



Architectural & Environmental Consultants

Noise | Vibration | Air Quality

Substation Noise Assessment

45 Caversham Road, Reading

Substation Noise Assessment

Project: 45 CAVERSHAM ROAD, READING

Report reference: RP02-21516-R0

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Document control:

REVISION	ISSUE DATE	REPORT BY	CHECKED BY	NOTES
0	08 August 2023	Chris McNeillie, MSc CEng MIOA, Director	Sam Bryant, MPhys CEng MIOA, Director	Initial issue

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1. EXECUTIVE SUMMARY

- 1.1 Cass Allen has been instructed by Oriel Housing Ltd to assess the acoustic design of a substation associated with the new residential development at 45 Caversham Road, Reading.
- 1.2 The assessment was carried out in accordance with relevant local planning guidance and British Standard BS4142:2014.
- 1.3 A noise survey was carried out at the site and the results used to calculate appropriate limits for noise from the substation at the positions of nearby sensitive receptors.
- 1.4 A 3D noise model of the substation was constructed based on the design of the substation and noise data for the transformers that will be located within the substation. The model was used to predict the substation noise levels at the positions of the nearby sensitive receptors.
- 1.5 The predicted substation noise levels were found to comply with the relevant noise limits at all nearby sensitive receptors.
- 1.6 It is our view therefore that the design of the substation is acceptable in relation to noise and compliant with Reading Borough Council's standard requirements.

2. INTRODUCTION

- 2.1 Cass Allen has been instructed by Oriel Housing Ltd to assess the acoustic design of a new substation associated with the development at 45 Caversham Road, Reading.
- 2.2 The assessment was carried out in accordance with relevant local and national planning guidance and British Standard BS4142:2014.
- 2.3 This report contains technical terminology; a glossary of terms can be found at www.cassallen.co.uk/glossary.

3. SUBSTATION DESCRIPTION

- 3.1 The substation is to be located behind the new residential development at 45 Caversham Road, Reading. Drawings showing the substation location and design are shown in Appendix 1. An annotated aerial photo of the site and surrounding area is also shown in Figure 1 below.

Figure 1 Site and Surrounding Area



- 3.2 The closest sensitive receptors to the new substation will be habitable rooms and gardens at the rear of existing residential properties on Caversham Road, habitable rooms at the rear of the new development, and habitable rooms at the rear of Lion Court. If acceptable substation noise levels are achieved at these positions, then acceptable substation noise levels will be achieved at all nearby sensitive receptors.

4. PLANT NOISE IMPACT ASSESSMENT

- 4.1 The assessment has been carried out in accordance with BS4142:2014+A1:2019 as requested by Reading Borough Council for compliance with Reading Borough Local Plan 2019 Policy CC8 and EN17.
- 4.2 BS4142:2014 - *Method for rating and assessing industrial and commercial sound* (hereafter BS4142) can be used to assess the impact of noise from external industrial and/or commercial noise sources on nearby sensitive receptors.
- 4.3 The BS4142 assessment methodology can be summarised as follows:
1. Measure the existing background noise levels (LA90,T dB) at the locations of nearby noise sensitive receptors during the quietest periods when the noise source(s) under investigation will operate;
 2. Predict or measure the noise emissions (LAeq,T dB) from the noise source(s) under investigation at the location(s) of the nearby sensitive receptors, and add corrections for any distinguishable acoustic features (e.g. tones, whines, screeches, hisses etc);
 3. Subtract the measured background noise levels (item 1 above) with the measured or predicted rating noise levels (item 2 above) at each sensitive receptor. BS4142 states that:
 - 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.*
- NOTE Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*
- 4.4 It is understood that Reading Borough Council consider “background -10 dB” to be an appropriate target criterion for new developments within their borough. This criterion has therefore been adopted for the assessment of noise emissions from the substation.
- 4.5 Background noise levels (LA90) at the site were measured as part of the site noise survey outlined in Appendix 2. The lowest typical measured background noise levels were during the night-time at 40 dB LA90,T.

- 4.6 It should be noted that the background noise levels were measured on the edge of the site facing Caversham Road. Noise levels at this position will generally be much higher than those at the rear of the site which is screened from the road by the buildings. However, during the very middle of the night-time, when the lowest background noise levels were measured, we would expect that background noise levels would be similar at the front and rear of the buildings. This is because the background levels will be dictated by distant traffic rather than traffic on Caversham Road as vehicle movements on Caversham Road will be intermittent and therefore not affect background noise levels. This can be seen from the graph in Appendix 2 which shows a significant reduction in background noise levels measured between around 1am and 4am.
- 4.7 Therefore, in our view the measured level of 40 dB LA90,T is appropriate for use in the assessment. The resultant plant noise limit at nearby receptors is as follows:
- 30 dB LArTr
- 4.8 Noise from the substation will be dictated by noise emissions from the transformer in the substation breaking out of the louvres of the substation housing. Noise data for the transformer to be used in the substation are shown in Appendix 3. The locations of the louvres are shown on the substation design drawings in Appendix 1.
- 4.9 A noise model was developed using Cadna/A environmental noise modelling software to predict resultant substation noise levels at the positions of nearby sensitive receptors based on the position, design and noise data for the substation. The results of the modelling are shown in Appendix 4.
- 4.10 Notes on the modelling:
- The modelling used a typical noise spectrum for substation transformers corrected to a total Sound Power Level (SWL) of 54 dB SWL as per the manufacturer noise data for the transformer.
 - The modelling assumed that all significant noise break out would be via the weather louvres to the substation (this is a reasonable assumption in our view as noise break out via the brick walls and roof will be significantly lower).
 - The noise data for the transformers is understood to represent the transformers at maximum duty. It should be noted that they will not be expected to run anywhere near maximum duty for most of the time, and particularly during the night-time when background noise levels will be lowest and residents will be most sensitive to noise. The modelling predictions are therefore 'worst case'.
 - No attenuation has been included for the louvres. In reality we would expect standard weather louvres to attenuate the noise emissions by around 3 dB and therefore noise emissions would be lower in practice than the modelled levels.
- 4.11 The results of the predictions are shown in Table 1.

Table 1 Predicted ‘Worst case’ Plant Noise Emissions from the Substation

Location	Predicted Substation Noise Levels (dB LAr,Tr)	BS4142 Criteria (dB LAr,Tr)
Nearest dwellings in the new development at 45 Caversham Road	28	30
Facade of nearest dwellings at the back of existing residential properties on Caversham Road	19	30
Gardens of nearest dwellings at the back of existing residential properties on Caversham Road	~15-28	30
Facade of nearest dwellings at the back of existing residential properties in Lion Court	20	30

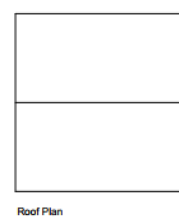
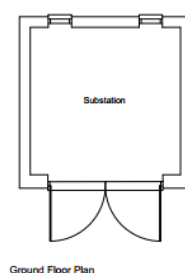
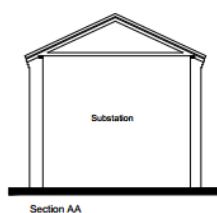
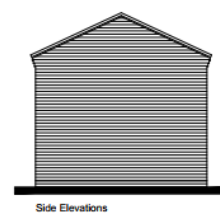
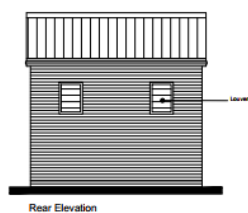
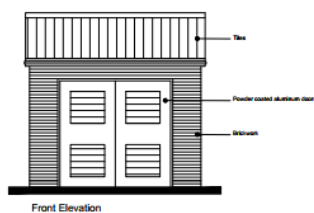
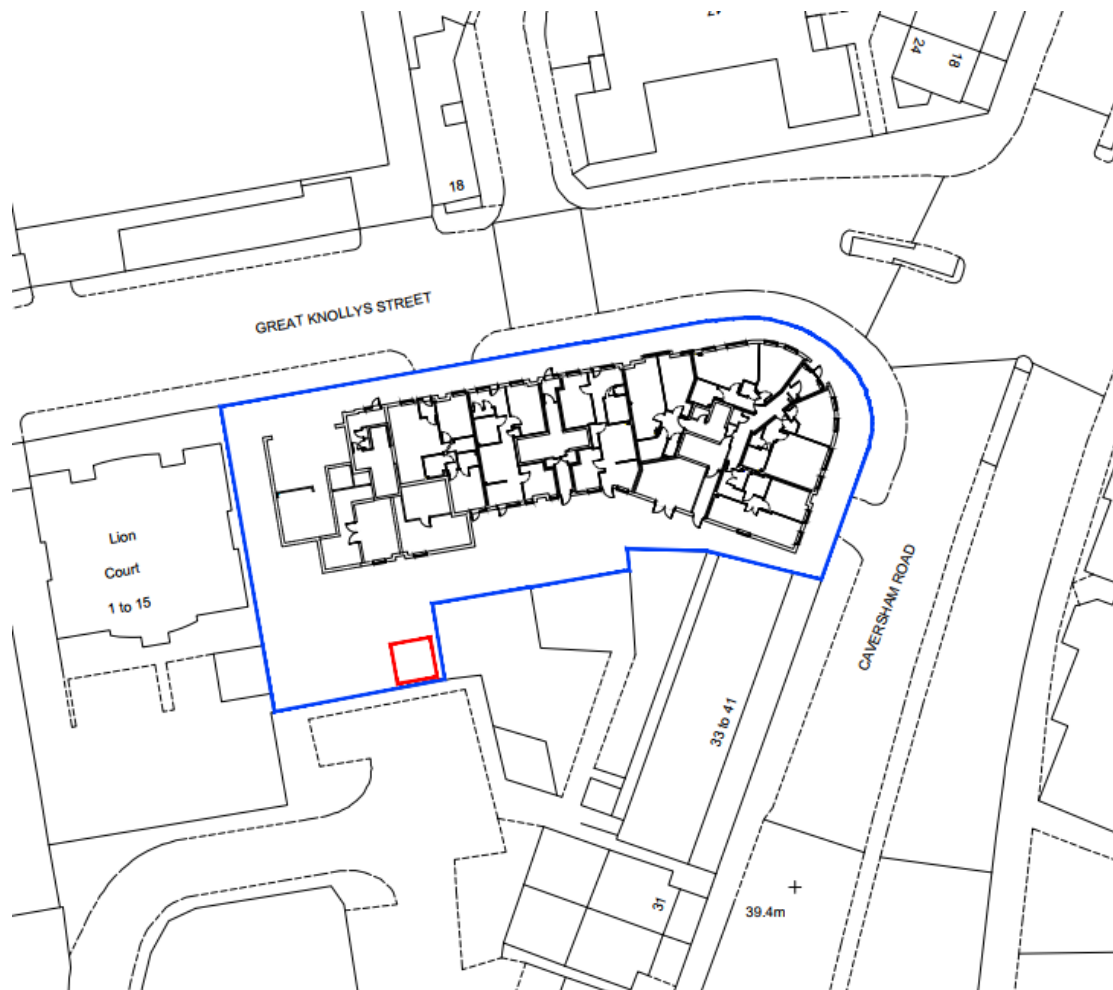
Note 1 The predicted substation noise levels include a +2 dB correction for tonality on the basis that we expect it may be faintly audible at receptor positions.

- 4.12 It can be seen from Table 1 that the predicted ‘worst case’ substation noise levels at the nearest sensitive receptors are all predicted to comply with the relevant noise criterion.
- 4.13 The proposed design of the substation is therefore considered to be acceptable with regards to noise and compliant with Reading Borough Council’s standard requirements.

5. CONCLUSIONS

- 5.1 Cass Allen was instructed by Oriel Housing Ltd to assess the acoustic design of the new substation at 45 Caversham Road, Reading.
- 5.2 The assessment was carried out in accordance with relevant local and national planning guidance and British Standard BS4142:2014.
- 5.3 Measured background noise levels at the site were used to calculate appropriate limits for noise from the substation at the positions of nearby sensitive receptors.
- 5.4 A 3D noise model of the substation was constructed based on the design of the substation and noise data for the transformers that will be located within the substation. The model was used to predict the substation noise levels at the position of the nearby sensitive receptors.
- 5.5 The predicted substation noise levels were found to comply with the relevant noise limits at all nearby sensitive receptors.
- 5.6 It is our view therefore that the design of the substation is acceptable in relation to noise and compliant with Reading Borough Council's standard requirements.

Appendix 1 Substation Design



Appendix 2 Survey Results

Survey Summary:

The survey comprised short-term operator attended noise measurements and longer-term unattended noise monitoring at the site. Noise levels at the site were generally dictated by road traffic on surrounding roads notably Caversham Road

Survey Period:

19/06/2020 to 23/06/2020

Survey Objectives:

- To identify noise sources that contribute to ambient noise levels at the site;
- To measure noise levels around the site over a typical day and night-time period.

Equipment Used:

Type	Manufacturer	Model	Serial Number
Sound level meter ¹	Rion	NL-52	00965090
Calibrator	Rion	NC-74	34551703
Sound level meter ¹ (noise logger)	Rion	NL-32	01182950

Note 1: All sound level meters were calibrated before and after measurement periods and no significant drift in calibration was found to have occurred. The results of the measurements are therefore considered to be representative.

Weather Conditions:

The observed weather conditions were acceptable for acoustic measurement throughout the attended survey periods (low-medium wind speeds and no rain). Weather records for the area confirmed that weather conditions were also generally acceptable for acoustic measurement during the unattended monitoring. Any periods of unattended monitoring that may have been adversely affected by weather conditions have been excluded from the data analysis.

Measurement Positions:

Position (refer plan below)	Description
N1	Attended noise monitoring position. 1.3m above ground. Free-field. Direct line of sight to Great Knollys Street and Caversham Road.
N2	
N3	Attended noise monitoring position. 1.3m above ground. Free-field. Direct line of sight to Caversham Road.
N4	
L1	Unattended noise logging position. 1.5m above ground level. Free-field. Direct line of sight to Caversham Road.

Site Plan showing Measurement Positions:



Attended Noise Monitoring Results:

Date	Position	Time	Meas. Length	LAeq, dB	LAmx, dB	LA90, dB	Observations
19/06/2020	N1	10:55	5 mins	61	71	55	Noise dictated by road traffic from Caversham Road
		11:00	5 mins	67	87	54	
	N2	11:05	13 secs	71	73	69	Noise dictated by activities associated with Thimbleby & Shotland Auction Centre and Farmers Market
		11:05	5 secs	73	75	71	
		11:06	4 secs	71	73	66	
		11:07	6 secs	71	74	70	
	N3	11:11	10 secs	76	83	70	Noise dictated by road traffic
		11:12	11 secs	72	77	70	
		11:12	8 secs	76	79	74	
		11:13	7 secs	75	79	72	
		11:14	12 secs	73	78	67	
		11:15	5 mins	74	87	64	
	N4	11:25	5 mins	74	85	67	
	N1	11:37	9 secs	61	63	60	
		11:38	6 secs	56	61	53	
		11:39	5 secs	53	55	52	
		11:45	5 mins	61	71	51	
	N3	12:12	5 mins	66	83	54	
		12:21	6 secs	77	82	73	
		12:22	5 secs	75	78	71	
		12:25	5 mins	74	83	65	

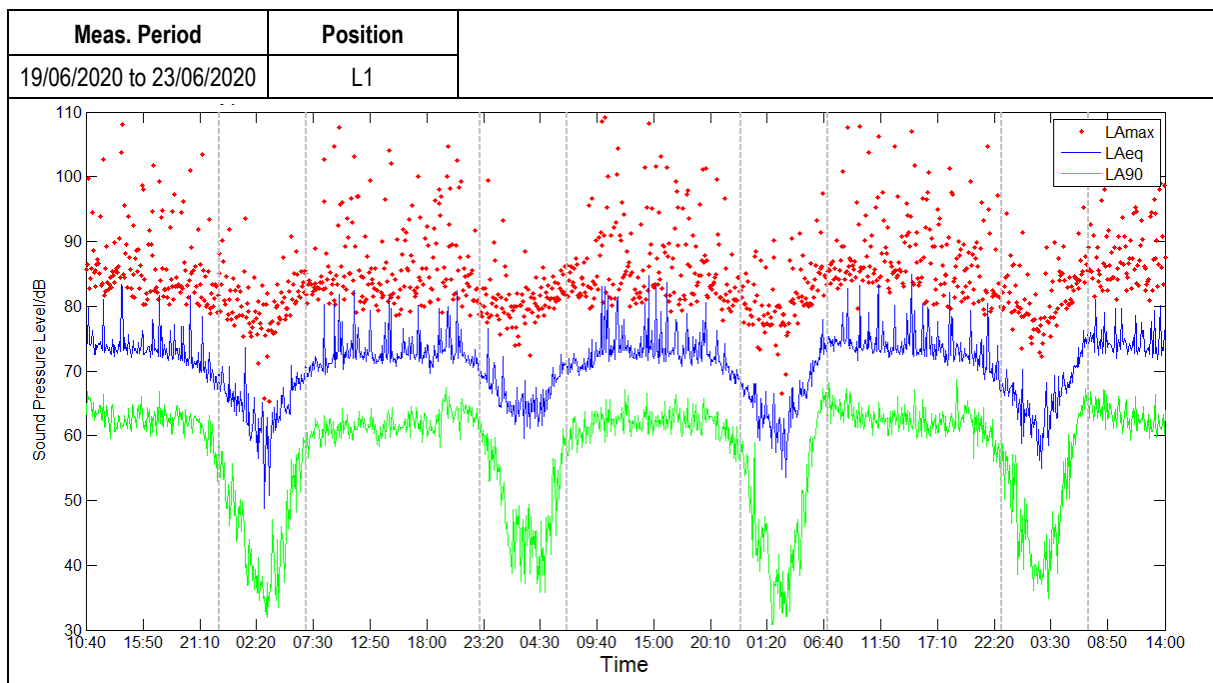
Unattended Noise Monitoring Results:

Meas. Period	Position	Daytime (0700-2300hrs)		Night-time (2300-0700hrs)		
		LAeq,16hr, dB	LA90,1hr dB ¹	LAeq,8hr, dB	LA90,5mins, dB ¹	LAmix, dB ²
19/06/2020 to 23/06/2020	L1	75	61	67	48	85-86

Note 1: Typical lowest measured during the period shown.

Note 2: Highest typical maximum noise level during the night-time (not exceeded more than 10-15 times per night).

Unattended Noise Monitoring Results:



Appendix 3 Substation Transformer Noise Data

ENA Technical Specification 35-1 Part 1

Issue 6 2014

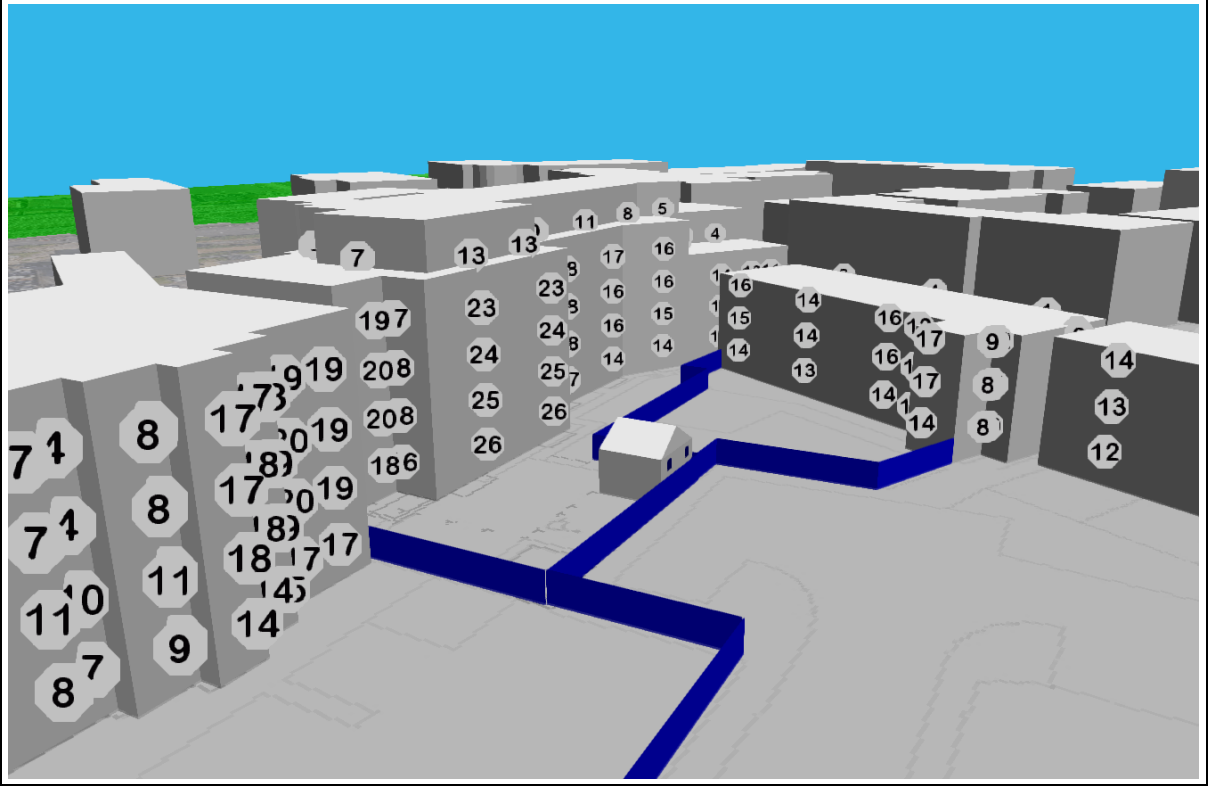
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Table 1 — Transformer details

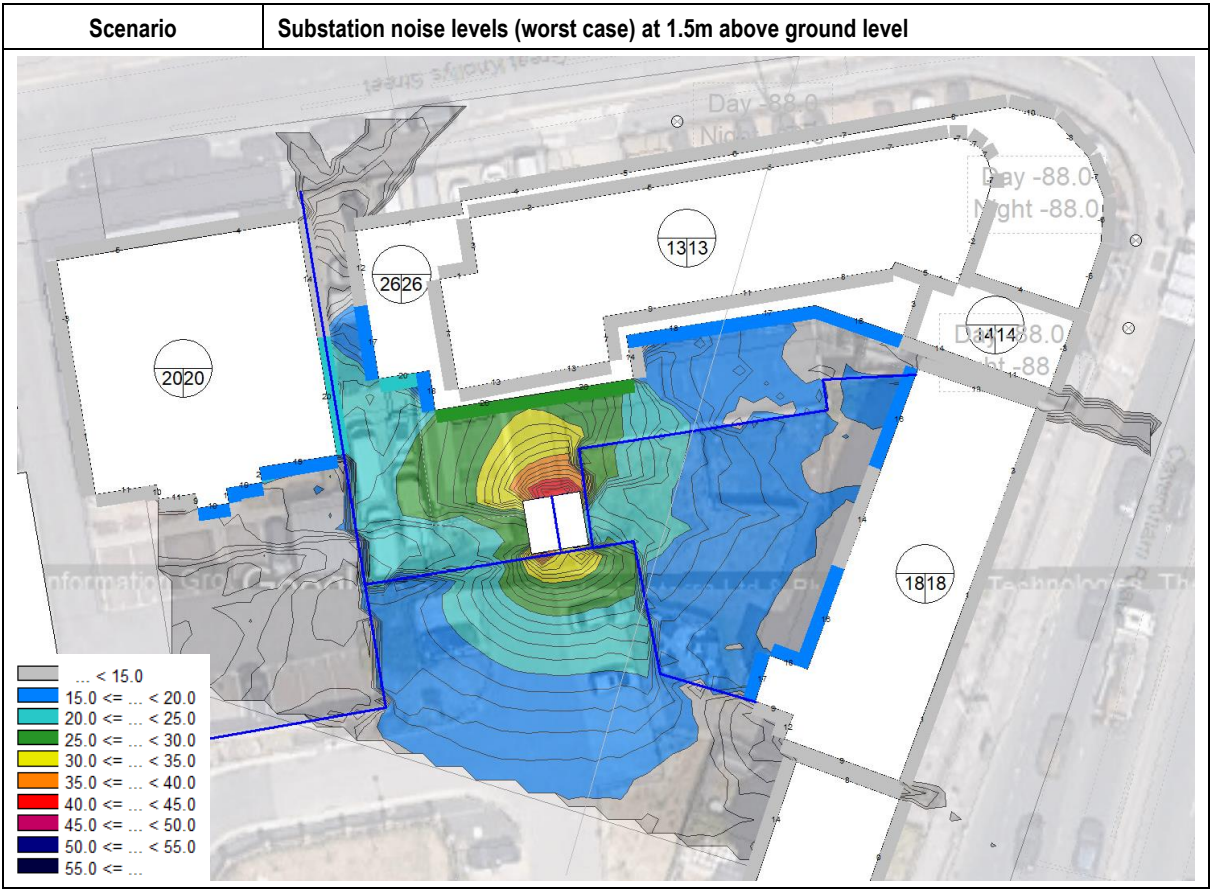
Voltage Ratio	Type	Phase	Connection phase displacement symbol	Rated Power(kVA)	Short-Circuit Impedance (%) (Note 10)	Sound Power Level (dBA)
6 600/250 or 11 000/250 or 20 000/250 or 33 000/250 (2-wire system)	3 3 3 3	Single	li0	16 25 50 100	4.5 4.5 4.5 4.5	45 45 45 48
6 600/500-250 or 11 000/500-250 or 20 000/500-250 or 33 000/500-250 (2- or 3-wire system)	1 3 3	Single	li0i0	25/50 50/100 (Note 3)	4.5 4.5	45 45
6 600/250-0-250 or 11 000/250-0-250 or 20 000/250-0-250 33 000/250-0-250 (3-wire system)	1 3 1 3 1 3 1 3	Single	li0 (i0) (i6)	50 100 160 200	4.5 4.5 4.5 4.75	45 48 48 52
6 600/433-250 or 11 000/433-250 or 20 000/433-250 or 33 000/433-250	1 3 1 3 1 3 1 2 3 1 2 3 1 2 1 2 1 2 1 2 1	Three	Dyn11	25 50 100 160 200 315 500 800 1 000 1 600 2 000	4.5 4.5 4.75 4.75 4.75 4.75 4.75 4.75 4.75 5.5 6.0	45 45 48 48 52 54 56 58 59 61 62
11 000-6 600/433-250 Dual ratio	1 1 2 1 2 1 2 1 2 1 2 1 2	Three	Dyn11	200 315 500 800 1 000 1 600 2 000	4.75 4.75 4.75 4.75 4.75 5.5 6.0	52 54 56 58 59 61 62

Appendix 4 Modelling Results

Modelling Software:	CADNA/A Version 2023
Modelled Scenarios:	Worst case substation noise emissions
Data inputs:	- Manufacturer noise data for transformers (corrected to reference spectra) - Development & substation design layout
Calculation Algorithms Used:	- ISO 9613-1:1993 Acoustics-Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere - ISO 9613-2:1996 Acoustics-Attenuation of sound during propagation outdoors – Part 2: General method of calculation
Modelling Printout:	

Scenario	Substation noise levels (worst case)
	

Modelling Printout:





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