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Dennis Harley Developments Ltd

Proposed Residential Development at (former) Mecca Bingo Hall Dean Road South Shields

Assessment of Noise Levels and Noise Amelioration Measures

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APPENDICES

SUMMARY

This report presents assessment of noise affecting the proposed residential development at the former Mecca Bingo Hall, Dean Road, South Shields.

The main purpose of the report is to

- present all measured noise levels **(Sections 3 & 4)**
- use measured noise data to determine noise exposure of proposed residential units **(Section 5)**
- detail appropriate noise amelioration schemes (enhanced building envelope sound insulation and/or screening) where necessary **(Section 6, in particular Table 4).** Table 4 defines numerous options for the configuration of the appropriate sound insulation performance of the building envelope. All these options, by full calculation (BS8233 detailed method, Annex G.2) show that the appropriate target noise levels within the proposed housing will be met.
- The final choice of noise amelioration inclusions (to be determined by developer) should ultimately be submitted to the Local Planning Authority for approval.

Subject to final definition and the subsequent provision of noise amelioration measures, the residents of the proposed dwellings will be provided with acceptable internal and external (private amenity areas) noise environments, in line with all current guidance.

1 INTRODUCTION

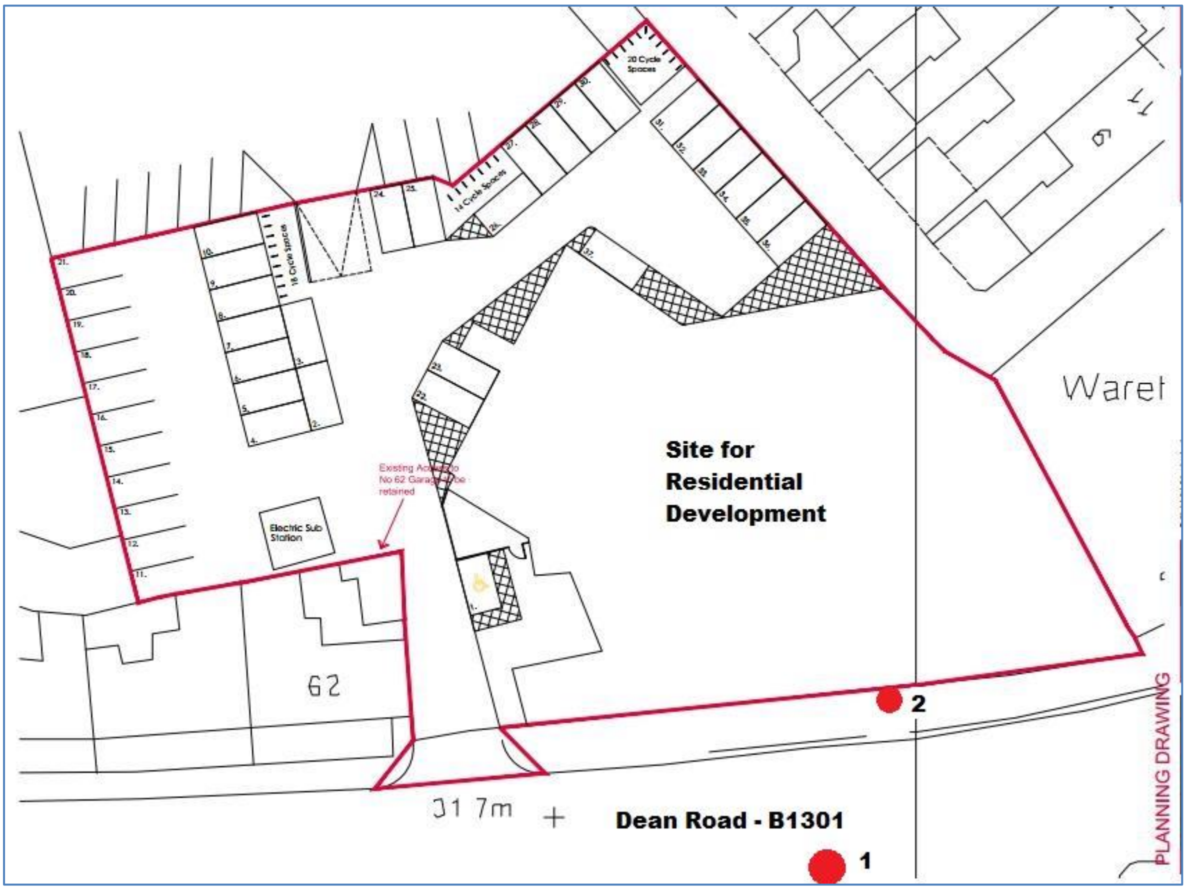
1.1 Context

1.1.1 Dennis Harley Developments Ltd have commissioned a noise assessment at a proposed residential development site (see Figure 1) at the former Mecca Bingo Hall Dean Road South Shields.

1.1.2 The noise climate at the site is influenced by road traffic noise from the busy Dean Road (B1301) directly outside. Detailed noise measurements were carried out on Thursday 21 July 2016.

1.1.3 The purpose of the assessment is to determine the existing noise climate at the site and consider all noise amelioration measures and sound insulation measures likely to be relevant to the site and building envelope such that the appropriate noise levels due to various sources may ultimately be achieved.

Figure 1: Site Location



2 LEGISLATIVE FRAMEWORK AND PLANNING POLICY

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework (NPPF) came into force in March 2012 and superseded numerous planning guidance and policy documents. The NPPF does not provide specific policies or define noise limits, but rather is intended to enable the planning system to support the Government's aims and objectives with respect to sustainable development, and provides a general framework within which planning applications for development "*must be determined in accordance with the [Local] development plan*".

2.1.2 The NPPF states that "*the planning system should contribute to an enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*".

2.1.3 The NPPF represents the Government's commitment in favour of sustainable development, through its intention to make the planning system more streamlined, localised and less restrictive.

2.1.4 Additional national planning guidance is provided in the Government's Noise Policy Statement for England (NPSE – "the Noise Policy"), to which the framework makes specific reference as the main source of national guidance on planning and noise.

2.1.5 The Noise Policy has a long term vision to "*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 vision is supported by three key aims intended to promote sustainable development with respect to noise so that *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

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

2.1.6 The Noise Policy recognises that it is not currently possible to define a single objective noise level having specific effects on people, hence the emphasis on "*promoting*" improvements to health and quality of life though effective management of noise, considered in the context of the wider environment and factors other than noise.

2.1.7 No specific criteria are provided by the NPPF or the Noise Policy to enable planning decisions to be made. In the absence of such guidance, the assessment of external noise levels for acceptable amenity criteria has been undertaken in consideration of the guidance provided in British Standard BS 8233: 2014 *Guidance on Sound Insulation and Noise reduction in buildings*.

2.1.8 This Standard provides, not only advice on acceptable external noise levels, reflecting those given in the World Health Organisation's 1999 *Guidelines for Community Noise*, but also advises on suitable design specifications for building envelopes to achieve suitable internal noise levels.

2.2 BS 8233: 2014 Guidance on Sound Insulation and Noise reduction in buildings

2.2.1 BS 8233 defines a range of ambient noise levels for design criteria, such that suitable conditions are achieved in certain internal and external environments. The noise levels that normally satisfy these criteria for most people are defined in Table 1.

Table 1: Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living rooms	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 $L_{Aeq,8hour}$

2.2.2 The levels shown in the table are based on the existing guidelines issued by the WHO and are based on annual average data and do not have to be achieved in all circumstances. For example it is normal to exclude occasional events such as fireworks night or New Year's Eve.

2.2.3 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting internal noise level.

2.2.4 The advice provided states that where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5dB and reasonable internal conditions still achieved.

2.2.5 It is considered desirable that external areas that are used for amenity space, such as gardens and patios that noise levels do not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$. However, it is also recognized that these guideline vales are not achievable in all circumstances where development might be desirable. Therefore, development should be designed to achieve the lowest practicable levels in these external amenity areas, but not prohibited.

2.3 WHO Guidelines for Community Noise

2.3.1 In 1999 the World Health Organisation proposed Guidelines for Community Noise. The scope of the WHO's effort to derive guidelines for community noise was to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

2.3.2 The guidelines suggest that during the daytime, few people are highly annoyed at L_{Aeq} levels below 55 dB(A), and few are moderately annoyed at L_{Aeq} levels below 50 dB(A). Sound levels during the evening and night should be 5–10 dB lower than during the day. For intermittent noise, it is emphasized that it is necessary to take into account both the maximum sound pressure level and the number of noise events.

2.3.3 Table 2 presents the various guideline values for community noise in various situations.

Table 2: Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	dB L_{Aeq}	Time period (hours)	L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, night-time	45	8	60

2.3.4 Indoor guideline values for bedrooms are 30dBL_{Aeq} for continuous noise and 45dBL_{Amax} for single sound events which correlates with the "good" criteria in BS8233. Lower noise levels may be disturbing depending on the nature of the noise source. At night-time, outside sound levels about 1 metre from facades of living spaces should not exceed 45dBL_{Aeq}, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dB. To enable casual conversation indoors during daytime, the sound level of interfering noise should not exceed 35dBL_{Aeq}.

3 SURVEY DETAILS

3.1 Instrumentation and weather conditions

3.1.1 The equipment used during the surveys is detailed in Appendix B and is fully compliant with that specified as Type 1 in British Standard BS EN61672 - 1: 2003: “*Electroacoustics. Sound level meters Specifications*.”

3.1.2 All the statistical analysis was directly carried out within the Sound Level Meter to yield Equivalent Continuous Noise Levels (Leq), Percentile Noise Levels (L_1,L_{10},L_{50},L_{90},L_{99}) and maximum/minimum (MAXL, MINL) noise levels during the measurement periods.

3.1.3 On-site calibration checks were performed before and after all measurements with no variation in calibration level observed. Equipment was also within a valid period of laboratory calibration.

3.1.4 The sound level meter was mounted on a tripod with the microphone 1.4m above the immediate ground level, where appropriate and positioned at least 3.5m from any reflecting surface.

3.1.5 A windshield was fitted over the microphone at all times during the survey periods to reduce the effects of any wind induced noise.

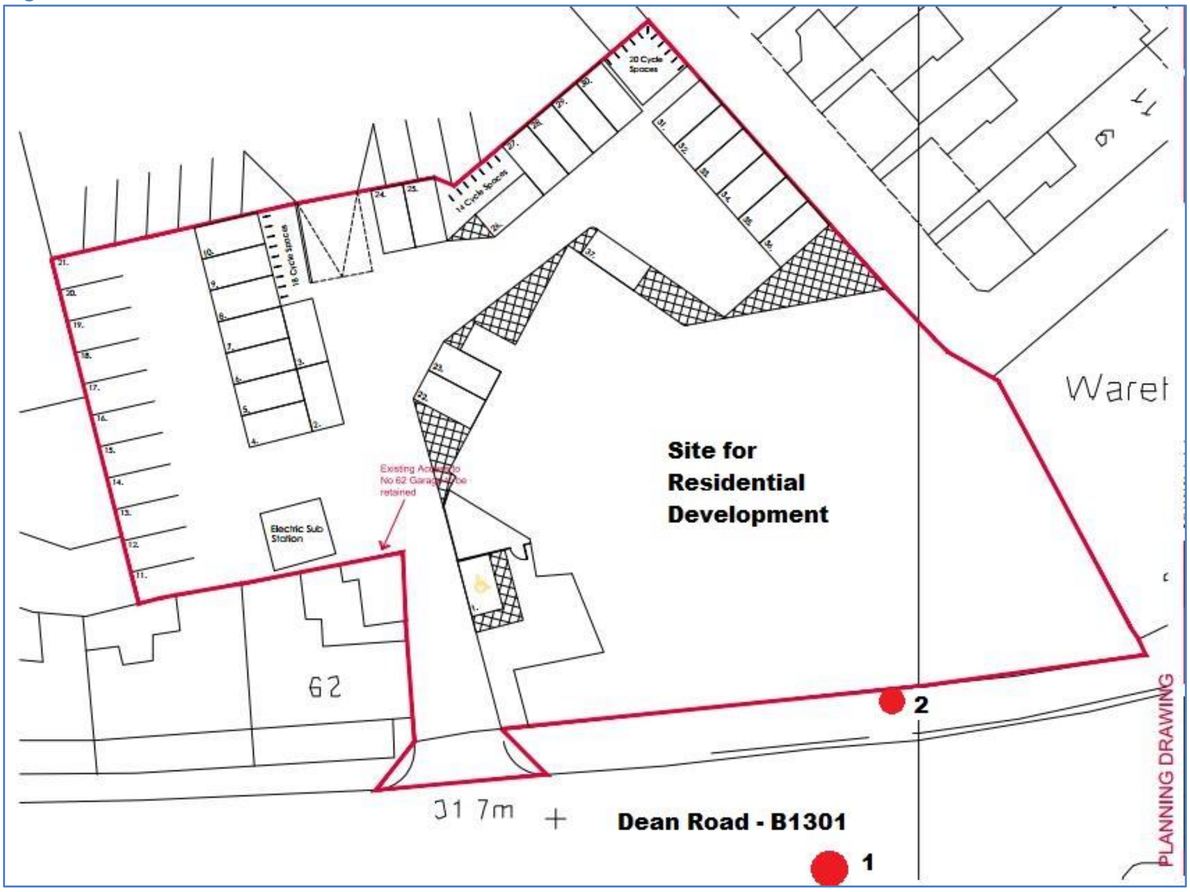
3.1.6 The average daytime temperature was 21^{o}C with a light south westerly breeze, less than 2m/s. There was no precipitation or wet roads during the survey periods.

3.2 Noise monitoring locations

3.2.1 Noise measurements were made at 2 measurement positions (see Figures 1 & 2 and Photographs 1 – 2) to assess the road traffic noise. Measurement positions and procedures are described below.

3.2.2 As the development building (to be residential at 1st Floor and above) is close to the road with no windows at 1st Floor level, Positions 1 & 2 were selected at roadside positions (2 metres from the road). Noise levels at higher floors could then be estimated according to well documented and reliable procedures.

Figure 2: Measurements Positions



Photograph 1: Position 1: 10m from A1068 – clear view

Photograph 2: Position 1: 10m from A1068 – clear view

3.3 Noise measurement procedure

Road Traffic Noise Measurement

3.3.1 For road traffic noise assessment, various statistical noise measurements, including A-weighted Equivalent Continuous Noise Levels and A-weighted Percentile Noise Levels were taken on Monday 25 July 2016. Measurements were made in consecutive hours between 11:00hrs and 14:00hrs.

3.3.2 The above procedure is sufficient to reliably determine 3 consecutive hourly values of LA_{10}, in accordance with the “shortened measurement procedure” as described in Calculation of Road Traffic Noise (Ref 3, para 43). As noise at all main measurement positions was dominated by noise from the moderately busy B1301, a sampling time of 5 - 10 minutes in each hour was sufficient (CRTN Ref 3, para 41.2).

4 RESULTS

4.1 Road Traffic Noise

4.1.1 Measured noise levels at both measurement positions are given in Table 3. Equivalent Continuous Noise Levels (LA_{eq}), Percentile Noise Levels (L_{10}, L_{90}) and Maximum/Minimum noise levels during the measurement periods are noted. Measurement Positions in relation to the proposed development are shown in Figure 2.

Table 3:
Noise Survey Results

Position	Start Time	Duration	Statistical Noise Parameter, dB(A)					LAeq
			LASMax	LA10	LA90	LAFMin	LAeq	(16hr)
1 (Free Field)	25/07/2016 11:28	00:10:55	79.9	73.4	66.3	52.3	69.6	
	25/07/2016 12:04	00:12:34	83.5	72.3	65.6	55.0	69.0	**70**
	25/07/2016 12:39	00:10:02	76.7	71.5	65.4	54.3	68.0	
	25/07/2016 13:01	00:05:35	83.4	73.1	65.8	52.6	69.7	
2 (Free Field)	25/07/2016 11:42	00:10:12	82.8	74.4	67.2	52.2	70.9	
	25/07/2016 12:24	00:10:24	76.4	73.3	66.6	54.7	69.1	**71**
	25/07/2016 13:10	00:05:46	79.0	73.7	65.9	53.5	69.4	

LA_{eq}(16hr) Calculated according to guidance of PPG24 (Ref 1) and CRTN (Ref 2)
LA_{eq}(16hr) = LA_{10}(18hr) – 2 = (LA_{10}(3 hour Daytime average) – 1) – 2
Although PPG24 is revoked the calculation methods are still valid

4.1.2 All measurement positions are ~2 metres from kerb edge as no other positions were possible and, under the circumstances, enable dependable extrapolation to noise levels at greater distances according to accepted methods.

5 DISCUSSION

5.1 Summary of Expected Noise Exposure of Proposed Development

Road Traffic Noise:

5.1.1 A summary of the above for the effects of road traffic at closest proposed residential facades to the B1301 would be:

LA_{eq}(16 hour Daytime, Facade)	**up to**	**70 dB(A)**
LA_{eq}(8 hour Night Time)	**less than**	**65 dB(A)**
Maxima	**up to**	**80 dB(A)**

5.1.2 The above detailed results (Table 2) enable reliable assessment of the noise levels affecting the proposed development (as shown in Figures 3 – 4).

5.2 Façade and Amenity Space Noise Levels

5.2.1 Discussions and assessments below relate to the scheme as shown in Figures 3-5 (1st, 2nd and 3rd Floors). Expected façade noise levels (LA_{eq}(16hr, Daytime)) and Maxima are summarised.

5.2.2 Subsequent discussions of relevant noise amelioration measures refer to these noise levels.

Figure 2: Proposed Development – Expected Facade Noise Levels – 1st Floor

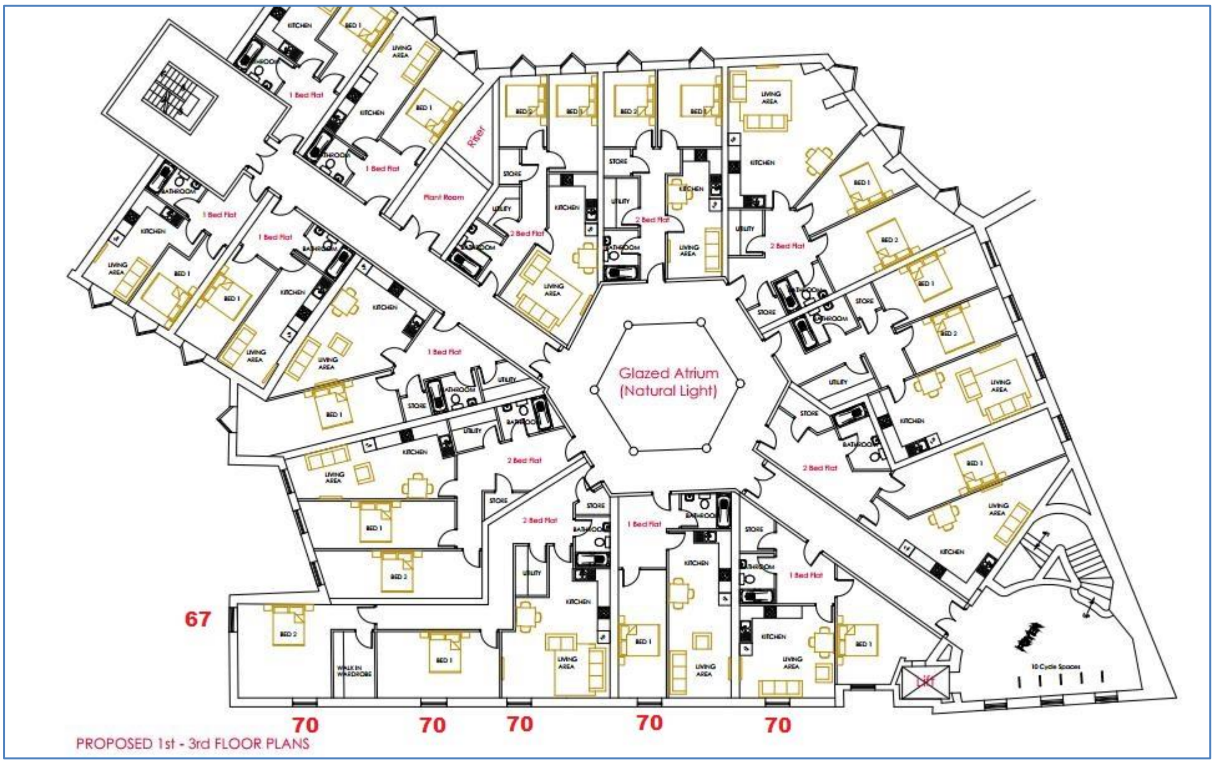


Figure 4: Proposed Development – Expected Façade Noise Levels – 2nd Floor

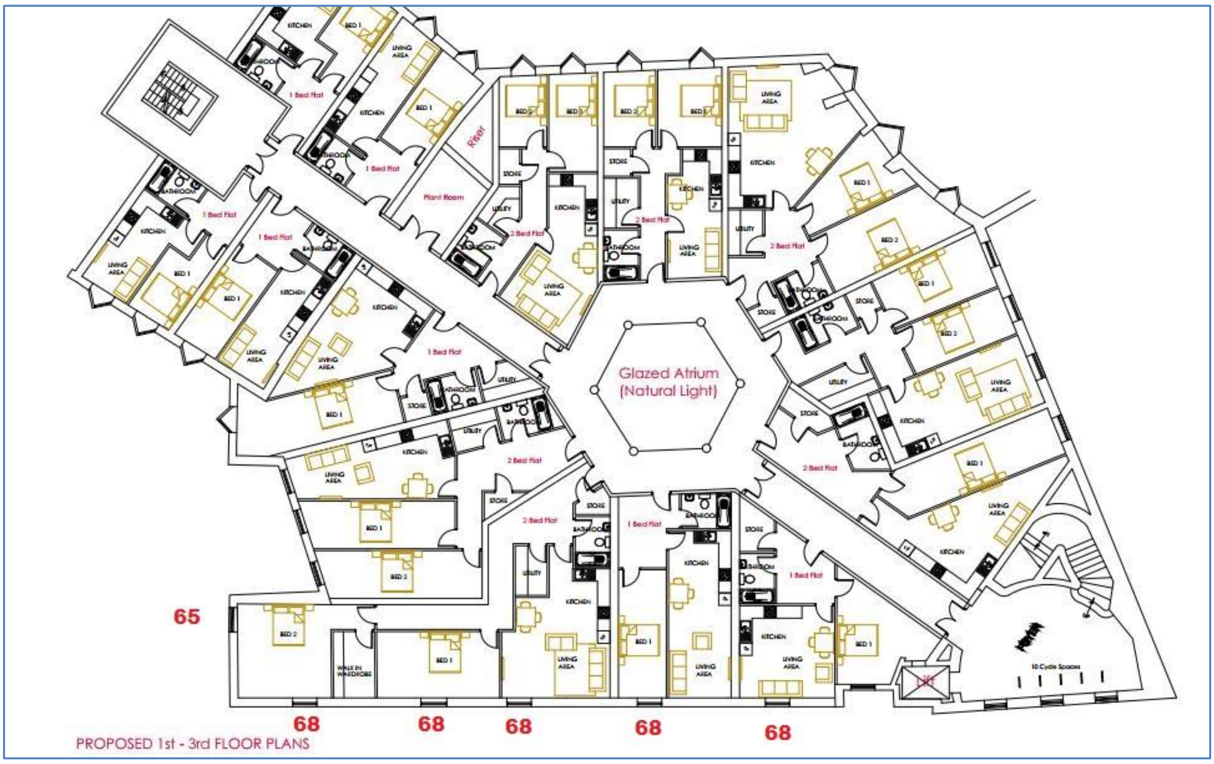
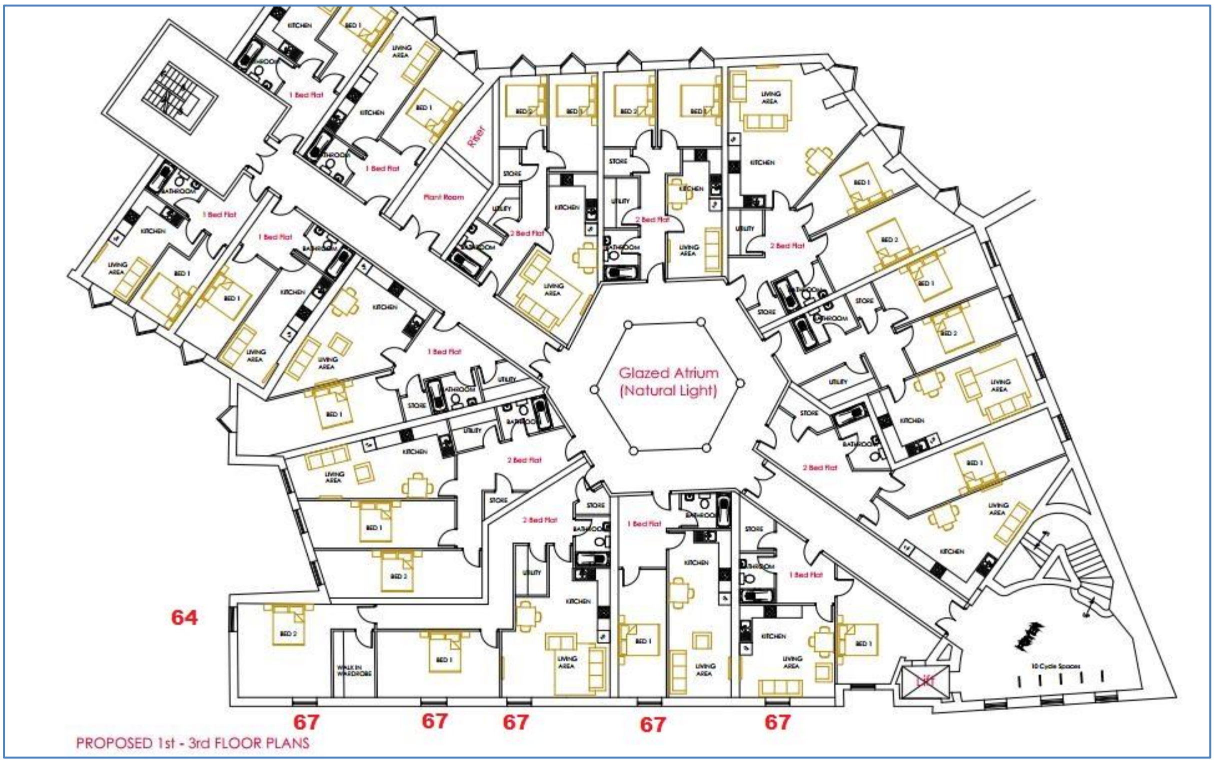


Figure 4: Proposed Development – Expected Façade Noise Levels – 3rd Floor



5.3 Summary of Design Criteria

5.3.1 The following are working design criteria for residential parts of this proposed development:

Resting Rooms	**LA_{eq}(16hr Daytime) < 35dB(A),**
	LA_{eq}(8hr Night Time) < 30dB(A)
Living Rooms	**LA_{eq}(16hr Daytime) less than 35dB(A)**
Amenity Gardens	**LA_{eq}(16hr Daytime) less than 55dB(A)**
Maxima	**LA_{Max}(Night Time) not generally exceeding 45dB(A)**

5.3.2 As night time noise levels will be at least 5dB(A) less than daytime, meeting the above criteria for daytime hours will automatically ensure appropriate night time conditions.

5.3.3 Noting the results of the noise survey and hence the noise levels affecting the site as proposed (Section 5 and Figures 3 & 4), ensuring these criteria are met will require some attention to noise screening on site and to noise amelioration measures of the building envelope and windows exposed to noise levels shown in red in Figures 3 and 4.

5.3.4 Recommended enhancements to sound insulation of the building envelope in these instances are discussed below in Section 6.

6 NOISE AMELIORATION MEASURES

6.1 Building Envelope Sound Insulation

6.1.1 The recommendations of this report for relevant noise amelioration define various possible combinations for wall, glazing, ventilation (acoustic parameters) and roof/ceiling construction, all of which should enable the guidance criteria defined above to be met.

6.1.2 Options given in this section (see Table 4) are based on calculations of resultant noise levels in habitable rooms as dependent upon measured/estimated external façade noise levels (Sections 4 & 5) and the insulation properties of the wall, glazing, roof/ceiling and ventilation. These calculations are based on typical habitable rooms with 2.5M^2 glazed area and a room volume of 50M^3 and "reverberation time" of 0.7 seconds.

6.1.3 The calculations are all carried out according to the full calculation method of BS8233:2014 (Annex G.2). Each insulation option identified within Table 4 (i.e. every row of the table defining glazing performance, ventilator acoustic performance and roof/ceiling type) should, according to the calculation procedure, enable the appropriate guidance criteria to be met.

6.1.4 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and, therefore, must be finally defined by the developers/architects. Only relevant recommendations for relevant combinations which may be expected to meet the acoustic requirements can be provided. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

Glazing

6.1.5 The weakest part of a building façade in terms of sound insulation is generally the glazed areas and windows are the main point of entry for external noise into a dwelling. The insulation of various glazing configurations has been assessed by reference to the Sound Insulation Index dB(R_w) and it's inclusion within the BS8233:2014 full calculation method, which takes into account an increased low frequency content usually associated with road traffic.

Ventilation

6.1.6 Enhanced glazing must be closed to provide the required benefit and it is consequently necessary to provide the required ventilation by suitably sound attenuated means.

6.1.7 The acoustic rating of such ventilators, when assessed as a façade element, is specified in terms of dB($D_{ne,w}$).

Roof Construction

6.1.8 In high noise level situations it is also necessary to ensure that roof/ceiling constructions also provide sufficient sound insulation in way of top floor habitable rooms.

6.1.9 Typical pitch roof constructions are categorised in guide calculations as 4 alternatives:

1 single ceiling boarding no mineral wool
2 single ceiling boarding with 100mm mineral wool
3 double ceiling boarding with 100mm mineral wool
4 double ceiling boarding with 100mm mineral wool solid layer (19mm ply) under tiles/felt.

6.1.10 Other roof constructions (e.g. flat roof) may be included in guide calculations according to their estimated or specified performance levels **dB(R_W).**

6.1.11 In this instance, roof construction is unlikely to be an issue as the building roof will be screened from road noise due to the building itself.

Walls

6.1.12 Walls, usually masonry, provide good sound insulation such that they need not be considered in relation to the above.

6.1.13 However, for lightweight walling construction methods (e.g. curtain walling) due attention must be given to design for appropriate sound insulation.

6.1.14 These may be included in guide calculations according to their estimated or specified performance levels dB(R_W).

6.2 Range of Building Envelope Recommended for this Development

6.2.1 Building envelope sound insulation enhancements that are recommended for those facades of this development subject to significant noise levels, as identified in Figures 3 - 5 (noise levels shown in red), are given in Table 4.

6.2.2 It is important to note that Table 4 details effective sound insulation enhancements:

- Glazing (configuration and acoustic performance, **dB(R_W)**)
- Ventilator (acoustic performance, **dB($D_{ne,W}$)**)
- Roof/Ceiling (as Type 1, 2, 3 or 4) – if top floor and pitch roof

As dependent upon

- External Façade Noise Level (left hand column) – dB(A) (as in Figure 3 - 5)

6.2.3 The resultant internal noise level (reverberant within receive room) is given in the right hand column of Table 4. In all cases these will be below the relevant guidance target level.

6.2.4 Any of these options, or equivalent performance configurations, may be used.

6.2.5 The architect/developer may choose the options (or equivalent) that best suit their development.

6.2.6 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and, therefore, must be finally defined by the developers/architects. Relevant recommendations can only be provided for relevant combinations which may be expected to meet the acoustic requirements. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

Table 4:

Building Envelope Enhanced Insulation Options

External Noise Level dB(A)	Glazing Config Glass/Cavity/Glass	Glazing dB(Rw)	Ventilator dB(Dnew)	Ceiling Roof (*)	External Internal Reduction dB(A)	Internal Noise Level dB(A)
70	6mm/100mm/4mm	46	48	3	37.3	**33**
70	10mm/12mm/6.4mm PVB	40	45	3	35.8	**34**
70	10mm/12mm/6mm	38	43	3	34.6	**35**
68	6mm/100mm/4mm	46	48	3	37.3	**31**
68	10mm/12mm/6.4mm PVB	40	45	3	35.8	**32**
68	10mm/12mm/6mm	38	43	3	34.6	**33**
68	10mm/12mm/4mm	36	41	3	32.8	**35**
67	10mm/12mm/6.4mm PVB	40	45	3	35.8	**31**
67	10mm/12mm/6mm	38	43	3	34.6	**32**
67	10mm/12mm/4mm	36	41	3	32.8	**34**
65	10mm/12mm/6mm	38	43	3	34.6	**30**
65	10mm/12mm/4mm	36	41	3	32.8	**32**
65	6mm/12mm/6.4mm PVB	34	39	3	30.9	**34**
64	10mm/12mm/4mm	36	41	3	32.8	**31**
64	6mm/12mm/6.4mm PVB	34	39	3	30.9	**33**
64	6mm/12mm/6mm	33	38	3	30.0	**34**

(PVB) Standard Laminated Glass (or equivalent)
(*) Roof/Ceiling Type (e.g. 3 = Double Boarded Ceiling plus Absorbently Lined Loft Cavity) (See Section 7.1)

6.2.7 Different glazing options may be used to achieve the same insulation performance (dB(R_W)). In general, for small cavity glazing (~12mm) reduction to 10mm cavity, to accommodate frame rebate sizes, would not be significant in terms of noise reduction. Other glazing configurations giving equivalent performance would be acceptable. In all cases windows may be openable but should be well sealed when closed. Ventilation systems should allow the appropriate air change capability (other than "purge ventilation" which may be achieved by opening windows) without resort to open (or partially open) windows.

6.2.8 It is recommended that consideration is given to using the better options, particularly where window sizes are relatively large.

6.2.9 Night time noise levels will be reduced by at least 5dB(A) such that the above glazing configuration will provide for equally acceptable night time conditions as all internal

Night Time Noise Levels will be reduced to below 30dB(A) and worst case Maxima will be below 45dB(A).

Table 4 - Important Note:

The right hand column is the resultant internal noise levels due to the external Façade Noise Level (left hand column).

For a façade with External Level - (marked in Red in Figure 3 - 5)
Select required amelioration package for External Level - Column 1
(May be any of the options or equivalents)

Possible amelioration configurations are detailed on row - Columns 2, 3, 4, 5

Overall estimated noise reduction External to Internal - Column 6

Resultant Noise Level within room is given - Column 7
(These are ALL below the required (Guidance) noise limit)
(The most suitable, or otherwise equivalent, maybe selected)
(Different configurations will require calculation to show acceptable performance)

Glazing/Walls – Explanatory Notes

6.2.10 The above calculations are based upon a glazed area of $2.5m^2$ in standard masonry walls. If the design departs significantly from this, such as curtain walling or significantly larger glazed areas then this should be taken into account in determination of the final scheme. “Curtain Wall” makeup should be designed to provide for at least $50dB(R_w)$ Sound Insulation.

Roof/Ceilings – Explanatory Notes

6.2.11 In this instance, roof construction is unlikely to be an issue as the building roof will be screened from road noise due to the building itself.

Ventilation – Explanatory Notes

6.2.12 For habitable rooms with windows in facades subject to the noise levels identified in Table 4, ventilation systems enabling adequate ventilation without recourse to open windows to noisy facades should be incorporated. Suppliers should be informed of the overall reduction required (Table 4, Column 6).

6.2.13 The reductions will typically require ventilation units or schemes to provide a sound reduction of 38 - 48 $dB(D_{ne,w})$ or better (as identified in Column 4) (See Appendix D for supplier list).

6.2.14 Table 4 is recommended for guidance and suppliers may offer alternative solutions based on the noise data provided within this report.

6.2.15 L A Environmental are unable to make recommendations for the specification of ventilation systems in relation to The Building Regulations Part F (Ventilation – Approved Document F). It is our understanding that if wall or window mounted ventilators are used they should provide the above level of acoustic insulation (dB($D_{ne,W}$)) whilst still providing the basic ventilation requirements (i.e. non-purge situations) for each habitable room for which they are required. It is our understanding that a passive ventilation unit will provide for sufficient ventilation in circumstances such as these. Should a purge ventilation requirement arise then windows may be opened in the normal manner.

6.2.16 Reputable suppliers will usually provide a free design service to satisfy both acoustic and ventilation requirements (see Appendices D & E). The noise levels detailed in this report should enable them to configure and recommend appropriate ventilation solutions.

7 CONCLUSIONS

7.1.1 A noise assessment has been carried out for the proposed residential development of the former Mecca Bingo Hall, Dean Road, South Shields.

7.1.2 Prevailing noise levels (road traffic) have been measured in detail and assessed according to representative "worst case" conditions. Detailed noise measurement has been carried out on a typical weekday. All potential issues with regard to noise and the resulting noise exposure may be ameliorated. The measured data presented allows the full and appropriate assessments.

7.1.3 On the basis of the proposed layout to date, noise amelioration measures for appropriate enhancement of the sound insulation of the building envelope of noise affected facades have been recommended. These have been assessed according to "worst case" noise levels estimated on the basis of the detailed noise measurement.

7.1.4 Recommendations for appropriate noise amelioration measures are given in Section 6 (in particular Table 4 cross-referenced to Figures 3 - 5). These relate to the inclusion of additional sound insulation measures in the building envelopes at those facades affected by road traffic noise. Subject to final definition and the subsequent provision of noise amelioration measures, as discussed above, the residents of the proposed dwellings will be provided with acceptable internal and external (private amenity areas) noise environments.

7.1.5 Ultimately, the chosen configurations of sound insulation enhancements involve considerations of design and cost and, therefore, must be finally defined by the developers/architects. Relevant recommendations can only be provided for relevant combinations which may be expected to meet the acoustic requirements. The finalised inclusions should be forwarded to the Local Planning Authority for approval.

7.1.6 This report has been compiled from the results of noise measurements undertaken in July 2016 and are considered to be representative of the prevailing noise climate.

Appendix A: Glossary of Acoustic Terminology

Decibel (dB): a unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 Pa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB(A): decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).

LAeq,T : the equivalent continuous sound level -the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). LAeq,T is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is written as Leq in connection with aircraft noise.

Maximum and Minimum (L_{Amax} and L_{Amin})
The simplest statistical parameters are the maximum level (L_{Amax}) and the minimum level (L_{Amin}) during the measurement period. The L_{Amax} is often used as a measure of the most obtrusive facet of the noise, even though it may only occur for a very short time and is the level of the maximum Root Mean Square reading. L_{Amin} is rarely used, but can be a useful way of identifying a constant noise amongst other intermittent noises.

Fast Time-weighting: An averaging time used in sound level meters, equivalent to 1/8 second.

Slow Time-weighting: An averaging time used in sound level meters, equivalent to 1 second.

Percentile Parameters ($L_{n,T}$)

Percentile parameters, L_n values, are useful descriptors of noise. The L_n value is the noise level exceeded for n per cent of the measurement period, which must be stated. The L_n value can be anywhere between 0 and 100. The two common ones are discussed below, but sometimes other values will be encountered.

Background Noise ($L_{A90,T}$)

The most commonly used percentile level is the $L_{A90,T}$, which is the 90th percentile level and is the level exceeded for 90 per cent of the time, T. It will be above the L_{min} and has been adopted as a good indicator of the “background” noise level. It is specified in BS 4142:1997 as the parameter to assess background noise levels. Whilst it is not the absolute lowest level measured in any of the short samples, it gives a clear indication of the underlying noise level, or the level that is almost always there in between intermittent noisy events. BS4142:1997 advises that the measurement period should be long enough to obtain a representative sample of the background level.

Level exceeded for 10% of the Time ($L_{A10,T}$)

$L_{A10,t}$ is the 10th percentile, or the level exceeded for 10 per cent of the time, and was used for road traffic noise assessments since it had been shown to give a good indication of people’s subjective response to noise. Although the L_{Aeq} has largely superseded its use for traffic, $L_{A10,T}$ may still be found in acoustic reports discussing road traffic. It is still used to assess traffic noise to determine eligibility for noise-insulation grants where a road is altered or a new one proposed. The $L_{A10,T}$ can be useful in assessing the overall noise climate, for example, if the $L_{A90,T}$, $L_{A10,T}$ and $L_{Aeq,T}$ are all within a few dB, then this indicates that the noise source is fairly constant.

Appendix B: Building Envelope Sound Insulation Calculations

Enhancements to Building Envelope Sound Insulation

Glazing

The weakest part of a building façade in terms of sound insulation is often the glazed areas. The insulation of various glazing configurations may be assessed by reference to the full calculation methods of BS8233:1999 & 2014 (which take account of spectral content of external façade noise level) (Ref 1, Sect 6,7).

Glazing configurations and the acoustic insulation rating of such are specified in terms of dB(R_W).

Ventilation

Enhanced glazing must be closed to provide the required benefit and it is consequently necessary to provide the required ventilation by suitably sound attenuated means.

The acoustic rating of such ventilators, when assessed as a façade element, is specified in terms of dB($D_{ne,W}$).

Roof Construction

In high noise level situations it is also necessary to ensure that roof/ceiling constructions also provide sufficient sound insulation in way of top floor habitable rooms.

Typical pitch roof constructions are categorised in guide calculations as 4 alternatives:

1. single ceiling boarding no mineral wool
2. single ceiling boarding with 100mm mineral wool
3. double ceiling boarding with 100mm mineral wool
4. double ceiling boarding with 100mm mineral wool solid layer (19mm ply) under tiles/felt.

Other roof constructions (e.g. flat roof) may be included in guide calculations according to their estimated or specified performance levels **dB(R_W)**..

Walls

Walls, usually masonry, provide good sound insulation such that they need not be considered in relation to the above.

However, for lightweight walling construction methods (e.g. curtain walling) due attention must be given to design for appropriate sound insulation. These may be included in guide calculations according to their estimated or specified performance levels **dB(R_W).**

Calculation procedures are “calibrated” by inputting the example from BS8233, Annex G.2. The results are summarised below to show exact equivalence

Data for all enhanced building envelope combinations are then pasted into identical spreadsheets to yield the basic Sound Insulation Summary Table within the report (Table 4).

Calibration of Calculation Procedures

Selected SRI (PASTE IN ROW BELOW)			Area	Rw	Rtra							
Element 1	6mm/12mm/6mm		1.5	33	27	24	26	29	33	28	24	33
Element 2	Brick Wall		8.5	50	45	27	40	44	45	51	56	60
Element 3	Roof		15	43	38	24	28	34	40	45	49	52
Element 4	-		0.00001	1000	1000	1000	1000	1000	1000	1000	1000	1000
Element 5	-		0.00001	1000	1000	1000	1000	1000	1000	1000	1000	1000
		Tot Area	25									
Ventilation Dne						38	37	36	35	36	34	34

	Length	Height	Breadth	Volume
Room Dimension	3	2	5	30

Tot Surface Area									
93		A	63	125	250	500	1000	2000	4000
(ENTER) Reverb Time (Secs):		0.5	0.44	0.44	0.345	0.302	0.302	0.32	0.32

Calcs Via BS8233		A	63	125	250	500	1000	2000	4000
Est Absorption (A)		9.66	10.98	10.98	14.00	15.99	15.99	15.09	15.09
10 Log (Stot/A)		4.13	3.57	3.57	2.52	1.94	1.94	2.19	2.19
SPL(A)(Façade.ext)		69.6	-25.0	57.0	60.0	63.0	64.0	65.0	2.0
10*Log(T1.S1/A)	6mm/12mm/6mm	-35.09	-32.64	-34.64	-38.70	-43.28	-38.28	-34.03	-43.03
Resulting SPL (Inside)		34.54	-57.64	22.36	21.30	19.72	25.72	30.97	-41.03
10*Log(T2.S2/A)	Brick Wall	-45.56	-28.11	-41.11	-46.17	-47.75	-53.75	-58.49	-62.49
Resulting SPL (Inside)		24.07	-53.11	15.89	13.83	15.25	10.25	6.51	-60.49
10*Log(T3.S3/A)	Roof	-36.09	-22.64	-26.64	-33.70	-40.28	-45.28	-49.03	-52.03
Resulting SPL (Inside)		33.54	-47.64	30.36	26.30	22.72	18.72	15.97	-50.03
10*Log(T4.S4/A)	-	-1059.85	-1060.40	-1060.40	-1061.46	-1062.04	-1062.04	-1061.79	-1061.79
Resulting SPL (Inside)		-990.23	-1085.40	-1003.40	-1001.46	-999.04	-998.04	-996.79	-1059.79
10*Log(T5.S5/A)	-	-1059.85	-1060.40	-1060.40	-1061.46	-1062.04	-1062.04	-1061.79	-1061.79
Resulting SPL (Inside)		-990.23	-1085.40	-1003.40	-1001.46	-999.04	-998.04	-996.79	-1059.79
10*Log (10*Tdne/A)			-38.40	-37.40	-37.46	-37.04	-38.04	-35.79	-35.79
Resulting SPL Inside		32.77	-63.40	19.60	22.54	25.96	25.96	29.21	-33.79
Total SPL Inside	(A-weighted is calc via A-weight stats)	38.60	-46.15	31.42	28.84	28.51	29.31	33.28	-32.94
	(A-weighted is calc via Octaves)	37.7							

Appendix C: Equipment

Instrumentation		
Sound Level Meter:	Bruel and Kjaer Type:	2250
	Serial No:	3007524
Microphone:	Bruel and Kjaer Type:	4189
	Serial No:	2237664
Calibrator:	Bruel and Kjaer Type:	4231
	Serial No:	1730932

Calibration was carried out before and after each measurement exercise using the “Charge Injection” facility within the Type 2260 Meter, enabling reference to previous calibrations of the instrument and providing warning of any significant change of sensitivity of the whole measurement chain (microphone and electronics) since the initial calibration. Full reference to all instrumentation is given above. Instrumentation was also checked with the above Calibrator.

Appendix D: Suppliers of Acoustic Ventilation Systems

Rytons Building Products Ltd Design House Kettering Business Park Kettering Northants NN15 6NL	01536 511874	Mr Anthony Irwin
Airflow Developments Limited Aidelle House Lancaster Road Cressex Business Park High Wycombe Bucks HP12 3QP	01494 525252	Mr Ian Thompson (07825 668782)
Passivent Brooklands Road Sale Cheshire M33 3SS	0161 962 7113	
Air Domestique Installations Ltd 31, Berkely Road London N15 6HH	0181-880-2426	``
Greenwood Air Management Brookside Industrial Estate Rustington West Sussex BN16 3LH	01903-771021	

Appendix E: Example of Acoustic Ventilation System Advice

Free acoustic ventilation evaluation service from Rytons

Working out the background ventilation requirements of properties with acoustic issues can be a juggling act between satisfying the acoustic requirements and providing sufficient ventilation to the Building Regulations.

To simplify this task we have a simple 3 step plan which will take you from acoustic report to product detailing quickly and easily.

STEP 1

- Email a copy of the site acoustic report to us at **admin@rytons.com**.
- We will evaluate the report and send you an assessment of which of our ventilators will satisfy the requirements of the property or properties.

STEP 2

- Use our free airflow calculation service to determine the total background ventilation requirement of the property or properties.
- Call 01536 511874 or email **admin@rytons.com**.

STEP 3

- Ask us for advice on which ventilators, or combination of ventilators, would fulfil the acoustic and background ventilation requirements of the property or properties.

Good to know:

- All Rytons Acoustic Background Ventilators provide in excess of the 5000mm² equivalent area threshold required by Part F, which allows the number of units used in a property to be kept to a minimum.
- All Rytons Acoustic Background Ventilators feature a fully adjustable vent on the inside allowing the occupier to regulate the airflow in each habitable room.
- All Rytons Acoustic Background Ventilators are independently tested by the BRE for both acoustic performance and equivalent area; your assurance that the figures are accurate and verifiable.
- Background ventilators are efficient and low cost to buy. With zero running and maintenance expenses for the occupants they are also less likely to be tampered with.

- NBS Plus specifications are available to cut and paste straight into your documentation from the product pages of our website at www.vents.co.uk

Rytons products are available **next working day** across the whole of the UK.

For product information, product guides, BRE acoustic test reports,
BBA Certificates and more visit our website at www.vents.co.uk
or call **01536 511874**.

Contact Us

T: 01536 511874
F: 01536 310455
E: admin@rytons.com

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