Chapter 9 Noise and vibration

Introduction

9.1 Terence O'Rourke was employed to identify noise sensitive receptors in the vicinity of the proposed development site and establish the baseline noise environment at these receptors. This information was then used to assess the significant noise effects arising from the proposals. During the scoping process noise effects were classed as a primary issue.

9.2 Consideration of the types of techniques that may be used during the construction of the proposals led to the conclusion that there would be no significant effects due to vibration. This is mainly because the construction of roads and residential properties does not require the use of piled foundations.

Perception and measurement of noise

Perception

9.3 Noise is defined as unwanted sound. Human ears are typically able to respond to sound in the frequency range 18 Hz to 18 kHz and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies; it is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

9.4 The weighting mechanism that best corresponds to the response of the human ear is the A-weighting scale. To help understand the range of noise levels that may be encountered, an indication of the level of some common sounds on the dB(A) scale is given in figure 9.1.

dB(A)	Description
140	Threshold of pain
120	Jet take off at 50 m
100	Maximum noise levels on an underground train platform
80	Kerbside of a busy urban street
60	Busy general office
40	Residential area at night
20	Background in a TV and recording studio
0	Threshold of hearing

Figure 9.1 Typical noise levels

9.5 The decibel scale is logarithmic rather than linear; hence a 3 dB(A) increase in sound level represents a doubling of the sound energy present. The perception of sound level is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness; whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change.

9.6 The overall perception of noise maybe determined by a number of other factors, both acoustic and non-acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality maybe important, as may the disposition of the affected individual. Any assessment of the significance of a noise source should give due consideration to all of these factors.

Noise measurement

9.7 Noise measurements are typically performed using an integrating sound level meter (SLM). As the 'A' weighting scale is widely used for environmental noise measurement, SLMs can apply the necessary weighting to the measured signal, producing results in terms of dB(A). These levels are denoted as dB(A) or dB L_A.

9.8 Measured noise levels can be expressed in a variety of ways. Four noise indices will be referred to in this chapter:

$L_{Aeq,T}$: this is defined as the 'value of the A-weighted sound pressure level of a continuous, steady sound that within a specified time interval T, has the same acoustical energy as a sound whose level varies with time during the time interval T'. This is a unit commonly used to describe construction, industrial and activity noise, and is generally referred to as the ambient noise level.

$L_{A90,T}$: this is the noise level that is exceeded for 90% of the measurement period and generally describes the background noise level. This noise index is often used in the assessment of the possibility of complaints due to industrial noise.

$L_{A10,T}$: the A-weighted noise level that is exceeded at the measurement position for 10% of the time period, T. This noise index is often used in the assessment of road traffic noise.

L_{AFmax} : the maximum noise level measured during a time period, with the SLM set to fast response.

Legislation and policy

9.9 As a pollutant noise is transient in nature, in that it does not accumulate in the environment in a similar manner to, for example, an air pollutant. However, the government Panel on Sustainable Development felt that noise control should be addressed as a sustainability issue(1). It also noted that currently there is a large, but somewhat piecemeal, body of legislation and guidance relating to noise assessment and control, and called for a more integrated approach.

Planning Policy Guidance Note 24 (1994): Planning and Noise

9.10 The Government's national policies on noise-related planning issues are set out in this guidance note. It gives guidance to local authorities in England on the use of their planning powers to minimise the adverse impact of noise, outlining some of the main considerations that should be taken into account when determining planning applications for development proposals that will either generate noise or be exposed to existing noise sources.

1 British Government Panel on Sustainable Development, February 2002, Sixth Report

Statutory powers

9.11 Additional statutory powers to control noise exist outside of the planning system, and the granting of planning permission does not remove the need to comply with these controls. The major legislative instruments are:

- Part III of the Environmental Protection Act 1990, as amended by the Noise and Statutory Nuisance Act 1993, and the Clean Neighbourhoods and Environment Act 2005, which requires local authorities to serve abatement notices where noise emitted from any premises constitutes a statutory nuisance
- Part III of the Control of Pollution Act 1974, which gives local authorities certain powers to control noise from construction sites.

9.12 It is usual for the implementation of this legislation to appear under delegated authority to the environmental health department of the relevant local authority, in this instance Cherwell District Council.

Methodology

Scope of assessment

9.13 The National Physics Laboratory performed a review of the methods available for the assessment of the adverse effects of ambient noise in 1998(2). It recognised that there were a number of health effects that could be caused or aggravated by noise, but concluded that sufficient evidence existed only to support the assessment of annoyance caused by ambient noise and, to a limited extent, sleep disturbance.

9.14 This chapter is only concerned with the effect of the proposed development on the existing noise sensitive receptors in the vicinity of the proposed development site. The suitability of this site for the proposed development and the interaction of the differing land uses on the site is a land use planning issue and is outside of the scope of this EIA.

Noise sources

9.15 The proposed development has the potential to generate noise from associated traffic flows. Indicative traffic flows have been provided for the purpose of road layout design and highway capacity considerations. These data have been used to determine if increased traffic flows will give rise to any significant noise effects.

Assessment guidance

9.16 There is currently no single publication that provides guidance and criteria for the assessment of noise effects, although the current draft ‘Guidelines for Noise Impact Assessment’ produced by the Institute of Acoustics and the Institute of Environmental Management and Assessment, sets out the principal considerations. These draft guidelines, together with the data sources listed in figure 9.1, were used to enable the significance of any effects of the identified noise sources to be adequately determined.

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2 NPL (1998), Health Effect-Based Noise Assessment Methods: A Review and Feasibility Study, Porter, N., Flindell, I. & Berry, B., National Physical Laboratory.

Publication	Relevant issue
Draft Guidance of the Institute of Acoustics / Institute of Environmental Management and Assessment Working Party (2002).	Determination of noise impacts in terms of noise change.
World Health Organisation (WHO): Guidelines for Community Noise (1999).	Guidance on acceptable absolute noise levels in a range of environments.
BS5228: 1997: Noise and vibration control on construction and open sites.	Noise from construction
Calculation of Road Traffic Noise (CTRN), Department of Transport, Welsh Office, HMSO, (1988).	Noise from road traffic
Design Manual for Roads and Bridges (DMRB), Vol 11, Section 3, Part 7, Traffic Noise and Vibration, Department of Transport, HMSO, (1994).	Noise from road traffic

Figure 9.2 Data sources and references

Effect significance

9.17 Effect significance is derived from measures of the magnitude (or scale) of an impact and the sensitivity (or importance) of the receptor affected. The significance of all potential noise effects is determined using a two-stage process.

9.18 The first stage involves determination of the magnitude of the impact and the sensitivity of the potentially affected receptors. The categories of receptor sensitivity are defined in figure 9.3 and impact magnitude is defined in figure 9.4. The magnitude categories used in the assessment are based on the scale advocated by the Institute of Acoustics and the Institute of Environmental Management and Assessment Joint Working Party on Noise Impact Assessment. However, consideration was also given to the absolute noise levels, e.g. those advocated by the World Health Organisation (WHO), annoyance scales and professional judgement.

9.19 The second stage involves the use of the determination of significance matrix shown in figure 9.5. The categories of sensitivity and magnitude are fed into the matrix to determine the significance of the potential effect.

Determination of sensitive receptors

9.20 The first stage of a noise impact assessment is to identify receptors that are sensitive to changes in the noise environment. This is achieved by considering the land uses in the vicinity of the proposed development site and along any roads which may be subject to increased traffic due to the development.

9.21 The sensitivity of a receptor is determined by a consideration of the likely response to a change in the noise environment, e.g. increased annoyance, inability to perform tasks, inability to use a premises for its intended purpose. The identified receptors are then categorised in accordance with figure 9.3.

Determination of noise impact magnitude

9.22 There are no legally defined methodologies or criteria to employ when determining the magnitude of the noise impact of a proposed development on the external environment. Instead, reliance has been placed on best practice, professional judgement and experience, and a consideration of criteria detailed in the documents in figure 9.2. Identified noise impacts are categorised with reference to figure 9.4.

Baseline

Sensitive receptors

9.23 A desktop study of maps of the vicinity, together with a site visit in April 2005, identified the groups of potential receptors listed in figure 9.6; their sensitivity to noise change is classified in accordance with the categories given in figure 9.3.

Ref.	Description of receptors	Sensitivity to noise change
R1	Houses and the garden centre to the east of the A41	Medium
R2	Hospital, sports ground and premises along King's End	Medium
R3	Residential properties along Middleton Stoney Road	Medium
R4	Residential properties and the hotel along the A4095 e.g. Bignell Lodge	Medium
R5	Residential and school premises to the north of Alchester Road, Chesterton, and Wendlebury Farm	Medium

Figure 9.6 Sensitive receptors

Noise monitoring locations

9.24 To determine the baseline noise environment in the vicinity of the sensitive noise receptors, it was necessary to perform a baseline noise survey. This survey involved noise monitoring at locations chosen to be representative of the noise environment at the sensitive receptors. The chosen monitoring locations, the receptors they represent and the dominant noise source at each location are given in figure 9.7 and shown in figure 9.8.

Monitoring location	Sensitive receptor ref.	Location description, all are freefield unless stated.	Dominant noise source
Loc. 1	R1	In lay-by off north bound carriageway of A41. 6 m from the edge of the carriageway.	Road traffic
Loc. 2	R2	10 m from the edge of King's End, alongside the sports ground.	Road traffic
Loc. 3	R3	10 m from the edge of Middleton Stoney Road, at the entrance to Loddon Close/ Villers Road.	Road traffic
Loc. 4	R4	In field, 10 m from the edge of the A4095, 50 m north of Bignell Lodge.	Road traffic
Loc. 5	R5	In field, 10 m from the edge of the road leading into Chesterton.	Road traffic

Figure 9.7 Noise monitoring locations

Survey procedure

9.25 The baseline noise survey comprised a series of short-term measurements undertaken on Monday 11th April 2005. The noise level was monitored continually for representative periods during the daytime, typically 10 to 20 minutes. Typical acoustic indices were recorded, namely, $L_{Aeq,T}$, $L_{A90,T}$, $L_{A10,T}$, L_{AFmax} .

9.26 All measurements were performed in accordance with the guidance given in British Standard 4142 (1997)(3) and ISO 1996-1 (1982)(4). The microphone was mounted on a tripod at approximately 1.3 m above local ground level and fitted with a windshield. The weather conditions were dry, with no wind; as such, they did not have any adverse effects on the results obtained. The SLM was field calibrated before and after the survey, no drift had occurred.

Observed noise sources

9.27 The principal noise source in the vicinity of the proposed development site is road traffic using the A41, with additional contributions from local traffic on Middleton Stoney Road and other sections of the A4095. Traffic noise from the M40, to the south-west of the site, was not notable at any of the monitoring locations.

Baseline noise monitoring results

9.28 The results of the monitoring undertaken at the various representative locations around the proposed development site are given in figure 9.9.

Location	Start time	Duration (mins)	Noise level dB				Comments
			$L_{Aeq.T}$	L_{Amax}	$L_{A90.T}$	$L_{A10.T}$	
1	11:35 15:58	18 10	79.8 80.6	85.7 85.0	71 76	82 83	Continuous fast moving traffic
2	12:10 14:35	16 10	67.7 68.0	73.1 71.6	64 64	69 69	Continuous flow of traffic
3	12:35 14:50	22 28	65.8 66.0	70.9 72.6	58 59	68 69	Regular flow of traffic
4	13:15 15:23	16 12	57.3 60.4	64.3 73.9	48 48	61 62	Infrequent fast moving traffic
5	13:40 15:41	16 10	53.4 54.9	61.9 59.4	47 51	56 57	Infrequent flow of traffic

Figure 9.9 Noise measurements taken on 11th April 2005

Assessment of existing baseline noise environment

9.29 With reference to the WHO guidelines(5), which are explicitly aimed at assessing noise environments dominated by steady noise sources such as road traffic, with the exception of R5, Chesterton (figure 9.8), the daytime noise environment at the sensitive receptors can be

3 BS4142 (1997), Method for rating industrial noise affecting mixed residential and industrial areas.

4 ISO 1996-1 (1982), Description and measurement of environmental noise, Part 1. Guide to quantities and procedures.

5 Although the WHO guidelines refer to 16 hr and 8 hr averaging periods it is considered that the noise environment in this vicinity is sufficiently constant for the chosen measurement period to be broadly representative of these averaging periods.

considered to be poor. Chesterton's relative isolation from the busy A41 and Middleton Stoney Road, results in lower noise levels and the noise environment is considered to be fair.

Potential effects

During construction

Assessment of construction noise

9.30 Methods do exist for the calculation of noise from construction activities. These methods require a level of detailed information that is not available at this stage of the proposals. It has therefore been judged that any noise level predictions made at this stage could be misleading and the level of potential error unacceptable.

9.31 However, the proposed development does involve the construction of lengths of road through the proposed development site. Road construction is a fairly generic process and therefore illustrative noise calculations have been produced.

9.32 The main method of controlling and reducing noise from construction activities is the adoption of Best Practical Means (BPM) as defined in the Control of Pollution Act 1974 (CoPA). Figure 9.10 illustrates a number of BPM measures that could be employed during the construction phase of these proposals.

9.33 Consideration of the construction methods likely to be employed during the construction phase of the proposed development did not highlight the need for any abnormal activities, such as night-time or Sunday working.

9.34 By their nature all construction works are temporary, as are any effects that may arise.

Plant and equipment

- modern, silenced and well-maintained plant will be used at all times, conforming to standards set out in EU Directives
- equipment including vehicles will be shut down when not in use
- engine compartments will be closed when equipment is in use and the resonance of body panels and cover plates will be reduced by the addition of suitable dampening materials. Any rattling noise will be addressed by the tightening of loose parts or the addition of resilient materials
- semi-static equipment is to be sited and orientated as far as is reasonably practicable away from noise sensitive receptors and will have localised screening if deemed necessary
- generators and water pumps required for 24-hour operation will be super-silenced or screened as appropriate
- crane spindles, pulley wheels, telescopic sections and moving parts of working platforms shall be adequately lubricated in order to prevent undue screeching and squealing
- where possible, mains electricity will be used rather than generators.

Methods of working

- where ground conditions permit, first preference shall be given to reaction piling methods ('silent piling'). Otherwise vibratory piling methods, together will pre-augering, shall be used. Percussive piling shall only be considered where ground conditions preclude the use of other methods and prior agreement should be sought from the local authority
- where practicable, pile caps will be cut and then broken with hydraulic rams to minimise the use of heavy air-powered breakers
- burning equipment will be used in preference to cold cutting where possible
- large concrete pours (for which an extension of working hours may be necessary) will commence as early as possible within normal working hours so that the activities can be completed within normal working hours as far as possible.

Demolition

- when breaking out concrete, an oversized breaker will be used to minimise the blow rate and hence the percussive nature of the noise produced. This should also minimise the time taken to complete the breaking out works. Where concrete obstructions arise, these will be removed and taken to a less sensitive location before being broken up
- where possible, hand breakout of structures will be encouraged and walls/structures will be dismantled or 'pushed over' rather than conventionally broken-out using pneumatic drills
- hydraulic 'munchers' will be used where reasonably practicable in preference to breakers
- all materials will be handled, stored and used in a manner that minimises noise
- concrete bursting and cutting will be considered where practical.

Management of works programme

- wherever practicable, noisy works, which are audible at the site boundary, should be undertaken during normal daytime hours, e.g. between 07:30 and 18:00 Monday to Friday and between 07:30 and 13:00 on Saturdays
- routes and programming for the transport of construction materials, fill, personnel etc are to be carefully considered in order to minimise the overall noise impact generated by these movements
- personnel will be instructed on BPM measures to reduce noise and vibration as part of their site induction training
- shouting and raised voices shall be kept to a minimum e.g. in cases where warnings of danger must be given. Use of radios is to be prohibited except where two-way radios are required for reasons of safety and communication.

Figure 9.10 Best Practical Means to control noise from construction activities

Road construction

9.35 It has been assumed that the road construction process will involve three phases of operations: ground levelling, removal of spoil and installation of sub-base, and the laying of asphalt. Each of these phases will last a number of weeks and will involve other activities such as drainage works. Figure 9.11 shows the noise levels predicted to arise at the sensitive receptors from the construction activities, the measured baseline ambient noise level, the combination of the two and the change in the baseline resulting from the construction activities.

Sensitive receptor	Road construction phase	Noise level dB(A)			
		Construction $L_{Aeq,10hr}$ (1)	Ambient $L_{Aeq,Typical}$	Combined $L_{Aeq,T}$	Change dB(A)
Wendlebury Farm	Levelling	49	54.9	55.9	+1.0
	Spoil away and sub-base	48	54.9	55.7	+0.8
	Laying of asphalt	44	54.9	55.2	+0.3
Houses off A41	Levelling	58	79.8	79.8	0.0
	Spoil away and sub-base	57	79.8	79.8	0.0
	Laying of asphalt	53	79.8	79.8	0.0
Houses at end of Shakespeare Drive	Levelling	67	65.8	69.5	+3.7
	Spoil away and sub-base	66	65.8	68.9	+3.1
	Laying of asphalt	62	65.8	67.3	+1.5
Houses off Isis Avenue	Levelling	63	65.8	67.6	+1.8
	Spoil away and sub-base	62	65.8	67.3	+1.5
	Laying of asphalt	58	65.8	66.5	+0.7
Bignell Lodge	Levelling	48	57.3	57.8	+0.5
	Spoil away and sub-base	46	57.3	57.6	+0.3
	Laying of asphalt	42	57.3	57.4	+0.1
Building at northern end of Tubbs Lane, Chesterton	Levelling	46	53.4	54.1	+0.7
	Spoil away and sub-base	44	53.4	53.9	+0.5
	Laying of asphalt	40	53.4	53.6	+0.2

Figure 9.11 Road construction noise levels

Note 1: Free-field level

9.36 The only receptors that will be subjected to a significant effect are the houses at the southern end of Shakespeare Drive. With reference to figure 9.4, the initial phases of the construction of the roundabout in Middleton Stoney Road will give rise to a small magnitude noise impact. These receptors are of medium sensitivity; it is thus determined that the construction of the junction will cause an adverse effect of moderate significance. This effect will be temporary in nature, lasting for only a number of months.

Construction traffic

9.37 Construction sites are in themselves generators of temporary periods of increased traffic flows. Peak flows can occur during demolition or excavation activities where large quantities of materials need to be moved off-site over an relatively short period of time, or if there is a need to import large quantities of soil for land raising. For the majority of the construction phase of a development such as that proposed, there will be a relatively constant flow of delivery traffic.

9.38 Based on experience of similar projects, it is assumed that the proposed development will generate approximately 145 movements per working day (see traffic and transport assessment chapter 11).

9.39 Under a worst-case scenario, whereby all the construction traffic accesses the proposed development site via the road that links Chesterton to the A41, the flow of traffic on this road would increase by around 10%, which according to the guidance in the Design Manual for Roads and Bridges would result in a noise change of negligible magnitude.

9.40 In practice the construction traffic will be spread across the local network, further reducing any noise impact. It is therefore concluded that construction traffic generated by the proposed development will not give rise to any significant noise effects.

Post construction

Noise sources assessed

9.41 The proposed development will generate additional road traffic that has the potential to create adverse noise effects. The provision of alternative routes from/to the A41 through the proposed development site, effectively bypassing King's End, may transfer the existing noise impact of traffic to different locations. The traffic generated by the proposals will have no significant effects on the level of noise generated by the M40, therefore this noise source is not assessed; this approach is also justified by the fact that noise from the M40 is not audible in the vicinity of the proposed development site.

9.42 The proposed development will close a section of the A4095, north of Chesterton, to through traffic, diverting it through the site.

Road traffic noise

9.43 The noise impact of the existing and future traffic flows was predicted using the NoiseMap 2000™ noise modelling program and the traffic data provided by WSP, which is presented in the Traffic Assessment that accompanies the planning application. The model was run using three scenarios:

1. Traffic flows for the baseline year of 2005.
2. Traffic flows for 2014, without the proposed development.
3. Traffic flows for 2014, with the development.

9.44 The comparison of the calculated noise levels for scenario three with the future baseline levels will determine the change in noise level likely to be caused by the proposed development.

Model calibration

9.45 The baseline noise survey measurement locations are entirely dominated by road traffic noise and are therefore comparable with calculated levels of road traffic noise. It is not expected that the calculated levels will exactly match those measured since the calculated levels are based on annualised traffic flows, an 18 hr averaging period (07:00-18:00 hrs), constant traffic speeds and an identical noise output from each car or HGV modelled. However, if the levels are significantly different (±5dB), this could indicate an error in the model. Figure 9.12 shows the comparison of measured and calculated noise levels.

Measurement location	Noise levels		
	Average measured $L_{A10.10\text{-}20mins}$	Calculated $L_{A10.18\,hrs}$	Difference dB(A)
1	82.5 dB	78.2 dB	-4.3
2	69.0 dB	68.5 dB	-0.5
3	68.5 dB	65.5 dB	-3.0
4	61.5 dB	65.3 dB	+3.8
5	56.5 dB	57.6 dB	+1.1

Figure 9.12 Comparison of measured and calculated levels

9.46 The differences between the measured and calculated levels are such that it can be considered with a degree of confidence that the model will calculate representative noise levels for the future year scenarios.

Modelling results

9.47 Noise calculations were undertaken for a total of 34 receptors in the vicinity of the proposed development site. The locations of the receptors are shown in figure 9.13. Calculations were undertaken for ground floor (1.5 m) and 1st floor (4.0 m) level, the exception being bungalows.

9.48 Figure 9.14 illustrates the change between the with and without development scenario in terms of noise level difference contours[6]. The change between the 2014 with and without scenarios is the noise impact of the proposed development. The magnitude of any impact has been categorised with reference to figure 9.4. Receptors that are predicted to be subject to an impact of a magnitude greater than negligible, i.e. a noise change of 3 dB(A) or more, are summarised in figure 9.15.

6 These contours are principally for illustration only, the level of accuracy being dependent on the spacing of the calculation points used to make up the contours. For accurate noise levels refer to the data in table 9.9.

Location	Receptor	Floor	Scenario	Predicted noise levels $L_{A10\ 18hr}$ dB 1	2	3	Change in noise level 3 - 2
			Year	2005	2014	2014	dB(A)
			With/without	Without	Without	With	
A4095, North of Chesterton	Pos 29	Grnd		60.8	61.1	58.0	-3.1
		1st		62.9	63.3	60.2	-3.1
	Pos 30	Grnd		70.8	71.2	68.1	-3.1
		1st		71.6	72.0	68.9	-3.1
	Pos 31	Grnd		65.1	65.5	62.3	-3.2
		1st		67.1	67.5	64.4	-3.1
	Pos 32	1st		49.9	50.3	47.3	-3.0
	Pos 33	Grnd		62.1	62.4	59.4	-3.0
		1st		69.1	69.4	66.3	-3.1

Figure 9.15 Significant noise impacts

9.49 For the no development scenario, there will be continued natural growth in traffic volumes, resulting in the increases in noise level between 2005 and 2014. In noise terms, the with development scenario leads to no significant changes in traffic flows (7). The exception is the large increase, circa, 200%, that will occur on the road towards Ambrosden, which is brought about by the closure of the existing grade-separated junction with the A41, and its replacement with a roundabout further north. The noise change that this gives rise to is insignificant relative to the noise from the A41, therefore the impact on the farmhouse at Wendlebury Farm, the closest sensitive receptor is negligible.

9.50 The significant improvement to the noise environment in the vicinity of the R4 receptor group, the A4095 north of Chesterton, results from reductions in the traffic flow, the percentage of HGVs and the speed limit, from 50 mph to 40 mph.

9.51 For the prediction locations not shown in figure 9.15, the noise change ranges from -2.9 to +2.0 dB. For the locations along Middleton Stoney Road, the noise change ranges from +0.1 to +1.0 dB and along Shakespeare Drive from +1.0 to +1.1 dB.

Design Manual for Road and Bridges (DMRB) assessment

9.52 Using the DMRB assessment methodology, the figures given in figure 9.15 can be converted into percentages of a given population being 'bothered very much or quite a lot' by road traffic noise and induced vibration. Figure 9.16 gives:

- the percentage 'bothered very much or quite a lot' for the without development scenarios
- the percentage change that will result from the development
- the resultant percentage of the population who will be 'bothered very much or quite a lot' by road traffic noise once the proposed development is operational.

9.53 Figure 9.17 gives the corresponding percentages for vibration.

7 To achieve a noise change of greater than 3 dB(A) traffic flow would have to increase by 50%.

Location	Receptor	Floor		% Before dev.		% Change due to dev.	Resultant %
			Scenario	1	2	3	3
			Year	2005	2014	2014	2014
			With/without	Without	Without	With	With
A4095, North of Chesterton	Pos 29	Grnd		14.4	14.8	-31.1	10.2
		1st		17.8	18.5	-31.4	12.7
	Pos 30	Grnd		35.8	36.9	-31.4	25.3
		1st		38.0	39.2	-31.4	26.9
	Pos 31	Grnd		22.0	22.8	-31.4	15.6
		1st		26.3	27.3	-31.4	18.7
	Pos 32	1st		4.3	4.5	-30.2	3.1
	Pos 33	Grnd		16.4	16.9	-31.1	11.6
		1st		31.3	32.0	-31.1	22.0

Figure 9.16 Percentage of population bothered very much or quite a lot by road traffic noise

Location	Receptor	Floor		% Before dev.		% Change due to dev.	Resultant %
			Scenario	1	2	3	3
			Year	2005	2014	2014	2014
			With/without	Without	Without	With	With
A4095, North of Chesterton	Pos 29	Grnd		13.0	13.3	-31.1	9.2
		1st		16.0	16.7	-31.4	11.4
	Pos 30	Grnd		32.2	33.2	-31.4	22.8
		1st		34.2	35.3	-31.4	24.2
	Pos 31	Grnd		19.8	20.5	-31.4	14.1
		1st		23.7	24.6	-31.4	16.9
	Pos 32	1st		0.0	0.0	0.0	0.0
	Pos 33	Grnd		14.8	15.2	-31.1	10.5
		1st		28.2	28.8	-31.1	19.8

Figure 9.17 Percentage of population bothered very much or quite a lot by road traffic induced vibration

Determination of the significance of the noise effects

9.54 Using the results in figures 9.15, 9.16 and 9.17, figure 9.18 summarises the categorisation of the sensitive receptors and the magnitude of the noise impacts. From these categories the significance of a noise effect is determined. Receptors subject to a negligible impact, i.e. not included in figure 9.15, will not be subjected to any significant noise effects and are not listed.

Description of receptor	Sensitivity to noise change	Magnitude of impact	Significance of effect	Beneficial or adverse
Pos. 29: Hotel off A4095.	Medium	Small	Moderate	Beneficial
Pos. 30: Houses off A4095, north of Alchester Road.	Medium	Small	Moderate	Beneficial
Pos. 31: House off A4095, opposite the hotel.	Medium	Small	Moderate	Beneficial
Pos. 32: Bignell House, off A4095	Medium	Small	Moderate	Beneficial
Pos. 33: Bignell Lodge, off A4095	Medium	Small	Moderate	Beneficial

Figure 9.18 Significance of noise effects

Mitigation

Road construction

9.55 The adverse impacts of the road construction phase of the development are limited to houses in close proximity to the proposed roundabout in Middleton Stoney Road. Due to the need for the works to extend to the edge of the existing road, there are no opportunities to consider the use of temporary noise barriers. It is also considered that the small magnitude of the noise impact, and its limited temporal nature, do not warrant any mitigation measures in addition to those listed in figure 9.10.

Operational noise

9.56 The alterations to traffic flows on the road network in the vicinity of the proposed development site are relatively small. This, together with reductions in speed limits along the A41, results in no significant adverse noise effects. The addition of a new roundabout on the A41, and the closure of the Chesterton junction, does not cause an effect due to the masking effects of the A41 traffic noise.

9.57 The development proposals include the provision of a noise fence along a length of the site's boundary with the A41. The attenuation provided by the fence will only affect the future occupiers of the development, as illustrated in figure 9.14; it has no effect on the existing receptors and is thus not considered within this EIA assessment.

9.58 Figure 9.18 illustrates that the only significant permanent noise effects of the proposed development are beneficial; hence, no mitigation is required.

Residual effects

9.59 The significant residual noise effects of the proposed development are shown in figure 9.19.

Topic	Significant residual effects	Sensitivity of receptor	Magnitude of change	Duration	Nature	Significance	Level of certainty
Noise	Construction noise						
	Noise from road construction effecting houses at southern end of Shakespeare Drive	Medium	Small	Temporary	Adverse	Moderate	Absolute
	Road traffic noise						
	Decreased road traffic noise effecting houses off A4095, north of Alchester Road	Medium	Small	Permanent	Beneficial	Moderate	Absolute

Figure 9.19 Noise and vibration residual effects

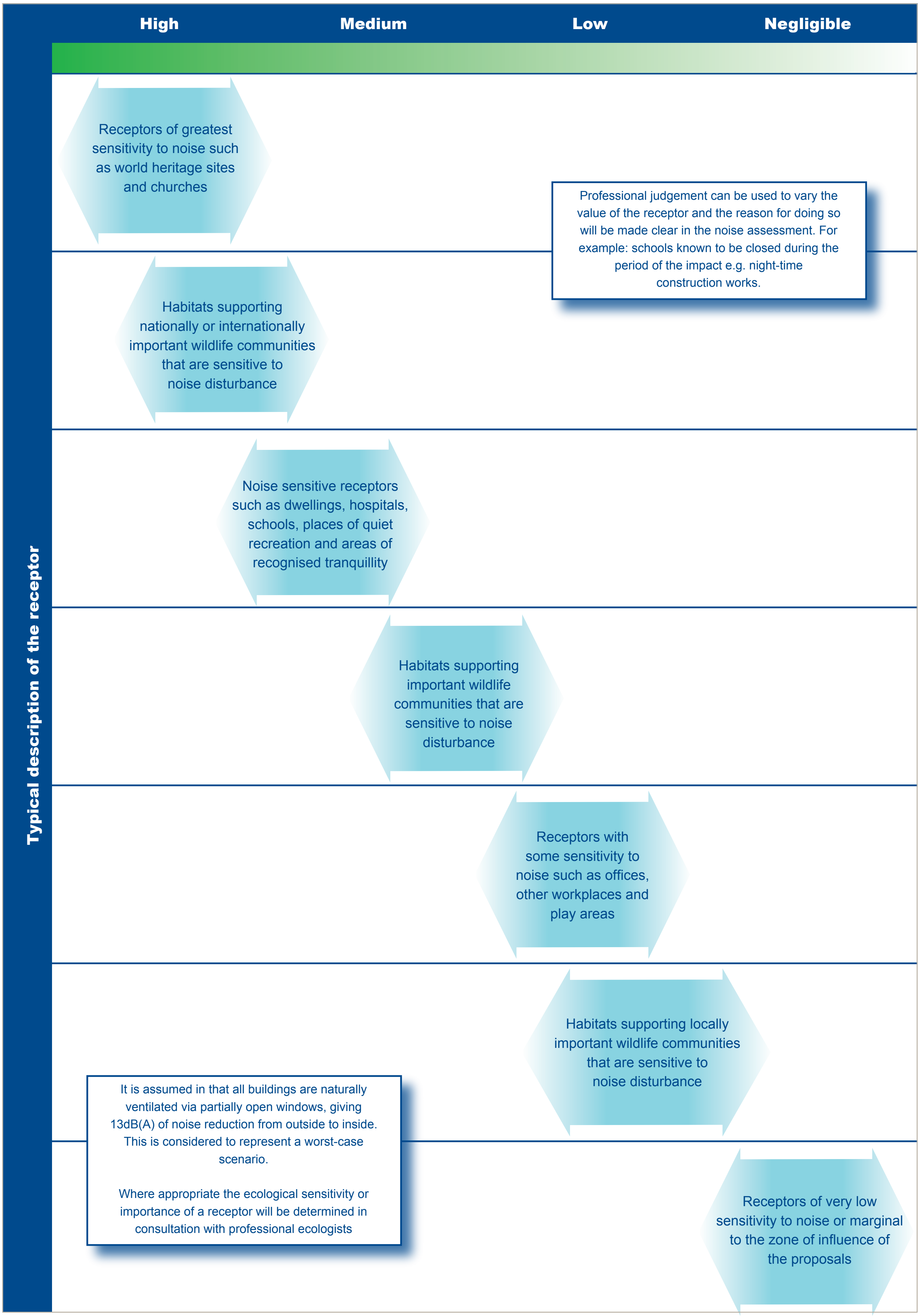


Figure 9.3 Noise and vibration: sensitivity or importance of receptor

Typical description of the receptor

	Large	Medium	Small	Negligible
	Relative change	**Relative change**	**Relative change**	**Relative change**
	Greater than 10 dB(A) change in sound level	5.0 to 9.9 dB(A) change in sound level	3.0 to 4.9 dB(A) change in sound level Relative change	2.9 dB(A) or less change in sound level
	Absolute change	**Absolute change**		
	Adverse day-time	**Adverse day-time**		
	If b <50 dB $L_{Aeq.16hr}$ and f ≥55 dB $L_{Aeq.16hr}$ If f triggers entitlement to statutory sound insulation	If b <50 dB $L_{Aeq.16hr}$ and 50≤ f <55 dB $L_{Aeq.16hr}$ If 50 ≤ b <55 dB $L_{Aeq.16hr}$ and f ≥55 dB $L_{Aeq.16hr}$		
	Adverse night-time	**Adverse night-time**		
	If b <45 dB $L_{Aeq.8hr}$ and f ≥45 dB $L_{Aeq.8hr}$ If b <60 dB L_{Amax} and f ≥60 dB L_{Amax} If b ≥60 dB L_{Amax} but does not exceed 85 dBL_{Amax} more than twice in a one hour period and f ≥85 dB L_{Amax} more than twice in a one hour period	If b >85 dB L_{Amax} though not regularly and f exceeds 85 dB L_{Amax} more than twice in any one hour period.		
	Beneficial day-time	**Beneficial day-time**		
	If b ≥55 dB $L_{Aeq.16hr}$ and f <50 dB $L_{Aeq.16hr}$	If 50 ≤ b <55 dB $L_{Aeq.16hr}$ and f <50 dB $L_{Aeq.16hr}$ If b ≥ 55 dB $L_{Aeq.16hr}$ and 50 ≤ f <55 dB $L_{Aeq.16hr}$		
	Beneficial night-time			
	If b ≥45 dB $L_{Aeq.8hr}$ and f <45 dB $L_{Aeq.8hr}$ If b ≥60 dB L_{Amax} and f <60 dB L_{Amax}			

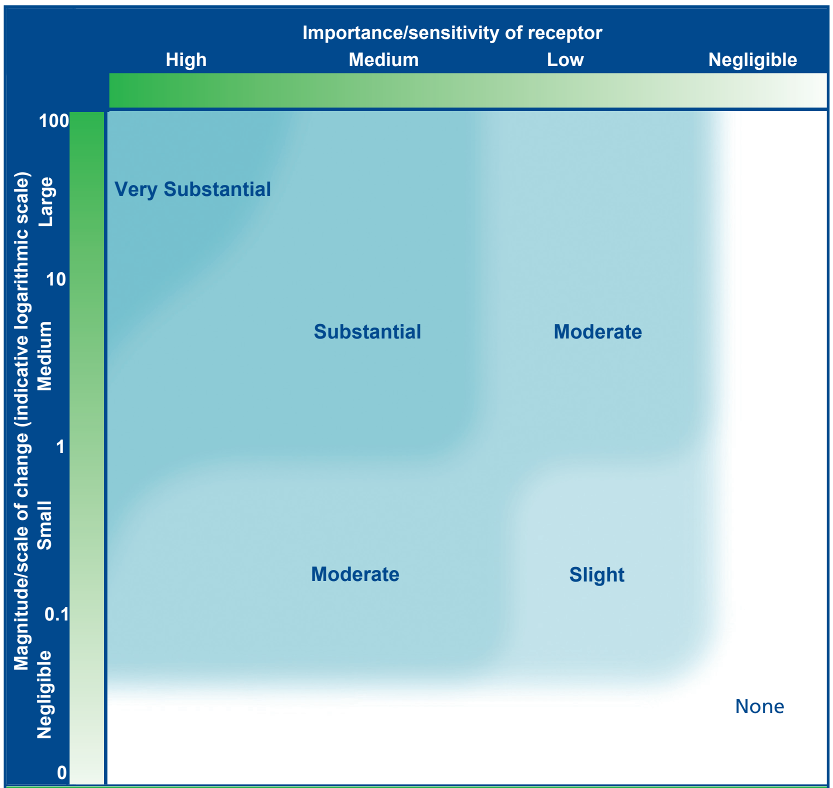
Absolute levels are with reference to the recommendations for dwellings made by the World Health Organisation and in British Standard 8233:1999. It is noted that additional guidance exists for other receptors e.g. schools and hospitals and this will be referred to when appropriate

1. It is noted that 0 dB(A) is considered to be the threshold of human hearing, but in practice, for steady noise sources, only changes of 3 dB(A) or more are considered to be perceptible to the human ear.
2. The use of one decimal place is not to be considered as an indication of the accuracy of the noise assessment. It serves only to give clear boundaries between the categories.

Relative and absolute changes considered in parallel and worst case taken.

b = existing or future baseline noise levels
f = predicted future noise levels

Figure 9.4 **Noise and vibration: magnitude of change**



Very substantial:
Greater than 10.0 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise

Substantial:
Greater than 5.0 dB L_{Aeq} change in sound level at a noise sensitive receptor, or a 5.0 to 9.9 dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise

Moderate:
A 3.0 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5.0 dB L_{Aeq} change in sound level at a receptor of some sensitivity

Slight:
A 3.0 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity

Not significant:
Less than 2.9 dB L_{Aeq} change in sound level and / or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

Figure 9.5 Noise and vibration significance matrix