



Environmental Noise Survey, Noise Break-In Assessment & Sound Insulation Scheme

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Site Address: South Side Of William Street, Littleborough, Greater Manchester, OL15 8JP

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Executive summary

An environmental noise survey and noise impact assessment has been undertaken to assess the suitability of the site at South Side Of William Street, Littleborough, Greater Manchester, OL15 8JP for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

A sound insulation scheme has been provided in Section 6.0, including glazing and an alternative ventilation strategy. These recommendations should be sufficient to achieve the internal and external noise levels for the proposed development according to the BS8233:2014 internal noise criteria. An overview of all recommendations can be found in the table below:

Recommendations and Mitigation Overview

- All facades across the development have been separated into designated Façade Zones
- The glazing for each façade designation requires the sound reduction specific in Tables 8.0. Appropriate glazing specifications can be found in Table 9.0.
- Appropriate acoustically treated alternative ventilation can be found in Table 10.0
- Fencing should be installed around external amenity areas. Further specification can be found in the body of the report.

The findings of this report will require written approval from the Local Authority prior to work commencing.

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') at the South Side of William Street, Littleborough, Greater Manchester, OL15 8JP ('the Site').

The applicant is preparing a planning application to be submitted ('the Application') to Rochdale Borough Council.

The following technical noise assessment has been prepared to support the planning application to Rochdale Borough Council. This report details the ambient sound climate at the proposed development site and provides a sound insulation scheme to protect the amenity of the occupants of the proposed residential dwellings.

This noise assessment is necessarily technical in nature; therefore, a glossary of terms is included in Appendix A to assist the reader.

Scope & Objectives

The scope of the noise assessment can be summarized as follows:

- Ambient sound monitoring survey to evaluate the prevailing ambient and maximum sound levels incident on the proposed development;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2019), Noise Policy Statement for England (2010), 4142:2014+A1:2019 and British Standard BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Further information on the legislation can be found in Appendix B.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey has been carried out from 21st of April of 2021 to 22nd of April of 2021. The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the day and night. The monitoring locations are shown in Figure 1.0. Measurement position 1 was located on a lamppost approximately 3.5m from the ground with no other reflective surfaces in close proximity. Measurement position 2 was located on a drain pipe of the existing building on site approximately 3m from the ground. Spot measurements were also undertaken of the nearby industrial and plant noise.

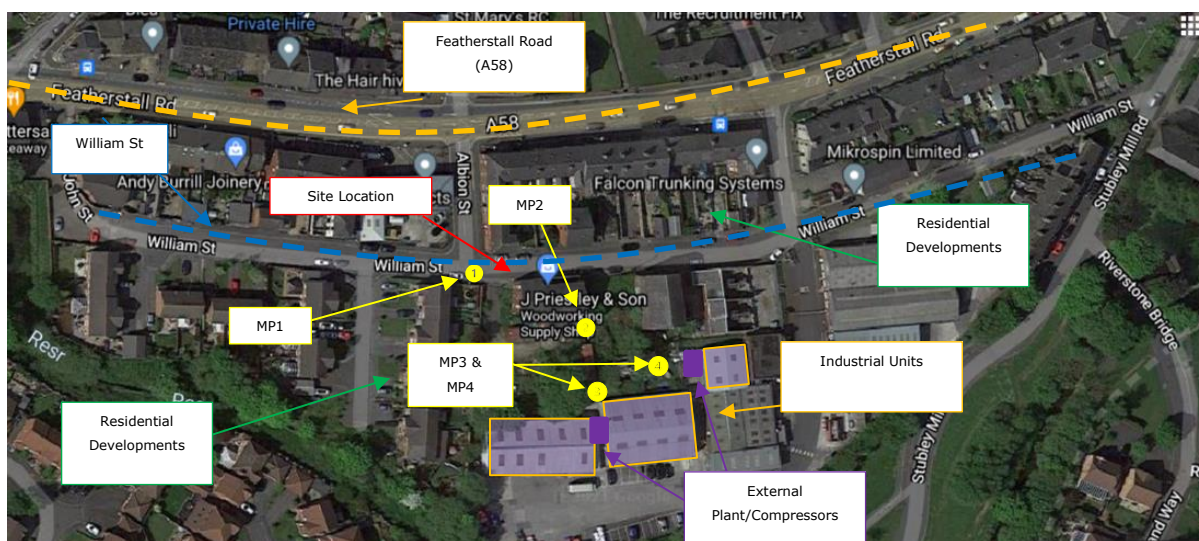


Figure 1.0 - Indicative Site Layout

Context, Subjective Impression and Acoustic Diary

The area surrounding the site is a mixture of residential dwellings and commercial/industrial units. The noise profile of the area is dominated by industrial noise and road noise.

MP1 was located in a lamppost on William St. The A58 was audible from MP1. William Street closer to the development has low levels of traffic flow. Noise from the industrial units to the south of the site was audible during the set-up and the collection of the equipment at this location.

MP2 was located on a drainpipe at the back of the existing building on-site "Priesley & Son". Industrial noise from the southern perimeter units at this location was audible.

Some spot measurements were undertaken due to the presence of industrial noise. MP3 was located at the bottom of the site along the southern perimeter facing the industrial development. The characteristic of the noise can be described as a constant with peaks similar to an air piston or compressor. Further summary details can be seen in Appendix D.

MP4 was facing the small unit to the east at which the doors were open and also has associated external plant outside, creating a constant noise. The internal activity taking part in this unit but can

be described as an engine type noise. The noise coming from the bottom units was also audible at this position. Further summary details can be seen in Appendix E.

Background

The existing buildings on site are used as a workshop for manufacturing metal and repairing machines. It is proposed that the existing building on site be demolished and 7 dwellings are erected.

Environmental Noise Survey Results

The following table outlines the average $L_{Aeq,16\text{hour}}$ and $L_{Aeq,8\text{hour}}$ noise levels as well as the highest 1 hour at each position measured during the day and night periods that will be used in the noise break in assessment and external noise level assessment. A full summary of all results can be found in Appendix D.

Measurement Position 1				
Measurement Period ('t')	$L_{Aeq,t}$	$L_{Amax,t}$	$L_{A90,t}$	$L_{A10,t}$
Day 2	62.0	101.0	59.0	64.0
Night 1	54.0	82.0	48.0	58.0
Highest 1 Hour Day	65.0	101.0	60.0	70.0
Highest 1 Hour Night	57.0	75.0	50.0	60.0
Measurement Position 2				
Measurement Period ('t')	$L_{Aeq,t}$	$L_{Amax,t}$	$L_{A90,t}$	$L_{A10,t}$
Day 1	57.0	93.0	48.0	59.0
Night 1	46.0	63.0	45.0	48.0
Highest 1 Hour Day	59.0	87.0	56.0	61.0
Highest 1 Hour Night	47.0	63.0	45.0	49.0

Table 1.0 – Sound Level Summary – Long Term Positions

In the following section, the maximum noise level events are assessed. ProPG states:

"...in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night."

The following table shows a summary of the maximum sound level results.

Measurement Position MP1			
Measurement Period ('t')	$L_{AFMax,15\text{min}}$	*SMR $L_{AFMax,15\text{min}}$	10th Highest $L_{AFMax,15\text{min}}$
Night 1	82.0	69.0	70.0
Measurement Position MP2			

Measurement Period ('t')	L _{AFMax,15min}	*SMR L _{AFMax,15min}	10 th Highest L _{AFMax,15min}
Night 1	63.0	50.0	54.0

Table 2.0 – Maximum Sound Level Summary Results

*Statistically Most Repeated

The following table outlines the results for spot measurements undertaken at measurement position three and four.

Measurement Position 3				
Measurement Period ('t')	L _{Aeq,t}	L _{Amax,t}	L _{A90,t}	L _{A10,t}
Sport measurement L _{Aeq,5min}	69.0	89.0	63.0	73.0
Measurement Position 4				
Sport measurement L _{Aeq,10min}	58.0	79.0	55.0	59.0

Table 3.0 – Sound Level Summary – Short Term Positions

3. BS4142 Screening Assessment

Due to the presence of the industrial noise on-site, a BS4142 screening assessment will be undertaken in the subsequent section of the report to assess the potential for the impact of the industrial noise on the proposed dwellings.

Specific Noise Levels

To calculate the specific noise levels of the surrounding industrial units the residual sound level of the area without the units operating has been subtracted from the spot measurements during which witnessed industrial plant and activity noise was measured.

No information on the operational times of the existing industrial units boarding the site could be obtained however it is assumed that the units operate between typical business hours of 07:00 – 17:00. This is further corroborated in the MP2 time history in Appendix D which indicates a rise in noise levels at 07:30 when the surrounding units begin operating and a drop in noise levels at 17:00 when it is assumed the surrounding units stop operation. Further information gained on-site by the engineer indicated the existing industrial units in the area did at one time operate 24 hours a day however due to noise complaints this is no longer the case and they now only operate during the daytime. Consequently, the residual sound levels will be taken from the period 18:00 – 19:00 during which there was no operation industrial activity in the surrounding units.

Description	MP3 (dB)	MP4 (dB)
Ambient sound level	69.0	58.0
Residual sound level (18:00 – 19:00)	55.0	55.0
Specific Sound Level	69.0	55.0

Table 4.0 – Specific Sound Levels

Based on the specific noise levels above and information obtained on site a sound map has been generated using SoundPlan 8.2, which undertakes its calculation in accordance with the guidance given in ISO9613 – 1:1993 and ISO9613 – 2:1996. The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- The ground between the source and receiver is modelled as mostly acoustically 'soft'
- The sound map is shown at a height of 1.5m.
- The specific sound levels above have been used to calibrate the sound model.
- Two point sources have been inputted to reflect the industrial activity at heights of 1.5m and 2m based on information gained on site.
- A 2m closed board perimeter fence has been installed along the Southern and Eastern perimeters of the site adjacent to the industrial noise.

The sound maps showing the specific noise emissions at each façade of the proposed development is shown below.

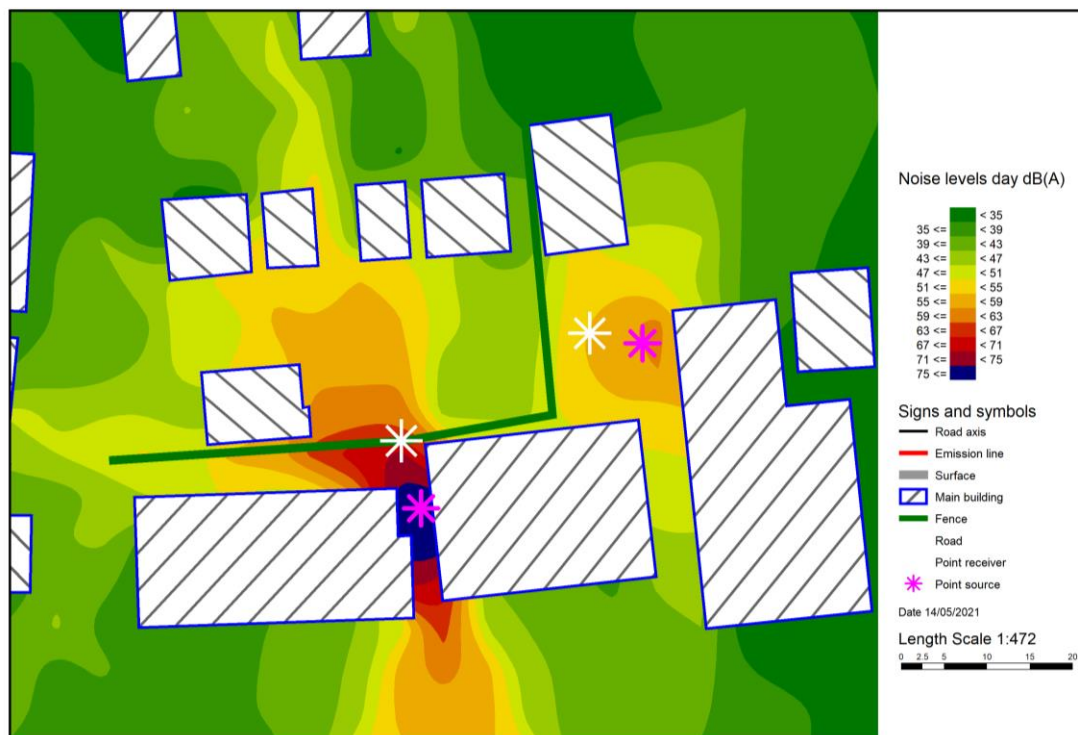


Figure 2.0 – Specific Noise Levels 1.5m Grid Height

A summary of the specific noise levels at the most exposed façade are outlined below. The noise level outlined below has been taken from the most exposed point on the facade on the first floor.

Rating penalties have been applied to the specific noise levels accounting for the engineer's subjective impression on site.

+6 dB for Impulsivity

+4 dB for Tonality

+3 dB for Intermittent Activity

The subsequent rating noise levels have then been compared to the background sound level during the same period as the residual sound level 18:00 – 19:00 when the industrial noise was not active in the area.

Description	Sound Level (dB)
Specific Sound Level	64.0
Rating Noise Level	77.0
Background sound level	52.0
Level Above Background	+25.0

Table 5.0 – BS4142 Assessment Most Exposed facade

Discussion:

As can be seen in the assessment above the industrial noise rating noise levels fall +25 dB above the background sound levels at the most exposed façade. This indicates the potential for significant adverse impact in accordance with BS4142. However, it should be noted that at the houses further away from the industrial noise the level of impact is lower than stated above.

BS4142 provides commentary on situations where new residential (noise-sensitive) dwellings are introduced to a location with existing industrial type noise and where the proposed development includes specific noise mitigation measures.

Section 8.5 of the Standard states *'Where a new noise-sensitive receptor is introduced and there is existent 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'.*

As well as this, BS4142 states that it uses external noise levels to assess the likely effects of sound on people who could be inside or outside a building in which the sound is incident. Where this is applied to new dwellings, the context is important. Further to the publication of BS4142, guidance notes have been issued in terms of this.

Section 11 of the Standard advises that *'When making assessments and arriving at decisions...it is essential to place the sound in context'* and further clarifies this by stating *'Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following...*

3) 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) façade insulation treatment

ii) ventilation and/or cooling that will reduce the need to have windows open so as to avoid rapid or purge ventilation, and

iii) acoustic screening'

Consequently, this commentary indicates that all mitigation measures should be taken into consideration when assessing the actual impact and that sound levels within a dwelling after allowance for these measures may be assessed on the basis of other design criteria appropriate to residential property i.e BS8233:214 and ProPG. Ultimately the comparison of the rating noise levels to the background sound level will always indicate impact as the industrial noise is a feature of the current environment. Instead, the sound insulation scheme for the development will be specified from the rating noise penalties of +13 dB on each façade exposed to industrial noise.

4. ProPG Noise Assessment

ProPG Stage 1 Initial Noise Risk Assessment

Considering the noise levels measured across the entire measurement period, the development site falls into Noise Risk Category (NRC) 2 at MP1 and Noise Risk Category (NRC) 1 at MP2. As shown in the following table.

Measurement Position	Noise Risk Category	Potential Effect if unmitigated	Pre-Planning Application Guidance
MP1 – Road Side	2 - Medium $L_{Aeq, 16hour} < 60 - 70dB$ $L_{Aeq, 8hour} < 50 - 60dB$	Significant adverse effect on health and quality of life	As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimize, and which clearly demonstrated that a significant adverse noise impact will be avoided in the finished development.
MP2 – Rear of the Site	1 - Low $L_{Aeq, 16hour} < 50 - 60dB$ $L_{Aeq, 8hour} < 40 - 50dB$	Adverse effect on health and quality of life	At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and the minimized in the finished development.

Table 6.0 – Noise Risk Category for Site

Discussion:

As can be seen, the noise levels measured at MP1 fall into the 'Medium Risk' Category however these were measured at roadside given the proximity of other residential dwellings to the road it is assumed that provided good acoustic design is implemented the amenity of all future occupants can be fully protected.

At MP2 the site falls into the 'Low Risk' Category. This provides further context to the BS4142 assessment above and indicates that the site is suitable for residential development and provided appropriate noise mitigation is implemented the amenity of future residents can be protected.

5. Noise Break In & External Noise Level Assessment

The following section analyses the ambient sound levels incident on the development compared with the internal noise level criteria presented within BS8233:2014.

To ensure a robust analysis the following considerations have been taken:

- The $L_{AFmax,15min}$ during the night exceeded less than ten times.
- The highest $L_{Aeq,16hour}$ and $L_{Aeq,8hour}$ during the day and night at MP1
- The specific noise levels in Table 4.0
- +13 dB BS4142 rating noise penalties will be applied to all facades exposed to industrial noise

An ambient sound map has been generated using SoundPlan 8.2, which undertakes its calculation in accordance with the guidance given in ISO9613 – 1:1993 and ISO9613 – 2:1996. The following assumptions have been made within the calculation software:

- To accurately model the land surrounding the development the topographical data has been taken from Google Maps, it is assumed this has an accuracy within the last 3 years.
- The ground between the source and receiver is modelled as mostly acoustically 'soft'
- The sound map is shown at a height of 1.5m.
- The specific sound levels above have been used to calibrate the sound model.
- Two point sources have been inputted to reflect the industrial activity at heights of 1.5m and 2m based on information gained on site.
- A 2m closed board perimeter fence has been installed along the Southern and Eastern perimeters of the site adjacent to the industrial noise.
- 1.8m Fencing has been installed around all garden perimeters
- Road noise levels from MP1 have been used to calibrate the sound model.

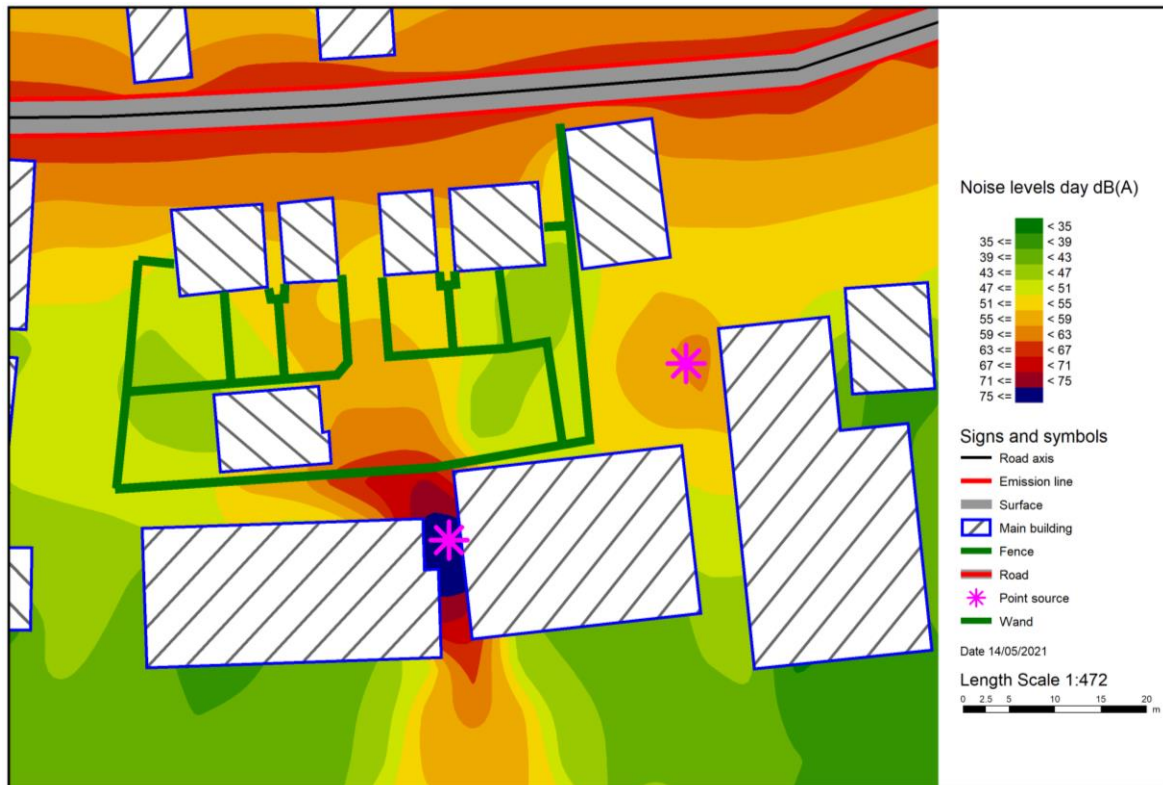


Figure 3.0 – Ambient Noise Levels Day Time

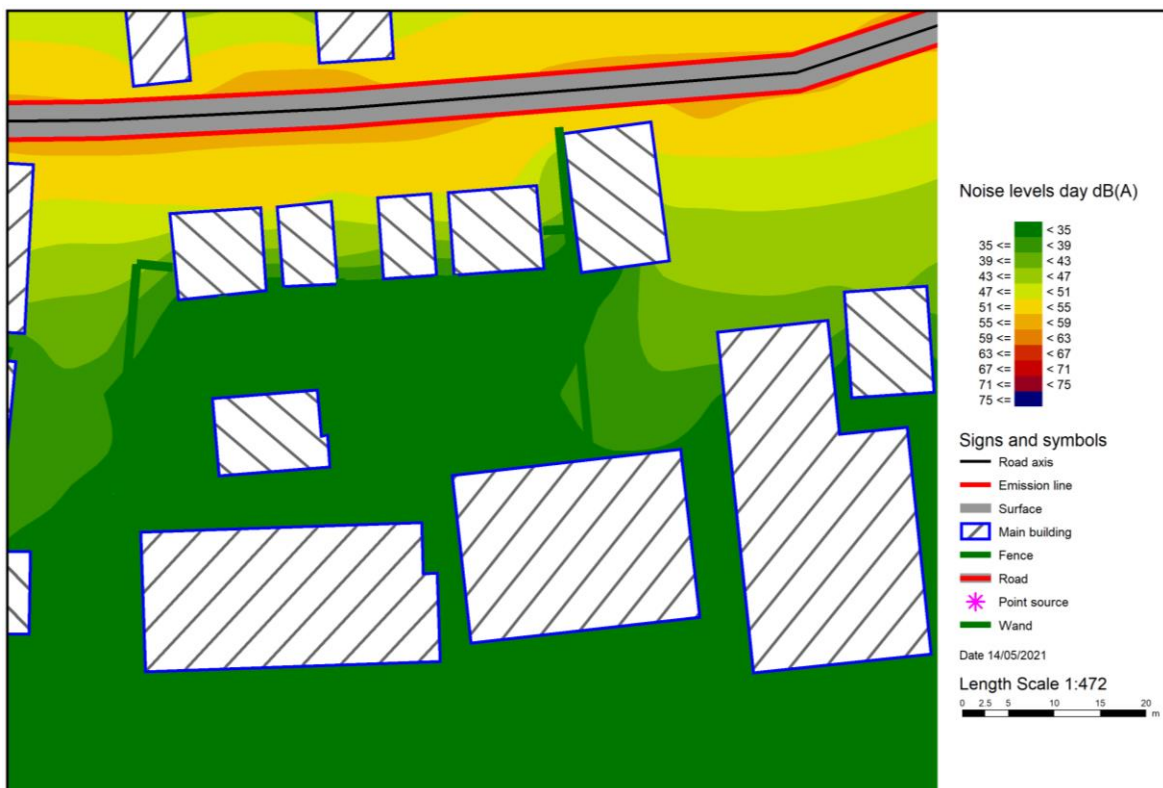


Figure 4.0 – Ambient Noise Levels Night Time

To allow ease of assessment the development has been divided into façade zone which have been colour-coded as per the figure below.



Figure 5.0 – Façade Designations

The table below outlines the noise levels at each facade as taken from the sound plan model. Again the noise levels have been taken from the most exposed point on the façade either ground or 1st floor.

Façade designation	Day Sound Level (dB)	Night Sound Levels (dB)
Red	64.0*	>45.0
Orange	60.0	51.0
Yellow	60.0*	51.0
Blue	55.0*	>45.0
Green	52.0*	>45.0

Table 7.0 – Façade Noise Levels

**These levels will have +13 rating penalty applied in the subsequent BS8233 assessment.*

The following table analyses the required composite SRI required of the dwelling to achieve appropriate internal noise levels.

Facade	Location	Time Period	Façade Noise Level	BS8233 Criteria	Min. SRI Required (dB)
Red	Bedroom / Living Room	Day time	77.0*	35 dB $L_{Aeq,16hour}$	42.0 $R_w + C_{tr}$
	Bedroom	Night time	45.0	30 dB $L_{Aeq,8hour}$	15.0 $R_w + C_{tr}$
	Bedroom	Night time	70.0	45 dB $L_{Amax,8hour}$	25.0 R_w^{**}
Orange	Bedroom / Living Room	Day time	60.0	35 dB $L_{Aeq,16hour}$	25.0 $R_w + C_{tr}$
	Bedroom	Night time	51.0	30 dB $L_{Aeq,8hour}$	21.0 $R_w + C_{tr}$
	Bedroom	Night time	70.0	45 dB $L_{Amax,8hour}$	25.0 R_w^{**}
Yellow	Bedroom / Living Room	Day time	73.0*	35 dB $L_{Aeq,16hour}$	38.0 $R_w + C_{tr}$
	Bedroom	Night time	51.0	30 dB $L_{Aeq,8hour}$	21.0 $R_w + C_{tr}$
	Bedroom	Night time	70.0	45 dB $L_{Amax,8hour}$	25.0 R_w^{**}
Blue	Bedroom / Living Room	Day time	68.0*	35 dB $L_{Aeq,16hour}$	33.0 $R_w + C_{tr}$
	Bedroom	Night time	45.0	30 dB $L_{Aeq,8hour}$	15.0 $R_w + C_{tr}$
	Bedroom	Night time	70.0	45 dB $L_{Amax,8hour}$	25.0 R_w^{**}
Green	Bedroom / Living Room	Day time	65.0*	35 dB $L_{Aeq,16hour}$	30.0 $R_w + C_{tr}$
	Bedroom	Night time	45.0	30 dB $L_{Aeq,8hour}$	15.0 $R_w + C_{tr}$
	Bedroom	Night time	70.0	45 dB $L_{Amax,8hour}$	25.0 R_w^{**}

Table 8.0 – BS8233 Internal Noise Level Analysis

**BS4142 rating penalty applied*

External Noise Level Assessment

The figure below analyses the external noise levels within the external amenity areas of the Proposed Development. Against the BS8233 Criteria of 50 – 55 dB.

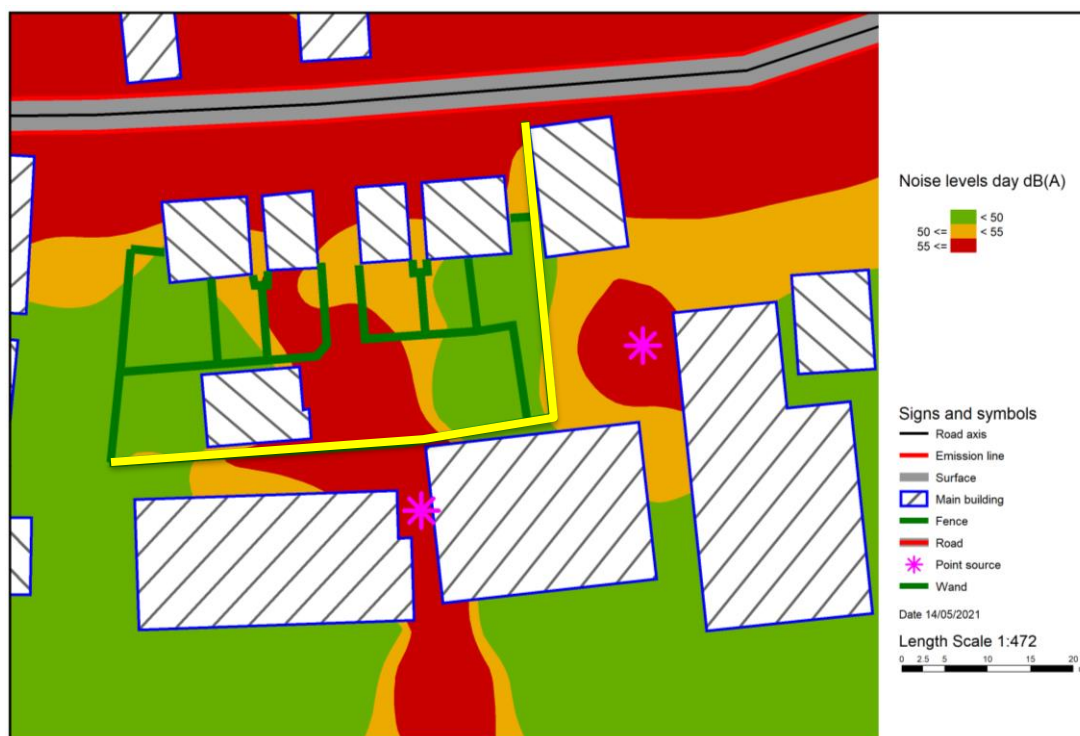


Figure 6.0 - External Amenity Area Sound Map - 1.5m Grid Height

Discussion:

As can be seen in the assessment sound map above. Provided the perimeter and garden fencing is installed the external garden criteria can be achieved in all pilots except one. The noise level in this garden is 56 dB which is considered a marginal exceedance when considering best practicable means has been implemented in terms of fencing around the site perimeter and garden areas. These external levels are deemed acceptable. The following fencing should be installed.

- 1.8m fencing should be installed around all garden areas. The fencing should have a minimum density of 10kg/m² with no gaps or holes. As indicated in green on the sound map in Figure 6.0 above.
- 2m fencing should be installed along the southern and eastern perimeters. The fencing should have a minimum density of 10kg/m² with no gaps or holes. Indicated in yellow in Figure 6.0 above.

6. Sound Insulation Scheme

The following section outlines the required sound insulation scheme that should be installed at the proposed development to protect the amenity of the future residents. The sound insulation scheme should be installed prior to occupation and be retained thereafter.

Building Envelope

The noise levels within the proposed dwellings will be dictated by the configuration, materials, and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels. The façade construction for lightweight or heavyweight constructions will provide ample levels of sound insulation, for the purposes of this report it is assumed the façade provides a minimum sound reduction of 50dB R_w . The following section provides a sound insulation scheme based on the weakest elements of the façade, including the glazing, ventilation and roof construction.

a) Roof Specification

If the development has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. Where the roof, is being utilized as a voided loft space with thermal insulation the following detailing is not required. Where rooms are within the roof, the ceilings should consist of standard roofing slates, 100mm 45kg/m³ insulation fitted tightly between the 200mm roof joists and 1no. 15mm SoundBloc plasterboard fixed to British Gypsum RB1 resilient bars to achieve a minimum sound reduction of 50dB R_w . Any other configuration of roof that would achieve at least 50dB R_w will be suitable for the development.

b) Glazing Specification

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. The glazed elements installed in all the living rooms and bedrooms require the minimum sound reduction as shown in Section 5.0.

The glazing units shown in the following table provide a suitable sound reduction, any other window capable of providing this attenuation will be suitable. The performance is specified for the whole window unit, including frame and other design features. The glazing specifications have been taken from the Pilkington Optiphon Range

Red Facade	Glazing Configuration						
Bedrooms and Living rooms	<i>Double Glazing</i>						
	10.8 mm Pilkington Optiphon™ / 24 mm argon /						
	16.8 mm Pilkington Optiphon						
Description	125	250	500	1k	2k	4k	$R_w + C_{tr}$
Sound Reduction (R_w)	35.0	41.0	48.0	53.0	55.0	65.0	46.0
Orange Facade	Glazing Configuration						

Bedrooms and Living Rooms	<i>Double Glazing</i> 4 mm glass / (6 - 16 mm) air cavity / 4 mm glass						
Description	125	250	500	1k	2k	4k	R_w + C_{tr}
Sound Reduction (R _w)	21.0	17.0	25.0	35.0	37.0	31.0	25.0
Yellow Facades	Glazing Configuration						
Bedrooms and Living Rooms	<i>Double Glazing</i> 10 mm Glass / 16 mm Argon / 8.8 mm Pilkington Optiphon™ Glass						
Description	125	250	500	1k	2k	4k	R_w + C_{tr}
Sound Reduction (R _w)	28.0	31.0	42.0	45.0	50.0	58.0	38.0
Blue facades	Glazing Configuration						
Bedrooms and Living Rooms	<i>Double Glazing</i> 6 mm Glass / 16 mm Argon Cavity / 6.8 mm Pilkington Optiphon™ Glass						
Description	125	250	500	1k	2k	4k	R_w + C_{tr}
Sound Reduction (R _w)	21.0	28.0	37.0	48.0	48.0	54.0	34.0
Green Facade	Glazing Configuration						
Bedrooms and Living Rooms	<i>Double Glazing</i> 10 mm Glass / (6 - 16 mm) Cavity / 4 mm Glass						
Description	125	250	500	1k	2k	4k	R_w + C_{tr}
Sound Reduction (R _w)	24.0	21.0	32.0	37.0	42.0	43.0	30.0

Table 9.0 – Glazing Specification

The glazing suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence based calculation.

c) Ventilation Specification

BS8233 States;

"If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

and

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied

upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

An alternative ventilation system, should be installed within habitable rooms to fully protect the amenity of future residents. As stated in BS8233:2014 section 5.4.4, having complete enclosure of the noise source or receiver is the most effective barrier of sound. An alternative ventilation strategy allows for maximum sound insulation from the noise source whilst still maintaining a sufficient level of ventilation. It is recommended that the alternative ventilation should provide the same resistance to sound as the glazed elements. The following table provides ventilation systems that meets the above recommendations.

Background Ventilation		
Façade Location	Model	Attenuation (dB)
Orange, Yellow, Blue & Green	Titon Trickle Ventilation SF Xtra V75 + Standard Canopy	38dB Open / 49dB Closed $D_{n,e,w+ctr}$
Through Wall Ventilation (not purge)		
Façade Location	Model	Attenuation (dB)
Red Facades	Titon Sonair F+ Mechanical Input Ventilator with G3 filter and DV100F duct ¹	56 dB $D_{n,e,w}$

Table 10.0 – Ventilation Specification

¹ The self-generated noise from the Titon Sonair F+ when measured at the maximum ventilation capacity of 60m³/h emits 23.5dB $L_{PA:10m2}$ which is below the required internal noise criteria from BS8233:2014.

The through wall ventilation specified within the table above is also capable of providing background ventilation. If the mechanical ventilation option is opted for the background trickle ventilation option is not required to be installed.

The ventilation suppliers are required to demonstrate the acoustic performance of their proposed system either by providing an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence based calculation.

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20µPa (20x10 ⁻⁶ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s ₁ and s ₂ is given by 20 log ₁₀ (s ₁ / s ₂). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20µPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
L _{eq,T}	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
L _{max,T}	A noise level index defined as the maximum noise level during the period T. L _{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L _{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L _{90,T}	A noise level index. The noise level exceeded for 90% of the time over the period T. L ₉₀ can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L _{10,T}	A noise level index. The noise level exceeded for 10% of the time over the period T. L ₁₀ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided. The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source. A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the L_{A10} , the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the

time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, L_{Aeq} .

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound. To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1\text{hour}}$ dB and $L_{A90,15\text{mins}}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125ms.

Appendix B – Legislation, Policy and Guidance

This report is to be primarily based on the following legislation, policy and guidance.

B.1 - National Planning Policy Framework (2019)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2019. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 170e, it states:

Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans;

Paragraph 180 states:

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) Mitigate and reduce to a minimum potential adverse impact resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- b) Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

B.2 - Noise Policy Statement for England (2010)

Paragraph 180 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

To achieve this vision the Statement identifies the following three aims:

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life;*
- Mitigate and minimise adverse impacts on health and quality of life;*
- Where possible, contribute to the improvement of health and quality of life.*

In achieving these aims the document introduces significance criteria as follows:

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur. It is stated that “significant adverse effects on health and quality of life should be avoided while also considering the guiding principles of sustainable development”.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected. It is stated that the second aim above lies somewhere between LOAEL and SOAEL and requires that: “all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also considering the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.”

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise. This can be related to the third aim above, which seeks: “where possible, positively to improve health and quality of life through the pro-active management of noise while also considering the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.”

The NPSE recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations and provides no guidance as to how these criteria should be interpreted. It is clear, however, that there is no requirement to achieve noise levels where there are no observable adverse impacts but that reasonable and practicable steps to reduce adverse noise impacts should be taken in the context of sustainable development and ensure a balance between noise sensitive and the need for noise generating developments.

Any scheme of noise mitigation outlined in this report will, therefore, aim to abide by the above principles of the NPPF and NPSE whilst recognizing the constraints of the site.

B.3 - BS8233:2014` Guidance on sound insulation and noise reduction for buildings`

The British Standard BS 8233: 2014, Guidance on Sound insulation and noise reduction for buildings provides additional guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, WHO Guidelines on Community Noise, 1999. The criteria desirable levels of steady state, “anonymous” noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB L _{Aeq,16hour}	--

Dining	Dining Room/Area	40 dB $L_{Aeq,16\text{hour}}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{hour}}$	30 dB $L_{Aeq,8\text{hour}}$

Table 11.0 - BS8233 Internal Noise Level Criteria

It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

The standard also recommends that for traditional external amenity areas, such as gardens, 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 locations, development should be designed to achieve the lowest practicable levels.

General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

For this assessment, the above criteria are considered to be the LOAEL as defined in the NPSE above.

B.4 – ProPG Planning Noise

The Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on the management of noise within the planning system in England.

Noise can have a significant effect on the environment and on the quality of life enjoyed by individuals and communities. For these reasons, noise is a material consideration in the planning process and a key aspect of sustainable development. Noise must therefore be considered and given serious attention when new developments might create additional noise and when new developments would be sensitive to the prevailing acoustic conditions.

It aims to:

- Advocate full consideration of the acoustic environment from the earliest possible stage of the development control process;
- Encourage the process of good acoustic design in and around new residential developments;
- Outline what should be taken into account in deciding planning applications for new noise-sensitive developments.
- Promote appropriate noise exposure standards; and
- Assist the delivery of sustainable development.

This document describes an acoustic design process which is multi-faceted and that seeks to deliver the best acoustic outcome for a particular site. The advice and procedures contained in the ProPG are restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from existing transport sources. New housing is the most common type of new residential development, however the ProPG can also be applied to other types of residential developments such as residential institutions, care homes etc.

The document a Stage 1 Initial Site Risk Assessment, as follows:

Noise Risk Category	Potential Effect if unmitigated	Pre-Planning Application Guidance
0 – Negligible $L_{Aeq, 16hour} < 50dB$ $L_{Aeq, 8hour} < 40dB$	No adverse effect	These noise levels indicate that the development site is likely to be acceptable from a noise perspective, and the application need not normally be delayed on noise grounds.
1 - Low $L_{Aeq, 16hour} < 50 - 60dB$ $L_{Aeq, 8hour} < 40 - 50dB$	Adverse effect on health and quality of life	At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and the minimized in the finished development.
2 - Medium $L_{Aeq, 16hour} < 60 - 70dB$ $L_{Aeq, 8hour} < 50 - 60dB$	Significant adverse effect on health and quality of life	As noise levels increase, the site is likely to be less suitable from a noise perspective and any subsequent application may be refused unless good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimize, and which clearly demonstrated that a significant adverse noise impact will be avoided in the finished development.
3 - High $L_{Aeq, 16hour} > 70dB$ $L_{Aeq, 8hour} > 60dB$	Unacceptable adverse effect on health and quality of life	High noise levels indicate that there is an increased risk that development may be refused on noise grounds. The risk may be reduced by following a good acoustic design process that is demonstrated in a detailed ADS. Applicants are strongly advised to seek expert advice.

Table 12.0 – ProPG Stage 1 Initial Risk Assessment Criteria

B.5 - British Standard BS 4142:2014+A1:2019 - Methods for rating and assessing industrial and commercial sound

Overview

BS4142:2014 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

The procedure contained in BS4142:2014 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating sound level'. A correction to include the

consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

Rating Penalty

Section 9 of BS4142:2014 describes how the rating sound level should be derived from the specific sound level, by deriving a rating penalty.

BS4142:2014 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. This can be approached in three ways:

- a) subjective method;*
- b) objective method for tonality;*
- c) reference method."*

Due to the nature of the development the subjective method has been adopted to derive the rating sound level from the specific sound level. This is discussed in Section 9.2 of BS4142:2014, which states:

"Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed. Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources."

BS4142:2014 defines four characteristics that should be considered when deriving a rating penalty, namely; tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

a) Tonality

A rating penalty of +2 dB is applicable for a tone which is "just perceptible", +4 dB where a tone is "clearly perceptible", and +6 dB where a tone is "highly perceptible".

b) Impulsivity

A rating penalty of +3 dB is applicable for impulsivity which is "just perceptible", +6 dB where it is "clearly perceptible", and +9 dB where it is "highly perceptible".

c) Other Sound Characteristics

BS4142:2014 states that where "the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied."

d) Intermittency

BS4142:2014 states that when the "specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time ... if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied."

Background Sound Level

The background sound level is the underlying level of sound over a period, T, and is indicative of the relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds.

To ensure the background sound level values used within the assessment are reliable and suitably represent both the particular circumstance and periods of interest, efforts have been made to quantify a 'typical' background sound level for a given period. The purpose has not been to simply select the lowest measured value. Diurnal patterns have also been considered as they can have a major influence on background sound levels, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night time period for sleep purposes.

Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.

Assessment of Impact

BS4142:2014 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 estimation of the impact of the specific sound can be obtained by the difference of the rating sound level and the background sound level and considering the following:

- "Typically, the greater this difference, the greater the magnitude of the impact."
- "A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."
- "A difference of around +5dB 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 negligible impact, depending on the context."

Interpreting the guidance given in BS4142:2014, with consideration of the guidance given in the NPSE and NPPG Noise, an estimation of the impact of the rating sound is summarised in the following text:

- A rating sound level that is +10 dB above the background sound level is likely to be an indication of a Significant Observed Adverse Effect Level;
- A rating sound level that is +5 dB above the background sound level is likely to be an indication of a Lowest Observed Adverse Effect Level;
- The lower the rating sound 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 sound level does not exceed the background sound level,

this is an indication of the specific sound source having a negligible impact and would therefore classified as a No Observed Adverse Effect Level.

During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of the Standard, are 07.00 to 23.00 and 23.00 to 07.00, respectively.

Appendix C – Site Plans



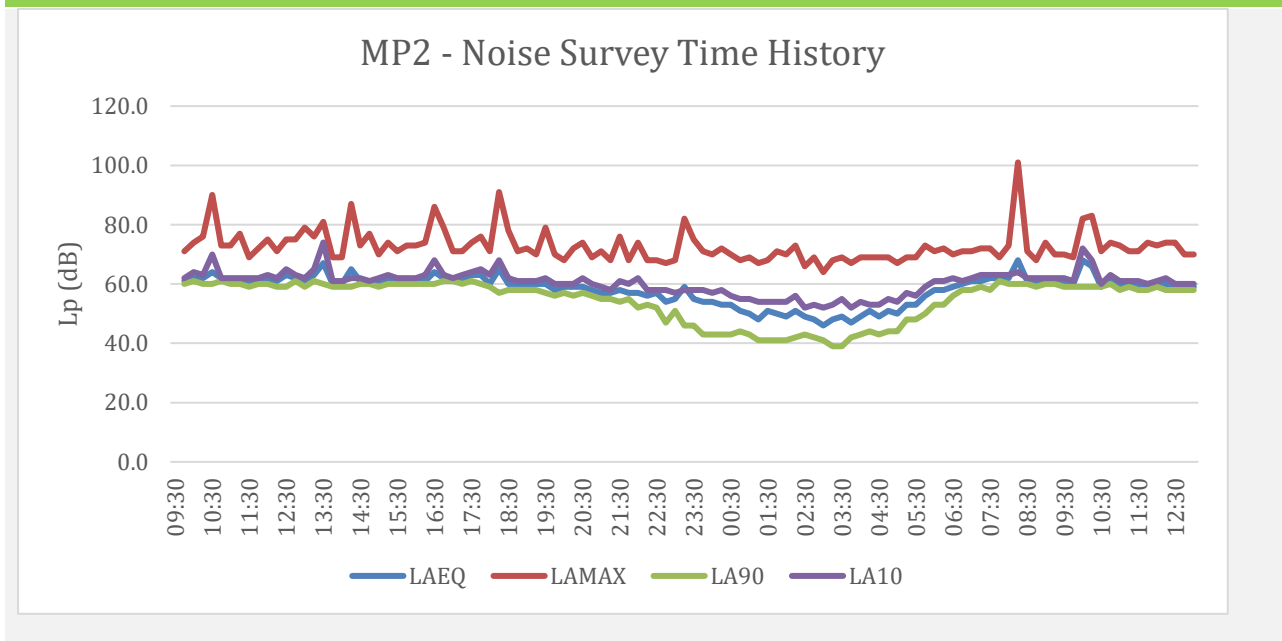
Appendix D – Environmental Survey

D.1 Tabulated Summary Noise Data

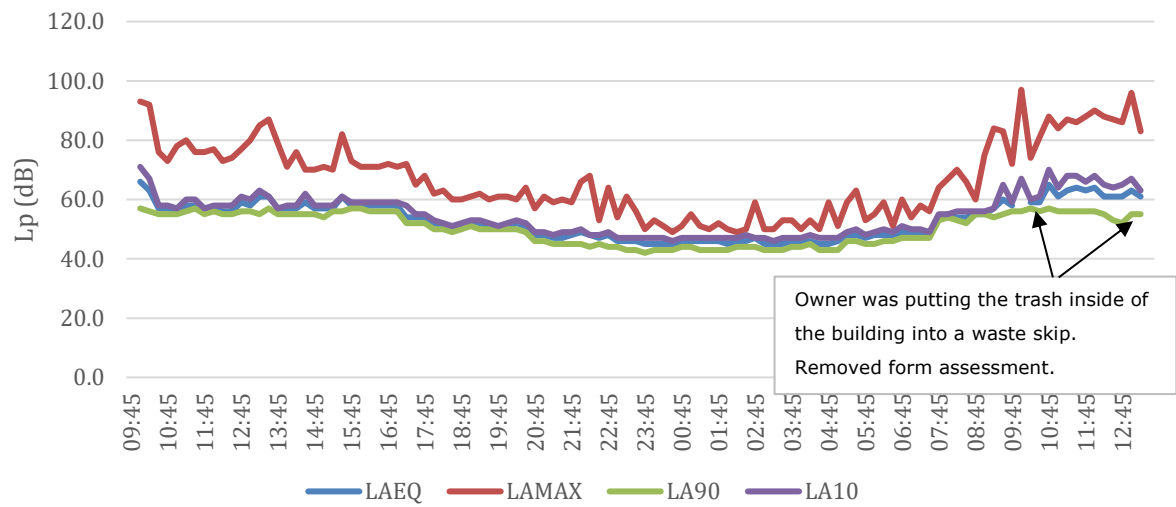
Measurement Position MP1				
Measurement Period ('t')	L _{Aeq,t}	L _{AMax,t}	L _{A90,t}	L _{A10,t}
Day 1 – 09:45 – 23:00 – 21/04/21	61.0	91.0	57.0	63.0
Night 1 – 23:00 – 07:00 – 21/04/21	54.0	82.0	48.0	58.0
Day 2 – 07:00 – 13:00 – 22/04/21	62.0	101.0	59.0	64.0

Measurement Position MP2				
Measurement Period ('t')	L _{Aeq,t}	L _{AMax,t}	L _{A90,t}	L _{A10,t}
Day 1 – 10:00 – 23:00 – 21/04/21	48.0	55.0	44.0	57.0
Night 1 – 23:00 – 07:00 – 21/04/21	45.0	43.0	42.0	47.0
Day 2 – 07:00 – 13:15 – 22/04/21	51.0	56.0	47.0	57.0

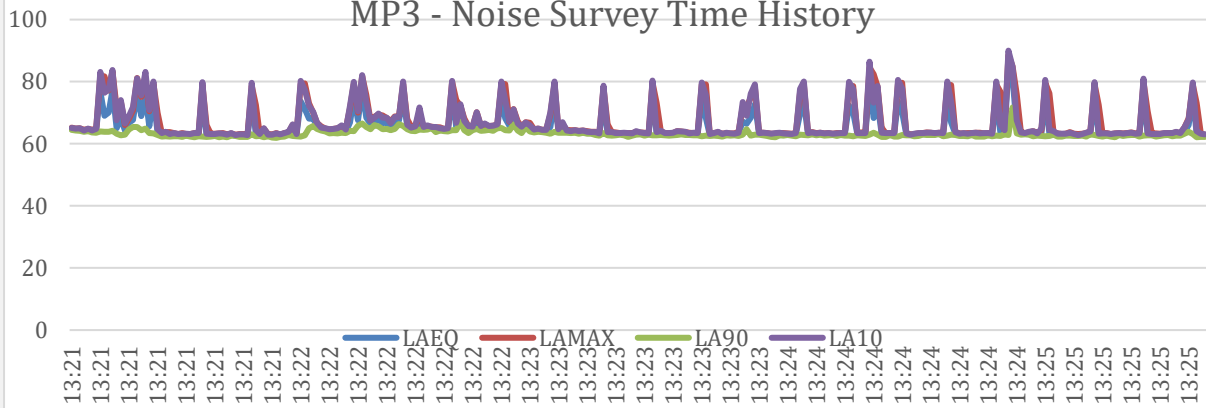
Graphical Time History



MP2 - Noise Survey Time History



MP3 - Noise Survey Time History



MP4 - Noise Survey Time History

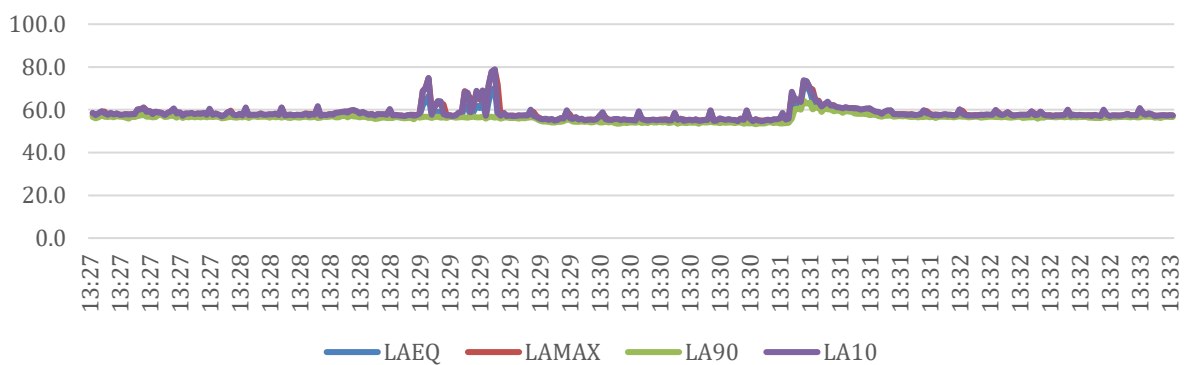


Table 13.0 – Sound Survey Summary Results

D.2 Surveying Equipment

Piece of Equipment	Serial No	Calibration Deviation
CESVA TA120 Class 1 Sound level meter	T251244	≤0.5
CESVA CB006 Class 1 Calibrator	901997	
CESVA SC420 Class 1 Sound level meter	T246452	≤0.5
CESVA CB006 Class 1 Calibrator	901997	

Table 14.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with a negligible deviation of ≤0.5 dB. All sound level meters are calibrated every 24 months and all calibrators are calibrated every 12 months, by a third-party calibration laboratory. All microphones were fitted with a protective windshield for the entire measurements period. Calibration certificates can be provided upon request.

D.3 Meteorological Conditions

As the environmental noise survey was carried out over a long un-manned period no localized records of weather conditions were taken. However, during the set up and collection of the monitoring equipment the weather conditions have been documented in the following table. All measurements have been compared with met office weather data of the area, specifically the closest weather station, the data from the weather station is outlined in the table below. When reviewing the time history of the noise measurements, any scenarios that were considered potentially to be affected by the local weather conditions have been omitted. The analysis of the noise data includes statistical and percentile analysis and review of minimum and maximum values, which aids in the preclusion of any periods of undesirable weather conditions. The weather conditions were deemed suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise. The table below presents the average temperature, wind speed and rainfall range for each 24-hour period during the entire measurement.

Weather conditions – Slaithwaite				
Time period	Air temp (°C)	Rainfall mm/h	Prevailing Wind Direction	Wind Speed (m/s)
21/04/21 – 00:00 – 23:59	-0.4 – 10.4	0.0	ENE	0.0 – 5.7
22/04/21 – 00:00 – 23:59	-2.3 – 15.3	0.0	ESE	0.0 – 3.5

Table 15.0 – Weather Summary

** correct wind speed from knots to m/s divide knots by 2