



**Noise and Vibration Assessment Report for
Proposed Residential Development
On Land off Thurnscoe Bridge Lane,
Thurnscoe**

**Report Reference no. 1545.24/1
20th September 2012**

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1.0 INTRODUCTION

- 1.1 Blue Tree Acoustics was commissioned jointly by Jaguar Estates and Wortley Construction JV Partnership to carry out an assessment of the potential impact of road and rail noise on a proposed residential development at land situated off Thurnscoe Bridge Lane in Thurnscoe. The assessment of levels of ground-borne vibration near the railway line was also requested.
- 1.2 The development site is located off Thurnscoe Bridge Lane to the south of Thurnscoe. The site is bounded by Thurnscoe Bridge Lane to the west, existing dwellings to the north, fields to the south, and a railway line to the east.
- 1.3 The site is currently undeveloped and consists of an open field.
- 1.4 The location of the development site is shown in Figure 1. Figure 2 represents the current development proposal and indicative layout.
- 1.5 The noise impact assessment has included:
- i) Inspection of the site and surroundings, and study of the development masterplan provided by Jaguar Estates and Wortley Construction.
 - ii) Daytime and night-time noise monitoring surveys.
 - iii) Evaluation of the site in accordance with relevant planning policy guidance.
 - iv) Consideration of noise control measures required to maintain acceptable noise levels within the proposed bedrooms and living rooms in accordance with *British Standard 8233: 1999, 'Code of practice for Sound insulation and noise reduction for buildings'*.
 - v) Daytime and night-time vibration surveys.
 - vi) Evaluation of the site in accordance with *BS6472 'Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)'*.

2.0 NOISE SURVEY

- 2.1 Manned noise surveys were undertaken by Blue Tree Acoustics in order to determine the existing ambient noise climate at different locations on the site. The measurement locations are indicated in Figure 1.
- 2.2 Noise measurements were carried out using a Svan 958 Class 1 Integrating Sound Level Meter. Noise was measured in terms of broadband A-weighted indices and at 1/3 octave bands from 50Hz to 10kHz. The sound level meter was mounted on a tripod at approximately 1.5m height from local ground level, and a proprietary windshield was fitted to the microphone. Calibration checks were carried out both before and after the measurements, with no variance observed. The sound level meter was within a period of laboratory calibration. Weather conditions during the noise surveys were calm with wind speeds <5m/s.
- 2.3 The primary noise source at the western boundary of the development site is road traffic, mainly from Thurnscoe Bridge Lane.
- 2.4 The railway line is in close proximity to the eastern site boundary, and appears to be used by passenger trains throughout the day and in the beginning and end of the night-time period. From our experiences on site and from timetables, it appears that there are typically around six train movements past the site in one hour during the day and up to five per hour at night. There are also freight train movements sporadically occurring. Noise from passing trains is audible across the development site, and it is the primary noise source affecting the eastern side of the site.
- 2.5 The measurement results are detailed in Appendix II and are summarised in the tables below. Measurement positions were selected to provide data to establish the noise climate at the development in the most critical locations in terms of noise exposure. During the survey, the railway line is understood to have been operating normally, with a number of trains passing the site both during the daytime and at night.

Table 1: Averaged Daytime Noise Levels

Location	dB L _{Aeq}	dB L _{Amax}	dB L _{A10}	dB L _{A90}
1	56.3	67.6	58.3	50.3
2	60.6	80.5	57.5	51.0

Table 2: Averaged Night-time Noise Levels

Location	dB L _{Aeq}	dB L _{Amax}	dB L _{A10}	dB L _{A90}
1	48.2	61.9	49.3	36.1
2	57.4	65.7	49.1	36.2

- 2.6 Based on the above, it can be seen that noise levels are highest at Location 2, which is most exposed to the railway.
- 2.7 Ambient noise levels are lower during the night-time than during the day, due to the reduced volume of passing road and rail traffic.
- 2.8 It is anticipated that the above results can be considered representative of the normal daytime and night-time conditions of the site, and that it is unlikely that noise levels would be significantly higher on another day.

3.0 NOISE ASSESSMENT

3.1 The planning system has recently been radically changed. On 27th March 2012, the National Planning Policy Framework came into force. This document replaces a great many planning guidance documents which previously informed the planning system in England. The new framework states that:

The planning system should contribute to and enhance the natural and local environment by:

- *protecting and enhancing valued landscapes, geological conservation interests and soils;*
 - *recognising the wider benefits of ecosystem services;*
 - *minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
 - *preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability;*
- and*
- *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.*

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts²⁷ on health and quality of life as a result of new development;*
 - *mitigate and reduce to a minimum other adverse impacts²⁷ on health and quality of life arising from noise from new development, including through the use of conditions;*
 - *recognise 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;²⁸*
- 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.*

²⁷ See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

²⁸ Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.

In preparing Local Plans, local planning authorities should:

- *identify and include policies for extraction of mineral resource of local and national importance in their area, but should not identify new sites or extensions to existing sites for peat extraction;*
- *so far as practicable, take account of the contribution that substitute or secondary and recycled materials and minerals waste would make to the supply of materials, before*

considering extraction of primary materials, whilst aiming to source minerals supplies indigenously;

- *define Minerals Safeguarding Areas and adopt appropriate policies in order that known locations of specific minerals resources of local and national importance are not needlessly sterilised by non-mineral development, whilst not creating a presumption that resources defined will be worked; and define Minerals Consultation Areas based on these Minerals Safeguarding Areas;*
- *safeguard:*
 - *existing, planned and potential rail heads, rail links to quarries, wharfage and associated storage, handling and processing facilities for the bulk transport by rail, sea or inland waterways of minerals, including recycled, secondary and marine-dredged materials;*
 - and*
 - *existing, planned and potential sites for concrete batching, the manufacture of coated materials, other concrete products and the handling, processing and distribution of substitute, recycled and secondary aggregate material.*
- *set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible, if it is necessary for non-mineral development to take place;*
- *set out environmental criteria, in line with the policies in this Framework, against which planning applications will be assessed so as to ensure that permitted operations do not have unacceptable adverse impacts on the natural and historic environment or human health, including from noise, dust, visual intrusion, traffic, tip- and quarry-slope stability, differential settlement of quarry backfill, mining subsidence, increased flood risk, impacts on the flow and quantity of surface and groundwater and migration of contamination from the site; and take into account the cumulative effects of multiple impacts from individual sites and/or a number of sites in a locality;*
- *when developing noise limits, recognise that some noisy short-term activities, which may otherwise be regarded as unacceptable, are unavoidable to facilitate minerals extraction; and*
- *put in place policies to ensure worked land is reclaimed at the earliest opportunity, taking account of aviation safety, and that high quality restoration and aftercare of mineral sites takes place, including for agriculture (safeguarding the long term potential of best and most versatile agricultural land and conserving soil resources), geodiversity, biodiversity, native woodland, the historic environment and recreation.*

When determining planning applications, local planning authorities should:

- *give great weight to the benefits of the mineral extraction, including to the economy;*
- *as far as is practical, provide for the maintenance of landbanks of nonenergy minerals from outside National Parks, the Broads, Areas of Outstanding Natural Beauty and World Heritage sites, Scheduled Monuments and Conservation Areas;*
- *ensure, in granting planning permission for mineral development, that there are no unacceptable adverse impacts on the natural and historic environment, human health or aviation safety, and take into account the cumulative effect of multiple impacts from individual sites and/or from a number of sites in a locality;*
- *ensure that any unavoidable noise, dust and particle emissions and any blasting vibrations are controlled, mitigated or removed at source, and establish appropriate noise limits for extraction in proximity to noise sensitive properties;*
- *not grant planning permission for peat extraction from new or extended sites;*

- *provide for restoration and aftercare at the earliest opportunity to be carried out to high environmental standards, through the application of appropriate conditions, where necessary. Bonds or other financial guarantees to underpin planning conditions should only be sought in exceptional circumstances;*
- *not normally permit other development proposals in mineral safeguarding areas where they might constrain potential future use for these purposes;*
- *consider how to meet any demand for small-scale extraction of building stone at, or close to, relic quarries needed for the repair of heritage assets, taking account of the need to protect designated sites; and*
- *recognise the small-scale nature and impact of building and roofing stone quarries, and the need for a flexible approach to the potentially long duration of planning permissions reflecting the intermittent or low rate of working at many sites.*

3.2 In addition, the Noise Policy Statement for England (NPSE) states:

Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

Noise Policy Aims

Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- **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.**

Guiding principles of sustainable development

Ensuring a Strong Healthy and Just Society – Meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity for all.

Using Sound Science Responsibly – Ensuring policy is developed and implemented on the basis of strong scientific evidence, whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values.

Living Within Environmental Limits – Respecting the limits of the planet's environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations.

Achieving a Sustainable Economy – Building a strong, stable and sustainable economy which provides prosperity and opportunities for all, and in which environmental and social costs fall on those who impose them (polluter pays), and efficient resource use is incentivised.

Promoting Good Governance – Actively promoting effective, participative systems of governance in all levels of society – engaging people's creativity, energy and diversity.

Source: Securing the future – delivering UK sustainable development strategy, HM Government, March 2005.

3.3 The Noise Policy Statement for England Explanatory note states that:

Noise is an inevitable consequence of a mature and vibrant society. For some the noise of city life provides a desirable sense of excitement and exhilaration, but for others noise is an unwanted intrusion that adversely impacts on their quality of life, affecting their health and well being.

The management of noise has developed over many years as the types and character of noise sources have altered and as people's attitude to noise has changed. The Noise Abatement Act came into law in 1960 and the Report from the Committee on the Problem of Noise was published in 1963 (the Wilson report). Since then, examples of noise management can be found in many areas including reducing noise at source; the use of the land use and transport planning systems, compensation measures, the statutory nuisance and licensing regimes and other related legislation.

Furthermore, the broad aim of noise management has been to separate noise sources from sensitive noise receivers and to 'minimise' noise. Of course, taken in isolation and to a literal extreme, noise minimisation would mean no noise at all. In reality, although it has not always been stated, the aim has tended to be to minimise noise as far as reasonably practical. This concept can be found in the

Environmental Protection Act 1990, where, in some circumstances, there is a defence of 'best practicable means' in summary statutory nuisance proceedings.

By describing clear policy vision and aims the NPSE provides the necessary clarity and direction to enable decisions to be made regarding what is an acceptable noise burden to place on society.

The intention is that the NPSE should apply to all types of noise apart from noise in the workplace (occupational noise). For the purposes of the NPSE, "noise" includes:

- "environmental noise" which includes noise from transportation sources;*
- "neighbour noise" which includes noise from inside and outside people's homes;*

And

- "neighbourhood noise" which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.*

The application of the NPSE should mean that noise is properly taken into account at the appropriate time. In the past, the opportunity for the cost effective management of noise has often been missed because the noise implications of a particular policy, development or other activity have not been considered at an early enough stage.

In addition, the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications.

In the longer term, the Government hopes that existing policies could be reviewed (on a prioritised basis), and revised if necessary, so that the policies and any noise management measures being adopted accord with the vision, aims and principles of the NPSE.

Noise management is a complex issue and at times requires complex solutions. Unlike air quality, there are currently no European or national noise limits which have to be met, although there can be specific local limits for specific developments. Furthermore, sound only becomes noise (often defined as 'unwanted sound') when it exists in the wrong place or at the wrong time such that it causes or contributes to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance.

Unlike many other pollutants, noise pollution depends not just on the physical aspects of the sound itself, but also the human reaction to it. Consequently, the NPSE provides a clear description of desired outcome from the noise management of a particular situation.

The guiding principles of Government policy on sustainable development should be used to assist in its implementation. The development of further principles specifically to underpin implementation of noise management policy will be kept under review as experience is gained from the application of the NPSE.

There are several key phrases within the NPSE vision and these are discussed below.

Health and quality of life

The World Health Organisation defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, and recognises the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being.

It can be argued that quality of life contributes to our standard of health. However, in the NPSE it has been decided to make a distinction between 'quality of life' which is a subjective measure that refers to people's emotional, social and physical well being and 'health' which refers to physical and mental well being.

It is recognised that noise exposure can cause annoyance and sleep disturbance both of which impact on quality of life. It is also agreed by many experts that annoyance and sleep disturbance can give rise to adverse health effects. The distinction that has been made between 'quality of life' effects and 'health' effects recognises that there is emerging evidence that long term exposure to some types of transport noise can additionally cause an increased risk of direct health effects. The Government intends to keep research on the health effects of long term exposure to noise under review in accordance with the principles of the NPSE.

Promote good health and good quality of life

This statement expresses the long term desired policy outcome, but in the use of 'promote' and 'good' recognises that it is not possible to have a single objective noise-based measure that is mandatory and applicable to all sources of noise in all situations.

Effective management of noise

This concept confirms that the policy applies to all types of 'noise' (environmental, neighbour and neighbourhood) and that the solution could be more than simply minimising the noise.

Within the context of Government policy on sustainable development

Sustainable development is a core principle underpinning all government policy. For the UK Government the goal of sustainable development is being pursued in an integrated way through a sustainable, innovative and productive economy that delivers high levels of employment and a just society that promotes social inclusion, sustainable communities and personal wellbeing. The goal is pursued in ways that protect and enhance the physical and natural environment, and that use resources and energy as efficiently as possible.

There is a need to integrate consideration of the economic and social benefit of the activity or policy under examination with proper consideration of the adverse environmental effects, including the impact of noise on health and quality of life. This should avoid noise being treated in isolation in any particular situation, i.e. not focussing solely on the noise impact without taking into account other related factors.

There are several key phrases within the NPSE aims and these are discussed below.

“Significant adverse” and “adverse”

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL . No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL . Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL . Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.

The first aim of the Noise Policy Statement for England

Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

The second aim of the Noise Policy Statement for England

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur.

The third aim of the Noise Policy Statement for England

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

- 3.4 Unfortunately, the above guidance gives no objective, tangible standards or criteria which enable planning decisions to be made. In the absence of such guidance, reference to the former principal noise planning policy document (PPG24) is often made in order to quantify the exposure of the site to noise, particularly with regard to residential development.
- 3.5 Quantification impact in terms of PPG24 and associated guidance such as BS8233, which present noise limits and criteria based on World Health Organisation recommendations, can therefore be considered as appropriately assessing the potential noise impact with regard to toxicology concepts and hence in line with the principles of the NPPF and NPSE. Therefore, meeting the recommendations of BS8233 and any associated local authority noise requirements can be considered as below the level where there is no detectable adverse effect on health and quality of life due to noise, which meets the NOEL (No Observed Effect Level) set out in the NPSE.
- 3.6 Until its recent withdrawal in March 2012, *Planning Policy Guidance note No 24 'Planning and Noise'* (PPG24), issued by the Department of the Environment in 1994, set out the Government's policies relating to noise. The document gave guidance to local authorities in England on the use of their planning powers to minimise the adverse impact of noise. PPG24 outlined the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities which generate noise. It introduced the concept of Noise Exposure Categories (NEC) for new residential developments.

Table 3: PPG24 NEC Categories

Categories For New Dwellings dB L_{Aeq,T}				
	Noise Exposure Category			
Noise Source	A	B	C	D
Road Traffic				
07.00 - 23.00	<55	55 – 63	63 – 72	>72
23.00 - 07.00	<45*	45 – 57*	57 – 66	>66
Rail Traffic				
07.00 - 23.00	<55	55 – 66	66 – 74	>74
23.00 - 07.00	<45*	45 – 59*	59 – 66	>66
Air Traffic				
07.00 - 23.00	<57	57 – 66	66 – 72	>72
23.00 - 07.00	<48*	48 – 57*	57 – 66	>66
Mixed Sources				
07.00 - 23.00	<55	55 – 63	63 – 72	>72
23.00 - 07.00	<45*	45 – 57*	57 – 66	>66

*if maximum noise levels through the night regularly exceed 82dB L_{Amax(slow)} several times in any hour, a location should be categorised NEC C unless it is already NEC D.

- 3.8 The western part of the site is dominated by road traffic noise, whilst the eastern part of the site is dominated by rail noise. No significant industrial or commercial noise was found to be present during the noise surveys.
- 3.9 The entire site was found to fall within NEC B both during daytime and night-time.
- 3.10 For sites with noise levels in this range, planning permission can be granted provided that noise is taken into account and adequate acoustic mitigation measures are included in the scheme.
- 3.11 In order to protect potential future residents against the impact of noise, the guidance given in *British Standard 8233: 1999, 'Code of practice for Sound insulation and noise reduction for buildings'* (BS8233) should be considered.
- 3.12 The table below sets out the range of levels recommended in BS8233 for residential accommodation.

Table 4: BS8233 Guidance Criteria

Criterion	Typical Situations	Design Range ($L_{Aeq,T}$ dB)	
		Good	Reasonable
Reasonable resting / sleeping conditions	Living rooms	30	40
	Bedrooms ¹	30	35

¹For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB L_{Amax}

3.13 In addition, BS8233 makes reference to external noise levels in gardens and balconies, etc., and states that it is desirable that the steady noise level not exceed 50dB $L_{Aeq,T}$ dB. It also states that 55dB $L_{Aeq,T}$ should be regarded as the upper limit.

3.14 The following noise mitigation section is based on achieving the adopted noise criteria to ensure a good level of protection for the future occupants of the development. The following criteria are therefore proposed in accordance with BS8233:

Inside Bedrooms:	$L_{Aeq(8hour)}$ 30dB (2300 to 0700 hours)
Inside Bedrooms:	$L_{Amax(8hour)}$ 45dB (2300 to 0700 hours)
Inside Living Rooms:	$L_{Aeq(16hour)}$ 40dB (0700 to 2300 hours)
External areas such as Gardens:	$L_{Aeq(16hour)}$ 55dB (0700 to 2300 hours)

3.15 Noise ingress calculations have been carried out in accordance with BS8233.

4.0 NOISE MITIGATION MEASURES

- 4.1 PPG24 acknowledged a variety of proportionate and reasonable techniques that could be introduced to mitigate the effects of noise. These were, specifically:

Engineering: reduction of noise at source (e.g. use of quiet machinery and working methods), containment of generated noise, and protection of noise-sensitive buildings (e.g. by sound insulation and/or screening them by purpose-built barriers);

Layout: adequate distance between source and noise-sensitive building; screening by natural barriers, other buildings or non-critical rooms in a building;

Administrative: limiting operating time of source, restricting activities on site, specifying an acceptable noise limit.

Site Layout

- 4.2 Based on the noise survey data, dwellings located within 30m of the railway line will require some enhanced sound insulation measures to protect habitable rooms on the exposed facades (i.e. facing the noise sources). It would therefore be beneficial to design the internal room layout or orientate the dwellings as much as possible such that only windows serving non-habitable rooms face directly towards the road or rail traffic. Wherever possible, the most noise-sensitive rooms, i.e. bedrooms, should be positioned on facades facing away from the road or rail traffic. Alternatively, facades that are normal to the line of the road or railway generally experience noise exposure around 5dB(A) less than facades parallel to the noise source, and this is therefore preferable to locating bedroom windows on facades directly exposed to road or railway noise.
- 4.3 Similarly, where possible, gardens should be orientated to be on the building elevation that is shielded from the railway in order to reduce railway noise impact.
- 4.4 Properties further within the site will experience lower ambient noise levels and will also benefit from additional acoustic screening and scattering provided by the other surrounding houses, and therefore these dwellings will not require significant acoustic mitigation.
- 4.5 Suitable sound insulation measures are discussed in the Dwelling Protection section below.

Dwelling Protection

- 4.6 Fencing of minimum 2m height should be provided to all residential gardens. Acoustic fences should be constructed of solid, weather-treated timber (or ply) of at least 18mm minimum thickness. All joints should be tight-buttred with timber cover strips or tongue and groove boards used to ensure there are no air gaps in the structure or between the base of the fence and the ground. We advise that fences be built to be 2m high in all cases. Such a barrier will provide the 6dB minimum noise attenuation required in order to achieve the 55dB L_{Aeq} garden target in all cases. This is based on the assumption that ground level at the new dwellings is no lower than the level of the railway; if ground level is lower, then the barrier height should be increased accordingly.
- 4.7 The design of the building envelope of the new dwellings can incorporate suitable sound insulation to satisfy the requirements of BS8233. The precise requirements will depend on the external noise level experienced at the property. Assuming the minimum reductions to achieve noise levels of around 55dB L_{Aeq} in gardens as outlined above are put in place, the following examples would be indicative of suitable building envelope construction.
- 4.8 Generally, all new housing should be of masonry construction, e.g. external cavity walls with blockwork inner leaf and external brick leaf.
- 4.9 Roof constructions should be tiled, with ceilings to rooms below comprising a minimum of 2 or more layers of gypsum-based board (total minimum mass per unit area 22kg/m^2), with all joints staggered and overlaid with 100mm mineral fibre insulation. Any proposed rooms in the roof-space should be designed to have suitable internal linings to achieve the required sound insulation.
- 4.10 Bedroom windows facing the railway, within 30m of the railway (e.g. plots 1-8 on Figure 2) should have a minimum double glazing of 10mm glass/12mm airgap/6mm glass.
- 4.11 All other windows to noise-sensitive rooms should have a minimum double glazing of 4mm glass/16mm airgap/6mm glass.
- 4.12 Living rooms may be provided with standard window trickle ventilators, whilst bedrooms within 30m of the railway should have suitable passive acoustic ventilators, such as Greenwood

EHA574 or Renson Invisivent AK49 (a minimum performance of 43dB $D_{n,e,w}$ will provide sufficient sound insulation). Alternatively, a ducted ventilation system (e.g. 'whole house' or MEV/MVHR) could be implemented, and it may be possible to design a system with no requirement for ventilation openings in window frames or external walls into habitable rooms exposed to noise sources. Bedrooms more than 30m from the railway may be provided with standard window trickle ventilators.

- 4.13 Precise specification of sound insulation measures will be defined once the final site layout and bund design is confirmed. It may be feasible to reduce specification for properties within the site (i.e. shielded from noise sources), depending on the layout, without compromising the specified acoustic criteria.
- 4.14 The specifications given above are suitable recommendations. Equivalent acoustic performance may be achieved by other materials or products. Acoustic performance data for all proposed systems should be checked by a competent acoustic consultant in order to ensure adequate acoustic performance will be achieved.
- 4.15 All recommendations given above are for acoustic purposes only. Any other requirements such as energy, structural, fire safety, etc. should be checked by suitably qualified specialists.

5.0 VIBRATION ASSESSMENT

- 5.1 Guidance on assessing the potential annoyance resulting from vibration in buildings is set out in *British Standard 6472: 2008 'Guide to the evaluation of human exposure to vibration in buildings'* (BS6472). The standard includes a section on intermittent vibrations, which requires the vibration exposure to be determined in terms of a 'vibration dose value' ('VDV'). This takes into account the magnitude of the vibration and the duration of the exposure.
- 5.2 Vibration dose values ($\text{ms}^{-1.75}$) in residential buildings at which various degrees of adverse comment may be expected are quoted in BS6472 and are reproduced below:

Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $\text{m}\cdot\text{s}^{-1.75}$ 1)	Adverse comment possible $\text{m}\cdot\text{s}^{-1.75}$	Adverse comment probable $\text{m}\cdot\text{s}^{-1.75}$ 2)
Residential buildings 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

- 5.3 Measurements of ground vibration from passing trains were carried out at Location 2 during the noise survey. The survey gathered a series of 10-minute VDV in each of the three orthogonal directions. From these measurements, the 16-hour or 8-hour VDV may be estimated, allowing assumptions to be made about numbers of events.
- 5.4 Vibration measurements were carried out for a sample of passing trains using a Svan 958 vibration meter and VDV transducer. Measurements were made during periods where both passenger trains and freight trains were passed by the site.
- 5.5 There was no perceptible vibration underfoot during the passage of trains, however, the objective measurement is deemed more critical than the subjective assessment on site. The highest 10-minute VDV measurement made during a train pass-by was $0.05 \text{ ms}^{-1.75}$. Given the

number of trains operating on the line during the day, the daytime VDV at Location 2 has been calculated to be $0.15 \text{ ms}^{-1.75}$. The result at night is $0.10 \text{ ms}^{-1.75}$. This assumes that every train passing the site generates the highest level of vibration measured during the survey. Clearly, this is very much a worst case situation, which was not witnessed on site, as most trains generated significantly less vibration.

- 5.6 Given the guidelines stated in BS6472, the edge of the site adjacent to the railway line just touches the bottom of the region where there is a low probability of adverse comment.
- 5.7 It is therefore considered that vibration is not a material planning consideration for this site.

6.0 SUMMARY AND CONCLUSIONS

- 6.1 A noise and vibration assessment has been carried out for a proposed residential development on land off Thurnscoe Bridge Lane in Thurnscoe.
- 6.2 The assessment has included measurements of the prevailing ambient noise levels at the site during daytime and night-time.
- 6.3 The assessment has also considered the magnitude of vibration experienced on the site due to passing trains.
- 6.4 Passing trains were found to be the most prominent noise sources at the site during day and night.
- 6.5 The suitability of the noise climate at the site for residential development has been determined. The assessment has been undertaken in accordance with the National Planning Policy Framework (NPPF) and the Noise Policy Statement for England (NPSE). Noise assessment and design targets for internal and external noise levels recommended in PPG24 and BS8233 guidance have been used to quantify noise impact and determine suitability for residential development with due regard to effects on health and quality of life as set out in the NPSE.
- 6.6 Outline noise control measures have been recommended in order to meet suitable noise level criteria for the proposed residential development.
- 6.7 Levels of vibration at close proximity to the railway line were found to be relatively low.
- 6.8 It is considered that the site should be deemed acceptable in planning terms, given that acceptable noise levels can be achieved following the implementation of suitable noise mitigation measures, and that acceptable levels of vibration can be achieved.
- 6.9 We consider that the site can be considered suitable for residential development, as acceptable noise levels can be achieved following the design and implementation of suitably specified noise mitigation measures. On this basis, we consider that the noise and vibration assessment methodology and conclusions meet the principles for sustainable residential development set out in the NPPF and NPSE.

FIGURE 1 – SITE AERIAL PHOTO & APPROXIMATE MEASUREMENT LOCATIONS



FIGURE 2 – INDICATIVE SITE LAYOUT



APPENDIX I – NOISE UNITS AND INDICES

a) Sound Pressure Level and the decibel (dB)

A sound wave is a small fluctuation of pressure in air. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. Due to the wide range of pressure variations detectable by the ear, a logarithmic scale is used to convert the values into manageable numbers. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

b) Frequency and Hertz (Hz)

Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or Hertz (Hz). Sometimes large frequencies are often written as kilohertz (kHz), where 1kHz = 1000Hz.

Young people with normal hearing can hear frequencies in the range 20Hz to 20kHz. However, the upper frequency limit gradually reduces as a person gets older.

As the ear hears some frequencies better than others, the A-weighting scale is used to mimic human hearing. A-weighting applies a correction to the sound level at a given frequency depending on how well the ear hears that frequency.

c) Glossary of Terms

In order to describe noise where the level is continuously varying, a number of other indices, including statistical parameters, are used. The indices used in this report are described below.

L_{Aeq} This is the A-weighted equivalent continuous sound level which is an average of the total sound energy measured over a specified time period. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period.

L_{Amax} This is the maximum A-weighted sound level that was recorded during the monitoring period.

L_{A90} This is the A-weighted sound level exceeded for 90% of the time period. L_{A90} is used as a measure of background noise.

L_{A10} This is the A-weighted sound level exceeded for 10% of the time period and is often used in the assessment of road traffic noise.

VDV Vibration Dose Value: cumulative measurement of the vibration level received over an 8-hour night time or 16-hour daytime period. It is the integrated fourth power vibration value with units $ms^{-1.75}$ and has the advantage of sensitivity to vibration peak levels.

APPENDIX II – NOISE SURVEY DATA

Equipment: SVAN 958 Class I integrating sound level meter

Weather: Dry and calm

All values in dB(A), free field, 10-minute measurement periods unless stated otherwise.

Location 1 – Western side of the development site

Date	Time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	Comments
18/9/12	10:49	57.5	67.2	60.9	49.2	Road traffic noise from Thurnscoe Bridge Lane
18/9/12	11:55	54.1	72.0	55.3	50.1	“
18/9/12	12:05	53.0	63.0	54.4	50.2	“
18/9/12	12:15	58.2	68.7	61.3	51.4	“
18/9/12	13:17	54.0	65.7	55.8	51.4	“
18/9/12	13:27	58.1	68.6	61.2	50.7	“
18/9/12	13:37	55.8	68.2	59.1	49.4	“
18/9/12	23:00	53.1	72.8	54.5	36.4	“
18/9/12	23:10	46.1	62.6	50.2	39.8	“
19/9/12	00:10	48.6	66.9	49.6	34.8	“
19/9/12	00:20	43.3	51.9	46.5	38.4	“
19/9/12	01:10	39.2	54.1	43.8	31.2	“
19/9/12	01:20	47.6	67.2	49.1	34.2	“
19/9/12	01:30	47.5	57.8	51.5	38.0	“

Location 2 – Approx 5m from Railway boundary to east

Date	Time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	Comments
18/9/12	11:00	56.9	63.7	61.0	50.5	
18/9/12	11:13	54.8	73.4	56.2	50.2	
18/9/12	11:23	60.1	83.6	55.2	50.1	Train
18/9/12	11:33	62.1	85.4	58.6	51.6	Train
18/9/12	11:43	56.5	78.6	55.6	50.3	
18/9/12	12:26	64.8	88.8	56.9	51.6	Train
18/9/12	12:36	58.9	79.1	58.1	51.3	Train
18/9/12	12:46	55.5	66.1	57.7	52.0	
18/9/12	12:56	63.3	89.1	58.3	50.4	Freight train
18/9/12	13:06	61.3	97.1	57.7	52.1	Train
18/9/12	23:20	44.5	58.8	47.6	38.4	
18/9/12	23:30	50.0	65.5	53.2	38.9	
18/9/12	23:40	43.5	57.8	47.4	36.5	
18/9/12	23:50	52.5	71.9	50.6	38.6	Train
19/9/12	00:00	64.3	89.4	50.0	36.9	Freight train
19/9/12	00:30	46.2	54.1	49.6	40.4	
19/9/12	00:40	62.7	83.1	52.2	32.2	Train
19/9/12	00:50	41.9	55.5	45.9	31.7	
19/9/12	01:00	41.9	55.2	45.6	32.4	

APPENDIX III – VIBRATION SURVEY DATA

Equipment: SVAN 958 vibration meter

Weather: Dry and calm

All values in $\text{ms}^{-1.75}$, 10-minute measurement periods unless stated otherwise.**Location 2 – Approx 5m from Railway boundary to east**

Date	Time	X VDV	Y VDV	Z VDV	Comments
18/9/12	11:00	0.004605	0.005392	0.004728	
18/9/12	11:13	0.02083	0.019534	0.017348	
18/9/12	11:23	0.00502	0.005123	0.012103	Train
18/9/12	11:33	0.006226	0.004971	0.015422	Train
18/9/12	11:43	0.003437	0.003666	0.004996	
18/9/12	12:26	0.009201	0.008827	0.017368	Train
18/9/12	12:36	0.007693	0.00851	0.009928	Train
18/9/12	12:46	0.006708	0.007606	0.005059	
18/9/12	12:56	0.011415	0.010494	0.017563	Freight train
18/9/12	13:06	0.005667	0.006103	0.008538	Train
18/9/12	23:20	0.004548	0.00426	0.004084	
18/9/12	23:30	0.00407	0.003774	0.003917	
18/9/12	23:40	0.003958	0.003716	0.003827	
18/9/12	23:50	0.004134	0.003827	0.006158	Train
19/9/12	00:00	0.005392	0.005504	0.026467	Freight train
19/9/12	00:30	0.004005	0.00417	0.006562	
19/9/12	00:40	0.044112	0.049136	0.005271	Train
19/9/12	00:50	0.006335	0.005143	0.026739	
19/9/12	01:00	0.003929	0.003574	0.00344	