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

Client:	SA Associates
Client Address:	Pollard Street South, Milnsbridge, Huddersfield, HD3 4NB
Site Address:	61-65 New Street, Huddersfield, HD1 2BQ
Date:	13/04/2023

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Version Reference	002
Amendments Summary	This version of the report has been provided to answer the LPA comments concerning the commercial noise emissions at Albert Yard.

Disclaimer

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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 61 – 65 New Street, Huddersfield, HD1 2BQ 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 background ventilation strategy. In order to ensure the amenity of residents is fully protected against commercial noise in the area, the Specific Noise Level from the commercial activity at Albert Yrad has been assessed, in line with BS4142:2014 recommendations. Further to this, the façade sound reduction has been calculated based on the loudest 1-hour measurements as opposed to the average 16-hour and 8-hour measurements specified in BS8233:2014. As such, it should be considered to provide a more robust assessment method.

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

Recommendations and Mitigation Overview
- Appropriate glazing specifications can be found in Tables 6.0, 7.0 and 8.0. - Appropriate background ventilation can be found in Table 9.0. - It is recommended that the partitions between the proposed residential development and adjoining retail units score a minimum of 53 dB $D_{nT,w}$ + C_{tr} when tested for airborne sound insulation. Construction details that are predicted to provide this level of attenuation can be found in Section 8.0.

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 61 – 65 New Street, Huddersfield, HD1 2BQ ('the Site').

The applicant has submitted a planning application, 2021/62/93305/W – *'Change of use and conversion of existing buildings, erection of split-level seven storey extension comprising four-storey stairwell, five-storey roof-top tower block and enclosed courtyard to form 31 dwellings and sub-division of the retail unit forming 61-63 New Street (Listed Building within a Conservation Area)'* ('the Application) to Kirklees Council. Kirklees Council has requested additional supporting documentation in order to approve the application.

A previous report (Ref. 7062SA) was submitted with the planning application. Comments were raised by the LPA concerning the fact that the initial environmental noise assessment was carried out when some restrictions due to covid were still in place. It was the client's impression that the surrounding public house was working on a normal basis, however, further noise measurements were required.

In addition, further comments were raised about report Ref. 7856SA Version one in relation to the "*…noise from the use or for collections of the commercial waste which services the commercial units and is stored in Albert Yard…".* Hence, the Specific Noise Level from the commercial activity at Albert Yrad has been assessed.

Therefore, the following technical noise assessment has been prepared to support the planning application to Kirklees Council with a new environmental noise survey carried out at the same measurement positions once the covid restrictions have been removed. 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.

2. Environmental Noise Survey

Measurement Methodology

In order to characterise the sound profile of the area at the proposed development, an environmental sound survey was carried out from 27/05/2022 to 30/05/2022. For the long-term monitoring, two sound level meters were used: one was placed protruding from a window at the front façade of the property (MP1) and the other was placed protruding from a window at the rear façade (MP2). Both microphones were positioned at 1st floor level approximately 1m from the façades of the building. The monitoring positions were chosen in order to collect representative sound levels at the proposed development during the daytime and night-time periods. The monitoring locations are shown in Figure 1.0 below.

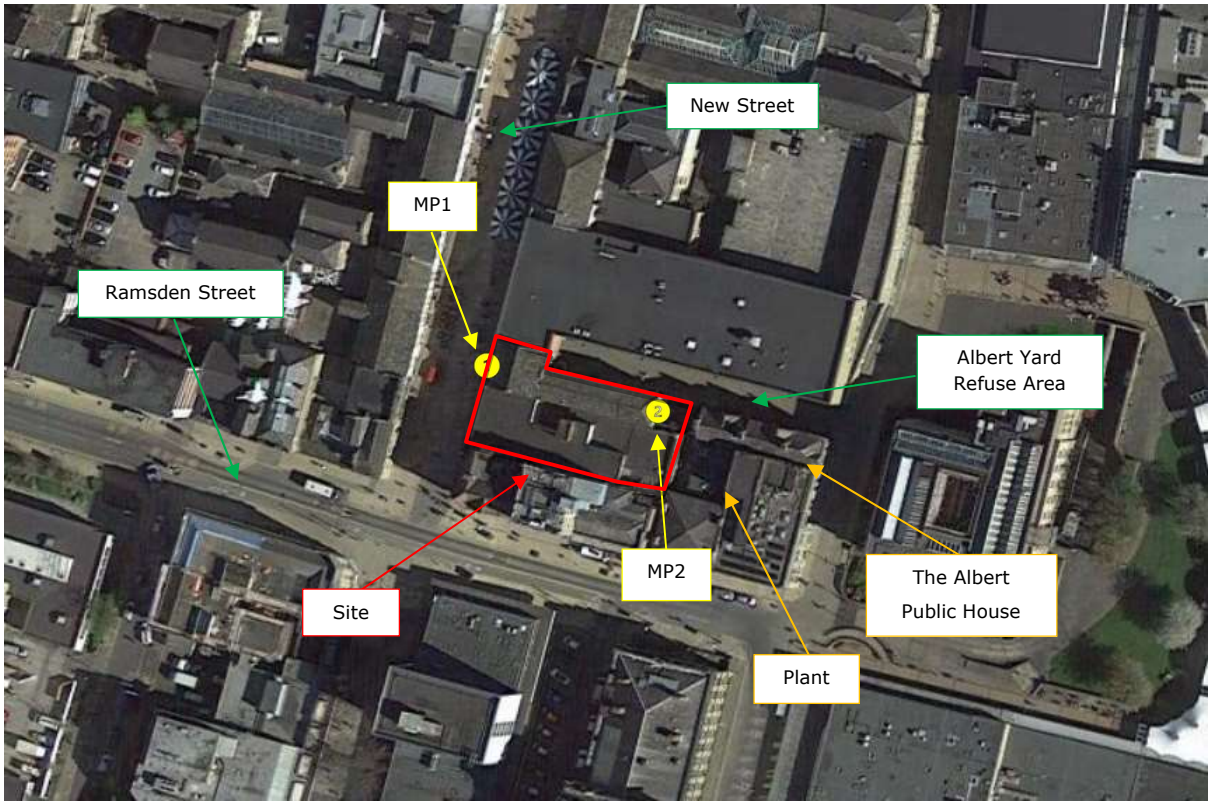


Figure 1.0 – Indicative Site Layout

Context & Subjective Impression

The proposal is for the change of use of the existing building and the erection of split-level seven storey extension to form 31 dwellings and sub-division of the retail unit.

The area surrounding the site is primarily commercial in nature with a minority of residential dwellings. At the front, the noise profile is typical for this type of area and is dominated by road traffic noise emissions from surrounding roads and footfall from pedestrians and patrons of the local retail units and public houses. Plant units are located to the rear of the site which service the neighbouring public house (The Albert). A commercial refuse area associated with the surrounding commercial premises (The Albert, The Rock Café and Cask Ales) can be found in Albert Yard, located to the north of the proposed development. Buses frequently pass by the property to the south. Therefore, at the rear, the noise profile is also dominated by road and patron noise:

however, the sporadic noise emissions from commercial activity at Albert Yard are assumed to be dominant when occurring.

Environmental Noise Survey Results

It is stated in BS8233:2014 that the integration periods for a residential noise assessment should typically be 16 hours for daytime and 8 hours for night-time. However, due to the nature of the sound climate of the area, which includes noise coming from surrounding commercial mechanical plant and refuse area, a more stringent integration period of 1-hour will be used to provide a conservative and robust approach. The following table outlines the highest octave band $L_{eq,1hr}$ sound levels measured during the daytime and night-time periods that will be used in the noise break in assessment. Both environmental noise surveys (Ref 7062SA and Ref 7856SA)) have been assessed and the highest values from both are presented. A full summary of all results can be found in Appendix D.

Measurement Position MP1 – 7856SA								
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)	66.0	60.0	58.0	62.0	62.0	63.0	55.0	65.0
Highest $L_{eq,1hr}$ (Night)	79.0	64.0	64.0	60.0	57.0	55.0	47.0	62.0
Measurement Position MP2 – 7856SA								
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	62.0	54.0	59.0	62.0	57.0	50.0	64.0
Highest $L_{eq,1hr}$ (Night)	67.0	62.0	50.0	53.0	51.0	46.0	42.0	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 72 dB $L_{AFMax,15min}$**
Night 1	89.0	73.0	10
Night 2	85.0	66.0	3
Night 3	87.0	70.0	2

Measurement Position MP2			
Measurement Period ('t')	**$L_{AFMax,15min}$**	***SMR $L_{AFMax,15min}$**	**No. of Exceedances of 68 dB $L_{AFMax,15min}$**
Night 1	83.0	65.0	8
Night 2	83.0	65.0	10
Night 3	76.0	76.0	5

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.

It is stated in BS8233 that:

> *"This subclause applies to external noise as it affects the internal acoustic environment from sources without specific character, previously termed "anonymous noise". Occupants are usually more tolerant of noise without a specific character than, for example, that from neighbours which can trigger complex emotional reactions. For simplicity, only noise without character is considered in Table 4.0. For dwellings, the main consideration are:*
>
> *a.) For bedrooms, the acoustic effect on sleep; and*
> *b.) For other rooms, the acoustic on resting, listening and communicating.*
>
> *NOTE: 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."*

It is clear from this statement that noise that is not considered to be "anonymous" in nature may require more stringent noise criteria than is typically recommended for anonymous steady-state noise sources. This could include applying penalties to account for specific acoustic characteristics that may be deemed to cause increased annoyance or a shortening of the assessment period.

Paragraph 6.5.2 of BS8233 states the following for residential developments in areas affected by industrial noise:

> *"Where industrial noise affects residential or mixed residential areas, the methods for rating the noise in BS4142 should be applied. BS4142 describes methods for determining, at the outside of a building:*
>
> *a.) Noise levels from factories, industrial premises or fixed installations, or sources of an industrial nature in commercial premises; and*
> *b.) Background noise level."*

The paragraph above states that the methods for rating the noise in BS4142 should be applied (specifying a rating level (L_{Ar})). It does not imply that a BS4142 'assessment' should be conducted, the reference to the background noise level is simply stating the scope of BS4142.

As with the internal noise levels, it is recommended that the character of the industrial noise source affecting external areas is accounted for by applying the rating corrections provided within BS4142.

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. These design measures should also be weighed against other factors of sustainable development.

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 existing 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 the required noise mitigation."*

From this it can be inferred that standards other than BS4142 can also be considered in the context

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:*

1.) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2.) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3: Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available.

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"

Where the impact affects internal noise levels it is necessary to develop a mitigation scheme in the form of façade insulation and alternative ventilation. Section 11 of BS4142:2014 implies 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. As such, it is thought that the provided the façade sound reduction is specified considering the BS4142 rating noise level, the amenity of future residents can be fully protected.

BS4142:2014 Rating Calculations of Surrounding Commercial Activity

The following section relates specifically to the noise emissions associated with the rear commercial refuse area and plant units from the surrounding commercial premises. This section defines the BS4142:2014 Rating Noise Levels used to conduct the BS8233:2014 noise break-in assessment and generate the subsequent sound insulation scheme.

Analysis of the measurements recorded at Measurement Position 2 (MP2) shows that the noise profile is dominated by traffic noise and patron noise as expected from such a central location. In addition, when Albert Yard is used as a refusal area for surrounding commercial premises, those noise emissions can become the dominant noise sources over the traffic and patron noise. That can be further corroborated in Appendix D.

To assess these noise emissions, a BS4142:2014 rating noise level must be defined. The specific sound level has been calculated by subtracting the residual sound level without the business in operation from the overall ambient sound level (during operational hours). No exact operation hours of the refusal yard are available; therefore, the following approach has been taken to provide a robust indicative assessment.

The ambient sound level has been taken from the highest 1-hour for daytime and the highest 15-minute for night-time while the residual has been taken from the lowest 1-hour and 15-minute data. In addition, a rating penalty is then applied to account for audible characteristics of the sound which may be deemed to cause increased annoyance, such as intermittency or impulsivity.

The following table presents the calculated Specific Noise Levels for both the day and night-time periods, assuming the reference assessment periods as specified within BS4142:2014 of 1-hour during the day and 15-minute during the night.

BS4142:2014 Specific Noise Levels – MP2								
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	
Ambient Noise Level – MP2 (Day 3: 18:00 – 19:00)	51.0	55.0	49.0	59.0	62.0	57.0	50.0	64.0
Residual Noise Level – MP2 (Day 3: 07:00 – 08:00)	46.0	44.0	39.0	36.0	34.0	29.0	20.0	38.0
Day Time Specific Noise Level	49.0	54.0	49.0	59.0	62.0	57.0	50.0	64.0
Ambient Noise Level – MP2 (Night 2: 23:30 – 23:45)	67.0	62.0	50.0	53.0	51.0	44.0	35.0	55.0
Residual Noise Level – MP2 (Night 1: 03:15 – 03:30)	56.0	58.0	43.0	44.0	43.0	39.0	35.0	48.0
Night-Time Specific Noise Level	67.0	62.0	49.0	54.0	54.0	46.0	36.0	57.0

Table 4.0 – BS4142:2014 Specific Noise Levels

In accordance with BS4142:2014, and a +3.0 dB penalty will be applied to all octave frequency bands to account for the delivery noise emissions being intermittent. An additional +2.0 dB penalty is applied to the global level to account for the slight tonality of both delivery and plant noise. This is shown in the following table.

BS4142:2014 Rating Noise Levels								
Measurement Period ('t')	**Octave Band $L_{eq,t}$ (Hz, dB)**							**$L_{Aeq,t}$ (dB)**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	
BS4142:2014 Rating Penalty	+3.0	+3.0	+3.0	+3.0	+3.0	+3.0	+3.0	+5.0
BS4142:2014 Rating Noise Level – MP2 Day Time	N/A	55.0	49.0	61.0	65.0	60.0	53.0	69.0
BS4142:2014 Rating Noise Level – MP2 Night-Time	70.0	58.0	52.0	55.0	53.0	45.0	N/A	59.0

Table 5.0 – BS4142:2014 Rating Noise Levels

To fully protect the amenity of future occupants from commercial noise produced by the adjacent commercial properties, sound reduction of those façades deemed to be affected by the noise emissions will be specified using the highest of the following:

- The highest $L_{Aeq,1hour}$ values measured during the day time and night time at MP1, as opposed to the standard $L_{Aeq,16hr}$ day and $L_{Aeq,8hr}$ night time criteria as prescribed in BS8233:2014, and/or;
- The BS4142:2014+A1:2019 octave frequency band Rating Noise Levels during the day and night time periods.

In either case, the façade sound reduction shall be specified considering the 63Hz octave frequency band in order to account for low frequency components of any commercial noise.

Furthermore, additional mitigation measures shall be recommended where necessary following the 'good acoustic design principles' outlined in the ProPG and Section 1.0 of this report.

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.
- The highest between the measured highest 1-hour and the calculated specific noise from commercial activity (including rated values) during the day and night-time periods at MP2.
- 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 to 8.0. Secondary glazing and double-glazing options have been given for the existing facades when possible.

Figure 2.0 – Façade Colour Grouping

Glazing and Background Ventilation Specification

Windows can be considered the weakest element of a façade in terms of reduction of external noise. The glazing units shown in the following tables provide 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.

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria.

Red Façades – Living Rooms – Secondary Glazing Configuration									
Secondary Glazing 4mm Existing Glass / 100mm Cavity / 4mm 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_W, dB)	13.0	14.0	29.0	38.0	45.0	49.0	42.0	42.0	31.0

Red Façades – Bedrooms – Secondary Glazing Configuration									
Secondary Glazing 4mm Existing Glass / 200mm Cavity / 10mm 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_w, dB)	19.0	33.0	41.0	47.0	48.0	45.0	54.0	50.0	47.0

Table 6.0 – Glazing Specification –Red Façades – Secondary Glazing

Red Façades – Living Rooms – Double Glazing Configuration									
Double Glazing 4mm Glass / 16mm Air Cavity / 4mm 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_w, dB)	19.0	21.0	17.0	25.0	35.0	37.0	31.0	29.0	25.0

Red Façades – Bedrooms – Double Glazing Configuration									
Double Glazing 10mm Glass / 16mm Air Cavity / 6mm 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_w, dB)	23.0	24.0	24.0	32.0	37.0	37.0	44.0	35.0	32.0

Table 7.0 – Glazing Specification – Red Façades – Double Glazing

Green Façades – Living Rooms – Secondary Glazing Configuration									
Secondary Glazing 4mm Existing Glass / 100mm Cavity / 6mm 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_w, dB)	13.0	17.0	32.0	41.0	47.0	48.0	46.0	45.0	35.0

Green Façades – Bedrooms – Double Glazing Configuration									
Double Glazing 12.8mm Optiphon Glass / 20mm Argon Cavity / 16.8mm 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_w, dB)	28.0	35.0	45.0	49.0	50.0	54.0	65.0	51.0	47.0

Table 8.0 – Glazing Specification – Green Façades – Secondary Glazing

The following table shows the background ventilation that achieves the relevant internal noise criteria.

All Façades – Living Rooms & Bedrooms									
Greenwoods MA3051 (Through Wall – EA 2500mm^2) (not purge)									
Description	**Octave Band $D_{n,e}$ (Hz, dB)**							**$D_{n,e,w}$**	**$D_{n,e,w}$ + C_{tr}**
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**		
Sound Reduction	30.0	46.0	45.0	50.0	55.0	65.0	67.0	55.0	52.0

Table 9.0 – Ventilation Specification – All Façades – Bedrooms

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 10.0 – 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.

5. Open Window Assessment and Ventilation Strategy

Internal Noise Levels with Open Windows Criteria

BS8233:2014 states that when relying on closed windows to achieve the internal acoustic design criteria, appropriate alternative ventilation should be provided. Approved Document F states: *"Account should be taken of outside noise when considering whether openable windows are appropriate for purge ventilation"*. If windows are open regularly to provide higher rates of ventilation to mitigate overheating, this will lead to elevated internal noise levels which could lead to undesirable living conditions. If windows are opened rarely the occupants may be able to tolerate elevated noise levels due to the inherent benefits of natural ventilation. To advise if openable windows can be used as the ventilation strategy (whilst maintaining reasonable internal noise levels), an open window assessment will be provided. The suitability of the internal noise levels will be based upon a 5dB relaxation of the internal noise criteria and an open window providing 13dB attenuation. If required, an alternative ventilation strategy compliant with Approved Document F will be proposed.

Open Window Assessment

This assessment will firstly consider whether the internal noise level criteria can be achieved with open windows at the most exposed rooms. The criteria from Table 3 – 3 of the AVO Guide 'Windows Rarely Open'* is shown in the table below for reference.

Green Façade External Noise Levels	BS8233 Relaxed Criteria	Exceedance	AVO Guide Windows Rarely Open	Exceedance
65 $L_{Aeq,1h}$ (Day)	53.0	+12.0	63.0	+2.0
62 $L_{Aeq,1h}$ (Night)	48.0	+14.0	55.0	+7.0
72 $L_{AF,max}$ (Night)	63 .0	+9.0	78.0	-6.0
Red Façade External Noise Levels	**BS8233 Relaxed Criteria**	**Exceedance**	**AVO Guide Windows Rarely Open**	**Exceedance**
69 $L_{Aeq,1h}$ (Day)	53.0	+16.0	63.0	+6.0
59 $L_{Aeq,1h}$ (Night)	48.0	+11.0	55.0	+4.0
68 $L_{AF,max}$ (Night)	63 .0	+5.0	78.0	-10.0

Table 11.0 – Open Window Assessment

**This criterion is taken from the Acoustics Ventilation and Overheating (AVO) Guide, which is relevant to the planning, design, and commissioning of new dwellings. For dwellings formed by material change of use, the alternative 'new dwelling' criteria supports the principle of "Good Acoustic Design".*

As can be seen in the table above, the external noise levels exceed the AVO Guides 'Rarely Open' criteria which means that windows cannot be used for the primary means of ventilation and an

alternate ventilation strategy is required that is capable of a higher rate of ventilation. A mechanical extract ventilation system should be installed to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F. It is understood that continuous MEV extract fans installed in accordance with the specified trickle ventilators to allow the ingress of fresh air will be adequate. The ventilation system should be designed by an appropriately qualified person to ascertain compliance with the relevant Building Regulations. Special consideration should be given to 1.5 to 1.7 of Approved Document F to assist in the design of the ventilation system and to ensure the self-generated noise levels from the MEV extract fans to not exceed the specified criteria. It is noted that the windows will remain openable at the occupant's choice.

6. Predicted Internal Noise Levels

BS8233:2014 states that when relying on closed windows to achieve the internal acoustic design 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 – Secondary Glazing										
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	51.0	45.0	23.0	22.0	19.0	9.0	8.0	31.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-8.0	-3.0	-16.0	-12.0	-11.0	-17.0	-16.0	-4.0	--
Bedroom – Day Time	Façade Noise Ingress	50.0	31.0	19.0	21.0	21.0	16.0	1.0	27.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-9.0	-17.0	-20.0	-13.0	-9.0	-10.0	-23.0	-8.0	--
Bedroom – Night-time	Façade Noise Ingress	53.0	34.0	17.0	16.0	13.0	5.0	-10.0	28.0	19.0
	NR25 Curve	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
	Exceedance of NR25 Curve	-2.0	-9.0	-18.0	-13.0	-12.0	-16.0	-29.0	-2.0	-26.0

Table 12.0 – Internal Noise Levels – Red Façades – Secondary Glazing

Red Façade Noise Ingress – Double Glazing										
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	46.0	38.0	34.0	34.0	27.0	20.0	19.0	34.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-13.0	-10.0	-5.0	0.0	-3.0	-6.0	-5.0	-1.0	--
Bedroom – Day Time	Façade Noise Ingress	48.0	39.0	31.0	31.0	29.0	24.0	10.0	33.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-11.0	-9.0	-8.0	-3.0	-1.0	-2.0	-14.0	-2.0	--
Bedroom –	Façade Noise Ingress	51.0	42.0	29.0	26.0	21.0	13.0	-1.0	30.0	33.0

Night-time	NR25 Curve	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
	Exceedance of NR25 Curve	-4.0	-1.0	-6.0	-3.0	-4.0	-8.0	-20.0	0.0	-12.0

Table 13.0 – Internal Noise Levels – Red Façades – Double Glazing

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**		
Living Room – Day Time	Façade Noise Ingress	50.0	40.0	24.0	20.0	15.0	12.0	6.0	28.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-9.0	-8.0	-15.0	-14.0	-15.0	-14.0	-18.0	-7.0	--
Bedroom – Day Time	Façade Noise Ingress	45.0	27.0	22.0	21.0	17.0	11.0	-3.0	24.0	--
	NR30 Curve	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0	--
	Exceedance of NR30 Curve	-14.0	-21.0	-17.0	-13.0	-13.0	-15.0	-27.0	-11.0	--
Bedroom – Night-time	Façade Noise Ingress	58.0	31.0	28.0	19.0	12.0	3.0	-11.0	27.0	22.0
	NR25 Curve	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
	Exceedance of NR25 Curve	3.0	-12.0	-7.0	-10.0	-13.0	-18.0	-30.0	-3.0	-23.0

Table 14.0 – 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. The only exception is the 63 Hz band, which is exceeded by 3 dB. However, this exceedance is deemed negligible as the human hearing system does not perceive sound pressure differences under 3 dB. Further to this, the internal noise levels are predicted to be a minimum of 3 dB below the criteria in all octave band frequencies at the rear of the development. This is equal to a doubling in external noise sources and accounts for the BS4142:2014 rating penalty shown in Section 3.0.

7. Non-Glazed Façade Elements

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

The 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.

8. Noise Breakthrough Assessment

The proposed development contains commercial units both on the ground floor and in the adjacent buildings, and as such the level of noise breaking through the floor and wall partitions must be assessed. The commercial units are currently vacant, and their intended use is not known. Therefore, for this assessment it has been assumed that the units will be used as retail spaces, which 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 floor achieves a minimum of 10.0 dB above the criteria shown in Part E of Building regulations. This means the floors and walls must score a minimum of 53.0 dB $D_{nT,w} + C_{tr}$ when tested for airborne sound attenuation.

As construction details of the adjoining partitions have not been provided, a prediction based upon observations made on site by the attending engineer has been used for the assessment. It is assumed that the existing partitions are comprised as follows:

Party Floor between GF and FF (Retail 2A&B)

- 22mm Floorboards
- 100mm Timber Joists
- 150mm Steel 'I' Beams
- Approx. 700mm Cavity
- Timber Frame Ceiling (connected to steel beams in places – not independent)
- Plasterboard
- 300mm Cavity
- MF Suspended Ceiling

The current build-up has been modelled with INSUL 9.0 software and it is predicted to score approximately 40 dB $D_{nT,w} + C_{tr}$.

Party Floor between GF and FF (Post Office)

- 22mm Floorboards
- 50mm Timber Battens
- 90mm Timber Joists
- 40mm Timber Battens
- Plasterboard

The current build-up has been modelled with INSUL 9.0 software and it is predicted to score approximately 35 dB $D_{nT,w} + C_{tr}$.

Part Wall

- 200mm Brick

The current build-up has been modelled with INSUL 9.0 software and it is predicted to score approximately 42 dB $D_{nT,w} + C_{tr}$.

The following floor construction is predicted to achieve the required attenuation:

- 18mm Cement Particle Board (min. density of 1600 kg/m^3)
- 18mm Chipboard (min. surface mass of 11.9 kg/m^2)
- 200mm Timber Joists / Steel 'I' Beams
- 100mm RW45 Slab Insulation (min. density of 45 kg/m^3)
- Gyproc Acoustic Hangers
- MF Suspended Ceiling (min. cavity of 150mm)
- 2 x 15mm SoundBloc Plasterboard (min. surface mass per board of 12.6 kg/m^2)

The following Wall construction is predicted to achieve the required attenuation:

- 1 x 15mm SoundBloc Plasterboard (min. surface mass of 12.6 kg/m^2 per board)
- 200mm Concrete/Brick Wall (min. density 1600 kg/m^3)
- 48mm Steel "C" Battens with 25mm RW45 Slab Insulation (min. density of 45 kg/m^2)
- Resilient Bars
- 2 x 15mm SoundBloc Plasterboard (min. surface mass per board of 12.6 kg/m^2)

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 15.0 – BS8233:2014 Internal Noise Level Criteria

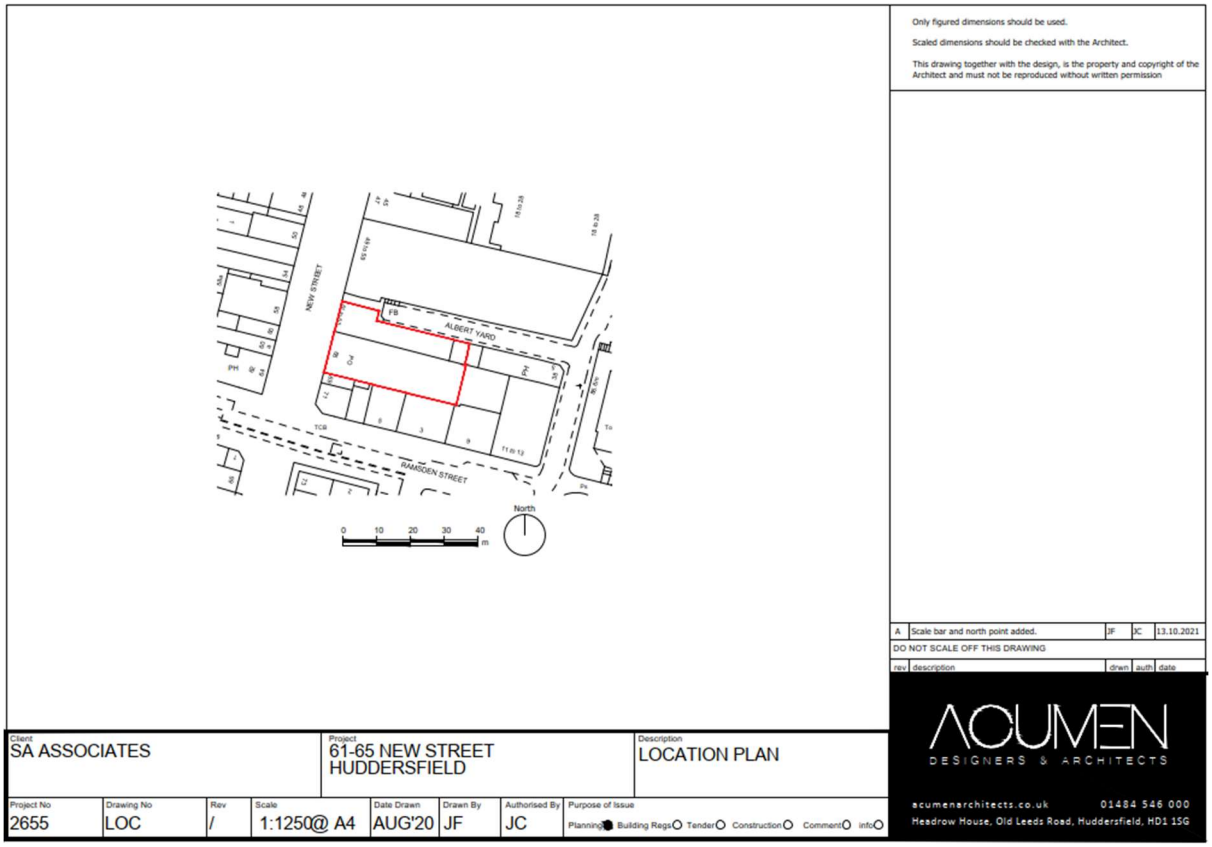
It is noted, however that where development is considered necessary or desirable, despite external noise level above WHO guidelines, the above target levels may be relaxed by up to 5 dB.

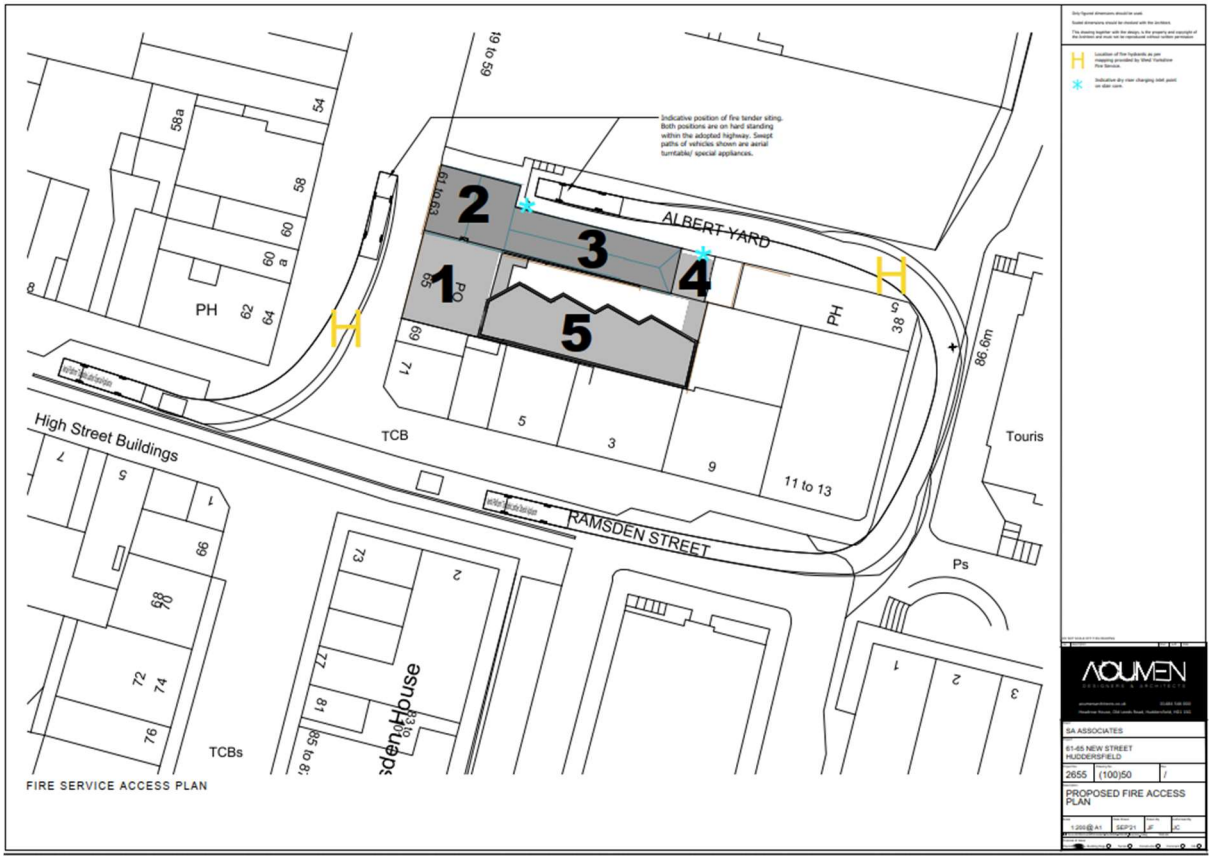
The standard also recommends that for traditional external amenity areas, such as gardens, it is desirable that external noise levels do not exceed 50 dB $L_{Aeq,T}$, and that 55 dB $L_{Aeq,T}$ would be acceptable in noisier environments. However, it is recognised that these values may not be achievable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

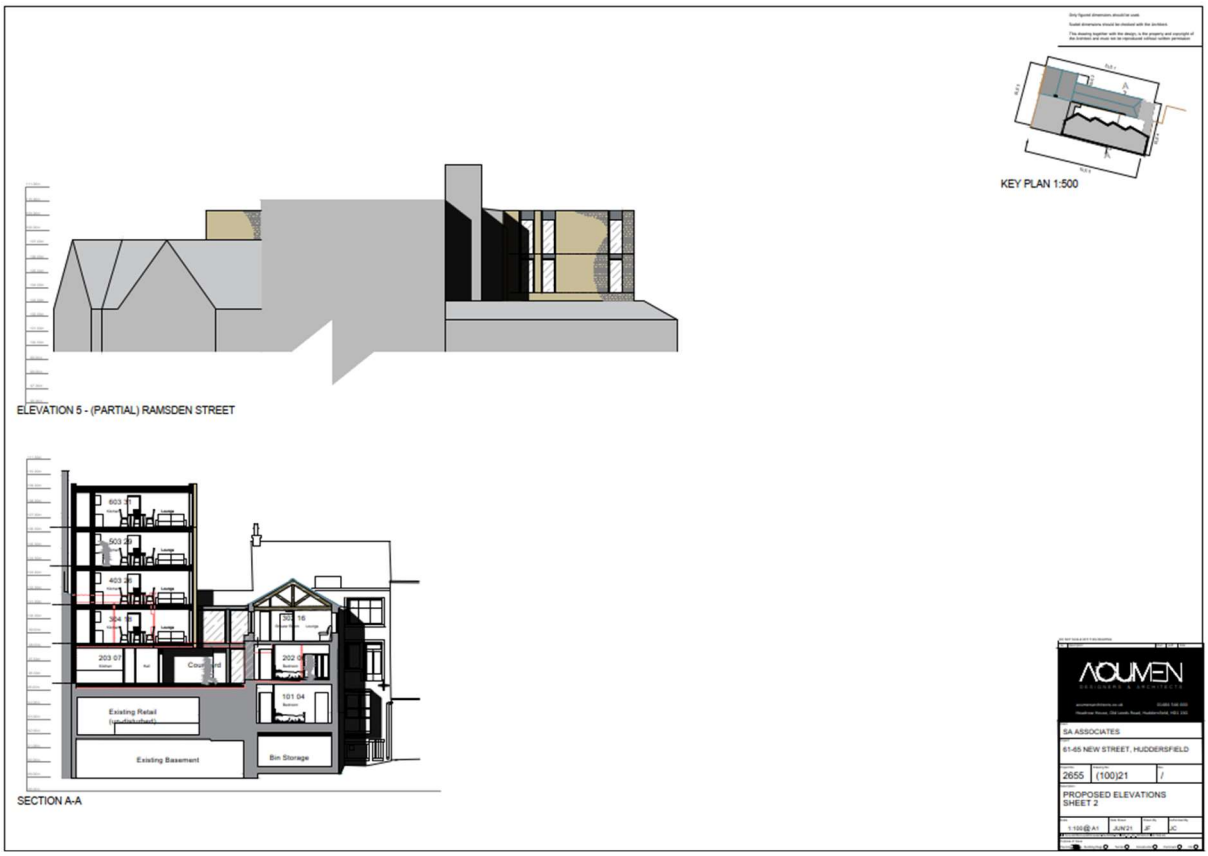
General recommendations for mitigation to enable these targets to be achieved are provided, including the use of bunds and barriers to reduce external noise and space planning and sound insulation for the control of internal noise levels.

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

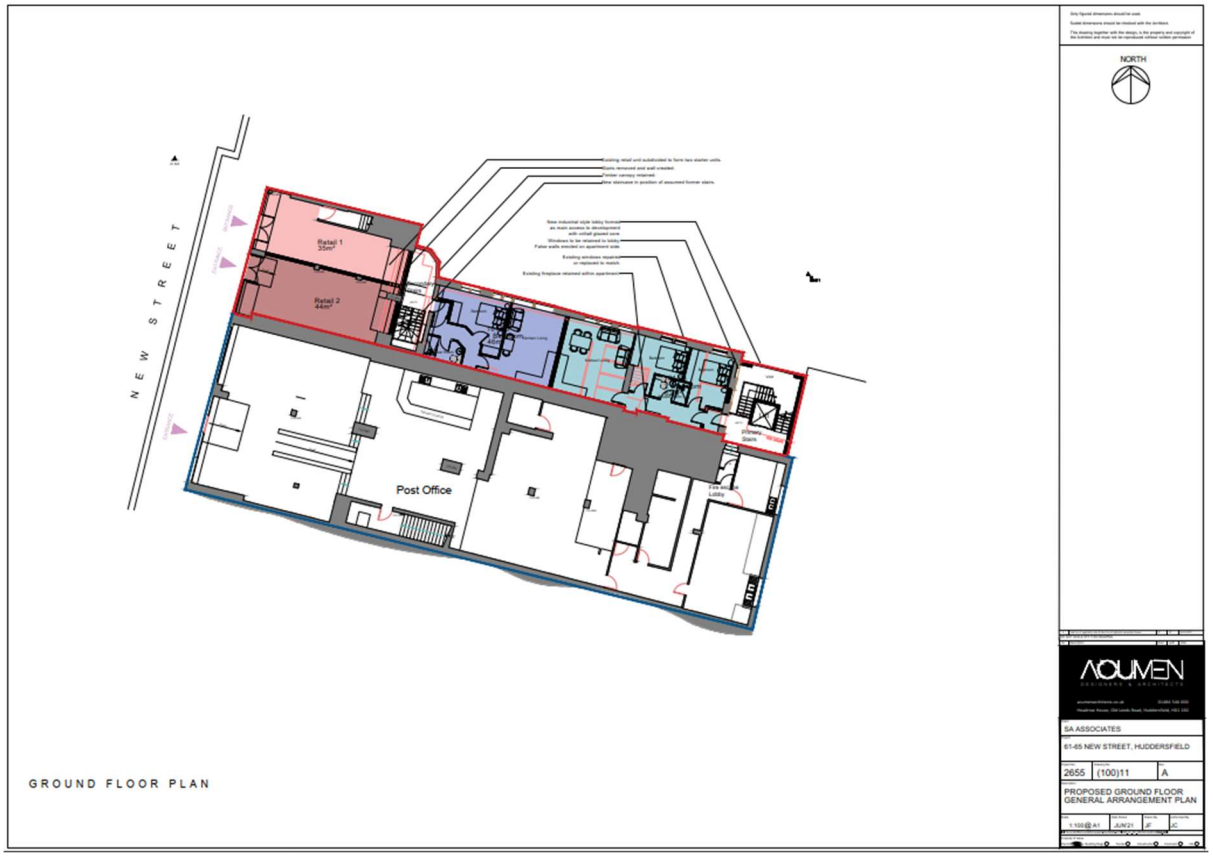
Appendix C – Location and Site Plans






KEY PLAN 1:500
ELEVATION 5 - (PARTIAL) RAMSDEN STREET
SECTION A-A
Existing Retail
Existing Basement
Bin Storage
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655
(100)21
PROPOSED ELEVATIONS SHEET 2


KEY PLAN 1:500
ELEVATION 1 - ALBERT YARD
ELEVATION 2 - ALBERT YARD
RETAIL 1 SIGN
RETAIL 2 SIGN
EXISTING RETAIL SIGNAGE
ELEVATION 3 - NEW STREET
ELEVATION 4 - ALBERT YARD
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655
(100)20
PROPOSED ELEVATIONS SHEET 1


NORTH
NEW STREET
Retail 1
35m²
Retail 2
44m²
Post Office
GROUND FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655
(100)11
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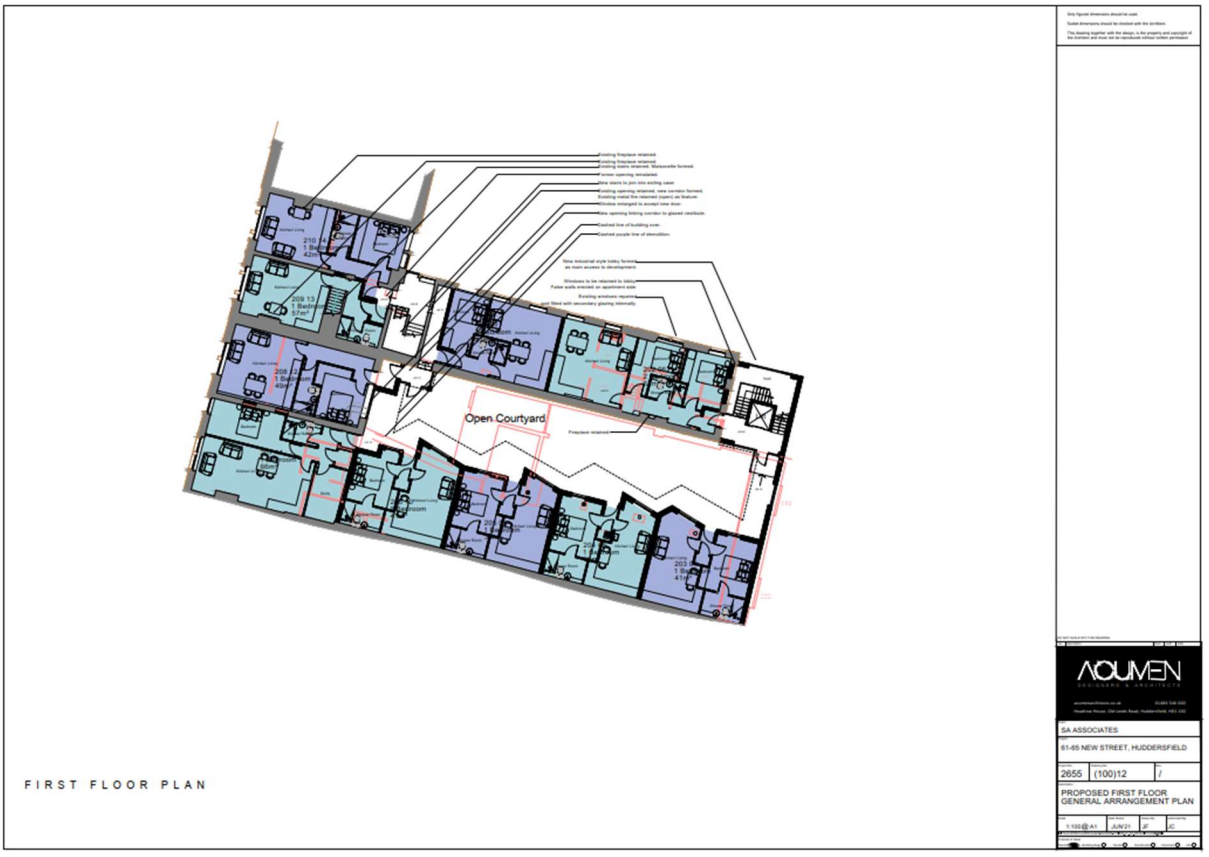
PROPOSED GROUND FLOOR
GENERAL ARRANGEMENT PLAN
1:100@A1
JUN'21


Open Courtyard
FIRST FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
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PROPOSED FIRST FLOOR
GENERAL ARRANGEMENT PLAN
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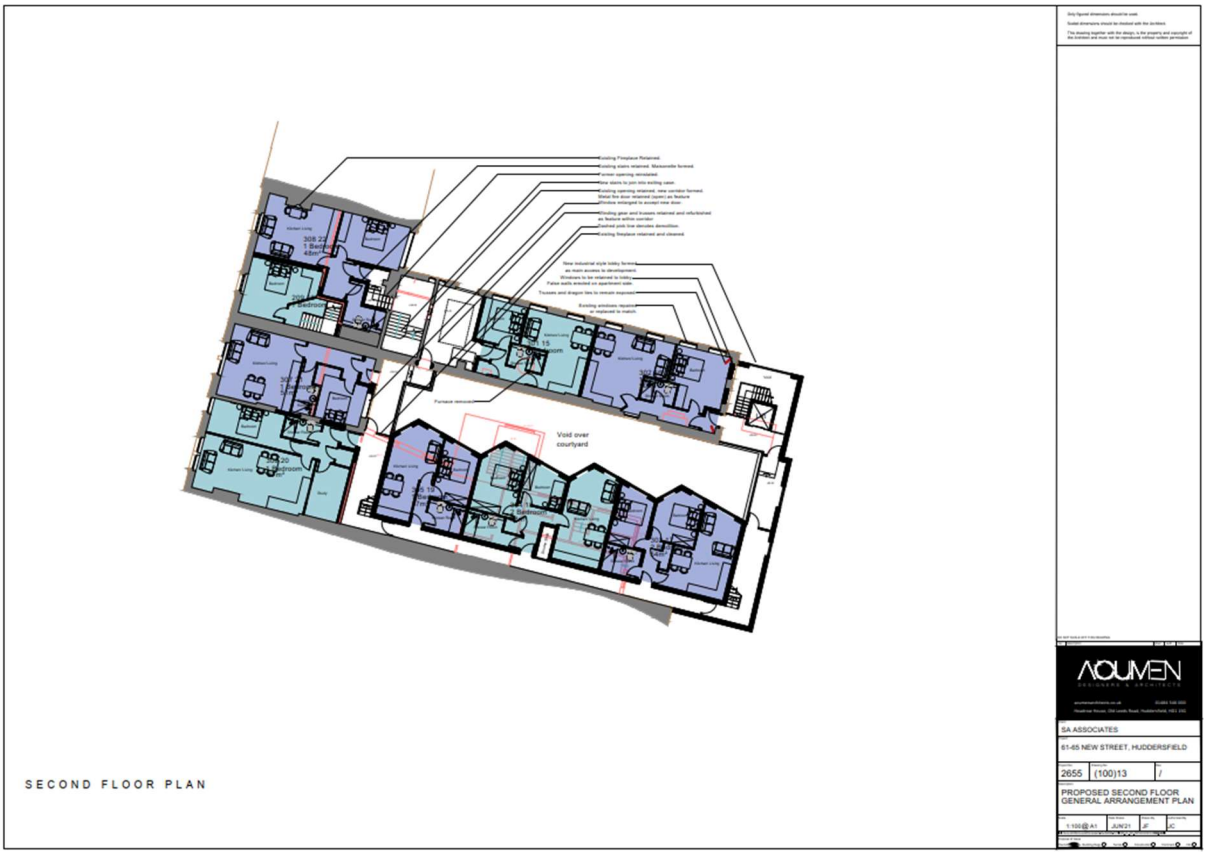
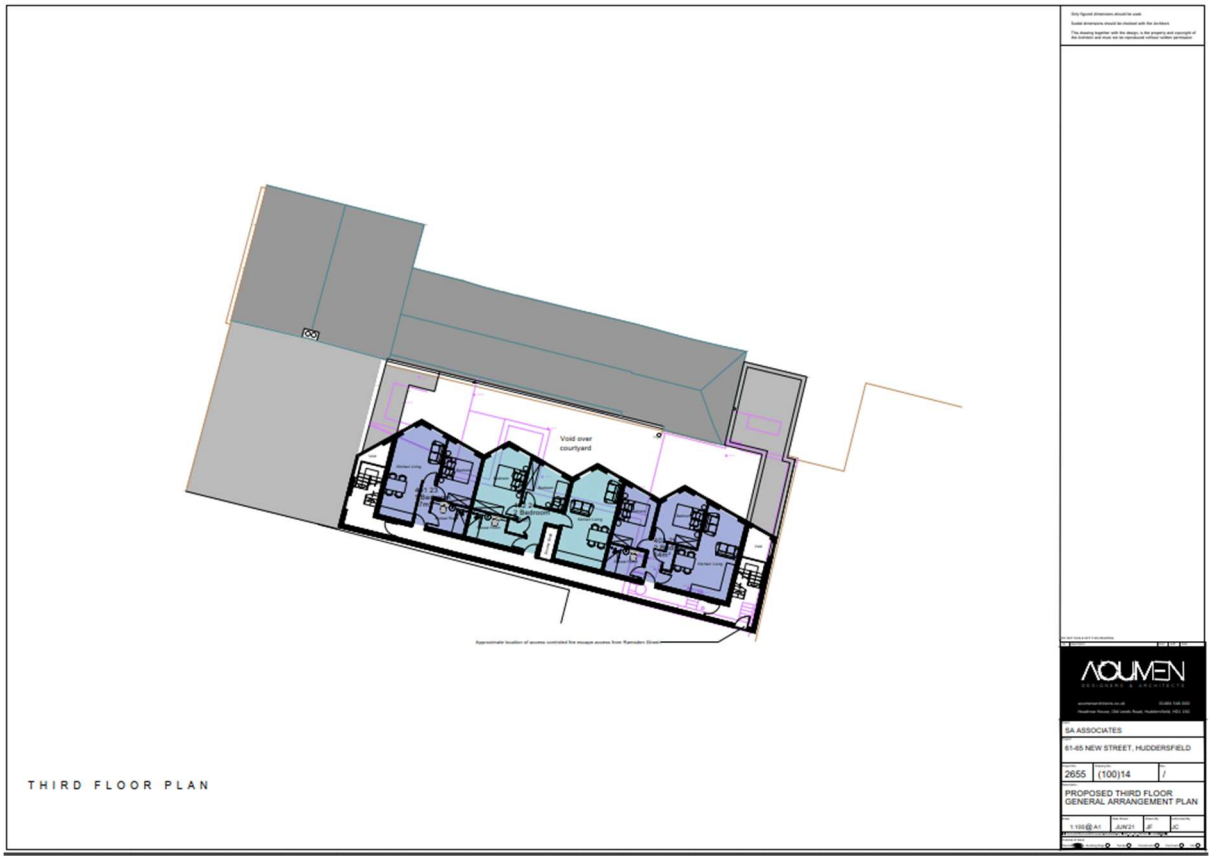
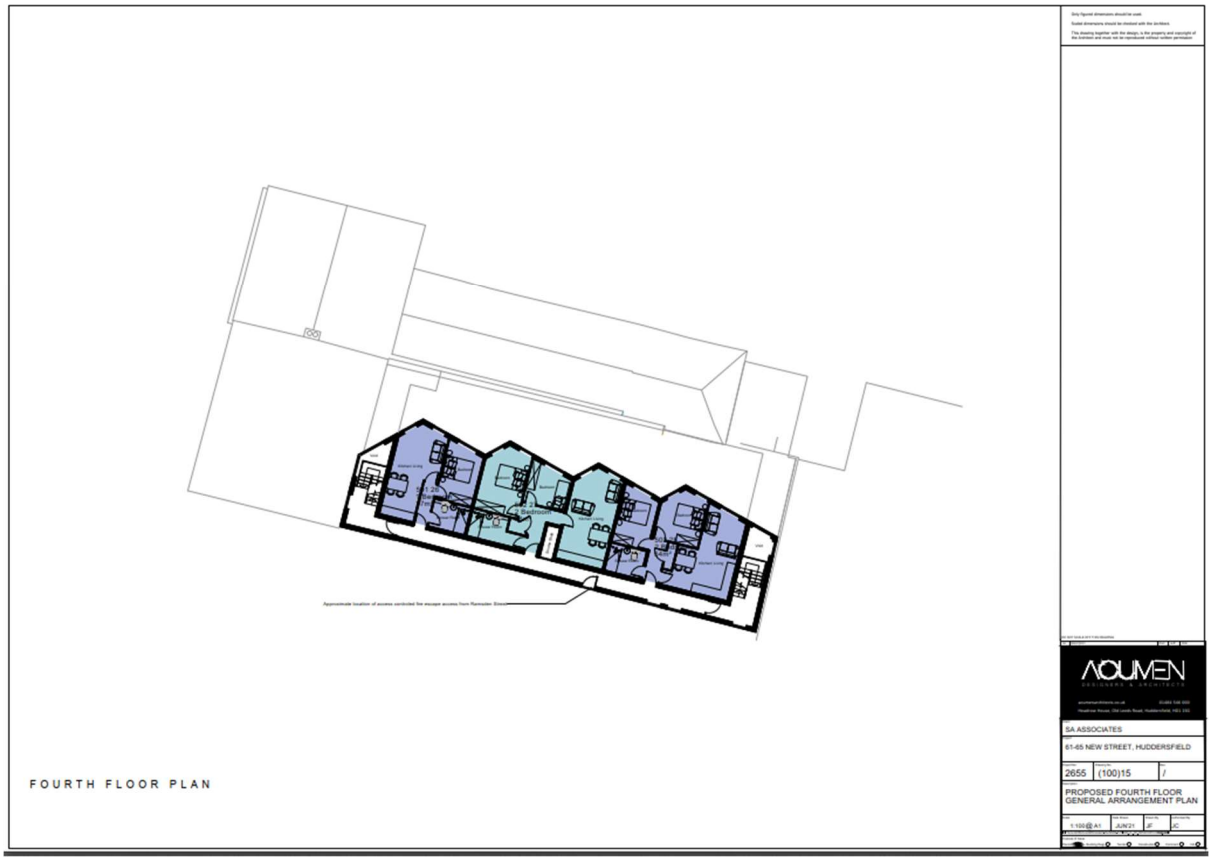
JUN'21


Void over courtyard
SECOND FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655 (100)13 7
PROPOSED SECOND FLOOR GENERAL ARRANGEMENT PLAN
1:100@A1 JUN'21 JF JC


Void over courtyard
THIRD FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655 (100)14 7
PROPOSED THIRD FLOOR GENERAL ARRANGEMENT PLAN
1:100@A1 JUN'21 JF JC


FOURTH FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655
(100)15
PROPOSED FOURTH FLOOR GENERAL ARRANGEMENT PLAN
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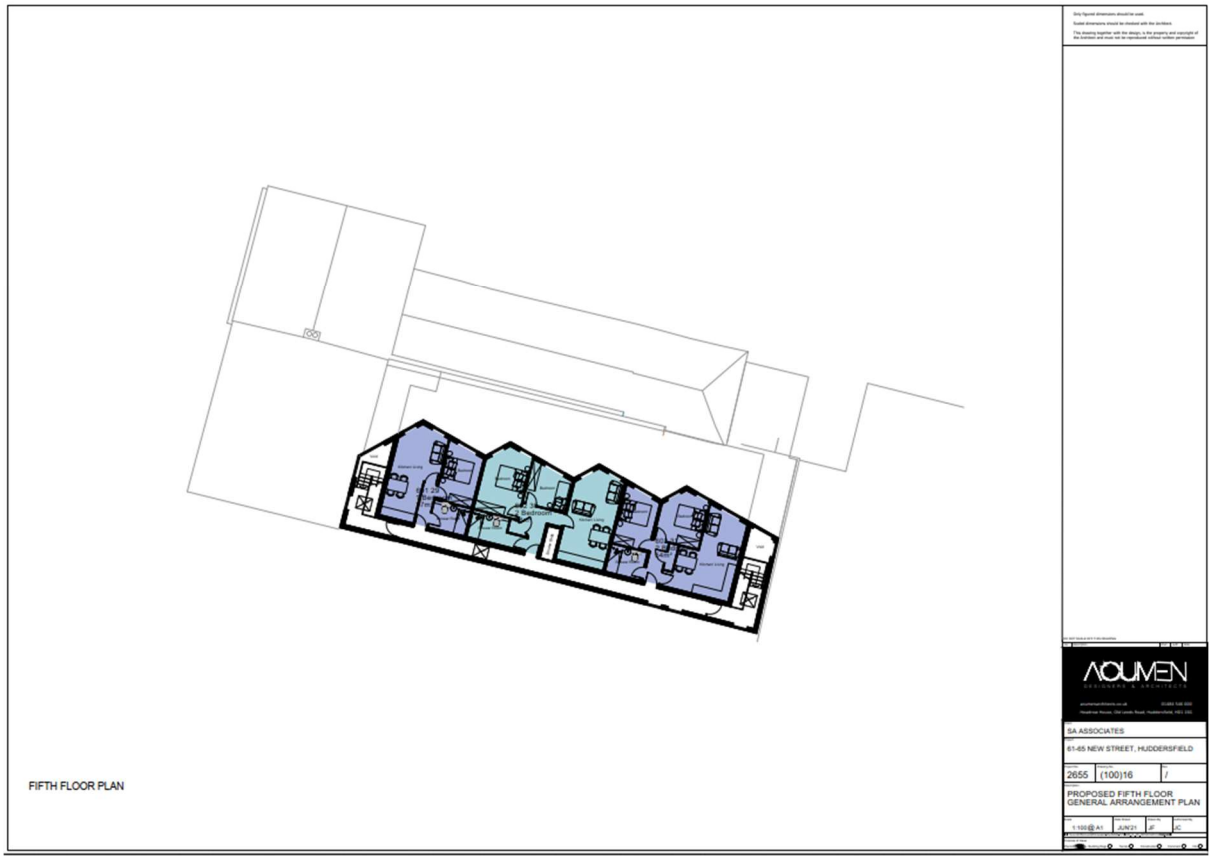
JUN'21


FIFTH FLOOR PLAN
ACUMEN
SA ASSOCIATES
61-65 NEW STREET, HUDDERSFIELD
2655
(100)16
PROPOSED FIFTH FLOOR GENERAL ARRANGEMENT PLAN
1:100@A1
JUN'21

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**		
Day 1 – 27/05/22: 13:30 – 23:00	63.0	57.0	55.0	54.0	52.0	54.0	47.0	59.0	81.0
Night 1 – 27/05/22: 23:00 – 07:00	71.0	56.0	55.0	52.0	51.0	47.0	41.0	55.0	89.0
Day 2 – 28/05/22: 07:00 – 23:00	57.0	53.0	53.0	56.0	54.0	49.0	40.0	58.0	84.0
Night 2 – 28/05/22: 23:00 – 07:00	61.0	52.0	55.0	52.0	46.0	43.0	38.0	52.0	85.0
Day 3 – 29/05/22: 07:00 – 23:00	54.0	51.0	50.0	49.0	48.0	44.0	39.0	52.0	91.0
Night 3 – 29/05/22: 23:00 – 01:45	70.0	60.0	58.0	56.0	53.0	51.0	44.0	59.0	87.0

Table 16.0 – Sound Survey Summary Results – MP1

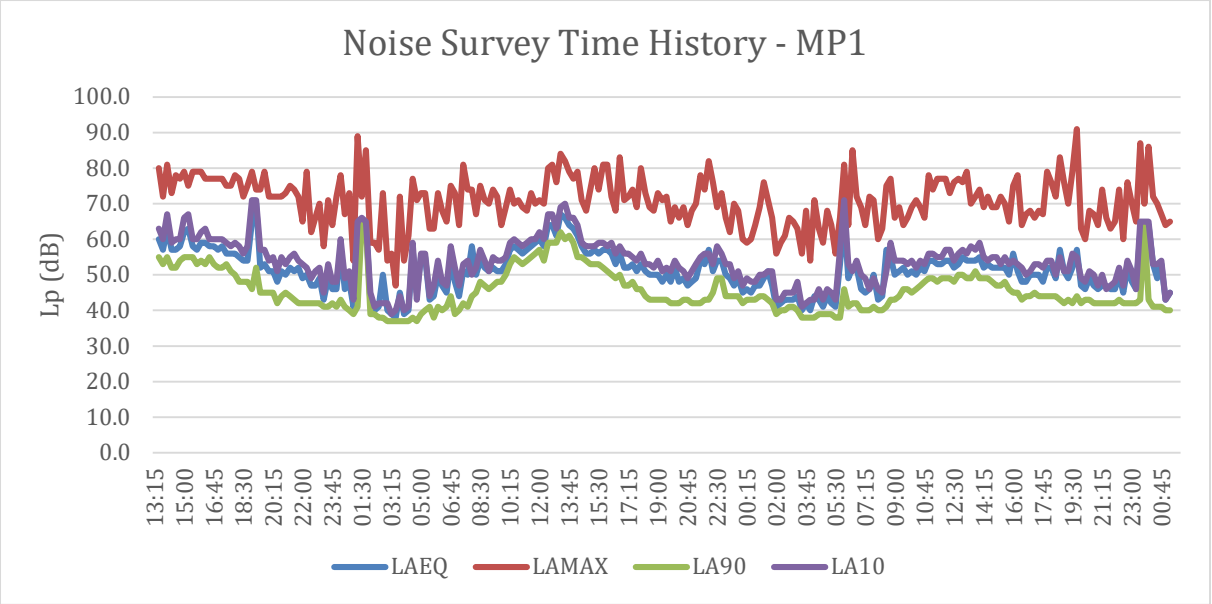


Figure 3.0 – Noise Survey Time History – MP1

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		
Day 1 – 27/05/22: 13:15 – 23:00	58.0	58.0	51.0	53.0	51.0	45.0	37.0	54.0	83.0
Night 1 – 27/05/22: 23:00 – 07:00	55.0	54.0	45.0	45.0	45.0	41.0	35.0	49.0	83.0
Day 2 – 28/05/22: 07:00 – 23:00	59.0	56.0	49.0	51.0	48.0	45.0	36.0	52.0	87.0
Night 2 – 28/05/22: 23:00 – 07:00	60.0	57.0	45.0	47.0	45.0	40.0	33.0	49.0	83.0
Day 3 – 29/05/22: 07:00 – 23:00	50.0	51.0	47.0	53.0	53.0	48.0	40.0	56.0	93.0
Night 3 – 29/05/22: 23:00 – 02:00	53.0	55.0	47.0	51.0	50.0	44.0	36.0	51.0	76.0

Table 17.0 – Sound Survey Summary Results – MP2

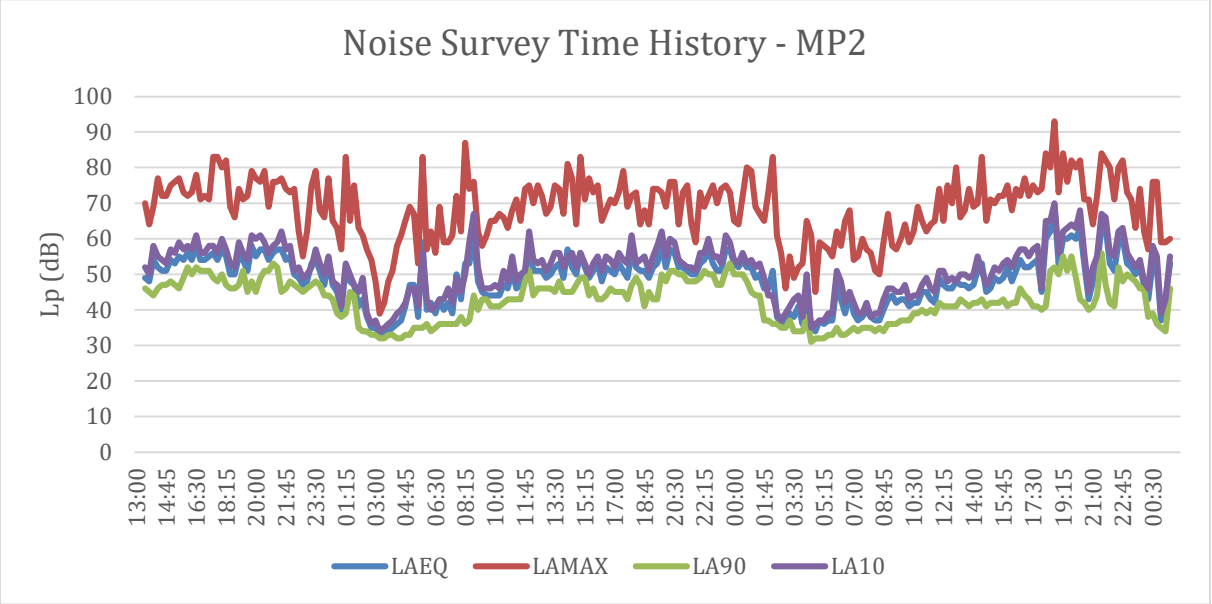


Figure 4.0 – Noise Survey Time History – MP2

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	901955	
CESVA SC420 Class 1 Sound Level Meter	T246471	≤0.5
CESVA CB006 Class 1 Calibrator	901955	

Table 18.0 – 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. 3 km North-West of Site)				
Time Period	**Air Temp (^{0}C)**	**Rainfall (mm/h)**	**Prevailing Wind Direction**	**Wind Speed (m/s)**
27/05/22: 00:00 – 23:59	7.7 – 14.6	0.0	NE	0.0 – 2.2
28/05/22: 00:00 – 23:59	7.3 – 15.2	0.0	NE	0.0 – 1.2
29/05/22: 00:00 – 23:59	7.7 – 12.7	0.0	ENE	0.0 – 1.2

Table 19.0 – Weather Summary

Appendix E – Façade Sound Reduction Calculations

E1 – Green Façades – Secondary Glazing

Measurement Position MP1	
Living Room	
Volume m^3 (V)	52
Window Area m^2 (S)	4
T60 s (T)	0.5
No. of vents required	2

Bedroom	
Volume m^3 (V)	22.0
Window Area m^2 (S)	4
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
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	(dBA)
Daytime Free-Field Noise Level	66.0	60.0	58.0	62.0	62.0	63.0	55.0	65.0
Rw of Glazing	13.0	17.0	32.0	41.0	47.0	48.0	46.0	35.0
Façade Noise Ingress (Glazing)	50.0	40.0	23.0	18.0	12.0	12.0	6.0	28.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	40.0	18.0	17.0	16.0	11.0	2.0	-8.0	17.0
Total Ingress	50.0	40.0	24.0	20.0	15.0	12.0	6.0	28.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-9.0**	**-8.0**	**-15.0**	**-14.0**	**-15.0**	**-14.0**	**-18.0**	**-7.0**

Bedroom Day Time, 07:00 - 23:00								
Description	Sound Pressure Level Leq (dB)							Overall
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	(dBA)
Daytime Free-Field Noise Level	66.0	60.0	58.0	62.0	62.0	63.0	55.0	65.0
Rw of Glazing	28.0	35.0	45.0	49.0	50.0	54.0	65.0	47.0
Façade Noise Ingress (Glazing)	39.0	26.0	14.0	14.0	13.0	10.0	-9.0	19.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	44.0	22.0	21.0	20.0	15.0	6.0	-4.0	22.0
Total Ingress	45.0	27.0	22.0	21.0	17.0	11.0	-3.0	24.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-14.0**	**-21.0**	**-17.0**	**-13.0**	**-13.0**	**-15.0**	**-27.0**	**-11.0**

Bedroom Night Time, 23:00 - 07:00									
Description	Sound Pressure Level Leq (dB)							Overall	LAmax
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	(dBA)	
Night Time Free-Field Noise Level	79.0	64.0	64.0	60.0	57.0	55.0	47.0	62.0	72.0
Rw of Glazing	28.0	35.0	45.0	49.0	50.0	54.0	65.0	47.0	51.0
Façade Noise Ingress (Glazing)	52.0	30.0	20.0	12.0	8.0	2.0	-17.0	26.0	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)	57.0	26.0	27.0	18.0	10.0	-2.0	-12.0	18.0	17.0
Total Ingress	58.0	31.0	28.0	19.0	12.0	3.0	-11.0	27.0	22.0
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Exceedance of Criteria	3.0	**-12.0**	**-7.0**	**-10.0**	**-13.0**	**-18.0**	**-30.0**	**-3.0**	**-23.0**

E2 – Red Façades – Double Glazing

Measurement Position MP2	
Living Room	
Volume m^3 (V)	52
Window Area m^2 (S)	4
T60 s (T)	0.5
No. of vents required	2

Bedroom	
Volume m^3 (V)	22
Window Area m^2 (S)	4
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	67.0	62.0	54.0	62.0	65.0	60.0	53.0	69.0
Rw of Glazing	19.0	21.0	17.0	25.0	35.0	37.0	31.0	25.0
Façade Noise Ingress (Glazing)	45.0	38.0	34.0	34.0	27.0	20.0	19.0	34.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	41.0	20.0	13.0	16.0	14.0	-1.0	-10.0	21.0
Total Ingress	46.0	38.0	34.0	34.0	27.0	20.0	19.0	34.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-13.0**	**-10.0**	**-5.0**	**0.0**	**-3.0**	**-6.0**	**-5.0**	**-1.0**

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	67.0	62.0	54.0	62.0	65.0	60.0	53.0	69.0
Rw of Glazing	23.0	24.0	24.0	32.0	37.0	37.0	44.0	32.0
Façade Noise Ingress (Glazing)	45.0	39.0	31.0	31.0	29.0	24.0	10.0	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)	45.0	24.0	17.0	20.0	18.0	3.0	-6.0	23.0
Total Ingress	48.0	39.0	31.0	31.0	29.0	24.0	10.0	33.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-11.0**	**-9.0**	**-8.0**	**-3.0**	**-1.0**	**-2.0**	**-14.0**	**-2.0**

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	70.0	65.0	52.0	57.0	57.0	49.0	42.0	62.0	68.0
Rw of Glazing	23.0	24.0	24.0	32.0	37.0	37.0	44.0	32.0	35.0
Façade Noise Ingress (Glazing)	48.0	42.0	29.0	26.0	21.0	13.0	-1.0	30.0	33.0
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)	48.0	27.0	15.0	15.0	10.0	-8.0	-17.0	18.0	13.0
Total Ingress	51.0	42.0	29.0	26.0	21.0	13.0	-1.0	30.0	33.0
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Exceedance of Criteria	**-4.0**	**-1.0**	**-6.0**	**-3.0**	**-4.0**	**-8.0**	**-20.0**	**0.0**	**-12.0**

E3 – Green Façades

Measurement Position MP2	
Living Room	
Volume m^3 (V)	52
Window Area m^2 (S)	4
T60 s (T)	0.5
No. of vents required	2

Bedroom	
Volume m^3 (V)	22
Window Area m^2 (S)	4
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	67.0	62.0	54.0	62.0	65.0	60.0	53.0	69.0
Rw of Glazing	13.0	14.0	29.0	38.0	45.0	49.0	42.0	31.0
Façade Noise Ingress (Glazing)	51.0	45.0	22.0	21.0	17.0	8.0	8.0	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)	41.0	20.0	13.0	16.0	14.0	-1.0	-10.0	21.0
Total Ingress	51.0	45.0	23.0	22.0	19.0	9.0	8.0	31.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-8.0**	**-3.0**	**-16.0**	**-12.0**	**-11.0**	**-17.0**	**-16.0**	**-4.0**

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	67.0	62.0	54.0	62.0	65.0	60.0	53.0	69.0
Rw of Glazing	19.0	33.0	41.0	47.0	48.0	45.0	54.0	47.0
Façade Noise Ingress (Glazing)	49.0	30.0	14.0	16.0	18.0	16.0	0.0	25.0
Dne,w of Ventilation	30.0	46.0	45.0	50.0	55.0	65.0	67.0	52.0
Façade Noise Ingress (Ventilation)	45.0	24.0	17.0	20.0	18.0	3.0	-6.0	23.0
Total Ingress	50.0	31.0	19.0	21.0	21.0	16.0	1.0	27.0
NR30	59.2	48.1	39.9	34.0	30.0	26.9	24.7	35.0
Exceedance of Criteria	**-9.0**	**-17.0**	**-20.0**	**-13.0**	**-9.0**	**-10.0**	**-23.0**	**-8.0**

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	70.0	65.0	52.0	57.0	57.0	49.0	42.0	62.0	68.0
Rw of Glazing	19.0	33.0	41.0	47.0	48.0	45.0	54.0	47.0	50.0
Façade Noise Ingress (Glazing)	52.0	33.0	12.0	11.0	10.0	5.0	-11.0	27.0	18.0
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)	48.0	27.0	15.0	15.0	10.0	-8.0	-17.0	18.0	13.0
Total Ingress	53.0	34.0	17.0	16.0	13.0	5.0	-10.0	28.0	19.0
NR25	55.2	43.7	35.2	29.2	25.0	21.9	19.5	30.0	45.0
Exceedance of Criteria	**-2.0**	**-9.0**	**-18.0**	**-13.0**	**-12.0**	**-16.0**	**-29.0**	**-2.0**	**-26.0**

Appendix F – AVO Guide Level 1 Site Risk Assessment