SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990

Acoustic Report

Proposed Residential Development, near the Foremans Centre, Headcorn, Kent

Prepared by

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Appendices

1.0 Introduction

1.1 Sharps Redmore (SR) has been instructed to provide an acoustic planning assessment of a proposed residential development on land to the south of the Foremans Centre car park and the High Street in Headcorn, Kent. The site is directly adjacent to the South Eastern railway line.

1.2 This proposal is for five residential properties all with ground floor living, dining and kitchen areas and first floor bedrooms. This report addresses noise and vibration intrusion to the scheme.

1.3 The site is presently a private car park. To the north and east are residential properties. In close proximity to the south is a three track railway line, with trains passing between Dover Priory, Ashford and London on the South Eastern mainline. Directly to the east is the Headcorn station and car park. To the west is a nature area and village hall.

1.4 Section 2 of the report outlines relevant noise guidance policy. Sections 3 and 4 provides the findings of the noise and vibration surveys and respective assessments, and Section 5 concludes the report.

1.5 Appendix A indicates the proposed site with measurement locations and a sketch of the scheme. Appendix B provides acoustic terminology used in the report.

2.0 Guidance Criteria

National Policy

2.1 The National Planning Policy Framework (NPPF), July 2021, sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 185 of the NPPF states the following:

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

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

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

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".

2.2 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in the table below.

Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate ad reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. 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.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.3 The NPPF and NPPG reinforce the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

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

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

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

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

2.5 Taking an overview of national policy aims and guidance it is clear that when considering the impact of noise that the fact can be heard and causes impact, is not reason to refusal an application as consideration should also be given to the significance of the impact and the mitigation measures available.

2.6 It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

i) The effect may be determined by reference to guideline noise values, such as those contained in the World Health Organisation (WHO) "*Guidelines for Community Noise"*.

ii) Alternatively, the impact may be determined by considering the change in noise level that would result from the proposal, in an appropriate noise index for the characteristic of the noise in question. There are various criteria linking change in noise level to effect. This is the method that is suited to, for example, the assessment of noise from road traffic because it is capable of displaying impact to all properties adjacent to a road link irrespective of their distance from the road.

iii) Another method is described within BS 4142:2014 to determine the significance of sound impact from sources of industrial and/or commercial nature. The sources that the newly revised standard is intended to assess are sound from industrial and manufacturing processes, sound from fixed plant installations, sound from loading and unloading of goods at industrial and/or commercial premises and the sound from mobile plant and vehicles, such as forklift, train or ship movements.

ProPG: Planning & Noise (2017)

2.7 On 22nd June 2017, a professional practice guidance document (ProPG) was launched to provide practitioners with guidance on evaluating the potential impact of existing (predominantly transportation) noise on new residential development. This has been joint produced by the Chartered Institute of Environmental Health (CIEH), Institute of Acoustic (IOA) and Association of Noise Consultants (ANC).

2.8 The primary goal of the ProPG is to assist in the delivery of sustainable development by promoting good health and well-being through the effective management of noise. The ProPG recommends a 2 stage approach, an initial noise risk assessment of the proposed development and where the results indicate that noise requires further consideration a full assessment in the form of an Acoustic Design Statement (ADS) which would include four key elements as follows:

- Stage 1: An initial noise risk assessment of the proposed development site;
- Stage 2: A systematic consideration of four key elements

A table is provided for the Initial Stage 1 risk assessment, replicated below:

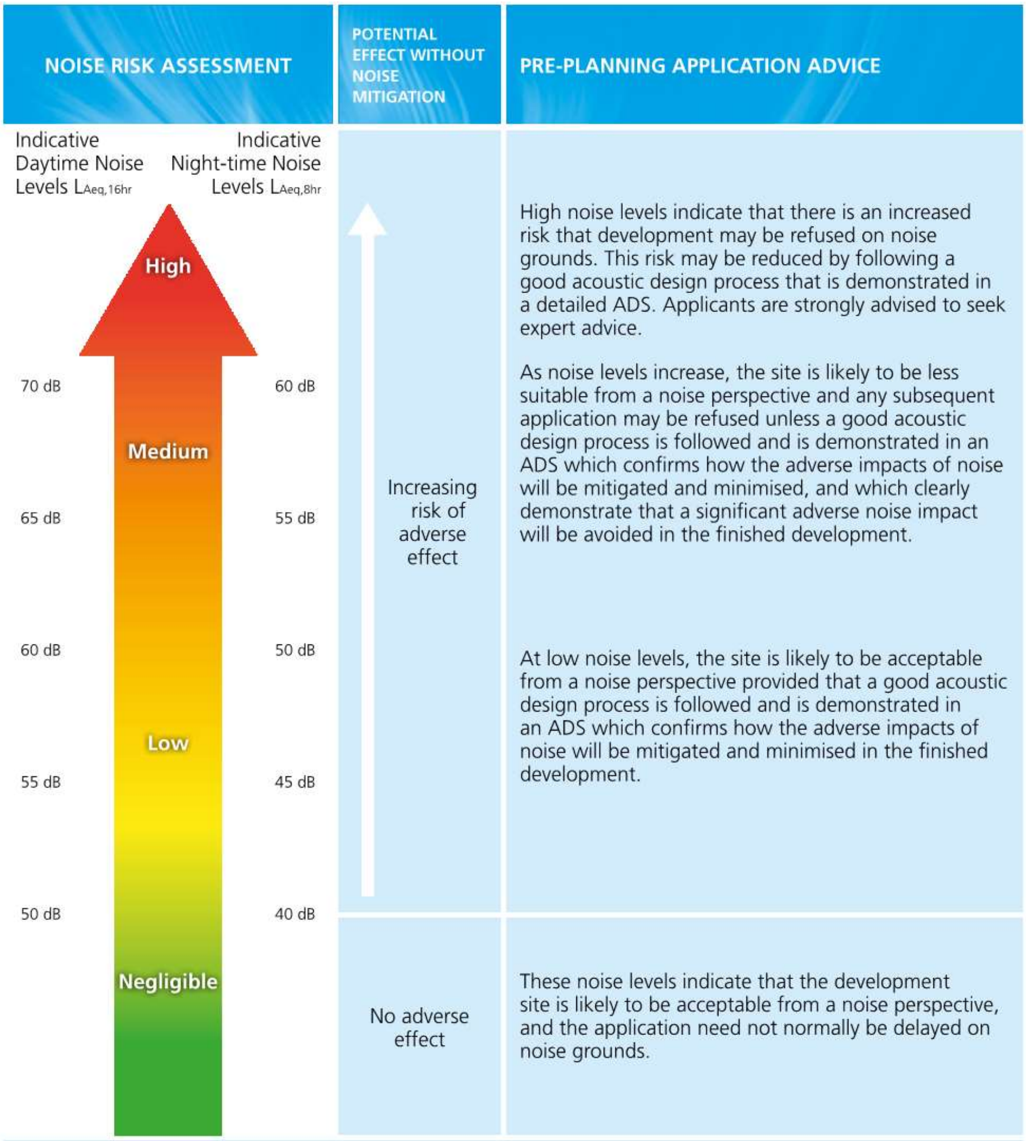


Figure 1 Notes:

a. Indicative noise levels should be assessed without inclusion of the acoustic effect of any scheme specific noise mitigation measures.

b. Indicative noise levels are the combined free-field noise level from all sources of transport noise and may also include industrial/commercial noise where this is present but is "not dominant".

c. $L_{Aeq,16hr}$ is for daytime 0700 – 2300, $L_{Aeq,8hr}$ is for night-time 2300 – 0700.

d. An indication that there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB means the site should not be regarded as negligible risk.

Figure 1. Stage 1– Initial Site Noise Risk Assessment

2.9 The four key elements to be undertaken in parallel during Stage 2 of the recommended approach are:

- Element 1: Demonstrating a *"Good Acoustic Design Process"*
- Element 2: Observing internal *"Noise Level Guidelines"*
- Element 3: Undertaking an *"External Amenity Noise Assessment"*
- Element 4: Consideration of *"Other Relevant Issues"*

2.10 The advice contained within ProPG is based on the policy objectives contained within the NPPF and the objective noise guidelines within British Standard 8233:2014 *'Guidance on sound insulation and noise reduction for buildings'*.

2.11 Paragraph 1.3 of ProPG 2017 states:

> *"The scope of this ProPG is restricted to the consideration of new residential development that will be exposed predominantly to airborne noise from transport sources (noting that good professional practice should have regard to any reasonably foreseeable changes in existing and/or new sources of noise)."*

2.12 It is then stated:

> *"… detailed consideration of … other sources of noise (such as dominant noise from industrial, commercial or entertainment premises) and of ground-borne noise and vibration, is outside the scope of this document."*

2.13 This development utilises the same principles as Pro PG in terms of many aspects of good design and practice but is not applied in its fullest form here as this is a small out-of-town residential scheme, next to a transportation noise source for which Para 2.3.4 of Pro PG states:

> *Where the LPA accepts that there is a justification that the internal target noise levels can only be practically achieved with windows closed, which may be the case in urban areas and at sites adjacent to transportation noise sources, special care must be taken to design the accommodation so that it provides good standards of acoustics, ventilation and thermal comfort without unduly compromising other aspects of the living environment. In such circumstances, internal noise levels can be assessed with windows closed but with any façade openings used to provide "whole dwelling ventilation" in accordance with Building Regulations Approved Document F (e.g. trickle ventilators) in the open position. (See supplementary Document 2) Furthermore in this scenario the internal LAeq target noise levels should not generally be exceeded.*

Design Guidance for Internal & External Noise Limits

2.14 The current nationally recommended internal noise levels for dwellings are given in BS 8233:2014 'Guidance on Sound Insulation & Noise Reduction for Buildings'. BS 8233 recommends the following internal noise standards:

Guideline noise values

BS 8233:2014 Table 4 – Indoor ambient noise levels for dwellings			
Activity	Location	0700 to 2300	2300 to 0700
Resting	Living room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

2.15 The previous version (1999) of BS 8233 contained two guidelines for internal criteria; good and reasonable. The difference between the good and reasonable criteria was 5 dB. Whilst the 5 dB relaxation in noise criteria is not specifically referred to in the table above (the latest version), Note 7 advises that "where development is considered necessary or despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved."

2.16 There is no longer a L_{AMAX} standard for bedrooms In BS 8233. However, footnote 4 to Table 4 states that "Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values." In this case, it is proposed that the previous BS 8233 internal standard (also referenced in World Health Organisation Guidelines for Community Noise) is applied. This is 45 dB L_{AMAX}, inside bedrooms.

2.17 In respect to external amenity spaces Para. 7.7.3.2 of BS 8233 states:

> *For traditional external areas that are used for amenity, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB LAeq,T, with an upper guideline value of 55 dB LAeq,T. which would be acceptable in noisier environments. However, it is recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, 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, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity space, but should not be prohibited.*
>
> *Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations specification of noise limits is not necessarily appropriate. Small balconies may be included for such uses as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, design to achieve the lowest practicable levels. Achieving levels of 55 dB LAeq,T or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space*.

Design Guidance for Ground Borne Vibration Limits

2.18 The scheme is closely located to the railway lines to the south and hence vibration and has also been considered. In respect to national vibration guidance this can be considered against various parameters, such as acceleration, peak particle velocity and vibration dose values; we note:

- BS 6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting*' provides guidance as to vibration to vibration acceleration weightings and limits and vibration dose values.

- Paragraph 3.3, states in regards to human threshold of perception:

  > *"Perception thresholds for continuous whole-body vibration vary widely among individuals. Approximately half the people in a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2. The weighting used is W_b. A quarter of the people would perceive a vibration of 0.01 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.02 m/s^2 peak or more. Perception threshold are slightly higher for vibration duration of less than about 1s."*

- *Peak Particle Velocity:* Guidance as to the effects of vibration levels in terms of peak particle velocity (PPV) are also given in BS 5228-2:2009 + A1:2014 '*Code of Practice for noise and vibration control on construction and open sites – Part 2 Vibration*'. Table B.1 states the following guideline.

BS 5228-2:2009 + A1:2014 Table B.1: Guidance on effects of vibration levels

Vibration Level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situation for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

- Vibration dose values (VDV) are stated within the document with regard to 16 hour day and 8 hour night period. Table 1 of BS 6472-1:2008 gives the following values, with respect to their probability of adverse comment, reproduced below.

BS 6472-1:2008 Table 1: Vibration dose value ranges

Place and Time	Low Probability of Adverse Comment ($m/s^{-1.75}$)	Adverse Comment Possible ($m/s^{-1.75}$)	Adverse Comment Probable ($m/s^{-1.75}$)
Residential buildings 16 hr 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

2.19 In this case the assessment ahead has considered the BS 5228 PPV criteria as the most suitable at this stage.

3.0 Noise Survey & Assessment

Survey Summary

3.1 A noise survey was undertaken during the day on Wednesday 30th March 2022. Measurements were taken at locations A & B between 11:10-13:45 hours. The measurement locations are shown in Appendix A. Location A is approximately in line with the nearest façade to the railway tracks and Location B is approximately in line with the back of the rear dwellings. The arrows show the train directions of the nearest two tracks to and from London.

3.2 Noise levels were recorded using a Norsonic 140 type 1 sound level meter which was calibrated before and after the survey with no drift in accuracy found. Weather conditions were dry, cool 8-12°C, cloud 100%, still/light from the NE (< 5m/s). The weather was considered suitable measurement.

3.3 Overall the noise environment is dominated by distant road traffic, birdsong and the intermittent trains arriving and departing the station. When no trains are occurring the ambient noise levels during the day are typically between 47-51 dB L_{Aeq}. A summary of the ambient, maximum and background noise levels are presented in the table below for the day period with the train activity at both locations.

Summary of ambient day-time noise environment

Location	Noise Level dB		
	$L_{Aeq,T}$	L_{AFMax}	$L_{A90,T}$
A	47 – 57	61 – 81	37 – 43
B	47 – 50	70 – 72	39 – 42

3.4 Specific measurement of train activity was taken from each location. are summarised in Table below in terms of their $L_{Aeq\ (event)}$, L_{Amax} and L_{AE}. The latter are equivalent 1 second noise events, sometimes termed SEL.

Summary of train events

Location	Direction	Noise Level dB		
		$L_{Aeq,T}$	L_{AFMax}	L_{AE}
A	To London	67 – 71	75 – 76	82 – 83
	From London	69 – 71	77 – 82	83 – 85
B	To London	59	65 – 67	72 – 73
	From London	57 – 59	63 – 64	73

3.5 Location B, at the back of the site, generally has noise levels 10 dB below the noise levels measured at Location A, indicating the noise is decaying more as a moving point source rather than a line source. The L_{AE} results are used to calculate the 16 hour daytime and 8 hour night-time $L_{Aeq,T}$ levels from the train events.

3.6 The main activity occurs on the closest two lines. The closest line has trains arriving at the station slowing down, whilst the further line has trains leaving the station. No public address or similar noise was heard from the station at either measurement location.

3.7 The route includes regular trains to and from London, typically 4 trains an hour. During the night-time period (23.00-07.00 hrs), trains continue until the around 1 am of the night, and begin again around 5.45 am. On a typical weekday, there are 68 trains passing the site, and 11 during the night-time period.

3.8 *Freight:* However timetables also indicate a number of freight trains occurring on the lines. None occurred during the survey. This is commonly the case as they can be regularly cancelled or time reallocated. From the 'real trains' data available the indication is there potential for a number of freight both during the day and night period and potentially of a similar order, approximately 17 trains in each period. In reality this may not be the case, as noted that they often are cancelled or slots not used. However for the purposes of assessment and for robustness this estimate has been made.

- Freight trains have therefore taken from Sharps Redmore's database of freight activity. These typically have freight train maximum of 80-84 dB $L_{Amax,f}$ at 10 metres controlled by engine noise, travelling between 7-20 mph. High frequency wheel squeal can raise this level to around 90 dBA at 10 metres.

Train Noise Impact

3.9 As noted earlier the site without the trains has noise levels in the 51 dB L_{Aeq} or less during the day-time, and anticipated in the mid-low 40 dB L_{Aeq} at night. Comparing these levels with Stage 1 initial risk assessment under ProPG, these are borderline low/negligible, where is it is stated that the site *is likely to be acceptable from a noise perspective.* This is understandable as internal noise levels with windows partially open are likely to be close to those acceptable under BS 8233, and hence more so with windows closed and any standard window ventilation system. This indicates that the scheme needs only be reviewed in regard to the impact of the trains events dwelling, and can, in effect, be considered in isolation.

3.10 Based on the number of trains, and the typical event levels of each, L_{AE}, the following formula derives the day and night-time ambient noise levels. : $L_{Aeq(16hr\ day]}$ / $_{(8\ hr\ night]}$ = L_{AE} per event +10 log (N events) – 10log(57,600 $_{[day]}$/ 28,800$_{[night]}$).

3.11 *For the passenger trains,* the measured events derive the following day and maximum values.

Derived train event L_{Aeq} day and night levels

Plot	Passenger Trains	
	Daytime dB $L_{Aeq,16hr}$	Night-time dB $L_{Aeq,8hr}$
1 (2)	54	49
3,4,5	44	39

3.12 For the Freight trains, the derived values are highly variable as the number of actual events are not known. Taking a typical time period and number of trains estimated in Para. 3.8 for both day or night, this would equate to day and night-time levels at the nearest plots of 56-59 dB L_{Aeq} respectively.

3.13 The maximum noise levels from the passenger trains affect mainly the bedrooms which are up to 82 dB L_{Amax} at the front of the site and 67 dB L_{Amax} at the rear. From the freight trains these are taken as up to 82 dB from engine noise and 90 dB L_{Amax} (from break squeal) at the front, and 72 dB (engine) at 80 dB L_{Amax} (squeal)respectively at the rear.

3.14 Calculations have been undertaken to indicate the minimum laboratory sound reduction requirements required by the building elements (primarily wall, windows and ventilators[1]) are outlined below. Due to the shape of the building, multi-variations could be calculated but these have been simplified for planning purposes to those with a view of the rail line and those without of the line.

All wall elements (non-glazed): 44 dB (R_w+ C_{tr}).

This can be achieved with a traditional cavity masonry wall or a single masonry leaf and inner and insulated boarded lining, or lightweight construction.

All roof elements with a view of the rail line (predominately pitched roof) over bedrooms shall achieve at least 48 dB (R_w + C_{tr})

This is expected to be provided only by prediction, and would expect the roof space to include a 100 mm mineral wool quilt, a dense plasterboard ceiling, and a single plywood or equivalent board as part of the roof make-up behind the timber battens.

Bedrooms (windows)

- Window elements *with* view of the train tracks: 41 dB (R_w+ C_{tr}), and at least 26 dB at 125 Hz.

(Example: glazing arrangement: 10 mm pane – 20 mm cavity – 8.4 mm pane)

- Window elements *without* a view of the train tracks: 33 dB (R_w+ C_{tr})

(Example glazing arrangement: 10.8 mm pane – 12 mm cavity – 6 mm pane)

Bedroom (Ventilators):

- Any passive ventilators through room facades *with* a view of the rail line should be acoustic wall ventilators and shall achieve at least 46 dB $D_{ne,w}$. Acoustic trickle ventilators are not suitable.

(Example: Greenwood MA3051)

- Any passive ventilators through a room facades *without* a view of the rail line should be at least 37 dB $D_{ne,w}$. This can be an acoustic wall ventilator or acoustic trickle ventilator.

1 Products/build elements shall provide laboratory test evidence of compliance in accordance with BS EN ISO 10140-2 Part:2021 and rated in accordance with BS EN ISO 717 Part 1:2020, or equivalent or superseded version of the standard.

Living rooms/dining/kitchens (windows and patio doors)

- Window and patio door elements *with* view of the train tracks: 34 dB (R_w+ C_{tr}),

  (Example: glazing arrangement: 6 mm pane – 12 mm cavity – 8 mm pane)

- Window elements *without* a view of the train tracks: 26 dB (R_w+ C_{tr})

  (Example glazing arrangement: 4 mm pane – 12 mm cavity – 4 mm pane)

Living room (Ventilators):

- Any passive ventilators through room facades *with* a view of the rail line should be acoustic wall ventilators and shall achieve at least 37 dB $D_{ne,w}$. Acoustic trickle ventilators are suitable.

- Any passive ventilators through a room facades *without* a view of the rail line should be at least 35 dB $D_{ne,w}$. This can be achieved by basic acoustic trickle ventilator and some standard ventilators.

3.15 The window and/or patio glazed door system shall be considered as a single element, with seals and frame combined, appropriate protected between frame and wall.

External Amenity Areas

3.16 The patio, private and garden areas around proposed five dwellings are subject during the day-time to levels which may vary between the high-40 dB to the mid-50 dB $L_{Aeq,\ 16\ hour}$.

3.17 As noted in Section 2, BS 8233:2014 recommends that *"it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$"*. It is recommended that the garden fences which separate the properties are at least 1.8 metres high and are a solid imperforate fence with no gaps between boards (i.e. overlapping) and underneath. This should ensure noise levels will be reduced to be below the lower guideline level at all day-time periods.

4.0 Vibration Survey & Assessment

4.1 Due to the proximity of the train tracks to the proposed development a vibration survey was also undertaken on Monday 4th April 2022. The measurements were taken with a RION VM-56 vibration meter, which allows measurements of acceleration and peak particle velocity in three axises (X, Y & Z). The monitor was positioned at both of the noise measurement locations, with X axis parallel to track and Y axis pointing towards the tracks, the Z-axis is vertical. The ground is currently paved brickwork assumed laid on top of a thin layer of hardcore or sand. No deeper foundation/build elements were available in the car park. Only passenger train passes were able to be measured.

4.2 The table below presents a summary of the peak particle velocity (PPV) vibration measured of each event, which was never more than 1 minute.

Summary of vibration measurements

Loc.	Start Time	PPV (mm/s)			Notes
		X axis	Y axis	Z axis	
A	12:03 – 12:16	0.02	0.02	0.02	Background - No trains (typical)
A	11:52	1.11	1.83	0.9	Train closest track fast pass.
	12:02	0.29	0.48	0.22	Passenger pass, far track, fast.
	12:17	0.94	1.35	0.78	1 track further out, train approaching station before hitting the sleeper.
	12:18	0.28	0.31	0.21	1 track further out train departing station clipping the sleeper area.
B	12:22 – 12:25	0.03	0.03	0.03	Background - No trains (typical)
	12:20	0.08	0.11	0.04	Close track, passenger train arriving at station, hitting the sleeper.
	12:21	0.43	0.68	0.09	Above train departing the station, sleeper in question not being passed over.
	12:26	0.11	0.16	0.11	Passenger pass, far track, fast.

4.3 As can be seen from the table above, the vibration levels with no trains activity at both locations are very low, being 0.02 and 0.03 mm/s respectively. Based on a BS 5228-2 criteria in Para 2.19 above, these are below levels of perception, as would be expected.

4.4 This indicated:

- *At Location A:* the nearest location to the tracks, with activity on the closest track the PPVs were around 0.9 – 1.8 mm/s with the Y axis being dominant. On the next track, the PPVs are between 0.8 – 1.3 mm/s, again with the Y axis being dominant. There was evidence some of the vibration amplitude was the movement of a sleeper or sleepers, As the trains move further down the tracks where the sleeper was not present the PPV's level was 0.1 – 0.3 mm/s. On the furthest tracks levels of 0.2 – 0.5 mm/s were measured during a fast pass by.

- *At Location B:* a fast pass train on the furthest track showed PPV's of 0.1 – 0.2 mm/s and on the closest track, passes showed levels between 0.4 – 0.7 mm/s with the Y axis being dominant.

4.5 Table 4 in Section 2 notes that PPVs around 0.3 mm/s might just be perceptible in residential environments and vibration around 1.0 mm/s is likely to cause complaint in residential environments.

- Therefore at the closest measurement to the building line vibration is potentially both perceptible and even cause complaint, and still perceptible at the rear of the site.

Comments

4.6 The vibration data measured at both locations indicate levels which would not be considered sufficiently low as to avoid disturbance, and these are also without freight activity which may induce higher levels. There is also the potential of ground borne noise from the higher levels.

4.7 However the measurements on a car park, without a significant connection to a foundation typical for the scheme, can produce results with a wider variability than desirable, and hence potentially a false impression of the ground-borne vibration. Therefore these measurements should be considered solely as preliminary and not a determinant in themselves.

4.8 Therefore we recommend that an approved scheme includes a planning condition which requires, prior to the superstructure being constructed, a vibration and ground borne noise assessment to be undertaken based on a sample period of measurements on a part the foundation at one or two locations, which is sufficient to measure both passenger and freight activity. Based on the findings, and if found necessary, vibration amelioration measures are included in the scheme to control to predicted levels of no more than typically 0.3 mm/s. This can also be undertaken with trial pit foundations.

5.0 Conclusions

5.1 Sharps Redmore has undertaken an environmental noise assessment for the proposed dwellings in Headcorn, Kent to determine the impact of noise and vibration on the living conditions of the potential future residents.

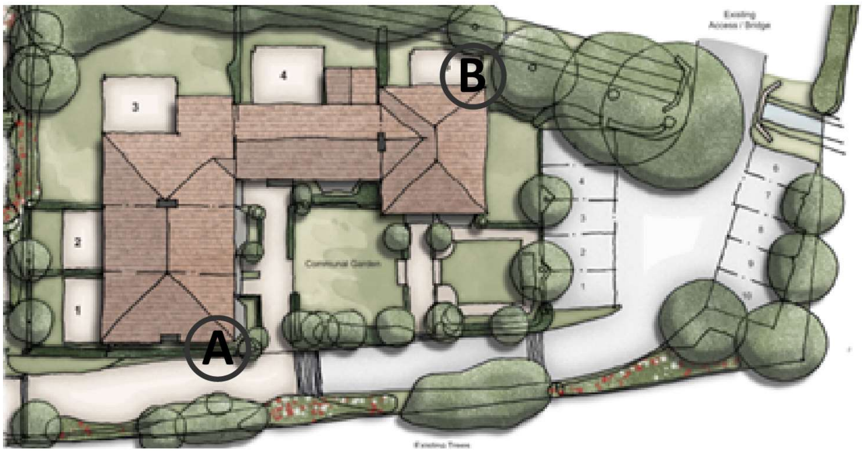
5.2 A noise survey has been carried out to measure daytime noise levels from train passes. The mitigation measures outlined Section 4 of this report are provided to meet internal and external noise guideline values in BS 8233:2014.

5.3 A vibration survey on a non-ideal surface, indicated that vibration may not be sufficiently ameliorated by the existing distance and ground conditions, and this should be subject to a further investigation as part of a planning condition. Note this would be prior to super-structure construction, i.e. with test foundations, and if shown necessary vibration amelioration measures could be included.

5.4 If the identified amelioration measures proposed are included within the scheme this is considered suitable for a conditioned planning approval.

Appendix A: Aerial View, Measurement Locations and Proposed Layout

Proposed layout of housing development (rail side to the south)



Rail line

Appendix B: Acoustic Terminology

B.1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. 50 dB + 50 dB = 53 dB. Increases in <u>continuous</u> sound are perceived in the following manner:

1 dB increase - barely perceptible.

3 dB increase - just noticeable.

10 dB increase - perceived as twice as loud.

B.2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

B.3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).

B.4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p. Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p.

B.5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.

B.6 The main noise indices in use in the UK are:

L_{A90}: The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.

L_{Aeq}: The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

L_{A10}: The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX}: The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

B.7 The sound energy of a transient event may be described by a term L_{AE} or SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = L_{AE} + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

B.8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance from a point source. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \text{ Log } {}^{160}/{}_{10} = 60 - 24 = 36 \text{ dB.}$$