



10.0 Noise

10.1 Introduction

- 10.1.1 This Chapter of the ES assesses the potential impact of noise upon the proposed receptors due to existing sources of noise, as well as the impact of the development, construction and operational phases, upon existing noise sensitive receptors.
- 10.1.2 The chapter describes the methods used to assess the impacts, the baseline conditions currently existing at the Site and surroundings, the potential direct and indirect impacts of the development arising from the construction and operational phases, the mitigation measures required to prevent, reduce, or offset the impacts and the residual impacts.
- 10.1.3 Key sources of noise impacting upon the proposed development include College Road to the West and the A3 (M) to the east.

10.2 Methodology and Scope

Policy Background

National Planning Policy Frameworkⁱ

- 10.2.1 The National Planning Policy Framework (NPPF) sets out the Government’s core policies and principles with respect to land use planning. In respect to noise, the Framework states that planning policies and decisions should aim to:
 - Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
 - Mitigate and reduce to a minimum other adverse impact on health and quality of life arising from noise from new development, including through the use of conditions;
 - Recognising that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
 - Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Noise Policy Statement for Englandⁱⁱ

- 10.2.2 The Noise Policy Vision is to ‘promote good health and a good quality of life through the effective management of noise within the context of government policy on sustainable development’.
- 10.2.3 Through effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development, there are the following aims:
 - 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.

Planning Practice Guidanceⁱⁱⁱ

- 10.2.4 Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustics environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.
- 10.2.5 Local planning authorities’ plan-making and decision taking should take account of the acoustic environment and in doing so consider:
 - Whether or not a significant adverse effect is occurring or likely to occur;
 - Whether or not an adverse effect is occurring or likely to occur; and
 - Whether or not a good standard or amenity can be achieved.
- 10.2.6 In line with the Explanatory Note of the Noise Policy Statement for England, the would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.
- 10.2.7 The Observed Effect Levels are as follows:
 - Significant Observed Adverse Effect Level (SOAEL): This is the level of noise exposure above which adverse effects on health and quality of life occur;
 - Lowest Observed Adverse Effect Level (LOAEL): This is the level of noise exposure above which adverse effects on health and quality of life can be detected; and
 - No observed Effect Level (NOEL): This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

10.2.8 Table 10.1 summarises the noise exposure hierarchy, based on the likely average response.

Table 10.1 – Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No effect	No observed effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any changes in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
Lowest observed adverse effect level			



Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
Significant observed adverse effect level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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 effect	
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening;	Unacceptable adverse effect	Prevent

	loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.		
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Key Legislation

10.2.9 The noise effects that will occur during the site preparation, construction and operational phases of the Proposed Development are summarised below.

Site Preparation, Earthworks and Construction Phase

- Direct construction noise at existing local sensitive receptors from construction activities; and,
- Increase in indirect construction noise at existing local noise-sensitive receptors from construction traffic.

Operational Phase

- Changes in road traffic noise levels associated with the Proposed Development on existing local noise-sensitive receptors along the affected road network;
- The noise levels generated by the existing nearby road on future receptors within the proposed development; and,
- Noise from Mechanical and Electrical (M&E) plant on proposed and existing residential receptor.

Standards and Guidance

10.2.10 The following documents have been referenced in this assessment:

British Standard 5228: Noise and Vibration Control on Construction and Open Sites – Part 1: Noise: 2009+A1 2014 (BS 5228-1)^{iv}

- 10.2.11 This British Standard sets out techniques required to predict and assess the likely noise effects from construction works, based on detailed information on the type and number of plant being used, their location, and the length of time they are in operation.
- 10.2.12 The noise prediction method is used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day.
- 10.2.13 This British Standard also documents a database of information, comprising previously measured sound power levels for a variety of different construction plant undertaking various common activities.
- 10.2.14 Example criteria are presented for the assessment of the significance of noise effects. Such criteria maybe concerned with fixed noise limits and/or ambient noise level changes. With respect to fixed noise limits, BS 5228-1 presents the following noise limits which are taken as an average over a 10-hour working day:
- 70.0dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise; and,
 - 75.0dB(A) in urban areas near main roads and heavy industrial areas.



British Standard BS 8233:2014: Guidance on sound insulation and noise reduction for buildings^v

Noise Criteria Limits

10.2.15 The scope of this standard is the provision of recommendations for the control of noise in and around buildings including residential dwellings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

10.2.16 The standard suggests suitable internal noise levels within different types of buildings, including residential dwellings, as shown in Table 10.2.

Table 10.2 – BS8233 Recommended Internal Noise Levels

Criterion	Typical Situation	Design LAeq, T
Suitable resting/sleeping conditions	Living Room	35
	Bedroom	30
For a reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not exceed 45dB LAmax,fast		

10.2.17 BS8233: 2014 goes on to recommend noise levels for gardens. According to BS8233:

"It is desirable that the external noise level does not exceed 50dB LAeq,T, with an upper guideline value of 55dB LAeq,T which would be acceptable in noisier environments. However, it is also 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 might be warranted."

10.2.18 BS8233 goes on to say:

"In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited".

Ventilation Requirements

10.2.19 Where a partially open window cannot be relied upon to provide an adequate level of facade sound insulation performance, it is necessary to consider alternative ventilation for habitable rooms. Section 8.4.5.4 within BS8233 states:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice."

Alternatively, acoustic ventilation units (see 7.7.2 below) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans."

10.2.20 Section 7.7.2 states:

"NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

World Health Organisation's (WHO) 'Guidelines for Community Noise'^{vi}

10.2.21 The WHO 'Guidelines for Community Noise' offers advice with regard to setting noise criteria applicable to sleep disturbance. Section 4.2.3 specifies

'If the noise is not continuous, LAmax or SEL are used to indicate the probability of noise-induced awakenings. Effects have been observed at individual LAmax exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a LAmax exceeding 45 dB.'

10.2.22 The sound insulation performance value of 15dB for a façade containing a partially open window accords with the guidance offered in BS8233:2014.

10.2.23 The guidelines reference a study by Vallet & Vernet, 1991, which concluded that:

'For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB LAf,max more than 10-15 times per night.'

10.2.24 Accordingly, this assessment has utilised the 10th highest measured maximum noise level from the night-time period and allows for an assessment of a typical maximum noise level in determining façade sound insulation performance.

BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'^{vii}

10.2.25 This standard describes methods for rating and assessing sound of an industrial or commercial nature which includes:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and,
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

10.2.26 The procedure detailed in the standard compares the measured or predicted noise level 'the specific noise level' from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

10.2.27 The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00 – 23:00) 1 hour; and,
- Night-time (23:00 – 07:00) 15 minutes.

10.2.28 There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:



Tonality

- +2dB: where the tonality is just perceptible;
- +4dB: where the tonality is clearly perceptible; and,
- +6dB: where the tonality is highly perceptible.

Impulsivity

- +3dB: where the impulsivity is just perceptible;
- +6dB: where the impulsivity is clearly perceptible; and,
- +9dB: where the impulsivity is highly perceptible.

Intermittency

- +3dB: where the intermittency is readily distinctive against the acoustic environment.

10.2.29 In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

Institute of Environmental Management & Assessment 'Guideline for Environmental Noise Impact Assessment', October 2014^{viii}

10.2.30 The guidelines address the key principles of noise impact assessment and are applicable to all development proposals where noise effects are likely to occur. The guidelines provide specific support on how noise impact assessment fits within the Environmental Impact Assessment (EIA) process. They cover:

- How to scope a Noise Assessment;
- Issues to be considered when defining the baseline noise environment;
- Prediction of changes in noise levels as a result of implementing development proposals; and,
- Definition and evaluation of the significance of the effect of changes in noise levels (for use only where the assessment is undertaken within an EIA).

10.2.31 Although the guidance states that it is only applicable for use in an Environmental Impact Assessment (EIA), in the absence of any other relevant guidance for assessing changes in ambient noise levels, it is the most appropriate document for establishing significance of effect.

10.2.32 Table 10.3 categorises the change in noise level for a noise sensitive receptor.

Table 10.3 - Effect Descriptors

Effect	Change in Ambient Noise Level
Substantial	>10dB
Moderate	5.0dB – 10.0dB
Slight	3.0dB – 5.0dB
Negligible	1.0 – 3.0dB

None/not significant	0 – 1.0dB
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Scoping Assessment Stage

10.2.33 A scoping opinion was sought from Havant Borough Council (HBC) and direct communication was sought with Daphney Haywood, Principal Planner at HBC, by email on 13th February 2018. Our queries were passed on to Mark Moss, Environmental Health Officer (EHO) at HBC. The purpose of the consultation was to agree on the appropriate assessment methodology and criteria. To this end all appropriate assessments, measurement locations and noise level criteria were included. The EHO did not comment on most elements, implying tacit approval. The following points were however made:

- BS4142:2014; HBC would be looking for NOAEL (No Observable Effect Level) or better, when measured according to British Standard BS4142-2014, at the boundary of the nearest sensitive receptor; and,
- For external amenity, a level of 50dBA is preferred.

10.2.34 Scoping opinion provided separately by HBC identified that Vibration could be scoped out of the assessment unless piling was to be used. It has been confirmed that this is not the case, and therefore vibration is scoped out.

Assessment Methodology

10.2.35 The assessment aims to predict any impacts associated with existing sources of sound impacting on the development as well of the impact of the proposed development if any, upon surrounding existing residential. The assessment will consider all relevant sources, where information is available, and make reasonable assumptions based on likely activities.

10.2.36 The assessments are based on all current and relevant guidance as detailed above. Where an exceedance of the criteria or advice given in the above is predicted, mitigation measures will be specified.

Receptor Sensitivity

10.2.37 The sensitivity of receptors depends upon their nature. Where the sensitivity of a receptor is greater, identified impacts could be more significant, and vice versa. For instance, it is commonly considered that heavy industrial installations are not particularly sensitive to noise whilst residential dwellings are. Between these two receptor types are other locations and places of work such as offices.

10.2.38 In determining the significance criteria, it is necessary to consider the sensitivity of the receptor in conjunction with the predicted noise and vibration levels / level changes. Table 10.4 presents the criteria used to define the sensitivity of receptors in relation to noise and vibration impacts.

Table 10.4 - Criteria Used to Describe Sensitivity of Receptors

Sensitivity	Description	Example Receptor
High	Receptors where people or operations are particularly sensitive to noise/vibration	Internal and external living areas associated with residential dwellings, quiet outdoor areas used for recreation, conference facilities, auditoria/studios, schools in the



		daytime, hospitals/residential care homes
Medium	Receptors moderately sensitive to noise/vibration where it may cause some distraction or disturbance	Offices, community facilities, scheduled Ancient Monuments/Listed Buildings
Low	Receptors with a low sensitivity to noise/vibration where it may in extreme cases cause some disturbance	Restaurants, commercial Installations
Negligible	Receptors where distraction or disturbance from noise/vibration is minimal	Factories, storage centres, Industrial sites

Effect Magnitude

Construction Noise

- 10.2.39 With respect to hours of work, BS 5228 makes reference to the fact that noise levels generated during the evening (19:00 to 23:00) may need to be lower than the daytime (07:00 to 19:00) period (a figure of 10dB is quoted) and also that for any night-time operations (23:00 to 07:00) levels should be quieter still. The Standard does not, however, offer guidelines with respect to acceptable levels.
- 10.2.40 Following the fixed noise level limits presented in BS 5228-1 for urban areas and regions close to main road traffic, where it is calculated that construction noise levels will exceed 70dB $L_{Aeq,T}$ (facade) applicable to the core working day, it is considered that a noise impact of ‘major’ magnitude could arise. Noise levels which are calculated to fall below this criterion are considered to give rise to a ‘negligible’.

Table 10.5 - Construction Noise Magnitude of Impact

Noise Level, $L_{Aeq,T}$ (dB)	Magnitude of Impact
70dB Criterion	No Effect
0.1 – 0.9	Negligible
1.0 – 2.9	Slight
3.0 – 4.9	Moderate
5.0+	Substantial

10.2.41 With regards the significance, a moderate or substantial adverse impact is considered significant.

Changes in Road Traffic Noise

10.2.42 DMRB Volume 11 'Environmental Assessment', Section 3 'Environmental Assessment Techniques', Part 7 HD 213/11 - Revision 11 'Noise and Vibration' states that:

"A change in road traffic noise of 1 dB $LA_{10,18h}$ in the short term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening), a 3 dB $LA_{10,18h}$ change is considered perceptible." (Paragraph 3.37).

10.2.43 The assessment of noise impact due to changes in road traffic has been undertaken drawing upon the suggested classification of effect provided within the DMRB. The DMRB classification of effects has been adapted to produce a set of magnitude criteria ranging from no effect to major as presented within Table 10.6 for the short term and Table 10.7 for the long term.

Table 10.6 - Classification of Magnitude of Noise Impacts for Comparison for Future Noise against Existing Noise – Short Term

Noise Level Change, $L_{A10,18hr}$ (dB)	Magnitude of Impact
0	No Effect
0.1 – 0.9	Negligible
1.0 – 2.9	Slight
3.0 – 4.9	Moderate
5.0+	Substantial

Table 10.7 - Classification of Magnitude of Noise Impacts for Comparison for Future Noise against Existing Noise - Long-term

Noise Level Change, $L_{A10,18hr}$ (dB)	Magnitude of Impact
0	No Effect
0.1 – 2.9	Negligible
3.0 – 4.9	Slight



5.0 – 9.9	Moderate
10.0+	Substantial

10.2.44 Any impact of moderate or major adverse, in the short term, is considered significant and any change categorised as minor or above is considered significant in the long term.

Road Traffic Noise Impact upon Proposed Development

10.2.45 During the baseline noise survey, it was noted that noise generated by road traffic dominated the noise climate across the Site.

10.2.46 For the assessment of internal noise levels, the BS8233:2014 criteria of 30dB $L_{Aeq,8hr}$ and 45dB L_{AFmax} applicable to bedrooms and 35dB $L_{Aeq,16hr}$ applicable to living rooms have been adopted for the night-time and daytime periods respectively.

10.2.47 For external amenity area, such as gardens, the BS8233 upper guideline value of 55dB $L_{Aeq,16hr}$ for areas close to the road and 50dB for the majority of the Site will be aimed for.

Plant Noise Emission Limits upon Proposed & Existing Residential Development

10.2.48 The impact of any proposed fixed plant items upon existing receptors will be assessed in accordance with the guidance and criteria given in BS4142:2014. The assessment will set plant noise emission limits based on the existing background sound level.

10.2.49 The aim is to ensure no more than a negligible impact at the receptors by way of design of the fixed plant.

Effect Significance

10.2.50 The significance of noise impacts has been assessed against the magnitude of change and sensitivity of the receptor according to the impact matrix presented in Table 10.8. The significance of the impact is dependent on the context and nature of the noise and will be approached individually for each assessment/source.

Table 10.8 - Matrix for Determining the Significance of Impact

		Magnitude of Impact			
		Substantial magnitude	Moderate magnitude	Slight magnitude	Negligible magnitude
Sensitivity of Receptor	Very High	Major	Major	Intermediate	Neutral
	High	Major	Intermediate	Minor	Neutral

		Magnitude of Impact			
		Substantial magnitude	Moderate magnitude	Slight magnitude	Negligible magnitude
	Medium	Major	Intermediate	Minor	Neutral
	Low	Intermediate	Minor	Neutral	Neutral

10.2.51 The following noise sensitive receptors have been considered with regards to the construction and development impacts upon existing receptors.

Table 10.9 – Noise Sensitive Receptors

Receptor	Address	X	Y
R1	24 Atlantis Ave	468618.38	106924.67
R2	16 Atlantis Ave	468572.39	107074.00
R3	9 Atlantis Ave	468810.99	107201.73
R4	Havant & South Downs College – South East Building	469058.20	107236.47

Limitations of the Assessment

10.2.52 Whilst basic information regarding machinery and plant to be used during the construction phase of the development has been supplied, assumptions have been made for any additional plant items used during construction. Accordingly, the calculations performed are accurate to a reasonable level based on knowledge of other development schemes completed in the past.

10.2.53 The exact layout of the outline portion of the proposed development is not fixed. As such, recommendations were made based within the limits set for each usage. Any recommendations and mitigation measures are indicative and further detailed assessment of any required mitigation measures and site layout may need to be undertaken once the layout for the outline section of the Site is finalised.



10.3 Baseline Environment

Existing baseline

10.3.1 In order to determine baseline noise levels at existing and proposed receptors, Baseline Noise surveys have been undertaken at the Site. The Baseline Noise Survey consisted of two Road Traffic Noise Surveys and a full weekday and weekend ambient sound survey.

Road Traffic Noise Survey – A3 (M)

10.3.2 REC has carried out an unattended Road Traffic Noise Survey for the A3 (M) Motorway. The survey took place during the following period:

- Tuesday 20th and Friday 23rd February 2018.

10.3.3 The following location was chosen for the survey:

- Noise Measurement Position 1 (NMP1): Located on the eastern Site boundary approximately 59m from the nearside kerbstone of the A3 (M). The microphone of the sound level meter was raised to a height of 1.5m in free-field conditions. The dominant noise source in this location was associated with vehicles travelling on the A3 (M).

10.3.4 A summary of the measured sound pressure levels is presented in Table 10.10. Full results are available in Appendix 10.2

Table 10.10 - Road Traffic Sound Measurement - A3 (M)

Date	Period	Average Measured Sound Pressure Levels, free-field (dB) L _{Aeq,T}	10 th highest L _{Amax,fast}
20/02/2018 – 21/02/2018	Night-time	57.0	68.6
21/02/2018 – 22/02/2018	Daytime	59.9	-
	Night-time	55.5	66.7
22/02/2018 – 23/02/2018	Daytime	60.8	-
	Night-time	56.5	69.1

Road Traffic Noise Survey – College Road

10.3.5 REC has carried out a 3-hour Road Traffic Noise Survey in accordance with the shortened procedure given in CRTN for College Road. The survey took place during the following period:

- Thursday 15th February 2018 between 11:00 and 14:00.

10.3.6 The following location was chosen for the survey:

- Noise Measurement Position 2 (NMP2): Located on the western Site boundary approximately 4.2m from the nearside kerbstone of College Road. The microphone of the sound level meter was raised to a height of 1.5m in free-field conditions. The noise climate at this location comprised noise associated with road traffic vehicles.

Table 10.11 – Road Traffic Sound Measurements – College Road

Measurement Period Start	Measured Sound Pressure Levels (dB)		
	L _{Aeq,T}	L _{Amax,fast}	L _{A10,T}
15/02/2018 11:00	66.2	81.0 ¹	71.2
15/02/2018 12:00	65.5		70.1
15/02/2018 13:00	65.8		70.1
* 10 th highest measured maximum noise level in three-hour period.			

Ambient Sound Survey

10.3.7 REC has conducted a full weekday and weekend ambient sound survey in the centre of the Site, in order to measure the background sound level at the closest proposed receptors to the proposed local centre.

10.3.8 The survey was undertaken during the following time period:

- 11:00 Thursday 15th February to 11:00 Monday 19th February 2018.

10.3.9 The following noise measurement position was chosen for the ambient sound survey:

- Noise Measurement Position 3 (NMP3): Located near the centre of the site. The microphone was located 1.5m above ground level and in free-field conditions. Noise at this location was dominated by distant vehicle noise from both the east and west, with no other sources noted as being significant.

10.3.10 A summary of the average measured 1-hour daytime and 15-minute night-time background sound pressure levels are presented in Table 10.12 below for the relevant time periods in accordance to operating hours. Full detail is available on request:

Table 10.12 - Summary of Measured Ambient Sound Pressure Levels

Date	Period	Measured Ambient Sound Pressure Levels, L _{Aeq,T} (dB)		Measured Background Sound Level, L _{A90,T} (dB)	
		Median	Range	Median	Range
	Daytime	N/A	N/A	N/A	N/A



Thursday 15 th February 2018	(07:00 – 23:00)				
	Night-time (23:00 – 07:00)	40.3	36.6 - 53.8	36.8	32.6 - 50.8
Friday 16 th February 2018	Daytime (07:00 – 23:00)	57.3	48.7 - 62.5	52.6	44.6 - 59.1
	Night-time (23:00 – 07:00)	51.2	47.8 - 56.9	47.6	40.5 - 55.1
Saturday 17 th February 2018	Daytime (07:00 – 23:00)	54.4	51.1 - 58.5	52.2	48.2 - 56.5
	Night-time (23:00 – 07:00)	51.8	46.9 - 57.8	47.6	40.6 - 54.9
Sunday 18 th February 2018	Daytime (07:00 – 23:00)	56.4	47.1 - 58.5	54.4	41.7 - 56.7
	Night-time (23:00 – 07:00)	41.6	36 - 49.5	34.0	27.5 - 47.7

10.3.11 The noise surveys were completed using the following specification noise measurement equipment shown in Table 10.13 Calibration dates relate to those at the time of the surveys.

Table 10.13 - Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1-3	Sound Level Meter	01dB-Metravib Black Solo	65211	30 th March 2019
	Pre-amplifier	01dB-Metravib PRE 21 S	16831	

	Microphone	01dB Metravib MCE212	142644	
	Calibrator	01dB-Metravib CAL-21	34113643	25 th October 2018

10.3.12 The sound level meters were field-calibrated on Site prior to and after noise measurements were taken. No significant drift was witnessed. Calibration certificates are available upon request.

Future baseline

10.3.13 In addition to the above surveys road traffic data has been supplied in the form of 18-hour Annual Average Weekday Traffic (AAWT) with and without development generated traffic movements in order to assess the impact of road traffic sound on the site and the existing receptors off the surrounding road network. Traffic data without development generated traffic shows the change in baseline noise levels that occur due to natural growth.

Mitigation within the Submitted Design

Construction

10.3.14 It is assumed that best practicable means would be followed by the contractor/s such as those detailed below.

10.3.15 Accepted safeguards exist to minimise the effects of construction noise, these include:

- The various EC Directives and UK Statutory Instruments that limit noise emissions from a variety of construction plant;
- Guidance set out in BS5228-1 which covers noise control on construction sites; and,
- The powers that exist for local authorities under Sections 60 and 61 of the Control of Pollution Act 1974 to control noise from construction application sites.

10.3.16 The adoption of Best Practicable Means, as defined in Section 72 of the Control of Pollution Act 1974 is usually the most effective means of controlling noise from construction sites. Such measures where appropriate may include the following:

10.3.17 Any compressors brought on to the Site to be silenced or sound reduced models fitted with acoustic enclosures;

- All pneumatic tools to be fitted with silencers or mufflers;
- Care to be taken when erecting or striking scaffolds to avoid impact noise from banging steel. All operatives undertaking such activities to be instructed on the importance of handling the scaffolds to reduce noise to a minimum;
- The majority of deliveries to be programmed to arrive during normal working hours only. Care to be taken when unloading vehicles to minimise noise. Delivery vehicles to be routed so as to minimise disturbance to local residents. Delivery vehicles to be prohibited from waiting within or in the vicinity of the Site with their engines running;



- All plant items to be properly maintained and operated according to manufacturers' recommendations in such a manner as to avoid causing excessive noise;
- All plant to be sited so that the noise impact at nearby noise sensitive properties is minimised;
- Local hoarding, screens or barriers to be erected as necessary to shield particularly noisy activities; and,
- Problems concerning noise from construction works can often be avoided by taking a considerate and neighbourly approach to relations with the local residents. Works should only take place during given periods, e.g. during normal construction hours and not at night.

10.3.18 It is recommended that the above measures be included in any Construction Environmental Management Plan (CEMP) that may be issued to and agreed with the contractor(s) conducting the works.

10.3.19 Experience from other sites has shown that by implementing the above measures, typical noise levels from construction works can be reduced by approximately 5dB to 10dB.

Operation

10.3.20 Regarding Phase 1 of the development, embedded mitigation measures include 2.4m high Acoustic Barriers for garden areas which exceed the criteria for external amenity areas. With regards to internal noise levels, a glazing unit with configuration 6mm glass/12mm air space/6mm glass or similar affording a sound insulation performance in the order of 30dB + Ctr is to be implemented at all habitable rooms. Furthermore, a through-frame window mounted trickle ventilator is to be incorporated into the glazing unit of the habitable rooms, which would otherwise exceed internal criteria so that fresh air can enter the room without having to open windows.

10.3.21 As the remaining phases form the outline section of the Site, no embedded mitigation measures were recommended.

10.4 Likely Significant Environmental Effects of the Scheme

Construction Phase Effects

Effect during construction Phase

Construction Noise

- 10.4.1 It is inevitable with any major development that there will be some disturbance caused to those nearby during the clearance and construction phases of the Site. However, disruption due to construction is only temporary, limited to the Site and is of medium term duration.
- 10.4.2 It is anticipated that construction will take place on a plot-by-plot basis due to the nature of the Proposed Development. It would be expected that noise would be intermittent and would decrease in intensity over the duration of the construction period.
- 10.4.3 The predictions have followed the methodology contained within BS 5228-1 and are in terms of the $L_{Aeq,T}$ over the core working day, which is 08:00 to 18:00 hours Monday to Friday and 08:00 to 13:00 on Saturdays. The predictions assume all plant being located at the approximate centre of the Site to represent an average case scenario.
- 10.4.4 Table 10.14 sets out the typical plant type, number and assumed utilisation (percentage 'on-time') used in the prediction of noise levels during the key construction activities.

Table 10.14 - Assumed Construction Plant Details

Plant Type	Sound Pressure Level @ 10m	No. of Plant	Assumed % 'On-time'
Dozer	75	2	80
Tracked Excavators	77	4	80
Dump Truck	79	3	80
Lorry	80	2	80
Road Roller	80	3	80
Asphalt Paver	77	2	80
Cement Mixer Truck Idling	71	1	60
Concrete mixer truck and Cement Mixer	67	2	80
Mobile Telescopic Crane	77	2	40
Telescopic Handler	79	1	50
Compressor	77	2	80
Circular Saw	85	1	40
Diesel Generator	61	1	100
Dump Truck	86	3	80
Fork Lift Trucks	88	3	70
Wheeled Excavator with Hydraulic Breaker	78	2	70

10.4.5 Predictions have been carried out to determine noise levels likely to be generated during the construction phase. For the purpose of these predictions, it was assumed that the intervening ground between the construction noise sources and the receivers will be acoustically hard such that there will be no additional attenuation of sound due to ground absorption, and that no acoustic barriers such as local buildings will be present, thus informing a worst-case assessment.

10.4.6 Noise predictions have been undertaken for the four off-Site noise sensitive receptors R1 to R4.

10.4.7 Table 10.15 sets out the average predicted embedded mitigation earthworks and construction noise levels for the construction stage of the works. A 70dB assessment criterion has been adopted in accordance with guidance contained in BS 5228 for rural areas. Any exceedances are highlighted in bold.



10.4.8 The average assessments are based on the average position to the centre of the closest phase/development plot to that receptor. Any works that take place closer to the receptor will be for a short period and an average, central position is considered robust.

Table 10.15 – Predicted Embedded Best Practice Average Construction Noise levels, $L_{Aeq, 10hr}$

Receptor	Average Earthworks Noise Levels, $L_{Aeq, 10hr}$ (dB)	Average Construction Noise Levels, $L_{Aeq, 10hr}$ (dB)
R1	56.7	63.0
R2	58.2	64.5
R3	60.6	66.9
R4	62.6	68.9

10.4.9 A review of Table 10.15 identifies that the calculated embedding best practice construction noise level meets the lower 70dB $L_{Aeq, 10hr}$ Stated in BS 5226.

10.4.10 The sensitivity of the residential receptors is categorised as **high** and the magnitude of impact is categorised as **no effect**. Accordingly, there is predicted to be a **neutral** effect at receptors R1, R2, R3 and R4.

10.4.11 It should be noted that these predictions are worst case in that it is assumed that any mitigation measures, or screening afforded by site hoardings have not been implemented. Furthermore, it should be noted that it is unlikely that operations are to be conducted on the sections of the Site closest to each of the identified receptors for significant periods of time. For the majority of the construction phase it is expected that activities will be conducted at greater distances from the receptors.

Construction Generated Road Traffic Noise

10.4.12 The main deliveries and Site traffic will be related to the following:

- Daily site staff and labour;
- Movements arising from the groundworks and any demolition;
- Aggregate and concrete deliveries for early activities;
- Deliveries of building components and services equipment;
- Periodic inspections, visitors and inspectors; and,
- Disposal of waste material.

10.4.13 It is anticipated that in order to complete the preparation and construction phases of the development, it will be necessary to move a significant amount of material to and from the Site, thus resulting in a number of construction generated road traffic movements.

10.4.14 It should be noted that relatively large increases in road traffic movements would need to prevail in order for noticeable increases in road traffic noise levels to occur as a result of construction generated road traffic. As a general guide, although not accounting for changes in the percentage of HGV's, a 25% increase in traffic movements will only result in a 1dB increase in noise levels. Similarly, a 58% increase would be required for 2dB and 100% increase for a 3dB increase. It should be noted that a 3dB increase in noise levels is generally barely perceptible to the average human.

10.4.15 The applicant has calculated the likely number of construction traffic movements per day. It is estimated there would be an average of 90 two-way HGV movements per day visiting the Site during peak periods in the construction programme. In addition, it is estimated that between 50 and 70 construction workers vehicles would travel to the site per day however these would be outside of the AM and PM peak period. This is considered to be a lot less than a 25% increase in road traffic levels considering the amount of traffic.

10.4.16 The sensitivity of the residential receptors is categorised as **high** and the magnitude of impact is categorised as **negligible**. Accordingly, there is predicted to be a **neutral** impact at all receptors. Furthermore, it should be noted that any increase in noise levels associated with construction generated road traffic is expected to be limited to the daytime hours only.

10.4.17 Given the predicted effect on local receptors it is not necessary to consider mitigation measures.

Operational Phase Effects

Change in Road Traffic Noise

10.4.18 Upon completion of the development, it is anticipated that local road traffic noise levels may change as a result of development generated vehicle movements. Therefore, it is appropriate to consider the magnitude of any impacts that might arise.

10.4.19 The results of the Transport Assessment have been used as the basis for the road traffic noise assessment. This focuses on roads immediately surrounding the site before the development generated traffic is dispersed across the wider network. The traffic data supplied in the form of 18-hour AAWT flows was used in the calculations.

10.4.20 Where road traffic route alignments are to remain unchanged, road traffic noise calculations have been carried out in accordance with CRTN, being undertaken for a notional receptor location 10m from the edge of the carriageway of each road considered and 0.5m above ground level. A notional receptor has been used because the change in noise level adjacent to any given road will be the same at all locations where noise from this route is dominant.

10.4.21 In the first instance, it is required to compare the Do-Minimum (DM) scenario in the baseline year against the DM scenario in the future assessment year in order to establish a baseline for the subsequent short and long-term assessments. Table 10.16 details this assessment.

**Table 10.16 - Predicted Change in Road Traffic Noise between 2018 Do Minimum and 2035 Do Minimum**

Road	Baseline Year (2018) Without Development L _{A10,18hr} (dB)	Future Year (2035) Without Development (Do-Min) L _{A10,18hr} (dB)	Change in Noise Level +/- (dB)	Corresponding Magnitude of Impact
College Road, Purbrook				
College Road NB	63.2	64.2	+1.0	Slight
College Road SB	64.1	65	+0.9	Negligible
College Road/Purbrook Way				
College Road NB	66.1	65.6	-0.5	Negligible (Beneficial)
College Road SB	67.4	68.1	+0.7	Negligible
Purbrook Way (W) WB	70.8	71.5	+0.7	Negligible
Purbrook Way (W) EB	70.5	71.2	+0.7	Negligible
Purbrook Way (E) WB	71.8	72.5	+0.7	Negligible
Purbrook Way (E) EB	72.2	72.9	+0.7	Negligible
Stakes Hill Roundabout				
Stakes Hill Road NB	69.1	69.8	+0.7	Negligible
Stakes Hill Road SB	69.4	70.2	+0.8	Negligible
Purbrook Way WB	70.1	70.8	+0.7	Negligible
Purbrook Way EB	70.6	71.3	+0.7	Negligible
Crookhorn Lane NB	66.2	66.9	+0.7	Negligible
Crookhorn Lane SB	66.1	66.8	+0.7	Negligible

Stakes Road WB	68.1	68.9	+0.8	Negligible
Stakes Road EB	68.4	69.2	+0.8	Negligible
A3 (M) Offslip				
Purbrook Way (e) EB	73.8	74.5	+0.7	Negligible
Purbrook Way (e) WB	70.2	70.9	+0.7	Negligible
A3M Offslip NB	70.7	71.4	+0.7	Negligible
Purbrook Way (W) EB	71.8	72.5	+0.7	Negligible
Purbrook Way (W) WB	71.8	72.5	+0.7	Negligible
A3 (M) Onslip				
B&Q NB	61.2	62.3	+1.1	Slight
B&Q SB	61.5	62.5	+1.0	Slight
Purbrook Way (E) WB	71.5	72.2	+0.7	Negligible
Purbrook Way (E) EB	71.8	72.6	+0.8	Negligible
A3M Onslip SB	70.7	71.4	+0.7	Negligible
Purbrook Way (W) WB	68.6	69.3	+0.7	Negligible
Purbrook Way (W) EB	72.8	73.6	+0.8	Negligible
ASDA/Hulbert Road/Purbrook Way RBT				
Hulbert Road NB	68.7	69.5	+0.8	Negligible
Hulbert Road SB	66.8	67.6	+0.8	Negligible
Purbrook Way (E) EB	69.4	70.1	+0.7	Negligible
Purbrook Way (E) WB	70.4	71.2	+0.8	Negligible



B2150 NB	64.9	65.7	+0.8	Negligible
B2150 SB	63	63.9	+0.9	Negligible
ASDA NB	63	62.9	-0.1	Negligible (Beneficial)
ASDA SB	63.9	64.8	+0.9	Negligible
Purbrook Way (W) EB	69.2	69.9	+0.7	Negligible
Purbrook Way (W) WB	69.5	70.2	+0.7	Negligible
Crookhorn Lane/Portsmouth Hill				
Crookhorn Lane NB	67.3	68	+0.7	Negligible
Crookhorn Lane SB	67.7	68.5	+0.8	Negligible
Portsmouth Hill Road (W) WB	69.9	70.6	+0.7	Negligible
Portsmouth Hill Road (W) EB	69.2	69.9	+0.7	Negligible
Portsmouth Hill Road (E) WB	69.8	70.5	+0.7	Negligible
Portsmouth Hill Road (E) EB	69.4	70.2	+0.8	Negligible
Bedhampton Hill Road RBT				
Maylands Avenue NB	59.5	60.7	+1.2	Slight
Maylands Avenue SB	59.1	60.2	+1.1	Slight
Bedhampton Road EB	70.7	71.5	+0.8	Negligible
Bedhampton Road WB	70.8	71.5	+0.7	Negligible
Bedhampton Hill NB	69.5	70.3	+0.8	Negligible
Bedhampton Hill SB	69.4	70.1	+0.7	Negligible
Portsmouth Hill Road EB	67.4	68.1	+0.7	Negligible

Portsmouth Hill Road WB	67.6	68.4	+0.8	Negligible
A3 (Southern Point)	85.7	86.3	+0.6	Negligible
A3 (Northern Point)	84.4	85.1	+0.7	Negligible
A3 (London Road)	72.7	73.4	+0.7	Negligible
A2030	74.5	75.3	+0.8	Negligible
A27	75.6	76.3	+0.7	Negligible
A3(M)	76.9	77.6	+0.7	Negligible

10.4.22 It can be seen from Table 10.16 that there is predicted to be a **negligible to slight** increase in road traffic noise levels due to natural growth on the vast majority of roads. This will be used to inform the following assessments.

10.4.23 The predicted changes in short term road traffic noise are shown in Table 10.17. This Table shows the difference between the assumed opening year without development (2035 DM) and with the development (2035 Do-Something (DS)).

Table 10.17 - Predicted Change in Road Traffic Noise Resulting from Operations of the Development – Future Year 2035

Road	Future Year (2035) Without Development (Do-Min) LA10,18hr (dB)	Future Year (2035) With Development (Do-Som) LA10,18hr (dB)	Change in Noise Level +/- (dB)	Corresponding Magnitude of Impact
College Road, Purbrook				
College Road NB	64.2	68.6	+4.4	Moderate
College Road SB	65.0	66.4	+1.4	Slight
College Road/Purbrook Way				
College Road NB	65.6	69.8	+4.2	Moderate
College Road SB	68.1	70.3	+2.2	Slight
Purbrook Way (W) WB	71.5	71.8	+0.3	Negligible



Purbook Way (W) EB	71.2	71.5	+0.3	Negligible
Purbook Way (E) WB	72.5	73.2	+0.7	Negligible
Purbook Way (E) EB	72.9	73.6	+0.7	Negligible
Stakes Hill Roundabout				
Stakes Hill Road NB	69.8	70.0	+0.2	Negligible
Stakes Hill Road NB	70.2	70.4	+0.2	Negligible
Purbrook Way WB	70.8	71.1	+0.3	Negligible
Purbrook Way EB	71.3	71.6	+0.3	Negligible
Crookhorn Lane NB	66.9	66.9	0.0	No Change
Crookhorn Lane SB	66.8	66.8	0.0	No Change
Stakes Road WB	68.9	69.0	+0.1	Negligible
Stakes Road EB	69.2	69.3	+0.1	Negligible
A3 (M) Offslip				
Purbrook Way (e) EB	74.5	75.0	+0.5	Negligible
Purbrook Way (e) WB	70.9	71.2	+0.3	Negligible
A3M Offslip SB	71.4	72.0	+0.6	Negligible
Purbrook Way (W) EB	72.5	73.2	+0.7	Negligible
Purbrook Way (W) WB	72.5	73.2	+0.7	Negligible
A3 (M) Onslip				
B&Q NB	62.3	62.3	0.0	No Change
B&Q SB	62.5	62.5	0.0	No Change
Purbook Way (E) WB	72.2	72.4	+0.2	Negligible
Purbook Way (E) EB	72.6	72.7	+0.1	Negligible

A3M Onslip SB	71.4	72.0	+0.6	Negligible
Purbrook Way (W) WB	69.3	69.7	+0.4	Negligible
Purbrook Way (W) EB	73.6	74.1	+0.5	Negligible
ASDA/Hulbert Road/Purbrook Way RBT				
Hulbert Road NB	69.5	69.6	+0.1	Negligible
Hulbert Road SB	67.6	67.8	+0.2	Negligible
Purbook Way (E) EB	70.1	70.3	+0.2	Negligible
Purbook Way (E) WB	71.2	71.3	+0.1	Negligible
B2150 NB	65.7	65.7	0.0	No Change
B2150 SB	63.9	63.9	0.0	No Change
ASDA NB	62.9	63.9	+1.0	Slight
ASDA SB	64.8	64.8	0.0	No Change
Purbrook Way (W) EB	69.9	70.3	+0.4	Negligible
Purbrook Way (W) WB	70.2	70.5	+0.3	Negligible
Crookhorn Lane/Portsmouth Hill				
Crookhorn Lane NB	68.0	68.7	+0.7	Negligible
Crookhorn Lane SB	68.5	69.2	+0.7	Negligible
Portsmouth Hill Road (W) WB	70.6	70.8	+0.2	Negligible
Portsmouth Hill Road (W) EB	69.9	70.1	+0.2	Negligible
Portsmouth Hill Road (E) WB	70.5	70.7	+0.2	Negligible
Portsmouth Hill Road (E) EB	70.2	70.4	+0.2	Negligible
Bedhampton Hill Road RBT				
Maylands Avenue NB	60.7	60.7	0.0	No Change



Maylands Avenue SB	60.2	60.2	0.0	No Change
Bedhampton Road EB	71.5	71.6	+0.1	Negligible
Bedhampton Road WB	71.5	71.6	+0.1	Negligible
Bedhampton Hill NB	70.3	70.3	0.0	No Change
Bedhampton Hill SB	70.1	70.1	0.0	No Change
Portsmouth Hill Road EB	68.1	68.4	+0.3	Negligible
Portsmouth Hill Road WB	68.4	68.6	+0.2	Negligible
A3 (Southern Point)	86.3	86.6	+0.3	Negligible
A3 (Northern Point)	85.1	85.1	0.0	No Change
A3 (London Road)	73.4	73.5	+0.1	Negligible
A2030	75.3	75.3	0.0	No Change
A27	76.3	76.3	0.0	No Change
A3(M)	77.6	77.6	0.0	No Change

10.4.24 It can be seen from Table 10.17 that the greatest predicted short-term road traffic noise level change is expected along College Road, with increases between 1.4 and 4.4dB.

10.4.25 Comparing this increase in road traffic noise levels as a result of the Proposed Development with the guidance contained in the DMRB, it can be shown that the magnitude of impact is categorised as **moderate** for the short term. The sensitivity of the existing noise sensitive receptors is categorised as **high** and the magnitude of impact is categorised as **negligible to moderate**. Accordingly, there is predicted to be a **neutral to intermediate** effect on existing receptors.

Road Traffic Noise Impacts upon Proposed Receptors

10.4.26 The development will be located in an environment dominated by road traffic noise and it is important to consider the implications of these impacts upon any proposed noise sensitive receptors.

10.4.27 In order to accurately assess noise from the A3 (M) and College Road across the Site, a 3D Noise Model has been constructed using the modelling software CadnaA 2018 MR1. The following assumptions, inputs and considerations have been included in the model:

- Masterplan Layout (536_A-02-200-MP Rev C) dated 26th March 2019 provided by Persimmon Homes;
- Site elevations have been taken using 1m Lidar data that has been converted into contours;
- Embedded mitigation in the form of 2.4m high barriers for Phase 1 are included in the model;
- A reflection order of 2 has been used in all calculations; and

- Noise levels generated using ISO 9613-1 and ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors" as incorporated into CadnaA software.

External Amenity Areas

10.4.28 In order to assess noise levels in any proposed external amenity areas across the Site, a grid noise map was calculated in the noise model. According to BS8233:2014,

"It is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments".

10.4.29 Therefore, the aim was to achieve 50dB, where possible, with 55dB being acceptable for external amenity areas closer to the noise sources.

10.4.30 Figure 2 and Figure 3 on Appendix 10.1 show the grid noise maps.

10.4.31 For Phase 1 of the development, Figure 2 has determined that the predicted noise levels within garden areas ranges from below 43dB and up to 53dB; barrier locations are highlighted orange.

10.4.32 The sensitivity of the receptors is **high** and it is predicted that there would be a **negligible**. Accordingly, there is predicted to be a **neutral** magnitude of impact with the implementation of embedded mitigation measures.

10.4.33 Regarding the later phases of the development, the grid noise map has determined that the predicted noise levels within the development proposals range between below 41dB and up to 64dB within the proposed residential areas.

10.4.34 Without mitigation in place, garden areas located along the boundary with the A3(M), particularly gardens on the north east boundary will experience Lowest Observed Adverse Effect Level (LOAEL): which would mean road traffic noise would be noticeable and disruptive resulting in the following:

"The noise causes a material change in behaviour and/or attitude, 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. Quality of life diminished due to change in acoustic character of the area."

10.4.35 Garden areas in the centre of the site would be offered protection due to intervening dwellings, and as such should experience the No Observed Adverse Effect Level (NOAEL) where the noise is noticeable but not intrusive resulting in the following:

"Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life".

10.4.36 Therefore, suitable Site design and potential mitigation measures are required in order to achieve the lowest practicable levels in the garden areas, specifically for gardens located on the north eastern section of the Site.

10.4.37 The sensitivity of the receptors is **high** and it is predicted that there would be a **negligible to substantial**, with the **substantial** impact being predicted at the closest garden areas to the roads, without mitigation in place or considered. Accordingly, there is predicted to be a **neutral to major** magnitude of impact before the implementation of mitigation measures.

Internal Habitable Rooms

10.4.38 In order to accurately determine the noise level within habitable rooms, it has been necessary to calculate the external noise level immediately outside the façade. Accordingly, the noise model has been used in order to calculate façade noise levels due to the impact of road traffic noise.



- 10.4.39 With regards to internal noise levels, BS8233:2014 suggest that a glazing unit with configuration 6mm glass/12mm air space/6mm glass affords sound insulation performance in the order of 33dB however this is for a pink noise spectrum. The same unit, weighted for road traffic noise using the '+C_{tr}' correction, has a sound insulation performance value of approximately 30dB and so this value has been used to calculate internal noise levels. It also goes on to recommend that a partially open window provides approximately 15dB attenuation.
- 10.4.40 For Phase 1 of the development, the predicted internal noise levels within habitable rooms would achieve the criteria with the embedded mitigation in place; acoustic trickle vent locations are highlighted orange in Figure 4 and Figure 5.
- 10.4.41 The sensitivity of the receptors is **high** and it is predicted that there would be a **negligible** impact. Accordingly, there is predicted to be a **neutral** magnitude of impact with the implementation of embedded mitigation measures.
- 10.4.42 For the remaining phases of the development, it has been predicted that during the daytime and night-time periods, standard thermal double glazing will not be sufficient across all of the site. This mostly affects the closest dwellings with line of sight to the A3 (M) and the majority of dwellings would achieve acceptable internal noise levels considering a glazing specification of at least 30dB R_w + C_{tr}.
- 10.4.43 With regards to alternative ventilation, it has been assumed that the opening of windows would be required for fresh air flow and background ventilation. If windows are opened, it has been shown, that the internal criteria would be exceeded for the majority of habitable rooms. Therefore, a system is required that provides fresh air flow and background ventilation to the habitable rooms with windows remaining openable for purge ventilation.
- 10.4.44 With regards the maximum instantaneous noise levels at night for the A3 (M), the 10th highest measured level at NMP2 has been measured as 69.1dB L_{Amax,fast} which is considered representative of the closest proposed bedrooms. Accordingly, standard glazing is sufficient (note no frequency content is accounted for due to the instantaneous nature of the noise so no correction for road traffic is applied). However, alternative ventilation would be required for bedrooms overlooking the A3 (M). It should be noted that this is not above and beyond the requirements for the average noise level and, as such, additional measures are not required.
- 10.4.45 With regards the maximum instantaneous noise levels at night for College Road, the 10th Highest measured level at the closest boundary was 81dB L_{Amax,fast} which has been corrected to the closest assumed façade (30m from the road) equating to 67.7dB. Accordingly, standard glazing is sufficient. However, there would be an exceedance of when windows are open. Accordingly, alternative ventilation would be required for bedrooms overlooking College Road. However, this is not above and beyond the requirements for the average noise level and, as such, additional measures are not required.
- 10.4.46 The sensitivity of the receptors is **high** and it is predicted that there would be a **negligible** to **substantial**, with the **substantial** impact being predicted at the closest habitable rooms to the A3 (M), without mitigation in place or considered. Accordingly, there is predicted to be a **neutral** to **major** magnitude of impact before the implementation of mitigation measures.

Proposed Commercial Sound Impact upon Proposed and Existing Receptors

- 10.4.47 Background sound measurements have been taken during daytime and night-time periods over typical weekday and weekend periods. This allows plant noise emission limits to be set for all periods thus allowing a degree of flexibility when operational details of M&E plant associated with the development, if any, become available.
- 10.4.48 The lowest, over the days surveyed, of the median measured daytime and night-time background sound levels have been used in order to inform the assessment. Table 10.18 derives the plant noise emission limits.

Table 10.18 - Plant Noise Emission Limits

Day	Assessment Period	Median Background Sound Level L _{A90, T} (dB)	BS4142:2014 Criteria	Derived Rating Level, L _{A,r} (dB)
Weekday	Daytime (07:00 – 23:00)	52.6	L _{A,r} = L ₉₀	52.6
	Night – Time (23:00 – 07:00)	36.8		36.8
Weekend	Daytime (07:00 – 23:00)	52.2		52.2
	Night – Time (23:00 – 07:00)	47.6		47.6

- 10.4.49 This indicates that the Rating Level, from any single or combined plant items, shall not exceed the existing background noise level when measured or calculated at the façade of the closest proposed residential receptor. Limits are specified in terms of the rating level, and therefore the acoustic feature penalties given in BS4142:2014 should be applied.
- 10.4.50 As long as the derived rating levels are not exceeded at the receptors, a **negligible** impact should be observed due to fixed plant noise. The sensitivity of the existing noise sensitive receptors is categorised as **high** and the magnitude of impact is categorised as **negligible**. Accordingly, there is predicted to be a **neutral** impact at the noise sensitive receptors.

10.5 Additional Mitigation, Compensation and Enhancement Measures

Construction Phase

Construction Generated Road Traffic Noise

- 10.5.1 As there is unlikely to be any significant increase in noise levels on the local road network as a result of construction generated traffic, the implementation of mitigation measures is not required.

Operational Phase

Existing Receptors – Change in Road Traffic Noise

- 10.5.2 It is noted that in the Future Year (2035), there is a predicted increase in road traffic noise along College Road. As such, additional mitigation measures may need to be considered to protect existing receptors in future years.
- 10.5.3 Measures to mitigate and reduce road traffic noise would include but are not necessarily limited to resurfacing, traffic calming and/or reducing speeds. The reduction of speeds is likely to be the most beneficial and can readily provide the 3-4 dBA of mitigation required for the worst-case roads considered.
- 10.5.4 Accordingly, the sensitivity of the residential receptors is categorised as **high** and the magnitude of impact following mitigation is categorised as **negligible**. Accordingly, there is predicted to be a **neutral** impact on existing receptors.



Proposed Receptors – Road Traffic Noise

External Amenity Areas

- 10.5.5 The previous section has indicated that the noise level in certain garden areas range between 41dB and up to 64dB without any mitigation and as such are not considered the lowest practicable noise levels and are in exceedence of the lower and upper criteria levels.
- 10.5.6 Noise levels in garden areas for Phase 1 of the development are predicted to range between below 43dB and up to 53dB with embedded mitigation measures in place in the form of 2.4m high barriers for two plots. This is sufficient to achieve the external criterion and as such, no further mitigation is required for garden areas in Phase 1 of the development.
- 10.5.7 For the remainder of phases, specific barrier heights have not been recommended at this stage. However, considering the level of noise at certain plots along the north eastern boundary, the maximum permitted acoustic barriers may not be sufficient in mitigating noise levels to meet the criterion. Therefore, the most suitable way to control noise at the Site is through considerate Site design and orientating the affected plots so that the gardens are protected from the A3 (M) in order to achieve the best practicable levels.
- 10.5.8 If acoustic barriers are not preferred, it is highly recommended that dwellings face the noise source so that the building envelope shields the rear gardens from road traffic noise. This way the lowest practicable noise levels can be achieved in accordance with BS8233:2014 as it can be shown that all is being done to achieve the lowest practicable noise levels through effective site design.
- 10.5.9 Additionally, it is recommended that all exposed edges associated with the development as a whole be shielded by buildings so that all garden areas are enclosed within the development by the building envelopes of the dwellings. Gaps between dwellings should be kept to a minimum. And where access roads are perpendicular to the road, dwellings should form around corners, where possible.

Internal Habitable Rooms

- 10.5.10 For Phase 1 of the development, embedded mitigation measures include the implementation of a glazing unit with configuration 6mm glass/12mm air space/6mm glass affording a sound insulation performance of 30dB $R_w + C_{tr}$ for all habitable rooms. Alternative ventilation is to be provided in the form of Acoustic Trickle Ventilators. With these measures in place, the internal criteria for habitable rooms is achieved, and therefore, no further mitigation measures are required.
- 10.5.11 For the remainder of the development, the exact requirements for internal habitable rooms cannot be determined at this stage. However, consideration towards glazing requirements may be needed as dwellings located along the boundary with the A3 (M) will be subject to high noise levels to which standard thermal double glazing would be insufficient. The exact requirements would be determined at the reserved matters stage.
- 10.5.12 With a partially open window for background ventilation, the internal noise levels for habitable rooms would exceed the internal target criteria, particularly those that have line of sight to the noise source. Accordingly, it is necessary to consider an alternative ventilation scheme which does not require the opening of windows to provide fresh air flow and background ventilation, windows are to remain openable for purge ventilation.
- 10.5.13 Based on the grid maps, mitigation measures have been categorised into “no mitigation required”, “alternative ventilation required” and “alternative ventilation and higher specification glazing required”.
- 10.5.14 It is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the habitable rooms of the facades facing the roads so that fresh air can enter the room without having to open windows.

10.5.15 Alternatively, a through wall trickle ventilator could be used. It is recommended that the trickle ventilator be combined with a system that provides whole house background ventilation without the need for opening windows, but windows should be openable in order to provide purge ventilation. Ideally, any inlet for fresh air should be located away from the noise source to ensure the freshest air available is brought into the habitable rooms.

10.5.16 The exact requirement for alternative ventilation ultimately falls to the developer and, from an acoustics perspective, needs to ensure that fresh air flow can be achieved without the need for opening windows. It is necessary to meet the requirements given in BS8233:2014, Section 8.4.5.4, which states that:

"The Building Regulations' supporting documents on ventilation [48, 49, 50] recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant's choice."

10.5.17 Alternatively, acoustic ventilation units (see 7.7.2) are available for insertion in external walls. These can provide sound reduction comparable with double glazed windows. However, ducted systems with intakes on the quiet side of the building might be required in very noisy situations, or where appearance rules out through-the-wall fans.

10.5.18 Section 7.7.2 states:

"NOTE 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level."

10.5.19 Wherever possible habitable rooms should be located away from the noise source with less noise-sensitive rooms facing the noise source.

Existing and Proposed Receptors – Proposed Commercial Sound

- 10.5.20 Additionally, this Chapter has set plant noise emission limits for any proposed fixed plant items associated with the proposed commercial premises in order to protect the amenity of proposed and existing receptors.
- 10.5.21 It is worth considering appropriate site design for the commercial premises to lessen any potential impact at the receptors. Such as:
- Selection of low noise plant; and
 - Siting plant items away from receptors, i.e. on the shadow side of the commercial.

10.6 Assessment Summary and Likely Significant Residual Environmental Effects

Construction Phase

- 10.6.1 A short-term neutral impact is predicted during the construction phases of the development. As such, mitigation measures are not required and any significant impacts upon existing and proposed receptors are unlikely.

Operational Phase

Change in Road Traffic Noise Levels

- 10.6.2 For the opening baseline year, with the development operational it is shown the majority of roads will be subject to the same magnitude of impact as they would through natural predicted growth.



- 10.6.3 Comparing the changes, as a whole, in road traffic noise levels as a result of the Proposed Development with the guidance contained in the DMRB, it can be determined that the magnitude of impact is categorised as short-term **negligible** to **moderate** at the local level.

Existing Road Traffic Noise Impact

- 10.6.4 Without appropriate Site design, it is considered that a long-term **negligible** to **substantial** adverse impact at the local level would be experienced in the garden areas. However, if the upper criteria can be achieved the impacts should range between **negligible and minor**.
- 10.6.5 Within internal habitable rooms, a **negligible** long term permanent impact at the local level can be achieved through the use of higher specification glazing and alternative ventilation, where required.

Proposed Commercial Sound Impact

- 10.6.6 At this stage, any residual impacts are unknown as the exact nature of the development is not known. However, as long as the BS4142:2014 criterion is achieved, there should be a **negligible** adverse long-term impact at any existing or proposed receptors at the local level.

Conclusions

- 10.6.7 This chapter assesses the impact of the proposed development on Noise. In particular, it considers the potential effects of construction noise and changes in road traffic noise levels on existing receptors as well as existing and proposed sources of noise upon the proposed and existing receptors.
- 10.6.8 The chapter describes the methods used to assess the impacts, the baseline conditions currently existing at the site and surroundings, the potential direct and indirect impacts of the development arising from the proposed fixed plant and changes in road traffic levels, the mitigation measures required to prevent, reduce, or offset the impacts and the residual impacts.
- 10.6.9 In order to determine baseline noise levels at existing and proposed receptors, a Baseline Noise Survey has been carried out around the Site. The Baseline Noise Survey consisted of Road Traffic Noise Surveys and Background Sound Surveys.
- 10.6.10 A short-term **neutral** impact at local level is predicted during the duration of the construction phase at existing and any proposed receptors due to construction noise. The impacts are not considered significant. Additionally, there is predicted to be a short term **neutral** impact at all receptors at the local level due to construction generated traffic
- 10.6.11 For the opening year, with the development operational, but without the development in place it is shown the majority of roads will be subject to the same magnitude of impact as they would through natural predicted growth.
- 10.6.12 Comparing the changes, as a whole, in road traffic noise levels as a result of the Proposed Development with the guidance contained in the DMRB, it can be shown that the magnitude of impact is categorised as short-term **neutral** to **intermediate** at the local level.
- 10.6.13 Through Good Acoustic Design and implementation of Acoustic barriers (where required), the lowest practicable levels can be achieved. As such, it is considered that a long term **negligible to minor** adverse impact at the local level would be experienced in the garden areas of the proposed dwellings.
- 10.6.14 Within internal habitable rooms, a **negligible** long term permanent impact at the local level can be achieved through the use of higher specification glazing and alternative ventilation, where required.
- 10.6.15 With regards to noise from the existing commercial units impacting upon proposed receptors, it is assumed that a long term **negligible** impact can be achieved through suitable site design and mitigation measures at the local level.

- 10.6.16 At this stage, any impacts due to proposed commercial premises are unknown as the exact nature of the development is not known. However, as long as the BS4142:2014 criteria are achieved at the detailed planning stage, there should be a **negligible** adverse long-term impact at any existing or proposed receptors at the local level.



Table 10.19 Assessment Summary and Residual Environmental Effects (Noise)

Summary description of the identified impact	Sensitivity of Receptor	Impact Magnitude	Significance and Nature of Effect	Additional Mitigation	Residual Impact Magnitude	Residual Significance and Nature of Effect	Confidence Level
Construction							
Construction Noise	High	Negligible	Neutral	Incorporation of Best practicable means and a phase by phase Construction Environment Management Program (CEMP)	Negligible	Neutral	High
Construction Generated Traffic	High	Negligible	Neutral	N/A	Negligible	Neutral	High
Operation							
Change in Road Traffic Noise Levels	High	Negligible to Moderate	Neutral to Intermediate	Good Acoustic Design	Negligible	Neutral	High



Existing Road Traffic Noise Levels	High	Negligible to Substantial	Neutral to Major	Good Acoustic Design, Higher specification glazing and Alternative Ventilation	Negligible to Slight	Neutral to Minor	High
Proposed Fixed Plant Sound	High	Negligible	Neutral	Good Acoustic Design	Negligible	Neutral	High



Table 10.20 Glossary

Term	Definition
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
L _{Aeq, T}	L _{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L _{Amax}	L _{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L _{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may

	have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L ₁₀ & L ₉₀	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L ₁₀ is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L ₉₀ is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L ₁₀ index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

References

ⁱ Ministry of Housing, Communities & Local Government (2012) National Planning Policy Framework.
ⁱⁱ Department for Environment Food and Rural Affairs (2010) Noise Policy Statement for England.
ⁱⁱⁱ Ministry of Housing, Communities & Local Government (2014) Planning Practice Guidance on Noise.
^{iv} British Standard Institution (2014) Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.
^v British Standard 8233 (2014) Guidance on sound insulation and noise reduction for buildings.
^{vi} World Health Organisation (1999) Guidelines for Community Noise.
^{vii} British Standard Institution (2014) Methods for rating and assessing industrial and commercial sound.
^{viii} **Institute of Environmental Management & Assessment (2014) Guideline for Environmental Noise Impact Assessment.**