

# NOVA

## ACOUSTICS

### **Noise Survey of a Residential Development**

**Client:** Colin Thwaites - Delta Union

**Address:** Jovil Garage, 549 Manchester Road,  
Linthwaite,  
Huddersfield,  
HD7 5RH

**Date:** 22/03/2018



Version	1	2	3
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<b>Date</b>	22/03/2018	--	--
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**Executive summary**

An environmental noise survey and noise impact assessment has been undertaken at the proposed residential development Jovil Garage, 549 Manchester Road, Linthwaite, Huddersfield HD7 5RH to assess the suitability of site. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

Outline mitigation measures have been recommended in section 5.0, including glazing and ventilation for both the front and rear facade. Recommendation to ensure the amenity of any future residents can also be protected in the external areas to the rear of the proposed development.

These recommendations should be sufficient to achieve the internal and external noise levels for the proposed development according to BS8233:2014 noise criteria.

Written approval of the findings of this report is required from the Local Authority prior to works commencing.



## **1. Introduction**

### **1.1 Overview**

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') at Jovil Garage, 549 Manchester Road, Linthwaite, Huddersfield HD7 5RH ('the Site').

The Applicant has submitted a full planning application no. 2017/62/92/92742/W ('the Application') to Kirklees District Council.

Accordingly, the following technical noise assessment has been produced to accompany the Application to the local Authority.

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

### **1.2 Scope & Objectives**

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

- Ambient sound monitoring survey to evaluate the prevailing sound levels incident on the Site;
- Detailed sound modelling, acoustic calculation and analysis in accordance with ISO9613 – 1 prediction methodology to predict sound levels incident on the Site;
- 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 Practice Guidance in England and Wales, BS8233:2014, World Health Organisation Guidelines and other relevant standards.



## 2. Legislation, Policy and Guidance

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

### 2.1 National Planning Policy Framework (2012)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2012. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 11, Conserving and enhancing the natural environment, paragraph 109, it states:

*The planning system should contribute to and enhance the natural and local environment by: preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;*

Paragraph 123 states and Planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impact on health and quality of life arising from noise from new development, including using conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established.*

### 2.2 Noise Policy Statement for England

Paragraph 123 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.

### **2.3 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
<p>0 – Negligible</p> <p><math>L_{Aeq, 16hour} &lt; 50dB</math></p> <p><math>L_{Aeq, 8hour} &lt; 40dB</math></p>	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.
<p>1 - Low</p> <p><math>L_{Aeq, 16hour} &lt; 50 - 60dB</math></p> <p><math>L_{Aeq, 8hour} &lt; 40 - 50dB</math></p>	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.
<p>2 - Medium</p> <p><math>L_{Aeq, 16hour} &lt; 60 - 70dB</math></p> <p><math>L_{Aeq, 8hour} &lt; 50 - 60dB</math></p>	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.
<p>3 - High</p> <p><math>L_{Aeq, 16hour} &gt; 70dB</math></p> <p><math>L_{Aeq, 8hour} &gt; 60dB</math></p>	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 1.0 – ProPG Stage 1 Initial Risk Assessment Criteria

**2.4 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 $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

*Table 2.0 - BS8233 criteria for internal noise levels in dwellings*

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.

## **2.5 CRTN: Calculation of Road Traffic Noise - 1988**

This document was published by the Department for Transport and the Welsh office in 1988. It sets out the procedures used to calculate noise generated by road traffic. The calculation method is based on various input variables such as traffic speed, road surface and the percentage of heavy's (HGVs) as well as the site geometry and barrier attenuation. The calculation inputs allow for the  $L_{A10,18hour}$  and  $L_{A10,1hour}$  to be calculated at any given receiver.

The document also provides methods for measuring the noise produced by road traffic stating three different methodologies. The first, "The Measurement Method" is used for direct measurement of the  $L_{A10,18hour}$ . The second, "The Shortened Measurement Procedure" for measurement of the  $L_{A10,3hour}$  noise level from which the  $L_{A10,18hour}$  and  $L_{Aeq,16hour}$  level can be derived. The third method 'Comparative Measurements' is a procedure to ascertain noise levels from a single road traffic route at various points, where the road traffic on that route is the dominant source. CRTN states that if the Shortened Measurement Procedure is followed, a correction of -1dB can be applied to approximate the  $L_{A10,18hour}$  noise level a further subtraction -2dB gives and approximation of the  $L_{Aeq,16hour}$ .

## **2.6 Local Policy Guidance & Discussions with the Local Authority**

The application for the residential development was submitted to the local authority and subsequently conditionally approved. The condition relating to noise from the nearby road traffic stated on decision notice no. 2017/62/92/92742/W is shown below:

*'Condition 10. Prior to the superstructure of the hereby approved dwellinghouse commencing a report specifying the measures to be taken to protect the development from noise from road traffic shall be submitted to and approved in writing by the Local Planning Authority. The report shall: (i) Determine the existing noise climate (ii) Predict the noise climate in gardens (daytime), bedrooms (night-time) and other habitable rooms of the development (this is for housing think whether there would be alternative wording for other uses) (iii) Detail the proposed attenuation/design necessary to protect the amenity of the occupants of the new residences (including ventilation if required). Unless otherwise approved in writing with the Local Planning Authority the development shall not be occupied until all works specified in the approved report have been carried out in full and such works shall be thereafter retained.'*



### 3. Site Description & Background Information

#### 3.1 Site & Surroundings

The proposed site is located at Jovil Garage, 549 Manchester Road, Linthwaite, Huddersfield HD7 5RH. The surrounding area is a mixture of commercial units and residential dwellings. To the north of the proposed development runs Manchester Road with moderate to high levels of traffic flow. To the east and south there are multiple residential dwellings and garden areas. To the west of the proposed site there is a commercial yard 'Huddersfield Pallents Ltd' which operates from 07:00 – 16:00 on weekdays with no weekend activity.

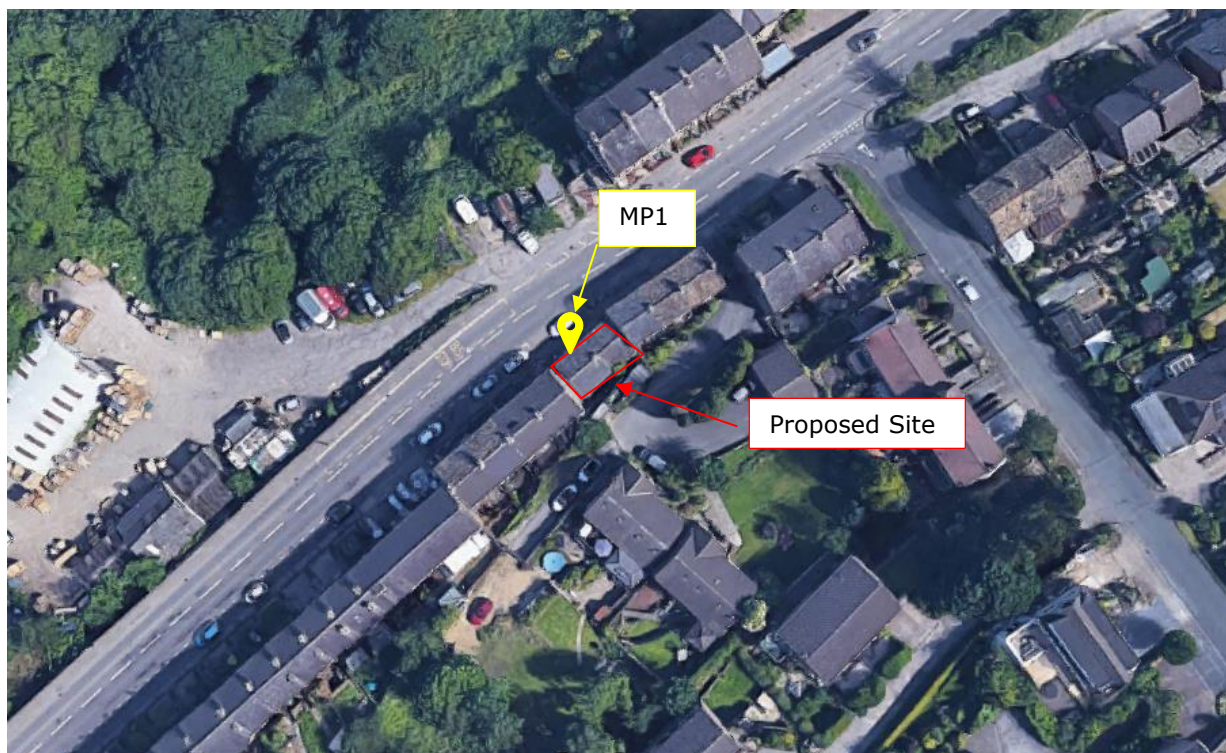


Figure 1.0 - Site and Surroundings

#### 3.2 Background

It is proposed that the existing M.O.T Garage building be demolished and 2 No. two storey residential dwellings be erected on site. Due to the proximity of the site to Manchester Road the local authority has requested a noise survey to ensure the amenity of all future residents can be fully protected.

#### 4. Environmental Noise Survey

In order to characterise the sound profile of the area of the proposed development, a short term 4-hour environmental sound survey was carried out on the 26<sup>th</sup> and 27<sup>th</sup> of February 2018.

##### 4.1 Measurement Methodology

For the short-term sound monitoring, the sound level meter was placed at ground floor level approximately 2m from the proposed façade and 5m from Manchester road. The microphone was positioned approximately 1.5m from the floor. The monitoring position was chosen in order to collect representative sound levels of the area during the week day time and night time periods. The measurement position can be found in figure 1.0.

##### 4.2 Measurement Equipment

Piece of Equipment	Serial No	Calibration Deviation
SVAN 977 Class 1 Sound Level Meter	34826	≤0.5
SVAN Class 1 Calibrator SV31	32569	

Table 3.0 – Measurement Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with 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 wind shield for the entire measurements period. Calibration certificates can be provided upon request.

##### 4.3 Weather Summary

As the environmental noise survey was carried out over a short-term 4-hour period no records of weather conditions were taken. However, during the monitoring the weather was calm with wind speeds of less than 5m/s and no precipitation. The weather conditions were suitable for the measurement of environmental noise in accordance with BS7445 Description and Measurement of Environmental Noise.

#### 4.4 Results

##### 4.4.1 Summary Results

The following table shows a summary of the sound survey results;  $L_{Aeq}$ ,  $L_{Amax}$ ,  $L_{A90}$  and the  $L_{A10}$  for the measurement period.

Measurement Position MP1				
Measurement Time Period ('t')	$L_{Aeq,t}$	$L_{Amax,t}$	$L_{A90,t}$	$L_{A10,t}$
Day 1 – 26/02/18 -11:35 – 14:35	71.8	87.6	70.4	72.7
Hour 1 – 26/02/18 – 11:35 – 12:35	72.1	86.7	54.1	75.5

Hour 2 – 26/02/18 – 12:35 – 13:35	71.7	86.9	55.5	75.2
Hour 3 – 26/02/18 – 13:35 – 14:35	71.5	87.6	51.8	74.9
Night 1 – 27/02/18 – 06:00 – 07:00	71.5	87.3	51.4	75.0

*Table 4.0 – Sound Survey Summary Results*

The following table shows the calculated  $L_{Aeq,16hour}$  according to the CRTN shortened method.

<b>Measurement Position MP1</b>	
<b>Description</b>	<b>Value (dB)</b>
Hour 1 $L_{A10}$	75.5
Hour 2 $L_{A10}$	75.2
Hour 3 $L_{A10}$	74.9
Average $L_{A10,1hour}$	75.2
$L_{A10,18hour}$	73.2
$L_{Aeq,16hour}$	72.2

*Table 5.0 – Sound Survey Operational Hours Results*

#### **4.5 Subjective impression & Context**

Whilst on site it was found that the noise emissions for the traffic along Manchester Road were the dominant noise source in the area. The commercial noise from 'Huddersfield Pallets Ltd' was barely audible at the site over the road noise. It is assumed that if the amenity of any future occupants can be protected from the road traffic noise then they will also be protected from any commercial activities in the area.



**5. Noise Assessment**

**5.1 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) 3. As shown in Table 6.0

Noise Risk Category	Potential Effect if unmitigated	Pre-Planning Application Guidance
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 6.0 – Noise Risk Category for Site

**5.2 BS8233:2014 Noise Assessment**

**5.2.1 Internal 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. The sound levels incident on the proposed site have been calculated using SoundPlan Essential 4.1, 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 mixed, 'soft' and 'hard', for the purpose of the assessment the ground has been considered as 'hard'.
- The measured and calculated noise levels shown above have been used to calibrate the noise map.
- Road noise levels are assumed to drop a minimum 3 dB over the full 8-hour night time period

The sound map showing the sound level incident on the Proposed Development can be seen below in Figure 2.0, 3.0 & 4.0.

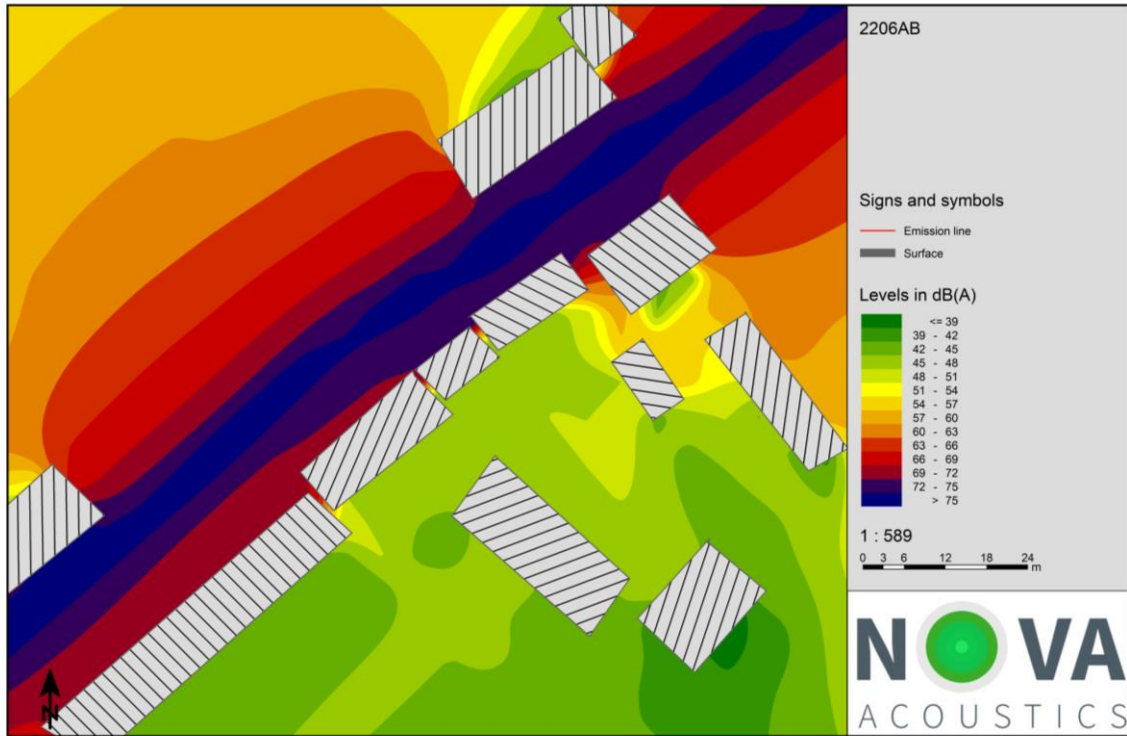


Figure 2.0 – Day Time - Average Sound Level Map

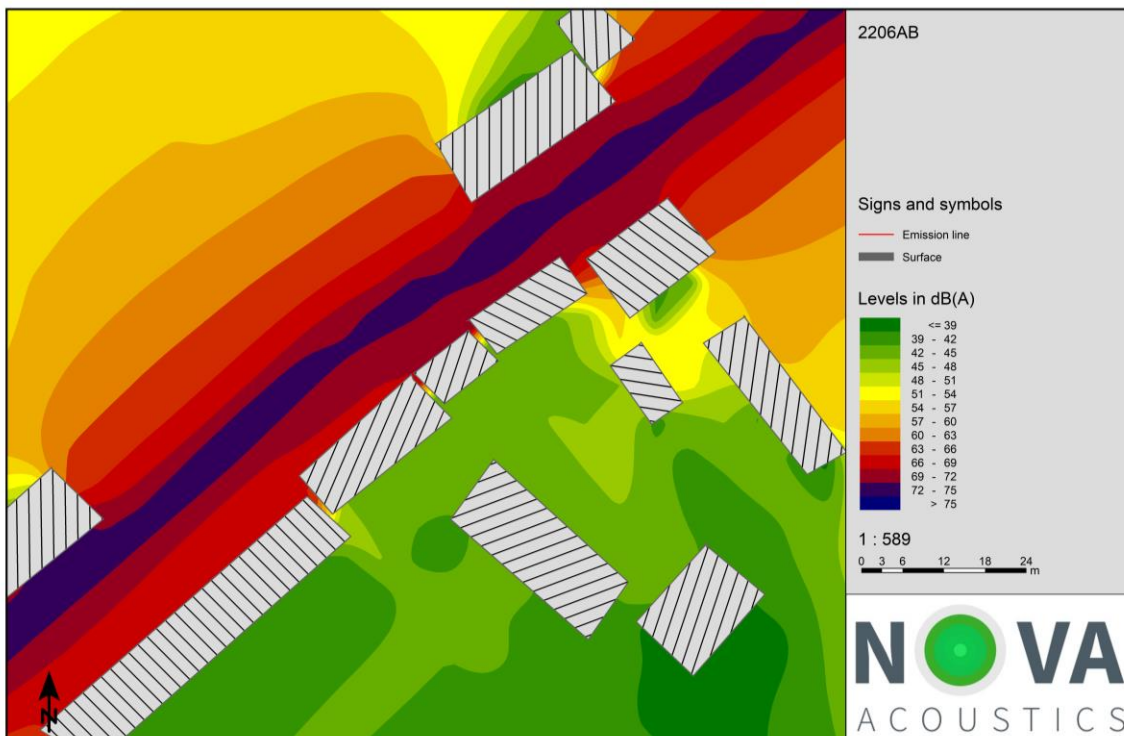


Figure 3.0 – Night Time - Average Sound Level Map

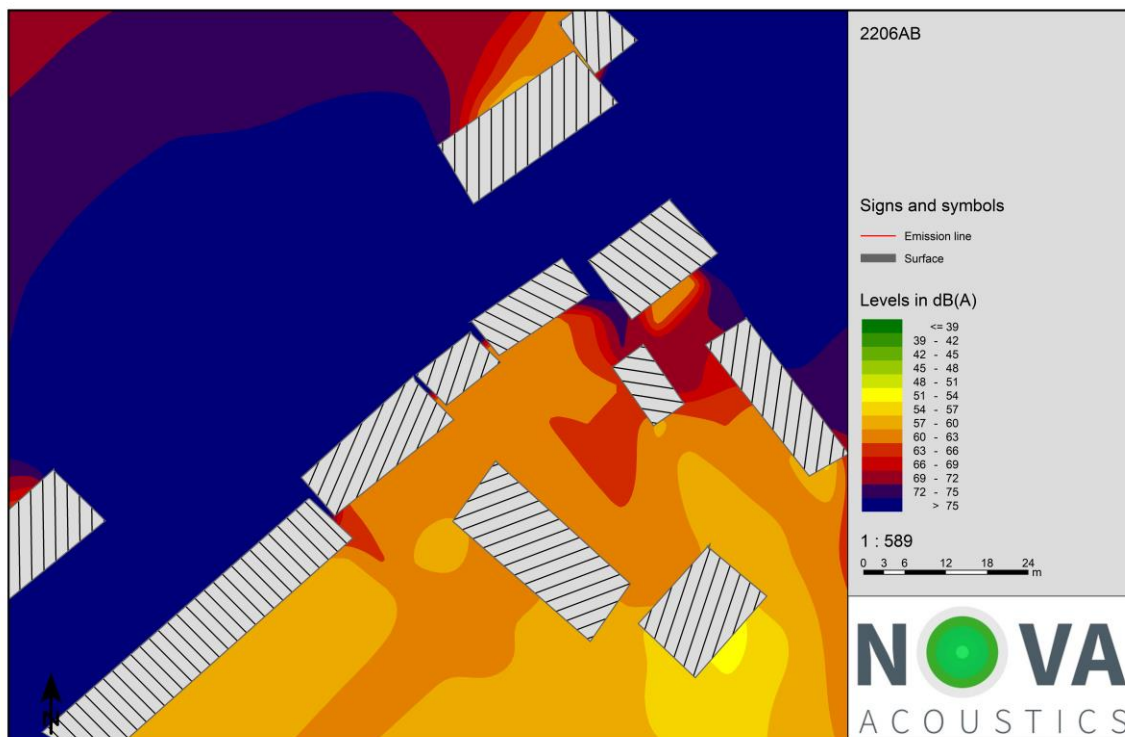


Figure 4.0 – Night Time - Maximum Sound Level Map

A summary of the sound levels incident on the propose development, based on the sound maps shown in above, can be seen below in Table 7.0.

Location	L <sub>Aeq,16hour</sub>	L <sub>Aeq,8hour</sub>	L <sub>Amax,8hour</sub>	Garden L <sub>Aeq,16hour</sub>
Front Facade	69.4	66.4	84.5	n/a
Rear Facade	47.3	44.3	62.4	47.9

Table 7.0 - Specific Sound Level at NSR Summary

Table 8.0 analyses the required composite SRI required of the dwelling to achieve appropriate internal noise levels based on the sound maps shown above.

Location	Location	Time Period	Façade Noise Level	BS8233 Criteria	Min. SRI Required (dB)
Front Facade	Bedroom / Living Room	Day time	69.4	35 dB L <sub>Aeq,16hour</sub>	35 R <sub>w</sub> + C <sub>tr</sub>
	Bedroom	Night time	66.4	30 dB L <sub>Aeq,8hour</sub>	37 R <sub>w</sub> + C <sub>tr</sub>
	Bedroom	Night time	84.5	45 dB L <sub>Amax,8hour</sub>	40 R <sub>w</sub> **
Rear Facade	Bedroom / Living Room	Day time	47.3	35 dB L <sub>Aeq,16hour</sub>	13 R <sub>w</sub> + C <sub>tr</sub>

	Bedroom	Night time	44.3	30 dB L <sub>Aeq,8hour</sub>	15 R <sub>w</sub> + C <sub>tr</sub>
	Bedroom	Night time	62.4	45 dB L <sub>Amax,8hour</sub>	18 R <sub>w</sub> **

Table 8.0 – BS8233 Internal Noise Level Analysis

### 5.2.2 External Noise Level Assessment

Table 9.0 analyses the expected external noise levels within the external amenity areas of the Proposed Development, such as the gardens.

Façade Location	Location	Time Period	Garden Noise Level	BS8233 Criteria	Min. Attenuation Required (dB)
Rear	Garden	Day time	47.9	50 -55 dB L <sub>Aeq,16hour</sub>	-2.1

Table 9.0 – BS8233 External Noise Level Analysis

### 5.2.3 Recommendations & Mitigation

#### 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 in combination with a superior quality appropriate acoustic glazing specification.

#### a) Facades

The prediction of the performance of the facade is based upon a construction of proposed façade 100mm stone, 100mm cavity with 50mm Kingspan, 100mm medium density block and a 12.5mm plaster board and is calculated within INSUL software, the expected performance is shown in Table 10.0.

Frequency (Hz)	63	125	250	500	1K	2K	4K	Rw
Façade SRI	41	46	43	47	57	67	77	53

Table 10.0 – Façade SRI

Any other configuration of external walls that would achieve at least these insulation figures will be suitable for the development.

#### b) Roofs

If the dwelling has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. The ceilings in the roof space should consist of loft void, 200mm timber joists, 400mm thermal insulation, 2x layers of 12.5mm sound bloc plaster board to achieve a uniform sound reduction. The expected performance as predicted within INSUL software is shown in Table 11.0.

Frequency (Hz)	63	125	250	500	1K	2K	4K	Rw
Roof SRI	33	43	53	54	60	57	61	54

Table 11.0 – Roof SRI

Any other configuration of roof that would achieve at least these insulation figures will be suitable for the development.

c) *Glazing*

Windows can be considered the weakest point of a façade in terms of noise reduction from external noise. To provide a robust assessment the composite SRI required for the entire building envelope will be used to provide the glazing specification.

Glazed elements installed in all the living rooms and bedrooms require a minimum sound reduction index value as shown in Table 8.0. The glazing units shown in Table 12.0 would 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.

Location	Glazing Configuration	Attenuation (dB)
Front Facade	<i>Double Glazing</i>	44.0 R <sub>w</sub>
	10 mm glass / 16 mm argon cavity / 8.8 mm Pilkington Optiphon™ glass	38.0 R <sub>w</sub> + C <sub>tr</sub>
Rear Facade	<i>Double Glazing</i>	29.0 R <sub>w</sub>
	4mm Glass – 6 to 16mm Air Cavity – 4mm Glass	25.0 R <sub>w</sub> + C <sub>tr</sub>

Table 12.0 – Glazing SRI

The glazing system above will protect the amenity of the occupants of the dwellings against the extraneous noise. The glazing specifications have been taken from the BS6262 – 2 and Pilkington’s Optiphon range however any glazing providing the same attenuation can be used.

d) *Ventilation*

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.”*

It is recommended that an alternative ventilation system is installed to fully protect the amenity of future inhabitants. 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. Table 13.0 provides ventilation systems that meets the above recommendations.

Model	Attenuation (dB)
Titon Sonair F+	55dB $D_{n,e,w}$
Titon Trickle Vent SFxtra V75 + Standard Canopy	40dB Open / 53dB Closed $D_{n,e,w}$

*Table 13.0 – Ventilation Specification*

If the above ventilation systems are not deemed suitable for the development then a mechanical heat-recovery ventilation (MHRV) system should be employed. It should be noted that if a MHRV system is used, the self-generating noise from the system will need to conform to the internal noise levels outlined in BS8233:2014.

**External Areas**

The external Areas assessment shows that the noise levels in external amenity areas to the rear of the proposed development fall within the criteria set out in BS8233. Upon inspection of the site it was noted that the rear external area was encircled with a 2.5m perimeter wall, not included in the model above. This should further decrease the noise levels in external areas and account for any uncertainties within the predictions and calculations stated above.



## 6. Conclusion

An environmental noise survey and noise impact assessment has been undertaken at the proposed residential development Jovil Garage, 549 Manchester Road, Linthwaite, Huddersfield HD7 5RH to assess the suitability of site. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

Outline mitigation measures have been recommended in section 5.0, including glazing and ventilation. These recommendations should be sufficient to achieve the internal and external noise levels for the proposed development according to BS8233:2014 noise criteria.

Written approval of the findings of this report is required from the Local Authority prior to works commencing.



**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 <sup>-6</sup> 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 s1 and s2 is given by 20 log <sub>10</sub> ( s1 / s2 ). 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 <sub>eq,T</sub>	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 <sub>max,T</sub>	A noise level index defined as the maximum noise level during the period T. L <sub>max</sub> is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L <sub>eq</sub> noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L <sub>90,T</sub>	A noise level index. The noise level exceeded for 90% of the time over the period T. L <sub>90</sub> can be considered to be the "average minimum" noise level and is often used to describe the background noise.
L <sub>10,T</sub>	A noise level index. The noise level exceeded for 10% of the time over the period T. L <sub>10</sub> 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

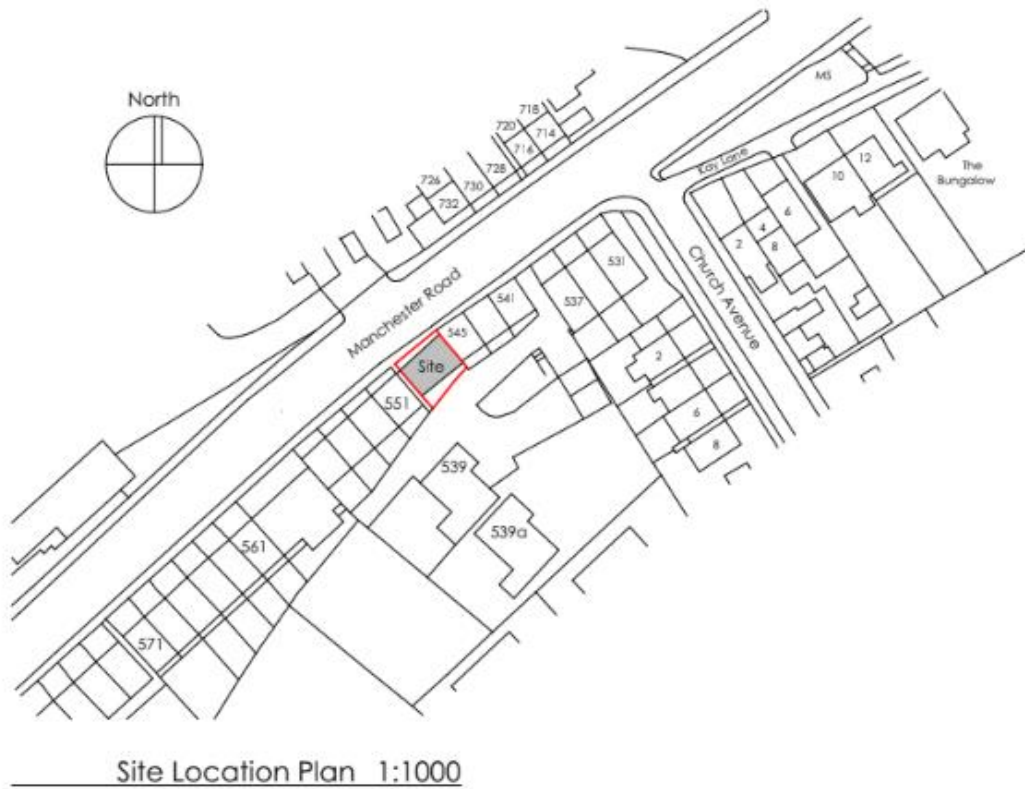
time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level,  $L_{Aeq}$ .

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).

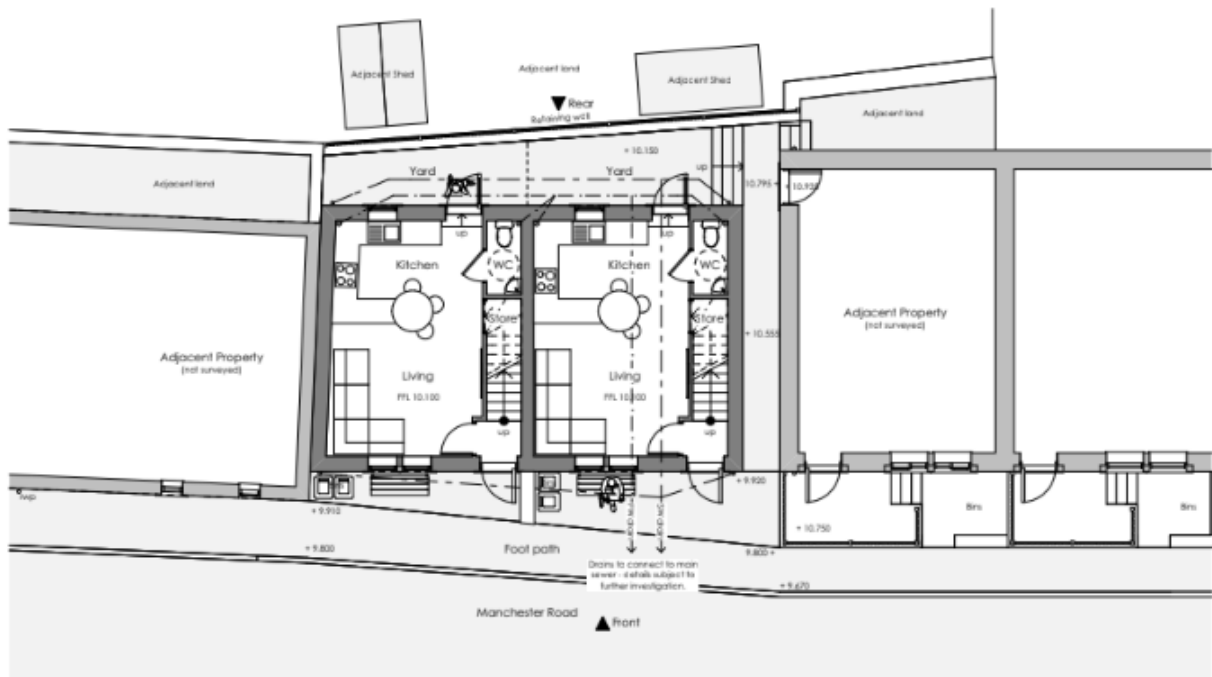
Note that the time constant and the period of the noise measurement should be specified. For example, BS4142:2014 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as  $L_{A90,1hour}$  dB and  $L_{A90,15mins}$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



**Appendix B – Location Plan**



**Appendix C – Site Plans**



Ground Floor Plan 1:100



**Appendix D – Environmental Sound Survey**

