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

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Date	17/01/2022
Project Number	7084JG
Version Reference	001

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Executive Summary

An environmental noise survey and noise impact assessment have been undertaken to assess the suitability of the site at 4-18 King Street, Huddersfield, HD1 2QE for residential development. The measured ambient sound levels have allowed a BS8233:2014 noise assessment to be carried out.

A sound insulation scheme has been provided in Sections 4.0 and 5.0, including glazing and an alternative ventilation strategy. Provided the recommendations specified in this report are adhered to, the noise levels within the residential development are predicted to be within the BS8233:2014 criteria.

An overview of all recommendations can be found in the table below:

Recommendations and Mitigation Overview
- Appropriate glazing specifications can be found in Table 4.0. - Appropriate alternative ventilation can be found in Table 5.0. - It is recommended that the partition walls and floors between the residential development and adjacent commercial units should score a minimum of 53 dB $D_{nT,w}$ + C_{tr} when tested for airborne sound insulation. Partition constructions that are predicted to achieve this level of sound reduction can be found in Section 6.0.

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

1. Introduction

Overview

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a residential development ('the Proposed Development') at 4-18 King Street, Huddersfield, HD1 2QE ('the Site').

The applicant has submitted a planning application, 2021/62/93374/W – '*Change of use of first and second floor, erection of extension to form 3rd floor and external alterations to form 9no. apartments (Within a Conservation Area)'* ('the Application') to Kirklees Council.

Kirklees Council have requested further information in order to approve the planning application.

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

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

Scope & Objectives

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

- Ambient sound monitoring survey to evaluate the prevailing ambient and maximum sound levels incident on the proposed development;
- A detailed assessment of the suitability of the Site, in accordance with relevant standards in respect of sound from the surrounding noise sources; and
- Recommendation of mitigation measures, where necessary, to comply with the requirements of the National Planning Policy Framework (2021), Noise Policy Statement for England (2010), British Standard BS8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings', and the Association of Noise Consultants 'Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO). Further information on the legislation and the latest Entertainment Noise Legislation can be found in Appendix B.

Local Authority Policies and Guidance

The following comment has been made by Kirklees Council Environmental Health regarding the proposed development.

The development is situated in the town centre and will introduce new receptors into a noisy environment including traffic noise, pedestrian/customer noise and noise associated with the business below and from nearby businesses (including noise from refrigeration and ventilation systems).

It was noted in your Planning Statement, Ref: 2659, dated Aug 2021 you state in your conclusions, 6.3 Technical reports accompanying the application are comprehensive in their coverage and where necessary provide appropriate and deliverable mitigation measures. I have been unable to find any technical reports relating to Noise assessments.

Therefore, it will be necessary for a condition requiring a noise assessment. The assessment should include a scheme for any necessary mitigation to protect any new noise sensitive receptors from external noise sources and from noise transfer within the development from the business below and the other apartments."

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, two environmental sound surveys were carried out from 17/12/21 to 20/12/21 and 13/01/22 to 14/01/22. For the long-term monitoring, one sound level meter was placed protruding from a 2nd floor window fronting the intersection of Victoria Lane and King Street (MP1) and one sound level meter was attached to a drainpipe at the rear façade. The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the day time and night time periods and are shown in Figure 1.0 below.

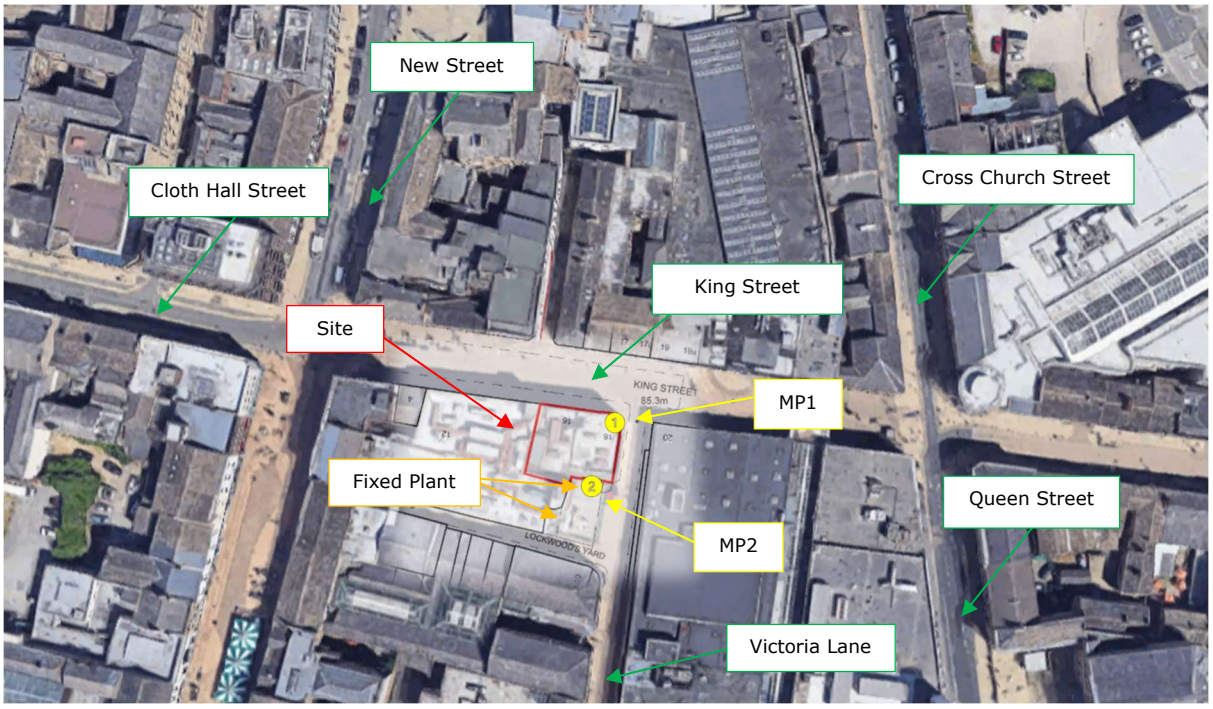


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The proposal is for the conversion of the upper floors of the building from retail space to residential units and the erection of a 3rd floor.

The area surrounding the site is primarily commercial in nature with a minority of residential properties. The noise profile is typical for this type of area and is dominated by road traffic noise emissions from surrounding road networks and noise from pedestrians on King Street and Victoria Lane. Multiple commercial businesses are located on King Street and Victoria Lane including a Boots Pharmacy and a Footlocker. The 'Chinese Buffet' restaurant is located directly opposite the proposed development which operates until 22:30 at the latest. The restaurant has a small external seating area located at 1st floor level.

During the site visits, fixed plant noise emissions were consistently audible and dominant at the rear façade of the development property. Plant noise emissions were also occasionally audible at the front façades of the property but were rarely dominant in the environment.

Environmental Noise Survey Results

Long-Term Measurement Results

The following table outlines the highest 1-hour octave band sound levels measured during the day time and night time periods that will be used in the noise break in assessment. A full summary of all results can be found in Appendix D.

Measurement Position MP1								
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	
Highest $L_{eq,1hr}$ (Day)	70.0	63.0	69.0	68.0	64.0	58.0	50.0	68.0
Highest $L_{eq,1hr}$ (Night)	69.0	58.0	62.0	60.0	56.0	54.0	48.0	62.0
Measurement Position MP2								
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	
Highest $L_{eq,1hr}$ (Day)	67.0	70.0	69.0	62.0	62.0	56.0	49.0	66.0
Highest $L_{eq,1hr}$ (Night)	62.0	57.0	58.0	52.0	49.0	46.0	43.0	55.0

Table 1.0 – Long-Term Monitoring Results – MP1 and MP2

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

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

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

Measurement Position MP1			
Measurement Period ('t')	**$L_{AFmax,15min}$**	***SMR $L_{AFmax,15min}$**	**No. of Exceedances of 77 dB $L_{AFmax,15min}$**
Night 1	84.0	77.0	8
Night 2	82.0	74.0	5
Night 3	80.0	77.0	3
Measurement Position MP2			
Measurement Period ('t')	**$L_{AFmax,15min}$**	***SMR $L_{AFmax,15min}$**	**No. of Exceedances of 63 dB $L_{AFmax,15min}$**
Night 1	76.0	44.0	8

Table 2.0 – Maximum Sound Level Summary Results – MP1 and MP2

**Statistically Most Repeated*

3. Internal Noise Design Criteria

This section highlights the guidance outlined in BS8233:2014 and the criteria used in to achieve appropriate internal noise levels.

BS8233:2014 'Guidance on Sound insulation and noise reduction for buildings'

BS8233 provides guidance on noise levels from sources without specific character in the built environment, based on the recommendations of the World Health Organization; specifically, 'WHO Guidelines on Community Noise, 1999'. The Guidelines on Community Noise (1999) document defines community noise to include noise from "industries" and "construction". The desirable criteria levels of steady state, "anonymous" noise in unoccupied spaces within dwellings, from sources such as road traffic, mechanical services and other continuously running plant, are tabulated below:

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 3.0 – BS8233:2014 Internal Noise Level Criteria

It should be noted that the WHO Guidelines should be considered as aspirational. Furthermore, BS8233:2014 states that where development is considered necessary or desirable, despite external noise levels that are above WHO guidelines, the target levels may be relaxed by up to 5 dB.

It is stated that the desirable internal and external noise criteria outlined in Table 4.0 of BS8233, are based on anonymous steady state sources and where there are normal diurnal fluctuations in external noise. Where the external noise climate comprises of dominant non-anonymous sources or does not follow normal diurnal fluctuations an alternative assessment period may be appropriate.

Commercial Noise Penalties and BS4142:2014

BS4142:2014 provides commentary on situations where new noise sensitive premises are introduced to a site and where the new development incorporates specific noise control measures. Section 8.5 of the Standard states '*Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognised that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances, other guidance and criteria in addition to, or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.*'

In addition, the standard states that it uses outdoor levels to assess the likely effects of sound on people who might be inside or outside a dwelling upon which the sound is incident. Where this is applied to new dwellings, the context is important. Subsequent to the publication of the standard, guidance notes have been issued in this respect.

Section 11 of the Standard advises that '*When making assessments and arriving at decisions… it is essential to place the sound in context'* and further clarifies this by stating '*Where the initial estimate*

of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following…

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;

i) façade insulation treatment

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

iii) acoustic screening'

This commentary implies, therefore, that all control measures should be taken into consideration and that sound levels within a dwelling after allowance for these measures may be assessed on the basis of other design criteria appropriate to residential property.

During the site visit, it was noted that plant noise emissions were consistently audible at the rear façade of the property. In order to account for this, a rating penalty will be added to the measured day time and night time noise levels. In accordance with BS4142:2014, a +3 dB penalty will be applied to account for the intermittent nature of the plant noise emissions. Further to this, the façade sound reduction will be calculated using the highest 1-hour measurements from both measurement positions, as opposed to the average 16-hour and 8-hour measurements specified in BS8233:2014. We consider this to be a robust assessment method.

4. Noise Break-in Assessment

Noise Break-in Assessment

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

In order to fully protect the amenity of future occupants from the surrounding road noise and commercial activity, the noise break-in assessment has been conducted based on the following:

- The highest 1-hour measurements during the day and night time periods recorded at MP1 and MP2.
- The BS4142:2014 rating penalty for measurements recorded at MP2 during the day time and night time.
- The $L_{AFmax,15min}$ exceeded fewer than 10 times during the night time recorded at MP1 and MP2.

The façade sound reduction and predicted internal noise levels are calculated assuming the following criteria:

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and the principles of BS EN 12354-3. Further details of the calculations can be found in Appendix E.
- The reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room in the UK. This value is used for both living rooms and bedrooms.
- The room and window dimensions are taken from the architect's plans and elevations. The calculations are undertaken for those rooms most exposed to noise ingress as a worst-case scenario. It is thought that if these have sufficient sound insulation to meet the appropriate internal noise criteria, noise levels in less exposed but similarly protected rooms will be lower and therefore also comply with the appropriate internal noise criteria. The most exposed rooms are those with the largest ratio of window area to room volume, as well as those closest and most exposed to the noise sources. Further details can be found in Appendix C.
- The acoustic performance of the glazing systems is taken from the Pilkington glazing catalogue.

Façade Allocation

The measured sound levels at the façades of the property vary significantly. In order to correctly specify the required sound reduction, the façades have been divided into two colour groups: red and green. Appropriate models of glazing and ventilation for each façade colour are shown in Tables 4.0 and 5.0.

Figure 2.0 – Façade Colour Grouping

Glazing Specification

Windows can be considered the weakest point of a façade in terms of reduction of external noise. The glazing unit shown in the following table provides a suitable sound reduction, however any other window capable of providing this attenuation will be suitable provided the glazing suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation. The performance is specified for the whole window unit, including frame and other design features.

Green and Red Façades – Living Rooms and Bedrooms – Glazing Configuration									
Double Glazing 8mm Glass – 16mm Argon Cavity – 8.8mm Optiphon Glass									
Description	**Octave Band $L_{eq,t}$ (Hz, dB)**							**R_W**	**$R_W + C_{tr}$**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
Sound Reduction (R, dB)	21.0	21.0	30.0	39.0	47.0	50.0	55.0	42.0	34.0

Table 4.0 – Glazing Specification – All Façades – Living Rooms and Bedrooms

Open Window Assessment and Ventilation Strategy

In the following section, the ventilation requirements for the proposed development are assessed.

According to the 'Acoustics Ventilation and Overheating Guide' (AVO Guide), considering the noise levels measured on site, it is likely that using opening windows as a primary means of mitigating overheating could cause adverse effects. Further to this, in order for opening windows to be relied upon exclusively, internal noise levels should be within the BS8233:2014 criteria with windows partially open. To predict the levels of sound reduction provided by a partially open window, figures have been taken from a report titled: 'Sound Insulation though Ventilated Domestic Windows' compiled for Napier University. The calculations show that the internal noise levels are predicted to be significantly above the criteria, and as such, it is recommended that secondary ventilation is employed.

It is stated in BS8233:2014 that:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice. Alternatively, acoustic ventilation units are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

Considering this, the ventilation system that is shown in the table below achieves the above recommendations.

Green and Red Façades – Through Wall Ventilation (not purge)		
Façade Location	**Model**	**Attenuation (dB)**
Living Rooms and Bedrooms	Greenwoods MA3051	52.0 $D_{n,e,w}$ + C_{tr} (Open)

Table 5.0 – Ventilation Specification

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

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

The following table outlines recommended noise levels from mechanical ventilation in dwellings.

Ventilation Condition	**Possible System**	**Desirable Internal Ambient Noise Levels from Mechanical Services, L_{Aeq} (dB)**		
		Bedrooms	**Living Rooms**	**Bathrooms / Kitchens**
Whole dwelling ventilation	Continuous MEV[1] at low ventilation rates Continuous MVHR[2] at minimum ventilation rates	≤ 26.0	≤ 30.0	--
Extract ventilation	Intermittent Extract Fans Continuous MEV at high ventilation rates	≤ 26.0	≤ 35.0	≤ 45.0

Table 6.0 – Recommended Internal Noise Levels from Mechanical Ventilation

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

Predicted Internal Noise Levels

A summary of the predicted internal noise levels for the most exposed rooms of the Proposed Development is outlined in the tables below. Where octave band sound levels have been assessed these have been compared to the appropriate Noise Rating Curves (NR Curves).

Red Façade Noise Ingress										
Location / Time Period	**Description**	**Octave Band $L_{eq,t}$ (Hz, dB)**							**Overall (dBA)**	**$L_{Amax,t}$ (dB)**
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
Living Room – Day Time	Façade Noise Ingress	50.0	42.0	39.0	30.0	18.0	8.0	-4.0	33.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-9.0	-6.0	0.0	-4.0	-12.0	-18.0	-28.0	-2.0	--
Bedroom – Day Time	Façade Noise Ingress	49.0	39.0	37.0	28.0	18.0	6.0	-6.0	31.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-10.0	-9.0	-2.0	-6.0	-12.0	-20.0	-30.0	-4.0	--
Bedroom – Night Time	Façade Noise Ingress	48.0	34.0	30.0	20.0	10.0	2.0	-8.0	26.0	35.0
	NR25 Curve	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
	Exceedance of NR25 Curve	-7.0	-9.0	-5.0	-9.0	-15.0	-19.0	-27.0	-4.0	-10.0

Table 7.0 – Internal Noise Levels – Red Façades

Green Façade Noise Ingress										
Location / Time Period	**Description**	**Octave Band $L_{eq,t}$ (Hz, dB)**							**Overall (dBA)**	**$L_{Amax,t}$ (dB)**
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
Bedroom – Day Time	Façade Noise Ingress	45.0	45.0	36.0	21.0	15.0	3.0	-8.0	32.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-14.0	-3.0	-3.0	-13.0	-15.0	-23.0	-32.0	-3.0	--
Bedroom – Night Time	Façade Noise Ingress	40.0	32.0	25.0	11.0	2.0	-7.0	-14.0	20.0	21.0
	NR25 Curve	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
	Exceedance of NR25 Curve	-15.0	-11.0	-10.0	-18.0	-23.0	-28.0	-33.0	-10.0	-24.0

Table 8.0 – Internal Noise Levels – Green Façades

Discussion

As can be seen in the tables above, provided the specified glazing is installed, the internal noise levels are predicted within the BS8233:2014 criteria in all octave band frequencies. Further to this,

the internal noise levels for rooms at the rear façades are predicted to be a minimum of 3 dB below the criteria. This accounts for the BS4142:2014 penalty specified in Section 3.0.

External Noise Assessment

The following table analyses the predicted noise levels in the external balcony areas. The predicted noise level has been taken from the loudest 16-hour day time measurement recorded at Measurement Position MP1.

Time Period	Measured Level	BS8233:2014 Criteria (dB $L_{Aeq,16hour}$)	Level Above Criteria (dB)
Day time	60.0	50.0 – 55.0	+5.0

Table 9.0 – External Noise Level Analysis

Discussion

As can be seen in the table above, the noise levels in the balcony areas are predicted to be 5 dB above the BS8233:2014 criteria, however, it is expected that the glass barriers will provide the required attenuation (-5 dB from partial acoustic shielding). As such, no further mitigation is recommended.

5. Structural Elements

The noise levels within the dwelling will be dictated by the configuration, materials, and elements of the façade. The non-glazed elements of the facade will contribute significantly to the reduction of ambient noise levels.

The following section outlines the required sound insulation that should be provided by the non-glazed elements of the façade to protect the amenity of the future residents. The sound insulation scheme should be installed prior to occupation and be retained thereafter.

a) Façade Construction

The façade construction for lightweight or heavyweight constructions is likely to provide ample levels of sound insulation, and for the purposes of this report it is assumed the façade provides a minimum sound reduction of 50.0 dB R_w.

b) Roof Construction

If the development has rooms within the roof space the roof system will require additional sound insulation to achieve appropriate internal noise levels. Where the roof, is being utilised as a voided loft space with thermal insulation the following detailing is not required. Where rooms are within the roof, the ceilings should consist of standard roofing slates, 100mm 45kg/m^3 insulation fitted tightly between the 200mm roof joists and 1no. 15mm SoundBloc plasterboard fixed to British Gypsum RB1 resilient bars to achieve a minimum sound reduction of 50dB R_w. Any other configuration of roof that would achieve at least 50dB R_w would also be suitable for the development.

6. Noise Breakthrough Assessment

The proposed development contains commercial units on the ground floor, and commercial units are also located in the buildings adjacent to the west and south. As such the level of noise breaking through the floor and wall partitions must be assessed. As the commercial units are used for retail, they are not expected to generate high levels of noise, however, to ensure the amenity of future residents is fully protected, it is recommended that the separating partitions achieve a minimum of 10 dB above the criteria shown in Part E of Building regulations. As such, the floor and wall adjoining the commercial units must score a minimum of 53 dB $D_{nT,w} + C_{tr}$ when tested for airborne sound attenuation.

A floor construction that is predicted to achieve this level of attenuation is shown below.

- 150mm Concrete (min. density of 1600 kg/m^3)
- Gyproc Acoustic Hangers
- 150mm MF Ceiling with 50mm RW45 Insulation (min. density of 45 kg/m^3)
- 2no. 15mm SoundBloc Plasterboards

A wall construction that is predicted to achieve this level of attenuation is shown below.

- 200mm Brickwork
- 48mm Steel Studwork with 50mm Mineral Wool Insulation (min. density of 10 kg/m^3)
- Resilient Bars
- 2no. 15mm SoundBloc Plasterboards

Appendix A – Acoustic Terminology

Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. Lmax is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L90 can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L10 can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

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

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

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

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

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

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

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

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

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

Appendix B – Legislation, Policy and Guidance

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

B.1 – National Planning Policy Framework (2021)

Government policy on noise is set out in the National Planning Policy Framework (NPPF), published in 2021. This replaced all earlier guidance on noise and places an emphasis on sustainability. In section 15, Conserving and enhancing the natural and local environment, paragraph 174e, it states:

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

Paragraph 185 states:

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

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

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

Paragraph 185 of the NPPF also refers to advice on adverse effects of noise given in the Noise Policy Statement for England (NPSE). This document sets out a policy vision to:

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

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

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

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

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

SOAEL – Significant Observed Adverse Effect Level

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

LOAEL – Lowest Observed Adverse Effect Level

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

NOEL – No Observed Effect Level

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

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

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

B.3 – BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'

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

Activity	Location	07:00 – 23:00	23:00 – 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hour}$	--
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

Table 10.0 – BS8233:2014 Internal Noise Level Criteria

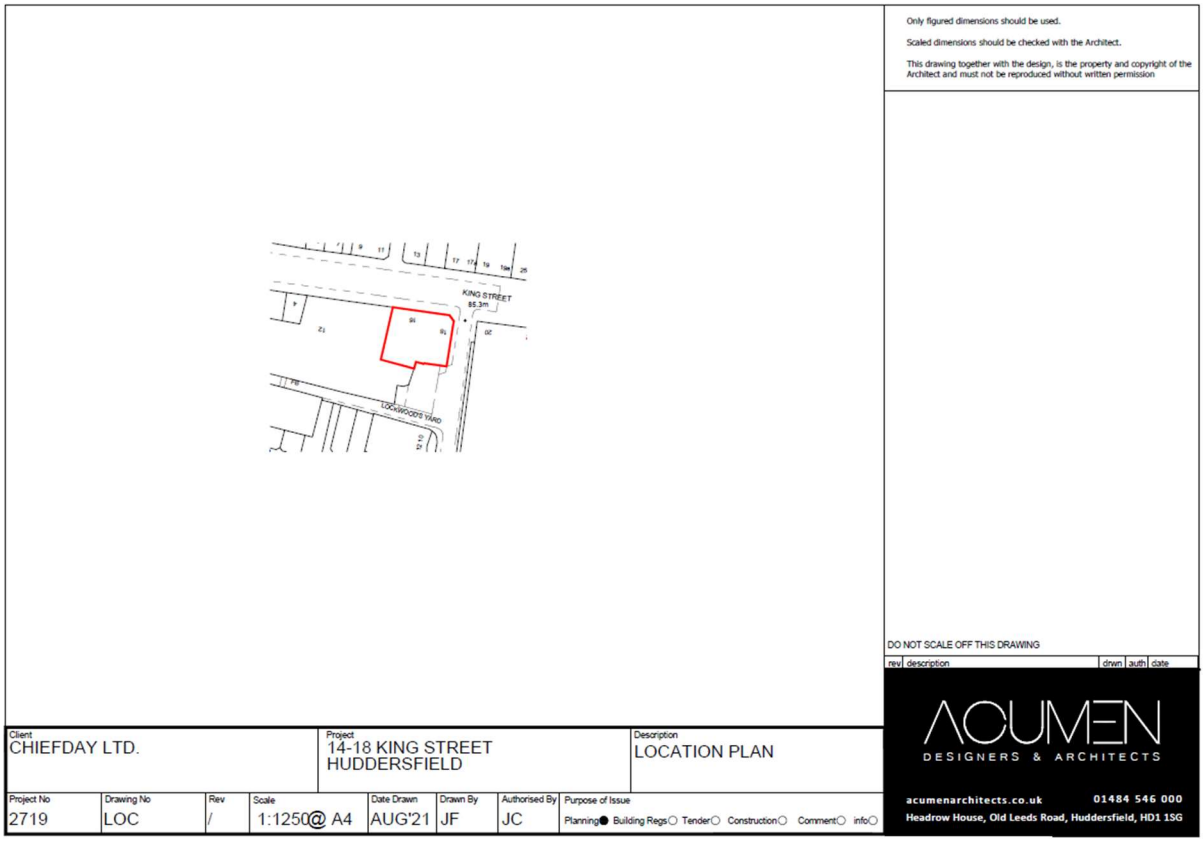
It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

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

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

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

Appendix C – Location and Site Plans




SHOP SIGNAGE
PRINCESS STREET ELEVATION
(EAST)
SHOP SIGNAGE
SHOP SIGNAGE
KING STREET ELEVATION
(NORTH)
ACUMEN
DESIGNERS & ARCHITECTS
CHEFDAY LTD.
14-18 KING STREET
HUDDERSFIELD
2719
(100)05
PROPOSED NORTH &
EAST ELEVATIONS
1:50@A1
AUG'21
JF
JC

Appendix D – Environmental Survey

D.1 – Tabulated Summary Noise Data

Measurement Position MP1									
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**	**$L_{Amax,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
17/12/21: 13:00 – 23:00	64.0	57.0	53.0	55.0	53.0	47.0	37.0	56.0	82.0
17/12/21: 23:00 – 07:00	66.0	54.0	50.0	54.0	53.0	48.0	40.0	56.0	84.0
18/12/21: 07:00 – 23:00	59.0	57.0	56.0	56.0	55.0	51.0	41.0	59.0	90.0
18/12/21: 23:00 – 07:00	67.0	55.0	49.0	51.0	50.0	45.0	33.0	54.0	82.0
19/12/21: 07:00 – 23:00	58.0	56.0	61.0	60.0	56.0	49.0	43.0	60.0	82.0
19/12/21: 23:00 – 07:00	57.0	51.0	54.0	52.0	49.0	47.0	41.0	54.0	80.0
20/12/21: 07:00 – 09:15	62.0	62.0	59.0	58.0	56.0	52.0	47.0	60.0	93.0

Table 11.0 – Sound Survey Summary Results – MP1

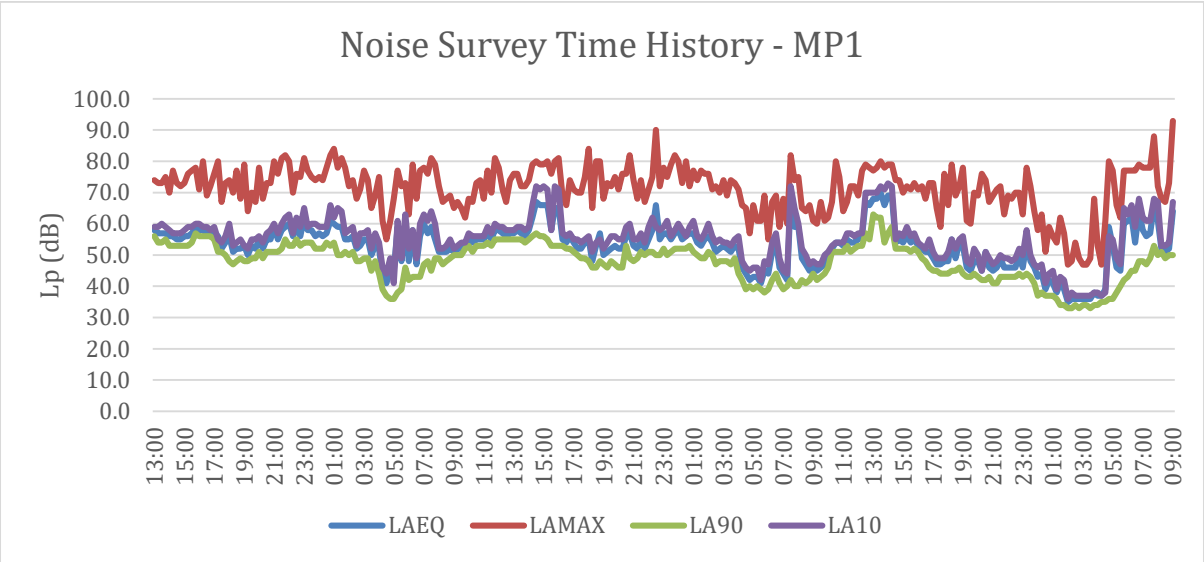


Figure 3.0 – Noise Survey Time History – MP1

Measurement Position MP2									
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**	**$L_{Amax,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
13/01/22: 13:00 – 23:00	64.0	66.0	63.0	57.0	56.0	50.0	43.0	61.0	87.0
13/01/22: 23:00 – 07:00	55.0	50.0	51.0	44.0	42.0	39.0	35.0	48.0	76.0
14/01/22: 07:00 – 12:00	66.0	66.0	60.0	55.0	52.0	49.0	42.0	58.0	102.0

Table 12.0 – Sound Survey Summary Results – MP2

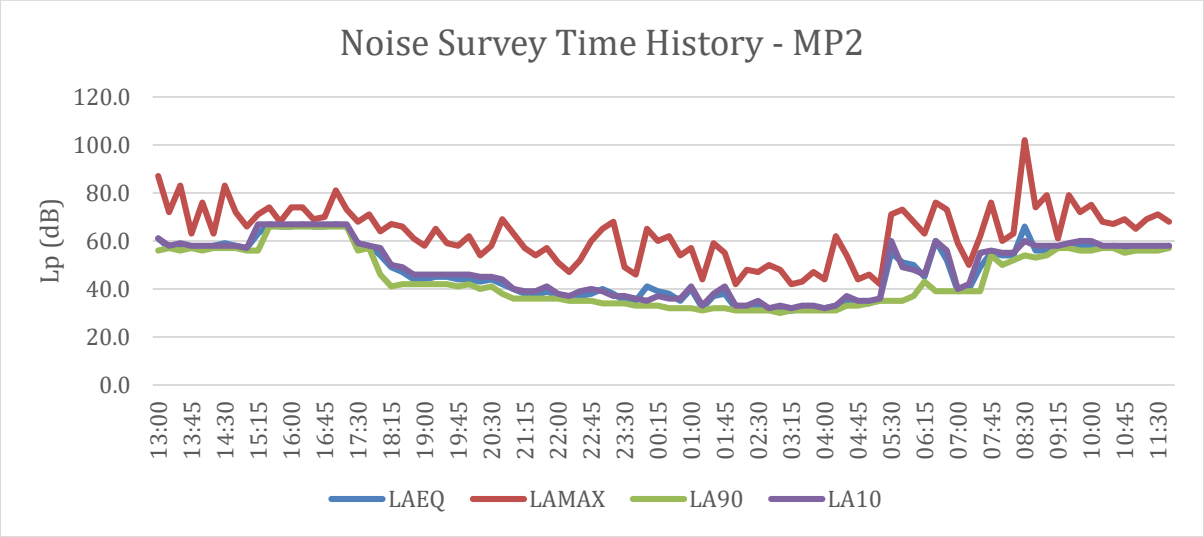


Figure 4.0 – Noise Survey Time History – MP2

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
CESVA SC420 Class 1 Sound Level Meter	T246452	≤0.5
CESVA CB006 Class 1 Calibrator	901997	

Table 13.0 – Measurement Equipment

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

D.3 – Meteorological Conditions

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

Weather Conditions – Lindley (Approx. 3km North-West of Site)				
Time Period	**Air Temp (°C)**	**Rainfall (mm/h)**	**Prevailing Wind Direction**	**Wind Speed (m/s)**
17/12/21: 00:00 – 23:59	1.8 – 7.1	0.0	SSW	0.0 – 0.6
18/12/21: 00:00 – 23:59	0.0 – 4.3	0.0	SSE	0.0 – 0.6
19/12/21: 00:00 – 23:59	-0.6 – 3.7	0.0 – 1.8	WSW	0.0 – 0.2
20/12/21: 00:00 – 23:59	3.1 – 4.3	0.0 – 1.8	SE	0.0 – 0.8
13/01/22: 00:00 – 23:59	4.4 – 6.5	0.0	WSW	0.0 – 2.8
14/01/22: 00:00 – 23:59	0.4 – 5.8	0.0	W	0.0 – 2.4

Table 14.0 – Weather Summary

Appendix E – Façade Sound Reduction Calculations

E1 – Red Façades

Living Room	
Volume m^3 (V)	67.7
Window Area m^2 (S)	10.4
T60 s (T)	0.5
No. of vents required	2

Bedroom	
Volume m^3 (V)	35.0
Window Area m^2 (S)	3
T60 s (T)	0.5
No. of vents required	2

Living Room Day Time, 07:00 - 23:00								
Description	Sound Pressure Level Leq (dB)							Overall (dBA)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Daytime Free-Field Noise Level	70.0	63.0	69.0	68.0	64.0	58.0	50.0	68.0
Rw of Glazing	21.0	21.0	30.0	39.0	47.0	50.0	55.0	34.0
Façade Noise Ingress (Glazing)	49.0	42.0	39.0	29.0	17.0	8.0	-5.0	33.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	43.0	20.0	27.0	21.0	12.0	-4.0	-14.0	19.0
Total Ingress	50.0	42.0	39.0	30.0	18.0	8.0	-4.0	33.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-9.0**	**-6.0**	**0.0**	**-4.0**	**-12.0**	**-18.0**	**-28.0**	**-2.0**

Bedroom Day Time, 07:00 - 23:00								
Description	Sound Pressure Level Leq (dB)							Overall (dBA)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Daytime Free-Field Noise Level	70.0	63.0	69.0	68.0	64.0	58.0	50.0	68.0
Rw of Glazing	21.0	21.0	30.0	39.0	47.0	50.0	55.0	34.0
Façade Noise Ingress (Glazing)	46.0	39.0	36.0	26.0	14.0	5.0	-8.0	30.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	46.0	23.0	30.0	24.0	15.0	-1.0	-11.0	26.0
Total Ingress	49.0	39.0	37.0	28.0	18.0	6.0	-6.0	31.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-10.0**	**-9.0**	**-2.0**	**-6.0**	**-12.0**	**-20.0**	**-30.0**	**-4.0**

Bedroom Night Time, 23:00 - 07:00									
Description	Sound Pressure Level Leq (dB)							Overall (dBA)	LAmax
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
Night Time Free-Field Noise Level	69.0	58.0	62.0	60.0	56.0	54.0	48.0	62.0	77.0
Rw of Glazing	21.0	21.0	30.0	39.0	47.0	50.0	55.0	34.0	42.0
Façade Noise Ingress (Glazing)	45.0	34.0	29.0	18.0	6.0	1.0	-10.0	25.0	35.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0	55.0
Façade Noise Ingress (Ventilation)	45.0	18.0	23.0	16.0	7.0	-5.0	-13.0	16.0	22.0
Total Ingress	48.0	34.0	30.0	20.0	10.0	2.0	-8.0	26.0	35.0
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Exceedance of Criteria	**-7.0**	**-9.0**	**-5.0**	**-9.0**	**-15.0**	**-19.0**	**-27.0**	**-4.0**	**-10.0**

E2 – Green Façades

Bedroom	
Volume m^3 (V)	43.5
Window Area m^2 (S)	2.5
T60 s (T)	0.5
No. of vents required	2

Bedroom Day Time, 07:00 - 23:00								
Description	Sound Pressure Level Leq (dB)							Overall (dBA)
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Daytime Free-Field Noise Level	67.0	70.0	69.0	62.0	62.0	56.0	49.0	66.0
Rw of Glazing	21.0	21.0	30.0	39.0	47.0	50.0	55.0	34.0
Façade Noise Ingress (Glazing)	42.0	45.0	35.0	19.0	11.0	2.0	-10.0	31.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	42.0	29.0	29.0	17.0	12.0	-4.0	-13.0	23.0
Total Ingress	45.0	45.0	36.0	21.0	15.0	3.0	-8.0	32.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-14.0**	**-3.0**	**-3.0**	**-13.0**	**-15.0**	**-23.0**	**-32.0**	**-3.0**

Bedroom Night Time, 23:00 - 07:00									
Description	Sound Pressure Level Leq (dB)							Overall (dBA)	LAmax
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
Night Time Free-Field Noise Level	62.0	57.0	58.0	52.0	49.0	46.0	43.0	55.0	63.0
Rw of Glazing	21.0	21.0	30.0	39.0	47.0	50.0	55.0	34.0	42.0
Façade Noise Ingress (Glazing)	37.0	32.0	24.0	9.0	-2.0	-8.0	-16.0	20.0	21.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0	55.0
Façade Noise Ingress (Ventilation)	37.0	16.0	18.0	7.0	-1.0	-14.0	-19.0	8.0	8.0
Total Ingress	40.0	32.0	25.0	11.0	2.0	-7.0	-14.0	20.0	21.0
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Exceedance of Criteria	**-15.0**	**-11.0**	**-10.0**	**-18.0**	**-23.0**	**-28.0**	**-33.0**	**-10.0**	**-24.0**

Appendix F – AVO Guide Level 1 Site Risk Assessment