



ACOUSTIC
CONSULTANTS LTD

Noise Impact Assessment

**Proposed Residential Development Site
Crymlyn Parc, Skewen, Neath**

**Reference: 8911/JA/BL
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Client:	Acoustic Consultant:
	

Document Control

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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Introduction

Hale Group appointed Acoustic Consultants Limited to carry out a noise impact assessment and provide a noise impact assessment for the proposed residential development on the land currently occupied by farming land.

The assessment takes into consideration the local authority requirements and considers the impact of road traffic noise from the M4 motorway, train noise from the rail line to the north and the nearby operational farm to the west of the site.

The report assesses the suitability of the site with respect to TAN 11, British Standard 8233:2014+A1:2019 / WHO (1999) and British Standard 4142:2014+A1:2019.

This report presents the basis and conclusions in relation to the noise from external noise sources.

The author of this report is an Associate Member of the Institute of Acoustics (AMIOA) with a recognised acoustic qualification and over two years' experience within the field. The report has been checked by a Member of the Institute of Acoustics (MIOA) with over 14 years' experience in the field of acoustics.

2. The Site & Proposals

The site is in a semi-residential area, with a recent residential site completed immediately to the south and south-east, and a further site nearing completion to the east. To the immediate west is an operational farm with associated land, with the closest farmyard building (cowshed) approximately 50 metres away from the closest boundary point.

To the north are vacant fields separating the proposed site and the train line travelling west/east towards Swansea/Cardiff, respectively. The train track lies approximately 65 metres away at the closest boundary points. Further to the north is the M4 motorway, which lies approximately 115 metres to the centre of the nearest carriageway.

The Google site location and site plan are provided below in Figure 1 and Figure 2. The Google maps image shows the proposed site boundary highlighted in red.

Figure 1: Existing Site Location – Google Maps



Figure 2: Proposed Site Plan



Proposals include for a mixture of 1-4-bedroom houses, 1-bedroom flats, and amenity spaces; a total of 154 proposed plots.

3. Planning Policy

3.1. Planning Policy Wales

Planning Policy Wales (PPW) Edition 12 dated February 2024 sets out the land use planning policies of the Welsh Government. Section 1 states:

1.1 Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. PPW, the TANs¹, MTANs² and policy clarification letters comprise national planning policy.

The most relevant statements for noise are provided in Section 6.7 and summarised below:

"6.7.1 Clean air and an appropriate soundscape, contribute to a positive experience of place as well as being necessary for public health, amenity and well-being. They are indicators of local environmental quality and integral qualities of place which should be protected through preventative or proactive action through the planning system. Conversely, air, noise and light pollution can have negative effects on people, biodiversity and the resilience of ecosystems and should be reduced as far as possible."

"6.7.3 Certain sounds, such as those created by trees, birds or water features, can contribute to a sense of tranquillity whilst others can be reassuring as a consequence of their association with the normality of everyday activities. Problematic forms of sound are generally experienced as noise pollution and can affect amenity and be prejudicial to health or a nuisance. Noise action plans drawn up by public bodies aim to prevent and reduce noise levels where necessary and preserve soundscape quality where it is good. Noise levels used to identify priority areas contained in noise action plans are usually set quite high in order to focus resources on the most polluted areas and noise must meet a number of tests before it qualifies as a statutory nuisance. Lower levels of noise, however, can still be annoying or disruptive and impact on amenity and as such should be protected through the planning process wherever necessary. The planning system must protect amenity and it is not acceptable to rely on statutory nuisance under the Environmental Protection Act 1990 to do so.

6.7.4 The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

6.7.5 In taking forward these broad objectives the key planning policy principle is to consider the effects which proposed developments may have on air or soundscape quality and the effects which existing air or soundscape quality may have on proposed developments. Air Quality and soundscape influence choice of location and distribution of development and it will be important to consider the relationship of proposed development to existing development and its surrounding area and its potential to exacerbate or create poor air quality or inappropriate soundscapes. The agent of change principle says that a business or person responsible for introducing a change is responsible for managing that change. In practice, for example, this means a developer would have to ensure that solutions to address air quality or noise from nearby pre-existing infrastructure, businesses or venues can be found and implemented as part of ensuring development is acceptable.

6.7.6 In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;*
- not create areas of poor air quality or inappropriate soundscape; and*
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.*

6.7.7 To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer."

6.7.8 Good design, for example setting back buildings from roads to avoid canyon effects and using best practice in terms of acoustic design to ensure the appropriate and intended acoustic environment of completed developments should be incorporated at an early consideration in the design and planning process. Other mitigation measures must be capable of being effectively implemented for their intended purpose, and could include those related to:

- traffic management and road safety;*
- ensuring progress towards a shift to low or zero emissions means of road transport, such as electrical charging points;*
- supporting low or zero emissions public transport;*
- providing active travel infrastructure; and*
- incorporating green infrastructure, where it can improve air quality by removing air pollution and aiding its dispersal, reduce real or perceived noise levels by absorbing and scattering noise and introducing natural sounds to soften man-made noise, provide areas of relative tranquillity, and reduce exposure by putting a buffer between sources of pollution and receptors.*

6.7.9 When proposing new strategies for development and when allocating sites in development plans it will be important to avoid instances where incremental development of infrastructure, housing, commercial and industrial development creates or exacerbate health and amenity inequalities by introducing more sensitive receptors into an area or by making existing occupiers more vulnerable to poor air quality or noise. This may particularly be the case when proposing high density developments adjacent to transport hubs or where development pressure to meet short-term needs may have detrimental long-term effects and care must be taken not to exacerbate health inequalities whilst recognising accessibility needs.

6.7.11 Air and noise pollution are often, but not exclusively, emitted from the same sources, notably road transport, commercial and industrial activities. Consequently, areas of poor air quality often coincide or overlap with areas subject to high noise levels. Even where they do not, poor air quality at one location and high levels of noise at a neighbouring location may be related to one another, depending on the characteristics of the place in question, including the way in which people use and occupy places and the way in which traffic is managed in the wider area. Where air and noise pollution are generated from the same source they should be considered and addressed together and links should be made with active travel and other strategies for reducing vehicular use so as to reduce or minimise, pollution and to ensure an appropriate soundscape.

6.7.12 Planning authorities must consider current and future sources of air and noise pollution as part of developing their strategies for locating new development. The pattern of proposed development should be informed by the sensitivity of, and compatibility of, uses in relation to the sources of airborne pollution and the importance of ensuring appropriate soundscapes. Green infrastructure provision will be an important means of addressing the cumulative impacts of air and noise pollution and soundscapes on individuals and society and provide benefits for social and ecosystems resilience.

6.7.13 When developing strategies, proposing or assessing development proposals it will be essential to understand the implications of the transport demand associated with the proposal and the effect this may have now and in the foreseeable future. When proposing to introduce a development activity into an area the impacts which existing pollution sources (including roads, railways and industrial or commercial operations) have in terms of air and noise pollution should be carefully considered, particularly taking into account any increases in pollution levels which may be reasonably expected in the foreseeable future as a result of increased transport activity.

6.7.14 Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur. In circumstances where impacts are unacceptable, for example where adequate mitigation is unlikely to be sufficient to safeguard local amenity in terms of air quality and the acoustic environment it will be appropriate to

refuse permission. Location of Commercial, Industrial and other Potentially Polluting Development

6.7.15 For the purposes of this section, potentially polluting development includes commercial, industrial, energy and agricultural or transport infrastructure. Such development should be located in areas where there is low potential for public exposure, or where its impact can be minimised. Novel or new development types may potentially cause pollution and should be carefully considered, and where appropriate, decisions should be based on the precautionary principle.

6.7.16 Relevant considerations in making planning decisions for potentially polluting development are likely to include: • location, including the reasons for selecting the chosen site itself;

impact on health and amenity;

effect of pollution on the natural and built environment and the enjoyment of areas of landscape and historic and cultural value;

impact on groundwater and surface water quality;

effect on biodiversity and ecosystem resilience, including where there may be cumulative impacts on air or water quality which may have adverse consequences for biodiversity and ecosystem resilience;

the risk and impact of potential pollution from the development, insofar as this might lead to the creation of, or worsen the situation in, an air quality management area, a noise action planning priority area or an area where there are sensitive receptors; and impact on the road and other transport networks, and in particular on traffic generation, particularly where the proposed development is not transport infrastructure itself.

6.7.17 The location of potentially polluting development adjacent to sensitive receptors will be unacceptable where health and amenity impacts cannot be minimised through appropriate design and mitigation measures. It is the overall expectation that levels of pollution should be reduced as far as possible and for this reason the location of potentially polluting development should be taken into account as part of overall strategies in development plans to ensure it can be appropriately located and maximum environmental benefits can be gained through measures such as green infrastructure.

6.7.18 Early consideration is required to ascertain whether the location and design of proposed development is acceptable where air pollution or noise generating development is likely to affect a protected species, or is proposed in an area likely to affect a statutorily designated site (such as Natura 2000 sites or SSSIs) or a tranquil urban green space (including but not limited to formally designated 'quiet areas') valued for the restorative respite and contact with nature that they offer to residents of busy towns and cities. Sensitive Development

6.7.19 The health imperative of good air quality and appropriate soundscapes in contributing to the overall character and quality of places and the health and well-being of people and wildlife should be fully recognised. It will not be appropriate to

locate sensitive uses, such as hospitals, schools, care homes and housing adjacent to busy roads or other transport routes, where there are no connectivity benefits to be gained and where health and amenity impacts associated with increased exposure of people to pollution will be unacceptable. Whilst some uses may be appropriate with the aid of good design air quality and soundscape considerations can be overriding factors, especially for sensitive uses, if they cannot be adequately mitigated and impacts minimised.

6.7.20 Where sensitive developments need to be located close to existing transportation infrastructure for sustainable movement and access they should be designed, as far as practicable, to limit harmful substances and noise levels within and around those developments both now and in the future. This may include employing the principles of good acoustic design and the inclusion of active travel or travel management measures as part of development proposals. Such development, however, should preferably be located away from existing sources of significant noise, which may include aircraft noise or roads, particularly new roads or those with programmed route improvements.

6.7.21 Regard should be paid to current air quality and noise levels and the quality of the existing soundscape and account taken of any relevant local air quality action plan, noise action plan and/ or local or regional air quality strategy as part of development strategies and proposals in development plans and before determining planning applications. Soundscapes and Compatibility of Uses

6.7.22 Certain qualities of sound can be associated with particular places and the activities within them. Taking steps to foster the continued longevity of uses and activities which provide wider cultural benefit and experience for people and contribute towards the local economy, both in terms of a vibrancy of place and in creating a space for creativity to flourish, is an important role for the planning system.

6.7.23 When considering the formulation of strategies or individual proposals, bearing in mind the agent of change principle, it will be necessary to identify the nature of the soundscape which exists in an area and the characteristics of the place, or specific activities, which have shaped it. 6.7.24 The potential impacts of noise pollution arising from existing development, be this commercial, industrial, transport related or cultural venues (such as music venues, theatres or arts centres), must be fully considered to ensure the effects on new development can be adequately controlled to safeguard amenity and any necessary measures and controls should be incorporated as part of the proposed new development. This will help to prevent the risk of restrictions or possible closure of existing premises or adverse impacts on transport infrastructure due to noise and other complaints from occupiers of new developments. It will be important that the most appropriate level of information is provided and assessment undertaken.

6.7.25 Planning authorities should identify areas of cultural or historic importance to be given special consideration in terms of soundscape where this may be necessary to safeguard the vibrancy of places or provide tranquil, restorative environments

within busy built-up areas. As well as this, it will be invaluable to identify synergies between the mapping of green infrastructure and the moderating effect the protection of, or provision of, green infrastructure may have in terms of maintaining good air quality and appropriate soundscapes. This will include, but is not limited to, protecting tranquillity, the role of tranquil green spaces such as the 'quiet areas' designated in noise action plans and the benefits of green infrastructure as part of good design.

Managing Potential Environmental Risk Arising through Construction Phases

6.7.26 Planning authorities must consider the potential for temporary environmental risks, including airborne pollution and surface and subsurface risks, arising during the construction phases of development. Where appropriate planning authorities should require a construction management plan, covering pollution prevention, noisy plant, hours of operation, dust mitigation and details for keeping residents informed about temporary risks.

PPW does not provide any quantifiable criteria and directs you to the Technical Advice Notes (TAN 11).

4. Assessment Criteria

4.1. Technical Advice Note (Wales) - Noise

Planning Policy Wales (PPW) Edition 11 dated February 2021 sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes. The relevant planning criteria for proposed residential development is in Technical Advice Note (Wales) 11 entitled "Noise" which was published in October 1997. The introduction states:

"This note provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.

It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources".

Table 1 provides Noise Exposure Categories, which relate to proposed residential developments near to a transportation noise source. Noise Exposure Categories, (NEC's) in relation to road traffic noise are addressed in ranges according to the free-field equivalent noise levels ($L_{Aeq, T}$) measured at the position of the proposed dwellings.

Table 1: TAN 11 Noise Exposure Categories

NOISE SOURCE	NOISE EXPOSURE CATEGORY			
	A	B	C	D
Road Traffic				
07.00 - 23.00 hrs	<55	55 – 63	63 – 72	>72
23.00 - 07.00 hrs	<45	45 – 57	57 – 66	>66

The Technical Advice Note (Wales) 11 gives advice to Local Planning Authorities on assessing proposals for residential developments near a source of noise, depending upon which of the four Noise Exposure Categories the proposed site falls into:

- NEC A. *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.*
- NEC B. *Noise should be taken into account when determining planning applications and where appropriate, conditions imposed to ensure an adequate level of protection.*
- NEC C. *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.*

- NEC D. *Planning permission should normally be refused.*

In addition, it states: *"Night-time noise levels (23.00 - 07.00): sites where individual noise events regularly exceed 82 dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8h}$ (except where the $L_{Aeq,8h}$ already puts the site in NEC D)."*

4.2. British Standard 8233:2014

The below informative section is based on British Standard 8233:2014 and WHO 1999. By meeting the below criteria, the residential amenity should not be adversely affected. The below criteria would apply to all plots which fall into NEC B - D.

4.2.1. Internal Equivalent Noise Levels

British Standard 8233:2014 entitled "Guidance on sound insulation and noise reduction for buildings" came into effect on 28th February 2014.

Section 7.7.2 Table 4 of the British Standard 8233:2014 provides internal ambient noise levels for dwellings from noise sources 'without a specific character'.

The British Standard guideline states that noise levels should not exceed those as noted in Table 2 of the British Standard. These criteria are based on the guidance provided within WHO 1999 and are summarised below:

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16\text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hour}}$	30 dB $L_{Aeq,8\text{ hour}}$

4.2.2. Maximum Noise Levels

Section 7.7.2 Note 4 of the British Standard states "Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".

British Standard BS8233 provides no definitive criteria for maximum noise levels from individual events ($L_{Amax,F}$). Section 3.4 of the "Guidelines for Community Noise" published by the World Health Organisation in 1999 (WHO 1999) states *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)"*.

As such, maximum noise levels would be considered acceptable if the maximum noise level from individual events does not exceed 45 dB $L_{Amax(F)}$ no more than 10 to 15 times during the night-time period.

4.2.3. **Amenity Space**

British Standard 8233:2014 section 7.7.3.2 entitled 'Design criteria for external noise' states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."

4.3. **Approved Document O - Overheating Conditions**

Approved Document O (ADO) is a building regulations requirement in Wales from November 2022. ADO (Wales) states:

2.2 High levels of external noise could limit the use of cross-ventilation to mitigate the risk of summer overheating. External noise is a material consideration considered when applying for Planning permission and mitigating measures may be required in the design in order to obtain Planning permission and controlled through a condition imposed on the consent. In exceptional cases, this could include non-openable windows. More commonly, windows will be openable in order to enable natural ventilation to occur at less sensitive times of day, when there is lower noise, when people are not present in the room, or when they are present but not engaged in noise-sensitive activities. But those windows may need to be kept closed at times to maintain acceptable indoor acoustic conditions, for example when people are using the rooms for sleep or office work. A noise issue may be identified at the Planning stage but rely on occupants to close windows at noise sensitive times rather than prevent them from ever opening them, and in those cases overheating strategies should assume windows will be closed during noise-sensitive periods even if they are not fixed closed.

2.3 When the removing excess heat as part of the overheating strategy, noise levels in bedrooms should be kept to a minimum during the sleeping hours of 23:00-07:00. Building control bodies may accept as evidence that this requirement is satisfied:

a. documentation to demonstrate that the local planning authority did not consider external noise to be an issue at the site at the planning stage or;

b. if the local planning authority did consider external noise to be an issue that should be controlled through a condition at planning stage, then documentation to demonstrate that the proposals for heat removal (during the sleeping hours of 23.00 – 07.00) are accommodated within or do not conflict with documentation provided to the local planning authority to satisfy any related planning permission condition(s). (For example any expectation that windows on one or more façade, or in certain rooms, will need to be kept closed during noise-sensitive periods.)"

ADO (Wales) does not apply any clearly defined noise limits. ADO (Wales) relies on the noise criteria within planning conditions or documentation submitted at planning stage. As such it is our opinion that the most relevant guidance for overheating noise limits (at night) is ADO (England) which states:

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

*a. **40dB** $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).*

*b. **55dB** L_{AFmax} , more than 10 times a night (between 11pm and 7am).*

4.4. British Standard 4142:2014+A1:2019

For industrial and commercial noise, the most relevant guidance is provided within British Standard 4142:2014+A1:2019. The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premise used for residential purposes.

The initial estimate principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'. The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Clause 9 entitled 'Rating Level' states:

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location. In Clause 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.

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

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that contextual matters should be considered before determining what the potential impact is. This paragraph states:

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

The second part of Clause 11 sets out three contextual matters that should be taken into account once the initial numerical estimate has been determined. It is important to note that the three listed are not exhaustive and all pertinent factors should be considered.

In terms of good internal acoustic conditions, the most relevant criteria and methodology is provided in BS8233:2014. This is in accordance with a March 2020 Technical published by the ANC Working Group, which provided comments and guidance to clear any ambiguity in BS414:2014+A1:2019.

This document states the following regarding Sub-Clause 8.5 of BS4142:2014:

"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

Examples of such guidance might include:

- *BS8233: 2014 where an industrial/commercial sound source is constant and new residential development is proposed nearby"*

The March 2020 Technical Note later states:

"Whilst BS 4142 can be used to assist in the determination of the likelihood of an adverse or significant adverse impact, guidance on internal design criteria and mitigation is provided elsewhere. BS 8233:2014, for example, provides guidance on indoor ambient noise levels."

5. Noise Monitoring

A long-term noise monitoring exercise was undertaken at two locations between 14:00 hours on the 30th of March and 11:00 hours on the 1st of April 2021.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using Class 1 sound level meters with a half-inch condenser microphone. The equipment is checked annually using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2005 and in accordance with British Standard EN 10012:2003 and traceable to the National Standards. This equipment was checked and calibrated as noted below and the certificates are available for inspection. Table 3 provides the equipment and calibration status.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-11053-E0	22/04/2020	34610
Pre-Amp, NTI, MA220	5871	22/04/2020	34610
Microphone, NTI, MC230A	9276	22/04/2020	34609
Calibrator, Nor-1251	35227	02/10/2020	35886
SLM, NTI, XL2	A2A-13617-E0	13/03/2020	UK-20-012
Pre-Amp, NTI, MA220	7727	13/03/2020	UK-20-012
Microphone, NTI, MC230A	A16151	13/03/2020	UK-20-012
Calibrator, Larson Davis, CAL200	12605	09/03/2021	32690

The measurement systems were checked before and after use with the calibrators and no significant drift was detected.

5.2. Weather Conditions

During the monitoring conditions were clear, dry, and calm. The weather conditions are not expected to have adversely affected the measured data.

Table 4: Weather conditions during survey

Wind Speed (m/s)	Average Air Temperature (°C)	Precipitation (time/hrs)	Cloud Cover (%)
< 5	~ 15 to 20	0	~ 0 to 25

5.3. Noise Monitoring Procedure

A long term partially attended noise monitoring exercise was carried out at two locations between 14:00 hours on the 30th of March and 11:00 hours on the 1st of April 2021. The measurements were carried out at positions noted as 'Monitoring Location A' and 'Monitoring Location B' below.

Figure 3: Long-term Monitoring Locations



Both microphones were mounted on a tripod approximately 1.5 metres above the ground and in free-field positions. Both meters used during the monitoring exercise had their internal clock synchronised.

During our site visits attended survey work was undertaken at both locations to obtain data and relevant notes about the noise climate, specifically the M4, train line vehicle movements and farmyard noise. These are detailed in the following section.

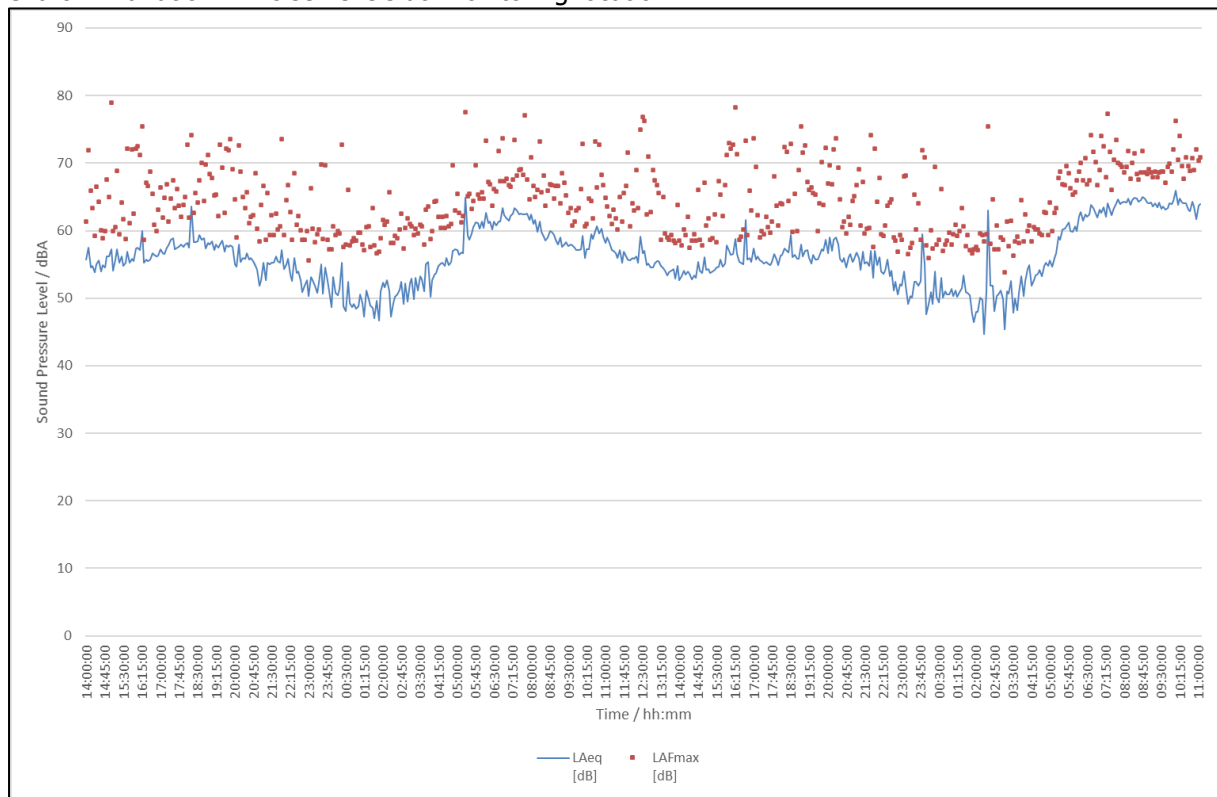
5.4. Measured Noise Levels & Observations

The main noise affecting the whole site was determined to be road traffic noise from the M4. Train events were audible at the nearest boundary, and were not considered overbearing once background noise was considered.

5.4.1. Long Term 'Monitoring Location A'

A chart of the variation in equivalent and maximum noise levels with time is provided below:

Chart 1: Variation in Noise Levels at 'monitoring location A'



From the measured road traffic noise data propagating from the M4, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels at the monitoring location:

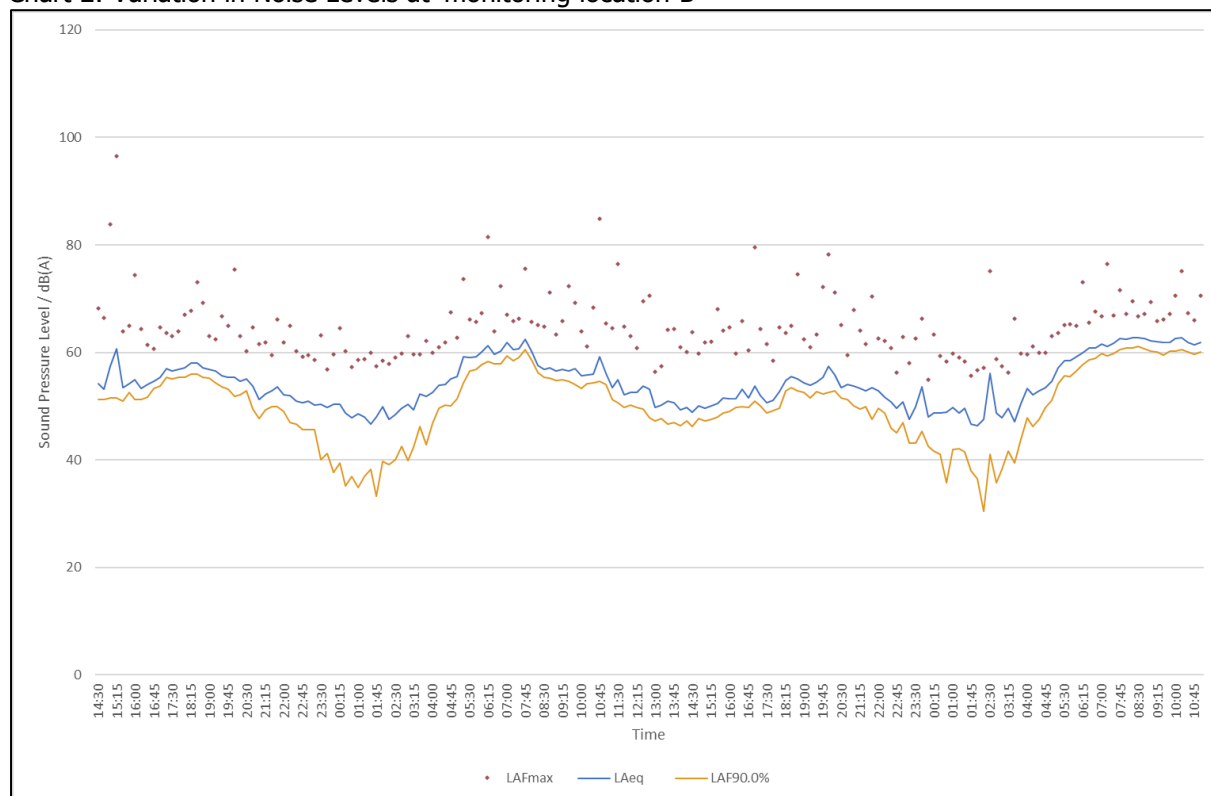
Table 5: Measured Octave Band Design Noise Levels at 'Monitoring Location A' (Free-Field Levels)

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $Leq_{(16hr)}$	61	56	51	55	57	50	44	41	59
Night $Leq_{(8hr)}$	57	52	47	53	55	47	40	38	56
Night $L_{max(F)}$	77	71	66	73	73	66	52	39	75

5.4.2. Long Term 'Monitoring Location B'

A chart of the variation in equivalent, maximum and background noise levels with time is provided below:

Chart 2: Variation in Noise Levels at 'monitoring location B'



From the measured road traffic noise data, we have determined the following free-field octave band design 'daytime' and 'night-time' equivalent noise levels, and maximum noise levels at the monitoring location:

Table 6: Measured Octave Band Design Noise at 'monitoring location B' (Free-Field Levels)

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Day $L_{eq,(16hr)}$	59	54	49	53	55	48	42	39	59
Night $L_{eq,(8hr)}$	55	50	45	51	53	45	38	36	55
Night $L_{max(F)}$	69	63	58	65	65	58	44	31	69

We have also determined the following background noise levels $L_{A90, 15 \text{ min}}$ at this monitoring location. This data will be used to aid in a BS4142 assessment.

Table 7: Measured background noise levels $L_{A90, 15 \text{ min}}$ at 'Monitoring Location B'

Period	$L_{A90,15min}$	
	Range	Mode
Day (07:00 - 23:00 hrs)	45 - 61	50
Night (23:00 - 07:00 hrs)	30 - 59	42

5.4.3. Train Event Attended Monitoring

During our site visits several passing train events were monitored. The different events encompassed a variety of train vehicles, both local and main line trains, with between 2 and 12 carriages, respectively. It was noted that noise levels of passing trains were slightly higher at Monitoring Location B.

The worst-case SEL data measured at Location B is presented below.

Table 8: Measured Octave Band Train Noise at Monitoring Location B

Parameter	63	125	250	500	1000	2000	4000	8000	dB(A)
Passing Train @ Location B	69	51	42	46	52	43	44	39	54

Our attended monitoring has noted that maximum noise levels across the site were dictated by road traffic along the M4 alone, passing motorcycles and cars travelling at high speeds. Passing trains had no effect on the maximum noise levels at either monitoring location.

5.5. Farmyard Noise

Although operational during our visits and long-term survey, noise from the farm was not an incongruous sound in relation to the transportation noise climate at the closest proposed boundary.

During our attended survey, there was no audible noise from the cowshed at the closest boundary location. The recorded audio from the long-term survey shows that the M4 road noise is clearly dominant at all times of the day, and farmyard noise has no effect on this noise climate, and cow shed noise is not present on the audio files. The audio from the long-term surveys can be provided upon request.

6. Transportation Noise Assessment

6.1. Noise Modelling Parameters

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and the measured data noted above.

The software predicts road traffic noise propagation using the method of 'The Calculation of Road Traffic Noise 1988' (CRTN'88) and rail traffic noise using the method of 'Calculation of Railway Noise 1995' (CRN'95). A verification model has been created for the road and rail noise separately to ensure the measured and predicted levels are comparable.

All buildings and ground are reflective. The site layout follows the drawings provided in Figure 2 of this report. The building evaluations for all the residential buildings are predicted at the worst-case residential receiver height, that being the typical height of a person in a bedroom.

Transportation Noise maps have been generated to determine the required Noise Exposure Category across the site for 'mixed noise' sources. Road noise has been determined from the measured data provided above. Rail noise has been determined through our attended monitoring and individual event noise data. The train $L_{Aeq, 16\text{hour}}$, $L_{Aeq, 8\text{hour}}$ noise levels have been determined by weighting the measured noise data, over the number of trains that pass the site during the day and night-time hours. The number of trains calculated to have been gathered from open-source data provided by 'Real Time Trains', <https://www.realtimetrains.co.uk/>.

The NEC transportation noise maps are provided in Figures 4-6. The colour key is as follows:

Table 9: NEC noise map colour coding key

NEC A	Daytime equivalent noise levels up to 55 dB L_{Aeq} (16 hour), night-time equivalent noise levels up to 45 dB L_{Aeq} (8 hour).
NEC B	Daytime equivalent noise levels of between 55-63 dB L_{Aeq} (16 hour), night-time equivalent noise levels of between 45-57 dB L_{Aeq} (8 hour).
NEC C	Daytime equivalent noise levels of between 63-72 dB L_{Aeq} (16 hour), night-time equivalent noise levels of between 57-66 dB L_{Aeq} (8 hour). Night-time maximum noise levels in excess of 82 dB L_{Amax} (slow). No part of the site falls into this category.
NEC D	Daytime equivalent noise levels in excess of 72 dB and night-time equivalent noise levels in excess of 66 dB.

6.2. Noise Modelling Results

Predicted noise emission maps for equivalent noise levels during the daytime ($L_{Aeq, 16\text{hour}}$) and night-time ($L_{Aeq, 8\text{hour}}$), and maximum noise events (L_{Amax}) during the night-time are provided below in the figures below.

Figure 4: Predicted Daytime $L_{Aeq, 16\text{hours}}$ Noise Map due to Road Traffic Noise

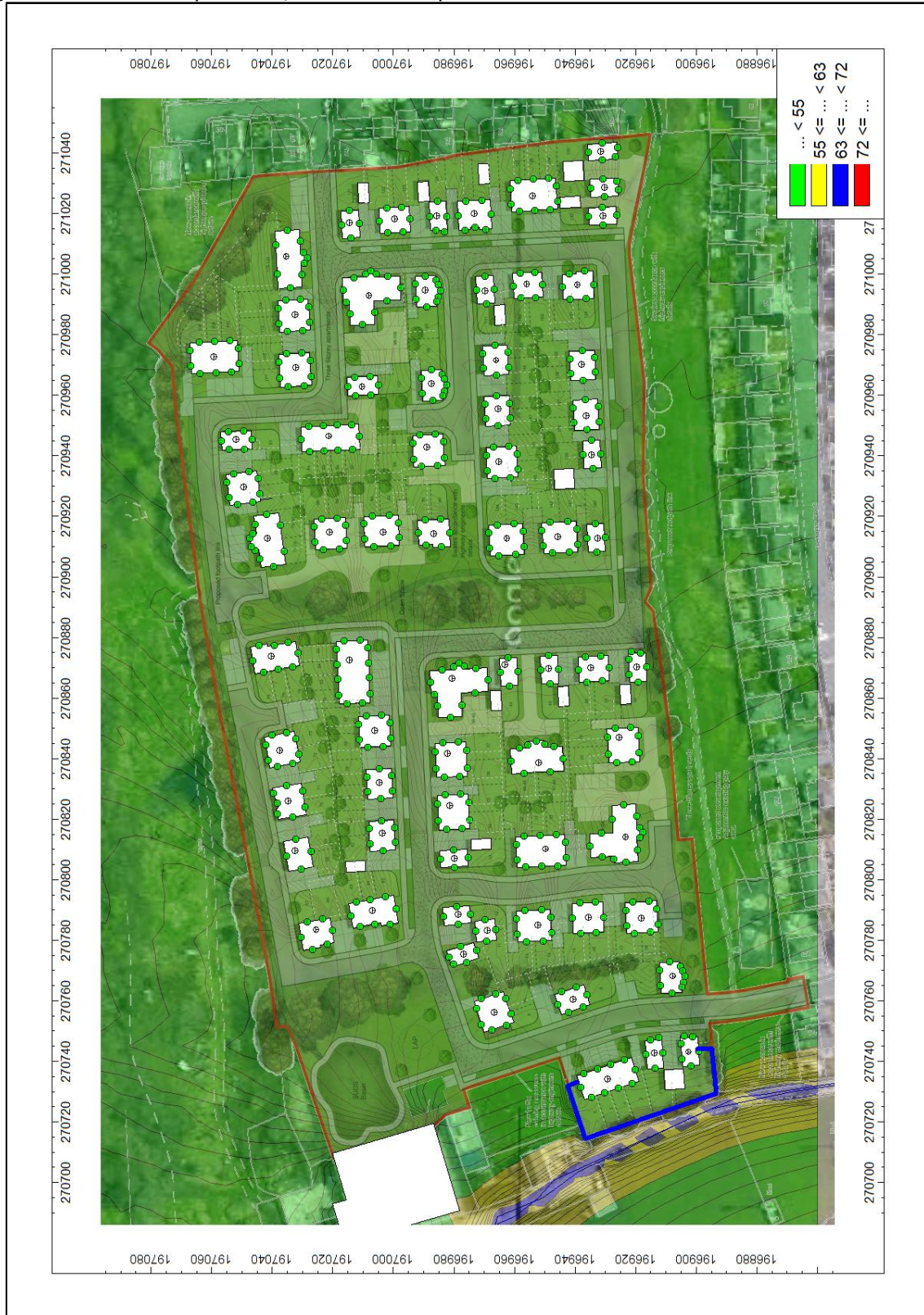


Figure 5: Predicted Night Time $L_{Aeq, 8\text{hours}}$ Noise Map due to Road Traffic Noise

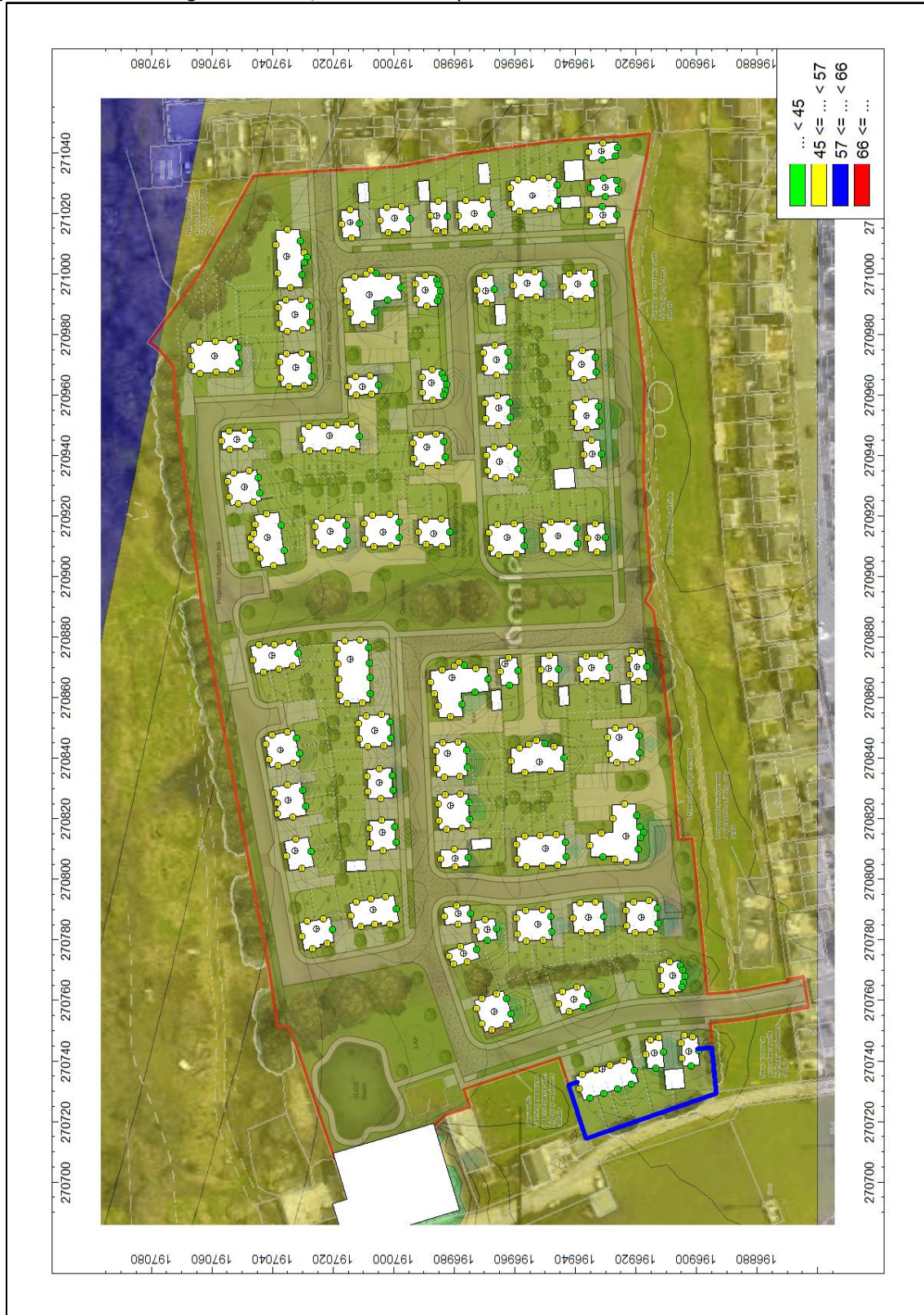
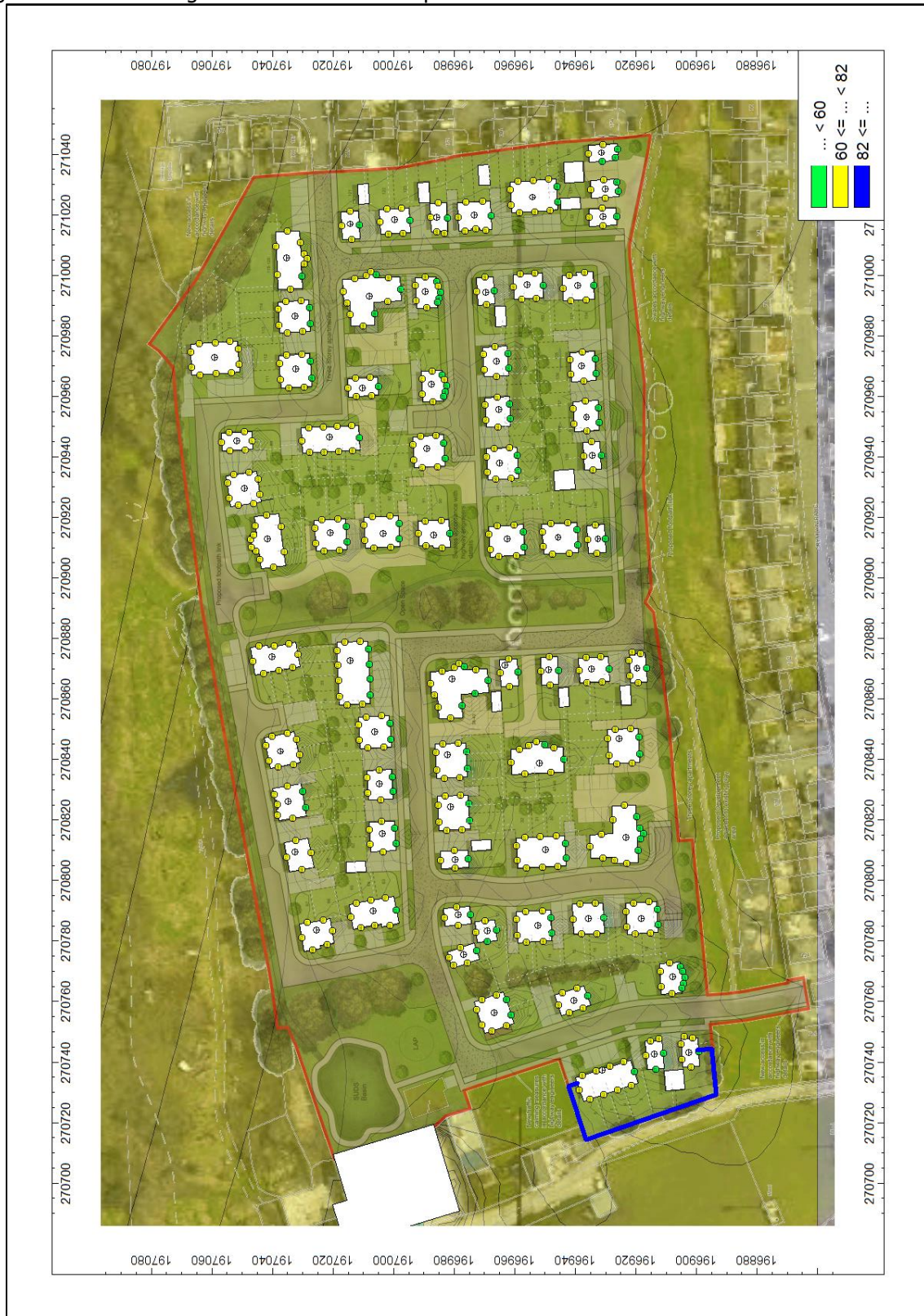


Figure 6: Predicted Night Time L_AF_{max} Noise Map due to Road Traffic Noise



6.3. Noise Exposure Category

From the measurements and predictions above this site falls into Noise Exposure Category B (NEC B) which states the following:

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

6.4. Building Mitigation Measures

It will be necessary to design the building fabric of the residential properties to control road traffic noise levels internally. The noise maps indicate only slight changes in noise levels between the day and night periods, which reaffirms that noise from the M4 is dominant across the whole site.

6.4.1. Calculation Method

Calculations for the internal ambient noise levels due to road traffic noise have been undertaken using the calculation method provided in Annex G Section G.2 of British Standard 8233:2014, the building facade construction specified below and the octave band free-field design equivalent noise levels and maximum noise levels taken from the measured noise spectra noted above. The calculations assume the following based on typical room sizes:

- Room size: 20m² to living rooms and 9m² to bedrooms
- Windows: 4m² to living rooms and 2m² to bedrooms
- Façade: 10m² to living rooms and 8m² bedrooms
- Ventilation: 1 open per living room and bedroom

We advise that building elements, having the sound insulation performances noted below, be incorporated into the design of the façades including the windows, doors, floor, and the building roof.

Alternative constructions to those noted below could be used, however, they would need to be assessed to ensure they control external noise to within the BS 8233:2014.

6.4.2. External Wall Construction

External Wall Construction

Within all zones the external walls could comprise either a masonry or light weight timber frame construction.

- The masonry construction could comprise at least two skins of block (one of density 1850 Kg/m³, 100mm cavity, 100mm block (density of 400 Kg/m³). The inner skin of block would be plastered.
- Or,
- The timber frame construction could comprise a single frame construction with an external leaf of 100mm brick or block (density 1600 kg/m³), 100mm timber stud with 50 millimetres of mineral wool insulation within the cavity and inner lining comprising two layers of dense plasterboard (minimum total surface mass 16 kg/m²).

The constructions above are expected to achieve the following minimum sound reduction indices:

Table 10: Required minimum sound reduction indices of external wall

Construction	Sound Reduction Index 'R' (dB) per Octave Band (Hz)								R _w
	63	125	250	500	1k	2k	4k	8k	
Masonry	31	38	46	45	55	66	77	70	52
Lightweight	25	40	45	46	53	60	65	60	

Any alternative constructions must achieve the above noted performance.

6.4.3. Roof Construction

Within all zones, the dwellings could have a roof constructed using traditional techniques, such as a timber construction with concrete/slate tiles (minimum mass per unit area of 30 Kg/m²) with a loft space and a plasterboard ceiling above the habitable rooms. The above construction is expected to achieve the following sound reduction indices:

Table 11: Required minimum sound insulation performance of the roof

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	R _w
R (dB)	25	39	47	53	58	56	60	55	56

Any alternative constructions should achieve the above-noted performance.

6.4.4. Window Construction

The windows on all elevations could be openable. However, they need to be sealed airtight to control external noise and adequate levels of ventilation should be provided with windows closed.

The windows should be constructed from sturdy good quality frames with airtight compression seals. The sound reduction indices required of the windows on all facades are as follows:

Table 12: Required Minimum Sound Insulation Performance of Windows

Location	Required Windows Sound Reduction Index (dB) per Octave Band (Hz)								R _w (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
North, East and West Elevations	20	25	22	33	40	43	44	44	36	10-12-4
South Elevations	20	24	20	25	35	38	35	36	31	4-12-4

6.4.5. Ventilation Provision

Background Ventilation

There should be no un-attenuated vents or openings in the building façades. There will need to be suitably attenuated ventilation provisions in the habitable rooms where specific noise mitigation measures are required. The ventilation provisions should include the necessary sound attenuation so that the ingress of external noise is controlled to be compatible with the building fabric.

The minimum required performance for the vents is provided below. The supplier should provide test data confirming ventilation meets the below performance.

Table 13: Required Minimum Sound Insulation Performance of Vents

Location	Required Ventilator Sound Insulation Performance, D _{n,e} per Octave Band (Hz)								D _{n,e,w} (dB)	Typical Construction
	63	125	250	500	1k	2k	4k	8k		
North, East and West Elevations	30	37	37	36	47	49	55	61	44	Titon – SF X V75 / SFSA C75
South Elevations	30	35	35	36	34	29	33	34	32	Standard Trickle

Overheating Ventilation

It should be noted under overheating conditions the windows may need to be opened. Approved Document O may need to be considered.

The Welsh Approved Document O does not set out noise thresholds above which overheating should be considered. As no thresholds are set in the Welsh guidance, we would consider it reasonable to apply the limits set in the English Approved Document O.

On the basis that a partially open window achieves 13 dB attenuation, bedrooms that have windows on the red facades shown on the figure below are not expected to achieve the requirements of ADO for the night time period of 40 dB $L_{Aeq, 8\text{hour}}$ and 55 dB L_{AFmax} :

Figure 7: Overheating Map



6.5. Effect of Mitigation Measures

With the above noted noise control measures the BS8233 criteria can be met in all rooms. The calculation for the worst-case room is provided below:

Free Field Level at Facade									
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, L_{eq16h}	61	56	51	55	57	50	44	41	59
Night, L_{eq8h}	58	53	48	54	56	48	41	39	58
Night-time L_{night}	77	71	66	73	73	66	52	39	76
Building Facade Construction									
External Element	D_{eq}	63	125	250	500	1000	2000	4000	8000
SF X V75 / SFA C75 (open) - 44 Dnew	Number of	30	37	37	36	47	49	55	61
		1							
		0.00050	0.00010	0.00010	0.00012	0.00001	0.00001	0.00000	0.00000
100mm brick, 100mm timber frame, 50mm m.f., 2x12.5mm Wallboard - S2 Rw	Area	25	40	45	46	53	60	65	60
		8							
		0.00126	0.00004	0.00001	0.00001	0.00000	0.00000	0.00000	0.00000
Double Glazed: 10/12/4 - 36 Rw	Area	20	25	22	33	40	43	44	44
		2							
		0.00100	0.00032	0.00063	0.00005	0.00001	0.00001	0.00000	0.00000
Pitched Roof - S6 Rw	Area	25	39	47	53	58	56	60	55
		10							
		0.001581139	6.29463E-05	9.97631E-06	2.50594E-06	7.92447E-07	1.25594E-06	0.0000005	1.58114E-06
Calculations to BS EN 12354									
		63	125	250	500	1000	2000	4000	8000
Sum		0.00434605	0.000518937	0.000753346	0.000185408	2.30059E-05	1.26791E-05	6.11754E-06	6.33287E-06
10log sum		-23.6190529	-32.84885236	-31.23005581	-37.31872348	-46.38161051	-48.96910281	-52.13423277	-51.98399725
10log S/A		4.24235019	4.242350195	5.482135645	6.615435064	7.340036295	5.287082889	4.134126953	4.134126953
correction factor +3		3	3	3	3	3	3	3	3
Octave Band		63	125	250	500	1000	2000	4000	8000
Day, L_{eq16h}		44	30	28	27	21	9	-1	-4
Night, L_{eq8h}		42	27	25	26	20	7	-4	-6
Night-time L_{night}		61	45	43	45	37	25	7	-6

6.6. Amenity Space Assessment

The daytime noise map provided as Figure 4 indicates that the proposed amenity areas will fall within the upper guideline value of 55 dB $L_{Aeq,16h}$ and are therefore acceptable. It is also expected that once timber fencing is introduced, amenity levels will be reduced further, particularly at the most exposed houses to the north.

7. Industrial Noise Assessment

The noise impact from the existing farmyard will need to be addressed in accordance with BS4142:2014.

As described, farmyard noise was not audible during our attended survey, neither is it considered audible from the audio recorded. The noise from the M4 is clearly dominant across the site, and as indicated above, can easily be mitigated through façade and element design as noted above to control road and railway noise.

Typical noise of farm activity is considered due to vehicle movements, namely tractors. During busy farming periods it is typical that tractors could be operating frequently, travelling up and down the access track to the adjacent farm. We have undertaken similar assessments in previous projects that give us access to library data of tractor movements. This data forms our following noise modelling exercise, and can be provided on request.

7.1. Tractor Noise Modelling Parameters

To determine the specific noise level of tractor movements, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik and our library data. Cadna:A software uses the calculation method of ISO 9613 to predict noise levels. The model predicts noise from a line source representing the moving tractor.

We have accounted for the following tractor movements:

- Daytime, over a 1-hour period: 4 tractors in and out of the farm, 8 movements total.
- Night-time, over a 15-minute period: 1 tractor in and out of the farm, 1 movement total.

The Cadna:A noise data used in the model is shown below and is at a distance of 10 metres.

Table 14: Cadna:A imputed plant noise data

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Tractor at 10m (dB)	88	75	68	64	59	56	50	42	68

The ground is considered to be 'hard'. The site layout follows the drawings provided in planning above. The building evaluation noise level for all plots are predicted at the worst-case residential receiver height.

All buildings were assumed to be reflective, and 1st order of reflections were used.

A noise control barrier was also introduced along the western boundary amenity areas of the most exposed areas to control tractor noise impact. The required noise control

barrier is 1.8 metres, must provide minimum mass per unit area of 10kg/m^2 , and is imperforated.

7.2. **Tractor Noise Modelling Results**

Predicted noise levels at the worst-case façades are provided in the following noise maps:

Figure 8: Daytime Noise Map Predictions of Tractor Noise



Figure 9: Night-time Noise Map Predictions of Tractor Noise



Table 15: Predicted Tractor Noise Levels at Nearest Façades

Parameter	L _{Aeq(T)} dB
Daytime	47
Night-time	44

7.3. BS4142:2014 Initial Estimate Assessment

Noise from industrial activity (farmyard tractor noise) has the potential to affect the proposed residential properties and is assessed in accordance with BS4142:2014.

7.3.1. Specific Sound Level

The specific sound levels at the worst-case receivers are 47 dB L_{Aeq(1hour)} during the day and 44dB L_{Aeq(15mins)} during the night.

7.3.2. Background Noise Level

From the measured data obtained at Monitoring Location B noted above, we have determined a typical daytime design background sound level to be 50 dB L_{A90(1hr)} and 42 dB L_{A90(15mins)}.

7.3.3. Character Correction

Character corrections should be added to the “specific sound level” if the “specific sound level” exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. Based on our site visit the character corrections to be applied are as follows:

- **Tonality** –Tractor noise is not normally tonal
- **Impulsivity** –The vehicle pass-by is not impulsive
- **Intermittency** – Intermittency is not a considered due to the high level of residual sound resulting in the intermittency not being clearly distinguishable.
- **Other Sound Characteristics** – No other sound characteristic corrections are considered necessary due to the high level of residual sound.

7.3.4. Initial Estimate of Impact

On the basis of the above, the British Standard 4142:2014 initial estimate at the most sensitive location is as follows:

Table 16: British Standard 4142:2014 Initial Estimate

Parameter	Daytime	Night-time
Background Level, L _{A90(T)}	50 dB	42 dB
Specific Sound Level, L _{Aeq(T)}	47 dB	44 dB
Acoustic Character Correction	0 dB	
Rating Level	53 dB	50 dB
Excess of rating over background level	-3 dB	+2 dB

This means that the rating noise level will result in a British Standard 4142:2014 assessment 'difference' of -2dB during the daytime and +2dB during the night time period at the proposed worst-case façades of the proposed development.

BS 4142 states that *"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."*

Therefore, the impact during the daytime period will be low in accordance with BS4142:2014.

During the night time period, the rating level is just exceeding the background. BS4242:2014 does not specifically states the outcome of a marginal exceedance, but states: *"A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context."*

This means that the impact of industrial noise due to tractor operations could result in an adverse when assessed to BS4142 during the night time period. Section 11 of British Standard 4142:2014, entitled 'Assessment of the Impacts', states the following regarding context.

It should be noted that the numerical outcome only represents the initial estimate of impact, as stated in the first paragraph of Clause 11, and that **contextual matters should be considered before determining what the potential impact is.** This is provided below.

7.4. Contextual Assessment

7.4.1. Good Internal Acoustic Conditions

During the night period, people will be most likely indoors and consequently less subject to tractor noise impact. It will also be necessary to consider closed window strategy to control road traffic internally, including the night time period.

With regards to internal noise limits, BS8233:2014 provides internal levels from external noise levels without character, previously termed "anonymous noise". It provides limits to bedrooms, which the main acoustic feature is the effect on sleep, as well as limits to other daytime rooms that can be used for resting e.g. living rooms.

While these guidelines focus on sources of noise with no character, we still consider BS8233:2014 the most appropriate standard for setting internal noise limits. However, no character correction is needed as stated above in the BS4142 assessment.

In addition, Section 11 of British Standard 4142:2014, entitled 'Assessment of the Impacts', states the following regarding context. *"The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*

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

Based on all of the contextual matters, it is therefore reasonable to state that, the initial outcome of BS4142:2014 assessment that resulted in an adverse impact can be revised by adopting appropriate internal noise criteria, particularly for the night time when occupants are more vulnerable to disturbance. Noise control barrier as stated above in the noise maps on the most exposed houses will also be required, following this way the above BS4142 recommendations.

The design target is to achieve a Rating Noise Level as determined in accordance with British Standard 4142:2014 which does not exceed the internal daytime noise criteria within a dwelling of 35dB $L_{Aeq(16\text{hour})}$ during the day within the habitable rooms.

This can be easily achieved by applying the "Building Mitigation Measures" as stated in Section 6.4 used to control Transportation Noise Levels to meet BS8233:2014 internal noise criteria.

Therefore the noise impact of farm yard activities is low and acceptable when assessed to BS4142:2014.

8. Summary & Conclusions

Hale Group appointed Acoustic Consultants Limited to carry out a noise impact assessment and provide a suitability assessment and acoustic mitigation advice for the proposed residential development on the land currently occupied by farming land.

The assessment takes into consideration the local authority requirements and considers the impact of road traffic noise from the M4 motorway, train noise from the rail line to the north and the nearby operational farm to the west of the site.

The report assesses the suitability of the site with respect to TAN 11, British Standard 8233:2014+A1:2019 / WHO (1999) and British Standard 4142:2014+A1:2019.

The dominant noise source across the site is road traffic emanating from the M4. The site falls into NEC B which therefore requires noise mitigation measures to the building façade construction, namely external walls, windows and ventilation to habitable rooms, to ensure an adequate level of protection.

With the noted building fabric construction, and suitable ventilation provisions as stated above in this report, the predicted internal noise levels within the proposed dwellings from both road traffic and rail noise are easily within the criteria of British Standard 8233:2014 of 35 dB L_{Aeq} (16 hour) in the daytime rooms, and 30 dB L_{Aeq} (8 hour) and 45 dB $L_{Amax(F)}$ in the night-time rooms.

As such, we would consider external noise to be suitably controlled within the habitable rooms of the proposed residential development and good internal conditions can be achieved. The noise map predictions provided in this report also indicate that noise levels in amenity spaces fall within the upper guideline value of BS8233 and are therefore acceptable.

We have assessed farmyard tractor noise using previously measured library data, and our measured background noise data from the site survey. This has been used to inform an assessment to BS4142 at the nearest sensitive receivers to the farm access track. The daytime specific noise level of tractor movements falls below the background noise levels of the area and therefore the impact is considered to be low. The night-time specific noise level of tractor movements marginally exceeds the measured background by 2 decibels.

When considering all the contextual matters with regards to the farmyard tractor operations, we believe that the initial assessment of adverse impact can be revised by adopting appropriate internal noise criteria, particularly for the night time when occupants are more vulnerable to disturbance.

It is considered that with the building mitigation measures installed as detailed above, noise from the tractor movements would be sufficiently reduced internally to the habitable rooms.

In terms of environmental noise, we would consider that acceptable conditions can be achieved within the dwellings on the site as long as the noise control measures noted above are followed.

9. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t₂ – t₁, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \log_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_S = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level, once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, $eVDV$ – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



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