



ACOUSTIC
CONSULTANTS LTD

Environmental Noise Assessment

**Proposed Retirement Living Development
Kirkby, Liverpool**

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Client:

McCARTHY STONE

Document Control

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Revision A	Added results of overheating assessment	22/11/2023	Samuel Lawrence, MIOA	Blake Lucas, MIOA	Blake Lucas, MIOA
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The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above. The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

The report limits itself to addressing solely on the noise, acoustic, and vibration aspects as included in this report. We provide advice only in relation to noise, vibration and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g. CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment. It should be noted that noise predictions are based on the current information as we understand it and, on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.

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1. Executive Summary

It is proposed to construct a retirement living development at St Chad's Drive Car Park, Kirkby, Liverpool, L32 8RD. The site is located adjacent to the A5208 County Road to the north-east and St Chad's Drive to the west. This report provides a noise impact assessment of the environmental noise sources (road traffic) and provides mitigation measures to address the ingress of external noise.

To establish the noise climate at the site, an environmental noise survey was completed between 16th-17th November 2023. Using the measured data reported in Section 6, computer noise modelling has been undertaken to predict the external noise levels at each façade of the proposed development as described in Section 7.

Noise mitigation measures have been designed to achieve appropriate internal noise levels. Road traffic noise has been assessed to British Standard 8233:2014 and WHO 1999.

The results of the modelling have been used to determine mitigation measures to control external noise ingress in the form of minimum glazing requirements (Section 8.3.3) and the sound level difference required through the proposed mechanical ventilation system (Section 8.4).

This report identifies bedrooms which are likely to require closed windows throughout the night to mitigate external noise ingress. In order to achieve the Approved Document O overheating criteria in these rooms, specific g-values are required to the windows, which have been specified by Focus Consultants. The results of the overheating assessment are summarised in Section 8.4.2.

With the advice set out in the report, we would consider external noise can be suitably controlled within the habitable rooms of the residential development and we would consider that with a suitably designed noise scheme as set out in this report the development achieves the aims of the NPPF.

2. Introduction

McCarthy Stone appointed Acoustic Consultants Limited to undertake an environmental noise assessment for the proposed retirement living development located at St Chad's Drive Car Park, Kirkby, Liverpool.

The report identifies relevant planning and noise guidance, establishes environmental noise levels at the site and provides noise mitigation measures for the proposed retirement living development in support of a planning application.

The assessment has been undertaken in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG), British Standard 8233:2014 (BS8233), WHO 1999 and British Standard 4142:2014+A1:2019.

The author of this report is a Member of the Institute of Acoustics with more than seven years' experience within the field and is considered suitably qualified to undertake this noise impact assessment. This report has been reviewed by a Member of the Institute of Acoustics and director of the company with more than sixteen years' experience within the field.

3. The Site & Proposals

The proposal site is currently in use as a car park at St Chad's Drive Car Park, Kirkby, L32 8RD. It is proposed to construct a retirement living development, comprising 53 units in total (37 one bedroom and 16 two bedroom flats). The development will also include a carpark and communal garden.

The site is located in a mixed use area, with existing dwellings to the east; Trentham Medical Centre to the north; Kirkby Police Station, Kirkby Community Fire Station and Kirkby Ambulance Station are located to the south; and Kirkby Shopping Centre to the west.

The predominant sources of noise affecting the site are road traffic along County Road and St Chad's Drive.

The proposed site plan is shown below:

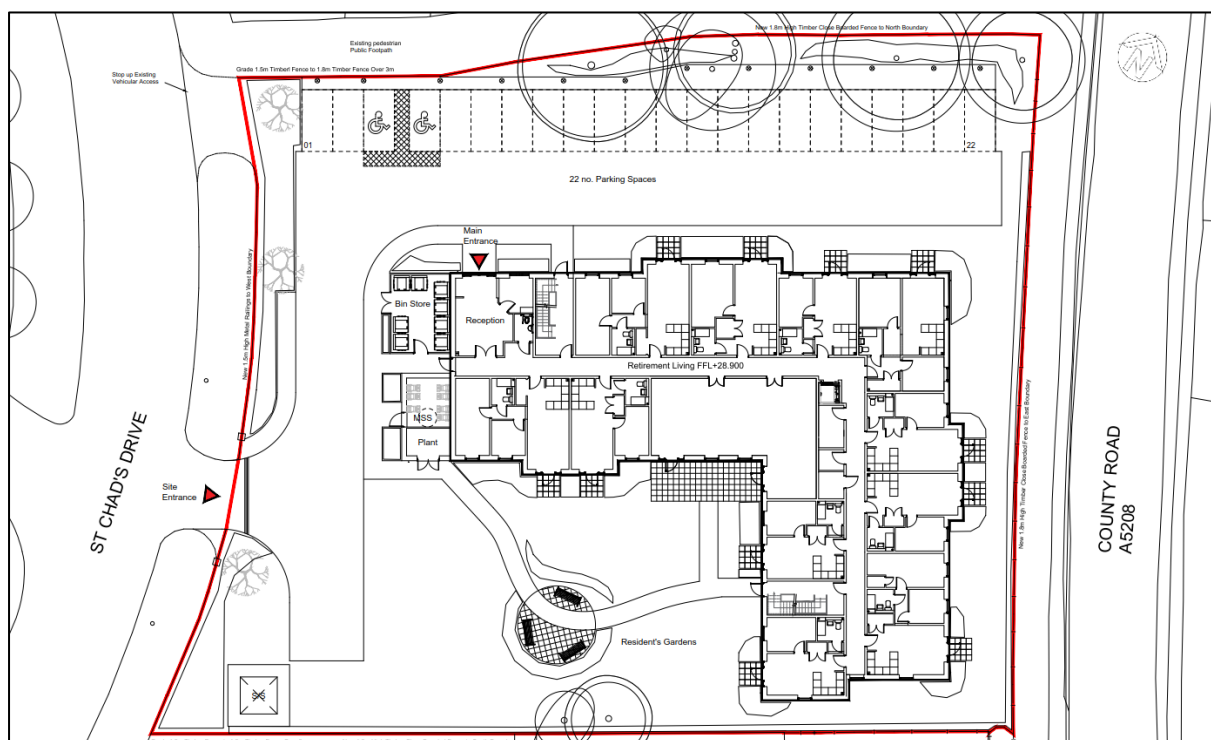


Figure 1: Proposed Site Plan

4. Planning & Noise

4.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in September 2023. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 174 states:

"174. Planning policies and decisions should contribute to and enhance the natural and local environment by:

- e) 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; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."*

Paragraph 185 states:

"185. 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 impacts 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. "*

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise, and refers you to the NPSE.

4.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion and applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise.

The NPSE sets out the long-term vision of Government noise policy. This long-term vision is supported by three noise policy aims as follows:

"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; and*
- *where possible, contribute to the improvement of health and quality of life."*

The NPSE introduces the concept of "Significant adverse" and "Adverse" impacts of noise which relate to the noise policy aims. These are applied as follows:

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.

LOAEL – Lowest Observed Adverse Effect Level - This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level - This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum.

With regard to where there is potential for noise impact it states the following in relation to the second noise policy aim:

"The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur."

The NPSE does not provide any assessment criteria for the noted effect levels and each case must be considered on its merits. The NPSE does, however, emphasise that in dealing with noise Local Planning Authorities are required to take a balanced approach in considering the benefits of development as against any adverse effects which arise. Paragraph 2.18 of the NPSE is particularly relevant in this respect and states:

"There is a need to integrate consideration of the economic and social benefits of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focusing solely on the noise impact without taking into account other related factors."

The planning need is outside the scope of noise and acoustics and will need to be addressed by others.

4.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise, referred to here, is based on the current version (July 2019) as provided on the Planning Guidance Website.

It states that *"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment."*

The document provides generic guidance on how to determine the impact of noise and what factors could be a concern.

It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.

Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE.

Table 1: NPPG Noise – Perception of Effect Levels

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum

Response	Examples of Outcomes	Increasing Effect Level	Action
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels.

The NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.

The Noise Policy Statement for England (NPSE) states that noise levels above the Lowest Observed Adverse Effect Level are acceptable in planning where reduced to a minimum when taken into account against all other planning considerations.

Section 4 of this report identifies guidance which is considered to provide noise criteria equivalent to effect levels below the Lowest Observed Adverse Effect Level. This is where the perception of noise is “not noticeable” or “noticeable but not intrusive” as indicated in Table 1 above.

5. Assessment Criteria

5.1. British Standard 8233:2014

This standard, entitled 'Guidance on sound insulation and noise reduction for buildings', provides advice on noise as it affects buildings of all types, giving consideration to various common sources of noise.

This is considered relevant when assessing noise from external noise sources as it effects the proposed residential properties. It outlines design guidance in general terms and provides criteria for the indoor ambient noise levels (IANLs) for different types of room. These are stated in terms of the 'equivalent continuous sound pressure level' over the reference time period, the $L_{Aeq, T}$. The IANLs specified by British Standard 8233 that are relevant to this development are as follows.

Table 2: British Standard 8233:2014 Internal Noise Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq, 16 \text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq, 16 \text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 \text{ hour}}$	30 dB $L_{Aeq, 8 \text{ hour}}$

The British Standard does not provide any internal noise criteria for maximum noise levels. Section 3.4 of the WHO Guidelines state *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night (Vallet & Verbey 1991)"*.

5.2. Approved Document O

The relevant noise requirements under overheating conditions are provided in the recently published and adopted Approved Document O. These are as follows:

"Noise

3.2 In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

3.3 Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- a. 40dB $L_{Aeq, T}$, averaged over 8 hours (between 11pm and 7am).*
- b. 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).*

3.4 Where in-situ noise measurements are used as evidence that these limits are not exceeded, measurements should be taken in accordance with the Association of Noise Consultants' Measurement of Sound Levels in Buildings with the overheating mitigation strategy in use. NOTE: Guidance on reducing the passage of external noise into buildings can be found in the National Model Design Code: Part 2 – Guidance Notes (MHCLG, 2021) and the Association of Noise Consultants' Acoustics, Ventilation and Overheating: Residential Design Guide (2020)."

6. Noise Monitoring

A partially attended long term noise survey was undertaken at the site between 16th and 17th November 2023.

6.1. Monitoring Equipment

Sound Pressure Levels were measured using a Class 1 sound level meter with a half-inch condenser microphone, using the 'fast' setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 3: Equipment and Calibration Status

Equipment Description / Manufacturer / Type	Serial Number	Date of Calibration	Calibration Certification Number
SLM, NTI, XL2	A2A-18475-E0	19/10/2022	UK-22-106
Pre-Amp, NTI, MA220	9378	19/10/2022	UK-22-106
Microphone, NTI, MC230A	A19093	19/10/2022	UK-22-106
Calibrator, Larson Davis, CAL200	17656	07/02/2023	44552-17656-CAL200
SLM, NTI, XL2	A2A-22077-F0	07/02/2023	UK-22-106
Pre-Amp, NTI, MA220	11392	07/02/2023	UK-22-106
Microphone, NTI, MC230A	A24696	07/02/2023	UK-22-106
Calibrator, Larson Davis, CAL200	17656	07/02/2023	44552-17656-CAL200

The measurement systems were checked before and after use with the noted calibrators and no significant drift was detected on the A2A-18475-E0 system. A -2.7 dB drift from the factory calibration level was detected on the A2A-22077-F0 system and as such a +2.7 dB correction has been applied to the measured levels.

6.2. Weather Conditions

The weather conditions are as below and are considered acceptable with no adverse impact on the measured data.

Table 4: Weather Conditions During Survey

Date	Wind Speed (m/s)	Prevailing Wind Direction	Average Air Temperature (°C)	Precipitation (time/hrs)
16/11/2023	2-3	W	5-9	0
17/11/2023	3-4	SW	5-9	0

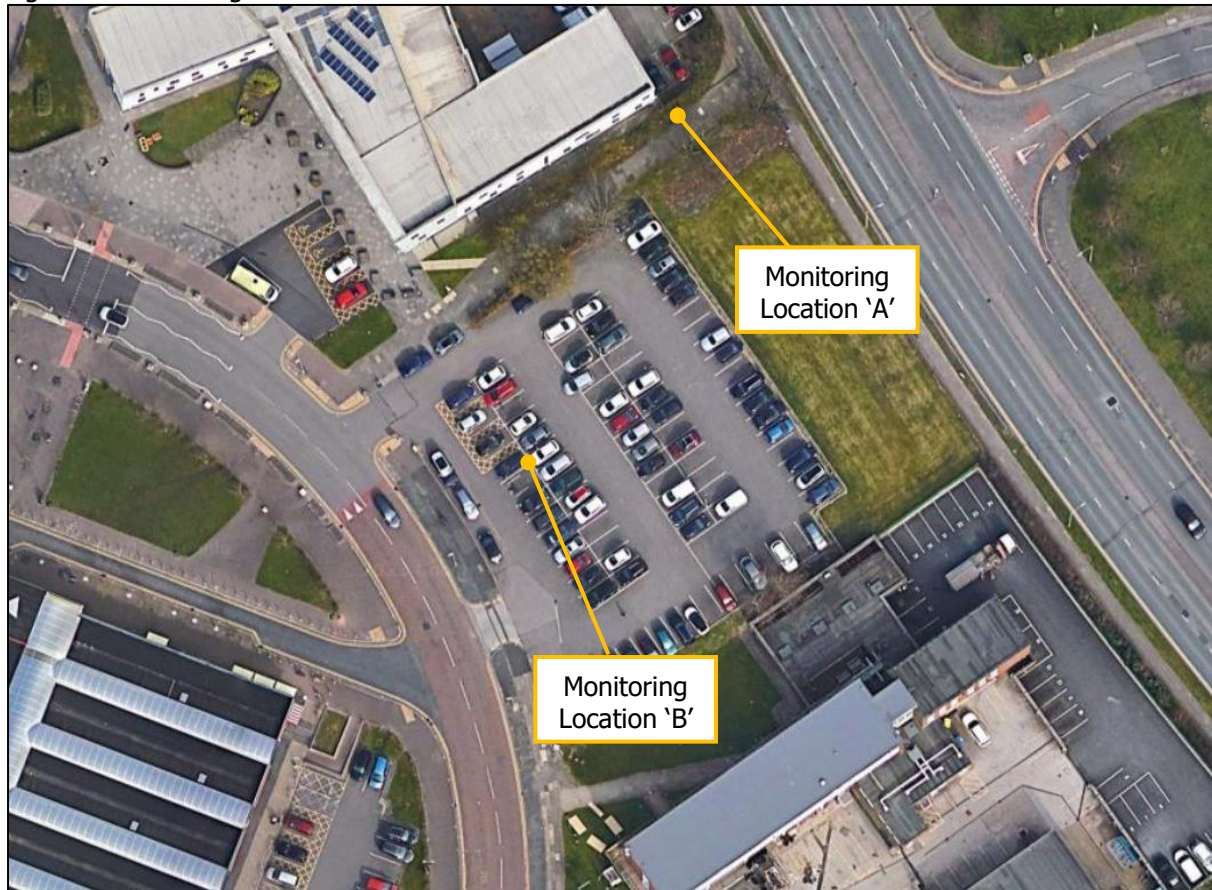
6.3. Noise Monitoring Procedure

A partially attended monitoring exercise was undertaken at Monitoring Location 'A'. The purpose of this measurement location was to establish the level road traffic noise along County Road. The sound level meter was fixed to a lamppost in a free-field position at a height of approximately 2.5 metres above ground.

A second partially attended long term survey was carried out at Monitoring Location 'B'. The sound level meter was installed in a free-field position fixed to a signpost at a height of approximately 2.5 metres above ground. The purpose of this measurement was to measure noise levels from both County Road and St Chad's Drive to help calibrate the noise model.

The monitoring locations are shown on the figure below:

Figure 2: Monitoring Locations

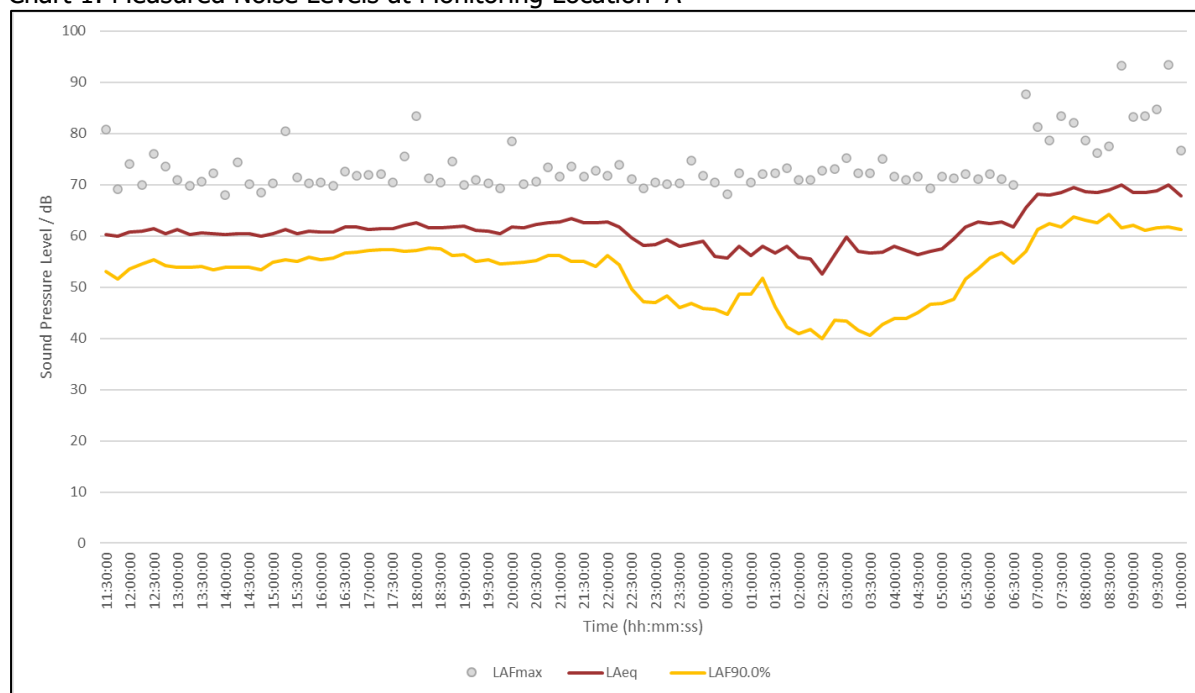


6.4. Measured Noise Levels

6.4.1. Monitoring Location 'A'

A chart showing the variation in maximum, equivalent and background sound levels at Monitoring Location 'A' is shown below:

Chart 1: Measured Noise Levels at Monitoring Location 'A'



The equivalent noise levels and night-time maximum noise levels determined from the measurement data at the monitoring location are provided in the table below.

Table 5: Measured equivalent and maximum noise Levels for Monitoring Location 'A'

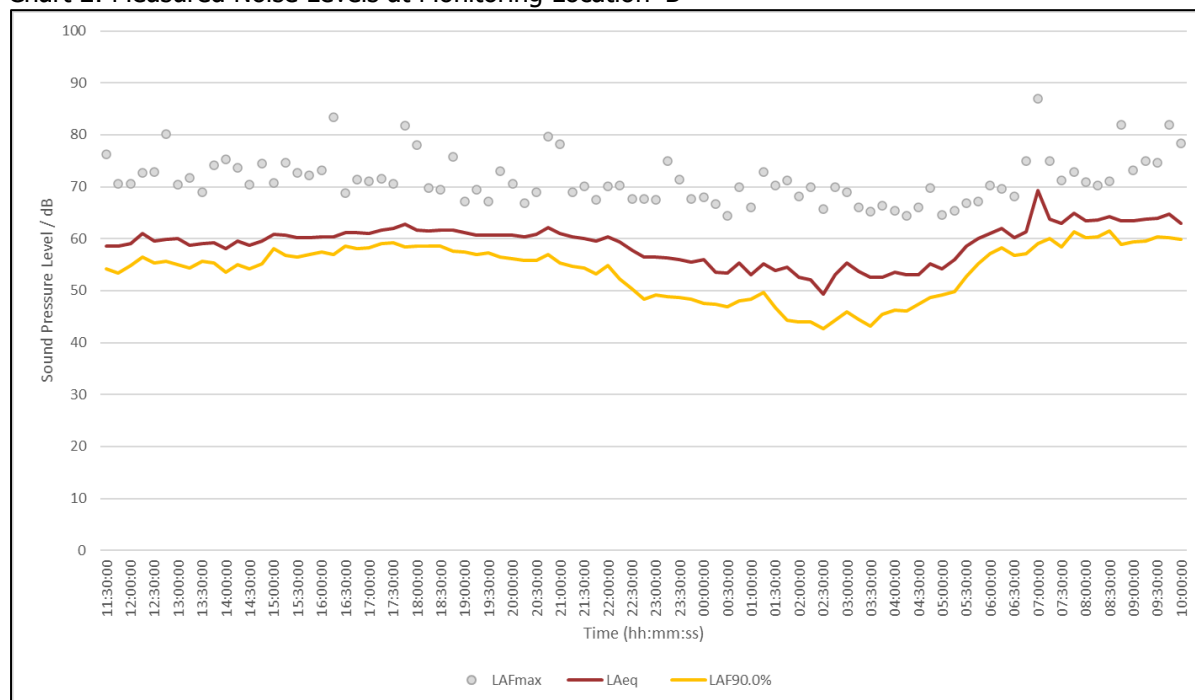
Parameter	Sound Pressure Level per Octave Band (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
$L_{eq,16hour}$	67	62	60	64	65	55	49	45	67
$L_{eq,8hour}$	62	57	55	55	59	56	48	45	62
$L_{max,F}^*$	74	71	72	71	70	70	68	66	76

*10th highest maximum noise event during the night as per WHO Guidelines.

6.4.2. Monitoring Location 'B'

A chart showing the variation in maximum, equivalent and background sound levels at Monitoring Location 'B' is shown below:

Chart 2: Measured Noise Levels at Monitoring Location 'B'



The equivalent noise levels and design night-time maximum noise levels determined from the measurement data at the monitoring location are provided in the table below.

Table 6: Measured equivalent and maximum noise levels for Monitoring Location 'B'

Parameter	Sound Pressure Level per Octave Band (dB)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Leq,16hour	66	60	58	56	59	54	47	43	62
Leq,8hour	61	55	52	51	54	49	42	37	56
Lmax,F*	70	70	68	67	66	62	58	51	70

*10th highest maximum noise event during the night as per WHO Guidelines.

7. Noise Modelling

7.1. Modelling Parameters

To determine noise levels across the site, noise modelling has been undertaken using computer modelling package Cadna:A by DataKustik. The software predicts road traffic noise propagation using the method of '*The Calculation of Road Traffic Noise 1988*' (CRTN'88) and commercial noise to the General Method of Calculation in ISO 9613. A verification model has been created to calibrate the noise model to the measured survey data. This model is available upon request.

The noise predictions have been undertaken using supplied plans of the proposed site and the following general modelling parameters:

- Road traffic noise levels have been calibrated to the long-term noise data measured at Monitoring Locations 'A' and 'B'.
- The ground across the full model is considered to be hard and reflective ($G = 0.0$).
- Reflections are calculated via the correction method of CRTN (+1.5 dB).
- All buildings are considered reflective.
- The topography of the site and surrounding area has been considered to be flat.
- Surrounding building heights have been determined based on site observations and Google Maps imagery.
- The proposed building height has been taken to be 11.3 metres based on the proposed elevations.
- Receiver heights for each storey are taken to be 1.5 metres and each storey is considered to be approximately 3 metres.
- The calculation grid's receiver height is 4.5 metres.
- Building evaluation markers are displayed as the maximum level per façade.
- Building evaluation markers are shown across all façades where there are habitable rooms.

7.2. Modelling Results

Figure 3: Predicted equivalent noise levels due to road traffic during the day (dB LAeq, 16hour)



Figure 4: Predicted equivalent noise levels due to road traffic during the night (dB LAeq 8 hour)



Figure 5: Predicted typical maximum noise event due to night-time traffic on County Road (dB LA_{Fmax})



Figure 6: Predicted typical maximum noise event due to night-time traffic on St Chad's Drive (dB LA_{Fmax})



8. Noise Mitigation Measures

8.1. Calculation Method

Calculations for the internal ambient noise levels have been undertaken using the calculation method provided in Annex G Section G.2 of British Standard 8233:2014.

The calculations have been undertaken using the building façade construction specified below and the octave band free-field design equivalent noise levels and maximum noise levels taken from the measured noise spectra noted above.

The calculations work on the basis of the following, based on the typical room dimensions set out in the proposals:

- Room size: 21m² to living rooms and 9m² bedrooms.
- Windows: 7m² to living rooms and 2m² to bedrooms.
- Façade: 18m² to living rooms and 4m² bedrooms.
- We have worked on the basis of a reverberation time (T_{mf}) of 0.5 seconds in all habitable rooms.

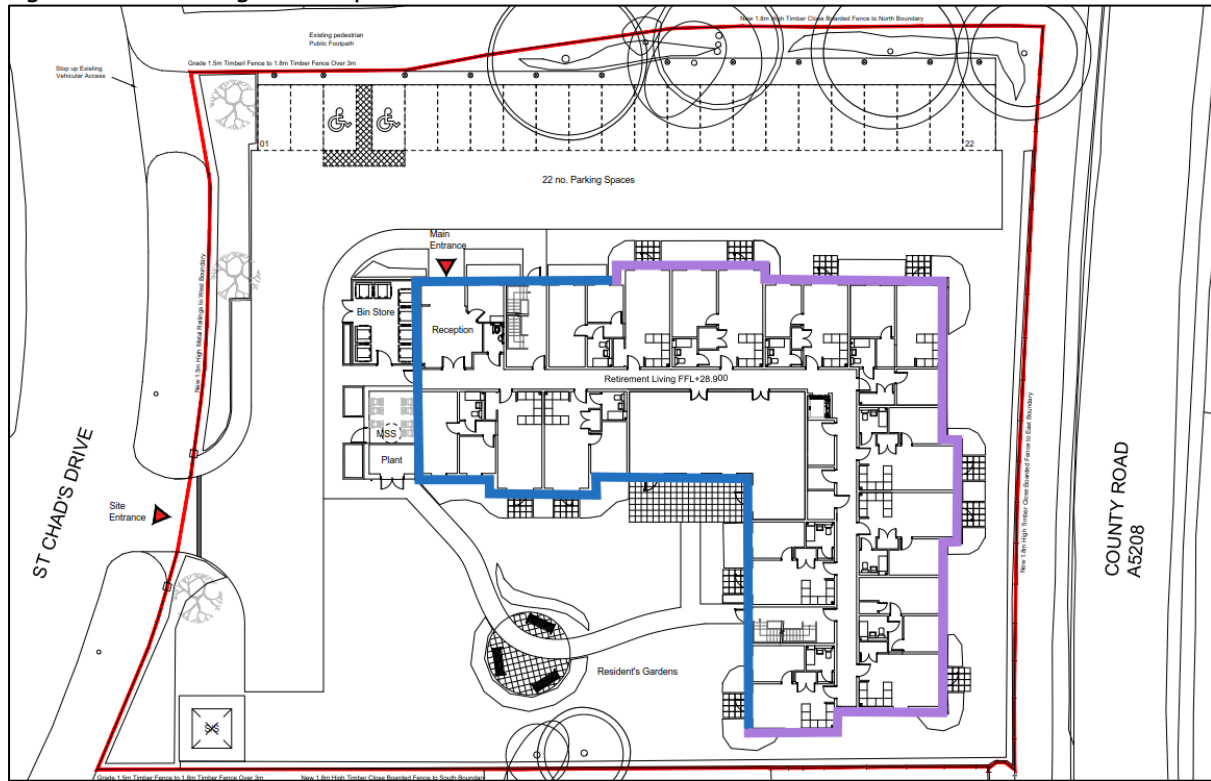
We advise that building elements, having the sound insulation performances noted below, are incorporated into the design of the façades including the windows, doors, floor, and the building roof.

Alternative constructions to those noted below could be used, however they would need to be assessed to ensure they control external noise to within the BS 8233:2014 recommended internal ambient noise level criteria.

8.2. Mitigation Zones

As follows are set out the noise mitigation “zones” in purple and blue which correspond to the colour code in the tables in Sections 8.3.3 and 8.4.1 below.

Figure 7: Noise mitigation map

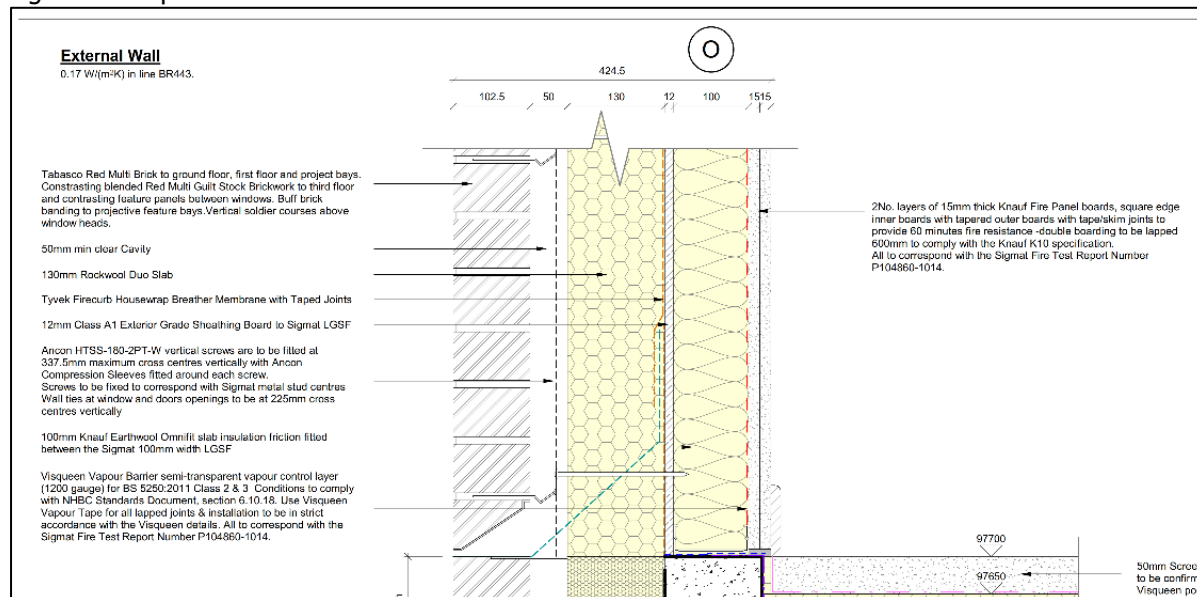


8.3. Building Façade Construction

8.3.1. External Wall Construction

As follows is shown the proposed external wall construction as provided by the client:

Figure 8: Proposed external wall construction



The above construction has been modelled in the proprietary software INSUL based on the following assumptions:

- 102.5-millimetre medium dense brick (1600 kg/m³).
- 12-millimetre plasterboard sheathing board (surface mass 8.5 kg/m²).
- 100-millimetre cavity formed by "line connection".
- Cavity fully filled with mineral wool insulation (minimum density 10 kg/m³).
- Two layers of 15-millimetre Knauf FireShield plasterboard (total surface mass 24 kg/m²).

The proposed external wall is predicted to achieve the following sound reduction indices:

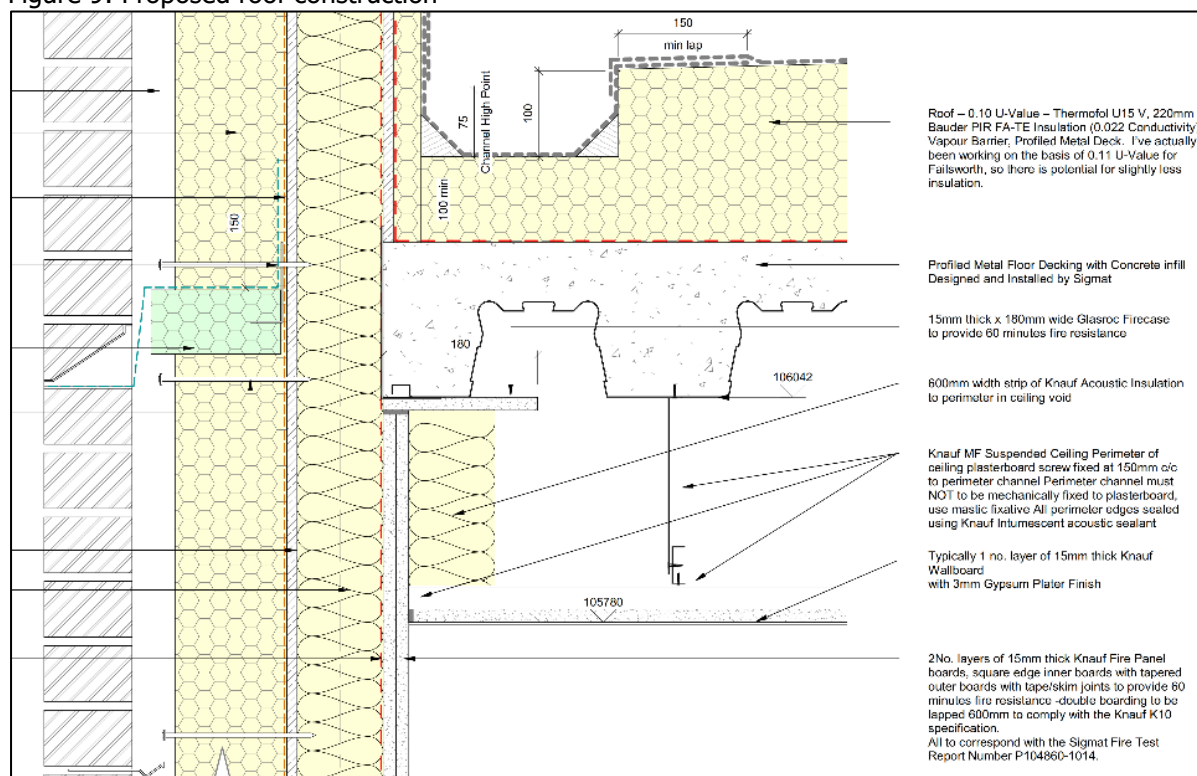
Table 7: Minimum sound insulation performance of external walls

Construction	Sound Reduction Index (dB) per Octave Band								R _w
	63	125	250	500	1k	2k	4k	8k	
As above	36	48	41	42	49	54	74	74	48

8.3.2. Roof Construction

The figure below shows the proposed roof construction:

Figure 9: Proposed roof construction



The above construction has been modelled in the proprietary software INSUL based on the following assumptions:

- 80-millimetre 2340 kg/m³ concrete (thinnest point of metal deck profile).
- 200-millimetre cavity with no insulation.
- One layer of 15-millimetre Knauf Wallboard plasterboard (surface mass 10kg/m²).

The proposed external wall is predicted to achieve the following sound reduction indices:

Table 8: Expected minimum sound insulation performance of roof

Construction	Sound Reduction Index (dB) per Octave Band								R _w
	63	125	250	500	1k	2k	4k	8k	
As above	24	42	49	48	58	63	71	71	56

8.3.3. Window Construction

The windows on all elevations could be openable at occupier discretion. However, they need to be sealed airtight to control external noise when the windows are closed within the areas noted above. There should be no un-attenuated vents or openings in the building façade.

The minimum performance requirements for windows in each zone are provided below. Other constructions may also achieve this level of sound attenuation.

Table 9: Required minimum sound reduction indices of windows

Zone	Room Type	Minimum Sound Reduction Index (dB) per Octave Band								R _w	Typical Construction
		63	125	250	500	1k	2k	4k	8k		
	All Habitable Rooms	22	27	29	36	41	42	52	50	39	10/12/6.4
	All Habitable Rooms	20	24	20	25	35	38	35	36	31	4/12/4

The glazing supplier should confirm the performances above are achievable when tested to the current British Standards.

8.4. Ventilation

8.4.1. Background Ventilation

The habitable rooms of the development will be ventilated via attenuated means. It is proposed to install Vent Axia Sentinel MVHR units to provide whole dwelling ventilation which will reduce the need to open windows.

The total sound level difference to 'habitable rooms' through the mechanical ventilation system required to meet BS8233:2014 and WHO 1999 guidelines would be, at a minimum, as follows:

Table 10: Required total sound level difference for MVHR system

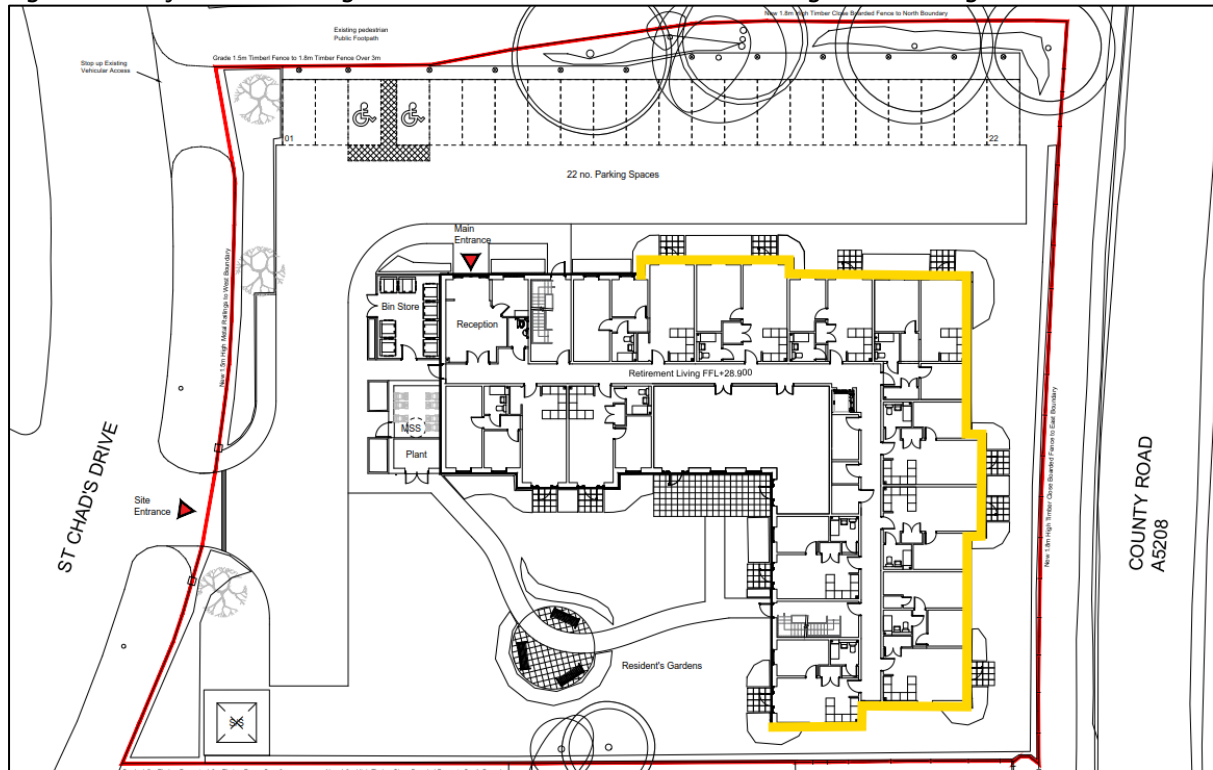
Zone	Minimum Sound Level Difference per Octave Band (dB)							
	63	125	250	500	1k	2k	4k	8k
	28	33	40	48	52	48	46	42
	21	28	33	38	40	37	33	24

This is the difference between the free-field atmospheric level at the building façade and the reverberant level inside a furnished room at one-and-a-half metres from the vent. The supplier should ensure the chosen mechanical ventilation system is designed to achieve the 'out-to-in' sound level differences above.

8.4.2. Overheating

ADO states that bedroom windows are likely to be closed during sleeping hours where internal noise levels exceed 40 dB $L_{Aeq,8hour}$ and 55 dB L_{AFmax} . On the basis that a partially open window achieves up to 13 dB attenuation, bedrooms on the following yellow façades are predicted to exceed these internal threshold levels with windows open:

Figure 10: Façades exceeding thresholds for bedroom windows being closed at night



Where windows must be closed to mitigate noise at night, there could be a risk of bedrooms overheating and where this is the case mechanical cooling measures are likely to be required.

An overheating assessment has been undertaken by Focus Consultants who were provided with the figure above denoting bedroom windows which would typically need to be closed to mitigate noise. Focus have determined the required g-values of the glazing to achieve the Approved Document O overheating requirements while keeping windows shut and the specification per window is set out in the overheating report. With the proposed g-values, the overheating criteria are achieved in all bedrooms across the scheme.

As follows are shown the results of the overheating assessment for bedrooms issued by Focus:

Figure 11: Results of overheating assessment

Room name	Naturally ventilated Criterion a check	Naturally ventilated Criterion b check	Mechanically ventilated check	Corridor overheating risk check
Bedroom 1 Flat 01 GF	-	-	Pass	-
Bedroom 1 Flat 02 GF	-	-	Pass	-
Bedroom 1 Flat 05 GF	-	-	Pass	-
Bedroom 1 Flat 08 GF	-	-	Pass	-
Bedroom 1 Flat 09 GF	-	-	Pass	-
Bedroom 1 Flat 12 FF	Pass	Pass	-	-
Bedroom 1 Flat 13 FF	-	-	Pass	-
Bedroom 1 Flat 16 FF	-	-	Pass	-
Bedroom 1 Flat 19 FF	-	-	Pass	-
Bedroom 1 Flat 20 FF	-	-	Pass	-
Bedroom 1 Flat 21 FF	-	-	Pass	-
Bedroom 1 Flat 24 FF	Pass	Pass	-	-
Bedroom 1 Flat 26 SF	Pass	Pass	-	-
Bedroom 1 Flat 27 SF	-	-	Pass	-
Bedroom 1 Flat 30 SF	-	-	Pass	-
Bedroom 1 Flat 33 SF	-	-	Pass	-
Bedroom 1 Flat 34 SF	-	-	Pass	-
Bedroom 1 Flat 35 SF	-	-	Pass	-
Bedroom 1 Flat 38 SF	Pass	Pass	-	-
Bedroom 1 Flat 40 TF	Pass	Pass	-	-
Bedroom 1 Flat 41 TF	-	-	Pass	-
Bedroom 1 Flat 44 TF	-	-	Pass	-
Bedroom 1 Flat 47 TF	-	-	Pass	-
Bedroom 1 Flat 48 TF	-	-	Pass	-
Bedroom 1 Flat 49 TF	-	-	Pass	-
Bedroom 1 Flat 52 TF	Pass	Pass	-	-
Bedroom 2 Flat 02 GF	-	-	Pass	-
Bedroom 2 Flat 05 GF	-	-	Pass	-
Bedroom 2 Flat 08 GF	-	-	Pass	-
Bedroom 2 Flat 09 GF	-	-	Pass	-
Bedroom 2 Flat 13 FF	-	-	Pass	-
Bedroom 2 Flat 16 FF	-	-	Pass	-
Bedroom 2 Flat 19 FF	-	-	Pass	-
Bedroom 2 Flat 21 FF	-	-	Pass	-
Bedroom 2 Flat 27 SF	-	-	Pass	-
Bedroom 2 Flat 30 SF	-	-	Pass	-
Bedroom 2 Flat 33 SF	-	-	Pass	-
Bedroom 2 Flat 35 SF	-	-	Pass	-
Bedroom 2 Flat 41 TF	-	-	Pass	-
Bedroom 2 Flat 44 TF	-	-	Pass	-
Bedroom 2 Flat 47 TF	-	-	Pass	-
Bedroom 2 Flat 49 TF	-	-	Pass	-

8.5. Effect of Mitigation Measures

With the mitigation measures installed to habitable rooms of the dwellings in the rooms noted above, the predicted internal noise levels are below British Standard 8233:2014 and WHO (1999) criteria and, on this basis, we would consider noise to be below the lowest observed adverse effect level of the NPPG.

The predictions are shown below for the worst-case bedroom on County Road:

Free Field Level at Façade									
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, L_{10hour}	70	65	63	67	68	58	52	48	70
Night L_{15min}	64	59	57	57	61	58	50	47	64
Night-time $L_{night(10)}$	77	74	75	74	73	73	71	69	79
Building Façade Construction									
External Element		63	125	250	500	1000	2000	4000	8000
Wall: McCarthy and Stone proposed wall		36	48	41	42	49	54	74	74
Area		4							
		0.0	0	0	0	0	0	0	0
Double Glazed: 10/12/6.4 - 39 Rw		22	27	29	36	41	42	52	50
Area		2							
		0	0	0	0	0	0	0	0
Roof: McCarthy and Stone proposed roof (with 5dB reduction to noise incident on roof)		29	47	54	53	63	68	76	76
Area		9							
		0	0	0	0	0	0	0	0
Calculations to BS EN 12354									
	63	125	250	500	1000	2000	4000	8000	
Sum	0	0	0	0	0	0	0	0	
10log sum	-28	-35	-37	-43	-48	-50	-60	-58	
10log S/A	3	3	3	3	3	3	3	3	
correction factor +3	3	3	3	3	3	3	3	3	
MVHR Insertion Loss	28	33	40	48	52	48	46	42	
Cumulative Predicted Internal Noise Levels									
Octave Band	63	125	250	500	1000	2000	4000	8000	dBA
Day, L_{10hour}	50	38	33	31	27	16	7	6	33
Night L_{15min}	44	32	27	21	20	16	5	5	26
Night-time $L_{night(10)}$	57	47	45	38	32	31	26	27	41

9. Summary and Conclusion

McCarthy Stone appointed Acoustic Consultants Limited to undertake an environmental noise assessment for the proposed retirement living development located at St Chad's Drive Car Park, Kirkby, Liverpool.

A noise survey was carried out at the site between 16th and 17th November 2023 to determine environmental noise levels at the site. Computer noise modelling has been undertaken to predict road traffic noise levels at the proposed dwellings.

The modelling results have been used to advise on the mitigation measures required to achieve acceptable internal noise levels with the proposed dwellings in accordance with the relevant noise guidance.

Noise mitigation measures will be required to meet the relevant noise guidance in British Standard 8233:2014 and WHO (1999) in all habitable rooms across the proposed development. Noise mitigation advice is provided in this report in the form of building façade constructions, minimum window performance and minimum sound level differences for the proposed mechanical ventilation system.

With the proposed fabric construction and suitable MVHR design as set out in this report, the predicted internal equivalent noise levels due to external noise are within the British Standard 8233:2014 and WHO (1999) criteria for good conditions.

This report identifies bedrooms which are likely to require closed windows throughout the night to mitigate external noise ingress. In order to achieve the Approved Document O overheating criteria, specific g-values are required to the windows that are likely to be closed at night; these have been specified by Focus Consultants in their report. The results of the overheating assessment are summarised in Section 8.4.2.

The proposals and recommended mitigation measures set in this report achieve the aims of the NPPF to "*mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development*" via good acoustic design.

10. Appendix 1 – Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network.

A-weighted sound pressure level, L_{pA} – quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);
 p_0 is the reference sound pressure (20 μ Pa)

Background sound level, $L_{A90,T}$ – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Break-in - noise transmission into a structure from outside.

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$ – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2/p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Facade level – sound pressure level 1 m in front of the façade. Facade level measurements of L_{pA} are typically 1 dB to 3 dB higher than corresponding free-field measurements because of the reflection from the facade.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example, third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Sound reduction index, R – laboratory measure of the sound insulating properties of a material or building element in a stated frequency band.

Specific sound level, $L_s = L_{Aeq,T_r}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Structure-borne noise – audible noise caused by the vibration of elements of a structure, the source of which is within a building or structure with common elements.

Rating level, L_{A_r,T_r} – Specific sound level plus any adjustment for the characteristic features of the sound.

Reverberation Time, T – The reverberation time is defined as the time taken for a noise level in an enclosed space to decay by 60 dB from a steady level once the noise source has stopped. It is measured in seconds. Often a 60 dB decay cannot be measured so the reverberation time is measured over a lesser range and corrected back to the time for a 60 dB drop assuming a constant decay rate. Common parameters are T20 (time taken for a 20 dB decay multiplied by three) and T30 (time taken for a 30 dB decay multiplied by two).

Vibration Dose Value, VDV – measure of the total vibration experienced over a specified period of time.

Estimated Vibration Dose Value, $eVDV$ – estimation of the total vibration experienced over a specified period of time. This is usually based on the number of events and shortened measurement data.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



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