INFINITY ACOUSTICS

September 2023

Noise Impact Assessment

Oxford Road,
Dewsbury,
WF13 4LW

INFINITY ACOUSTICS

Project Description:

Noise Impact Assessment of a Proposed Care Home.

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1. Introduction

1.1 Infinity Acoustics Ltd has been appointed to undertake a noise impact assessment for a residential care home development located at Oxford Road, Dewsbury, WF13 4LW. The assessment will be undertaken to analyse the potential impact of noise on the future residents of the proposed development as well as the potential noise impact the development may have on existing Noise Sensitive Receptors in the area.

1.2 As part of the development process, the client will be submitting a planning application to Kirklees Council.

1.3 The client has sought pre-application advice from the LPA who have provided the following commentary in relation to noise and residential amenity.

'Noise

We have considered whether the proposed development may be adversely affected by existing noise sources and whether noise from the proposed development may have an adverse impact on nearby noise sensitive receptors. The proposed development may generate noise which will have the potential to cause a loss of amenity to the occupiers of nearby noise sensitive premises. We will therefore expect a noise impact assessment to be provided with any future application. The assessment should determine the likely noise that will arise from all aspects of the proposed development (including but not limited to fixed mechanical plant and equipment) and detail the control and mitigation measures that will be necessary to provide to prevent the amenity of nearby receptors being affected by any such noise.'

1.4 The aim of the noise survey and assessment below is to provide the relative information to assist the client and the local planning authority in validating and approving the 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 and noise control measures will be provided where necessary to ensure the amenity of any future residents and existing residents in the area can be protected from noise and that relative criteria can be achieved.

The following noise assessment will be undertaken with reference to the National Planning Policy Framework 2021 and the Noise Policy Statement for England 2010 as well as the following standards.

- BS8233:2014 – Guidance on Sound Insulation and Noise Reduction In Buildings
- BS4142:2014+A1:2019 - Methods for Rating and Assessing Industrial and Commercial Sound.
- IEMA Guidelines on Noise Impact Assessments:2014

2. Assessment Methods and Criteria

2.1 *BS8233:2014*

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)

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.

The above criteria are desirable however BS8233 states the following: *'where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.'* It is assumed the development is desirable. Therefore, it is assumed that when considering an open window condition reasonable internal conditions can be achieved with a 5 dB relaxation in criteria.

2.2 *BS4142:2014+A1:2019*

BS4142 is a British Standard that provides guidance and a standardised methodology for assessing industrial and commercial noise sources. BS4142 outlines methods for defining specific sound levels from a given development and/or noise source. Rating penalties are then applied to account for the acoustic characteristics of the noise source. Rating penalties can be applied for the following:

- Tonality
- Impulsivity
- Intermittency

Using the subjective method, the penalties vary in magnitude depending on how perceptible the acoustic characteristic is to the human ear. The rating noise level is then compared to the underlying L_{A90} background sound level of the area without the source under assessment operating to assess the likely noise impact. The level by which the rating noise level exceeds the background L_{A90} defines the potential for noise impact. The table below outlines the relevant criteria bandings described in BS4142.

Description	Impact Rating
Rating noise levels +10 dB above the background	Significant adverse impact, depending on the context.
Rating noise levels +5 dB above the background	Adverse impact, depending on the context.
Where the rating level does not exceed the background	Low impact dependent on Context

Table 1.0 – BS4142 Criteria

The above criteria will be utilised to assess the potential noise impact on existing residential dwellings in the area due to any external mechanical plant units associated with the development. It is assumed that provided mechanical plant noise falls a minimum of 5 dB below the background sound level this would indicate low impact and 'No Observed Effect Level' when assessed in accordance with the NPPF and NPSE.

2.3 *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, such as noise from access roads and car parks. 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 ambient 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 2.0 – IEMA Guidelines on Noise Impact Assessment Criteria

The above assessment methodology will be utilised to assess the potential impact of vehicle movements to and from the development via access road and car park areas will have on the surrounding Noise Sensitive Receptors. It is assumed that if access road/car park noise falls within the None/Not Significant' Impact rating band this would equate to 'No Observed Effect Level' when assessed in accordance with the NPPF and NPSE.

3. Site & Surroundings

3.1 The proposed development is located on the outskirts of Dewsbury town centre and the surrounding area could be described as suburban and primarily residential.

3.2 To the south of the site is St John Fisher Academy which is assumed to operate between 08:00 and 17:00. The school has multiple sports pitches in the vicinity of the development. During the site visit noise from the school and associated sports pitches were not audible however it is assumed that during school arrival and departure times as well as sports lessons noise from the school activities would be one of the dominant noise sources in the area along Oxford Road.

3.3 To the north and south of the development are Oxford Road and Reservoir Street both these roads facilitate moderate to low levels of road traffic and car pass-bys were audible at the site locations.

3.4 The closest Noise Sensitive Receptors (NSRs) to the development are the residential dwellings on the adjacent plots to the east and west of the site. Due to the proximity of these dwellings to the site they will be considered the primary Noise Sensitive Receptors in the plant noise and vehicle noise assessments outlined below.

4. Survey

4.1 A noise survey of the site was undertaken between Monday the 18th of September and Wednesday the 20th of September 2023.

4.2 The following equipment was used to undertake the noise survey. All equipment used was field calibrated at 1kHz to 114 dB with a tolerance of less than 0.5 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 – 113352
- SVAN 971A Class 1 Sound Level Meter – SN – 139441
- SVAN SV33B Class 1 Calibrator – SN – 122241

4.3 The long-term noise meter and associated microphone at Measurement Location 1 (ML1) were located on a lamppost adjacent to the nearby School and Oxford Road. The meter was approximately 3.5m from the ground with no other reflective surfaces in proximity.

The long-term noise meter and associated microphone at Measurement Location 2 (ML2) were located on a telegraph pole along Reservoir Street. The meter was approximately 3.5m from the ground with no other reflective surfaces in proximity.

The measurement location can be found in the site map in Appendix B.

4.4 The weather during the setup of the equipment is outlined below. The temperature was 18 degrees Celsius with wind speeds of 5.2 m/s and no precipitation. During the collection of the equipment, the temperature was 17 degrees Celsius and wind speeds of less than 1.m/s with some light precipitation. 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. The weather data is taken from the nearest functioning weather stations and historical data.

Weather Data 18/09/23 – 20/09/23					
Date	**Temp (C)**	**Rain Fall (mm)**	**Wind Speed (m/s)**	**Prevailing Wind**	**Mean Relative Humidity (%)**
18/09/23 – Day 1	10.2 – 17.6	0.0 – 2.8*	0.0 – 3.1	SSE	88.3
19/09/23 – Day 2	10.4 – 18.8	0.0 – 1.3**	0.0 – 3.1	SW	87.5
20/09/23 – Day 3	11.1 – 18.5	0.0 – 1.0***	0.0 – 1.3	S	85.5

Table 3.0 – Weather Data

**Period of heavy rain between 12:30 – 13:30 deleted from assessment*

*** Period of heavy rain between 07:30 – 08:30 deleted from assessment*

**** Period of rain occurred after the survey period*

4.5 The results of the ambient noise survey are presented in the tables below and will be used in the subsequent Noise Assessment. A full noise survey time history can be found in Appendix C.

16 & 8 Hour Results ML1			
Time Period	**$L_{Aeq\ (dB)}$**	**$L_{Afmax\ (dB)}$**	**$L_{A90,t\ (dB)}$**
Day – 18/09/23 – 10:30 – 23:00	62.0	104.0	50.0
Night – 18/09/2023 – 23:00 – 07:00	52.0	79.0	42.0
Day – 19/09/2023 – 07:00 – 11:00	63.0	93.0	54.0
Night – 19/09/2023 – 23:00 – 07:00	57.0	80.0	47.0
Day – 20/09/2023 – 07:00 – 09:30	65.0	85.0	57.0

ML1 L_{Afmax} Analysis		
Time Period	**$L_{Afmax,t}$**	**10th Highest $L_{Afmax,15min}$**
Night 1	79.0	72.0
Night 2	80.0	74.0

Table 4.0 – Noise Survey Data ML1

16 & 8 Hour Results ML2			
Time Period	**$L_{Aeq\ (dB)}$**	**$L_{Afmax\ (dB)}$**	**$L_{A90,t\ (dB)}$**
Day – 18/09/23 – 11:15 – 23:00	57.0	86.0	47.0
Night – 18/09/2023 – 23:00 – 07:00	49.0	78.0	41.0
Day – 19/09/2023 – 07:00 – 11:00	58.0	88.0	50.0
Night – 19/09/2023 – 23:00 – 07:00	53.0	78.0	46.0
Day – 20/09/2023 – 07:00 – 10:00	61.0	79.0	51.0

ML1 L_{Afmax} Analysis		
Time Period	**$L_{Afmax,t}$**	**10th Highest $L_{Afmax,15min}$**
Night 1	78.0	71.0
Night 2	78.0	72.0

Table 5.0 – Noise Survey Data ML2

4.6 As can be seen in the table above the 16-hour and 8-hour period noise levels are typical of what could be considered a residential environment. The higher noise levels were measured at ML1 due to the proximity of this noise meter to the roads accessing the nearby school and sports pitches. However, given the presence of existing residential dwellings in a similar proximity or closer to the nearby school it is assumed that provided good

acoustic design is implemented the residents can be fully protected from all nearby noise sources.

4.7 The table below indicates the lowest measured $L_{Aeq,1hour}$ during the day that will be used to assess the access road and car park noise associated with the development. The table also indicates the lowest measured $L_{A90,1hour}$ during the Day and Night that will be used within the BS4142 plant noise assessment.

Ambient & Background Noise Levels – ML2	
Time Period	**Noise Level (dB)**
Lowest $L_{Aeq,1hour}$ Day Time	53.0
Lowest $L_{A90,1hour}$ Day Time	41.0
Lowest $L_{A90,1hour}$ Night Time	39.0

Table 6.0 – Ambient and Background Noise Levels

5. Computer Noise Model Results

5.1 In order to calculate the sound levels at the façades of the development and specific noise levels at the facades of the NSRs computer sound model has been generated using DGMR Noise Prediction Software.

5.2 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 specific noise levels of the access road and car park have been inputted into the noise model as a line source and have been calculated using the CRTN method all calculations can be found in Appendix D.
- The surrounding roads have been inputted into the model as line sources at a height of 0.5m. The sound power levels of the line sources have been increased until they calibrated with measured noise levels at ML1 and ML2
- The nearby sports pitch has been inputted into the model as an area source and calibrated to the noise level data provided by Sports England of 58 dB at 10m.

5.3 The results of the total ambient noise computer noise model can be found in the table below. These results are inclusive of all noise sources including roads and sports pitch. 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)**	**Night Time 10th Highest $L_{Afmax,t}$ (dBA)**
Red	56.0	48.0	65.0
Orange	53.0	46.0	63.0
Yellow	50.0	46.0	63.0
Green	≤ 50.0	≤ 45.0	≤ 60.0
Garden Areas	46 – 50 dB $L_{Aeq,16hour}$		

Table 7.0 – Noise Model Results – Ambient Noise Levels

Figure 1.0 – Development Façade Zones

5.4 The results of specific noise modelling of vehicle noise associated with the proposed access roads and car parks are presented in the table below. The traffic noise associated with this element has been calculated via the CRTN method assuming a total of 37 car movements from the main car park and a total of 4 car movements from the small car park per hour. These levels of car movements per hour equate to the same number of car parking spaces.

Specific Car Park Noise	
NSR Designation	**Day Time $L_{Aeq,t}$ (dBA)**
NSR 1	46.0
NSR 2	43.0
NSR 3	41.0

Table 8.0 – Noise Model Results – Car Park Noise

6. Noise Assessment Results

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**
Red	21.0 R_{w+ctr}
Orange	18.0 R_{w+ctr}
Yellow	16.0 R_{w+ctr}
Green	15.0 R_{w+ctr}

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 assuming the predicted highest and is presented in Appendix D.2. The assessment indicates appropriate internal noise criteria can generally be achieved across the site with an open window. Along the red facades, however, the criteria is exceeded by 1 dB. However, this is considered a minor exceedance.

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

6.3 An external garden noise levels assessment has been undertaken in Appendix D3. The result indicates that the $L_{Aeq,16hour}$ noise levels within the garden areas fall below the 50 dB criteria outlined in the W.H.O Guidelines on Community Noise and BS8233. Thus, indicating an appropriate external acoustic environment can be achieved at the site without further noise mitigation.

6.4 An increase in ambient noise level assessment has been undertaken to assess the potential impact of the use of the access roads and car parks associated with the development. The table below indicates the potential increase in noise levels at the most exposed NSR. As can be seen, this level of increase is 'Not Significant' when assessed in accordance with the IEMA Guidelines on Noise Impact. The full assessment can be found in Appendix D4.

IEMA Increase In Noise Level Assessment		
NSR	**Expected Increase In Noise Level (dBA)**	**Impact Rating**
NSR 1	+0.8	'Not Significant'
NSR 2	+0.4	'Not Significant'
NSR 2	+0.3	'Not Significant'

Table 10.0 – IEMA Guidelines Assessment – Car Parks

6.5 The BS4142 Assessment in Appendix D5 Indicates that provided the plant rating noise limit level defined in Section 7.0 below is adhered to all relative criteria can be achieved and noise from external mechanical plant noise on the NSRs will achieve 'Low Impact' when assessed in accordance with BS4142.

7. Sound Insulation Scheme and Noise Control Measures

7.1 The following section of the report details the sound insulation scheme and noise control measures required to ensure internal noise criteria can be achieved and that future residents are protected from noise ingress from the external environment as well as ensuring existing residents are protected from excess noise from the site. 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 100mm masonry Brick, 100mm cavity and 100mm inner leaf of concrete block. This is a heavyweight construction and as such is deemed to provide sufficient sound reduction. When modelled in INSUL 9.0 typical cavity wall constructions such as this are found to provide a minimum of 50 dB R_w.

If there are to be rooms within the roof spaces the roof will be required to provide the minimum sound reduction outlined in Table 9.0 above. The following detail will be sufficient to provide this level of sound reduction However any other detail providing the minimum required sound reduction could be installed.

- Standard Roof Tile
- 50mm Roofing Batten
- 100mm Timber Roof Truss
- 100mm Insulation minimum density 45kg/m^3
- A Resilient Bar System applied to the underside of the Roof Truss
- No. 1 layer of 15mm sound bloc plasterboard (min surface mass 12.6 kg/m^2)
  Expected performance 46 dB R_{w+ctr}

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:

- All Facades – 4mm Gglass / 6 – 16mm Air Cavity / 4mm Glass (25 dB R_{w+ctr} / 29 dB R_w)

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

The open window assessment indicated that generally appropriate internal noise criteria can be achieved with an open window however it is assumed that the development will require a degree of ventilation to comply with Building Regulations. Thus, in order to achieve this and protect the amenity of future residents further an alternative ventilation system will be advised. Table B-3 of the AVO Guide indicates System 1 outlined in the Building Regulations Approved Document F should be sufficient for the development based on the noise levels incident on site. System 1 outlines the use of trickle ventilation or through-wall ventilation and intermittent mechanical extract, as indicated in the figure below. It is assumed however that the residents can still use open windows for purge ventilation and rapid dispersion of moisture and odour at their discretion.

Figure 2.0 – 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.

Extract ventilation system noise should not exceed:

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

- All Facades – Titon Trickle Vent SF Xtra Standard Vent Standard Canopy (32 dB $D_{n,e,w+ctr}$)

7.5 External Mechanical Plant Noise

The cumulative rating noise level of all proposed mechanical plant should not exceed **34 dB $L_{Ar,Tr}$** at the closest noise sensitive receptors. The Rating Noise Limit Level above is inclusive of all rating penalties as outlined in BS4142.

Should the above Rating Noise Limit Level be achieved 'Low Impact' is expected at all surrounding NSRs when assessed in accordance with BS4142.

7.6 Car Park Noise Control

To reduce any potential impact from the car parks and vehicle movements associated with the development the following recommendations should be implemented.

- The car park speed limit should not exceed 10 MPH
- The car park should be surfaced with a low noise impervious surface

8. Conclusion

8.1 In conclusion, a noise survey has been undertaken at Oxford Road, Dewsbury, WF13 4LW. 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 and noise control measures and recommendations to protect the amenity of existing nearby residents.

8.2 As a result of the noise assessment, a sound insulation scheme and further noise control measures have been defined in Section 7.0 to ensure all the criteria outlined in BS8233:2014, BS4142:2014 and the IEMA Guidelines on Noise Impact can be achieved. Provided the sound insulation scheme and recommendations are installed and retained thereafter the amenity of future residents and existing 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 3.0 – Site and Measurement Location

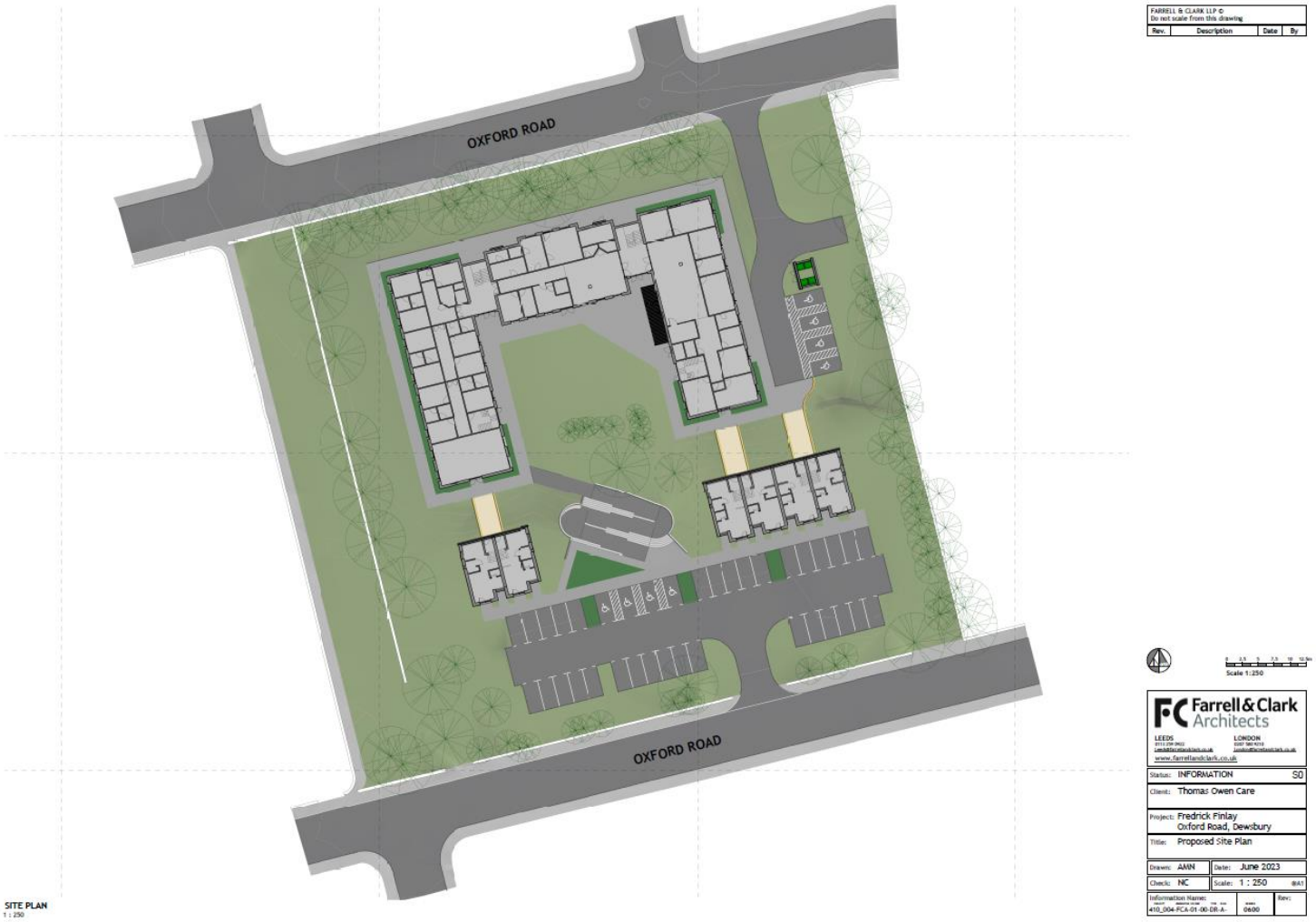

Figure 4.0 – Site Plan

APPENDIX C – Noise Survey Time History

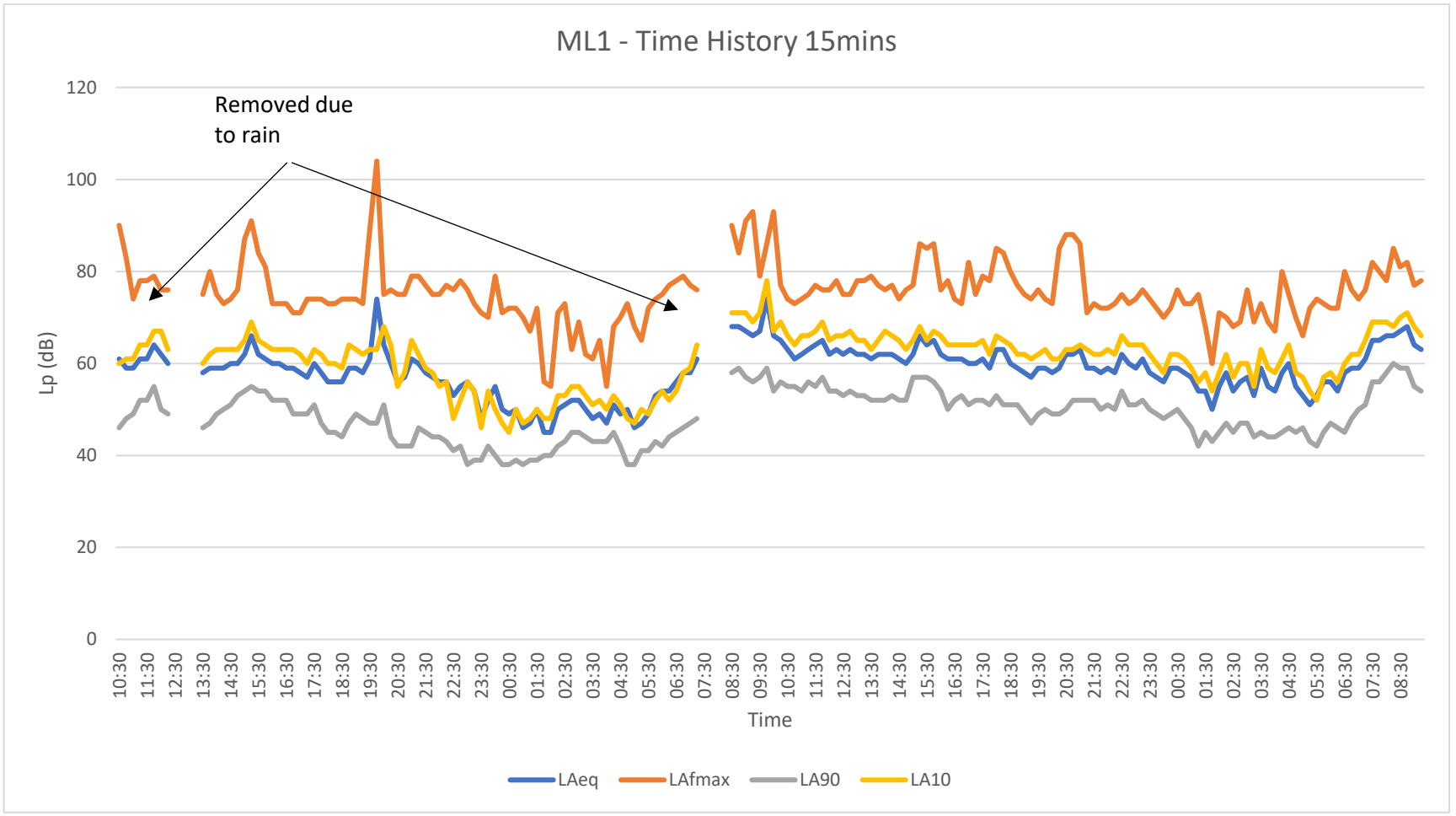

Figure 5.0 – Noise Survey Time History – ML1

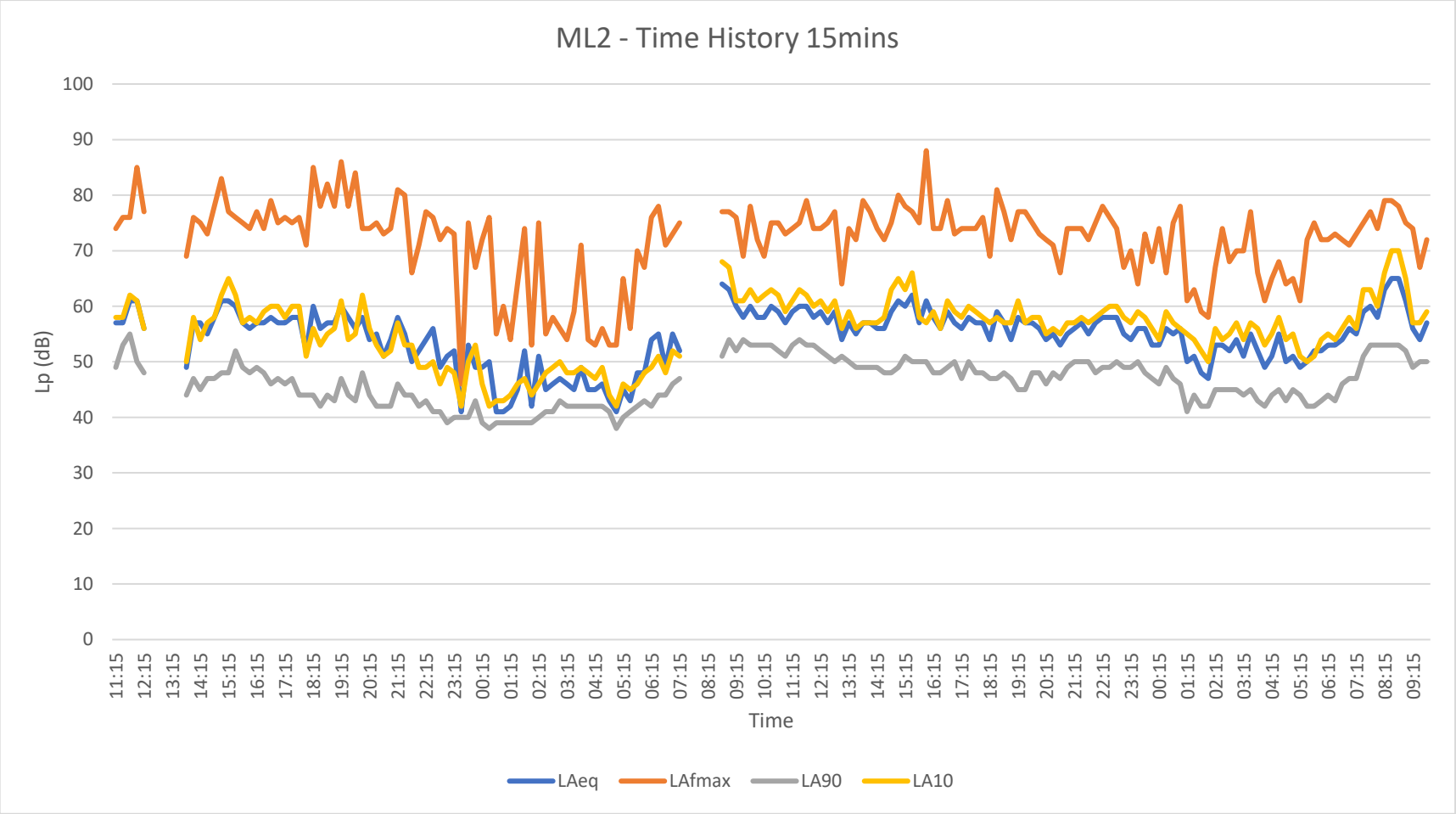

Figure 6.0 – Noise Survey Time History – ML2

APPENDIX D – Noise Maps and Calculations

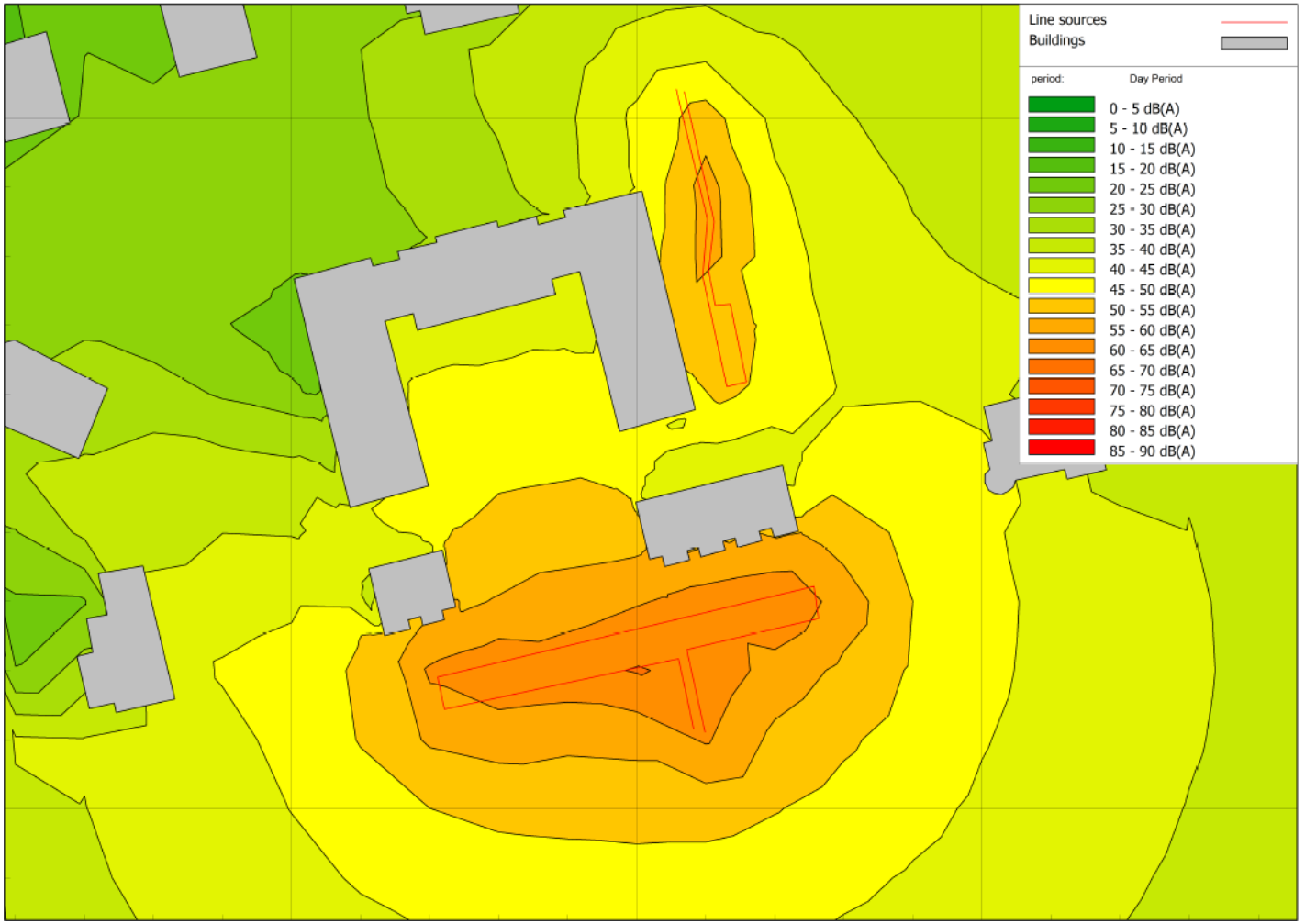

Figure 7.0 – Car Park Noise $L_{Aeq,1hour}$ Noise Map - Grid Height 1.5m – Ground Floor

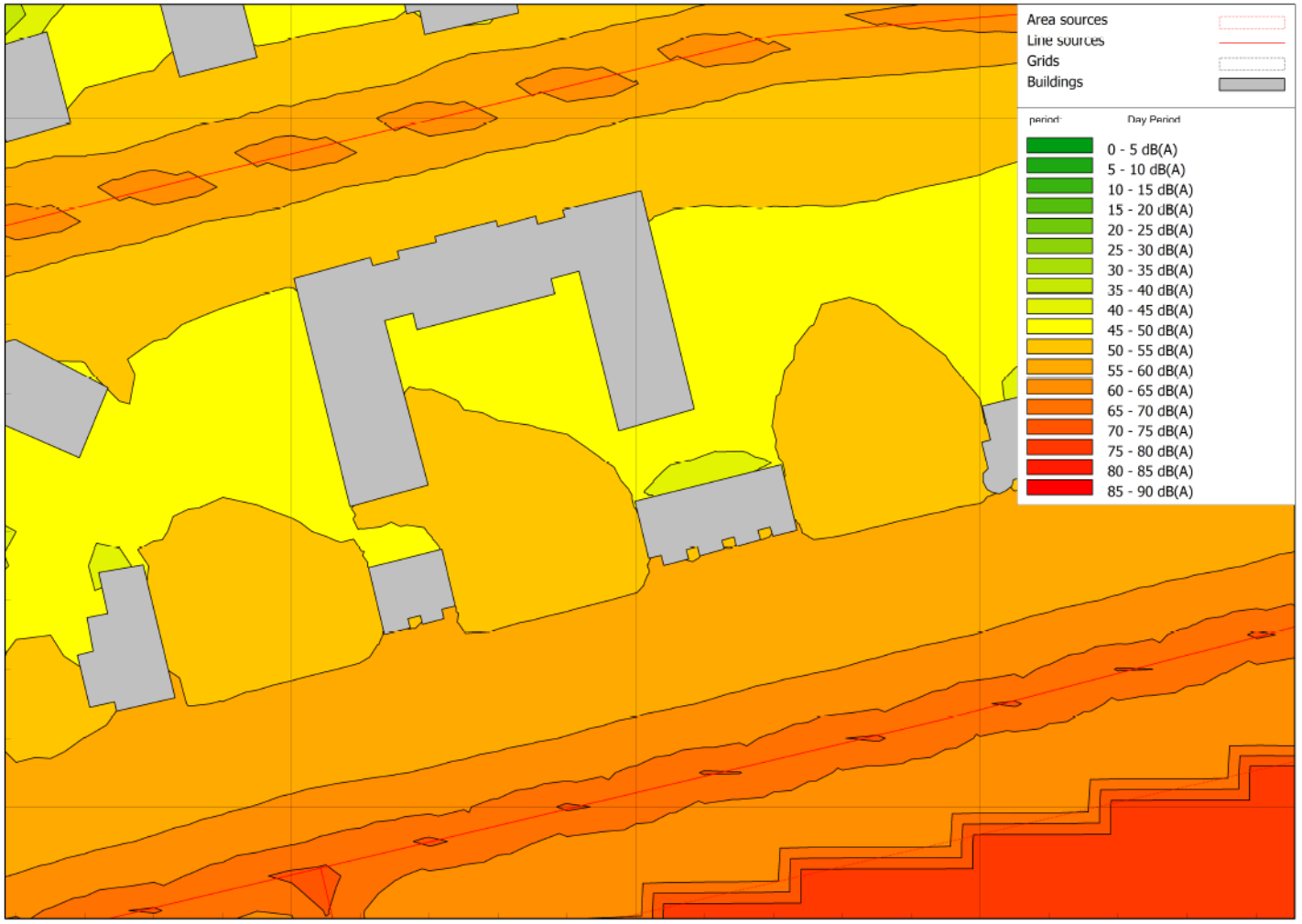

Figure 8.0 - Day Time L_{Aeq} Noise Map - Grid Height 1.5m – Ground Floor

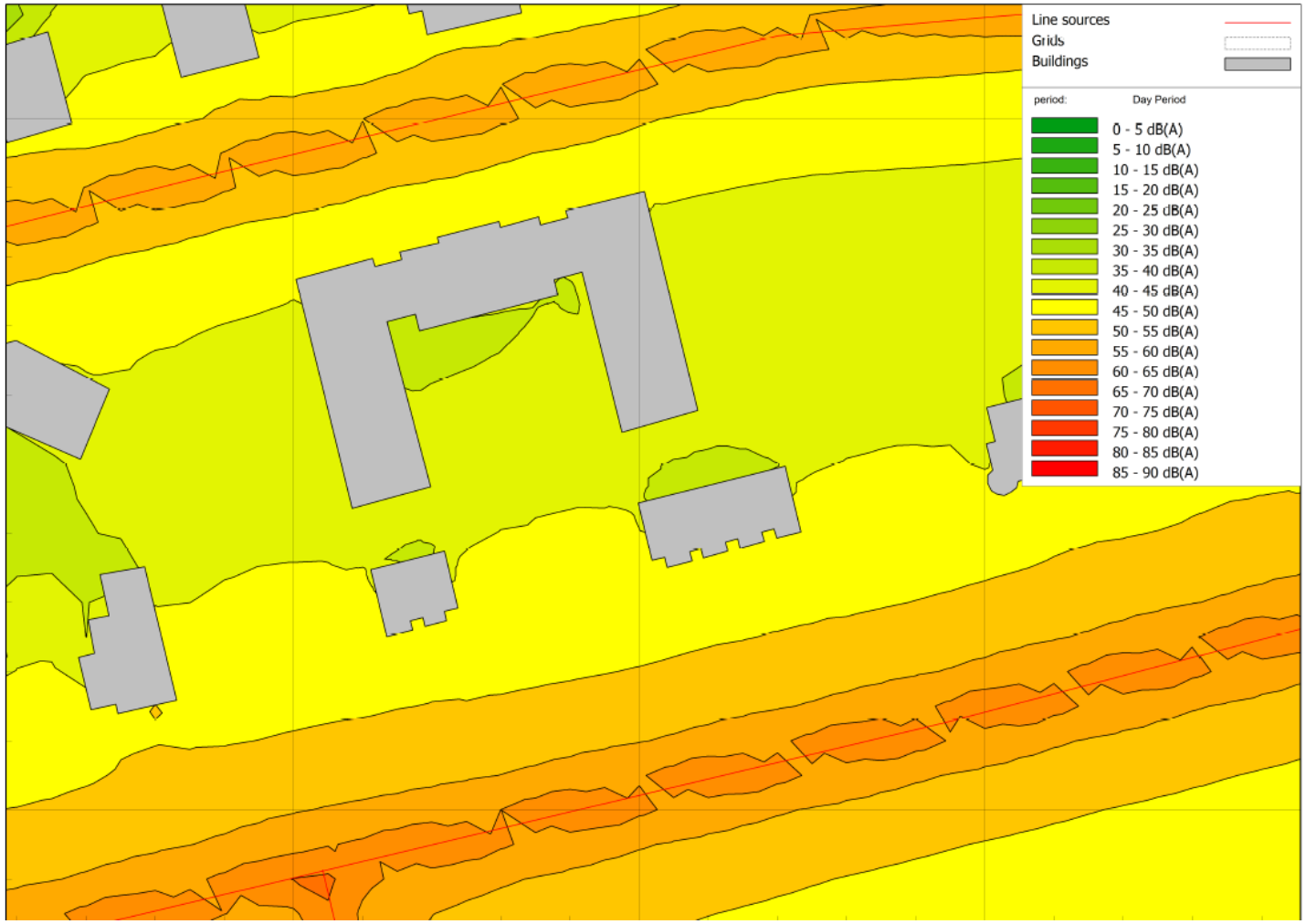

Figure 9.0 – Night Time - $L_{Aeq,}$ Noise Map - Grid Height 1.5m – Ground Floor

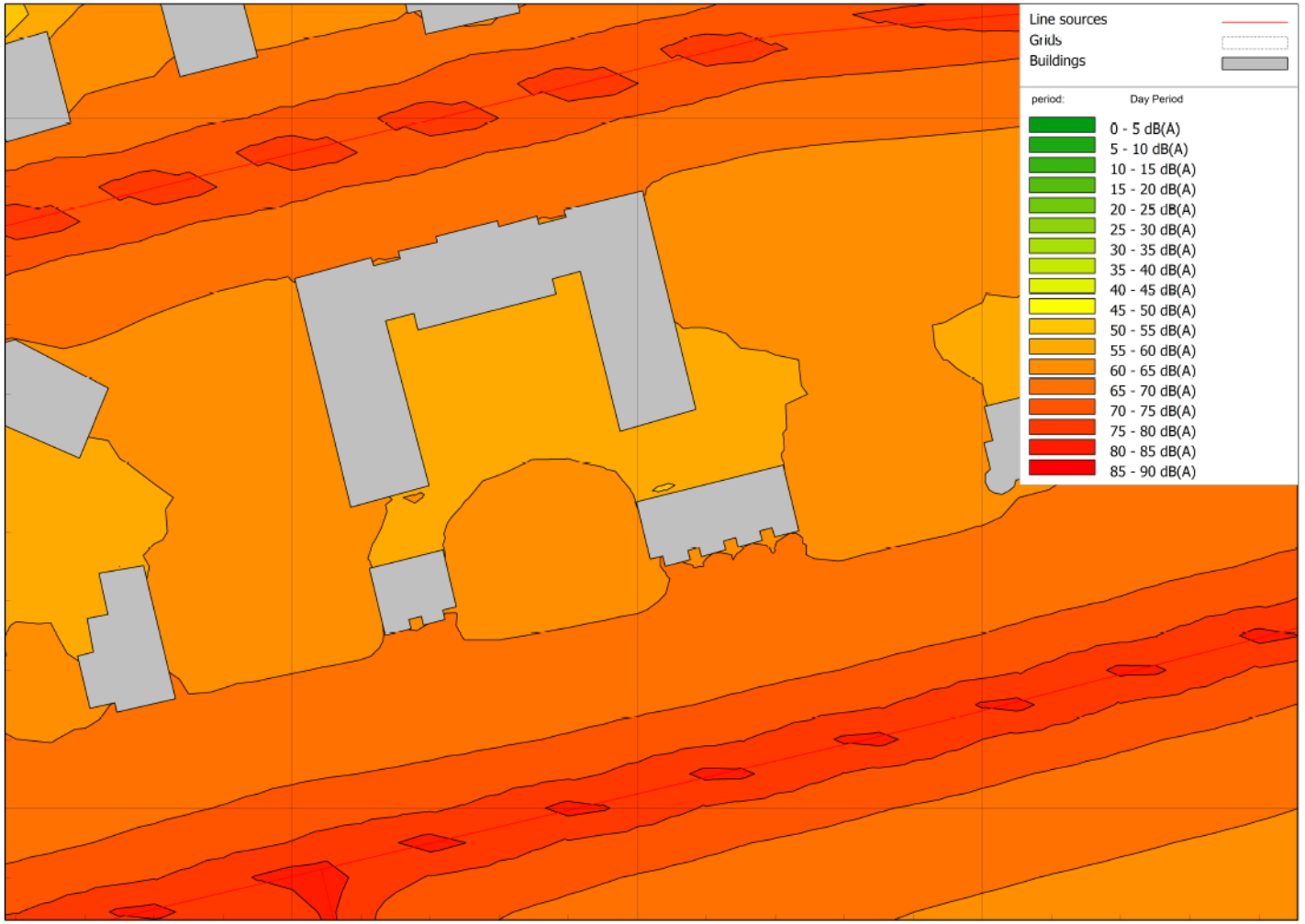

Figure 10.0 – Night Time L_{AFmax} Noise Map - Grid Height 1.5m – Ground Floor

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 $L_{Aeq,16Hour}$ (dBA)	Adapted BS8233 Criteria (dBA)	Required Sound Reduction (dB)
Bedroom / Living Room Day	Red	56.0	35 dB $L_{Aeq,16hour}$	21.0 R_{w+ctr}
Bedroom Night		48.0	30 dB $L_{Aeq,8hour}$	18.0 R_{w+ctr}
Bedroom Night		65.0	45 dB L_{Afmax}	20.0 R_w
Bedroom / Living Room Day	Orange	53.0	35 dB $L_{Aeq,16hour}$	18.0 R_{w+ctr}
Bedroom Night		46.0	30 dB $L_{Aeq,8hour}$	16.0 R_{w+ctr}
Bedroom Night		63.0	45 dB L_{Afmax}	18.0 R_w
Bedroom / Living Room Day	Yellow	50.0	35 dB $L_{Aeq,16hour}$	15.0 R_{w+ctr}
Bedroom Night		46.0	30 dB $L_{Aeq,8hour}$	16.0 R_{w+ctr}
Bedroom Night		63.0	45 dB L_{Afmax}	18.0 R_w
Bedroom / Living Room Day	Green	≤ 50.0	35 dB $L_{Aeq,16hour}$	15.0 R_{w+ctr}
Bedroom Night		≤ 45.0	30 dB $L_{Aeq,8hour}$	15.0 R_{w+ctr}
Bedroom Night		≤ 60.0	45 dB $L_{Afmax,}$	15.0 R_w

Table 11.0 – BS8233 Façade Break-In Assessment

D.2 – BS8233 Open Window Assessment

The assessment below has been undertaken assuming a 15 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 an open window condition and still achieving acceptable internal noise levels.

BS8233 Open Window Assessment					
Location / Time Period	**Façade Zone**	**Internal Noise Level $L_{Aeq,16hour}$ (dBA)**	**BS8233 Criteria (dBA)**	**Exceedance (dBA)**	**AVO Guide Risk Level**
Bedroom / Living Room Day	Front	41.0	40 dB $L_{Aeq,16hour}$	+1.0	Low
Bedroom Night		33.0	35 dB $L_{Aeq,8hour}$	-2.0	Low
Bedroom Night		50.0	50 dB $L_{Afmax,8hour}$	0.0	Low
Bedroom / Living Room Day	East	38.0	40 dB $L_{Aeq,16hour}$	-2.0	Low
Bedroom Night		31.0	35 dB $L_{Aeq,8hour}$	-4.0	Low
Bedroom Night		48.0	50 dB $L_{Afmax,8hour}$	-2.0	Low
Bedroom / Living Room Day	West	35.0	40.0 dB $L_{Aeq,16hour}$	-5.0	Negligible
Bedroom Night		31.0	35 dB $L_{Aeq,8hour}$	-4.0	Low
Bedroom Night		48.0	50 dB $L_{Afmax,8hour}$	-2.0	Low
Bedroom / Living Room Day	Rear	≤ 35.0	40 dB $L_{Aeq,16hour}$	-5.0	Negligible
Bedroom Night		≤ 30.0	35 dB $L_{Aeq,8hour}$	-5.0	Negligible
Bedroom Night		≤ 45.0	50 dB $L_{Afmax,8hour}$	-5.0	Negligible

Table 12.0 – Open Window Assessment

D.3 – BS8233 Garden Noise Assessment

The Garden Noise Levels Assessment is presented in the table below. The calculated noise levels in the external amenity areas of the development have been compared to the lower criteria band outlined in BS8233 to assess compliance. As can be seen below all criteria have been achieved and as such no further mitigation would be required to achieve external noise levels.

BS8233 Garden Noise Level Assessment	
Description	**Garden Noise Level (dBA)**
Garden Noise Level $L_{Aeq,16hour}$	46 - 50
BS8233 Criteria $L_{Aeq,16hour}$	50 dB
Exceedance	-4 to 0 dB

Table 13.0 – BS8233 Garden Noise Level Assessment

D.4 – Increase in Ambient Noise Level Assessment – Car Park Noise

The table below assesses the potential increase in noise levels at the surrounding Noise Sensitive receptors due to car movements within the proposed car park areas. The specific vehicle noise is logarithmically added to the lowest measured 1-hour period. The higher the increase in noise level at the NSR the higher for potential noise impact.

Specific Car Park Noise					
NSR Designation	**Specific Car Park Noise $L_{Aeq,t}$ (dBA)**	**Lowest Ambient $L_{Aeq,1hour}$**	**Resulting Noise Level (dBA)**	**Increase In Noise Level**	**IEMA Impact Rating**
NSR 1	46.0	53.0	53.8	+0.8	'Not Significant'
NSR 2	43.0	53.0	53.4	+0.4	'Not Significant'
NSR 3	41.0	53.0	53.3	+0.3	'Not Significant'

Table 14.0 – Noise Model Results – IEMA Assessment

D.5 – BS4142 Assessment

At this stage of the project, there are no specific mechanical plant specifications available and thus a Plant Rating Noise Limit Level has been defined to ensure all plant noise falls below the background sound level by a minimum of 5 dB. The table below assesses the defined cumulative Plant Rating Noise Limit Level against the underlying background sound levels of the area in order to assess compliance. As can be seen below provided the cumulative rating noise level of a proposed mechanical plant does not exceed 34 dB $L_{Ar,Tr}$ at the closest noise sensitive receptors Low Impact is expected and all criteria can be achieved.

BS4142 Plant Limit Level Assessment		
Description	**Day Sound Level (dBA)**	**Night Sound Level (dBA)**
Plant Rating Noise Limit Level	34.0	34.0
Background Sound Level	41.0	39.0
Level Above Background	-7.0	-5.0

Table 15.0 – BS4142 Plant Limit Level Assessment

D.6 – Noise Model Inputs and Data Sheets

Vehicle Type		CRTN Calculation Large Car Park	(dB)
Cars	37	Basic Noise Level L10,1hr	57.9
HGV	0	Correction Speed and HGVs	-4.8
Calculation details		Surface Correction (impervious)	-1.0
Total Vehicles	37	L10,1hour	52.1
Percentage HGVs	0.00	**LAeq,1hour at 10m**	**51.1**
Speed Kph	16	**LwA at Source**	**69.0**

Table 16.0 – Vehicle Noise Calculations Large Car Park

Vehicle Type		CRTN Calculation Small Car Park	(dB)
Cars	4	Basic Noise Level L10,1hr	48.2
HGV	0	Correction Speed and HGVs	-4.8
Calculation details		Surface Correction (impervious)	-1.0
Total Vehicles	4	L10,1hour	42.5
Percentage HGVs	0.00	**LAeq,1hour at 10m**	**41.5**
Speed Kph	16	**LwA at Source**	**59.0**

Table 17.0 – Vehicle Noise Calculations Small Car Park

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