Land at Heaton Grange, Batley

Noise impact assessment

11457.1

7th February 2025

Revision A

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1 Summary

1.1 This report has been prepared in response to planning condition no. 10 associated with the outline planning permission ref. no. 2020/60/93777/E, for the residential development consisting of 19 no. new dwellings at land to the east of Mill Lane, Heaton Grange in Batley.

1.2 Condition no. 10 requires the external noise levels within gardens and internal noise levels within habitable rooms to be below set limits.

1.3 Noise levels affecting the proposed development predominantly from road traffic and rail traffic have been measured during the day and night, and the façade noise impact calculated.

1.4 Noise propagation across the site is calculated in environmental noise modelling software, CadnaA.

1.5 The existing noise risk at the site is assessed in accordance with relevant noise guidelines.

1.6 The acoustic performance requirements for glazing and ventilators are summarised in Table 1.

1.7 Based on these ventilator acoustic constraints, potential Building Regulations, Approved Document F (AD-F) ventilation strategies are suggested. The sound insulation treatments required for each façade are shown in Table 1, with mark-ups presented in Figure 1.

1.8 The potential for noise impact when utilising open windows to provide thermal comfort during the daytime period is also assessed according to the *Acoustics Ventilation and Overheating Residential Design Guide*; results indicate that open windows can be relied upon for the purpose of overheating mitigation during the daytime.

1.9 Noise levels in majority of gardens are calculated to be below the BS 8233 guideline lower limit of 50 dB $L_{Aeq,\ 16\ hr}$, which aligns with the planning condition criterion.

1.10 For the most exposed gardens proposed to the west of the site (Plots 5 – 13), barriers of minimum 2.3 m height are required to reduce external noise levels to be below the BS 8233 guideline upper limit of 55 dB $L_{Aeq,\ 16\ hr}$. The location of the proposed barriers is shown in Figure 1.

1.11 To be effective in practice, the barrier should have no cracks or gaps, be continuous to the ground, and have a surface density ≥ 10 kg/m^2 such as a closeboard timber fence, earth mound, brick wall or any combination of these.

1.12 Given that the scheme offers additional quieter public open space with noise levels below the 50 dB $L_{Aeq\ 16\ hr}$ limit set in the planning condition, in light of the Association of Noise Consultants guidance *ProPG: Planning & Noise - New Residential Development*, the current external amenity areas proposal can be deemed acceptable.

1.13 Based on the details outlined in this report, the noise risks identified are mitigated and minimised, and the site is considered suitable for residential development. As such, based on the report findings, it is concluded that the requirements of planning condition no. 10 have been suitably satisfied as far as practicable.

Locations (mark-ups as per Figure 1)	Rooms affected	Glazing performance	Trickle ventilator performance	Potential AD-F whole dwelling ventilation strategy
All façades of Plots 17 and 18; façades marked in **blue**	All habitable rooms	**≥ 31 dB R_w** Any standard double glazing of minimum sound performance feasible e.g. 4 mm/12 mm/4mm Pilkington Insulight or 4 mm/12 mm/4mm Saint-Gobain Glass	4 x vents **≥ 30 dB $D_{ne,w}$** Standard (non-acoustic) trickle vents feasible.	Any AD-F strategy feasible
All façades of Plots 1-4, 14-16, 19, and eastern façades of Plots 5-13; façades marked in **yellow**	All habitable rooms		*Either*: 1 x vent **≥ 30 dB $D_{ne,w}$** *or* 2 x vents **≥ 31 dB $D_{ne,w}$** Standard (non-acoustic) trickle vents feasible.	Continuous mechanical extract ventilation *or* Mechanical ventilation with heat recovery (trickle ventilators not required)
Western façades of Plots 5-13; façades marked in **red**	Bedrooms		*Either*: 1 x vent **≥ 33 dB $D_{ne,w}$** *or* 2 x vents **≥ 38 dB $D_{ne,w}$** Acoustic trickle ventilators required.	
	Dining / Living rooms		*Either*: 1 x vent **≥ 30 dB $D_{ne,w}$** *or* 2 x vents **≥ 31 dB $D_{ne,w}$** Standard (non-acoustic) trickle vents feasible.	
EA = Equivalent Area, as defined by Approved Document F. Example trickle ventilators that achieve the minimum performance standards are identified in Table 9.				

Table 1: Summary of minimum façade sound insulation treatment

Figure 1: Key of the proposed minimum façade sound insulation treatment (mark-ups detail as per Table 1) and acoustic barrier location (green line)

2 Introduction

2.1 A residential development of 19 no. new dwellings has been proposed at land to the east of Mill Lane, Heaton Grange in Batley.

2.2 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the potential noise impact on the proposed site to address planning condition no. 10 associated with the outline planning permission ref. no. 2020/60/93777/E.

2.3 The primary noise sources considered in this assessment are:

- Road traffic noise on Mill Lane located immediately to the west of the proposed site;
- Rail traffic from the railway to the west of both the proposed site and Mill Lane road;
- Industrial site at the neighbouring area to the north, west and east of the proposed site.

2.4 The site location is shown in Figure 2.

2.5 The purpose of this report is to identify appropriate acoustic design parameters and the manner in which these may be achieved in practice.

2.6 The scope of our appointment includes:

- Measure the existing noise environment over a 24-hour period at two locations;
- Noise modelling based on the proposed layouts to determine noise levels impacting across the site;
- Determine potential noise impact under whole dwelling ventilation condition according to Approved Document F strategies and when utilising an open windows for mitigation of overheating risks;
- Provide a detailed scheme for the mitigation of noise to address the planning condition requirements.

Figure 2: Site location outlined in red and measurement positions P1 and P2 indicated by yellow markers

3 Planning condition

3.1 Planning condition no. 10 associated with the outline planning permission ref. no. 2020/60/93777/E for this development is shown in Figure 3.

> 10/. Before construction work commences, a further noise assessment report shall be submitted to and approved in writing by the Local Planning Authority. The report shall:
>
> - Clearly show which habitable rooms in which plots will not achieve satisfactory indoor sound levels with windows open and for these rooms provide a detailed specification of the noise mitigation measures that are necessary to achieve satisfactory indoor sound levels, including an alternative ventilation scheme which shall show how these rooms shall be provided with sufficient ventilation to help control thermal comfort and avoid over heating during hot weather without the need to open windows.
> - The acoustic specification of the proposed ventilation system demonstrating that when operated it will not cause indoor noise target levels to be exceeded
> - The ventilation Scheme must demonstrate how habitable rooms of these plots shall be provided with sufficient ventilation to help control thermal comfort and avoid over heating during hot weather without the need to open windows. This should include details of the air intake location and any summer bypass for any heat recovery system including a calculation for air changes/hour. A Standard Assessment Procedure (SAP) assessment would be acceptable to demonstrate that a risk of overheating is minimised.
> - Clearly show which external amenity areas at which plots will have daytime noise levels that exceed 50dB LAeq,16hour and for these plots provide a detailed specification for the noise mitigation measures that are required for outdoor noise levels of no more than 50dB LAeq,16hour to be achieved at these plots.
>
> All works which form part of the approved scheme shall be completed prior to occupation of the aforementioned plots and retained thereafter.
>
> **Reason:** To ensure the amenity of future residents in accordance with the principles set out within Policy LP52 of the Kirklees Local Plan. This pre-commencement condition is necessary to ensure appropriate measures are designed and agreed prior to any construction works being erected which could otherwise prevent satisfactory noise attenuation being installed.

Figure 3: Requirements of planning condition no. 10 (planning ref. no. 2020/60/93777/E)

3.2 The "satisfactory indoor sound levels" targets are understood to be in line with the ProPG guide as summarised in Section 3.10.

3.3 In a reference to overheating risk assessment, it should be noted that the Standard Assessment Procedure (SAP) as per planning condition requirement is outside of scope of this report.

3.4 Acceptable night-time $L_{Aeq,8hr}$ and L_{AFmax} noise limits under overheating conditions is regulated by Approved Document O (AD-O) of the Building Regulations, Reference 10. Government guidance, www.gov.uk/guidance/use-of-planning-conditions states:
"*Conditions requiring compliance with other regulatory regimes will not meet the test of necessity and may not be relevant to planning. Use of informatives to remind the applicant to obtain further planning approvals and other consents may be more appropriate.*"

3.5 Therefore the night-time $L_{Aeq,8hr}$ and L_{AFmax} assessment is not presented in this planning report; such assessment should be addressed through compliance with Approved Document O noise limits. It is noted that the ADO assessment may limit window open areas, or further preclude the use of an open window for thermal comfort reasons, where the AD-O noise limits are exceeded.

3.6 *AVO Guide*

3.7 Overheating risks associated with the daytime noise impact for this scheme are addressed in this planning report based on Acoustics Ventilation and Overheating Residential Design Guide (AVO Guide).

3.8 The AVO Guide indicates a two-stage process to determine the risk of adverse noise effects while using opening windows for ventilative cooling.

3.9 The guidance is discussed in Appendix A.

3.10 *Professional Practice Guidance on Planning & Noise*

3.11 Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG), Reference 1, is a guidance document on the management of noise within the planning system in England for new build housing developments.

3.12 The document draws together guideline limits for internal noise levels from external transport sources from other sources of guidance, including BS 8233, Reference 3, and the World Health Organisation (WHO) Guidelines for Community Noise, Reference 4.

3.13 These criteria are consistent with those usually adopted by the Local Environmental Health Department and are presented in Table 2.

Activity	Location	Guideline upper limit, dB		
		$L_{Aeq,\ daytime}$	$L_{Aeq,\ night\text{-}time}$	L_{AFmax}
Resting	Living room	35	-	-
Dining	Dining room	40	-	-
Sleeping (daytime resting)	Bedroom	35	30	45

Table 2: Internal noise level requirements

3.14 The daytime period is defined as the 16 hours between 07:00 to 23:00 hours and the night-time period is defined as the 8 hours between 23:00 to 07:00 hours.

3.15 With regards to the night-time L_{AFmax} criterion, ProPG 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 45 dB $L_{Amax,F}$ more than 10 times a night."

3.16 ProPG states:

"Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as "unacceptable" by most people, particularly if such levels occur more than occasionally."

3.17 ProPG guidance on external amenity area assessments "reflects and extends the advice contained in BS 8233:2014 and the current Government guidance in PPG-Noise". Relevant guidance from these sources is summarised in the document as follows:

- "If external spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended."
- "The acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50-55 dB $L_{Aeq, 16\ hr}$."
- "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces."

4 Noise sources and measurements

4.1 Measurements

4.2 Measurements of the existing noise environment were made for a 24-hour period from 13:01 hours on 9th January 2024 using the guidance of BS 7445, Reference 5.

4.3 The measurement locations, P1 and P2, are shown in Figure 2.

4.4 The microphones were located approx. 2 m above ground level, away from other reflecting surfaces, such that the measurements are considered to be free-field.

4.5 The equipment used is listed in Table 3.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-09585-E0
Calibrator	Larson Davis CAL 200	12573
Sound Level Meter	NTi XL2	A2A-12269-E0
Calibrator	Larson Davis CAL 200	13404

Table 3: Equipment used

4.6 All sound level meters and calibrators used meet the technical specifications of BS 7445 and have current calibration certificates traceable to national standards. The equipment was field-calibrated before and after the measurement with no significant drift in sensitivity noted.

4.7 Weather conditions were dry with wind speeds below 5 m/s.

4.8 Noise sources

4.9 The most significant noise sources affecting the proposed development during both daytime and night-time periods were passing trains on the railway to the west of the proposed site. The second most dominant noise source identified was road traffic associated with Mill Lane to the west of the proposed site.

4.10 The measurement positions were therefore selected as those most exposed to noise from a combination of the most dominant sources.

4.11 Other noise sources included birdsong and sporadic works at surrounding sites e.g. forklift activity.

4.12 A steady, continuous, low-frequency noise coming from the further site located to the east of the development have been noted during the night from approx. 6 AM, and during the daytime at position P2 (ceased just before 5 PM). It was not possible to identify a specific source of noise during the site inspection. No other plant impact was noted.

4.13 An identified plant noise impact assessment has been undertaken as per Section 4.19.

4.14 On the second day of the noise surveys, construction activities were occurring within the site affecting mainly noise data measured at position P2. Given that such activities are temporary and not representative of the typical sound environment, the sound data affected by the construction noise are excluded from the assessment.

4.15 **Survey results**

4.16 The time histories of the $L_{Aeq,\ 1\ sec}$ recorded are shown in Figure 4.

4.17 The measured daytime and night-time noise levels are shown in Table 4.

Position	Parameter	dB(A)	Octave band centre frequency, Hz					
			125	250	500	1k	2k	4k
P1	Daytime, $L_{Aeq,\ 16\ hr}$	**54**	39	43	47	51	47	39
	Night-time, $L_{Aeq,\ 8\ hr}$	**47**	30	35	41	44	40	35
	Night time, $L_{AF,max}$	**66**	-	-	-	-	-	-
P2	Daytime, $L_{Aeq,\ 16\ hr}$	**49**	38	39	42	45	40	32
	Night-time, $L_{Aeq,\ 8\ hr}$	**44**	32	33	38	41	34	30

Table 4: Measured free-field noise levels

4.18 The single event maximum noise level presented in Table 4 is exceeded no more than 10 times during the night at position P1, therefore is used as the design case to determine compliance against ProPG Note 4 of Figure 2.

4.19 **Existing plant noise BS 4142 assessment**

4.20 The plant noise impacts identified has been analysed and assessed using the guidance of BS 4142, Reference 4, to determine the potential for adverse effects on the proposed development.

4.21 A summary of the assessment process and result for the night-time period is presented in Table 5. *Note*: As the background sound is higher at night than during the daytime period due a dominant character of the transportation noise sources, whereas plant impact observed does not increase during the daytime, the night-time assessment will represent the worst-case scenario.

Parameter	Night-time assessment	Relevant clause of BS 4142	Commentary
Measured ambient sound level L_a,	48 dB $L_{Aeq,\ 15\text{-}min}$	7.3.1	The plant noise source was turned on for the duration of the measurement period at position P2
Measured residual sound level L_r,	47 dB $L_{Aeq,\ 15\text{-}min}$	7.3.2	The L_r was measured at P2 location just before the plant noise source was operational; the L_r is considered representative of the assessment position.
Representative background sound level	46 dB $L_{A90,\ 15\text{-}min}$	8.1.2	Presented a 15-minute L_{A90} sample of background sound from a period 5:45 AM-6:00 AM, just before the plant was operational.
Specific sound level L_s	37 dB $L_{Aeq,\ 15\text{-}min}$	7.2 7.3.3 – 7.3.4	Based on survey findings, the plant operates continuously between 6 AM and 7 AM during the night-time. Specific plant noise level was calculated by subtracting the residual noise level from ambient noise level in frequency bands; for frequency bands over 1 kHz the residual noise slightly exceeds the ambient level due to other noise sources impact; as a prudent assumption, plant noise impact for these frequency bands is deemed to be at least 10 dB below the measured ambient noise level
Acoustic feature correction	+3 dB	9.2 9.3	An objective assessment of tonality has not identified any prominent tonal components of measured plant noise. Based on the audio recordings, a subjective assessment to determine acoustic features is undertaken, and a 3 dB penalty due to audible tonal component is considered. No other penalties are considered relevant in this assessment.
Rating level, $L_{Ar,Tr}$	40 dB		
Uncertainty of assessment	--	10	The measurement of background sound level taken from the period just before the plant was operational is likely to be representative for the assessment period, however there is an associated uncertainty that the background sound representative for the assessment period when the plant operates (post 6 AM) may be higher due to increase of transportation noise.
Context	--	11	The calculated specific plant noise level is 11 dB lower than ambient noise level for the quietest period; the ambient noise level across the proposed site is predominantly determined by transportation noise. Potential plant noise impact on indoor ambient noise level within proposed dwellings is expected to be below NR 20, which is a Noise Rating criterion typically recommended by local authorities to assess commercial noise impact indoors. The existing plant noise impact is likely to pose a low risk in terms of restricting opening windows during the night-time. The impact is expected to be mitigated even further with any standard glazing and trickle vents provision.
Excess of $L_{Ar,Tr}$ over background sound level	-6 dB		With a consideration of the context of the existing acoustic environment, the **assessment result indicates the likelihood of a low impact.**

Table 5: BS 4142 assessment of the observed plant noise impact measured during the sound surveys

4.22 ProPG advises:

"In the special case where industrial or commercial noise is present on the site but is "not dominant" (i.e where the impact would be rated as lower than adverse (subject to context) if a BS 4142:2014 assessment was to be carried out), its contribution may be included in the noise level used to establish the degree of risk (and if included, this should be clearly stated)."

4.23 The BS 4142 results indicate that the noise impact is rated lower than adverse, such that this noise source is included in ProPG Stage 1 and Stage 2 assessment.

4.24 The noise impact is considered suitably mitigated within acoustic design strategy proposed in the report. Note: Plant impact is assessed against NR 20 noise rating criterion typically recommended by local authorities to address commercial noise impact within habitable rooms. Details are presented in Section 7.

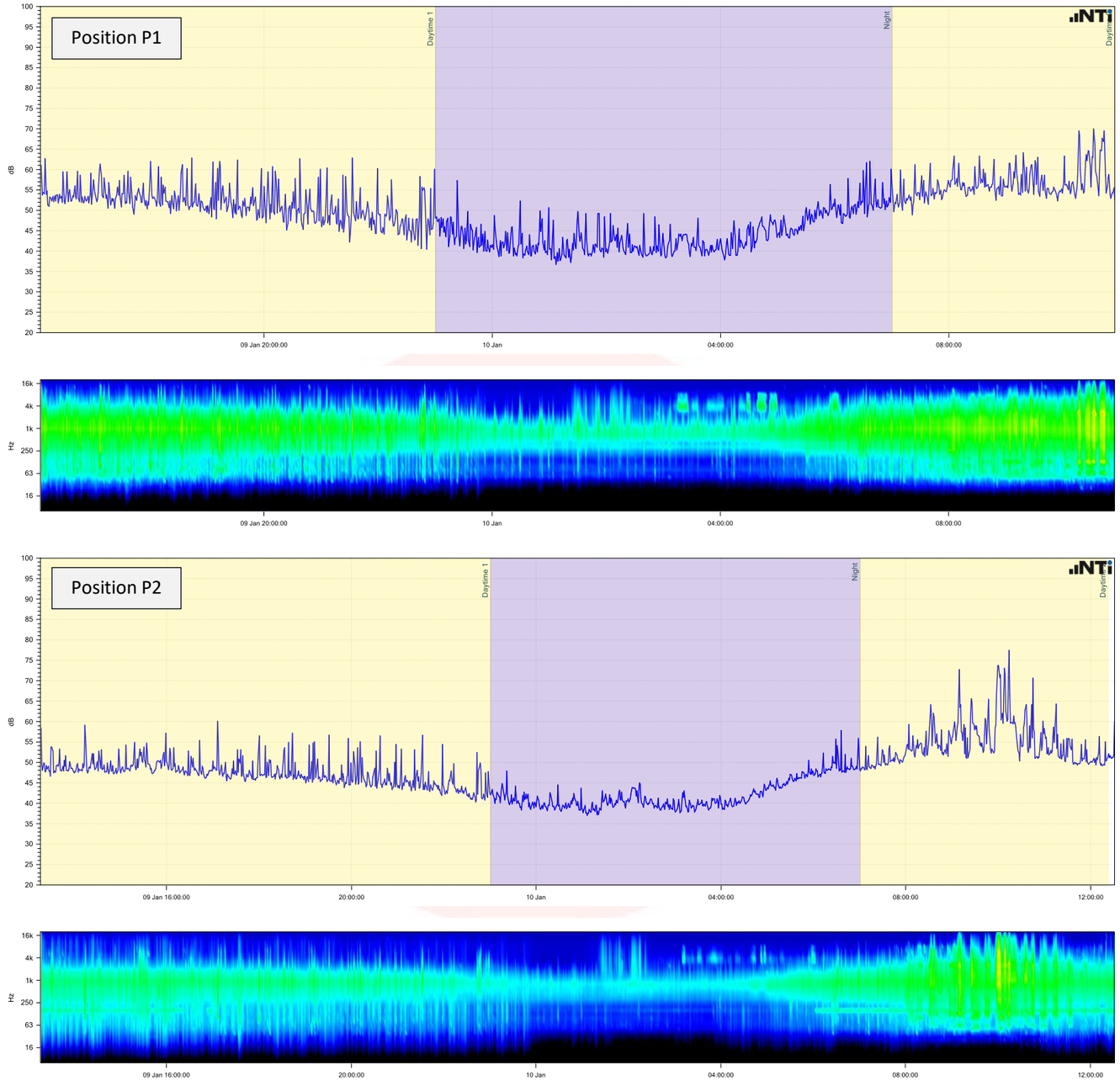

Figure 4: Time history of the recorded $L_{Aeq,\ 1\ sec}$ for each noise survey location

5 Noise impact on the site

5.1 Noise transmission and propagation is modelled using proprietary software, Cadna/A, Reference 6. This models noise propagation outdoors according to ISO 9613, Reference 7.

5.2 The modelling parameters used, source of data and details are described in Table 6.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects' drawings	Architects' drawings, Reference 8
Topography –within and outside of the site	Department for Environment Food & Rural Affairs Data Services Platform	LIDAR Composite DTM 1 m (2022)
Building heights – proposed buildings	Drawings	Architects' drawings
Building heights – outside of site	Site observations and Google Street view	3 m per storey + 2 m roof (residential properties)
Receptor positions	Site observations and Google Street view	On the façade closest to the source at a height of 1.5 m, 4.5 m and 7 m to represent ground, first and second floor window heights, respectively
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB (smooth surface) and 0.37 to represent a reflection loss of 2 dB (structured surface)
G, Ground factor	ISO 9613-2	Porous ground, G = 1, Hard ground, G = 0 (locally on model)
Max. order of reflections	Apex Acoustics	Three

Table 6: Modelling parameters and assumptions

5.3 Measured daytime and night-time noise levels have been used to ascribe sound power levels to the surrounding road and railway line, and the noise impact at the proposed building façades has been calculated.

5.4 Measured maximum noise levels due to train movements and vehicle passes have been used to attribute a sound power level to a point source for each railway noise event and road traffic noise event. The position of each point source has been shifted along the road / railway line to calculate the potential worst-case noise impact at each building façade.

5.5 A plan view and a 3D perspective of the CadnaA model are shown in Figure 5 and Figure 6.

Figure 5: Plan view of the CadnaA model

Figure 6: 3D view of the CadnaA model from the western side of the site

5.6 The calculated noise contours results for the daytime $L_{Aeq,\ 16\ hr}$ and night-time $L_{Aeq,8\ hr}$ are shown in Figure 12 and Figure 13 respectively in Appendix B. Note – the model and sound contours presented include the measures proposed for external amenity area discussed in Section 6.

6 External amenity area assessment

6.1 The gardens for all plots are considered as an intrinsic part of the overall design.

6.2 Noise levels in gardens associated with the proposed Plots 1-4 and 14-19 are calculated to be below the planning condition limit of 50 dB $L_{Aeq,\ 16\ hr}$, which is a lower guideline criterion as per BS 8233, Reference 3, and therefore additional noise mitigation measures are not required.

6.3 For the most exposed gardens associated with Plots 5-13, noise levels are calculated to exceed the BS 8233 upper guideline limit of 55 dB $L_{Aeq,\ 16\ hr}$. Installing noise barriers of 2.3 m height in locations as shown as a black line in Figure 7, will reduce external noise levels to below the BS 8233 guideline upper limit.

6.4 To be effective in practice, the barrier should have no cracks or gaps, be continuous to the ground, and have a surface density ≥ 10 kg/m^2 such as a closeboard timber fence, earth mound, brick wall or any combination of these.

6.5 It is calculated that extending the proposed barriers or increasing their height will not provide sufficient benefit to achieve the lower guideline limit required by the planning condition. Given the proximity of the train line located on higher ground elevation, it is concluded that achieving a lower noise limit for these plots is not feasible in practice. It is considered that external amenity noise levels for the most exposed gardens are mitigated as far as reasonably practicable, in line with the ProPG guidance.

6.6 Alternative quieter public open space with a natural play area is proposed within this scheme, and is viewed as an additional outdoor quiet buffer zone for residents' use; it is calculated that the noise limit 50 dB $L_{Aeq,\ 16\ hr}$ required by a planning condition is met for this area.

6.7 Although the advised lower limit is suggested within the planning condition wording, noise impacts are considered to have been mitigated as far as reasonably practicable and such the current proposals for the external amenity area are considered to be acceptable where considering the ProPG guidance.

6.8 The proposed barriers and their acoustic benefit are considered in the noise contour results shown in Appendix B, and included within the calculations detailed further in this report.

Figure 7: Daytime noise level contours, $L_{Aeq\ 16\text{-}hours}$, calculated at the 1.5 m receiver height for proposed external amenity areas with the proposed 2.3-m-high noise barriers to the west (black line)

7 Achieving internal noise levels

7.1 Façade sound insulation calculations

7.2 Free-field noise levels at the windows of the most exposed rooms which are used in the façade sound insulation calculations for each proposed Plot are shown in Table 7.

7.3 Octave band $L_{Aeq,T}$ noise levels in the 125 Hz to 2 kHz calculation range indicated in BS 8233 have been adjusted to match the single figure calculated A-weighted noise level.

Façades affected	Parameter	dB(A)	Octave band centre frequency, Hz A-weighted free-field noise level, dB				
			125	250	500	1k	2k
Western part of the site: Plots 5-13	$L_{Aeq,16\ hr}$	**59**	41	47	51	56	54
	$L_{Aeq,8\ hr}$	**53**	33	40	46	50	47
	L_{AFmax}	**74**	-	-	-	-	-
Central part of the site: Plots 1-4, 14-16, 19	$L_{Aeq,16\ hr}$	**49**	33	41	44	44	40
	$L_{Aeq,8\ hr}$	**41**	23	31	36	38	33
	L_{AFmax}	**70**	-	-	-	-	-
Eastern part of the site: Plots 17-18	$L_{Aeq,16\ hr}$	**42**	26	35	37	37	34
	$L_{Aeq,8\ hr}$	**34**	16	24	29	30	26
	L_{AFmax}	**65**	-	-	-	-	-
	$L_{Aeq,15\text{-}min,\ plant}$	**37**	25	25	29	31	25*

Table 7: A-weighted external free-field noise levels for worst-case elevations used to calculate façade sound insulation
**specific plant noise level calculated by subtracting the residual noise level from the ambient noise level; for frequency bands over 1 kHz the residual noise slightly exceeds the ambient levels due to other noise sources impact / negligible impact of the plant noise; as a prudent assumption, plant noise impact for these frequency bands is deemed to be at least 10 dB below the measured ambient noise level*

7.4 The calculation method for façade sound insulation is in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 11.

7.5 From ISO 16283, Reference 13, the reverberation time is typically 0.5 seconds across the relevant frequency range for a furnished living room. This value is used for both living rooms and bedrooms.

7.6 Details of the methodology used to calculate internal noise levels are provided on our website: https://www.apexacoustics.co.uk/calculation-facade-sound-insulation/.

7.7 The minimum glazing and ventilator performances presented in the summary table are calculated to be required to reduce noise levels to guideline internal noise levels in those rooms most exposed to external noise ingress.

7.8 Noise levels in less exposed but similarly protected rooms will be lower and therefore also comply with the internal noise level targets.

7.9 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.

7.10 It is calculated that typical double-glazing units are sufficient to achieve the performance standards for all plots, as shown in Table 1 along with the window product examples.

7.11 The room and window dimensions used in the calculations are taken from the architects' plans and elevations, Reference 8.

7.12 The sound reduction of the masonry portion of the facade is much higher than that of the glazing and ventilation provision. Therefore, noise penetration through the masonry is disregarded as relatively insignificant.

7.13 Calculated internal noise levels on the basis of the identified minimum performance requirements are presented in Table 8.

7.14 An example full calculation for the worst affected location is shown in Appendix C based on manufacturers test data from the example glazing and ventilator products.

Location	Room affected	Calculated internal level			
		Daytime dB $L_{Aeq,\ 16\ hr}$	Night-time dB $L_{Aeq,\ 8\ hr}$	Night-time dB $L_{Amax,\ F}$	Night-time dB $L_{Aeq\ 15\text{-}min}$
Western part of the site: Plots 5-13	Bedroom	33	27	45	n/a
	Dining room / Living room	28	-	-	n/a
Central part of the site: Plots 1-4, 14-16, 19	Any habitable room	25	17	45	n/a
Eastern part of the site: Plots 17-18	Any habitable room	23	15	45	NR 15

Table 8: Summary of calculated worst-case internal noise levels

7.15 Based on the proposed façade sound insulation provision and the level and frequency of the measured maximum noise event, 45 dB $L_{Amax,\ F}$ is unlikely to be exceeded more than 10 times per night and is therefore in line with the ProPG guidance.

7.16 **Noise and Approved Document F ventilation conditions**

7.17 The proposed development will be required to meet Part F of the Building Regulations with regard to the whole dwelling ventilation condition, as described in Approved Document F (AD-F), Reference 9.

7.18 Relying on open windows for ventilation purposes is not recommended due to potential exceedance of indoor ambient noise levels criteria for the night-time period for all proposed plots.

7.19 The maximum number of trickle ventilators and the required minimum acoustic performance that are calculated to achieve the indoor noise targets are summarised in Table 1.

7.20 Based on the ventilators identified to Plots 17 and 18 (eastern side of the site), any AD-F whole dwelling ventilation strategy as described in Table 1.6 of AD-F may be acoustically feasible.

7.21 However, for all remaining plots, based on the acoustic constraints for trickle ventilators identified to Plots 1-16 and Plot 19 (western and central part of the site), a natural ventilation strategy as described by AD-F (background ventilators and intermittent extract ventilation) would not be feasible. Therefore, either a continuous mechanical extract or mechanical ventilation with heat recovery (MVHR) ventilation system as described by AD-F would be required. Should a MVHR system be implemented, trickle ventilators are not required.

7.22 Where a continuous mechanical extract ventilation system is proposed, trickle ventilators are required to habitable rooms, as described by AD-F. Trickle ventilators are required to provide a minimum equivalent ventilation area of 4000 mm^2 for each habitable room, and the total number of ventilators in the dwelling should be at least the same as the number of bedrooms plus two ventilators (i.e. a one-bedroom dwelling should have three background ventilators, a two-bedroom dwelling should have four ventilators, etc). Calculations of noise ingress are undertaken on this basis.

7.23 Example ventilators that achieve the performance standards are identified in Table 9. This list of examples is not exhaustive, and other vents are feasible that meet the specified performance standard.

Locations (mark-ups as per Figure 1)	**Trickle ventilator performance and example products (others also feasible)**
All façades of Plots 17 & 18; façades marked in **blue**	4 x vents **≥ 30 dB $D_{ne,w}$** *e.g. Greenwood 8000 HD*
All façades of Plots 1-4, 14-16 & 19, and eastern façades of Plots 5-13; façades marked in **yellow**	Either: 1 x vent **≥ 30 dB $D_{ne,w}$** *e.g. Greenwood 8000 HD* or 2 x vents **≥ 31 dB $D_{ne,w}$** *e.g. RW Simon Framevent*
Western façades of Plots 5-13; façades marked in **red**	**Bedrooms** Either: 1 x vent **≥ 33 dB $D_{ne,w}$** *e.g. Greenwood 5000EA* or 2 x vents **≥ 38 dB $D_{ne,w}$** *e.g. RW Simon Acoustic EHAS*
	Dining / Living rooms Either: 1 x vent **≥ 30 dB $D_{ne,w}$** *e.g.* Greenwood 8000 HD or 2 x vents **≥ 31 dB $D_{ne,w}$** *e.g. RW Simon Framevent*

Table 9: Example trickle ventilators

7.24 On the basis of the AD-F strategies, the façade sound insulation with the provision for whole dwelling ventilation may be assessed with windows closed.

7.25 Purge ventilation conditions as described by AD-F is manually controlled ventilation of rooms or spaces at a relatively high rate to rapidly dilute pollutants and/or disperse water vapour. Purge ventilation may be provided by natural means (e.g. an openable window) or mechanical means (e.g. a fan).

7.26 For AD-F purge ventilation conditions, ProPG states:

"It should also be noted that the internal level guidelines are generally not applicable under "purge ventilation" conditions as defined by Building Regulations Approved Document F, as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food)."

7.27 Considering this guidance, opening windows is considered acceptable for these occasional events without giving risk to potential adverse effect on occupants.

It should be emphasised that the above is not intended to constitute a ventilation strategy design, which is the responsibility of others. Once the ventilation strategy is established, if the details vary from those described above, the proposed details should be reassessed for acoustic performance.

7.28 **Noise and overheating**

7.29 The assessment of overheating risk for the daytime noise impact $L_{Aeq,16hr}$ has been analysed based on the AVO Guide.

7.30 The night-time $L_{Aeq,8hr}$ and L_{AFmax} assessment should be addressed through compliance with Approved Document O noise limits. A further discussion is shown in Section 3.3.

7.31 The AVO guide states:

"The Level 1 site risk assessment is based on external free-field noise levels and the assumed scenario where a partially open window is used to mitigate overheating. The Level 1 assessment is sufficient for developments on 'Negligible' risk sites (as defined by Table 3-2). The Level 2 assessment is recommended for 'High' risk sites. For 'Low' and 'Medium' risk sites, a Level 2 assessment can optionally be undertaken to give more confidence regarding the suitability of internal noise conditions. This may be particularly appropriate for sites in the 'Medium' risk category."

7.32 Considering the highest daytime period noise levels impacting on the site, a Level 1 assessment is undertaken as shown in Figure 8.

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,8hr}$ during 23:00 - 07:00 High: 65 dB / 55 dB Medium: 60 dB / 50 dB Low: 55 dB / 45 dB Negligible: 50 dB / 45 dB	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Figure 8: AVO Guide – Level 1 risk assessment for the daytime period (considering ground floor habitable rooms typically used during the daytime period). Red arrow shows noise risk for the most exposed elevation for western plots, yellow arrow shows noise risk for the most exposed elevation for plots located at the central part of the site, whereas green arrow shows noise risk for the eastern plots

7.33 It should be borne in mind that this is one scale of risk for all dwellings in England, i.e. it spans single aspect flats in London to houses in the north.

7.34 A risk between "Low" and "Negligible" is identified for the purpose of utilising open windows to provide thermal comfort for the most exposed Plots located to the west of the site; for other plots located at the central and eastern part of the proposed site, a "Negligible" risk is. As such, level level 2 assessment is "Not required" for this site.

7.35 Based on this assessment, open windows may be used as part of an overheating control strategy during the daytime period. This assessment does not indicate that window openings should be restricted in any way; rather, that occupants may find their own personal balance between passive ventilative cooling and noise. It is considered on the basis of the AVO Guide that a reasonable balance should be available that is comfortable for occupants, without requiring provisions other than opening windows to mitigate overheating.

8 Conclusion

8.1 The existing noise impact across the proposed development site has been assessed to address the requirements of planning condition no. 10 associated with the planning application ref. no. 2023/61/93597/E.

8.2 An acoustic design process is undertaken to demonstrate how the identified risks of adverse noise impact can be mitigated and minimised in the finished development addressing the planning condition requirements.

8.3 With suitable 2.3 m high noise barriers located to the west of the site, the daytime noise levels in the gardens for Plots 5-13 are calculated to be below the guideline upper limit of 55 dB $L_{Aeq,\ 16\ hr}$, whereas for remaining gardens of Plots 1-4, 14-16 and 17-19, as well as for the proposed open public amenity area the impact is calculated to be below the guideline lower limit 50 dB $L_{Aeq,\ 16\ hr}$ meeting the condition requirement without additional mitigation measures.

8.4 The location of the proposed 2.3-meter-high barriers is shown with green line in Figure 1.

8.5 The potential implications for the design of the façade sound insulation under whole dwelling conditions as described by AD-F is discussed, and the glazing and ventilator acoustic performance requirements to achieve the indoor noise level targets are identified in Table 1.

8.6 The potential for noise impact when utilising an open window to provide thermal comfort during the daytime period is also assessed; results based on AVO guidelines indicate open windows can be relied upon for this purpose.

8.7 Based on the existing noise risks and details outlined in this report, the site is considered suitable for residential development and the planning condition requirements have been suitably satisfied.

9 References

1 Association of Noise Consultants (ANC), Institute of Acoustics (IOA) and Chartered Institute of Environmental Health (CIEH), "ProPG: Planning & Noise - New Residential Development," May 2017.

2 BS 4142: 2014, Method for rating and assessing industrial and commercial sound.

3 BS 8233: 2014, Guidance on sound insulation and noise reduction for buildings.

4 Guidelines for Community Noise, Edited by Birgitta Bergland, Thomas Lindvall, Dietrich H Schwela, World Health Organisation, 1999.

5 BS 7445:2003, Description and measurement of environmental noise. Guide to quantities and procedures.

6 CadnaA environmental noise modelling software, version 2024, Datakustik GmbH.

7 ISO 9613: Acoustics - Attenuation of sound during propagation outdoors.

8 Architects Drawings: Proposed Site Layout Plan ref. L023113 – 102 Rev. N (Nov. 2023), House Type F2 Section A-A For Plots 14 & 15 ref. L023113 – 719 Rev. B (Jun. 2024), House Type F1 Section A-A For Plots 7 & 8 ref. L023113 – 706 Rev. C (Jun. 2024), House Type C – The Hickory - Proposed Section A-A For Plots 9, 17 & 19 ref. L023113 – 404 Rev. C (Jun. 2024), Proposed Plans House Type F1 and F2 ref. L023113 – 115 Rev. D (Nov. 2023), Proposed Plans House Type C – The Hickory ref. L023113 – 109 (Nov. 2023), Proposed Elevations House Type F ref. L023113 – 116 Rev. B (Nov. 2023), Proposed Elevations House Type C – The Hickory ref. L023113 – 110 (Nov. 2023).

9 Approved Document F 2021 Edition, The Building Regulations 2010.

10 Approved Document O 2021 Edition, The Building Regulations 2010.

11 BS EN 12354-3:2000, Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements – Part 3: Airborne sound insulation against outdoor sound.

12 Practical Acoustic Design – the Apex Method, Proceedings of the Institute of Acoustics Vol 36 Pt 3 2014. Full paper and Poster presentation at Institute of Acoustics Conference 2014, available to download from www.apexacoustics.co.uk

13 BS EN ISO 16283-1:2014 Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation.

14 How loud is too loud? noise from domestic mechanical ventilation systems, International Journal of Ventilation, 2019. J Harvie-Clark, N Conlan, W Wei, M Siddall. https://doi.org/10.1080/14733315.2019.1615217.

15 Assessing noise with provisions for ventilation and overheating in dwellings. Harvie-Clark J, Chilton A, Conlan N, Trew D; Building Services Engineering Research and Technology. 2019;40(3):263-273. https://doi.org/10.1177%2F0143624418824232.

16 The London Plan, Chapter 5: London's response to climate change, Policy 5.9. https://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan/london-plan-chapter-five-londons-response/poli-8.

Appendix A Acoustics, Ventilation and Overheating

A.1 Ventilation conditions

A.2 The term “ventilation” is used here to refer to the ventilation required for reasonable indoor air quality (IAQ), as described in Approved Document F (AD-F).

A.3 There are three types of ventilation considered necessary to achieve good indoor air quality:

- **whole dwelling ventilation**, required continuously while the dwelling is occupied, for fresh air for the occupants to breathe and to disperse pollutants;
- **extract ventilation**, required to overcome the build up of water vapour in wet rooms (e.g. kitchens and bathrooms); and
- **purge ventilation**, which is manually controlled ventilation at a relatively high rate to rapidly dilute pollutants and / or water vapour from occasional activities, such as painting and decorating, or smoke from burnt food.

A.4 The AVO Guide links the indoor ambient noise levels identified as LOAELS with the provision of whole dwelling ventilation, as described in AD-F. Table 3-1 from the AVO Guide is reproduced in Figure 9.

Table 3-1 Indoor Ambient Noise Levels resulting from transport noise sources - ADF ventilation condition

Ventilation condition	Operational condition of System	Desirable internal ambient noise level from transport noise sources
Part F - Whole dwelling ventilation	Systems 1 & 2: Background (‘trickle’) ventilators open to provide whole dwelling ventilation in the winter period. Additional ventilation required at other times of the year – windows are assumed to be ajar for assessment [Note 2].	Guideline values from Table 4 of BS 8233:2014.
	System 3: Continuous mechanical extract with background (‘trickle’) ventilators open [Note 2].	
	System 4: Continuous mechanical supply and extract with heat recovery (MVHR) – no trickle vents required.	
Part F – Purge Ventilation [Note 1]	Option 1: Opening external window(s) meeting requirements described in Appendix B of Part F.	No specific acoustic criterion needs to be met in a room using purge ventilation for the purpose of rapidly diluting indoor pollutants.
	Option 2: Manually controlled fan extracting 4 air changes per hour.	

Figure 9: AVO Guide noise level guidance while providing whole dwelling ventilation

A.5 The AVO Guide approach - noise from mechanical services

A.6 Recommended guideline levels for internal ambient noise limits from mechanical services are taken from Figure 3-4 the AVO Guide, reproduced in Figure 10, which collates guidance from various sources.

A.7 For bedrooms, a more prudent limit of 26 dB(A) is adopted based on the conclusions of “How loud is too loud? noise from domestic mechanical ventilation systems” by Harvie-Clark et al, Reference 14, which reviews research from across Europe and North America into the impacts of noise from domestic mechanical services.

A.8 The proposed levels adopted for this assessment are taken from these guidelines.

Ventilation condition	Possible system or design solution	Desirable internal ambient noise levels from mechanical services
ADF – Whole Dwelling Ventilation	System 3: Continuous mechanical extract (MEV), minimum low ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum low ventilation rates	Bedrooms ≤ L_{Aeq} 26 or 30 dB [Note 1] Living Rooms ≤ L_{Aeq} 30 dB
ADF – Extract Ventilation	System 1: Intermittent extract fans System 3: Continuous mechanical extract (MEV), minimum high ventilation rates System 4: Continuous mechanical supply and extract with heat recovery (MVHR), minimum high ventilation rates	Bedrooms ≤ L_{Aeq} 26 or 30 dB Living / Dining Rooms ≤ L_{Aeq} 35 dB Bathroom / WC / Kitchen ≤ L_{Aeq} 45 dB
ADF – Purge Ventilation	Manually controlled fan exchanging a minimum 4 air changes per hour	No desirable noise levels are currently proposed based on the lack of evidence of acceptable noise levels when providing purge ventilation for the purpose of rapidly diluting indoor pollutants.

Figure 10: Desirable internal ambient noise levels from mechanical services for ventilation

A.9 The AVO Guide – noise and overheating

A.10 The AVO Guide has an implicit concept of *adaptive acoustic comfort*, i.e. where occupants have control over the internal environment, they are likely to have greater tolerance of increased noise levels when they are balancing their exposure to external noise and thermal comfort with opening windows.

A.11 This concept is explained by the main authors of the AVO Guide in “Assessing noise with provisions for ventilation and overheating in dwellings” by Harvie-Clark et al, Reference 15.

A.12 Different noise criteria are appropriate when considering ventilation for IAQ of for mitigating overheating. Using ventilation to mitigate overheating is described as ventilative cooling. The most common form of ventilative cooling is to open windows.

A.13 Where ventilation for IAQ is required all year round while occupied, ventilative cooling is only required for a part of the year, and intermittently, under the control of the occupants when using opening windows.

A.14 The AVO Guide proposes different criteria for the assessment of noise and ventilative cooling compared with noise guidelines that are adopted for all-year-round performance.

A.15 The AVO Guide indicates a two-stage process to determine the risk of adverse noise effects while using opening windows for ventilative cooling. The first stage of the process considers only noise levels outside, with an assumption of an outside-to-inside level difference of 13 dB for an open window.

A.16 The AVO Guide criteria and guidance for a Level 1 assessment is reproduced in Figure 11.

A.17 The second stage is to consider internal noise levels, based on the detailed design proposals and an assessment of overheating. As demonstrated in the planning report, this assessment is not relevant for the current scheme.

A.18 When considering strategies to mitigate overheating, the Cooling Hierarchy, Policy 5.9 of The London Plan, Reference 16, is followed as far as possible. This hierarchy prioritises sustainable solutions: natural ventilation over mechanical ventilative cooling over mechanical cooling, for the purpose of sustainable development in minimising operational energy use.

Table 3-2 Guidance for Level 1 site risk assessment of noise from transport noise sources [Note 1] relating to overheating condition

Risk category for Level 1 assessment [Note 5]	Potential Effect without Mitigation	Recommendation for Level 2 assessment
$L_{Aeq,\ T}$ [Note 3] during 07:00 - 23:00 / $L_{Aeq,\ 8hr}$ during 23:00 - 07:00 65 dB / 55 dB 60 dB / 50 dB 55 dB / 45 dB 50 dB / 45 dB High Medium Low Negligible	Increasing risk of adverse effect	Recommended Optional
	Use of opening windows as primary means of mitigating overheating is not likely to result in adverse effect	Not required

Figure 11: AVO Guidance for a Level 1 risk assessment of noise levels *externally*

Appendix B Modelling results: noise contours

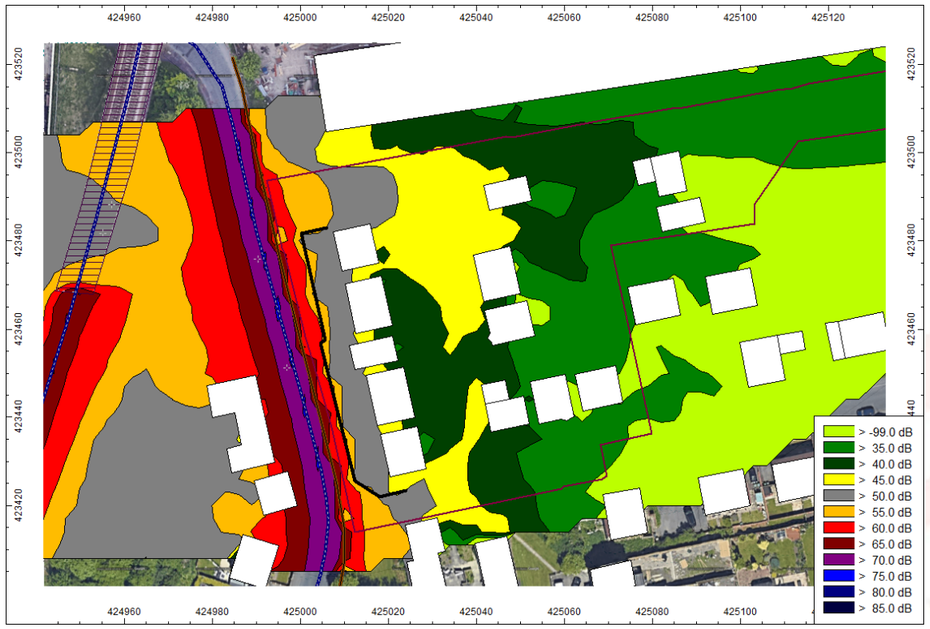

Figure 12: Plan viewing daytime $L_{Aeq,\ 16\ hr}$ sound contours at ground floor level (1.5 m receiver height)

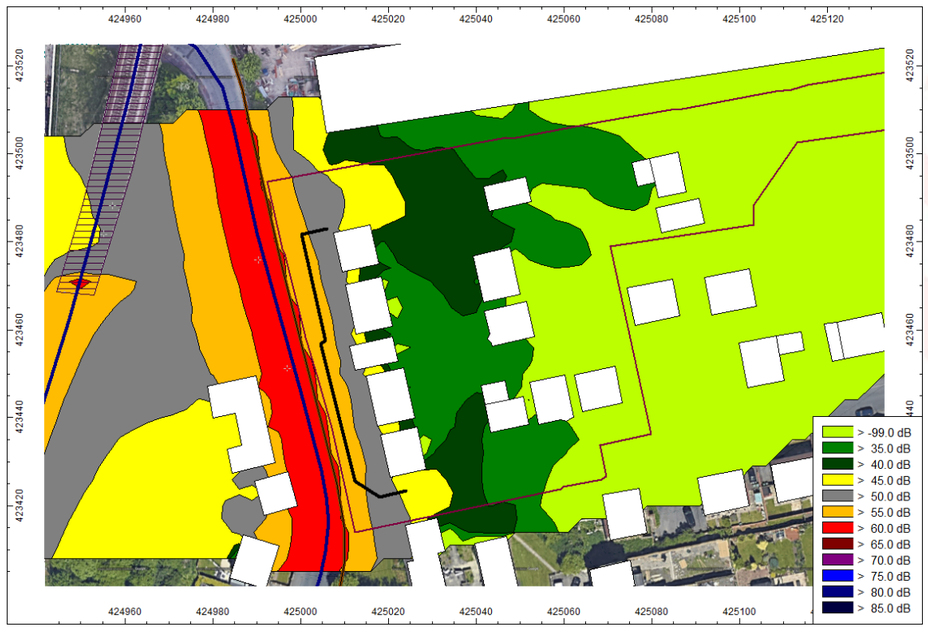

Figure 13: Plan viewing night-time $L_{Aeq,\ 8\ hr}$ sound contours at upper floor level (4.5 m receiver height)

Appendix C Example façade sound insulation calculations

House type C, 1st floor - Bedroom 3	
Volume, V / m^3	18
Window area, S / m^2	2
Reverberation Time, T / s	0.5
Number of vents feasible	1

Daytime $L_{Aeq,\ T}$ (dB)	**dB(A)**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**
External free-field noise, L_{1in}	**59**	40	46	51	56	53
Glazing: 4/12/4 mm, R		24	20	25	35	38
Equation 1, L_2(a)	**27**	13	23	23	18	13
Vent: 5000EA, $D_{n,e}$		40	37	36	32	31
Equation 2, L_2(b)	**32**	6	14	21	30	28
Total noise through all elements, L_2	**33**					

Night-time $L_{Aeq,\ T}$ (dB)	**dB(A)**	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**
External free-field noise, L_{1in}	**53**	33	39	46	50	47
Glazing: 4/12/4 mm, R		24	20	25	35	38
Equation 1, L_2(a)	**21**	6	17	18	12	6
Vent: 5000EA, $D_{n,e}$		40	37	36	32	31
Equation 2, L_2(b)	**26**	-1	7	15	23	21
Total noise through all elements, L_2	**27**					

Night-time L_{AFmax} (dB)	**dB(A)**
External free-field noise, L_{1in}	**72**
Glazing: 4/12/4 mm, R_w	31
Equation 1, L_2(a)	38
Vent: 5000EA, $D_{n,e,w}$	33
Equation 2, L_2(b)	44
Total noise through all elements, L_2	**45**

Table 10: Example calculation for the worst-case habitable room