



Report No. DJB/6982/E

Page 1 of 13

for
GPL 2014 Ltd
9 Bridewell Place
London
EC4V 6AW

Dated: 19 May 2017

NOISE AND VIBRATION MEASUREMENT SURVEY
FOR
PROPOSED FIRST AND SECOND FLOOR
RESIDENTIAL DEVELOPMENT,
FOUNTAIN HOUSE, WELWYN GARDEN CITY

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NOISE AND VIBRATION MEASUREMENT SURVEY**FOR****PROPOSED FIRST AND SECOND FLOOR****RESIDENTIAL DEVELOPMENT,****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 first and second floor level residential redevelopment at Fountain House, 1-7 Howardsgate, Welwyn Garden City.

This report details noise and vibration level measurements made at the site during the period Friday 31 March to Tuesday 4 April 2017.

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 vacant, having previously been occupied by NHS staff offices.

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. 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 provides access to the rear of the ground floor commercial properties and Charter House.

The main noise sources affecting the proposed development site are road traffic noise from Parkway and Howardsgate together with noise from the adjacent club, pub and other commercial premises. Plant noise, associated plant ducts and terminations located to the rear of the building, and on the roof, also affect the local noise level around the building. To a lesser extent noise associated with town centre activity (general usage and deliveries etc.) also contributes.

Figure 3 in Section 4 of this report provides an aerial view of the site location.

3. NOISE AND VIBRATION MEASUREMENT UNITS

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

As its name suggests, the $L_{Aeq,T}$ 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} .

3.4 Vibration Dose Value - VDV

Vibration Dose Value, VDV, is based on the frequency range 0.5 Hz to 80 Hz which has been shown to be the most important in respect of the human perception of whole body vibration and is weighted in a manner which reflects human sensitivity to the various frequencies.

Triaxial measurements utilise two frequency weightings specified for different orientations to the vibration. In accordance with BS 6472-1:2008 (ref 3) the " W_b " weighting is used for the vertical component (referred to as the 'z' axis) and the " W_d " weighting is used for the horizontal components of vibration (referred to as the 'x' and 'y' axes).

The VDV measurement strongly reflects the importance of significant single vibration events while still taking account of the fact that many such events will give rise to greater adverse comment than one. The unit for VDV is $m/s^{1.75}$.

4. MEASUREMENT SURVEY

4.1 Measurement Survey

Measurements of noise levels were made at the site during the period 15:00 hours on Friday 31 March to 09:00 hours on Tuesday 4 April 2017.

Hourly noise level measurements over the full survey period were made inside the existing, empty building using automatic data logging sound level meters at Positions A, B, C, D, E and F.

Position A was located at first floor level within the ladies toilet adjacent to Club 67, approximately 2.5 metres from the external wall and 0.5 metres from the separating wall to Club 67.

Positions B and C were located at first floor level within the main office area that fronts Howardsgate, with both positions approximately 3.8 metres from the Howardsgate facade. Position B was approximately 2 metres from the western end wall whilst Position C was approximately 6.5 metres from the eastern wall.

Position D was also located at first floor level (within the extension office area close to the Two Willows Pub) approximately 3.5 metres from the wall to the pub and 4 metres from the eastern wall.

Positions E and F were located at second floor level. Position E was located within the office space directly above Club 67 that fronts Parkway, approximately 2 metres from the Parkway facade and 3.8 metres from the northern wall. Position F was located in the extension office space adjacent to the Two Willows Pub, approximately 3 metres from the pub wall and 5 metres from the northern end wall.

For all of the full survey period measurement positions (A to F) the microphone was located approximately 1.6 metres above the local floor level.

In addition to the full duration noise level measurements vibration measurements were also carried out at Position V1. Position V1 was located close to Position A, within the first floor level ladies toilets adjacent to Club 67. The vibration measurements were made using a triaxial accelerometer mounted on a purpose built metal block resting on the local floor surface via three short metal spikes. The vibration levels were measured simultaneously on the three axes, the x-axis representing vibration parallel to the separating wall, the y-axis representing vibration perpendicular to the separating wall and the z-axis representing vertical vibration. Measurements were taken of Vibration Dose Values (VDV in $m/s^{1.75}$) and one third octave frequency band acceleration values. The frequency range of measurement was from 0.8 Hz to 80 Hz.

In addition, shorter term sample attended measurements were made at three further positions in relation to the club and club patron noise levels on during the night of 31 March/1 April 2017 whilst the club was active.

Attended measurement Position A1 was located on the pavement of Parkway approximately 10 metres from the smoking area outside Club 67. Position A2 was located across the road from the club on the grass approximately 8 metres from the building facade. Position A3 was located further to the south on the grass, approximately 10 metres from the club entrance.

Summaries of the noise levels measured at Positions A to F are shown in Tables 1, 2 and 3. A summary of the vibration levels measured is presented in Table 4. Full tabulations of the hourly values for Positions A to F are provided in Appendix A. A summary of the attended sample noise level measurements is presented in Table 5 whilst full details together with commentary notes provided in Appendix B.

Figures 1 and 2 present floor plans of the existing development indicating the indoor, full period measurement locations. Figure 3 provides an aerial view of the development site and indicates the attended measurement locations.

Details of the measurement equipment and recorded weather conditions are given in Appendix C.

Graphical representations of the noise levels measured during the survey period at Positions A, D, E and F are presented in Figures 4, 5, 6 and 7 respectively. Figure 8 provides a graphical representation of the Vibration Dose Values measured during the survey period.

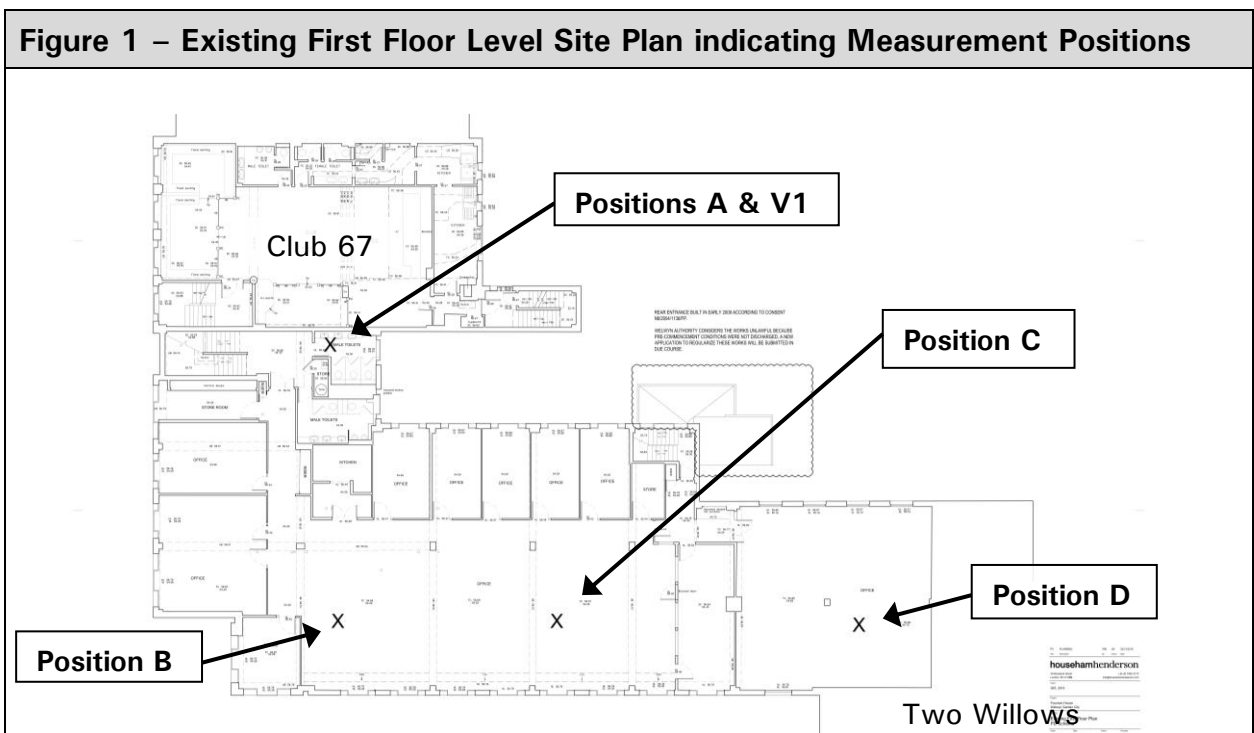


Figure 2 – Existing Second Floor Level Site Plan indicating Measurement Positions

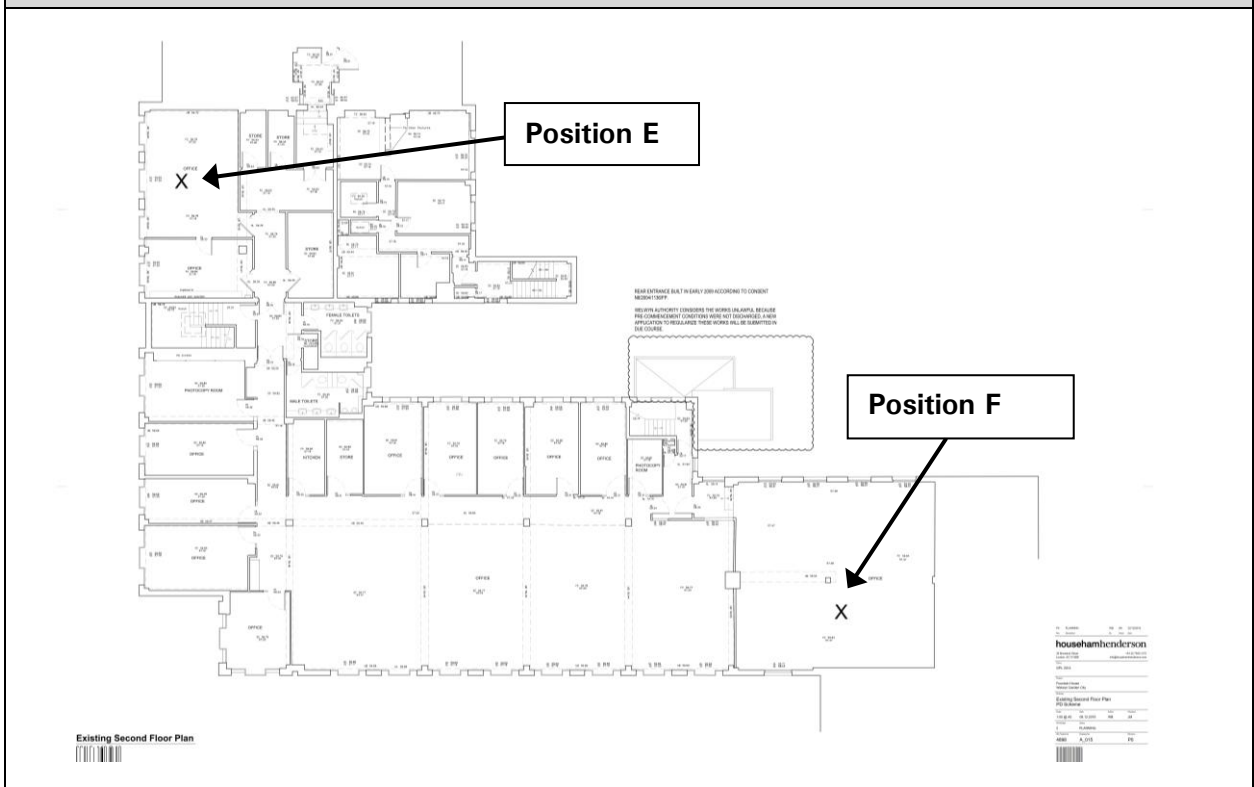
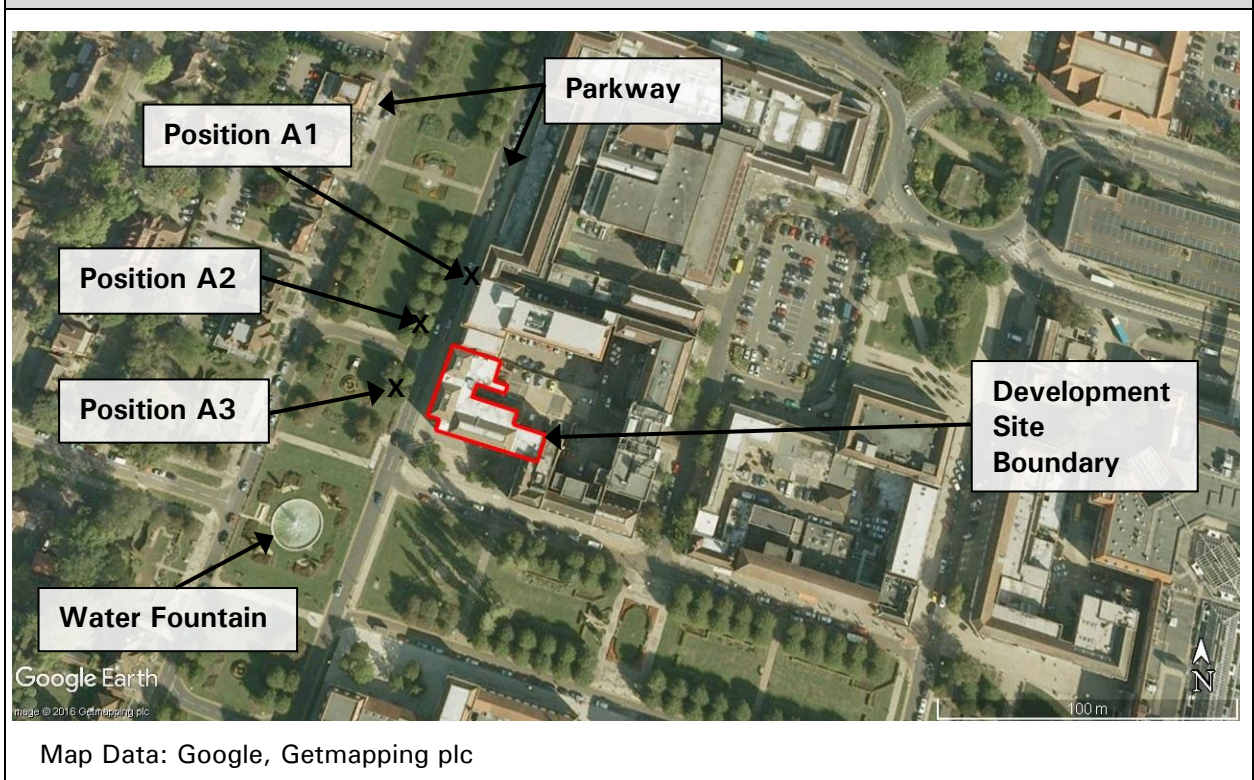


Figure 3 – Aerial View indicating Attended Measurement Positions



4.2 Noise Level Measurement Results

Table 1 – Summary of Period L_{Aeq} Noise Levels							
Start Date	Period	L_{Aeq} Noise Levels in dB at Position					
		A	B	C	D	E	F
31/3/17	Friday Day (15:00-23:00)	49	39	36	34	46	33
31/3/17	Friday Night (23:00-07:00)	52	37	34	36	46	32
1/4/17	Saturday Day (07:00-23:00)	47	38	35	32	45	31
1/4/17	Saturday Night (23:00-07:00)	51	36	33	33	43	31
2/4/17	Sunday Day (07:00-23:00)	47	37	34	29	44	30
2/4/17	Sunday Night (23:00-07:00)	46	32	29	26	38	28
3/4/17	Monday Day (07:00-23:00)	47	38	35	29	45	31
3/4/17	Monday Night (23:00-07:00)	48	32	29	28	38	29

Table 2 – Summary of Period L_{AFmax} Noise Levels							
Start Date	Period	L_{Amax} Noise Levels in dB at Position					
		A	B	C	D	E	F
31/3/17	Friday Day (15:00-23:00)	82	63	60	64	78	67
31/3/17	Friday Night (23:00-07:00)	82	68	67	56	66	55
1/4/17	Saturday Day (07:00-23:00)	83	63	62	59	75	60
1/4/17	Saturday Night (23:00-07:00)	74	68	66	57	65	59
2/4/17	Sunday Day (07:00-23:00)	81	66	65	56	80	58
2/4/17	Sunday Night (23:00-07:00)	76	60	58	55	61	52
3/4/17	Monday Day (07:00-23:00)	82	61	61	59	73	58
3/4/17	Monday Night (23:00-07:00)	84	60	60	64	61	59

Table 3 – Summary of Hourly L_{A90} Noise Level Ranges							
Start Date	Period	L_{A90} Noise Levels in dB at Position					
		A	B	C	D	E	F
31/3/17	Fri. Day	47 - 50	-	-	28 - 33	34 - 41	28 - 30
31/3/17	Fri. Night	46 - 51	-	-	23 - 36	28 - 43	27 - 32
1/4/17	Sat. Day	46 - 48	-	-	24 - 32	29 - 38	27 - 29
1/4/17	Sat. Night	46 - 52	-	-	23 - 34	28 - 41	27 - 30
2/4/17	Sun. Day	46 - 47	-	-	24 - 27	29 - 37	27 - 27
2/4/17	Sun. Night	46 - 46	-	-	23 - 25	28 - 28	27 - 27
3/4/17	Mon. Day	46 - 47	-	-	25 - 28	29 - 38	27 - 29
3/4/17	Mon. Night	46 - 46	-	-	23 - 25	28 - 31	27 - 27

Table 3 notes: The time periods are the same as those presented in Tables 1 and 2, i.e. the daytime period is 07:00 to 23:00 hours, except for Friday Day which is 15:00 to 23:00 hours, and the night period is 23:00 to 07:00 hours. L_{A90} noise levels are not available for Positions B and C. The values presented are the lowest and highest hourly values for each period.

Table 4 – Summary of Period Vibration Dose Values (VDV)				
Start Date	Period	Vibration Dose Value VDV $m/s^{1.75}$		
		X-axis	Y-axis	Z-axis
31/3/17	Friday Day (15:00-23:00)	0.003	0.003	0.033
31/3/17	Friday Night (23:00-07:00)	0.004	0.004	0.052
1/4/17	Saturday Day (07:00-23:00)	0.002	0.002	0.028
1/4/17	Saturday Night (23:00-07:00)	0.004	0.003	0.046
2/4/17	Sunday Day (07:00-23:00)	0.002	0.002	0.016
2/4/17	Sunday Night (23:00-07:00)	0.001	0.001	0.007
3/4/17	Monday Day (07:00-23:00)	0.001	0.002	0.016
3/4/17	Monday Night (23:00-07:00)	0.001	0.001	0.007

Table 5 – Summary of Attended Measurement Noise Levels Measured on 1 April 2017						
Position	Start Time	End Time	Duration (m:s)	Free-field Noise Levels in dB		
				L_{Aeq}	L_{A90}	L_{AFmax}
A1	00:08	00:27	15:00	60	48	91
A3	00:35	00:56	14:46	62	53	80
A3	00:58	01:00	02:00	62	54	77
A3	01:01	01:02	00:30	60	54	73
A2	01:12	01:24	10:00	60	52	80
A1	01:39	01:40	01:01	52	46	72
A3	01:42	01:44	02:10	54	48	72
A3	01:46	01:46	00:06	55	51	65
A3	01:47	01:48	01:06	50	47	64
A3	01:48	01:49	01:00	52	48	65
A3	01:49	01:51	01:19	54	49	68
A3	01:53	01:57	03:00	59	53	76

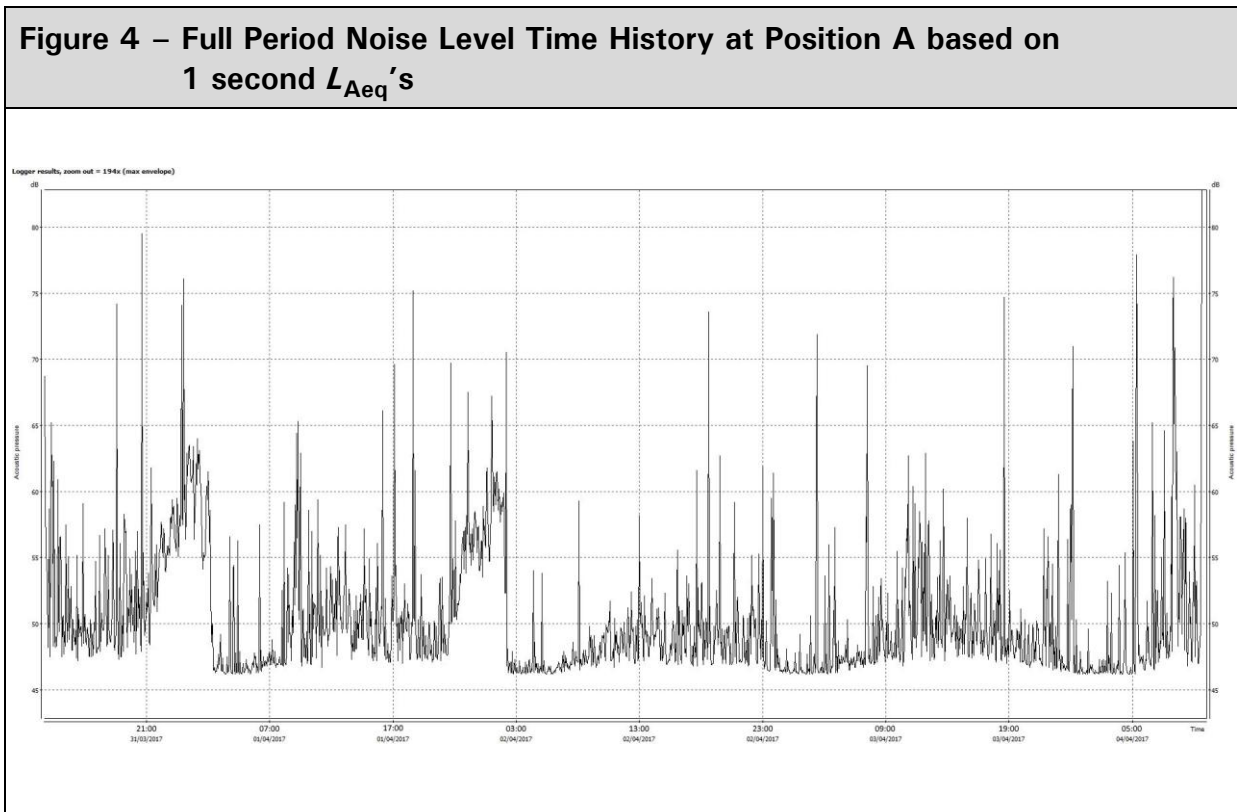


Figure 5 – Full Period Noise Level Time History at Position D, using 32 second L_{Aeq} 's

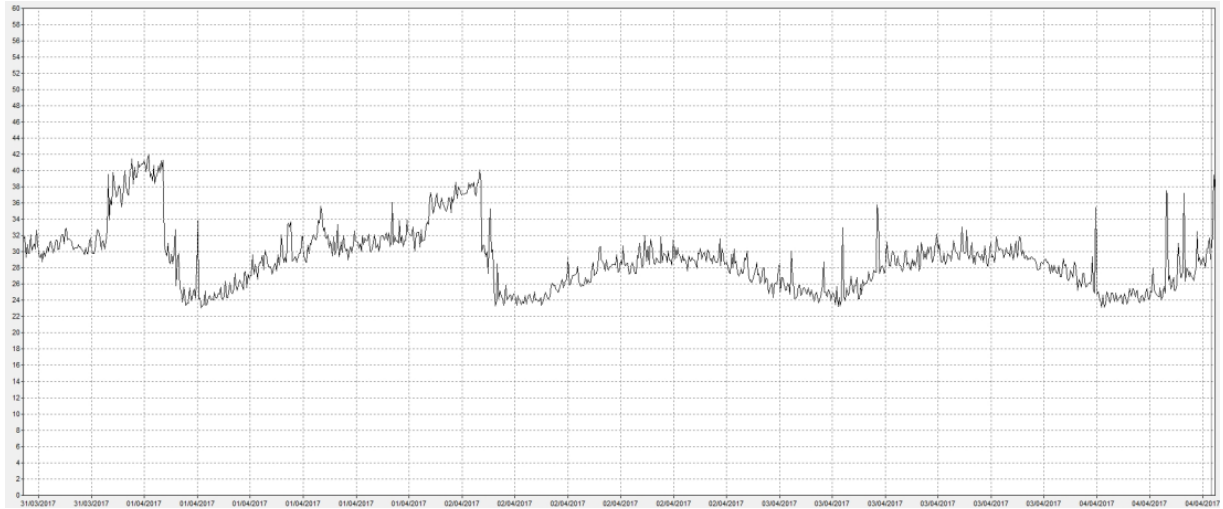


Figure 6 – Full Period Noise Level Time History at Position E, using 32 second L_{Aeq} 's

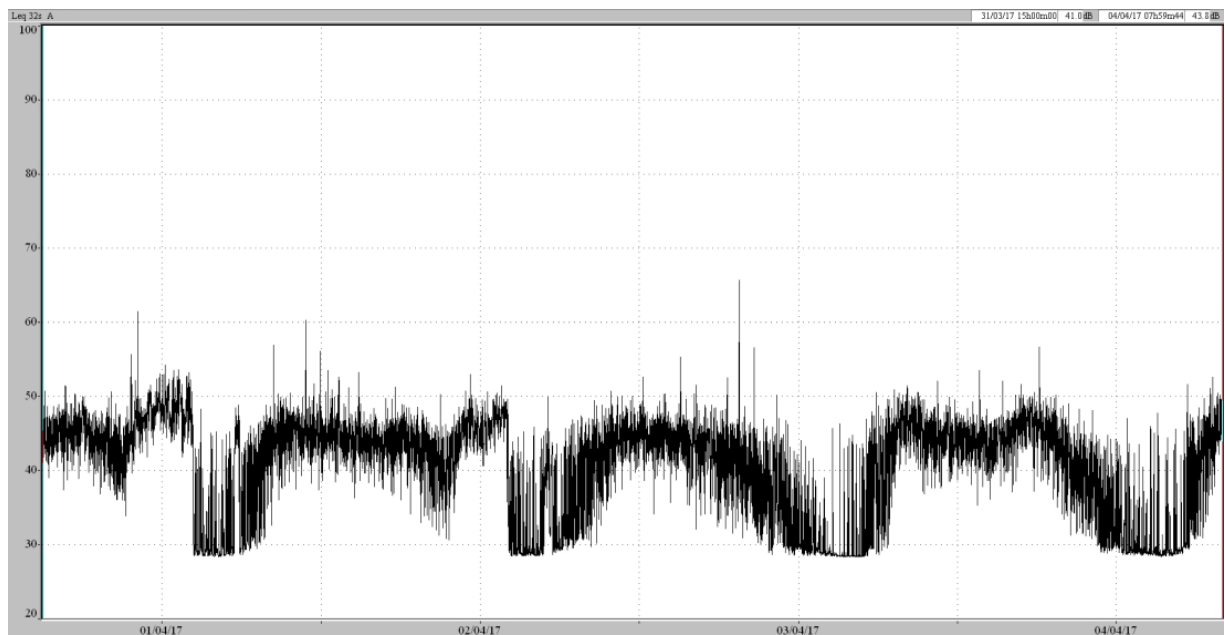


Figure 7 – Full Period Noise Level Time History at Position F, using 32 second L_{Aeq} 's

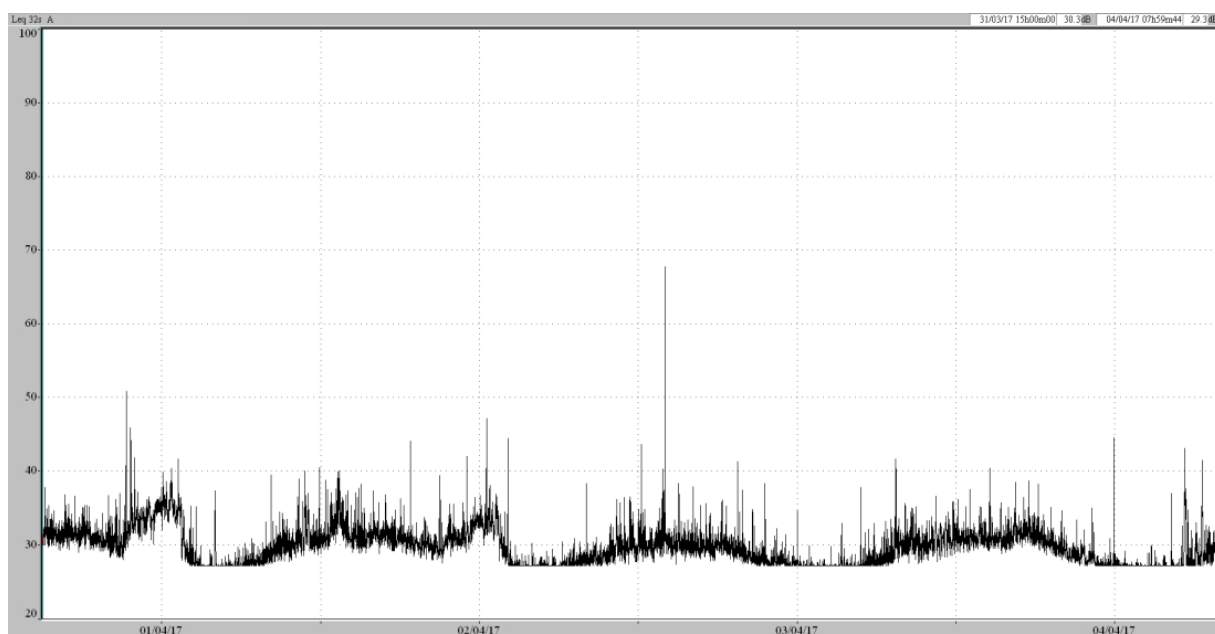
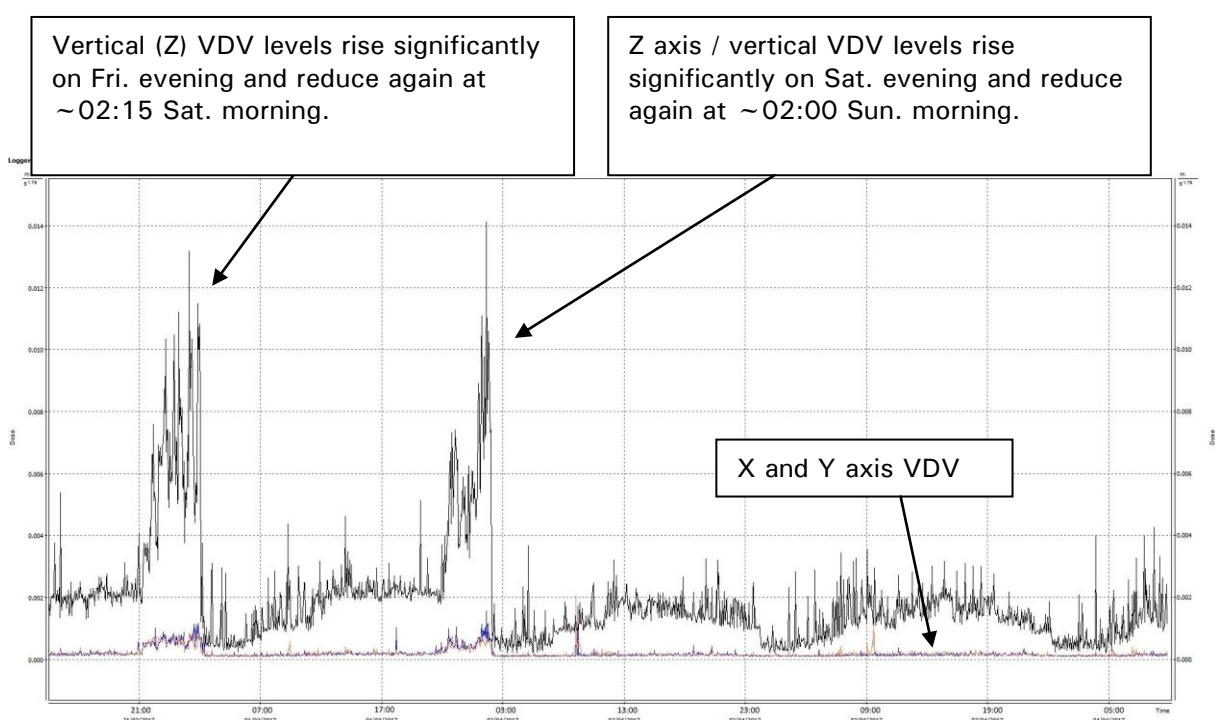


Figure 8 – 1 second X, Y and Z axis VDV at Position V1, $m/s^{1.75}$



5. CONCLUSIONS

This report has presented the details and results of noise and vibration level measurements carried out at Fountain House, Welwyn Garden City between 31 March and 4 April 2017.

Report Approved by:

Report Author:

*D L Watts**D J Boaden*

Eur Ing D L Watts BEng CEng FIOA
Principal Consultant

D J Boaden BSc MInstP MIOA
Managing Consultant

APPENDIX A – Measured Noise Levels

Table A1 - Noise Levels Measured at Position A – 31 March to 4 April 2017				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	47	47	64
	16:00	47	47	57
	17:00	47	47	64
	18:00	48	47	82
	19:00	47	47	65
	20:00	50	47	82
	21:00	49	47	65
	22:00	53	50	63
	23:00	54	51	82
Saturday 1 April 2017	00:00	56	51	80
	01:00	55	51	67
	02:00	47	46	62
	03:00	46	46	63
	04:00	46	46	62
	05:00	46	46	48
	06:00	47	46	58
	07:00	46	46	50
	08:00	47	46	66
	09:00	47	46	71
	10:00	47	46	65
	11:00	47	47	60
	12:00	47	47	64
	13:00	47	47	64
	14:00	47	47	59
	15:00	47	47	62
	16:00	47	47	71
	17:00	47	47	75
	18:00	48	47	83
	19:00	47	47	59
	20:00	47	47	60
	21:00	47	47	76
	22:00	51	48	63
	23:00	53	50	71

Table A1 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	53	50	66
	01:00	55	52	74
	02:00	47	46	71
	03:00	46	46	48
	04:00	46	46	61
	05:00	46	46	59
	06:00	46	46	50
	07:00	46	46	49
	08:00	47	46	60
	09:00	46	46	52
	10:00	46	46	57
	11:00	47	46	54
	12:00	47	46	64
	13:00	47	46	58
	14:00	47	46	56
	15:00	47	46	55
	16:00	47	46	60
	17:00	47	46	68
	18:00	47	46	81
	19:00	47	47	65
	20:00	47	47	66
	21:00	47	46	56
	22:00	47	46	62
	23:00	47	46	69
Monday 3 April 2017	00:00	46	46	53
	01:00	46	46	50
	02:00	46	46	55
	03:00	48	46	76
	04:00	46	46	64
	05:00	46	46	52
	06:00	46	46	52
	07:00	47	46	74
	08:00	47	46	59
	09:00	47	46	59
	10:00	47	46	69
	11:00	47	47	67
	12:00	47	47	71

Table A1 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	47	47	65
	14:00	47	47	57
	15:00	47	47	62
	16:00	47	47	60
	17:00	47	47	62
	18:00	47	47	82
	19:00	47	47	56
	20:00	47	47	55
	21:00	46	46	63
	22:00	46	46	68
	23:00	46	46	62
Tuesday 4 April 2017	00:00	47	46	77
	01:00	46	46	53
	02:00	46	46	57
	03:00	46	46	60
	04:00	46	46	63
	05:00	52	46	84
	06:00	47	46	71
	07:00	47	46	71
08:00	50	47	82	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	49	47 to 50	--
31/3/17	Friday Night (23:00-07:00)	52	46 to 51	82
1/4/17	Saturday Day (07:00-23:00)	47	46 to 48	--
1/4/17	Saturday Night (23:00-07:00)	51	46 to 52	74
2/4/17	Sunday Day (07:00-23:00)	47	46 to 47	--
2/4/17	Sunday Night (23:00-07:00)	46	46 to 46	76
3/4/17	Monday Day (07:00-23:00)	47	46 to 47	--
3/4/17	Monday Night (23:00-07:00)	48	46 to 46	84

Table A2 - Noise Levels Measured at Position B – 31 March to 1 April 2017				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	39	--	53
	16:00	39	--	53
	17:00	39	--	56
	18:00	39	--	53
	19:00	38	--	52
	20:00	37	--	63
	21:00	38	--	61
	22:00	39	--	63
	23:00	39	--	55
Saturday 1 April 2017	00:00	41	--	68
	01:00	39	--	54
	02:00	34	--	56
	03:00	30	--	49
	04:00	29	--	48
	05:00	31	--	50
	06:00	33	--	57
	07:00	35	--	52
	08:00	38	--	60
	09:00	39	--	50
	10:00	39	--	55
	11:00	39	--	58
	12:00	39	--	56
	13:00	40	--	57
	14:00	39	--	63
	15:00	39	--	58
	16:00	38	--	53
	17:00	38	--	60
	18:00	38	--	56
	19:00	37	--	52
	20:00	37	--	55
	21:00	36	--	62
	22:00	37	--	56
23:00	38	--	55	

Table A2 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	40	--	67
	01:00	40	--	68
	02:00	33	--	54
	03:00	29	--	48
	04:00	29	--	47
	05:00	29	--	47
	06:00	31	--	49
	07:00	33	--	52
	08:00	36	--	51
	09:00	36	--	54
	10:00	38	--	53
	11:00	38	--	55
	12:00	39	--	61
	13:00	38	--	59
	14:00	38	--	58
	15:00	39	--	59
	16:00	37	--	60
	17:00	37	--	53
	18:00	36	--	54
	19:00	37	--	66
	20:00	35	--	54
	21:00	34	--	60
	22:00	34	--	51
	23:00	34	--	59
Monday 3 April 2017	00:00	30	--	50
	01:00	28	--	51
	02:00	28	--	46
	03:00	29	--	60
	04:00	29	--	47
	05:00	33	--	50
	06:00	35	--	51
	07:00	38	--	54
	08:00	39	--	58
	09:00	39	--	51
	10:00	39	--	48
	11:00	38	--	49
12:00	38	--	53	

Table A2 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	38	--	53
	14:00	38	--	61
	15:00	38	--	53
	16:00	40	--	55
	17:00	40	--	56
	18:00	39	--	58
	19:00	38	--	51
	20:00	36	--	48
	21:00	35	--	48
	22:00	34	--	50
	23:00	32	--	60
Tuesday 4 April 2017	00:00	31	--	53
	01:00	29	--	44
	02:00	29	--	48
	03:00	29	--	48
	04:00	31	--	57
	05:00	35	--	55
	06:00	36	--	49
	07:00	39	--	50
08:00	41	--	59	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	39	--	--
31/3/17	Friday Night (23:00-07:00)	37	--	68
1/4/17	Saturday Day (07:00-23:00)	38	--	--
1/4/17	Saturday Night (23:00-07:00)	36	--	68
2/4/17	Sunday Day (07:00-23:00)	37	--	--
2/4/17	Sunday Night (23:00-07:00)	32	--	60
3/4/17	Monday Day (07:00-23:00)	38	--	--
3/4/17	Monday Night (23:00-07:00)	32	--	60

Table A3 - Noise Levels Measured at Position C – 31 March to 1 April 2017				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	36	--	51
	16:00	36	--	52
	17:00	36	--	54
	18:00	36	--	53
	19:00	35	--	49
	20:00	35	--	59
	21:00	36	--	60
	22:00	36	--	59
	23:00	36	--	53
Saturday 1 April 2017	00:00	40	--	67
	01:00	36	--	53
	02:00	31	--	53
	03:00	27	--	50
	04:00	27	--	42
	05:00	28	--	47
	06:00	29	--	54
	07:00	32	--	47
	08:00	35	--	62
	09:00	35	--	51
	10:00	36	--	57
	11:00	36	--	56
	12:00	36	--	58
	13:00	38	--	55
	14:00	36	--	59
	15:00	36	--	55
	16:00	36	--	56
	17:00	35	--	58
	18:00	35	--	55
	19:00	34	--	49
	20:00	33	--	51
	21:00	33	--	58
	22:00	33	--	51
23:00	35	--	55	

Table A3 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	38	--	66
	01:00	37	--	65
	02:00	30	--	52
	03:00	26	--	44
	04:00	26	--	44
	05:00	26	--	44
	06:00	28	--	46
	07:00	30	--	45
	08:00	32	--	47
	09:00	33	--	57
	10:00	34	--	53
	11:00	35	--	52
	12:00	35	--	57
	13:00	35	--	61
	14:00	35	--	57
	15:00	35	--	54
	16:00	34	--	58
	17:00	34	--	50
	18:00	34	--	52
	19:00	34	--	65
	20:00	32	--	55
	21:00	31	--	57
	22:00	31	--	53
	23:00	31	--	58
Monday 3 April 2017	00:00	27	--	48
	01:00	25	--	47
	02:00	25	--	42
	03:00	26	--	55
	04:00	26	--	48
	05:00	30	--	47
	06:00	32	--	49
	07:00	35	--	54
	08:00	36	--	61
	09:00	35	--	53
	10:00	36	--	50
	11:00	35	--	47
12:00	35	--	56	

Table A3 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	35	--	50
	14:00	35	--	59
	15:00	35	--	48
	16:00	36	--	53
	17:00	37	--	51
	18:00	36	--	54
	19:00	34	--	50
	20:00	33	--	52
	21:00	32	--	50
	22:00	31	--	50
	23:00	29	--	60
Tuesday 4 April 2017	00:00	28	--	53
	01:00	26	--	41
	02:00	26	--	45
	03:00	26	--	45
	04:00	28	--	56
	05:00	33	--	55
	06:00	32	--	47
	07:00	35	--	50
08:00	38	--	56	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	36	--	--
31/3/17	Friday Night (23:00-07:00)	34	--	67
1/4/17	Saturday Day (07:00-23:00)	35	--	--
1/4/17	Saturday Night (23:00-07:00)	33	--	66
2/4/17	Sunday Day (07:00-23:00)	34	--	--
2/4/17	Sunday Night (23:00-07:00)	29	--	58
3/4/17	Monday Day (07:00-23:00)	35	--	--
3/4/17	Monday Night (23:00-07:00)	29	--	60

Table A4 - Noise Levels Measured at Position D - 31 March to 1 April 2017				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	31	28	57
	16:00	30	28	50
	17:00	31	28	55
	18:00	31	29	53
	19:00	30	29	54
	20:00	31	28	54
	21:00	37	30	64
	22:00	38	33	55
	23:00	40	35	55
Saturday 1 April 2017	00:00	40	36	55
	01:00	38	28	55
	02:00	29	23	56
	03:00	24	23	46
	04:00	27	23	43
	05:00	25	23	38
	06:00	25	23	46
	07:00	26	24	52
	08:00	28	25	58
	09:00	29	26	54
	10:00	31	27	54
	11:00	31	27	53
	12:00	31	28	56
	13:00	33	29	57
	14:00	31	28	50
	15:00	31	28	56
	16:00	31	29	54
	17:00	31	28	56
	18:00	32	29	59
	19:00	32	28	54
	20:00	32	28	55
	21:00	34	29	51
	22:00	36	32	55
23:00	37	33	57	

Table A4 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	38	34	57
	01:00	36	27	56
	02:00	29	23	57
	03:00	24	23	47
	04:00	24	23	37
	05:00	24	23	35
	06:00	25	23	41
	07:00	26	24	43
	08:00	27	25	49
	09:00	27	24	49
	10:00	29	26	56
	11:00	28	26	54
	12:00	29	26	51
	13:00	30	26	56
	14:00	30	26	53
	15:00	30	27	54
	16:00	30	27	56
	17:00	29	27	47
	18:00	30	27	46
	19:00	29	27	52
	20:00	29	26	54
	21:00	28	26	54
	22:00	27	25	53
	23:00	26	24	46
Monday 3 April 2017	00:00	27	25	55
	01:00	25	24	40
	02:00	25	24	41
	03:00	25	24	44
	04:00	26	23	54
	05:00	26	23	47
	06:00	26	23	41
	07:00	30	25	59
	08:00	29	26	54
	09:00	29	26	53
	10:00	29	27	56
	11:00	30	27	52
	12:00	30	27	56

Table A4 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	30	28	56
	14:00	30	28	55
	15:00	29	27	52
	16:00	30	27	53
	17:00	30	28	52
	18:00	30	28	48
	19:00	29	27	42
	20:00	28	27	47
	21:00	28	26	46
	22:00	27	25	50
	23:00	29	24	59
Tuesday 4 April 2017	00:00	24	23	39
	01:00	24	23	32
	02:00	25	23	35
	03:00	25	24	35
	04:00	25	24	47
	05:00	31	24	56
	06:00	30	25	64
	07:00	29	25	43
08:00	33	26	58	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	33.6	28 to 33	--
31/3/17	Friday Night (23:00-07:00)	35.5	23 to 36	56
1/4/17	Saturday Day (07:00-23:00)	31.7	24 to 32	--
1/4/17	Saturday Night (23:00-07:00)	33.3	23 to 34	57
2/4/17	Sunday Day (07:00-23:00)	28.8	24 to 27	--
2/4/17	Sunday Night (23:00-07:00)	25.8	23 to 25	55
3/4/17	Monday Day (07:00-23:00)	29.3	25 to 28	--
3/4/17	Monday Night (23:00-07:00)	27.5	23 to 25	64

Table A5 - Noise Levels Measured at Position E - 31 March to 1 April 2017

Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	45	37	62
	16:00	46	38	62
	17:00	46	38	68
	18:00	46	37	67
	19:00	45	35	59
	20:00	43	34	64
	21:00	45	35	67
	22:00	48	41	78
	23:00	49	43	64
	Saturday 1 April 2017	00:00	49	42
01:00		49	41	63
02:00		45	28	66
03:00		33	28	59
04:00		33	28	58
05:00		42	28	60
06:00		39	28	59
07:00		42	29	58
08:00		46	33	72
09:00		46	35	62
10:00		47	37	75
11:00		46	38	69
12:00		46	38	64
13:00		45	37	65
14:00		45	37	64
15:00		44	37	62
16:00		44	36	67
17:00		45	36	62
18:00		45	36	61
19:00		44	34	60
20:00		42	32	57
21:00		42	31	66
22:00		45	36	61
23:00	46	40	65	

Table A5 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	46	39	61
	01:00	48	41	63
	02:00	39	28	65
	03:00	33	28	59
	04:00	37	28	59
	05:00	39	28	59
	06:00	37	29	59
	07:00	41	29	59
	08:00	43	30	60
	09:00	45	32	59
	10:00	45	35	62
	11:00	45	37	57
	12:00	45	37	63
	13:00	45	36	64
	14:00	45	36	57
	15:00	45	35	68
	16:00	44	34	67
	17:00	44	32	59
	18:00	43	31	66
	19:00	47	32	80
	20:00	42	31	71
	21:00	40	29	57
	22:00	40	29	62
23:00	36	28	59	
Monday 3 April 2017	00:00	34	28	57
	01:00	31	28	53
	02:00	31	28	56
	03:00	33	28	61
	04:00	34	28	58
	05:00	41	28	60
	06:00	43	28	61
	07:00	46	34	62
	08:00	47	38	61
	09:00	46	36	63
	10:00	45	36	65
	11:00	45	36	65
	12:00	45	36	58

Table A5 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	37	37	71
	14:00	35	35	57
	15:00	36	36	61
	16:00	37	37	58
	17:00	38	38	61
	18:00	36	36	73
	19:00	34	34	60
	20:00	32	32	60
	21:00	31	31	59
	22:00	29	29	59
	23:00	28	28	58
Tuesday 4 April 2017	00:00	28	28	57
	01:00	28	28	56
	02:00	28	28	60
	03:00	28	28	61
	04:00	28	28	58
	05:00	29	29	60
	06:00	31	31	61
	07:00	35	35	62
08:00	38	38	63	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	46	34 to 41	--
31/3/17	Friday Night (23:00-07:00)	46	28 to 43	66
1/4/17	Saturday Day (07:00-23:00)	45	29 to 38	--
1/4/17	Saturday Night (23:00-07:00)	43	28 to 41	65
2/4/17	Sunday Day (07:00-23:00)	44	29 to 37	--
2/4/17	Sunday Night (23:00-07:00)	38	28 to 28	61
3/4/17	Monday Day (07:00-23:00)	45	29 to 38	--
3/4/17	Monday Night (23:00-07:00)	38	28 to 31	61

Table A6 - Noise Levels Measured at Position F - 31 March to 1 April 2017				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Fri. 31 March 2017	15:00	32	29	50
	16:00	32	29	49
	17:00	32	29	48
	18:00	32	29	47
	19:00	31	28	52
	20:00	31	28	51
	21:00	36	28	67
	22:00	34	30	49
	23:00	35	31	49
Saturday 1 April 2017	00:00	36	32	55
	01:00	33	27	53
	02:00	28	27	51
	03:00	27	27	46
	04:00	29	27	42
	05:00	28	27	39
	06:00	28	27	47
	07:00	28	27	44
	08:00	30	27	60
	09:00	30	27	52
	10:00	32	28	54
	11:00	32	28	49
	12:00	32	28	54
	13:00	34	29	55
	14:00	32	28	51
	15:00	32	28	50
	16:00	32	29	49
	17:00	31	28	48
	18:00	32	28	60
	19:00	30	27	45
	20:00	30	27	48
	21:00	31	27	55
	22:00	31	28	46
23:00	33	29	59	

Table A6 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Sun. 2 April 2017	00:00	34	30	59
	01:00	32	27	48
	02:00	30	27	58
	03:00	27	27	45
	04:00	27	27	38
	05:00	27	27	44
	06:00	28	27	37
	07:00	28	27	45
	08:00	29	27	45
	09:00	29	27	43
	10:00	30	27	49
	11:00	30	27	51
	12:00	31	27	58
	13:00	31	27	54
	14:00	30	27	46
	15:00	31	27	50
	16:00	31	27	52
	17:00	30	27	49
	18:00	31	27	49
	19:00	30	27	58
	20:00	29	27	50
	21:00	28	27	52
	22:00	28	27	45
	23:00	28	27	43
Monday 3 April 2017	00:00	28	27	45
	01:00	27	27	43
	02:00	27	27	46
	03:00	28	27	48
	04:00	28	27	52
	05:00	28	27	42
	06:00	29	27	45
	07:00	32	27	58
	08:00	31	27	49
	09:00	30	27	51
	10:00	31	27	49
	11:00	32	28	47
	12:00	31	28	48

Table A6 - Continued				
Hour Commencing		Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
Mon. 3 April 2017	13:00	32	28	52
	14:00	32	28	57
	15:00	31	28	48
	16:00	32	28	50
	17:00	32	29	50
	18:00	32	28	49
	19:00	30	28	47
	20:00	29	27	50
	21:00	29	27	45
	22:00	28	27	51
	23:00	29	27	59
Tuesday 4 April 2017	00:00	27	27	41
	01:00	27	27	39
	02:00	27	27	49
	03:00	27	27	41
	04:00	28	27	49
	05:00	32	27	56
	06:00	30	27	59
	07:00	31	27	46
08:00	33	27	57	
Start Date	Period	Free-Field Noise Levels in dB		
		L_{Aeq}	L_{A90}	L_{AFmax}
31/3/17	Friday Day (15:00-23:00)	33	28 to 30	--
31/3/17	Friday Night (23:00-07:00)	32	27 to 32	55
1/4/17	Saturday Day (07:00-23:00)	31	27 to 29	--
1/4/17	Saturday Night (23:00-07:00)	31	27 to 30	59
2/4/17	Sunday Day (07:00-23:00)	30	27 to 27	--
2/4/17	Sunday Night (23:00-07:00)	28	27 to 27	52
3/4/17	Monday Day (07:00-23:00)	31	27 to 29	--
3/4/17	Monday Night (23:00-07:00)	29	27 to 27	59

APPENDIX B
Attended Noise Level Measurement Results

Table B1- 1 April 2017 Attended Noise Level Measurement Results – Part 1

Position	Comment	Start Time	End Time	Elapsed Time	L_{Aeq}	L_{A90}	L_{Amax}
1	Average 8 people in smoking area chatting. Music bass just audible. 3 people for a period of the meas. On grass chatting. Car passbys dominant when they happen otherwise dominant source is people chatting.	00:08:24	00:27:30	00:15:00	60.0	48.0	91.0
3	6 people outside club chatting and some shouting. MC in club audible when club doors open. 3 people on the grass chatting and singing. Waterfall noise also contributing. Roughly half way through meas. No. of people goes up to 8 in smoking area and 5 on the grass. Taxi pick up directly outside the club. Towards the end of the period particularly noisy people leave club shouting and singing. Other traffic noise excluded.	00:35:21	00:56:03	00:14:46	62.0	53.0	80.0
3	9 people in smoking area shouting and chatting. 5 people on the grass. Music just audible when doors open.	00:57:44	00:59:52	00:02:00	62.0	54.0	77.0
3	Doors to club open. Music from inside dominant.	01:00:47	01:01:17	00:00:30	60.0	54.0	73.0
2	Car idle outside club, 8 people outside. Music from inside just audible with doors shut, more audible when open. Road traffic excluded. Pub almost empty. Club still operating.	01:12:04	01:24:28	00:10:00	60.0	52.0	80.0
1	General noise. 3 people outside club. Road traffic included.	01:39:10	01:40:11	00:01:01	52.0	46.0	72.0
3	3 people outside club chatting. Bass music just audible (doors shut). Road traffic excluded. Dominant noise source is the water fountain.	01:41:48	01:44:22	00:02:10	54.0	48.0	72.0
3	Music noise from inside club with doors open.	01:45:28	01:45:34	00:00:06	55.0	51.0	65.0
3	Relatively quiet. 2 People outside chatting. Music from inside club audible only some of the time.	01:46:23	01:47:41	00:01:06	50.0	47.0	64.0
3	Club doors open. Music clearly audible. Nobody outside.	01:47:47	01:48:47	00:01:00	52.0	48.0	65.0
3	Dominant noise source is bass music. Club doors are open. 2 - 3 people outside chatting. Road traffic excluded.	01:49:34	01:51:15	00:01:19	54.0	49.0	68.0
3	Taxi idle outside club. 8 people outside club. Some chatting and shouting. Road traffic excluded.	01:53:31	01:57:05	00:03:00	59.0	53.0	76.0

Table B2 – 1 April 2017 Attended Noise Level Measurement Results – Part 2 – Frequency Band Data 16 to 100 Hz

Pos.	Start Time	End Time	Elapsed Time	L_{eq} Noise Levels in dB at One-third Octave Centre Band Frequency Hz								
				16	20	25	31.5	40	50	63	80	100
1	00:08:24	00:27:30	00:15:00	53	52	55	56	53	55	54	54	52
3	00:35:21	00:56:03	00:14:46	53	52	58	55	55	57	58	57	56
3	00:35:21	00:56:03	00:14:46	53	52	58	55	56	57	58	56	56
3	00:57:44	00:59:52	00:02:00	51	50	54	53	60	59	59	57	58
3	01:00:47	01:01:17	00:00:30	54	52	54	52	54	61	61	58	58
2	01:12:04	01:24:28	00:10:00	59	58	63	54	55	64	63	59	57
1	01:39:10	01:40:11	00:01:01	62	63	65	63	55	59	61	55	51
3	01:41:48	01:44:22	00:02:10	61	61	60	60	58	57	58	57	53
3	01:45:28	01:45:34	00:00:06	57	59	59	59	60	61	65	64	57
3	01:46:23	01:47:41	00:01:06	63	62	61	60	59	58	57	57	54
3	01:47:47	01:48:47	00:01:00	57	56	59	54	54	56	60	60	58
3	01:49:34	01:51:15	00:01:19	67	65	64	63	62	61	62	62	61
3	01:53:31	01:57:05	00:03:00	61	60	65	69	57	57	61	59	54

Table B3 – 1 April 2017 Attended Noise Level Measurement Results – Part 3 - Frequency Band Data 125 to 800 Hz

Pos.	Start Time	End Time	Elapsed Time	L_{eq} Noise Levels in dB at One-third Octave Centre Band Frequency Hz								
				125	160	200	250	315	400	500	630	800
1	00:08:24	00:27:30	00:15:00	50	47	47	48	47	49	49	51	53
3	00:35:21	00:56:03	00:14:46	52	51	50	51	50	49	51	53	54
3	00:35:21	00:56:03	00:14:46	52	51	50	51	50	50	51	53	54
3	00:57:44	00:59:52	00:02:00	54	49	49	51	52	50	52	52	52
3	01:00:47	01:01:17	00:00:30	53	50	49	53	52	48	50	52	51
2	01:12:04	01:24:28	00:10:00	52	48	47	50	50	49	53	53	53
1	01:39:10	01:40:11	00:01:01	50	47	47	46	44	44	42	43	44
3	01:41:48	01:44:22	00:02:10	51	47	44	44	44	44	44	44	44
3	01:45:28	01:45:34	00:00:06	57	49	48	48	46	42	43	45	46
3	01:46:23	01:47:41	00:01:06	49	44	42	42	44	40	39	41	41
3	01:47:47	01:48:47	00:01:00	53	46	43	44	45	41	41	43	45
3	01:49:34	01:51:15	00:01:19	56	48	46	46	45	45	43	46	44
3	01:53:31	01:57:05	00:03:00	52	48	46	47	46	45	48	50	52

Table B4 – 1 April 2017 Attended Noise Level Measurement Results – Part 4 - Frequency Band Data 1000 to 8000 Hz

Pos.	Start Time	End Time	Elapsed Time	L_{eq} Noise Levels in dB at One-third Octave Centre Band Frequency Hz									
				1000	1250	1600	2000	2500	3150	4000	5000	6300	8000
1	00:08:24	00:27:30	00:15:00	54	52	51	45	42	42	41	35	32	31
3	00:35:21	00:56:03	00:14:46	55	53	51	49	46	45	42	38	36	35
3	00:35:21	00:56:03	00:14:46	55	54	52	49	46	45	42	38	36	35
3	00:57:44	00:59:52	00:02:00	55	54	53	49	45	45	43	38	36	34
3	01:00:47	01:01:17	00:00:30	53	51	51	46	46	45	43	40	39	37
2	01:12:04	01:24:28	00:10:00	52	51	50	46	44	44	41	38	37	36
1	01:39:10	01:40:11	00:01:01	43	40	38	37	36	36	35	34	34	33
3	01:41:48	01:44:22	00:02:10	45	42	41	42	42	42	40	33	--	--
3	01:45:28	01:45:34	00:00:06	45	44	43	42	41	40	39	38	36	35
3	01:46:23	01:47:41	00:01:06	40	42	38	37	36	35	33	33	--	--
3	01:47:47	01:48:47	00:01:00	42	41	41	40	41	37	36	35	--	--
3	01:49:34	01:51:15	00:01:19	45	46	43	41	38	38	35	34	--	--
3	01:53:31	01:57:05	00:03:00	53	49	49	45	44	43	41	39	37	34

APPENDIX C – Equipment, Calibration and Weather Details

Table C1 - Schedule of Noise Instrumentation			
Pos(s)	Use	Type	Serial No.
A/V1	Measuring System	Svantek SVAN 958A	45502
V1	Triaxial Accelerometer	Svantek SV84	D6018
A	Microphone	Microtech Gefell Gmbh MK 255	11730
A	Microphone Pre-	Svantek SV12L	47652
V1	Vibration Calibrator	Svantek SV111	40587
A	Sound Level Calibrator	B&K 4230	1472196
B/C	Measuring System	Norsonic 121	31359
B	Microphone	GRAS 40AE	56714
B	Microphone Pre-	Norsonic 1201	28083
C	Microphone	GRAS 40AE	56718
C	Microphone Pre-	Norsonic 1201	29386
B/C	Calibrator	Norsonic 1251	29213
D	Measuring System	Nor140	1406786
D	Microphone	Norsonic 1225	264702
D	Microphone Pre-	Norsonic 1209	21313
D	Calibrator	B&K 4230	543357
E	Measuring System	Cirrus CR 704B (Unit G)	011182
E	Microphone	Cirrus MK 224 (Unit G)	20040519
E	Calibrator	Cirrus CR 511D (Unit G)	011970
F	Measuring System	Cirrus CR 7.02 (Unit D)	012622
F	Microphone	Cirrus MK 224 (Unit D)	890259
F	Calibrator	Cirrus CR 511D (Unit D)	014087
*	Measuring System	B&K 2260	2341172
*	Microphone	B&K 4189	2339504
*	Calibrator	B&K 4231	2342748

* denotes that the B&K 2260 system was used for the attended sample noise level measurements.

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 C2 – Record of Weather Conditions		
	31 March 2017	4 April 2017
Temperature, °C	13	12
Relative Humidity, %	75	80
Wind Speed, m/s	3 - SW	3 – NW