AIRO

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for
GPL 2014 Ltd
9 Bridewell Place
London
EC4V 6AW

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ENVIRONMENTAL NOISE
SURVEY AND ASSESSMENT
FOR
PROPOSED THIRD FLOOR,
FOUNTAIN HOUSE, WELWYN GARDEN CITY

Report Author: D J Boaden BSc MInstP MIOA

ACOUSTICAL INVESTIGATION & RESEARCH ORGANISATION LTD

Duxons Turn
Maylands Avenue
Hemel Hempstead
Hertfordshire
HP2 4SB

Telephone: 01442 247146
Facsimile: 01442 256749
E-mail: AIRO@bcs.org.uk
URL: http://www.airo.co.uk/

ENVIRONMENTAL NOISE

SURVEY AND ASSESSMENT

FOR

PROPOSED THIRD FLOOR,

FOUNTAIN HOUSE, WELWYN GARDEN CITY

1. INTRODUCTION

AIRO is retained by GPL 2014 Ltd to provide independent specialist advice and measurement services in respect of proposed third floor residential development at Fountain House, 1-7 Howardsgate, Welwyn Garden City.

This report replaces AIRO Report No. DJB/6892/D dated 2 May 2017 which is now withdrawn.

The noise assessments reported herein are based on noise level measurements made at the site from Friday 1 to Tuesday 5 July 2016.

Reference is made to current national planning guidance and the noise level measurements have been used to provide mitigation advice aimed at satisfying the internal noise level limits outlined in British Standard BS 8233:2014 (ref 1) and World Health Organization document Guidelines for Community Noise (ref 2).

The report concludes that acceptable noise levels within dwellings can be achieved through the introduction of mitigation measures as described in Section 6.

2. DESCRIPTION OF SITE

The site for which residential development is proposed lies off Parkway, Welwyn Garden City. A three storey building, known as Fountain House, currently occupies the site.

At the time of the noise level survey the ground floor of the building was occupied by commercial premises whilst the first and second floor levels were occupied by NHS staff offices. The first and second floor level offices are now vacant whilst the commercial premises continue to operate at ground floor level.

The development proposals include the construction of new dwellings at third floor level above the existing building. Elsewhere the proposals comprise conversion of the office spaces located at first and second floor levels to dwellings (this is not specifically considered here and is assessed separately). Commercial property at ground floor level is proposed to be retained.

The development site is within the town centre of Welwyn Garden City and therefore, as one might expect, the immediate area is mainly retail / commercial in nature. Within the adjacent building lies a pub (The Parkway Tavern) at ground floor level and a club (Club 67) at first floor level. Beyond this lies Charter House, an office building for NHS East and North Hertfordshire Clinical Commissioning Group (who also occupied Fountain House offices at the time of the survey). Beyond Charter House lies a large department store (John Lewis).

The site is bordered to the west by Parkway, a two lane in each direction dual carriageway road split by a large grassed area that also includes a fountain. Beyond the road lies a mix of offices and residential properties. To the south of the site is Howardsgate, another two lane in each direction dual carriageway road split by a large grassed area. Beyond the road lies retail / commercial properties.

To the immediate east of the site is the Two Willows pub beyond which are further retail / commercial properties.

Car parking areas lie to the immediate north east of the development building that also provide access to the rear of the ground floor commercial properties and Charter House.

The noise sources affecting the proposed development (at third floor level) are road traffic noise from Parkway and Howardsgate together with plant noise associated with roof mounted air handling plant and plant terminations. To a lesser extent noise associated with town centre activity (general usage and deliveries etc.) also contributes.

Figure 1 in Section 4 of this report provides a site location plan.

3. NOISE AND VIBRATION MEASUREMENT UNITS

3.1 A-Weighted Equivalent Continuous Sound Level - $L_{\text{Aeq},T}$

As its name suggests, the $L_{\text{Aeq},T}$ is a measure of the acoustic energy of a fluctuating noise climate over a given period T expressed as the single continuous noise level having the same energy as the time varying signal.

The 'A' within the descriptor means A-weighted, an internationally agreed frequency response generally similar to that of the human ear so that A-weighted sound levels in dB correspond reasonably well with what is heard.

For assessment purposes, the day is typically divided into a 16-hour daytime period (07:00 to 23:00) and an 8-hour night-time period (23:00 to 07:00). The period values may be derived from the logarithmic average of the relevant hourly values.

3.2 Maximum Noise Level - L_{AFmax}, L_{ASmax}

In some circumstances it is useful to quantify the maximum level of fluctuating noise and a commonly used descriptor is L_{Amax}. The L_{Amax} represents the maximum reading given by a sound level meter for a given event or period of time and is usually qualified by F for 'Fast' or S for 'Slow' according to the response time setting of the meter.

3.3 A-Weighted Percentile Noise Levels - L_{An}

Percentile noise levels are a statistical representation of the time varying level. The value is the noise level L exceeded for n% of the period T.

To measure background environmental noise levels the statistical index L_{A90} is commonly preferred. The L_{A90} is the Sound Pressure Level that is exceeded for 90% of the measurement period. The L_{A90} therefore discriminates against short duration peaks of noise and is consequently considered to provide a better representation of typical minimum noise levels compared with, for example, the L_{Aeq}.

4. MEASUREMENT SURVEY

4.1 Measurement Survey

Measurements of noise levels were made at the site during the period 15:00 hours on Friday 1 July to 10:00 hours on Tuesday 5 July 2016. The survey period was selected to include representative club and pub activity over the weekend and also road traffic noise during a typical weekday.

Hourly noise level measurements over the period were made using an automatic data logging sound level meter at Positions A and B. The two positions were located approximately 1.7 metres above the flat walking surface of the roof of the existing building. Position A was located approximately 2.4 metres from the

Parkway elevation whilst Position B was located approximately 2.3 metres from the Howardsgate elevation.

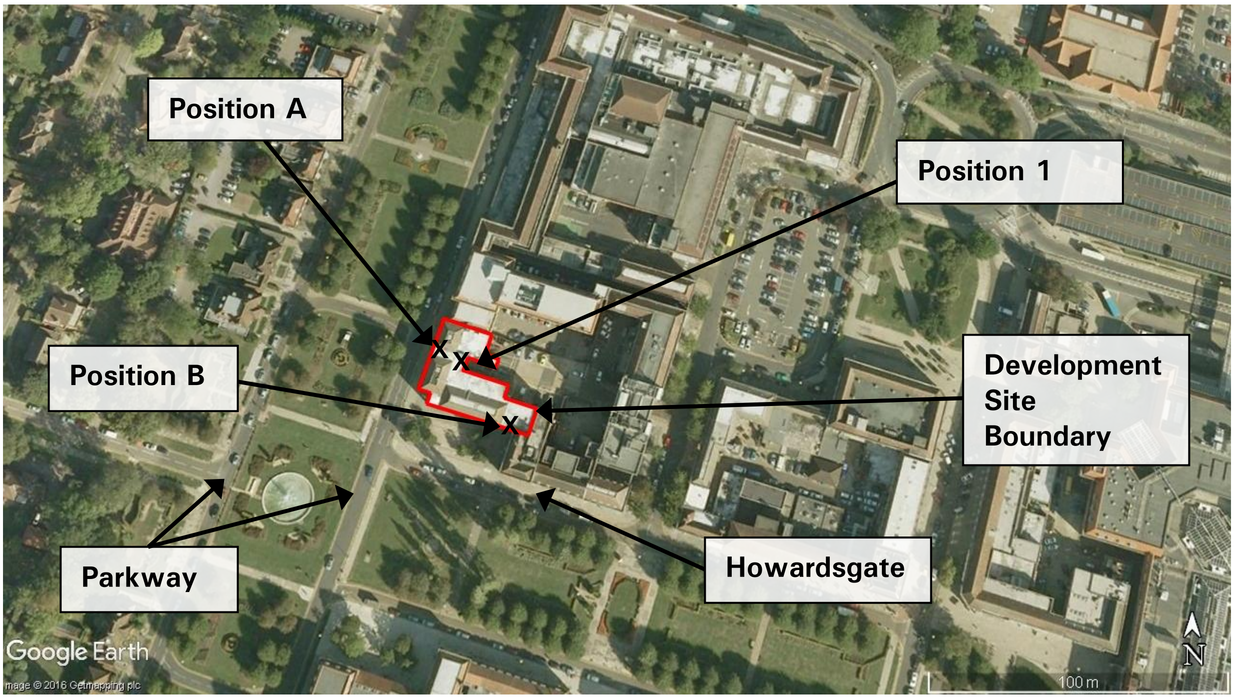
In addition, a shorter term sample attended measurement was made at Position 1 on 5 July 2016 with the microphone at approximately 1.6 metres above the roof level and approximately 1 metre from the termination of an operating air handling exhaust duct. The duct passed vertically up the rear of the building close to the boundary with Club 67 and is assumed to be associated with the kitchen of the ground floor restaurant. The noise from the termination was subjectively prominent in the immediate locality.

Summaries of the noise levels measured at Positions A and B are shown in Tables 1 and 2. The noise levels measured at Position 1 are provided in Table 3. Full tabulations of the hourly values for Positions A and B are provided in Appendix A.

Figure 1 presents an aerial view of the development site and indicates the measurement locations. Details of the measurement equipment and recorded weather conditions are given in Appendix B.

A graphical representation of the noise levels measured during the survey period at Positions A and B are presented in Figure 2 and Figure 3 respectively.

Figure 1 – Aerial View indicating Measurement Positions



Map Data: Google, Getmapping plc

4.2 Noise Level Measurement Results

Table 1 – Summary of Period Noise Levels Measured at Position A (Parkway)

Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
1/7/16	Friday Day (15:00-23:00)	57	51 to 54	--
1/7/16	Friday Night (23:00-07:00)	54	48 to 51	92
2/7/16	Friday Day (07:00-23:00)	59	50 to 54	--
2/7/16	Friday Night (23:00-07:00)	53	48 to 51	75
3/7/16	Saturday Day (07:00-23:00)	56	49 to 53	--
3/7/16	Saturday Night (23:00-07:00)	53	49 to 52	78
4/7/16	Monday Day (07:00-23:00)	57	51 to 54	--
4/7/16	Monday Night (23:00-07:00)	53	49 to 51	73

Table 2 – Summary of Period Noise Levels Measured at Position B (Howardsgate)

Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
1/7/16	Friday Day (15:00-23:00)	57	51 to 53	--
1/7/16	Friday Night (23:00-07:00)	54	49 to 53	81
2/7/16	Friday Day (07:00-23:00)	57	50 to 53	--
2/7/16	Friday Night (23:00-07:00)	56	49 to 55	79
3/7/16	Saturday Day (07:00-23:00)	56	49 to 52	--
3/7/16	Saturday Night (23:00-07:00)	53	49 to 51	75
4/7/16	Monday Day (07:00-23:00)	57	50 to 53	--
4/7/16	Monday Night (23:00-07:00)	55	48 to 51	80

Table 3 - Attended Noise Levels Measured on 5 July 2016	
Position	1
Start time	10:08
End time	10:11
L_{Aeq}	55
L_{AF10}	56
L_{AF90}	55
L_{AFmax}	62
L_{eq} 31.5 Hz	28
L_{eq} 63 Hz	38
L_{eq} 125 Hz	51
L_{eq} 250 Hz	46
L_{eq} 500 Hz	48
L_{eq} 1 kHz	50
L_{eq} 2 kHz	45
L_{eq} 4 kHz	37

Figure 2 – Full Period Noise Level Trace at Position A, using 32 second L_{Aeq}'s

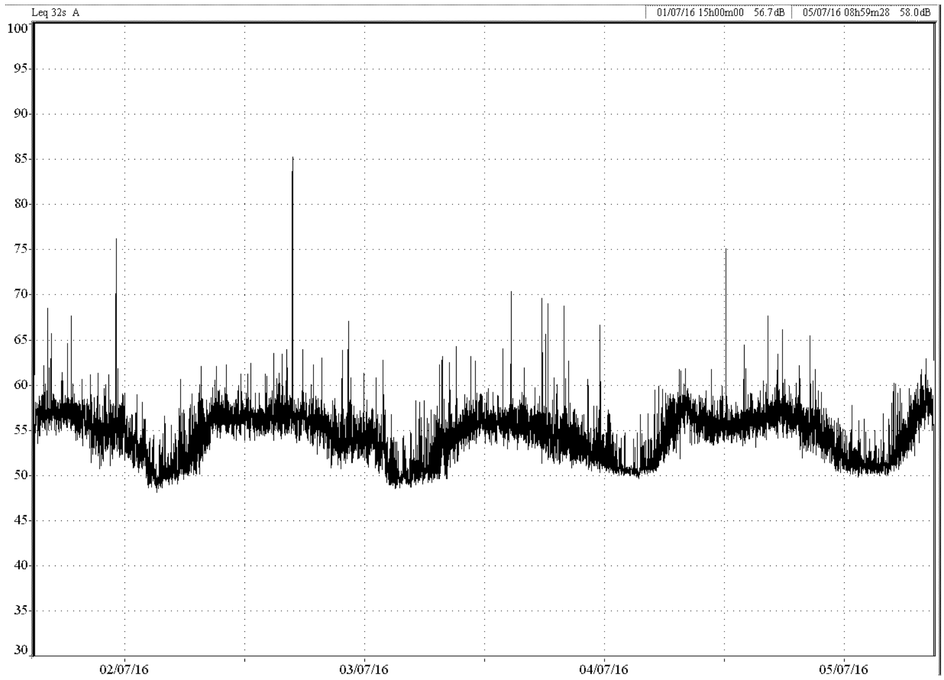
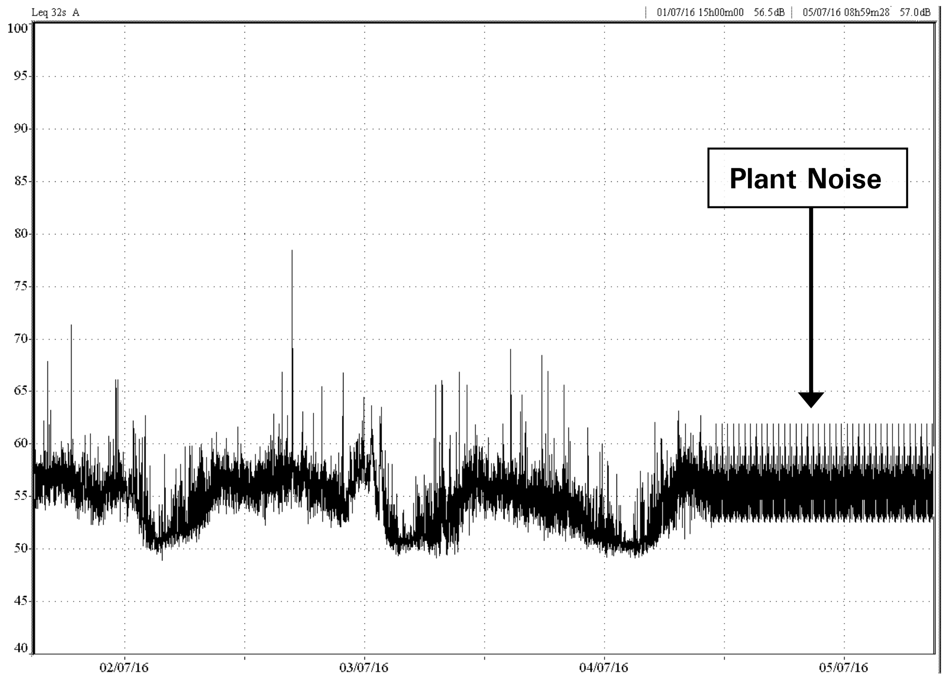


Figure 3 – Full Period Noise Level Trace at Position B, using 32 second L_{Aeq}'s



The noise climate at Positions A and B was witnessed to be reasonably similar with the noise levels at the two locations including contributions from road traffic on the surrounding road network but also plant noise associated with roof mounted air handling plant and to a lesser extent noise associated with town centre activity (general usage and deliveries etc.) and also the nearby fountain. The similarity of the two positions can be seen in noise level traces shown in Figures 2 and 3.

Due to the proximity of condenser units Position B was more affected by plant noise in comparison with Position A. The noise level trace presented in Figure 3 clearly shows the dominance of plant noise from Monday morning through to the end of the survey period.

Away from Positions A and B other air handling plant affected the noise climate. Whilst on site the noise from the duct / termination described in relation to Position 1 was clearly audible close to it's location.

5. REQUIREMENTS AND ASSESSMENT GUIDANCE

5.1 National Planning Policy Framework, Planning Practice Guidance and Noise Policy Statement for England

Since its publication on 27 March 2012 the National Planning Policy Framework (NPPF) (ref 3) provides the current national planning policies for England, including those related to noise. It is accompanied by the Planning Practice Guidance (ref 4) updated in March 2014.

With particular reference to noise, the NPPF and the Planning Practice Guidance refer to the Noise Policy Statement for England (NPSE) (ref 5), published in March 2010. The NPSE provides the long-term vision of Government noise policy:

"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."

The NPSE says that the long-term vision is supported by the following aims:

"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 impact on health and quality of life;*
- *mitigate and minimise adverse impact on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE and the Planning Practice Guidance discuss the terms "*Significant adverse*" and "*adverse*" linking concepts from toxicology that are being applied to noise impacts (for example, by the World Health Organization). The concepts are "NOEL" and "LOAEL" which are the "No Observed Effect Level" and "Lowest Observed Adverse Effect Level" respectively. The Note extends these concepts to introduce a "SOAEL" (Significant Observed Adverse Effect Level) but recognises that objective noise measures or limits are not developed for SOAEL.

It is important to note that the NPSE says it makes 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"*.

The Noise Policy Aims include reference to both of these aspects.

Guidelines for Community Noise (GCN) (ref 2) published by WHO is often cited in relation to noise level limits.

Since its publication another WHO document, Night Noise Guidelines for Europe (ref 6) (NNG) published in 2009, has been released that also provides guidance in this area.

WHO defines health in the NNG as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity and recognizes the enjoyment of the highest attainable standard of health as one of the fundamental rights of every human being"*. This definition of 'health' clearly aligns with the joint definitions of 'quality of life' and 'well-being' presented in the NPSE.

It is reasonable therefore to suggest that the guideline limits presented by WHO can be drawn on in relation to the requirements of the NPPF.

Guidelines for Community Noise provides guideline noise level limits which it says are *"essentially values for the onset of health effects from noise exposure"* and includes consideration of various aspects including Sleep Disturbance, Mental Illness, Performance and Social and Behavioural Effects of Noise.

Night Noise Guidelines for Europe provides updated guidance with, as the title suggests, particular regard to night-time noise. Consideration and threshold noise level limits are given for Biological Effects, Sleep Quality, Well-being and Medical Conditions.

The indoor noise level limits presented where sufficient evidence is available align reasonably well with the night-time limits given in the earlier GCN. Indeed NNG says that it *"complements the 1999 guidelines"* and also that *"the recommendations on government policy framework on noise management elaborated in the 1999 Guidelines should be considered valid and relevant for the Member States to achieve the guideline values of this document"*.

AIRO interprets this to mean that the internal noise level limits given in Guidelines for Community Noise are current and the relevant limits to be used in relation to providing a reasonable noise environment inside newly built dwellings.

5.2 Guidelines for Community Noise and BS 8233:2014 Indoor Noise Level Limits

World Health Organization document Guidelines for Community Noise (ref 2) and BS 8233:2014 (ref 1) are often cited in relation to internal noise level limits. Indeed, as discussed earlier, AIRO considers that satisfying the indoor noise level limits presented in Guidelines for Community Noise should be considered appropriate in relation to satisfying the requirements of the NPPF (ref 3).

The indoor noise limits for dwellings presented in Table 4 of BS 8233:2014 are reproduced in Table 4.

Table 4 – BS 8233:2014 Dwelling Indoor Ambient Noise Level Limits

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)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

BS 8233:2014 does not set a limit for maximum noise levels but does state in notes attached to the table that the noise levels presented are based on the guidelines issued by WHO. The notes go on to state that '*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guidance 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.*'

The targets given in Guidelines for Community Noise are presented in Table 5.

Table 5 - Guidelines For Community Noise Indoor Noise Level Limits for Dwellings			
Specific Environment	Upper Limit Noise Level (dB)		
	Daytime $L_{Aeq,16h}$	Night-time $L_{Aeq,8h}$	Night-time L_{AFmax}
Indoor Living Areas	35	--	--
Bedrooms	--	30	45

It may be noted that Guidelines for Community Noise also states that

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10–15 times per night"*

It can be seen from the tables above that the indoor noise level daytime and night-time period criteria presented in the two documents align with each other and that the WHO document presents a limit for night-time L_{AFmax} events that may breached up to 10 -15 times per night whilst maintaining reasonable sleeping conditions.

6. NOISE MITIGATION

6.1 Internal Noise Level Design Targets

As mentioned in Section 5 of this report it is considered that WHO document Guidelines for Community Noise (CGN) sets out current standards with regard to noise level limits inside dwellings.

As outlined in the sections above, the limits given in GCN are that in living rooms noise levels should be no more than 35 dB L_{Aeq} during the daytime period whilst during the night-time period noise levels in bedrooms should also not exceed 30 dB L_{Aeq}.

AIRO's interpretation of the maximum noise level criteria is that the maximum noise level for individual events should not exceed 45 dB, L_{AFmax} in bedrooms at night-time more than 10 – 15 times.

6.2 Building Envelope Sound Insulation Performance

External noise may be transmitted into habitable rooms through many paths but, in general, the most significant paths to consider are through windows, through any doors or patio doors giving direct access outside, through ventilators and through the external wall itself.

The overall or composite sound insulation depends on the sound insulation of the separate elements and on their area relative to the overall area of the façade (when viewed from inside the room of interest).

The noise level in the room will also depend on the sound absorption in the room which is affected by the volume of the room and by the amount and type of furnishings.

The following guidance noise mitigation specifications are based on the measured noise levels whilst building element relative areas and internal conditions are assumed to be typical.

The assessment and guidance information is also provided based on the layouts presented in the supplied Househam Henderson drawings (ref 7).

The building envelope should be capable of providing a sound insulation performance appropriate to reduce the external noise levels to no more than the noise level design target limits.

The highest daytime L_{Aeq} free-field period noise levels for both Position A and Position B across the full survey period (weekend and weekday) was 59 dB whilst the equivalent value for the night-time period was 56 dB. The highest L_{AFmax} free-field noise level during the night-time periods was 92 dB.

Analysis of the noise measurement data indicates that the highest measured L_{AFmax} during the night-time period of 92 dB is not typical.

Taking into consideration the allowance for 10 – 15 exceedances above the indoor 45 dB L_{AFmax} requirement, AIRO considers that an external L_{AFmax} of 80 dB is more appropriate for design purposes.

To achieve the internal noise level requirement of 35 dB during the daytime period a reduction from outside to inside of at least 24 dB would be needed.

Similarly, to achieve the night-time period and maximum internal noise level requirements of 30 dB L_{Aeq} and 45 dB L_{AFmax} respectively an outside to inside reduction of at least 35 dB would be needed to satisfactorily reduce both the night time period noise level and also the typical maximum noise level.

The data provided for external fabric building elements and glazing would normally be given in relation to urban road traffic noise in the form of '$R_w + C_{tr}$' values in dB. R_w is the Weighted Sound Reduction Index in dB and C_{tr} is the Spectrum Adaptation term in dB for urban road traffic. The R_w and C_{tr} performance indices are calculated from laboratory based tests carried out in accordance with BS EN ISO 10140-2 (ref 8) (formerly BS EN ISO 140-3) and rated in accordance with BS EN ISO 717-1 (ref 9).

Overall, therefore the building envelope should be capable of achieving $R_w + C_{tr}$ attenuations of at least 35 dB.

It is understood that the current proposals are for the third floor external walls to comprise an outer leaf of nominal 100 mm facing brick, 100 mm cavity including 50 mm PIR insulation, and an inner leaf consisting of a breather membrane and sheathing on the cavity side of a 100 mm wide Metsec frame (fully filled with mineral wool insulation) finished on the room side with two layers of 15 mm plasterboard. AIRO would normally expect this form of construction to achieve an $R_w + C_{tr}$ attenuation of approximately 45 dB, in itself comfortably above the minimum needed for the building envelope.

Similarly, the roof construction will require careful selection. It is understood that the mansard roof is proposed to comprise clay roof tiles fixed via timber battens, over a breather membrane and 120 mm PIR insulation, to a timber rafters and a structural steel frame with two layers of 15 mm plasterboard fixed to the room side. AIRO would expect a construction of this type should be borderline with respect to the overall reduction required. AIRO would suggest that in order to supplement the overall reduction a 10 kg/m^3 mineral wool be included between the rafters (to fully fill the space without undue compression). With the inclusion of the mineral wool AIRO would expect this form of construction to be capable of reductions from outside to inside of around 39 dB $R_w + C_{tr}$.

The manufacturer/supplier of the preferred system(s)/product(s) should be asked to provide independent test evidence, preferably from a United Kingdom Accreditation Service (UKAS) accredited laboratory and to the appropriate standards detailed above, that their system can provide the $R_w + C_{tr}$ performance(s) required.

With the external wall constructions providing satisfactory reductions the overall sound insulation will depend on the performance of the windows and ventilators.

6.3 Windows and Ventilators Required Sound Insulation Performance

As mentioned previously, the composite sound insulation will depend on the sound insulation performance of the separate elements, their areas relative to the overall area of the façade, and also the sound absorption in the room. The following guidance is provided based on the wall and roof performances achieving the performance values expected.

We have looked at the proposed layouts and consider that the calculations should be based on a bedroom that has relatively adverse room conditions (external wall area of 8.5 m^2, window area of 4 m^2 and 33 m^3 volume of the room) and a living room that also looks to be typical or slightly adverse (mansard roof area of 9.0 m^2, window area of 4.4 m^2 and 50 m^3 volume of the room).

We have first considered the sound insulation performance of the window units assuming no ventilators are included.

Finally, the issue of ventilators has been considered by determining the minimum sound insulation required from a ventilator to avoid compromising the overall sound insulation. The sound insulation of small elements such as ventilators is specified as the $D_{n,e,w} + C_{tr}$ where the $D_{n,e,w}$ is the Weighted Element Normalized Level Difference.

In order to reduce the daytime noise levels (59 dB $L_{Aeq,16h}$) to no more than 35 dB $L_{Aeq,16h}$ in the living room a sound insulation performance of at least 24 dB from outside to inside is required from the window whether inset to the proposed external wall or mansard roof construction.

To reduce the night-time external noise levels (56 dB $L_{Aeq,16h}$) to no more than 30 dB $L_{Aeq,8h}$ and 45 dB L_{AFmax} in the bedroom a reduction of at least 35 dB from outside to inside should be provided where the external wall surrounds the window and 36 dB where the mansard roof surrounds the window.

It may be noted that the adverse room conditions of the example rooms essentially offset the enhanced performance of the external wall / mansard roof.

In order that noise transmitted via the ventilation systems does not compromise the overall internal noise levels the ventilators will need to have performances numerically 10 dB or more better than the windows.

As such the ventilation units should satisfy a performance specification of at least 34 dB $D_{n,e,w}$ + C_{tr} for the living rooms and 47 dB $D_{n,e,w}$ + C_{tr} for the bedrooms.

It is recommended that the preferred window unit supplier is asked to provide independent test evidence, preferably from a United Kingdom Accreditation Service (UKAS) accredited laboratory and to the appropriate standards detailed above, that their proposed units can satisfy the performance specifications required.

It should be noted that the evidence supporting the preferred window units should be for the entire unit that would be supplied (i.e. this should include the glazing, frame, any integral ventilation unit etc.).

6.4 Window Unit Selection Guidance

For guidance, AIRO would consider that a typical proprietary double-glazed window with 4 mm glass either side of a 6 to 16 mm sealed cavity in a conventional masonry façade is capable of providing up to 28 dB(A) attenuation against road or rail traffic noise, provided that any integral vents are closed or omitted and that all units have effective seals, that is airtight when compressed and without there being distortion to any framing. With conventional trickle vents open the performance would be expected to drop to a maximum attenuation of around 25 dB(A).

A double-glazed unit with a 10 mm glass, 12 mm sealed cavity then 6 mm glass configuration would be expected to provide up to 33 dB R_w + C_{tr}.

High specification double-glazed units incorporating laminated glass e.g. a 16.8 mm laminated glass, 16 mm sealed cavity, 16.8 mm laminated glass configuration may be capable of providing up to 42 dB R_w + C_{tr}.

Secondary glazing systems will be able to offer higher sound insulation values up to 45 dB(A) depending on the thickness of the glass used and the depth of the cavity between the primary and secondary panes. A configuration comprising 10 mm glass, 200 mm sealed cavity and 6 mm glass would be expected to provide up to 45 dB R_w + C_{tr}. The side and top reveals of the windows should be lined with acoustically absorbent material which could comprise either 15 mm proprietary mineral fibre "acoustic" tiles (with a Noise Reduction Coefficient of 0.6 or more) or 25 mm thick mineral wool of around 50 kg/m^3 density retained behind a thin perforated metal or plastic facing sheet having 20% open area.

Secondary glazed systems utilizing double glazed units for both the primary and secondary elements can offer very high sound insulation performances. As an example, a primary unit comprising 8.4 mm laminated glass, 16 mm argon filled cavity and 6 mm glass together with a secondary unit consisting of 4 mm glass, 18 mm argon filled cavity and 6.4 mm laminated glass set with a 200 mm spacing between the glass of the separate units can achieve up to 51 dB $R_w + C_{tr}$.

6.5 Ventilation System Selection Guidance

It is unlikely that window units incorporating trickle ventilation will provide sufficient sound insulation performance to satisfy the performances required for bedrooms detailed in the sections above (they may be satisfactory for living rooms). It is likely therefore that an alternative ventilation strategy will need to be selected that can appropriately provide the background ventilation requirements.

Acoustically treated ventilator units or appropriately designed whole house ventilation strategies are generally required to rooms requiring enhanced glazing.

Passive through the wall ventilation units are understood to be capable of achieving up to 52 dB $D_{n,e,w} + C_{tr}$. Comparison against the most stringent requirement of 47 dB $D_{n,e,w} + C_{tr}$ for the bedrooms indicates that passive through the wall ventilators are likely to be satisfactory.

For whichever system is selected it should be noted that any self generated noise must be maintained at a level at least 10 dB lower than the appropriate indoor noise level limit for the given room type (i.e. in addition to a suitable outside to inside sound insulation performance any self generated noise should be no more than 25 dB(A) in living areas and no more than 20 dB(A) in bedrooms).

6.6 Plant Noise Considerations

The noise level measurements carried out included the contributions from air handling plant and ducting located on the roof of Fountain House. It is our understanding that all of the air handling plant located on the existing roof is now redundant, it having served the first and second floor offices which are now vacant. As such this plant will be removed and therefore the noise levels measured during the survey may be considered likely to represent a 'worst case' scenario.

It is further understood that the only plant to remain that may have a noise impact on the proposed third floor residential units are the two restaurant extract ducts that currently terminate above the existing roof line and will be extended above the proposed third floor level roof.

For guidance a sample noise level measurement was carried out in relation to the vertical vent mounted to the rear of the building that terminates above the roof line that was witnessed to be in operation on the morning of 5 July 2016. Subjectively this was the most prominent plant noise witnessed at roof level. The measurement resulted in an overall noise level, at a distance of 1 metre away, of 55 dB L_{Aeq}.

The mitigation specifications outlined in the sections above should satisfactorily reduce this noise level to within the indoor limits outlined by WHO.

If additional measures are perceived to be required, and this has not already been carried out, we would suggest that a suitably specified silencer be introduced close to the source fans and a flexible coupler be introduced at the base of the vertical section of duct. These measures should reduce both the noise levels and also any vibration transmitted to the building facade.

We would suggest that an assessment of specific plant noise should be carried out during the detailed design stage in relation to the restaurant extract duct noise levels once further details are known to ensure that, if necessary, appropriate mitigation measures are carried out. The general noise levels measured together with the sample measurement carried out in relation to the plant noise duct indicate that appropriate noise levels should be achievable inside the proposed dwellings.

7. CONCLUSIONS

This report has presented the results of environmental noise level measurements and an assessment carried out in relation to proposed third floor level residential development at Fountain House, Welwyn Garden City.

Reference has been made to current national planning guidance and the noise level measurements have been used to provide mitigation advice aimed at satisfying the internal noise level limits outlined in World Health Organization document Guidelines for Community Noise (ref 2).

The noise assessments indicate that reasonable indoor noise levels should be achievable using standard forms of external wall and roof constructions together with enhanced sound insulation performance window and ventilation systems.

Report Approved by:

D L Watts

Eur Ing D L Watts BEng CEng FIOA
Principal Consultant

Report Author:

D J Boaden

D J Boaden BSc MInstP MIOA
Managing Consultant

REFERENCES

1. British Standard BS 8233:2014
   Guidance on sound insulation and noise reduction for buildings
   British Standards Institution, 2014

2. Guidelines for Community Noise
   World Health Organization, 1999

3. National Planning Policy Framework
   Department for Communities and Local Government, 2012

4. Planning Practice Guidance
   Department for Communities and Local Government, 2014

5. Noise Policy Statement for England
   Department for Environment, Food and Rural Affairs, 2010

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

7. Househam Henderson Drawings:

Drawing No.	Title	Date
4898 A_380 T0	Typical Roof Details	20.05.2016
4898 A_905 T0	Existing Roof Plan	03.03.2016
4898 A_163 P4	Proposed Third Floor Plan	20.02.2017
4898 A_200 T0	Proposed Elevations South & East Elevations	12.02.2016
4898 A_201 T0	Proposed Elevations North & West Elevations	12.02.2016
4898 A_210 T0	Proposed Sections	12.02.2016
4898 A_211 T0	Proposed Sections	12.02.2016

8. British Standard BS EN ISO 10140
Acoustics – Laboratory measurement of sound insulation of building elements

BS EN ISO 10140-2:2010
Measurement of airborne sound insulation

9. British Standard BS EN ISO 717
Acoustics - Rating of sound insulation in buildings and of building elements

BS EN ISO 717-1:1997
Airborne sound insulation

APPENDIX A – Measured Noise Levels

Table A1 - Noise Levels Measured at Position A - 1 to 5 July 2016				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 1 July 2016	15:00	57	54	78
	16:00	58	54	79
	17:00	57	54	70
	18:00	58	54	78
	19:00	57	53	68
	20:00	56	52	69
	21:00	55	51	71
	22:00	56	51	76
	23:00	59	51	92
Saturday 2 July 2016	00:00	54	51	74
	01:00	54	50	70
	02:00	52	48	64
	03:00	50	48	63
	04:00	51	48	65
	05:00	52	48	70
	06:00	53	49	68
	07:00	55	50	78
	08:00	56	51	70
	09:00	57	54	70
	10:00	57	54	69
	11:00	57	54	72
	12:00	57	54	74
	13:00	56	53	70
	14:00	57	54	75
	15:00	57	54	74
	16:00	67	53	102
	17:00	57	53	72
	18:00	57	52	77
	19:00	56	52	71
	20:00	55	51	66
	21:00	55	50	77
	22:00	56	51	81
	23:00	55	51	71

Table A1 - Continued

Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 3 July 2016	00:00	55	51	70
	01:00	54	50	75
	02:00	52	48	65
	03:00	50	48	64
	04:00	50	48	70
	05:00	51	48	66
	06:00	52	49	69
	07:00	55	49	69
	08:00	54	50	70
	09:00	55	51	76
	10:00	56	53	73
	11:00	57	53	70
	12:00	56	53	70
	13:00	56	53	73
	14:00	57	53	81
	15:00	56	53	72
	16:00	56	52	67
	17:00	57	52	76
	18:00	56	51	83
	19:00	55	51	75
	20:00	56	51	84
	21:00	54	51	63
	22:00	54	50	66
	23:00	54	50	78
Monday 4 July 2016	00:00	52	50	65
	01:00	51	49	61
	02:00	51	49	63
	03:00	51	49	65
	04:00	52	50	70
	05:00	53	50	69
	06:00	56	52	67
	07:00	57	52	67
	08:00	58	54	69
	09:00	57	53	71
	10:00	56	52	71
	11:00	56	53	68
	12:00	58	53	91

Table A1 - Continued

	Hour Commencing	Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 4 July 2016	13:00	56	53	71
	14:00	56	53	76
	15:00	57	53	72
	16:00	57	54	79
	17:00	58	54	87
	18:00	57	54	72
	19:00	57	53	71
	20:00	56	52	80
	21:00	56	51	70
	22:00	54	51	66
	23:00	53	49	72
Tuesday 5 July 2016	00:00	52	49	66
	01:00	52	49	63
	02:00	51	49	65
	03:00	52	49	64
	04:00	53	49	67
	05:00	54	50	69
	06:00	55	51	73
	07:00	58	53	71
	08:00	59	55	72
	09:00	69	54	94

Table A2 - Noise Levels Measured at Position B - 1 to 5 July 2016				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 1 July 2016	15:00	57	53	73
	16:00	58	53	75
	17:00	57	53	66
	18:00	58	53	82
	19:00	56	52	68
	20:00	56	52	77
	21:00	55	51	68
	22:00	56	52	80
	23:00	57	53	77
Saturday 2 July 2016	00:00	56	52	73
	01:00	55	51	79
	02:00	53	49	81
	03:00	51	49	63
	04:00	52	49	69
	05:00	53	50	66
	06:00	54	50	72
	07:00	55	50	68
	08:00	56	51	75
	09:00	57	52	69
	10:00	57	52	67
	11:00	57	52	74
	12:00	56	52	69
	13:00	56	52	72
	14:00	57	52	73
	15:00	57	53	79
	16:00	61	53	90
	17:00	57	53	78
	18:00	57	52	78
	19:00	56	52	79
	20:00	55	52	67
	21:00	56	51	82
	22:00	56	52	68
	23:00	59	54	77

Table A2 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 3 July 2016	00:00	59	55	78
	01:00	58	52	79
	02:00	53	50	73
	03:00	51	49	63
	04:00	51	49	63
	05:00	52	49	71
	06:00	52	49	67
	07:00	56	49	84
	08:00	54	49	70
	09:00	56	50	77
	10:00	57	52	67
	11:00	57	52	72
	12:00	56	52	68
	13:00	56	52	79
	14:00	57	52	78
	15:00	56	52	80
	16:00	56	51	73
	17:00	56	51	76
	18:00	56	51	80
	19:00	55	50	78
	20:00	55	50	76
	21:00	54	50	69
	22:00	53	50	71
	23:00	52	49	75
Monday 4 July 2016	00:00	52	49	67
	01:00	51	49	68
	02:00	51	49	60
	03:00	52	49	67
	04:00	52	49	69
	05:00	54	50	72
	06:00	55	51	68
	07:00	57	51	76
	08:00	58	52	75
	09:00	57	52	78
	10:00	56	51	75
	11:00	56	51	79
	12:00	57	52	80

Table A2 - Continued

	Hour Commencing	Noise Levels in dB L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 4 July 2016	13:00	57	52	70
	14:00	56	52	66
	15:00	57	53	70
	16:00	58	53	83
	17:00	58	53	71
	18:00	57	52	74
	19:00	56	51	75
	20:00	55	51	75
	21:00	55	51	69
	22:00	54	50	69
	23:00	51	48	72
Tuesday 5 July 2016	00:00	51	48	68
	01:00	51	49	63
	02:00	51	49	67
	03:00	52	49	66
	04:00	58	49	75
	05:00	58	50	80
	06:00	55	51	74
	07:00	57	52	72
	08:00	58	53	77
	09:00	70	52	95

APPENDIX B – Equipment, Calibration and Weather Details

Table B1 - Schedule of Noise Instrumentation		
Use	Type	Serial No.
Measuring System Microphone Calibrator	Cirrus CR 7.02 (Unit D) Cirrus MK 224 (Unit D) Cirrus CR 511D (Unit D)	012622 890259 014087
Measuring System Microphone Calibrator	Cirrus CR 7.02 (Unit T) Cirrus MK 224 (Unit T) Cirrus CR 511D (Unit T)	012626 89655 014086
Measuring System Microphone Calibrator	B&K 2260 B&K 4189 B&K 4231	2341172 2339504 2342748

The Cirrus systems (Units D & T) were used as the automatic data logging sound level meters at Positions A and B. The B&K 2260 system was used for the sample noise level measurement at Positions 1.

CALIBRATION

AIRO is accredited by the United Kingdom Accreditation Service as a UKAS testing laboratory No. 0483 and although the measurements carried out for this survey are not listed on our schedule of accreditation, all of AIRO's noise measurement equipment is routinely calibrated as part of the calibration regime in our Quality Manual and these calibrations are traceable to National Standards.

In addition, the calibration level of the measuring equipment was checked at the start and the end of each survey period using the appropriate calibrator for the relevant meter/system.

WEATHER CONDITIONS

Table B2 – Record of Weather Conditions		
	1 July 2016	5 July 2016
Temperature, °C	15	18
Relative Humidity, %	75	70
Wind Speed, m/s	1-2 (W)	1 (W)