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SHARPS REDMORE PARTNERSHIP

ACOUSTIC CONSULTANTS

NOISE ASSESSMENT OF REFRIGERATION AND VENTILATION PLANT AT TESCO METRO STORE, PRINCESS STREET, MANCHESTER

Prepared by:

M. Taylor
AMIOA

Project No: 089329/1

23rd July 2008

REPORT - Princess Street, Manchester

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2.0	The noise control scheme – conclusions and recommendations
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1.0 Introduction

1.1 Sharps Redmore Partnership (SRP) has been instructed by Tesco Stores Limited (Tesco) to provide them with an acoustic consultancy relating to the installation of refrigeration and ventilation plant at the proposed store on Princess Street, Manchester.

1.2 The proposal is to install the external refrigeration condenser/compressor pack, Air Handling Unit, and small A/C condensers on the roof of No. 55 Princess Street. In addition to these items, extract fans serving the toilets and bake-off area will be located within the building itself discharging at roof level.

1.3 This assessment is based on a computer model of the site which establishes the noise control scheme to comply with the noise criteria established in Section 3.0. The noise model and prediction methodology are discussed in Section 4.0

1.4 The noise control scheme is discussed in Section 2.0.

1.5 SRP has worked for Tesco on about 500 new or existing stores over a fifteen year period and has developed considerable expertise in dealing with noise matters relating to superstores.

1.6 The Appendix contains various schedules and the calculations from the noise model.

1.7 The store is located on Princess Street, backing on to Kennedy Street and the surrounding neighbourhood is mainly commercial, with some residential dwellings above the commercial properties.

1.8 There are dwellings which SRP consider could potentially be affected by this development.

The nearest residential properties are located at third floor level above the Vine Inn Public House on Kennedy Street.

2.0 The noise control scheme – conclusions and recommendations

2.1 SRP is confident that with the adoption of the noise control scheme described in this report there will not be any noise giving rise to complaints from the additional externally located refrigeration and plant. The predicted noise levels are:

Table 2.1 – predicted free field noise levels at nearest residence

Daytime	L_{Aeq} = 35 dB
Night time	L_{Aeq} = 29 dB

2.2 At this stage we understand that there are conditions relating to noise under application 069867/FO/2003/C1 which was submitted for the development of 41/44 Princess Street, 29/40 Kennedy Street and 23/25 Bow Lane as follows: "*before the use commences, the building, together with any externally mounted ancillary equipment, shall be acoustically insulated in accordance with a scheme submitted to and approved by the city Council as local planning authority in order to secure a reduction in the level of noise emanating from the site / property. The scheme shall be designed so as to achieve a noise level 5 dBA below the night time background noise levels at 42 Kennedy Street*" which is understood to be the Vine Inn Public House. Therefore based on our monitored environmental noise levels which are shown in full in Figure Five of the Appendix and summarised in Table 3.4, we propose the following criteria:

Table 2.2 – proposed noise criterion at nearest residence

Daytime	L_{Aeq} = 41 dB
Night time	L_{Aeq} = 38 dB

2.3 A schedule of noise data used for the proposed plant is shown in Figures One in the Appendix. The data used is based on Tesco standard specification for plant used on "Metro" stores.

2.4 The proposal is to locate the plant on the roof of the property which is significantly higher than the nearest residential dwelling, therefore screening will be provided by the parapet of the building itself.

3.0 Establishing Noise Criteria

3.1 It is usual in dealing with fixed sources of ventilation and refrigeration noise to use BS 4142:1997 "Method for rating noise affecting mixed residential and industrial areas" as a means of establishing an overall noise level from the new sources which is unlikely to cause eomplaints.

3.2 As detailed in Section 2.2 we understand the criteria requested by the City Council for this site is to achieve a noise level at least 5 dB below the night time background noise level L_{A90}.

3.3 An environmental noise survey was undertaken at forth floor level overlooking Princess Street and Kennedy Street, at a position best representative of the nearest residential properties. The survey was undertaken between 1730 hours on 30th June until 0850 hours on 1st July to determine the minimum daytime and night time noise climate.

3.4 The meters were Norsonic 118. Which were located at least 1m away from the façade of the building. The meter was calibrated before and after the surveys with no sign of drift noted. During the surveys the weather conditions were clear, with a light breeze, and as such would not result in any unusual sound propagation or interference with the meter's accuracy.

3.5 The surveys were undertaken to determine current environmental noise conditions so as to enable us to establish a criteria for the additional plant to be installed on the store roof.

Table 3.5 - Minimum environmental noise levels

Princess Street	Background	Ambient
	L_{A90}	L_{Aeq}
Daytime 0700 - 2300 hours	51 dB	63 dB
Night time 2300 – 0700 hours	44 dB	48 dB

Kennedy Street	Background	Ambient
	L_{A90}	L_{Aeq}
Daytime 0700 - 2300 hours	46 dB	48 dB
Night time 2300 – 0700 hours	43 dB	45 dB

3.6 In our experience this type of plant does not exhibit any distinguishable tonality features as defined in paragraph 8 of BS 4142:1997. Therefore based on our monitored environmental noise levels which are shown in full in Figure Seven of the Appendix and summarised in Table 3.5 the following criteria has been adopted:

Table 3.6 – proposed noise criterion at nearest residence

Daytime	L_{Aeq} = 41 dB
Night time	L_{Aeq} = 38 dB

3.7 The method of establishing the likelihood of complaints from new sources is given in paragraph 9 of BS 4142:1997 by subtracting the measured background noise level from the rating level:

Table 3.7- Predicted noise level at nearest residential property

	Predicted L_p (L_{Aeq})	Background (L_{A90})	Difference dB
Daytime	35	46	-11
Night time	29	43	-14

3.8 The day, and night time comparison shows that the predicted noise level at the nearest residence are at least 10 dB below the minimum background noise levels measured during the survey.

BS 4142:1997 indicates that this difference is a good indication that complaints are unlikely (BS 4142 paragraph 9). Additionally this indicates that there would be no significant environmental impact (ref PPS1) when this new plant is introduced.

3.9 It is understood that the proposed opening hours of the store are from 0600 hours to midnight (depending on the day of the week). Generally 0600 to 0700 and 2300 to midnight is considered as night time operation. However it should be noted that during these additional hours, based on the environmental noise survey, the minimum background noise levels do not drop below the minimum daytime noise levels as detailed in Table 3.5. Therefore the operation of the plant between 0600 to 0700 hours and 2300 to midnight can be assessed against the daytime criteria, and the comments detailed in para 3.8 remain valid.

Table 3.9 Minimum environmental noise levels – extended hours

Princess Street	Background	Ambient	
	L_{A90}	L_{Aeq}	
0600 - 0700 hours	46 dB	48 dB	
2300 – midnight	46 dB	48 dB	
Kennedy Street	Background	Ambient	
	L_{A90}	L_{Aeq}	
0600 - 0700 hours	48 dB	59 dB	
2300 – midnight	51 dB	63 dB	Daytime

4.0 The noise model and prediction methodology

4.1 The noise model employed has been written in-house to provide an accurate prediction method for assessing environmental noise from, in particular, plant and equipment items which can be perceived as being point sources. It has been mainly used for the prediction of noise emanating from superstores.

4.2 There are three input spreadsheets containing:

4.2.1 noise sources data
4.2.2 receiver data
4.2.3 acoustic screening data

These are included in Figure Two in the Appendix

4.3 The noise sources data include:

4.3.1 noise data in one of the following forms for each item of plant:
4.3.1.1 either, octave band sound power levels in the range of 63 to 8000Hz – this being available from manufacturer of many of the supply and extract fans.
4.3.1.2 or, octave band sound pressure levels in the range of 63 to 8000Hz – this is available usually for the small, externally mounted split units' condenser fans from the manufacturer's product catalogue when measured at one metre in anechoic conditions, thus allowing straight forward calculation of the equivalent sound power levels.
4.3.1.3 or, single value sound pressure levels at a stated distance – this has become the common method of specifying the maximum permitted noise levels from the condenser units and the acoustically housed compressor equipment. The specified measurement distance for this plant is 10 metres.

The program "converts" the last two sets of data into octave band sound power levels using "textbook" methods.

4.3.2 The relative location of the plant using X and Y co-ordinates with an arbitrary datum point and a Z (height) co-ordinate based on supporting steel and screening heights from the main contractor and then the equipment heights based, in this case, on the mechanical services consultants drawings.

4.3.3 Where known, the area and orientation of the noise outlet is entered together with its location adjacent to either one, two or three reflective surfaces so that the calculation can establish the directivity pattern and outlet reflection losses.

4.4 The receiver data needed are the X, Y and Z co-ordinates so that the relative distance and angle can be calculated between the source and the receiver.

In the case of this projcct the heights of the plant has been taken at roof level, with he nearest residential dwellings at 3rd floor level.

4.5 Finally, several types of acoustic screening may be entered. In this case, this is designated "R" meaning a ring barrier. The ring barrier indicates the parapet of the building itself.

4.6 The noise model carries out "text book" atmospheric side calculations at each receiver position from each source allowing for the attenuation from such as the calculated distance and screening. The calculations are performed in eight Octave bands from 63 to 8000Hz but can then be summarised as dBA, NR or NC for convenience. In this case, the overall summary levels are in single dBA. Individual calculations for the day and night time situations are included in Figures Three and Four in the Appendix which should make this clear. The computer maintains a logarithmic total of the noise levels in Octave bands.

At the end of each program "run", the overall day or night time noise level at each receiver position are calculated and ranked in descending order of noise level. Where this ranking shows that the receiver position's noise level exceeds the noise criterion, each calculation can be interrogated to determine the plant items needing more detailed inspection to establish the attenuation needed. The process is repeated until either the noise level meets the noise criterion or the program demonstrates that other noise control methods are needed. This may take the form of restricting the offending plant's period of operation or improving the screening or re-selection to give quieter plant.

4.7 The source data which were entered into the model is shown in Figure One in the Appendix.

4.8 Calculations for the daytime and night time situation are shown in summary only form in Figures Three and Four in the Appendix. The full calculations are available.

5.0 Conclusions

5.1 This report has been undertaken in accordance with BS 4142:1997 "Method for rating noise affecting mixed residential and industrial areas" which is generally applied by local authorities for the assessment of mechanical services plant.

5.2 The method of establishing the likelihood of complaints from new sources is given in paragraph 9 of BS 4142:1997 by subtracting the measured background noise level from the predicted noise level:

Table 3.5 - Predicted noise level at nearest residential property

	Predicted L_p (L_{Aeq})	Background (L_{A90})	Difference dB
Daytime	35	46	-11
Night time	29	43	-14

5.3 BS 4142:1997 states *"a difference of around +10 dB or more indicates that complaints are likely. A difference of around + 5 dB is of marginal significance. If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely."*

5.4 As detailed in Section 2.2 we understand the criteria requested by the City Council for this site is to achieve a noise level at least 5 dB below the night time background noise level L_{A90}.

5.5 The day, and night time comparison shows that the predicted noise level at the nearest residence are at least 10 dB below the minimum background noise levels measured during the survey.

BS 4142:1997 indicates that this difference is a good indication that complaints are unlikely (BS 4142 paragraph 9).

SRP is therefore of the opinion that these comparisons show that there should be no significant environmental impact (PPS1 refers) when the new plant is introduced.

Appendices

Figure One	Source data
Figure Two	Noise model inputs
Figure Three	Daytime calculations - summary
Figure Four	Night time calculations - summary
Figure Five	Environmental survey data

FIGURE ONE

SOURCE DATA

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Telephone: 44(0)1473 730073 Facsimile: 44(0)1473 730030 Email: srp@sharpsredmore.co.uk

CLIENT :Tesco Stores Ltd	One Sht: 1 of 1
PROJECT :Manchester Princess St	PROJECT No:089239
CONSULTANT:J Fosker	DATE :04 July 2008

SOUND POWER LEVELS (Lw) & SOUND PRESSURE LEVELS (Lp)
FOR FANS AND OTHER EQUIPMENT

EQUIPMENT NAME/REFERENCE	Lw/Lp	DIST. (m)	OP. TIME DNA	MID FREQUENCY OCTAVE BANDS (HZ) 63	125	250	500	1k	2k	4k	8k
Refrigeration Compressor Pack	Lp	10	A	Maximum 45dBA at 10 metres							
Refrigeration Condenser (3 fans) - Day	Lp	10	D	Maximum 50dBA at 10 metres							
Refrigeration Condenser (3 fans) - Night	Lp	10	N	Maximum 45dBA at 10 metres							
Split A/C condenser A	Lp	10	A	Maximum 45dBA at 10 metres							
Split A/C condenser B	Lp	10	A	Maximum 45dBA at 10 metres							
Split A/C oondenser C	Lp	10	A	Maximum 45dBA at 10 metres							
Bake Off / Chiller - Exhaust	Lp	10	A	Maximum 45dBA at 10 metres							
Toilet Extract Exhaust	Lp	10	A	Maximum 45dBA at 10 metres							
AHU Overall noise level - Day	Lp	10	D	Maximum 60dBA at 10 metres							
AHU Overall noise level - Night	Lp	10	N	Maximum 50dBA at 10 metres							

NOTES:

1. Lw/Lp:
   Lw means sound power level (dB)
   Lp means sound pressure level at stated distance (dB/m)
2. Operational time (OP.TIME D/N/A):
   D (Day) - could operate at any time between 0700 & 2300
   N (Night) - could operate at any time between 2300 & 0700
   A (All) - could operate at any time during the day and night

FIGURE TWO

NOISE INPUT MODEL

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Tel: 44 (0) 1473 730073 Fax: 44 (0) 1473 730030 Email: srp@sharpsredmore.co.uk

Filename : c:\Noysplot\Princess Street\030708_1 - base model

Date : 04 July 2008

Entries by : J Fosker

Project number : 089239

Project title : Manchester Princess St

Client's name : Tesco Stores Ltd

Map/plot details :

Length :200
Width :200
Height :250

SHARPS REDMORE PARTNERSHIP

The White House, London Road, Copdock, Ipswich, IP8 3JH
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Source data - description, coordinates, outlet size, percentage to atmosphere, directivity, sound levels and running period.

Filename : c:\Noysplot\Princess Street\030708_1 - base model

Source Description	Coordinates X(m)	Y(m)	Z(m)	Outlet details A(mm)	B(mm)	Ang.	%	Q	Run DNA	Lp/ Lw	dBA Y/N	Dist. (m)	Mid frequency octave bands 63	125	250	500	1k	2k	4k	8k
Refrigeration Compressor Pack	104.8	115.3	27.5	0	0	0	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
Refrigeration Condenser (3 fans	107.3	115.3	27.2	0	0	0	100	2	D	P	Y	10.0	50	0	0	0	0	0	0	0
Refrigeration Condenser (3 fans	107.3	115.3	27.2	0	0	0	100	2	N	P	Y	10.0	45	0	0	0	0	0	0	0
Split A/C condenser A	109.2	112.2	26.5	0	0	0	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
Split A/C condenser B	109.2	109.8	26.5	0	0	0	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
Split A/C condenser C	109.2	107.8	26.5	0	0	0	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
Bake Off / Chiller - Exhaust	93.8	119.8	26.0	300	300	180	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
Toilet Extract Exhaust	123.6	122.7	26.0	200	200	0	100	2	A	P	Y	10.0	45	0	0	0	0	0	0	0
AHU Overall noise level - Day	105.7	109.5	26.7	0	0	0	100	2	D	P	Y	10.0	60	0	0	0	0	0	0	0
AHU Overall noise level - Night	105.7	109.5	26.7	0	0	0	100	2	N	P	Y	10.0	50	0	0	0	0	0	0	0

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Receptor data - description and coordinates

Filename : c:\Noysplot\Princess Street\030708_1 - base model

Receptor Description	Coordinates X(m)	Y(m)	Z(m)	DNA
Nearest 3rd floor window above The Vine P	133.5	129.5	13.0	A

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Barrier data - description and coordinates

Filename : c:\Noysplot\Princess Street\030708_1 - base model

Barrier type	Coordinates Start X(m)	Start Y(m)	Start Z(m)	Finish X(m)	Finish Y(m)	Finish Z(m)
R	100.0	104.5	25.5	100.0	118.3	25.5
R	100.0	118.3	25.5	89.0	119.5	25.5
R	89.0	119.5	25.5	90.0	127.4	25.5
R	90.0	127.4	25.5	126.5	124.2	25.5
R	126.5	124.2	25.5	126.7	104.5	25.5
R	126.7	104.5	25.5	100.0	104.5	25.5

FIGURE THREE

DAYTIME CALCULATIONS - SUMMARY

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Day time overall receptor listings

Filename: c:\Noysplot\Princess Street\030708_1 - base model
Date: 04/07/2008

	Mid frequency Octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Nearest 3rd floor window above The Vine PH	55	43	34	28	24	23	23	25	35

SHARPS REDMORE PARTNERSHIP

The White House, London Road, Copdock, Ipswich, IP8 3JH
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Day time source sound pressure levels at receptor: Nearest 3rd floor window above The Vine PH

Filename: c:\Noysplot\Princess Street\030708_1 - base model
Date: 04/07/2008

	Mid frequency Octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
AHU Overall noise level - Day	54	41	32	26	23	22	22	24	33
Refrigeration Condenser (3 fans) - Day	46	34	24	17	14	13	13	15	25
Toilet Extract Exhaust	38	29	24	18	14	10	10	10	22
Split A/C condenser A	40	28	18	12	9	8	8	10	20
Refrigeration Compressor Pack	41	28	18	11	8	7	7	9	19
Split A/C condenser C	39	27	17	11	8	7	7	9	19
Split A/C condenser B	39	26	17	11	8	7	7	9	18
Bake Off / Chiller - Exhaust	34	22	13	3	0	0	0	0	11
Total Free field Lp and dBA	55	43	34	28	24	23	23	25	35

FIGURE FOUR

NIGHT TIME CALCULATIONS - SUMMARY

SHARPS REDMORE PARTNERSHIP

The White House, London Road, Copdock, Ipswich, IP8 3JH
Tel: 44 (0) 1473 730073 Fax: 44 (0) 1473 730030 Email: srp@sharpsredmore.co.uk

Night-time overall receptor listings

Filename: c:\Noysplot\Princess Street\030708_1 - base model
Date: 04/07/2008

	Mid frequency Octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Nearest 3rd floor window above The Vine PH	49	37	29	22	19	17	17	19	29

SHARPS REDMORE PARTNERSHIP

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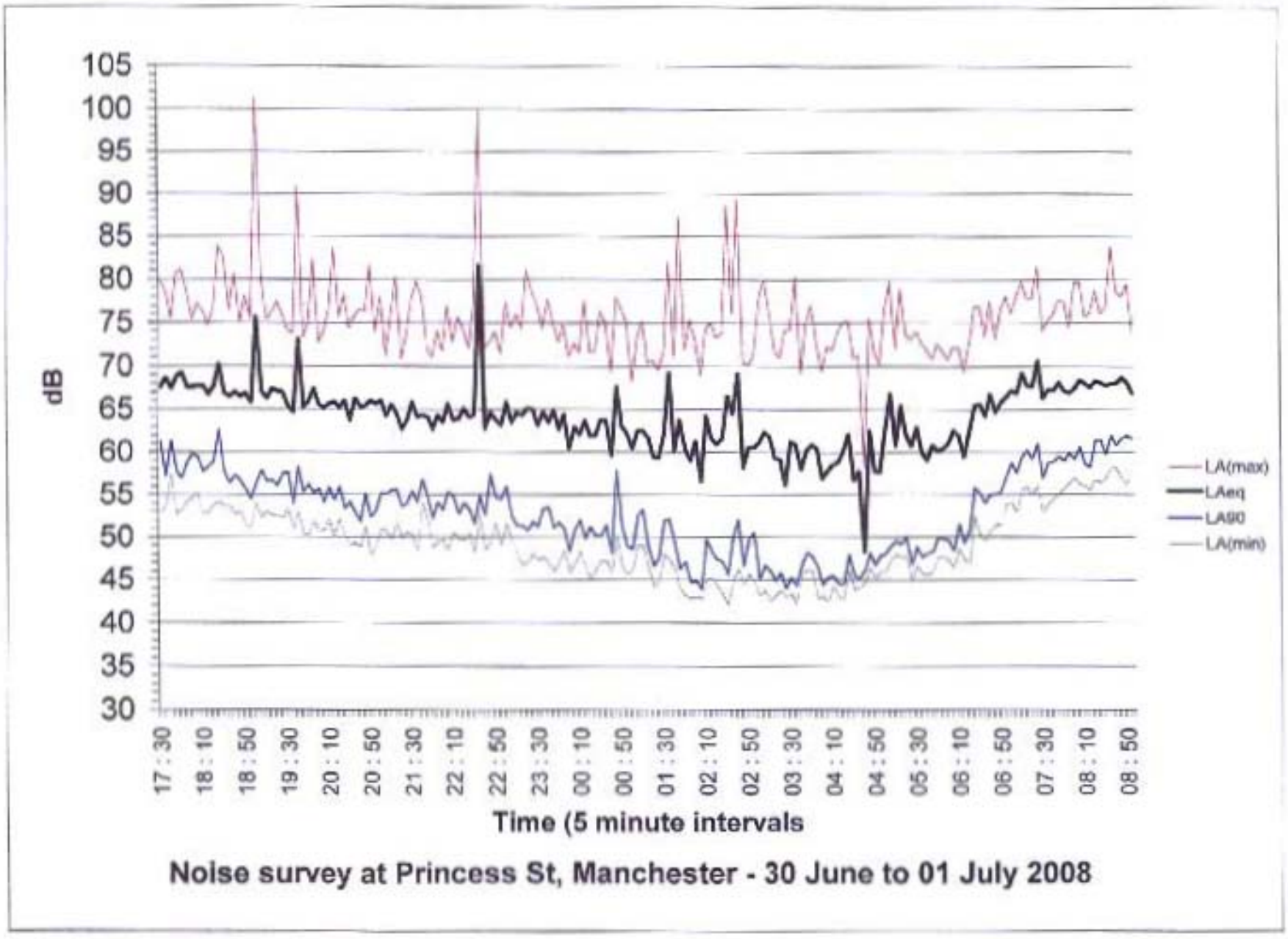
Night-time source sound pressure levels at receptor: Nearest 3rd floor window above The Vine PH

Filename: c:\Noysplot\Princess Street\030708_1 - base model
Date: 04/07/2008

	Mid frequency Octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
AHU Overall noise level - Night	44	31	22	16	13	12	12	14	23
Toilet Extract Exhaust	38	29	24	18	14	10	10	10	22
Refrigeration Condenser (3 fans) - Night	41	29	19	12	9	8	8	10	20
Split A/C condenser A	40	28	18	12	9	8	8	10	20
Refrigeration Compressor Pack	41	28	18	11	8	7	7	9	19
Split A/C condenser C	39	27	17	11	8	7	7	9	19
Split A/C condenser B	39	26	17	11	8	7	7	9	18
Bake Off / Chiller - Exhaust	34	22	13	3	0	0	0	0	11
Total Free field Lp and dBA	49	37	29	22	19	17	17	19	29

FIGURE FIVE

ENVIRONMENTAL SURVEY DATA


105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
dB
17 : 30
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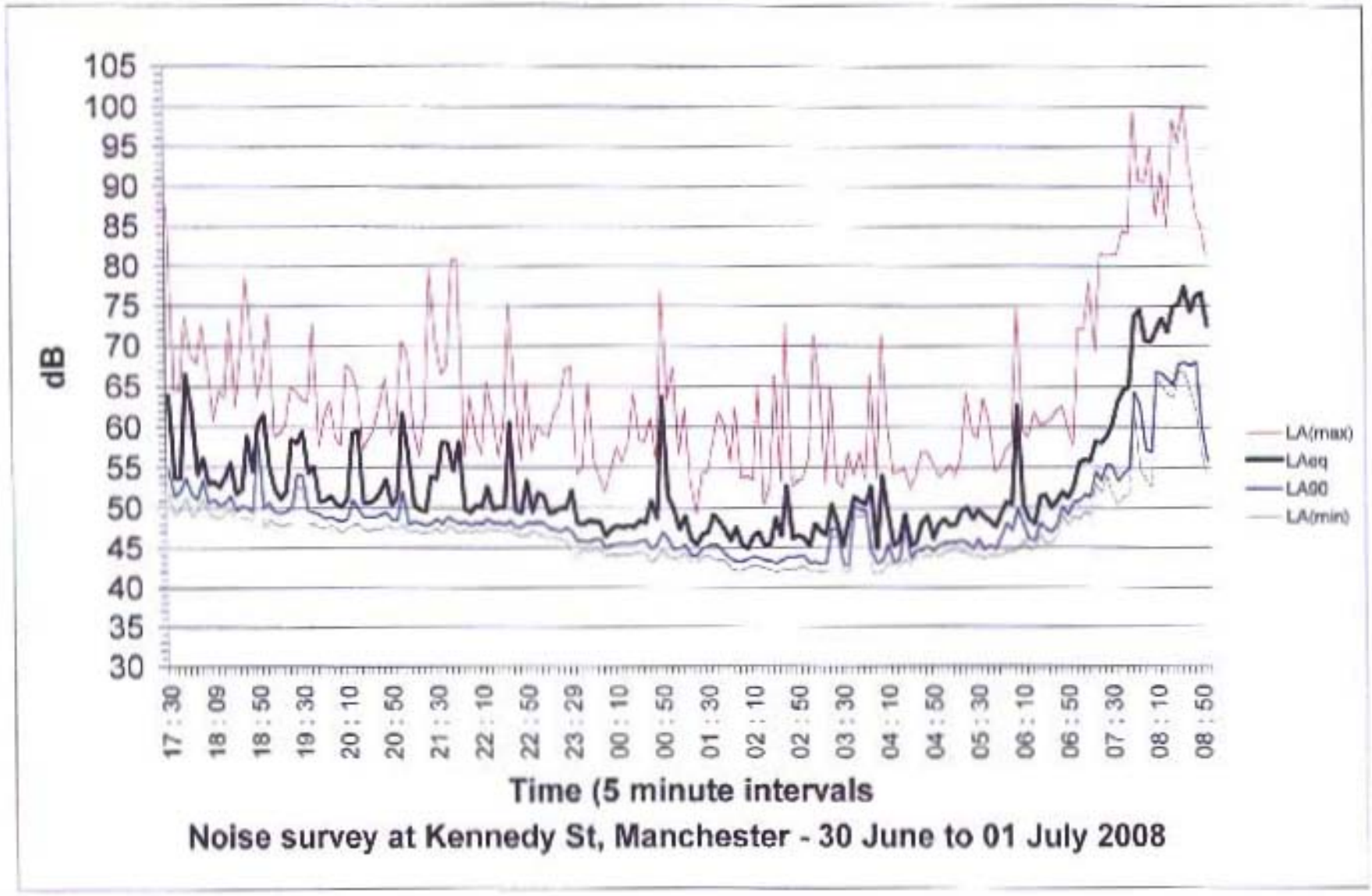
18 : 50
19 : 30
20 : 10
20 : 50
21 : 30
22 : 10
22 : 50
23 : 30
00 : 10
00 : 50
01 : 30
02 : 10
02 : 50
03 : 30
04 : 10
04 : 50
05 : 30
06 : 10
06 : 50
07 : 30
08 : 10
08 : 50
Time (5 minute intervals
LA(max)
LAeq
LA90
LA(min)
Noise survey at Princess St, Manchester - 30 June to 01 July 2008


105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
dB
17 : 30
18 : 09
18 : 50
19 : 30
20 : 10
20 : 50
21 : 30
22 : 10
22 : 50
23 : 29
00 : 10
00 : 50
01 : 30
02 : 10
02 : 50
03 : 30
04 : 10
04 : 50
05 : 30
06 : 10
06 : 50
07 : 30
08 : 10
08 : 50
Time (5 minute intervals
LA(max)
LAeq
LA90
LA(min)
Noise survey at Kennedy St, Manchester - 30 June to 01 July 2008

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