



Residential Noise Assessment

Site Address: Land Opposite to 1-35 Bentley Street, Rochdale, OL12 6EU

Client Name: Hidayatullah Hatami - Tang & Associates Architecture Ltd

Project Reference No: NP-009083



Authorisation and Version Control

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Amendment History

Revision	Summary of Amendments
01	First draft
02	Updated site layout

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1. Introduction

NOVA Acoustics Ltd has been commissioned to prepare a noise assessment for a new build residential development ('the Proposed Development') at Land Opposite to 1-35 Bentley Street, Rochdale, OL12 6EU ('the Site'). The proposed development is for the erection of 2 no. 3-storey apartment buildings. The site is subject to noise from road traffic emissions and commercial businesses.

A noise survey has been undertaken to establish the prevailing sound levels at the proposed development. The findings have been subsequently used to assess the suitability of the site for residential use. Measures required to mitigate noise impacts for the proposed development have been assessed in accordance with the relevant performance standards, legislation, policy, and guidance.

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

1.1 *Standards, Legislation, Policy & Guidance*

The following performance standards, legislation, policy, and guidance have been considered to ensure good acoustic design in the assessment:

- National Planning Policy Framework (2021)
- Noise Policy Statement for England (2010)
- British Standard BS8233:2014 – 'Guidance on sound insulation and noise reduction for buildings'
- ProPG: 'Planning and Noise 2017' (including supplementary documents 1 & 2).
- Approved Document O: Overheating (2021)
- Acoustics Ventilation Overheating: Residential Design Guide 2020' (AVO Guide)

Further information on the legislation can be found in Appendix B.

1.2 Proposal Brief

The proposal is for the erection of a 2 no. new apartment buildings comprised of 23 no. residential flats. The figure below shows the proposed development.



Drawing Ref No. 9757/102-A from 'Tang & Associates Architects Ltd'

Figure 1 – Proposed Development

2. Environmental Noise Survey

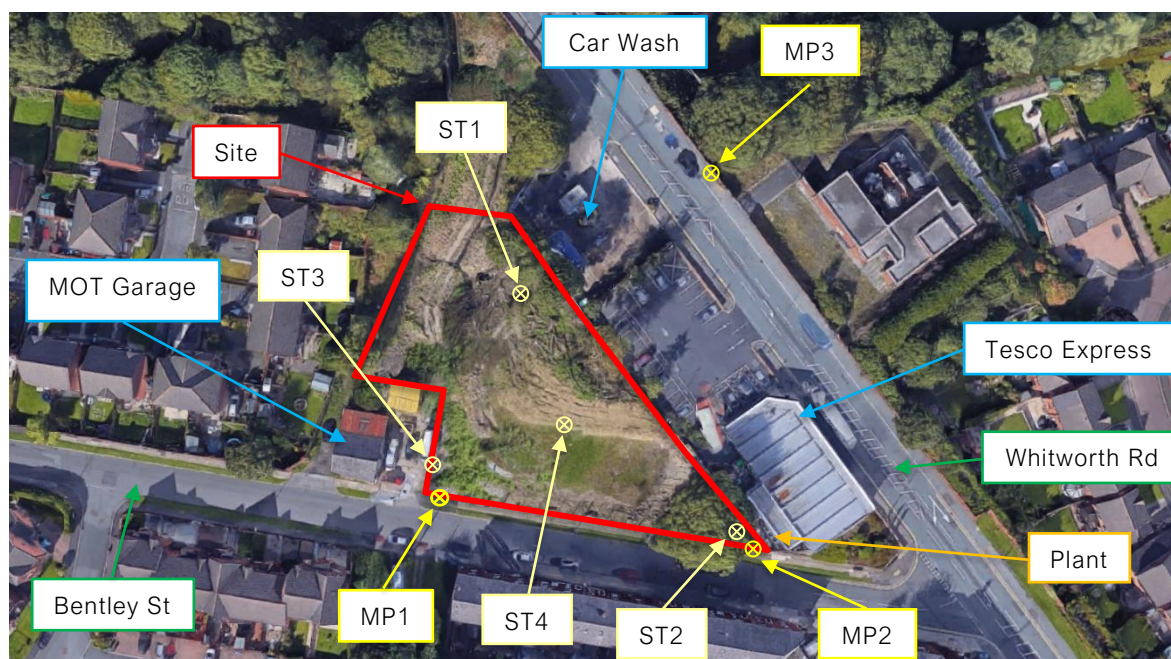
2.1 Measurement Methodology

The following table outlines the measurement dates and particulars.

Location	Survey Dates	Measurement Particulars
MP1	27/02/2023 – 28/03/2023	Equipment mounted on a lamp post at a height of 3.5m on Bentley Street, close to MOT Garage.
MP2	27/02/2023 – 28/03/2023	Equipment mounted on a lamp post at a height of 3.5m on Bentley Street, close to the rear of Tesco Express.
MP2	27/02/2023 – 28/03/2023	Equipment mounted on a lamp post at a height of 3.5m on Whitworth Road, opposite Car Wash and Tesco Express.
ST1	27/02/2023	Equipment mounted on a tripod at a height of 1.5m, 8m from site boundary, close to the rear of Car Wash.
ST2	27/02/2023	Equipment mounted on a tripod at a height of 1.5m, 4m from plant units at the rear of Tesco Express.
ST3	27/02/2023	Equipment mounted on a tripod at a height of 1.5m, on site boundary 11m from MOT Garage.
ST4	28/02/2023	Equipment mounted on a tripod at a height of 1.5m, at centre of site.

Table 1 – Measurement Methodology

The figure below outlines the site surroundings and measurement locations:



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Figure 2 – Measurement Locations and Site Surroundings

2.2 Context & Subjective Impression

The proposed development site is located on vacant land off Bentley Street, Rochdale. The area surrounding the site consists primarily of residential dwellings to the west and south. Situated on the eastern, north-eastern and south-western boundaries of the site are a mixture of commercial premises that are understood to operate with the hours of 06:00 – 23:00.

The acoustic environment at the site is deemed to be moderate to high in level and the noise profile is influenced by road traffic noise emissions from the Whitworth Rd (A671), vehicle pass-bys along Bentley Street and noise from the commercial properties.

During the site visits, noise emissions from 'Recardo Car Wash' were audible at the proposed development. Any vehicle repairs within the MOT garage (Continental Motors) are significantly shielded by the façade as the main roller doors of the business face away from site. It was noted by the on-site engineer that noise from the MOT garage was not perceptible at the proposed development above the prevailing residual noise level.

Plant units were visible to the rear of Tesco Express, however, the associated noise emissions were also deemed to be significantly lower than other noise levels in the area during the daytime (i.e., road traffic noise and noise associated with the car wash). It is anticipated that noise associated with nearby plant is more likely to be perceptible during the quieter night-time period.

The following table outlines the specific opening hours of the surrounding businesses.

Business Name	Operating Hours
Recardo Car Wash	All Week, 08:00 – 18:00
Continental Motors	Mon - Fri, 09:00 – 17:00
Tesco Express	All Week, 06:00 – 23:00

Table 2 – Surrounding Businesses and Operating Times

2.3 Environmental Noise Survey Results

The following section outlines the measured sound levels during the long-term environmental survey. The time history results can be found in Appendix D.

The highest octave band $L_{eq,16hr}$ and $L_{eq,1hr}$ sound levels measured during the daytime and loudest $L_{eq,8hr}$ and $L_{eq,1hr}$ measured during the night-time period are presented below.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$ dB)						$L_{Aeq,T}$ (dB)	Exceeded Fewer Than 10 Times $L_{AFmax,1min}$ (dB)
		125	250	500	1k	2k	4k		
MP1	$L_{eq,16hr}$ (Day)	60	61	61	65	62	51	68	--
	$L_{eq,1hr}$ (Day)	61	62	62	66	64	53	69	
	$L_{eq,8hr}$ (Night)	50	52	52	56	54	44	63	82
	$L_{eq,1hr}$ (Night)	54	55	56	60	58	47	63	
MP2	$L_{eq,16hr}$ (Day)	63	63	63	65	61	49	68	--
	$L_{eq,1hr}$ (Day)	64	64	64	66	62	53	69	
	$L_{eq,8hr}$ (Night)	56	55	54	57	53	43	60	80
	$L_{eq,1hr}$ (Night)	62	60	59	62	58	47	64	
MP3	$L_{eq,16hr}$ (Day)	67	67	68	69	66	57	72	--
	$L_{eq,1hr}$ (Day)	70	67	68	70	67	57	73	
	$L_{eq,8hr}$ (Night)	57	59	58	62	59	50	65	83
	$L_{eq,1hr}$ (Night)	62	64	64	67	65	55	71	

Table 3 – Sound Level Results Summary

Short-Term Noise Survey

The following table outlines a summary of noise levels measured at the short-term positions.

Location	Measurement Period ('T')	Octave Frequency Band (Hz, $L_{eq,T}$ dB)						$L_{Aeq,T}$ (dB)
		125	250	500	1k	2k	4k	
ST1	27/02/2023: 12.51 – 13:07 (Day)	54	52	56	53	51	50	59
ST2	27/02/2023: 13.13 – 13:28 (Day)	63	61	59	62	57	47	65
ST3	27/02/2023: 13.44 – 13:59 (Day)	60	58	58	61	55	47	64
ST4	28/02/2023: 11.00 – 11:20 (Day)	56	51	51	54	50	39	57

Table 4 – Sound Level Results Summary (Short-Term)

3. Noise Modelling

The environmental noise survey has allowed the sound levels at the proposed development to be modelled within SoundPlan 8.2. The modelling particulars are outlined in Appendix F. The sound maps showing the predicted daytime L_{Aeq} , night-time L_{Aeq} and night-time $L_{AFmax,1min}$ sound levels incident upon the proposed development can be seen in the figures below.

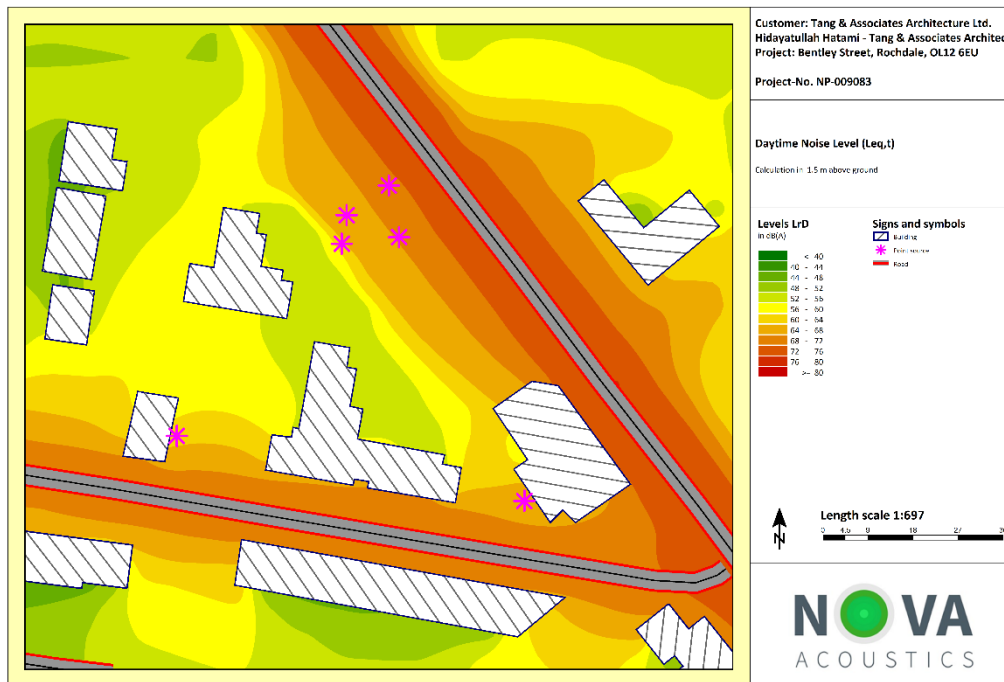


Figure 3 – Daytime L_{Aeq} Ambient Sound Map (1.5m Grid Map Height)

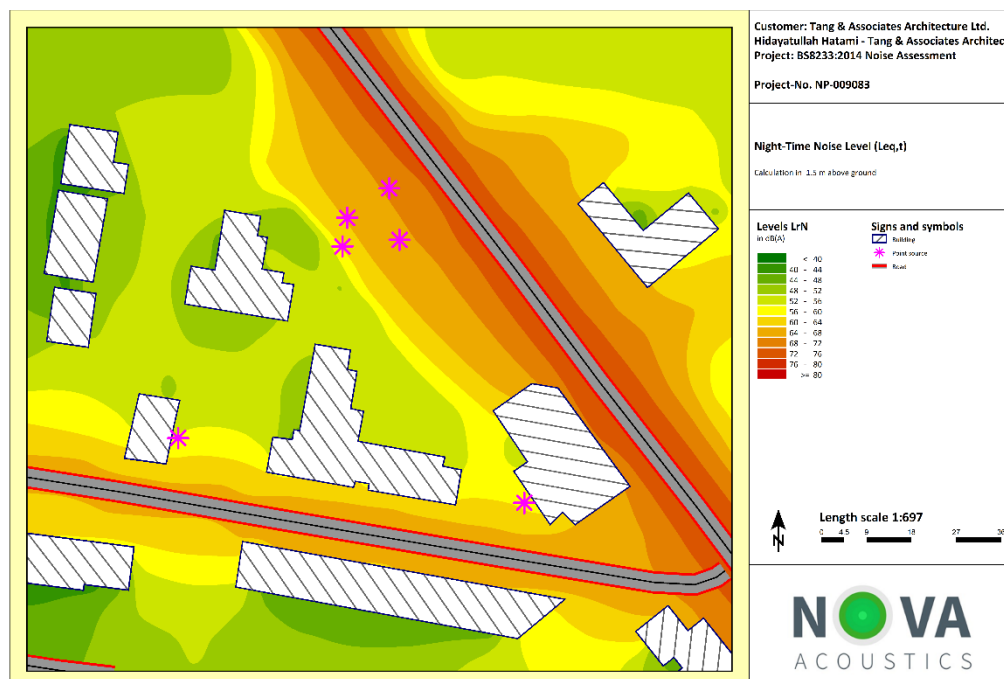


Figure 4 – Night-time L_{Aeq} Ambient Sound Map (1.5m Grid Map Height)

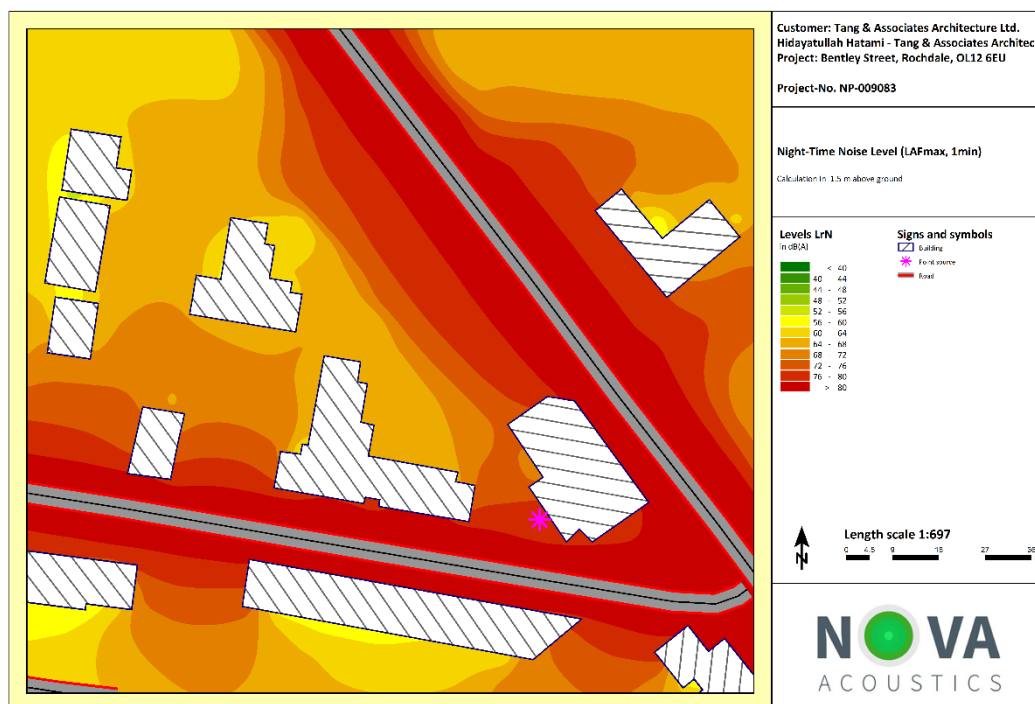


Figure 5 – Night-time $L_{AFmax,1min}$ Sound Map (1.5m Grid Map Height)

4. Noise Break-in Assessment and Sound Insulation Scheme

4.1 Internal Noise Level Criteria

The following table outlines the internal and external acoustic design criteria used in the following assessment.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$ / NR30	--
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$ / NR35	--
Sleeping (Daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$ / NR30	30 dB $L_{Aeq,8hr}$ / NR25 45 dB L_{AFmax} *

*Note 1: The maximum criteria have been taken from the World Health Organisation (WHO) Guidelines for Community Noise.

*Note 2: ProPG:2017 which is relevant to 'New Residential' states; "In most circumstances 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. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability, and regularity of noise events".

Note 3: BS8233:2014 states: "Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".

Note 4: BS8233:2014 states: "The levels shown in Table 4 (criteria shown above) are based on the existing guidelines issued by the WHO and assume normal diurnal fluctuations in external noise. In cases where local conditions do not follow a typical diurnal pattern, for example on a road serving a port with high levels of traffic at certain times of the night, an appropriate alternative period, e.g., 1 hour, may be used, but the level should be selected to ensure consistency with the levels recommended in Table 4.

Note 5: BS8233:2014 states: "If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level.

Table 5 – Acoustic Design Criteria

The measured sound levels at the proposed development are assessed against the relevant criteria and a sound insulation scheme is provided to achieve a good internal acoustic environment.

4.2 Commercial Noise Sources

As can be seen in time history graphs in Appendix D, the measured noise levels are clearly diurnal in nature. It was also noted the noise profile of the area is predominantly "anonymous" steady state noise sources (e.g., road traffic).

However, to protect the amenity of future residents from noise associated with nearby commercial premises, in particular during the late evenings and between 06:00 to 07:00 hours, the façade sound reduction will be specified using the loudest 1-hour measurement periods as opposed to the average 16-hour (daytime) and 8-hour (night-time) periods recommended in BS8233. This methodology is further discussed in Note 4 of the above table.

4.3 Glazing and Background Ventilation Specification

The following section provides a glazing and background ventilation specification that achieves the relevant internal noise criteria. The calculations considering the following sound insulation scheme can be found in Appendix E.

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 three colour groups. Appropriate models of glazing and ventilation for each façade colour are shown in Table 6.



Figure 6 – Façade Allocation

Red Façades – Living Rooms								
Description	Octave Frequency Band (Hz, dB)						Overall (dB)	
	125	250	500	1k	2k	4k		
6mm Glass / 16mm Argon Cavity / 6.8mm Optiphon Glass	21	28	37	48	48	54	39 (R _w)	33 (R _w + C _{tr})
Greenwoods 2500EA.AC1 (2no. Trickle Vents)	41	40	37	47	43	46	44 (D _{ne,w})	38 (D _{ne,w} + C _{tr})
Red Façades – Bedrooms								
Description	Octave Frequency Band (Hz, dB)						Overall (dB)	
	125	250	500	1k	2k	4k		
10mm Glass / 16mm Argon Cavity / 8.8mm Optiphon Glass (SRI)*	28	31	42	45	50	58	44 (R _w)	38 (R _w + C _{tr})
Greenwoods MA3051 (Through-Wall Vent)	46	45	50	55	65	67	55 (D _{ne,w})	52 (D _{ne,w} + C _{tr})

Table 6 – Glazing and Ventilation Specification, Red Façades

Yellow Façades – Living Rooms & Bedrooms								
Description	Octave Frequency Band (Hz, dB)						Overall (dB)	
	125	250	500	1k	2k	4k		
6mm Glass / 16mm Air Cavity / 4mm Glass	21	20	26	38	37	39	31 (R _w)	27 (R _w + C _{tr})
Titon Standard Vent + C75 (Trickle Vent)	46	45	50	55	65	67	35 (R _w)	34 (R _w + C _{tr})

Table 7 – Glazing and Ventilation Specification, Yellow Façades

Any other glazing or ventilation specification capable of providing this attenuation will be suitable provided the suppliers can provide an acoustic test report in accordance with BS EN ISO 10140-2:2010 or an evidence-based calculation.

5. Open Window Noise Break-In Assessment

5.1 Internal Noise Levels with Open Windows Criteria

The AVO Guide advises that 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. This assessment will firstly assess whether the internal noise level criteria can be achieved with open windows. The AVO Guide provides criteria for both daytime and night-time periods which shown below.

Windows	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	AVO Guide Table 3-3 Example Outcomes	AVO Guide Table 3 – 2 Recommendation for Level 2 Assessment
Rarely Open	50 dB $L_{Aeq,16hour}$	42 dB $L_{Aeq,8hour}$ Normally Exceeds 65 dB $L_{AF,max}$	Noise causes a material change in behaviour e.g., having to keep windows closed most of the time	Recommended
Increasing Noise Level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	Optional
Often Open	40 dB $L_{Aeq,16hour}$	35 dB $L_{Aeq,8hour}$ Normally Exceeds 45 dB $L_{AF,max}$	Noise can be heard, but does not cause any change in behaviour	Not Required

Table 8 – AVO Guide Open Window Criteria

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 the internal noise criteria above and an open window providing 13dB attenuation. If required, an alternative ventilation strategy compliant with Approved Document F will be proposed.

5.2 Open Window Assessment

This assessment will firstly consider whether the internal noise level criteria from Table 3 – 3 of the AVO Guide can be achieved with open windows.

AVO Open Window Assessment – Red Façades				
External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
68 $L_{Aeq,1hr}$ (Day)	53	+15	63	+5
62 $L_{Aeq,1hr}$ (Night)	48	+14	55	+7
80 $L_{AF,max}$ (Night)	58	+22	78	+2
AVO Open Window Assessment – Yellow Façades				
External Noise Levels	AVO Guide Windows Open Often	Exceedance	AVO Guide Windows Rarely Open	Exceedance
57 $L_{Aeq,1hr}$ (Day)	53	+4	63	-6
52 $L_{Aeq,1hr}$ (Night)	48	+4	55	-3
69 $L_{AF,max}$ (Night)	58	+11	78	-9

Table 9 – Open Window Assessment

Discussion

For Red façades, 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.

For Yellow façades, the external noise levels exceed the AVO Guides 'Windows Open Often' criteria which means that windows being used for the primary means of ventilation (whilst maintaining reasonable internal noise levels) could vary dependent on the outcome of a TM59 overheating assessment. To assist in the design of the alternative ventilation strategy a TM59 overheating assessment should be undertaken to ascertain how frequently open windows at yellow façades will be required to mitigate overheating. The TM59 assessor should be provided with this report to base their study.

6. External Noise Level Assessment

6.1 External Noise Level Criteria

The following table outlines the external acoustic design criteria used in the following assessment.

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Relaxation	External Amenity Spaces	50 - 55 dB $L_{Aeq,16hr}$	--

Table 10 – Acoustic Design Criteria

6.2 External Noise Level Assessment

The following section analyses the external amenity area noise levels across the proposed development.

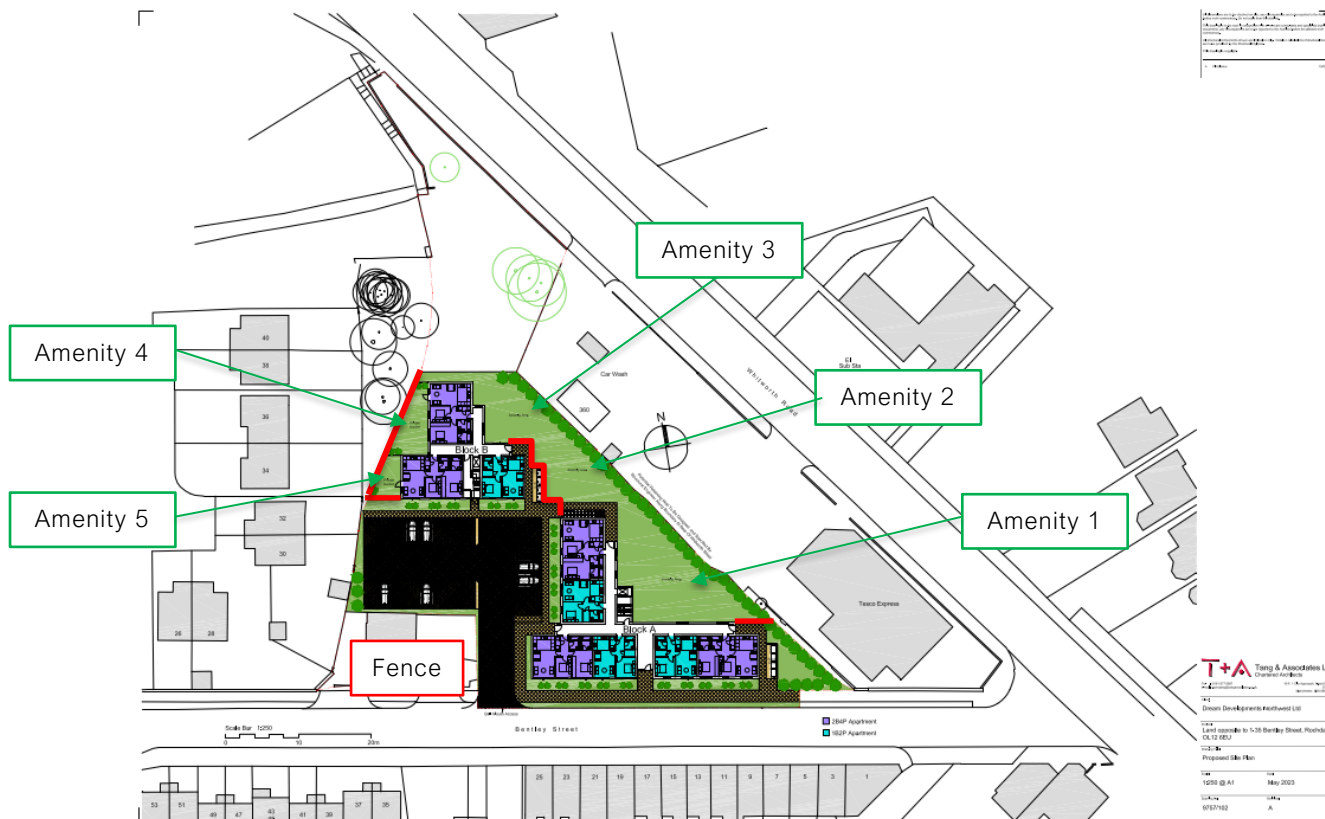
The external amenity area sound levels are summarised in the table below.

External Amenity Area Noise Level Assessment			
Ref.	$L_{Aeq,1hr}$ Noise Level (dB)	BS8233:2014 Criteria (dB)	Exceedance (dB)
1	55	50 – 55	0
2	54		-1
3	53		-2
4	53		-2
5	55		0

Table 11 – BS8233:2014 External Amenity Area Noise Level Assessment

As can be seen in the table above, the noise levels within each of the proposed amenity areas are below the BS8233:2014 upper criteria of 55dB. As such, further mitigation is not deemed to be required.

However, should the client want to further mitigate external noise within amenity spaces, a 1.8m tall close-boarded fence could be installed around the perimeter of the garden areas.



7. Conclusion and Action Plan

The proposed development has been assessed against the acoustic design criteria and a sound insulation scheme has been provided to ensure the criteria has been achieved.

The following 'Action Plan' is outlined to ensure the design considerations and specifications from this report are duly implemented:

1. The proposed glazing system, or a suitable alternative, should be installed as shown in Section 4.
2. A mechanical ventilation system should be installed for dwellings along red façades to provide 'Whole Dwelling Ventilation' in accordance with Approved Document F.
3. For yellow façades, it is recommended that a TM59 assessment is undertaken to ascertain how frequently open windows will be required to mitigate overheating.

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

Appendix A – Acoustic Terminology

A-weighted sound pressure level, L_{pA}	Quantity of A-weighted sound pressure given by the following formula in decibels (dBA). $L_{pA} = 10 \log_{10} (pA/p_0)^2$. Where: pA is the A-weighted sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
Background Sound	Underlying level of sound over a period, T , which might in part be an indication of relative quietness at a given location
Equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$	Value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound that, within a specified time interval, T , has the same mean-squared sound pressure as the sound under consideration that varies with time
Facade level	Sound pressure level 1 m in front of the facade
Free-field level	Sound pressure level away from reflecting surfaces
Indoor ambient noise	Noise in a given situation at a given time, usually composed of noise from many sources, inside and outside the building, but excluding noise from activities of the occupants
Noise Criteria	Numerical indices used to define design goals in a given space
Noise Rating (NR)	Graphical method for rating a noise by comparing the noise spectrum with a family of noise rating curves
Octave Band	Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit
Percentile Level, $L_{AN,T}$	A-weighted sound pressure level obtained using time-weighting “F”, which is exceeded for $N\%$ of a specified time interval
Rating Level, $L_{Ar,Tr}$	Equivalent continuous A-weighted sound pressure level of the noise, plus any adjustment for the characteristic features of the noise
Sound Pressure, p	root-mean-square value of the variation in air pressure, measured in pascals (Pa) above and below atmospheric pressure, caused by the sound
Sound Pressure Level, L_p	Quantity of sound pressure, in decibels (dB), given by the formula: $L_p = 10 \log_{10} (p/p_0)^2$. Where: p is the root-mean-square sound pressure in pascals (Pa) and p_0 is the reference sound pressure (20 μ Pa)
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

Appendix B – Standards, Legislation, Policy, and Guidance

This report is to be primarily based on the following standards, 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’

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	Daytime (07:00 – 23:00)	Night-time (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 $L_{Aeq,8hour}$ 45 dB L_{AFmax}^*

Table 12 – BS8233:2014 Internal Ambient Noise Level Criteria

**ProPG:2017 states that's good acoustic design can be used so that individual noise events do not normally exceed 45 dB L_{AFmax} more than 10 time a night within noise sensitive rooms such as bedrooms. However, where it is not reasonably practicable to achieve the guideline then the judgment of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number distribution, predictability, and regularity of noise events.*

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.

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 in Appendix B.

B.4 – ProPG: Planning and Noise (2017)

ProPG Planning and Noise published May 2017 by the Association of Noise Consultants (ANC) was produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. ProPG aims to encourage better acoustic design of new residential developments promoting good health and wellbeing through the effective management of noise. It therefore outlines four key elements which should be considered in the assessment of noise:

- Element 1 – demonstrating a “Good Acoustic Design Process”.
- Element 2 – observing internal “Noise Level Guidelines”.
- Element 3 – undertaking an “External Amenity Area Noise Assessment”; and
- Element 4 – consideration of “Other Relevant Issues”.

The ProPG supplementary document 2 provides the following 'Good Acoustic Design' hierarchy of noise management measures which LPAs should encourage. These are shown below, In descending order of preference:

Order of Preference	Noise Management Measure
1	Reduction of the noise generated at source by redesign, relocation, or containment. *
2	Maximising the spatial separation of noise source(s) and receptor(s).
3	Using existing topography and existing structures (that are likely to last the expected life of the noise-sensitive scheme) to screen the proposed development site from significant sources of noise.
4	Investigating the necessity and feasibility of reducing existing noise levels and relocating existing noise sources.
5	Incorporating noise barriers as part of the scheme to screen the proposed development site from significant sources of noise.
6	Using the layout of the scheme to reduce noise propagation across the site.
7	Using the orientation of buildings to reduce the noise exposure of noise sensitive rooms.
8	Using the building envelope to mitigate noise to acceptable levels.

Table 13 – Hierarchy of Noise Management Measures

*Not from ProPG

B.5 – Approved Document O: Overheating (2021)

Approved Document O states the following in relation to noise:

1. 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).
2. 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. 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).B.6 - Acoustics Ventilation and Overheating – Residential Design Guide 2020

B.6 – Acoustics Ventilation and Overheating – Residential Design Guide 2020

It is suggested that the desirable internal noise criteria within BS8233:2014 should be achieved considering adequate ventilation as defined by Building Regulations 'Approved Document F' ('ADF') whole dwelling ventilation. However, for a whole dwelling ventilation system such as MVHR it is considered

The AVO Guide (2020) seeks to determine the level of risk associated with overheating in a new residential development based on the existing noise climate. The AVO risk categories are detailed in the table below with clearer categorisation.

Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)	Risk Category	Mitigation
≥ 63 dB $L_{Aeq,16hr}$	≥ 55 dB $L_{Aeq,8hr}$	High Risk	Level 2 assessment recommended. Windows which are unopenable on grounds of noise will inevitably create issues for the overheating strategy.
57 – 62 dB $L_{Aeq,16hr}$	52 – 54 dB $L_{Aeq,8hr}$	Medium Risk	Level 2 assessment optional to give more confidence regarding the suitability of internal noise conditions.
54 – 56 dB $L_{Aeq,16hr}$	49 – 51 dB $L_{Aeq,8hr}$	Low Risk	
≤ 53 dB $L_{Aeq,16hr}$	≤ 48 dB $L_{Aeq,8hr}$	Negligible Risk	None required – openable windows suitable for ventilation

Table 14 – AVO Guide (2020) Level 1 Risk Assessment

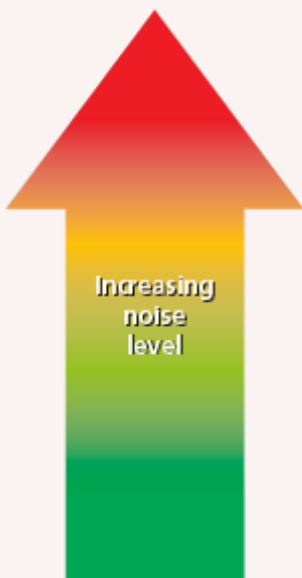
Level 2 Risk Assessment:

A 'Level 2' assessment of noise is recommended where a dwelling using purge ventilation (e.g., open windows) reaches Level 1 'High Risk' or 'Medium Risk'. The Level 2 assessment guidance comments that where internal ambient noise levels are >50 dB $L_{Aeq,16hr}$ (day) or >42 dB $L_{Aeq,8hr}$ (night) then the outcome might be that the noise causes a material change in behaviour, e.g., having to keep windows closed for the majority of the time, or there is the potential for sleep disturbance.

To conduct a Level 2 assessment, the following minimum information is required:

- Statement of the overheating criteria being applied.
- Description of the provisions for meeting the stated overheating criteria. This should include, where relevant, the area of façade opening.
- Details of the likely internal ambient noise levels whilst using provisions for mitigating overheating, and the method used to predict these.
- Estimation of how frequently and for what duration such provisions are required to mitigate overheating.
- Consideration of the effect of individual noise events.
- Assessment of the adverse effect on occupants.

The figure below outlines the AVO Guide (2020) guidance for a Level 2 assessment of noise from transport sources relating to the Overheating Condition.

Internal ambient noise level ^[Note 2]			Examples of Outcomes ^[Note 5]	
$L_{Aeq,T}$ ^[Note 3] during 07:00 – 23:00 ^[Note 6]	$L_{Aeq,8h}$ during 23:00 – 07:00	Individual noise events during 23:00 – 07:00 ^[Note 4]		
> 50 dB	> 42 dB	Normally exceeds 65 dB $L_{A,max}$	Noise causes a material change in behaviour e.g. having to keep windows closed most of the time	Avoiding certain activities during periods of intrusion. 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.
 Increasing noise level			Increasing likelihood of impact on reliable speech communication during the day or sleep disturbance at night	At higher noise levels, more significant behavioural change is expected and may only be considered suitable if occurring for limited periods. As noise levels increase, small behaviour changes are expected e.g. turning up the volume on the television; speaking a little more loudly; having to close windows for certain activities, for example ones which require a high level of concentration. Potential for some reported sleep disturbance. Affects the acoustic environment inside the dwelling such that there is a perceived change in quality of life. At lower noise levels, limited behavioural change is expected unless conditions are prevalent for most of the time. ^[Note 8]
≤ 35 dB	≤ 30 dB	Do not normally exceed $L_{A,max}$ 45 dB more than 10 times a night	Noise can be heard, but does not cause any change in behaviour	Noise can be heard, but does not cause any change in behaviour, attitude, or other physiological response ^[Note 9] . Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.

Note 1 The noise levels suggested in Tables 3-2 and 3-3 assume a steady road traffic noise source but may be adapted for other types of transport.

Table 3-3 of AVO Guide (2020)

Figure 9 – AVO Guide Level 2 Internal Ambient Noise Levels

Appendix C – Location Plans



Figure 10 – Location Plans

Appendix D – Environmental Survey

D.1 – Time History Noise Data

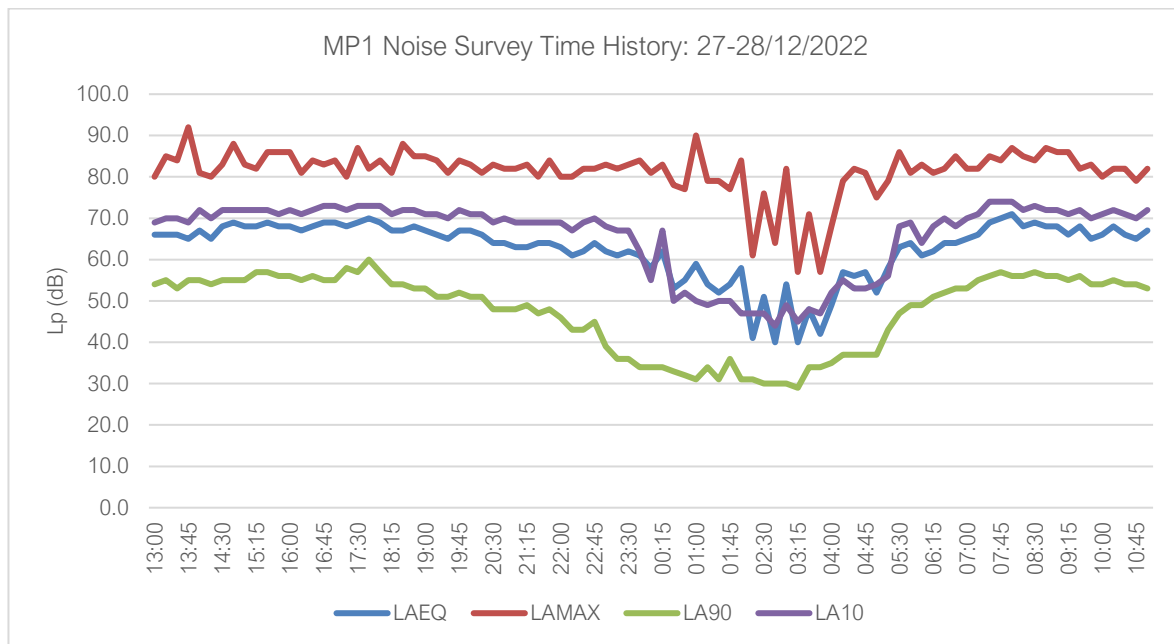


Figure 11 – MP1 Noise Survey Time History

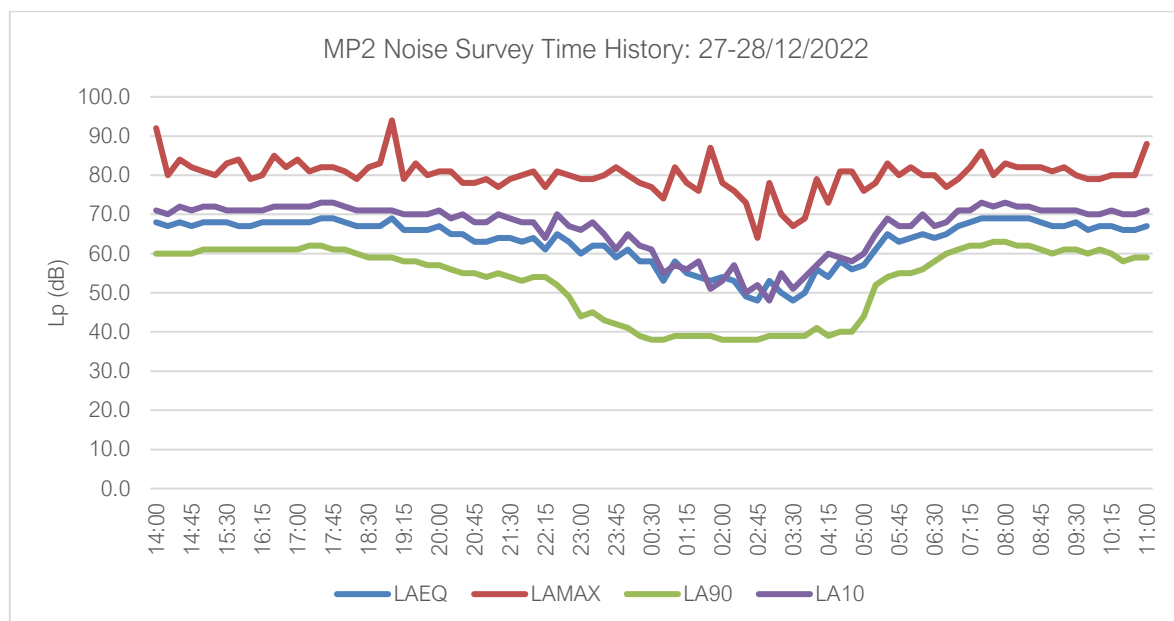


Figure 12 – MP2 Noise Survey Time History

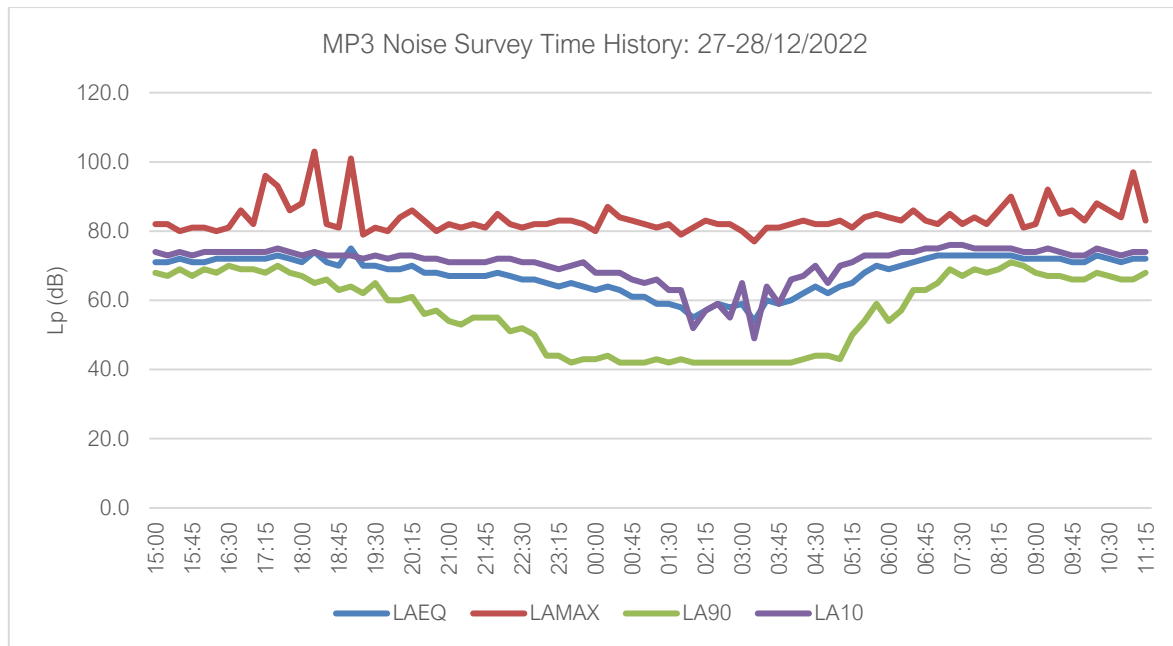


Figure 13 – MP3 Noise Survey Time History

D.2 – Surveying Equipment

Piece of Equipment	Serial No.	Calibration Deviation
Svantek SV307 Class 1 Sound Level Meter	87871	≤0.2
CESVA CB006 Class 1 Calibrator	901997	
CESVA SC250 Class 1 Sound Level Meter	T252860	
CESVA CB011 Class 1 Calibrator	T253524	
CESVA SC250 Class 1 Sound Level Meter	T252915	
CESVA CB011 Class 1 Calibrator	T251945	

Table 15 – Surveying Equipment

All equipment used during the survey was field calibrated at the start and end of the measurement period with negligible deviation noted. 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 – Starring Weather (Approx. 3.5km ENE of Site)				
Time Period	Air Temp (°C)	Rainfall (mm/h)	Prevailing Wind Direction	Wind Speed (m/s)
27/02/23 – 00:00 – 23:59	2.5 – 8.0	0.0	ENE	0.0 – 3.9
28/02/23 – 00:00 – 23:59	-4.0 – 6.5	0.0	E	0.0 – 4.4

Table 16 – Weather Conditions

Appendix E – Noise Break-in Calculations

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

- The calculation method for façade sound reduction is in accordance with BS8233:2014 and BS EN 12354-3.
- Based on previous experience and measure reverberations in furnished habitable rooms, a reverberation time of 0.3 seconds (RT60) is assumed for bedrooms and 0.5 seconds (RT60) for living rooms.
- Based on the technical drawings provided to NOVA Acoustics, the following dimensions have been used based on typical bedrooms and living rooms at the proposed development:
 - o Bedrooms: 22 – 24m³ with 2m² of glazing
 - o Living Rooms: 57 – 65m³ with 2 - 3.5m² of glazing
- The acoustic performance of the façade elements is taken from the relevant manufacturers' technical information, or the sound reduction has been predicted using INSUL 9.0.
- For background trickle ventilation a total Equivalent Area of 5000mm² per habitable room has been used in the calculations, which equates to 2 No. trickle vents (2500mm² each).

It should be noted that assessment against the equivalent Noise Rating (NR) curves are included in the noise break calculations. In certain locations there are slight exceedances of the NR criteria however, the single-figure values (as provided in BS8233) are achieved and therefore the recommended glazing and ventilation specification are considered suitable.

Living Rooms (Red Facades) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	68	63	63	63	65	61	52
Glazing Noise Ingress	22	34	27	18	9	5	-10
Ventilation Noise Ingress	25	21	22	25	17	17	5
Wall Noise Ingress	10	15	13	3	4	0	-9
Roof Noise Ingress							
Room Absorption Correction		8	8	7	7	7	6
Total Noise Ingress	34	42	36	33	25	24	11
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-1	-6	-3	0	-5	-2	-13

Bedrooms (Red Facades) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	68	63	63	63	65	61	52
Glazing Noise Ingress	23	30	27	16	15	6	-11
Ventilation Noise Ingress	22	22	23	18	15	1	-10
Wall Noise Ingress	9	14	12	2	3	-1	-10
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	5
Total Noise Ingress	32	38	35	27	25	14	-1
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-3	-10	-4	-6	-5	-12	-25

Bedrooms (Red Facades) Night Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	62	59	57	56	59	55	44
Glazing Noise Ingress	17	27	22	10	10	1	-18
Ventilation Noise Ingress	15	19	18	12	10	-4	-17
Wall Noise Ingress	3	10	6	-5	-3	-7	-18
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	5
Total Noise Ingress	26	34	30	20	19	8	-9
NR25	30	43	35	28	25	21	19
Exceednce of Criteria	-4	-9	-5	-8	-6	-13	-28

Bedrooms (Red Facades) Night Time Max

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	80	77	75	74	77	73	62
Glazing Noise Ingress	35	45	40	28	28	19	0
Ventilation Noise Ingress	33	37	36	30	28	14	1
Wall Noise Ingress	21	28	24	13	15	11	0
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	5
Total Noise Ingress	44	52	48	38	37	26	9
NR40	45	56	49	43	40	37	34
Exceednce of Criteria	-1	-4	-1	-5	-3	-11	-25

Living Rooms (Yellow Facades) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	57	52	52	52	54	50	41
Glazing Noise Ingress	19	23	24	18	8	5	-6
Ventilation Noise Ingress	17	13	15	16	11	10	-2
Wall Noise Ingress	-1	4	2	-8	-7	-11	-20
Roof Noise Ingress							
Room Absorption Correction		8	8	7	7	7	6
Total Noise Ingress	28	31	32	27	20	18	5
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-7	-17	-7	-6	-10	-8	-19

Bedrooms (Yellow Facades) Day Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	57	52	52	52	54	50	41
Glazing Noise Ingress	22	26	27	21	11	8	-3
Ventilation Noise Ingress	23	19	21	22	17	16	4
Wall Noise Ingress	-2	3	1	-9	-8	-12	-21
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	4
Total Noise Ingress	32	34	35	31	24	22	9
NR30	35	48	39	33	30	26	24
Exceednce of Criteria	-3	-14	-4	-2	-6	-4	-15

Bedrooms (Yellow Facades) Night Time Leq

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Leq,T Spectrum	52	49	47	46	49	45	34
Glazing Noise Ingress	17	23	22	15	6	3	-10
Ventilation Noise Ingress	18	16	16	16	12	11	-3
Wall Noise Ingress	-7	0	-4	-15	-13	-17	-28
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	4
Total Noise Ingress	27	31	30	25	19	18	3
NR25	30	43	35	28	25	21	19
Exceednce of Criteria	-3	-12	-5	-3	-6	-3	-16

Bedrooms (Yellow Facades) Night Time Max

Item / Description	dB(A)	125	250	500	1k	2k	4k
Corrected Lmax Spectrum	69	66	64	63	66	62	51
Glazing Noise Ingress	34	40	39	32	23	20	7
Ventilation Noise Ingress	35	33	33	33	29	28	14
Wall Noise Ingress	10	17	13	2	4	0	-11
Roof Noise Ingress							
Room Absorption Correction		7	6	6	6	6	4
Total Noise Ingress	44	48	47	42	36	35	20
NR40	45	56	49	43	40	37	34
Exceednce of Criteria	-1	-8	-2	-1	-4	-2	-14

Appendix F – Noise Modelling Particulars

The SoundPlan 9.0 noise model has been setup with the following inputs and assumptions:

- To accurately model the land surrounding the development the topographical data has been taken from the EAs 'National LIDAR Programme' on the DEFRA Data Services Platform.
- For the purpose of the assessment, the ground between the source and receiver is considered to consist primarily of acoustically 'hard' surfaces.
- The sound map grid height has been set to 1.5m, however, the noise levels used in the assessment will be taken from the most exposed point on each NSR façade.
- All buildings and any intervening objects have been modelled according to the technical drawings provided by the applicant, and those provided by the LIDAR data.
- The noise levels presented in Table 3 and Table 4 have been used to calibrate the noise model.



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