INFINITY ACOUSTICS

Noise Assessment

10 Rickmansworth Road,
Northwood,
HA6 1HA

INFINITY ACOUSTICS

Project Description:

Residential Noise Assessment and Vehicle Noise Assessment

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1. Introduction

1.1 Infinity Acoustics Ltd has been appointed to undertake a noise assessment for a residential development located at 10 Rickmansworth Road, Northwood, HA6 1HA. The assessment will be undertaken to analyse the potential impact of both road and rail noise on the development as well as the noise impact produced by vehicle movements to and from the site.

1.2 As part of the development process, the client has submitted a planning application to the Local Planning Authority Hillingdon Council. The planning application reference and title are *20026/APP/2024/1737 Erection of a single storey extension to rear. Conversion of the single dwellinghouse to two flats. Amendments to fenestration.*

1.3 The application was subsequently refused by the local planning authority one of the reasons for the refusal was noise and noise generated by vehicles utilising the driveway associated with the site and neighbouring dwelling. The reason for refusal is outlined below.

2) The proposed development, by virtue of the proximity of the on-site car parking space in relation to the front habitable windows, would cause unacceptable noise, disturbance, overlooking and loss of privacy for the future occupants of Flat A. The proposal would therefore result in a substandard form of internal residential accommodation to the detriment of the amenity of the future occupiers of the proposed development,

1.4 The aim of the noise survey and assessment below is to provide the relevant information to assist the client and the local planning authority in approving a re-submission application. The noise levels at the site will be measured and assessed according to the relative standards and local planning policy, a sound insulation scheme will be provided where necessary to ensure the amenity of any future residents can be protected from surrounding transport and vehicle movement noise and that relative criteria can be achieved.

1.5 The following noise assessment will be undertaken with reference to the National Planning Policy Framework 2023 and the Noise Policy Statement for England 2010 as well as the following standards.

1.6 BS8233:2014 - Guidance on Sound Insulation and Noise Reduction In Buildings

The general noise criteria used in the assessment will be obtained from BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings' The criteria in BS8233 are largely based on the World Health Organisation Guidelines on Community Noise. The BS8233 criteria are outlined below:

- Living Room/Bedroom - 35 dB $L_{Aeq,16hour}$ (Day)
- Dining Room – 40 dB $L_{Aeq,16hour}$ (Day)
- Bedroom – 30 dB $L_{Aeq,8hour}$ (Night)

1.7 L_{Afmax} levels during the night will also be assessed based on the criteria defined by the World Health Organisation. The WHO state within the 'Guidelines on Community Noise' that in order to avoid sleep disturbance within bedrooms during the night, the internal sound pressure level should not exceed 45 dB $L_{Afmax.}$ The frequency of L_{Afmax} events should also be considered it is understood that for an L_{Afmax} noise event to adversely impact sleep the criteria would need to be exceeded more than ten times during a night time period.

1.8 *IEMA Guidelines for Noise Impact Assessments*

The IEMA Guidelines for Noise Impact Assessment specify general methods for assessing noise and the potential for noise impact. Specifically, this guidance can be used to assess the potential impact of noise sources for which there are no specifically designed standards or guidance or to provide further context to a noise assessment. In order to assess the potential for noise impact these guidelines outline an approach whereby the increase or change in noise levels in the assessment area due to the operation of the new source or development is calculated. The magnitude by which the ambient acoustic environment increases directly relates to the potential for noise impact. The table below indicates the significance of changes in noise levels in incremental intervals.

IEMA Guidelines for Noise Impact Assessment Criteria	
Effect Description	**Definition**
None / Not significant	Less than 2.9dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise.
Slight	A 3dB to 4.9dB L_{Aeq} change in sound level at a receptor of some sensitivity.
Moderate	A 3dB to 4.9dB L_{Aeq} change in sound level at a sensitive or highly sensitive receptor, or a greater than 5dB L_{Aeq} change in sound level at a receptor of some sensitivity.
Substantial	Greater than 5dB L_{Aeq} change in sound level at a noise-sensitive receptor, or a 5dB to 9.9dB L_{Aeq} change in sound level at a receptor of high sensitivity to noise.
Severe	Greater than 10dB L_{Aeq} change in sound level at a receptor of high sensitivity to noise.

Table 1.0 – IEMA Guidelines on Noise Impact Assessment Criteria

2. Site & Surroundings

2.1 The development site is situated to the southeast of Northwood. The area surrounding the site is primarily residential and could be considered suburban.

2.2 To the south of the site is Rickmansworth Road which facilitates moderate to high levels of road traffic flow throughout the day and night time periods.

2.3 To the north of the site is a rail line which runs between Northwood Hills and Moor Park stations. A review of the train timetable indicates that there are regular train movements every 5min – 10mins between 05:30 – 01:00 daily.

2.4 The building itself is constructed from masonry brick with existing double glazing and trikle vents however the exact make and model of glazing could not be fully established. The roof is constructed from timber truss and roof tiles.

2.5 To the east of the development, sie is a driveway associated with the development and no.12 Rickmansworth Road. There is also a driveway situated to the front of the proposed flats. At worst, it is assumed both driveway and parking could facilitate 2- 3 vehicles.

3. Survey

3.1 A noise survey of the site was undertaken between Thursday 19th of September to Monday the 23rd of September 2024.

3.2 The following equipment was used to undertake the noise survey. All equipment used was field calibrated with a tolerance of less than 0.2 dB drift before and after the measurement. Calibration certificates for the equipment can be provided upon request.

- SVAN 971A Class 1 Sound Level Meter – SN – 113251
- Rion NL-52 Class 1 Sound Level Meter – SN – 00231646
- Cassella CEL 120-1 Class 1 Calibrator – SN – 3864607

3.3 The long-term noise meter and associated microphone at Measurement Location 1 (ML1) were located at the first-floor level protruding from a window. The microphone was located approximately 1m from the façade.

The long-term noise meter and associated microphone at Measurement Location 2 (ML1) were located at the first-floor level attached to the rear balcony balustrade. The microphone was located approximately 1m from the façade of the building.

The exact measurement locations can be found in the site plan in Appendix B. Given the proximity of the microphones to the building's facades appropriate façade corrections will be applied to the measured data to establish free field noise levels as stipulated in BS8233.

3.4 The weather during the setup of the equipment is outlined below:

- 22.9 Degrees Celsius
- ENE wind with speeds of 2.6m/s
- Low cloud cover and no precipitation

During the collection of the equipment, the weather was.

- 16.3 Degrees Celsius
- W wind with speeds of 2.2m/s.
- Partial cloud cover and no precipitation

3.5 Generally, the weather across the majority of the survey complied with the requirements of BS 7445-2. A full weather summary for the duration of the survey is outlined in the table below and has been taken from the nearest functioning weather stations.

** Periods of rain deemed to impacted noise levels between 03:00 – 05:00 on the 22nd of September have been removed from the assessment*

Weather Data	
Description	**Data**
Temp (C)	13.3 – 24.3
Rain Fall (mm)	0.0 – 0.5*
Wind Speed (m/s)	0.0 – 3.5
Prevailing Wind	E
Relative Humidity	87.0

Table 2.0 – Weather Data

3.6 The results of the ambient noise survey are presented in the tables below and will be used in the subsequent Noise Assessment.

16 & 8 Hour Results ML1 Front Facade			
Date	**Time Period**	**$L_{Aeq\ (dB)}$**	**$L_{Afmax\ (dB)}$**
Day – 19/09/2024	13:15 – 23:00	67.0	97.0
Night – 19/09/2024	23:00 – 07:00	60.0	88.0
Day – 20/09/2024	07:00 – 23:00	67.0	97.0
Night – 20/09/2024	23:00 – 07:00	60.0	81.0
Day – 21/09/2024	07:00 – 23:00	67.0	102.0
Night – 21/09/2024	23:00 – 07:00	61.0	81.0
Day – 22/09/2024	07:00 – 23:00	68.0	95.0
Night – 22/09/2024	23:00 – 07:00	63.0	85.0
Day – 23/09/2024	07:00 – 13:15	70.0	92.0
ML1 L_{Afmax} Analysis			
Time Period		**$L_{Afmax,t}$**	**10^{th} Highest $L_{Afmax,1min}$**
Night		88.0	79.0

Table 3.0 – Noise Survey Global Data ML1 – Front Façade

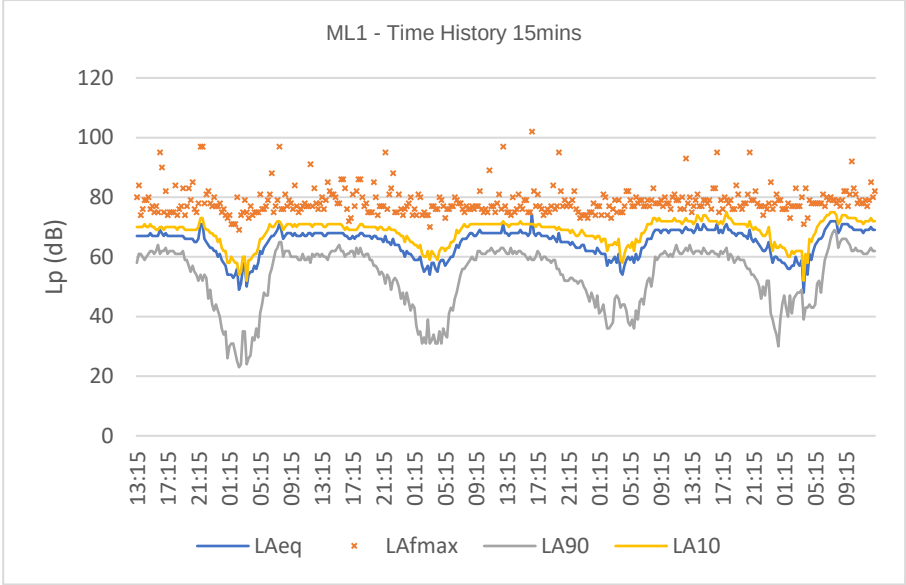

Figure 1.0 – Survey Time History ML1 – Front Facade

3.7 As can be seen in the results of the measurement at the front façade the noise levels incident on the site could be considered moderate to high. The time history indicates that the noise incident on the site is steady-state continuous noise generated by road traffic. The subjective impression gained on-site by the engineer indicated the road noise was pervasive at the front and side of the development. This is a positive indication that the movement of vehicles on and off the driveway would likely not cause a significant impact on future residents.

16 & 8 Hour Results ML2 Rear Facade			
Date	**Time Period**	**$L_{Aeq\ (dB)}$**	**$L_{Afmax\ (dB)}$**
Day – 19/09/2024	14:15 – 23:00	58.0	80.0
Night – 19/09/2024	23:00 – 07:00	52.0	85.0
Day – 20/09/2024	07:00 – 23:00	57.0	81.0
Night – 20/09/2024	23:00 – 07:00	51.0	81.0
Day – 21/09/2024	07:00 – 23:00	56.0	81.0
Night – 21/09/2024	23:00 – 07:00	50.0	75.0
Day – 22/09/2024	07:00 – 23:00	55.0	77.0
Night – 22/09/2024	23:00 – 07:00	53.0	77.0
Day – 23/09/2024	07:00 – 13:30	57.0	81.0
ML1 L_{Afmax} Analysis			
Time Period		**$L_{Afmax,t}$**	**10^{th} Highest $L_{Afmax,1min}$**
Night		85.0	76.0

Table 4.0 – Noise Survey Global Data ML2 – Front Façade

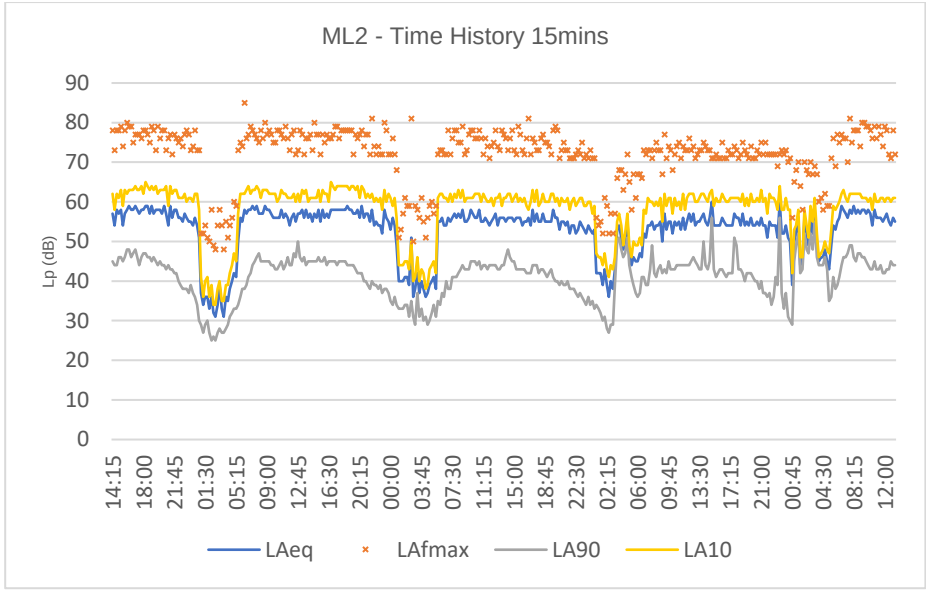

Figure 2.0 – Survey Time History ML2 – Front Facade

3.8 As can be seen in the results of the measurement at the rear façade the noise levels incident on this area of the site could be considered moderate. The noise levels are lower than that along the front façade. The time history indicates that the noise incident on the site is steady-state continuous noise generated by distance road traffic and rail noise.

4. Computer Noise Model Results

4.1 In order to calculate the sound levels at the façades of the development a computer sound model has been generated using DGMR Noise Prediction Software. This software undertakes calculations using the methods outlined in ISO 9613-2:1996

4.2 The computer sound model assumptions are outlined below:

- The ground in the area has been considered a mixture of hard.
- The topography of the site and surrounding land has been taken from Google Earth and information gained on-site.
- The elevations and building heights for the proposed development have been obtained from the associated plans and information gained on-site.
- The road has been inputted into the model as a line source at a height of 0.5m. The sound power level of the line source has been increased until noise levels within the model calibrated with the measured noise levels at ML1.
- The rail line has been inputted into the model as a line source at a height of 1m. The sound power level of the line source has been increased until the noise model calibrated with the noise levels at ML2.
- A 1.8m closed board timber fence has been inputted around the rear garden area.
- Two cars using the driveway have been inputted into the model as moving point sources at a height of 0.5m. Both cars represent a sound power of 78 dB LwA. The vehicle noise has been time corrected to represent a worst-case 5-minute period with two cars arriving and taking a worst-case 1 minute to park/leave.

4.3 The results of the computer noise model assuming the highest 16-hour and 8-hour periods period can be found in the table below. These results are inclusive of all noise sources including road and rail noise. Full noise contours can be found in Appendix D. To allow ease of assessment the development has been divided into discrete façade zones. The noise levels presented are obtained from the most exposed point on each façade zone.

Ambient Noise Levels		
Façade Zone	**Day Time $L_{Aeq,t}$ (dBA)**	**Night Time $L_{Aeq,t}$ (dBA)**
Front	68.0	63.0
East	57.0	52.0
Rear	55.0	50.0
Garden Centre	53.0	--

Table 5.0 – Noise Model Results – Ambient Noise Levels

4.4 The results of the computer noise model indicating the specific noise levels of vehicles utilising the parking at the site are outlined below. To provide a representative assessment two vehicles parking within the front and eastern driveway have been assumed. This is deemed a robust and conservative assessment given the scale and size of the parking areas.

Vehicle Noise Levels		
Façade Zone	**Day Time $L_{Aeq,5min}$ (dBA)**	**Night $L_{Aeq,5min}$ (dBA)**
Front	54.0	54.0
East	53.0	53.0

Table 6.0 – Noise Model Results – Driveway Vehicle Movements

4.5 As can be seen, the noise levels produced by the vehicle movement along the driveway are relatively low and lower or similar to the existing surrounding acoustic environment. Given that the dominant noise source on the development is road and vehicle noise from the surrounding road network it is unlikely that vehicle movements in and around the development would cause any significant impact.

5. Increase in Ambient Noise Levels Assessment

5.1 In order to assess the potential for noise impact caused by vehicle movements to and from the driveways associated with the development and neighbouring dwellings on the future residents an increase in ambient noise levels assessment will be undertaken.

5.2 The increase in ambient noise levels assessment is undertaken by logarithmically adding the noise levels produced by vehicle usage at the site to existing ambient sound levels. The higher the increase in noise level higher the potential for impact.

	Day Time	
Description	**Front Façade**	**East Façade**
Vehicle Noise Level	54.0	53.0
Typical Average Ambient Noise Level at Facade	68.0	57.0
Resulting Noise Level	68.2	58.5
Increase in Noise Level	+0.2	+1.5
Impact Rating	'Not Significant'	'Not Significant'

Table 7.0 – Vehicle Noise Impact Assessment – Day

5.3 The daytime assessment of vehicle noise produced by the parking and driveway areas of the site indicates that the increase in noise level would be 'Not Significant'.

Night Time		
Description	**Front Façade**	**East Façade**
Vehicle Noise Level	54.0	53.0
Typical Average Ambient Noise Level at Facade	61.0	52.0
Resulting Noise Level	61.8	55.5
Increase in Noise Level	+0.8	+3.5
Impact Rating	'Not Significant'	'Slight'

Table 8.0 – Vehicle Noise Impact Assessment - Night

5.4 The nighttime assessment of vehicle noise produced by the parking and driveway areas of the site indicates that the increase in noise level would be 'Slight'.

5.5 The outcome of both the daytime and nighttime vehicle noise assessment indicates that the potential impact on future residents as a result of driveway and parking usage would be 'Not Significant' to 'Slight'. When assessing noise impact the context surrounding the assessment should also be considered when analysing the outcome of the assessment. The key context surrounding the assessment is the number of vehicles using the site and the number of vehicle movements. It is highly likely that there would be no more than 2-3 vehicles using the site and neighbouring driveway and that their movements would generally be limited to the daytime period between 07:00 – 23:00. Given the context of the surrounding acoustic environment it is assumed there would be little to no noise impact on future residents. When assessed in accordance with the NPPF and NPSE this would equate to noise levels falling below the 'Lowest Observed Effect Level'.

5.6 To provide a robust and conservative noise break-in assessment where the ambient noise levels across the site fall lower than the cumulative levels resulting from IANL assessment the cumulative noise levels including ambient and car parking vehicle noise will be used for the calculations.

6. BS8233 Assessment Results and Requirements

6.1 As can be seen in the section above the noise levels incident on site vary depending on location. The table below indicates the required sound reduction in each façade zone to ensure the BS8233 Internal noise criteria can be achieved. Full noise break-in calculations can be found in Appendix D.1.

Required Sound Reduction	
Façade Zone	**Required Sound Reduction**
Front	33 dB R_{w+ctr} / 34 dB R_w
East	26 dB R_{w+ctr} / 31 dB R_w
Rear	20 dB R_{w+ctr} / 31 dB R_w

Table 9.0 – Required Sound Reduction

6.2 In order to assess the need for an alternative ventilation strategy an open window assessment has been undertaken The assessment indicates appropriate internal noise criteria cannot be achieved with an open window and as such an alternative ventilation strategy is required.

The AVO Guide Assessment indicates a Medium to High Risk of overheating at the site due to keeping windows closed to avoid ingress from external noise.

6.3 The external garden noise level assessment outlined in Appendix D3 indicates appropriate external noise criteria can be achieved provided the advised 1.8m closed board timber fence is installed around the external garden area.

7. Sound Insulation Scheme and Recommendations

7.1 The following section of the report details the sound insulation scheme required to ensure internal noise criteria can be achieved and that future residents are protected from noise ingress from the external environment. Prior approval of the sound insulation scheme should be sought from the local authority before any of the works outlined below are implemented.

7.2 Facades and Roof

The façade build-up was yet to be defined however it is assumed to be a minimum 210mm masonry brick, it is assumed that the extension will be constructed of a typical cavity construction of 105mm brick, 100mm cavity and 100mm inner leaf of concrete block. When modelled in INSUL 10.0 typical facade wall constructions such as this are found to provide a minimum of 50 dB R_w and are deemed sufficient.

The plans indicate that there not be rooms within the roof space however there will be a flat roof to the rear of the site. In areas where voided loft space is closed provided a minimum of 400mm thermal insulation is installed no further upgrades would be required. The flat roof of the new extension should be installed as follows, the detail below provides a minimum 50 dB R_w and thus is deemed suitable.

- Waterproof membrane
- 22mm OSB roofing board
- 200mm timber roof truss
- Minimum 200mm insulation minimum density 22kg/m^3 within the roof trusses
- 30mm resilient bar system
- No.2 layers of 12.5mm sound bloc plasterboard.
-

7.3 Glazing

To ensure the amenity of the future residents can be protected the minimum sound reduction defined in the BS8233 Assessment above should be achieved by all glazing. The following glazing units are sufficient to achieve said performance and could be installed along each facade zone for both bedrooms and living rooms:

- Front Façade – 6mm Glass / 16mm Argin Cavity / 6.8mm Optiphon glass (34 dB R_{w+ctr} / 40 dB R_w)
- East & Rear Façade – 6mm Glass / 16mm Air Cavity / 4mm Glass 28 dB R_{w+ctr} / 32 dB R_w)

It is advised that the exact make and model of the existing glazing and trickle vents be defined and compared to the specifications above. Should the existing glazing and trickle vents match the required sound reduction outlined in Table 9.0 they could be retained.

The glazing above has been taken from the Pilkington database however any other glazing capable of achieving the minimum required sound reduction is outlined in the BS8233 Break-in Assessment in Appendix D.1 could be installed.

7.4 Ventilation

An alternative ventilation system should be employed across the site the ventilation system will be specified to ensure noise ingress can be reduced whilst vents are open and operating and the internal noise criteria achieved.

The AVO Guide is typically used to assess the risk of overheating in dwellings due to elevated noise. The AVO Guide can also be used to specify an appropriate ventilation system with regard to the level of sound reduction it can provide. Based on the noise levels incident on each façade zone and Table B-3 of the AVO Guide, System 3 outlined in the Building Regulations Approved Document F should be sufficient for the development. System 3 outlines the use of trickle ventilation or through-wall ventilation and continuous mechanical extract, as indicated in the figure below. It should be noted the results of the AVO guide assessment indicated there is a Medium to High risk of overheating due to elevated noise. Therefore an overheating assessment would likely be required to establish the potential for overheating with windows closed using the system below for ventilation. Should the overheating assessment indicate that the system is not sufficient to provide effective cooling then a full MVHR system may need to be employed. The MVHR system should be designed to provide sufficient ventilation and prevention from overheating.

Figure 3.0 – Proposed Ventilation System

Internal mechanical ventilation such as extract systems produce self-generated noise which needs to be fully considered. The following criteria should be archived by any mechanical ventilation systems employed at the site. The criteria below have been defined by the ANC in consultation on the Future Home Standards 2019 and the AVO Guide 2020.

Whole-dwelling ventilation system noise should not exceed:

- 26 dB $L_{Aeq,t}$ in Bedrooms
- 30 dB $L_{Aeq,t}$ in Living rooms

This would apply to Mechanical Extract Ventilation (MEV) and Mechanical Ventilation with Heat Recovery (MVHR) systems.

Extract ventilation system noise should not exceed:

- 26 dB $L_{Aeq,t}$ in Bedrooms
- 35 dB $L_{Aeq,t}$ in Living rooms
- 45 dB $L_{Aeq,t}$ in Kitchens and Bathrooms

This would apply to intermittent fans used with natural ventilation as well as MEV and MVHR.

The section below outlines a trickle ventilation model for the glazing that is suitable for ventilation on all facades and locations both bedrooms and living rooms. According to the Building Regulations Part F when adopting system 3 utilising continuous mechanical extract the required equivalent area of ventilation within a dwelling is 4000mm^2. Given this, the vents will be specified to provide both the required sound reduction and the required equivalent area.

- Front Façade – Greenwoods 5000EAW.AC2
  (Open - 42 dB Dn,e,w /38 dB $D_{n,e,w+ctr}$)
- East & Rear Façade – Greenwoods Solvent 5000EA
  (Open – 33 dB $D_{n,e,w}$)

7.5 External Noise Barriers

To ensure that the noise levels within the garden area fall below the criteria outlined in BS8233:2014 a 1.8m closed board timber fence should be installed around the entire garden perimeter. The fence should have no gaps or holes and provide a minimum surface mass of 10kg/m^2.

8. Conclusion

8.1 In conclusion, a noise survey has been undertaken at 10 Rickmansworth Road, Northwood HA6 1HA. The noise levels obtained during the survey have allowed a noise assessment to be undertaken in order to calculate the requirements for a sound insulation scheme to ensure the amenity of future residents can be protected.

8.2 The vehicle parking noise assessment indicated that when considering a worst-case scenario there would be a 'Not Significant' to 'Slight' increase in ambient noise levels when assessed in accordance with the IEMA Guidelines on Noise Impact Assessment. When considering the outcome of the assessment and the wider context of the assessment i.e. the number of vehicles using the driveway, the number of trips produced by the vehicles and the existing noise sources in the surrounding acoustic environment nose from cars using the driveway is likely to have little to no noise impact. When assessed in accordance with the NPPF and NPSE this would equate to the 'Lowest Observed Effect Level'

8.3 As a result of the noise assessment, a sound insulation scheme and further mitigation measures have been defined in Section 7.0 to ensure all the criteria outlined in BS8233:2014 can be achieved. Provided the sound insulation scheme and recommendations are installed and retained thereafter the amenity of future residents can be fully protected and all criteria should be achieved. Prior to the commencement of any works or implementation of the sound insulation works the above assessment should be fully approved by the local authority.

APPENDIX A – List of Terms and Glossary

The following section of the report outlines a glossary of terms used in the assessment to assist the reader in understanding the assessment above which is by necessity technical in nature.

Decibel DB - The decibel often denoted as dB is the logarithmic unit used to describe the magnitude of sound or noise levels. The typical range of sound pressure levels is from 0 dB, defined as the threshold of hearing to 120dB defined as the threshold of pain.

Frequency Hz – As well as the decibel sound and noise is also measured and defined in frequency. Frequency or Hertz (Hz) is an expression of the number of cycles a sound wave will complete per second. Lager frequencies may be expressed in Kilo Hertz (kHz). The typical range of human hearing is from 20 Hz to 20,000Hz however with age the audible frequency range decreases in most humans.

A - Weighting – The A-weighting is the most commonly used weighting curve taken IEC 61672:2003 and is applied to sound pressure level measurements. The A-weighting is applied to measured sound levels to account for the loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies.

LAeq - The A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over any given time period. L_{Aeq} is the level of a continuous noise that has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period. The A-weighting represents a curve that is applied to the measured noise levels to represent the way the human auditory system perceives sound.

LAfmax - The maximum A-weighted noise level that was recorded during the monitoring period using a fast time weighting. This acoustic parameter represents more transient sound levels within the acoustic environment which may only occur for a few seconds or minutes.

LA10 - This is the A-weighted noise level exceeded for 10% of a given time period. This parameter is typically used to measure and predict road traffic noise.

LA90 - This is the A-weighted noise level exceeded for 90% of any given time period. Generally, this acoustic parameter represents the underlying background sound level in a given area and doesn't generally include transient or short-term noise events that may occur within the surroundings.

Sound Pressure – Sound pressure is the difference between the instantaneous pressure at a point in the presence of a sound wave and the static pressure of the medium. Sound pressure fluctuates due to refractions and compressions of air molecules.

Sound Reduction Index – The sound reduction index denoted by the parameter 'R' is the laboratory-measured sound reduction given material or construction. R is measured in 1/3 octave band frequencies. The R_w sound insulation parameter stands for the weighted standardised sound reduction index and is a single-figure global rating of the sound insulation of a given material or construction.

APPENDIX B – Site Plans, Surroundings and Location

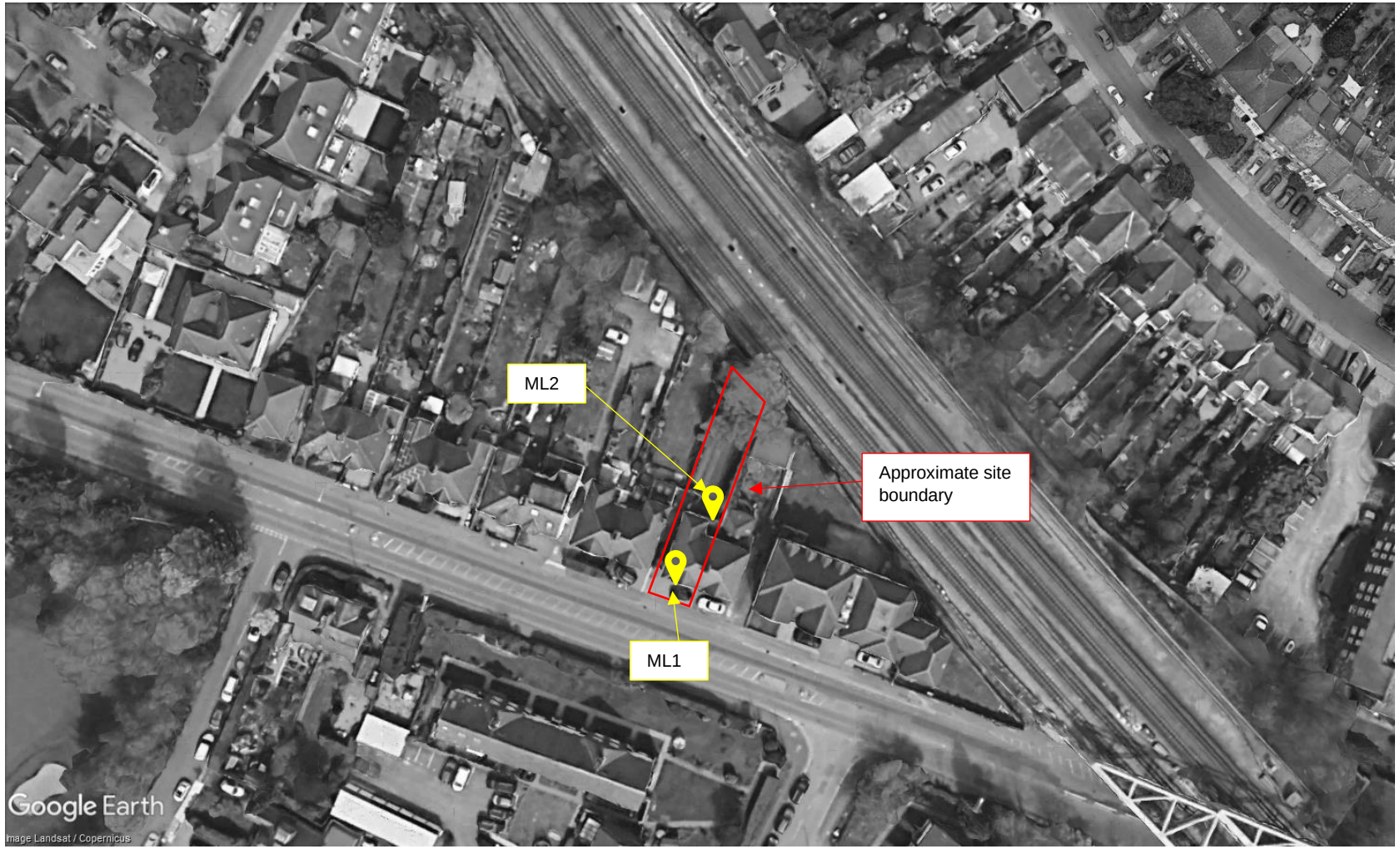

Figure 4.0 – Site and Measurement Location

APPENDIX C – Site Plans

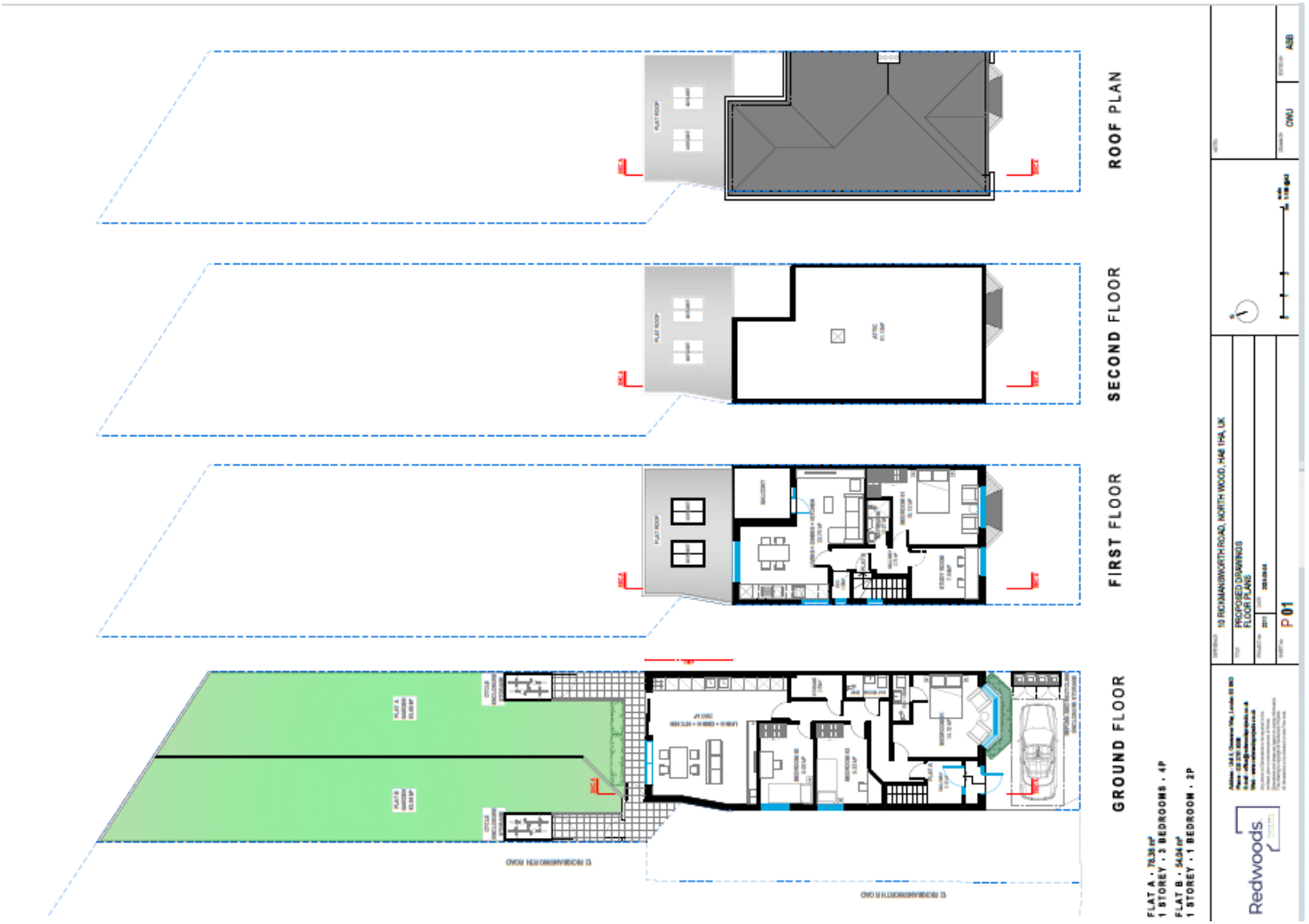

Figure 5.0 – Proposed Site Plans

APPENDIX D – Noise Maps and Calculations

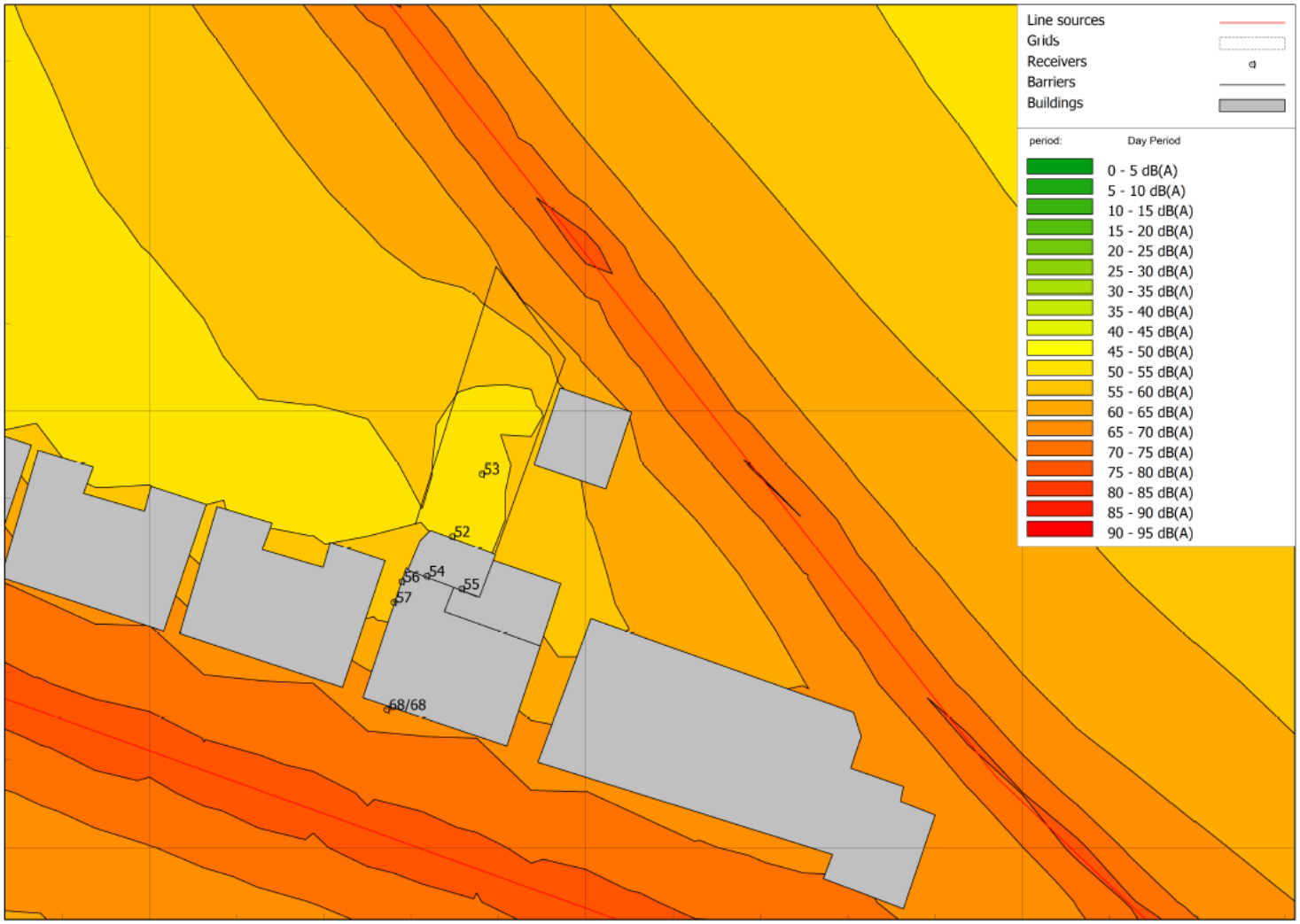

Figure 6.0 - Day Time Ambient - $L_{Aeq,16hour}$ Noise Map - Grid Contour Height 1.5m

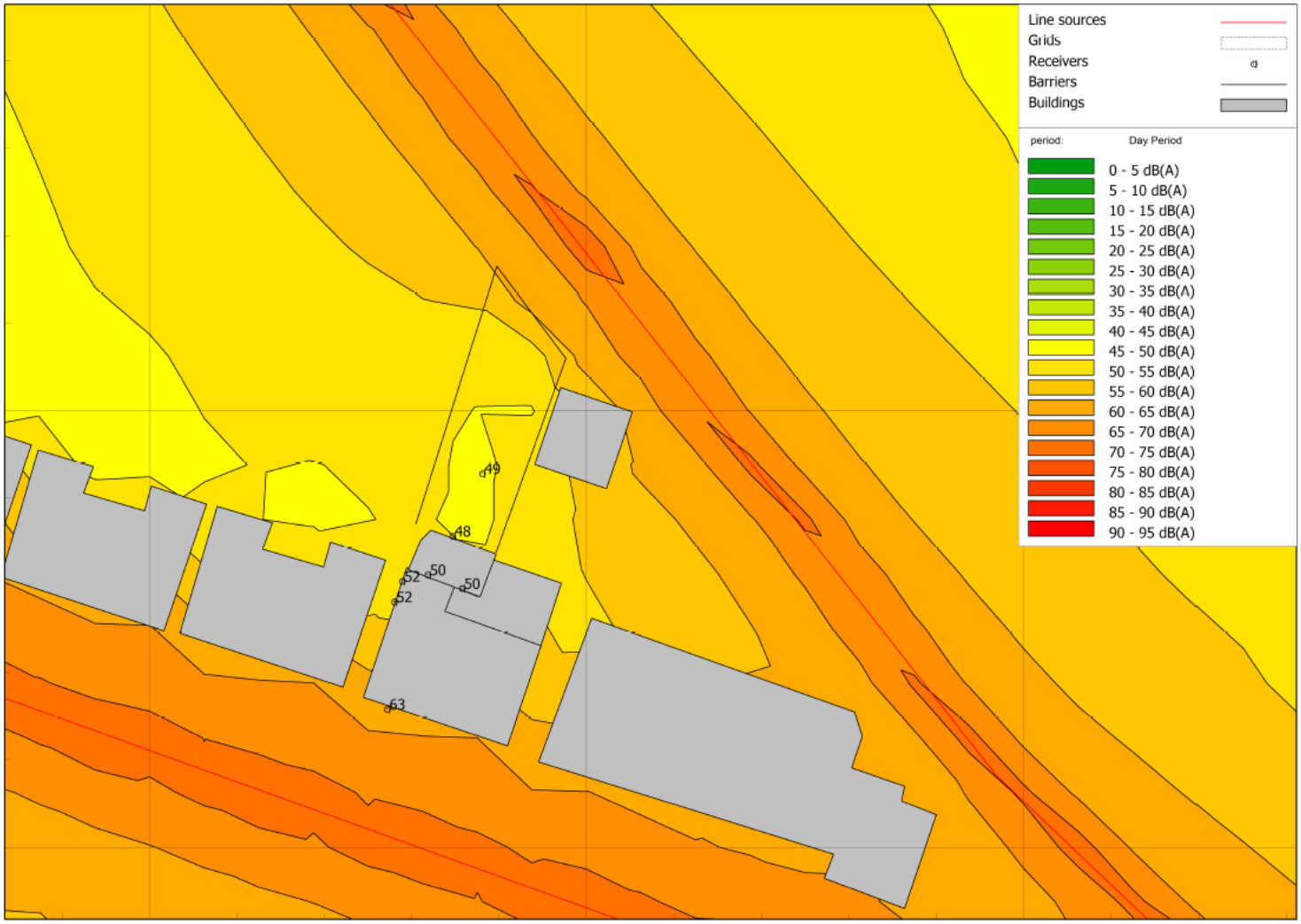

Figure 7.0 – Night Time Ambient - $L_{Aeq,8hour}$ Noise Map - Grid Contour Height 1.5m

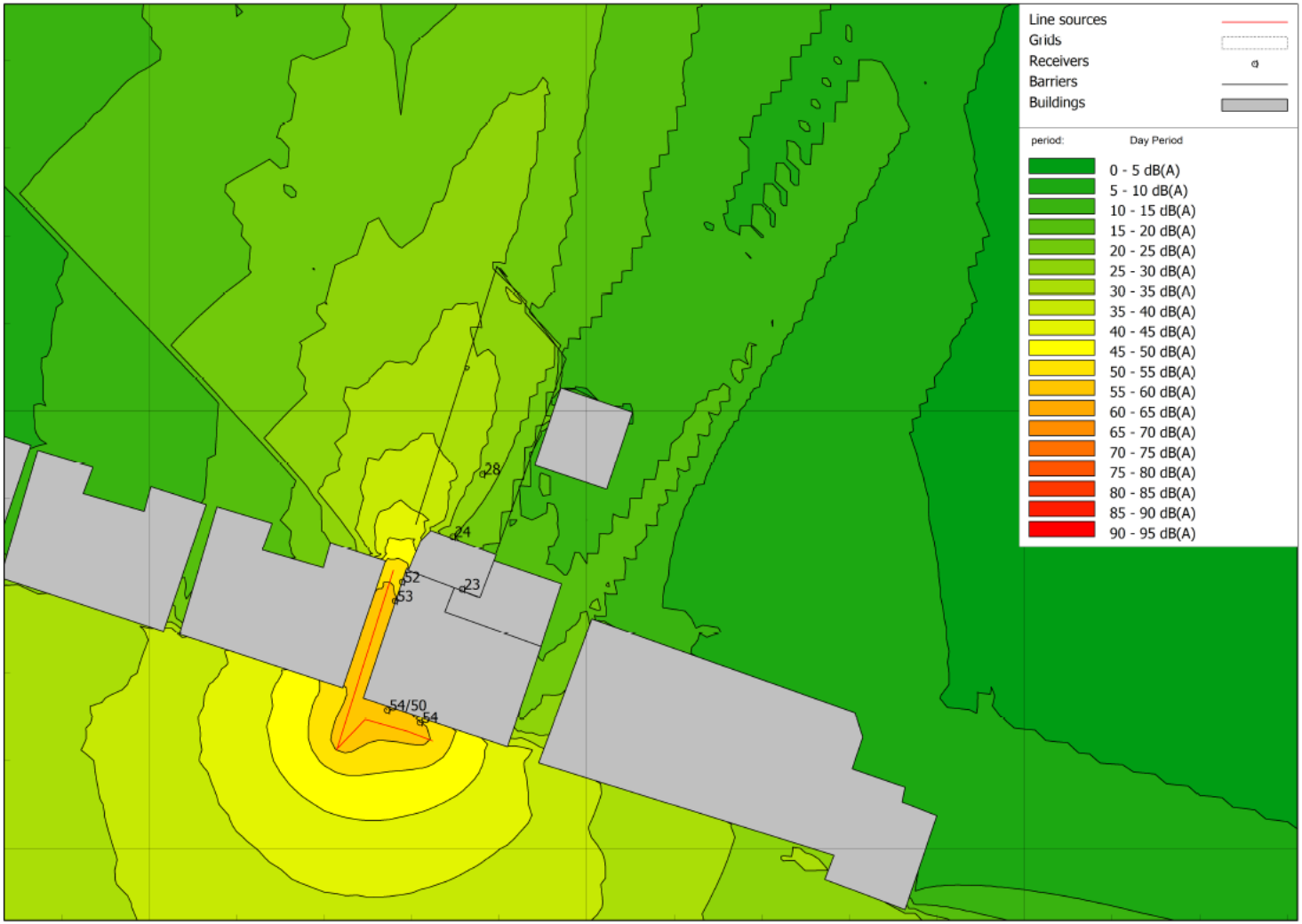

Figure 8.0 – Specific Vehicle Noise – $L_{Aeq,5min}$ – Noise Map – Grid Contour Height 1.5m

D.1 – BS8233 Noise Break-In Assessment

The tables below compare the noise levels expected at each of the defined facade zones to the criteria outlined in BS8233:2014 in order to calculate the required sound reduction index of the proposed dwellings.

Location/Time Period	Façade Zone	Façade Noise Level $L_{Aeq,1hour}$ (dBA)	Adapted BS8233 Criteria (dBA)	Required Sound Reduction (dB)
Bedroom / Living Room Day	Front	68.0	35 dB $L_{Aeq,16hour}$	33.0 R_{w+ctr}
Bedroom Night		63.0	30 dB $L_{Aeq,8hour}$	33.0 R_{w+ctr}
Bedroom Night		79.0	45 dB L_{Afmax}	34.0 R_w
Bedroom / Living Room Day	East	59.0*	35 dB $L_{Aeq,16hour}$	24.0 R_{w+ctr}
Bedroom Night		56.0*	30 dB $L_{Aeq,8hour}$	26.0 R_{w+ctr}
Bedroom Night		76.0	45 dB L_{Afmax}	31.0 R_w
Bedroom / Living Room Day	Rear	55.0	35 dB $L_{Aeq,16hour}$	20.0 R_{w+ctr}
Bedroom Night		50.0	30 dB $L_{Aeq,8hour}$	20.0 R_{w+ctr}
Bedroom Night		76.0	45 dB $L_{Afmax,}$	31.0 R_w

Table 10.0 – BS8233 Façade Break-In Assessment

**Cumulative ambient & Vehicle Noise*

D.2 – BS8233 Open Window Assessment

The assessment below has been undertaken assuming a 13 dB attenuation from an open window to establish the internal noise levels. BS8233 states that where development is desirable noise criteria can be relaxed by 5 dB. The AVO Guide indicates at levels approximately 5 dB above the criteria there would be a low risk of overheating. Document O of the Building Regulations also stipulates internal levels of 40 dB $L_{Aeq,8hours}$ or below and L_{Amax} levels not regularly exceeding 55 dB are sufficient when using open windows for ventilation and prevention of overheating. Given this, it is reasonable to expect a 5 dB relaxation in the BS8233 criteria when assuming open windows and still achieving acceptable internal noise levels.

BS8233 Open Window Assessment					
Location / Time Period	**Façade Zone**	**Internal Noise Level $L_{Aeq,t}$ (dBA)**	**BS8233 Criteria (dBA)**	**Exceedance (dBA)**	**AVO Guide Risk Level**
Bedroom / Living Room Day	Front	55.0	40 dB $L_{Aeq,16hour}$	+15.0	High
Bedroom Night		50.0	35 dB $L_{Aeq,8hour}$	+16.0	High
Bedroom Night		66.0	50 dB $L_{Afmax,8hour}$	+16.0	High
Bedroom / Living Room Day	East	44.0	40 dB $L_{Aeq,16hour}$	+4.0	Medium
Bedroom Night		40.0	35 dB $L_{Aeq,8hour}$	+5.0	Medium
Bedroom Night		63.0	50 dB $L_{Afmax,8hour}$	+13.0	Medium
Bedroom / Living Room Day	Rear	42.0	40 dB $L_{Aeq,16hour}$	+2.0	Low
Bedroom Night		37.0	35 dB $L_{Aeq,8hour}$	+2.0	Medium
Bedroom Night		63.0	50 dB $L_{Afmax,8hour}$	+13.0	Medium

Table 11.0 – Open Window Assessment

D.3 – BS8233 Garden Noise Assessment

The Garden Noise Levels Assessment is presented in the table below. Predicted noise levels in the centre of the garden assuming the proposed 1.8m closed board timber fence has been installed as per the sound insulation scheme in the section.

BS8233 Garden Noise Level Assessment	
Description	**Garden Noise Level (dBA)**
Garden Noise Level $L_{Aeq,16hour}$	53.0
BS8233 Criteria $L_{Aeq,16hour}$	50 - 55 dB $L_{Aeq,16hour}$
Exceedance	-2.0

Table 12.0 – BS8233 Garden Noise Level Assessment

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