

ACOUSTIC REPORT
for
PROPOSED RESIDENTIAL DEVELOPMENT
at
**LAND OFF HIGH STREET,
GARTHORPE
DN17 4RP**

Date of visits: 12th & 13th July, 3rd August 2022
Date of report: 7th September 2022
Prepared for: Howard Wroot & Wroot Homes Ltd
Prepared by: David Garritt, BEng, MIOA

Members of the Association of Noise Consultants (ANC) & Institute of Acoustics (IOA)
Originally established in 1981. Company number 4688174.



CONTENTS

1.0	Introduction	3
1.1	Summary Conclusions	3
2.0	Standards and Guidance Documents	6
2.1	Central Government Policies	6
2.2	Methods of BS 4142: 2014	7
2.3	BS 8233: 2014	8
2.4	World Health Organisation: 2000	9
2.5	Good Practice Guide for Noise from Pubs and Clubs	9
2.6	Acoustics, Ventilation and Overheating	10
3.0	Site Location, Layout and Photographs	12
4.0	Sound Survey	15
5.0	Suggested Building Specification	17
6.0	Predicted Internal Sound Levels, Environmental	18
6.1	Internal Sound Levels, Garage Sources	18
6.2	Sound Levels in Garden Amenity Areas	20
7.0	Acoustics, Ventilation and Overheating	20
7.1	Building Regulations Part O	21
8.0	BS 4142: Commercial Garage	21
(a)	Qualifications and Experience	22
(b)	Sources Being Assessed	22
(c)	Subjective Impressions	24
(d)	Existing Context	24
(e)	Measurement Locations	25
(f)	Instrumentation	26
(g)	Operational Tests	26
(h)	Weather Conditions	26
(i)	Date and Time of Measurements	27
(j)	Measurement Time Intervals	28
(k)	Reference Time Interval	28
(l)	Specific Sound Levels	28
(m)	Background Sound Level	29
(n)	Rating Levels	29
(o)	Background Comparisons	30
(p)	BS 4142 Conclusions	31
(q)	Uncertainty	32
	Appendix 1 – Outdoor Sound Level Measurements	33
	Appendix 2 – Sound Level Calculations & Predictions	37

1.0 **Introduction**

A new residential development is proposed on land off High Street, Garthorpe. The applicant received a consultation response from the Environmental Health Department of the Local Planning Authority requesting that a noise impact assessment is submitted to accompany the planning application. The reason for this request is that the proposed development is directly adjacent to an existing commercial garage and so there is potential for noise impact on residential amenity.

The memo requested that the noise impact assessment should provide details of the existing sound climate, likely noise sources that may impact on the proposed development and details of mitigation measures required to preserve residential amenity.

This survey has been commissioned by the applicant in response to the request made by the Local Planning Authority.

1.1 **Summary Conclusions**

Outdoor sound levels were measured at the proposed development site. The site location is generally relatively quiet, with ambient sound levels caused by environmental sources typically around 40 – 45 dB LA_{eq} during the daytime and under 40 dB LA_{eq} at night.

Short duration outdoor maximum levels during each 15 minute measurement logging period were in the range 50 – 60 dB LA_{max,f} during the daytime and 45 – 55 dB LA_{max,f} at night.

Outdoor background sound levels measured at the site were 36 – 39 dB LA_{90,15min} during the daytime and 32 – 34 dB LA_{90,15min} at night.

The normal criteria for residential development is that indoor sound levels caused by outdoor environmental sources should not regularly exceed:

Living rooms	35 dB LA _{eq}	from 07.00-23.00
Bedrooms	35 dB LA _{eq} 30 dB LA _{eq}	from 07.00-23.00 from 23.00-07.00
Gardens	50 dB LA _{eq} 55 dB LA _{eq}	is the desirable limit is the upper guideline value.

Short duration maximum levels should not regularly exceed 45 dB LA_{max,f} at night in bedrooms.

Internal sound levels are predicted to comply with these requirements if the dwellings are built with an acoustic specification consisting of:

- Conventional cavity block work or timber framed external walls
- Single plasterboard ceilings with pitched tiled roofs
- Double glazing consisting of two leaves of 4mm float glass separated by a 12 – 20mm airgap (eg, 4-16-4)
- Good quality but relatively standard trickle ventilators; those used in the calculations were Greenwood 5000EA or the Titon SFX V25 range.

It is suggested that the side and rear elevations of plots 4 & 5 could have an upgraded acoustic specification to provide additional mitigation against sound from commercial garage, consisting of

- Double glazing comprising 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon with a 12- 20mm airgap between
- Greenwood 5000 EAW.AC1 or Titon SFX V50 + C25 in frame acoustic trickle ventilators
- Imperforate garden fences (eg, overlapped or close boarded timber)

The commercial garage is owned and operated by a single person and the magnitude of potential noise impact is governed by the level of activity. A full assessment to BS 4142 has been undertaken and is detailed in this report. Source sound levels are based on measurements taken at site and also data obtained during previous survey work for similar commercial garage sites.

The predictions are undertaken based on the garage being busy with reasonably intensive activities taking place inside. It is assumed that the access door is open for ventilation purposes, as is the case now. This approach allows for assessment of sound when the current occupier is undertaking more intensive levels of activity and also for the reasonable future scenario if the garage is sold on and operated within its current permissions. During periods of lower activity, sound levels and noise impact at the proposed dwellings will be correspondingly lower.

The specific Sound levels and BS 4142 Rating Levels are:

Description	Plot 1 - 3	Plot 4	Plot 5
Total Specific Levels, dB LA _{eq,1hour}	37.1	42.7	45.7
Rating Levels, dB	39	46	49

The comparison between BS 4142 Rating Level and background are:

- 1 dB above background at plots 1 – 3
- 8 dB above background at the rear of plot 4 facing the garage
- 11 dB above background at the rear of plot 5 facing the garage

The magnitude of noise impact at plots 1 - 3 is likely to be low by the methods of BS 4142.

At the rear of plots 4 & 5, the initial conclusion of the BS 4142 assessment is 'significant adverse impact,' without the consideration of context or existing sound climate.

The actual magnitude of impact at any given time will depend on the intensity of activities at the garage and also the perceptions of individuals.

We understand that the current owner operates on a fairly sporadic basis with many periods of quiet activity and some periods of more intensive sound. We are also informed that they have operated for around 14 years without complaint, despite there being existing residential premises around the premises. It remains a possibility that the current occupier may increase their level of activity or a future occupier may use the facility to its full potential, and a BS 4142 survey should assess these potential activity levels.

The final decision on whether the potential for noise impact from the commercial garage is acceptable lies with the Local Planning Authority. It is clear from our visits to site that there are currently significant periods where very little sound is audible from the garage, but there is also the potential for the commercial garage sound to be clearly audible when activity levels are greater.

The absolute levels remain fairly low compared to many development sites and this may modify the conclusion of 'significant adverse impact,' to one of lower noise impact, but if residential development is to take place on this site it must be accepted that garage sound may dominate the climate at the rear of plots 4 and 5 when it is in full use, partly due to the relatively low environmental sound levels.

A slightly enhanced acoustic specification is suggested for the rear of plots 4 and 5, ensuring that internal sound levels remain well within all of the normal guidance criteria, even during periods of more intense garage activity. It is recommended that the rear gardens of plots 4 and 5 are surrounded by an imperforate timber fence. This is likely to provide some positive benefit to commercial sound, though the exact amount cannot be quantified since the building will still be visible above the fence line.

2.0 **Standards and Guidance Documents**

The memo received from the Environmental Health Department made reference to several standards and guidance documents that would normally be expected to be considered as part of a noise impact assessment. These documents and central government policy is described in this section of the report.

The standards and guidance documents adopted in this report for the different sources affecting the development are:

- BS 4142 : 2014 'Methods for rating and assessing industrial and commercial sound' for noise impact arising from the commercial garage
- BS 8233 : 2014 'Guidance on sound insulation and noise reduction for buildings' for indoor sound levels caused by outdoor environmental and general sources
- Additional guidance on indoor sound levels issued by the World Health Organisation, which is in general agreement with BS 8233.
- Information on frequency dependent Noise Rating (NR) levels contained in the "Good Practice Guide on the Control of Noise from Pubs and Clubs," that also have useful applications at sites not affected by entertainment sound from pubs or clubs.
- The Acoustics, Ventilation and Overheating (AVO) Guide is used to provide non-regulatory discussion on the acoustic suitability of the site for different ventilation strategies. Some outline information is also provided on the new Part O of The Building Regulations that deals with the subject of acoustics and overheating.

The policies, standards and guidance documents used in this report are discussed in more detail in the next subsections.

2.1 **Central Government Policies**

The government's planning policies are described in the National Planning Policy Framework (NPPF) which includes consideration of potential adverse impacts of noise caused by new development. The NPPF makes reference to the Noise Policy Statement for England (NPSE) which includes an Explanatory Note describing three incremental categories of noise impact:

- No Observed Effect Level (NOEL) being the situation below which no effect caused by noise can be detected,

- Lowest Observable Adverse Effect Level (LOAEL) being the situation above which adverse effects caused by noise can be detected,
- Significant Observed Adverse Effect Level (SOAEL) being the level above which significant adverse effects caused by noise occur.

Stated objectives of the NPSE are:

1. Avoid significant adverse impacts, usually interpreted as calling for sound levels above SOAEL to be avoided.
2. Mitigate and minimise adverse impacts, usually interpreted as calling for noise mitigation to be used within the bounds of practicality for situations between LOAEL and SOAEL.
3. Where possible contribute to the improvement of health and quality of life, usually interpreted as calling for noise reductions to be made where possible for situations between NOEL and LOAEL.

Although introducing these subjective concepts for the assessment of impact, the NPPF and NPSE documents do not provide quantitative values against which the suitability of a site for development can be assessed in terms of sound levels.

2.2 **Methods of BS 4142: 2014**

The noise rating method of BS 4142 is to measure or predict the outdoor sound levels at noise-sensitive premises during the emission of noise from the industrial or commercial premises under investigation and measure the background sound level typical of that location in the absence of the industrial or commercial noise. A correction factor is applied if appropriate to the measured levels for some acoustic features that affect acceptability, described as tonal, impulsive or other characteristic features which are distinctive against the residual acoustic environment. The corrected measured level, the rating level, is compared with the background.

- If the rating level exceeds the background by around +10 dB or more then this is an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the background, the less likely it is that the industrial / commercial source will have an adverse impact.

- Where the rating level does not exceed the background, this is an indication of the industrial / commercial source having a low impact, depending on the context.

Situations where a noise impact assessment may need to be modified due to the context include those where:

- The residual sound levels in the absence of the industrial / commercial source are particularly high or low.
- The character of the residual sound has acoustic features comparable to those of the industrial / commercial sound.
- The sensitivity of the receptor is significant, and whether residential properties incorporate design measures that secure good internal or outdoor acoustic conditions.

Section 12 of BS 4142 lists information that is to be reported in an assessment; the relevant section of this report follows the same order.

2.3 **BS 8233: 2014**

BS 8233 provides guidance on interior sound levels inside various building interiors caused by external sources of an anonymous nature, for example flowing road traffic and mixed environmental sound. It is recommended that the internal ambient sound levels in dwellings do not exceed:

Living rooms	35 dB LA _{eq}	from 07.00-23.00
Dining rooms	40 dB LA _{eq}	from 07.00-23.00
Bedrooms	35 dB LA _{eq}	from 07.00-23.00
	30 dB LA _{eq}	from 23.00-07.00
Gardens	50 dB LA _{eq}	is the desirable limit
	55 dB LA _{eq}	is the upper guideline value.

The above sound limits are described in BS 8233 as applying to “steady external noise sources”. A note in paragraph 7.7.1 of the same document states that “Noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate.”

BS 8233 describes a ‘More Rigorous’ calculation procedure for the prediction of internal sound levels, which is adopted in this report.

2.4 **World Health Organisation: 2000**

Guidance from the WHO gives additional guidance to BS 8233 on the interior sound levels in bedrooms at which sleep disturbance can be expected to occur:

Bedrooms	30 dB LA _{eq} }	to avoid sleep
	45 dB LA _{max} }	disturbance

The guidance on LA_{max} is usually intended to apply to sound from regular and typical events only. The definition of 'regular and typical' is open to some interpretation and depends on the context and sources being considered.

2.5 **Good Practice Guide for Noise from Pubs and Clubs**

Additional guidance on acceptable sound levels is given in the "Good Practice Guide on the Control of Noise from Pubs and Clubs, March 2003". Although this document was prepared to give guidance on sound from entertainment venues (as the title suggests), it can also be useful for other sites.

The Good Practice Guide provides internal sound level recommendations based on Noise Rating (NR) criteria, which take into account the frequency (or musical pitch) of the sound being assessed. This provides an alternative approach that is generally accepted to better take account of any strong tones, low-frequency sound or non environmental sources.

Design Targets

The design targets given in the Good Practice Guide are different for music than for other non music sources. The design guidance for dwellings affected by existing entertainment premises is that sound levels are advised to not exceed the following limits inside residential properties:

Non-music sources

NR 25 in bedrooms between 2300 and 0700 hours
NR 30 in habitable rooms between 0700 and 2300 hours.

Music sources

NR 20 in bedrooms between 2300 and 0700 hours
NR 25 in habitable rooms between 0700 and 2300 hours.

In our experience, these NR criteria are often adopted by LPAs for the assessment of indoor sound caused by a variety of non-traffic outdoor

sources, using the more stringent (music) criteria for typically annoying non music sources. These criteria are used in this survey when considering indoor sound levels caused by commercial garage sources.

2.6 **Acoustics, Ventilation and Overheating**

The Acoustics, Ventilation and Overheating (AVO) guide seeks to provide guidance on the interaction between these three factors. It is an in depth document that covers many types of ventilation systems. There are three types of ventilation condition identified, which are given in the table below, taken from the AVO guide.

Ventilation system	Provision with ADF system / purpose		
	Whole dwelling ventilation	Extract ventilation	Purge ventilation
System 1: Background ventilators and intermittent extract fans	Background ventilators (trickle vents)	Intermittent extract fans	Typically provided by opening windows
System 2: Passive stack ("natural")	Background ventilators (trickle vents) and passive stack ventilation	Continuous via passive stack	Typically provided by opening windows
System 3: Continuous mechanical extract (MEV)	Continuous mechanical extract – minimum low rate Trickle vents provide inlet air	Continuous mechanical extract – minimum high rate Trickle vents provide inlet air	Typically provided by opening windows
System 4: Continuously mechanical supply and extract with heat recovery (MVHR)	Continuous mechanical supply and extract – minimum low rate	Continuous mechanical supply and extract – minimum high rate	Typically provided by opening windows

In addition to this, the control of overheating should be considered. The conventional way of controlling overheating is to open window casements, but this leads to an increase in indoor sound levels. It may be accepted that slightly elevated sound levels are acceptable during the control of overheating, and a relatively low chance of adverse impact exists if internal conditions remain reasonable.

High levels of outdoor sound may result in unacceptable acoustic conditions inside dwellings with open windows, forcing a decision from the resident to have either acoustic or thermal comfort. Depending how often these conditions occur, significant adverse effect may be caused to living amenity.

If the various recommendations in the AVO guide are followed, the table below gives the level of risk to acoustic comfort during overheating conditions, if a partially open window casement is used (typical attenuation 13 dBA).

These are not fixed thresholds and use the full day and night time averaging periods of 16 and 8 hours, but give an indication as to the suitability of open windows to be the sole method of controlling overheating.

Likely suitability of using windows to control overheating

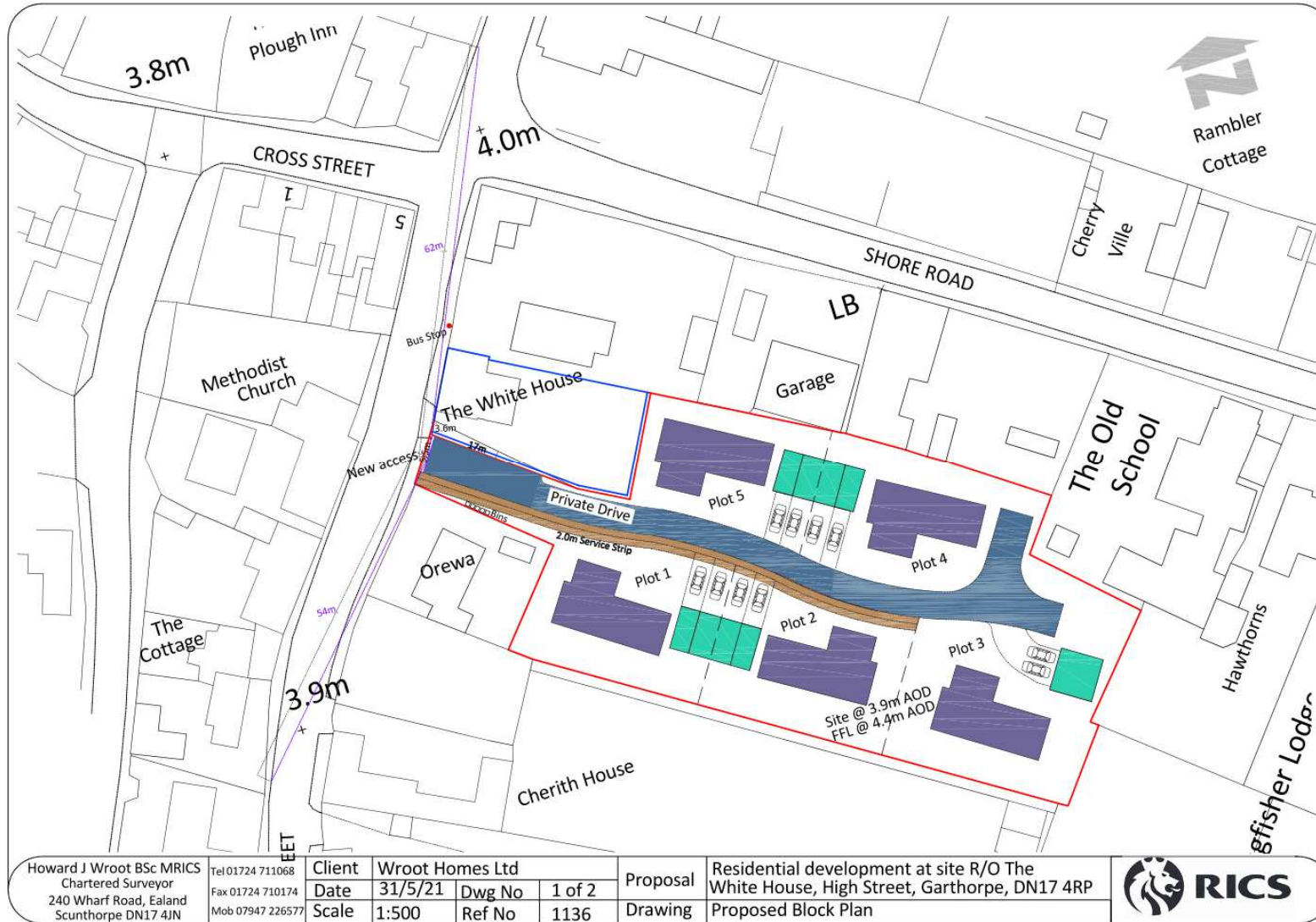
Risk Level	Daytime LA_{eq,16 hour}	Night LA_{eq,8 hour}	Night Maxima LA_{max,f}	Overheating Control
High	Above 63 dB	Above 55 dB	Regularly exceeds 78 dB	Overheating Control with open windows unlikely to be possible without adverse impact.
Medium	53 - 63 dB	48 - 55 dB		Risk of adverse impact with open windows, suitability depends on overheating regularity.
Low	48 - 53 dB	43 - 48 dB		Reasonable conditions with open windows
Negligible	Under 48 dB	Under 43 dB	Does not regularly exceed 58 dB	Open windows with no adverse impact

3.0 Site Location, Layout & Photographs

Google Earth Site Plan



Site Plan



Front of Garage



Site Facing Rear of Garage



Development Site



4.0 **Sound Survey**

The site is currently open grassland and is insecure. For this reason, attended measurements of sound were undertaken, the site being unsuitable for unattended monitoring equipment to be left on site.

Outdoor sound levels were measured at the site during the daytime of 12th July and 3rd August 2022, with late evening / night time sound levels measured on 12th – 13th July 2022.

Measurements were taken using a calibrated type I sound level meter, details of which are given later in this report. The microphone was mounted on a tripod 1.5m above ground level at two positions. One position was at the approximate location of proposed dwelling plots 1-3 at the south of the site and the other at plots 4-5 to the north of the site, though as may be expected given the location, the sound levels at the two positions were very similar. Sound levels were logged every 15 minutes.

Internal sound levels have been predicted and compared to the requirements of BS 8233. These predictions of internal sound level have been undertaken for each of the 15 minute measurement sets obtained during the survey of existing sound climate on site.

A full assessment of commercial garage sound is undertaken to the relevant standard BS 4142 and contained in section 8 of this report.

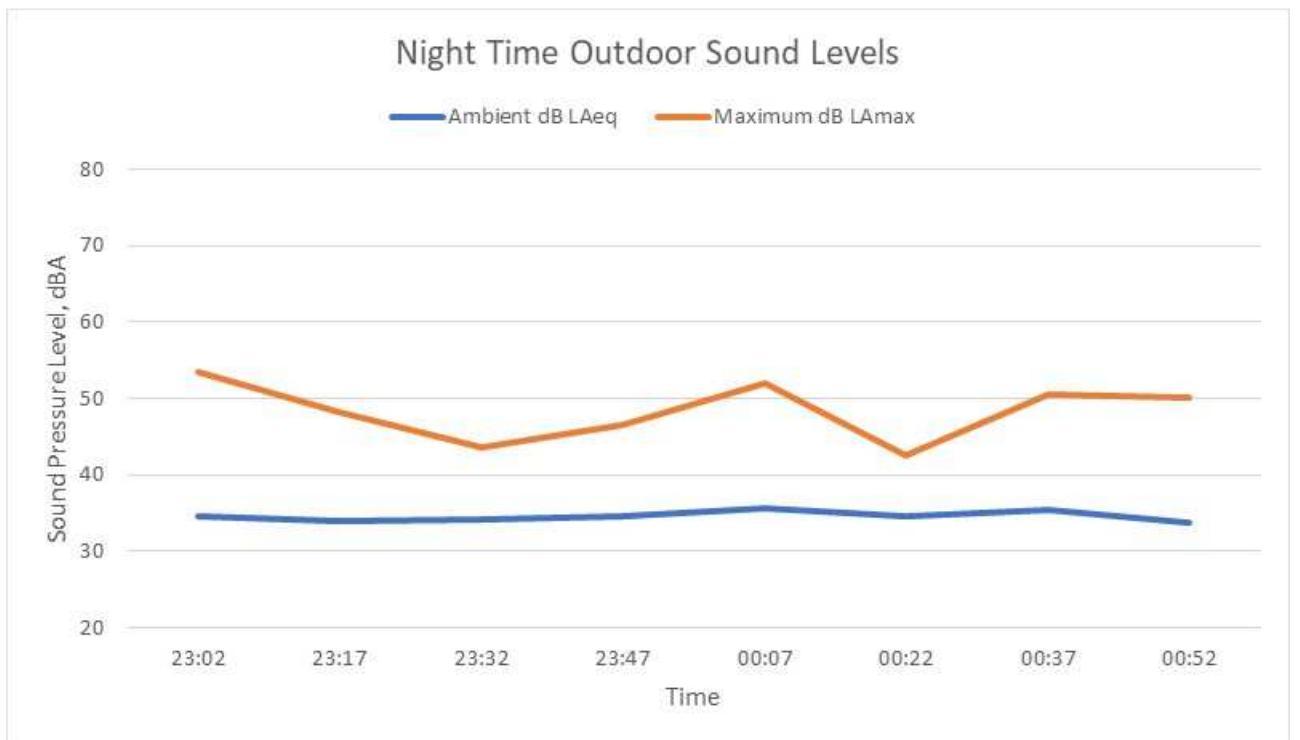
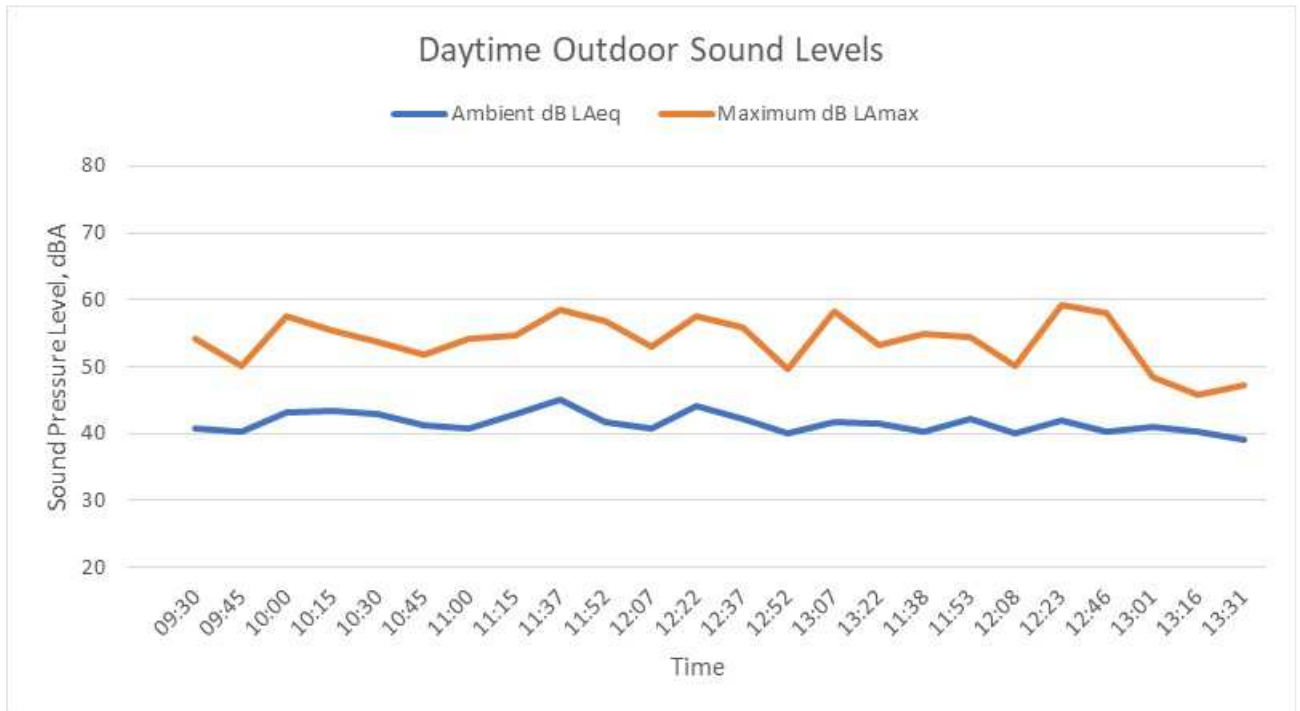
Background Sound

The assessment of commercial garage sound to BS 4142 detailed later in this report requires comparison of the commercial 'Rating Levels' to the typical background sound level. These background levels are defined as the sound levels that are exceeded for 90% of the time and are generally caused by distant traffic sources.

We previously undertook an acoustic survey for the same planning consultant at a site off West End, Garthorpe (approx 400m away) where the site was secure and monitoring could be undertaken over a period of several days. Given the rural location of these sites, it is likely that the background sound level at the previously survey site will be similar to that at this site.

For this reason, background sound levels measured as part of our previous survey have also been included in the commentary of commercial sound impact. It was found that our attended measurements of background sound at this site agreed entirely with those taken at the previous site and so this approach provides useful additional data points.

All outdoor measurement results are included in the appendices of this report. The graphs below show the 15 minute ambient LA_{eq} outdoor sound levels (blue line) and short duration maxima $LA_{max,f}$ levels (orange line) measured at this site to provide visual representation of the typical sound climate during daytime and nighttime periods.



The graphs demonstrate that the location is generally relatively quiet with ambient sound levels typically around 40 – 45 dB LA_{eq} during the daytime and under 40 dB LA_{eq} at night, as would be expected given the location. The potential for noise impact stems from activity at the commercial garage rather than road traffic sound.

The background sound levels measured at this site were 36 – 39 dB LA_{90,15min} during the daytime and 32 – 34 dB LA_{90,15min} at night. Our measurements at the previous site in Garthorpe showed background sound levels of 38 dB LA_{90,15min} during the daytime and 33 dB LA_{90,15min} at night

5.0 **Suggested Building Specification**

Internal sound levels from all environmental sources and garage activity are predicted to comply with the requirements detailed in section 2 of this report if the acoustic specification given in this section is followed.

Sound levels from environmental sources can be adequately controlled to all rooms of all plots using a fairly standard building envelope specification. An enhanced specification of glazing and trickle ventilators are suggested for the rear and side elevations of plots 4 and 5 facing the commercial garage to provide additional mitigation for dwelling interiors during periods of increased garage activity.

External walls should be constructed using either two leaves of 100mm concrete blockwork with a cavity between them, or an external leaf of 100mm blockwork then a cavity to an inner timber frame with two layers of 12.5mm plasterboard fixed to it.

Ceilings on top floors should be constructed using one layer of 12.5mm plasterboard with conventional tile and mineral wool insulation above.

Habitable Rooms at Rear (North) or Sides of Plots 4 and 5 Facing the Garage

- Glazing comprising 4mm float glass and 6.8mm acoustic glass such as Pilkington Optiphon with a 12- 20mm airgap between, eg 4-16-6.8
- Greenwood 5000 EAW.AC1 or Titon SFX V50 + C25 in frame acoustic trickle ventilators if desired as part of the ventilation strategy.
- Imperforate garden fences, eg, overlapped or tightly butted close board timber panels.

All Other Habitable Rooms at All Plots

- Glazing comprising two leaves of 4mm float glass with a 12 – 20mm airgap between, eg 4-16-4.
- Greenwood 5000EA or the Titon SFX V25 range of in frame trickle ventilators if desired as part of the ventilation strategy.

These models of trickle ventilators given above are suggestions for which we have accurate sound test data on file provided by their manufacturers. If a different manufacturer or model of trickle ventilator is preferred by the design team, we can advise their acoustic suitability if test data is available.

6.0 Predicted Internal Sound Levels, Environmental Sources

The predicted internal sound levels caused by environmental sound sources are summarised in the table below. The results of calculations performed on the highest sound levels and also the mean / average predictions are shown. Full results are given the appendices of this report.

Internal Sound Level Predictions.

Quantity / Rank	Living Room Daytime LA_{eq}	Bedroom, Daytime LA_{eq}	Bedroom, Night LA_{eq}	Bedroom, Night LA_{max}
<i>Plots 1 – 3</i>				
Mean	13.7	13.2	10.3	23.4
Maximum	16.9	16.4	11.0	27.3
<i>Plots 4 & 5</i>				
Mean	10.3	10.3	9.1	25.1
Maximum	12.9	13.0	12.2	31.4

6.1 Internal Sound Levels, Commercial Garage Sources

The internal sound levels predicted using the cumulative measurements of commercial garage activity are:

Windows Closed, Trickle Ventilators Open

Quantity / Rank	Living Room dB LA_{eq}	Living Room Noise Rating	Bedroom, dB LA_{eq}	Bedroom, Noise Rating
Plot 1 – 3	10.3	NR 5	11.1	NR 4
Plot 4 (Rear)	11.2	NR 6	11.3	NR 6
Plot 5 (Rear)	14.9	NR 8	15.0	NR 8

It can be seen that these internal Noise Rating predictions comply with the more stringent criteria for more annoying sources described in section 2 of no more than NR 25 in habitable rooms during the daytime. This provides some protection from noise impact caused by garage activity when windows are closed and trickle ventilators are open irrespective of the BS 4142 Rating Level.

Open Windows

The sound insulation across an open window casement varies significantly depending on the type of window, opening mechanism and angle/aperture. Calculations have been undertaken on likely internal sound level from garage activity with windows open, based on results obtained by Napier University during a large body of publicly available research. The results of these calculations show approximate interior sound level predictions from garage activity of:

- Plot 1-3, front of other plots, 22 dB LA_{eq}, NR 17
- Rear of Plot 4, 28 dB LA_{eq}, NR 22
- Rear of Plot 5, 31 dB LA_{eq}, NR 25

These predictions are also equal to or within the criteria described in section 2 for internal sound level, accepting that garage sound would be clearly audible.

When garage activity is low or sporadic, sound levels from the premises will be correspondingly lower than described above and as noted, the site is generally subjectively quiet and rural. During periods of more significant garage activity, the overall sound levels remain within the normal guidance for internal sound, but the dominant source would be the commercial garage.

This presents some difficulty for the Local Planning Authority in determining whether planning permission should be granted for the site. Absolute sound levels remain lower than many residential sites, but the potential for garage sound to dominate the soundscape exists during periods of greater activity. Clearly, the extent to which commercial garage sound is audible or dominant at the proposed development site depends entirely on the activities of the current proprietor, whoever occupies the premises in the future and the perception of individual residents.

The option remains to fit a mechanical ventilation system to plots four and five so that windows do not need to be opened for control of overheating, but such systems generate noise themselves and are likely to be clearly audible in the dwelling rooms when in operation. Further commentaries given on mechanical ventilation section 7 and a full assessment of commercial garage activity is given in section 8.

6.2 Sound Levels in Garden Amenity Areas

The graph of daytime outdoor sound levels measured at the site shows that the typical ambient level at garden areas is within the more desirable target of 50 dB LA_{eq} set by the WHO.

During periods of significant activity at the garage, sound levels in the area of garden facing the premises are likely to be in the region of 45 – 50 dB LA_{eq}, depending on type and intensity of activities and position within the garden.

This prediction is within the more desirable target but as noted sound from the commercial garage would be a significant contributor to the sound climate since the site sits in a relatively quiet area.

7.0 Acoustics, Ventilation and Overheating

The building specification given in this report contains recommendations for trickle ventilators for background ventilation in compliance with the normal Building Regulations requirements. When increased ventilation rates are needed, for example when cooling is required, the default method is to open windows, which of course leads to increased internal sound levels.

The measured day and night time sound levels are used for comparison to the recommendations of the AVO guide. This document is not regulatory, but provides the most up to date guidance and commentary on this topic.

The average of attended daytime and night time ambient sound levels are

- 41.8 LA_{eq} daytime
- 34.6 LA_{eq,8hour} at night.

Using the results measured on site, the site falls into the **low risk** category at all times.

The only potential benefit to internal sound climate from implementation of a mechanical ventilation system is control of sound levels from the commercial garage during busy periods. The fitment of a mechanical ventilation system is not always a desirable imposition and the potential pitfalls of a mechanical ventilation system should be considered against the protection they offer from sound entering the building through open windows.

Mechanical ventilation systems generate sound themselves. It is likely that at this site, a mechanical ventilation system would be audible inside most of the rooms if fitted and in operation.

7.1 **Building Regulations Part O**

The new Part O of The Building Regulations deals with overheating and also the noise indications of relying on open windows for control of thermal comfort.

This is a brand-new piece of regulation, so may take some time full adoption. It forms part of Building Regulations compliance, which is generally beyond the scope of requirements for planning application submissions. However, there are instances where the inclusion of a mechanical ventilation system may have some influence on details submitted with a planning application and so it is prudent to bear these potential requirements in mind from the early stages of a development proposal.

If this development will be subject to the requirements of the new Part O then we can provide assistance at the required stage.

From the information we have gathered so far at site, it appears unlikely that outdoor environmental sound levels would mandate fitment of a mechanical ventilation system for compliance with Part O of the Building Regulations.

We can provide further assistance if required depending on the version of Building Regulations adopted, requirements of the LPA and Building Control.

8.0 **BS 4142: Commercial Garage**

The most common standard for the outdoor assessment of industrial or commercial sound is BS 4142. The initial conclusions are reached based on quantitative data and predictions, then consideration of context is required to reach final conclusions.

The assessment is undertaken for all current and reasonably expected activities at the adjacent commercial car repair garage.

Section 12 of BS 4142 lists the information that should be reported in an assessment. For ease of reference and completeness of information, this section of the report follows the same order as BS 4142 section 12.

(a) **Qualifications and Experience**

S & D Garritt Ltd are members of the Association of Noise Consultants (ANC). All work related to this report was undertaken by David Garritt, with site work being undertaken by David and Elizabeth Garritt.

David Garritt has been a member of the Institute of Acoustics since 2005 and holds an honours degree in Electronic and Computer Systems Engineering.

David teaches acoustics at post graduate level on a part time basis for the Institute of Acoustics and sits on the ANC Communications and PR Committee. David has extensive experience in the preparation of surveys involving industrial sound sources directly comparable to the subject of this report.

(b) **Sources Being Assessed**

The commercial garage to the north of the proposed development site is operated by the owner currently with no other employees.

We met with the owner to discuss their operation and likely sound sources. The garage is open during daytime hours only and the owner stated they have been operational for 14 years without complaints from nearby residents.

The current owner undertakes work on a variety of road vehicles including occasional agricultural machinery. Sound output from the garage varies entirely depending on the owners workload and current job. There is the potential for the garage to be sold on in the future, which may lead to more intensive use within the existing planning permissions.

To provide an accurate assessment that includes an assessment of reasonable worst-case current sound levels and likely future noise impact, we have used measurements taken at the site and also data collected during previous surveys of similar premises.

1) The source measurements used in this assessment are:

- Tyre fitting, use of impact wrench and vehicle lift, Meersbrook Garage, Sheffield
- General vehicle workshop sound, Stoneacre Volvo, Sunderland
- Additional MOT bay sources, GG Steel, Kirton in Lindsey

- Compressor and Air Drill, taken directly at the commercial garage at this site

The source sound levels are shown below as overall dBA quantities and also linear octave frequency spectra, either taken at a specific distance from outdoor sources, or as a roaming measurement around building interiors.

Linear Frequency Spectra

Octave Conversion	Overall dB LA_{eq}	63	125	250	500	1000	2000	4000	8000
MOT Bay	69.7	74.6	63.0	58.5	59.0	67.9	61.0	55.2	58.6
Tyre Fitting Area*	67.6	64.7	63.7	66.1	60.4	58.6	60.9	61.6	57.1
Impact wrench	75.8	64.1	63.4	66.8	66.5	67.4	70.6	69.3	66.9
Vehicle Lift	68.8	61.1	54.2	55.9	60.7	66.1	61.3	58.7	53.9
General Workshop	66.7	65.3	68.5	65.2	64.3	60.0	59.3	55.7	52.8
Compressor, 1m	87.8	70.8	74.0	92.0	89.0	65.6	66.1	61.8	55.7
Air Drill, 1m	82.2			68.9	74.3	78.5	73.7	75.1	71.4

**This is a measurement in the area of tyres being fitted with appropriate time averaging, not a short duration measurement of the tyre machine or 'pops' in isolation*

Use of these source sound levels appears reasonable and accurate given the current use of the premises. We have experience from a previous survey of large-scale agricultural repair and body shop premises, which generate significantly higher sound levels than used in this assessment. Given the size of this commercial garage and its current use, it would appear unreasonable to anticipate sound levels associated with the large-scale repair premises and indeed such activity would be likely to give rise to complaints from other existing residents.

2. It has been assumed that all activities may take place during the daytime only during the normal opening hours of 08.00 – 17.30, Monday to Friday.
3. The 'on times' assumed per activity are shown in the table below:

Description	Mins used in 1 hr
MOT Bay	60
Tyre Fitting Area	60
Impact wrench	5
Vehicle Lift	5
General Workshop	60
Compressor	4
Air Drill	15

Use of these simultaneous sources and 'on times' presents a reasonable scenario for a busy garage with 2–3 employees / mechanics.

An outdoor flue / chimney is visible at the back of the garage from the proposed development site. The owner of the garage informs us that this is used as a chimney for a small heating stove and is not associated with any mechanical fixed plant.

4. All items were being used their normal full capacity during our source measurements.
5. The garage building is constructed using single skin concrete blockwork walls with a profile steel roof. An access door is at the front of the garage facing away from the proposed development site, which is left open for ventilation.

Sound levels from garage activity received at the proposed development site have been calculated from both the building envelope and open door, then combined to give a more accurate result.

Barrier attenuation for sound from the open doors reaching proposed dwellings behind is calculated using the frequency dependent method of Maekawa. A conservative path difference of 0.1m has been used for ground floor receptors.

(c) **Subjective Impressions**

Source sound levels were taken at distances where the source under test was the dominant source at the distances used for measurements.

Subjective impressions of the existing noise climate at the proposed site in the absence of garage sound was a quiet and peaceful rural environment, with distant road traffic and birdsong audible.

(d) **Existing Context**

The proposed development is within an existing and well established village. The site is surrounded by existing dwellings, except to the north where the site shares a boundary with the commercial garage. The rear elevation of the garage is clearly visible from the development site to the immediate north of plot 5.

The application is for proposed dwellings and while some sound from garage activity may be expected given the context, the potential for

disruption to living or sleeping amenity from the commercial use now and in the future should be considered.

The garage is currently owned and operated by a single person whose use of the property and intensity of activity varies significantly. The possibility of future sale of the garage to another party who may use the premises more intensively should be considered. For this reason, source sound levels measured at other active comparable garage premises have been used in the assessment.

(e) **Measurement Locations**

The receptors considered in this report are the proposed new dwellings. The distances between each set of dwellings and the closest part of the garage wall or open front door are shown in the table below.

Plot Number	Distance to Garage Wall	Distance to Open Door
Plot 5	5m	20m
Plot 4	10m	25m
Plot 1-3	35m	45m

The grid reference of the centre of the garage building is SE 84915 19144, and the centre of the proposed development site has grid reference SE 84913 19116.

The correct formula for distance decay from a point source over relatively short distances over mixed ground is $Decay = 20 \times \log (Distance Ratio) dB$. The principle of Rathe dictates that this point source decay occurs at distances from sources that are greater than the major dimension of the source divided by pi (3.14), so measurement positions were chosen with this principle in mind. Distance decay from the building elevation is also calculated using the principle of Rathe for plane, line and point sources.

A Google Earth image showing the site and receptors is given in section 2 of this report.

Background Measurements

Background sound levels are described in section m) to follow the same order as section 12 of BS 4142: 2014. The background sound levels were measured at the proposed development site as attended measurements and as described earlier in this report, previous data from a similar site in the same village has been used to provide additional data points.

The previously survey site is approximately 400m to the south-west of this development site, but is subject to similar background sources. It was found that the measurements taken at this previous site and the current site agreed with each other entirely. This means that use of the background data obtained at the previous site serves to increase the number of data points available given that the site is unsuitable for leaving unattended equipment over a longer period of time.

(f) **Instrumentation**

Equipment Description	Type number	Manufacturer	Date of expiration of Calibration	Calibration Certificate Number
Sound Level Meter	2260 s/n 2409281	Bruel & Kjaer	07.10.2022	147227
Preamplifier	ZC 0026	Bruel & Kjaer	07.10.2022	147227
Sound Level Meter	XL2 TA s/n A2A-10019-EO	NTi Audio	25.08.2022	145408
Microphone	MK 224 s/n 210762A	Cirrus Research	20.08.2022	145404
Calibrator	4231 s/n 2564324	Bruel & Kjaer	02.03.2023	A2013

(g) **Operational Tests**

1. The reference level of the calibrator is 94 dB SPL at 1000 Hz.
2. The meter readings with the calibrator before and after measurements were also 94.0 dB SPL before and after the unattended monitoring and source measurements. No drift was apparent during any measurements.

(h) **Weather Conditions**

Proposed Development Site

The weather conditions during our attended at the proposed development site were entirely suitable for the outdoor measurement of environmental sound.

- 12th July daytime, 22 – 26^oC, 25-50% cloud cover early, increasing to almost complete cover in some directions later in the day. No significant rainfall. Wind speeds under 2 ms⁻¹.
- 12th July night time, 16 – 19 ^oC, cloud cover reducing from daytime, no rainfall, wind speeds under 2 ms⁻¹.

- 3rd August daytime, 23 – 25°C, approximately 50% cloud cover. No rainfall. Wind speeds generally under 3 ms⁻¹, some brief periods of higher wind speeds that did not coincide with measurements of outdoor sound.

Previous Site Background Measurements

Weather conditions during the survey periods are shown in the table below. Conditions were generally entirely suitable for the outdoor measurement of environmental sound, though there were some brief occasions where the wind speed was higher than the desirable limit of 5 ms⁻¹. Analysis of the measured sound levels (all of which are included in the appendices of this report) show that these periods of increased wind speed have not had a discernible effect on the conclusions of outdoor sound.

Date	Wind Speed (ms)	Temperature (deg C)	Cloud cover (%)
08/03/2022	2-5	7-10	0-25
09/03/2022	2-5	8-13	0-25
10/03/2022	2-4	11-15	0-50
11/03/2022	3-7	9-13	0-25
12/03/2022	2-4	8-13	25-75
13/03/2022	2-5	8-11	25-75
14/03/2022	2-4	6-12	0-25

(i) **Date and Time of Measurements**

Measurements at this site were taken on 12th July from 09:30 - 13:37, then later the same day from 23:00 to 01:07 on 13th July. Measurements were also taken on 3rd August from 09:30 – 14:00. Background sound measurements at the previous site were taken between 11.00 on Tuesday 8th March and 09.30 on Monday 14th March 2022.

The dates of sound levels taken of sources at similar commercial sites were:

- Sheffield MOT and vehicle repair garage, Tuesday 11th December 2012,
- Rotherham tyre fitting facility, Friday 15th July 2016
- Existing Sunderland Volvo dealership, Thursday 31st October 2019
- Kirton in Lindsey MOT garage, November 2019
- Propagation across open door, Tetney Lock, 9th September 2020.

(j) **Measurement Time Intervals**

Background sound levels were measured over continuous 15 minute intervals in accordance with BS 4142: 2014. Measurements of specific source machinery were taken over time periods that allowed the measured results to settle to a constant value.

(k) **Reference Time Interval**

The reference time interval is 1 hour during the daytime in accordance with 3.8 of BS 4142. There is no night time working at the garage.

(l) **Specific Sound Levels**

The specific sound levels from each source as received at the proposed dwelling are shown below as time averaged LA_{eq} quantities as required. Residual sound levels and frequency spectra are shown in the appendices of the report for completeness.

Specific Sound Levels at Proposed Dwellings, dB LA_{eq,1hour}

Description	Plot 1 - 3	Plot 4	Plot 5
MOT Bay	31.3	37.0	40.0
Tyre Fitting	28.7	34.3	37.2
Impact wrench	25.2	30.7	33.4
Vehicle Lift	19.3	24.9	27.6
General Workshop	28.7	34.4	37.5
Compressor	30.7	36.4	39.4
Air Drill	28.4	33.9	36.6
Total dB LA_{eq,1hour}	37.1	42.7	45.7

The methods of determining the specific sound levels of the sources are in accordance with section F.2.1 of BS 5228-1 which describes methods of quantifying the sound levels of sources on a site. Three alternative means of obtaining the necessary data on source sound levels are described in BS 5228 as:

- (a) Carry out sound measurements on similar plant items operating in the same mode as those proposed at the application site.
- (b) Use data on typical sound levels of various plant items as provided in Annexes C and D of BS 5288-1.

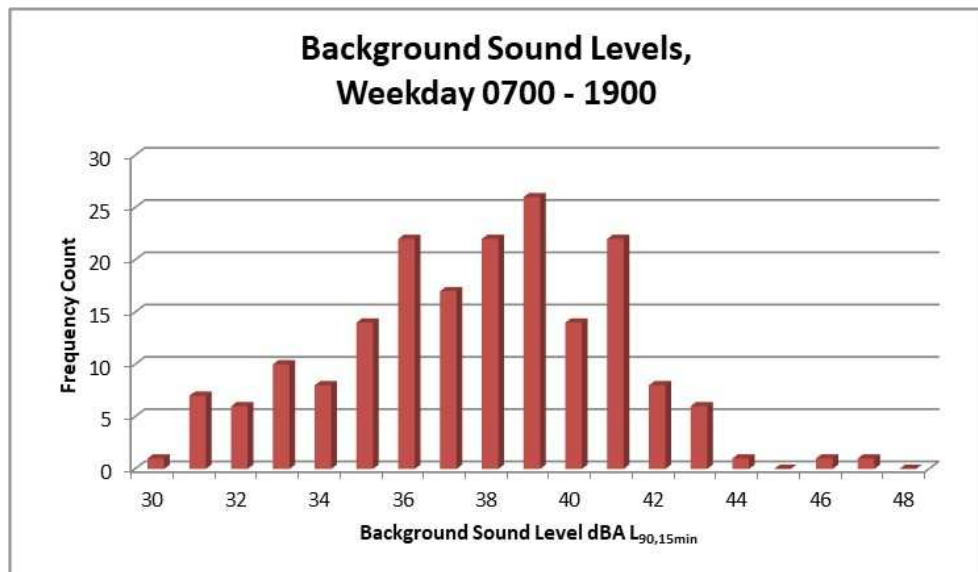
- (c) Use data on the maximum permitted sound levels of plant items under EC Directive 2000/14/EC[11].

Section F.2.1 advises that “The method given in item (a) is likely to provide the most accurate prediction” and that method has been employed at this site, using direct measurements of the commercial garage and also other previously surveyed similar sites.

(m) **Background Sound Level**

The attended measurements taken at this site showed background sound levels of 36 – 39 dB LA_{90,15min} during the daytime and 32 – 34 dB LA_{90,15min} at night.

A graphical summary of the measured sound levels taken previous site are shown below for daytime periods. Full measurement data is included in the appendices of this report. The sound levels are in complete agreement with those measured during our attended surveys at this site.



The typical background sound level identified for use in the assessment is 38 dB LA_{90,15min}

(n) **Rating Levels**

The BS 4142 Rating Levels are shown in this section. BS 4142 dictates that correction factors or penalties are applied to Rating Levels to take account of the acoustic characteristics as received at the receptors. Generally the

corrections are applied for whichever character is dominant, though more than one correction can be applied if deemed appropriate.

- Up to 6 dB for tonality as perceived at the receptor (eg, +2dB for just perceptible, up to +6 dB for highly perceptible),
- Up to 9 dB for impulsivity as perceived at the receptor (eg, +3dB for just perceptible, up to +9 dB for highly perceptible),
- 3 dB for intermittency, ie. if the source has easily identifiable repeated on/off conditions
- The option to add 3 dB if the source is neither tonal, impulsive or intermittent, but is of a character that is likely to cause annoyance

The corrections for sources at this site as received at plots 4 and 5 are:

- Tonality, 2 dB for the compressor.
- Intermittency, 3 dB penalty for tyre fitting, impact wrench, compressor and air drill.
- Impulsivity, 3 dB for the impact wrench.

At plots 1 – 3, the lower sound levels compared to background mean that the only corrections deemed necessary are for the compressor, being the same overall 5 dB as detailed above.

The BS 4142 Rating Levels from Garage activity are:

Plot Numbers	Rating Level, dB
Plot 1-3	39
Plot 4	46
Plot 5	49

(o) **Background Comparisons**

The comparison between BS 4142 Rating Level and background are:

- 1 dB above background at plots 1 – 3
- 8 dB above background at the rear of plot 4 facing the garage
- 11 dB above background at the rear of plot 5 facing the garage

The conclusion without taking context into account is that sources associated with the commercial garage will have low impact at plots 1 – 3 and significant adverse impact at the rear of plots 4 & 5, directly facing the garage.

(p) **BS 4142 Conclusions**

The magnitude of noise impact at plots 1 - 3 is likely to remain low.

At the rear of plots 4 & 5, the magnitude of impact will depend on the intensity of activities at the garage and also the perceptions of individuals, given that the overall sound climate is relatively low.

We understand that the current owner operates on a fairly sporadic basis with many periods of quiet activity and some periods of more intensive sound. It remains a possibility that the current occupier may increase their level of activity and also may at some stage sell the premises to another party.

It is correct to assess the premises for levels of noise output that can be reasonably expected. The slim possibility exists that a future occupier may attempt to undertake regular intensive activities on large-scale agricultural vehicles, which would lead to higher sound levels than predicted in this report. However, it is thought that this is unlikely and may be deemed unreasonable given the large number of other existing residential premises, where such sound levels may well give rise to complaint.

The final decision on whether the potential for noise impact from the commercial garage is acceptable lies with the Local Planning Authority. It is clear from our visits to site that there are currently significant periods where very little sound is audible from the garage, but there is also the potential for the commercial garage sound to be clearly audible when activity levels are greater.

The absolute levels remain fairly low compared to many development sites and this may modify the conclusion of 'significant adverse impact,' to one of lower noise impact, but if residential development is to take place on this site it must be accepted that garage sound may dominate the climate at the rear of plots 4 and 5 when it is in full use, partly due to the relatively low environmental sound levels.

A slightly enhanced acoustic specification is suggested for the rear of plots 4 and 5, ensuring that internal sound levels remain well within all of the normal guidance criteria, even during periods of more intense garage activity.

In addition to this, it is recommended that the rear gardens of plots 4 and 5 are surrounded by an imperforate timber fence. This is likely to provide some positive benefit to commercial sound, though the exact amount cannot be quantified since the building will still be visible above the fence line.

(q) **Uncertainty**

It is a requirement of BS 4142: 2014 that the level of uncertainty in data and calculations should be considered. These uncertainties and how they have been minimised are considered in this section.

Sound data for the sources has been taken from measurements taken by us directly at the site and also at a site surveyed as part of previous work. All assumptions have been made on a reasonable worst-case basis.

The procedures used for the calculation of specific sound levels at the nearest noise-sensitive receptors are based on basic, fundamental principles of acoustics. Sound decay with distance from the sources has been calculated using the principles and methods recommended in BS 5228 and by the methods of Rathe. The addition and subtraction of sound levels was done logarithmically on an energy basis, which is the correct method for decibel calculations. It is anticipated that this method would be considered by other suitably qualified acousticians to be relevant, correct and appropriate for this survey and is a method examined by the Institute of Acoustics on their post graduate diploma course.

All sound level measurements were taken with a calibrated type 1 sound level meter, which represents the most accurate type of SLM available. Sound levels were measured to the nearest 0.1 dB, time periods were measured and recorded to the nearest second. No rounding was done in any calculations, the only rounding being done on final results, in compliance with BS 4142 : 2014. The sound level meter was calibrated before and after each survey period and no drift was apparent.

Background sound data was obtained using long duration unattended measurements at another local site and attended measurements at this site. The results have been analysed to ensure applicable and representative data is used in the assessment of noise impact.

The greatest uncertainty surrounds the intensity of commercial garage sound, for which detailed commentary is given in the previous section of this report.

It is concluded that the uncertainty in this survey has been minimised as far as possible and is believed to be below the level at which it would have an impact on the assessment conclusions contained in this report.

APPENDIX 1 – OUTDOOR SOUND LEVEL MEASUREMENTS

Position to North (plots 4 & 5)

Date	Time	Outdoor dBA					Outdoor Leq (Hz)							Outdoor Lmax (Hz)						
		dB LA _{eq}	dB LA _{max}	dB LA _{min}	dB LA ₁₀	dB LA ₉₀	63	125	250	500	1000	2000	4000	63	125	250	500	1000	2000	4000
12/07/2022	09:30	40.7	54.3	33.3	43.0	37.4	43.5	40.2	39.6	40.5	30.3	27.4	33.5	65.6	53.5	51.4	52.4	42.9	38.1	53.9
12/07/2022	09:45	40.2	50.2	33.0	42.9	36.6	40.9	35.9	36.3	40.9	32.1	27.2	31.8	54.7	47.6	47.4	52.6	50.8	42.5	46.5
12/07/2022	10:00	43.1	57.6	32.9	44.8	36.8	40.7	32.7	32.2	44.9	28.9	26.0	33.7	52.9	42.4	41.1	62.0	42.4	42.9	46.3
12/07/2022	10:15	43.5	55.4	33.3	47.8	37.0	45.0	36.5	34.7	44.9	33.3	27.5	33.8	63.1	48.6	46.2	58.1	54.7	42.9	52.8
12/07/2022	10:30	42.9	53.8	32.4	46.5	38.0	54.3	39.8	35.4	43.0	35.6	32.2	32.9	69.3	52.8	44.9	58.5	46.8	45.9	48.3
12/07/2022	10:45	41.3	51.9	31.4	44.9	36.8	43.4	42.9	41.8	42.3	29.0	26.4	30.7	57.7	58.3	58.3	55.7	48.9	43.3	44.2
12/07/2022	11:00	40.8	54.1	30.7	43.2	36.3	58.0	39.9	34.8	39.5	32.8	29.1	31.8	78.5	57.1	46.5	53.6	49.1	48.1	47.5
12/07/2022	11:15	42.9	54.6	34.1	45.9	37.2	48.4	44.2	46.4	41.4	34.2	28.9	33.7	67.3	60.1	62.7	53.4	50.2	40.3	49.8
03/08/2022	11:38	40.3	54.9	35.7	40.8	38.4	44.1	40.0	38.3	35.0	31.5	29.6	36.4	49.5	49.3	47.4	41.3	39.1	35.5	54.4
03/08/2022	11:53	42.3	54.4	35.3	45.2	38.8	46.4	37.6	32.3	38.2	32.4	29.3	38.9	57.1	52.8	45.2	50.9	51.9	45.2	51.0
03/08/2022	12:08	40.1	50.1	35.5	42.6	37.8	44.5	37.0	32.4	33.7	32.6	29.9	36.1	50.9	43.9	36.8	39.3	47.3	40.1	49.2
03/08/2022	12:23	42.0	59.2	36.4	44.2	38.4	50.8	45.2	38.2	38.5	35.5	34.5	33.4	66.2	59.6	56.0	53.2	54.1	55.8	46.6
13/07/2022	00:07	35.6	52.1	31.0	36.9	33.0	51.6	45.3	36.8	33.0	27.7	22.8	18.0	69.4	63.7	53.7	46.2	44.0	39.2	40.0
13/07/2022	00:22	34.6	42.6	32.2	35.7	33.7	44.4	44.6	36.6	32.3	26.5	21.7	16.6	57.4	54.0	43.4	37.8	34.8	30.7	28.2
13/07/2022	00:37	35.4	50.5	31.4	36.4	33.9	57.3	44.5	36.3	31.8	26.1	20.8	16.5	78.0	54.5	45.6	37.2	32.8	30.7	27.6
13/07/2022	00:52	33.8	50.1	31.1	35.1	33.1	44.0	44.7	36.5	31.5	24.1	17.8	16.2	67.4	61.3	49.2	41.7	38.1	36.6	38.5

Position to South (plots 1-3)

Date	Time	Outdoor dBA					Outdoor Leq (Hz)							Outdoor Lmax (Hz)						
		dB LA _{eq}	dB LA _{max}	dB LA _{min}	dB LA ₁₀	dB LA ₉₀	63	125	250	500	1000	2000	4000	63	125	250	500	1000	2000	4000
12/07/2022	11:37	45.0	58.6	35.3	48.8	38.8	48.7	39.5	37.6	43.6	41.0	30.8	33.4	63.8	53.5	50.5	56.7	58.5	46.5	47.7
12/07/2022	11:52	41.7	56.8	33.3	44.1	37.6	51.4	40.7	34.3	40.8	33.2	26.6	34.4	68.4	52.6	42.3	54.9	56.4	39.9	49.0
12/07/2022	12:07	40.7	53.1	34.0	43.4	37.4	50.8	41.0	39.3	36.2	30.3	29.1	36.0	67.1	53.0	56.5	49.8	44.8	43.2	49.8
12/07/2022	12:22	44.0	57.5	32.8	47.3	38.3	54.6	41.1	38.1	42.3	39.8	33.1	33.5	72.6	55.5	49.9	56.2	57.6	46.8	46.8
12/07/2022	12:37	42.3	55.9	33.6	45.9	37.2	49.5	37.1	35.4	42.7	34.2	27.8	34.1	66.3	53.7	43.6	55.4	48.1	40.9	54.0
12/07/2022	12:52	40.1	49.7	33.8	42.4	37.9	47.0	35.9	34.2	38.8	31.1	27.9	34.3	63.4	49.4	42.8	49.0	40.6	38.7	50.5
12/07/2022	13:07	41.6	58.2	35.2	43.7	38.6	44.2	38.7	34.8	38.1	35.4	33.3	34.3	56.1	49.7	49.2	52.9	53.9	52.3	54.5
12/07/2022	13:22	41.4	53.2	35.3	44.4	38.4	46.2	39.7	36.5	39.0	33.1	33.7	34.7	61.0	49.8	46.2	47.6	45.0	50.8	46.0
03/08/2022	12:46	40.3	58.0	36.0	40.6	38.0	42.3	36.1	33.2	35.5	35.0	32.4	32.6	48.9	42.0	41.8	47.1	54.7	54.1	48.7
03/08/2022	13:01	40.9	48.5	36.5	42.6	39.0	45.7	37.4	35.3	37.7	34.7	32.2	33.5	57.2	44.3	42.3	43.8	44.7	42.8	43.7
03/08/2022	13:16	40.3	45.9	36.0	42.8	38.4	43.7	39.9	35.5	37.8	34.8	31.4	30.4	48.7	45.9	40.9	44.0	40.5	36.7	44.1
03/08/2022	13:31	39.0	47.2	35.8	40.2	38.0	49.6	40.5	33.0	35.2	33.5	29.9	30.0	58.2	54.9	40.9	41.7	41.0	34.4	40.6
12/07/2022	23:02	34.6	53.5	31.1	35.2	32.1	49.2	44.2	37.2	31.9	26.3	21.2	16.3	66.2	58.5	51.8	51.2	48.3	45.2	37.7
12/07/2022	23:17	34.0	48.3	31.1	35.6	32.7	47.3	44.3	35.9	31.9	25.3	20.2	15.7	63.1	55.9	45.9	39.8	40.9	42.7	38.1
12/07/2022	23:32	34.1	43.6	32.0	34.9	33.2	44.8	44.9	36.4	31.9	24.8	18.4	15.1	57.0	54.0	46.0	38.5	34.1	31.6	28.1
12/07/2022	23:47	34.6	46.6	31.5	35.2	33.0	51.1	45.4	36.4	32.3	24.8	18.1	15.4	68.3	57.0	46.7	38.9	32.7	32.5	37.2

Outdoor Background Measurements from Other Site

Date	Time	dB LA _{eq}	dB LA ₉₀
08/03/2022	11:00:00	38.9	34.4
08/03/2022	11:15:00	39.4	35.1
08/03/2022	11:30:00	43	35
08/03/2022	11:45:00	38.9	34
08/03/2022	12:00:00	39.7	34.6
08/03/2022	12:15:00	39.4	34.5
08/03/2022	12:30:00	41.5	35.3
08/03/2022	12:45:00	44.9	36.4
08/03/2022	13:00:00	41.6	36.5
08/03/2022	13:15:00	42.2	36.7
08/03/2022	13:30:00	40	35.7
08/03/2022	13:45:00	45.7	36.4
08/03/2022	14:00:00	41.2	36.2
08/03/2022	14:15:00	39	35.4

Date	Time	dB LA _{eq}	dB LA ₉₀
08/03/2022	14:30:00	38.6	33.7
08/03/2022	14:45:00	40.3	34.8
08/03/2022	15:00:00	47.9	35.8
08/03/2022	15:15:00	42.5	35.5
08/03/2022	15:30:00	48.5	36.9
08/03/2022	15:45:00	44.2	39.2
08/03/2022	16:00:00	47.1	38.2
08/03/2022	16:15:00	39.7	35.1
08/03/2022	16:30:00	44.9	37.3
08/03/2022	16:45:00	44	35.9
08/03/2022	17:00:00	40.4	35.5
08/03/2022	17:15:00	40.9	36.2
08/03/2022	17:30:00	37.7	35.1
08/03/2022	17:45:00	40.2	35.2

Date	Time	dB LA _{eq}	dB LA ₉₀
08/03/2022	18:00:00	37.3	34.9
08/03/2022	18:15:00	40.4	35.8
08/03/2022	18:30:00	40.3	36.1
08/03/2022	18:45:00	39.8	36.9
08/03/2022	19:00:00	44.6	37.5
08/03/2022	19:15:00	39.7	37.2
08/03/2022	19:30:00	39.2	36.4
08/03/2022	19:45:00	39	36.5
08/03/2022	20:00:00	39.1	36.8
08/03/2022	20:15:00	39.3	36.9
08/03/2022	20:30:00	38.5	36.3
08/03/2022	20:45:00	38.7	36.9
08/03/2022	21:00:00	42.8	35.6
08/03/2022	21:15:00	36.8	35.1

Date	Time	dB LA _{eq}	dB LA ₉₀
08/03/2022	21:30:00	37.6	35
08/03/2022	21:45:00	37.2	35.9
08/03/2022	22:00:00	37.7	36.3
08/03/2022	22:15:00	36.9	35.2
08/03/2022	22:30:00	35.7	34.3
08/03/2022	22:45:00	35.4	33.9
08/03/2022	23:00:00	34.8	32.8
08/03/2022	23:15:00	34.4	33.2
08/03/2022	23:30:00	34.5	33.3
08/03/2022	23:45:00	34.8	33.3
09/03/2022	00:00:00	36	34
09/03/2022	00:15:00	34.9	33.9
09/03/2022	00:30:00	34.9	33.7
09/03/2022	00:45:00	34.6	32.8
09/03/2022	01:00:00	33.9	32.4
09/03/2022	01:15:00	33.5	32
09/03/2022	01:30:00	33.2	31.8
09/03/2022	01:45:00	33.3	31.8
09/03/2022	02:00:00	34.5	32.6
09/03/2022	02:15:00	34.4	32.8
09/03/2022	02:30:00	33.9	31.9
09/03/2022	02:45:00	32.1	30.9
09/03/2022	03:00:00	34.1	32.4
09/03/2022	03:15:00	34.7	33.3
09/03/2022	03:30:00	35	33.3
09/03/2022	03:45:00	35.7	33.3
09/03/2022	04:00:00	35.6	32.6
09/03/2022	04:15:00	36.3	32
09/03/2022	04:30:00	34.9	32.4
09/03/2022	04:45:00	34.7	32.4
09/03/2022	05:00:00	34.4	32
09/03/2022	05:15:00	35.9	33.4
09/03/2022	05:30:00	40	34.5
09/03/2022	05:45:00	52.3	35.9
09/03/2022	06:00:00	41.1	35.1
09/03/2022	06:15:00	40	35.1
09/03/2022	06:30:00	43.3	37
09/03/2022	06:45:00	42.4	37.1
09/03/2022	07:00:00	41.7	37.6
09/03/2022	07:15:00	41.5	37.8
09/03/2022	07:30:00	42.4	37.7
09/03/2022	07:45:00	42.8	38.4
09/03/2022	08:00:00	41.3	37.8
09/03/2022	08:15:00	41.6	37
09/03/2022	08:30:00	44.7	37.5
09/03/2022	08:45:00	43.9	37.3
09/03/2022	09:00:00	43.2	36.1
09/03/2022	09:15:00	42.8	36.1
09/03/2022	09:30:00	42.5	36.1
09/03/2022	09:45:00	42.7	36
09/03/2022	10:00:00	44	35
09/03/2022	10:15:00	42.3	36.3
09/03/2022	10:30:00	48.2	38.9
09/03/2022	10:45:00	49.1	40.6
09/03/2022	11:00:00	52.4	42.3
09/03/2022	11:15:00	51	41
09/03/2022	11:30:00	47.5	42.9
09/03/2022	11:45:00	49.2	43
09/03/2022	12:00:00	45.9	41.2
09/03/2022	12:15:00	48.5	40.1
09/03/2022	12:30:00	48.4	40.1
09/03/2022	12:45:00	48.4	40.7
09/03/2022	13:00:00	48.2	41.1
09/03/2022	13:15:00	49.3	41.6
09/03/2022	13:30:00	52.4	43.2

Date	Time	dB LA _{eq}	dB LA ₉₀
09/03/2022	13:45:00	50.6	41.3
09/03/2022	14:00:00	47.4	38.5
09/03/2022	14:15:00	47.8	39.4
09/03/2022	14:30:00	47.9	39.9
09/03/2022	14:45:00	47.5	38.4
09/03/2022	15:00:00	47.4	39
09/03/2022	15:15:00	49	40.5
09/03/2022	15:30:00	50.3	40.9
09/03/2022	15:45:00	48.4	38.9
09/03/2022	16:00:00	46.7	38.5
09/03/2022	16:15:00	46.5	37.8
09/03/2022	16:30:00	46	39.1
09/03/2022	16:45:00	42.5	34.7
09/03/2022	17:00:00	38.7	33.9
09/03/2022	17:15:00	39.8	33.4
09/03/2022	17:30:00	38	33.4
09/03/2022	17:45:00	35.9	32.5
09/03/2022	18:00:00	35.8	33.2
09/03/2022	18:15:00	40	32.9
09/03/2022	18:30:00	34.5	31.6
09/03/2022	18:45:00	34.7	31
09/03/2022	19:00:00	34.7	32.1
09/03/2022	19:15:00	34.6	32.9
09/03/2022	19:30:00	35.7	33.7
09/03/2022	19:45:00	35.9	34.2
09/03/2022	20:00:00	38.1	34.5
09/03/2022	20:15:00	35.8	34.3
09/03/2022	20:30:00	41.2	34.7
09/03/2022	20:45:00	36.9	34.9
09/03/2022	21:00:00	37.2	35.3
09/03/2022	21:15:00	37.2	34.8
09/03/2022	21:30:00	37	35.1
09/03/2022	21:45:00	37.7	35.4
09/03/2022	22:00:00	36.8	34.7
09/03/2022	22:15:00	36.8	34.9
09/03/2022	22:30:00	35.7	34.4
09/03/2022	22:45:00	45.2	34.1
09/03/2022	23:00:00	35.8	34.2
09/03/2022	23:15:00	35.5	34.2
09/03/2022	23:30:00	36	34.5
09/03/2022	23:45:00	36	34.5
10/03/2022	00:00:00	37	35
10/03/2022	00:15:00	35.4	34.2
10/03/2022	00:30:00	35.7	33.8
10/03/2022	00:45:00	36.8	34.5
10/03/2022	01:00:00	35.6	33.8
10/03/2022	01:15:00	34.9	33.2
10/03/2022	01:30:00	34.8	33.4
10/03/2022	01:45:00	35.9	34.1
10/03/2022	02:00:00	36.2	33.9
10/03/2022	02:15:00	35.4	32.5
10/03/2022	02:30:00	33.9	30.9
10/03/2022	02:45:00	34.5	31.2
10/03/2022	03:00:00	35.7	31.5
10/03/2022	03:15:00	34.3	31.5
10/03/2022	03:30:00	34	32.4
10/03/2022	03:45:00	36.8	32.7
10/03/2022	04:00:00	35.5	33.3
10/03/2022	04:15:00	35.5	33.2
10/03/2022	04:30:00	35.9	33.2
10/03/2022	04:45:00	36.7	33.5
10/03/2022	05:00:00	37.8	34
10/03/2022	05:15:00	41.3	34.2
10/03/2022	05:30:00	47.9	35.6
10/03/2022	05:45:00	42.6	36.2

Date	Time	dB LA _{eq}	dB LA ₉₀
10/03/2022	06:00:00	40.6	35.2
10/03/2022	06:15:00	43.5	36.3
10/03/2022	06:30:00	42.7	37.6
10/03/2022	06:45:00	42.8	37
10/03/2022	07:00:00	42.7	37.4
10/03/2022	07:15:00	41.9	37.5
10/03/2022	07:30:00	43.4	37.2
10/03/2022	07:45:00	43.5	38
10/03/2022	08:00:00	44.7	38.8
10/03/2022	08:15:00	49.4	38.8
10/03/2022	08:30:00	43.4	39.2
10/03/2022	08:45:00	45.4	39.4
10/03/2022	09:00:00	44.3	38.1
10/03/2022	09:15:00	42.7	37.8
10/03/2022	09:30:00	45.9	38.7
10/03/2022	09:45:00	42.6	37.6
10/03/2022	10:00:00	47.5	37.3
10/03/2022	10:15:00	46.9	38
10/03/2022	10:30:00	56.8	38.7
10/03/2022	10:45:00	51.3	45.8
10/03/2022	11:00:00	48	41
10/03/2022	11:15:00	48.2	41.2
10/03/2022	11:30:00	47.1	41.2
10/03/2022	11:45:00	45.6	41.2
10/03/2022	12:00:00	48.5	42.5
10/03/2022	12:15:00	46.7	40.8
10/03/2022	12:30:00	47.5	42.1
10/03/2022	12:45:00	51.5	44.2
10/03/2022	13:00:00	52.8	43
10/03/2022	13:15:00	49.8	39.7
10/03/2022	13:30:00	46	38.4
10/03/2022	13:45:00	45.6	38.7
10/03/2022	14:00:00	45.1	39.8
10/03/2022	14:15:00	45.4	39
10/03/2022	14:30:00	44	37
10/03/2022	14:45:00	46.5	36.1
10/03/2022	15:00:00	41.8	35.4
10/03/2022	15:15:00	42.8	36.1
10/03/2022	15:30:00	41.7	36.1
10/03/2022	15:45:00	39.1	35.6
10/03/2022	16:00:00	47.7	34.1
10/03/2022	16:15:00	37.8	32.4
10/03/2022	16:30:00	39.6	33
10/03/2022	16:45:00	39	33.1
10/03/2022	17:00:00	37	32.8
10/03/2022	17:15:00	36.8	31.8
10/03/2022	17:30:00	36.8	30.6
10/03/2022	17:45:00	37.7	30.7
10/03/2022	18:00:00	39.3	31.4
10/03/2022	18:15:00	42.1	30.4
10/03/2022	18:30:00	33.6	31.5
10/03/2022	18:45:00	34.2	32.4
10/03/2022	19:00:00	37.8	33.3
10/03/2022	19:15:00	37.9	34.4
10/03/2022	19:30:00	36.6	34
10/03/2022	19:45:00	37.7	34.7
10/03/2022	20:00:00	37.9	35.1
10/03/2022	20:15:00	37.9	35.2
10/03/2022	20:30:00	39.9	35.8
10/03/2022	20:45:00	38.2	35.8
10/03/2022	21:00:00	37.8	35.3
10/03/2022	21:15:00	37.8	35.6
10/03/2022	21:30:00	37.8	35.5
10/03/2022	21:45:00	42.5	35.3
10/03/2022	22:00:00	37.1	34.6

Date	Time	dB LA _{eq}	dB LA ₉₀
10/03/2022	22:15:00	36.5	34.6
10/03/2022	22:30:00	36.7	35.3
10/03/2022	22:45:00	37.6	35.6
10/03/2022	23:00:00	37.6	35.7
10/03/2022	23:15:00	44.2	36.4
10/03/2022	23:30:00	37.6	35.2
10/03/2022	23:45:00	39.4	34.7
11/03/2022	00:00:00	38.4	35.6
11/03/2022	00:15:00	41	35.6
11/03/2022	00:30:00	36.8	33.4
11/03/2022	00:45:00	35	32.6
11/03/2022	01:00:00	36	33.3
11/03/2022	01:15:00	34.6	32.8
11/03/2022	01:30:00	32.8	31.3
11/03/2022	01:45:00	32.8	31.3
11/03/2022	02:00:00	32.2	30.9
11/03/2022	02:15:00	32.8	31.3
11/03/2022	02:30:00	33.7	31.9
11/03/2022	02:45:00	33.5	31.8
11/03/2022	03:00:00	34.8	31.8
11/03/2022	03:15:00	35.4	31.9
11/03/2022	03:30:00	35.4	32.3
11/03/2022	03:45:00	36.4	32.1
11/03/2022	04:00:00	35.9	32.6
11/03/2022	04:15:00	36.6	32.8
11/03/2022	04:30:00	37.3	33.8
11/03/2022	04:45:00	39.8	34.2
11/03/2022	05:00:00	37.8	34.3
11/03/2022	05:15:00	43.9	33.8
11/03/2022	05:30:00	40.4	34.8
11/03/2022	05:45:00	40.1	35
11/03/2022	06:00:00	40.9	36.2
11/03/2022	06:15:00	44.6	36.6
11/03/2022	06:30:00	40.8	36.9
11/03/2022	06:45:00	44	37.3
11/03/2022	07:00:00	42.3	37.1
11/03/2022	07:15:00	44.6	37.5
11/03/2022	07:30:00	41.4	36.7
11/03/2022	07:45:00	44.2	37.7
11/03/2022	08:00:00	42.7	37.5
11/03/2022	08:15:00	43.4	37.2
11/03/2022	08:30:00	43.2	38.1
11/03/2022	08:45:00	40.6	37.7
11/03/2022	09:00:00	42.1	37.2
11/03/2022	09:15:00	41.6	36.8
11/03/2022	09:30:00	39.7	35.8
11/03/2022	09:45:00	41	35.9
11/03/2022	10:00:00	43.6	38.3
11/03/2022	10:15:00	45.9	40.9
11/03/2022	10:30:00	46.8	40.2
11/03/2022	10:45:00	46.3	39.5
11/03/2022	11:00:00	43.8	38.8
11/03/2022	11:15:00	43.6	38.8
11/03/2022	11:30:00	44.8	41.5
11/03/2022	11:45:00	47	39.9
11/03/2022	12:00:00	48.4	41.4
11/03/2022	12:15:00	45.8	39.3
11/03/2022	12:30:00	44.8	38.9
11/03/2022	12:45:00	46.9	39.8
11/03/2022	13:00:00	43.3	37.3
11/03/2022	13:15:00	45.4	39.4
11/03/2022	13:30:00	43.3	38.8
11/03/2022	13:45:00	43.9	38.8
11/03/2022	14:00:00	45.1	39.3
11/03/2022	14:15:00	46.5	41

Date	Time	dB LA _{eq}	dB LA ₉₀
11/03/2022	14:30:00	46.3	42.3
11/03/2022	14:45:00	47.4	41.1
11/03/2022	15:00:00	45.8	40.6
11/03/2022	15:15:00	47.1	41.4
11/03/2022	15:30:00	46.8	40.8
11/03/2022	15:45:00	47.8	41.7
11/03/2022	16:00:00	45.1	40.8
11/03/2022	16:15:00	46.2	41.7
11/03/2022	16:30:00	48	42.6
11/03/2022	16:45:00	44.5	40.3
11/03/2022	17:00:00	43.3	39.9
11/03/2022	17:15:00	47.1	42
11/03/2022	17:30:00	45.8	40.6
11/03/2022	17:45:00	43.4	39.1
11/03/2022	18:00:00	45.8	40.3
11/03/2022	18:15:00	45	39.8
11/03/2022	18:30:00	45.3	38.9
11/03/2022	18:45:00	44.5	39.7
11/03/2022	19:00:00	43.2	39.9
11/03/2022	19:15:00	42.6	39.3
11/03/2022	19:30:00	43	39.5
11/03/2022	19:45:00	43.7	40.3
11/03/2022	20:00:00	43.1	38.7
11/03/2022	20:15:00	39.3	37
11/03/2022	20:30:00	38.9	36.5
11/03/2022	20:45:00	40	37.5
11/03/2022	21:00:00	39.1	36.6
11/03/2022	21:15:00	39.5	36.1
11/03/2022	21:30:00	37.8	33.4
11/03/2022	21:45:00	37.3	33.2
11/03/2022	22:00:00	40.5	33.3
11/03/2022	22:15:00	36	33.5
11/03/2022	22:30:00	37.7	34.1
11/03/2022	22:45:00	35.9	34.3
11/03/2022	23:00:00	34	32.4
11/03/2022	23:15:00	34.8	33.3
11/03/2022	23:30:00	34.3	32.8
11/03/2022	23:45:00	35.1	32.7
12/03/2022	00:00:00	35.1	33
12/03/2022	00:15:00	34.3	32.8
12/03/2022	00:30:00	34.7	32.7
12/03/2022	00:45:00	38.8	33.7
12/03/2022	01:00:00	41.1	36.7
12/03/2022	01:15:00	38.6	34.2
12/03/2022	01:30:00	37.1	34.1
12/03/2022	01:45:00	35.5	33.6
12/03/2022	02:00:00	36.3	33.7
12/03/2022	02:15:00	37	33.4
12/03/2022	02:30:00	36.2	33.9
12/03/2022	02:45:00	35.8	33.9
12/03/2022	03:00:00	36.1	34.3
12/03/2022	03:15:00	37.9	35
12/03/2022	03:30:00	38.6	35.5
12/03/2022	03:45:00	38	35.1
12/03/2022	04:00:00	37.1	33.9
12/03/2022	04:15:00	36.3	33.1
12/03/2022	04:30:00	37.5	33.8
12/03/2022	04:45:00	38.2	34.2
12/03/2022	05:00:00	39.7	34.6
12/03/2022	05:15:00	36.8	33.4
12/03/2022	05:30:00	40.6	35.6
12/03/2022	05:45:00	48.3	36.4
12/03/2022	06:00:00	46.1	37.6
12/03/2022	06:15:00	43.5	37.7
12/03/2022	06:30:00	41.1	36.5

Date	Time	dB LA _{eq}	dB LA ₉₀
12/03/2022	06:45:00	42.2	36.7
12/03/2022	07:00:00	44.1	37.5
12/03/2022	07:15:00	46	38.5
12/03/2022	07:30:00	47.4	40.6
12/03/2022	07:45:00	47.9	40.6
12/03/2022	08:00:00	45.9	39.5
12/03/2022	08:15:00	46.6	39.5
12/03/2022	08:30:00	47.1	40.3
12/03/2022	08:45:00	48.4	39.2
12/03/2022	09:00:00	47.8	40
12/03/2022	09:15:00	46	39.5
12/03/2022	09:30:00	48.2	40
12/03/2022	09:45:00	49.7	42.6
12/03/2022	10:00:00	47.4	40
12/03/2022	10:15:00	49.6	42
12/03/2022	10:30:00	45.6	36.9
12/03/2022	10:45:00	47.5	38.8
12/03/2022	11:00:00	48.6	40.5
12/03/2022	11:15:00	50.4	39.5
12/03/2022	11:30:00	48.9	40.8
12/03/2022	11:45:00	45.5	38.3
12/03/2022	12:00:00	51.2	38
12/03/2022	12:15:00	45.4	36.7
12/03/2022	12:30:00	48.4	39.7
12/03/2022	12:45:00	50	41.1
12/03/2022	13:00:00	50.1	40.9
12/03/2022	13:15:00	50.1	40.7
12/03/2022	13:30:00	51.9	42.8
12/03/2022	13:45:00	49.8	41.5
12/03/2022	14:00:00	50	39.1
12/03/2022	14:15:00	49.4	40.2
12/03/2022	14:30:00	47.8	39.8
12/03/2022	14:45:00	47.6	39.8
12/03/2022	15:00:00	51.7	40.2
12/03/2022	15:15:00	46.9	38.4
12/03/2022	15:30:00	43.8	37.1
12/03/2022	15:45:00	44.1	38.2
12/03/2022	16:00:00	42.6	36.7
12/03/2022	16:15:00	43	36
12/03/2022	16:30:00	41.4	37
12/03/2022	16:45:00	38.1	34.4
12/03/2022	17:00:00	38.7	34.5
12/03/2022	17:15:00	37.4	32
12/03/2022	17:30:00	38.8	31.6
12/03/2022	17:45:00	36.9	31.6
12/03/2022	18:00:00	37.1	32.7
12/03/2022	18:15:00	37.1	32.6
12/03/2022	18:30:00	36	33.3
12/03/2022	18:45:00	35.9	33.3
12/03/2022	19:00:00	35.1	32.6
12/03/2022	19:15:00	36.6	33.6
12/03/2022	19:30:00	38	34.4
12/03/2022	19:45:00	37.3	34.5
12/03/2022	20:00:00	37.2	34.5
12/03/2022	20:15:00	37.8	35.3
12/03/2022	20:30:00	37.8	35.1
12/03/2022	20:45:00	38.8	36.4
12/03/2022	21:00:00	37.8	35.7
12/03/2022	21:15:00	40	36.9
12/03/2022	21:30:00	42.4	38
12/03/2022	21:45:00	42.3	37.7
12/03/2022	22:00:00	42.3	38.3
12/03/2022	22:15:00	41.8	39
12/03/2022	22:30:00	41.3	37.3
12/03/2022	22:45:00	39.8	37.2

Date	Time	dB LA _{eq}	dB LA ₉₀
12/03/2022	23:00:00	42	37.2
12/03/2022	23:15:00	42	37
12/03/2022	23:30:00	39.3	36.9
12/03/2022	23:45:00	40.9	37.4
13/03/2022	00:00:00	39.2	36.3
13/03/2022	00:15:00	38.3	36.1
13/03/2022	00:30:00	38.2	36
13/03/2022	00:45:00	40.7	37.3
13/03/2022	01:00:00	40.2	37.6
13/03/2022	01:15:00	39.6	37
13/03/2022	01:30:00	41.1	37.3
13/03/2022	01:45:00	39.2	36.3
13/03/2022	02:00:00	38.9	36.2
13/03/2022	02:15:00	39	36
13/03/2022	02:30:00	39.2	36.8
13/03/2022	02:45:00	38.1	36.2
13/03/2022	03:00:00	41.4	37.1
13/03/2022	03:15:00	42.9	38.7
13/03/2022	03:30:00	42.4	38.6
13/03/2022	03:45:00	44.2	38.7
13/03/2022	04:00:00	46.2	37.7
13/03/2022	04:15:00	40.9	36.8
13/03/2022	04:30:00	41.8	36.6
13/03/2022	04:45:00	39.3	35.8
13/03/2022	05:00:00	38.9	35.8
13/03/2022	05:15:00	46.1	36.2
13/03/2022	05:30:00	52.8	37.2
13/03/2022	05:45:00	42	37.1
13/03/2022	06:00:00	39.6	36.3
13/03/2022	06:15:00	43.2	37.7
13/03/2022	06:30:00	41.7	37.6
13/03/2022	06:45:00	50.1	38.4
13/03/2022	07:00:00	43.3	38.5
13/03/2022	07:15:00	42.6	38.9
13/03/2022	07:30:00	44.3	37.7
13/03/2022	07:45:00	41.3	38.3
13/03/2022	08:00:00	43.1	38
13/03/2022	08:15:00	43.9	39.4
13/03/2022	08:30:00	44	39.5
13/03/2022	08:45:00	44.2	39.2
13/03/2022	09:00:00	42.8	38.7
13/03/2022	09:15:00	44.1	39.2
13/03/2022	09:30:00	45.2	38.9
13/03/2022	09:45:00	44.8	39.9
13/03/2022	10:00:00	42.9	38.7
13/03/2022	10:15:00	51.9	41

Date	Time	dB LA _{eq}	dB LA ₉₀
13/03/2022	10:30:00	53	38.7
13/03/2022	10:45:00	45.9	38.1
13/03/2022	11:00:00	44.2	37.4
13/03/2022	11:15:00	44.1	38.4
13/03/2022	11:30:00	45.7	38
13/03/2022	11:45:00	44.9	37
13/03/2022	12:00:00	44.2	38.9
13/03/2022	12:15:00	45.6	39.9
13/03/2022	12:30:00	44.4	37.7
13/03/2022	12:45:00	46.2	40
13/03/2022	13:00:00	44.2	36.2
13/03/2022	13:15:00	45.7	37.9
13/03/2022	13:30:00	43.7	38.6
13/03/2022	13:45:00	42.9	37.1
13/03/2022	14:00:00	41.3	37.2
13/03/2022	14:15:00	39	34.9
13/03/2022	14:30:00	38.4	32.9
13/03/2022	14:45:00	38.8	34.2
13/03/2022	15:00:00	37.8	33.8
13/03/2022	15:15:00	39	34
13/03/2022	15:30:00	42.9	34.9
13/03/2022	15:45:00	39.1	32.9
13/03/2022	16:00:00	37.9	32.2
13/03/2022	16:15:00	37.6	33.2
13/03/2022	16:30:00	37.8	33.7
13/03/2022	16:45:00	36.5	32.1
13/03/2022	17:00:00	44.1	33.3
13/03/2022	17:15:00	37	33.5
13/03/2022	17:30:00	39.6	33.6
13/03/2022	17:45:00	38.2	32.6
13/03/2022	18:00:00	48.3	32.8
13/03/2022	18:15:00	39.1	32.8
13/03/2022	18:30:00	40.8	32.3
13/03/2022	18:45:00	38	31.6
13/03/2022	19:00:00	33.2	30.9
13/03/2022	19:15:00	34.5	31.2
13/03/2022	19:30:00	34.5	31.6
13/03/2022	19:45:00	34.2	31.3
13/03/2022	20:00:00	32.9	29.9
13/03/2022	20:15:00	31.1	29.2
13/03/2022	20:30:00	31.9	29.8
13/03/2022	20:45:00	33.1	29.6
13/03/2022	21:00:00	30.5	29.1
13/03/2022	21:15:00	30.1	27.6
13/03/2022	21:30:00	30.8	26.9
13/03/2022	21:45:00	31.5	26.9

Date	Time	dB LA _{eq}	dB LA ₉₀
13/03/2022	22:00:00	32.5	25.1
13/03/2022	22:15:00	26	24.7
13/03/2022	22:30:00	27.2	25
13/03/2022	22:45:00	33	25
13/03/2022	23:00:00	26.1	25
13/03/2022	23:15:00	27	24.8
13/03/2022	23:30:00	26.1	25.2
13/03/2022	23:45:00	26.3	24.8
14/03/2022	00:00:00	25.5	24.6
14/03/2022	00:15:00	24.7	23.9
14/03/2022	00:30:00	25.1	24.1
14/03/2022	00:45:00	30.1	24.2
14/03/2022	01:00:00	24.6	23.8
14/03/2022	01:15:00	25.9	24
14/03/2022	01:30:00	24.5	23.8
14/03/2022	01:45:00	24.6	23.9
14/03/2022	02:00:00	24.6	23.8
14/03/2022	02:15:00	25.7	24.3
14/03/2022	02:30:00	25.9	23.7
14/03/2022	02:45:00	25.3	23.5
14/03/2022	03:00:00	24.4	23.3
14/03/2022	03:15:00	24.7	23.3
14/03/2022	03:30:00	26.1	23.1
14/03/2022	03:45:00	33.5	24
14/03/2022	04:00:00	34.2	24
14/03/2022	04:15:00	34.7	24
14/03/2022	04:30:00	34.9	23.7
14/03/2022	04:45:00	34.2	24.4
14/03/2022	05:00:00	38.8	24.9
14/03/2022	05:15:00	46.6	27.2
14/03/2022	05:30:00	40.7	31.8
14/03/2022	05:45:00	46.5	30.8
14/03/2022	06:00:00	42.5	34.1
14/03/2022	06:15:00	44.4	33.7
14/03/2022	06:30:00	43.4	34.5
14/03/2022	06:45:00	44.2	34.7
14/03/2022	07:00:00	42.6	34.2
14/03/2022	07:15:00	48.7	34.1
14/03/2022	07:30:00	44.3	34.1
14/03/2022	07:45:00	39.5	33.4
14/03/2022	08:00:00	40.3	32.9
14/03/2022	08:15:00	38.4	31.4
14/03/2022	08:30:00	44.9	31.9
14/03/2022	08:45:00	50.5	46.7
14/03/2022	09:00:00	42.1	31
14/03/2022	09:15:00	42.4	31.2

APPENDIX 2 – SOUND LEVEL CALCULATIONS AND PREDICTIONS

Source sound levels, taken as roaming or reverberant field measurements unless a fixed distance is specified.

Sound Pressure Levels, dB Linear

Item / Frequency (Hz)	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	20000	
MOT Bay				68.9	71.1	69.2	58.8	59.1	56.2	57.1	50.4	48.9	53	54.3	55.2	54.6	66.4	61.6	58.1	56.2	53	51.4	49.5	50.1	54.4	55.2	50.6				
Tyre Fitting					64.7			63.7			66.1			60.4			58.6			60.9			61.6			57.1					
Impact wrench					64.1			63.4			66.8			66.5			67.4			70.6			69.3			66.9					
Vehicle Lift					61.1			54.2			55.9			60.7			66.1			61.3			58.7			53.9					
General Workshop	66	75.1	58.7	60	59.9	61.6	66.8	59.5	61.4	61.2	60.6	59.1	57.8	62.4	55.8	55.4	55.2	55.1	55	54.7	53.7	52.5	50.5	49.2	48.4	49.4	45.5	45.5	41.4	40.5	
Compressor (1m)	63.8	67.8	61.3	65.2	67.9	63.9	60.9	68.3	72.3	78.3	84.8	90.8	88.7	76.2	66.3	63.4	59.4	57.3	63.5	60.4	58.8	59.3	55.7	54.4	52.3	50.3	49.6				
Air Drill (1m)										52.3	67.3	63.4	53.4	71.3	71.2	71.6	71	76.4	71.7	63.3	68	70.2	70.9	69.7	67.6	67.9	63.1				

Octave and overall dBA sound levels including conversion to roaming levels for measurements taken at fixed distances.

Sound Pressure Levels, dBA and dB Linear spectra

Octave Conversion	Overall dB LA _{eq}	63	125	250	500	1000	2000	4000	8000
MOT Bay	69.7	74.6	63.0	58.5	59.0	67.9	61.0	55.2	58.6
Tyre Fitting	67.6	64.7	63.7	66.1	60.4	58.6	60.9	61.6	57.1
Impact wrench	75.8	64.1	63.4	66.8	66.5	67.4	70.6	69.3	66.9
Vehicle Lift	68.8	61.1	54.2	55.9	60.7	66.1	61.3	58.7	53.9
General Workshop	66.7	65.3	68.5	65.2	64.3	60.0	59.3	55.7	52.8
Compressor	78.8	61.8	65.0	83.0	80.0	56.6	57.1	52.8	46.7
Air Drill	73.2	-4.2	-4.2	59.9	65.3	69.5	64.7	66.1	62.4

Propagation:

The propagation of sound across open doors has been based on measurements taken by us for a previous consultancy exercise where a pink noise source was located inside a barn to be converted to commercial use, then measured outside across an open large agricultural barn door of similar dimensions to the pit garage doors (*see photo to the right*). The outdoor measurements were taken at a distance of 10m from the open door beyond which the point source propagation of Rathe could be accurately applied. Measurements were taken in third octave frequency bands.

The results have been combined to octaves using transmissibility calculations, the results of which are given below

Sound Level Difference, dB

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Building Interior to 10m Outdoors	16.8	17.8	15.8	14.8	13.9	17.1	11.4	10.3



The access door is on the garage elevation facing away from the proposed dwellings, so barrier calculations can be undertaken using Maekawa with a conservative nominal path difference of 0.1m

Shadow Loss from Garage Building

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Open Doors to Development Site	5.7	6.2	7.3	8.9	11.1	13.9	15	15

For sound reaching proposed dwellings directly through the building envelope, calculations have been undertaken using transmission coefficients for walls and roof, also including refraction effects from the roof, to 1m outside the building, then the principle of Rathe used for distance calculations to a normalised distance of 10m. The formula for calculating transmission coefficients is $\tau = 1 / 10^{R/10}$. The coefficients are multiplied by surface area and then combined to calculate the overall sound insulation of the building envelope.

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Outer Walls	22	27	32	37	40	41	45	48
Roof	11	15	18	23	22	24	30	36
Roof Refraction	2	3	4	5	5	6	6	6
Overall Roof	13	18	22	28	27	30	36	42
τ Walls	0.006309573	0.001995262	0.000630957	0.000199526	0.0001	7.94328E-05	3.16E-05	1.58E-05
τ Roof	0.050118723	0.015848932	0.006309573	0.001584893	0.001995262	0.001	0.000251	6.31E-05
SA walls	77	77	77	77	77	77	77	77
SA Roof	84	84	84	84	84	84	84	84
SA Total	161	161	161	161	161	161	161	161
τ overall	0.029166521	0.009223264	0.003593714	0.000922326	0.001088833	0.000559729	0.000146	4.05E-05
R Overall	15.4	20.4	24.4	30.4	29.6	32.5	38.4	43.9

Distance decay from 1m to 10m is calculated using the plane, line and point source principles of Rathe as being 11 dB. The sound levels at 10m distance transmitted via the open door including barrier effect and via the building envelope are shown in the tables below.

Sound via Open Door

Sound Pressure Levels, dBA and dB Linear Spectra

Outdoor Level @ 10m	Overall dB LA _{eq}	63	125	250	500	1000	2000	4000	8000
MOT Bay	44.1	52.1	39.0	35.4	35.3	42.9	30.0	28.8	33.3
Tyre Fitting	41.5	42.2	39.7	43.0	36.7	33.6	29.9	35.2	31.8
Impact wrench	48.9	41.6	39.4	43.7	42.8	42.4	39.6	42.9	41.6
Vehicle Lift	43.0	38.6	30.2	32.8	37.0	41.1	30.3	32.3	28.6
General Workshop	41.5	42.9	44.5	42.1	40.6	35.0	28.3	29.3	27.5
Compressor	55.3	39.3	41.0	59.9	56.2	31.6	26.1	26.3	21.4
Air Drill	47.4	-26.7	-28.2	36.8	41.6	44.5	33.7	39.7	37.1

Sound Through Building Envelope

Sound Pressure Levels, dBA and dB Linear Spectra

Outdoor Level @ 10m	Overall dB LA _{eq}	63	125	250	500	1000	2000	4000	8000
MOT Bay	29.3	48.3	31.6	23.0	17.7	27.2	17.5	5.8	3.7
Tyre Fitting	26.2	38.3	32.3	30.7	19.0	18.0	17.4	12.2	2.2
Impact wrench	32.3	37.7	32.0	31.4	25.1	26.8	27.1	19.9	12.0
Vehicle Lift	27.1	34.7	22.8	20.5	19.3	25.5	17.8	9.3	-1.0
General Workshop	27.1	39.0	37.1	29.7	23.0	19.4	15.8	6.4	-2.1
Compressor	40.6	35.4	33.6	47.5	38.6	15.9	13.6	3.4	-8.3
Air Drill	30.7	-30.6	-35.6	24.4	23.9	28.9	21.1	16.7	7.5

These sound levels from the different transmission paths are combined logarithmically at each octave frequency band to predict the overall sound level from garage activity as received at each dwelling.

The corrections for on-time per assessment period of one hour are:

Description	Mins used in 1 hr	Time Correction, dB
MOT Bay	60	0
Tyre Fitting	60	0
Impact wrench	5	10.79
Vehicle Lift	5	10.79
General Workshop	60	0
Compressor	4	11.76
Air Drill	15	6.02

The specific sound levels from each source at each dwelling, and as an combined level are:

Plot 1-3

Description	Overall dB LAeq	63	125	250	500	1000	2000	4000	8000
MOT Bay	31.3	41.3	27.1	22.7	22.4	30.0	17.3	15.7	20.2
Tyre Fitting	28.7	31.4	27.8	30.3	23.7	20.7	17.2	22.2	18.7
Impact wrench	25.2	20.0	16.7	20.2	19.1	18.8	16.1	19.1	17.8
Vehicle Lift	19.3	17.0	7.5	9.3	13.3	17.5	6.8	8.5	4.8
General Workshop	28.7	32.0	32.6	29.4	27.7	22.2	15.6	16.3	14.5
Compressor	30.7	16.7	17.3	35.4	31.5	6.9	1.7	1.6	-3.5
Air Drill	28.4	-43.6	-46.1	18.1	22.6	25.6	15.0	20.6	18.1
Combined	37.1	42.2	34.8	37.6	34.3	32.5	23.5	26.5	25.3

Plot 4

Description	Overall dB LAeq	63	125	250	500	1000	2000	4000	8000
MOT Bay	37.0	49.7	34.4	28.7	27.8	35.6	23.4	20.9	25.3
Tyre Fitting	34.3	39.8	35.1	36.4	29.2	26.3	23.2	27.4	23.9
Impact wrench	30.7	28.4	24.0	26.3	24.5	24.4	22.2	24.3	22.9
Vehicle Lift	24.9	25.4	14.8	15.4	18.7	23.1	12.9	13.7	9.9
General Workshop	34.4	40.4	39.9	35.4	33.1	27.7	21.6	21.5	19.6
Compressor	36.4	25.1	24.6	41.5	37.0	12.5	7.7	6.8	1.7
Air Drill	33.9	-35.2	-38.9	24.2	28.0	31.2	21.0	25.8	23.2
Combined	42.7	50.6	42.1	43.7	39.8	38.1	29.5	31.7	30.4

Plot 5

Description	Overall dB LAeq	63	125	250	500	1000	2000	4000	8000
MOT Bay	40.0	54.9	38.9	32.2	30.3	38.4	26.8	23.1	27.3
Tyre Fitting	37.2	45.0	39.6	39.8	31.7	29.2	26.7	29.5	25.9
Impact wrench	33.4	33.6	28.6	29.8	27.0	27.2	25.6	26.4	24.9
Vehicle Lift	27.6	30.6	19.4	18.9	21.2	25.9	16.3	15.8	11.9
General Workshop	37.5	45.6	44.4	38.9	35.7	30.6	25.0	23.6	21.6
Compressor	39.4	30.3	29.2	44.9	39.5	15.4	11.1	8.9	3.7
Air Drill	36.6	-30.0	-34.3	27.6	30.6	34.0	24.4	28.0	25.2
Combined	45.6	55.8	46.7	47.2	42.3	40.9	32.9	33.9	32.4

Specific and Rating Levels

Description	Plot 1 - 3	Plot 4	Plot 5
MOT Bay	31.3	37.0	40.0
Tyre Fitting	28.7	34.3	37.2
Impact wrench	25.2	30.7	33.4
Vehicle Lift	19.3	24.9	27.6
General Workshop	28.7	34.4	37.5
Compressor	30.7	36.4	39.4
Air Drill	28.4	33.9	36.6
Total Specific Levels, dB LA_{eq,1hour}	37.1	42.7	45.7
Rating Levels, dB	39	46	49

MORE RIGOROUS CALCULATION METHOD OF BS 8233: 2014

The method in BS 8233:2014 requires certain building parameters to be known or assumed as part of the calculation procedure. These parameters are:

Living Room

Building Element	Value (m ²)
Reference absorption A_0	10
Total façade area S_f	13
Window area S_{wi}	2.88
External Wall area S_{ew}	10.12
Ceiling area S_{rr}	17.5
Total area $S = S_f + S_{rr}$	30.5

Bedroom

Building Element	Value (m ²)
Reference absorption A_0	10
Total façade area S_f	10.4
Window area S_{wi}	2.16
External Wall area S_{ew}	8.24
Ceiling area S_{rr}	14
Total area $S = S_f + S_{rr}$	24.4

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Outer Walls	34	41	45	50	56	65	69	72
4-16-6.8 acoustic	19	20	27	36	47	47	52	55
4-16-4 glazing	18	21	17	25	35	37	31	35
5000EAW.AC1 ventilator	33	39	38	31	44	43	46	49
Greenwood 5000EA	33	39	37	31	32	31	35	38
Single Board	29	34	40	45	49	46	48	50

Calculated Loss, Plots 1 - 3

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Living Room	20	23	21	27	30	29	32	36
Bedroom	20	24	22	27	31	30	32	36

Calculated Loss, Plots 4 - 5

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Living Room	21	23	30	30	42	41	45	48
Bedroom	20	23	30	30	42	41	44	48

Plot 1 -3 Outdoor Sound Levels

Date	Time	Outdoor dBA					Outdoor Leq (Hz)								Outdoor Lmax (Hz)							
		dB LA _{eq}	dB LA _{max}	dB LA _{min}	dB LA ₁₀	dB LA ₉₀	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
12/07/2022	11:37	45.0	58.6	35.3	48.8	38.8	48.7	39.5	37.6	43.6	41.0	30.8	33.4	34.8	63.8	53.5	50.5	56.7	58.5	46.5	47.7	52.7
12/07/2022	11:52	41.7	56.8	33.3	44.1	37.6	51.4	40.7	34.3	40.8	33.2	26.6	34.4	34.0	68.4	52.6	42.3	54.9	56.4	39.9	49.0	55.9
12/07/2022	12:07	40.7	53.1	34.0	43.4	37.4	50.8	41.0	39.3	36.2	30.3	29.1	36.0	32.2	67.1	53.0	56.5	49.8	44.8	43.2	49.8	53.1
12/07/2022	12:22	44.0	57.5	32.8	47.3	38.3	54.6	41.1	38.1	42.3	39.8	33.1	33.5	26.8	72.6	55.5	49.9	56.2	57.6	46.8	46.8	45.1
12/07/2022	12:37	42.3	55.9	33.6	45.9	37.2	49.5	37.1	35.4	42.7	34.2	27.8	34.1	30.5	66.3	53.7	43.6	55.4	48.1	40.9	54.0	56.2
12/07/2022	12:52	40.1	49.7	33.8	42.4	37.9	47.0	35.9	34.2	38.8	31.1	27.9	34.3	29.7	63.4	49.4	42.8	49.0	40.6	38.7	50.5	47.2
12/07/2022	13:07	41.6	58.2	35.2	43.7	38.6	44.2	38.7	34.8	38.1	35.4	33.3	34.3	30.4	56.1	49.7	49.2	52.9	53.9	52.3	54.5	46.1
12/07/2022	13:22	41.4	53.2	35.3	44.4	38.4	46.2	39.7	36.5	39.0	33.1	33.7	34.7	27.2	61.0	49.8	46.2	47.6	45.0	50.8	46.0	42.1
03/08/2022	12:46	40.3	58.0	36.0	40.6	38.0	42.3	36.1	33.2	35.5	35.0	32.4	32.6	30.5	48.9	42.0	41.8	47.1	54.7	54.1	48.7	50.1
03/08/2022	13:01	40.9	48.5	36.5	42.6	39.0	45.7	37.4	35.3	37.7	34.7	32.2	33.5	31.0	57.2	44.3	42.3	43.8	44.7	42.8	43.7	47.0
03/08/2022	13:16	40.3	45.9	36.0	42.8	38.4	43.7	39.9	35.5	37.8	34.8	31.4	30.4	29.9	48.7	45.9	40.9	44.0	40.5	36.7	44.1	44.5
03/08/2022	13:31	39.0	47.2	35.8	40.2	38.0	49.6	40.5	33.0	35.2	33.5	29.9	30.0	30.2	58.2	54.9	40.9	41.7	41.0	34.4	40.6	46.6
12/07/2022	23:02	34.6	53.5	31.1	35.2	32.1	49.2	44.2	37.2	31.9	26.3	21.2	16.3	16.0	66.2	58.5	51.8	51.2	48.3	45.2	37.7	30.0
12/07/2022	23:17	34.0	48.3	31.1	35.6	32.7	47.3	44.3	35.9	31.9	25.3	20.2	15.7	15.9	63.1	55.9	45.9	39.8	40.9	42.7	38.1	30.3
12/07/2022	23:32	34.1	43.6	32.0	34.9	33.2	44.8	44.9	36.4	31.9	24.8	18.4	15.1	16.0	57.0	54.0	46.0	38.5	34.1	31.6	28.1	29.1
12/07/2022	23:47	34.6	46.6	31.5	35.2	33.0	51.1	45.4	36.4	32.3	24.8	18.1	15.4	15.9	68.3	57.0	46.7	38.9	32.7	32.5	37.2	28.8

Plot 4 – 5 Outdoor Sound Levels

Date	Time	Outdoor dBA					Outdoor Leq (Hz)								Outdoor Lmax (Hz)							
		dB LA _{eq}	dB LA _{max}	dB LA _{min}	dB LA ₁₀	dB LA ₉₀	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
12/07/2022	09:30	40.7	54.3	33.3	43.0	37.4	43.5	40.2	39.6	40.5	30.3	27.4	33.5	29.0	65.6	53.5	51.4	52.4	42.9	38.1	53.9	52.6
12/07/2022	09:45	40.2	50.2	33.0	42.9	36.6	40.9	35.9	36.3	40.9	32.1	27.2	31.8	22.3	54.7	47.6	47.4	52.6	50.8	42.5	46.5	40.3
12/07/2022	10:00	43.1	57.6	32.9	44.8	36.8	40.7	32.7	32.2	44.9	28.9	26.0	33.7	29.1	52.9	42.4	41.1	62.0	42.4	42.9	46.3	48.4
12/07/2022	10:15	43.5	55.4	33.3	47.8	37.0	45.0	36.5	34.7	44.9	33.3	27.5	33.8	30.0	63.1	48.6	46.2	58.1	54.7	42.9	52.8	52.7
12/07/2022	10:30	42.9	53.8	32.4	46.5	38.0	54.3	39.8	35.4	43.0	35.6	32.2	32.9	30.3	69.3	52.8	44.9	58.5	46.8	45.9	48.3	51.8
12/07/2022	10:45	41.3	51.9	31.4	44.9	36.8	43.4	42.9	41.8	42.3	29.0	26.4	30.7	25.6	57.7	58.3	58.3	55.7	48.9	43.3	44.2	44.5
12/07/2022	11:00	40.8	54.1	30.7	43.2	36.3	58.0	39.9	34.8	39.5	32.8	29.1	31.8	31.8	78.5	57.1	46.5	53.6	49.1	48.1	47.5	52.3
12/07/2022	11:15	42.9	54.6	34.1	45.9	37.2	48.4	44.2	46.4	41.4	34.2	28.9	33.7	32.1	67.3	60.1	62.7	53.4	50.2	40.3	49.8	49.6
03/08/2022	11:38	40.3	54.9	35.7	40.8	38.4	44.1	40.0	38.3	35.0	31.5	29.6	36.4	29.3	49.5	49.3	47.4	41.3	39.1	35.5	54.4	42.5
03/08/2022	11:53	42.3	54.4	35.3	45.2	38.8	46.4	37.6	32.3	38.2	32.4	29.3	38.9	29.6	57.1	52.8	45.2	50.9	51.9	45.2	51.0	41.0
03/08/2022	12:08	40.1	50.1	35.5	42.6	37.8	44.5	37.0	32.4	33.7	32.6	29.9	36.1	28.8	50.9	43.9	36.8	39.3	47.3	40.1	49.2	43.7
03/08/2022	12:23	42.0	59.2	36.4	44.2	38.4	50.8	45.2	38.2	38.5	35.5	34.5	33.4	28.9	66.2	59.6	56.0	53.2	54.1	55.8	46.6	41.0
13/07/2022	00:07	35.6	52.1	31.0	36.9	33.0	51.6	45.3	36.8	33.0	27.7	22.8	18.0	16.6	69.4	63.7	53.7	46.2	44.0	39.2	40.0	34.0
13/07/2022	00:22	34.6	42.6	32.2	35.7	33.7	44.4	44.6	36.6	32.3	26.5	21.7	16.6	15.9	57.4	54.0	43.4	37.8	34.8	30.7	28.2	27.0
13/07/2022	00:37	35.4	50.5	31.4	36.4	33.9	57.3	44.5	36.3	31.8	26.1	20.8	16.5	16.3	78.0	54.5	45.6	37.2	32.8	30.7	27.6	27.1
13/07/2022	00:52	33.8	50.1	31.1	35.1	33.1	44.0	44.7	36.5	31.5	24.1	17.8	16.2	16.4	67.4	61.3	49.2	41.7	38.1	36.6	38.5	31.3

Plot 1 -3 Indoor Sound Levels

Date	Time	Bedroom			Living Room	Indoor Bedroom								Indoor Living Room								Indoor Bed Max							
		Day L _{eq}	Night L _{eq}	Night L _{max}	Daytime L _{eq}	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
12/07/2022	11:37	16.4			16.9	29	16	16	16	10	1	1	0	29	16	17	17	11	1	2	0	44	30	29	29	28	17	16	17
12/07/2022	11:52	13.6			14.1	32	17	12	14	3	0	2	0	31	17	14	14	3	0	3	0	48	29	21	28	26	10	17	20
12/07/2022	12:07	13.3			13.9	31	17	17	9	0	0	4	0	31	18	19	9	0	0	4	0	47	29	35	23	14	14	18	17
12/07/2022	12:22	16.3			16.7	35	17	16	15	9	4	1	0	35	18	17	16	9	4	2	0	53	32	28	29	27	17	15	9
12/07/2022	12:37	14.5			15.0	30	13	14	15	4	0	2	0	30	14	15	16	4	0	2	0	46	30	22	28	18	11	22	20
12/07/2022	12:52	11.8			12.3	27	12	12	11	1	0	2	0	27	12	14	12	1	0	3	0	44	25	21	22	10	9	18	11
12/07/2022	13:07	12.6			13.1	24	15	13	11	5	4	2	0	24	15	14	11	5	4	3	0	36	26	27	26	23	23	22	10
12/07/2022	13:22	13.2			13.7	26	16	15	12	3	4	3	0	26	16	16	12	3	4	3	0	41	26	24	20	14	21	14	6
03/08/2022	12:46	11.1			11.5	22	12	11	8	4	3	0	0	22	13	12	9	5	3	1	0	29	18	20	20	24	25	17	14
03/08/2022	13:01	12.2			12.7	26	14	13	10	4	3	1	0	26	14	15	11	4	3	2	0	37	20	20	17	14	13	12	11
03/08/2022	13:16	12.0			12.6	24	16	14	11	4	2	0	0	24	16	15	11	4	2	0	0	29	22	19	17	10	7	12	9
03/08/2022	13:31	11.0			11.4	30	17	11	8	3	0	0	0	30	17	12	9	3	0	0	0	38	31	19	14	10	5	8	11
12/07/2022	23:02		10.6	27.3		29	20	15	5	0	0	0	0	29	21	17	5	0	0	0	0	46	35	30	24	18	16	6	0
12/07/2022	23:17		9.7	22.5		27	20	14	5	0	0	0	0	27	21	15	5	0	0	0	0	43	32	24	12	10	13	6	0
12/07/2022	23:32		9.8	19.3		25	21	15	5	0	0	0	0	25	21	16	5	0	0	0	0	37	30	24	11	4	2	0	0
12/07/2022	23:47		11.0	24.4		31	22	15	5	0	0	0	0	31	22	16	6	0	0	0	0	48	33	25	12	2	3	5	0

Plot 4 – 5 Indoor Sound Levels

Date	Time	Bedroom			Living Room	Indoor Bedroom								Indoor Living Room								Indoor Bed Max							
		Day L _{eq}	Night L _{eq}	Night L _{max}	Daytime L _{eq}	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
12/07/2022	09:30	9.5			9.7	23	17	10	11	0	0	0	0	23	18	10	11	0	0	0	0	45	30	21	23	1	0	10	5
12/07/2022	09:45	9.0			9.1	20	13	6	11	0	0	0	0	20	13	7	11	0	0	0	0	34	24	17	23	9	2	2	0
12/07/2022	10:00	12.3			12.4	20	10	2	15	0	0	0	0	20	10	3	15	0	0	0	0	32	19	11	32	0	2	2	1
12/07/2022	10:15	12.6			12.6	24	13	5	15	0	0	0	0	24	14	5	15	0	0	0	0	43	25	16	28	13	2	8	5
12/07/2022	10:30	12.6			12.6	34	17	5	13	0	0	0	0	33	17	6	13	0	0	0	0	49	30	15	29	5	5	4	4
12/07/2022	10:45	11.4			11.6	23	20	12	13	0	0	0	0	23	20	12	13	0	0	0	0	37	35	28	26	7	2	0	0
12/07/2022	11:00	13.0			12.9	38	17	5	10	0	0	0	0	37	17	5	10	0	0	0	0	58	34	16	24	7	7	3	4
12/07/2022	11:15	12.6			12.9	28	21	16	12	0	0	0	0	28	22	17	12	0	0	0	0	47	37	33	24	8	0	5	2
03/08/2022	11:38	6.7			6.9	24	17	8	5	0	0	0	0	23	18	9	5	0	0	0	0	29	26	17	12	0	0	10	0

Date	Time	Bedroom			Living Room	Indoor Bedroom								Indoor Living Room								Indoor Bed Max							
		Day L _{eq}	Night L _{eq}	Night L _{max}	Daytime L _{eq}	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
03/08/2022	11:53	7.7			7.7	26	15	2	9	0	0	0	0	26	15	3	9	0	0	0	0	37	30	15	21	10	4	7	0
03/08/2022	12:08	4.9			5.0	24	14	2	4	0	0	0	0	24	14	3	4	0	0	0	0	30	21	7	10	5	0	5	0
03/08/2022	12:23	10.7			10.9	30	22	8	9	0	0	0	0	30	23	9	9	0	0	0	0	46	37	26	24	12	15	2	0
13/07/2022	00:07		9.5	27.2		31	22	7	3	0	0	0	0	31	23	7	3	0	0	0	0	49	41	24	17	2	0	0	0
13/07/2022	00:22		7.5	16.9		24	21	7	3	0	0	0	0	24	22	7	3	0	0	0	0	37	31	13	8	0	0	0	0
13/07/2022	00:37		12.2	31.4		37	21	6	2	0	0	0	0	37	22	7	2	0	0	0	0	57	31	15	8	0	0	0	0
13/07/2022	00:52		7.3	24.8		23	22	6	2	0	0	0	0	23	22	7	2	0	0	0	0	47	38	19	12	0	0	0	0
