

CLIENT:	Powell Dobson Architects Ltd.
PROJECT:	Fairwater Social Club, Cardiff – Noise Impact Assessment
SUBJECT:	BS 4142 Assessment of Substation
JOB NO:	GM13476
DATE:	20/08/2024
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1 INTRODUCTION

1.1 Purpose of this Report

1.1.1 This note has been prepared further to an instruction from Powell Dobson Architects Ltd. to provide a noise assessment of a substation located beside a proposed residential development at Fairwater Social Club, Cardiff. The assessment has been undertaken in accordance with British Standard 4142:2014+A1:2019 *Method for rating and assessing industrial and commercial sound*¹ (BS4142).

1.1.2 This technical note details the assessment, findings and outcome of the assessment and recommend mitigation measures where required.

1.2 Proposed Development

1.2.1 The proposed residential development is located at Fairwater Social Club, Cardiff, and comprises circa 14 dwellings.

1.3 Previous Work Undertaken

1.3.1 Previously, a noise assessment report for the proposed residential development was provided by WA in October 2022 (CA12479/0001). The 2022 report assessed the impact of road traffic noise on the proposed development, and the substation opposite the development was considered to be a potential source of noise affecting the development. However, during the noise survey on site observations showed no

¹ British Standards Institute, 2014. BS 4142:2014:2014 + A1:2019 Methods for rating and assessing industrial and commercial sound. BSI London, UK

noise from the substation was audible and therefore it was considered not further in the assessment.

- 1.3.2 Since the preparation of the original report, national grid has provided an objection to the proposed development due to the proximity to the existing substation opposite the site.

1.4 Assessment Criteria

British Standard 4142:2014+A1:2019

- 1.4.1 The criteria used are based on the background comparison thresholds, in accordance with BS 4142:2014¹.
- 1.4.2 BS 4142:2014¹ provides guidance on appropriate methodology and criteria for assessing the impacts of a new or existing sound source by comparing the operational sound level (rating level) with the sound level that is present without development (background sound level) i.e. the existing acoustic environment. The assessment is based on the potential results shown in **Table 1** below:

Table 1 BS4142 Assessment Guidance	
Penalty	Source Condition
Rating level from site operations of around +10 dB or more above the existing L_{A90} background sound level	An indication of significant adverse impact, depending on the context
Rating level from site operations of around +5 dB above the existing L_{A90} background sound level	An indication of an adverse impact, depending on the context
Rating level from site operations does not exceed the existing L_{A90} background sound level	An indication of a specific sound source having a low impact, depending on the context

- 1.4.3 The context considers the existing use in the area and the existence of the current use of the site. It is therefore considered that the sensitivity of the area to site activity noise would be lower than might be considered with a rural or completely residential location.

British Standard 8233:2014 and WHO Guidelines for Community Noise

- 1.4.4 Acceptable internal sound levels are presented with BS8233:2014² and WHO³. A summary of the criteria for continuous daytime and night-time noise levels are reproduced in

Table 2: Recommended Internal Ambient Noise Levels

- 1.4.5 2 below.

Table 2: Recommended Internal Ambient Noise Levels			
Activity	Location	0700 – 2300 hrs	2300 – 0700 hrs
Resting	Living room	35 dB LAeq,16 hr	-
Dining	Dining room/ area	40 dB LAeq,16 hr	-
Sleeping	Bedroom	35 dB LAeq,16 hr	30 dB LAeq,8 hr 45 dB LAFmax

Noise Rating (NR) Curve Assessment

- 1.4.6 An assessment of likely internal sound levels at the nearest PSRs will use predicted external noise levels at the façade of the nearest PSR, adjusted for the attenuation provided by a partially open window, and compare them against the NR 20 criterion curve, to determine whether predicted internal sound levels are compliant within each octave band between 63 Hz and 4 KHz.

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- 1.4.7 To assess the sensitivity of the receptor it has been assumed that dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions. To determine the impact in accordance with the TAN 11⁴.
- 1.4.8 **Table 3** presents thresholds to describe the effect level regarding noise and its relationship to guidance documents.

² British Standards Organisation, 2014. BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings'. BSI, London.

³ World Health Organization (WHO) (1999) Guidelines for Community Noise

⁴ Planning Guidance (Wales) Technical Advice Note (Wales) 11 Noise October 1997

Table 3: Noise Level Criteria and Actions			
Noise exposure categories	Assessment	Noise Level Criteria	TAN 11 Noise Exposure Action
A	BS 4142:2014+A1:2019 – Background comparison	BS4142 initial estimate of impact is equal to or below background sound level	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
	BS 8233:2014 and WHO -Noise Break-in Assessment	Noise levels are below: Bedrooms: 30 dB $L_{Aeq,8hr}$ / 45 dB L_{Amax} Living Rooms: 35 dB $L_{Aeq,16hr}$	
B	BS 4142:2014+A1:2019 – Background comparison	BS4142 initial estimate of impact is equal to or below +5 dB above background sound level	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
	BS 8233:2014 and WHO -Noise Break-in Assessment	Noise levels are: Bedrooms: 30 - 35 dB $L_{Aeq,8hours}$ / 50 dB L_{Amax} Living Rooms: 35 - 40 dB $L_{Aeq,16hr}$	
C	BS 4142:2014+A1:2019 – Background comparison	BS4142 initial estimate of impact is above +5 dB above background sound level	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
	BS 8233:2014 and WHO -Noise Break-in Assessment	Noise levels are exceeded: Bedrooms: 35 – 40 dB $L_{Aeq,8hours}$ / 55 dB L_{Amax} Living Rooms: 40 - 45 dB $L_{Aeq,16hours}$	
D	BS 4142:2014+A1:2019 – Background comparison	BS4142 initial estimate of impact is above +10 dB above background sound level	Planning permission should normally be refused.
	BS8233:2014 and WHO - Noise Break-in Assessment	Noise levels are exceeded: Bedrooms: 40 dB $L_{Aeq,8hours}$ / 55 dB L_{Amax} Living Rooms: 45 dB $L_{Aeq,16hr}$	

2 DETAILS OF NOISE MODELLING

2.1.1 SoundPlan modelling software has been used to undertake this assessment and utilises publicly available topography data and digital terrain mapping to generate a 3D environmental model. The model implements the following factors to predict noise propagation:

- Sound source location;
- Relative distances between sound sources/receivers;
- Location and dimensions of object barriers including man-made or natural;
- Ground contours, determining the relative ground heights; and
- Ground absorption effects due to soft/hard ground.
- Ground absorption areas entered for the site and surrounding area (0= hard ground) and for the surrounding fields (1= soft ground).

2.1.2 Data gathered during the noise 2022 survey has been used to calculate the noise level of the substation opposite the site. Details of the noise survey are shown below.

3 BASELINE NOISE SURVEY

3.1.1 Between the 8th and 12th of September 2022, Wardell Armstrong LLP carried out a noise survey at the proposed development site. Noise measurements were carried out at two monitoring locations (MLs) within the site, ML1 and ML2. A summary of the results of the full monitoring period is presented in **Table 4**, with full details of the survey in report CA12479/0001.

Table 4: Measured Daytime and Night-time noise levels		
Monitoring Location	Time Period	Measured Noise Level (Figures in dB LAeq,T)
ML1	Daytime (0700-2300)	52.9
	Night-time (2300-0700)	44.6
ML2	Daytime (0700-2300)	56.8
	Night-time (2300-0700)	46.7

Determination of Sound Levels Used in the Assessment

- 3.1.2 ML1 was approximately 15 m from the substation and analysis from the noise data showed that during the quieter periods of the night-time, tones consistent with noise from a substation were observed. Therefore, this location was used to calibrate the noise level from the substation in the model.
- 3.1.3 The noise data shows that at ML1 during the quieter periods between 03:30 – 03:45 on 09/09/22, the difference between the background noise level (29 dB_{LA90 15min}) and the ambient sound level (31dB_{LAeq 15min}) was 2dB. This means that the influence of other sound sources such as road traffic were minimal, and the measured sound would have been dominated by noise from the substation. To calculate the specific sound level, the residual noise level measured during the same period (03:30 – 03:45) at ML2 on 12/09/22 was subtracted from the ambient level measured at ML1. ML2 was far enough away from the substation that noise from the substation was not detected, and the calculated level would represent that contributed by the substation alone.
- 3.1.4 At ML2, noise from substation was not detected, and therefore this location was used to provide the background noise level for the proposed sensitive receptors. As a worst-case scenario, the night-time period on the Sunday 11th night into Monday 12th Morning has been used. The modal background noise level during the night-time period was used in the assessment.
- 3.1.5 The background noise level for the proposed sensitive receptors is 43dB LA90 during the daytime and 24 dB LA90 during the night-time.

4 BS 4142 ASSESSMENT OF INDUSTRIAL NOISE

Identification of Sensitive receptors

- 4.1.1 Plot 1 and Plot 14 have been identified as the most sensitive receptors as they are the closest proposed dwellings to the substation. All other receptors may experience a similar or lower noise impact than that experienced at Plots 1 and 14.

Identification of the Specific Sound

- 4.1.2 The calculated specific sound level was used to calibrate the SoundPLAN model at ML1 and predict the specific sound levels at receptors. Daytime levels are calculated at ground floor level and night-time levels calculated at First floor level. These are summarised in **Table 5** below.

Table 5: Specific Sound Levels at Existing Sensitive Receptors		
Receptor	Daytime (dBA) (0700-2300)	Night-time (dBA) (2300-0700)
Plot 1	21	24
Plot 14 (Bungalow)	27	27

BS 4142 Penalties

- 4.1.3 BS 4142 includes guidance on the application of penalties to be applied in cases where the noise is considered to be 'tonal', 'impulsive', or 'intermittent' at the existing sensitive receptor.
- 4.1.4 Initial analysis of the substation noise at ML1 has shown that there are some just noticeable tonal elements detected around the 63Hz and 250Hz octave band frequency bands during the night-time, as would typically be expected for this type of noise source. As the substation noise was not observed during the daytime, and no attended observations were made during the night-time, the informative objective method of BS 4142 was used to determine if any penalty should be added for tonality. The results of the assessment showed that no 1/3 octave band exceeded the adjacent bands by the assessment criteria, therefore no penalty has been added to the specific level for tonality.
- 4.1.5 No penalty has been added for impulsivity, or intermittency as these characteristics are not present in the assessment source.

BS4142 Initial Estimate of Impact

- 4.1.6 To undertake the initial estimate of BS 4142:2014, the predicted noise rating levels associated with the development have been compared with the existing background sound levels. These comparisons are summarised in **Table 6** below.

Table 6: BS4142 Assessment of the Proposed Development as received at Proposed Receptors				
	Daytime (dBA) (0700-2300)		Night-time (dBA) (2300-0700)	
	Plot 1	Plot 14	Plot 1	Plot 14
Specific Level – $L_{Aeq,T}$ dB	21	27	24	27
Character Penalty dB	0		0	
Rating Level – $L_{Ar,Tr}$ dB	21	27	24	27
Background Sound Level – $L_{A90,T}$ dB	43	43	24	24
Difference dB	-22	-16	0	+3

- 4.1.7 The results of the initial estimate of impact show that noise from the proposed development is unlikely to exceed the existing background sound levels at ESRs during the daytime. Therefore, this is an indication of a **low** impact in accordance with BS 4142.
- 4.1.8 During the night-time the rating level is equal to the background noise level by at Plot 1 and exceeds the background noise level by 3dB at Plot 14. This is an indication that a **low** Impact may occur at Plot 1 and an **adverse** impact may occur at Plot 14, depending on the context, in accordance with BS 4142:2014.

Consideration of Context

- 4.1.9 Consideration of the contextual aspects is provided below, in accordance with BS 4142:2014, and is followed by determination of significance of potential impacts.
- 4.1.10 The 2022 noise survey showed that road traffic noise on Plas-Mawr Road was the dominant source of noise at the receptors during the daytime. Therefore, sound levels from the substation were undistinguishable from the existing acoustic environment as observed during the noise survey.

- 4.1.11 During quieter periods of the night-time, the measured data showed that the substation may be just perceptible. However future occupants are likely to be indoors during the nighttime, further reducing the impact.
- 4.1.12 Furthermore, the existing dwellings on Ferrier Avenue are at a similar distance to the substation as the proposed dwellings and would likely experience similar sound levels from the substation. We are unaware of any complaints relating to the operation of the substation that are currently on-going from existing occupants.
- 4.1.13 The only exceedance of the background noise level is at Plot 14 during the night-time and during this period it is expected that residents will be indoors. An NR curve assessment has been undertaken at both plots to determine likely internal sound of noise levels from the substation at the proposed receptors, during the night-time, using the BS 8233² NR curves.
- 4.1.14 It is generally accepted that NR20 represents a very good standard for indoor noise levels, The NR curve assessment showed that with an open window, the internal noise levels of both plots would be below the NR15 curve, showing that the internal noise levels during the night-time will be at a highly acceptable level.
- 4.1.15 Additionally, guidance from the previous version of the relevant standard, BS 4142:1997, stated that background sound levels below around 30 dB L_{A90} , and rating levels below around 35 dB $L_{Ar,Tr}$, were considered very low and therefore outside the scope of the assessment method.
- 4.1.16 The Association of Noise Consultants (ANC) produced guidance on the application of BS 4142 which states that “similar values [i.e. background sound levels below around 30 dB L_{A90} , and rating levels below around 35 dB $L_{Ar,Tr}$] would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate.”
- 4.1.17 As such, when considering this in context, the impact is reduced to a **low** impact at both Plot 1 and Plot 14.

Planning Policy Determination

- 4.1.18 When considering the results of the assessment in accordance with TAN 11⁴ noise exposure categories, the outcome of the assessment is Category A at Plot 1 and Category B at Plot 14.

For Category A TAN 11 states

“Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.”

For Category B TAN 11 states

“Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.”

- 4.1.19 Based on the above, noise should be considered and where appropriate planning conditions should be included to control noise. The assessment indicates a low level of impact in accordance with BS4142:2014 and as such no additional mitigation is required. As no mitigation is required above what is already incorporated into the design no additional requirements to ensure an adequate level of protection are needed through the imposition of planning conditions for this proposed development.

5 CONCLUSIONS

- 5.1.1 This technical note has been prepared to present the relevant information to inform an assessment of industrial noise from a substation in accordance with BS 4142¹ for a residential development at Fairwater Social Club, Cardiff.
- 5.1.2 The information contained in this note is informed by survey data obtained to inform previous report prepared for the site by WA in 2022 (CA12479/0001).
- 5.1.3 The assessment has shown that the substation has potential to cause a **low** impact at the proposed sensitive receptors in accordance with BS 4142¹.
- 5.1.4 Finally, when considering the results of the assessment in accordance with TAN 11⁴ noise exposure categories, the outcome of the assessment is Category A at Plot 1 and Category B at Plot 14. The assessment indicates a low level of impact in accordance with BS4142:2014 and as such no additional mitigation is required. As no mitigation is required above what is already incorporated into the design no additional requirements to ensure an adequate level of protection are needed through the imposition of planning conditions for this proposed development.