
**New Residential Apartments
Swinbourne Grove, Manchester**

Transformer Noise Survey

Project: Swinbourne Grove - Transformer Noise Survey

Client: Truman Design and Build Ltd

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Authorised by	Ryan Swales, BSc, MIOA Director & Principal Consultant
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1. Introduction

- 1.1 RS Acoustic Engineering Ltd have been appointed by Truman Design and Build Ltd to undertake a noise survey and assessment with regard to the new transformer and substation associated with the recently constructed apartment building off Swinbourne Grove, Manchester, M20.
- 1.2 The development was granted full planning permission subject to a number of conditions. With regard to transformer related noise, condition no.28 applies (further details are provided overleaf).
- 1.3 An environmental noise survey was previously conducted in February 2021 in order to determine the lowest and typical background sound levels during the daytime and night-time period. The background sound levels were used to determine appropriate noise criteria for new building services plant, including the transformer.
- 1.4 The manufacturer's sound level data for the transformer and the substation construction details have also been previously used to estimate the noise break-out levels at adjacent dwellings.
- 1.5 There are semi-detached dwellings located along Swinbourne Grove to the east and an extra-care residential property immediately south of the new apartment building. The dominant noise source at the site was observed to be road traffic on Wilmslow Road.
- 1.6 Site visits were conducted in July 2021 in order to inspect the substation, conduct subjective observations at the nearest dwellings with regard to audibility and also conduct sample noise measurements in close proximity to the substation.
- 1.7 The survey and assessment was conducted by Mr Ryan Swales (BSc(Hons), MIOA), Principal Acoustic Consultant and Corporate Member of the Institute of Acoustics.
- 1.8 The report provides details of the relevant planning condition, appropriate acoustic criteria for plant noise emissions, construction details of the new substation and the results of the transformer noise survey.

2. Assessment Criteria

Manchester City Council Planning Condition

- 2.1 The following noise related planning condition has been attached to the permission:

Condition No.28:

The electrical substation shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as local planning authority. The scheme shall be implemented in full before the use commences. Upon completion of the development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

- 2.2 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.
- 2.3 Outdoor sound levels are used to assess the likely effect on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The standard is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.
- 2.4 The standard states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.
- 2.5 A difference of around +5 dB is likely to be an indication of an adverse 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 or a significant adverse impact.
- 2.6 Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3. Noise Criteria, Transformer & Survey Details

Noise level criteria

- 3.1 Taking into account MCC's requirements, the sound rating level ($L_{Aeq,T}$) from all new building services plant should be at least 5 dB below the typical background sound level ($L_{A90,T}$).
- 3.2 Table 3.1 presents the applicable sound level targets for new fixed plant. The sound level targets should be achieved at approximately 1 metre from the nearest noise sensitive window/elevation.

Table 3.1 – Sound level targets for new building services plant

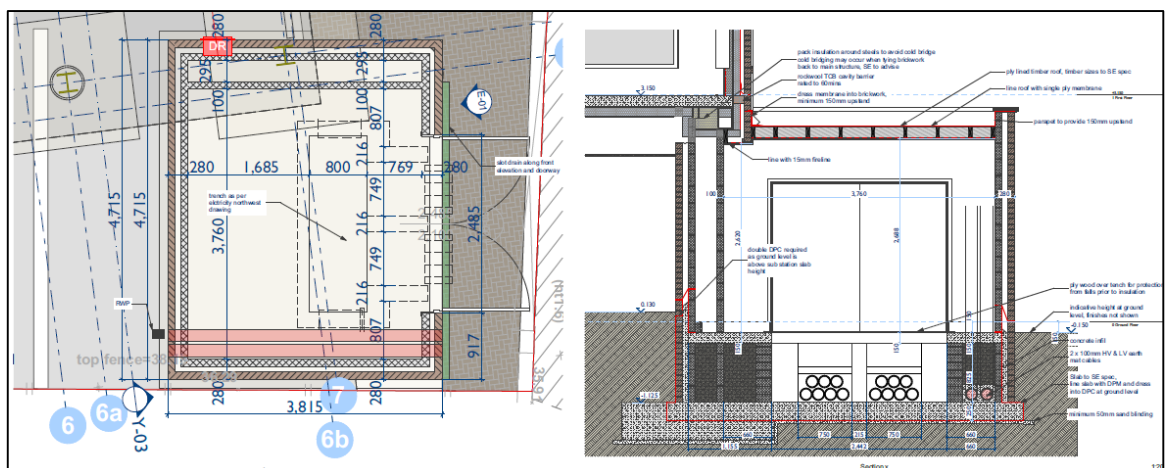
Period, Hours	Lowest Background Sound Level $L_{A90,15min}$ dB	Target Rating Level $L_{Aeq,15min}$ dB
Daytime (07:00-23:00)	44	39
Night-time (23:00-07:00)	39	34

- 3.3 The new substation operates continuously and therefore the relevant sound level target is 34 dB $L_{Aeq,15min}$.

Transformer and substation construction details

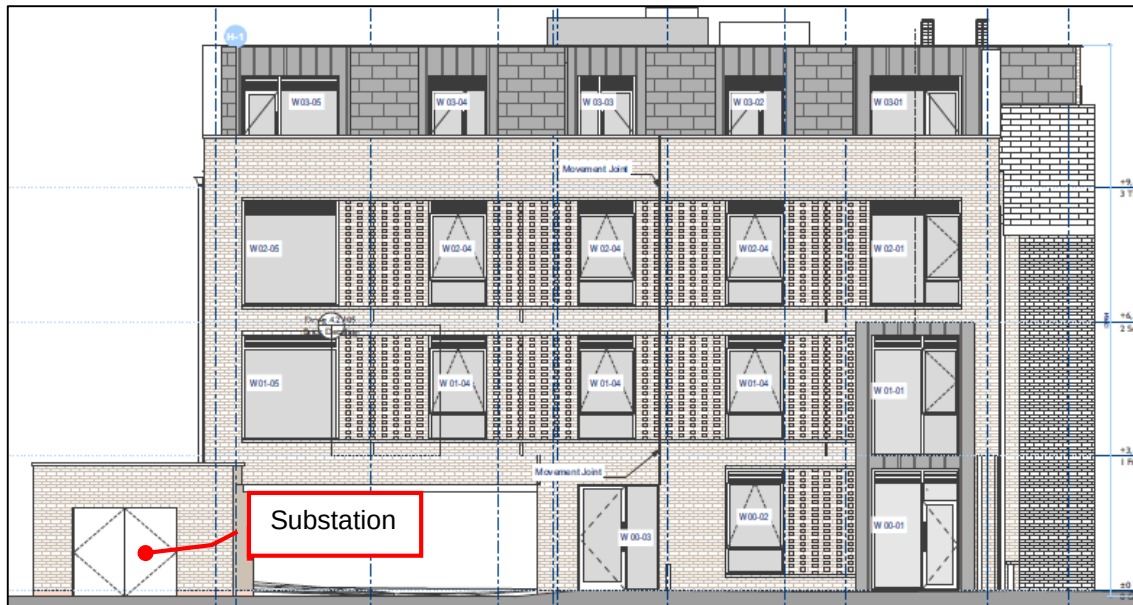
- 3.4 The datasheet for the proposed transformer indicates a sound pressure level of 56 dBA at a distance of 0.3 metres from the unit.
- 3.5 The external wall construction consists of a brickwork outer leaf, 75 mm cavity and 100 mm thick blockwork inner leaf. The sound insulation performance of such a construction is typically 50 to 60 dB R_w .
- 3.6 The roof construction consists of a membrane backed plywood sheet, 150 mm timber joists, insulation fitted between joists and two layers of 15 mm Fireline plasterboard. It is estimated that the roof construction is providing a sound insulation performance of approximately 44 dB R_w .
- 3.7 There are steel double-doors to the substation that face the dwellings on Swinbourne Grove.
- 3.8 Figure 3.1 shows the construction details and orientation of the transformer substation.

Figure 3.1 – Plan and section showing new substation



3.9 Figure 3.2 shows the Swinbourne Grove elevation and transformer substation.

Figure 3.2 – Swinbourne Grove elevation showing new substation



3.10 The previous calculation results indicated a specific sound pressure level of approximately 13 dB $L_{Aeq,T}$ at the nearest dwelling (apartment). The corresponding sound rating level was 13 dB $L_{Ar,15min}$.

3.11 The calculation results also indicated a specific sound pressure level of approximately 18 dB $L_{Aeq,T}$ at the adjacent dwellings on Swinbourne Grove. The corresponding sound rating level was 18 dB $L_{Ar,15min}$.

3.12 The predicted sound rating level of the transformer therefore easily achieves the target noise limit of 34 dB $L_{Aeq,15min}$ during the night-time period.

Sample measurements of new transformer

3.13 Site visits were conducted on Tuesday 20th and Wednesday 28th July 2021 in order to inspect the substation, conduct subjective observations at adjacent dwellings with regard to audibility/tonality and conduct a number of sample noise measurements in close proximity to the substation.

3.14 Sample measurements were conducted at a separation distance of approximately 3 metres from the substation doors. The doors are considered to be the weakest point acoustically with regard to noise egress from the substation.

3.15 The survey was performed using the following Class-1 specification equipment:

- Brüel & Kjaer 2250-Light data logging sound level meter, with microphone type 4189 and pre-amplifier type ZC0032.
- CEL-120/1 Acoustic calibrator.

3.16 Calibration of the sound level meter and microphone used for the measurements are traceable to UKAS accredited laboratories. Calibration certificates are provided within Appendix A.

3.17 The calibration of both sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the survey. The drift in calibration was less than 0.1 dB.

- 3.18 Table 3.2 presents a summary of the measured sound pressure levels with the transformer continuously operating. Measured values have been rounded to the nearest whole number.

Table 3.2 – Summary of measured sound pressure levels

Date & Start Time	$L_{Aeq,15min}$ dB	$L_{A90,15min}$ dB
20/07/2021 04:00	44	38
20/07/2021 04:15	44	39
28/07/2021 04:35	43	38

- 3.19 The results of the survey indicate ambient sound pressure levels ranging between 43 and 44 dB $L_{Aeq,15min}$ and background sound pressure levels ranging between 38 and 39 dB $L_{A90,15min}$.
- 3.20 Measurements previously conducted during the early morning hours in February 2021 (circa 04:00 to 05:00 hours) indicate ambient L_{Aeq} sound pressure levels ranging between 44 and 48 dB $L_{Aeq,15min}$ and background sound levels ranging between 39 and 41 dB $L_{A90,15min}$.
- 3.21 The sound pressure levels measured in July are therefore slightly lower than those measured in February 2021 (prior to the installation of the substation).
- 3.22 Subjectively, there was no audible noise emanating from the structure and no tonal characteristics (hum) audible at neighbouring dwellings. The only audible sources of noise were intermittent road traffic and an extract fan at the adjacent property.
- 3.23 Since the sample measurement results are slightly lower than those previously measured and there has been no increase in background sound level, this indicates that the specific sound level emanating from the transformer substation is less than 34 dB $L_{Aeq,15min}$.
- 3.24 By way of example, if the specific sound level was 34 dB $L_{Aeq,T}$ and this was combined with an existing ambient sound level of 44 dB $L_{Aeq,T}$, the resulting ambient sound level would be approximately 44.4 dB $L_{Aeq,T}$.
- 3.25 However, if for example the specific sound level was 39 dB $L_{Aeq,T}$, the resulting ambient sound level would increase to approximately 45.2 dB $L_{Aeq,T}$. The results of the survey show no increase in ambient or background sound level since February 2021 and noise from the transformer is inaudible when stood in close proximity.
- 3.26 Since the transformer is inaudible, it is appropriate to take the specific sound level and rating level as equal values.
- 3.27 It is therefore evident that the sound rating level of the transformer is achieving the sound level targets specified within this report.

4. Conclusion

- 4.1 Appropriate noise targets for the daytime and night-time period and have been determined for new building services plant.
- 4.2 The sound rating level of the transformer achieves the daytime and night-time targets at the nearest dwellings.
- 4.3 Subjectively, noise from the transformer is inaudible at the nearest dwellings and there is no audible tonal element (mains hum) associated with the plant.
- 4.4 No additional noise mitigation measures are deemed necessary with regard to the substation construction.
- 4.5 The relevant noise emission criteria have been met and therefore condition No.28 has been satisfied.

Appendix A

Equipment calibration certificates

Certificate of Calibration Issued by University of Salford (Acoustic Calibration Laboratory) UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801		 UKAS CALIBRATION 0801  University of Salford MANCHESTER
Page 1 of 3		
APPROVED SIGNATORIES Claire Lomax [x] Andy Moorhouse [] Gary Phillips [] Danny McCaul [] 		
acoustic calibration laboratory The University of Salford, Salford, Greater Manchester, M5 4WT, UK http://www.acoustics.salford.ac.uk t 0161 295 3030/0161 295 3319 f 0161 295 4456 e c.lomax1@salford.ac.uk		

Certificate Number: 04853/1

Date of Issue: 6th October 2020

PERIODIC TEST OF A SOUND LEVEL METER to IEC 61672-3:2006

FOR:	RS Acoustic Engineering Ltd 76 Marple Road Stockport Cheshire SK2 5QH
FOR THE ATTENTION OF:	Ryan Swales
DATE RECEIVED:	30/09/2020
PERIODIC TEST DATE:	5 th and 6 th October 2020
TEST PROCEDURE:	CTP12 (Laboratory Manual)

Sound Level Meter Details

Manufacturer	Bruel & Kjaer
Model	2250 Light
Serial number	2638934
Class	1
Hardware version: 2.0	Software version: BZ7130 Version 3.1

Associated Items	Microphone	Preamplifier	Calibrator
Manu	Bruel & Kjaer	Bruel & Kjaer	CEL
Model	4189	ZC 0032	CEL-120/1
Serial Number	2143254	8938	3321859

Test Engineer (initial): GP Name: Gary Phillips

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to the units of measurement realized at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

Certificate of Calibration

Issued by University of Salford (Acoustic Calibration Laboratory)
UKAS ACCREDITED CALIBRATION LABORATORY NO. 0801

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Certificate Number: 04853/1

Date of Issue: 6 October 2020

Procedures from IEC 61672-3: 2006 and TPS 49 Edition 2 June 2009 were used to perform the periodic tests. The manufacturer's instruction manual was marked as follows: B&K 2250-L with mic 4950 BE 1774-11 June 2007 From hardware version 2.0.

Adjustment data used to adjust the sound levels indicated in response to the application of an electrostatic actuator to sound levels equivalent to those that would be indicated in response to plane, progressive sound waves were obtained from the microphone manufacturer. The sound level meter calibration check frequency is 1000 Hz, the reference sound pressure level is 94 dB. As this instrument only has a single range, this range is the reference level range.

The environmental conditions in the laboratory at the start of the test were:

Static pressure 98.795 kPa $\pm$ 0.014 kPa; air temperature 23.2 °C $\pm$ 0.3 °C; relative humidity 45.4 % $\pm$ 2.6 %.

The initial response of the instrument to application of the associated sound calibrator was 94.3 dB (C). The instrument was then adjusted to indicate 94.0 dB (C). This indication was obtained from the calibration certificate of the calibrator, 04738/1 and information in the manufacturer's instruction manual specified in this certificate, when the instrument is configured as follows; Transd. Used 4189(2143254), Sound Field Correction: Free-field, Windscreen Correction: None. The instrument was calibrated without a windscreen. Consult manufacturer's instructions if using a windscreen.

With the microphone installed the level of self-generated noise was:

A: 22.7 dB†

†Indicates that the measured level exceeds the highest anticipated level of self-generated noise stated in the manufacturer's instruction manual.

With the microphone replaced by an electrical input device with a similar capacitance to the supplied microphone, the levels of self-generated noise were:

A: 11.8 dB*

B: 11.1 dB*

C: 12.6 dB*

Z: 17.5 dB*

Indicates that the measured level exceeds the highest anticipated level of self-generated noise stated in the manufacturer's instruction manual.

The environmental conditions in the laboratory at the end of the test were:

Static pressure 98.862 kPa $\pm$ 0.014 kPa; air temperature 22.6 °C $\pm$ 0.3 °C; relative humidity 49.1 % $\pm$ 2.6 %.

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Certificate of Calibration

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Certificate Number: 04853/1

Date of Issue: 6 October 2020

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

The microphone corrections applied as specified in 12.6 of IEC 61672-3:2006 were obtained from a frequency response measured by this Laboratory using the electrostatic actuator method. This response in isolation is not covered by our UKAS accreditation.

Instruments used in the verification procedure were traceable to *National Standards*. The electrostatic actuator method was employed in the acoustical tests of a frequency weighting.

The uncertainty evaluation has been carried out in accordance with UKAS requirements. All measurement results are retained at the acoustic calibration laboratory for at least four years.

-----END OF CERTIFICATE-----

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Appendix B

Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Background sound level	The sound level in the absence of a specific noise source under consideration (e.g. plant/machinery), measured as $L_{A90,T}$.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Specific sound source	Sound source being assessed.
Specific sound level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
Rating level $L_{Ar,T}$	Specific sound level plus any adjustment for the characteristic features of the sound.