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NOISE IMPACT ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT, HEALEY LANE, BATLEY, WF17 8DE

REPORT REFERENCE NO. J004896-7802-DH-02

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	Name	Position
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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.

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1.0 SUMMARY

PDA Ltd was commissioned by gwparchitecture to carry out a noise impact assessment for the proposed residential development located at Healey Lane, Batley, WF17 8DE.

The proposed development comprises the erection of 19 no. residential dwellings which are understood to range between semi-detached and terraced units. The current site is mainly overgrown vegetation on wasteland and is bordered by Healey Lane to the north and West Park Road to the south. Immediately to the east of site is Healey Junior Infant and Nursery School.

The local noise climate was dominated by traffic noise from West Park Road during the day and night-time periods and lesser so from Healey Lane. To the east of site there are periods of noise from the playground associated with Healey Junior Infant and Nursery School.

Based upon the measured and predicted noise levels, calculations have been undertaken for the Bedrooms and Kitchen/Living spaces to evaluate the internal noise levels. Recommendations are given for glazing, ventilation and building façade elements to meet the internal noise level requirements of good practice guidance given in BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Calculations suggest that the noise level criteria of BS8233:2014 can be achieved within the proposed accommodation.

Furthermore, the noise level incident on the proposed dwellings indicates that the requirements of Approved Document O (ADO) are likely to be exceeded and therefore require an alternative means of ventilation as opposed to openable windows.

An assessment of the external amenity areas suggests that all outdoor amenity areas are expected to be equal to or below 55dB (A) with Plots 1-5 and 15-19 predicted to be below 50 dB (A). We would consider that as the location of the development is situated in close proximity to Healey Junior Infants and Nursery School with West Park Road serving as an important connecting route the predicted external amenity noise levels, which do not exceed 55 dB(A), may be acceptable.

2.0 SITE DESCRIPTION

The proposed development comprises the erection of 19 no. residential dwellings which are understood to range between semi-detached and terraced units. The current site is mainly overgrown vegetation on wasteland and is bordered by Healey Lane to the north and West Park Road to the south. Immediately to the east of site is Healey Junior Infant and Nursery School.

An aerial photo presenting the location of the site and surrounding local area is shown in Figure 1 below. The proposed site layout is shown in Figure 2.

Figure 1. Location with proposed site outlined

Figure 2. Proposed site layout

3.0 NOISE ASSESSMENT CRITERIA

3.1 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in December 2023. With regard to Noise the Framework states the following;

Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.*

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*

- *identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

The terms '*significant adverse*' and '*adverse*' impacts are defined in the explanatory notes of the 'Noise Policy Statement for England (NPSE) which states;

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.

The notes also offer an explanation of the term 'adverse impacts' as follows;

… 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 (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise, updated in July 2019. A summary is reproduced in Section 4.2 below, and the full document is published at https://www.gov.uk/guidance/noise--2. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

3.2 Planning Practice Guidance – Noise

The UK Planning Practice Guidance on noise offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL, reproduced in the table below.

Table 1. Planning Practice noise level guidance

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not Present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

3.3 BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings

Dwelling houses, flats and rooms in residential use

British Standard 8233:2014, *Guidance on Sound Insulation and noise reduction for buildings*, gives guidance on internal noise levels within dwellings, flats and rooms in residential use when unoccupied. The following criteria are for Living and Dining Rooms for daytime use and Bedrooms for night time.

Table 2. BS8233 recommended indoor ambient noise levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	–
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	–
Sleeping (daytime resting)	Bedrooms	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

It should however be stressed that the above criterion relates to steady noise, in this case from road traffic etc., excluding unusual noise events departing from the typical noise character of the area.

In addition BS 8233 suggests, '*regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values'.*

With regard to external areas of residential developments BS8233:2014 states the following;

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.

3.4 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following internal noise levels are applicable within dwellings.

Table 3. WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours)*
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night time	30	8

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

In addition to the above continuous equivalent noise levels, WHO guidelines indicates that exceedances of 45 dB L_{Amax} for single sound events should be limited to no more than 10 – 15 times per night, when measured with a 'fast' time weighting.

3.5 Approved Document O (ADO)

Approved Document O (ADO) 2021, provides guidance on meeting the requirements of the Building Regulations 2010, part 'O1 Overheating mitigation'. The aim of the Building Regulations part O1 is to protect the health and welfare of occupants of the building by reducing the occurrence of high indoor temperatures.

Building Regulations part O1 requires that dwellings, institutions or any other buildings containing one or more rooms for residential purposes (other than a room in a hotel) to:

(a) Limit unwanted solar gains in summer:

(b) Provide an adequate means to remove heat from the indoor environment

However in meeting the obligations of ADO the buildings overheating mitigation strategy for use by occupants must consider 'Noise at night' in addition to other non-noise related considerations.

In regards to 'Noise at night', ADO stipulates the following.

In locations where external noise may be an issue (for example, where the local planning authority considered external noise to be an issue at the planning stage), the overheating mitigation strategy should take account of the likelihood that windows will be closed during sleeping hours (11pm to 7am).

Windows are likely to be closed during sleeping hours if noise within bedrooms exceeds the following limits.

a. 40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am).

b. 55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)

It should be noted that the above noise limits are with reference to internal noise levels within a bedroom.

Within Appendix A of '*Guide to Demonstrating Compliance with the Noise Requirements of Approved Document O*' July 2022 as published by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA), it is discussed that for a partially open window approximately 5% of the floor area, a reduction of 9 dB between external and internal noise levels is calculated. Therefore ADO and the guidance document infer that windows will be required to remain closed when the external noise climate exceeds the following external noise limits.

49dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am)

64dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)

Subsequently, where windows are required to be closed at night (due to the above noise limits being exceeded), the overheating mitigation strategy as required by ADO must provide an alternative method to removing heat other than relying on windows remaining open.

4.0 SURVEY DETAILS AND RESULTS

4.1 Environmental Noise Survey

A noise level survey was undertaken at the site between 14:01 hours on Monday 22nd April and 15:00 hours on Tuesday 23rd April 2024. The periods measured were deemed to be representative of day and night-time hours.

Long-term noise measurements were taken to the north and south boundaries of the proposed site. The measurement locations are shown in the Figure below:

Figure 3. Noise survey locations

The microphones at the measurement positions were located on a mast at a height of 3m at Position 1, on a pole at a height of 1.5m at Position 2 and at least 3m from any reflective surface.

All measurements were made and partly attended by David Hible and Sam Iles of PDA Ltd. Measurements were of continuous 5 minute samples. The survey was conducted using 2 no. NTi XL2 sound level meters. Calibration certificates for the sound level meters are held.

The NTi meters are Class 1 frequency response as per BS EN 61672-1:2003. The sound level meters were field calibrated both before and after the measurement period, during which time no significant

deviation from the calibrated level was observed. The sound level meters were fitted with outdoor microphone windshields at all times.

All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. In addition, octave band frequency spectra were recorded along with 16 bit/ 24kHz audio.

Weather

22/04/2024

- Temperature: 6 - 10°c
- Wind Speed: 0 – 3 m/s - NNE
- Overcast with scattered showers

23/04/2024

- Temperature: 5 - 11°c
- Wind Speed: 0 - 2m/s North
- Overcast – no precipitation

Weather data has been taken from weather underground measurement position 'I90581063'.

Noise Sources

The local noise climate was dominated by traffic noise from West Park Road during the day and night-time periods and lesser so from Healey Lane. To the east of site there are periods of noise from the playground associated with Healey Junior Infant and Nursery School.

4.2 Measurement Results

Environmental Noise

A summary of the noise levels measured at each position across site is given in the table below.

Table 4. Summary of the noise levels measured across site

Measurement Position	Date	Time Period (hh:mm)	$L_{Aeq,T}$ (dB)	Range of Night-Time $L_{Amax,5mins}$ (dB)
1	22/04/2024 - 23/04/2024	Day 14:25 – 23:00	59	-
		Night 23:00 – 07:00	53	40 - 80
		Day 07:00 – 15:00	62*	-
2	22/04/2024 - 23/04/2024	Day 14:01 – 23:00	54	-
		Night 23:00 – 07:00	48	35 - 76
		Day 07:00 – 14:40	55	-

* Includes for periods of noise from adjacent school yard during school break-times and PE lessons.

5.0 NOISE PROPAGTION AND IMPACT ASSESSMENT

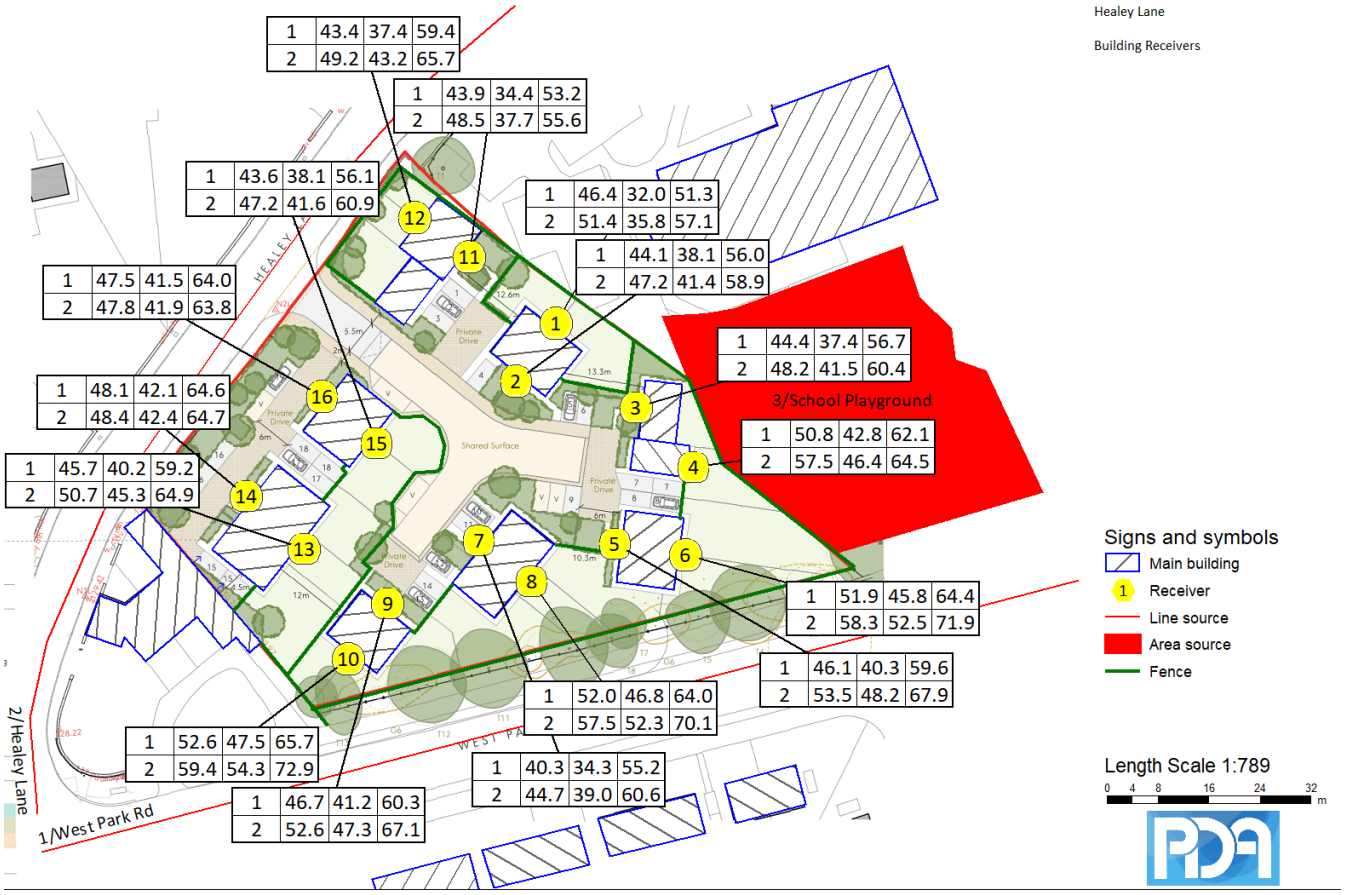
A 3-dimensional computer noise model has been constructed using SoundPLAN noise modelling software to determine the noise level impact upon the proposed development. All calculations have followed the methodology contained within ISO 9613-2:1996 *Attenuation of sound during propagation outdoors - Part 2: General method of calculation*. The topographical data for the site and surrounding area is taken from Google Maps. The proposed site layout is derived from the received gwparchitecture drawing.

The model has been calibrated to the noise levels measured on-site as discussed within Section 4. A ground absorption coefficient of 1 has been used to account for areas of grassland and a coefficient of 0 for the areas of hard ground such as roads, hard standing etc.

The school playground has been modelled as an area source at 1 meter height and calibrated by identifying activity through audio recordings and using the respective measured noise levels.

Noise levels have been calculated at each façade and their respective floors at a height of 1.5m for ground floor and 4m for first floor.

Figure 4. Calculcated levels at receivers – Daytime, Night-time, L_{max}



6.0 NOISE LEVEL PREDICTIONS

Based upon the predicted noise levels in Section 5, calculations have been undertaken to determine internal noise levels for the proposed accommodation.

6.1 Glazing Requirements

The dominant paths for noise transfer to the interior of buildings are generally the glazing and ventilation elements of the façade constructions thus we have provided the following specifications for each dwelling of the development. It should be noted that as General Arrangement plans are not yet available we have made the following assumptions of typical room dimensions shown in Table 5 which have been used within the noise break-in calculations.

Table 5. Assumed Room Dimensions

Room	Volume m^3	Window Area m^2
Lounge	38	4
Kitchen/Dining	55	7
Bedroom	29	2

The calculation of noise break-in to the residential rooms has been undertaken in accordance with the calculation methods of BS EN 12354-3:2000 *Building Acoustics – Estimation of acoustic performance of buildings from the performance of elements. Part 3: Airborne sound insulation against outdoor sound*, in octave bands. Reverberation time is 0.5 seconds as per the BS EN 12354-3 reference time for dwellings. The specifications in the table below should also comply with the respective minimum sound reduction index (R) values detailed within Table 7 and 8.

Figure 5. Glazing and Ventilation Schedule

Table 6. Glazing Schedule

Plot no.	Specification	Rooms	Minimum Glazing Rating R_w dB	Minimum combined Ventilator Rating $D_{n,e,w}$ dB	Internal Noise Level Target (Day/Night/Night L_{max})[1] (dB(A))	Calculated Internal Noise Level (dB(A)) (Day/Night/Night L_{max})
6-14	Yellow	Lounge	34	33	35/-/-	33/-/-
		Kitchen/Diner			40/-/-	32/-/-
		Bedroom			35/30/45	31/26/45
1-5, 15-19	Green	Lounge	31	27	35/-/-	29/-/-
		Kitchen/Diner			40/-/-	27/-/-
		Bedroom			35/30/45	27/21/41

Notes:
1. Values for night-time and night L_{max} are only required in bedrooms.

With the glazing and ventilation specifications proposed in Table 6 above, calculations suggest that the internal day and night-time BS8233:2014/WHO noise level requirements can be achieved. Calculated internal noise levels are given on the worst-case internal receivers.

In addition to the above, calculations have been undertaken to determine L_{Amax} noise levels within the bedrooms at night-time. Using the full night-time L_{Amax} noise levels measured across site with the glazing and ventilation specifications above, the calculated L_{Amax} values will not normally exceed 45 dB L_{Amax}.

6.1.1 Glazing Specification and Installation Notes

Notes on Glazing Installation

For the glazing specifications in Table 7 below, all sound insulation values quoted must be achieved by the overall combination of frame and glazing, and not just by the glazing alone. The frame should not reduce the performance of the system overall. Glazing framing systems must be fully sealed with any small gaps (<10mm nominal) around the perimeter to be stuffed with dense mineral wool to full frame depth and sealed both sides with acoustic non-setting mastic, with additional weathering protection to be applied additionally externally to this. No gaps should be left unsealed.

Minimum performance requirements for the combination of glazing and framing recommended in the above tables are as follows:

Table 7. Required Minimum Sound insulation of Combined Glazing and Framing

Typical Product	Minimum Sound Reduction Index R (dB) at Octave Band Centre Frequency (Hz)								R_w dB
	63	125	250	500	1k	2k	4k	8k	
4/16/6mm	16	21	22	29	39	40	42	42	**34**
4/12/4mm	16	22	19	25	36	42	36	36	**31**

Figures stated in the table above are based on Saint Gobain manufacturer quoted data. Acoustic ratings should be checked with the manufacturer and supported by laboratory test reports where necessary.

6.1.2 Ventilator Requirements

The ventilator inlets described in the following table are calculated to provide adequate sound insulation to maintain internal noise levels compliant with the guidance criteria when used in conjunction with the selected glazing. Example ventilator products are noted below.

The acoustic specification relates to the combined performance of all ventilation elements. Please note that we have considered for 1 no. ventilator to bedrooms and 2 no. ventilators to lounges and kitchen/diners. Where additional ventilators are required the acoustic perfomance of a single ventilator must be selected so that the combined perfomance is as stated in the table below, e.g. for 2 no. ventilators to a bedroom, the acoustic performance of each will need to be $D_{n,e,w}$ 36 dB to meet a combined specification of $D_{n,e,w}$ 33 dB. Requirements should be checked with the manufacturer. Please note that the treatment is generally not considered necessary for non-habitable rooms such as bathrooms etc.

Table 8 below gives the acoustic performance of the ventilator used in the calculations. Any alternative vent should achieve the same performance or greater in each octave band.

Table 8. Required ventilator performance

Typical Product	Minimum Sound Reduction Index $D_{n,e}$ (dB) at Octave Band Centre Frequency (Hz)								$D_{n,e,w}$ dB
	63	125	250	500	1k	2k	4k	8k	
Simon Acoustic EMM	40	40	36	35	31	33	36	43	**33**
Simon Airstrip 19000	30	30	27	27	25	27	30	38	**27**

Please note that the specification of vents is in terms of acoustic performance only. Ventilation strategy needs to be checked with Local Authority and other standards and regulations for compliance. It should be noted that inclusion of ventilators alone does not ensure compliance with Building Regulations or other regulatory requirements for ventilation. The ventilation strategy should be checked by others.

6.2 Approved Document O (ADO), Method of Removing Heat

With reference to the predictions discussed in Section 5, we would note that the calculated noise levels are predicted to exceed the following criteria.

49dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am)

64dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)

Consequently based on a partially open window, noise levels within bedrooms are predicted to exceed the following ADO limits.

40dB $L_{Aeq,T}$, averaged over 8 hours (between 11pm and 7am)

55dB L_{AFmax}, more than 10 times a night (between 11pm and 7am)

Therefore, an alternative means of ventilation is recommended as opposed to relying on openable windows at all Plots except no. 4 and 5. Alternative means of ventilation for bedrooms at night time will need to be determined by the mechanical engineer on the basis of the overheating assessment, but typical solutions can include passive solutions such as acoustic louvres, and/or mechanical solutions such as mechanical extract ventilation or MVHR.

6.3 External Walls

It is understood that the external wall construction will be a timber frame construction clad in either brick, stone or rendered blockwork. Within our calculations it has been determined that the sound insulation performance of the façade should be no less than 54 dB R_w, and the above proposal is likely to be acceptable to meet this value.

6.4 External Amenity Areas

Calculations have been carried out in order to assess the noise levels in the external amenity spaces of the proposed dwellings as shown in the Figure below. Please note that we have assumed there will be perimeter fencing to garden areas and have included for this within the model. We would consider that this is of a solid construction with no gaps between the panelling, at least 10 kg/m^2 surface mass and 1.8m height. The results of the model are presented in the Figure below:

Figure 6. Calculated noise levels in amenity areas – grid noise map

It can be seen from the grid noise map above that all outdoor amenity areas are expected to be equal to or below 55dB (A) with Plots 1-5 and 15-19 predicted to be below 50 dB (A). As previously mentioned within Section 3.3, BS8233:2014 discusses how it is desirable that external noise levels do not exceed 50 dB(A). It is further discussed how this may be increased to 55 dB(A), and potentially higher than this in noisier environments as follows:

'*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.

We would consider that as the location of the development is situated in close proximity to Healey Junior Infants and Nursery School with West Park Road serving as an important connecting route the predicted external amenity noise levels, which do not exceed 55 dB(A), presented in the figure above may be warranted.

7.0 CONCLUSIONS

PDA Ltd was commissioned by gwparchitecture to carry out a noise impact assessment for the proposed residential development located at Healey Lane, Batley, WF17 8DE.

The proposed development comprises the erection of 19 no. residential dwellings which are understood to range between semi-detached and terraced units. The current site is mainly overgrown vegetation on wasteland and is bordered by Healey Lane to the north and West Park Road to the south. Immediately to the east of site is Healey Junior Infant and Nursery School.

The local noise climate was dominated by traffic noise from West Park Road during the day and night-time periods and lesser so from Healey Lane. To the east of site there are periods of noise from the playground associated with Healey Junior Infant and Nursery School.

Based upon the measured and predicted noise levels, calculations have been undertaken for the Bedrooms and Kitchen/Living spaces to evaluate the internal noise levels. Recommendations are given for glazing, ventilation and building façade elements to meet the internal noise level requirements of good practice guidance given in BS8233:2014 Guidance on Sound Insulation and Noise Reduction for Buildings. Calculations suggest that the noise level criteria of BS8233:2014 can be achieved within the proposed accommodation.

Furthermore, the noise level incident on the proposed dwellings indicates that the requirements of Approved Document O (ADO) are likely to be exceeded and therefore require an alternative means of ventilation as opposed to openable windows.

An assessment of the external amenity areas suggests that all outdoor amenity areas are expected to be equal to or below 55dB (A) with Plots 1-5 and 15-19 predicted to be below 50 dB (A). We would consider that as the location of the development is situated in close proximity to Healey Junior Infants and Nursery School with West Park Road serving as an important connecting route the predicted external amenity noise levels, which do not exceed 55 dB(A), may be acceptable.

APPENDIX A – NOTES FOR QUALITY CONTROL

1. Blockwork

All blockwork is to be mortared to an almost fair faced standard both horizontally and vertically. Only perfect blocks may be used with no pitting or cracks. The blockwork must seal effectively to the underside of the soffit.

Where blockwork walls form a cavity wall, care should be taken to avoid rubble and snots from bridging the cavity. This is especially important where one or more of the leaves is floating.

2. Plasterboard

All plasterboard joints are to be butted tight. The rule of thumb is that the joint should be tight enough over its entire length to prevent a normal business card from being inserted. Multiple layers should be fitted with staggered joints.

Base details and deflection heads are to be as per the British Gypsum White Book unless otherwise stated, and copious amounts of mastic to be used when fitting to the walls, floor and ceiling respectively.

3. Mineral Fibre

Mineral fibre slabs are to be butted tightly together and to boundary structures, to form a homogeneous layer.

4. Windows

All window frames are to be a good tight fit into the building structure with any gaps to be filled both internally and externally with a non-setting mastic in addition to the usual weather proofing seal to the exterior. Any gaps between the frame and building that are greater than 5 mm are to packed with a dense mineral fibre prior to mastic sealing.

5. Electrical Sockets

Electrical sockets must not be fitted back to back and removed areas of blockwork and plasterboard should be kept to an absolute minimum.

6. Water Pipes

All water pipes (and any other pipework) are to be resiliently mounted to avoid “water hammer”. This is particularly important for plasterboard walls.

7. Penetrations

Penetrations are to be dealt with as described in this report. Details for specific services penetrations may be supplied upon request.

8. Approved Samples and Inspections

Samples of each individual acoustic element should be provided for inspection at the beginning of its installation. Once approved, the Clerk of Works must ensure that the same level of quality continues throughout construction.

APPENDIX B – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB $L_{Aeq.}$ Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq}. It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB $L_{An.}$ It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) $L_{max,}$ dB $L_{Amax,}$ etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq}, L_{90}, L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.

APPENDIX C – Measured Noise Levels

Figure 6. Ambient Noise Survey – Chart – Position 1

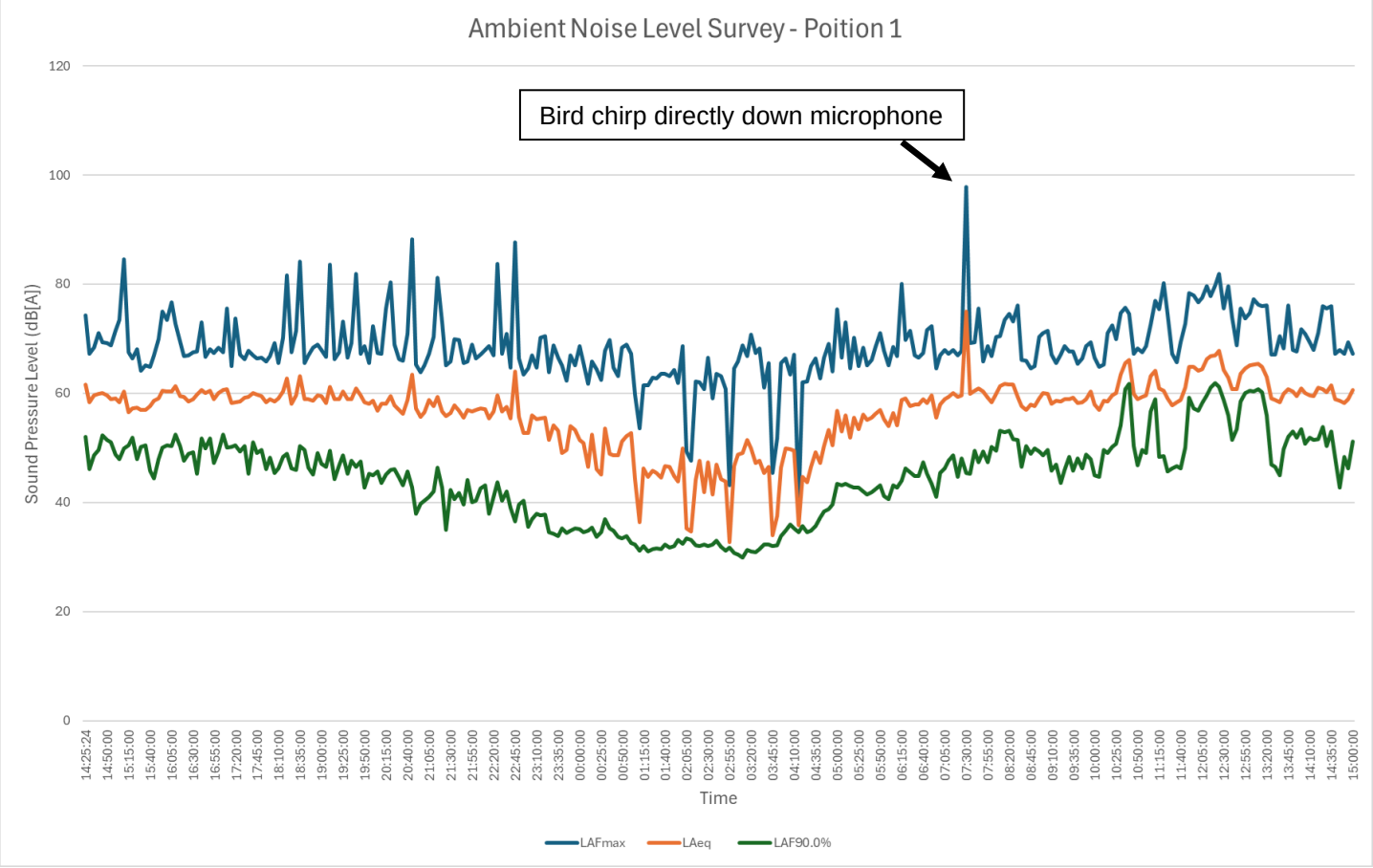


Figure 7. Ambient Noise Survey – Chart – Position 2