

NOISE AND VIBRATION ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT ON LAND OFF MEADOW WAY / HAWTHORN BANK, SPALDING

BROADGATE HOMES

OCTOBER 2025



LF Acoustics Ltd
Pond Farm
7 High Street
Pulloxhill, Beds
MK45 5HA

t: 01525 888046
e: mail@lfacoustics.co.uk

Registered in England
Company Reg: 8434608

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Status	Prepared By	Date
1.0	L Jephson BEng (Hons) MIOA	3/10/25

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1. Introduction

LF Acoustics Ltd have been appointed by Broadgate Homes to carry out an assessment of the noise and vibration environment on land off Meadow Way / Hawthorn Bank, Spalding, proposed for a new residential development.

The proposed development is adjacent to a recently constructed residential development within Holland Park. The site is bounded to the east by the railway line, with Hawthorn Bank along the north-eastern site boundary. Noise levels within the proposed development are principally influenced by road and rail traffic noise.

At present, there is a factory building within the northern part of the site, which would be demolished during the construction of the proposed development. The unit is occupied by a sports equipment import company, which operates during weekdays. It is proposed to phase the residential development, constructing the dwellings within the southern and eastern parts of the site initially. During this period, it is anticipated that the unit would continue to operate. The unit would be demolished as the development progresses, with the housing constructed in this area of the site during the final phase. Noise generated by the operation of the unit has been considered within this report, to ensure any houses constructed during the initial phases are not impacted by the use.

The following section of this report provides a brief description of the Standards and guidance applicable to this development. Section 3 provides a description of the site and its surroundings. Section 4 presents the results of a noise and vibration monitoring exercise, carried out to determine the present noise and vibration levels across the site. Section 5 presents an assessment of the noise environment within the proposed development, with an assessment of the vibration attributable to the vibration movements presented in Section 6. Finally, Section 7 provides a summary of the report and recommendations.

2. Applicable Standards and Guidance

A description of the noise and vibration units referred to in this report is provided in Appendix A.

2.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF), revised in December 2024 [1], sets out the Government's planning policies for England and how these should be applied. It provides a framework upon which locally prepared plans for housing and other development can be produced.

The purpose of the planning system is to contribute to the achievement of sustainable development and at the heart of the Framework is a presumption in favour of sustainable development.

With regards noise, the NPPF advises that local planning policies and decisions should contribute to and enhance the natural and local environment by:

- preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels noise pollution;
- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development (including cumulative effects) – and avoid noise giving rise to significant adverse impacts on health and the quality of life;
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The Planning Policy Guidance note on noise, published in March 2014 and updated July 2019 [2], defines potential adverse effects and the required mitigation, as follows:

No Observed Adverse Effect

Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life (no specific measured required to mitigate noise).

Observed Adverse Effect

Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life (mitigate and reduce noise levels to a minimum).

Significant Observed Adverse Effect

The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area (avoid).

2.2. British Standard BS 8233

BS 8233 [2] recommends design aims for noise levels to be achieved in new buildings and is the most appropriate guidance in defining applicable noise levels within the proposed development. The Standard was updated in 2014 to better reflect the requirements of the NPPF in terms of impact classifications and achieving the recommended guidance values, seeks to ensure that the occupants would not be subject to any significant adverse impacts, to ensure compliance with the requirements of the NPPF.

For residential properties, the guidance recommends the following design aims for the daytime (07:00 – 23:00) and night-time (23:00 – 07:00) periods:

- 35 dB $L_{Aeq,T}$ within living rooms and bedrooms during the daytime period;
- 40 dB $L_{Aeq,T}$ within dining areas / rooms during the daytime period;
- 30 dB $L_{Aeq,T}$ within bedrooms at night; and
- 50 – 55 dB $L_{Aeq,T}$ within gardens and patios during the daytime.

With regards internal noise levels, the Standard advises:

“Where development is considered necessary or desirable, external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.”

Where the above limits require windows to be closed to maintain the standard of noise, there needs to be appropriate alternative ventilation provided that does not compromise the façade insulation or resulting noise level.

With regards outdoor amenity space, it is recognised in the Standard that these guideline values may not be achievable in all circumstances. Where development might be desirable, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, the development should be designed to achieve the lowest practicable levels, but should not be prohibited. Given that there is a need for the development, it is considered in this situation, that this relaxation could be applied, providing the lowest practicable levels have been achieved.

2.3. British Standard BS 4142:2014+A1:2019

BS 4142 [3] is the British Standard for rating and assessing noise of a commercial or industrial nature and is relevant to the noise associated with the operation of the factory unit.

BS 4142 is a comparative standard in which the estimated noise levels from the proposed development are compared to the representative / typical background noise level from existing uses.

The initial assessment relates the likelihood of adverse impact to the difference between the Rating Level of the noise being assessed and the background noise level. This assessment can be modified to take account of the context.

The background noise level is the L_{A90} noise level, usually measured in the absence of noise from the source being assessed, but may include other existing industrial or commercial sounds. The background noise levels should generally be obtained from a series of measurements each of not less than 15-minute duration.

The Rating Level of the noise being assessed is defined as its L_{Aeq} noise level (the 'specific noise level'), with the addition of appropriate corrections should the noise exhibit a marked impulsive and/or tonal component or should the noise be irregular enough in character to attract attention. The extent of the correction is dependent upon the degree of tonality or character in the noise and is determined either by subjective professional judgement, where the plant is not operational at present, or by measurements.

Where the noise is tonal in nature, the standard imposes the following character corrections when assessing the rating level based on a subjective assessment:

- 2 dB for a tone which is just perceptible;
- 4 dB where the tone is clearly perceptible; and
- 6 dB where the tone is highly perceptible.

Methods for identifying whether noise is tonal in nature are provided within BS 4142 Section 9.2, Annex C or Annex D.

Where noise exhibits other sound characteristics, the Standard advises a character correction of 3 dB should be applied.

During the daytime, the specified noise levels are determined over a reference time interval of 1 hour, with a 15 minute reference period adopted when assessing night-time noise.

If the Rating Level of the noise being assessed exceeds the background level by 10 dB or more BS 4142 advises that there is likely to be an indication of a significant adverse impact, depending upon context. A difference between background level and Rating Level of around 5 dB is likely to be an indication of an adverse impact, depending upon context. The lower the Rating Level is, relative to the background noise level, the less likely the specific source will have an adverse or significant adverse impact. Where the Rating Level does not exceed the background noise level is an indication of a low impact, depending upon context.

The assessment method outlined above is intended for the assessment of external noise levels and is not intended to assess the extent of impact at internal locations.

Where the initial assessment of impact, based upon and assessment of the external noise levels, needs to be modified due to the context, all pertinent factors should be taken into account, including:

- The absolute level of sound;
- Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night; and

2.4. The sensitivity of the receptor and whether the premises will already incorporate measures to ensure good internal and/or external acoustic conditions.

2.5. ProPG: Planning and Noise

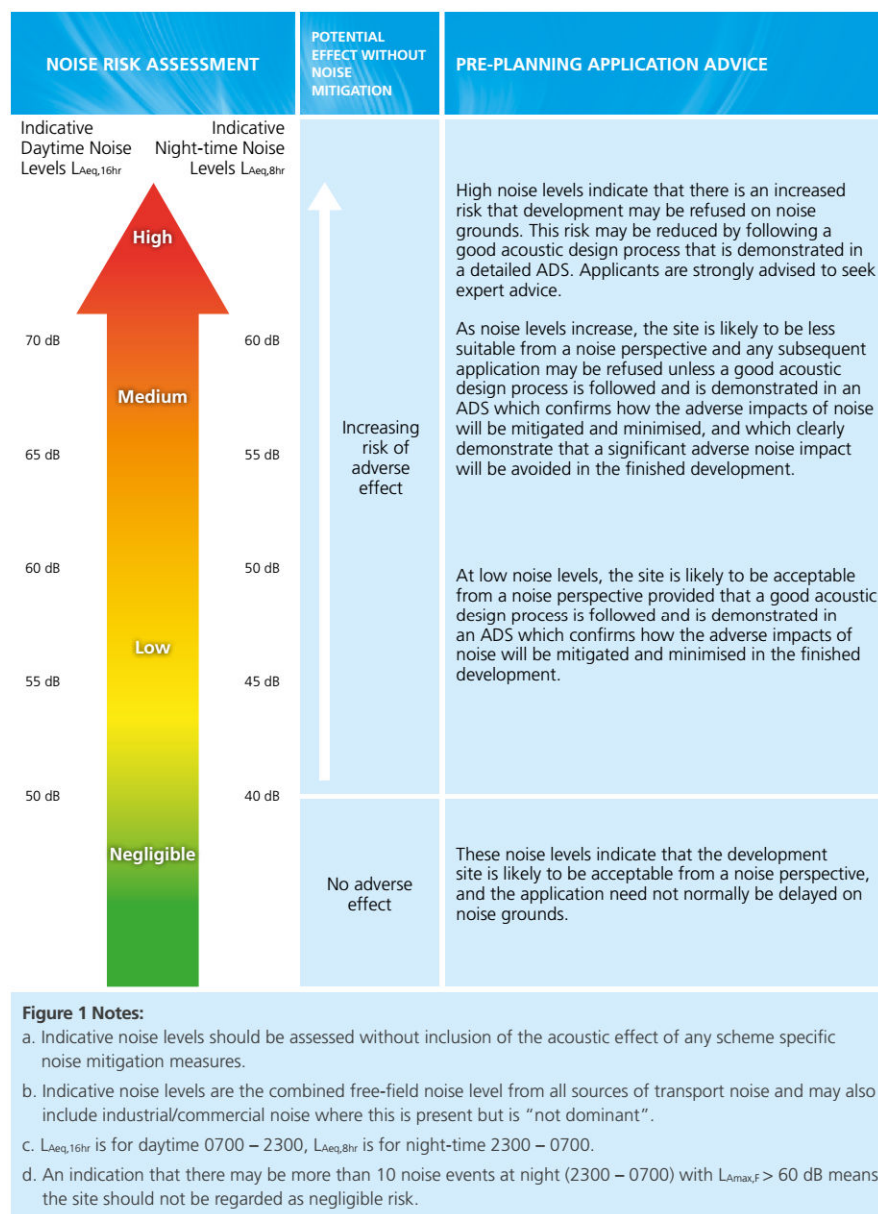
Professional planning guidance on planning and noise was published in May 2017 [4]. The guidance seeks to provide a recommended approach to the management of noise within the planning system in England. The guidance has been prepared jointly between the Association of

Noise Consultants, The Institute of Acoustics and the Chartered Institute of Environmental Health with the aim of providing a coherent approach to achieving the requirements of the NPPF.

The guidance advocates a systematic, proportionate, risk based, 2-stage approach, encouraging early consideration of noise within the design process for new residential developments:

- Stage 1 provides an initial noise risk assessment of the development site;
- Stage 2 provides systematic consideration of four key elements: demonstrating a good acoustic design process; observing internal noise level guidelines; undertaking an external amenity area noise assessment; and consideration of other relevant issues.

The initial risk assessment should identify the risk of adverse effects from noise and identifying whether the site poses a negligible, low, medium or high risk. The level of risk does not determine whether a site may be unsuitable for development, but highlights an increasing requirement for noise to be considered within the design of the development and the likelihood of a need for specific noise mitigation measures, as follows:



This preliminary report considers the Stage 1 Risk Assessment.

The categories / noise levels indicated in the figure above do not provide specific limits above which adverse effects would occur and are intended as a guide to the requirement for additional noise mitigation and design measures. Based upon the above figure significant adverse noise effects would be unlikely to occur at noise levels below 65 dB $L_{Aeq, 16 \text{ hour}}$, with a number of other local authorities having adopted a limit of 72 dB $L_{Aeq, 16 \text{ hour}}$, as representing a daytime level above which significant adverse effects would occur.

For a Stage 2 assessment, the guidance additionally refers to BS 8233 with respect of achieving an acceptable internal noise environment and within gardens.

Internally, the guidance recommends that the targets within BS 8233 are adopted as an aim. Expanding upon the guidance within BS 8233, for internal noise environments It is stated:

“Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal L_{Aeq} target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved. The more often internal L_{Aeq} levels start to exceed the internal L_{Aeq} target levels by more than 5 dB, the more that most people are likely to regard them as “unreasonable”. Where such exceedances are predicted, applicants should be required to show how the relevant number of rooms affected has been kept to a minimum. Once internal L_{Aeq} levels exceed the target levels by more than 10 dB, they are highly likely to be regarded as “unacceptable” by most people, particularly if such levels occur more than occasionally. Every effort should be made to avoid relevant rooms experiencing “unacceptable” noise levels at all and where such levels are likely to occur frequently, the development should be prevented in its proposed form.”

Within external amenity areas, the guidance reflects BS 8233, as follows:

“These guideline values (i.e. a level of between 50 – 55 dB L_{Aeq}) 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 noise levels in these external amenity spaces but should not be prohibited.”

In addition, for night-time periods, ProPG requires consideration of the maximum noise levels within bedrooms, making reference to World Health Organisation Guidelines. A guideline value of 45 dB $L_{Amax,F}$ between 23:00 – 07:00 hours within bedrooms is specified, advising that individual events do not normally exceed this value more than 10 times per night. However, it is noted that where it is not reasonably practicable to achieve this guideline value, then the judgement of acceptability will depend not only on the maximum noise levels, but also other factors, including source, number, distribution and regularity of noise events.

2.6. Approved Document O

Approved Document O of the Building Regulations came into force during June 2022. The document provides the requirements within dwellings to minimise the potential solar gains and to provide adequate means to remove heat from the indoor environment.

Whilst the requirements of ADO have not been considered in detail at this stage, reference has been made to identify areas where the requirement for additional assisted ventilation may be required.

ADO requires excess heat to be removed by the following means:

- Opening windows;
- Ventilation louvres in external walls;
- A mechanical ventilation system; and
- A mechanical cooling system.

The building should be designed to remove excessive heat by passive means as far as reasonably practical.

With regards to noise, ADO requires the following:

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

- 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- 55dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).

Assuming a partially open windows typically provides around 15 dB(A) reduction between outside and in, windows would be likely to be considered closed when the following equivalent external noise levels are exceeded:

- 55dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).
- 70dB L_{AFmax} , more than 10 times a night (between 11pm and 7am).

2.7. Guidance Relating to Vibration

The criteria applied to perceptible vibration are detailed in BS 6472 [5], in terms of the Vibration Dose Value (VDV) for both the 16 hour daytime period 07:00 to 23:00 and the 8 hour night-time period from 23:00 to 07:00. The VDV effectively takes into account the intermittent nature of train passbys and the number of trains passing the site during the assessment period.

The human body is most sensitive to vibration in the vertical direction (foot to head). The VDV is divided into various degrees of adverse comment for day and night-time periods, Table 2.1 below, duplicated from Table 7 in BS 6472, defines these categories.

Time Period	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
07:00 - 23:00	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
23:00 - 07:00	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Table 2.1 Vibration Dose Value (ms^{-1.75}) Ranges Which Might Results in Various Probabilities of Adverse Comment Within Residential Buildings

3. Site Description

The site is located within Spalding. The site location is indicated on Figure 1.

A railway line runs along the eastern site boundary, with trains clearly visible as they travel along the line. The railway principally carries local passenger trains, with a number of freight trains booked throughout the day (although these movements depend upon demand and only a proportion of the timetabled movements would normally operate). Typical movements along the line, obtained from the Realtime trains information, indicate the following weekday movements.

Train Type	Daytime Movements (07:00 – 23:00)	Night-time Movements (23:00 – 07:00)
DMU Passenger Trains	26	2
Freight (Typical movements)	26	9

Table 3.1 Typical Weekday Train Movements

Hawthorn Bank runs to the north-east of the site. This road carries local traffic and is subject to a 30 mph speed limit as it passes the site.

As indicated on Figure 1, there is a factory unit located within the northern area of the application site. This unit would be demolished during the latter phases of the development to allow residential properties to be constructed in this area. The factory unit is presently let on a short-term lease to a sports equipment company, who import and distribute sports goods. There are two people work in the unit, generally sorting and packing orders by hand. On occasion during the day, a forklift is used within the yard to load and unload vehicles. It is understood that they typically have 2 – 3 HGV deliveries per day, with their operational house Mondays – Fridays between 08:00 – 17:00 hours. There is no working during evenings, overnight or at weekends.

It is proposed to construct a residential development of 241 residential properties on the site. The proposed layout is provided below.



As indicated above, noise from the road and railway have been taken into account within the proposed development layout.

Dwellings would be set back from the railway by approximately 30 metres, in line with the recently constructed properties to the south. This measure seeks to ensure vibration levels and noise from the passing trains is minimised. In addition, these properties would front onto the railway line, with the gardens to the rear, thus screened from the railway by the property façades.

Dwellings along Hawthorn Bank would also be set back from the road, utilising the accesses to the properties to provide separation. These properties would also be orientated to front onto the road, with the gardens to the rear and screened from the passing traffic.

4. Noise and Vibration Surveys

In order to establish the current noise and vibration climate within the site, noise and vibration surveys were carried out between Monday 18 and Friday 22 August 2025.

Unattended noise surveys were used to determine the day and night-time noise environment along the proposed residential boundaries with Hawthorn Bank and the railway line. A further monitor was installed at the factory unit, to evaluate the typical noise levels associated with their operations.

An unattended vibration survey was carried out along the eastern development boundary during the same period, to evaluate the levels attributable to the passing rail traffic.

Weather conditions for the survey were acceptable for environmental noise monitoring, with dry conditions and light winds throughout.

4.1. Unattended Noise Surveys

Unattended noise surveys were carried out at three positions along the northern, eastern and factory site boundaries. The survey positions were selected to ascertain the noise levels attributable at the proposed closest dwellings to the railway line (30 metres from the eastern site boundary) and along the Hawthorn Bank boundary (with the microphone set 10 metres from the kerb), to determine the existing noise levels attributable to passing road and rail traffic. In addition, a third monitor was installed along the eastern boundary of the service yard of the factory unit, located at a position with a clear line of sight onto the loading bays, to establish the typical noise levels attributable to the vehicle movements and loading operations.

The monitoring positions are indicated on Figure 1.

At each position, the instrument was set with the microphone in free-field conditions and at a height of 1.4 metres above the ground.

Rion NL-52 Class 1 Sound Level Analysers were used for the exercise, which were calibrated with a Rion NC-74 Class 1 Acoustic Calibrator before and after the exercise, with the instruments reading 94.0 dB on each occasion. The instruments had been laboratory calibrated within the previous 12 / 24 months according to National Standards. Details of the most recent laboratory calibrations are provided below.

Instrument	Serial No.	Calibration Date	Laboratory / Certificate No.
Rion NL-52 Class 1 SLM (Railway boundary)	00231655	10/4/25	AcSoft – 1511971-1
Rion NL-52 Class 1 SLM (Road Boundary)	00231657	27/2/25	AcSoft – 1511971-2
Rion NL-52 Class 1 SLM (Factory Unit)	00654029	25/9/23	AcSoft – 1506621-5
Rion NC-74 Class 1 Acoustic Calibrator	35125830	5/9/24	AcSoft – 1509697-1

The instruments were configured to record over contiguous 5-minute periods throughout the survey period, with audio recording capability used to identify the periods when trains were passing.

The results of the surveys are provided in Appendices B to D.

Ambient noise levels across the site were noted to be generally influenced by passing trains. Road traffic was audible but noted to be generally associated with the traffic in the town and thus at a low level, with road traffic noise levels higher along the eastern site boundary close to Hawthorn Bank.

4.2. Results of Noise Monitoring Along Eastern (Railway) Boundary

The noise monitoring equipment at this position was set 30 metres from the railway tracks, representative of the closest properties to the line.

The period noise levels evaluated from the results are presented below.

Period	Period $L_{Aeq,T}$ Noise Levels [dB]	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Monday 18/8/25	55.5*	54.3
Tuesday 19/8/25	55.2	54.3
Wednesday 20/8/25	55.1	54.2
Thursday 21/8/25	54.9	53.1
Average	55.2	54.0

Note: * Period comprised 09:00 – 23:00 hours

Table 4.1 Period L_{Aeq} Noise Levels Evaluated from Unattended Noise Survey Position (U1 – 30m from Railway Boundary)

There were regular freight movements along the line noted overnight throughout the survey period, which resulted in little variation in the period $L_{Aeq,T}$ noise levels between the day and night-time periods.

Maximum noise levels monitored at this location were principally attributable to the train passbys and were typically of the order of 78 – 82 dB $L_{Amax,F}$ throughout the day and overnight, principally associated with the passing freight trains.

4.3. Results of Noise Monitoring Along North-Eastern Boundary

Noise levels monitored at the north-eastern boundary were influenced by a mix of road traffic travelling along Hawthorn Bank and trains passing to the east of the monitoring position.

The period noise levels evaluated from the results are presented below.

Period	Period $L_{Aeq,T}$ Noise Levels [dB]	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Monday 18/8/25	55.7*	48.3
Tuesday 19/8/25	54.8	49.0
Wednesday 20/8/25	55.5	53.1
Thursday 21/8/25	57.5	53.3
Average	55.9	51.0

Note: * Period comprised 09:00 – 23:00 hours

Table 4.2 Period L_{Aeq} Noise Levels Evaluated from Unattended Noise Survey Position (U2 – North-Eastern Boundary – 10m from Kerb)

Maximum noise levels monitored at this location were principally attributable to vehicle and train passbys and were typically of the order of 65 – 72 dB $L_{Amax,F}$ throughout the day and night-time periods.

4.4. Results of Noise Monitoring at Factory Unit

Noise monitoring was carried out at the eastern boundary of the service yard of the factory unit, to evaluate the typical noise levels attributable to vehicle movements and the loading / unloading of vehicles using a forklift.

The results obtained at this location indicated generally low levels of noise, as there was minimal activity audible from the operation of the unit. Furthermore, there is a ~5m-high bund around the boundary of the factory unit, which effectively screened the road and rail traffic at this monitoring location.

The monitoring result indicated that the units was only operational during the daytime periods, with no activity observed during the evening or overnight.

Analysis of the monitoring data over the daytime periods when activity was noted within the monitoring results, associated with vehicles / loading operations, indicated typical noise levels of between 50 – 53 dB $L_{Aeq, 1 hr}$, noting that for larger periods during the day there was minimal noise generated by the operation.

4.5. Vibration Survey

To evaluate the vibration levels attributable to the trains passing along the railway line, an unattended vibration survey was carried out between Monday 18 and Friday 22 August 2025.

The survey was carried out using a Rion VM-54 Vibration Meter which was fitted with a PV-83CW triaxial accelerometer.

The instrument was positioned along the eastern site boundary, 30 metres from the railway tracks (Position U1). The accelerometer was affixed to a steel plate and placed firmly on the ground.

The instrument was configured to record over 1-minute intervals, which enabled the individual passbys to be identified.

The results of the monitoring are presented graphically in Appendix E.

The results have been analysed to determine the period day and night-time Vibration Dose Values (VDV) attributable to the train passbys.

Date	Period Vibration Dose Values [$\text{ms}^{-1.75}$]					
	Daytime (07:00 – 23:00)			Night-time (23:00 – 07:00)		
	Horizontal [X]	Horizontal [Y]	Vertical [Z]	Horizontal [X]	Horizontal [Y]	Vertical [Z]
Monday 18/8/25	0.014	0.010	0.113	0.011	0.008	0.089
Tuesday 19/8/25	0.014	0.011	0.109	0.012	0.009	0.099
Wednesday 20/8/25	0.014	0.010	0.107	0.012	0.009	0.093
Thursday 21/8/25	0.014	0.013	0.104	0.012	0.009	0.092
Average	0.01	0.01	0.11	0.01	0.01	0.09

Note: * Period comprised 09:00 – 23:00 hours

Table 4.3 Period Vibration Levels

5. Assessment of Noise Levels

5.1. Calculation of Road and Rail Noise Levels

Road and rail traffic noise levels within the development have been calculated using the SoundPlan computer modelling package.

With regards to road traffic, the modelling software implements the CRTN methodology [6], with corrections for the L_{Aeq} noise levels for the day and night-time periods derived from the Defra method [7]. The railway noise calculations adopt the CRN calculation methodology [8].

An initial noise model has been prepared to calculate the noise levels at the two noise survey positions adjacent to the road and railway which has been used to calibrate the model against the survey results.

The noise model has utilised LiDAR ground data for the surrounding area and railway line. The rail track levels have been assumed to be 0.5m above the LiDAR levels.

A second model has been prepared, taking account of the proposed development layout.

The calculated period $L_{Aeq,T}$ noise levels attributable to the road and rail traffic are presented on Figures 2 and 3 for the day and night-time periods respectively.

5.2. Assessment of Noise Levels Within Gardens

The layout of the proposed development seeks to ensure that the properties would be set back from the road and railway, utilising buffer zones and property accesses, with the gardens of the properties located closest to the road and railway sited to the rear of the properties and thus screened by the property façades. The modelling results, based upon the proposed layout, demonstrates that noise levels within the gardens would be below 55 dB $L_{Aeq,16\text{ hr}}$ daytime, with the noise levels within the majority of the gardens below 50 dB $L_{Aeq,16\text{ hr}}$, thus meeting the requirements of BS 8233 to ensure a satisfactory level of noise.

5.3. Assessment of Noise Levels Within Properties

The dwellings would be of standard brick / blockwork construction with a tiled roof. Generally for this type of construction, the weak areas within the construction are the glazing and window trickle vents. A construction with standard 4-16-4 double glazing and vents with an indirect air path would typically provide around 30 dB(A) reduction in noise levels between outside and in.

The noise modelling results indicated on Figures 2 and 3 indicate façade noise levels along Hawthorn Bank of 60 dB $L_{Aeq,16\text{ hr}}$ daytime and up to 56 dB $L_{Aeq,8\text{ hr}}$ night-time. Façade noise levels at the properties adjacent to the railway have been predicted to be up to 56 dB $L_{Aeq,16\text{ hr}}$ daytime and 55 dB $L_{Aeq,8\text{ hr}}$ night-time.

An initial assessment against the requirements in ProPG would indicate that the development would be a low risk, in terms of the ambient (L_{Aeq}) noise levels.

Consideration should also be given to the maximum noise levels overnight. Neither the CRTN nor CRN methodologies predict maximum noise levels. An assessment of the maximum noise levels has therefore been made based upon the noise levels monitored, which indicated typical levels of up to 72 dB $L_{Amax,F}$ along the Hawthorn Bank boundary and between 78 – 82 dB $L_{Amax,F}$ at an equivalent distance from the railway as the proposed properties. The railway timetable information additionally indicates that there are typically 9 freight movements overnight, which are likely to generate the highest noise levels.

Noise levels within the properties closest to the road and railway have been calculated, based upon a typical construction. The calculation details are provided in Appendix F.

The results of the noise modelling, which are based upon the assumption of closed windows and window vents open for ventilation indicate the following noise levels.

Receptor	Calculated Internal Noise Levels		
	Daytime L_{Aeq} , 16 hr	Night-time L_{Aeq} , 8 hr	Night-time $L_{Amax,F}$
Hawthorn Bank Facades	30	26	44
Railway Facades	27	26	56

Table 5.1 Calculated Internal Noise Levels Assuming Closed Windows

An assessment of the noise levels presented in the table above indicates that the internal ambient (L_{Aeq}) noise levels would achieve the requirements of BS 8233 internally within the properties.

Consideration has also been given to the maximum noise levels overnight, in relation to the ProPG / WHO guidelines and the requirements of Approved Document O.

Maximum noise levels within the properties along Hawthorn Bank, assuming windows closed, would remain below the guideline value of 45 dB $L_{Amax,F}$ overnight and thus acceptable. Noise levels within the bedrooms of the properties adjacent to the railway line would be clearly above the guideline value, based upon a standard construction, noting that there are typically only 9 freight movements overnight which generate the highest noise levels, thus marginally below the suggested number of events exceeding the 45 dB $L_{Amax,F}$ guideline value.

With regards to the requirements of ADO, this requires consideration of an open window to provide ventilation in bedrooms overnight to minimise potential overheating effects. A partially open window, open for ventilation purposes, would typically provide a level difference of around 15 dB(A) between outside and in.

Based upon the overnight maximum external levels of 72 dB $L_{Amax,F}$ at the façades of the properties along Hawthorn Bank, internal maximum noise levels within bedrooms overnight would be marginally above 55 dB $L_{Amax,F}$ assuming an open window. Consideration would therefore need to be given to the potential overheating effects within those bedrooms overnight, during the detailed design stage and consideration may need to be given to the provision of assisted ventilation within affected bedrooms to allow occupants to maintain windows closed, should they choose.

Maximum noise levels at the properties adjacent to the railway line would be higher, typically up to 82 dB $L_{Amax,F}$, associated with the passing freight trains. Assuming a partially open window within a bedroom facing onto the line, maximum night-time noise levels in the room would be of the order of 67 dB $L_{Amax,F}$, thus considerably above the level of 55 dB $L_{Amax,F}$ specified in ADO.

In assessing the acceptability of the overnight noise levels within the bedrooms adjacent to the railway, it is the number of events which becomes important, when considering potential sleep disturbance effects. Given that there are only 9 freight trains typically passing overnight, which would be those that would generate the highest noise levels, the number would remain below the threshold of 10 events specified in both ProPG and ADO. On this basis, the noise levels within the bedrooms of the properties facing onto the railway line, taking account of the proposed 30-metre minimum separation distance equivalent to the recently constructed properties, would remain acceptable. On this basis, no additional noise mitigation measures have been identified to be required for these properties.

Utilising standard constructions, the noise levels internally would achieve the requirements of BS 8233 and thus the NPPF and additionally comply with the requirements of ADO.

5.4. Assessment of Noise from Factory Unit

It is proposed that the factory unit would be retained and operational whilst the southern and potentially eastern areas of the development are completed.

As discussed earlier in the report, noise levels associated with the operation of the unit are generally very low, as the main packing is carried out by hand internally. The main sources of noise are associated with occasional delivery vehicle movements, some of which are unloaded using a forklift.

The service yard and loading bays are effectively screened from the surrounding area, by the perimeter bunding, which is ~5 metres in height.

In order to assess the noise levels attributable to the continued use upon occupants of completed areas of the proposed development, calculations of the noise levels have been made using the SoundPlan computer modelling package.

The calculations have been based upon 4 HGV movements along the access road and turning within the service yard into the loading bays. A forklift has been assumed to be operational externally for 30% of the time over a 1-hour assessment period. The calculated noise levels indicate a level of 53 dB $L_{Aeq, 1 \text{ hr}}$ at the noise monitoring position, equivalent to that monitored on site, which provides confidence in the predictions.

The noise modelling has been extended to include the residential development area. The modelling results are provided on Figure 5.

The results indicate low levels of noise associated with the operation. The main source of noise would be associated with the occasional vehicle movements along the access to the units, with the modelling results indicating noise levels of up to 50 dB $L_{Aeq, 1 \text{ hr}}$ along the northern development boundary. This level of noise is low and below that attributable to the road and rail traffic. The occasional daytime vehicle movements would therefore be unlikely to result in a potential for adverse noise impacts.

The loading operations would be effectively screened from the neighbouring properties by the existing boundary bunding. The modelling results indicate noise levels of up to 40 dB $L_{Aeq, 1 \text{ hr}}$ associated with the loading operations along the boundaries closest to the unit.

To assess the potential impact of the loading operations upon occupants of dwellings which may be constructed in the initial phase of the development, an assessment has been made against the requirements of BS 4142.

Taking the highest predicted loading operations noise level of 40 dB $L_{Aeq, 1\text{ hr}}$ and applying a 3 dB(A) other acoustic feature correction to take account of the potential characteristic nature of the noise, would result in a rating level of 43 dB $L_{Aeq, 1\text{ hr}}$.

Typical daytime background noise levels, obtained from monitoring Position 1, which are considered to be representative, were typically of the order of 40 – 42 dB L_{A90} during the daytime periods. On this basis, an initial BS 4142 assessment against the background noise levels would indicate a difference of between 1 – 3 dB(A), thus resulting in a low potential for impact.

The context is also important to consider within the assessment.

The operational noise levels are very low for daytime noise, remaining substantially below acceptable noise levels for amenity areas defined in BS 8233. The noise levels would also be substantially lower than attributable to the road / rail traffic noise, which would tend to mask any noise from the loading operations, particularly during train passbys. More importantly, the activity is not continuous throughout the day, with only typically 2 – 3 vehicles loaded daily, and no operations carried out during early morning or evening periods, which would normally be considered more sensitive.

On this basis, retaining the factory unit whilst the initial phases of the proposed development are constructed would not result in a potential for adverse impacts upon future occupants of dwellings within the development.

6. Assessment of Vibration Levels

As discussed earlier, the railway line is used by a mix of passenger and freight services throughout the day and predominantly freight overnight.

Given that the tracks appeared to be in good condition and the stock travelling along it all modern, the levels of vibration monitored at a distance of 30 metres from the tracks were evaluated to be low.

Vibration levels internally have been calculated on the basis of the provision of a standard dwelling construction with concrete ground floors and well-constructed first floors, with consideration to ensuring that the floors are rigid, which would seek to ensure any potential amplification between the free-field levels measured and internal levels was minimised. On this basis, an amplification factor of 2 has been assumed.

Calculations of the vibration levels within the upper floor rooms of the closest properties constructed at a distance of 30 metres from the railway boundary would therefore be:

$\leq 0.22 \text{ ms}^{-1.75}$ during the daytime period; and

$\leq 0.18 \text{ ms}^{-1.75}$ during the night-time period.

The levels of vibration internally would not exceed a Low Probability of Adverse Comment when assessed against the requirements of BS 6472, thus ensuring no significant adverse effects.

On this basis, providing the dwellings are constructed as shown on the current plans, maintaining a buffer to ensure that they are no closer than 30 metres from the railway tracks, passing trains would not result in a potential for adverse impacts and would therefore be acceptable.

7. Summary

LF Acoustics Ltd were appointed to carry out an assessment of the noise and vibration environment on land off Meadow Way / Hawthorn Bank, Spalding, proposed for a new residential development.

The proposed development is adjacent to a recently constructed residential development within Holland Park. The site is bounded to the east by the railway line, with Hawthorn Bank along the north-eastern site boundary. Noise levels within the proposed development are principally influenced by road and rail traffic noise.

There is an existing factory unit within the northern area of the site, which would be demolished as part of the development. It is proposed that this unit would remain operational initially, as other parts of the residential development are constructed.

A series of noise and vibration surveys have been undertaken to evaluate the existing noise and vibration climate within the site.

An initial risk assessment of the noise levels within the site indicates that the site is exposed to a low to medium risk from exposure to road and rail noise.

An assessment of the road traffic noise levels at the properties to be constructed adjacent to Hawthorn Bank, indicated low levels of noise throughout the day and night-time periods. Standard constructions for these dwellings would ensure that the requirements of BS 8233 would be achieved within these properties. Consideration to the night-time maximum noise levels within bedrooms facing onto the road would be made at the detailed design stage, as part of an overheating assessment to comply with the requirements of Approved Document O to ensure the appropriate levels of ventilation are maintained.

Generally, noise levels along the railway boundary would be low and acceptable living conditions would be achieved within those properties with regards to the requirements of BS 8233, through standard constructions. Maximum noise levels attributable to the passing freight trains were noted to be relatively high, although the numbers of movements overnight remain low and below thresholds for the numbers of events specified within ProPG and Approved Document O that would trigger any requirement for additional noise mitigation measures to be required.

An assessment of the noise associated with the continued operation of the factory unit has been made upon occupants of dwellings constructed during the initial phase of the development. The unit only operates during the daytime period, with noise only generated by occasional loading operations within the service yard. An assessment of the noise levels associated with this use, indicated that the operation would not result in a potential for adverse impacts.

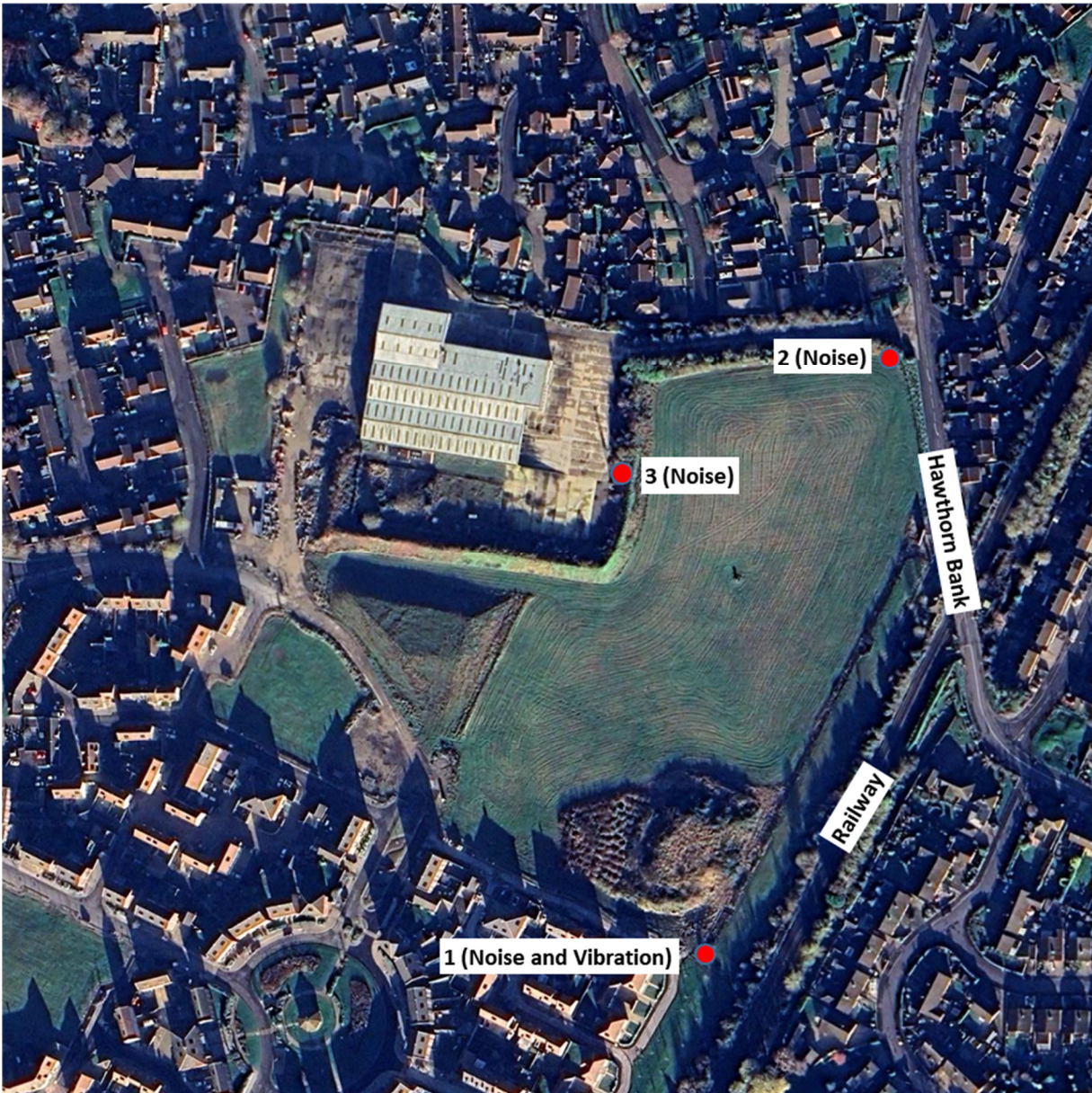
An assessment of the vibration levels attributable to the railway movements has been made. The dwellings adjacent to the railway line would be constructed no closer than 30 metres to the tracks. Maintaining this separation distance would ensure that vibration levels within the properties would be acceptable.

In summary, noise and vibration levels within the proposed development would be acceptable, meeting the requirements of BS 78233 and BS 6472, thus ensuring compliance with the requirements of the NPPF.

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1. Ministry of Housing, Communities and Local Government. National Planning Policy Framework. December 2024.
2. British Standards Institute. Guidance on Sound Insulation and Noise Reduction for Buildings. BS 8233. 2014.
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5. British Standards Institute. British Standard Guide to Evaluation of Exposure to Vibration in Buildings. Part 1: Vibration Sources Other than Blasting. BS 6472-1. 2008.
6. Department of Transport. A Calculation of Road Traffic Noise. The Stationary Office. 1988.
7. Defra. Method for Converting the UK Traffic Noise Index $L_{A10,18h}$ to the EU Noise Indices for Road Noise Mapping. TRL/ Casella. Doc Ref. st/05/91/AGG04442. 2006.
8. The Department of Transport. A Calculation of Railway Noise. The Stationary Office. 1995.
9. Bsi. Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: Engineering Method for the Prediction of Sound Pressure Levels Outdoors. BS ISO 9613-2. 2024.

Figures

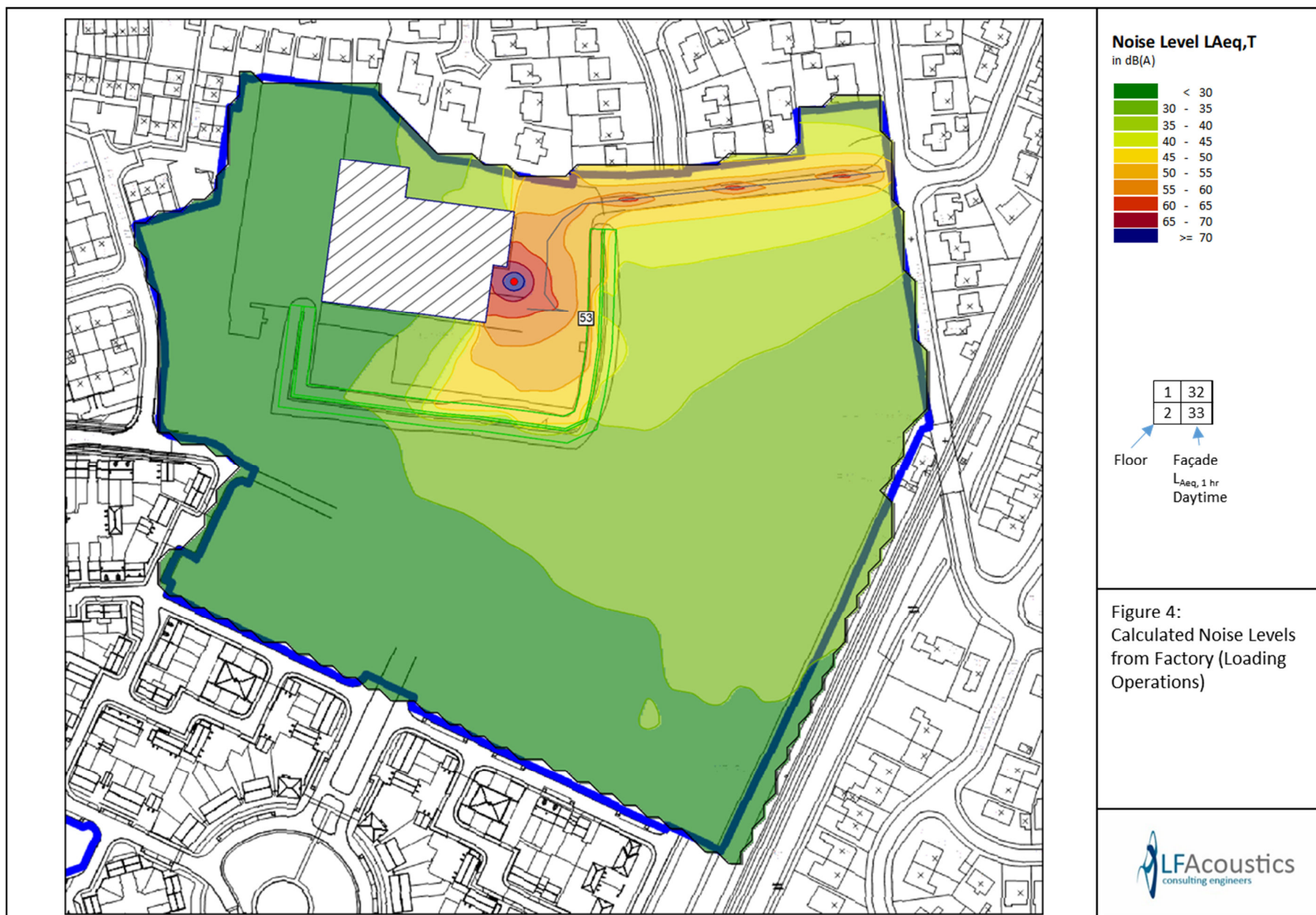


● Unattended Noise Survey Position

Figure 1:
Existing Site Showing
Noise and Vibration
Monitoring Positions







Appendix A

Noise and Vibration Units

Noise Units

Decibels (dB)

Noise can be defined as unwanted sound. Sound in air can be considered as the propagation of energy through the air in the form of oscillatory changes in pressure. The size of the pressure changes in acoustic waves is quantified on a logarithmic decibel (dB) scale firstly because the range of audible sound pressures is very great, and secondly because the loudness function of the human auditory system is approximately logarithmic.

The dynamic range of the auditory system is generally taken to be 0 dB to 140 dB. Generally, the addition of noise from two sources producing the same sound pressure level, will lead to an increase in sound pressure level of 3 dB. A 3 dB noise change is generally considered to be just noticeable, a 5 dB change is generally considered to be clearly discernible and a 10 dB change is generally accepted as leading to the subjective impression of a doubling or halving of loudness.

A-Weighting

The bandwidth of the frequency response of the ear is usually taken to be from about 18 Hz to 18,000 Hz. The auditory system is not equally sensitive throughout this frequency range. This is taken into account when making acoustic measurements by the use of A-weighting, a filter circuit which has a frequency response similar to the human auditory system. All the measurement results referred to in this report are A-weighted.

Units Used to Describe Time-Varying Noise Sources (L_{Aeq} , L_{A90} and L_{Amax})

Instantaneous A-weighted sound pressure level is not generally considered as an adequate indicator of subjective response to noise because levels of noise usually vary with time.

For many types of noise the Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$) is used as the basis of determining community response. The $L_{Aeq,T}$ is defined as the A-weighted sound pressure level of the steady sound which contains the same acoustic energy as the noise being assessed over a specific time period, T.

The L_{A90} is the noise level exceeded for 90% of the measurement period. It is generally used to quantify the background noise level, the underlying level of noise which is present even during the quietest part of the measurement period.

The L_{Amax} is the maximum value that the A-weighted sound pressure level reaches during a measurement period. $L_{Amax,F}$, or Fast, is averaged over 0.125 of a second.

Vibration Units

Groundborne vibration generally occurs as cyclic movement of the ground and is normally induced by repetitive energy generated at sources, which are directly coupled to the ground. The magnitude of the movement inside properties varies with distance from the source and is dependent on a number of factors which include:

- ground lithology;
- foundation design; and
- floor design.

The human body is sensitive to vibration in the three orthogonal directions and is capable of detecting vibration at magnitudes far below those which are necessary to cause adverse effects on buildings or structures. Vibrations at relatively low levels above the threshold of perception may, however, give rise to a small chance of disturbance and/or adverse comment from residents.

It is widely agreed that the risks of building damage are determined by the maximum peak particle velocity in any of the three orthogonal axes (radial, perpendicular or vertical), at the foundation of the structure. Human response to vibration is, by contrast, generally considered to be related to the forth power average of the vibration acceleration.

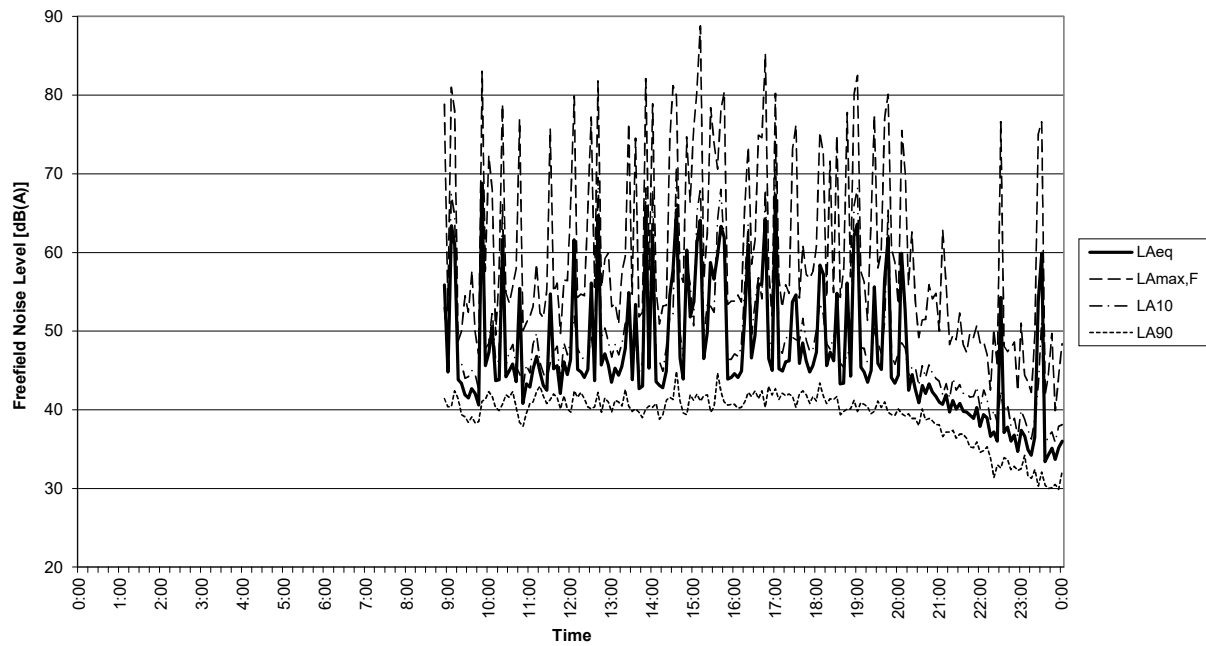
The Vibration Dose Value (VDV, $\text{ms}^{-1.75}$) specified in British Standard 6472: 1992 'Guide to Evaluation of Human Exposure to Vibration in Buildings' is used in this country as a basis for assessing human exposure to vibration over a given period of time T and is defined by the following equation:

$$\text{VDV} = \left(\int a^4(t) dt \right)^{1/4}$$

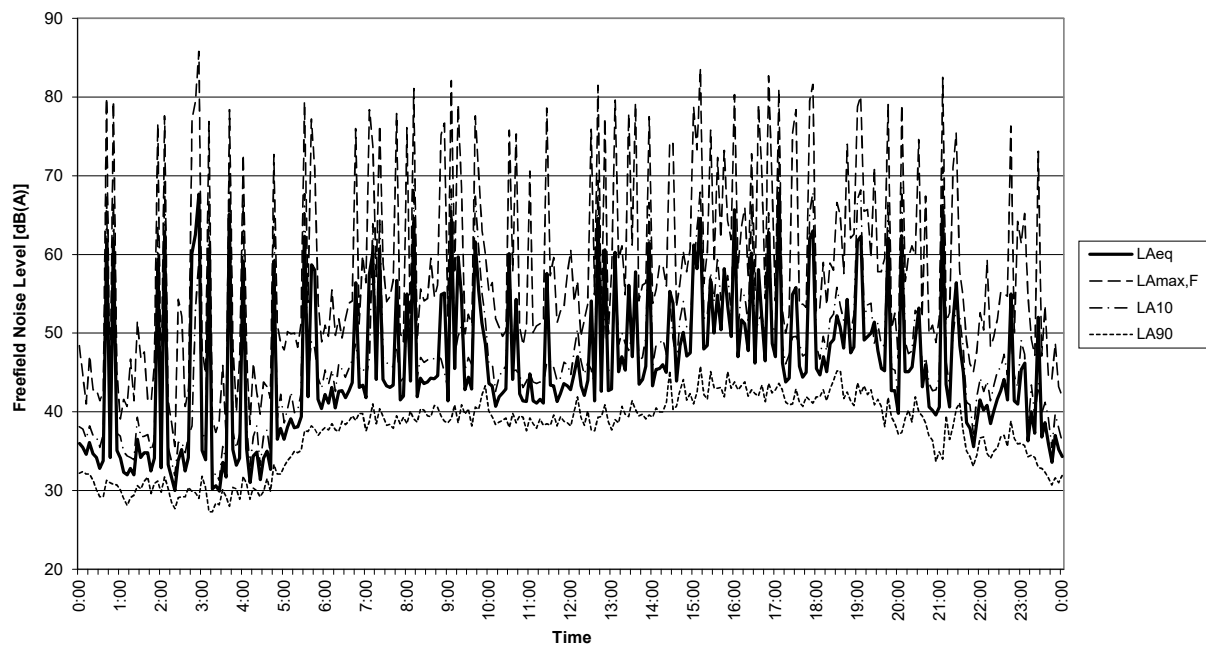
Where $a(t)$ = the weighted acceleration at time t in ms^{-2} and the integration time, T, is the total day or night-time period of interest, in seconds.

Appendix B
Results of Unattended Noise Survey
At Position U1 – Eastern 30m from Railway Boundary

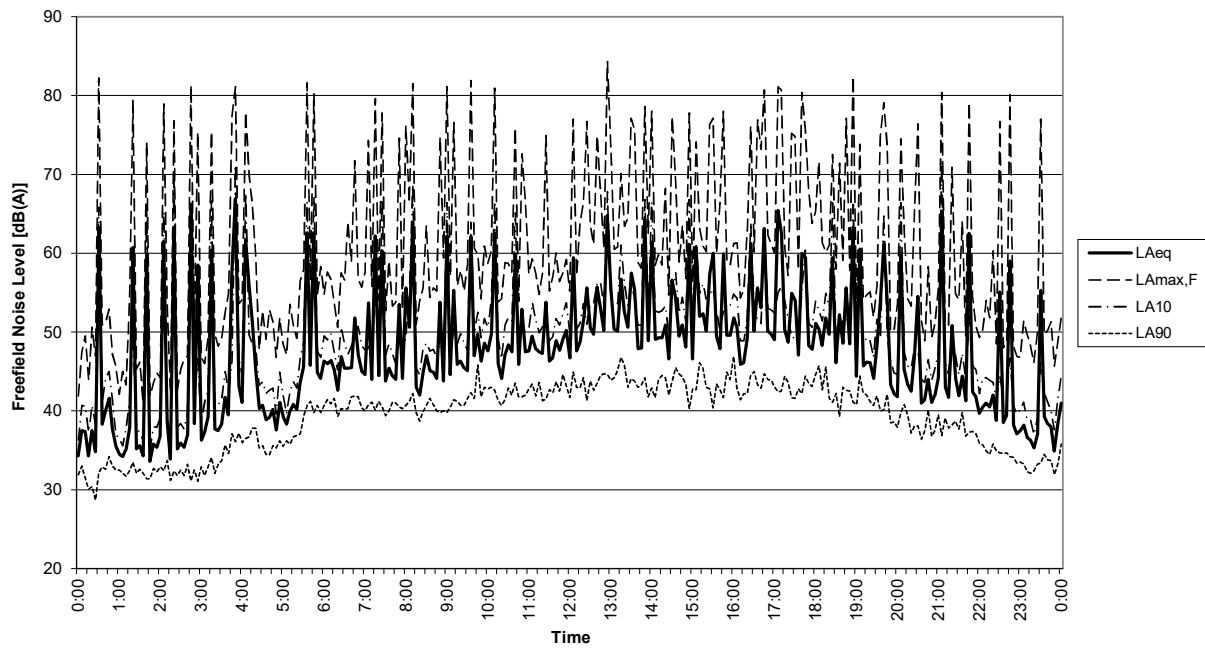
Monday 18/8/25



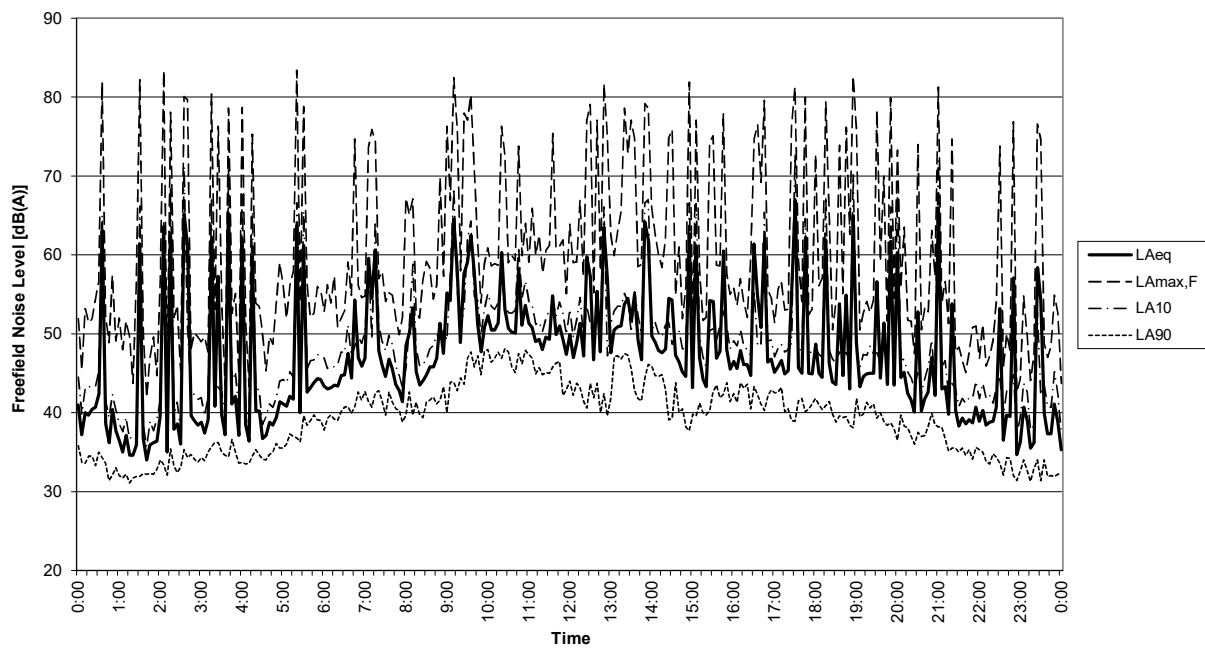
Tuesday 19/8/25



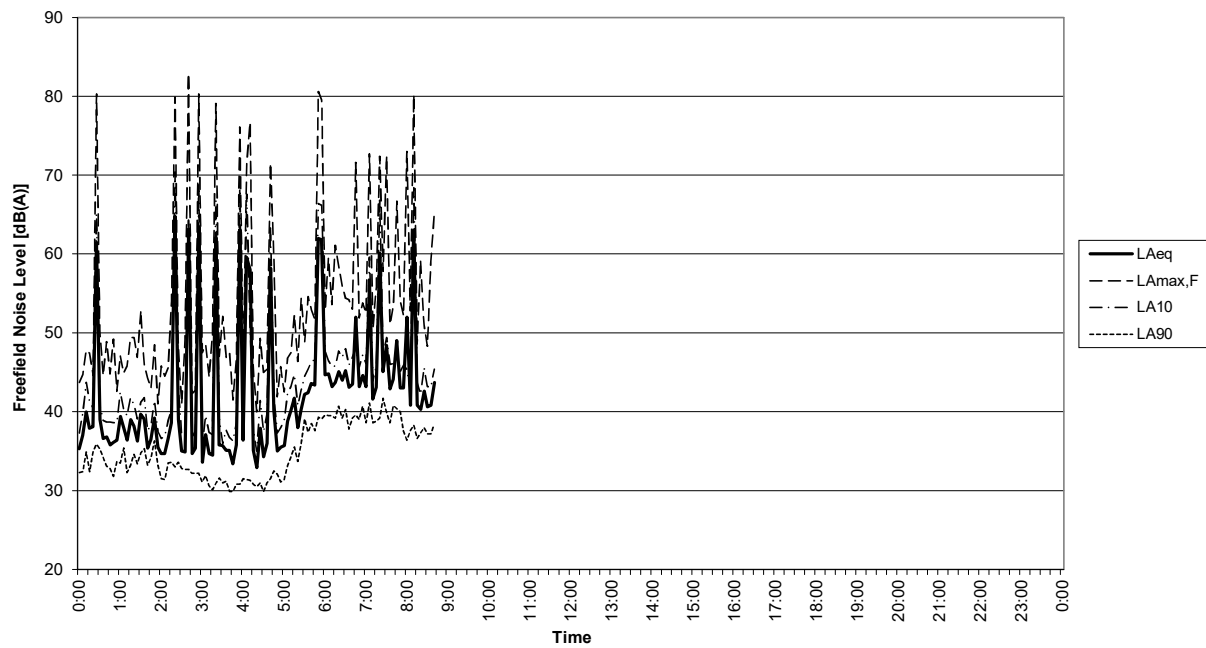
Wednesday 20/8/25



Thursday 21/8/25



Friday 22/8/25

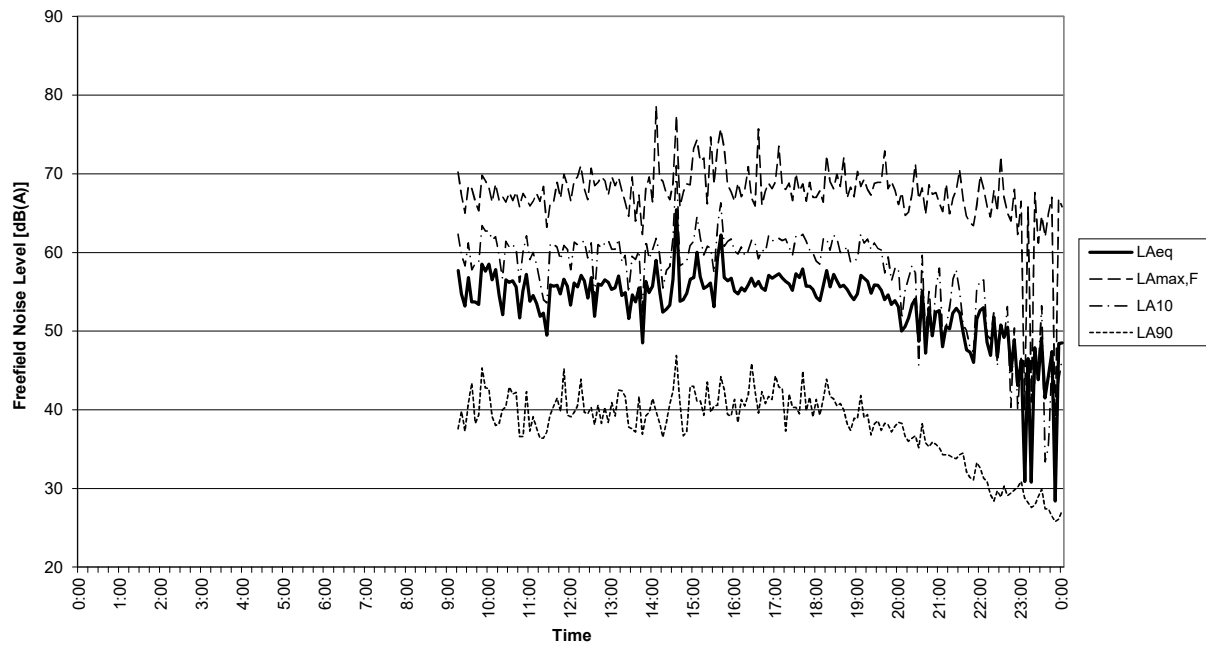


Appendix C

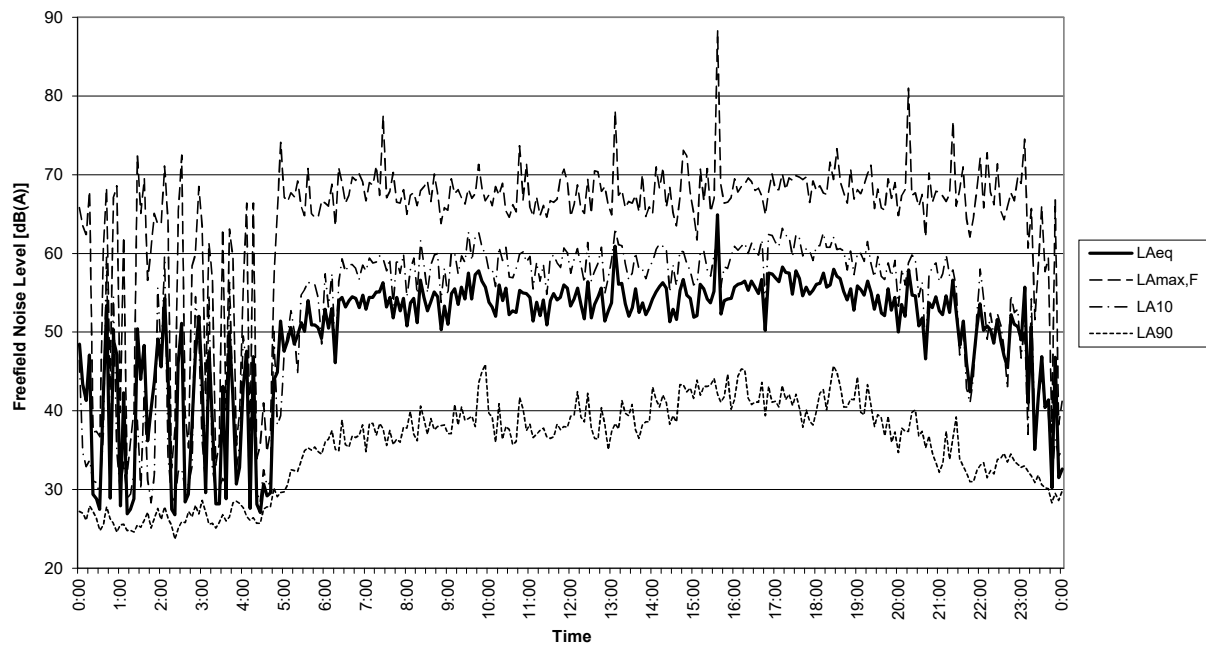
Results of Unattended Noise Survey

Position U2 – North-Eastern Site Boundary (10m from Kerb of Hawthorn Bank)

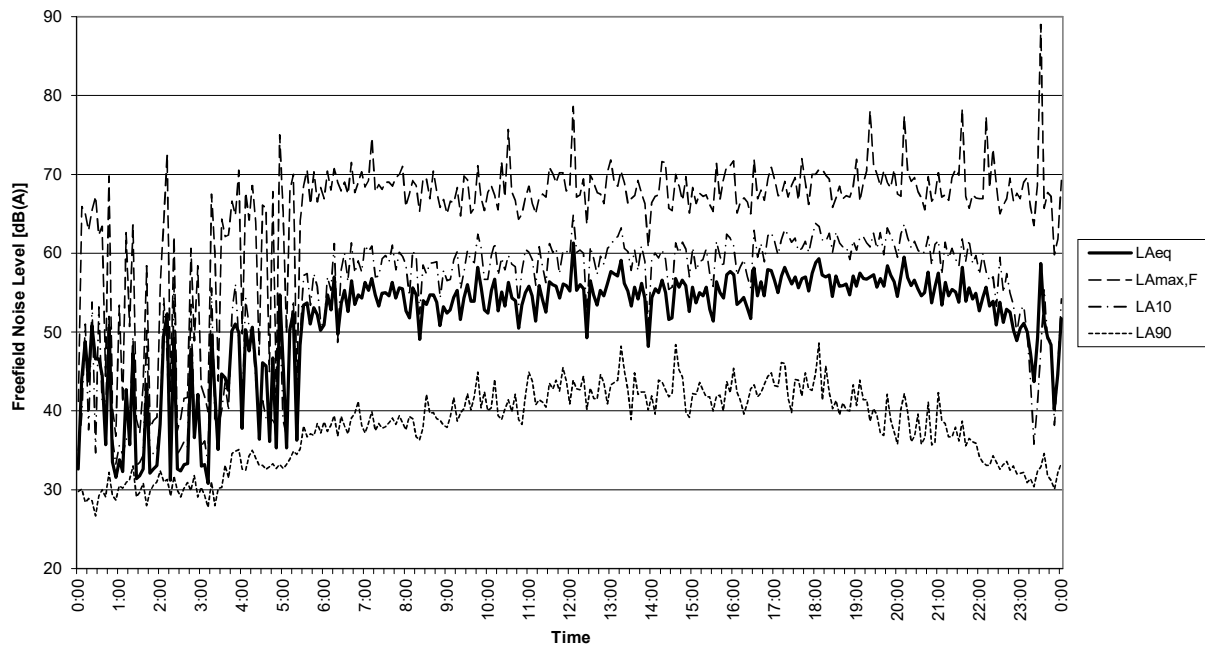
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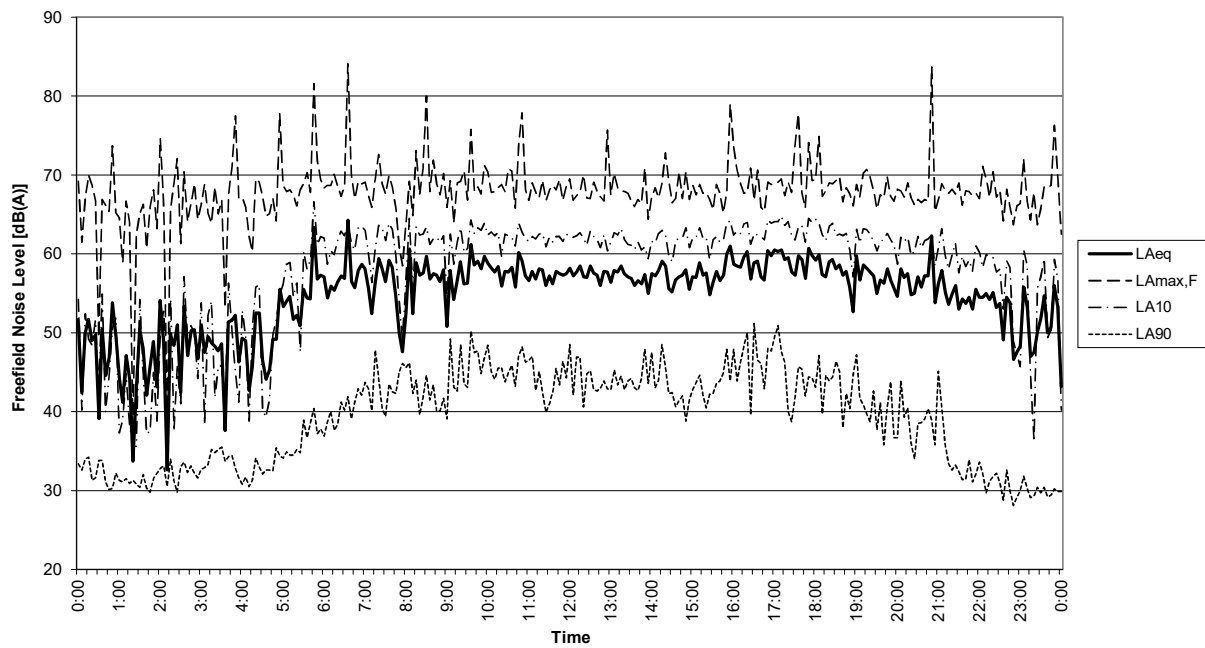
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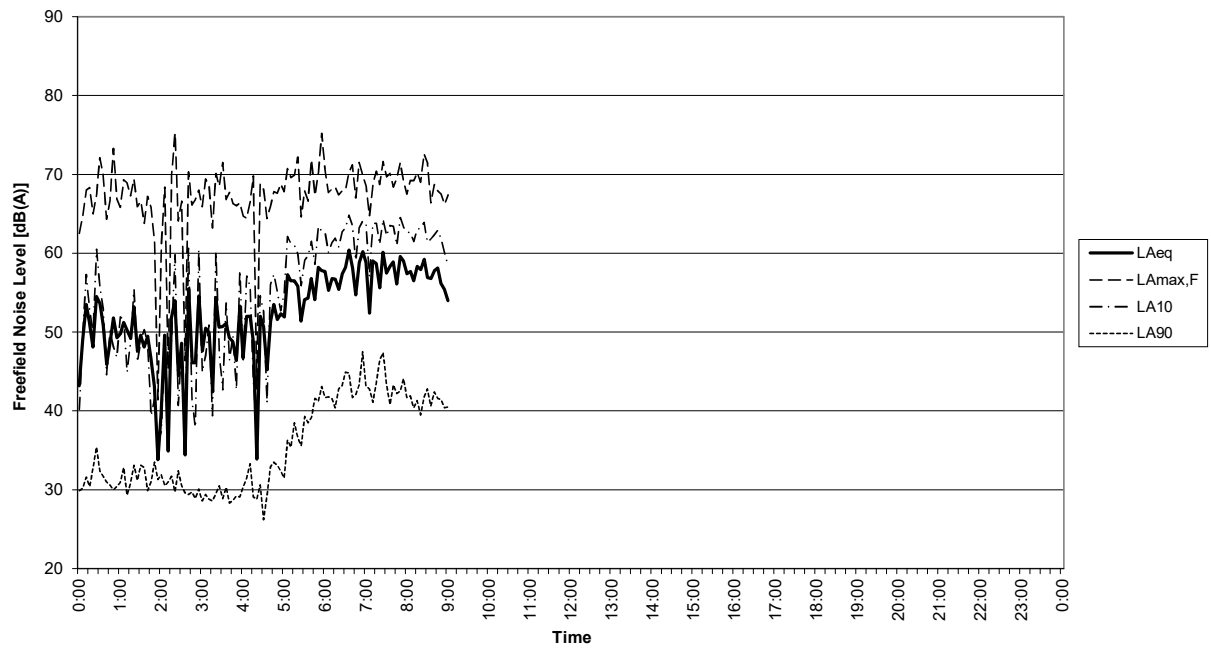
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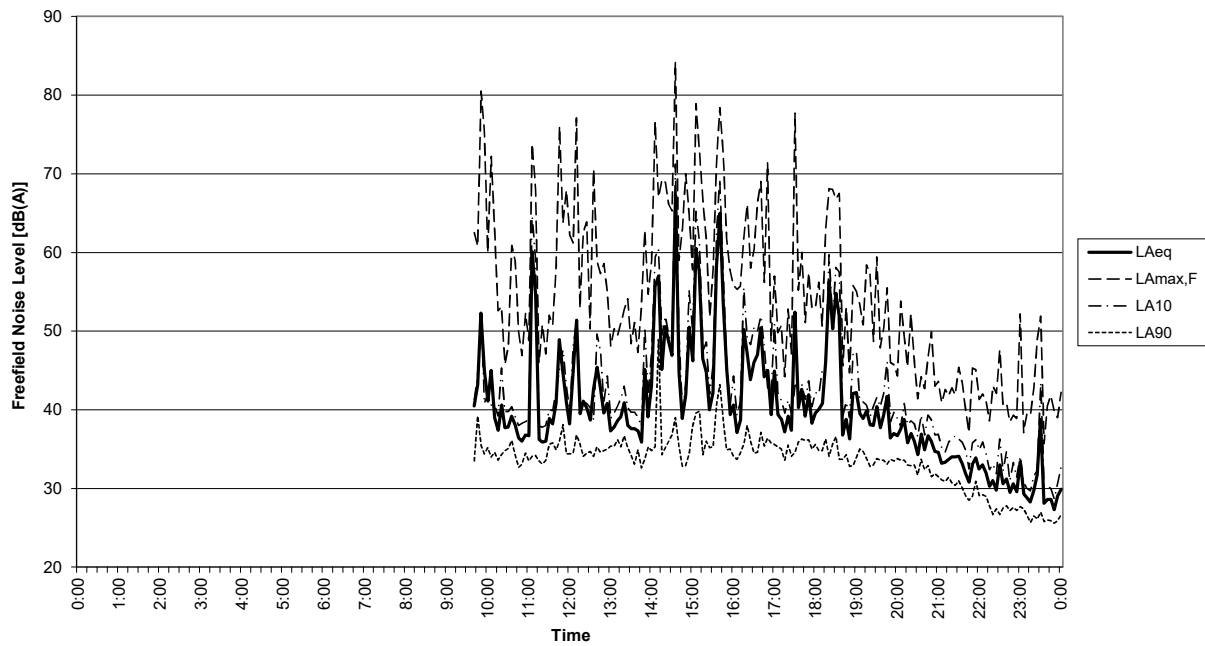


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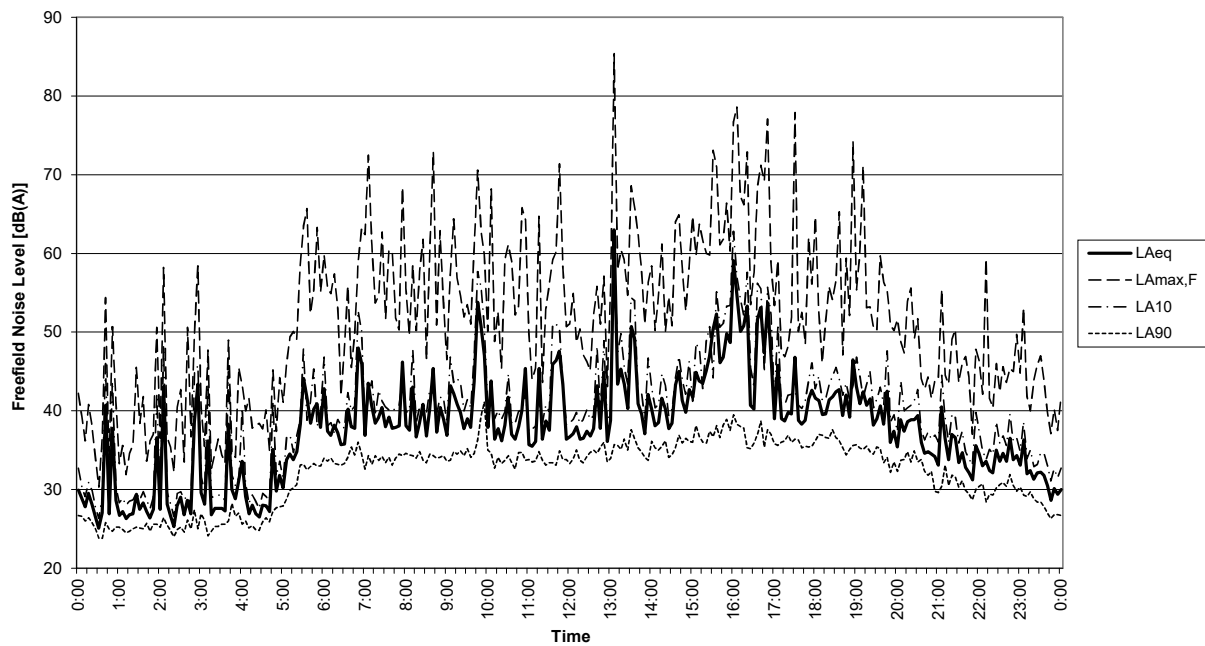


Appendix D**Results of Unattended Noise Survey****Position U3 – Factory Unit (Located on Eastern Side of Service Yard Opposite Loading Bays)**

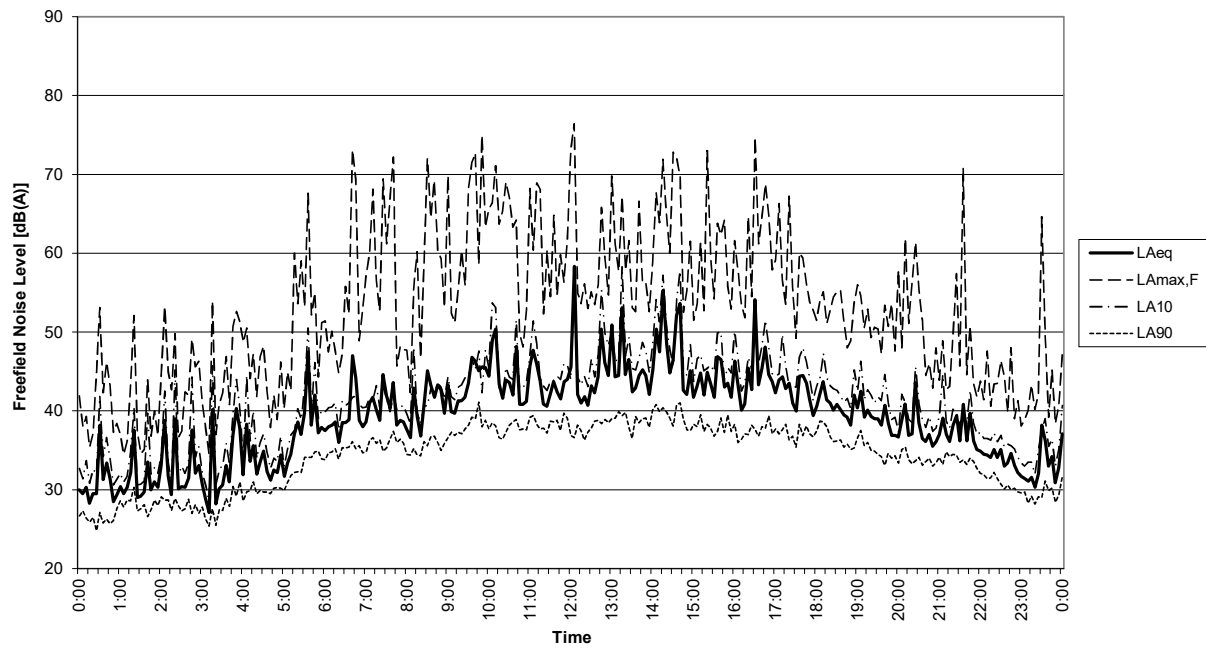
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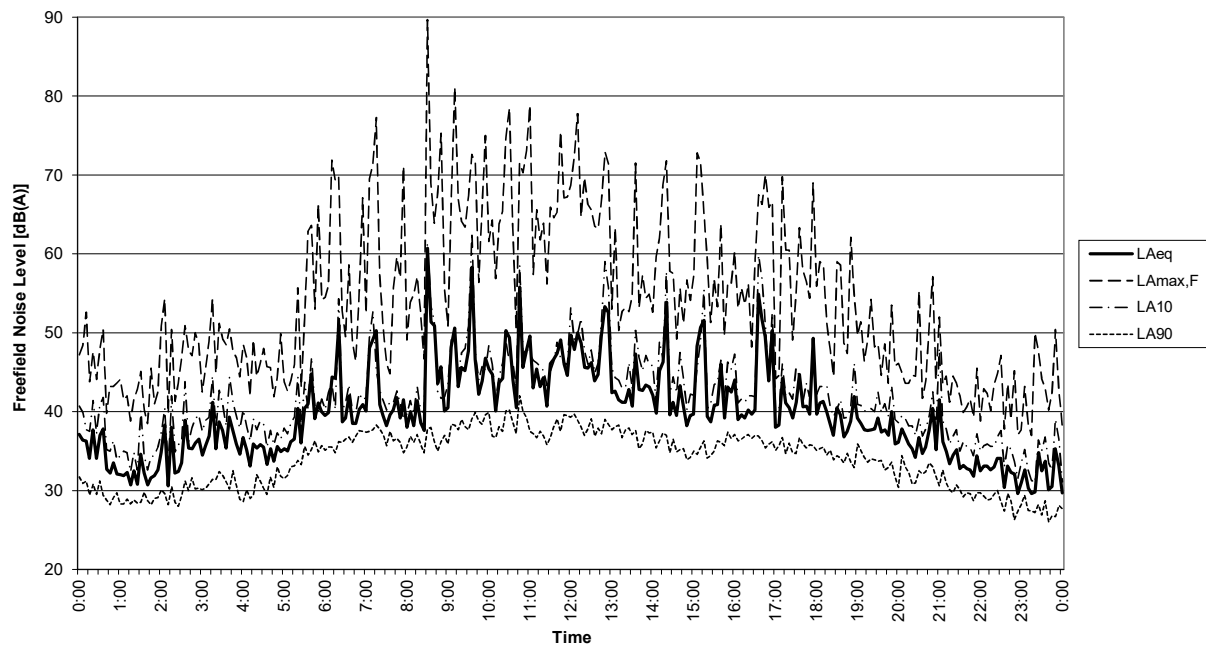
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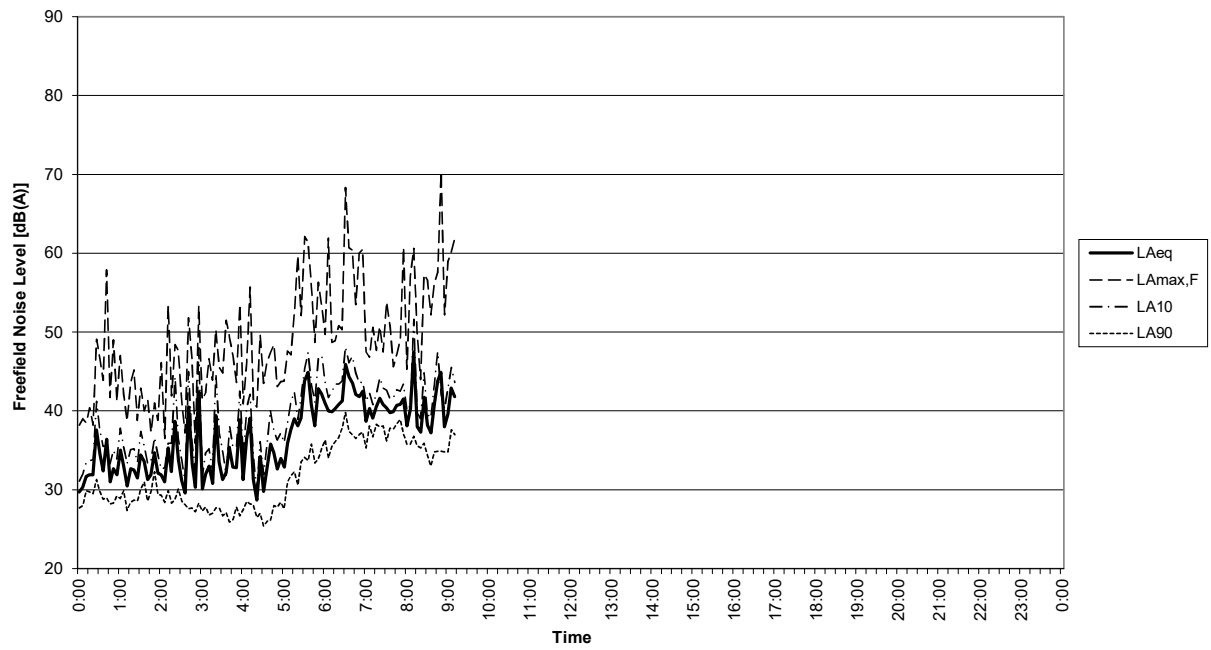
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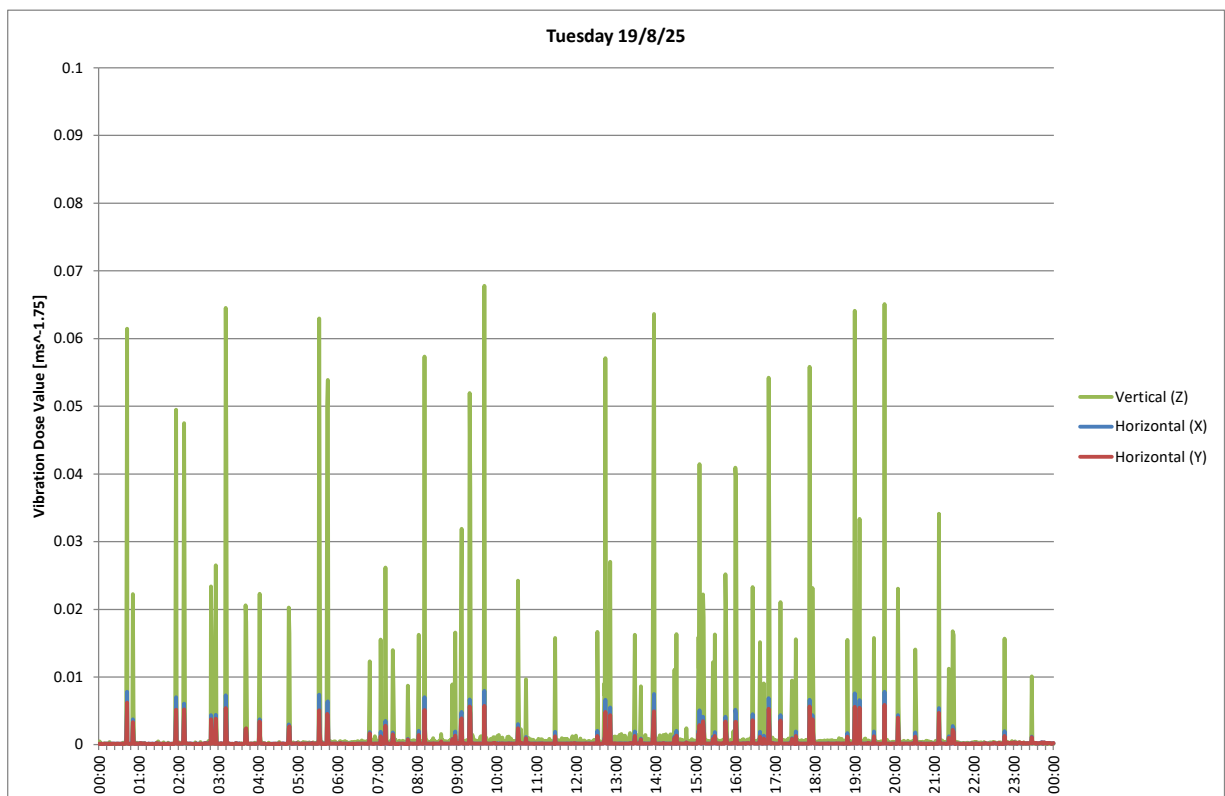
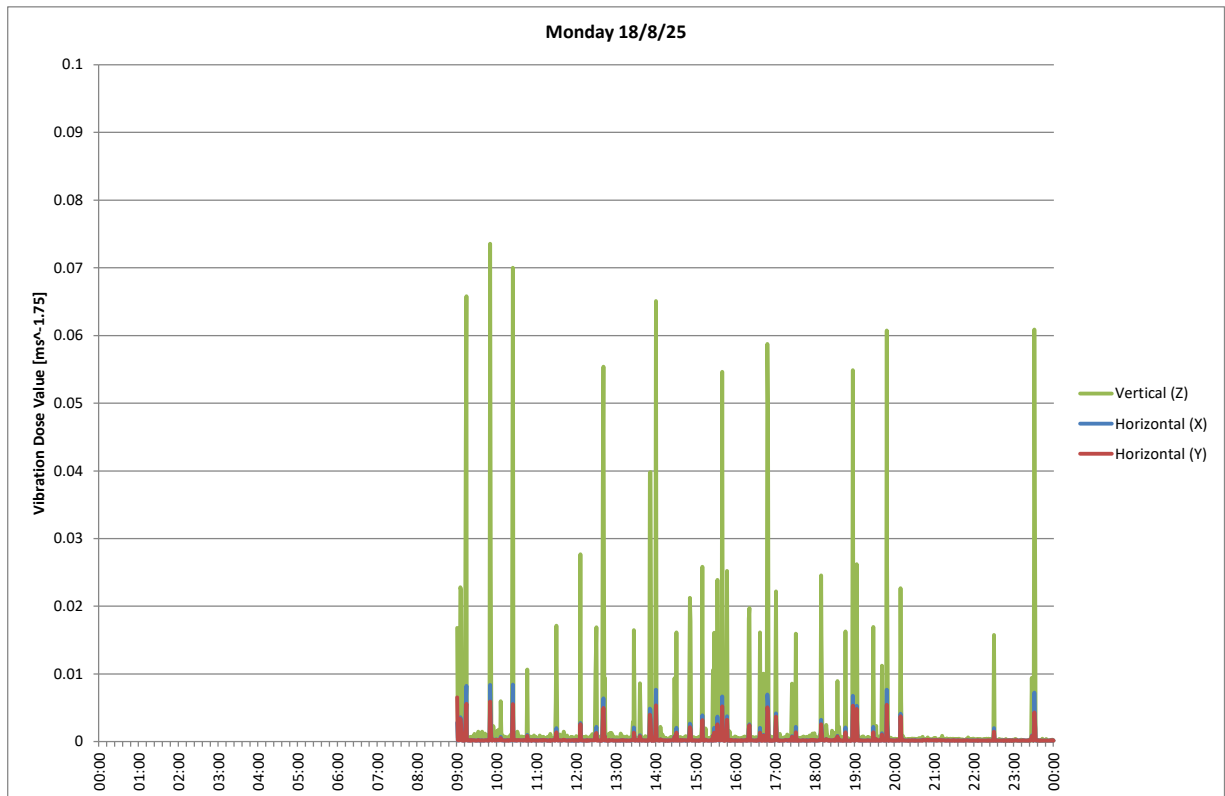
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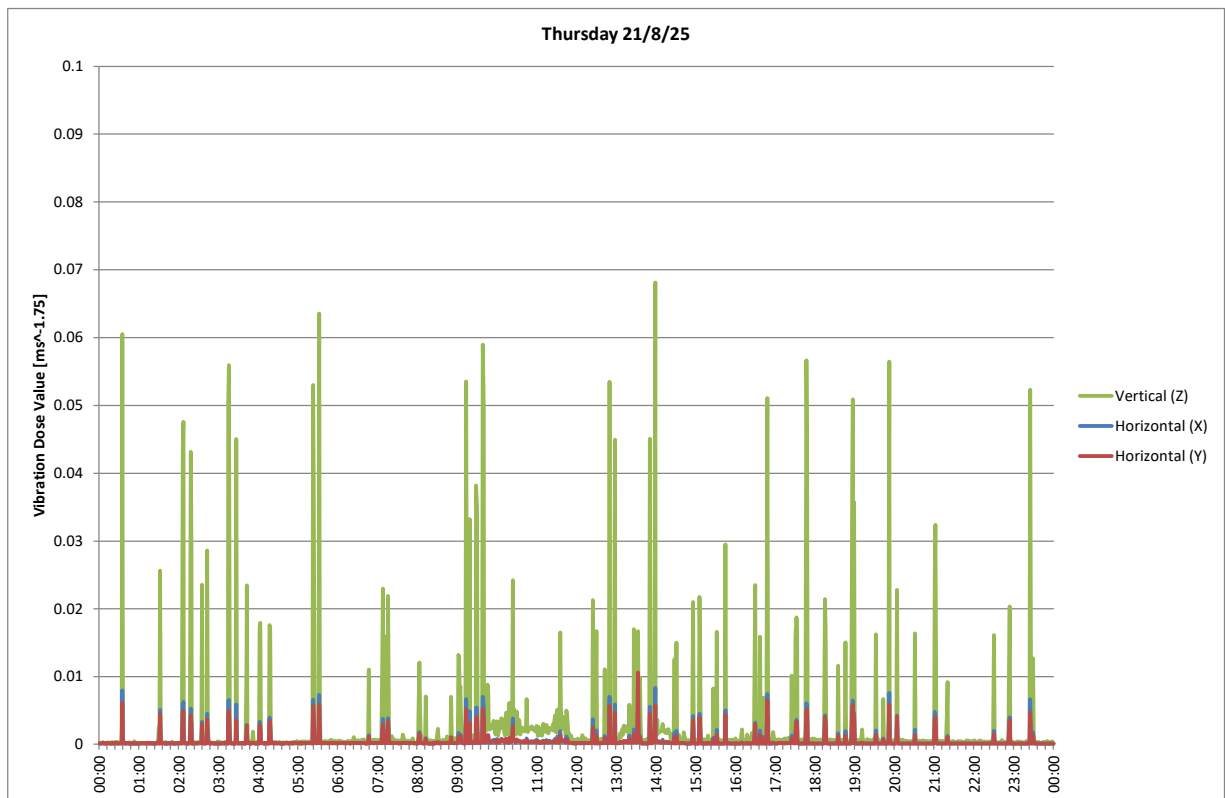
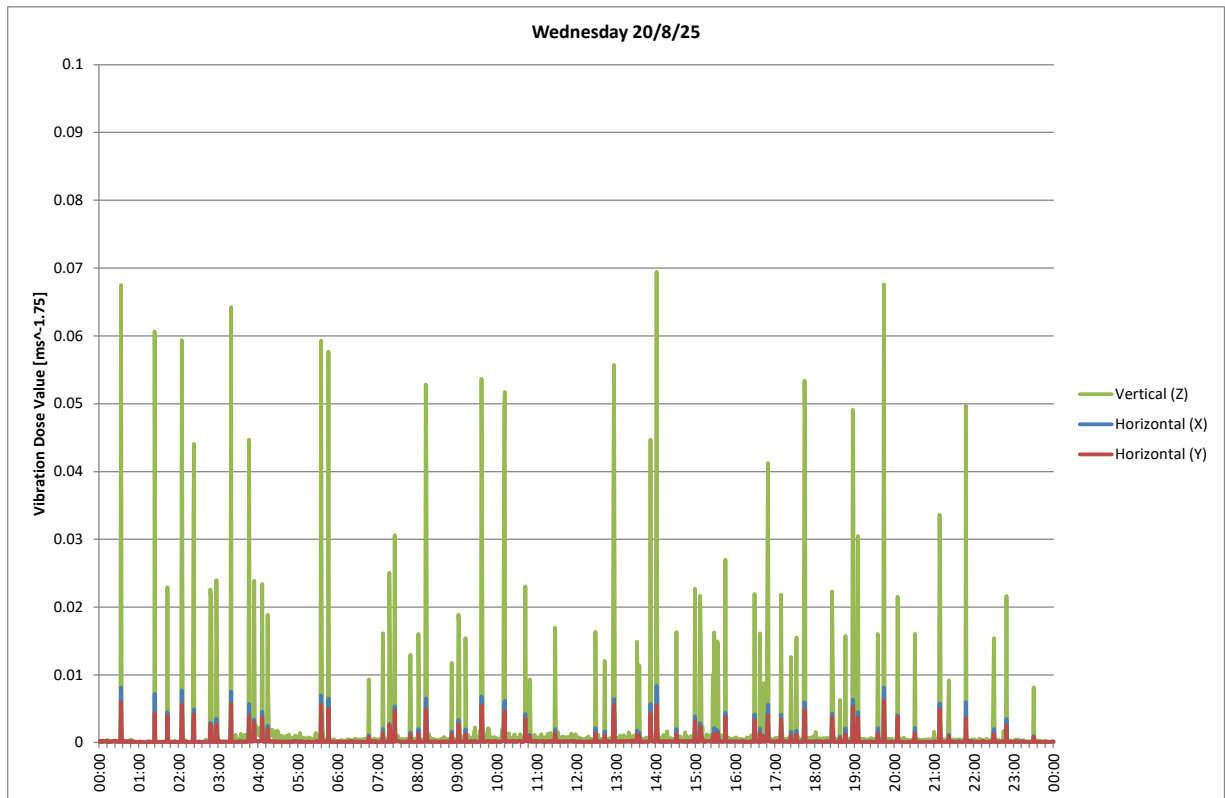


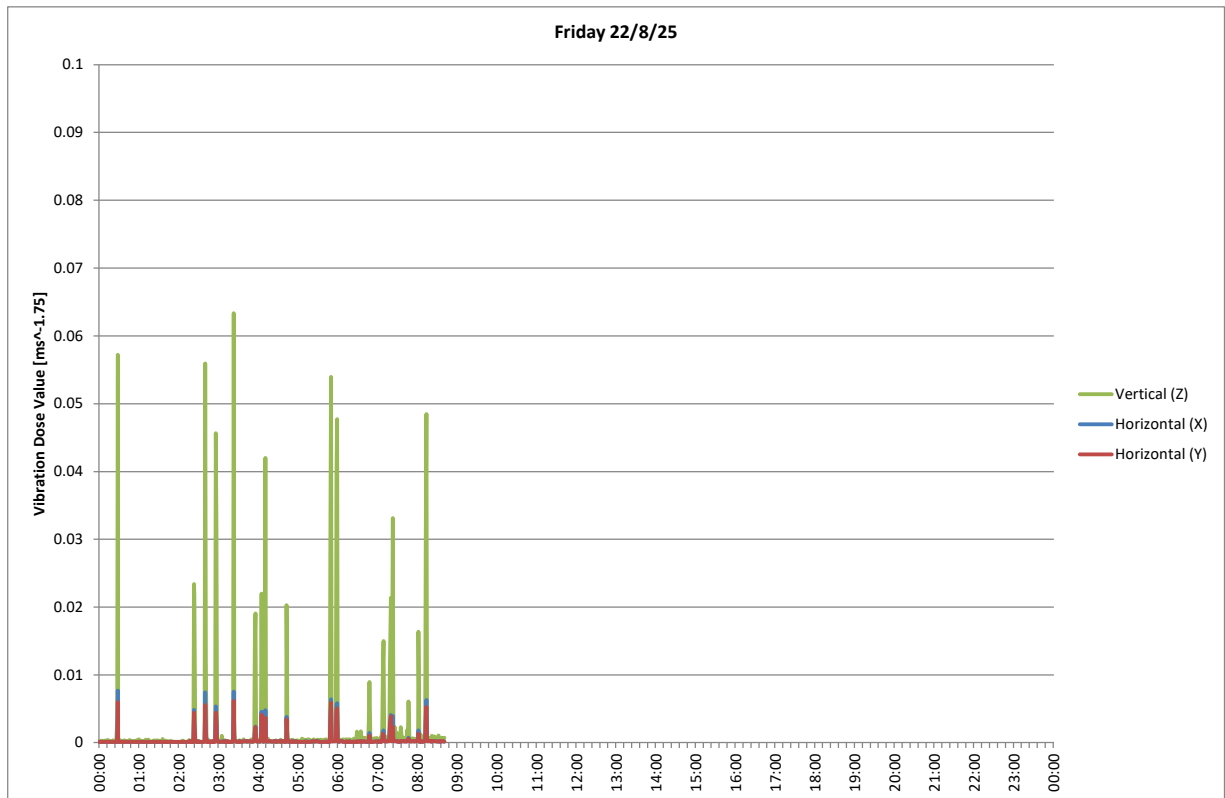
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Appendix E
Results of Vibration Survey Carried Out Adjacent to Railway
(30m from Railway Boundary)







Appendix F

Calculation Details

Proposed Residential Development - Meadow Way / Hawthorn Bank, Spalding

Calculation of Internal Noise Levels

Position : Dwellings Adjacent to Railway

Prepared By: LPJ - 1/10/25

STANDARD GLAZING & OPEN VENTS

Sf	Facade Area (inc Window)	10
Swi	Window Area	2
Sew	Sf-Swi	8
Srr	Area of Ceiling	12
S	Sf+Srr	22
A0	Ref Absorption Area	10

		Overall A-Wtd	125	250	500	1000	2000	4000		
Source Level	L _{eq} Freefield A	54	54	50	50	51	44	39	Equivalent Freefield Level	(56 dB LAeq Façade)
Window Vent	Dn,e		21	34	33	29	31	36	M335 TV (Open)	
	B		0.00361	0.00018	0.00023	0.00057	0.00036	0.00011		
Glazing	Rwi		25	21	26	34	43	45	Standard Glazing 4-20-4	
	C		0.00029	0.00072	0.00023	0.00004	0.00000	0.00000		
Wall	Rew		41	45	45	54	58	58		
	D		2.888E-05	1.15E-05	1.15E-05	1.448E-06	5.763E-07	5.763E-07		
Ceiling	Rrr		30	42	50	54	54	54		
	E		0.0005455	3.442E-05	5.455E-06	2.171E-06	2.171E-06	2.171E-06		
	10Log (B+C+D+E)		-23.494592	-30.227386	-33.250292	-32.132134	-34.337248	-39.215458		
	A (Furnished)		11	14	16	16	15	15		
	10*log (S/A)		3.0103	1.9629465	1.383027	1.383027	1.6633142	1.6633142		
	Leq,2		36.8	24.6	20.7	23.2	14.7	4.0		
	A-Weighting		-16.1	-8.6	-3.2	0	1.2	1		
	LAeq,2		20.7	16.0	17.5	23.2	15.9	5.0		
	LAeq, Internal	Day 27	Night 26							
	Reduction	-27								

Proposed Residential Development - Meadow Way / Hawthorn Bank, Spalding

Calculation of Internal Noise Levels

Position : Dwellings Adjacent to Hawthorn Bank

Prepared By: LPJ - 1/10/25

STANDARD GLAZING & OPEN VENTS

Sf	Facade Area (inc Window)	10
Swi	Window Area	2
Sew	Sf-Swi	8
Srr	Area of Ceiling	12
S	Sf+Srr	22
A0	Ref Absorption Area	10

			Overall A-Wtd	1/3 Octave Band Leq									
				125	250	500	1000	2000	4000				
Source Level	L _{eq} Freefield	A	57	57	54	51	55	49	38	Equivalent Freefield Level	(60 dB LAeq Façade)		
Window Vent	Dn,e			21	34	33	29	31	36	M335 TV (Open)			
	B		0.00361	0.00018	0.00023	0.00057	0.00036	0.00011					
Glazing	Rwi			25	21	26	34	43	45	Standard Glazing 4-20-4			
	C		0.00029	0.00072	0.00023	0.00004	0.00000	0.00000					
Wall	Rew			41	45	45	54	58	58				
	D		2.888E-05	1.15E-05	1.15E-05	1.448E-06	5.763E-07	5.763E-07					
Ceiling	Rrr			30	42	50	54	54	54				
	E		0.0005455	3.442E-05	5.455E-06	2.171E-06	2.171E-06	2.171E-06					
10Log (B+C+D+E)				-23.494592	-30.227386	-33.250292	-32.132134	-34.337248	-39.215458				
A (Furnished)				11	14	16	16	15	15				
10*log (S/A)				3.0103	1.9629465	1.383027	1.383027	1.6633142	1.6633142				
Leq,2				39.6	28.4	21.8	26.9	19.7	3.9				
A-Weighting				-16.1	-8.6	-3.2	0	1.2	1				
LAeq,2				23.5	19.8	18.6	26.9	20.9	4.9				
			Day 30	Night 26									
LAeq, Internal													
Reduction			-27										