Clydesmuir Road

Noise and Vibration Impact Assessment

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Clydesmuir Road

Noise and Vibration Impact Assessment

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This report dated 16 December 2025 has been prepared for Pegasus Developments (the “Client”) in accordance with the terms and conditions of appointment dated 01 August 2025(the “Appointment”) between the Client and **Arcadis Consulting (UK) Limited** (“Arcadis”) for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

Contents

Tables

Figures

Appendices

1 Introduction

1.1 Introduction

A noise and vibration assessment has been prepared by Arcadis UK Limited (Arcadis) on behalf of Pegasus Homes. It accompanies a planning application for a residential development (henceforth referred to as the 'proposed development') on land (the 'site') located on Clydesmuir Industrial Estate, Cardiff.

The proposed development comprises of 96 dwellings; the proposed development plan is included in HolderMathias architects drawing (CMWW-HMA-ZZ-ZZ-D-A-90002 P02) and the accommodation schedule is provided in drawing (CMWW-HMA-ZZ-ZZ-D-A-90003 P01).

The assessment is based upon an 7 day ambient noise and vibration survey undertaken in the confines of the site. The long-term noise survey was complemented by additional short-term noise measurements that were undertaken at relevant positions surrounding the site during selected times of the day to understand the noise climate of the surrounding industrial estate during the day, evening and night-time periods.

Details regarding the assessment methodology employed and the subsequent conclusions and recommendations drawn are also presented within the following report.

To assist with the understanding of this technical report a glossary of technical acoustic terms is provided in **Appendix A**.

1.2 Site Description

The site is located on land within the Clydesmuir Industrial Estate area just to the east of Cardiff (CF24 2QS) and is accessed via a private road sharing a junction with Clydesmuir Road.

As it stands, the site currently comprises of commercial premises typically associated with this type of land use such as warehousing and storage, vehicle cleaning and maintenance activities (MOT etc), an indoor flea market and an auction house. The site also currently contains a dance studio and the 'Rehoboth Centre' religious institution.

Surrounding the proposed development site to the east and south-east, running broadly from north to south is Clydesmuir Road (and the residential dwellings associated with Clydesmuir Road). There are other surrounding residential dwellings on Stenhousemuir Place. Immediately to the south and south-west are some small industrial and commercial buildings (industrial and commercial premises are also located to the north of the site). The mainline railway heading into and out of Cardiff Central (South Wales Main Line) can also be located immediately to the north and north-west of the proposed development site.

The site boundary of proposed development (and surrounding places of interest) is provided in the below figure.

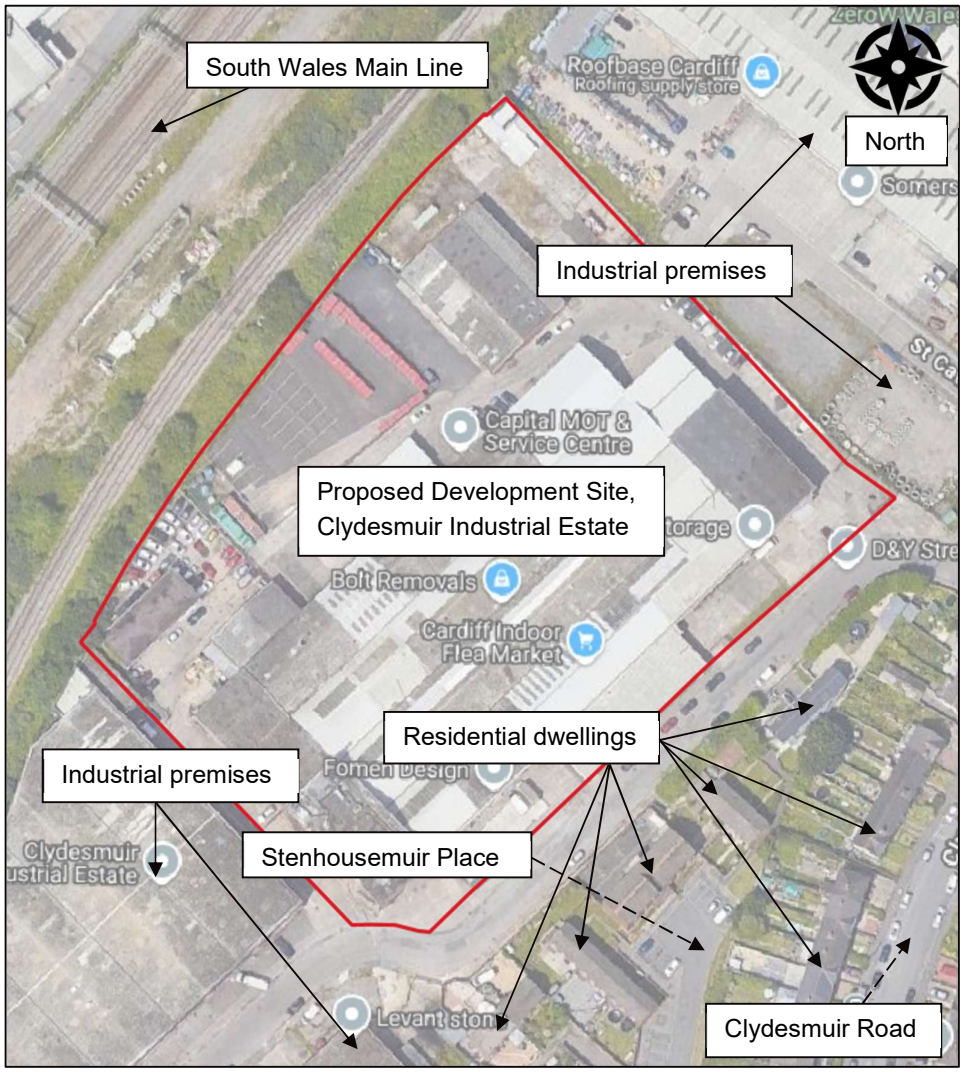

Figure 1-1 Proposed development site boundary, Clydesmuir Industrial Estate, east of Cardiff City Centre

1.3 Consultation

Table 1-1 provides a summary of the issues raised and agreed during consultation with respect to the assessment how they have been addressed within the scope of the study.

Specific consultation relating to noise and vibration was undertaken with the Pollution Control Department at Cardiff Council.

Table 1-1 Summary of consultation

Consultee	Summary of Consultation	Response from Cardiff Council (Pre-application advice PA_25_00121)	Action
Cardiff Council (10.10.2025)	General enquiry regarding the proposed noise monitoring locations and methodology.	Given the location of the proposed development and the presence of multiple noise sources in the surrounding area, I agree that a detailed assessment in accordance with Technical Advice Note (TAN) 11.	The assessment considers TAN 11 Guidance and Noise Exposure Categories using measured data. The report considers noise from rail traffic and surrounding industrial activities.
		The assessment should ensure that internal noise levels within the proposed residential units meet the standards set out in BS8233:2014 and the World Health Organization (WHO) Guidelines for Community Noise, as applicable in Wales	The assessment provides recommendations in order to meet the standards set out in BS8233:2014 and the World Health Organization (WHO) Guidelines for Community Noise.
		It is also important that the assessment considers both long-term ambient noise and short-term impact noise, particularly due to the site's exposure to a mix of noise sources.	The assessment has considered long-term ambient noise from the railway and short term noise impacts on the site from the adjacent industrial estate.
		The noise report to comprehensively address all aspects of the proposed development, including an evaluation of noise exposure across each level of the site layout, to ensure appropriate mitigation measures are identified and implemented where necessary.	The assessment has conducted noise surveys on all boundaries facing noise exposure such that mitigation can be identified for future end use.

2 Noise Assessment Criteria

The assessment presented in this report has been completed in accordance with the policy, standards and industry guidance described as follows:

2.1 Planning Guidance (Wales) Technical Advice Note (Wales) 11, Noise - October 1997

Technical Advice Note (TAN) 11 provides guidance to local planning authorities, developers and communities on how noise should be considered in the land-use planning process in Wales. Its purpose is to ensure that new development is compatible with surrounding noise environments and that people are protected from harmful noise exposure.

The guidance introduced the idea of noise exposure categories, defined in terms of their associated planning implications (see Table 2-1). The measured noise level or predicted noise level from the major noise source at the site of interest is used to determine the noise exposure category.

Table 2-1 Definitions of Exposure categories

Category	Meaning
A	Where measured or predicted noise levels are in this category, noise need not be considered as a determining factor in granting planning permission, although noise at the upper end of the suggested range for this category should not be taken as a desirable level.
B	Where measured or predicted noise levels noise levels are in this category, noise should be taken into account when determining planning applications and noise control measures should be required.
C	Where measured or predicted noise levels are in this category, planning permission should not be granted normally. Where permission is given, for example because there are no quieter alternative sites available, conditions should be imposed to ensure an adequate level of insulation against external noise.
D	Normally, where measured or predicted noise levels are in this category, planning permission should be refused.

The noise levels corresponding to the various noise exposure categories are expressed in terms of the unified index $L_{Aeq,\,T}$ over the periods 07:00 – 23:00 and 23:00 – 07:00 measured or predicted for locations at least 10m from any building and at between 1.2 and 1.5 m above the ground. These are listed for noise exposed dwellings in Table 2-2.

Table 2-2 Noise Exposure Categories (NEC) for Dwellings by Source – (levels in $L_{Aeq,\,T}$)

Source/Category	Period	A	B	C	D
Road Traffic	07:00 – 23:00	<55	55-63	63-72	>72
	23:00 – 07:00	<45	45-57	57-66	>66

Source/Category	Period	A	B	C	D
Air Traffic	07:00 – 23:00	<57	57 -66	66-72	>72
	23:00 – 07:00	<48	48-57	57-66	>66
Rail Traffic	07:00 – 23:00	<55	55-65	65-72	>74
	23:00 – 07:00	<45	45-59	59-66	>66
Mixed Sources	07:00 – 23:00	<55	55-63	63-72	>72
	23:00 – 07:00	<45	45-57	57-66	>66

2.2 World Health Organisation Guidelines for Community Noise 1999

Guideline values are given by the World Health Organisation (WHO) for specific health effects of noise in specific environments. For residential developments specifically, these typically include sleep disturbance, annoyance and speech interference.

For sleep disturbance, indoor guidelines for bedrooms are **30dB $L_{Aeq,\ 8\ hr}$** for continuous noise and **45dB $L_{Amax,\ F}$** for single sound events.

To enable casual conversation indoors during the daytime, the sound level of interfering noise should not exceed **35dB $L_{Aeq,\ 16\ hr}$**.

During the day, the outdoor sound level from steady, continuous noise should not exceed **55dB $L_{Aeq,\ 16\ hr}$** on balconies, terraces and in outdoor living areas. Where it is practical and feasible, the lower outdoor sound level of **50dB $L_{Aeq,\ 16\ hr}$** should be considered the maximum desirable sound level for new development.

A summary of the guideline internal noise levels for both the daytime and overnight periods, as taken from Table 4.1 of the WHO guidelines is presented below.

Table 2-3 Guideline values for community noise for residential dwellings

Specific Environment	Critical Health Effect(s)	L_{Aeq} (dB)	Time Base (Hours)	$L_{Amax,\ fast}$ (dB)
Dwelling, Indoors	Speech Intelligibility & Moderate annoyance daytime & evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45

2.3 BS8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

The British Standard BS8233: 2014 provides guidance for the control of noise within and around buildings. It is applicable to the design of new buildings.

The standard applies to external noise as it affects the internal acoustic environment from sources without a specific character, including road traffic road traffic, mechanical services or continuously running plant.

For these steady noise sources, it is desirable that the internal ambient noise levels do not exceed the guideline values listed below in Table 2-4.

Table 2-4 Indoor ambient noise levels for dwellings (from BS8233: 2014)

Activity	Location	07:00 – 23:00 Hrs	23:00 – 07:00 Hrs
Resting	Living room	35 dB $L_{Aeq,\ 16\ hr}$	-
Dining	Dining room/ area	40 dB $L_{Aeq,\ 16\ hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hr}$	30 dB $L_{Aeq,\ 8\ hr}$

It should be noted however where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

The standard also recommends that for traditional external amenity areas, such as gardens and patios, it is desirable that external noise levels do not exceed **50 dB $L_{Aeq,T}$**, and that **55 dB $L_{Aeq,T}$** would be acceptable in noisier environments. However, it is recognised that these values may not be achievable in all areas where development is desirable and in such a situation, development should be designed to achieve the lowest practicable levels.

3 Vibration Assessment Criteria – Human Exposure

3.1 BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting

BS6472-1:2008 provides guidance on predicting human response to vibration in buildings over the frequency range 0.5 Hz to 80 Hz. Frequency weighting curves for human beings exposed to whole-body vibration are included, together with advice on measurement methods to be employed. Methods of assessing and considering continuous, intermittent and impulsive vibration are also presented.

This part of BS6472 also describes how to determine the vibration dose value (VDV), from frequency-weighted vibration measurements defined as "*the fourth root of the time integral of the fourth power of the acceleration after it has been frequency-weighted*". The standard also states that "*where possible, the VDV should be determined from a measurement obtained over the full exposure to vibration*".

The vibration dose value is used to estimate the probability of adverse comment which might be expected from human beings experiencing vibration in buildings. Consideration is given to the time of day and use made of occupied space in buildings, whether residential, office or workshop.

Table 3-1 presents the levels of VDV and the likelihood of adverse comment.

Table 3-1 Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $ms^{-1.75}$	Adverse comment possible $ms^{-1.75}$	Adverse comment probable $ms^{-1.75}$
Residential buildings 16-hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8-hour night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

4 Baseline Survey

4.1 Introduction

To determine the existing noise and vibration climate of the site, attended and unattended baseline noise and vibration surveys were undertaken in late November 2025. The surveys were undertaken in accordance with the guidance set out within *BS7445: 2003 'Description and measurement of environmental noise - guide to quantities and procedures'*.

A longer term unattended baseline noise survey was undertaken at one location between Tuesday 18th November 2025 and Tuesday 25th November 2025 close to the northwestern site boundary facing towards the railway lines. Additionally, a shorter term noise survey comprising of attended 30-minute noise measurements taken at two locations within the industrial park (just outside the site boundary) during the daytime (07:00 – 19:00), evening (19:00 – 23:00) and night-time (23:00 – 07:00) periods on Tuesday 18th/19th November 2025.

An unattended vibration measurement was also obtained over a longer term period within the site between Tuesday 18th November 2025 and Tuesday 25th November 2025.

The measurement locations are shown on Figure 4-1. The location at NML 1 was selected to be representative of the potential effects of the existing noise environment on future sensitive residential receptors at the development site as shown in the proposed development plan (HolderMathias architects drawing (CMWW-HMA-ZZ-ZZ-D-A-90002 P02)).

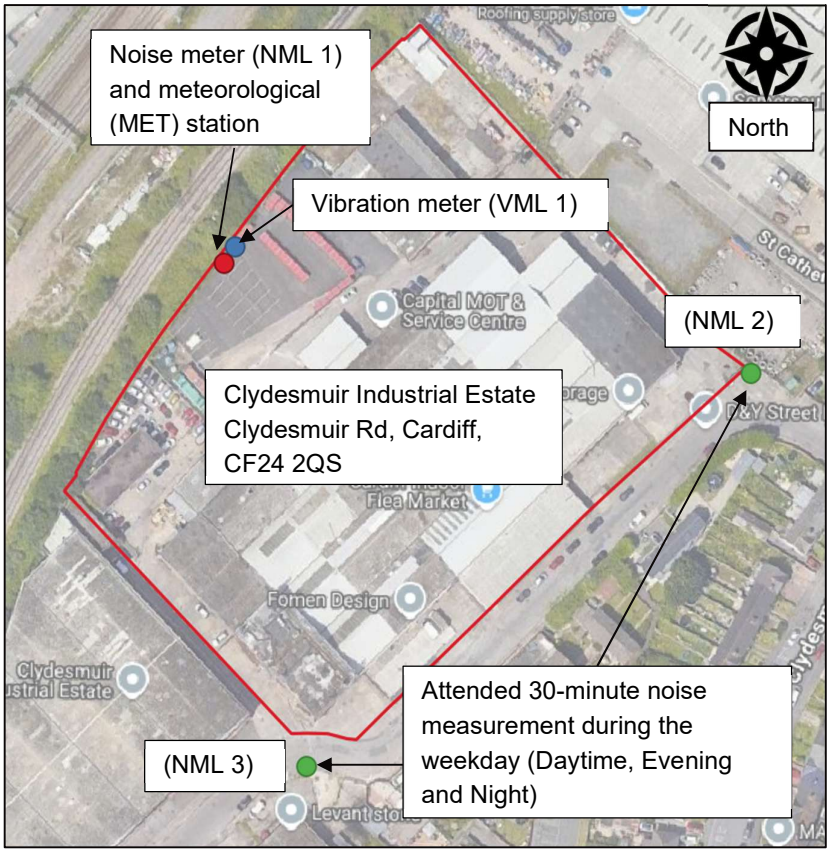

Figure 4-1 Noise monitoring location (NML), vibration monitoing location (VML) and meteorological (MET) monitoring location plan

A meteorological station (MET) was installed during the survey to enable weather data to be correlated with the logged noise data obtained from the survey.

4.2 Equipment Details

Each noise monitor was compliant with requirements for 'Class 1' instruments from *BS EN 61672-1:2013 Electroacoustics. Sound level meters. Specifications*.

Noise equipment was calibrated using an external calibrator calibrated in accordance with *BS EN IEC 60942:2018. Electroacoustics. Sound calibrators*.

The table below provides information regarding equipment that was used during the noise surveys.

Table 4-1 Equipment used during the noise and vibration survey

Location	Equipment	Brand	Type	Serial Number
NML 1	Noise Meter	01dB	DUO	12660
NML 2	Noise Meter	01dB	CUBE	14341
NML 3	Noise Meter	01dB	CUBE	14341
VML 1	Vibration Meter	OMNIDOTS	SWARM	WALIFU
MET	Meteorological Monitoring Station	VAISALA	Weather Transmitter WXT530 Series	P11420148
All NML locations	Noise Meter Calibrator	01dB	CAL31	93429

The noise meters were set to measure noise levels using the Fast Time Weighting and logged measurements using the A-weighted filter.

The noise equipment used was set to record the following parameters and remained unaltered throughout all noise measurements:

- L_{Aeq} in dB

The sound level meter equipment was locally calibrated using a reference tone prior to commencement of the survey and following completion of the survey; no significant (±0.5dB) drift in the measured levels at 94dB; 1000 Hz was observed.

All measurements were undertaken in free-field measurement conditions, and as such, had no reflective surfaces within 3.5m (other than the ground) of the microphone position.

Noise level meter microphones were mounted vertically during all measurements. The microphones were positioned at approximately 1.5m above ground level.

The vibration meter was set to record the following parameters and remained unaltered throughout all vibration measurements:

- Vibration Dose Values (VDV) in $m/s^{-1.75}$ for the x axis, y axis, z axis directional planes.

All equipment was within the valid calibration period. Calibration certificates for all equipment can be provided on request.

4.3 Site Observations

As the noise meter at NML 1 was left unattended during the period between Tuesday 18th November 2025 and Tuesday 25th November 2025, a VAISALA WTX530 series meteorological station was setup to log the weather conditions concurrently with the noise data from this monitoring location.

The period between Tuesday 18th November 2025 and Tuesday 25th November 2025 was characterised by mixed conditions with some periods of windy gusts and rain, however, mostly dry conditions prevailed with little to no wind.

Some measurements logged during noise survey have been excluded from the calculations due to inclement weather. However, in consideration of the entire survey period, the weather conditions throughout the survey were deemed acceptable for the measurement of environmental noise in accordance with *BS7445-1:2003 'Description and measurement of environmental noise'*.

Subjective observations were made by the noise surveyors during the installation of the longer term noise survey at NML 1 and during the shorter term attended noise surveys at NML 2 and NML 3.

Additional observations on train movements were noted for approximately an hour following the installation of the vibration equipment at VML 1.

All observations are provided in the tables below:

Table 4-2 Subjective surveyor notes for the longer term noise survey location

Location	Survey Notes
NML 1	Survey location selected to be representative of future residential receptors. Survey location noise climate dominated by rail noise from the South Wales Main Line. Some distant road traffic noise from Newport Road (A4161). Some bird song at times. Some noise from distant sirens. Some noise noted from the MOT and service centre on the existing site.

Table 4-3 Subjective surveyor notes for the shorter term noise survey locations

NML 2	Survey Notes		
NML 2	**Day**	**Evening**	**Night**
	11:21 survey start time. Cars from Clydesmuir Road and users of the industrial estate. Some vehicle (Hiab) movements from adjacent compound (Although not picked up in this measurement session, surveyor noted on afternoon of 18th November there was a Hiab lorry moving and picking up concrete from the adjacent compound area).	21:05 survey start time, No noise from industrial estate, some noise from cars on Clydesmuir Road. Some distant noise from roads, trains and aircraft. Substation noise barely audible.	02:57 survey start time. No noise from industrial estate. Some distant noise from road traffic. Substation noise barely audible.
NML 3	**Day**	**Evening**	**Night**
	10:43 survey start time, Various noise sources from the industrial estate including cutting tiles from 'Levant Stone', idling van and banging metal noises from unit opposite tile cutting warehouse, cars/vans using the industrial estate access road. Some construction work adding a new roof to an adjacent warehouse. Some noise from seagulls at times.	20:28 survey start time, No noise from the industrial estate. Some distant noise from trains and aircraft. Some noise from wind on metal shutters.	02:20 survey start time, No noise from industrial estate. Barely audible distant road traffic noise. Some noise from wind on metal shutters.
Weather Conditions	50% cloud cover, dry roads, no wind or rain, 6 degrees.	Clear evening, dry roads, little/no wind, 6 degrees.	Clear night, dry roads, little/no wind, 5 degrees.

4.4 Results

Periods of the noise survey which were subject to wind speeds equal to, or greater than 5.0 m/s or rainfall equal to, or greater than 0.5 mm/hr (based on the data from the meteorological station). As a precautionary approach, measurements logged during these periods have been excluded from the calculations below.

A summary of the measured free field ambient noise levels is provided in the below tables (Table 4-4 and Table 4-5).

A summary of the measured vibration levels is provided in Table 4-6.

Table 4-4 Summary of the ambient noise levels from the longer term survey at NML 1

Date	Daytime Ambient Noise Level (dB) ($L_{Aeq, 16\ hour}$) (07:00 – 23:00)	Night-time Ambient Noise Level (dB) ($L_{Aeq, 8\ hour}$) (23:00 – 07:00)
18/11/2025	57.3*	53.9
19/11/2025	58.3	52.7
20/11/2025	56.7	53.3
21/11/2025	54.9	51.0
22/11/2025	55.1	49.5
23/11/2025	55.5	51.0
24/11/2025	57.2	54.1
25/11/2025	56.8**	-
Overall	**56.6**	**52.5**

* survey period 14:45 to 23:00
** survey period 07:00 to 13:00

Table 4-5 Summary of the ambient noise levels from the shorter term surveys at NML 2 and NML 3

Location	Ambient Noise Level (dB) ($L_{Aeq, 30min}$)		
	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
NML 2 (Duration)	57.5 (11:27 – 11:57)	48.6 (21:05 – 21:35)	43.7 (02:57 – 03:27)
NML 3 (Duration)	59.1 (10:43 – 11:13)	45.3 (20:28 – 20:58)	40.9 (02:20 – 02:50)

No activities/noise events worthy of comment were observed from the industrial estate during the evening and night-time periods of the shorter term surveys at NML 2 and NML 3. As such, only the daytime noise results have been graphically provided below. These graphs used for context and to be considered alongside the levels provided in Table 4-5.

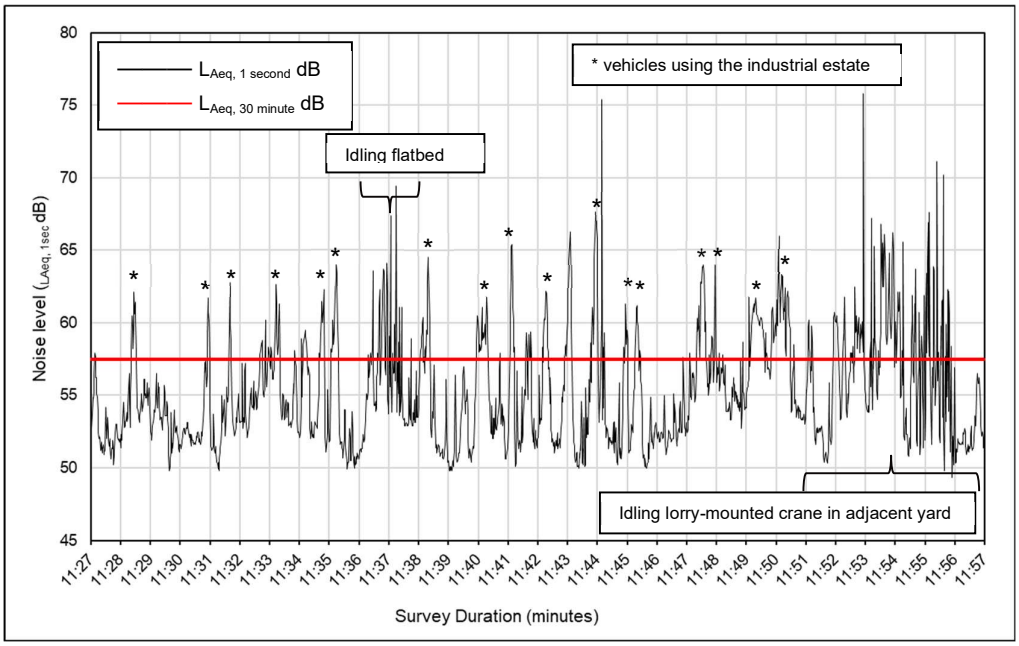

Figure 4-2 Noise levels activity associated with the Clydesmuir Industrial Estate at NML 2 during the daytime period.

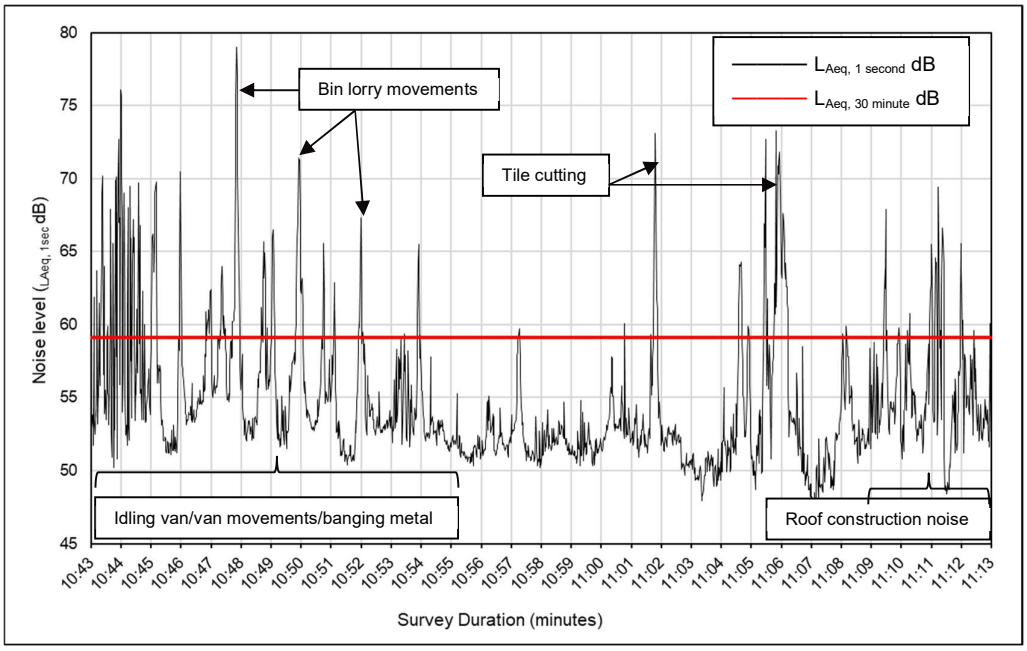

Figure 4-3 Noise levels activity associated with the Clydesmuir Industrial Estate at NML 3 during the daytime period.

Table 4-6 Summary of the vibration levels from VML 1 (VDV)

Period	Date	Time	X axis in $ms^{-1.75}$		Y axis in $ms^{-1.75}$		Z axis in $ms^{-1.75}$	
			VDV ($ms^{-1.75}$)	Probability of Adverse Comment	VDV ($ms^{-1.75}$)	Probability of Adverse Comment	VDV ($ms^{-1.75}$)	Probability of Adverse Comment
Day	18/11/2025	07:00 - 23:00*	0.0036	**Low**	0.0035	**Low**	0.0168	**Low**
Night	18/11/2025 & 19/11/2025	23:00 - 07:00	0.0034	**Low**	0.0033	**Low**	0.0170	**Low**
Day	19/11/2025	07:00 - 23:00	0.0043	**Low**	0.0043	**Low**	0.0210	**Low**
Night	19/11/2025 & 20/11/2025	23:00 - 07:00	0.0035	**Low**	0.0036	**Low**	0.0187	**Low**
Day	20/11/2025	07:00 - 23:00	0.0041	**Low**	0.0041	**Low**	0.0172	**Low**
Night	20/11/2025 & 21/11/2025	23:00 - 07:00	0.0034	**Low**	0.0034	**Low**	0.0229	**Low**
Day	21/11/2025	07:00 - 23:00	0.0042	**Low**	0.0041	**Low**	0.0171	**Low**
Night	21/11/2025 & 22/11/2025	23:00 - 07:00	0.0035	**Low**	0.0038	**Low**	0.0200	**Low**
Day	22/11/2025	07:00 - 23:00	0.0040	**Low**	0.0039	**Low**	0.0240	**Low**
Night	22/11/2025 & 23/11/2025	23:00 - 07:00	0.0033	**Low**	0.0032	**Low**	0.0107	**Low**
Day	23/11/2025	07:00 - 23:00	0.0041	**Low**	0.0040	**Low**	0.0120	**Low**
Night	23/11/2025 & 24/11/2025	23:00 - 07:00	0.0034	**Low**	0.0034	**Low**	0.0339	**Low**
Day	24/11/2025	07:00 - 23:00	0.0043	**Low**	0.0042	**Low**	0.0220	**Low**
Night	24/11/2025 & 25/11/2025	23:00 - 07:00	0.0036	**Low**	0.0035	**Low**	0.0204	**Low**
Day	25/11/2025	07:00 - 23:00**	0.0036	**Low**	0.0035	**Low**	0.0184	**Low**

* Vibration survey start time – 14:46

** Vibration survey finish time – 13:21

5 Site Suitability Noise Assessment – TAN 11

5.1 Introduction

This section of the report considers the measured baseline noise data described in Section 4 in order to determine the suitability of the proposed development for the intended end use, namely residential, based upon the concept masterplan layout.

5.2 Noise Exposure Categories (NEC)

To assist in the understanding of any potential implications of noise on the proposed residential development site, consideration has been given to the baseline noise data from NML 1 (Table 4-4).

The survey results at NML 1 are considered to be representative of future noise levels at dwellings facing the adjacent railway lines.

The monitored results daytime and night-time ambient noise levels ($L_{Aeq,T}$ dB) have been compared to the NECs from the TAN 11 Guidance summarised in Section 2.

Table 5-1 Comparison of the measured ambient noise levels from NML 1 to the TAN 11 NECs

Monitored Location (NML)	Summary of measured $L_{Aeq,T}$ dB levels		TAN 11 NEC for dwellings (Rail Traffic)	
	Daytime (07:00 – 23:00 hrs)	Night-time (23:00 – 07:00 hrs)	Daytime (07:00 – 23:00 hrs)	Night-time (23:00 – 07:00 hrs)
NML 1	56.6	52.5	B	B

Based upon the measured noise levels, it is concluded that for the dwellings closest to the railway line, the noise levels are such that the site can be characterised into NEC '**Category B**' for both the day and night-time period, where:

> '*noise should be taken into account when determining planning applications and noise control measures should be required*'.

As such, outline consideration needs to be given to ways in which the potential risk of the noise impact from rail traffic on the proposed development site can be mitigated to acceptable levels.

6 Residential Land Use Assessment

6.1 Introduction

Reflecting on the outcomes of the TAN 11 categorisation, further assessment of the main elements that need to be considered include including good acoustic design, internal and external noise amenity.

Where necessary other relevant issues should be considered including compliance with policy.

6.2 Internal Noise Assessment – Ambient Railway Noise (L_{Aeq} levels)

The measured noise levels at NML 1 have been used to determine the potential worst-case noise levels at the façades of future dwellings closest to the South Wales Main Line during the daytime and night-time period.

Before internal noise levels can be calculated, 3 dB correction must be added to the measured free-field levels to allow for the reflection of noise from the façades of the proposed dwellings.

The calculated noise levels at the façades, together with the level of insulation required to achieve BS8233: 2014 (and WHO 1999) 35dB $L_{Aeq,16hour}$ in living rooms and bedrooms is summarised in Table 6-1. The level of insulation required to achieve BS8233: 2014 30dB $L_{Aeq,8hour}$ in bedrooms at night is summarised in Table 6-2.

Table 6-1 Façade noise level at properties facing the South Wales Main Line and level of insulation required to achieve the internal daytime guideline noise levels (dB(A))

Residential property	Noise levels at façade of property (1.5m) $L_{Aeq,T}$ dB	Level of insulation required to meet BS8233: 2014 (and WHO) guideline noise levels in living rooms and bedrooms (resting) 35 dB $L_{Aeq, 16\ hr}$
2 Bed, 4 Person (2B4P) houses closest to the railway lines	59.6	24.6

Table 6-2 Façade noise level at properties facing the South Wales Main Line and level of insulation required to achieve the internal night- time guideline noise levels (dB(A))

Residential property	Noise levels at façade of property (1.5m) $L_{Aeq,T}$ dB	Level of insulation required to meet BS8233: 2014 (and WHO) guideline noise levels in bedrooms (sleeping) 30 dB $L_{Aeq, 8\ hr}$
2 Bed, 4 Person (2B4P) houses closest to the railway lines	55.5	25.5

7 Acoustic Design Considerations

7.1 Internal Amenity Considerations (Rail Noise)

Generally, the window portion of a typical dwelling facade would occupy a much smaller area of the façade than the block-work element (the composite façade). The blockwork element is likely to perform to an approximate R_w value of 45-50 dB, whereas a standard 4/12/4 double glazed unit would be limited to an R_w value of around 30 dB.

The “composite façade” of a dwelling would give a considerably higher insulation value than the glazed element alone (providing the glazed element of the façade is not an excessively high percentage of the overall façade). The former PPG24 stated that a relatively standard thermal double-glazed unit (assumed 4/12/4) set in a standard brick/block wall in a dwelling would offer in the region of 35 dB reduction from noise attributable to diesel trains. However, a standard sealed double-glazed unit with a partially open window would provide a sound reduction value of only 10 to 15 dB, assumed in this consideration to be an average of 13 dB.

Assuming a partially open window on the dwelling façades facing the railway lines as a worst-case scenario when internal ventilation is required, the internal levels would be above the 35 dB $L_{Aeq,16\ hr}$ recommendation of the BS8233:2014 / WHO 1999 during the daytime period. Similarly, at night the recommended BS8233:2014 / WHO 1999 internal limit would also be exceeded with a partially open window.

As such the recommended internal levels for rooms facing the railway for both the day and night-time, could only be achieved through closed windows with the inclusion of acoustic trickle vents to prevent the need to open the windows for ventilation. This enables the assumed façade insulation to increase to 35 dB (diesel trains) when combined with standard 4/12/4 (or similar) double-glazed units (as above). As such façades facing the South Wales Main Line would require:

- Glazing providing a sound reduction of minimum R_w value 26 dB to achieve the required internal noise levels from within the BS8233:2014 / WHO 1999 daytime, and by extension night-time levels.

With the inclusion of these measures, internal noise criteria as detailed in the BS8233:2014 / WHO 1999 would be achieved in all sensitive rooms across the proposed development.

However, should the end design of the building include rooms with a high percentage of glazing to blockwork, additional enhanced glazing may be required but this should be controlled by condition and concluded on a room by room basis through the detailed design and specification of the buildings.

7.2 External Amenity Considerations (Rail Noise)

The measured noise levels, as detailed in Table 4-4 indicate that outdoor living areas in the part of the site closest to the railway, will require a free-field noise reduction of approximately 7 dB to achieve the BS8233:2014 and WHO 1999 daytime external noise guideline level of 50 dB $L_{Aeq,16hour}$ for gardens.

This could be achieved by utilising close boarded fencing on these properties.

7.3 Noise from Clydesmuir Industrial Estate

As expected, the site is subject to noise from industrial activity; these noises have been fully described above but generally consist of vehicular movements (both cars/ vans and HGV's), noise from workshops, such as banging metal, tile cutting, and general construction noise.

Since there is no activity from the industrial estate during the evening and night period, it is expected that for the proposed properties facing the existing industrial estate, standard 4/12/4 (or similar) double-glazed units would enable the internal noise level in living rooms and bedrooms (resting) to be compliant with BS8233:2014 / WHO 1999 guidelines during the daytime (35 dB $L_{Aeq,16\ hr}$).

It is expected that these properties would also require of close boarded fencing in the gardens to achieve the daytime BS8233:2014 / WHO 1999 external guideline level of 50 dB $L_{Aeq,16hour}$. The figure visually shows the future dwellings which would require mitigation from noise associated with the industrial estate.

Figure 7-1 Proposed dwellings (red hatch) which would require mitigation from daytime noise from the industrial estate

8 Summary

8.1 Internal Amenity Summary

With regards to glazing specification for doors and windows the following is recommended:

- **Dwellings facing the railway**: It is recommended that standard sealed double-glazed windows, combined with acoustic trickle vents, would provide suitable sound insulation from railway noise.
- **Dwellings facing the industrial estate**: It is recommended that standard sealed double-glazed windows, combined with acoustic trickle vents, would provide suitable sound insulation from railway noise.
- **Example glazing specification providing an insulation value of sufficient magnitude would be minimum standard 4/12/4 thermal double glazing**.

With the inclusion of the measures listed above the recommended levels set out in *BS8233* and *WHO Guidelines for Community Noise* can be met.

8.2 External Amenity Summary

External amenity is provided across the site through the provision of private gardens. Noise levels are shown to be above the external guidance criteria for amenity spaces closest to the railway and facing the industrial estate, as defined within the *BS8233:2014 / WHO Guidelines for Community Noise1999.*

In order to achieve the recommended levels set out in *BS8233* and *WHO Guidelines for Community Noise* it is recommended that gardens utilise close boarded fencing along the perimeter of these properties' gardens where they face towards the railways lines or the Clydesmuir Industrial Estate.

8.3 General Conclusion and Recommendations

Overall, it is concluded that the proposed development on the site would be suitable for residential provision as proposed, however, care would need to be taken in the design of the site to ensure that a good quality of acoustic design is inherent in the proposals and appropriate mitigation strategies employed.

As discussed in Section 4, noise measurements were conducted to understand the nature of the ambient noise from the railway on the site and any noise from nearby industrial activity. This has enabled an assessment using suitable guidance to understand the suitability of the site for residential end use and considered appropriate for this assessment.

The assessment has considered the guidance provided in TAN 11, Noise, WHO Guidelines for Community Noise and BS8233 as agreed during the consultation with the Local Planning Authority and determined that with appropriate mitigation measures, the recommendations of these technical standards and guidance can be met for internal living conditions and for their external amenity spaces (gardens).

To achieve suitable internal living conditions, standard 4/12/4 double glazing with trickle vents would be sufficient to mitigate noise from the railway and industrial estate.

To achieve suitable external conditions for the amenity spaces, close boarded fencing should also be employed along the perimeter of these properties' gardens where they face towards the railways lines, and with reference to Figure 7-1, face towards the Clydesmuir Industrial Estate.

It is recommended that further acoustic calculations are undertaken to determine the exact sound reduction required based on the detailed design showing the window dimensions and internal room layout and size. It is expected that some of the proposed dwellings will provide screening such that mitigation would not be

required; again, this would be determined by further noise calculations and modelling once the detailed design has been finalised.

Vibration emanating from the railway has been considered and based on the measured results, will not affect the end users of the proposed development on the site.

Appendix A

Glossary of Terms

Term	Description
Air-borne noise	This refers to noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise and receiver.
Ambient sound	The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far and expressed in the L_{Aeq} statistical parameter.
Assessment Period	The period over which assessments are made. Usually defined as Daytime and Night-time, categorised as 07:00 – 23:00, and 23:00 – 07:00 respectively.
Audible range	The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.
Background Noise	Background noise is defined by the L_{90} statistical parameter, as “the noise for 90% of a given time interval”, representative of the quieter portions of the noise climate; and usually in the A-weighted noise weighting descriptor.
Decibel [dB]	The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed such that it can be set to mimic the operation of the human ear (“A” Weighted filter band). The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sounds are heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Four engine jet aircraft at 100m — 120 dB Riveting of steel plate at 10m — 105 dB Pneumatic drill at 10m — 90 dB Circular wood saw at 10m — 80 dB Heavy road traffic at 10m — 75 dB Telephone bell at 10m — 65 dB Male speech, average at 10m — 50 dB Whisper at 10m — 25 dB Threshold of hearing, 1000 Hz — 0 dB
A-weighted dB(A) decibels	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not perceived to be as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" weighting filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise for the assessment and

Term	Description
	consideration of impacts upon humans is measured using the “A” weighted filter. The sound pressure level in dB(A) gives a close indication of the subjective loudness of the noise.
Façade	A facade sound level is that determined 1 metre in front of the most exposed window or door in a facade. Sound is reflected from hard surfaces in a similar manner to light by a mirror and the effect is to produce a slightly higher (about 2.5 dB) sound level than would occur if the building was not there.
Free-Field	A situation in which the radiation from a sound source is completely unaffected by the presence of any reflecting surfaces.
Ln noise Descriptors	Because noise varies with time, a single noise value cannot adequately define the noise climate. For this reason, the acoustic environment is described using a number of noise level descriptors, statistical parameters, as follows; L10: The sound pressure level that is exceeded for 10% of the time for which the given sound is measured. L90: The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A). Leq: The Equivalent sound pressure level - the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. LAmax: The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is 4 times the loudness of a sound of 65 dB.
Microphone	An electro acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
Noise	Sound which a listener does not wish to hear.
R_w	Single number rating used to describe the sound insulation of building elements. It is defined in BS 5821: 1984.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The fluctuations in air pressure, from the steady atmospheric pressure, created by sound, when measured on the decibel scale.

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