



KIRKLAND DEVELOPMENTS LTD

VINE STREET, GORTON

**NOISE & VIBRATION ASSESSMENT FOR
PLANNING PURPOSES**

07 December 2020

AEC REPORT: P4238/R1c/RDC

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1.0 INTRODUCTION

- 1.1 Acoustic & Engineering Consultants Limited (AEC) has been instructed by Kirkland Developments to undertake a noise and vibration assessment in relation to the proposed residential development located on land off Vine Street, Gorton.
- 1.2 This report details the noise and vibration levels measured on the development site, presents the assessment criteria and discussed the implications on the site layout and building design, to achieve acceptable noise and vibration level limits as required by the Local Authority.
- 1.3 Acoustic terminology is discussed in brief in Appendix A.

2.0 BACKGROUND AND SITE DESCRIPTION

Background and Site Description

- 2.1 The proposed development is situated on unoccupied land, located off Vine Street, Gorton, as identified on the attached Figure 1.
- 2.2 The northern site boundary of the development is bound by a railway line, with two tracks, that links Manchester Piccadilly Station and Hadfield Station in New Mills. The railway line is located down in an embankment around 9m below the ground floor level of the proposed properties.
- 2.3 A desktop assessment suggests that on a typical day, there will be up to 160 passenger and 10 freight trains movements past the site during each daytime period (0700h to 2300h). During the night-time (2300 to 0700h), it has been calculated that up to 40 passenger and 10 freight trains would pass the site.
- 2.4 The eastern elevation of the site is bound by Vine Street, a relatively quiet residential street, from which access to the development will be gained.
- 2.5 To the south of the site are existing residential properties recently built within the last ten years. There is a 2m high barrier running across this boundary.
- 2.6 The western elevation of the development is bound by a number of industrial units, comprising mainly of vehicle repair and MOT centres. Based on a desktop review, none of these units operate before 0700h, or after 1800h, Monday to Sunday.
- 2.7 It should be noted that due to the lockdown caused by the Covid-19 pandemic, AEC are unable to confirm whether or not all of the industrial units were operating at their typical duty (prior to the pandemic). Methods of accounting for this are presented in the assessment.
- 2.8 However, a noise assessment was carried out for a residential scheme on the same plot in 2013 and the noise levels in the RS Acoustic Engineering Ltd report has been used from comparison purposes.

Development Layout

- 2.9 The proposed development will comprise of 25 residential properties with associated gardens and driveways.
- 2.10 As part of the scheme, it is understood that 3m and 2.5m high close boarded timber barrier will be erected along the northern and western site boundaries, as identified on Figure 2.

3.0 BASIS OF ASSESSMENT

Determining of External Noise Levels

- 3.1 BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' (BS8233) describes how noise levels can be determined and assessed from different sources in chapters 6.2 to 6.7.
- 3.2 BS8233 states the recognised national calculation method for airborne noise from railways is given in the Department of Transport 1995 document '*Calculation of Railway Noise*' (CRN). The calculation method takes into account the sound exposure level of train pass-bys and the number and type of trains passing-by the site.
- 3.3 In relation to road traffic noise, BS8233 states that the noise from road traffic can be determined using the Calculation of Road Traffic Noise (CRTN). CRTN presents the shortened measurement procedure which can be used to convert the arithmetic mean of the measured $L_{A10,T}$ levels (measured over 3 consecutive hours during the period 1000h to 1700h) into an 18-hour L_{A10} level by subtracting 1dB.
- 3.4 As it is understood that the Manchester City Council require that noise surveys are carried out during typical rush-hour periods, while AEC has not carried out a daytime noise survey between 1000h and 1700h (but rather 0700h and 1000h), AEC deem it suitable to use the same assessment methodology as stated in CRTN.
- 3.5 BS8233 suggests that the conversion of the $L_{A10,18h}$ to $L_{Aeq,16h}$ can be achieved by the (approximate) relationship of $L_{Aeq,16h} = L_{A10,18h} - 2dB$. Therefore, the daytime ambient noise level can be determined by subtracting 3dB from the arithmetic mean of the $L_{A10,T}$ levels measured on-site over 3 consecutive hours (between 1000 and 1700h).
- 3.6 Chapter 6.5 provides guidance on how to assess noise from industrial and commercial sites. Paragraph 6.5.2 states that where industrial noise affects residential or mixed residential areas, the methods for rating noise in BS4142: 2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*', (BS4142) should be applied.

National Planning Policy Framework

- 3.7 The latest Planning Policies are included in the National Planning Policy Framework published by the Department for Communities and Local Government and dated March 2012 and revised in February 2019.

- 3.8 This planning policies which relate specifically to noise are presented in paragraphs 170, 180 and 182 which are reproduced below:

170. 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 of noise.

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

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

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

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed.

- 3.9 Further to the above, the Governments ‘*Planning Practice Guidance*’ published on 6 March 2014 and updated on 22 July 2019 states:

‘Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.’

- 3.10 In addition, the guidance indicates that, whilst noise can override other planning concerns, it is important to look at noise in the context of the wider characteristics of a development proposal, its likely users and its surroundings, as these can have an important effect as to whether or not noise is likely to pose a concern.

Local Authority Requirements

- 3.11 Manchester City Council has produced '*Planning & Noise – Technical Guidance*' (2015) (PNTG) in relation to their requirements for noise assessments to accompany planning applications.

Internal Noise Limits

- 3.12 Section 3.6.1.1 of this document states "*Manchester City Council has adopted the following internal limits for residential properties:*

- *Bedroom (night-time – 23.00 – 07.00) 30dB_{LAeq} (individual noise events should not normally exceed 45dB_{LAmax,F} by more than 15 times);*
- *Living Rooms (daytime – 07.00 – 23.00) 35dB_{LAeq}.*

- 3.13 These levels are based on guidance presented in BS8233 and the Association of Noise Consultants (ANC) document '*ProPG: Planning and Noise - New Residential Development*', 2017 (ProPG).
- 3.14 It should be noted that BS8233 does note that where noise has a specific character, such as being intermittent in nature, containing a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has a strong low-frequency content, lower noise limits may be appropriate.
- 3.15 In addition to the above, ProPG assumes that the attenuation of free-field external noise levels to internal noise levels provided by a window partially open for ventilation is up to 15dB. Therefore, to ensure that whole dwelling (background) ventilation can be provided via a partially open window at the nearby properties, AEC would propose that the external noise levels outside habitable rooms should not exceed 50dB_{LAeq,T} during the daytime, and 45dB_{LAeq,T} and 60dB_{LAmax,F} at night.
- 3.16 In locations where the noise has a specific character AEC propose that the design aim should be to achieve internal noise levels at least 5dB below those presented PNTG.

Ventilation and Overheating

- 3.17 The ventilation specifications presented in BS8233 and ProPG are based on achieving the requirements of Approved Document F (ADF) '*Ventilation*' (2010) of the Building Regulations only.
- 3.18 ADF requires that continuous whole dwelling ventilation is provided to limit the accumulation of moisture and other pollutants originating within a building. This is typically achieved either via a partially opened window, or by a whole building ventilation system through the provision of trickle ventilators or mechanical ventilators. ADF states that '*The ventilation provisions will not necessarily meet cooling needs*'.
- 3.19 In relation to purge ventilation, Pro-PG suggests that as this should only occur occasionally (e.g. to remove odour from painting and decorating or from burnt food), the internal desired noise levels are not generally applicable. Therefore, internal noise levels due to windows being opened for purge ventilation has not been discussed further.

- 3.20 AEC has not been presented with a thermal assessment for this development and we cannot provide a comment on which properties may be adversely affected by excessive or prolonged internal high temperatures (overheating). Therefore, the indicative overheating assessment presented in this report is only based on the noise levels measured on-site and would only apply to the dwelling(s) at risk of overheating which would be determined by others.
- 3.21 In order to provide guidance on the relationship between internal noise levels and the control of overheating in residential properties, the ANC issued '*Acoustic ventilation and Overheating – Residential Design Guide*' (AVO) in January 2020. It is important to note that this is a design guide only and not a statutory document and the Local Authority may have their own requirements.
- 3.22 AEC understands that there are no specific Local Authority requirements in relation to acceptable internal noise level limits in habitable rooms with windows open to aid with the control of overheating. Therefore, this indicative assessment is based on the guidance presented AVO.
- 3.23 Table 3.3 of AVO presents guidance for allowable noise from transportation sources whilst windows are open for the control of overheating. With reference to this document AEC would propose that windows can be utilised in the control of overheating provided that the resultant internal ambient noise levels are below approximately 50dB_{LAeq, 16h} during the daytime, and 42dB_{LAeq, 8h} and 65dB_{LAmax} during the night-time.
- 3.24 These internal noise levels are the upper end of the medium risk category for adverse effects. Where these internal noise levels would be exceeded, AVO states that "*noise causes a material change in behaviour (e.g. having to keep windows closed most of the time)*". In this situation, AEC would suggest alternative means for the control of overheating are considered.
- 3.25 AVO states that where transportation is the main source of noise, "*it is assumed that a partially open window will provide an outside-to-inside level difference of 13dB and is considered representative of typical domestic rooms with simple façade openings of around 2% of the floor area*".
- 3.26 Considering the above, it is considered acceptable to control summertime heating via opening windows where external free-field noise levels are no greater than those presented in the following Table 3.1. This is based on simple façade openings to around 2% of the floor area.

Table 3.1 – External Free-Field Noise Level Limits for the Control of Overheating via Openable Windows

Activity	Location	Noise Level Limit, dB		
		Daytime 0700 – 2300h	Night-Time 2300 – 0700h	
		L _{Aeq,16h}	L _{Aeq,8h}	L _{Amax,F}
Resting	Living Room	63	-	-
Dining	Dining Room/Area	63	-	-
Sleeping (daytime resting)	Bedroom	63	55	75

External Noise Level Limits

- 3.27 For traditional external areas that are used as an amenity space, such as gardens and patios, BS8223 states that it is desirable that ambient noise levels should be not exceed 50dBL_{Aeq, 16 hour} during the daytime, with an upper limit of 55dBL_{Aeq, 16h}.
- 3.28 WHO guidance also provides a limit of 55dBL_{Aeq, 16 h} to stop the majority of people from being “*seriously annoyed most of the time*”. Furthermore, PNTG provides a limit for 50dBL_{Aeq,16h} to stop ‘*moderate annoyance*’, and an upper limit of 55dBL_{Aeq,16h} for ‘*serious annoyance*’.

BS4142 Assessment Methodology

- 3.29 BS4142 describes a method for determining the potential impact of sound from an industrial and/or commercial source on a noise sensitive receptor during the day and night-time periods.
- 3.30 The impact of the source on the receptor is assessed by comparing the noise level during its operation with the background noise level when it is not operating.
- 3.31 For the purposes of BS4142 a noise source is assessed over a 1-hour period during the daytime (typically between 0700 and 2300h) and a 15-minute period during the night-time (typically between 2300 and 0700h).
- 3.32 In relation to selecting the measured background noise level to use in the assessment BS4142 states that “*the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular times of interest*”.

Paragraph 9.1 of BS4142 identifies that “*Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.*”

- 3.33 The potential impact of a sound from an industrial and/or commercial source depends upon both the difference between the rating level of the specific sound and the background noise level at the nearest noise sensitive receptor, and the context in which the sound occurs.
- 3.34 The potential impact of the specific sound is estimated by subtracting the measured background noise level from the rating level and the following should be considered.
- a) Typically, the greater this difference between the rating level and background, the greater the magnitude of the impact.
 - b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - c) A difference of around +5 is likely to be an indication of an adverse impact, depending on the context.
 - d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Vibration

- 3.35 The assessment of vibration on humans within buildings is presented in BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*' (BS6472). The assessment of vibration on buildings i.e. damage, is presented in BS 7385-2:1993 '*Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration*' respectively.
- 3.36 BS6472 uses acceleration in terms of a 'vibration dose value' (VDV), which is a measure of vibration exposure, weighted for human perception, over a specified time period, to determine human response to vibration within a building.
- 3.37 The VDV's above which various degrees of adverse comment may be expected in residential buildings are reproduced in Table 3.2, below.

Table 3.2 – Vibration Dose Values Relating to Various Degrees of Adverse Comment

Place and Time	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Vibration dose values ($\text{m/s}^{1.75}$) above which
various degrees of adverse comment may be expected

- 3.38 The levels at which vibration resulting from rail traffic could cause damage to a residential property are presented in BS7385-2. This guidance uses the Peak Particle Velocity (PPV) of an event to determine whether vibration could potentially cause cosmetic damage to a property.

- 3.39 Based on BS7385-2, the risk of cosmetic damage is considered minimal below 15mm/s PPV, unless the building condition, foundations and/or ground type make it more susceptible to vibration. In addition, it is understood that certain soils can start to become vulnerable at levels of 10mm/s to the potential for differential settlement of ground caused by vibrations.
- 3.40 Therefore, taking the above into account, it is considered that PPV levels below 10mm/s should be deemed acceptable in relation avoiding the potential for causing cosmetic damage to a new development.

4.0 ON-SITE MEASUREMENTS

- 4.1 AEC has undertaken noise and vibration measurements around the proposed development site, these are discussed separately below.
- 4.2 A night-time (0500 to 0700h) and daytime (0700 to 1000h) attended noise level survey was undertaken by AEC on Friday 20 October, between approximately 0500 and 1000h. Measurements were undertaken at three locations around the development site, identified as A to C on the attached Figure 1.
- 4.3 All measurements were undertaken under free-field conditions in general accordance with BS7445-1: 2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*'.
- 4.4 A full measurement procedure is presented in Appendix B and the measured data is presented in Tables B1 and B2.
- 4.5 Location A was selected to measure noise levels from road traffic on Vine Street. During the survey, ambient and maximum noise levels during both the daytime and night-time periods were due to car pass-bys on Vine Street.
- 4.6 Location B was selected to measure industrial noise from the units to the west. During the survey, the daytime ambient noise levels was a combination of noise from distant road traffic and activities on the industrial estate.
- 4.7 Location C was chosen to measure noise levels from train pass bys at a distance of around 20m away that was representative of the northern site boundary of the development. Sound Exposure Levels (SEL's) measured at this location ranged from 67dBL_{AE} to 84dBL_{AE}, with the average being around 75dBL_{AE}. During the daytime measurement periods where there no train movements, the noise climate was dominated by distant road traffic.
- 4.8 Full details of the measured SEL's and maximum noise levels due to train pass-bys are presented in Appendix B, in Table B3.
- 4.9 In relation to the night-time measurements at Locations B and C, the ambient and maximum levels at these locations were due to distant road traffic and birdsong, respectively.
- 4.10 A summary of the external noise levels measured at each measurement location is presented in Table 4.1, below. In addition to the daytime and night-time ambient, L_{A10} and L_{A90} noise levels, and the highest non-erroneous maximum noise level at each location is also presented. In this noise survey, a non-erroneous maximum noise level was anything such as a siren or loud birdsong.
- 4.11 It should be noted that all summarised noise levels in Table 4.1 exclude the influence of train pass bys. At Location C, however, one 10-minute measurement did include the influence of a train pass-by for comparative purposes, and this is presented in brackets in Table 4.1.
- 4.12 Full details of the measured SEL's are presented in Appendix B, in Table B3.

Table 4.1 – Summary of Measured External Noise Levels

Measurement Location	Period	Noise levels, dB			
		L _{Aeq, T}	L _{A10, T}	L _{A90, T}	L _{Amax, F}
A	Daytime	52	54	43	-
	Night-time	50	-	39	72
B	Daytime	47	49	43	-
	Night-time	44	-	40	57
C	Daytime	47	47	45	-
	Night-time	45 (51)	-	42	56 (71)

Previous Noise Assessment

- 4.13 As previously stated, AEC are unable to confirm whether or not the industrial units were in full operation (as they would have been before the Covid-19 pandemic). Therefore, AEC has reproduced the measured data from the 2013 noise survey for comparative purposes, and these are discussed below. This noise survey was conducted by RS Acoustic Engineering Ltd in March 2013.
- 4.14 Within the RS Acoustic Engineering Ltd survey, a 3.5-hour daytime noise level survey was undertaken at a distance of around 10m away from the industrial sources. The highest 1-hour ambient noise level measured was 53dBL_{Aeq,1h}.

Vibration Measurements

- 4.15 Vibration levels were measured by AEC between approximately 1355 and 1515h on 25 November 2020. The transducers for the vibration monitoring system were installed at the location of the nearest proposed property within the development to the railway line, approximately 25m away.
- 4.16 Based on the train timetable and trains observed during the measurement period, it was considered that the vibration survey made reference to each train type (passenger and freight) that would typically use the railway line.
- 4.17 Three measurement periods were undertaken within the survey; the number and type of train movement is presented in Table 4.2, below, along with the VDV for each measurement period and the highest PPV levels measured on-site.

Table 4.2 – Measured Vibration Levels on Site

Period	Duration, hhmm	$VDV_{period}, m/s^{1.75}$ Measurement direction			PPV, mm/s
		x	y	z	
1 (4 Passenger)	1356 - 1426	0.0013	0.0010	0.0039	0.11
2 (5 Passenger & 1 Freight)	1430 - 1500	0.0014	0.0013	0.0058	0.12
3 (2 Passenger & 1 Freight)	1500 - 1515	0.0007	0.0007	0.0037	0.07

5.0 ASSESSMENT OF NOISE LEVELS

- 5.1 As identified above, there are three noise sources affecting the proposed development site; road traffic from Vine Street to the east, industrial noise associated with the units to the west, and railway noise from the north. Noise from these sources are assessed separately below.

Road Traffic Noise

- 5.2 The daytime ambient noise levels affecting the development as a result of road traffic on Vine Street has been determined using the calculation method presented in Section 3 of CRTN to convert the arithmetic average of the three consecutively measured L_{A10} noise levels, into an overall 16-hour L_{Aeq} noise level.
- 5.3 At night, based on AEC's experience of road traffic on similar streets to Vine Street, ambient noise levels are typically lower in the period between 2300 and 0500h. Therefore, night time noise levels were measured during 0500 and 0700 hours, and the highest ambient and maximum noise level measured during this period has been used in the assessment.
- 5.4 Based on the above, the daytime ambient and night-time ambient and maximum noise levels affecting the development have been determined and are presented on Figure 5.2, below.

Industrial Noise

- 5.5 As identified in Section 4, the daytime ambient noise level measure at Location B was consistently around $47\text{dB}L_{Aeq}$ due to a combination of noise from the industrial units and road traffic. At a similar location RS Acoustic Engineering Ltd measured a 1-hour ambient noise level of $53\text{dB}L_{Aeq,1h}$ due to industrial sources.
- 5.6 Due to the uncertainty regarding which units were operating due to the Covid-19 pandemic, the assessment of noise from the industrial units has been based on the previously measured ambient noise level of $53\text{dB}L_{Aeq,1h}$.
- 5.7 The daytime BS4142 assessment of industrial noise on the nearest properties is presented in Table 5.1, below.
- 5.8 A +3dB correction has been applied due to the distinctive nature of the industrial noise on the noise climate.
- 5.9 As stated in Section 2, a 2.5m high close boarded timber barrier has been proposed for the western elevation, between the development and the industrial units. Calculations indicate that based on a source height of 1m and a receiver height of 1.5m, the barrier would provide acoustic attenuation of around -14dB. This has been incorporated into the calculation below.

Table 5.1 – BS4142 Assessment for Properties on Western Boundary

Description	Noise Levels	Comments
Measured Ambient Noise Level	53dB _{LAeq,15min}	Measured specific noise level
Residual Sound	45dB _{LAeq,15min}	Measured with the specific source not audible
Typical Background Sound Level	43dB _{LA90,15 min}	Measured with the specific source not audible at Location B
Specific Sound	53dB _{LAeq,15min}	Specific noise level
Acoustic feature correction	+3dB	The noise source is distinctive
Barrier Attenuation	-14dB	Provided by the 2.5m high close boarded timber barrier
Rating Level	$(53 + 3 - 14) = 42\text{dB}_{LA_{Ar,Tr}}$	
Excess of rating over background sound level	$(42 - 43) = -1\text{dB}$	
The assessment indicates a low likelihood of an adverse impact		
Uncertainty of the assessment		This is discussed in detail below.

- 5.10 The industrial noise level used in the BS4142 assessment is based on an ambient noise level measured on-site 7 years ago. However, due to the Covid-19 pandemic it is considered that the noise level measured by AEC is not representative of the noise climate during normal working conditions.
- 5.11 Taking this into account, the BS4142 assessment indicates that the rating noise level would be -1dB below the existing background noise level, this is an indication that the specific noise would have a low impact. It should also be noted that the rating noise level would be significantly below the BS8233 desired ambient noise level limit in gardens of 50dB_{LAeq,16h}.
- 5.12 The daytime ambient noise level determined above is presented on Figure 5.1, below.

Railway Noise

- 5.13 The external daytime and night-time ambient noise levels as a result of the railway movements have been calculated based on the sound exposure levels measured from individual train pass bys, the number of train movements during both periods, and distance attenuation.
- 5.14 The night-time maximum noise levels have been based on the highest maximum noise level measured of a train-pass by during the daytime measurement period.
- 5.15 The calculated external ambient and maximum noise levels included acoustic attenuation provided by the proposed 3m high barrier along the northern boundary of the site.

Calculations indicate that this would provide around 15dB and 7dB of attenuation to the ground and first floor rooms respectively.

5.16 These calculated noise levels have also been presented on Figure 5.1, below.

Assessment of Calculated External Noise Levels

5.17 Based on the above assessments, the determined daytime ambient and night-time ambient and maximum noise levels external to each elevation due to road traffic, industrial activities and train movements is presented in Figure 5.1 and Table 5.2, below.

Figure 5.1 – Calculation External Noise Levels

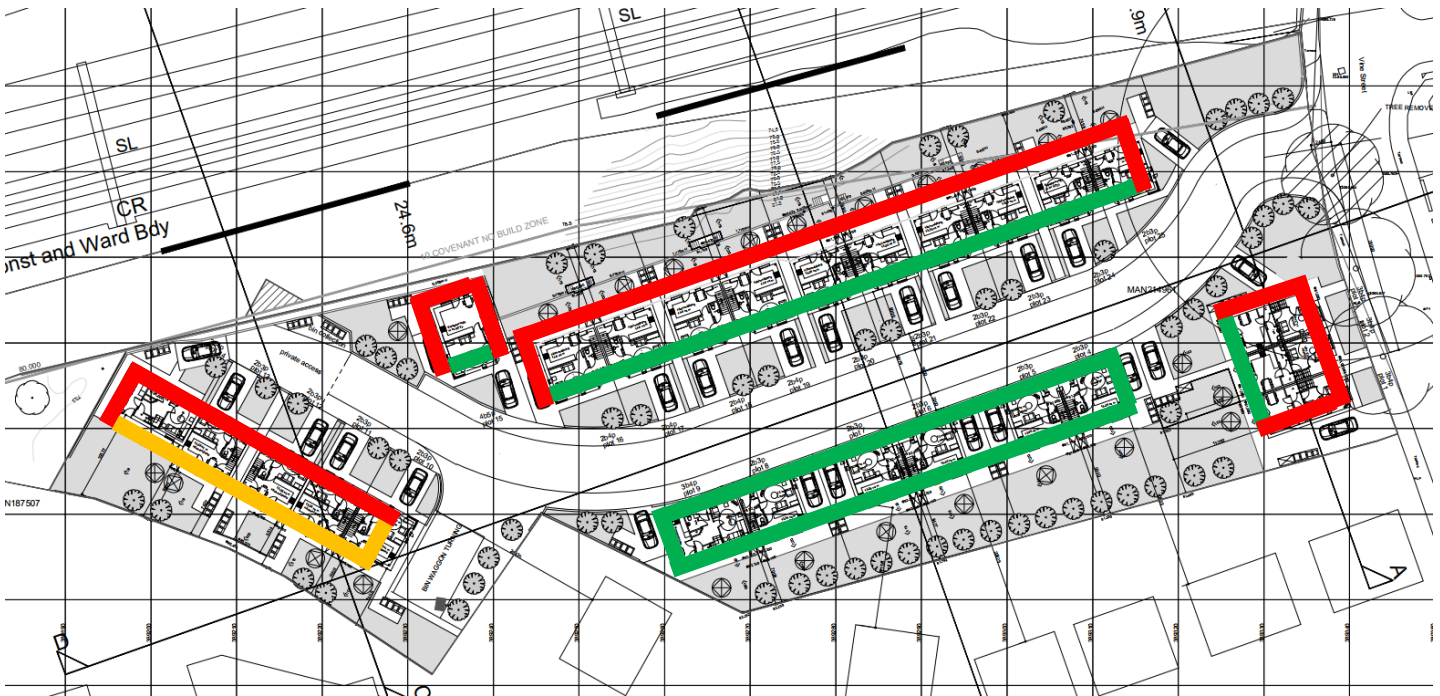


Table 5.2 – Determined Daytime and Night-time Noise Levels

Elevation	Noise Levels, dB		
	Daytime, Ambient $L_{Aeq,16h}$	Night-time	
		Ambient, $L_{Aeq,8h}$	Maximum $L_{Amax,F}$
	≤ 52	≤ 50	≤ 72
	≤ 45	≤ 40	≤ 65
	≤ 40	≤ 40	≤ 60

Internal Noise Levels with Whole Dwelling Ventilation

- 5.18 As identified earlier, the allowable external noise levels for properties with windows open for ventilation purposes is $50\text{dBL}_{\text{Aeq},16\text{h}}$ during the daytime, and $45\text{dBL}_{\text{Aeq},8\text{h}}$ and $60\text{dBL}_{\text{Amax},\text{F}}$ at night.
- 5.19 A comparison between these levels and the noise levels presented in Table 5.2, indicates that whole dwelling ventilation can be provided by a partially opened window to the habitable rooms on the Green elevations during both the daytime and night-time periods and the Orange elevations during the daytime. Windows would need to be closed on all other elevations during the day and night and alternative means of ventilation provided.
- 5.20 Mitigation measures are discussed in Section 7.

Control of Overheating

- 5.21 If it is determined by others that there is a need to control overheating within this development, this could be supplied by opening windows to provide comfort cooling for the control of overheating.
- 5.22 Based on the above, a mechanical ventilation system is not required and as such, AEC would propose that whole dwelling ventilation is provided via the use of acoustic trickle vents. Mitigation measures are discussed in Section 7.

Noise Levels within Gardens

- 5.23 Based on the noise levels presented in Table 5.2, within all garden locations, noise levels within gardens would not exceed the BS8233 limit of $50\text{dBL}_{\text{Aeq},16\text{h}}$, within external amenity areas.
- 5.24 Therefore, the noise level in gardens would meet MCC's requirement for noise in external amenity spaces.

6.0 VIBRATION ASSESSMENT

- 6.1 Using the guidance in BS6472, the measured VDV values in Table 3.2, and the expected number of trains on the line during the day and night periods, the full 16-hour day and 8-hour night-time VDV values have been calculated. Table 6.1, below, compares the highest calculated 16-hour daytime and 8-hour night-time VDV values against the guidance provided in BS6472:2008.

Table 6.1 – Calculated 16-Hour Daytime and 8-Hour Night-time VDV Levels Compared to BS 6472 Guidance

VDV period	VDV, m/s ^{1.75}			
	Measurement direction*			BS 6472 “Low probability of adverse comment”
	x	y	z	
Day (0700 – 2300)	0.003	0.003	0.014	0.2 to 0.4
Night (2300 – 0700)	0.002	0.003	0.010	0.1 to 0.2

x - parallel to track y - perpendicular to track z – vertical

- 6.2 Table 6.1 demonstrates that the highest measured 16-hour and 8-hour VDV levels are significantly below the levels where there is a low probability of adverse comment.
- 6.3 It is possible that amplification of vibration can occur on suspended timber floors. However, even allowing for amplification of factor of 4, the VDV levels would be comfortably below the levels where there is a low probability of adverse comment.
- 6.4 The PPV levels measured on-site did not exceed 0.2mm/s, which is acceptable in terms of avoiding any potential damage to proposed buildings.
- 6.5 N.B. Please notify AEC if the building foundation design requires piling or deep foundations into harder substrate / rock layers. This may introduce a different vibration transmission path and check measurements may be advised.

7.0 MITIGATION MEASURES

- 7.1 As previously stated, based on the calculated noise levels, all elevations apart from habitable rooms on the Green elevations during both the daytime and night-time periods and the Orange elevations during the daytime would need their windows to be kept closed and alternative means of whole dwelling ventilation would need to be provided.
- 7.2 The sound insulation performance of the glazing and ventilator, necessary to meet the internal noise level requirements, have been calculated based on the spectrum noise data measured on-site and the room sizes and the approximate glazing areas presented on the architectural drawings provided to AEC. These sound insulation performances are presented in Table 7.1, below.

Table 7.1 – Outline Requirements of Glazing and Ventilation to Achieve Internal Noise Levels in Habitable Rooms

Elevation Colour (Figure 2 & 3)	Sound Insulation Performance			
	Daytime		Night-Time	
	Glazing	Ventilator	Glazing	Ventilator
	29dBR _w / 25dBR _w + C _{tr}	33dBD _{ne,w}	41dBR _w / 35dBR _w + C _{tr}	38dBD _{ne,w}
	29dBR _w / 25dBR _w + C _{tr}	33dBD _{ne,w}	29dBR _w / 25dBR _w + C _{tr}	33dBD _{ne,w}

- 7.3 Please note that while it is not a requirement, it is understood that green elevation will have standard glazing and standard trickle vents.
- 7.4 Example glazing build-ups to achieve the required sound insulation performances are presented in Table 7.2, below.

Table 7.2 – Example Glazing Constructions

Sound Insulation Performance	Example Construction
41dBR _w / 35dBR _w + C _{tr}	6mm Glass / 16mm Argon / 8.8mm Optiphon
29dBR _w / 25dBR _w + C _{tr}	4mm Glass / 6 – 16mm Cavity / 4mm Glass

- 7.5 Prior to any glazing being installed, octave band sound insulation performance data of the glazing build-ups and ventilators selected must be verified by AEC or others.
- 7.6 Windows can be openable for purge ventilation providing that they are effectively acoustically sealed when closed and it is important that any frames and seals do not downgrade the sound insulation performance of the glazing.
- 7.7 All ventilation requirements have been based on the use of a single vent per room. If more than one unit is required, such as may be required to satisfy Building Control requirements, the performance of each unit might need to increase.

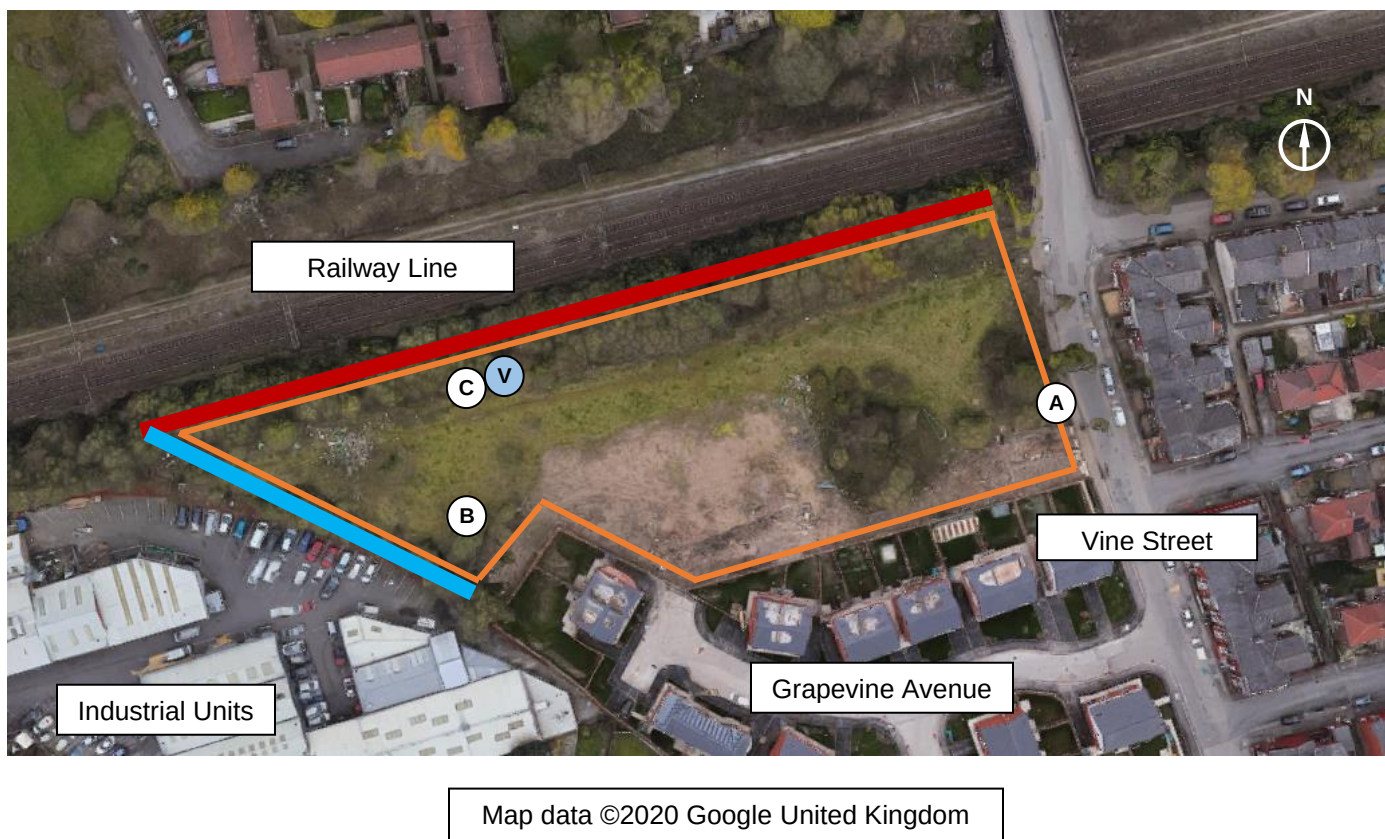
- 7.8 With regard to the other façade elements (walls and roof) these should be constructed such that the on-site sound insulation performance ($\text{dB } R'_w$) is at least $50\text{dB}R'_w$. This is not an overly onerous requirement for external walls and would be readily achieved by standard cavity wall constructions. This performance would also be met by a typical pitched roof construction with suitable ceiling. This will require further development at the design stage and advice from an acoustic consultant should be sought.

8.0 CONCLUSION

- 8.1 Acoustic and Engineering Consultants Limited (AEC) has been instructed by Kirkland Developments Ltd to undertake a noise and vibration assessment of the proposed development location on land off Vine Street, Gorton.
- 8.2 The development will be comprised of 25 residential properties with associated gardens. There will be a 2.5m high and 3.0m high close boarded timber barrier located along the northern and western site boundaries, respectively.
- 8.3 An attended daytime and night-time noise level survey was undertaken by AEC on 20 October 2020, between 0500 and 1000h. Full details of the noise levels measured on-site are shown in Tables B1, B2 and B3 of Appendix B. The measurement locations are presented on Figure 1.
- 8.4 During the daytime noise level survey, railway noise from train pass bys, road traffic on Vine Street, and industrial noise from the commercial units to the west were dominating noise sources at each of the measurement locations.
- 8.5 During the night-time noise level survey, as the industrial units were not operational, only railway and road traffic noise impacted the measurements.
- 8.6 A basis of assessment for the development is presented in Section 3 for the various noise sources and vibration levels.
- 8.7 A summary of the measured daytime and night-time noise levels is presented in Table 4.1 of Section 4.
- 8.8 In addition to a noise level survey, a separate vibration survey was also undertaken by AEC on Wednesday 25 November 2020, between approximately 1355 to 1515h. This survey was carried out at a single location, representative of the nearest property to the railway line and this is shown on Figure 1.
- 8.9 A summary of the measured vibration levels is presented in Table 4.2 of Section 4.
- 8.10 Based on the noise level measurements, an assessment was carried out to determine the noise levels impacting each façade of the residential properties within the development.

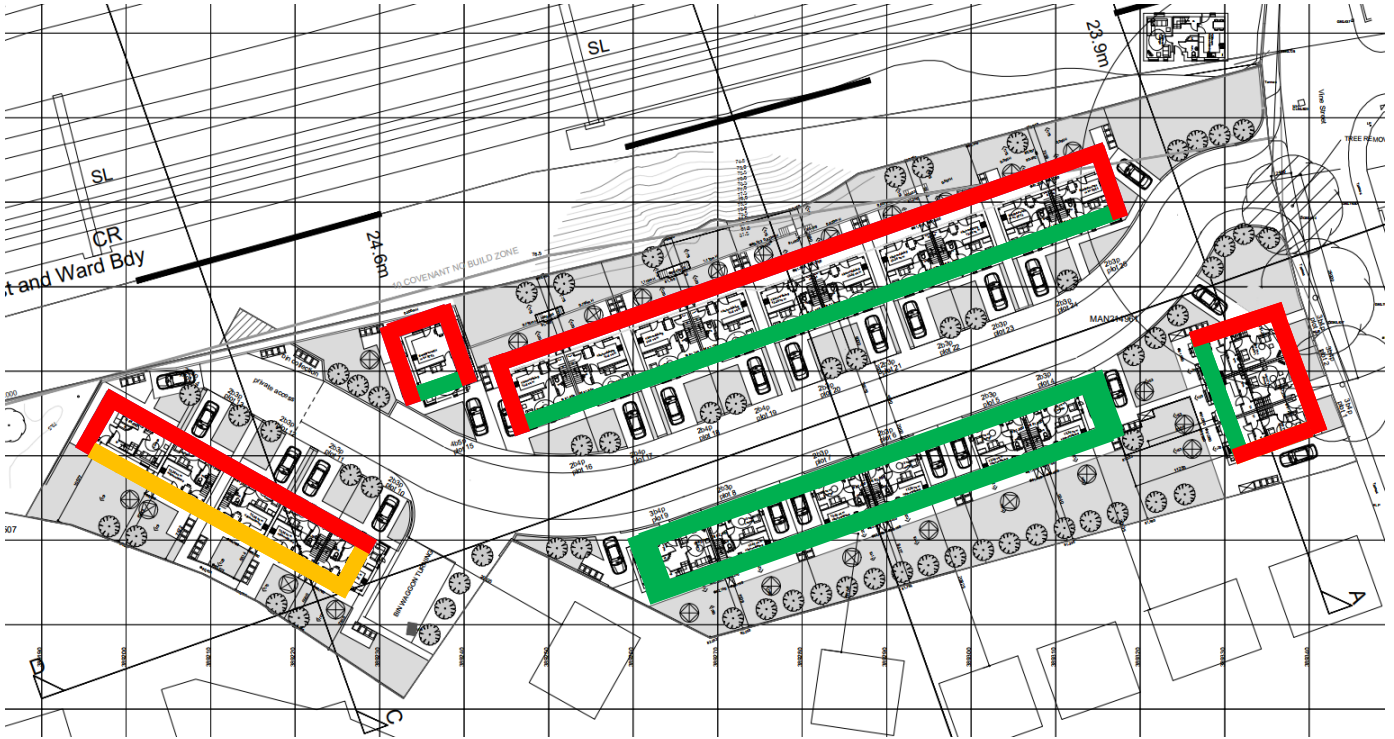
- 8.11 Depending on the type of noise source, these noise levels were determined in accordance with guidance from BS 8233:2014 '*Guidance on sound insulation and noise reduction for buildings*' and BS4142: 2014+A1:2019 '*Methods for rating and assessing industrial and commercial sound*'. The resultant noise levels external to the different elevations take into account screening, distance and barrier attenuation, where applicable, and the results are presented in Table 5.2 of Section 5.
- 8.12 In relation to the daytime BS4142 assessment, it should be noted that as the calculated rating level did not exceed the background noise level (and the level of uncertainty within the calculation methodology is low), that this would indicate that there is a low likelihood of adverse impact from the industrial units impacting the proposed residential development.
- 8.13 Based on the calculated external noise levels presented in Table 5.2, it was determined that alternative means of ventilation (to opening windows) would need to be provided to all habitable rooms in the development apart from those on the Green elevations and on the Orange elevations during the night-time periods.
- 8.14 In relation to the vibration levels measured on-site, an assessment was carried out in accordance with BS6472. This is presented in Section 6.0
- 8.15 This assessment demonstrated that the highest measured 16-hour and 8-hour VDV levels are significantly below the levels where there is a low probability of adverse comment. Furthermore, the PPV levels measured on-site did not exceed 0.5mm/s, which would be acceptable in terms of avoiding any potential damage to proposed buildings.
- 8.16 Based on the determined noise levels, mitigation measures for the development are proposed in Section 7. These mitigation measures are presented in the form of enhanced glazing and acoustic trickle vents and required on all elevations stated.
- 8.17 The required sound insulation performances of the enhanced glazing and acoustic trickle vents is presented in Tables 7.1 and 7.2 of Section 7, of which have also been reproduced on Figure 2 at the back of this report.
- 8.18 With regard to noise levels within gardens, AEC has calculated that the 16-hour ambient noise levels do not exceed the upper limit within BS8233 of 55dBL_{Aeq,16h} at any location and, therefore, should be deemed acceptable.
- 8.19 It should be noted that all barriers would need to be a close boarded timber barrier with no gaps at the base with a minimum mass per unit area of 12kg/m² or a proprietary noise barrier product.
- 8.20 Based on the mitigation measures in Section 6 being implemented correctly, external and internal noise levels would be controlled to suitable levels and, therefore, noise should not be considered a determining factor in relation to any planning permission being sought.

FIGURE 1 – Existing Site Showing Monitoring Locations



- 3m High Close Boarded Timber Barrier
- 2.5m High Close Boarded Timber Barrier

FIGURE 2 – Glazing & Ventilation Strategy



Elevation	Noise Levels, dB		
	Daytime, Ambient $L_{Aeq,16h}$	Night-time	
		Ambient, $L_{Aeq,8h}$	Maximum $L_{Amax,F}$
	≤ 52	≤ 50	≤ 72
	≤ 45	≤ 40	≤ 65
	≤ 40	≤ 40	≤ 60

Elevation Colour (Figure 2 & 3)	Sound Insulation Performance			
	Daytime		Night-Time	
	Glazing	Ventilator	Glazing	Ventilator
	$29dBR_w / 25dBR_w + C_{tr}$	$33dBD_{ne,w}$	$41dBR_w / 35dBR_w + C_{tr}$	$38dBD_{ne,w}$
	$29dBR_w / 25dBR_w + C_{tr}$	$33dBD_{ne,w}$	$29dBR_w / 25dBR_w + C_{tr}$	$33dBD_{ne,w}$

APPENDIX A – Acoustic Terminology in Brief

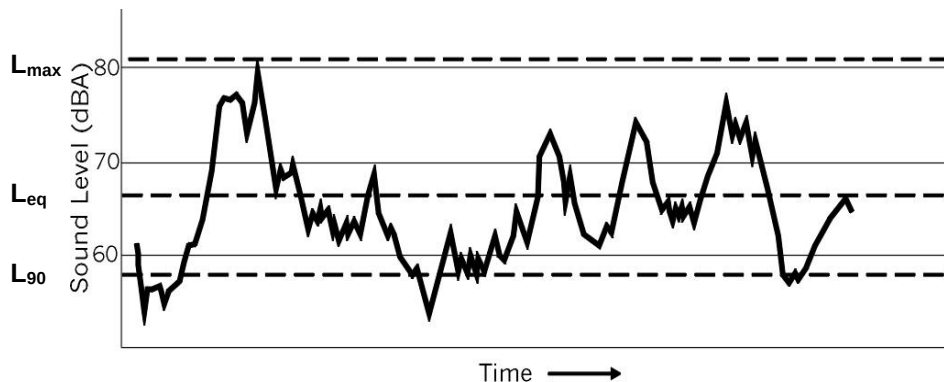
Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air. The rate at which the pressure fluctuations occur determines the pitch or *frequency* of the sound. The frequency is expressed in Hertz (*Hz*), that is, cycles per second. The human ear is sensitive to sounds from about 20 Hertz to 20,000 Hertz. Although sound can be of one discrete frequency - a 'pure tone' - most sound is made up of many different frequencies.

The human ear is more sensitive to some frequencies than others, and modern instruments can measure sound in the same subjective way. This is the basis of the A-weighted sound pressure level *dBA*, normally used to assess the effect of noise on people. The *dBA* weighting emphasises or reduces the importance of certain frequencies within the audible range.

Sound Units

In order to assess environmental noise, measurements are carried out by sampling over specific periods of time, such as fifteen minutes or one hour, the statistically determined results being used to quantify various aspects of the sound.

The figure below shows an example of sound level varying with time. Because of this time variation the same period of sound can be described by several different levels. The most common of these are described below. It should be noted that in many instances in the main body of text, the unit will be preceded by a *dB* descriptor in the report e.g. $L_{Aeq,T}$ could be written $dB L_{Aeq,T}$



Example of Sound Level Varying With Time

$L_{Aeq,T}$	The equivalent continuous (A-weighted) sound level. It may be thought of as the "average" sound level over a given time, <i>T</i> . It is used for assessing noise from various sources: industrial and commercial premises, construction sites, railways and other intermittent noises and can be considered as the "ambient" noise level.
$L_{A1,T}$	The (A-weighted) sound level exceeded for 1% of a measurement period. It is the value generally used to indicate a 'typical' maximum noise level.
$L_{A10,T}$	The (A-weighted) sound level exceeded for 10% of a measurement period. It is the value often used to describe traffic noise.

L_{A90,T}	The (A-weighted) sound level exceeded for 90% of a measurement period. It is the value often used to describe background noise.
L_{Amax}	The maximum (A-weighted) sound level measured during a given time. 'Fast' or 'Slow' meter response should be cited.
L_{AE}	The sound exposure level is a notional noise level and describes the average L _{Aeq} noise level of an event over a given time period as if it occurred during a one second period. This allows the L _{Aeq} to be determined over a time period with a number of distinct events.
Free-field Level	This refers to the sound level measured outside, away from reflecting surfaces.
R_w	Single number rating used to describe the <u>laboratory</u> airborne sound insulation properties of a material or building element over a range of frequencies, typically 100-3150Hz.
VDV	Vibration Dose Value is a single number value and provides a convenient measure of the cumulative vibration received by a person during a measurement period. The measurement units are m/s ^{1.75} .
PPV	Peak particle velocity is the maximum velocity value of a vibration event during a measurement period. The measurement units are mm/s
D_{n,e,w}	Weighted element-normalised level difference. Single number rating used to describe the sound insulation performance.

APPENDIX B – Noise & Vibration Survey Details

Date & Time of Survey:	Noise Survey: Friday 20 October 2020, 0500 to 1000h Vibration Survey: Wednesday 25 November 2020, 1355 to 1515h						
Personnel:	Ross Chamberlain (AEC).						
Equipment Used:	Noise Survey: B&K 2250 Real Time Analyser (AEC Kit 1) Vibration Survey: 01dB Orion Smart Vibration Monitoring Terminal						
Calibration:	The sound level analysers, which conforms to BS EN 61672-1: 2003 ‘ <i>Electro acoustics – sound level meters - Part 1 Specifications</i> ’ for Class 1 Type Z meters, was in calibration and check calibrated before and after the measurement periods using a Brüel & Kjær type 4231 (94dB) calibrator. There was no significant drift of calibration. Calibration certificates are available on request. Calibration certificates for the equipment used during the vibration survey are available upon request.						
Weather Conditions:	Survey	Date	Period	Wet/Dry	Temp°C	Wind Speed & Direction	Cloud Cover
	Noise	20/10/20	Night	Dry	10°C	Negligible wind speed & direction	40%
		20/10/20	Day	Dry	15°C		20%
	Vibration	25/11/20	Day	Dry	6°C		5%
Measurement Locations:	Noise Survey: Measurements were undertaken at three locations around the development site. Identified as A to C on Figure 1 and described below. A – 5m away from the edge of Vine Street B – 10m from the edge of the western site boundary C – at the edge of the proposed northern site boundary Vibration Survey: Measurements were undertaken at a single location at the development site, identified as V on Figure 1 and described below. V – At a location representative of the northern most property within the development.						
Measurement Details:	Noise Survey: Measurements were undertaken over various periods in terms of L _{eq} , L ₁₀ , L ₉₀ , and L _{max} . Vibration Survey: Measurements were undertaken over various periods in terms of PPV and VDV.						
Façade / Free-Field:	A, B and C – Free-field						
	Full results for the noise measurements are given in Tables B1 and B2.						
Measured Data:	Full octave band centre frequency data was obtained for all measurements.						

TABLE B1 – Measured Daytime Noise Levels

Location	Period, h	Noise Level, dB				Comments
		L _{Aeq}	L _{A10}	L _{A90}	L _{Amax, F}	
A	0700 – 0715	51.3	54.7	42.7	67.2	Noise levels due to train pass bys and road traffic. Maximum noise levels due to car pass bys on Vine Street.
	0800 – 0815	51.5	53.8	42.8	67.2	
	0900 – 0915	52.0	54.2	43.3	68.2	
B	0719 – 0734	46.8	49.1	43.7	63.6	Noise levels due to distant road traffic. Noise from industrial sites just audible – including sound similar to hammering. Maximum levels due to industrial site. Measurement between 0819 and 0834 did not include industrial noise.
	0819 – 0834	45.0	46.8	42.9	59.2	
	0918 – 0933	47.4	49.1	43.4	61.5	
C	0736 – 0743	46.5	47.2	45.3	54.7	All measurements taken with train pass-bys paused out, apart from 0635 – 0643 measurement. In absence of trains, noise levels were due to distant road traffic. Maximum noise levels due to road traffic.
	0744 – 0748	47.1	48.1	45.7	56.6	
	0835 – 0837	46.3	47.2	45.0	54.2	
	0838 - 0848	47.0	48.7	45.1	57.9	

TABLE B2 – Measured Night-Time Noise Levels

Location	Period, h	Noise Level, dB			Comments
		L _{Aeq}	L _{A90}	L _{Amax, F}	
A	0500 – 0515	46.1	38.9	64.5	Noise levels due to train pass bys and road traffic. Maximum noise levels due to car pass bys on Vine Street.
	0600 – 0615	50.4	41.3	71.8	
B	0520 – 0535	41.7	39.9	55.9	Noise levels due to distant road traffic. No noise from industrial sites. Maximum levels due to birdsong.
	0619 – 0634	44.1	42.9	56.5	
C	0536 – 0543	42.9	41.5	56.3	All measurements taken with train pass-bys paused out, apart from 0635 – 0643 measurement. In absence of trains, noise levels were due to birdsong and distant road traffic. Maximum noise levels due to birdsong.
	0544 – 0551	44.1	42.7	55.8	
	0635 – 0643	51.1	44.3	70.6	
	0645 - 0650	44.9	44.0	52.5	

TABLE B3 – Measured Sound Exposure Levels

Duration, s	Train Type	Noise Level, dB	
		LAE	L _{Amax,F}
8	Freight	84	77
10	Passenger	67	60
9		80	73
9		67	60
7		79	73
4		80	76
4		76	73
9		70	63
7		80	73
14		78	72