

11 Noise and Vibration

Introduction

- 11.1 This Chapter has been prepared by dBx Acoustics Ltd and assesses the likely significant effects of the Proposed Development with respect to Noise and Vibration. This chapter also describes the methods used to assess the effects; the baseline conditions currently existing at the Site and surrounding area; the mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted.
- 11.2 Appendix 11.1 provides a glossary of acoustic terminology.
- 11.3 Appendix 11.4 provides details of the environmental noise and vibration survey carried out at the site.

Assessment Methodology

Legislation and Planning Policy Context

- 11.4 The relevant legislation and planning policy applicable to the noise and vibration impact assessment is listed below. Full details are provided within Appendix 11.2 to this report.
- Control of Pollution Act 1974;
 - Environmental Protection Act 1990;
 - Noise Policy Statement for England (NPSE) 2010;
 - National Planning Policy Framework (NPPF) 2018;
 - Reading Station Area Framework 2010;
 - Reading Borough Council Local Development Framework Sites and Detailed Policies 2012 with 2015 alteration;
 - Reading Borough Council Local Development Framework Core Strategy Jan 2008 with 2015 alteration;
 - Reading Borough Local Development Framework Reading Central Area Action Plan to 2026, 2009.

Relevant Guidance

- 11.5 The following guidance documents are applicable to the noise and vibration impact assessment. Further information is supplied in Appendix 11.3.
- World Health Organisation 'Environmental Noise Guidelines for the European Region' (2018);
 - BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' (BS8233);

- BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' (BS4142);
- BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites, Part 1, Noise' (BS5228-1);
- BS 5228, 2009: 'Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration' (BS5228-2).
- BS 6472:2008 – 'Guide to evaluation of human exposure to vibration in buildings'
- ISO 9613-2:1993: Acoustics – "Attenuation of sound during propagation outdoors - Part 2: General method of calculation".
- Calculation of Road Traffic Noise (CRTN), Department of Transport (Welsh Office), 1988;
- Calculation of Railway Noise (CRN), Department of Transport (Welsh Office), 1988;
- Design Manual for Roads and Bridges Volume 11, Part 3, Section 7, HMSO, 1994 (DMRB 11:3:7), 2011
- Acoustics, Ventilation and Overheating Residential Design Guide (AVO), Association of Noise Consultants, 2018.
- Professional Practice Guidance on Planning and Noise (ProPG), Association of Noise Consultants, 2017

Study Area

- 11.6 The study area includes the main construction site, as indicated in Figure 11.1, as well as all rail infrastructure associated with Reading Station, road traffic on Caversham Road and Vastern Road, and the nearest residential dwellings, flats and rooms for residential purposes on and local to Caversham Road and Vastern Road.
- 11.7 The noise and vibration survey encompassed a number of locations both within the site, and representative of the existing nearest noise sensitive receptors. The measurement locations are indicated on Figure 11.1.

Baseline Methodology

- 11.8 In order to determine the existing noise climate, and vibration levels due to trains using the nearby Reading Station, noise vibration surveys were carried out in December 2017 and November 2018.
- 11.9 Full details of the survey methodology and measured levels are provided in Appendix 11.4.
- 11.10 In summary, noise levels around the site are relatively high, and are dominated by road traffic on Caversham Road and Vastern Road, and train noise to the south of the site.

- 11.11 A noise map of the site and surrounding areas was created, and calibrated against the measurements taken. The baseline noise maps are shown as Figure 11.2 (daytime) and Figure 11.3 (night time).
- 11.12 This noise model was then used to calculate the noise levels affecting the proposed development, considering the impact of each Phase. These noise maps are shown as Figures 11.4-11.9.
- 11.13 A 24-hour vibration survey was undertaken in November 2018. The vibration monitoring equipment was located at a position representative of the nearest point of any proposed building to the railway lines as shown on Figure 11.1.
- 11.14 Measurements of both Vibration Dose Value (VDV) and Peak Particle Velocity (PPV) were taken. VDV is used to assess the potential impact on humans, whereas PPV is used to determine the likelihood of building damage as a result of external sources of vibration.

Consultation

- 11.15 The following consultations have taken place with regard to noise and vibration:

Table 11.1: Consultation Responses Relevant to this Chapter

Date	Consultee and Issues Raised	How/ Where Addressed
29 th March 2018	Reading Borough Council (Scoping Opinion) Issues Raised: Vibration effects on the development as a result of proximity to the railway. Chapter outline otherwise accepted.	A vibration survey has been carried out and discussion is included within this report. All other items within the scoping report for noise are addresses.
6 th December 2018	Rebecca Moon, Environmental Protection and nuisance team, Reading Borough Council. Issues Raised: Internal noise level criteria; Plant noise limits; Internal noise level criteria during overheating conditions.	Internal noise levels need to meet the requirements of BS8233 (see below). Plant noise needs to meet a specific level of 10dB below the background noise level, and a rating level no higher than background. A tolerance of 5dB can be allowed during overheating conditions (see below).

Receptor Sensitivity/Value

- 11.16 The receptors have been assigned the sensitivities detailed in Table 11.2, below.

Table 11.2: Proposed Receptor Sensitivity

Sensitivity	Typical Descriptors
High	Residential Properties
Medium	Commercial/Industrial Properties
Low	Train Station
Negligible	Car parking areas

Assessment Criteria and Assignment of Significance

- 11.17 This section describes the assessment criteria used when considering noise and vibration impacts on, and arising as a result of, the proposed development. Refer to Appendix 11, 3 for further details on the guidance outlined in this section.

Internal Noise Limits

- 11.18 The assessment criteria for environmental noise intrusion into residential apartments are aligned with the requirements of BS8233 and Reading Borough Council, as shown in Table 11.2, below.

Table 11.2: BS8233 Noise Limits

Room Type	Daytime Limit, dBL _{Aeq,16hour}	Night-time Limit, dBL _{Aeq,8hour}	Night-time Limit, dBL _{Amax,F}
Living Rooms	35	-	-
Bedrooms	35	30	45
Open Plan Office	45-50	45-50	-
Retail	50-55	50-55	-

- 11.19 BS8233 also states that “Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.”

Overheating

- 11.20 Based on comments provided by the Local Authority, the noise limits detailed in Table 11.3, above, can be increased by 5dB during overheating conditions. The exact definition of ‘overheating’ is not universally accepted, but the CIBSE Technical Manual 59 describes ‘overheating’. More information is provided in Appendix 11.3.
- 11.21 The following significance parameters have been used for internal ambient noise level, based on the requirements of BS 8233, Reading Borough Council, and impact levels set out in the Acoustics, Ventilation and Overheating Residential Design Guide.

Table 11.3 Internal Ambient Noise Level Magnitude of Impact

Magnitude	Typical Descriptors
High	Noise levels in Table 11.2 are exceeded by <10dB (Adverse).
	Noise levels are lower than those in Table 11.2 by <10dB (Beneficial).
Medium	Noise levels in Table 11.2 are exceeded by <6dB (Adverse).
	Noise levels are lower than those in Table 11.2 by <6dB (Beneficial).
Low	Noise levels in Table 11.2 are exceeded by <3dB (Adverse).
	Noise levels are lower than those in Table 11.2 by <3dB (Beneficial).
Negligible	Noise levels in Table 11.2 are exceeded by <1dB (Adverse).
	Noise levels are lower than those in Table 11.2 by <1dB (Beneficial).
No change	Noise levels in Table 11.2 are met

Construction Noise

- 11.22 The magnitude and significance of effects due to construction noise is determined in a different way to the above, and is based on “*Example Method 2 ‘5dB change’*” as described in BS5228-1. This method reflects the conventional approach within EIA methodologies. It states that noise levels generated by construction activities are deemed to be significant if the ‘total noise’ (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,period}$, from construction noise alone, for the daytime (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00) periods, respectively.
- 11.23 There is no recognised guidance to determine if any predicted significant adverse effects are of ‘minor’, ‘moderate’ or ‘major’ significance, consistent with the EIA terminology adopted, however the following approach could be taken where there is a +5dB change or greater:

Table 11.4 Construction Noise Magnitude of Impact

Total Noise Arising from Construction	Significance
≤65 dBA	Negligible
66-70 dBA	Minor
71-75 dBA	Moderate
>75 dBA	Major

- 11.24 It is also suggested that, depending on if the effect is for a short or long duration, the reported effects can move to adjacent significance bands. For example, piling noise may be >75dB, but may only occur over a 1-week duration and therefore would be considered as of ‘moderate’ significance.

Operational Noise – Commercial/Industrial Noise

- 11.25 The only operations which could impact on the nearest noise sensitive receptors relate to noise from activities associated with the retail units, and from any building services plant connected to the Proposed Development.
- 11.26 The assessment of noise from these sources is presented in BS4142, which compares the ‘rating’ noise level ($dB_{LAf,Tr}$) from a noise source with the background noise level (dB_{LA90}) without the noise source operating.
- 11.27 A ‘rating’ noise level is derived from the character correction applied to the ‘specific’ noise level ($dB_{LAeq,Tr}$) of the source if the noise has a defined acoustic character such as being tonal, impulsive, distinctive or intermittent in nature.
- 11.28 The impact of the noise source is calculated by subtracting the background noise level from the rating level, the resulting difference is then used to determine the likelihood of impact, as presented in Table 11.5, below. BS4142 states “Typically, the greater this difference, the greater the magnitude of impact”.

Table 11.6 - BS4142 Magnitude of Impact

Difference between rating and background noise level	Significance Assessment
+10dB or more	High adverse impact
+5dB	Medium impact
< 0dB	Low impact

- 11.29 Further to this, when one noise is 10dB lower than another (e.g. the background noise), the lower noise is generally inaudible. On this basis, the significance criteria detailed in Table 11.7, below, are proposed for building services noise.

Table 11.7 – Plant Noise Significance Criteria

Difference between rating and background noise level	Significance Assessment
≥+10dB	High (SOAEL)
+5dB – +9.9dB	Medium (LOAEL)
-4.9dB - +4.9dB	Low (NOEL)
≤-5dB	Negligible

- 11.30 As stated above, Reading Borough Council require that the 'rating' noise level from building services plant does not exceed the existing background noise level at the nearest noise sensitive residential property, which therefore relates to a Low (NOEL) significance.
- 11.31 However, Reading Borough Council also require that the 'specific' noise level is controlled to 10dB below the background noise level. On this basis, unless the plant is tonal or intermittent (unusual in new, modern plant), the significance would be Negligible.

Operational Noise – Transport

- 11.32 Traffic noise, particularly from freely flowing traffic, is a relatively uniform noise source without strong tonal or impulsive characteristics. It is common practice to use the change in noise level brought about by a Proposed Development as the basis for evaluating noise impacts (i.e. the impact of the Proposed Development on the pre-existing noise environment and the effects this may have on the receptors in that environment).
- 11.33 The scale or severity of any noise change, positive or negative, requires description to indicate the degree of impact where possible. This leads to the common practice of defining noise change impact categories with an associated semantic scale.
- 11.34 The latest version of DMRB (2011) uses this guidance in developing the classification of magnitude of noise impacts in the short term, included in Table 11.8 below. In order to determine the significance of any change in the noise environment at the location of nearby sensitive receptors, the significance criteria reflect advice defined in the draft document Guidelines for Noise Impact Assessment, published by the Institute of Environmental Management and Assessment (IEMA) and the Institute of Acoustics (IOA).

Table 11.8: Significance of changes in road traffic noise levels in short term

Change in Noise Level, dB	Impact Magnitude Category	Initial Indicator of Significance Effect
+5	Major adverse	Potentially significant adverse effect
+3 to +4.9	Moderate adverse	
+1 to +2.9	Minor adverse	
-0.9 to +0.9	Negligible	Unlikely to be significant
-1 to -2.9	Minor beneficial	Potentially significant beneficial effect
-3 to -4.9	Moderate beneficial	
-5	Major beneficial	

- 11.35 The significance of the noise impacts from vehicle movements and car parking upon nearby sensitive receptors has primarily been assessed by altering the traffic flow data used to calibrate the baseline noise model based on the increase in traffic movements predicted by the traffic consultants.
- 11.36 A more simplistic assessment of any noise impact can be calculated by comparing the predicted change in vehicle movements to and from the site with the existing situation, using the formula $10 \times \log (\text{new movements/existing movements})$. A doubling of movements would, for example, potentially result in a 3dB increase in noise levels.

Rail Noise

- 11.37 On a similar basis to those proposed for road traffic noise, the significance effects of rail noise are shown in Table 11.9, below.

Table 11.9: Significance of changes in rail noise levels in short term

Change in Noise Level, dB	Impact Magnitude Category	Initial Indicator of Significance Effect
+5	Major adverse	Potentially significant adverse effect
+3 to +4.9	Moderate adverse	
+1 to +2.9	Minor adverse	
-0.9 to +0.9	Negligible	Unlikely to be significant
-1 to -2.9	Minor beneficial	Potentially significant beneficial effect
-3 to -4.9	Moderate beneficial	
-5	Major beneficial	

Vibration

Construction Vibration, and Vibration from Railway

Human Perception of Vibration

- 11.38 BS6472:1992 contains guidance relating to human exposure to vibration. A methodology is presented for assessing the human response to vibration in terms of the vibration dose value (VDV).

- 11.39 Table 1 of this standard, which details the likely levels of Vibration Dose Value (VDV) which might result in various probabilities of adverse impact in residential buildings, is reproduced as Table 11.10, below.

Table 11.10 – Table 1 of BS6472

Place and Time	VDV Values which might result in various probabilities of adverse comment within residential buildings, $\text{mm}^{\text{s}-1.75}$		
	Low probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential Buildings, 16 h day	0.2-0.4	0.4-0.8	0.8-1.6
Residential Buildings, 8 h night	0.1-0.2	0.2-0.4	0.4-0.8

- 11.40 The above values are multiplied by two for commercial or retail units.

- 11.41 On this basis, the following significance criteria are proposed.

Table 11.11 Significance Criteria for Vibration Effects – Human Perception

VDV, $\text{mm}^{\text{s}-1.75}$		Significance Criteria
Day	Night	
0.8-1.6	0.4-0.8	High (SOAEL)
0.4-0.8	0.2-0.4	Medium (LOAEL)
0.2-0.4	0.1-0.2	Low (NOEL)
0-0.2	0-0.1	Negligible

Building Damage

- 11.42 For building damage criteria, Table 1 of BS 7385: Part 2:1993: “*Evaluation and Measurement for Vibration in Buildings - guide to damage levels from ground-borne vibration*”, sets out limits for primarily transient vibration above which cosmetic damage could occur. This is reproduced in Table 11.12, below.

Table 11.12 Vibration levels above which cosmetic damage could occur.

Building Type	Peak Particle Velocity (mm/s)	
Reinforced or framed structures. Industrial and heavy commercial buildings.	50mm/s at 4Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings.	4Hz to 15Hz	15Hz and above
	15mm/s at 4Hz, increasing to 20mm/s at 15Hz	20mm/s at 15Hz, increasing to 50mm/s at 40Hz and above

- 11.43 Taking the above into consideration, the following significance criteria are proposed;

Table 11.13 Significance Criteria for Vibration Effects – Building Damage

Peak Particle Velocity (mm/s)	Significance Criteria
≥ 50	Major (SOAEL)
$>0 < 50$	Minor-Moderate (LOAEL)
0	Negligible (NOEL)

- 11.44 Any predicted vibration effects which are significantly above the thresholds of perception and above the thresholds for cosmetic damage, would be considered as being of minor to major adverse significance, depending on the duration of the effects and the sensitivity of the receptor(s).

Operational Vibration

- 11.45 There are no expected operational vibration effects due to the Proposed Development. Heavy good vehicles will not pass within 10 metres of sensitive properties and road surfaces will be well maintained to avoid pot holes. Speed bumps or any other surface imperfections or discontinuities will not be located near noise sensitive properties.

Limitations of the Assessment

- 11.46 At this stage of the project the use of the ground floor commercial units has not been confirmed (Outline Planning Permission is sought for Use Classes A1, A2, B1, D1 or D2), and neither has the type or location of any building services plant. Therefore, noise level limits have been provided, based on the baseline noise levels measured on site, which can form the basis for any planning conditions relating to noise from the development. Confirmation can be provided at a later stage that the limits set within the planning conditions will be achieved. This is considered an appropriate approach in EIA terms as noise can be controlled using conventional mitigation measures, including location/selection of plant, screening and/or plant attenuation.

Baseline Environment

Noise

- 11.47 Based on the noise levels measured, and as described in Appendix 11.4, the noise levels over the undeveloped site are as indicated in Figures 11.2 and 11.3.
- 11.48 Full measurement results are provided in Appendix 11.4.

Vibration

- 11.49 The results of the vibration survey are shown in Table 11.14, below.

Table 11.14: Measured Vibration Levels

Date	Period	VDV, $\text{mms}^{-1.75}$	PPV, mms^{-1}
26th November 2018	15:20h-23:00h	0.051	0.275
26th-27th November 2018	23:00h-07:00h	0.045	0.300
27th November 2018	07:00h-16:00h	0.051	0.275

- 11.50 When compared to the significance values in Tables 11.11 and 11.13, it can be seen that the measured VDV and PPV values at the most potentially affected location are significantly lower than the lowest values in their respective significance criteria tables, and hence the significance of the

measured baseline vibration levels is Negligible for the entire site. Vibration is therefore not considered further.

Future Baseline Conditions

Road Traffic

- 11.51 The predicted increase in road traffic movements has been provided by the Transport Consultants (outlined in Chapter 9 of this ES), and the data has been used in our model to predict the future baseline conditions.
- 11.52 Based on both the predicted noise levels, and the simple relationship based on the percentage change in movements, the predicted increase in noise levels is less than 1dB, which is negligible – i.e. NOEL.
- 11.53 The number of HGV movements associated with the retail and commercial units are likely to be significantly lower than those currently occurring at the site, which is currently a disused Royal Mail sorting office and distribution centre.

Rail Noise

- 11.54 No details of any predicted changes in rail movements have been provided. However, given that train movements would need to double before any noticeable change in noise levels (3dB) would be experienced, it is highly unlikely that rail noise levels would change significantly. It has therefore been considered appropriate at this stage to consider the noise levels measured as representative of the Future Baseline condition.

Overall Noise Levels

- 11.55 Taking the above into consideration, the predicted future baseline noise levels are shown on Figures 11.4 – 11.9.
- 11.56 The noise levels incident upon each façade can be broadly broken down into three façade Types – Façade Types A, B and C, whereby noise levels within around 5dB of each other have been considered the same, as indicated on Figure 11.10, and as summarised in Table 11.15, below.

Table 11.15: Typical Worst Case Façade Noise Levels

Façade Type	Period	Typical Ambient Noise Level, dBL_{Aeq,T}	Typical Maximum Noise Level, dBL_{Amax}
A	Day	66	-
A	Night	58	75
B	Day	71	-
B	Night	62	84
C	Day	76	-
C	Night	69	87

Mitigation Measures Adopted as Part of the Project

Noise Ingress

11.57 Detailed calculations have been undertaken of noise break-in to the various noise sensitive room types on the following basis;

- The noise levels incident upon each façade can be broadly broken down into three façade Types – Facades A, B and C, whereby noise levels within around 5dB of each other have been considered the same, as indicated on Figure 11.10;
- The worst case predicted noise level for each façade type has been used;
- The noise levels are based on the predicted increase in road traffic levels;
- The worst case (i.e. highest) percentage glazing to each room type has been used in all calculations. However, a review of the difference between the lowest and highest percentage glazing has been determined to be 2dB or less, which is not significant;
- All calculations have been based on achieving the requirements of BS8233, as detailed above;
- The proposed phasing has been considered – i.e. any additional acoustic screening which will subsequently be provided to the Phase 1 buildings has not been considered;
- For bedrooms at night, both ambient (dBL_{Aeq}) and maximum (dBL_{Amax}) parameters have been considered.

11.58 The assessment is therefore considered worst case and robust. There may be scope to undertake a more detailed assessment and value engineering exercise of the facades and ventilation at a later date, but this is outside of the scope of this chapter, the purpose of which is to demonstrate that the requirements of Reading Borough Council can be met.

11.59 The mitigation measures required to achieve all relevant acoustic design targets in all noise sensitive rooms are as shown in Table 11.16, below.

Table 11.16 Acoustic Requirements for Facades

Façade	Room Type	Minimum Glazing Sound Insulation Performance, dBR_w	Example Glazing Construction, mm	Minimum Ventilator Sound Insulation Performance, $dBD_{n,e,w}$
A	Living rooms	33	6/12/6	44
	Bedrooms	34	6/12/6.4 pvb	48/MV
	Office	31	4/12/4	MV
	Retail	31	4/12/4	MV
B	Living rooms	42	10/12/8.8	38

C	Bedrooms	47	10/12/6.5 acoustic	46/MV
	Office	31	4/12/4	MV
	Retail	31	4/12/4	MV
	Living rooms	47	10/12/6.5 acoustic	44
	Bedrooms	47	10/12/6.5 acoustic	48/MV
	Office	36	10/12/4	MV
	Retail	31	4/12/4	MV

*MV = Mechanical Ventilation

- 11.60 The ventilators could be replaced with mechanical ventilation in all rooms if desirable.
- 11.61 Windows can be openable so long as they are well sealed when closed. The frames and seals should not downgrade the performance of the glazing.
- 11.62 There are many alternative glazing specifications which would also meet the required sound insulation performances, which can be developed at the design stage.

Noise Egress

- 11.63 To meet Reading Borough Council's requirements, plant noise should be controlled to a specific noise level 10dB lower than the background sound level.
- 11.64 On this basis, and based on the background sound levels measured, the cumulative, specific plant noise level should be controlled to meet the limits detailed in Table 11.17 below.

Table 11.17: Plant Noise Limits – Specific Noise Level Limits

Location	Daytime Limit, dBL _{Aeq,16hour}	Night time Limit, dBL _{Aeq,8hour}
Dwellings on Caversham Road	53	37
Dwellings on Vastern Road	54	42
Commercial on Caversham Road	53	n/a
Commercial on Vastern Road	54	n/a

- 11.65 These limits are not particularly onerous, and can be readily achieved with appropriate selection of plant, and/or noise control measures such as attenuators for air movement plant, acoustic screens, acoustic louvres and enclosures. This will be developed as the design progresses.

Vibration

- 11.66 The only potentially vibration generating activity associated with the proposed development would be HGV movements. However, as the increase in HGV movements has been predicted to be negligible, and as they would take place at a significantly greater distance to the sensitive properties than the existing road network, no vibration impacts are predicted, and hence no mitigation measures are required to control vibration.

Assessment of Construction Effects

- 11.67 Construction activities are a potential, albeit temporary, source of noise and vibration. British Standard BS 5228 “Code of practice for noise and vibration control on construction and demolition sites” provides methodologies for the assessment and control of noise and vibration from construction operations. The Standard contains detailed information on noise reduction measures and promotes the ‘best practicable means’ (BPM) approach to control noise and minimise the impact on local residents and construction workers.
- 11.68 For construction noise and vibration, it is not possible at the planning application stage to predict detailed noise effects given the uncertainty as to construction methods, processes and plant. However, indicative noise levels have been calculated at the closest noise sensitive receivers for assumed plant and processes. These calculations have been undertaken on the following basis:
- All buildings on current existing site are to be demolished and site cleared at one time (not phased);
 - Earthworks for all phases undertaken;
 - Piling undertaken (assumed CFA piling);
 - Phases 1-3 to be constructed in sequence;
 - The distance calculations have been based the lowest distance from the centre of each phase (as an average) to the nearest residential property (Vastern Road for Phases 1 and 2, at around 140m, and Vastern Road, at around 110m, for Phase 3). Properties at a greater distance will be subject to similar or lower noise levels;
 - The impact of the construction of Phase 2 has also been considered on the Phase 1 building (assumed average distance of 20m), and the impact of the construction of Phase 3 has been considered on the Phase 2 building (assumed average distance of 50m).

Construction Noise Impacts

- 11.69 Full calculations are provided in Appendix 11.5, with the references detailed, but in summary, typical noise levels anticipated at the nearest noise sensitive locations are detailed in Table 11.18, below.

Table 11.18: Predicted Construction Stage Noise Levels and Significance

Phase	Nearest Affected Location	Typical Daytime Noise Level, dBL _{Aeq,T}	Significance	Calculation Reference
Demolition	Buildings on Caversham Road	70	Minor	1
Earthworks Phase 1 & 2	Buildings on Vastern Road	67	Minor	2

Phase	Nearest Affected Location	Typical Daytime Noise Level, $dBL_{Aeq,T}$	Significance	Calculation Reference
Earthworks Phase 3	Buildings on Caversham Road	65	Negligible	3
Phase 1 Piling	Buildings on Vastern Road	56	Negligible	4
Phase 1 Concreting	Buildings on Vastern Road	72	Moderate*	5
Phase 1 Main Build	Buildings on Vastern Road	73	Moderate*	6
Phase 2 Piling	Phase 1 building	71	Moderate*	7
Phase 2 Concreting	Phase 1 building	87	Major	8
Phase 2 Main Build	Phase 1 building	87	Major	9
Phase 3 Piling	Phase 2 building	63	Minor	10
Phase 3 Concreting	Phase 2 building	79	Major	11
Phase 3 Main Build	Phase 2 building	79	Major	12

* Although when considered in isolation the significance is considered 'moderate', with typical existing daytime ambient noise levels of around $73dBL_{Aeq,T}$, this is below the Example Method 2 '5dB change' as described in BS5228-1.

- 11.70 All construction activities are therefore likely to be of minor or moderate significance, except the impact on Phase 1 of the construction of Phase 2, and on Phase 2 by the construction of Phase 3. In both cases this is due to the proximity of the construction site to the earlier phases of the Proposed Development. Noise sensitive dwellings outside of the development site are unlikely to be significantly affected by such a change.
- 11.71 Furthermore, it should be noted that the noise data provided in BS5228 is representative of older machinery. Based on the implementation of best practical means with the contractors CEMP, the above noise levels are likely to reduce by somewhere in the order of 5-10dB.
- 11.72 All properties outside of the main development site are likely to benefit from acoustic screening provided by the site boundary fence (assuming solid construction not wire mesh) during periods when construction takes place at ground level e.g. piling, earthworks etc. This would reduce noise levels at the houses on Vastern Road and Caversham Road by a further 5-10dB.
- 11.73 If evening, night-time and/or Sunday working is to be required, then this would need to be agreed with the Local Authority under the Control of Pollution Act (CoPA). A noise and vibration management plan and possibly a prior, CoPA Section 60 agreement with the Local Authority, could also be considered.

Construction Vibration Impacts

- 11.74 Construction vibration levels are discussed in BS 5228 Part 2. The document provides basic methods of vibration control relating to construction sites where work activities/operations generate significant vibration levels, describes the legislative background to vibration control and provides recommendations given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities.
- 11.75 Vibration during construction work may arise from activities such as piling (e.g. for building foundations), ground improvement and road construction. Selection of plant and methods will need to consider the possible effects of vibration on nearby buildings and their occupants.
- 11.76 The main impact will be on the users of the Phase 1 Building when Phase 2 is being constructed. All other Phases are at least 50m away, and external sensitive locations are at least 100m away. This will result in negligible vibration levels, assuming appropriately managed, and with nearby residents being informed of works schedules well in advance, along with being provided with site contact details, the severity of any effects is likely to be minor.
- 11.77 Ground-borne vibration from construction work has broadly two potential impacts; cosmetic/structural damage and human sensitivity.
- 11.78 Structural damage to buildings by vibration is extremely rare and only occurs when receiving buildings or structures are located very close (e.g. at least within around 10m) to very intensive vibration generating activities and/or are vulnerable due to their structural condition.
- 11.79 In terms of the impact on humans, perceptible vibration can give rise to complaints of disturbance over a wider area from the works. Depending on details of any proposed vibration causing activities, it is possible that certain activities such as piling/compacting, occurring close to the existing residential buildings, could give rise to perceptible vibration.
- 11.80 However, this is likely to be short in duration and hence the severity of any effects is likely to be of minor significance (given appropriate good practice and notification).
- 11.81 It is not possible to provide any detailed vibration assessment without full details of the plant and methods to be used.
- 11.82 Nonetheless, the strategic, Best Practical Means approach to vibration control is the same as that described in the construction noise section above (the Control of Pollution Act explicitly applies to vibration as well as noise).

Further Mitigation and Monitoring

- 11.83 No further mitigation or monitoring is considered to be required during the construction Phase, unless the Local Authority or Network Rail require noise and/or vibration monitoring. Noise levels in the surrounding area are relatively high, and, as detailed above, noise and vibration impacts are unlikely to have any significant adverse effects on nearby noise sensitive properties.

Accidents and/or Disasters

- 11.84 Accidents or disasters are not considered to be likely to have any significant effect on the noise and vibration impact of the proposed development. Any disasters (e.g. fire) would only result in a short-term effect, which in a disaster situation is unlikely to be an issue to local residents.

Assessment of Operational Effects

- 11.85 Given Reading Borough Council's stringent limitations on noise emissions from new development, and the acoustically insignificant change in traffic flows, operational noise and vibration effects associated with the Proposed Development are considered to be of negligible significance.

Further Mitigation and Monitoring

- 11.86 No further mitigation or monitoring is anticipated to be necessary during the operational stage of the project.

Accidents/Disasters

- 11.87 Operational accidents/disasters may have a short-term impact on noise levels, however given the nature of emergency events such impacts are likely to be of negligible significance.

Potential Changes to the Assessment as a Result of Climate Change

- 11.88 Climate change is not considered to be likely to have any significant effect on the noise and vibration impact of the proposed development.

Assessment of Cumulative Effects

- 11.89 The developments considered as part of the assessment of cumulative effects are provided in Appendix 4.3. The general redevelopment of the area around Reading Station has the potential to lead to cumulative noise and vibration impacts on existing residents and, to a lesser extent, commercial uses. However, given Reading Borough Council's stringent limitations on noise emissions from new developments (a rating level equal to background and a specific sound level 10 dB below background), and the logarithmic nature of decibel addition, the cumulative effect of multiple development would not cause any perceptible 'noise creep' in the area. Therefore, we do not anticipate any significant adverse cumulative noise or vibration effects will occur.
- 11.90 The assessment of noise impact upon the Proposed Development is based on predicted future traffic flows and therefore recommendations with regard to façade and ventilation acoustic requirements can be considered to incorporate the potential noise impact arising from increased traffic associated with the redevelopment of the area. It should be noted that as a rule of thumb, traffic volumes would need to double in order to cause a perceptible (3 dB) increase in noise levels, and as such it can be assumed that the predicted future traffic volumes and associated noise levels are sufficiently accurate on which to base the acoustic design of facades and ventilation.

Inter-relationships

- 11.91 There are not thought to be any inter-relationships between noise and vibration and other topics covered within this document, other than those already considered above.

Summary of Effects

- 11.92 A summary of the predicted effects is shown in Table 11.19, below. However, in brief, and based on the mitigation measures below, all receptors are expected to be subject to a Minor/Moderate significance effect in terms of noise and vibration, except for the construction stages of Phases 2 and 3 on the occupants of Phases 1 and 2, respectively.

Table 11.19: Summary of Likely Effects of Noise and Vibration

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes
Construction phase							
Residents on Vastern Road and Caversham Road	High	Construction noise and vibration	Medium term	Low/Medium	Minor/Moderate	Not significant	Impact will be controlled by limits on hours of construction, use of best practical means
Phase 1 residents	High	Construction noise and vibration from Phase 2	Short term	High	Major	Significant	
Phase 2 residents	High	Construction noise and vibration from Phase 3	Short term	High	Major	Significant	
Operational phase							
Residents on Vastern Road and Caversham Road	High	Road traffic and plant noise emissions	Long term	Negligible	Minor	Not significant	
Residents within Proposed Development	High	Road traffic and plant noise emissions	Long term	Negligible	Minor	Not significant	

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- World Health Organisation (2018) Environmental Noise Guidelines for the European Region. Geneva, WHO
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