Carlton Avenue, Blyth

Noise impact assessment

7748.1

29th April 2021

Revision C

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Prepared for
M A Utilities Ltd

4 High Street, Stanley, Co. Durham, DH9 0DQ

Prepared by

[redacted]

Weigang Wei, PhD, MIOA

Checked by

Jack Harvie-Clark MA MIOA

Apex Acoustics Limited Reg. in England no. 05656507
Design Works, William Street, Gateshead, NE10 0JP

T 0191 620 0750
E info@apexacoustics.co.uk
W www.apexacoustics.co.uk

Contents

1 Summary 3
2 Introduction 3
3 Planning policy and noise criteria 4
4 Noise sources and measurements 7
5 Number of train movements 8
6 Sound propagation modelling 8
7 Mitigation measures 10
8 Calculation of façade noise impact 10
9 External amenity area assessment 12
10 Achieving internal noise levels 12
11 Vibration calculations and assessment 13
12 Conclusion 14
13 References 14

1 Summary

1.1 This report has been prepared in support of a planning application for a residential development at Carlton Avenue, Blyth.

1.2 Noise levels affecting the proposed development have been measured, and the façade noise impact calculated.

1.3 Noise assessment methodologies have been discussed with the Environmental Health Officer; they have requested that the noise from the current use and possible future use of the railway line should be considered.

1.4 It is calculated that the required noise level limits are achieved with open windows for the noise from the current use of the railway line. The daytime noise level for future use of the railway line marginally exceeds the guideline values.

1.5 Therefore, noise mitigation measures are proposed as follows:

- Re-locate the master bedrooms to the quiet façade of the building;
- Install 2 m high noise barrier along the railway line; and
- Carry out façade sound insulation design to achieve the guideline values with closed windows.

1.6 Glazing and vent should meet the minimum acoustic performance requirements in Table 1.

1.7 Noise levels in all gardens are calculated to be below the guideline upper limit of 55 dB $L_{Aeq,\ 16hr}$ with the proposed noise barrier.

1.8 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 close-boarded timber fence or brick wall.

1.9 The daytime and night time vibration dose values are below the range of "Low probability of adverse comment", therefore, adverse comments are not expected.

Façade affected	Glazing performance	Trickle ventilator performance	Potential AD-F ventilation strategy
Facing directly towards the railway line	≥ 25 $R_w + C_{tr}$ e.g. Pilkington 4/16/4 mm	Maximum 1 vent each room; and ≥ 30 dB $D_{ne,w} + C_{tr}$ e.g. Greenwoods 4000L	AD-F System 3, continuous mechanical extract (MEV)
		Trickle vent not required	AD-F System 4, mechanical supply and extract with heat recovery (MVHR)
Other façades	Local Authority requirements are achieved with open windows, therefore, no acoustic restrictions on all other façades		

Table 1: Summary of minimum façade sound insulation treatment

2 Introduction

2.1 A residential development has been proposed at Carlton Avenue, Blyth.

2.2 Apex Acoustics has been commissioned to undertake a noise survey and assessment of the potential noise impact on the proposed development site in support of a full planning application.

2.3 The noise sources considered in this assessment are:

- Road traffic noise on the Newcastle Road to the west of the site; and
- The railway line to the east of the site.

2.4 The site location is shown in Figure 1.

2.5 The current use of the railway line is for freight trains only operating from 06:20 hrs to 21:30 hrs. However, this line may be used for passenger trains in the future.

2.6 Therefore, the noise impact of the railway line from the current use (freight trains) and future use (mixed freight trains and passenger trains) are assessed.

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

2.8 The scope of our appointment includes:

- measure the existing noise environment at locations considered most exposed to the noise sources;

- noise modelling based on the proposed layouts to determine noise levels impacting across the site;
- calculate the highest façade noise impact affecting the proposed development; and
- provide a detailed scheme for the mitigation of noise to reduce the risk of adverse effect, in accordance with local and national policy requirements.

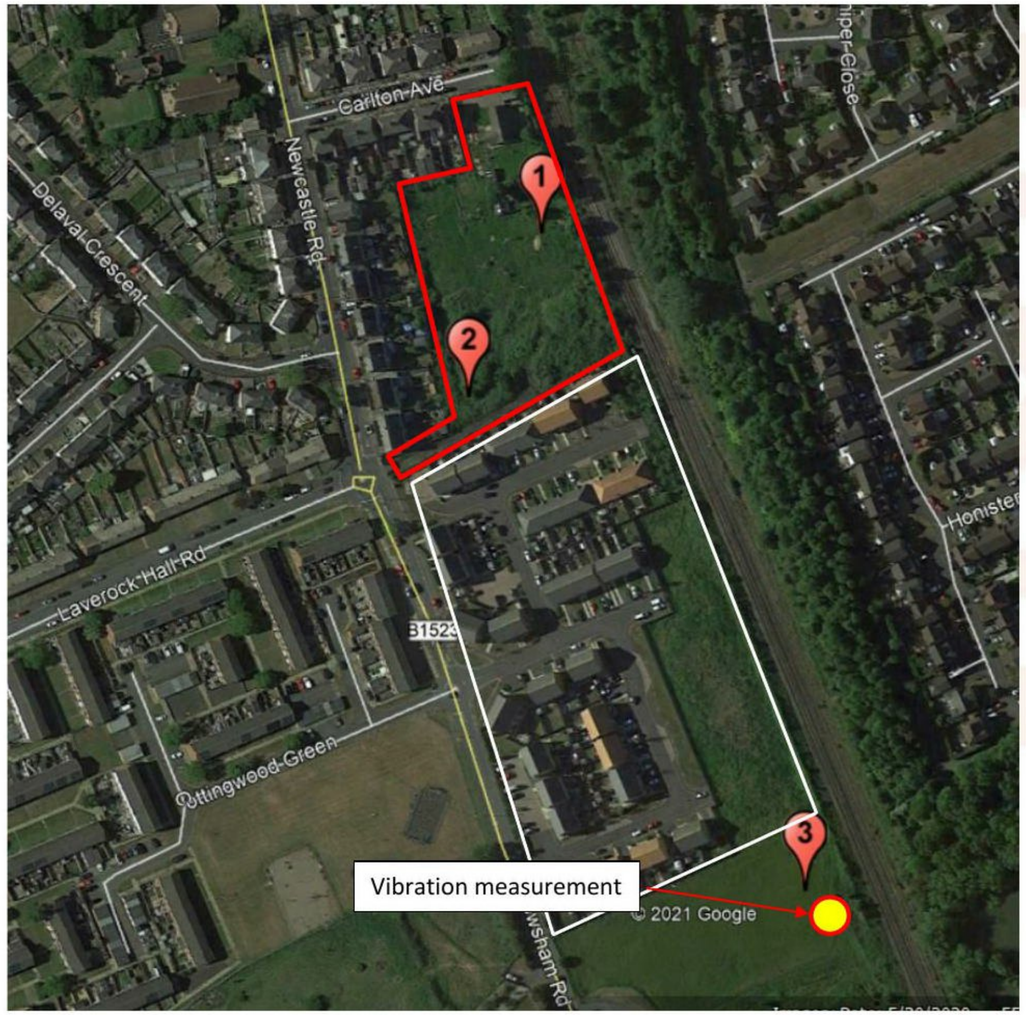

Figure 1: Site location outlined in red and measurement position indicated by a marker

3 Planning policy and noise criteria

3.1 National Planning Policy Framework (NPPF)

3.2 The National Planning Policy Framework (NPPF) Reference 1, sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 170, and 180 and 182 of the NPPF states the following:

3.3 Paragraph 170:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution…"

3.4 Paragraph 180:

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

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; … "

3.5 Paragraph 182:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on

new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

3.6 **Noise Policy Statement for England (NPSE)**

3.7 The Noise Policy Statement for England, Reference 2, states three policy aims as follows:

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

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.8 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  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.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

3.9 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

3.10 It is considered that meeting the internal ambient noise level limits given in BS 8233, which are in line with those given by the World Health Organisation, Reference, adequately achieve the first and second aims of the NPSE.

3.11 **Local Authority consultation**

3.12 The Local Environmental Health Department has been consulted regarding methodology and criteria, and the following local requirements have been identified:

- 30 dB LAeq,8hr for bedrooms - night time
- 35 dB LAeq,16hr for living rooms and bedrooms - daytime
- 45 dB L_{AFmax} for bedrooms - night time
- 50 dB $L_{Aeq,16hr}$ to 55 dB $L_{Aeq,16hr}$ for outdoor amenity areas

3.13 It is requested by the Environmental Health Officer that the indoor noise level requirements should be achieved with open windows. If it is not possible to achieve these indoor noise level limits with open windows, the master bedrooms should be located at the quiet façade where these limits are achievable with open windows. For the most exposed façade, façade sound insulation design should be carried out to achieve the requirements with windows closed.

3.14 **Noise criteria and assessment methodology**

3.15 Professional Practice Guidance on Planning & Noise: New Residential Development (ProPG), Reference 3, is a guidance document on the management of noise within the planning system in England for new build housing developments.

3.16 The document draws together guideline limits for internal noise levels from external transport sources from other sources of guidance, including BS 8233, Reference 4, and the World Health Organisation (WHO) Guidelines for Community Noise, Reference 5.

3.17 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
Resting	Gardens	50 desirable; 55 acceptable	-	-

Table 2: Internal noise level requirements

3.18 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.

3.19 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."

3.20 In the summary of the ProPG Appendix, it states:

"if, in bedrooms at night, the LAmax,F from individual noise events (from all sources) would not normally exceed 45 dB more than 10 time a night, then this represents a reasonable threshold below which the effects of individual noise events on sleep can be regarded as negligible."

"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."

3.21 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 $L_{Aeq,\ 16hr}$."
- "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."

3.22 **Vibration criteria**

3.23 Vibration is assessed based on the guidance of BS 6472, Reference 6, and the Association of Noise Consultants Guidelines, Reference 7.

3.24 Whilst there are no absolute levels of vibration defined as acceptable, BS 6472 defines levels at which various potential for adverse comment may be anticipated.

3.25 The potential adverse comment is determined based on the Vibration Dose Value (VDV).

3.26 These levels are shown in Table 3 which are based on the VDV parameter.

Residential Buildings [1)]	Low probability of adverse comment	Adverse comment possible	Adverse comment probable [2)]
16 hr day	0.2 - 0.4	0.4 - 0.8	0.8 - 1.6
8 hr night	0.1 - 0.2	0.2 - 0.4	0.4 - 0.8

Table 3: Guidance of BS 6472 on Vibration Dose Values (m/s1.75) and various degrees of adverse comment that may be expected in residential buildings

3.27 Note 1) below these ranges adverse comment is not expected; and Note 2) above these ranges adverse comment is very likely.

4 Noise sources and measurements

4.1 Noise sources

4.2 The most significant noise source affecting the proposed development during the daytime was road traffic on Newcastle Road and rail traffic on the railway line.

4.3 The measurement positions were therefore selected as those most exposed to noise from these sources.

4.4 The measurement locations are shown in Figure 1.

4.5 Noise measurements

4.6 The railway line is used for freight trains only when this report is prepared, therefore, the noise from future use of passenger trains can not be measured directly. The noise from passenger trains on East Coast Main Line is used for the noise assessment of the future passenger trains on this line. Measurement details are shown in Reference 8. This is considered as a prudent assumption as the train speed on East Coast Main Line is likely much faster than it on this railway line, which would increase the noise levels.

4.7 Measurements of the existing noise environment at Position 1 were made from 16:00 hours to 17:00 hours on 29th July 2019 using the guidance of BS 7445, Reference 9.

4.8 Measurements of the railway noise at Position 2 were made from 16:00 hours to 17:30 hours on the same day as Position 1, using guidance from Calculation of Railway Noise, Reference 10. During this period, two freight trains should pass the proposed site according to the train timetable. However, these two trains were cancelled.

4.9 The noise from this same railway line, measured at Position 3 in 2013, is still considered representative as the railway noise is unlikely to change significantly. Therefore, the noise measurements at position 3 are used for the noise impact assessment. The details of the measurement are available in Reference 11.

4.10 The microphone was located at 1.5 m above ground level, away from other reflecting surfaces, such that the measurements are considered to be free-field.

4.11 The equipment used is listed in Table 4.

Equipment	Model	Serial no.
Sound Level Meter	NTi XL2	A2A-09646-E0
Calibrator	Larson Davis CAL 200	12572
Sound Level Meter	NTi XL2	A2A-12269-E0
Calibrator	Larson Davis CAL 200	13404

Table 4: Equipment used

4.12 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.

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

4.14 Results

4.15 The measured sound exposure level (SEL) 15 m from the railway line at Position 3, is shown in Table 5.

Train type	dB(A)	Octave band centre frequency, Hz Sound exposure level, SEL						
		63	125	250	500	1k	2k	4k
Freight train	83	65	73	72	73	75	77	75

Table 5: SEL 15 m from the railway line –freight trains

4.16 The measured SEL 25 m from East Coast Main Line is shown in Table 6.

Train type	dB(A)	Octave band centre frequency, Hz Sound exposure level, SEL						
		63	125	250	500	1k	2k	4k
Passenger train	86	61	70	76	79	82	79	75

Table 6: SEL 25 m from the East Coast Main Line – passenger trains

4.17 The measured road traffic noise levels at Position 2 are shown in Table 7.

Position	Parameter	dB(A)	Octave band centre frequency, Hz					
			125	250	500	1k	2k	4k
2	$L_{Aeq,\ 1hr}$	46	34	34	39	42	36	28

Table 7: Measured free-field noise levels from road traffic at Position 2

4.18 The highest measured maximum noise levels 15 m from the railway line at Position 3 is shown in Table 8.

Event	L_{AFmax}, dB
Freight train pass	72

Table 8: Measured L_{AFmax} events 15 m from the railway line

4.19 **Vibration measurements**

4.20 The measured $VDV_{b/d,\tau}$ is shown in Table 9 at location close to Position 3, where τ is the measurement duration, in this case τ = 4 hrs.

Measurement position	$VDV_{b/d,4hr}$ $ms^{-1.75}$		
3	X	Y	Z
	0.018	0.022	0.035

Table 9: Measured $VDV_{b/d,4hr}$ in different directions

5 Number of train movements

5.1 **Number of freight train movements**

5.2 The number of freight train movement is taken from the train operation timetable, Reference 12. The freight trains operate between 6:20 hours and 21:30 hours.

5.3 The number of trains passing the site during the daytime and night time is show in Table 10.

Time period	No. of freight trains
Daytime 07:00-23:00 hrs	10
Night time 23:00-07:00	2

Table 10: Number of freight trains passing the site

5.4 **Assumed number of future passenger trains**

5.5 It is unknown how many passenger trains will operate on this line.

5.6 The number of the future passenger trains is estimated based on the Rail Future website (https://www.railfuture.org.uk/Ashington+Blyth+and+Tyne):

"A service every 30 minutes each way in peak hours and every hour during off-peaks (Northumberland County Council are also considering the option of a 30 minute service throughout the day)."

5.7 On this basis, the estimated number of passenger trains passing the site is shown in Table 11.

Time period	No. of freight trains
Daytime 07:00-23:00 hrs	18
Night time 23:00-07:00	2

Table 11: Estimated number of passenger trains passing the site

6 Sound propagation modelling

6.1 **Noise level from the railway line**

6.2 Using the guidance of CRN, Reference 10, overall daytime and night-time railway noise levels have been calculated based on the SEL values and typical frequencies of train movements.

6.3 The calculated noise levels due to single train pass are shown in Table 12.

Train type	Parameter	Total dB(A)	Octave band centre frequency, Hz A-weighted noise level, dB				
			125	250	500	1k	2k
Current freight train	$L_{Aeq,16hr}$ at 15 m	44	35	35	36	38	40
	$L_{Aeq,8hr}$ at 15 m	40	31	31	32	34	36
Future passenger trains	$L_{Aeq,16hr}$ at 15 m	54	37	43	46	49	47
	$L_{Aeq,8hr}$ at 15 m	47	31	36	40	43	40

Table 12: Calculated daytime and night time noise levels from a single train pass

6.4 The total noise level of all trains passes is calculated by:

$$L_{Aeq,T} = L_{Aeq,T,1\ train} + 10\log_{10} n$$

Where $L_{Aeq,T,1\ train}$ is noise level due to a single train pass; n is the number of trains.

6.5 **Sound propagation modelling**

6.6 Noise transmission and propagation is modelled using proprietary software, Cadna/A, Reference 13. This models noise propagation outdoors according to ISO 9613, Reference 14.

6.7 The modelling parameters used, source of data and details are described in Table 13.

Parameter	Source	Details
Model dimensions	Google Earth	British Transverse Mercator coordinates
Site location and layout	Architects drawings	Architects drawings, Reference 15
Topography	Site observations and Google Street view	Modelled with no changes in topography
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 4 m represent first floor window height respectively
Building and barrier absorption coefficient	ISO 9613-2	0.21 to represent a reflection loss of 1 dB
G, Ground factor	ISO 9613-2	Hard ground, G = 0
Max. order of reflections	Apex Acoustics	Three

Table 13: Modelling parameters and assumptions

6.8 Calculated daytime and night-time noise levels have been used to ascribe sound power levels to the surrounding roads and railway lines, and the noise impact at the proposed building façades has been calculated.

6.9 Measured maximum noise levels due to train movements passes have been used to attribute sound power levels to a point source. The position of the point source has been shifted along the railway line to calculate the potential worst-case noise impact at each building façade.

6.10 A plan view and a 3D perspective of the CadnaA model are shown in Figure 2 and Figure 3 respectively.

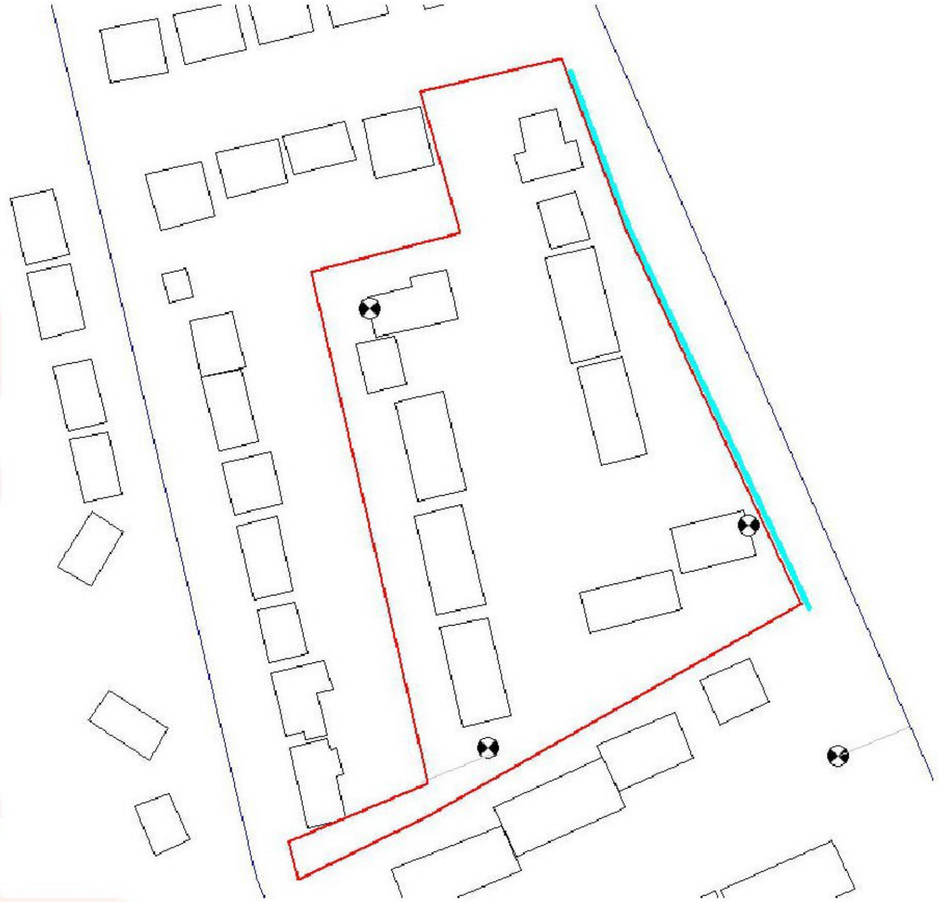

Figure 2: Plan view of the CadnaA model

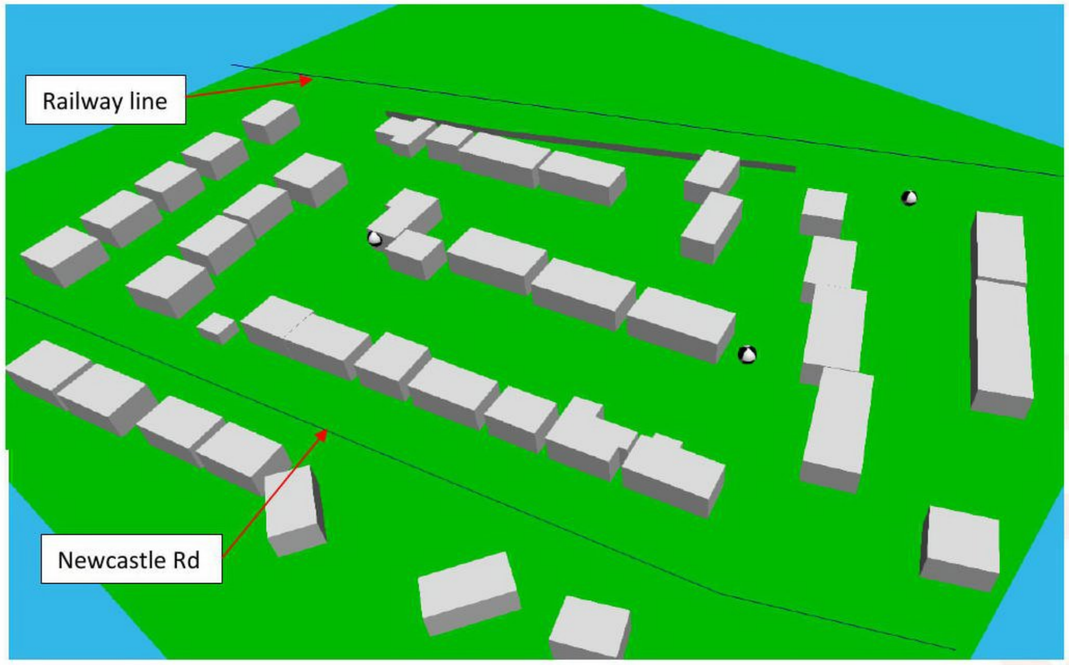

Figure 3: 3D view of the CadnaA model from west

7 Mitigation measures

7.1 Based on the initial calculations, it is indicated that without additional mitigation measures, the required noise level limits cannot be achieved with open windows at the façade directly facing towards the railway line.

7.2 Therefore, the following mitigation measures are proposed:

- 1) Relocate the master bedrooms to the quiet side;
- 2) Apply 2 m high noise barrier along the railway line, as shown in Figure 4;
- 3) Façade sound insulation design with windows closed, as shown in Section 10.

7.3 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 timber fence or brick wall.

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Figure 4: Location of the noise barrier

8 Calculation of façade noise impact

8.1 Based on the mitigation measures described in Section 7 and the proposed layout, the sound propagation has been calculated.

8.2 **Current operation of the railway line and road traffic**

8.3 The highest calculated noise levels due to the freight trains and road traffic at the façade of the proposed houses are shown in Table 14.

Receiver description	Parameter	Total dB(A)	Octave band centre frequency, Hz A-weighted noise level, dB					
			125	250	500	1k	2k	4k
Close to railway line	$L_{Aeq,16hr}$	43	33	33	33	36	38	35
	$L_{Aeq,8hr}$	38	26	26	29	31	33	31
Close to Newcastle Rd	$L_{Aeq,16hr}$	44	33	34	38	40	34	26
	$L_{Aeq,8hr}$	39	27	28	33	35	29	22

Table 14: Calculated noise levels at façade due to freight trains and road traffic

8.4 The calculate highest noise levels in the gardens is 46 dB $L_{Aeq,16hr}$.

8.5 **Possible future operation of the railway line and road traffic**

8.6 The calculated noise level contours across the whole site due to future operation of the railway line and road traffic is shown in Figure 5 and Figure 6.

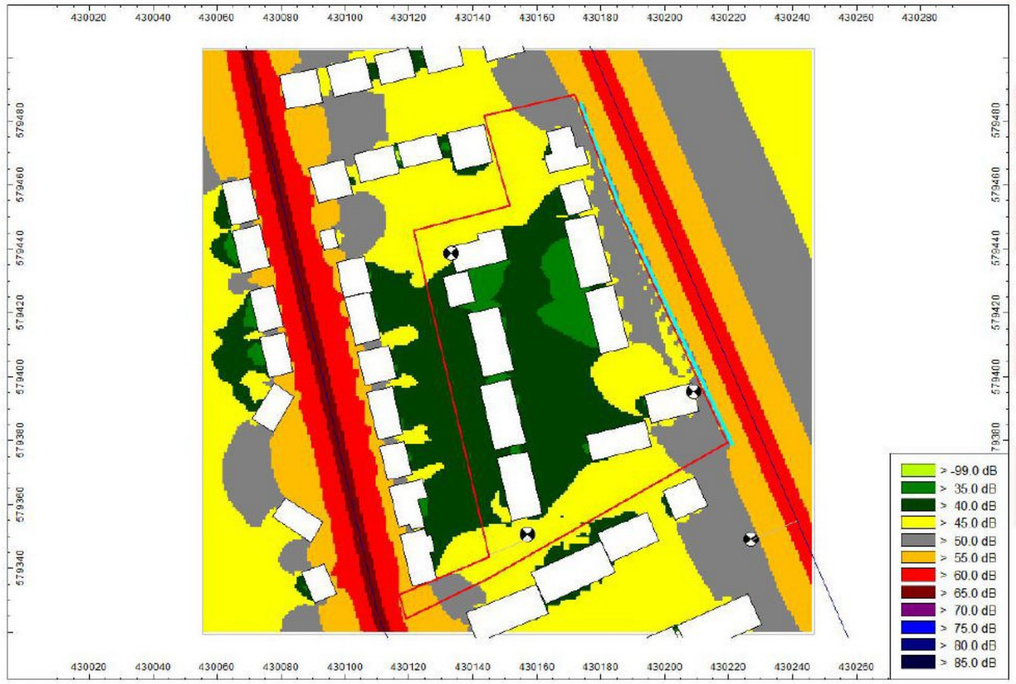

Figure 5: Noise level contour at 1.5 m due to freight trains, passenger trains and road traffic – daytime

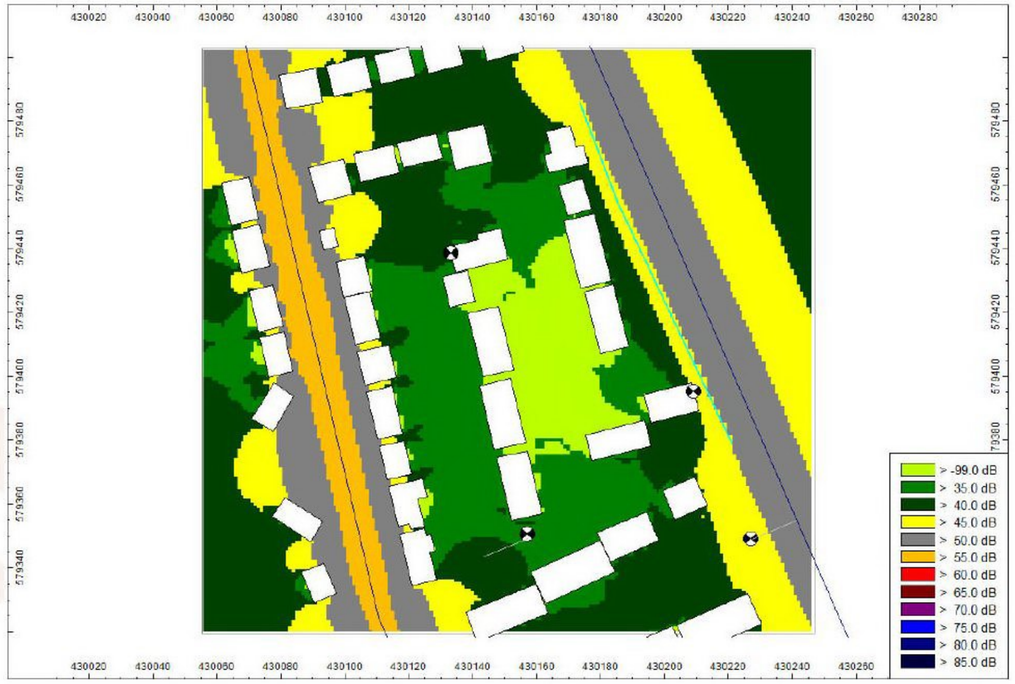

Figure 6: Noise level contour at 4 m due to freight trains, passenger trains and road traffic – night time

8.7 The highest calculated noise levels due to the freight trains, passenger trains and road traffic at the façade of the proposed houses are shown in Table 15.

Receiver description	Parameter	Total dB(A)	Octave band centre frequency, Hz A-weighted noise level, dB					
			125	250	500	1k	2k	4k
Close to railway line	$L_{Aeq,16hr}$	52	37	41	45	48	45	42
	$L_{Aeq,8hr}$	45	28	33	37	41	39	35
Close to Newcastle Rd	$L_{Aeq,16hr}$	44	33	34	38	40	34	26
	$L_{Aeq,8hr}$	39	27	28	33	35	29	22

Table 15: Calculated noise levels at façade due to freight trains, passenger trains and road traffic

8.8 The calculate highest noise levels in the gardens is 52 dB $L_{Aeq,16hr}$.

8.9 **Maximum noise levels from railway noise**

8.10 The maximum noise levels form the freight trains is likely higher than that from passenger trains.

8.11 Therefore, the maximum noise levels at the proposed houses are calculated based on measurements of the freight train passes.

8.12 The calculated highest maximum noise level at the façade of the proposed houses is 70 dB L_{AFmax}.

9 External amenity area assessment

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

9.2 The noise impact on the gardens has been assessed for the current operation of the railway line and possible future operation of the railway line respectively.

9.3 **Current operation of the railway line and road traffic**

9.4 With the proposed noise mitigation measures specified in Section 7, the highest noise levels in all gardens are calculated to be 46 dB $L_{Aeq,16hr}$ below the desirable limit of 50 dB $L_{Aeq,\ 16hr}$.

9.5 **Possible future operation of the railway line and road traffic**

9.6 With the proposed noise mitigation measures specified in Section 7, the highest noise levels in all gardens are calculated to be 52 dB $L_{Aeq,16hr}$, ie below the acceptable limit of 55 dB $L_{Aeq,\ 16hr}$.

9.7 It is therefore considered that external amenity noise levels are mitigated as far as reasonably practicable, in line with the aims of the NPPF and NPSE.

10 Achieving internal noise levels

10.1 **Current operation of the railway line and road traffic**

10.2 The highest noise level at façade during daytime and night time is 44 dB $L_{Aeq,16hr}$ and 39 dB $L_{Aeq,8hr}$ as shown in Table 14.

10.3 It is assumed that the noise level difference between the external noise level and internal noise level is 15 dB with open windows. The internal noise levels are calculated to be 29 dB $L_{Aeq,16hr}$ and 24 dB $L_{Aeq,8hr}$. This satisfies the Local Authority requirements.

10.4 The maximum noise level within the bedroom with open windows is 55 dB L_{AFmax}. As the number of train passes during night time is only 2, the impact on sleep disturbance is negligible according to the guidance in ProPG.

10.5 **Possible future operation of the railway line and road traffic**

10.6 The calculated highest noise level at the most exposed façade (towards the railway line) is 52 dB $L_{Aeq,16hr}$ and 45 dB $L_{Aeq,16hr}$ during daytime and night time respectively as shown in Table 15.

10.7 The predicted night time internal noise level with open windows is 30 dB $L_{Aeq,8hr}$ complying with the guideline limit.

10.8 The predicted daytime internal noise level with open windows is 37 dB $L_{Aeq,16hr}$ which is marginally above the internal noise guideline of 35 dB $L_{Aeq,16hr}$.

10.9 Therefore, façade sound insulation design with windows closed is carried out to further mitigate the noise impact.

10.10 Provision should be made for background ventilation and control of overheating.

10.11 Opening windows may still be acceptable to provide purge ventilation as described by Approved Document F (AD-F), Reference 16, given that the activities requiring purge ventilation are typically short in duration, such as painting and decorating, or removing smoke from burning toast.

10.12 The proposed development will be required to meet Part F of the Building Regulations with regard to ventilation provision, as described in AD-F.

10.13 A suitable ventilation strategy may be AD-F System 3 (continuous mechanical extract (MEV)), or AD-F System 4 (continuous mechanical supply and extract with heat recovery (MVHR)). Should the latter system be implemented, trickle vents are not required.

10.14 It should be emphasised that the above is not intended to constitute a ventilation strategy design, which is the responsibility of the mechanical engineers.

10.15 Once the ventilation strategy is established, if the details vary from those described above, the proposed details should be reassessed for acoustic performance.

10.16 Ventilation system design should be carefully considered. Research has shown that annoyance caused by noise from poorly designed systems frequently results in

occupants curtailing the operation of the ventilation system. Such action leads to inadequate ventilation resulting in poor air quality, which is well correlated with a range of adverse health effects.

10.17 The minimum glazing and ventilator performances presented in the summary table are calculated to be required to reduce noise levels to below the noise level limits in those rooms most exposed to external noise ingress.

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

10.19 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.

10.20 Free-field noise levels at the windows of the most exposed rooms which are used in the façade sound insulation calculations are shown in Table 15.

10.21 The calculation method for façade sound insulation is in accordance with BS 8233 and the principles of BS EN 12354-3, Reference 17.

10.22 From ISO 16283, Reference 18, 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.

10.23 Details of the methodology used to calculate internal noise levels are provided on our website. Full façade sound insulation calculations are available on request.

10.24 The room and window dimensions used in the calculations are taken from the architects' plans and elevations, Reference 15.

10.25 The sound reduction of other building elements of the facade is much higher than that of the glazing and ventilation provision. Therefore, noise penetration through the these building elements is disregarded as relatively insignificant.

10.26 Calculated internal noise levels based on manufacturer's test data for the example glazing and ventilation products listed in the summary table are presented in Table 16.

Façade affected	Room affected	Calculated internal level		
		Daytime dB $L_{Aeq,\ 16\ hr}$	Night-time dB $L_{Aeq,\ 8\ hr}$	Night-time dB $L_{Amax,\ F}$
Facing to railway line	Bedroom	29	22	43
	Living room	29	-	-

Table 16: Summary of calculated worst-case internal noise levels

11 Vibration calculations and assessment

11.1 Calculated $VDV_{b/d,day}$ and $VDV_{b/d,night}$

11.2 The possible future use of the railway line would include around 18 train passes during daytime and 2 train passes during night time.

11.3 The VDV for current use of the railway line and future railway line are calculated based on the measured VDV and the increase of the number of trains according to BS 6472-1.

11.4 The calculated $VDV_{b/d,day}$ and $VDV_{b/d,night}$ are shown in Table 17.

Use of railway line	Time period	$VDV_{b/d,t}$ $ms^{-1.75}$		
		X	Y	Z
Current freight trains only	Day (16 hours)	0.025	0.031	0.049
	Night (8 hours)	0.021	0.026	0.042
Future use of freight and passenger trains	Day (16 hours)	0.033	0.041	0.065
	Night (8 hours)	0.025	0.031	0.049

Table 17: Measured $VDV_{b/d,day/night}$ in different directions

11.5 Assessment

11.6 The calculated $VDV_{b/d,day}$ and $VDV_{b/d,night}$ are below the range of "Low probability of adverse comment". According to BS 6472, adverse comments are not expected.

12 Conclusion

12.1 Noise levels affecting the proposed development have been measured and the highest noise impact calculated.

12.2 It is calculated that for the current operation of railway line, the guideline values can be achieved with open windows.

12.3 For the possible future operation of the railway line, the daytime noise is marginally above the noise level limit with open windows. Therefore, noise mitigation measures are provided.

12.4 With the proposed mitigation measures, all the Local Authority requirements are satisfied.

13 References

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16 Approved Document F 2010 Edition, The Building Regulations 2000.

17 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.

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