



Consultants in Sound and Vibration

Report

19-0003-R3

21 February 2023

The Whitecroft Care Home

LTC ES Chapter 12 Review

BY Acoustics

105 Woodlands Avenue

West Byfleet

Surrey, KT14 6AP

E Office@byacoustics.com

T +44 1932 932038

www.byacoustics.com

Registered in England and Wales no. 12165927

Revision Number	Date	Comments	Author	Approved by
1	21/02/2023	Draft for Review	Johnny Berrill	Ian Yates

Prepared by

BY Acoustics

On behalf of:

Runwood Homes Ltd

Runwood House
107 London Road
Benfleet
SS7 2QL

Table of Contents

1	Introduction	1
2	Development Criteria	1
2.1	Baseline Noise Levels	1
2.2	Construction Noise	2
2.3	Operational Noise	3
2.4	Construction and development vibration	4
3	Noise Impact Assessment Criteria for Vulnerable Receptors	4
3.1	General Overview	4
3.2	Consideration of isolated or individual noise levels	5
3.3	Consideration of criteria for Health Sector buildings	6
3.4	Consideration of WHO Night Noise Guidelines	7
3.5	Considering residents at rest during daytime hours	7
3.6	Context and Cumulative Effects	7
3.7	Summary and Proposed Criteria	8
4	Operational Phase Noise Impact	8
5	Operational Phase Vibration Impact	9
6	Construction Noise Impact	9
7	Construction Vibration Impact	11
8	Conclusion	11
	Appendix A - Relevant Guidance and Criteria	
	Glossary of Terms	



1 Introduction

- 1.1 This report sets out a review and response to the latest Lower Thames Crossing (LTC) ES submission, focussing on the potential impact of the proposed scheme on The Whitecroft care home.
- 1.2 The documents reviewed comprise the Environmental Statement Chapter 12 – Noise and Vibration, its Figures and Appendixes, and other relevant chapters in the Environmental Statement (collectively referred to herein as “the ES”).
- 1.3 Reference is made in this memorandum to indicative analysis undertaken on the operational noise of the development, as summarised in BY Acoustics (BYA) report 19-0003-R2-2 dated 27 August 2020. That analysis is indicative only as it was based on the limited data that Highways England provided, both in terms of the level of detail and the dates assessed (the data, and subsequent analysis, was based on an opening year of 2027 rather than 2030 as referenced in the ES). No further information has been provided to allow updating of that analysis to the latest proposal.
- 1.4 In particular, the criteria applied to noise and vibration impacts from the development are discussed in detail in this report. The Whitecroft is home to sensitive and vulnerable residents, and as such it is necessary to consider it appropriately. The noise and vibration assessments in the ES do not currently differentiate between the care home and the general population.

2 Development Criteria

In Environmental Statement Chapter 12 the noise and vibration criteria are set with reference to guidance set out in the Design Manual for Roads and Bridges (DMRB) document LA111¹. This section sets out a summary of the criteria along with baseline data relevant to The Whitecroft.

The relevance of the noise criteria, along with potential alternative and more appropriate considerations, are discussed further in Section 3.

2.1 Baseline Noise Levels

- 2.1.1 A short term, 3 hour, baseline noise survey was undertaken at the care home, referred to as A-NML 15 in Appendix 12.5 – Baseline Noise Survey Information. Table 2.1 below sets out the results of the survey.

Time Period	$L_{A90,T}$	$L_{Aeq,T}$	$L_{A10,T}$
13:30-14:30	52.6	55.2	56.8
14:30-15:30	53.3	55.6	57.1
15:30-16:30	52.1	55.0	56.7
$L_{A10,3\text{ hour}}$ (CRTN shortened method: average of the three $L_{A10,1\text{ hour}}$ levels)			56.9
$L_{A10,18\text{ hour}}$ (CRTN shortened method: $L_{A10,3\text{ hour}} - 1\text{ dB}$)			55.9

Table 2.1 Appendix 12.5 Baseline noise survey information for A-NML 15: The Whitecroft



2.1.2 Appendix 12.4 Construction Noise and Vibration Assessment states that the baseline level is either calculated from the baseline survey information or from the Do Minimum opening year operational traffic road model. The daytime baseline is the arithmetic average of the three measured $L_{Aeq, 1\text{ hour}}$ levels from the survey (55.3 dB).

2.1.3 The evening level is taken as 10 dB lower than the daytime level with the night level a further 10 dB lower. While full survey information for this receptor would be preferable, in the absence of such information the approach taken in terms of assumed baseline levels for evening and night time is likely to be robust.

2.2 Construction Noise

2.2.1 The ES noise chapter sets out observable adverse effect level thresholds for construction noise. The Lowest Observable Adverse Effect Level (LOAEL) is set as equal to the baseline noise level. The Significant Observable Adverse Effect Level (SOAEL) is set in accordance with Table E.1 from BS5228-1ⁱⁱ.

Time Period	LOAEL	SOAEL
Day (07:00-19:00 weekdays and 07:00-13:00 Saturdays)	55.3 dB $L_{Aeq,T}$	65.0 dB $L_{Aeq,T}$
Night (23:00 – 07:00)	35.3 dB $L_{Aeq,T}$	45.0 dB $L_{Aeq,T}$
Evenings and weekends (time periods not covered in above rows)	45.3 dB $L_{Aeq,T}$	55.0 dB $L_{Aeq,T}$

Table 2.2 Construction noise LOAEL and SOAEL values for The Whitecroft (BS 5228 method 1)

2.2.2 In line with the DMRB LA 111, the magnitude of impact from construction noise is defined as follows:

- a. Negligible: Below LOAEL
- b. Minor: Above or equal to LOAEL and below SOAEL
- c. Moderate: Above or equal to SOAEL and below SOAEL + 5 dB
- d. Major: Above or equal to SOAEL + 5 dB

2.2.3 Additionally, the following magnitude of impact from construction traffic noise is applied:

- a. Negligible: <1.0 dB change in road traffic noise
- b. Minor: ≥1.0 dB; <3.0 dB change in road traffic noise
- c. Moderate: ≥3.0 dB; <5.0 dB change in road traffic noise
- d. Major: ≥5.0 dB change in road traffic noise

2.2.4 Construction noise is considered to constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- a. 10 or more days or nights in any 15 consecutive days or nights
- b. A total number of days exceeding 40 in any 6 consecutive months



2.3 Operational Noise

2.3.1 The operational noise assessment takes a two-step approach. The short or long-term change magnitude is calculated as set out in Table 2.3 while the adverse effect levels on an absolute level basis are also assessed as set out in Table 2.4.

Short-term magnitude	Long-term magnitude	Change in road traffic noise level
No Change	No Change	0 dB
Negligible	Negligible	>0 dB; <1 dB
Minor	Minor	≥1 dB; <3 dB
Moderate	Moderate	≥3 dB; <5 dB
Major	Major	≥5 dB; <10 dB
		≥10 dB

Table 2.3 Operational road traffic noise impact magnitude classification

2.3.2 It is stated that a significant effect from road traffic noise on the occupants of noise sensitive buildings is deemed to have occurred if the predicted change in road traffic noise level is:

- Moderate or greater in magnitude with a resulting level below the SOAEL
- Minor or greater in magnitude with a resulting level above the SOAEL

Time Period	Adverse effect level	Noise level
Day	LOAEL	55 dB $L_{A10, 18 \text{ hour}}$ (façade incident)
	SOAEL	68 dB $L_{A10, 18 \text{ hour}}$ (façade incident)
Night	LOAEL	40 dB $L_{\text{night, outside}}$ (free field)
	SOAEL	55 dB $L_{\text{night, outside}}$ (free field)

Table 2.4 Operational road traffic noise LOAEL and SOAEL levels

2.3.3 It is noteworthy that the following is also stated, under clause 12.3.135 of the ES Chapter.

A significant environmental effect would be determined based upon the instructions within DMRB LA 111, taking into account factors such as:

- Magnitude of change in short term and long term
- Absolute noise level with reference to LOAEL and SOAEL
- Acoustic context and characteristics of the resultant noise climate
- Circumstance of receptor, i.e. location of noise sensitive rooms (bedrooms/living rooms) and whether the receptor would also experience benefits from the Project



2.3.4 Factor d does not appear to have been adequately considered in relation to The Whitecroft. Factors c and d also do not appear to have been fully considered in relation to construction noise.

2.4 Construction and development vibration

2.4.1 The following Table 2.5 sets out the vibration adverse effect significance thresholds applied to both construction and operational vibration.

Vibration level (PPV)	Effect	Adverse effect / Impact level
>0.14; <0.3 mm/s	Vibration might be just perceptible in the most sensitive n/a situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	n/a / Negligible
≥0.3; <1.0 mm/s	Vibration might be just perceptible in residential <1.0mm/s environments.	LOAEL / Minor
≥1.0; <10 mm/s	It is likely that vibration of this level in residential <10mm/s environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.	SOAEL / Moderate
≥10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.	SOAEL / Major

Table 2.5 Construction vibration LOAEL and SOAEL thresholds (Peak Particle Velocity, PPV)

2.4.2 Construction vibration is considered to constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- a. 10 or more days or nights in any 15 consecutive days or nights
- b. A total number of days exceeding 40 in any 6 consecutive months

2.4.3 It could be appropriate to consider lower threshold levels for the SOAEL and Moderate and Major impact levels at the care home due to its vulnerable residents. For operational development vibration, it is considered unlikely that this would have a bearing on the conclusions.

2.4.4 The Whitecroft has not been adequately considered in terms of construction vibration and so it is not possible to comment on whether the criteria applied are appropriate. Further discussion on the construction vibration assessment, and lack thereof, is set out in Section 7.

3 Noise Impact Assessment Criteria for Vulnerable Receptors

3.1 General Overview

3.1.1 As noted, in both Operational and Construction noise impact assessments in the ES, the impact and significance criteria applied are commensurate with those typically applied to the general population. The Whitecroft is home to residents with decreased personal abilities, particular



diseases and medical problems (such as dementia), and the elderly in general. The residents are therefore a “vulnerable subgroup” as defined in World Health Organisation guidelines^{iv}.

3.1.2 The DMRB LA 111 document states in various assessment sections that “where specific local circumstances mean that an alternative method of setting LOAEL and SOAEL for ... sensitive receptors is more appropriate, the alternative method can be submitted as a departure from standards to the Overseeing Organisation for approval”. Under operational noise assessment, local circumstances where the adverse level thresholds shall be modified are stated as including:

- 1) Noise sensitive receptors that have reduced sensitivity to noise or vibration e.g., sensitivity to noise is reduced if receptors have good noise insulation.
- 2) Noise sensitive receptors that have an increased sensitivity to noise or vibration e.g., if a building is regularly used by people with hearing impairments, it is likely to be more sensitive to the users, as noise affects speech intelligibility at lower levels than it would for those with non-impaired hearing.

3.1.3 It is clear for the above statement that The Whitecroft is a receptor where local circumstances warrant an alternative method of setting LOAEL and SOAEL.

3.1.4 On this basis it is appropriate that they be subject to “individual consideration by the developer or promoter”ⁱⁱ. This has not been the case to date, despite confirmation in Clause 12.3.135 of the ES Chapter 12 that “circumstance of receptor” is taken into account in determining the environmental effect of the development.

3.1.5 Construction noise limits, in particular, require further consideration. There is an understanding in the setting of such criteria that the elevated noise should occur for a limited time only. The construction period for this development is 5 years, with daytime elevated noise levels noted for the majority of this time. Evening and night time periods show elevated levels continuously for up to 2.5 years. Such time periods could conceivably exceed the entirety of a residents stay in the care home. To subject a resident to such impacts towards the end of their life, at a time when they could be considered particularly vulnerable, is not appropriate. These extended durations when noise levels are above the LOAEL should be taken into account in any assessment.

3.1.6 There are no set criteria or specific guidance for such vulnerable receptors. However, several considerations are set out below, which could be used individually or in combination.

3.2 Consideration of isolated or individual noise levels

3.2.1 The assessments have been undertaken with reference primarily to $L_{Aeq,T}$, which is in line with DMRB LA111 guidance. However, regarding construction noise, BS 5228-1 notes that “when describing noise from isolated events that might not be apparent from a longer period $L_{Aeq,T}$, it can be useful to use a short period”. Short term levels, e.g. $L_{Aeq,5\text{ min}}$, one percentile level, $L_{A01,T}$, or L_{Amax} levels are suggested.

3.2.2 Given the proposed development layout, it is considered unlikely that the operational phase will give rise to notable, if any, increase in L_{Amax} levels at the care home.



- 3.2.3 However, construction activities have the potential to result in significant L_{Amax} levels. For example, earthworks activities as well as traffic on local haul routes could result significant impacts.
- 3.2.4 L_{Amax} noise levels at night (internally, with windows open or other means of ventilation provided) should be considered, to ensure that levels of 45 dB L_{Amax} are not regularly exceeded (i.e. no more than 10-15 times per night), as per the WHO Guidelines for community noiseⁱⁱⁱ. This consideration is essential, regardless of which other criteria are also adopted.
- 3.2.5 More recent guidance, such as the WHO Night Noise Guidelines^{iv} indicate that a threshold lower than 45 dB L_{Amax} could be considered. However, the use of the 45 dB threshold in guidance such as the AVO guide^v indicate this is a robust design target.

3.3 Consideration of criteria for Health Sector buildings

- 3.3.1 There are potential alternative methods which could be used to define the criteria for construction noise. For example, Appendix E of BS 5228 sets out a second example method, in addition to method 1 discussed in section 2 of this report. The standard states that the first method, defining potential significant effects at dwellings, is applied to residential receptors only. The second method is stated as being generally applicable to residential buildings, as well as others including those in health and/or community use.
- 3.3.2 The second example method in BS 5228 sets the significance thresholds at 5 dB above the pre-construction ambient noise level, subject to lower cut-off values of 65 dB, 55 dB and 45 dB for each of the day, evening, and night periods. Taking the LOAEL values in Table 2.2 as the baseline ambient noise level for each period, this would result in the same SOAEL thresholds as stated in Table 2.2 for method 1. Therefore, in this case, either method is likely to be appropriate as a starting point.
- 3.3.3 However, the standard highlights that non-residential buildings in which the occupants are particularly sensitive to noise (including hospitals and clinics) should be “subject to individual consideration by the developer or promoter, upon application by the affected party”. Other guidance can then also be referred to, as below.
- 3.3.4 HTM 08-01^{vi} sets out acoustic design criteria for health sector buildings, which the care home designation would fall under. The criteria for single person wards are considered most comparable to a care home bedroom. The design target during day time hours is ≤ 40 dB $L_{Aeq, 1 \text{ hour}}$, during night time hours the targets are ≤ 35 dB $L_{Aeq, 1 \text{ hour}}$ and ≤ 45 dB L_{Amax} for events that occur several times in the night.
- 3.3.5 The 1 hour time period utilised for the $L_{Aeq, T}$ design criteria is noteworthy, as it prevents the “averaging out” of elevated levels in comparison to, for example, a 8 or 12-hour period. The threshold for individual noise event levels at night reflects that stated in Section 3.2.
- 3.3.6 On this basis it is suggested that the construction noise criteria applied in the Construction Noise and Vibration assessment could remain as proposed, but with an averaging period of 1-hour rather than the 4-hour (evening), 8-hour (night), and 12-hour (day time) periods currently used. This approach potentially makes the criteria more onerous compared with T being the full day, evening and night periods (depending on the profile of noise generation across each of those periods).



3.4 Consideration of WHO Night Noise Guidelines

- 3.4.1 WHO Night Noise Guidelines for Europe set out guidelines for exposure to noise during sleep. The document states that $40 \text{ dB } L_{\text{night, outside}}$ should be the target of the night noise guideline (NNG) “to protect the public, including the most vulnerable groups, including ... the chronically ill and the elderly”. $L_{\text{night, outside}}$ equates the free-field $L_{\text{Aeq, 8 hour}}$ level from 23:00 to 07:00.
- 3.4.2 It should be noted that the NNG document does not represent statutory requirements or guidance. Rather it presents ideal noise level targets, which are often not appropriate as criteria applying in many development locations in the UK. Nevertheless, the document contains potentially useful information when considering noise in the context of protecting vulnerable care home residents.

3.5 Considering residents at rest during daytime hours

- 3.5.1 The proposed ES noise and vibration criteria are set on the basis of the general population, with the implied assumption being that the hours of 23:00 to 07:00 are for rest and/or sleeping. In a care home, particularly one which caters to more vulnerable patients such as those suffering from dementia. It is likely that daytime hours will also be used for rest.
- 3.5.2 On this basis it could be reasonable that the noise impact on rest be considered at all times. Application of this across the full day would change the SOAEL threshold from $65 \text{ dB } L_{\text{Aeq, 12h}}$ day and $55 \text{ dB } L_{\text{Aeq, 4h}}$ evening to $45 \text{ dB } L_{\text{Aeq, 12h}}$ and $45 \text{ dB } L_{\text{Aeq, 4h}}$ respectively.
- 3.5.3 This is likely to be an impracticable approach, given for example the 20 dB reduction compared to normal daytime limits. A compromise is conceivable, where the daytime criteria are somewhere between those normally applying in the day and night periods.
- 3.5.4 Assessment of L_{Amax} levels during the day and evening could also be undertaken, in order to identify the potential for significant impact upon the care home residents.

3.6 Context and Cumulative Effects

- 3.6.1 When assessing the potential impact on any population (vulnerable or not), various factors should be taken into account, such as overall duration. For example, if it were anticipated that residents will be exposed to noise levels at or near the SOAEL during the day, evening and night, for months at a time, this would clearly have a greater impact than just a few days.
- 3.6.2 Clause 12.6.4 of Chapter 12 states that “activities have been assumed to occur for a full calendar month”. Appendix 12.4 accordingly shows the predicted levels on a monthly basis. However, discussion on the Whitecroft in Table 12.33 reasons potential exceedance of the SOAEL on the basis that only “2No 48 hr possessions” would occur. These two statements do not accord.
- 3.6.3 In an ES, it is also appropriate to consider cumulative effects, in terms of both effects in conjunction with other nearby developments, and noise effects in combination with non-acoustic effects such as dust and light pollution and intrusion. Currently, Chapter 16 acknowledges a Significant, Large adverse cumulative effect at the Whitecroft from combination of adverse air quality, noise, visual and human health effects. The ES does not appear to directly consider light pollution (for example by qualitatively assessing the combined effect of noise and artificial light on care home residents at night).



3.7 Summary and Proposed Criteria

- 3.7.1 On the basis of the above points it is suggested that the following amendments, at a minimum, are applied to the assessment criteria for The Whitecroft (and also to any other noise sensitive receptor in the development area with particularly vulnerable people):
- For levels at night in bedrooms due to construction or operational noise, the SOAEL would be considered ≥ 45 dB $L_{A_{maxF}}$ more than 10-15 times in any one night (in addition to the L_{Aeq} criterion adjusted as in the subsequent bullet)
 - External day, evening, and night construction SOAEL thresholds should be based on a 1-hour period for L_{Aeq} , rather than the full day, evening, or night period
 - All limits should be based on the assumption of open windows, to allow sufficient ventilation
- 3.7.2 As noted above, it could be considered reasonable to reduce thresholds and limits further to protect the vulnerable residents, for example by considering the likelihood that residents would require restful conditions during day and evening hours also.
- 3.7.3 Commentary in the following sections is in relation to the criteria set out in the ES Chapter unless otherwise noted. Reference to these criteria does not indicate agreement with the impact level thresholds. If the applicant considers the standard criteria to remain applicable to the care home for this development, it would be necessary for the applicant team to explain the basis on which it is not considered appropriate to provide additional protection for vulnerable residents during both the construction and operational phases, with regard to the various points made on this topic throughout this report.

4 Operational Phase Noise Impact

- 4.1 Noise contours are provided as an appendix the ES to show the calculated sound level changes due to the operation of the proposed development. As is standard, the sound level difference with and without development is analysed both in the short term for the opening year (2030) and in the long term (opening year without development versus future year 2045 with the development).
- 4.2 There is insufficient resolution to view the sound level contours at The Whitecroft care home in detail. It appears that a Minor Beneficial Change is calculated in the short term while No (or Negligible) Change is calculated in the long term.
- 4.3 Information is not provided on the resolution of the calculation grid, i.e. what distance apart the discrete calculation points are and therefore what level of interpolation exists in the provided sound level contours. Specific calculated levels are not provided for the various façade orientations. It is expected that the worst case level change across all facades is used, as is required under the Design Manual for Roads and Bridges (DMRB) document LA111¹. However, this does not appear to be specifically stated, and depending on the calculation grid resolution used may not be the case.
- 4.4 Paragraph 4.3 is relevant as the BYA calculated sound level changes from the August 2020 analysis ranged from -2 dB(A) (beneficial) to +10 dB(A) (adverse) depending on façade orientation. The use of calculated levels from a location which is not the worst case could therefore result in a receptor subject to a Major adverse impact being ascribed a beneficial impact.



- 4.5 Reference is made to the use of a low-noise road surface with Road Surface Influence (RSI_H) of -7.5 dB(A) on the LTC to the south of The Whitecroft. To the west and north, and to all adjacent slip roads a surface with RSI_H of -3.5 dB(A) is proposed. It is conceivable that this could provide a reduction in the operational sound level (compared with the situation with standard hot rolled asphalt or similar), commensurate with the difference in assessed impact compared to the BYA analysis. However, insufficient information is provided to assess this.
- 4.6 As previously requested, the following information would be required at a minimum to analyse the impact of the low-noise surface:
- Specific information on the actual low-noise surface proposed
 - Information on the proposed maintenance strategy for the road surface to ensure it maintains its performance unabated for the lifetime of the road (or the assessment takes account of any degradation of the noise reduction performance during each maintenance cycle)
- 4.7 It is stated in Appendix 12.7 that no dwellings across the development area would qualify for noise insulation under the Noise Insulation Regulations 1975. This statement appears to be accurate based on the data presented, subject to the limitations referenced above. The BYA analysis indicated this may not be the case, and that The Whitecroft could be a borderline case. Therefore, detailed analysis should be undertaken and the results published to confirm eligibility status of The Whitecroft.

5 Operational Phase Vibration Impact

- 5.1 Vibration during the operational phase has not been assessed in relation to The Whitecroft. This is considered a reasonable position, given that vibration impacts upon the care home from the completed development are unlikely.

6 Construction Noise Impact

- 6.1 A construction noise impact assessment has been undertaken. The definition of Significant Observed Adverse Effect Level (SOAEL) of 65 dB $L_{Aeq,T}$ daytime, 55 dB $L_{Aeq,T}$ evening, 45 dB $L_{Aeq,T}$ night, for external noise levels, are based on guidance in DMRB document LA111 and BS5228-1ⁱⁱ. For the general population, this assessment approach appears reasonable and in line with current guidance.
- 6.2 The residents of the care home are, however, considered more vulnerable than the general population. It is reasonable to expect that the assessment should take this into account. Further discussion on this point is set out in Section 2.4.2.
- 6.3 During construction works, a worst case maximum level, without mitigation, has been calculated of 7.3 dB(A) above the SOAEL during daytime and 10.5 dB(A) above the SOAEL at night. In Appendix 12.4 it is indicated that this exceedance could occur for a small number of months during daytime hours, but at night it would continue for the first 18 months, and then again for a small number of months around month 46.
- 6.4 Mitigation measures are proposed. However, an assessment of the resulting levels with mitigation is not detailed in the ES. The mitigation measures are rather general, for example:
- “up to 10 dB reduction” for screening from general construction works
 - “up to 20 dB” for static plant



- 6.5 A “10 dB(A) attenuation” is “reasonably applied” for the assumed robust implementation of Best Practical Means during daytime works. If the stated reduction is not achieved, there is a risk that daytime levels could regularly exceed the SOAEL.
- 6.6 Unmitigated night-time construction noise levels are shown unchanging at 55 dB(A) for the first 18 months of construction, with the exception of month 12 at 56 dB(A), in Appendix 12.4. Using the optimistic reductions stated for Best Practical Means, there is a high risk that night time levels would therefore regularly exceed the SOAEL of 45 dB(A) throughout this period. If the reductions stated are not achieved, this exceedance could be significant.
- 6.7 The ES Chapter 12 concedes that, even with the mitigation measures, “there remains the potential for construction noise to exceed a SOAEL and report a Moderate or greater impact” during night time hours for two 48-hour periods. Due to the lack of presentation of mitigated levels, the magnitude of this SOAEL exceedance is unknown. Given in particular the approximate nature of the mitigation allowances, it is possible that the exceedance above SOAEL could be significant.
- 6.8 The Chapter 12 statement of potential for SOAEL exceedance for two 48-hour periods does not accord with the consistent levels shown across the first 18 months of construction stated in Appendix 12.4, as referenced above in paragraph 6.6 above.
- 6.9 As with the operational noise analysis, no information is provided as to which care home façade the calculated noise levels apply at.
- 6.10 The difficulty in providing detailed information on the construction activities and mitigation measures given the stage of the development is understandable to a certain extent. However, The Whitecroft care home is a particularly sensitive receptor close to the site and so should be afforded due consideration. Based on the information provided, it does not appear to be correct to state that the noise would “not constitute a significant effect”.
- 6.11 It is evident that, for some periods of construction at a minimum, the care home is marginal and could conceivably be subject to noise levels above the SOAEL. It is therefore reasonable to expect that a full, detailed assessment be undertaken to **all** facades. Such analysis should include the specific mitigation measures with detailed attenuation.
- 6.12 The extent to which the mitigation is likely to be achievable in practice needs to be considered now, to minimise the risk of it transpiring to be unachievable at a later stage, potentially with no realistic method of rectifying it. Approximations such as “up to 10 dB reduction” are not acceptable for such a sensitive receptor, unless full and detailed justification is given, including the methods of achieving this level of reduction in the specific site circumstances. If the magnitude of reduction allowed for is not realised, then the care home could be subject to levels significantly above the SOAEL. Full details of this analysis should be provided for review by the care home and its representatives.
- 6.13 It is noteworthy that uncertainty is not mentioned in relation to the calculated construction noise levels. Differences between assessed and actual source levels for the various activities and attenuation allowances for mitigation measures are two examples where there is likely to be uncertainty. This uncertainty gives potential for actual construction noise levels to exceed SOAEL levels by a greater amount than referenced above.
- 6.14 The foregoing discussion is based on the SOAEL used in the ES being appropriate for the Whitecroft. In fact this, may not be the case, and lower levels could be more appropriate



(please refer to section 2.4.2). If that were the case, the likelihood of a Significant Adverse Effect could be greater than assessed.

- 6.15 In addition, the current assessment does not appear to consider maximum noise levels associated with impulsive and other short-duration noise events. This is of greatest relevance when considering the potential for sleep disturbance at night. However, in the case of the Whitecroft, it may also be relevant during the day, since residents may also be sleeping then. Even if the L_{Aeq} ambient noise assessment is robust and the proposed mitigation achievable, this may still leave a significant adverse effect in terms of L_{Amax} , which has not been assessed.

7 Construction Vibration Impact

- 7.1 The Whitecroft does not appear to be considered in terms of vibration impact. Vibratory piling for a retaining wall is proposed to the west of the care home. The closest receptor assessed is 242 Heath Road. Percussive piling for retaining wall is also proposed, with even numbers 202 – 224 Heath Road assessed.
- 7.2 The levels predicted at the assessed receptors indicate a low likelihood of impact due to piling vibration at The Whitecroft. This appears to be a reasonable conclusion given the distances (>400m) involved.
- 7.3 Aside from tunnel boring, no other vibration sources are considered in the assessment. This is reasoned based on Transport Research Laboratory Supplementary Report 328 (*Ground vibrations caused by road construction operations*, which was published in 1977 and has been withdrawn by TRL), which is quoted in the ES as follows:
- “at distances greater than 20m, the vibration levels measured were below the level of human perception because of attenuation in the ground and that it is unlikely that people would be disturbed by vibration from general construction activities at distances of 20m or more”
- 7.4 However, such reasoning appears to disregard the proposal for significant earthworks, in the form of a bund construction, directly to the west of the care home. Part of these works could potentially take place within 20m of the care home, though it is not currently possible to identify exact distances given the resolution of the submitted drawings.
- 7.5 Additionally, haulage routes are proposed near The Whitecroft, including within the footprint of the proposed bund. Movement of HGVs along these routes has the potential to create significant and noticeable levels of vibration.
- 7.6 Even if located a little more than 20 m from the care home, it may not be appropriate to dismiss all vibration arising from the haul routes and bund construction without further assessment. For example, earth moving and compaction activities as part of the construction of the bund could potentially result in problematic levels of vibration at The Whitecroft.
- 7.7 It is therefore reasonable to expect that a detailed analysis of vibration impacts due to earthworks and haulage routes in the vicinity of the care home be undertaken, and that suitable criteria will be adopted for such an assessment.

8 Conclusion

- 8.1 The ES contains insufficient detail to support its claims that the care home is not subject to significant adverse effects.



- 8.2 Some of the information in the ES is conflicting, such as the Appendix 12.4 data not appearing to reflect the two 48 hour periods of increased noise levels due to construction works referenced in Chapter 12.
- 8.3 The ES contains insufficient information on the methods of attenuation of both operational noise (in terms of potential deterioration of noise reducing road surfaces over time) and construction noise (in terms of what actual mitigation will be employed and what the calculated noise level is with the mitigation in place). Without this information, there can be little confidence that the claimed attenuation will actually be achieved and maintained in practice.
- 8.4 Currently, the various assessment thresholds and criteria are generally in line with what would be reasonable when considering the general population – but with one deficiency, that being the absence of any consideration of noise events of short duration at night, in terms of L_{Amax} . No account is taken of the fact that the care home residents can be considered a vulnerable group and, therefore, potentially more sensitive to noise than the general population. Recommendation to consider such receptors is referred to in the DMRB LA 111 document.
- 8.5 Vibration effects at the care home appear not to have been considered. While the impacts from some construction activities are reasonably discounted due to distance, there appears to be a risk of impact from vibration due to earthworks and haul routes adjacent to the care home. It is reasonable to therefore expect that a detailed analysis of vibration impacts upon the care home be undertaken.

ⁱ Design Manual for Roads and Bridges, LA111 Noise and vibration, Highways England, May 2020

ⁱⁱ BS 5228-1:2009+A1:2014; Code of practice for noise and vibration control on construction and open sites - Part 1: Noise, BSI, 2014.

ⁱⁱⁱ Guidelines for Community Noise, World Health Organisation, 1999

^{iv} Night Noise Guidelines for Europe, World Health Organisation, 2009

^v Acoustics Ventilation and Overheating: Residential Design Guide, ANC & IOA, January 2020

^{vi} (HTM 08-01) Health sector buildings: acoustic design requirements, Department of Health, updated August 2021



Appendix A - Relevant Guidance and Criteria

A.1 Introduction

- A.1.1 This memorandum sets out the minimum information required to undertake a detailed analysis of the impact from the proposed LTC development upon The Whitecroft Care Home in terms of noise. The information is required for analysis of both the construction and fully operational stages of the development.
- A.1.2 The information required is based on national guidance and standards applicable to the development and is considered the minimum necessary for the LTC development team to be able to assess the impact of the proposals for their own and EIA purposes.

A number of standards will be referred to in assessment of the impact upon the residents of the care home. The main standards relevant to this are set out below, with a brief commentary on their scope and design advice contained within.

A.2 DMRB¹

- A.2.1 The DMRB is one of the more relevant standards for assessment of the care home. The standard sets out various steps in terms of difference in noise level with and without development and/or construction works along with the associated impact and impact significance.
- A.2.2 The DMRB does not differentiate between normal and vulnerable receptors but does include hospitals and health care facilities in its list of noise sensitive receptors.
- A.2.3 CRTN², which sets out the calculation methodology against which a DMRB assessment would be undertaken, similarly does not set out a distinction between normal and vulnerable receptors.
- A.2.4 The DMRB contains guidance on various methods to convert the CRTN calculation output ($L_{A10,18hr}$) to other indices such as $L_{Aeq,16hr}$ and $L_{Aeq,8hr}/L_{night}$.
- A.2.5 It should also be noted that for a major new road scheme such as the LTC, it is normally mandatory for an assessment to be undertaken in accordance with DMRB (which requires assessment of operational noise, as well as construction noise and vibration).

¹ Design Manual for Roads and Bridges: Volume 11, LA111 Noise and vibration revision 1, 2020

² Calculation of Road Traffic Noise, Department of Transport, Welsh Office, 1988



A.3 BS 8233³

A.3.1 BS 8233 set out standards for internal noise levels within residential buildings. Guidance on external noise levels is also provided with reference to WHO guidelines 1999⁴. The standard states that:

“For many common situations, this guide suggests criteria, such as suitable sleeping/resting conditions, and proposes noise levels that normally satisfy these criteria for most people. However, it is necessary to remember that people vary widely in their sensitivity to noise, and the levels suggested might need to be adjusted to suit local circumstances.”

A.3.2 The standard also states:

“The standard is intended to be used routinely where noise sources are brought to existing noise-sensitive buildings”

A.3.3 In relation to rooms for residential purposes (which include hospices and residential care homes), the standard makes the following statement:

“In hotels and other multi-occupancy premises containing rooms for residential purposes, it is desirable to avoid intrusive noise, both airborne and impact, in bedrooms, especially when occupants are sleeping (typically assumed to be at night-time).”

A.3.4 In the case of care homes, the expectation that residents could be sleeping during the day may be significantly higher than in an ordinary dwelling or even a hotel.

A.4 BS 5228-1:2009⁵

A.4.1 BS 5228-1:2009 sets out information and assessment methodology for noise during construction works. In particular the standard highlights that non-residential buildings in which the occupants are particularly sensitive to noise (including hospitals and clinics) should be “subject to individual consideration by the developer or promoter, upon application by the affected party”. The care home is considered to fall within this definition.

A.5 WHO Guidelines^{4,6,7}

A.5.1 The World Health Organization published a number of documents in relation to noise. The 1999 community noise guidelines are perhaps of most relevance, being directly referred to in BS 8233:2014. However, the 2018 and 2009 environmental and night noise guidelines are also of relevance.

³ BS 8233:2014 Guidance on sound insulation and noise reduction for buildings

⁴ Guidelines for Community Noise, 1999, World Health Organization

⁵ BS 5228-1:2009+A1:2014; Code of practice for noise and vibration control on construction and open sites - Part 1: Noise; BSI.

⁶ Night Noise Guidelines for Europe, 2009, World Health Organization

⁷ Environmental Noise Guidelines for the European Region, 2019, World Health Organization



A.5.2 The 1999 guidance sets out recommended internal levels in residential buildings and gardens, which informed those set out in BS 8233:2014. It also sets out recommended ambient ($L_{Aeq,T}$) and single event (L_{Amax}) levels in hospitals.

A.5.3 The 1999 guidance includes the following statements:

“Vulnerable subgroups of the general population should be considered when recommending noise protection...”

“Examples of vulnerable subgroups are; people with particular diseases or medical problems (e.g. high blood pressure); people in hospitals ...; the blind; people with hearing impairment; ... the elderly in general.”

“Supplementary to the guideline values ... , precautions should be taken for vulnerable groups”

“[vulnerable groups include] people with decreased personal abilities (old, ill, or depressed people); people with particular diseases or medical problems; ... ; people who are blind or who have hearing impairment; ... the elderly in general ... These people may be less able to cope with the impacts of noise exposure and be at greater risk for harmful effects.”

“The issue of vulnerable subgroups in the general population should thus be considered when developing ... recommendations for the management of community noise. This consideration should take into account the types of effects (communication, recreation, annoyance, etc.), specific environments (... public institutions, etc.)”

“guidelines in this report are developed for the population at large; guidelines for potentially more vulnerable groups are addressed only to a limited extent.” [no specific guidelines are given for people in care homes or similar environments]

“Guideline values [for indoor noise levels] typically correspond to the lowest effect level for general populations”

“Each population has sensitive groups or subpopulations that are at higher risk of developing health effects due to noise exposure. Sensitive groups include individuals impaired by concurrent diseases or other physiological limitations and those with specific characteristics that makes them more vulnerable to noise.”

A.5.4 The 2018 Environmental Noise Guidelines set out recommended day and night time noise levels outside noise sensitive receptors. The guidelines are said to be “source specific” rather than “environment specific”. Therefore the advice is split into different noise source groups, rather than different receptor groups.

A.5.5 There is therefore specific guidance on noise from road traffic. The guidance does, however, state that it is considered to cover all receptor types except for hospitals “due to the unique characteristics of the population involved”. Given this is a care home, and in particular a care home with a focus on dementia patients, this statement is considered to be of note here.

A.5.6 The 2018 Guidelines also indicate that vulnerable people may not be protected even when the aspirational guidelines are met:

“the recommended guideline values might not lead to full protection of the population, including all vulnerable groups”



- A.5.7 The 2009 Night Noise Guidelines (NNG) set out external noise level design targets.
- “an $L_{\text{night, outside}}$ of 40 dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. $L_{\text{night, outside}}$ value of 55 dB is recommended as an interim target for the countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach.”*
- A.5.8 The guidance states that:
- “Since with age the sleep structure becomes more fragmented, elderly people are more vulnerable to disturbance. This also happens in ... people with ill health, so they too are a group at risk”*
- A.5.9 The residents of The Whitecroft Care Home are considered to fall into both the elderly people and people with ill health groups, highlighting the significance of any increase in noise level at night.
- A.5.10 In considering the effects of noise upon the population, the NNG also states that for a given noise level range:
- “Vulnerable groups (for example children, the chronically ill and the elderly) are more susceptible.”*
- “Vulnerable groups are more severely affected.”*
- A.6 HTM 08-01⁸
- A.6.1 HTM08-01 sets out design standards for healthcare buildings. Of relevance to the care home here are the criteria set out for inside a hospital ward, which are set in terms of day and night time ambient, and night time single event levels.
- A.7 NPPF⁹ and PPG¹⁰
- A.7.1 The NPPF sets out qualitative standards for noise in order to protect receptors from noise as a result of development (i.e. both existing receptors due to new development and new receptors due to existing noise sources).
- A.7.2 The PPG sets out qualitative criteria at which various degrees of effect level can be observed.

⁸ Health sector buildings: acoustic design requirements (HTM08-01), Department of Health and Social Care, 2013

⁹ National Planning Policy Framework, Ministry of Housing, Communities and Local Government, February 2019

¹⁰ Planning Practice Guidance, Ministry of Housing, Communities and Local Government, July 2019



A.8 IEMA Guidelines for Environmental Noise Impact Assessment

A.8.1 The IEMA Guidelines¹¹ set out various factors that should be considered when undertaking a noise impact assessment.

A.8.2 The Guidelines make the following statements:

“A development proposal which would cause an increase in an existing level that is already well above an existing guideline should probably be regarded as worse than if the existing level were below the guideline. If the existing noise environment is already at a level where there might be significant risk of adverse quality of life and health effects, then almost any increase in noise level, regardless of how small, is an impact which should be taken into account in the assessment.

Similarly, but at the other end of the scale, for an area which is valued because of the soundscape, a relatively small impact could be considered as having a potentially substantive effect if the quality of the noise environment were to be eroded. This particularly relates to tranquil, quiet or calm areas.”

A.9 Other Factors

A.9.1 The Social Care Institute for Excellence (SCIE) is a UK organisation whose purpose is to improve lives by co-producing, sharing and supporting the use of the best available knowledge and evidence about what works in practice.

A.9.2 Its website¹² includes information relating to potential effects of noise on people with dementia. The primary points made are that dementia sufferers can be more sensitive to noise than the general population. The following statements illustrate this:

“noise that is acceptable to care staff may be particularly distressing and disorientating for a person with dementia”

“Of all the senses, hearing is the one that has the most significant impact on people with dementia in terms of quality of life.”

“As hearing is linked to balance this also leads to a greater risk of falls either through loss of balance or through an increase in disorientation as a result of people trying to orientate themselves in an environment that is overstimulating and noisy.”

¹¹ Guidelines for Environmental Noise Impact Assessment, Institute of Environmental Management and Assessment, October 2014

¹² <https://www.scie.org.uk/dementia/supporting-people-with-dementia/dementia-friendly-environments/noise.asp>



Glossary of Terms

decibel: Usually written as decibel or dB, it is a logarithmic scale used for two purposes. One is to make the expression of numerical sound levels more convenient (with a smaller range and fewer digits). The other is to express sound levels in a manner aligned with human interpretation of differences in sound level, which itself is logarithmic in nature.

A-weighting: Applies different weight to sound levels at different frequencies, to represent the variation in sensitivity of the typical human ear with frequency. Thus, a single-value expressed in terms of dBA or dB(A) is the A-weighted sound level, which takes account of the frequency content of the sound.

T: Can vary in meaning, depending on where it is used. For example, when used with L_{Aeq} or L_{Ar} (see below) it represents a specified time period. When used with $D_{nT,w}$ or T_{mf} for example, it represents the reverberation time (see below).

L_{Aeq} : The A-weighted equivalent continuous sound level in dB. This unit can be described as the notional steady noise level that would, over a period, contain the same energy as the fluctuating noise source. It is often considered as the energy average level. This unit is typically used to describe day and night period noise levels, $L_{Aeq,T}$ where T is the time period.

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

L_{A10} : The A-weighted sound level (in dB) exceeded for 10% of the time specified. This level gives an indication of the sound level during the louder periods of time in any given fluctuating sound sample. It is typically used to help define, measure, and assess road traffic noise.

L_{A01} : The A-weighted sound level (in dB) exceeded for 1% of the time specified. This level can help to quantify the impact of short-duration events (in addition to, or as an alternative to L_{Amax} – see below). For example, it is used in criteria for transient noise potentially affecting teaching and learning in schools.

L_{Amax} : The maximum A-weighted level (in dB) of sound measured in any given period. This unit is used to measure and assess transient noises, particularly those such as individual vehicles, etc impacting on sensitive receptors at night. Unless otherwise stated, the L_{Amax} level is measured using a "fast" sound level meter response (i.e. $L_{Amax,F}$).

L_{AX} , L_{AE} , or SEL: The sound exposure level which contains, within a notional 1-second period, the same quantity of sound energy as the time varying level contained in a single noise event. It could be considered an L_{Aeq} level normalised to 1 second. The use of this unit allows the calculation of the $L_{Aeq,T}$ level over a given period of time (T) for a known number of such single noise events.

L_{Ar,T_r} : The BS 4142:2014+A1:2019 defined rating level comprising the specific noise level for a given source over a given time period, T_r , plus any adjustment for the characteristic features of the noise.

T_{60} : Reverberation time, which is a characteristic of a given room. It is the time taken for sound energy to decay by 60 dB. It is usually impractical to measure directly, so is represented by T_{20}



(which is an estimate of the T_{60} based on the time taken for sound energy to decay by 20 dB), or the similar T_{30} .

T_{mf} : The mid-frequency reverberation time defined in BB93. It is the arithmetic average of the reverberation time in the 500 Hz, 1 kHz and 2 kHz octave bands, which constitute important speech frequencies.

$D_{nT,w}$: The level difference between one room and another, across a sound insulating separating element, normalised to a reverberation time of 0.5 seconds, and weighted to provide a single figure value.

$L'_{nT,w}$: The noise level in a room when the floor in the room above is excited by a calibrated tapping machine or similar, and normalised to a 'standard' reverberation time of 0.5 seconds, and weighted to provide a single figure value.

R_w : This is the sound reduction index, weighted to provide a single figure value, of a particular construction under laboratory conditions, where there is no contributing flanking sound transmission and where the test sample is constructed exactly in accordance with manufacturer's details.

R'_w : This value is the same as R_w but is measured under field conditions, where flanking details, workmanship, or other factors may cause a reduction in performance to that measured under laboratory conditions