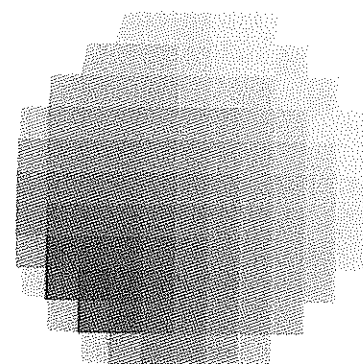




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Environmental and Intrusive Noise Study

28 October 2012



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acoustics

448,3000

PROJECT: Pendle Garage, Clitheroe
Environmental and Intrusive Noise Study

CLIENT: Bowsall Limited

DOCUMENT
REFERENCE: P1453-REP01-SJF

SIGNED: _____
SIMON FERENCZI

CHECKED: _____
MATTHEW FISHER

DATE: 28 October 2012

CONTENTS

1.0	INTRODUCTION	1
2.0	DESCRIPTION OF SITE	2
3.0	DETAILS OF INVESTIGATION	4
4.0	RESULTS SUMMARY	6
5.0	INTRUSIVE NOISE CONTROL TO HABITABLE ROOMS	7
6.0	ENVIRONMENTAL NOISE LIMITS FOR M&E PLANT	16
APPENDIX A		17

320130169P



SUMMARY

Sol Acoustics Ltd (Sol) has been commissioned by Bowsall Limited (Bowsall) to conduct an environmental noise and ground borne vibration assessment relating to the Pendle Garage residential development site located in Clitheroe.

The purpose of the report is to determine an appropriate acoustic performance specification for glazing (assuming either a mechanical whole house ventilation strategy or passive trickle vent system), together with the building envelope, all as based on the pre-existing site environmental noise climate, assumed intrusive noise requirements and currently available pre-planning building design details.

In addition, the maximum allowable daytime and night time environmental noise contribution from M&E plant, if any, has also been determined.

Full details are provided within the report, including acoustic performance specifications and suggested configurations for all glazing, trickle vent and external building envelope construction for habitable rooms.

1.0 INTRODUCTION

Sol Acoustics Ltd (Sol) has been commissioned by Bowsall Limited to conduct an environmental noise and ground borne vibration assessment relating to the Pendle Garage residential development site located in Clitheroe.

The purpose of the report is to determine an appropriate acoustic performance specification for glazing (assuming either a mechanical whole house ventilation strategy or passive trickle vent system), together with the building envelope, all as based on the pre-existing site environmental noise climate, assumed intrusive noise requirements and currently available pre-planning building design details.

In addition, the maximum allowable daytime and night time environmental noise contribution from M&E plant, if any, has also been determined.

320130169P

2.0 DESCRIPTION OF SITE

The proposed Pendle Garage residential development site is to comprise of twenty new build semi-detached houses and a three storey apartment building also.

To the west of the site, approximately 5 metres from the nearest apartment façade, is Clitheroe Road. This is a relatively busy road for the much of the daytime and early morning periods also, as regards traffic flow - carrying mixed traffic including some buses and HGVs. On the opposite side of Clitheroe Road is the Eagle Public House. This restaurant/public house also has a large customer car park.

To the north of the site lie industrial/commercial units for multiple companies. Subjectively, the most notable noise contributor from these was that of engineering process noise, including drilling and grinding, as emanating from the units belonging to UK Precision Engineering Limited during daytime periods only.

The industrial units appeared to be in use between the hours of 07:30 and 18:30. Intermittent noise was noted from these premises during the daytime survey, albeit no noise at all was heard at any time during the extensive evening and night time environmental noise surveys that were carried out. Accordingly therefore, as based on the noise survey data obtained, these units were not deemed to be a noise source of any significance during night time hours.

To the east of the site boundary, approximately 200 metres distant, is the A59/A671 roundabout junction. HGV and regular traffic noise could be heard at most times of the day and night from this source. The A59 runs along the south site boundary approximately 230 metres away.

Immediately to the south of the site boundary is a horticultural nursery; no noise was noted from these premises at any time.

Figure 1 shows an aerial photograph of the pre-development site, indicating its approximate location, relative to the surrounding buildings and roads.



LINCOLN STREET, WAKEFIELD

ENVIRONMENTAL & INTRUSIVE NOISE STUDY

P1453-REP01-SJF

320130169P

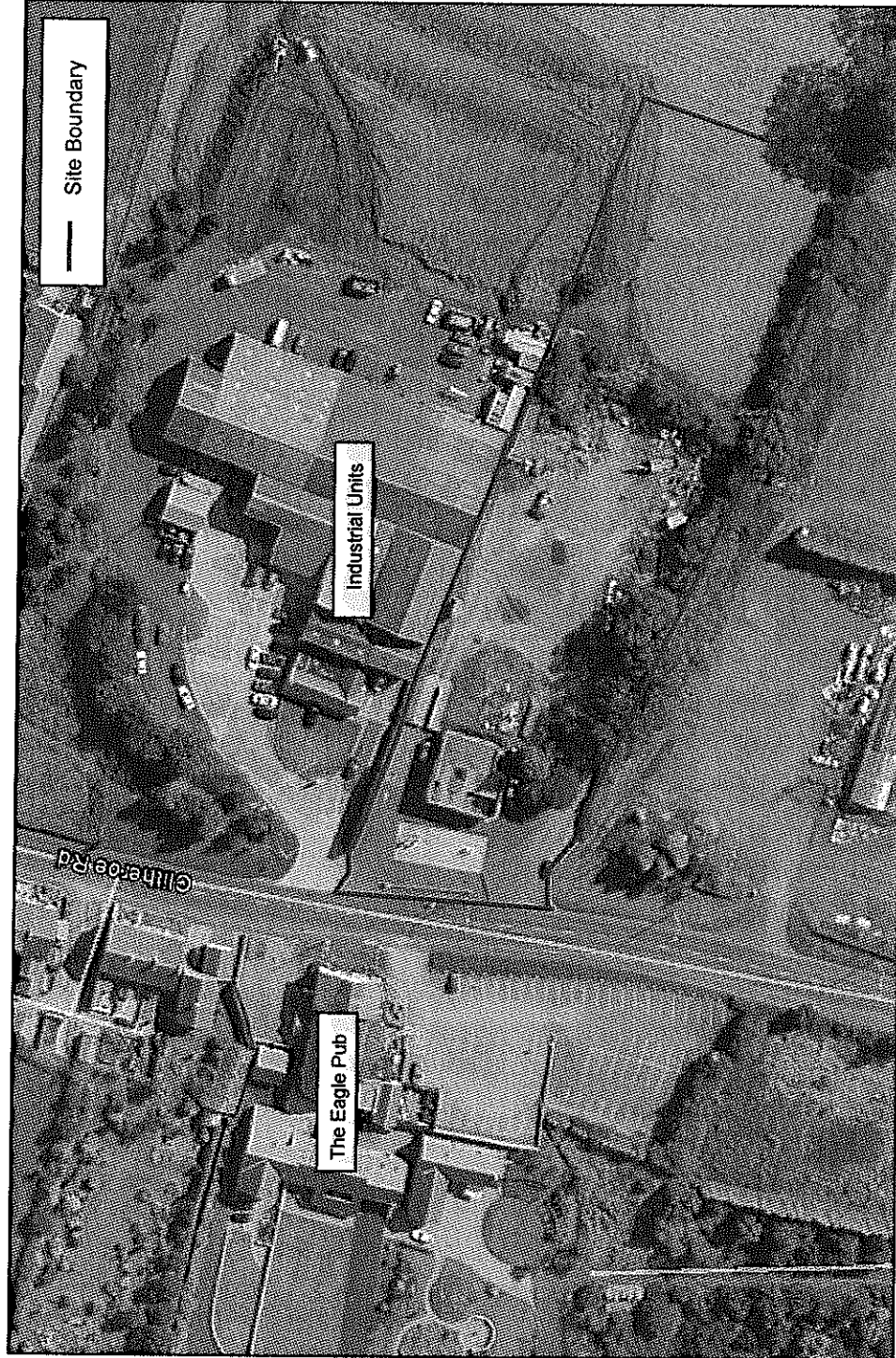


Figure 1: Site location plan and surrounding areas

3.0 DETAILS OF INVESTIGATION

In order to determine the prevailing environmental noise levels around the development site, surveys of the pre-existing noise climate have been carried out over a typical weekday, during daytime, evening and night time periods.

Specifically, noise surveys were undertaken during the following periods, with no site construction activities being undertaken:

- Late afternoon and evening – 18th October 2012 (15:12 hours to 23:00 hours)
- Night – 18th to 19th October 2012 (23:00 hours to 07:00 hours)

The prevailing weather conditions were suitable for the purposes of environmental noise measurements throughout the various noise surveys. No rain occurred at any time and mean wind velocities were below 5m/s, albeit microphone windshields were in use at all times.

Figure 2 shows the approximate location of all noise monitoring points. As shown, the various monitoring locations were selected to coincide with key future new build building façades and pre-existing residential housing also.

The noise measurements carried out at Position 2, 3 and 4 were undertaken at an elevated microphone height of 4.5 metres from ground level, so as to ensure no acoustic screening effects were present. Measurements at Position 1 were undertaken at a height of 1.5 metres, since this was unscreened from noise sources at this height.

All measuring locations were in so-called "free field" conditions, in acoustic terms (i.e. free from nearby reflective surfaces), and thus no correction has been applied to the noise survey data directly obtained.

All noise measurements were undertaken using continuous logged measurement durations of 5 minutes, with L_{Aeq} , L_{Amax} , L_{A10} and L_{A90} being recorded, together with unweighted octave band L_{eq} , L_{max} , L_{10} and L_{90} .

Full details of all instrumentation used (and their traceable calibration records) are retained on file by Sol and are available for inspection if required.

PENDLE GARAGE, CLITHEROE
 ENVIRONMENTAL & INTRUSIVE NOISE STUDY
 P1453-REP01-SJF

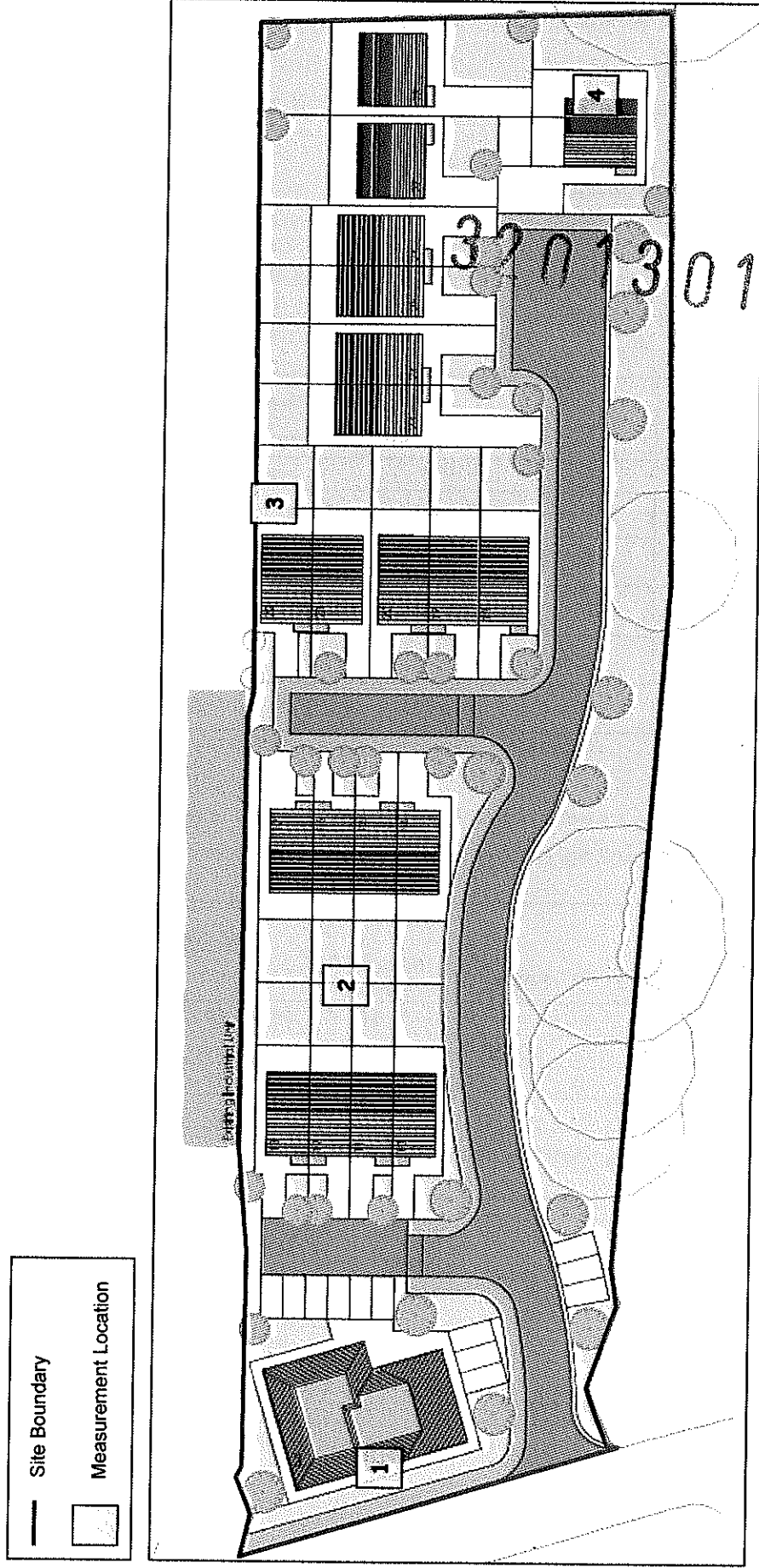


Figure 2: Noise survey monitoring locations

4.0 RESULTS SUMMARY

Table 1 provides a basic summary of the typical overall, A-weighted noise levels measured at the various locations around the site, in L_{Aeq} , L_{A90} and L_{Amax} terms:

Position	Typical Measured Noise Level (Average L_{Aeq} , Range L_{A90} & L_{Amax})					
	Daytime			Night-time		
	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}	dB, L_{Aeq}	dB, L_{Amax}	dB L_{A90}
1	64	72 to 83	43 to 59	56	38 to 85	30 to 49
2	55	61 to 76	45 to 57	47	46 to 75	29 to 50
3	55	57 to 76	51 to 55	n/a	n/a	n/a
4	54	56 to 71	44 to 55	46	44 to 64	27 to 50

Table 1: Summary of typical, measured environmental noise levels, in broadband terms

Tables 2 and 3 summarise the corresponding typical unweighted octave band noise spectra, for daytime and night time periods respectively, in time-averaged L_{eq} terms:

Measurement Location	Noise Level, dB L_{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
1	64	66	61	57	57	61	58	53
2	55	60	54	50	49	52	46	38
3	55	62	56	51	50	53	45	35
4	54	62	55	49	48	52	44	31

Table 2: Summary of daytime time-averaged environmental noise levels, octave band terms

Measurement Location	Noise Level, dB L_{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
		63	125	250	500	1k	2k	4k
1	56	59	53	49	49	53	51	43
2	47	55	48	42	43	45	38	27
3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	46	55	48	40	41	44	36	23

Table 3: Summary of night time, time-averaged environmental noise levels, octave band terms

Appendix A provides further information.

320130169P

5.0 INTRUSIVE NOISE CONTROL TO HABITABLE ROOMS

5.1 Basis of Acoustic Design

The applicable British Standard for setting appropriate internal intrusive noise limits within residential bedrooms and living rooms is BS8233: 1999 '*Sound insulation and noise reduction for buildings – Code of practice*'.

Table 4 lists the intrusive noise requirements of BS8233, for both "good" and "reasonable" conditions:

BS8233 Acoustic Design Criteria	
Unoccupied Location	Room Intrusive Noise Level
Living Rooms	Good 30dB L_{Aeq}
	Reasonable Standard 40dB L_{Aeq}
Bedrooms	Good 30dB L_{Aeq}
	Reasonable Standard 35 dB L_{Aeq} (45 dB L_{Amax})

Table 4: BS8233 intrusive noise design criteria

Thus, the maximum recommended daytime intrusive noise level range within habitable living rooms forming part of the development is 30-40dB $L_{Aeq(16 \text{ hours})}$ and the corresponding night time intrusive noise limit within bedrooms 30-35dB $L_{Aeq(8 \text{ hours})}$.

For night time periods, it is also recommended by World Health Organisation (W.H.O.) guidelines that maximum noise levels within bedrooms do not exceed 45dB L_{Amax} regularly.

By taking into account the actual levels of ambient noise measured at the future site façades, the proposed areas of façade elements and their intended constructions (i.e. glazing, walls, roof), and the likely acoustic characteristics of the noise sensitive receiving space (i.e. living rooms, bedrooms), the sound reduction required to be provided by façade elements have been determined through acoustic calculation.

The window areas, room dimensions and site layout used in all calculations are as shown by the JDA Architects drawings received by Sol on 25 October 2012 from Bowsall. (If there are any subsequent changes to any the proposed glazing areas and/or room layouts and floor plans, for any habitable room(s), these must be evaluated acoustically).

At the time of reporting, the required ventilation strategy for the development (i.e. passive trickle ventilators or fan-powered whole house ventilation) has not been determined. This will have a bearing on the acoustic performance requirements of the building elements, depending on which system is used. Therefore, acoustic advice is provided for both trickle vent and whole house ventilation strategies.

320130169P

5.2 Glazing and Building Envelope Recommendations

All glazing, trickle vent and wall construction specifications must have at least the minimum acoustic performance specifications indicated by Table 5 and Table 6 respectively, as confirmed and corroborated by independent acoustic laboratory test data of identical constructions, particularly in the case of glazing and trickle ventilator systems.

Where used, the total, aggregate trickle ventilator unit free area must not exceed 8000mm² free area, per habitable room, in any instance.

Thermal cavities must be specified by others, albeit these must not impinge upon the minimum required acoustic performance specification requirements.

The glazing and trickle vent specifications that would be required in order to achieve BS8233 defined "good" and "reasonable" conditions as regards to the control of intrusive noise to habitable rooms, are described in Sections 5.2.1 and 5.2.2

Glazing and trickle vent acoustic recommendations and advice have been prescribed according to which "Zone" is being considered. These Zones are defined by Figure 3.

PENDLE GARAGE, CLITHEROE

ENVIRONMENTAL & INTRUSIVE NOISE STUDY

P1453-REP01-SJF

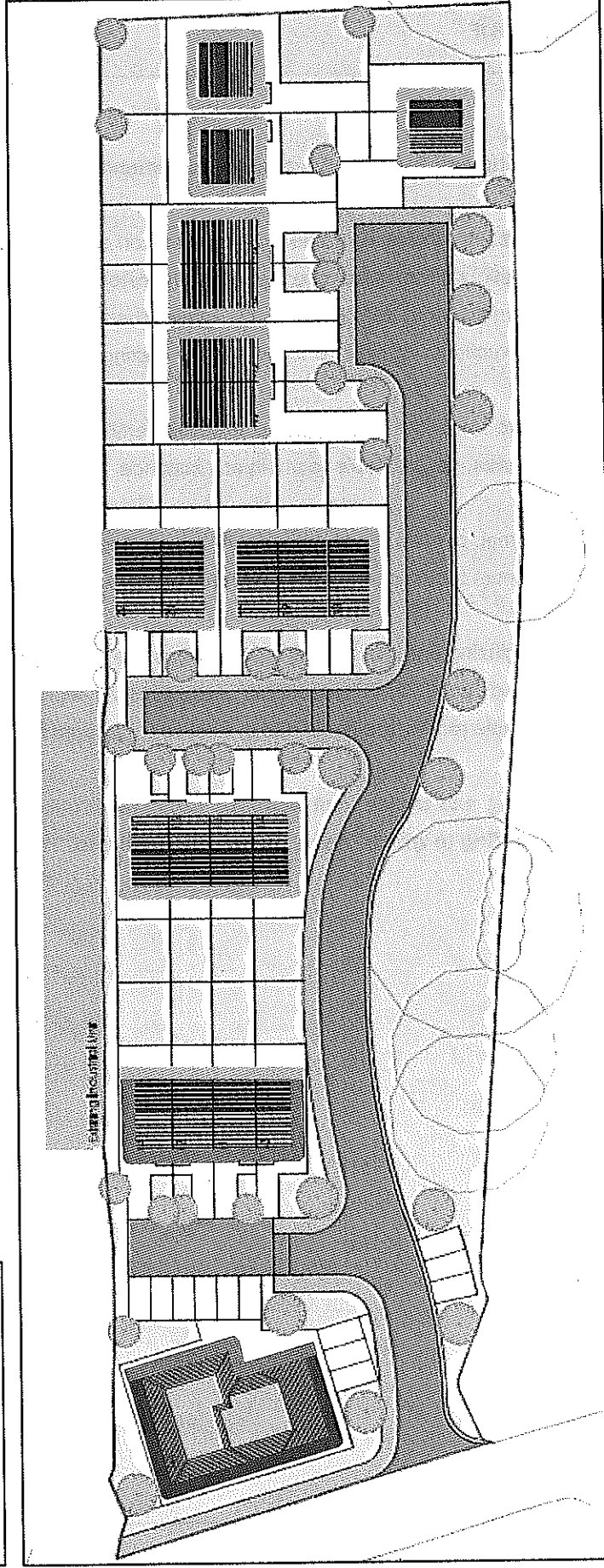
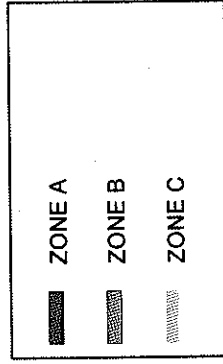


Figure 3: Glazing and trickle vent zones

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5.2.1 Whole House Vent System Option

In the case where a *whole house vent system* (i.e. no trickle vent) is to be used, the following acoustic design advice is applicable:

5.2.1.1 Zone A - Bedrooms

All bedrooms require 10mm/12mm thermal cavity/6mm glazing for acoustic performance purposes, as based on the current proposed external envelope wall specification given in Section 5.3 of this report.

5.2.1.2 Zone A - Living Rooms

BS8233 "Good" standard - 10.8mm/16mm thermal cavity/6mm glazing

BS8233 "Reasonable" standard - 4mm/16mm thermal cavity/4mm glazing

All above specifications are based on the current proposed external envelope wall specification given in Section 5.3 of this report. All glazing must achieve at least the minimum acoustic performance specification performances as indicated by Table 5.

5.2.1.3 Zones B and C

All bedrooms and living rooms require 4mm/16mm thermal cavity/4mm glazing for acoustic performance purposes, as based on the current proposed external envelope wall specification given in Section 5.3 of this report.

5.2.2 Passive Trickle Vent System

In the case where a *trickle vent system* is to be used, the following acoustic design advice is applicable:

5.2.2.1 Zone A - Bedrooms

Bedrooms require 10mm/12mm thermal cavity/6mm glazing with acoustic trickle vent Type 2, for acoustic performance purposes, all as based on the proposed external envelope wall specification given in Section 5.3 of this report.

5.2.2.2 Zone B - Bedrooms

Bedrooms require 4mm/16mm thermal cavity/4mm glazing with acoustic trickle vent Type 1, for acoustic performance purposes, all as based on the proposed external envelope wall specification given in Section 5.3 of this report.

5.2.2.3 Zone C - Bedrooms

Bedrooms require 4mm/16mm thermal cavity/4mm glazing with standard non-acoustic trickle vent, for acoustic performance purposes, all as based on the proposed external envelope wall specification given in Section 5.3 of this report.

5.2.2.4 Zone A - Living Rooms

BS8233 "Good" standard - 10.8mm/16mm thermal cavity/6mm glazing
- and -
acoustic trickle vent Type 2

BS8233 "Reasonable" standard - 10mm/12mm thermal cavity/6mm glazing
- and -
standard non-acoustic trickle vent

320130169P

5.2.2.5 Zones B and C - Living Rooms

BS8233 "Good" standard - 4mm/16mm thermal cavity/4mm glazing

- and -

acoustic trickle vent Type 1

BS8233 "Reasonable" standard - 4mm/16mm thermal cavity/4mm glazing

- and -

standard non-acoustic trickle vent

All the above glazing and trickle ventilators must achieve at least the minimum acoustic performance specification performances as indicated by Table 5 and Table 6 respectively.

Table 5 shows the minimum acoustic performance specification requirements for each type and configuration of glazing cited herein; these must be achieved for the entire window and frame construction in each case, as a complete unit (and as corroborated via independent acoustic laboratory test data):

Glazing Configuration	Minimum Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
4 mm / 16 mm / 4 mm	19	24	20	25	35	38	35
10 mm / 12 mm / 6 mm	21	26	27	34	37	38	38
10.8 mm / 16 mm / 6 mm	22	25	28	38	45	44	56

Table 5: Minimum recommended sound reduction index of glazing

All trickle ventilator types and specifications cited herein must achieve at least the minimum acoustic performance specification performances as indicated by Table 6:

Trickle Vent Specification	Minimum Element-Normalised Level Difference - $D_{n,e}$ (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Standard non-acoustic trickle vent	28	28	31	31	29	34	34
Acoustic trickle vent Type 1 (e.g. Renson AK41 Invisivent)	30	37	31	35	43	51	50
Acoustic trickle vent Type 2 (e.g. Greenwood AirVac)	40	46	46	49	56	66	64

Table 6: Minimum required sound reduction index of trickle vents

Table 6 shows the minimum required element-normalised level difference ($D_{n,e}$) for the installed free area of trickle vent, per room. It must be noted that the acoustic performance stated by manufacturers for various trickle vents will be related to the free area of the vent that has been acoustically tested in a laboratory. If a greater free area of vent is to be installed than that actually tested, then the acoustic performance will be less than that stated in the literature and/or acoustic laboratory report, then this must be taken account of when selecting trickle ventilator types and their required sizes.

5.3 Building Envelope Acoustic Requirements

The following minimum external wall constructional specification will be required in acoustic terms, which Sol understands is as already proposed for all facades:

- 100 mm facing brick, 50 mm clear cavity, 140mm timber stud with insulation in the cavity, complete with internal dry lining of 2 no. layers of 12.5 mm wall board.

The minimum required sound reduction indices of the external envelope elements applicable for this project are as follows:

Wall Construction Type	Sound Reduction Index (dB)						
	@ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
External envelope walls (brick outer)	39	46	44	46	56	64	69

Table 7: Minimum building envelope acoustic performance requirement

6.0 ENVIRONMENTAL NOISE LIMITS FOR M&E PLANT

The Local Authority will normally stipulate that the total, aggregate environmental noise contribution from all M&E plant (if any), when operating simultaneously, must equate to an ambient noise level (in $L_{Aeq,T}$ terms) equating to the lowest, pre-existing daytime or night time background noise level at any residential property façade, in L_{A90} terms, less a further 10dB.

In terms of plant noise limits, the lowest recorded daytime and night time background noise levels at the proposed development façades (and also at nearby, existing noise sensitive housing receptors) were 43dB L_{A90} in the day for Position 1 and 32dB L_{A90} at night for Position 4.

Thus, in order to minimise the environmental noise impact of the development, mechanical services plant should be selected and suitably attenuated so as to limit the environmental noise at any residential property facades to the following daytime and night time limits:

Location	Maximum Building Services Plant Noise Level	
	dB L_{Aeq}	
	Daytime (07:00hrs to 23:00hrs)	Night time (23:00hrs to 07:00hrs)
Any residential façade within (or adjacent to) the proposed development	33	17

Table 8: Environmental noise limits for building services plant

The above maximum allowable daytime and night time M&E plant environmental noise level limits must be forwarded to the M&E Engineer to allow selection of suitable plant and any required noise mitigation measures, such as attenuators, when full details of the entire proposed M&E scheme are known (including that which is to serve commercial areas).

It must be noted that the M&E plant noise limits identified above are applicable to all plant serving all areas of the development, when operating simultaneously. The allowable individual contribution from all plant items and atmospheric terminations such as louvres and cowls must be determined based on these overall noise limits, and will be lower.

320130169P

APPENDIX A
NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Pendle Garage, Clitheroe Road, Clitheroe

DATES AND TIMES

Thursday 18 th October 2012	15:12 hrs to 23:59 hrs
Friday 19 th October 2012	00:00 hrs to 07:00 hrs

PERSONNEL PRESENT DURING MEASUREMENTS

Darren Clucas – Sol

INSTRUMENTATION

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 28260)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 29917)

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 28957)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 31041)

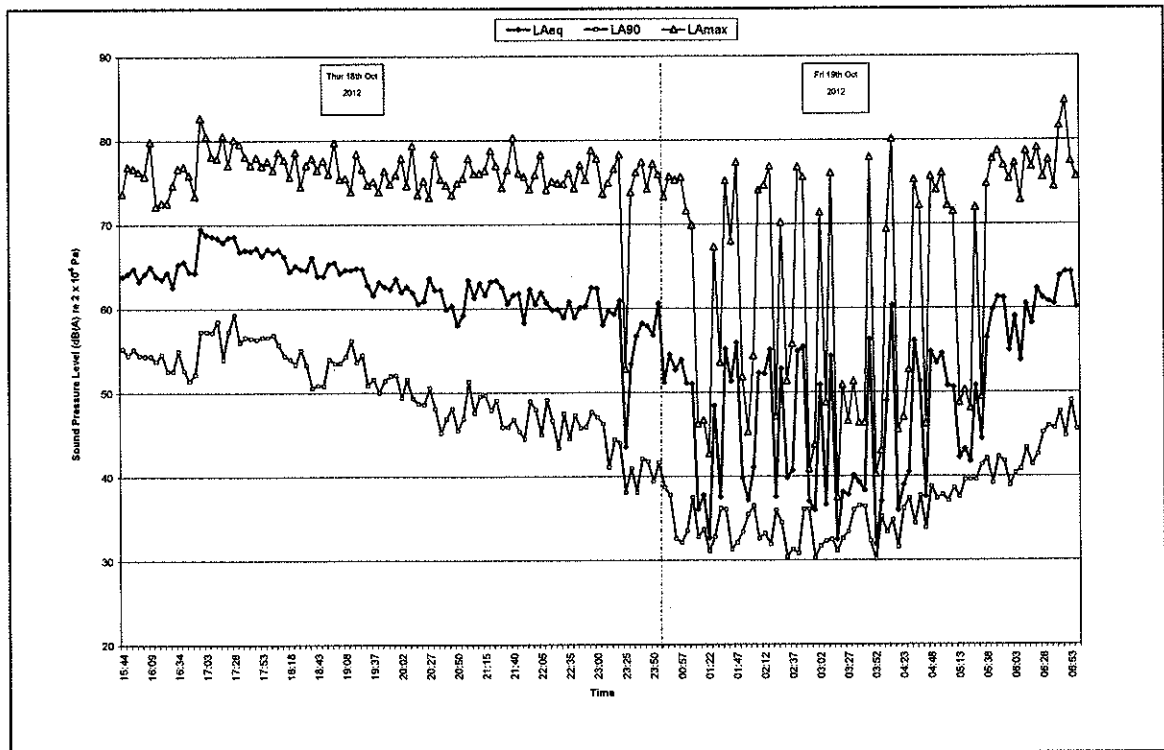
Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 31498)
Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrator (serial no. 31971)

METHODOLOGY

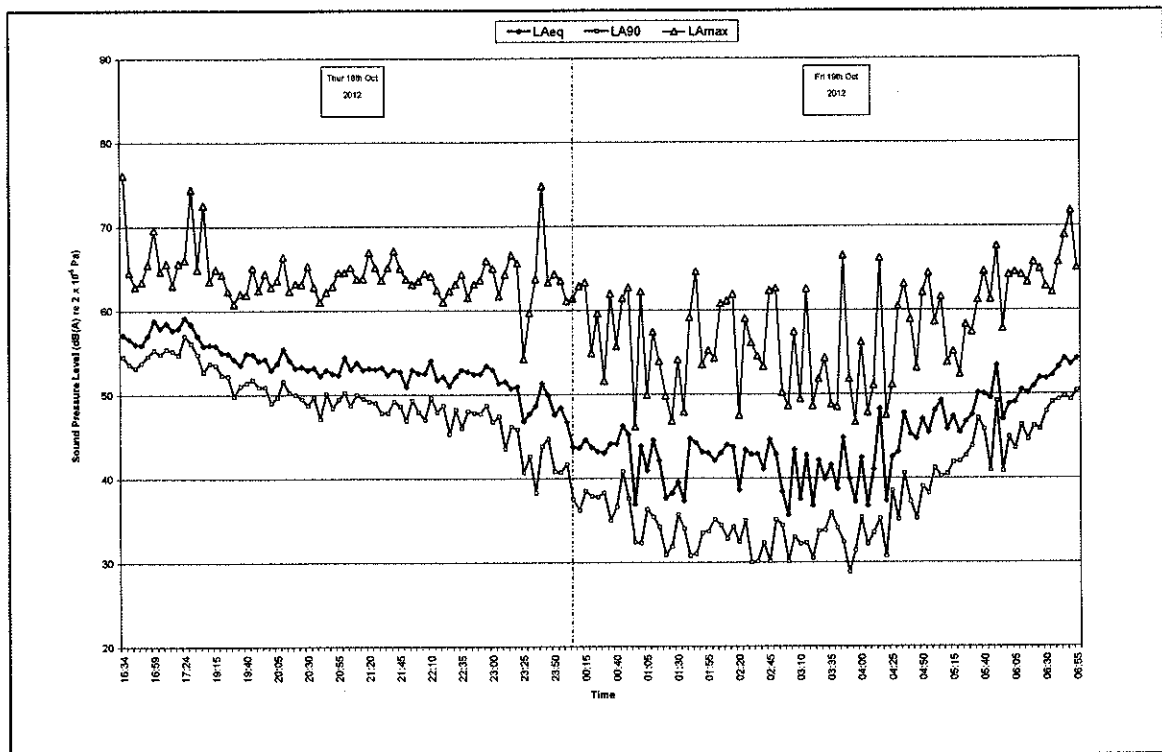
Before and after the measurements the Norsonic Type 118 was check calibrated to an accuracy of $\pm 0.3\text{dB}$ using the Norsonic Type 1251 Calibrator. The calibrator produces a sound pressure level of $114\text{ dB re } 2 \times 10^{-5}\text{ Pa}$ @ 1kHz.

MEASUREMENT RESULTS

Graphs A1 to A4 summarise the results obtained from the noise surveys.

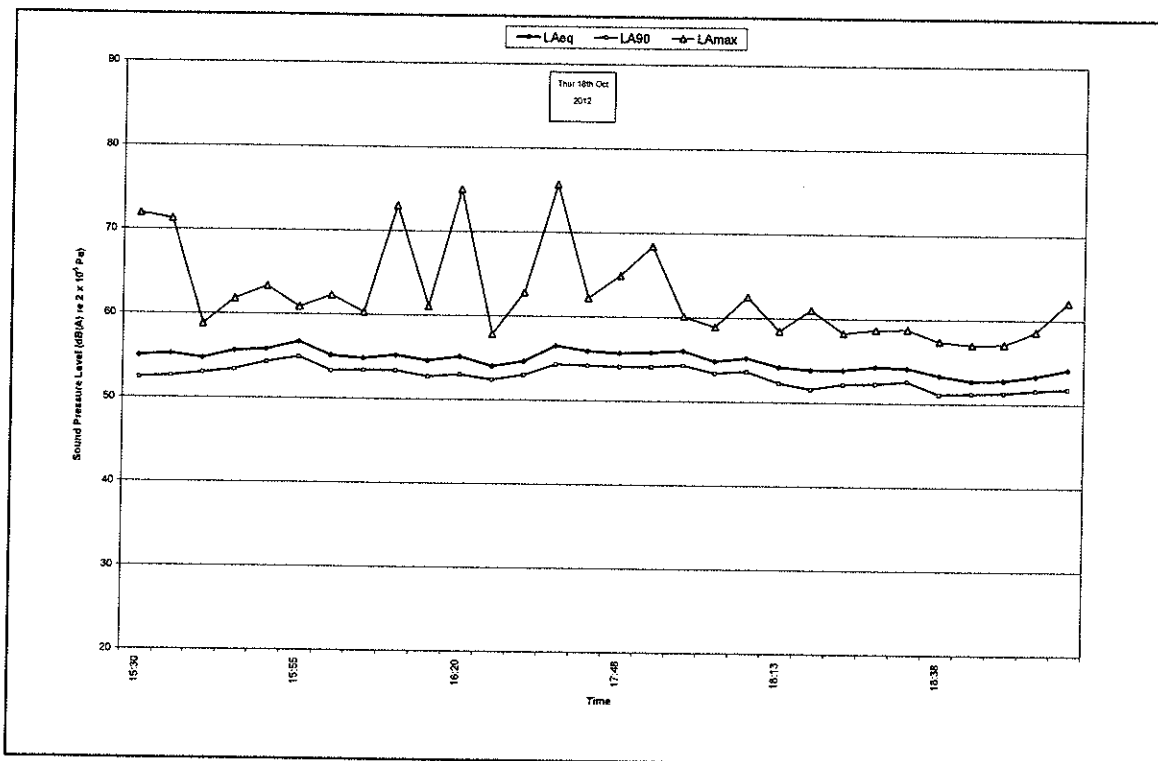


Graph A1: Summary Statistical Noise Levels – Position 1, 18th to 19th October 2012

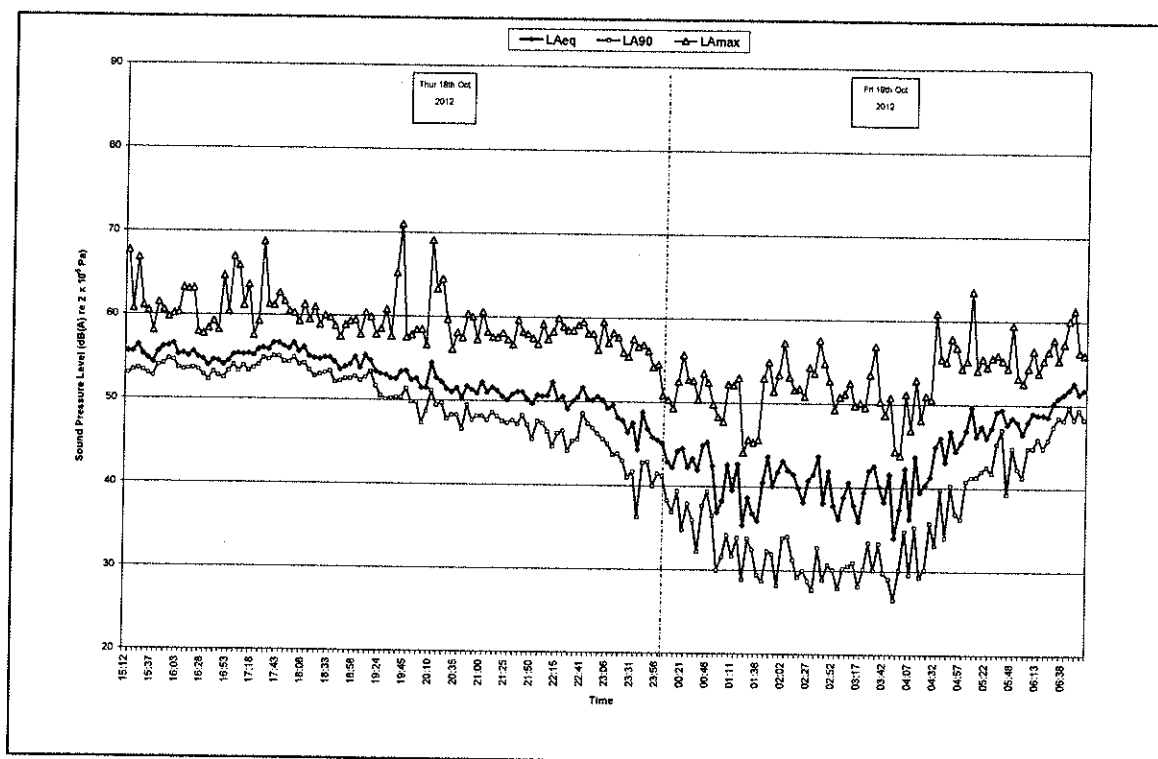


Graph A2: Summary Statistical Noise Levels – Position 2, 18th to 19th October 2012

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Graph A3: Summary Statistical Noise Levels – Position 3, 18th to 19th October 2012



Graph A4: Summary Statistical Noise Levels – Position 4, 18th to 19th October 2012

