

8 NOISE AND VIBRATION

Introduction

- 8.1 This chapter of the ES presents an assessment of the potential impacts and the likely significant effects with respect to noise and vibration associated with the demolition and construction stage, and the completed development/operational stage of the proposed development.
- 8.2 In the context of this assessment, noise is defined as unwanted or undesirable sound derived from sources such as construction activities, road traffic and building services plant.
- 8.3 The chapter provides a summary of the existing baseline conditions at the application site; the methods used to assess the potential impacts and effects arising from the proposed development during the construction stage and the completed development stage; the assessment of potential impacts and likely effects; and the residual effects following consideration of any required mitigation measures. The assessment is based on a baseline noise survey undertaken on 26 - 27 June 2019; prediction methods and guidance set out in industry standards; and modelled predictions undertaken using proprietary noise modelling software.
- 8.4 This chapter is supported by the following technical appendices in ES Volume 3:
 - Technical Appendix 8.1: Legislation and Policy;
 - Technical Appendix 8.2: Baseline Noise Survey;
 - Technical Appendix 8.3: Construction Noise Calculations and Embedded Mitigation; and
 - Technical Appendix 8.4: Site Suitability Assessment.

Methodology

- 8.5 The assessment has been informed by the following legislation, policies and published guidance:
 - Control of Pollution Act, 1974, Part III – Noise;¹
 - The Environmental Protection Act, 1990 (as amended); ²
 - NPPF; ³
 - PPG⁴;
 - Noise Policy Statement for England, 2010⁵;
 - Reading Borough Local Plan 2019⁶;
 - Reading Station Area Framework (RSAF)⁷;
 - Revised Sustainable Design and Construction: Adopted Supplementary Planning Document 2011⁸;

¹ Secretary of State, 1974, Control of Pollution Act, HMSO. Available: <http://www.legislation.gov.uk/ukpga/1974/40/contents>

² Secretary of State, 1990. Environmental Protection Act 1990, The Stationary Office. Available: <http://www.legislation.gov.uk/ukpga/1990/43/contents>

³ Secretary of State for Ministry of Housing, Communities and Local Government, 2019. National Planning Policy Framework.

⁴ <https://www.gov.uk/government/collections/planning-practice-guidance>.

⁵ Department of Environment, Food and Rural Affairs, 2010. Noise Policy Statement for England.

⁶ Reading Borough Council, 2019. Reading Borough Local Plan. RBC.

⁷ Reading Borough Council, 2010. Reading Station Area Framework. RBC.

⁸ Reading Borough Council, 2019. Revised Sustainable Design and Construction. Supplementary Planning Document. RBC.

⁹ British Standards Institution, 2014. British Standard 4142:2014 Method for Rating and Assessing Industrial and Commercial Sound. BSI.

¹⁰ British Standards Institution, 2014. BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, BSI.

¹¹ British Standards Institution, 1993. British Standard 7385-2:1993 Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration. BSI.

- BS 4142:2014⁹ – ‘Methods for Rating and Assessing Industrial and Commercial Sound’: used to assess plant noise including fixed plant installations;
- BS 5228:2009+A1:2014¹⁰ – ‘Code of Practice for Noise and Vibration Control on Construction and Open Sites’: used to assess construction noise impact on receptors;
- BS 7385-2:1993¹¹ - ‘Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration’: used to assess vibration impact on buildings;
- BS 8233:2014¹² – ‘Guidance on Sound Insulation and Noise Reduction for Buildings’: used to assess site suitability including internal ambient noise levels and noise levels in external amenity spaces;
- BS 6472-1:2008¹³ – ‘Guide to Evaluation of Human Exposure to Vibration in Buildings. Vibration Sources Other Than Blasting’: used to assess vibration impact on receptors;
- Calculation of Road Traffic Noise (CRTN), 1988¹⁴: used to calculate road traffic noise levels;
- The Design Manual for Roads and Bridges (DMRB), 2011¹⁵: used to assess traffic noise impacts both long and short-term;
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment, 2004¹⁶;
- WHO Guidelines for Community Health, 1999¹⁷: used to assess site suitability;
- ProPG: Planning & Noise: Professional Practice Guidance on Planning & Noise (2017)¹⁸; and
- European Commission EIA Directive Module 3 on Impact Assessment¹⁹.

Consultation

- 8.6 At the time of undertaking the assessment, the EIA Scoping Opinion remains outstanding.
- 8.7 In addition to the formal EIA Scoping Process, consultation with RBC environmental health officer (EHO) has been undertaken regarding the Scoping Report and the assessment methodology as summarised in Table 8.1.

Table 8.1: Summary of Consultation		
Consultee and Form/Date of Consultation	Summary of Comments	Action Taken
RBC EHO Pre-app feedback received on 13 August 2019	Site suitability to be assessed in accordance with BS8233:2014 (plus limit on L_{Amax} 45 dB internally) and where opening the window	Site suitability (Appendix 8.4) and delivery noise (paragraphs 8.76-8.82) assessed.

¹² British Standards Institution, 2014. BS 8233 2014 Guidance on sound insulation and noise reduction for buildings, BSI.

¹³ British Standards Institution, 2008. BS 6472:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting, BSI.

¹⁴ Department of Transport and the Welsh Office, 1988. Calculation of Road Traffic Noise, DoT & Welsh Office.

¹⁵ Highways Agency, 2011. Design Manual for Roads and Bridges Volume 11 Section 3 Part 7, HA.

¹⁶ Institute of Environmental Management & Assessment (IEMA), 2014, Guidelines for Environmental Noise Impact Assessment.

¹⁷ World Health Organisation. 1999. Guidelines for Community Noise. Geneva. WHO.

¹⁸ The Association of Noise Consultants (ANC), Institute of Acoustics (IoA), Chartered Institute of Environmental Health, 2017, Professional Practice Guidance on Planning & Noise (ProPG): New Residential Development.

¹⁹ European Commission, 2019. Nature Protection and Environmental Impact Assessment. Module 3: Environmental Impact Assessment (EIA) Directive – EIA procedure.

Table 8.1: Summary of Consultation		
Consultee and Form/Date of Consultation	Summary of Comments	Action Taken
	causes an exceedance of >5 dB then alternative ventilation e.g. Mechanical Ventilation Heat Recovery (MVHR) should be provided. - Delivery noise to be assessed - Plant specific sound level to be at least 10 dB below the measured background level and for the plant noise rating level to not exceed the measured background level. - Sound insulation should be in compliance with Approved Document Part E.	- Plant noise limits set in accordance with the criteria proposed by RBC. - Sound insulation to be specified during detailed design.
Consultation with EHO via email regarding noise survey methodology	The proposed survey and assessment methodology was sent to RBC on 29 November 2019 via email. No response was received.	

Assessment Scope

- 8.8 The assessment has been based on a series of development parameters, assumptions and commitments, as described in Chapter 2: EIA Process and Methodology, in Chapter 4; Proposed Development Description, and in Chapter 5: Demolition and Construction Environmental Management. Due to the flexibility being sought in respect of land use classes, the noise and vibration assessment has been undertaken based on a worst-case interpretation of the minimum and maximum land use schedule presented in Chapter 4: Proposed Development Description.
- 8.9 Therefore, the vehicle trip generation has been calculated based on the use classes with the highest trip generation and it has been assumed that the proposed development would be for residential use as that represents the most noise sensitive receptor. The assessment therefore provides a 'worst-case scenario' for both the existing receptors and the proposed development regardless of use.
- 8.10 It should be noted; however, that despite assuming a worst case in terms of traffic generation, a net reduction in traffic is still predicted compared with existing baseline.

Technical Scope

- 8.11 The technical scope considers the following:
- Demolition and construction noise and vibration from works being undertaken at existing off-site receptors;
 - Demolition and construction road traffic noise at existing off-site residential receptors;
 - Operational road traffic noise at off-site residential receptors;
 - Site suitability for on-site residential use; and
 - Operational noise from plant, servicing and operation at existing off-site residential receptors.

- 8.12 Operational vibration impacts have been scoped out of the assessment as there are no major sources of vibration within 50 m of the application site (the railway line is elevated and >50 m from the application site) and no vibration generating sources are proposed at the application site.

Spatial Scope

- 8.13 The study area incorporates the application site and the nearest existing noise-sensitive receptors.
- 8.14 The nearest noise-sensitive receptors that have been assessed are shown in Figure 8.1. It should be noted that R13 has been assessed as a cumulative scheme.

Temporal Scope

- 8.15 The following scenarios have been assessed:
- Scenario 1: Existing baseline (includes the existing 2019 baseline traffic flows);
 - Scenario 2: Future baseline + cumulative schemes; and
 - Scenario 3: Future baseline + cumulative schemes + proposed development (Year 2025).

Baseline Characterisation Method

Field Study

- 8.16 The existing noise environment was characterised by a baseline noise survey undertaken in accordance with BS7445-1:2003. This was undertaken in and around the application site to quantify the prevailing ambient and background noise levels during daytime and night-time periods. Attended measurements were taken over 1 day and 1 night-time period as outlined in Appendix 8.2 as no secure location could be found for longer term monitoring. The ambient and background noise levels have been used to inform the assessment criteria for plant noise emissions, building envelope and ventilation strategies and construction noise effects.
- 8.17 A noise model was created using the traffic data provided and calibrated to the measured baseline survey. The future baseline was updated using the traffic predictions provided.
- 8.18 Further information relating to the baseline noise survey methodology is presented within Technical Appendix 8.2.

Assessment Method

Methodology

- 8.19 A noise model of the proposed development and the study area was developed using the CadnaA® version 2019, a proprietary noise modelling software. The software implements the standard noise prediction methodology detailed in ISO in 9613:1996²⁰. This model was used to assess the likely effects of noise sources within the study area. The software utilises standard acoustic principles in conjunction with approved prediction methodologies and is a tried and tested method for accurately predicting and assessing the impact of noise from a variety of sources. This was calibrated to the existing noise climate and adjusted to reflect the future traffic flows.
- 8.20 Existing mapping and topography for the application site were obtained from OS mapping and provided by the design team. The 3D massing was based on the whole site being use for residential purposes (residential premises being more sensitive to noise than other proposed uses).
- 8.21 Demolition and construction noise, construction traffic and operational plant have been assessed against the existing baseline. Operational traffic and servicing have been assessed against the future baseline by including the cumulative development in both development scenarios, the effect of external

²⁰ International Organization for Standardization, 1996. ISO 9613: 1996 Part 2 Attenuation of sound during propagation outdoors, ISO.

noise sources remains constant and the effect of the proposed development itself is accurately reported.

Assessment Criteria

8.22 The criteria used to assess if an effect is significant or not, is set out in subsequent sub-sections. This is determined by consideration of the sensitivity of the receptor, magnitude of impact, duration of the effect, geographical extent of the effect and application of professional judgement.

Receptor Sensitivity Criteria

8.23 The sensitivity of receptors has been classified as low, medium or high, in accordance with the criteria set out in Table 8.2.

Table 8.2: Receptor Sensitivity Criteria	
Sensitivity	Criteria
Low	Commercial
Medium	Offices, Fire station
High	Residential

Impact Magnitude Criteria

8.24 The magnitude of impact has been classified as very low, low, medium, or high, in accordance with the criteria set out in Tables 8.3 – 8.8.

Demolition and Construction Noise

8.25 In order to determine the likely effect of noise during demolition and construction of the proposed development, noise predictions have been carried out in accordance with the procedures presented in BS5228, taking full account of Best Practicable Means (BPM) to be adopted by the proposed development (see Chapter 5: Demolition and Construction Environmental Management).

8.26 It is understood that construction would take place on weekdays (0800-1800) and Saturdays (0800-1300), with no noisy working on Sundays or bank holidays. The construction traffic flows provided are based upon a 10-hour working day which represents a 'worst-case scenario'.

8.27 The '5 dB change method', as described in BS5228-1:2014, has been applied. The resulting criteria to all receptors are set out in Table 8.3.

Table 8.3: Magnitude of Impact – Demolition and Construction Noise		
Description	Adverse Effect Level	Magnitude of Impact
> 10 dB change in noise level between total level and pre-existing ambient noise level	SOAEL	High
5 – 10 dB change in noise level between total level and pre-existing ambient noise level	LOAEL	Medium
< 5 dB change in noise level between total level and pre-existing ambient noise level	NOAEL	Low

8.28 Typical plant equipment and representative period of operation have been used to predict the expected noise levels for each activity during demolition and construction. This has been carried out in accordance with BS5228:2009+A1:2014, which accounts for the following variables:

- Distance attenuation between source and receiver;
- Percentage operating time of the plant;

- Any relevant barrier attenuation effects;
- Ground absorption; and
- Façade corrections.

8.29 Sound power levels for each item of equipment have been taken from BS 5228:2009+A1:2014.

8.30 No attenuation from site hoardings has been allowed for as the majority of receptors are several storeys high and therefore would have direct line of sight to the demolition and construction works.

Demolition and Construction Traffic Noise

8.31 Demolition and construction traffic to and from the application site has been assessed using the haul route method defined in BS 5228-1:2009+A1:2014.

8.32 The magnitude of the predicted change in noise levels has used the scale shown in Table 8.4. The criteria are based on the current guidance on short-term changes in traffic noise levels in the DMRB.

Table 8.4: Magnitude of Impact - Road Traffic Noise Changes (short term)		
Change in Traffic Basic Noise Level $L_{A10,18h}$ dB	Adverse Effect Level	Magnitude of Impact
≥ 5	SOAEL	High
3 to 4.9	LOAEL	Medium
1 to 2.9	NOAEL	Low
<1	NOEL	Very Low

Demolition and Construction Vibration

8.33 BS 5228 states that for the majority of people, vibration levels between 0.14 and 0.3 mm/s PPV are just perceptible. A vibration level of 1.0 mm/s is sufficient to cause complaint, but tolerable with prior warning, whereas a level of 10 mm/s is intolerable for anything more than a very brief exposure. Vibration levels exceeding 15 mm/s PPV are sufficient to result in minor cosmetic damage in light/unreinforced buildings. This magnitude of vibration is not considered likely as a result of the proposed construction activities being undertaken, and therefore an assessment of building damage has not been undertaken.

8.34 Table 8.5 presents the magnitude of impact for levels of demolition and construction vibration.

Table 8.5: Magnitude of Impact - Demolition and Construction Vibration			
Effect: Annoyance	Continuous Vibration Level ppv mms^{-1}	Adverse Effect Level	Magnitude of Impact
Vibration is likely to be intolerable for any more than a very brief exposure to this level.	10	SOAEL	High
It is likely that vibration of this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.	1.0	LOAEL	Medium
Vibration might be just perceptible in residential environments.	0.3	NOAEL	Low
Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	0.14	NOEL	Very Low

- 8.35 BS 5228:2009 Part 2 provides historical data of continuous flight auger (CFA) piling at various distances, as summarised in Table 8.6. This data can be used to provide an indicative assessment of the distance at which significant vibration impacts could occur. However, the ground conditions on-site would affect the propagation and piling methods employed and therefore this method is suitable for initial estimates only.

Table 8.6: Ranges of PPV for Piling			
Piling Method	Distance from source (m)		
	10	20	30
CFA	0.38 mms-1	0.3 mms-1	0.03 mms-1

Site Suitability – Noise

- 8.36 The site suitability assessment for residential use (methodology and results) is detailed in Technical Appendix 9.4: Site Suitability.
- 8.37 This assesses the noise levels as modelled on the building facades and gives outline guidance on the façade and ventilation strategy required to meet the BS8223:2014 internal ambient noise level criteria and WHO Guidelines for Community Noise (based on the parameter plans).

Operational Noise from Proposed Plant

- 8.38 The type, quantity and location of fixed mechanical and electrical (M&E) plant associated with the proposed development has not been finalised at this stage in the design and hence it is not possible to fully quantify the building services plant noise impact at the nearest noise sensitive receptors (NSRs).
- 8.39 As is standard good practice, the design of appropriate noise mitigation for each individual plant item would be undertaken during the detailed design stage. Noise emissions from plant associated with the proposed development would, therefore, be controlled via a suitably worded planning condition to ensure the appropriate details are provided at reserved matters stage.
- 8.40 Suitable criteria for determining the magnitude of the impact have been based on the guidance in BS4142: 2014. The basis of BS 4142 is a comparison between the existing background noise level at the façade of the nearest NSRs and the plant noise rating level of all new fixed plant sources associated with the proposed development. The relevant parameters in this instance are as follows:
- Background Sound Level – $L_{A90,T}$ – defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, and quoted to the nearest whole number of decibels;
 - Specific Sound Level – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given time interval, T;
 - Residual Sound Level - $L_{Aeq,T}$ – the equivalent continuous 'A' weighted sound pressure level at the assessment location in the absence of the specific sound source under consideration, over a given time interval, T; and
 - Rating Level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.
- 8.41 The background level and the rating levels are compared and the standard states that:
- "Typically, the greater the difference, the greater the magnitude of impact;
 - A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending upon the context;
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending upon the context; and

- The lower the rating level is to the measured background sound level, the less likely it is that the specific sound will have an adverse impact or a significant 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 upon the context."

- 8.42 The requirements of RBC, as outlined in the pre-application feedback (plant noise rating level 10 dB below background noise level and specific level less than or equal to background), form the governing criteria. However, the magnitude of impact is classified in accordance with BS4142:2014, as outlined in Table 8.7. The criteria are applicable to the nearest NSRs, thereby forming a worst-case scenario as more distant receptors will be subject to lower levels of noise from the proposed development.

Table 8.7: Magnitude of Impact - Operational Noise			
Rating level – background level (dB)	BS 4142 Descriptor	Adverse Effect Level	Magnitude of Impact
≥10	Indication of significant adverse effect, depending on context	SOAEL	High
5 to 9	Indication of adverse effect, depending on context	SOAEL	Medium
0 to 5	Indication of adverse effect, depending on context	LOAEL	Low
≤0	Indication of low impact	NOAEL	Low

Operational Road Traffic Noise

- 8.43 Operational road traffic has been assessed by updating the baseline noise model with the future baseline predicted traffic flows, including the proposed development.
- 8.44 The results have been compared with the baseline noise levels and the assessed using the current guidance on long-term changes in traffic noise levels in the DMRB. The magnitude of the predicted change in noise levels was determined by using the scale shown in Table 8.8.

Table 8.8: Magnitude of Impact - Road Traffic Noise Changes (long term)		
Change in Traffic Basic Noise Level $L_{A10,18h}$ dB	Adverse Effect Level	Magnitude of Impact
≥ 10	SOAEL	High
5 to 9.9	LOAEL	Medium
3 to 4.9	NOAEL	Low
<3	NOEL	Very Low

Operational Noise from Servicing

- 8.45 The delivery traffic has been assessed in accordance with Design Manual for Roads and Bridges²¹ and therefore has compared with the future baseline ambient noise levels.
- 8.46 The delivery vehicle idling and unloading has been treated as a plant noise assessment in accordance with BS4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'. Thus, the rating noise level from the vehicle idling has been compared with the existing baseline background noise levels, taking into consideration the site context.

Operational Noise from Cumulative Plant

- 8.47 The BS4142:2014 methodology has been used to assess the plant noise from cumulative schemes.

²¹ ²¹ Highways Agency, 2011. Design Manual for Roads and Bridges Volume 11 Section 3 Part 7, HA.

Significance Criteria

8.48 The scale of an effect has been derived from the magnitude of the impact and the sensitivity of the affected receptor, as detailed in Table 8.9.

Table 8.9: Scale of Effects				
Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible
Very Low	Negligible	Negligible	Negligible	Negligible

- 8.49 In line with the guidance contained within PPG-Noise:
- Major adverse effects are considered to be significant and should be prevented;
 - Moderate adverse effects are significant and should be mitigated, where possible;
 - Minor adverse effects are not significant but should be mitigated where possible; and
 - Negligible adverse effects are not significant and should not require mitigation.
- 8.50 For this assessment, major and moderate effects are considered significant.
- 8.51 Duration of effect has been described as short, medium or long-term, in accordance with the criteria set out in Table 8.10. This is based on the European Commission EIA Directive Module 3 on Impact Assessment which classifies short-term impact after completion of the project for impacts between 3 and 9 years.

Table 8.10 Duration of Effects Criteria	
Duration	Criteria
Low	< 3 years
Medium	> 3 years
High	> 9 years

Assumptions and Limitations

- 8.52 Demolition and construction noise and vibration calculations have been made based on the plant items, percentage on-times and programme provided; however, demolition and construction requirements may be subject to change by the contractor.
- 8.53 Solid site hoarding up to 2.4 m high around the perimeter of the proposed development has been included in the calculations.

Baseline Conditions

Existing Baseline

- 8.54 As secure locations were not available to carry out un-attended noise measurements, the baseline survey comprised attended noise measurements around the application site (ST1 on Caversham Road and ST2 on Vastern Road). The baseline noise and vibration climate was dominated by road traffic with noise levels of up to 74 dB LAeq in the daytime and 61 – 68 dB LAeq at night. Full details can be found in Appendix 8.2.



Figure 8.1: Noise Survey Measurement Locations

- 8.55 For this assessment, the noise levels presented in Table 8.11 have been used to assess the site suitability and set plant noise emission limits:

Table 8.11: Key Noise Measurements used in the Assessment				
Measurement Location	Period	Highest Ambient Noise Level / dB LAeq	Highest Maximum Noise Level / dB LAFmax	Lowest Background Noise Level / dB LA90
ST1 (representative of receptors R1 – R6)	Daytime (07.00-23.00)	74	96	63
	Night-time (23.00-07.00)	68	89	44
ST2 (representative of receptors R7 - R12)	Daytime (07.00-23.00)	70	91	60
	Night-time (23.00-07.00)	66	92	42

- 8.56 Demolition and construction noise thresholds have been set according to the baseline noise model, which has been calibrated to the measured ambient noise levels using the shortened CRTN methodology.

Future Baseline

- 8.57 The future baseline has been modelled based on the calibrated existing baseline model with traffic flows updated to reflect the data provided by the traffic consultant for the future baseline including the cumulative schemes.

Existing Sensitive Receptors

- 8.58 The impacts of all demolition and construction noise/vibration/traffic, and operational plant noise has been considered for the existing sensitive receptors closest to the application site.
- 8.59 The receptors identified as being sensitive to the proposed development and which have been 'scoped-in' to the assessment are summarised in Table 8.12 and shown in Figure 8.2. R13 is the Former Royal Mail site and a cumulative scheme and have been assessed as such.

Table 8.12: Summary of Sensitive Receptors	
Receptor	Sensitivity
R1 – County Borough of Reading Fire Station	Medium
R2 – 65-69 Caversham Road – commercial	Low
R3 – 71-73 Caversham Road - commercial	Low
R4 – Shurgard Self-Storage - commercial	Low
R5 – 87-98 Caversham - residential	High
R6 – 99-113 Caversham Road - residential	High
R7 – Great Brighams Mead – offices	Medium
R8 – 29-29 Vastern Road - residential	High
R9 – 31-51 Vastern Road - residential	High
R10 – SSE - offices	Medium
R11 – Sovereign House - offices	Medium
R12 – Reading Station Car park - industrial	Very low



Figure 8.2: Existing Site and Surrounding Noise-Sensitive Receptors (not to scale)

New Sensitive Receptors

- 8.60 The proposed development would be sequenced across the application site. Therefore it is likely that Building A could be occupied in advance of the completion of Buildings B, C and D. Were this to occur, Buildings B and C would be at an advanced stage of construction/ fit out such that significant noise and vibration emissions would be unlikely. These buildings would also by virtue of their massing, provide protection and screening from on-going works at Building D, which would be delivered in the final phase. Likewise, occupants of Buildings B and C would not be significantly affected by Building D works as these would be at an advanced stage, limiting the potential for significant noise and vibration effects. Accordingly on-site residential receptors have not been considered within the demolition and construction assessment.

Assessment of Effects

Demolition and Construction Effects

Demolition and Construction Noise

- 8.61 The predicted construction noise levels for each NSR are reported in Table 8.13. The medium and high impacts have been determined in accordance with Table 8.9. The significance of effect has been established on the basis of the receptor sensitivity in Table 8.9. The moderate adverse effects are highlighted in orange and the major adverse effects are highlighted in red. As a result, all highlighted cells are considered to be significant and non-significant results remain unshaded.

Table 8.13: Predicted Demolition and Construction Noise Levels Per Activity / dB L _{Aeq,1hour}																										
Receptors	Existing Ambient Noise Level	Plot A					Plot B					Plot C					Plot D					Concurrent Works*				
		Enabling and Demolition	Substructure	Superstructure	Envelope	Fit-out	Enabling and Demolition	Substructure	Superstructure	Envelope	Fit-out	Enabling and Demolition	Substructure	Superstructure	Envelope	Fit-out	Enabling and Demolition	Substructure	Superstructure	Envelope	Fit-out	S1	S2	S3	S4	S5
R1 – County Borough of Reading Fire Station	71	68	66	64	61	63	67	65	63	60	62	65	63	61	58	60	64	62	60	57	59	70	69	68	68	66
R2 – 65-69 Caversham Road	72	72	70	68	65	67	69	67	65	62	64	66	64	62	59	61	65	63	61	58	60	72	71	71	69	68
R3 – 71-73 Caversham Road	72	74	72	70	67	69	70	68	66	63	65	67	65	63	60	62	65	63	61	58	60	73	73	72	69	68
R4 – Shurgard Self-Storage	71	72	70	68	65	67	71	69	67	64	66	67	65	63	60	62	65	63	61	58	60	73	72	72	70	69
R5 – 87-98 Caversham	73	73	71	69	66	68	66	64	62	59	61	63	61	59	56	58	60	58	56	53	55	70	70	70	65	64
R6 – 99-113 Caversham Road	74	71	69	67	64	66	66	64	62	59	61	62	60	58	55	57	60	58	56	53	55	69	69	68	65	64
R7 – Great Brighams Mead	70	70	68	66	63	65	68	66	64	61	63	64	62	60	57	59	62	60	58	55	57	70	70	69	67	66
R8 – 29-29 Vastern Road	69	71	69	67	64	66	71	69	67	64	66	67	65	63	60	62	64	62	60	57	59	73	72	71	70	69
R9 – 31-51 Vastern Road	69	68	66	64	61	63	72	70	68	65	67	72	70	68	65	67	67	65	63	60	62	75	74	74	73	71
R10 – SSE	70	66	64	62	59	61	70	68	66	63	65	73	71	69	66	68	73	71	69	66	68	75	74	74	75	73
R11 – Sovereign House	69	61	59	57	54	56	64	62	60	57	59	68	66	64	61	63	71	69	67	64	66	70	69	69	72	70
R12 – Reading Station Car park	69	65	63	61	58	60	68	66	64	61	63	72	70	68	65	67	78	76	74	71	73	74	73	73	79	77
* S1 = Building A envelope, Plotg B demolition, Plot C Demolition S2 = Building A fit out, Building B envelope and fit out, Building C substructure and superstructure S3 = Building A fit out, Building B fit out, Building C superstructure and fit out S4 = Building B fit out, Building C envelope, fit out, Building D demolition S5 = Building B fit out, Building C fit out, Building D substructure																										

- 8.62 The above assessment is based on the proposed demolition and construction programme as presented in Chapter 5 of this ES. It should be noted that the construction of one building would effectively provide screening to some receptors from later phases of construction. This has not been allowed for in the modelling as the precise massing has not yet been determined (dependent on final usage); thus, the above levels provide a 'worst-case scenario'.
- 8.63 Solid site hoarding up to 2.4 m high on all sides (except the boundary with Reading sorting office) has been included in the calculations.
- 8.64 The results show that receptors 9, 10 and 12 would have 5 – 10 dB change in the period of concurrent works. These have sensitivities of high, medium and very low respectively. The resulting significance of effect is, therefore:
- Receptor 9 = **Moderate Adverse** (significant);
 - Receptor 10 = **Minor Adverse** (not significant); and
 - Receptor 12 = **Negligible** (not significant).
- Temporary **Minor Adverse – Negligible** effects (not significant) are predicted at all other receptors.
- 8.65 However, it should be noted that these are initial estimates only. A detailed management strategy would be developed by the contractor, particularly for any period of noisy works. For any noisy works it is recommended that the Contractor applies for consent for the works under Section 61 of the Control of Pollution Act 1974.

Demolition and Construction Traffic Noise

- 8.66 Table 8.14 summarises the predicted worst-case noise levels for demolition and construction traffic at 1 m from the façade of each NSR based on up to 7 Heavy Goods Vehicles (HGVs) per hour. This is taken from the peak scenario of 185 trips (370 movements) per 55-hour week, as calculated by construction advisor. The HGVs have been modelled with a speed of 15 mph.

Table 8.14: Demolition and Construction Traffic Noise Levels			
Receptor	Baseline ambient noise levels / dB L _{Aeq,18hour}	Predicted Noise Levels at receptor from construction traffic only / dB L _{Aeq,18hour}	Change in noise level / dB
R1 – County Borough of Reading Fire Station	70	58	0.3
R2 – 65-69 Caversham Road	71	61	0.4
R3 – 71-73 Caversham Road	72	62	0.4
R4 – Shurgard Self-Storage	71	65	1.0
R5 – 87-98 Caversham	73	60	0.2
R6 – 99-113 Caversham Road	73	62	0.3
R7 – Great Brighams Mead	70	59	0.3
R8 – 29-29 Vastern Road	69	59	0.4
R9 – 31-51 Vastern Road	69	60	0.5
R10 – SSE	69	61	0.6
R11 – Sovereign House	69	59	0.4
R12 – Reading Station Car park	69	57	0.3

- 8.67 The predicted levels show that the magnitude of impact would be very low at all receptors, except R4 which would be low. Due to sensitivity of the receptors, the significance of effect would be temporary **Negligible Adverse** (not significant) at all receptors.

Construction Vibration

- 8.68 All receptors (R1-R12) are at least 30 m away from potential piling activities, thus the vibrations are unlikely to significantly exceed 0.03mms⁻¹ and a low magnitude of impact is considered to arise. This would have a temporary **Negligible Adverse** effect (not significant).

Completed Development Effects

- 8.69 All operational effects are considered to be direct and permanent.
- 8.70 The following embedded mitigation forms part of the completed and operational proposed development:
- Suitable façade and ventilation design; and
 - Suitable fixed plant design to control plant noise emissions.

Operational Road Traffic Noise

- 8.71 The traffic noise has been modelled in accordance with the data provided by the traffic consultant. This shows that the proposed development would result in no increase of road traffic noise levels at any of the NSRs when compared with the future baseline. As a result, there would be **No** effect at existing NSRs. The noise maps showing the modelled scenarios are presented in Appendix 8.5.

Operational Plant Noise

Fixed Plant Installations

- 8.72 In accordance with pre-application advice provided by RBC (see Table 8.1), the specific sound level from fixed plant installations should be 10 dB below the lowest prevailing background noise level (L_{A90}) and the rating level should not exceed the background noise level. The lowest background noise level and the corresponding plant noise limit at each of the nearest NSRs has been outlined in Table 8.15. The rating noise level is the specific noise level, plus any corrections for intermittency or other sound characteristics outlined in BS4142:2014. It should be noted that this plant noise rating level applies to the cumulative noise levels from all plant installed as part of the proposed development.

Table 8.15: Fixed Plant Noise Limits				
Receptors	Period	Lowest Measured Background Noise Level Db L _{A90}	Specific Noise Level Limit / Db L _{Aeq}	Noise Rating Level Limit / Db L _{ar}
R1-R6	Daytime (0700-2300)	63	63	53
	Night-time (2300-0700)	44	44	34
R7-R8	Daytime (0700-2300)	60	60	50
	Night-time (2300-0700)	42	42	32

- 8.73 Suitable units should be chosen so as to meet the above criteria. This applies to the MVHR (mechanical ventilation heat recovery) units, FCUs (fan coil units), the proposed ASHP (air source heat pump) on the roof and all other plant associated with the proposed development.
- 8.74 Providing the above limits are met, the noise effect of fixed plant installations is predicted to be **Negligible**, which is not considered significant.

Operational Servicing Noise

Vehicle Movements

8.75 At peak times, up to four vehicle movements are proposed per hour with ingress and egress points as shown in Chapter 5: Demolition and Construction Management, Figure 5.3. Based on a lorry with a sound pressure level of 80 dBA at 10 m (based on the maximum passby sound pressure level given in BS5228-1 Table C.2 no. 34) travelling at 20 mph off-site and 15 mph on-site; this would result in a noise level of up to 52 dB $L_{Aeq,1hour}$ at 1 m from the façade of the nearest offsite noise-sensitive receptors. Thus, the increase in noise level is predicted to be < 1 dB in both the day and night-time period. Therefore, in accordance with the DMRB long-term impacts, the effect is considered to be **Negligible** (not significant) at the NSRs.

8.76 The noise levels predicted at 1 m from the façade of the proposed development are up to 61 dB $L_{Aeq,1hour}$. This would increase the ambient noise levels by up to 1 dB during the night-time period and by less than 1 dB during the day. Thus, in accordance with the DMRB long-term impacts, the effect is considered to be **Negligible Adverse** (not significant) at the proposed development.

Idling Vehicles on Proposed Development

8.77 The exact loading bay location has not been determined. However, idling HGV noise was modelled at 5 m from the façade and 0.5 m above the ground (receptor at 5 m above ground level) between Plots B and C to provide a reasonable 'worst-case' assessment based on the ingress and egress routes to the site. The HGV was modelled using the commercial software CadnaA as a point source with a sound pressure level of 68 dBA at 10 m (based on BS5228-1 Table C.2 no. 20).

8.78 The results of the modelling are presented in Table 8.16, which compares the idling HGV noise at the façade of the proposed development to the pre-existing background noise level using the methodology set out in BS4142:2014. A 3 dB feature correction has been applied for intermittency and a 4 dB feature correction has been applied for tonality in accordance with BS4142:2014. Thus, a total of 7 dB has been added to the specific noise level to calculate the rating noise level.

Table 8.16: HGV Delivery Noise Assessment to Proposed Development			
Assessment Period	Rating Sound Level (including 7 dB feature correction) at Development Façade L_{Ar} / dB	Modal Average Background Noise Level at Proposed Residential Façades $L_{A90,T}$ / dB	Difference between Rating Sound Level and Background Noise Level / dB
Daytime (07.00-23.00)	82	60	+22
Night-time (23.00-07.00)	82	42	+40
* based on pre-existing background noise levels			

8.79 The difference between the idling noise and the existing background noise levels is 22 dB and 40 dB in the daytime and night-time respectively; resulting in a **Major Adverse** effect (significant) at the proposed Building B receptors. A similar result would be calculated to the other residential buildings if adjacent to a loading bay. As a result, signage should be erected to remind service vehicles that idling is not permitted at any time. By eliminating idling, a **Negligible Adverse** effect is predicted (not significant).

Idling Vehicles on NSRs

8.80 The same principle has been applied to predict the noise impact on the existing NSRs. This is presented in Table 8.17.

Table 8.17: HGV Delivery Noise Assessment to NSRs			
Assessment Period	Rating sound level (including 7dB feature correction) at development façade L_{Ar} / dB	Modal average background noise level at proposed residential façades $L_{A90,T}$ / dB	Difference between rating sound level and background noise level / dB
Daytime (07.00-23.00)	59	60	-1
Night-time (23.00-07.00)	59	42	+17
* based on pre-existing background noise levels			

8.81 The difference between the idling noise and the existing background noise levels is -1 dB and 17 dB in the daytime and night-time respectively; resulting in a **Major Adverse** effect during the night (significant). As a result, signage would be erected to remind service vehicles that idling is not permitted at any time. By eliminating idling a **Negligible Adverse** effect is predicted (not significant).

Operational Activity Noise – Noise Breakout from Proposed Gym

8.82 Under the development parameters, the proposed development could include the provision of a gym; however, the operational hours and exact location are unknown at this stage. Therefore, as is standard practice, in order to mitigate potential noise break-out it is anticipated that a suitably worded planning condition would be imposed to ensure that noise levels do not exceed existing background noise levels at the nearest noise-sensitive receptors.

Assessment of Residual Effects Additional Mitigation

8.83 All fixed plant installations would be fitted with standard attenuation and acoustic screening, as required to meet the noise emissions limits. No additional mitigation would be required beyond this.

8.84 In order to minimise the impact of idling delivery vehicles on the closest residential premises, signage indicating that no vehicle idling is permitted, would be erected.

Demolition and Construction Residual Effects

8.85 Despite the adoption of embedded mitigation in the form of BPM and as proposed within Chapter 5: Demolition and Construction Environmental Management, which would be expected to be secured by a suitably worded planning condition requiring submission of a CEMP, temporary significant adverse effects are predicted at R9 during the demolition and construction of the proposed development during concurrent work periods. It should be noted that this would occur for relatively short-periods within the overall programme. The construction plant noise at all other receptors would not be significant.

8.86 The residual demolition and construction effects would therefore be as follows:

- Demolition and construction noise: direct, temporary **Moderate Adverse** effect at R9, **Minor-Negligible Adverse** effect at R1-8 and R10-12.
- Construction Vibration: indirect, temporary, **Negligible Adverse** vibration effects at existing noise-sensitive receptors; and
- Demolition and construction traffic noise: direct, temporary, **Negligible Adverse** effect at existing noise-sensitive receptors.

Completed Development Residual Effects

8.87 The residual completed development effects would therefore be as follows:

- Fixed plant installations: direct, permanent **Negligible Adverse** effect;
- Operational traffic: **No** effect;
- Operational servicing vehicle movements: direct, permanent **Negligible Adverse** effect; and
- Operational servicing idling noise: direct, permanent **Negligible Adverse** effect.

Summary of Residual Effects

8.88 The residual noise and vibration effects are summarised in Table 8.18.

Table 8.18: Summary of Residual Significance of Effects								
Receptor	Residual Effect	Additional Mitigation	Nature of Residual Effect*					
			Scale of Effect **	+ -	D I	P T	R IR	St Mt Lt
Demolition and Construction								
R9	Demolition and construction noise	N/A	Moderate	-	D	T	R	Mt
R1-8, R10-12		N/A	Minor-Negligible	-	D	T	R	Mt
All	Construction traffic noise	N/A	Negligible	-	D	T	R	Mt
All	Demolition and construction vibration	N/A	Negligible	-	D	T	R	Mt
Completed Development								
All	Changes in traffic noise	N/A	None	N/A	I	P	IR	Lt
All	Noise from fixed plant installations	Suitable selection and attenuation of plant	Negligible	-	D	P	IR	Lt
All	Noise from servicing vehicle movements	N/A	Negligible	-	D	P	IR	Lt
Proposed development		N/A	Negligible	-	D	P	IR	Lt
All	Noise from servicing vehicle idling	Signage stating no idling permitted	Negligible	-	D	P	IR	Lt
Proposed development		Signage stating no idling permitted	Negligible	-	D	P	IR	Lt
Notes:								
* - = Adverse/ + = Beneficial/ +/- Neutral; D = Direct/ I = Indirect; P = Permanent/ T = Temporary; R=Reversible/ IR= Irreversible; St- Short term/ Mt –Medium term/ Lt –Long term.								
**Negligible/Minor/Moderate/Major								

8.89 The likely significant effects, i.e. those residual effects which are moderate or major in scale are as follows:

- Receptor 9, 31-51 Vastern Road - **Moderate Adverse** during demolition and construction.

Cumulative Effects

8.90 Table 8.19 provides a summary of the likely cumulative effects resulting from the proposed development and the cumulative developments.

Table 8.19: Inter-Project Cumulative Effects				
Cumulative Development	Demolition and Construction		Operation / Completed Development	
	Cumulative Effects Likely?	Reason	Cumulative Effects Likely?	Reason
Thames Quarter (1) / Station Hill (2) / Land between Weldale-Chatham Street (4) / 29 Station Road (5) / 52-55 Friar Street (6) / Broad Street Mall (9)	No	High Existing ambient noise level means construction noise from other side of railway line unlikely to result in cumulative effect.	No	High Existing ambient noise level means operational noise from other side of railway line unlikely to result in cumulative effect.
Kenavon Drive (3)	No	Considerable distance between this development and assessed noise-sensitive receptors	No	Considerable distance between this development and assessed noise-sensitive receptors
Former Scottish and Southern Energy Site (8)	Unknown	The application has not yet been submitted so the timeframes are unknown. However, there is potential for construction phases to overlap. Nevertheless, the high pre-existing ambient noise levels on Vastern Road mean that significant deviation from the effects already predicted are unlikely.	No	Proposed residential scheme with minimal traffic expected. Plant noise is expected to be controlled by suitably worded planning condition in accordance with RBC recommendations.
Network Rail Thames Valley Area site office and Former Royal Mail site (7)	Yes	As outlined below	Yes	As outlined below

8.91 The Former Royal Mail site has been assessed below.

Demolition and Construction Cumulative Effects

8.92 The Noise and Vibration Chapter from the Environmental Statement undertaken for the Former Royal Main Site (80 Caversham Road planning application number 182252 as available on RBC planning portal) predicts that typical construction noise from this site alone would be up to 70 dB at receptors on Caversham Road and 73 dB at receptors on Vastern Road. If the works at the Former Royal Mail site are undertaken concurrently with the proposed development, there would be a change of up to 5 dB. This would result in **Minor Adverse** effect (not significant) and is applicable to the non-concurrent works (excluding scenarios 1-5 in Table 8.13).

8.93 However, if works at the Former Royal Mail Site were to be undertaken concurrent with construction of multiple buildings at the proposed development, a medium magnitude of impact would occur at receptors R7-R12. This would have the following temporary effects:

- R7, R10, R11: **Minor Adverse** effect (not significant);
- R8, R9: **Moderate Adverse** effect (significant); and
- R12: **Negligible Adverse** effect (not significant).

Thus, only R8 and R9 would experience significant effects. This is provided as a 'worst-case' scenario and may only occur for a short period, if it all.

- 8.94 Construction traffic noise assessment for the site at the Former Royal Mail Site has not been provided; however, it is considered that in the context of the existing ambient noise levels; a temporary **Minor-Negligible** effect (not significant) would result from cumulative construction traffic noise.
- 8.95 It is considered that demolition and construction vibration from adjacent cumulative sites would be controlled by BPM and that the resulting cumulative vibration effect at the receptors would not be in excess of the levels predicted for the proposed development alone; thus there would be a temporary **Negligible Adverse** effect.

Completed Development Cumulative Effects

- 8.96 Due to the net reduction in vehicle movements associated with the proposed development, the in combination road traffic noise effects from the proposed development cumulative developments would be **None**.
- 8.97 The plant noise rating limits for the development immediately south of the proposed development (80 Caversham Road) have been set at equal to background and the specific noise limits set at 10 dB below background (as detailed in the ES submission for planning application number 182252). Therefore, as a 'worst-case' scenario the cumulative plant noise from both developments would result in 1 dB increase in the specific noise level and up to 5 dB increase in the rating level. This is considered to be a low magnitude of impact and, therefore, a **Minor Adverse** effect (not significant).
- 8.98 The cumulative effect of servicing noise (both movements and idling) would be controlled in order to meet the on-site requirements by minimising idling at the proposed development. As the existing off-site receptors are at a greater distance from the proposed movements and loading bays, no cumulative effects are predicted as a result of servicing noise.