REPORT TITLE:

Warrender Primary School, Ruislip, HA4 8QG– Noise Impact Assessment.

CLIENT DETAILS:

Arcadis

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1. Introduction

Pace Consult Limited was commissioned by Arcadis to undertake a noise survey and assessment of the proposed new building at Warrender Primary School, Ruislip, HA4 8QG.

The proposed new building is a single storey building located to the East of the existing School.

This report assesses also the noise impact from any mechanical services located externally within the building, in case this ventilation strategy will be considered.

This report has been prepared in accordance with national standards such as BB93, BS4142: 2014, Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas.

2. Environmental Methodology

2.1 Perception

Noise is defined as unwanted sound. Human ears are able to respond to sound over the frequency range of about 20 Hz to 20 kHz and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, and is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates to the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear. To help understand the range of noise levels which may be encountered, an indication of the level of some common sounds on the dB(A) scale is given in the table below.

Table 1 Common Sounds on the dB(A) Scale

dB(A)	Description
140	Threshold of pain
120	Jet take off at 50 metres
100	Maximum noise levels on an
80	Kerbside of a busy urban street
60	Busy general office
40	Residential area at night
20	Background in a TV and
0	Threshold of hearing

Furthermore, the perception of noise may be determined by a number of other factors, both acoustic and non-acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time.

In addition, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual receptor. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that corresponds to the response of the human ear is the A-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90}, etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) of a steady source is generally regarded as the minimum difference needed to perceive a change.

2.2 Legislation and Policy

2.2.1 National Planning Policy Framework and the Noise Policy Statement for England

The National Planning Policy Framework (NPPF) sets out the general requirements for gaining planning permission. Comments regarding noise found within the document are as follows. The planning system should prevent 'both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or NOISE pollution' (paragraph 109). It adds to this by saying that 'planning policies and decisions should aim to avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development' (paragraph 123).

The NPPF references the Noise Policy Statement for England (NPSE) which intern references two concepts used by the World Health Organisation (WHO) which can be used to ascertain relevant noise levels for individual sites. The concepts are LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). The NPPF then gives three aims to adhere to:

Aim 1 – Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Aim 2 – Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy of sustainable development.

Aim 3 – Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

To avoid 'significant adverse impacts on health and quality of life', by creating a situation where the impact of noise lies below the SOAEL the guidance contained within Building Bulletin 93 *Acoustic Design of Schools* with considerations to the provisions of BB101 *Ventilation of School Buildings* will be adhered to.

2.2.2 Acoustic design of schools: performance standards (Building Bulletin 93) February 2015.

The objective is to provide suitable indoor ambient noise levels (IANL) for
a) clear communication of speech between teacher and student
b) clear communication between students
c) learning and study activities

The IANL includes 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)
• building services (eg, ventilation systems, plant, drainage etc). If a room is naturally ventilated, the IANL is calculated and measured with ventilators or windows open as required to provide ventilation as described in section 1.1.3. If a room is mechanically ventilated or cooled, the plant should be assumed to be running at its normal operating duty.

The IANL excludes noise contributions from:
• teaching activities within the school premises, including noise from staff, students and equipment within the building or in the playground (noise transmitted from adjacent spaces is addressed by the airborne and impact sound insulation requirements)
• equipment used in the space (eg machine tools, CadCam machines, dust and fume extract equipment, compressors, computers, projectors, fume cupboards) as these noise sources are considered as operational noise, see 0.3.8
• rain noise - however, Building Regulation submissions should demonstrate that lightweight roofs and roof glazing have been designed to provide suitable control of rain noise reverberant sound pressure level in a space (calculated using laboratory test data with 'heavy' rain noise excitation as defined in BS EN ISO 140-18).

Levels during heavy rain should not be more than 25 dB above the appropriate indoor ambient noise level given in table 1 (for refurbishments, this applies only to new roofing elements and not to repairs to existing roofs). Table 1 specifies upper limits for indoor ambient noise levels in terms of LAeq,30mins during normal teaching hours. Values for refurbishment are also the minimum acceptable standards for alternative performance standards in new buildings.

Table 1: noise activity and sensitivity levels and upper limits for indoor ambient noise level

Type of room	Upper limit for the indoor ambient noise level LAeq,30mins dB	
	New build	Refurbishment
Nursery school rooms Primary school: classroom, class base, general teaching area, small group room Secondary school: classroom, general teaching area, seminar room, tutorial room, language laboratory	35	40
Open plan: Teaching area Resource/breakout area	40	45
Primary music room	35	40
Secondary music classroom Small and large practice/group room1 Performance/recital room	35	40
Ensemble room Recording studio	30	35
Control room - for recording Control room - not for recording	35	40
Lecture room	35	40
Teaching space intended specifically for students with special hearing and communication needs	30	35
SEN calming room	35	35
Study room (individual study, withdrawal, remedial work, teacher preparation)	40	45
Libraries: Quiet study area Resource area	 40 40	 45 45
Science laboratory	40	45

Type of room	Upper limit for the indoor ambient noise level LAeq,30mins dB	
	New build	Refurbishment
Design and technology: Resistant materials, CADCAM area	40	45
Electronics/control, textiles, food, graphics, design/resource area, ICT room, art	40	45
Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music)	35	40
Atrium, circulation space not intended for teaching and learning	45	50
Sports hall Dance studio Gymnasium/Activity studio	40	45
Swimming pool	50	55
Meeting room, Interviewing/counselling room, video conference room	40	45
Dining room	45	50
Administration and ancillary spaces: Kitchen Office, medical room, staff room Corridor, stairwell, coats and locker area Changing area Toilet	 50 40 45 50 50	 55 45 55 55 55

In order to protect students from regular discrete noise events, eg, aircraft or trains, indoor ambient noise levels should not exceed 60 dB L_{A1}, 30mins. This is achieved by default for spaces with IANLs up to 40 dB L_{Aeq}, 30min, but requires assessment in spaces with higher IANL limits, eg, 45 and 50 dB.

Noise from building services under normal conditions should meet the limits for indoor ambient noise levels (IANL) given in table 1.

The table 2 of BB93 recommends the IANL according to different type of ventilation.

Condition	Ventilation system	Noise level limit
Normal - ventilation for normal teaching and learning activities	Mechanical (1)	Table 1 value
	Natural (2)	Table 1 value + 5 dB (4)
	Hybrid (2)	Mechanical system noise: Table 1 value
		Total noise level: Table 1 value + 5 dB
Summertime (5) - ventilation under local control of teacher to prevent overheating – allowable during the hottest 200 hrs of the year	Mechanical	Table 1 value + 5 dB (4)
	Natural or Hybrid	≤55 dB
Intermittent boost (6) – ventilation under local control of teacher for dilution of fumes during practical activities as in practical spaces for science, art, food technology and design and technology	Mechanical	Table 1 value + 5 dB (4)
	Natural	≤55 dB

Notes: **1** The normal condition for a ventilation system with purely mechanical air supply is defined as when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,000ppm with the maximum concentration not exceeding 1,500ppm for more than 20 consecutive minutes on any day during normal school operating hours. This would normally equate to a minimum ventilation rate of approximately 8l/s per person. Mechanical ventilation in this context refers to systems (or parts of systems) that use mechanical fans to mix or drive the air including those in mechanical, hybrid, mixed mode and natural ventilation systems and in fan convector heaters.

2 The normal condition for a ventilation system in natural or hybrid mode is defined as when the system is operating to limit the daily average carbon dioxide concentration to no more than 1,500ppm with the maximum concentration not exceeding 2,000ppm for more than 20 consecutive minutes on any day. This would normally equate to a minimum ventilation rate of approximately 5l/s per person. For hybrid systems, the mechanical noise excluding external noise break in, should meet the IANL figure in table 1.

4 The +5 dB does not apply to teaching and learning spaces where the Table 1 IANL is greater than or equal to 45 dB.

5 Natural, mechanical or hybrid ventilation systems may be used to improve thermal comfort in summer at the expense of higher indoor ambient noise levels. The normal ventilation IANL can be exceeded during the hottest 200 hours in peak summertime conditions and the design should show that IANLs, defined in table 3 can be met under these conditions as well as under normal operation. The ventilation must be under the local control of the teacher so that the noise level can be reduced to normal levels when needed. This does not apply to classrooms intended specifically for students with special hearing and communication needs, or to speech therapy rooms.

6 The noise level from locally controlled intermittent boost mechanical ventilation may exceed the IANL by up to 5

2.2.3 BS4142:2014 Method for rating and assessing industrial and commercial sound

This standard sets out a methodology for the assessment of whether noise from factories, industrial premises or fixed installations and sources of an industrial/commercial nature.

The procedure contained in BS4142 for assessing the likelihood of complaints is to compare the measured or predicted noise level from the source in question, the 'specific noise level', at the assessment position with the correct background noise level for the worst case time of operation.

Where the noise contains a 'distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks or clatters), or if the noise is irregular enough to attract attention' then a range of correction factors can be added to the specific noise level as appropriate to obtain the 'rating level'.

As this is a prescriptive report prior to plant installation, overall rating noise levels will be specified for the new installation. Compliance with the rating value will be necessary to provide evidence that significant adverse impact has been avoided as required by the NPSE.

To assess the likelihood of complaints, the measured background noise level is subtracted from the rating noise level. BS4142 states:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (See Clause 8) from the rating level (see Clause 9) and consider the following.

a) Typically the greater the difference, the greater the magnitude of the impact.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around 5dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

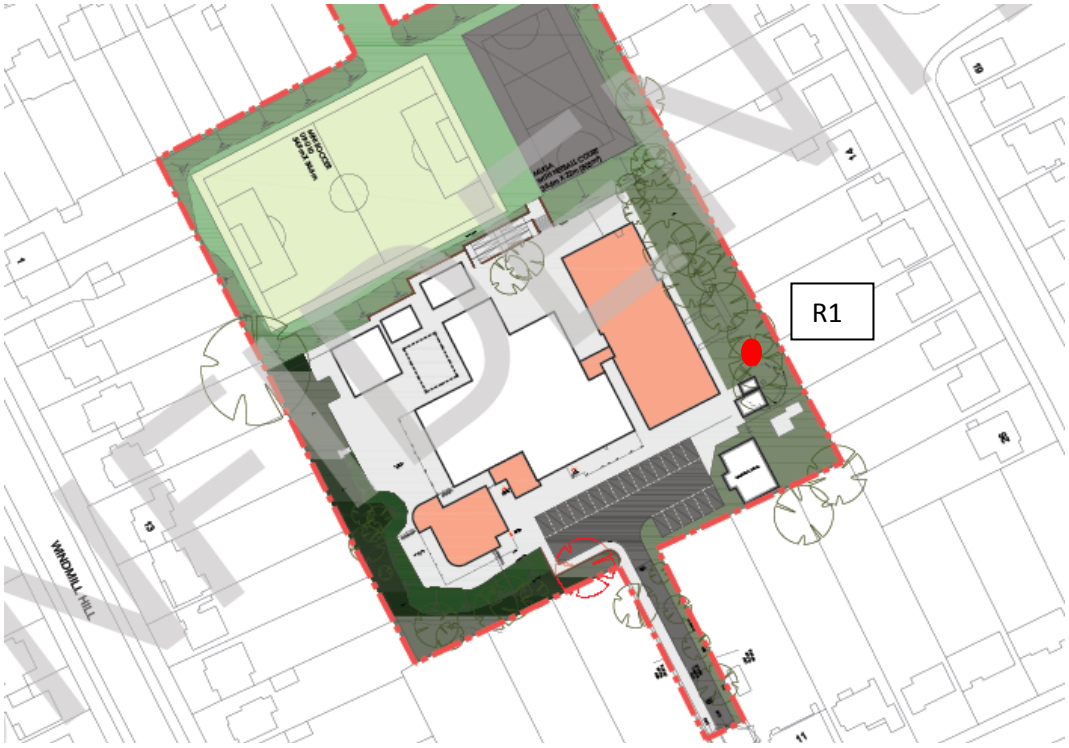
3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;

i) Façade sound insulation treatment

ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and Acoustic screening.

3. Noise Survey Details

The noise survey was carried out on site on Wednesday 28th and Thursday 30th September 2016. Survey location (R) is indicated on the aerial image below.



The noise levels at the measurement positions (R) are representative of the existing noise climate affecting the proposed development, and are also representative of the noise climate affecting the nearby noise sensitive receptors.

The survey was carried out at a height of 1.5 metre above local ground in accordance with the principles of BS 7445:1997 Parts 1-3, 'Description and Measurement of Environmental Noise'. The climatic conditions during the noise surveys were warm with light winds (< 2m/s).

All measurements were made with calibrated precision grade sound level meters (Svantek: Serial no 34927) which achieve the requirements of BS EN 61672: 2003.

The sound level meter was calibrated before and after the measurement period using a Norsonic 1251 calibrator, no significant drift had occurred.

The table below shows the measured data.

Table 2 Environmental Noise Data				
Position	Time period	LAeq $_{30\ min}$ dB (Log average)	LA90, 15 min dB Lowest measured	LA1$_{30\ min}$ dB 90th Percentile
R1	Day(07:00-18:00)	49	42	57
	Evening (18:23:00)	44	38	53
	Night (23:00-07:00)	43	35	52

The lowest measured background is shown in the above table. These levels are considered to be representative of the levels affecting the nearest noise sensitive receptor.

The table below includes the highest LAeq,$_{30\ min}$ and LA1$_{30min}$.

Table 3 Environmental Noise Data			
Position	Time period	LAeq $_{30\ min}$ dB (Log average)	LA1$_{30\ min}$ dB
R1	Day(07:00-18:00)	50	57

4. Noise from mechanical plant

The noise impact of items of plant and fixed installation has been determined in accordance with BS4142: 2014 and with Local Authority requirements.

Noise levels generated by mechanical plant and experienced by local receptors depends upon a number of variables, the most significant of which are:

- the noise generated by plant on site, generally expressed as sound power levels (SWL);
- the distance between the noise source and the receptor;
- the attenuation due to ground absorption, atmospheric and barrier effects; and
- the periods of operation of the plant on the site, known as its “on-time”.

Based on the above criteria, the plant limit is set up in the below table.

Table 4: Summary of the recommended Noise Rating Level dB	
Period	Recommended Rating Noise Level $L_{Ar,\ T}$ (dB)
Day Time	42
Evening Time	38
Night Time	35

Note: *Where the noise contains a ‘distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or humps), or if the noise is irregular enough to attract attention’ then a correction of up to 6 dB is added to the specific noise level to obtain the ‘rating level’.*

There are a number of measures that can be introduced to control noise from the mechanical and fixed plant installation associated with the proposed development. Consideration should be given to reducing noise at point of generation (e.g. by selecting quiet plant) or containment of noise generated (e.g. by insulating buildings which house machinery and/or providing purpose-built barriers around the site).

5. Indoor ambient noise levels.

Internal noise levels within the proposed new building are based on the requirements specified in table 1 of BB93 February 2015.

The assessment results show that the sound levels affecting the proposed building are low, and therefore natural ventilation via openable window can be used as a main ventilation strategy. The table below includes a noise intrusion calculation based on the sound reduction offered by a single sided window.

Table 5 Environmental Noise Data R2

Position	Time period	LAeq dB (Log average over 30 minutes period)	Sound reduction offered by a single sided window	Classroom Internal sound levels dBA
R1	Day(07:00-18:00)	50	16	34

As can be seen from the table above the internal sound levels in the classrooms are below the recommended levels by BB93 (LAeq 35 (Internal noise levels in classrooms) + 5 dB = LAeq 40 dB)

Note that BB93 states that when the classroom is natural ventilated the internal sound levels in Table 1 can be relaxed by 5 dB.

The LA1 noise levels are also below the recommended levels of 60 dB LA1.

Regarding external noise levels BB93 recommends that for new schools, 60 dB LAeq,30min should be regarded as an upper limit for external noise at the boundary of external areas used for formal and informal outdoor teaching and recreation. Noise levels in unoccupied playgrounds, playing fields and other outdoor areas should not exceed 55 dB LAeq,30min and there should be at least one area suitable for outdoor teaching activities where noise levels are below 50 dB LAeq,30min.

Based on the above recommendation, the noise survey shows that the levels affecting the proposed school meet the recommended criteria.

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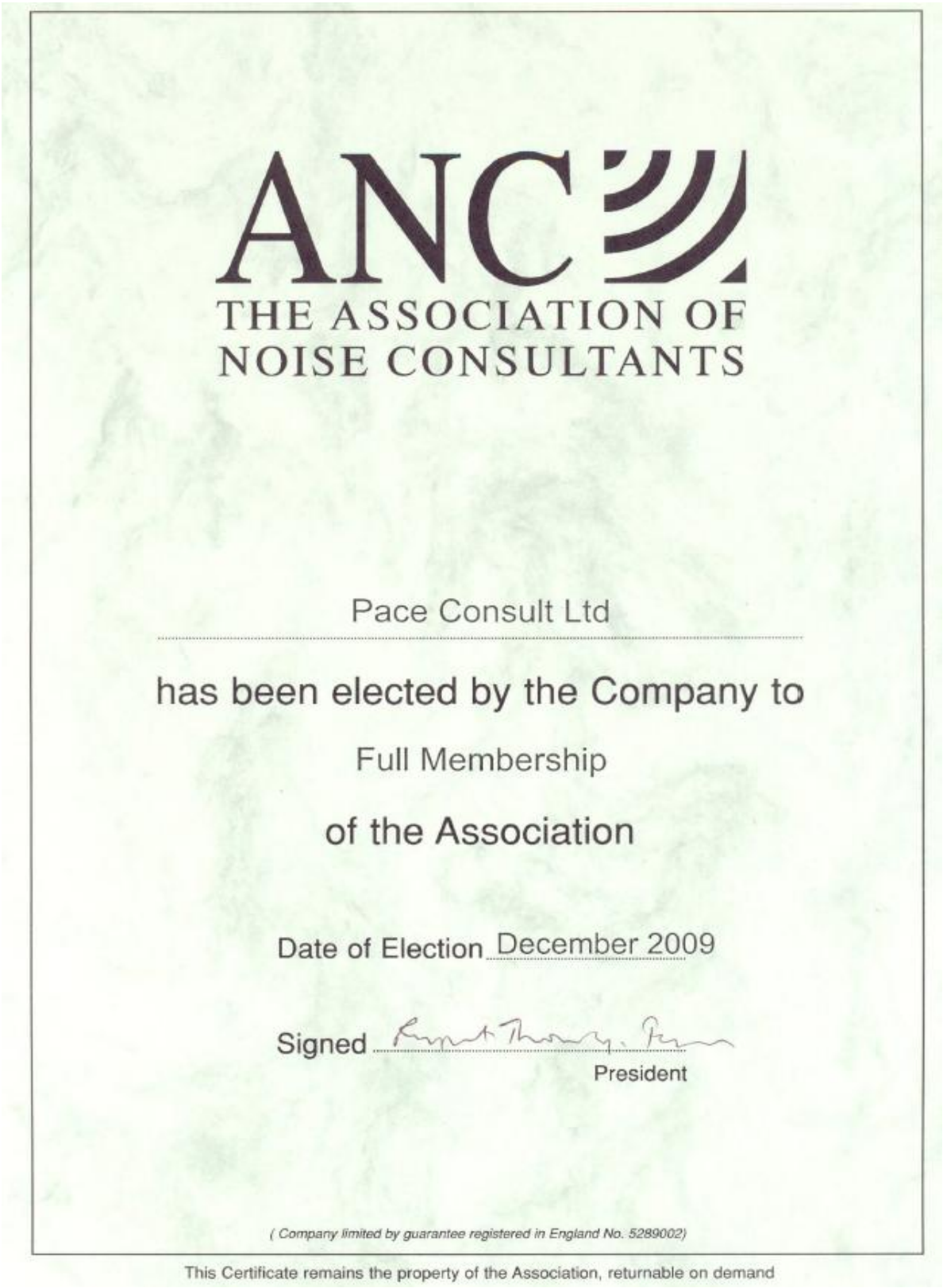
6. Conclusions

Internal noise levels within the new proposed building will be achievable via openable windows.

Plant noise limiting criteria has been proposed based on the lowest measured background levels which are representative of the levels at the nearest noise sensitive receptor.

Appendix 1 – ANC Accreditation



ANC

THE ASSOCIATION OF NOISE CONSULTANTS

Pace Consult Ltd

has been elected by the Company to

Full Membership

of the Association

Date of Election December 2009

Signed

President

(Company limited by guarantee registered in England No. 5289002)

This Certificate remains the property of the Association, returnable on demand