RSK Acoustics

North West Bicester – Hawkwell Village

Outline Acoustic Assessment

Appendix 7.1

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Outline Acoustic Assessment

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Hallam Land Management Limited

3 Apex Court
Woodlands
Bradley Stoke Bristol
BS32 4JT

Description	Date	Prepared	Approved
Final Issue	20 December 2021	Tim Fox	Adam Sharpe

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Outline Acoustic Assessment

1 Introduction

1.1 Planning permission is sought for mixed use development to include up to 3,100 residential dwellings, a primary school and commercial spaces on a broad area of land to the northwest of Bicester.

1.2 RSK Acoustics have been instructed to conduct a noise impact assessment for the proposed development and provide details of any mitigation measures required to ensure that a good level of amenity can be achieved within the new dwellings.

1.3 This report provides details of an environmental noise survey undertaken at the site along with an assessment of noise break-in to the proposed dwellings in line with relevant planning and guidance documentation. Where necessary, details of mitigation measures have been provided.

2 Site Description

2.1 The proposed development site is located to the north west of Bicester. The site is currently farmland which has been allocated for a residential development as well as the development of a new primary school, together with social and community facilities, business and retail accommodation. The site and its surrounds are illustrated on attached site plan 206/0079/SP1 rev.1.

2.2 The site is bound to the south by the A4095 beyond which is the town of Bicester and to the west by a trainline which runs the length of the site. The A4095 is to be realigned within the southern parcel of the site. The rail line is raised approximately 5 m above the level of the field. Bucknell Road leading to Bicester Road runs through the site on the west side.

2.3 To the north of the site is arable land leading up to the small village of Bucknell. To the east of the site is Elmsbrook containing residential and business properties as well as a primary school, the 1st phase of the North West Bicester development. The B4100 is beyond this development.

2.4 There are existing properties located within the development area which will be retained. These include Hawkwell Farm towards the western side of the site and Blanchford Building Supplies in the south west corner of the site.

3 Planning Guidance and Criteria

3.1 **Planning Guidance**

3.1.1 Guidance is available from various sources to aid the assessment and establish suitable criteria which the development should strive towards. Full details of relevant national planning guidance, local planning policy and design criteria are included in attached Annex A.

3.2 Proposed Residential Noise Criteria

3.2.1 Based on the guidance as set out in attached Annex A, the following noise level criteria are proposed:

Road traffic and railway noise

- Daytime $L_{Aeq,16hour}$ within habitable rooms no greater than 35 dB;
- Night time $L_{Aeq,8hour}$ within all bedrooms no greater than 30 dB;
- Night time L_{Amax} within bedrooms no greater than 45 dB (for typical[1] events).

3.2.2 We note the 'typical' event for maximum noise levels should apply to regularly occurring maximum noise levels experienced.

External amenity areas

3.2.3 External areas cannot, by definition, be contained or benefit from the levels of noise mitigation that are available to internal spaces within buildings. As a consequence, design standards for external noise cannot be considered as thresholds that determine whether a high quality design has been implemented and a good level of amenity achieved. Rather, the external noise standards should be used to establish whether mitigation is appropriate as a means of minimising the adverse impacts of environmental noise.

3.2.4 Paragraph 7.7.3.2 of BS 8233:2014 states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

3.2.5 The important principle here is that sustainable development sites will often be exposed to relatively high levels of environmental noise, and while means are available to insulate internal spaces, they are not always available to protect external spaces. This is why the external target of 55 dB $L_{Aeq,16hr}$ shall be viewed as an aspirational target or trigger where mitigation measures should be considered rather than thresholds not to be exceeded in all circumstances.

[1] Typical L_{Amax} corresponding to the level not exceeded more than 10 times per night-time period.

3.3 Proposed School Noise Criteria

Building Bulletin 93 (BB93)

3.3.1 The proposed new school block will have to be fully compliant with BB93 as it is a means of complying with Building Regulations' requirements.

3.3.2 BB93 indicates the minimum required performance standards for teaching spaces within school buildings, in terms of noise ingress and other acoustic parameters. Section 1.1 is related to indoor ambient noise levels (IANLs).

3.3.3 The assessment IANLs should include noise contributions from external sources outside the school premises (including, but not limited to, noise from road, rail and air traffic, industrial and commercial premises) as well as building services (i.e. mechanical ventilation systems).

3.3.4 The IANLs should exclude noise contributions from teaching activities within the school premises, including noise from staff, students and equipment within the building or in the playground. This is specifically set out in section 1.1.1 of BB93.

3.3.5 The criterion for typical classrooms is 35 dB $L_{Aeq,30mins}$. There is some flexibility on these limits depending on ventilation strategy; under some circumstances the limits can be relaxed.

Ventilation Design Requirements

3.3.6 Table 2 of BB93 and its accompanying notes set out the following requirements in terms of IANLs for different ventilation methods.

- With normal condition ventilation provided mechanically, either via fully mechanical or hybrid systems, IANLs from the mechanical elements should not exceed those levels set out in BB93 Table 1
- With normal condition ventilation provided naturally, or using a hybrid system, IANLs from total system noise should not exceed those levels set out in BB93 Table 1 by more than 5 dB
- With summertime and intermittent boost ventilation provided mechanically, IANLs should not exceed those levels set out in BB93 Table 1 by more than 5 dB
- With summertime and intermittent boost ventilation provided naturally, IANLs should not exceed 55 dB $L_{Aeq,30min}$
- Normal condition for a mechanical supply is typically equivalent to approximately 8l/s per person (additional carbon dioxide concentration requirements apply)
- Normal condition for a natural or hybrid supply is typically equivalent to approximately 5l/s per person (additional carbon dioxide concentration requirements apply)

- The + 5 dB criteria do not apply to teaching and learning spaces where the Table 1 level is 45 dB or greater

3.3.7 In addition to the above, noise from ventilators actuators or dampers should not exceed 5 dB above the resultant IANL based on the points set out above.

3.3.8 Discrete noise events, such as aircraft flyovers, should not exceed 60 dB $L_{A1,\ 30mins}$. It is stated within BB93 that this is achieved by default for spaces with IANLs up to 40 dB $L_{Aeq,\ 30min}$.

4 Environmental Noise Survey

4.1 **Methodology & Instrumentation**

4.1.1 An unattended environmental noise survey was undertaken at the site between 25th February 2021 and 1st March 2021.

4.1.2 Noise measurements were used to quantify the ambient noise levels at the site during day and night time periods at key locations around the site. The sound level meters were left for multiple days to ensure that the measured noise levels were representative.

4.1.3 The measurement positions are marked on the attached site plan 206/0079/SP1 rev.1 and are described as follows.

- MP1 – Free-field position located 1.5 m above local ground level on the southern boundary of the site approximately 12 m from the kerb of the A4095.
- MP2 – Free-field position located 4 m above local ground level on the western boundary of the site, approximately 16 m from the raised rail line that runs parallel with the site boundary.
- MP3 – Free-field position located 1.5 m above local ground level approximately 6 m from the kerb of Bicester Road.

4.1.4 Measurements at all positions were made in the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} indices (see the Glossary of Acoustic Terms for an explanation of the noise units used). All attended measurements were made over 15-minute periods.

4.1.5 The noise measurements were made using the equipment detailed in table T1.

Item	Manufacturer	Type
Sound Level Analyser (x1)	Norsonic	118
Sound Level Analyser (x2)	Rion	NL-52
Acoustic Calibrator (x1)	Norsonic	1251
Acoustic Calibrator (x2)	Rion	NC-74
Weatherproof windshield (x1)	Norsonic	1212
Weatherproof windshield (x2)	Rion	WS-15

T1 Equipment used during unattended noise survey

4.1.6 The microphones were extended from the sound level meters with cables and were fitted with weatherproof windshields.

4.1.7 Sound level meters were calibrated before and after measurement periods to ensure an acceptable level of accuracy. No significant drift was observed.

4.1.8 Weather conditions when setting up the noise monitors were clear, dry and cold with little wind and dry roads. On collection the weather was overcast, still, dry and cold. Analysis of publicly available weather data from local stations show that the weather conditions were suitable for noise measurements throughout the survey.

4.1.9 The noise climate at MP1 was controlled by road noise from the A4095. At MP2, the noise climate was controlled by road noise from the M40 and intermittent railway traffic and at MP3 the noise climate was controlled by traffic noise from Bicester Road and the M40. It was noted on collection that industrial farm noise was being undertaken at Hawkwell Farm and muck spreading had been carried out near measurement position MP2.

4.2 Results

4.2.1 The unattended noise survey results can be seen in the attached time history graphs 206/0079/TH1 to TH3.

4.2.2 The calculated ambient noise levels during the day and night-time periods, as well as the typical short-duration maximum levels at night are shown in table T2 below.

Location	Daytime (0700-2300)	Night time (2300-0700)	
	$L_{Aeq,16hr}$	$L_{Aeq,8hr}$	Typical $L_{Amax,F}$
MP1 – A4095 boundary	68	60	77
MP2 – Western boundary	55	50	74
MP3 – Bicester Road	61	53	77

T2 Measured $L_{Aeq,16hr}$, $L_{LAeq,8hr}$ and typical $L_{Amax,F}$ noise levels

5 Residential Noise Control Strategy

5.1 Overview and Assumptions

5.1.1 This section of the report provides guidance with respect to potential residential development constraints and mitigation requirements relating to key noise sources surrounding the site.

5.1.2 As the development is currently conceptual, the construction type of the proposed dwellings is unknown. It is assumed for the purposes of the assessment that the dwellings will be up to four storeys of traditional masonry construction with a tiled roof and plasterboard ceilings. Any alternative constructions should be reviewed and confirmed to ensure suitable sound insulation.

5.1.3 It is on this basis that the glazing and ventilation elements have been assessed, as discussed below. Typical room sizes have been assumed as follows:

- Living rooms 5 x 4 x 2.7 m with 3.6 m^2 of glazed elements
- Bedrooms 4 x 3 x 2.7 m with 1.8 m^2 of glazed elements

5.1.4 These dimensions are provided for information only, to illustrate the assumptions made for the purposes of assessment. They should not be taken as constraints in terms of the design of the proposed dwellings.

5.1.5 For the purposes of this indicative assessment, three types of glazing have been used in the calculations, as stated in table T3 below, and are referred to in the following sections. Where an indicative configuration or product is suggested, alternatives can be employed, so long as they perform to an equal or better performance than the octave band specification stated. These are to provide an indication of the amount of mitigation needed at set distances from the roads and railway line and are not restricting factors.

Glazing Type	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
G1	28	29	39	44	50	56
G2	26	27	34	40	39	46
G3	20	19	29	38	36	45
G5	Good quality standard thermal double glazing achieving an acoustic performance of R_w 30 dB					

T3 Glazing performance requirements

5.1.6 The table provides the specification necessary when each Glazing Type is referred to. These must be met in full in each octave band (where provided) and is to be achieved by the window system as a whole; i.e. no part of the window system, including frame, can allow these octave band figures to not be achieved.

5.1.7 It is expected that the performances for each Glazing Type set out within table T3 can typically be achieved by the following configurations.

- Glazing Type G1: 8.4mm acoustic laminate glass / 16mm airgap / 10.4 acoustic laminate glass
- Glazing Type G2: 10 mm glass / 16 mm airgap / 6 mm glass;
- Glazing Type G3: 6 mm glass / 16 mm airgap / 6 mm glass;
- Glazing Type G5: 4 mm glass / 16 mm airgap / 4 mm glass.

5.1.8 Two ventilator types have been used in the calculations and as with glazing types, are to provide an indication of mitigation necessary, rather than to serve as a restricting factor. These are:

Ventilator Type	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
V1	48	39	44	52	66	61
V2	35	35	34	35	34	29

T4 Ventilator performance requirements

5.1.9 Theses specifications must be met in full at each octave band. It is expected that the specifications can typically be met by the following:

- Vent Type 1: *Passivent* Fresh 80 dB;
- Vent Type 2: Direct path trickle ventilators.

5.1.10 The important principle here is that the mitigation measures proposed are by no means the only solution to adequately control noise but represent an example of how the means of mitigation could be approached.

5.2 Internal Noise

5.2.1 The A4095 is the principal noise source across the southern boundary of the site. The railway to the west of the site is seen to be the principal noise source in this part of the site. Bicester Road, which dissects the site in two towards the western side has also been noted as a significant noise source and has been considered in our assessment.

5.2.2 Just as an example, if façade mitigation measures were to be selected, to the first row of dwellings at **10 m from the A4095**, Glazing Type G1 and Vent Type V1 would be appropriate on any façades with a view of road.

5.2.3 For dwellings near to the western boundary, at the first row of dwellings at **15 m from the railway**, Glazing Type G3 and Vent Type V1 would be appropriate on any façades with a view of the railway lines.

5.2.4 For dwellings near Bicester Road, at the first row of dwellings at **12 m from Bicester Road**, Glazing Type G2 and Vent Type V1 would be appropriate on any façades with a view of the road.

5.2.5 With the above mitigation measures in place, it will be possible to achieve the internal noise criteria as set out within section 3.2 in the dwellings adjacent to the A4095, set back by 10 m, those adjacent to the railway line by 15 m and those set back by 12 m from Bicester Road. Dwellings behind these would typically be screened and could utilise good quality standard thermal double glazing and non-acoustic trickle ventilators. The general principles of this are shown in Diagram 1 below:

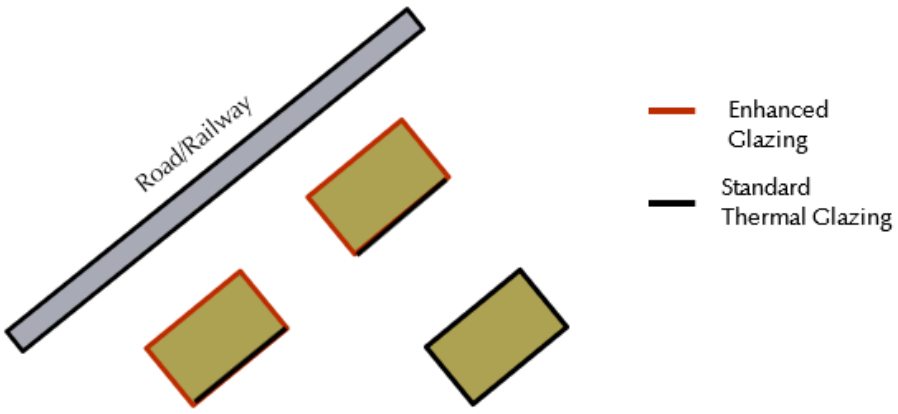

Diagram 1: Indicative Layout of Approach 1

5.2.6 It is noted that the distances above of 10m, 12m, and 15m are not a restriction - dwellings are not prohibited from being positioned closer than this but may require enhanced or different glazing and ventilation compared to the examples provided.

5.2.7 Within the site, the need for mitigation along the realigned A4095 will need to be considered at the reserved matters stage and have regard also to place-making principles requiring a strong design response close to the edge of the carriageway. Close proximity to the carriageway has been successfully achieved elsewhere within the North West Bicester development without onerous limitations or mitigation.

5.3 External Amenity Areas

5.3.1 If it is preferable to avoid the need for acoustic fences, dwellings should be orientated such that their associated external amenity areas are screened by the dwellings themselves.

5.3.2 This would mean locating external amenity areas for dwellings adjacent to the A4095 to the north of the associated dwellings and to the east for dwellings adjacent to the railway. By doing this noise levels within garden spaces should fall at or below the aspirational target of 55 dB $L_{Aeq,16hr}$.

5.3.3 Any gardens directly adjacent to the road or rail sources may require acoustic fencing, potentially up to 2.1m tall to achieve the aspirational target of 55 dB $L_{Aeq,16hr}$.

6 School Noise Control Strategy

6.1 A similar approach has been undertaken for assessing noise to the proposed primary school, based on noise breaking into a standard classroom space.

6.2 For the purposes of this indicative assessment, two types of glazing have been used in the calculations, as stated in table T5.

Glazing Type	Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
G4	17	22	22	28	39	39
G5	Good quality standard thermal double glazing achieving an acoustic performance of R_w 30 dB					

T5 Glazing performance requirements

6.3 The table provides the specification necessary when each Glazing Type is referred to. These must be met in full in each octave band (where provided) and is to be achieved by the window

system as a whole; i.e. no part of the window system, including frame, can allow these octave band figures to not be achieved.

6.1.1 It is expected that the performances for each Glazing Type set out within table T5 can typically be achieved by the following configurations.

- Glazing Type G4: 6 mm glass / 16 mm airgap / 4 mm glass;
- Glazing Type G5: 4 mm glass / 16 mm airgap / 4 mm glass.

6.1.2 One passive ventilator has been used in the calculations, and as with glazing types, are to provide an indication of the mitigation necessary rather than to serve as a restricting factor. The required performance is as follows:

Ventilator Type	**Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)**					
	125	**250**	**500**	**1k**	**2k**	**4k**
V3	18	21	24	32	40	42

T6 Ventilator performance requirements

6.1.3 Theses specifications must be met in full at each octave band. It is expected that the specifications can typically be met by the following:

- Vent Type V3: *Passivent* Aircool 265mm deep internal louvre with 40% free area.

6.1.4 The important principle here is that the mitigation measures proposed are by no means the only solution to adequately control noise but represent an example of how the means of mitigation could be approached.

6.4 If teaching spaces were to be located at **10 m from the railway** or **10m from Bicester Road**, it would be necessary to utilise Glazing Type G4 and Vent Type V3 on any façades with a view of the noise source.

6.5 If a buffer zone strategy were to be selected, Glazing Type G5 and Vent Type V3 would suffice on all façades if the teaching spaces were **20 m from the railway** and **15m from Bicester Road**.

7 Conclusions

7.1 Planning permission is sought for mixed use development to include up to 3,100 residential dwellings, a primary school and commercial spaces on a broad area of land to the northwest of Bicester.

7.2 RSK Acoustics have undertaken a noise survey at the site and a subsequent assessment to advise as to any design constraints on the site, and to provide an initial acoustic mitigation strategy to help guide the development of a layout.

7.3 Generally, the development behind the first line of building fronting the peripheral road, will require only the use of standard thermal double glazing and non-acoustic trickle ventilators will be an acceptable noise mitigation strategy.

7.4 As a general principle, external amenity areas adjacent to either road or railway noise sources should be provided with screening either by their adjoining dwelling or by suitable acoustic fencing. The exact requirements of this can be determined once an initial layout has been determined.

7.5 It is recommended that the school building is not positioned closer than 10 metres from the railway line and 10 metres from Bicester Road. If the school is positioned at least 20 metres from the railway line and 35 metres from Bicester Road, the use of standard thermal double glazing and wall mounted ventilators will be an acceptable noise mitigation strategy.

7.6 In principle therefore, the site is suitable for residential and school development providing suitable mitigation measures are put in place, where appropriate.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_{n}.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

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