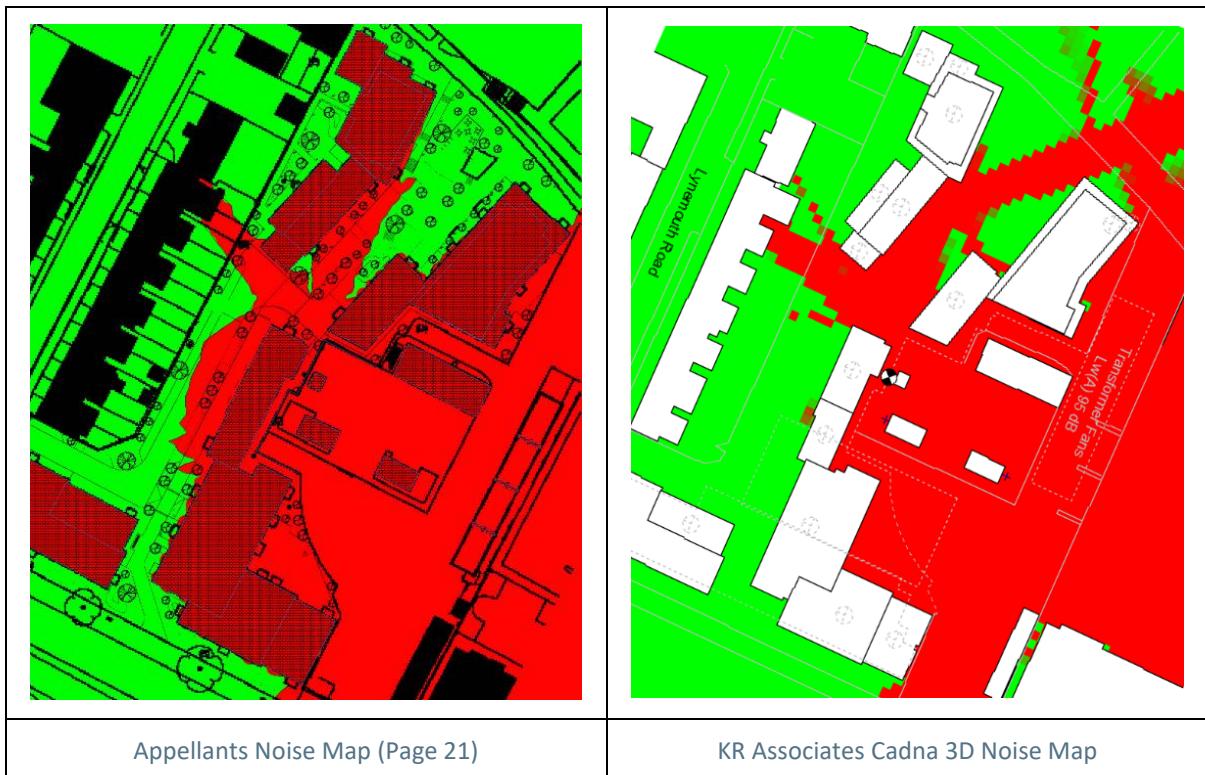
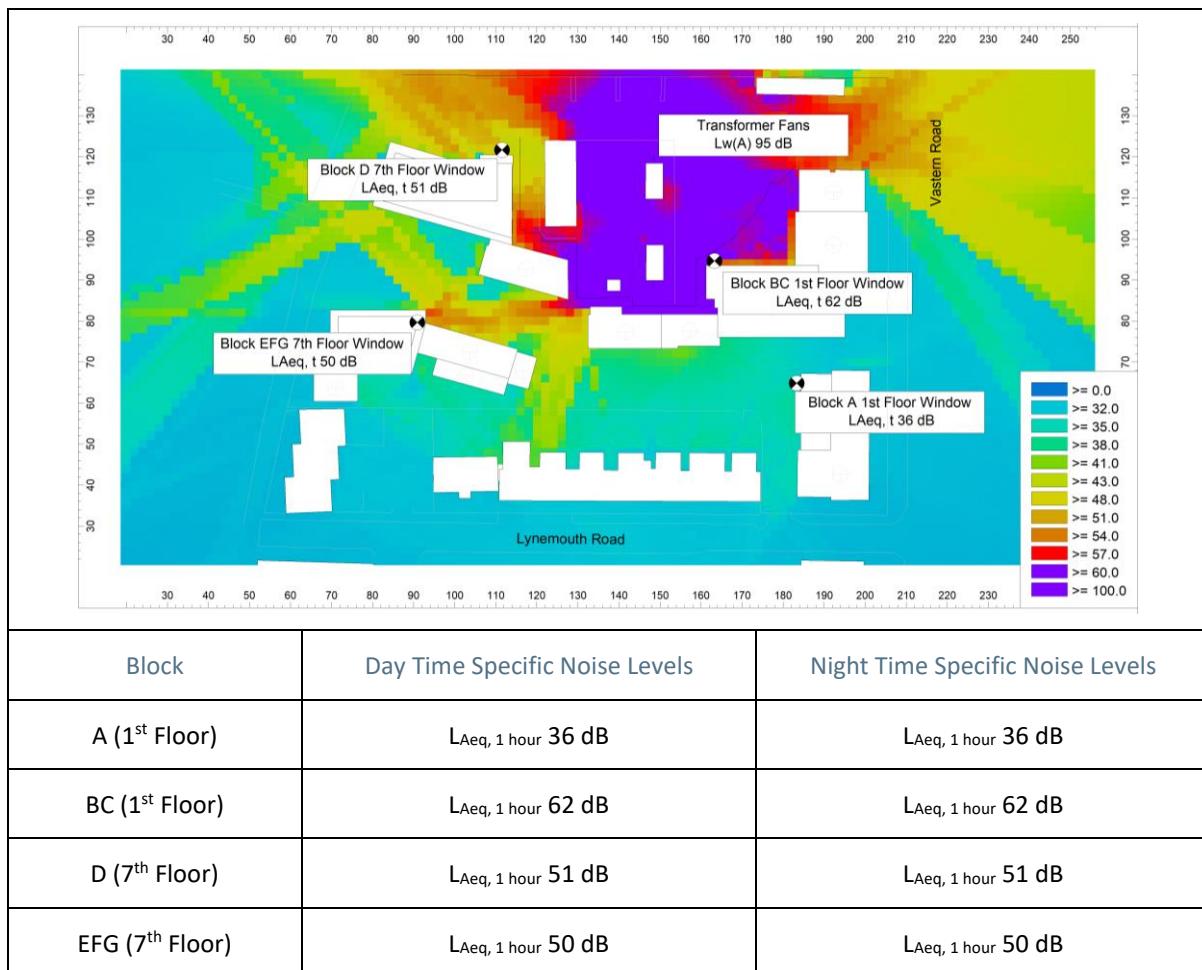


Figure 15 – Comparison with Appellants 3D noise map

5.9 The weakest point of any residential façade is the glazing and small ventilation openings. I have therefore used the same noise map to calculate the facades levels impacting all four main residential blocks and identified where the façade levels are at their highest in front of a window to a habitable room.

5.10 The 3D Noise map has been calculated on 1m x 1m resolution using the Datakustik program CadnaA. The sound power levels have been taken from the Appellants sound power levels within their report and it has been assumed the facades will be constructed from brick. The Cadna software uses the calculation principles with ISO 9613 to undertake the calculations.

Figure 16 – 3D noise map of SSE Transformers at 1st floor level

Appellants Residual Noise Levels

- 5.11 24 Acoustics Ltd undertook measurements at a position facing Vastern Road between 1st March 2019 and 8th March 2019 summarising the representative results in table 2 of their report entitled “*Noise Survey Results, Vastern Road Frontage*” in section 5.4 to establish the source noise levels from Vastern Road.

Position	Average Day Time	Average Night Time	Maximum Night Time
Vastern Road	L_{Aeq} , 16 hour 70 dB	L_{Aeq} , 8 hour 64 dB	L_{Amax} 80 dB

Figure 17 – Appellant’s residual noise levels

- 5.12 However, the Appellants did not report the background noise levels within the day and night time periods at this measurement position within their report.

- 5.13 I have therefore over-laid the approximate night time periods as transparent red squares and provided an approximation of the likely modal background noise levels. In my professional experience I would expect this estimate to be within 2 or 3 dB.

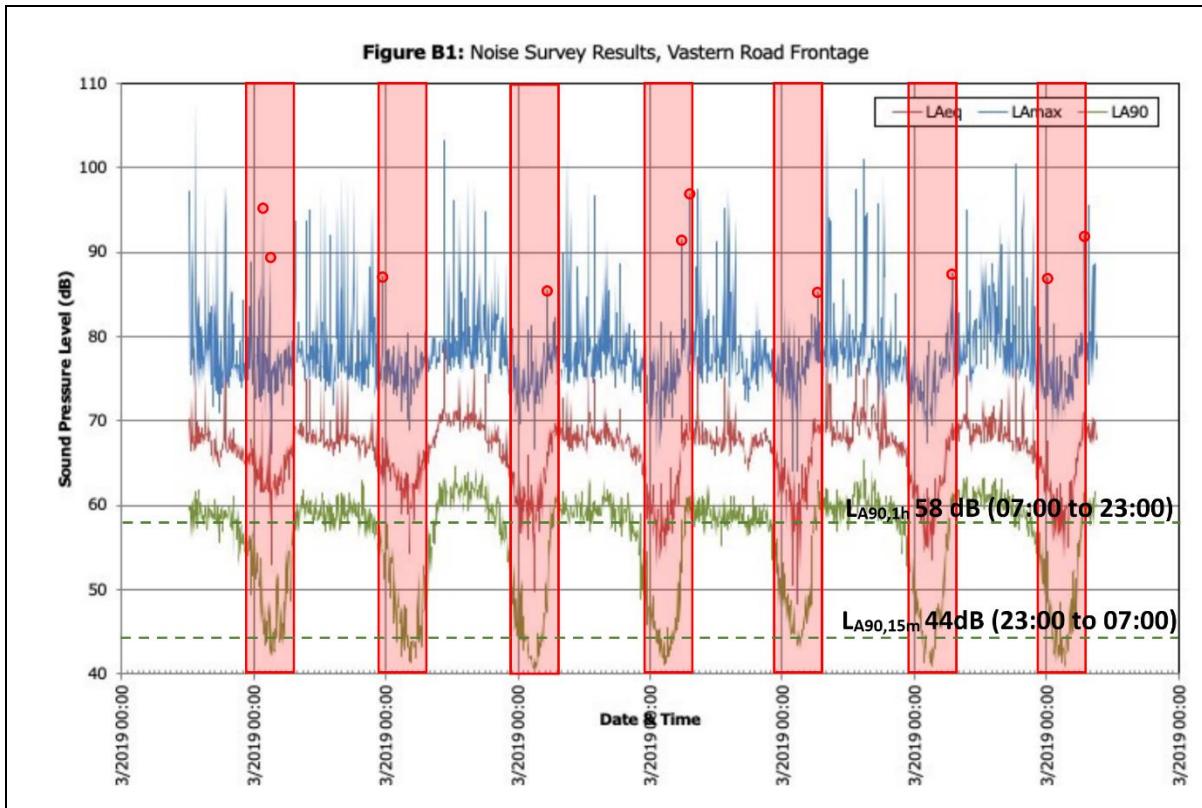


Figure 18 – Appellant's background noise level graph

Appellants Day Time Background Noise Levels

- 5.14 Without providing any justification the Appellants noise consultant estimates the day time background noise levels at the rear of the site as $L_{A90,1\text{ hour}} 40 \text{ dB}$ within section 6.1 of their noise report.

"It is difficult to accurately establish the prevailing background noise level due to the continuous operation (and hence noise) from the transformers. However, the surveys have indicated typical representative background noise levels of around 40 dB LA90 at the rear of the site (away from Vastern Road) during the day."

- 5.15 The Appellant has not provided any details of the background noise levels towards the rear of the site during the night time period.

Weather Conditions during Appellants Background Levels

- 5.16 The following table shows the weather conditions during the Appellants background measurement period between 1st and 8th March 2019. The wind speed mainly during the day time exceeds the normal limit of 5ms-1. However, as the data is taken from the Met Office at a nominal height of 10m and the measurements position is likely to have been against the Vastern Road Façade the weather may only have marginally increase the average day time levels but will have been unlikely to impact the night time levels.

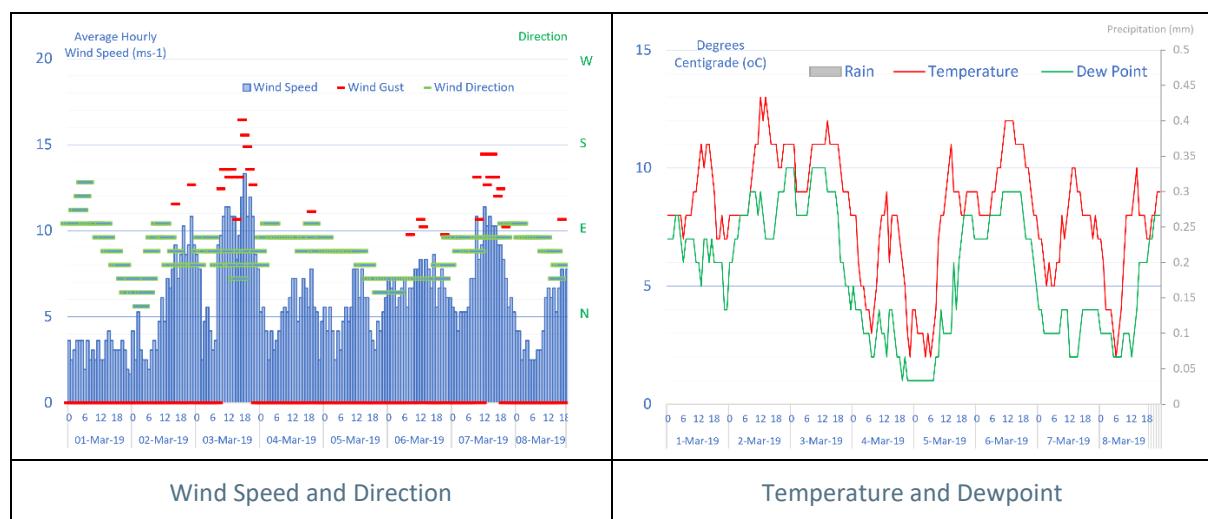


Figure 19 – Weather Conditions during Appellants background noise measurements.

Additional Background Noise Levels

- 5.17 The current SSE site is being updated and there is currently construction being undertaken on site. I therefore considered it appropriate to measure the background noise levels at an equivalent position at the end of De Montfort Road between 8th and 13th of September 2021 which included a weekday and the weekend period which are typically slightly quieter. There were construction works on site and the position was considered appropriate to determine the background noise levels at the rear of the Appeal site as it was a similar distance from Vastern Road.

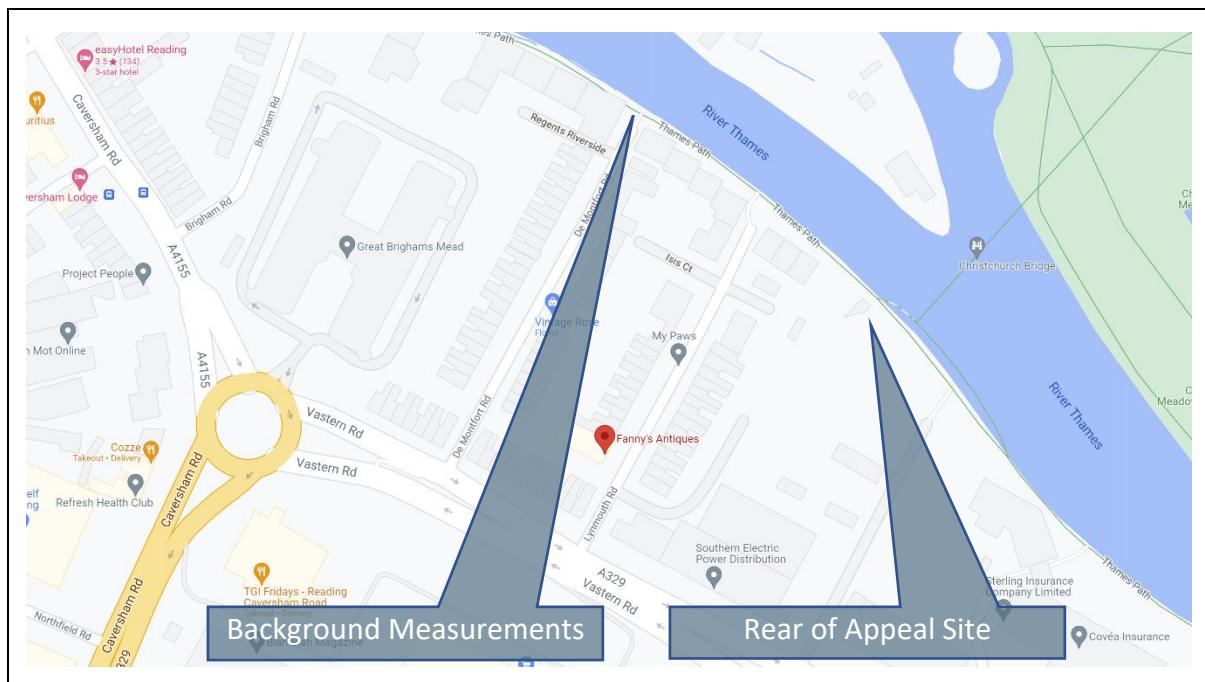


Figure 20 – Position of Background Noise Measurements.

5.18 The following equipment was used to measure the background noise levels.

Type	Sound Level Meter	Microphone	Calibrator
	CEL-633C1	CEL-251	CEL-120/1
Manufacturer	Casella	Casella	Casella
Serial Number	2145360	00709	5231047
Certificate Number	U36894	36893	U36892
Calibration Date	27 th January 2021	27 th January 2021	27 th January 2021

Figure 21 – Calibration details of measurement equipment.

5.19 The following were the prevailing weather conditions during the background measurements I undertook between the 8th and 13th September 2021.

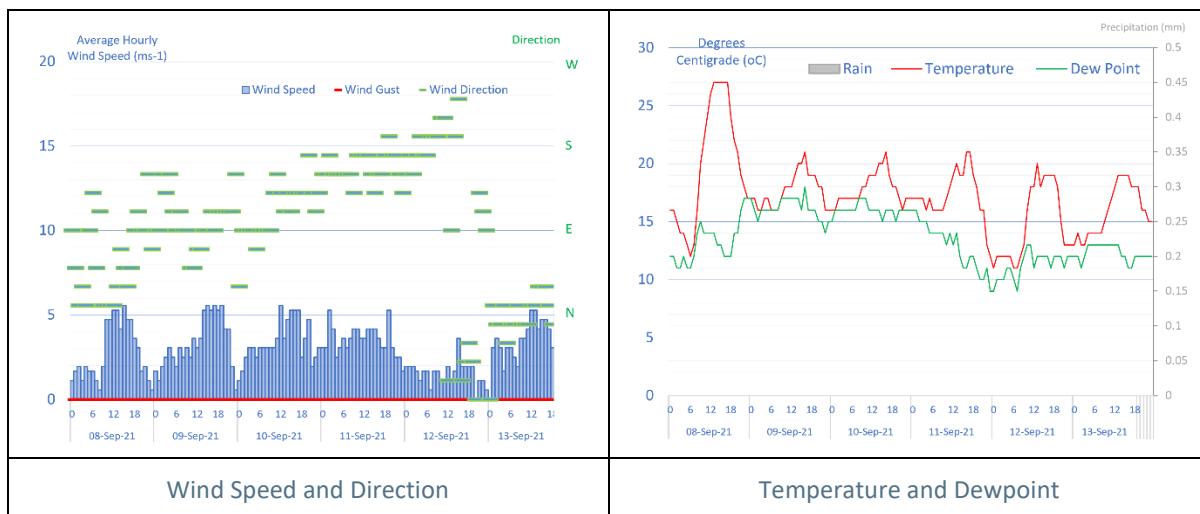


Figure 22 – Weather conditions during survey

5.20 The following graph shows the recorded average noise levels (L_{Aeq}), maximum noise levels (L_{AMax}) and background noise levels (L_{A90}) recorded at the measurement position.

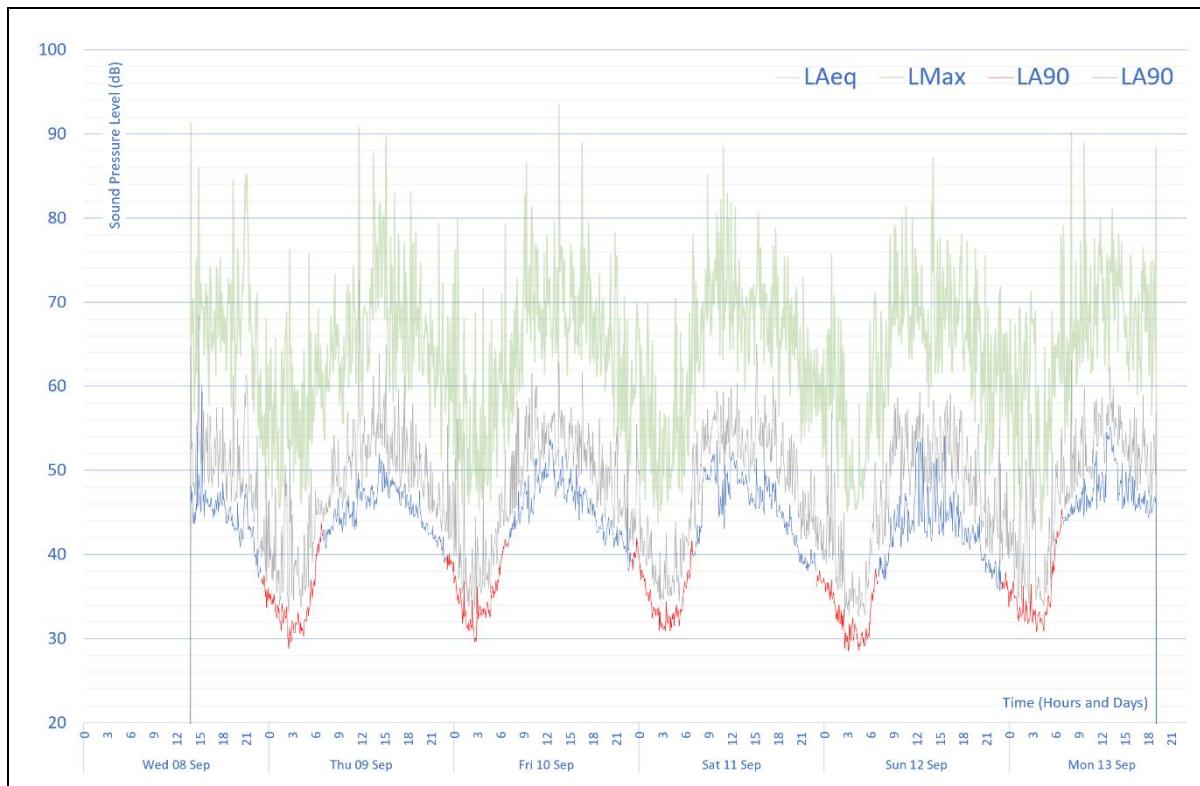


Figure 23 – Background noise measurement results

- 5.21 The background measurements undertaken at an alternative position in line with the guidance within section 8.1.2 of British Standard 4142: 2014 + A1: 2019 indicate that the background noise levels at the rear of the site are likely to be as follows:

Position	Day Time Background Noise Levels	Night Time Background Noise Levels
Rear of Site (Ground Floor)	$L_{A90, 1\text{hour}}$ 40 dB	$L_{A90, 15\text{ minutes}}$ 33 dB

Figure 24 – Day time and night time background noise levels.

- 5.22 The above background noise levels align with the Appellants background noise levels being within the day time period.

- 5.23 The following noise map of the existing average traffic noise levels within the day time shows that there is likely to be a similar background noise level at each of the four positions selected on the residential blocks. The rear of Blocks A and BC are shielded from the traffic noise on Vastern Road by the height of the buildings and though positions on Blocks D and EFG face Vastern Road they are some distance from Vastern Road and at 7th floor level.

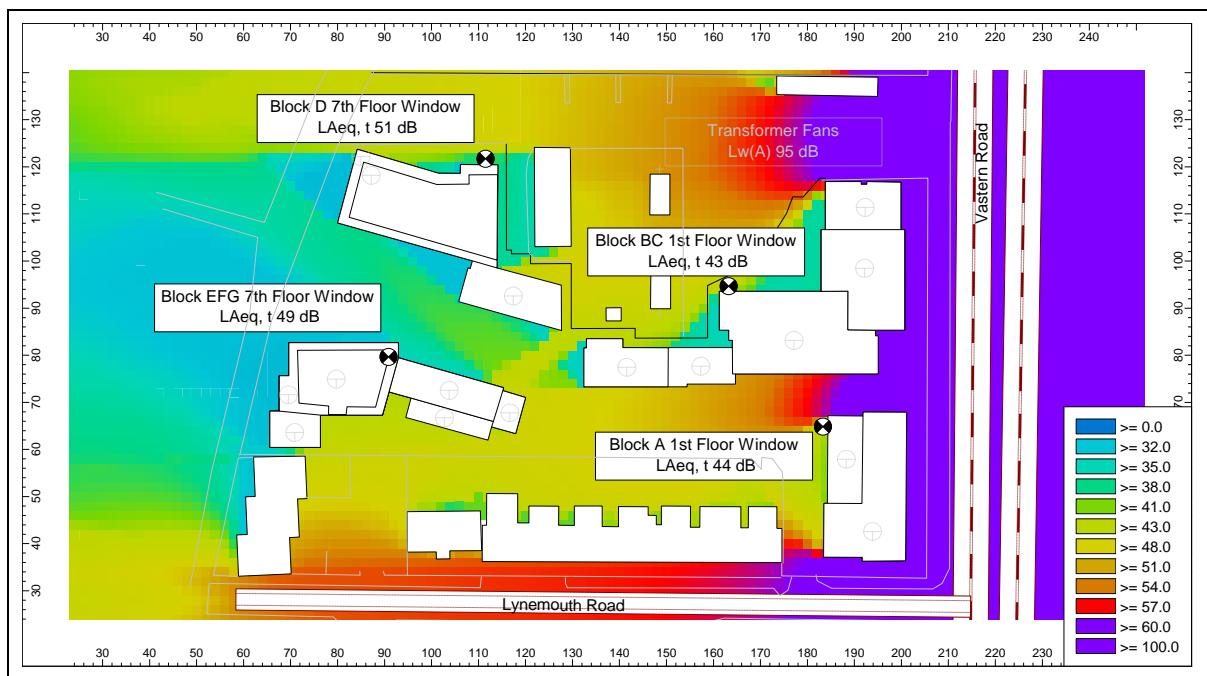


Figure 25 – Residual noise levels at 1st floor level of proposed site.

Feature Correction

- 5.24 The Appellant has proposed a feature correction of +6 dB within section 6.2 of their noise report.
- 5.25 Section 9.2 of British Standard 4142: 2014 + A1: 2019 entitled “*Subjective Method*” provides the following advice in the commentary of the section on “*Tonality*”.

“For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Day Time Feature Correction

- 5.26 In my professional opinion it is appropriate to have a feature correction of +0 dB at the assessment position on the rear of Block A, +4 dB at the assessment position on the rear of Block BC and +2 dB at the assessment positions on Blocks D and EFG during the day time.

Night Time Feature Correction

- 5.27 In my professional opinion it is appropriate to have a feature correction of +2 dB at the assessment position on the rear of Block A, +6 dB at the assessment position on the rear of Block BC and +2 at the assessment positions on Blocks D and EFG during the night time period.
- 5.28 The feature corrections are objective and are based on how prominent the tonality of the resultant noise levels when compared against the residual noise level. For reference these are lower than the arbitrary +6 dB feature correction added by the Appellant in their assessment of external noise levels.

Rating Noise Level

- 5.29 The following are the Rating Noise Levels which are obtained by adding the feature correction to the specific noise levels.

Block	Day Time Rating Noise Levels	Night Time Rating Noise Levels
A (1 st Floor)	$L_{Aeq, 1\ hour} 36\ dB + 0\ dB = 36\ dB$	$L_{Aeq, 1\ hour} 36\ dB + 2\ dB = 38\ dB$
BC (1 st Floor)	$L_{Aeq, 1\ hour} 62\ dB + 4\ dB = 66\ dB$	$L_{Aeq, 1\ hour} 62\ dB + 6\ dB = 68\ dB$
D (7 th Floor)	$L_{Aeq, 1\ hour} 51\ dB + 0\ dB = 51\ dB$	$L_{Aeq, 1\ hour} 51\ dB + 4\ dB = 55\ dB$
EFG (7 th Floor)	$L_{Aeq, 1\ hour} 50\ dB + 0\ dB = 50\ dB$	$L_{Aeq, 1\ hour} 50\ dB + 4\ dB = 54\ dB$

Figure 26 – Rating Noise Levels from SSE Transformers.

Assessment of Internal Noise Levels

- 5.30 The following table provides an initial estimate of the impact of people inside and outside the dwellings based on the external noise levels.

Block	Day Time Assessment Levels	BS 4142 Recommendations
A (1 st Floor)	$L_{Aeq, 1\ hour} 36\ dB - L_{A90, 1\ hour} 40\ dB = -4\ dB$ (Below Low Impact)	$L_{Aeq, 15\ min} 38\ dB - L_{A90, 1\ hour} 33\ dB = +5\ dB$ (Adverse Impact)
BC (1 st Floor)	$L_{Aeq, 1\ hour} 66\ dB - L_{A90, 1\ hour} 40\ dB = +26\ dB$ (Significant Adverse Impact)	$L_{Aeq, 15\ min} 68\ dB - L_{A90, 1\ hour} 33\ dB = +35\ dB$ (Significant Adverse Impact)
D (7 th Floor)	$L_{Aeq, 1\ hour} 51\ dB - L_{A90, 1\ hour} 40\ dB = +11\ dB$ (Significant Adverse Impact)	$L_{Aeq, 15\ min} 55\ dB - L_{A90, 1\ hour} 33\ dB = +22\ dB$ (Significant Adverse Impact)
EFG (7 th Floor)	$L_{Aeq, 1\ hour} 50\ dB - L_{A90, 1\ hour} 40\ dB = +10\ dB$ (Significant Adverse Impact)	$L_{Aeq, 15\ min} 54\ dB - L_{A90, 1\ hour} 33\ dB = +21\ dB$ (Significant Adverse Impact)

Figure 27 – BS4142 Initial estimate on the impact of people inside and outside the dwellings.

Context of the Site

- 5.31 The above initial estimates of how the outdoor sound levels of the SSE Transformers at the residential dwellings would impact people inside and outside the dwellings need to be considered within the context of the site in terms of the absolute level, character of the sound and sensitivity of the receptors.

Absolute Level

- 5.32 The Rating Noise Levels for Block BC in the day time and for Block BC, D and EFG within the night time period are over 20 dB above the background noise levels and will be clearly audible and dominant.

Character of the Sound

- 5.33 The noise from the SSE Transformers has a distinct tone within the 50 Hz and 100 Hz 1/3rd octave bands which is significantly different from the residual sound which is mainly influenced from traffic noise.

Sensitivity of the Receptors

- 5.34 The facades of the residential dwellings will be designed to deal with the traffic noise from Vastern Road with the windows closed and the layout of the buildings will provide some natural acoustic screening.
- 5.35 In terms of the context of the site (absolute Level, character, and sensitivity of the receptors) the initial estimate of the impact on people who may be inside or outside is correct.

Conclusion of Internal Noise Levels from SSE Transformers

- 5.36 I am of the professional opinion that the external noise level from the SSE Transformers will have a significant adverse impact on people inside and outside the dwellings at the rear of Block BC 24-hours per day and at the rear of Block A and the upper floors of Block D and EFG within the night time period.

5.37 The Appellant has not proposed any mitigation measures that could reduce the above assessments to below the level that will cause a significant adverse impact for all residents. Furthermore, I am of the professional opinion that due to the proximity of the rear facades of Block BC to the SSE Transformers and the general layout of the site there are no reasonable mitigation measures that could be introduced to provide acceptable living conditions for the future residents in terms of people inside or outside the dwellings.

6. Assessment of SSE Transformer Noise (NANR 45)

- 6.1 As detailed in section 5 above the noise from the SSE Transformers should be assessed in accordance with BS 4142 as it is industrial and or commercial in nature. However, as the generators clearly contain a dominant tone within the 50 Hz 1/3rd octave band frequency it is considered appropriate to undertake a further assessment in accordance with NANR 45 to assess this low frequency tone. This is an approach that was also recommended within the Appellant's original noise report.

Façade Levels to the Rear of Block BC

- 6.2 The following graph shows the resultant 1/3rd octave noise levels that will impact the rear of Block BC at 1st Floor level which clearly shows the 50 Hz tone from the SSE Transformers.

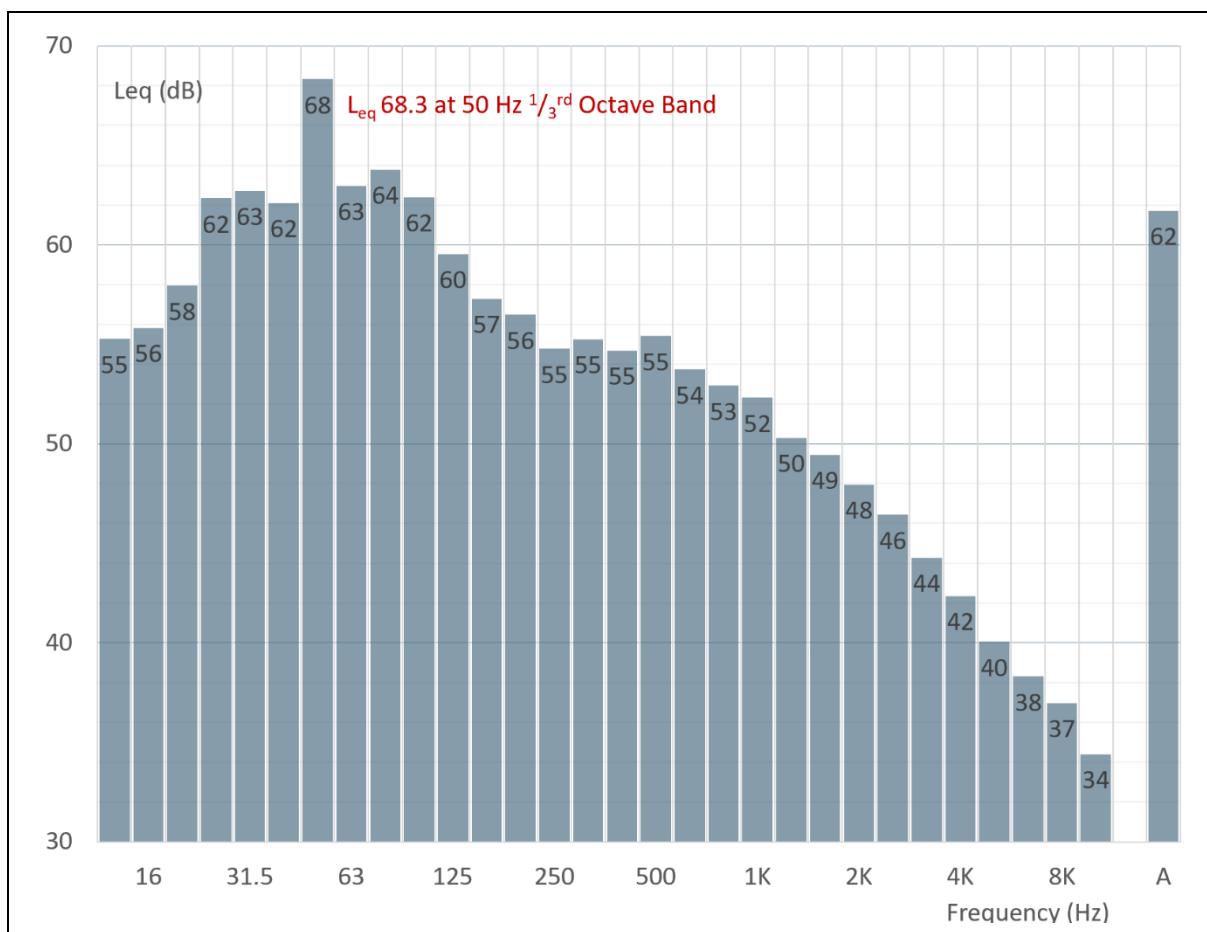


Figure 28 – 1/3rd octave band façade levels from the SSE Transformers.

6.3 The levels are calculated from the 3D noise map and checked with the following manual calculation:

- Transformer 1: 30m away with a direct line of site.
- Transformer 2: 14m away with barrier effect on edge of building ($\delta = 0.15m$).

6.4 The above graph with both transformers A1MP and A2MP operating at the levels measured by 24 Acoustics Ltd result in an obvious tone within the 50 Hz $^{1/3}$ rd octave band frequency.

Performance of Façade Elements

6.5 The following table shows the performance of the façade elements between 12.5 Hz and 160 Hz. However, it should be noted that the performance of the façade elements from 12.5 Hz to 40 Hz are based on the performance of the 50 Hz performance as no transmission loss data is easily available within these lower $^{1/3}$ rd octave band frequencies. However, as these frequencies are unlikely to be of concern this is not considered an issue.

Building Element	$^{1/3}$ rd octave band frequencies											
	12.5	16	20	25	31.5	40	50	63	80	100	125	160
Glazing (4-16-4-150-6)	22	22	22	22	22	22	22	12	20	28	32	35
MVHR System	8	9	10	11	12	13	14	15	17	20	23	27
Wall	33	33	33	33	33	33	33	36	39	41	42	44
Absorption	3	3	3	3	4	5	6	7	8	10	11	12
Transmission Loss (dB)												

Figure 29 – Transmission loss of the building façade elements

6.6 The above transmission loss figures for the MVHR system are based on each MVHR system having a standard 1,000mm atmospheric attenuator on both the inlet and outlet termination with atmosphere.

- 6.7 The Appellants proposed glazing results in a mass-air-mass frequency between the outer pane of the double-glazed unit (4 – 16 – 4) and the 6mm secondary glazing panel forming and air gap of 150mm of 63 Hz. At this frequency the air within the 150 mm airgap acts as a spring and the mass of the 6mm secondary glazing and the outer 4mm pane of the double-glazed unit start to vibrate in resonances causing the significant drop in performance of the window at this frequency. For reference if you reduced the airgap from 150mm the mass-air-mass frequency would start to increase.
- 6.8 It is assumed that the ratio of glazing to external brick façade does not exceed 1 to 4 respectively i.e., each façade has no more than 20% area of glazing. It should be noted that if the proportion of glazing is increased within the façade the overall performance of the façade will be reduced.

Resultant Low Frequency Internal Levels

- 6.9 The first graph on the left shows the internal level if all the mechanical ventilation was blocked up and the façade just consisted of brick and glazing. The graph on the right shows the internal levels with a fully attenuated MVHR system operating. For reference the NANR 45 criterion curve is shown in red on both graphs.

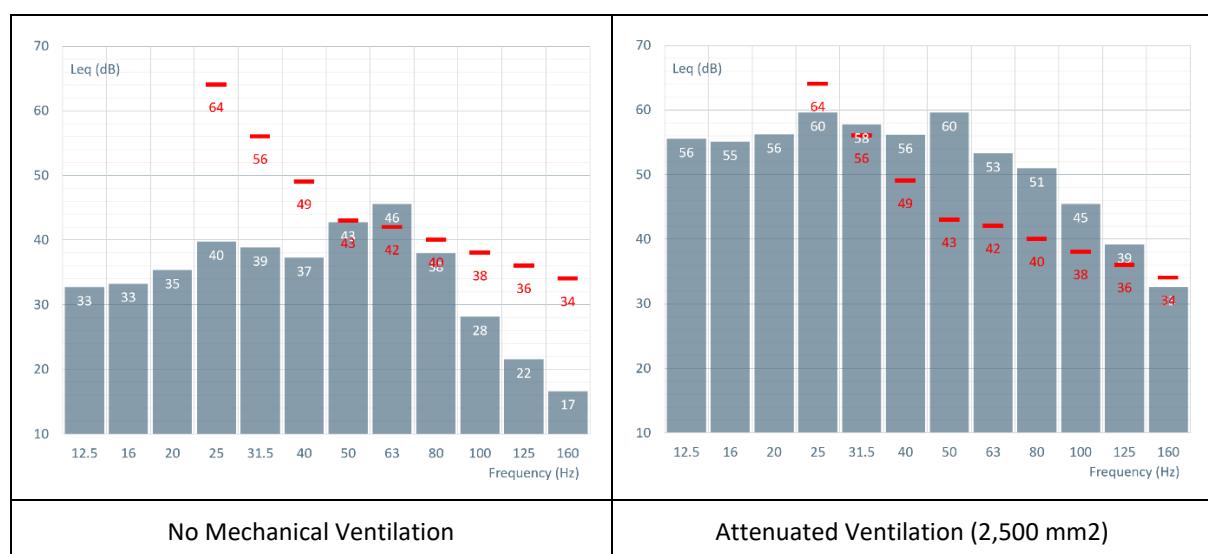


Figure 30 – Resultant low frequency internal noise levels.

6.10 The above graphs demonstrate that the resultant noise levels with the windows closed will exceed the criterion within NANR45 which indicates that complaints are likely to be received.

Standing Waves

6.11 The 50 HZ tone from the SSE transformers has an approximate wavelength of 6.8m depending on the metrological conditions and the exact speed of sound. However, care will need to be taken to ensure that none of the habitable rooms primary dimensions cause standing waves for the incoming 50 Hz tone.

- $\frac{1}{4}$ Wavelength of 50 Hz tone i.e., 1.7m.
- $\frac{1}{2}$ Wavelength of 50 Hz tone i.e., 3.4m.
- $\frac{3}{4}$ Wavelength of 50 Hz tone i.e., 5.1m.

6.12 The following two graphs show the effects a standing wave could start to have on the already dominant tone within the 50 Hz 1/3rd octave bands.

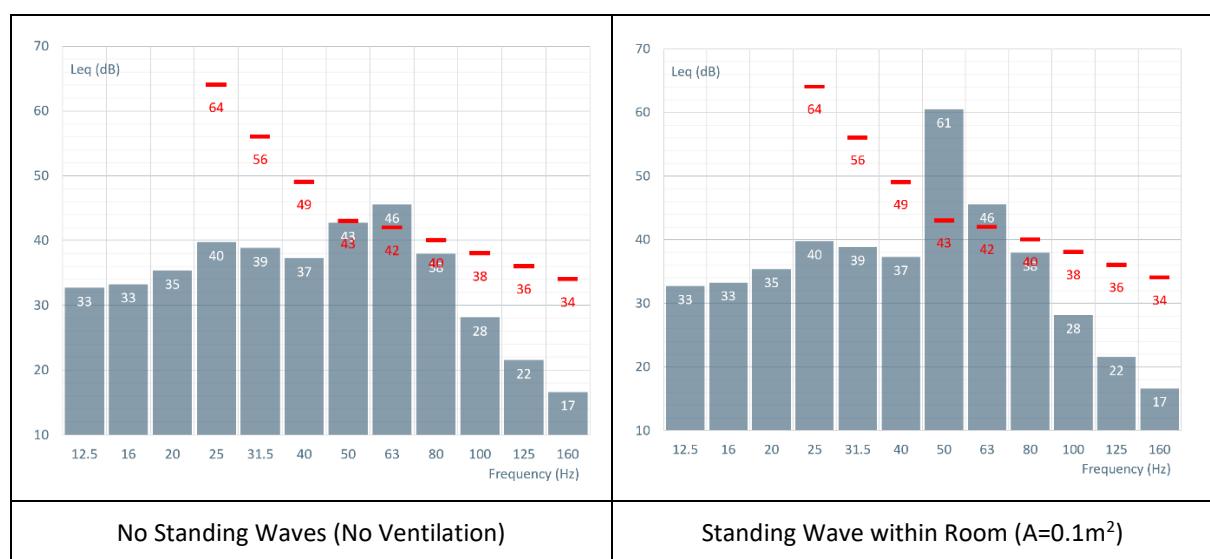


Figure 31 – Possible impact on low frequency internal noise levels from a standing wave.

6.13 The possible impact of standing waves at 50 Hz could be controlled by an appropriate condition which would require the Appellant to demonstrate that none of the rooms had a dimension or layout that would have a high potential of leading to standing waves.

Overall Conclusion – NANR45 Low Frequency Noise

6.14 The assessment of the SSE transformer noise with its dominant and distinctive 50 Hz tone will result in low frequency noise, that according to NANR 45, will disturb the future residents. This is due to the proximity of the residential facades to the SSE Transformers.

6.15 The Appellant has not identified the 50 Hz tone within their assessment and the mitigation strategy proposed by the Appellant will not result in acceptable internal living conditions. Furthermore, I am of the professional opinion that due to the proximity of the rear facades of Block BC to the proposed SSE Transformers there are no reasonable mitigation measures that could be introduced to provide acceptable living conditions for the future residents in terms of low frequency noise.

7. Conclusions

- 7.1 Reading Borough Council refused planning permission including reason for refusal number 4 (“RFR4”) which stated:

“The proposed development has failed to demonstrate that a suitable quality of accommodation can be provided for all future occupiers as the mitigation measures submitted would not be sufficient to minimise the impact of nearby noise pollution thereby contrary to Policies CC8, EN16 and CR6 of the Reading Borough Local Plan (2019).”

Traffic Noise from Vastern Road

- 7.2 The proposed site is located within the centre of Reading and is therefore exposed to the usual high levels of traffic noise. Therefore, in line with the guidance within paragraph 5.3.25 of the Reading Borough Local Plan adopted in 2019 I agree that the assessment of traffic noise from Vastern Road should be assessed internally with the windows closed. The proposed mitigation measures including high specification glazing and fully attenuated MVHR ventilation systems should result in internal noise levels that will provide a suitable quality of accommodation for future residents.

Noise from SSE Transformers

- 7.3 The proposed site is located adjacent to the large existing SSE transformer site which emits noise with a continuous low frequency 50 Hz tone and has intermittent noise from the cooling fans. The assessment of this industrial noise source indicates from the external levels impacting the façade of the proposed residential buildings that there will be a *“significant adverse impact”* on the people who might be inside or outside of the building within the context of the site. The resultant noise levels are contrary to Policy CC8, EN16 and CR6 of the Reading Borough Local Plan and will without question result in an unacceptable quality of accommodation for future residents.

Discussions of Results

- 7.4 I am of the professional opinion that in terms of RFR4 Reading Borough Council were correct to refuse planning permission as the Appellant failed to demonstrate that the noise from the SSE Transformers could be adequately mitigated to ensure a suitable quality of accommodation for the future residents.
- 7.5 I am of the professional opinion there are no mitigation measures that can be introduced within the current scheme that will adequately control the noise from the SEE Transformers.
- 7.6 I am also of the opinion that the layout along Vastern Road could be modified with possibly retail properties on the ground floor, offices on the 1st and 2nd floor and then residential dwellings on the third floor and above. If the building line was set back and carefully designed acoustic balconies were introduced, it may be possible to get to a position that when residents open the windows the internal noise levels would be acceptable.
- 7.7 Care would need to be taken with any future scheme that if all the facades facing the SSE Transformers were constructed only of brick that this did not increase the SSE Transformer noise levels experienced by the existing residents on the east of the site.

Agent of Change Principle

- 7.8 Throughout the report I have assumed that the Appellant has correctly measured the noise levels from the SSE Transformers and despite the current upgrade works being undertaken on the site the future noise levels will not be increased from the overall capacity of the site.

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