

Our Ref: JM/jm/EC8982_32970

Date: 01/06/2007

Updated 24/8/2007

Project : Waitrose
Caversham

BACKGROUND NOISE SURVEY AND PLANT NOISE ASSESSMENT

Client: Underwood Carpenter
South Ash Manor
South Ash Road
Ash
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REPORT



ENVIRONMENTAL EQUIPMENT CORPORATION



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1.00 INTRODUCTION

- 1.01 Environmental Equipment Corporation Limited have been commissioned by Underwood Carpenter on behalf of Waitrose Limited to undertake a background noise survey at their existing store in Caversham, with a view to ascertaining prevailing background noise levels for the immediate vicinity.
- 1.02 Proposals are being submitted to Reading Borough Council to install new condenser plant on the roof of the store. Noise levels from the plant need to be assessed as part of the planning application and are therefore addressed in this report.
- 1.03 This report is prepared solely for Underwood Carpenter and Waitrose Limited. Environmental Equipment Corporation Ltd accepts no responsibility for its use by any third party.

2.00 SITE

- 2.01 The Waitrose Store is situated in the town centre of Caversham. To the north of the store is Church Street, one of the main roads into Caversham. This road runs east-west. To the rear of the Waitrose building extending to the south and west is the store car park. There are other commercial properties along Church Street which effectively screen the car park from the road. The store is two storeys high and at its rear on the second floor level is a health gym.
- 2.02 Between the front of the store and the pitched roof at the rear over the health gym is a flat area of roof upon which are currently installed 5 No. condensers. It is proposed as part of the improvement to the store to decommission and remove three of the existing condensers on the rooftop and replace these with two new condensers. Appendix A shows a plan of the proposed roof layout and notes indicating properties in the surrounding area.
- 2.03 The nearest noise sensitive properties are the residential properties to the south west of the store in Promenade Road beyond the car park. These properties are approximately 140 metres from the proposed plant location and will have a direct line of sight onto the plant. The rear of the properties along Church Street are closer than these properties, however, all of these windows appear to serve only storage areas for the shops.



2.04 The following photos show the various locations.

Residential
Properties



Photo 1: View from plant location across to residential properties



Commercial
Properties

Photo 2: View from roof edge at plant location across to commercial properties



3.00 MEASUREMENTS

- 3.01 Background noise levels have been measured over a 15 hour period at a ground level location on the south side of the store. This enabled noise levels to be recorded that are representative of those experienced outside the nearest residential properties outside of any possible influence of the existing plant.
- 3.02 The equipment was set up to integrate sound levels over 5 minute intervals for 15 hours between 1710hrs, Tuesday 29th May and 0810hrs, Wednesday 30th May, 2007. This covers the quietest night time period over which the plant is expected to operate.
- 3.03 Levels were recorded as A weighted L_{eq} , L_{10} and L_{90} .
- 3.04 Weather conditions during the survey were generally clear and dry with a brief rain shower in the morning.

4.00 EQUIPMENT

- 4.01 Equipment for the survey was as follows:-

- Brüel & Kjær type 2236 Integrating Sound Level Meter conforming to type 1 BS EN 60804 & BS EN 60651: 1994.
- Brüel & Kjær Condenser Microphone and Connecting Leads.
- Brüel & Kjær Outdoor Microphone Kit, type UA1404.
- Tripod.

- 4.02 The equipment holds current UKAS accreditation and serial numbers as follows:

Sound Level Meter B&K2236	Serial No.	1764397
	Calibration Date	29 th July 2005
	Cal Certificate No.	14135
½" Condenser Mic. B&K4188	Serial No.	2051241
	Calibration Date	29 th July 2005
	Cal Certificate No.	14135
Calibrator B&K4231	Serial No.	2389051
	Calibration Date	20 June 2006
	Cal. Certificate No.	15141

N.B. Copies of certificates are available upon request.



- 4.03 The equipment was calibrated both before and after the survey with no difference noted in the levels.

5.00 **RESULTS**

- 5.01 A list of the levels measured is included in Appendix B and represented graphically in Appendix C.
- 5.02 A summary of the lowest measured background levels is shown in Table 5.1, below.

Period	L _{A90} – dB
Day time (0700-2300 hrs)	44.5
Night-time (2300-0700 hrs)	40.5

Table 5.1: Minimum measured background noise levels

6.00 **DISCUSSION**

- 6.01 The lowest background levels were L_{A90} of 44.5 dB during a daytime period and 40.5 dB during a night-time period.
- 6.02 It is proposed to install two identical condensers side by side on the flat roof of the store. The manufacturers publish the following noise levels from their unit.

Plant Item	Daytime Sound Pressure Level	Night Time Sound Pressure Level
HT/LT1 Condenser	40 dB(A) @ 10 m	TBC
HT/LT2 Condenser	37 dB(A) @ 10 m	TBC

Table 6.1: Manufacturer's quoted sound pressure level for proposed new condensers operating in free-field conditions over a reflective plane (dB(A) re 2 x 10⁻⁵ Pa)

- 6.03 Calculations have been carried out extrapolating the noise levels out to the nearest affected properties. In lieu of any specific planning conditions relating to the new plant we have compared the results against current British Standards to assess the impact the proposed new plant will have.



6.04 In accordance with current design policy and the recommendations of BS 4142:1997 'Method for rating industrial noise affecting mixed residential and industrial areas' new noise sources should be designed to mitigate the potential for community annoyance. BS4142 gives guidance on assessing the likelihood of complaints by calculating a 'rating level' of the new noise source and comparing its magnitude at noise sensitive locations to the existing or underlying background noise level. The background noise level is subtracted from the 'rating level' to assess the likelihood of complaints:

- The greater the difference the greater the likelihood of complaints.
- A difference of around +10dB or more indicates that complaints are likely.
- A difference of +5dB is of marginal significance.
- If the rating level is more than 10dB below the measured background noise level then this is a positive indication that complaints are unlikely.

6.05 The 'rating level' of the noise source is obtained taking the following factors into consideration:

- The new plant noise (the specific noise) is measured or predicted in terms of L_{Aeq} .
- A correction of +5dB shall be included if the noise contains a distinguishable, discrete continuous note, if the noise contains distinct impulses or if the noise is irregular enough to attract attention.

6.06 The following new plant noise levels have been calculated at the residential properties in Promenade Road approximately 140 metres away.

Operation	Calculated noise level	(BS4142) Rating Level minus background noise level	Assessment
Day	22	-21	Complaints will be very unlikely (noise inaudible)
Night	22	- 18	Complaints will be very unlikely (noise inaudible)

Table 6.2: Calculated noise levels external to the nearest residential properties

The calculations show that for both daytime and night time operation the noise levels from the new condensers will not result in complaints. The night time noise levels have been based on there being no reduction in the daytime noise level which is unlikely based on the reduced load during the night time.



- 6.07 The following noise levels have been calculated to the nearest affected commercial property on Church Street approximately 35 metres away.

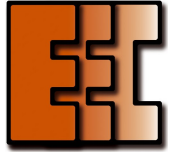
Operation	Calculated noise level	(BS4142) Rating Level minus background noise level	Assessment
Day	37	- 7	Complaints will be unlikely
Night	37	- 3	Complaints will be unlikely

Table 6.3: Calculated noise levels external to the nearest commercial property

The calculations show that for both daytime and night time operation the noise levels from the new condensers should not result in complaints. The night time noise levels have been based on there being no reduction in the daytime noise level which is unlikely based on the reduced load during the night time.

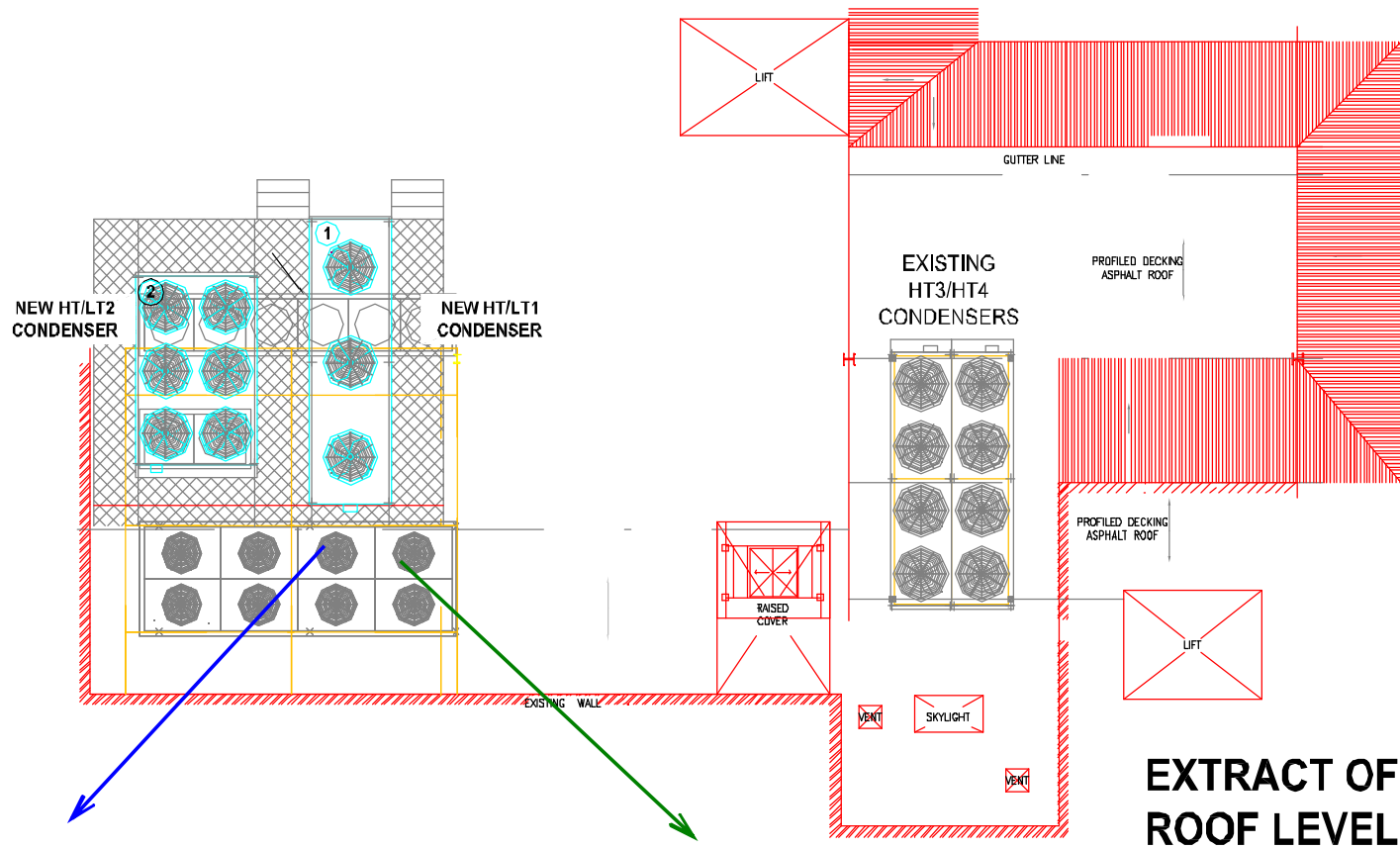
7.00 CONCLUSION

- 7.01 An ambient noise survey has been carried out to establish the typical background noise levels for the immediate vicinity to the Waitrose Store in Caversham prior to the proposed installation of two external items of refrigeration plant.
- 7.02 Using the manufacturers' noise data for the proposed plant, calculations have been carried out to establish the likely noise impact the new plant will have external to the nearest affected properties. Calculations have shown that, based on guidance within current British Standards, the new plant will be unlikely to result in noise complaints.



APPENDIX A

SITE PLAN



Nearest affected commercial property - 35 metres

Nearest affected residential property - 140 metres

**EXTRACT OF
ROOF LEVEL**



APPENDIX B

SURVEY RESULTS (TABULAR)

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Waitrose Limited



15 Hour Noise data

Time	L _{Aeq}	L _{A10}	L _{A90}
17:10	67.4	66.5	55.0
17:15	63.7	66.5	55.0
17:20	66.5	69.0	55.0
17:25	64.8	68.0	56.0
17:30	64.0	64.0	54.0
17:35	64.5	65.5	54.0
17:40	61.7	64.0	54.0
17:45	58.3	60.0	50.5
17:50	56.6	59.0	49.5
17:55	59.9	62.0	51.5
18:00	57.9	59.5	50.0
18:05	57.9	61.0	52.5
18:10	57.9	61.0	52.0
18:15	59.9	62.0	55.0
18:20	59.0	61.5	54.0
18:25	60.1	61.0	54.0
18:30	57.4	60.0	53.0
18:35	59.3	61.0	54.0
18:40	58.9	61.0	55.0
18:45	58.6	60.5	52.5
18:50	55.0	58.5	47.0
18:55	56.6	59.5	49.0
19:00	56.4	59.5	45.5
19:05	56.7	59.5	50.5
19:10	55.0	58.5	46.5
19:15	60.2	62.5	47.5
19:20	57.0	61.0	46.0
19:25	55.4	57.5	46.5
19:30	58.9	58.5	48.0
19:35	55.2	59.0	45.5
19:40	54.8	58.0	47.0
19:45	55.9	56.5	45.5
19:50	51.9	54.5	46.0
19:55	52.8	55.0	46.5
20:00	54.8	58.5	47.5
20:05	54.0	57.0	46.5
20:10	58.9	61.0	47.5
20:15	51.2	54.0	45.5
20:20	52.5	56.0	45.5
20:25	52.1	53.0	44.5
20:30	52.6	56.5	45.5
20:35	54.6	56.5	44.5
20:40	56.7	57.5	45.0
20:45	48.9	50.5	44.5
20:50	53.0	56.5	45.5
20:55	50.2	53.5	45.5
21:00	51.6	55.0	46.5
21:05	50.4	53.5	45.5

Time	L _{Aeq}	L _{A10}	L _{A90}
21:10	50.5	52.5	45.0
21:15	50.9	51.5	45.5
21:20	48.2	49.5	45.0
21:25	49.7	52.0	45.5
21:30	51.4	52.0	45.5
21:35	52.3	55.5	47.5
21:40	53.2	56.0	47.0
21:45	50.3	52.5	47.0
21:50	53.3	56.0	46.5
21:55	57.4	58.5	47.5
22:00	51.0	52.5	46.0
22:05	56.8	58.0	46.5
22:10	63.0	66.5	48.0
22:15	63.6	67.0	47.0
22:20	58.4	60.0	47.5
22:25	50.9	53.0	46.0
22:30	49.8	51.5	46.0
22:35	48.9	48.5	45.5
22:40	48.9	49.5	46.5
22:45	48.8	50.0	47.0
22:50	48.9	51.0	46.0
22:55	48.6	49.5	45.5
23:00	48.6	49.5	46.0
23:05	46.8	48.0	45.0
23:10	51.5	48.5	45.0
23:15	51.2	51.5	45.5
23:20	47.1	48.0	46.0
23:25	49.0	50.5	47.0
23:30	47.1	47.5	45.5
23:35	46.3	47.0	45.0
23:40	46.4	47.5	44.5
23:45	47.3	49.0	45.5
23:50	46.0	48.0	44.0
23:55	47.6	49.5	43.5
00:00	45.3	46.0	43.5
00:05	45.1	46.5	43.5
00:10	45.7	47.0	43.5
00:15	45.9	47.0	44.0
00:20	46.0	47.0	44.5
00:25	45.3	46.0	44.0
00:30	48.2	48.5	43.0
00:35	52.4	48.0	43.0
00:40	56.6	61.0	43.0
00:45	63.9	68.0	43.5
00:50	57.8	58.5	44.5
00:55	54.5	56.5	42.0
01:00	58.9	61.5	45.0
01:05	60.5	63.5	44.0

EC 8982 - Waitrose Caversham

Waitrose Limited



15 Hour Noise data

Time	L _{Aeq}	L _{A10}	L _{A90}
01:10	61.6	62.5	44.5
01:15	46.1	49.0	43.0
01:20	44.1	44.5	43.0
01:25	43.5	44.5	42.0
01:30	43.2	43.5	42.0
01:35	41.9	42.0	41.0
01:40	42.3	43.0	41.0
01:45	43.2	44.0	42.0
01:50	42.3	43.0	41.0
01:55	43.1	43.5	40.5
02:00	42.6	44.0	41.0
02:05	44.1	45.5	42.5
02:10	45.2	46.0	43.0
02:15	43.4	44.0	42.0
02:20	43.2	45.0	41.0
02:25	42.3	43.0	41.0
02:30	43.3	43.0	41.0
02:35	59.6	65.5	41.5
02:40	65.7	69.0	42.0
02:45	54.6	58.5	41.5
02:50	55.5	59.5	42.0
02:55	61.3	61.5	41.5
03:00	43.2	44.5	41.5
03:05	54.0	52.5	42.0
03:10	43.8	45.0	42.0
03:15	47.8	51.0	43.0
03:20	43.5	44.5	42.0
03:25	43.1	43.5	42.0
03:30	42.9	43.5	41.5
03:35	43.2	43.5	41.5
03:40	44.3	46.0	42.5
03:45	46.2	48.5	42.5
03:50	46.0	48.5	42.5
03:55	47.4	50.0	43.5
04:00	47.0	49.5	43.0
04:05	48.4	51.5	43.5
04:10	47.2	49.5	43.5
04:15	46.4	48.5	42.5
04:20	47.3	49.5	43.5
04:25	46.5	49.5	42.0
04:30	52.6	56.5	42.0
04:35	51.7	56.0	42.5
04:40	44.9	46.5	43.0
04:45	47.8	51.0	43.5
04:50	45.7	46.5	44.0
04:55	47.3	49.0	43.0
05:00	48.2	47.0	43.0
05:05	45.9	47.5	43.5

Time	L _{Aeq}	L _{A10}	L _{A90}
05:10	47.5	48.0	46.5
05:15	48.3	49.0	47.0
05:20	47.3	48.0	46.0
05:25	47.4	48.5	46.0
05:30	54.6	56.5	46.0
05:35	55.2	55.5	46.5
05:40	49.3	50.5	46.0
05:45	51.3	52.5	47.0
05:50	54.9	58.5	47.5
05:55	57.4	59.0	48.0
06:00	49.8	50.5	48.0
06:05	52.0	53.0	49.0
06:10	51.0	51.5	48.5
06:15	52.2	53.5	49.0
06:20	51.4	52.5	49.0
06:25	53.0	55.0	50.0
06:30	51.7	53.0	49.5
06:35	58.6	61.0	52.0
06:40	52.0	53.0	50.0
06:45	52.6	54.0	50.0
06:50	54.1	56.5	50.5
06:55	53.4	55.5	50.0
07:00	54.5	57.5	50.5
07:05	56.8	60.0	51.5
07:10	63.8	68.0	53.0
07:15	54.7	57.5	51.0
07:20	53.7	54.0	51.0
07:25	53.4	54.5	51.5
07:30	69.1	72.5	53.0
07:35	55.6	57.0	53.0
07:40	58.9	61.0	53.5
07:45	56.7	59.5	52.5
07:50	54.9	57.5	52.0
07:55	56.4	58.0	51.5
08:00	55.9	59.0	51.0
08:05	57.6	59.0	51.5
08:10	57.6	59.5	51.5



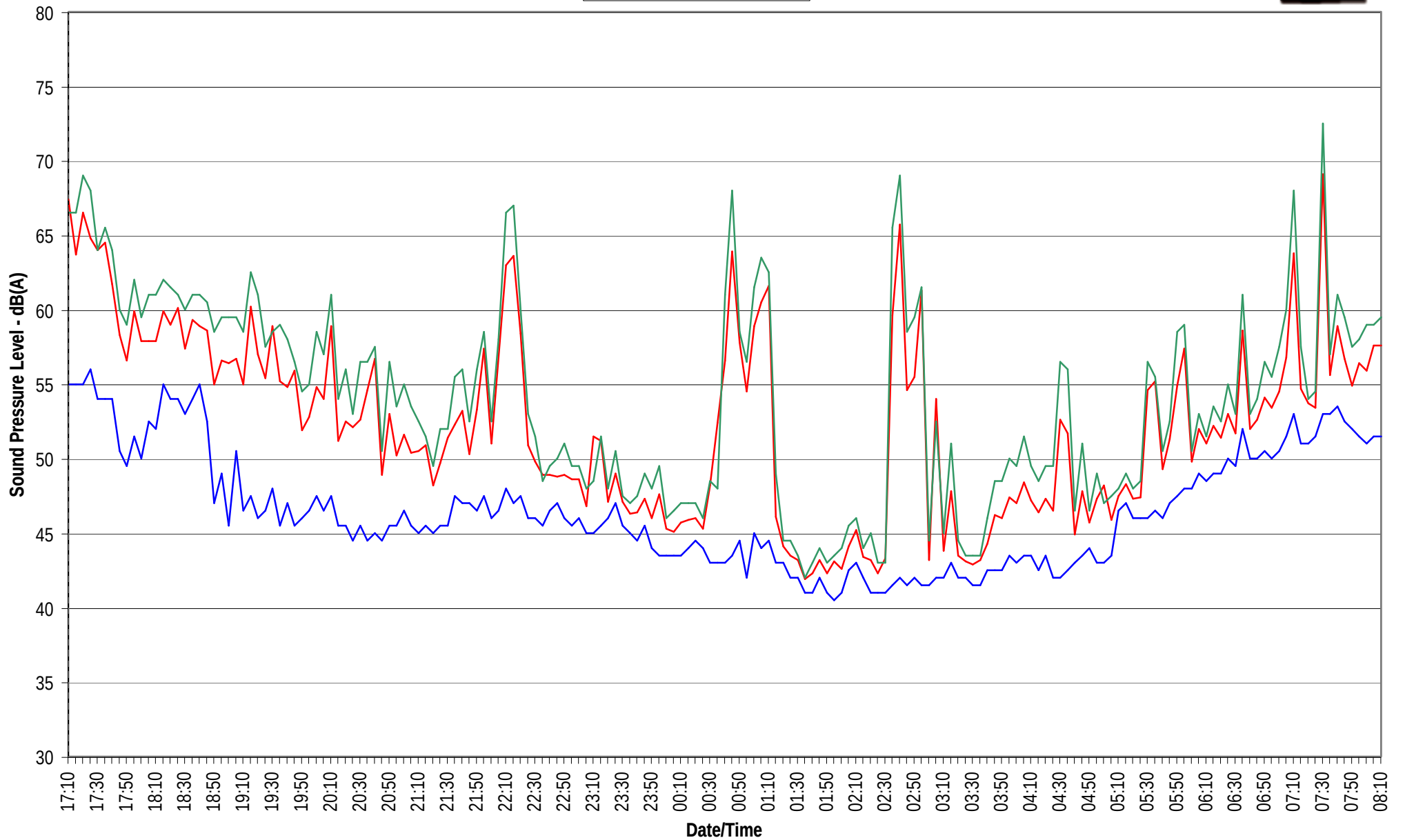
APPENDIX C

SURVEY RESULTS (GRAPHICAL)



Noise Level Time History

Leq L10 L90





APPENDIX D

GLOSSARY OF TECHNICAL TERMS



TECHNICAL TERMS AND UNITS

Decibel (dB) - This is the unit used to measure sound. The human ear has an approximately logarithmic response to sound over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). We therefore use a logarithmic scale to describe sound pressure levels, intensities and power levels. The logarithms used are to base 10; hence, an increase of 10 dB in sound pressure level corresponds to a doubling in perceived loudness of the sound.

Sound Power Level (PWL) - This is a function of the noise source alone and is independent of its surroundings. It is a measure of the amount of sound power output measured in decibels.

Sound Pressure Level (SPL) - This is a function of the source and its surroundings and is a measure of the sound pressure at a point in space. For example, a sound pressure level measured at 1 metre from a sound source of certain sound power in reverberant room will not be the same as the sound pressure level at 1 metre from the sound source measured in open space.

Octave and One-Third Octave Bands - The human ear is sensitive to sound over a range of approximately 20 Hz to 20 KHz and is generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum is divided into frequency bands and the sound pressure level is measured in each band. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For finer analysis, each octave band may be split into three one-third octave bands.

"A" Weighting - A number of frequency weightings have been developed to imitate the ear's varying sensitivity to sound of different frequencies. The most commonly used weighting is the "A" weighting. The "A" weighted SPL can be measured directly or derived from octave or one-third octave band SPLs. The result is a single figure index which gives some idea of the subjective loudness of the sound, but which contains no information as to its frequency content.

Noise Rating (NR) and Noise Criteria (NC) Curves - The "A" weighted sound pressure level cannot be used to define a spectrum or to compare sounds of different frequencies. NR curves convey frequency information in a single-figure index. This is done by defining the maximum permissible sound pressure level at each frequency for each curve. To measure the noise rating of a given environment, the SPL is measured in octave or one-third octave bands and the noise rating is then the highest NR curve touched by the measured levels.

Typical NR levels for various environments are shown below:

Workshops	NR 60-70
Mechanised Office	NR 50-55
Gymnasium, Sport Halls, Swimming Baths	NR 40-50
Restaurants, Bars, Cafeterias	NR 35-45
Cinemas, Hospitals, Churches, Small Conference Rooms	NR 25-35
Classrooms, TV Studios, Large Conference Rooms	NR 20-30
Concert Halls, Theatres	NR 20-25
Diagnostic Clinics, Audiometric Rooms	NR 10-20
Broadcasting Studios	NR 5-15

NC curves are similar to NR curves and are evaluated in the same way. At low frequencies, NC curves are below the equivalent NR curves. They are often used for setting ventilation noise levels.

Intermittency and Time-Weighting - The degree of annoyance caused by a noise also depends on its duration and intermittency of a noise. Intermittent, impulsive or repetitive noises tend to be more annoying than continuous noises. Various time-weightings have been derived to measure sounds of differing intermittences and these can be measured directly on modern equipment. The most common time-weightings in use are as follows:-

L₉₀	This is the sound pressure level exceeded for 90% of the measurement period. It is widely used to measure background noise levels.
L₅₀	this is the sound pressure level exceeded for 50% of the measurement period. It is widely used to measure background noise levels with an element of other intrusive noise. For a given measurement, the L ₅₀ level is by definition greater than or equal to the L ₉₀ level.
L₁₀	This is the sound pressure level exceeded for 10% of the measurement period. It is widely used to measure traffic noise. For a given measurement period, the L ₁₀ level is by definition greater than or equal to the L ₉₀ level.
L_e	The equivalent continuous noise level is often used to measure intermittent noise. It is defined as the notional steady noise level that would contain the same acoustic energy as the varying noise. Because the averaging process used is logarithmic, the L _{eq} level tends to be dominated by the higher noise levels measured.