SHARPS REDMORE PARTNERSHIP

ACOUSTIC CONSULTANTS

ENVIRONMENTAL NOISE ASSESSMENT OF INTERNAL VENTILATION AND ROOF MOUNTED REFRIGERATION PLANT ON A PROPOSED TESCO EXPRESS STORE AT 38 HIGH STREET, MANCHESTER

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REPORT - Tesco Express, Manchester

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1.0 Introduction

1.1 The calculations in Appendix B indicate that criteria, based on the minimum background noise levels minus 16 dB, can be achieved. BS 4142 states that this is a positive indication that complaints are unlikely.

1.2 The calculations show that noise control measures are needed as follows:

- In line attenuators on the extract fans

The schedule in Appendix C is a schedule of technical information to be given to the installer. This indicates the insertion losses required from the noise control equipment and the noise data on which the calculations have been based.

1.3 The purpose of this report is to respond to the request from the Local Planning Authority for further information as follows:

"8. Details regarding the noise output from the units, including the cumulative impact of all the units operating simultaneously, and any acoustic attenuation measures you are proposing to install to limit the breakout of noise from the units. You should also provide details of the ambient noise levels during the daytime, night and weekends and assess how noise from the units will impact on ambient noise levels."

"9. Confirmation of when the units will be in operation.

1.4 This report considers the noise resulting from the installation of refrigeration and ventilation plant at a proposed Tesco Express store at 38, High Street, Manchester and its affect on nearby residential properties.

1.5 This assessment has been undertaken by the Sharps Redmore Partnership (SRP) who has provided an acoustic consultancy service to Tesco Stores Limited for 17 years. SRP has provided this service for over 800 stores.

1.6 This report examines the avoidance of the likelihood of complaints about noise by adopting the guidance in BS 4142:1997. This Standard states in section *9 Assessment method: "....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.".*

1.7 A Glossary of Terms is contained in Appendix A.

1.8 This report is based on the following Architect's drawings:

3240 (P) 193	Proposed roof plan
3240 (P) 201	Proposed elevations

2.0 Assessment guidelines

2.1 The impact of noise from new ventilation and refrigeration equipment is universally assessed in England by reference to the guidelines in BS 4142 *"Method for rating industrial noise affecting mixed residential and industrial areas"*.

2.2 In section *9 Assessment method: "....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."*.

2.3 The rating level is the cumulative noise from the new noise sources plus an adjustment for the characteristic features of the noise. At this store it is considered that the refrigeration plant might operate intermittently and that the extract fans might exhibit tonality. Both these characteristics invoke a single 5 dB adjustment.

2.4 For this assessment, this characteristic adjustment has been allowed for by requiring the predicted levels to be at least 16 dBA below the minimum background noise levels. This is the equivalent of having a rating level which is 11 dBA below the minimum background noise levels

3.0 Data gatherings and Surveys

3.1 Environmental noise surveys were undertaken at five locations around the site in accessible and secure locations, referenced 1 to 5 inclusive shown on the site plan in Appendix E.

3.2 The survey results are shown in full in Appendix D.

3.3 Automated surveys were carried out during the period 16:00 to 09:00 using Norsonic 118 integrating sound level meters on 18 and 19 March 2008 and manned and automated surveys between 15:00 and 10:00 on 23 and 24 March 2008 again using Norsonic 118 meters. The later dates cover the weekend.
The meters were calibrated before and after the surveys with no change in the calibration level.

3.4 The weather condition for all the measurements was cold, -1^0C to 6^0C and dry with winds of less than 5 m/s We would not expect such conditions to adversely affect sound propagation.

3.5 Noise data for the ventilation and refrigeration plant have been obtained from the manufacturers. With one exception, these were supplied as either octave band sound power or sound pressure levels. The exception is the smaller refrigeration condenser for which only single figure dBA is available.

3.6 The location of the nearest residences has been obtained from site drawings, site observations and photographs.

3.6.1 The nearest residences to the proposed location for the refrigeration plant is the penthouse flat on the roof of 38, High Street and the apartment at the top of the building to the east.

3.6.2 The nearest residences to the proposed location of the extract fans exhaust louvres are apartments at first floor level and above on the opposite side of the alley way called Roman Entry.

4.0 Description of Baseline Conditions

4.1 The following table summarises the existing noise environment at the noise monitoring positions by giving the minimum levels noted. The full survey results are shown in Appendix D.

Table 4.1.1 – summary of minimum background, free field, noise levels on the roof of 38, High Street

Period	L_{A90}
Day time	57
Night time	54

Table 4.1.2 – summary of minimum background, façade, noise levels on Roman Entry

Period	L_{A90}
Night time	42
Day time	45

4.2 The background noise levels at the unmanned, longer term, monitoring position 5 covers the penthouse flat on the roof of 38, High Street and the apartment on the top of the adjacent building to the east. Noise here was predominantly as a result of local road traffic including the passage of trams and heavy goods vehicles together with ventilation and refrigeration plant noise.

Positions 1 and 4 cover the Roman Entry façade. Position 4 is at balcony level and is where the unmanned longer term monitoring took place. The chosen location was directly opposite the residential windows closest to the extract fans' exhaust louvres. Noise here was predominantly as a result of road traffic passing the end of the alley way on Church Road and more distant road traffic.

Locations 2 and 3 are locations relevant to the alternative refrigeration plant location dealt with in a separate report.

4.3 These noise monitoring positions are marked on the site plan in Appendix E.

5.0 Establishing suitable noise criteria

5.1 Based on the discussion in section 2.0, we consider that the meeting of a criterion which is more than 15 dBA below the minimum background noise levels is *"a positive indication that complaints are unlikely"*. Such a criterion is recognising that the plant may be operating intermittently or tonal and thus requires a plus 5 dBA correction.

5.2 The chosen criteria are shown in the tables below. These are 16 dBA less than the background noise levels given earlier.

Table 5.2.1 – criteria established for refrigeration plant located on the roof of 38, High Street and the apartment on top of the building to the east.

Period	$L_{Aeq,T}$
Day time	41
Night time	38

Table 5.2.2 – criteria established for the exhausts of the extract fans on the Roman Entry facade

Period	$L_{Aeq,T}$
Night time	26
Day time	29

6.0 Assessment methodology

6.1 Conventional "text book" atmospheric side calculations have been carried out for all the items of ventilation and refrigeration plant.

6.2 These calculations are given in Appendix B. Two sets of calculations are presented:

6.2.1 for the refrigeration plant on the roof of the penthouse flat at 38, High Street. These are free field calculations so that they are comparable with the location of the noise monitoring location which was on the penthouse flat's roof away from surfaces other than the roof.

6.2.2 for the extract fans' exhaust louvres on the Roman Entry façade again at ground floor level. These are façade calculations so that they are comparable with the location of the noise monitoring locations which were within one metre of a façade or similar.

7.0 Results and recommendations

7.1 The summaries of the results together with the criteria are shown in the Tables below.

Table 7.1.1 – predicted free field, day and night time, noise levels for the penthouse flat's northern windows on the roof of 38, High Street, north

North side	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
MGB condenser pack	18	16	14	8	11	8	3	0	15
Sales floor condensing unit A	23	22	17	12	8	0	0	0	14
Sales floor condensing unit B	23	22	17	11	8	0	0	0	14
Cash office condensing unit	7	6	3	0	0	0	0	0	0
Refuse extract exhaust	3	0	0	0	0	0	0	0	0
Bakeoff/freezer exhaust	8	0	0	0	0	0	0	0	0
Staff room exhaust	3	0	0	0	0	0	0	0	0
Staff toilet exhaust	5	0	0	0	0	0	0	0	0
Cash office exhaust	3	0	0	0	0	0	0	0	0
Total Free field Lp and dBA	**27**	**26**	**21**	**15**	**14**	**8**	**3**	**0**	**19**

Table 7.1.2 – predicted free field, day and night time, noise levels for the penthouse flat's southern windows on the roof of 38, High Street

South side	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
MGB condenser pack	23	20	19	13	15	12	7	0	19
Sales floor condensing unit A	16	14	10	4	2	0	0	0	7
Sales floor condensing unit B	16	14	10	4	2	0	0	0	7
Cash office condensing unit	2	1	0	0	0	0	0	0	0
Refuse extract exhaust	0	0	0	0	0	0	0	0	0
Bakeoff/freezer exhaust	2	0	0	0	0	0	0	0	0
Staff room exhaust	0	0	0	0	0	0	0	0	0
Staff toilet exhaust	0	0	0	0	0	0	0	0	0
Cash office exhaust	0	0	0	0	0	0	0	0	0
Total Free field Lp and dBA	**25**	**22**	**20**	**14**	**15**	**12**	**7**	**0**	**19**

Table 7.1.3 – predicted free field, day and night time, noise levels for the penthouse flat's eastern windows on the roof of 38, High Street

East side	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
MGB condenser pack	24	22	20	14	15	12	7	0	19
Sales floor condensing unit A	18	17	12	6	3	0	0	0	9
Sales floor condensing unit B	18	17	12	6	3	0	0	0	9
Cash office condensing unit	4	4	0	0	0	0	0	0	0
Refuse extract exhaust	3	0	0	0	0	0	0	0	0
Bakeoff/freezer exhaust	8	0	0	0	0	0	0	0	0
Staff room exhaust	3	0	0	0	0	0	0	0	0
Staff toilet exhaust	5	0	0	0	0	0	0	0	0
Cash office exhaust	4	0	0	0	0	0	0	0	0
Total Free field Lp and dBA	**26**	**24**	**21**	**15**	**16**	**12**	**7**	**0**	**20**

Table 7.1.4 – predicted free field, day and night time, noise levels for the penthouse flat's western windows on the roof of 38, High Street

West side	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Sales floor condensing unit B	29	29	25	20	16	0	0	0	22
Sales floor condensing unit A	28	28	24	19	15	0	0	0	21
MGB condenser pack	24	21	20	14	16	13	8	0	20
Cash office condensing unit	15	19	16	9	7	0	0	0	12
Refuse extract exhaust	0	0	0	0	0	0	0	0	0
Bakeoff/freezer exhaust	3	0	0	0	0	0	0	0	0
Staff room exhaust	0	0	0	0	0	0	0	0	0
Staff toilet exhaust	0	0	0	0	0	0	0	0	0
Cash office exhaust	0	0	0	0	0	0	0	0	0
Total Free field Lp and dBA	**32**	**32**	**28**	**23**	**21**	**13**	**8**	**0**	**26**

Table 7.1.5 – predicted free field, day and night time, noise levels for the apartment's windows on the building to the east

Adjacent flat to east	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
MGB condenser pack	26	29	30	27	31	28	23	14	34
Sales floor condensing unit A	22	24	25	22	21	5	2	0	24
Sales floor condensing unit B	22	24	25	22	21	5	2	0	24
Cash office condensing unit	7	10	12	9	9	6	6	6	14
Refuse extract exhaust	17	1	0	0	0	0	0	0	0
Bakeoff/freezer exhaust	22	11	0	0	0	0	0	0	0
Staff room exhaust	17	1	0	0	0	0	0	0	0
Staff toilet exhaust	15	3	0	0	0	0	0	0	0
Cash office exhaust	13	0	0	0	0	0	0	0	0
Total Free field Lp and dBA	**30**	**31**	**32**	**29**	**32**	**28**	**23**	**15**	**35**

Table 7.1.6 - predicted façade, day and night time, noise levels for the nearest apartment's window on the opposite side of Roman Entry

	Mid frequency octave bands (Hz)								
	63	125	250	500	1k	2k	4k	8k	dBA
Bakeoff/freezer extract exhaust	39	30	22	14	10	9	8	11	21
Refuse extract exhaust	34	20	19	15	10	9	10	10	19
Cash office extract exhaust	34	20	19	15	10	9	10	10	19
Staff toilet extract exhaust	36	24	18	12	8	8	6	6	18
Staff room extract exhaust	34	20	19	14	9	6	7	6	17
Total Facade Lp and dBA	**43**	**32**	**27**	**21**	**16**	**15**	**15**	**16**	**26**

7.2 Thus the predicted A-weighted noise levels, ranging from 19 to 26 dBA; 35 dBA and 26 dBA respectively for the roof top penthouse flat's north, south, east and west windows on 38, High Street; the apartment's windows in the building to the east and Roman Entry receiver locations, meet the stringent criteria given in Tables 5.2.1 and 5.2.2.

7.3 This will be achieved by a combination of intrinsically quiet refrigeration plant on the roof of the penthouse flat at 38, High Street façade and in-line attenuation fitted to the extract fans exhausting into Roman Entry.

7.4 The manufacturers' noise data used in the calculations is shown in Appendix C. For calculation purposes, we have assumed that the plant will be in operation all of the time which is a worst case situation. However, we understand that the plant will, in fact, operate at the times in the table below.

Table 7.4 – operational times of the refrigeration and ventilation plant

Refuse extract fan	Operates continuously for health reasons
Staff toilet extract fan	Controlled by the light switch. Will not be on when the store is not operating (thus off 2300 to 0600)
Staff room extract fan	Controlled by the light switch. Will not be on when the store is not operating (thus off 2300 to 0600)
Cash office extract fan	Controlled by the light switch. Will not be on when the store is not operating (thus off 2300 to 0600)
Bake-off/freezer extract fan	Controlled on a thermostat and thus could be on at any time

All refrigeration plant	Will operate as required to maintain the required temperatures for health reasons

7.5 Also found in Appendix C are the list of insertion loss requirements for the extract fans.

Appendix A: Glossary of Terms

Ambient noise: *The totally encompassing sound in a given situation at a given time. Most often described in terms of the index L_{AeqT}. With the source off, this is also referred to as the residual noise*

A-weighting: *A frequency weighting which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Units may be denoted as dB(A) or as sound pressure levels L_{pA} in dB. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).*

Background noise: *See L_{A90}.*

Correction (for characteristic features of noise source): *A 5 dB penalty applied to the specific noise level if the noise being assessed "contains a distinguishable, discrete continuous note", contains "distinct impulses", or is "irregular enough to attract attention" (ref BS 4142:1997).*

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

Façade noise level: *the noise level adjacent to the façade of a building, usually at a distance of 1 metre.*

Free-field noise level: *The noise level away from the façade of a building or other structure.*

Hertz (Hz): *Unit of frequency, equal to one cycle per second. Frequency is related to the pitch of a sound.*

L_{A90T}**:** *The A weighted noise level exceeded for 90% of the specified time period, T. In BS 4142: 1997 it is used to define background noise level.*

Rating level: *The "specific noise level" plus any adjustment for the characteristic features of the noise used in a BS 4142:1997 assessment.*

Specific noise level: *The noise source under investigation for assessing the likelihood of complaints by BS 4142:1997.*

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on north side of penthouse flat.

Receiver Penthouse flat windows north side Source: MGB condenser pack Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			61	61	62	59	63	60	55	46
Outlet reflection loss			0	0	0	0	0	0	0	0
Barrier loss			-11	-13	-16	-19	-20	-20	-20	-20
Directivity		1	3	3	3	3	3	3	3	3
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		15.4m	-35	-35	-35	-35	-35	-35	-35	-35
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-43	-45	-48	-51	-52	-52	-52	-52
Free field receptor Lp			18	16	14	8	11	8	3	0

Receiver Penthouse flat windows north side Source: Sales floor condensing unit A Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			68	67	66	66	65	52	49	45
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-10	-12	-15	-17	-20	-20	-20	-20
Directivity	146°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		9.5m	-31	-31	-31	-31	-31	-31	-31	-31
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-45	-45	-49	-54	-57	-60	-60	-60
Free field receptor Lp			23	22	17	12	8	0	0	0

Receiver Penthouse flat windows north side Source: Sales floor condensing unit B Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			68	67	66	66	65	52	49	45
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-10	-12	-15	-18	-20	-20	-20	-20
Directivity	140°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		10.2m	-31	-31	-31	-31	-31	-31	-31	-31
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-45	-45	-49	-55	-57	-60	-60	-60
Free field receptor Lp			23	22	17	11	8	0	0	0

Receiver Penthouse flat windows north side Source: Cash office condensing unit Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			53	53	53	53	53	53	53	53
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-10	-13	-15	-18	-20	-20	-20	-20
Directivity	136°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		10.9m	-32	-32	-32	-32	-32	-32	-32	-32
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-46	-47	-50	-56	-58	-61	-61	-61
Free field receptor Lp			7	6	3	0	0	0	0	0

Receiver Penthouse flat windows north side Source: Refuse extract exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	177°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.3m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-64	-67	-73	-86	-89	-87	-79	-73
Free field receptor Lp			3	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on north side of penthouse flat - continued

Receiver Penthouse flat windows north side
Source: Bakeoff/freezer exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	67	63	63	60	57	53	49
Outlet reflection loss		0.16m²	-10	-6	-2	0	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	179°	2	11	8	3	0	-3	-3	-6	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.3m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-7	-17	-24	-34	-33	-31	-26	-19
Total attenuation			-61	-73	-83	-94	-96	-94	-92	-85
Free field receptor Lp			8	0	0	0	0	0	0	0

Receiver Penthouse flat windows north side
Source: Staff room exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	178°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.3m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-64	-67	-73	-86	-89	-87	-79	-73
Free field receptor Lp			3	0	0	0	0	0	0	0

Receiver Penthouse flat windows north side
Source: Staff toilet exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	54	50	45	46	40	35	30
Outlet reflection loss		0.02m²	-17	-11	-7	-3	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	175°	2	11	11	8	5	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.3m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-3	-6	-11	-16	-23	-15	-12	-5
Total attenuation			-64	-64	-70	-74	-83	-78	-75	-71
Free field receptor Lp			5	0	0	0	0	0	0	0

Receiver Penthouse flat windows north side
Source: Cash office exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	172°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.4m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-64	-67	-73	-86	-89	-87	-79	-73
Free field receptor Lp			3	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on south side of penthouse flat.

Receiver Penthouse flat windows south side
Source: MGB condenser pack
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			61	61	62	59	63	60	55	46
Outlet reflection loss			0	0	0	0	0	0	0	0
Barrier loss			-10	-13	-15	-18	-20	-20	-20	-20
Directivity		1	3	3	3	3	3	3	3	3
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		9.7m	-31	-31	-31	-31	-31	-31	-31	-31
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-38	-41	-43	-46	-48	-48	-48	-48
Free field receptor Lp			23	20	19	13	15	12	7	0

Receiver Penthouse flat windows south side
Source: Sales floor condensing unit A
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			68	67	66	66	65	52	49	45
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-11	-14	-16	-19	-20	-20	-20	-20
Directivity	112°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		20.6m	-37	-37	-37	-37	-37	-37	-37	-37
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-52	-53	-56	-62	-63	-66	-66	-66
Free field receptor Lp			16	14	10	4	2	0	0	0

Receiver Penthouse flat windows south side
Source: Sales floor condensing unit B
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			68	67	66	66	65	52	49	45
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-11	-14	-16	-19	-20	-20	-20	-20
Directivity	113°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		19.5m	-37	-37	-37	-37	-37	-37	-37	-37
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-52	-53	-56	-62	-63	-66	-66	-66
Free field receptor Lp			16	14	10	4	2	0	0	0

Receiver Penthouse flat windows south side
Source: Cash office condensing unit
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			53	53	53	53	53	53	53	53
Outlet reflection loss		0.64m²	-6	-2	0	0	0	0	0	0
Barrier loss			-11	-14	-16	-19	-20	-20	-20	-20
Directivity	114°	1	2	0	-3	-6	-6	-9	-9	-9
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		18.6m	-36	-36	-36	-36	-36	-36	-36	-36
Insertion loss			0	0	0	0	0	0	0	0
Total attenuation			-51	-52	-55	-61	-62	-65	-65	-65
Free field receptor Lp			2	1	0	0	0	0	0	0

Receiver Penthouse flat windows south side
Source: Refuse extract exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-19	-20	-20	-20	-20	-20	-20	-20
Directivity	114°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		36.7m	-42	-42	-42	-42	-42	-42	-42	-42
Insertion loss			-6	-7	-12	-27	-29	-24	-18	-7
Total attenuation			-70	-71	-75	-88	-91	-89	-81	-75
Free field receptor Lp			0	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on south side of penthouse flat – continued

Receiver Penthouse flat windows south side Source: Bakeoff/freezer exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	67	63	63	60	57	53	49
Outlet reflection loss		0.16m²	-10	-6	-2	0	0	0	0	0
Barrier loss			-19	-20	-20	-20	-20	-20	-20	-20
Directivity	114°	2	11	8	3	0	-3	-3	-6	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		36.5m	-42	-42	-42	-42	-42	-42	-42	-42
Insertion loss			-7	-17	-24	-34	-33	-31	-26	-19
Total attenuation			-67	-77	-85	-96	-98	-96	-94	-87
Free field receptor Lp			2	0	0	0	0	0	0	0

Receiver Penthouse flat windows south side Source: Staff room exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-19	-20	-20	-20	-20	-20	-20	-20
Directivity	115°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		36.1m	-42	-42	-42	-42	-42	-42	-42	-42
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-70	-71	-75	-88	-91	-89	-81	-75
Free field receptor Lp			0	0	0	0	0	0	0	0

Receiver Penthouse flat windows south side Source: Staff toilet exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	54	50	45	46	40	35	30
Outlet reflection loss		0.02m²	-17	-11	-7	-3	0	0	0	0
Barrier loss			-18	-20	-20	-20	-20	-20	-20	-20
Directivity	116°	2	11	11	8	5	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		35.7m	-42	-42	-42	-42	-42	-42	-42	-42
Insertion loss			-3	-8	-11	-16	-23	-15	-12	-5
Total attenuation			-69	-68	-72	-76	-85	-80	-77	-73
Free field receptor Lp			0	0	0	0	0	0	0	0

Receiver Penthouse flat windows south side Source: Cash office exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-18	-20	-20	-20	-20	-20	-20	-20
Directivity	116°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		35.4m	-42	-42	-42	-42	-42	-42	-42	-42
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-69	-71	-75	-88	-91	-89	-81	-75
Free field receptor Lp			0	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on east side of penthouse flat.

Receiver Penthouse flat windows east side Source: MGB condenser pack Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		61	61	62	59	63	60	55	46
	Outlet reflection loss		0	0	0	0	0	0	0	0
	Barrier loss		-9	-11	-14	-17	-20	-20	-20	-20
	Directivity	1	3	3	3	3	3	3	3	3
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	9.9m	-31	-31	-31	-31	-31	-31	-31	-31
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-37	-39	-42	-45	-48	-48	-48	-48
	Free field receptor Lp		24	22	20	14	15	12	7	0

Receiver Penthouse flat windows east side Source: Sales floor condensing unit A Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		68	67	66	66	65	52	49	45
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-10	-12	-15	-18	-20	-20	-20	-20
	Directivity 154°	1	2	0	-3	-6	-6	-9	-9	-9
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	17.5m	-36	-36	-36	-36	-36	-36	-36	-36
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-50	-50	-54	-60	-62	-65	-65	-65
	Free field receptor Lp		18	17	12	6	3	0	0	0

Receiver Penthouse flat windows east side Source: Sales floor condensing unit B Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		68	67	66	66	65	52	49	45
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-10	-12	-15	-18	-20	-20	-20	-20
	Directivity 158°	1	2	0	-3	-6	-6	-9	-9	-9
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	17.0m	-36	-36	-36	-36	-36	-36	-36	-36
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-50	-50	-54	-60	-62	-65	-65	-65
	Free field receptor Lp		18	17	12	6	3	0	0	0

Receiver Penthouse flat windows east side Source: Cash office condensing unit Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		53	53	53	53	53	53	53	53
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-10	-12	-15	-18	-20	-20	-20	-20
	Directivity 161°	1	2	0	-3	-6	-6	-9	-9	-9
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	16.6m	-35	-35	-35	-35	-35	-35	-35	-35
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-49	-49	-53	-59	-61	-64	-64	-64
	Free field receptor Lp		4	4	0	0	0	0	0	0

Receiver Penthouse flat windows east side Source: Refuse extract exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		-15	-18	-20	-20	-20	-20	-20	-20
	Directivity 103°	2	11	8	5	3	0	-3	-3	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	28.3m	-40	-40	-40	-40	-40	-40	-40	-40
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-64	-67	-73	-86	-89	-87	-79	-73
	Free field receptor Lp		3	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on east side of penthouse flat – continued

Receiver Penthouse flat windows east side
Source: Bakeoff/freezer exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	67	63	63	60	57	53	49
Outlet reflection loss		0.16m²	-10	-6	-2	0	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	103°	2	11	8	3	0	-3	-3	-6	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		28.2m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-7	-17	-24	-34	-33	-31	-26	-19
Total attenuation			-61	-73	-83	-94	-96	-94	-92	-85
Free field receptor Lp			8	0	0	0	0	0	0	0

Receiver Penthouse flat windows east side
Source: Staff room exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-15	-18	-20	-20	-20	-20	-20	-20
Directivity	104°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.9m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-64	-67	-73	-86	-89	-87	-79	-73
Free field receptor Lp			3	0	0	0	0	0	0	0

Receiver Penthouse flat windows east side
Source: Staff toilet exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			69	54	50	45	46	40	35	30
Outlet reflection loss		0.02m²	-17	-11	-7	-3	0	0	0	0
Barrier loss			-15	-17	-20	-20	-20	-20	-20	-20
Directivity	105°	2	11	11	8	5	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.7m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-3	-6	-11	-16	-23	-15	-12	-5
Total attenuation			-64	-63	-70	-74	-83	-78	-75	-71
Free field receptor Lp			5	0	0	0	0	0	0	0

Receiver Penthouse flat windows east side
Source: Cash office exhaust
Period: Day and night time

			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
Source Lw			67	51	51	58	53	47	40	32
Outlet reflection loss		0.04m²	-14	-10	-6	-2	0	0	0	0
Barrier loss			-14	-17	-20	-20	-20	-20	-20	-20
Directivity	105°	2	11	8	5	3	0	-3	-3	-6
Volume loss		100%	0	0	0	0	0	0	0	0
Distance loss		27.5m	-40	-40	-40	-40	-40	-40	-40	-40
Insertion loss			-6	-7	-12	-27	-29	-24	-16	-7
Total attenuation			-63	-66	-73	-86	-89	-87	-79	-73
Free field receptor Lp			4	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on west side of penthouse flat.

Receiver Penthouse flat windows west side Source: MGB condenser pack Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		61	61	62	59	63	60	55	46
	Outlet reflection loss		0	0	0	0	0	0	0	0
	Barrier loss		-10	-13	-15	-18	-20	-20	-20	-20
	Directivity	1	3	3	3	3	3	3	3	3
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	9.0m	-30	-30	-30	-30	-30	-30	-30	-30
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-37	-40	-42	-45	-47	-47	-47	-47
	Free field receptor Lp		24	21	20	14	16	13	8	0

Receiver Penthouse flat windows west side Source: Sales floor condensing unit A Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		68	67	66	66	65	52	49	45
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-7	-8	-10	-12	-15	-17	-20	-20
	Directivity 79°	1	2	0	-3	-6	-6	-9	-9	-9
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	8.2m	-29	-29	-29	-29	-29	-29	-29	-29
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-40	-39	-42	-47	-50	-55	-58	-58
	Free field receptor Lp		28	28	24	19	15	0	0	0

Receiver Penthouse flat windows west side Source: Sales floor condensing unit B Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		68	67	66	66	65	52	49	45
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-7	-8	-10	-12	-15	-18	-20	-20
	Directivity 77°	1	2	0	-3	-6	-6	-9	-9	-9
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	7.1m	-28	-28	-28	-28	-28	-28	-28	-28
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-39	-38	-41	-46	-49	-55	-57	-57
	Free field receptor Lp		29	29	25	20	16	0	0	0

Receiver Penthouse flat windows west side Source: Cash office condensing unit Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		53	53	53	53	53	53	53	53
	Outlet reflection loss	0.64m²	-6	-2	0	0	0	0	0	0
	Barrier loss		-7	-8	-10	-13	-15	-18	-20	-20
	Directivity 74°	1	2	3	0	-4	-4	-8	-8	-8
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	6.2m	-27	-27	-27	-27	-27	-27	-27	-27
	Insertion loss		0	0	0	0	0	0	0	0
	Total attenuation		-38	-34	-37	-44	-46	-53	-55	-55
	Free field receptor Lp		15	19	16	9	7	0	0	0

Receiver Penthouse flat windows west side Source: Refuse extract exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		-19	-20	-20	-20	-20	-20	-20	-20
	Directivity 147°	2	11	8	5	3	0	-3	-3	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	34.6m	-42	-42	-42	-42	-42	-42	-42	-42
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-70	-71	-75	-88	-91	-89	-81	-75
	Free field receptor Lp		0	0	0	0	0	0	0	0

Appendix B: calculations for refrigeration plant on the roof of 38, High Street at windows on west side of penthouse flat - continued

Receiver Penthouse flat windows west side Source: Bakeoff/freezer exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		69	67	63	63	60	57	53	49
	Outlet reflection loss	0.16m²	-10	-6	-2	0	0	0	0	0
	Barrier loss		-18	-20	-20	-20	-20	-20	-20	-20
	Directivity 148°	2	11	8	3	0	-3	-3	-6	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	34.4m	-42	-42	-42	-42	-42	-42	-42	-42
	Insertion loss		-7	-17	-24	-34	-33	-31	-26	-19
	Total attenuation		-66	-77	-85	-96	-98	-96	-94	-87
	Free field receptor Lp		3	0	0	0	0	0	0	0

Receiver Penthouse flat windows west side Source: Staff room exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		-18	-20	-20	-20	-20	-20	-20	-20
	Directivity 149°	2	11	8	5	3	0	-3	-3	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	34.2m	-42	-42	-42	-42	-42	-42	-42	-42
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-69	-71	-75	-88	-91	-89	-81	-75
	Free field receptor Lp		0	0	0	0	0	0	0	0

Receiver Penthouse flat windows west side Source: Staff toilet exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		69	54	50	45	46	40	35	30
	Outlet reflection loss	0.02m²	-17	-11	-7	-3	0	0	0	0
	Barrier loss		-18	-20	-20	-20	-20	-20	-20	-20
	Directivity 150°	2	11	11	8	5	0	-3	-3	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	34.0m	-42	-42	-42	-42	-42	-42	-42	-42
	Insertion loss		-3	-6	-11	-16	-23	-15	-12	-5
	Total attenuation		-69	-68	-72	-76	-85	-80	-77	-73
	Free field receptor Lp		0	0	0	0	0	0	0	0

Receiver Penthouse flat windows west side Source: Cash office exhaust Period: Day and night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		-18	-20	-20	-20	-20	-20	-20	-20
	Directivity 151°	2	11	8	5	3	0	-3	-3	-6
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	33.9m	-42	-42	-42	-42	-42	-42	-42	-42
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-69	-71	-75	-88	-91	-89	-81	-75
	Free field receptor Lp		0	0	0	0	0	0	0	0

Appendix B: calculations for extract plant on Roman Entry façade

Receiver Residential window at first floor Source: Refuse extract exhaust Period: Day and Night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		0	0	0	0	0	0	0	0
	Directivity 55°	2	7	6	6	6	6	6	6	5
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	3.9m	-23	-23	-23	-23	-23	-23	-23	-23
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-36	-34	-35	-46	-46	-41	-33	-25
	Facade receptor Lp		34	20	19	15	10	9	10	10

Receiver Residential window at first floor Source: Bakeoff/freezer exhaust Period: Day and Night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		69	67	63	63	60	57	53	49
	Outlet reflection loss	0.16m²	-10	-6	-2	0	0	0	0	0
	Barrier loss		0	0	0	0	0	0	0	0
	Directivity 56°	2	7	6	5	5	3	3	1	1
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	3.8m	-23	-23	-23	-23	-23	-23	-23	-23
	Insertion loss		-7	-17	-24	-34	-33	-31	-26	-19
	Total attenuation		-33	-40	-44	-52	-53	-51	-48	-41
	Facade receptor Lp		39	30	22	14	10	9	8	11

Receiver Residential window at first floor Source: Staff room exhaust Period: Day and Night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		0	0	0	0	0	0	0	0
	Directivity 58°	2	7	6	6	5	5	3	3	1
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	3.8m	-23	-23	-23	-23	-23	-23	-23	-23
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-36	-34	-35	-47	-47	-44	-36	-29
	Facade receptor Lp		34	20	19	14	9	6	7	6

Receiver Residential window at first floor Source: Staff toilet exhaust Period: Day and Night time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		69	54	50	45	46	40	35	30
	Outlet reflection loss	0.02m²	-17	-11	-7	-3	0	0	0	0
	Barrier loss		0	0	0	0	0	0	0	0
	Directivity 57°	2	7	7	6	6	5	3	3	1
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	3.8m	-23	-23	-23	-23	-23	-23	-23	-23
	Insertion loss		-3	-6	-11	-16	-23	-15	-12	-5
	Total attenuation		-36	-33	-35	-36	-41	-35	-32	-27
	Facade receptor Lp		36	24	18	12	8	8	6	6

Receiver Residential window at first floor Source: Cash office exhaust Period: Night-time			Mid frequency octave bands (Hz)							
			63	125	250	500	1k	2k	4k	8k
	Source Lw		67	51	51	58	53	47	40	32
	Outlet reflection loss	0.04m²	-14	-10	-6	-2	0	0	0	0
	Barrier loss		0	0	0	0	0	0	0	0
	Directivity 55°	2	7	6	6	6	6	6	6	5
	Volume loss	100%	0	0	0	0	0	0	0	0
	Distance loss	3.9m	-23	-23	-23	-23	-23	-23	-23	-23
	Insertion loss		-6	-7	-12	-27	-29	-24	-16	-7
	Total attenuation		-36	-34	-35	-46	-46	-41	-33	-25
	Facade receptor Lp		34	20	19	15	10	9	10	10

Appendix C - 1 refrigeration and ventilation plant manufacturers' noise data

Client: Tesco Stores Limited			Appendix C - 1							Page: 1 of 1			
Project: Tesco Express 38 High Str Manchester			Project no: 089142										
Consultant: TAM			Date: 27 March 2008										
Sound power levels (Lw) & sound pressure levels (Lp) for fans & other equipment													
Equipment name/reference	Lw/ Lp	Dist. (m)	On time D/N/A	Mid-frequency Octave Bands (Hz)									
				63	125	250	500	1k	2k	4k	8k		
MGB condenser pack	Lw		A	61	61	62	59	63	60	55	46		
Sales floor condensing unit A	Lp	1	A	60	59	58	58	57	44	41	37		
Sales floor condensing unit B	Lp	1	A	60	59	58	58	57	44	41	37		
Cash office condensing unit	Lw		A	62	0	0	0	0	0	0	0		
Refuse extract exhaust	Lw		A	67	51	51	58	53	47	40	32		
Bakeoff/freezer exhaust	Lw		A	69	67	63	63	60	57	53	49		
Staff room exhaust	Lw		A	67	51	51	58	53	47	40	32		
Staff toilet exhaust	Lw		A	69	54	50	45	46	40	35	30		
Cash office exhaust	Lw		A	67	51	51	58	53	47	40	32		

Notes:

1. Lw/Lp
   Lw means sound power level (dB)
   Lp means sound pressure level at the stated distance (dB@m)
2. On times (On.time D/N/A):
   D (Day) means that the fan/equipment could operate at any time between 0700 and 2300 hours
   N (Night) means that the fan/equipment could operate at any time between 2300 and 0700 hours
   A (All) means that the fan/equipment could operate at any time during the day and night

Appendix C - 2 refrigeration and ventilation plant insertion loss requirements

Client: Tesco Stores Limited	Appendix C - 2 Page: 1 of 1
Project: Tesco Express 38 High Str Manchester	Project no: 089142
Consultant: TAM	Date: 27 March 2008
Atmospheric side dynamic insertion losses for noise control equipment	

Equipment name/reference	Mid-frequency Octave Bands (Hz)							
	63	125	250	500	1k	2k	4k	8k
Refuse extract exhaust	6	7	12	27	29	24	16	7
Bakeoff/freezer exhaust	7	17	24	34	33	31	26	19
Staff room exhaust	6	7	12	27	29	24	16	7
Staff toilet exhaust	3	6	11	16	23	15	12	5
Cash office exhaust	6	7	12	27	29	24	16	7

Notes:

1. Dynamic insertion loss is the logarithmic summation of the air regenerated sound power level and the residual fan sound power level after subtracting the proposed static insertion loss. If this concept is unclear or if you have other queries, contact Sharps Redmore Partnership.

2. After tendering, please send a copy of your proposed insertion losses, air regenerated Lw, passage velocities, pressure losses, air volumes & dimensions to Sharps Redmore Partnership

Appendix D – environmental noise survey background (L_{A90}) measurements

Location 1

Date	Time	L_{A90}
2008 - Mar - 23	22 : 40	49.7
2008 - Mar - 23	22 : 50	48.0
2008 - Mar - 24	06 : 20	44.3
2008 - Mar - 24	06 : 30	44.6

Location 2

Date	Time	L_{A90}
2008 - Mar - 23	23 : 10	62.9
2008 - Mar - 24	06 : 43	53.1
2008 - Mar - 24	06 : 50	53.2
2008 - Mar - 24	07 : 00	53.3

Location 3

Date	Time	L_{A90}
2008 - Mar - 18	16 : 00	60
2008 - Mar - 18	16 : 10	60
2008 - Mar - 18	16 : 20	59
2008 - Mar - 18	16 : 30	61
2008 - Mar - 18	16 : 40	59
2008 - Mar - 18	16 : 50	60
2008 - Mar - 18	17 : 00	60
2008 - Mar - 18	17 : 10	59
2008 - Mar - 18	17 : 20	60
2008 - Mar - 18	17 : 30	60
2008 - Mar - 18	17 : 40	59
2008 - Mar - 18	17 : 50	59
2008 - Mar - 18	18 : 00	58
2008 - Mar - 18	18 : 10	59
2008 - Mar - 18	18 : 20	60
2008 - Mar - 18	18 : 30	57
2008 - Mar - 18	18 : 40	56
2008 - Mar - 18	18 : 50	56
2008 - Mar - 18	19 : 00	55
2008 - Mar - 18	19 : 10	56
2008 - Mar - 18	19 : 20	55
2008 - Mar - 18	19 : 30	54
2008 - Mar - 18	19 : 40	54
2008 - Mar - 18	19 : 50	55
2008 - Mar - 18	20 : 00	54
2008 - Mar - 18	20 : 10	56
2008 - Mar - 18	20 : 20	54
2008 - Mar - 18	20 : 30	55
2008 - Mar - 18	20 : 40	53
2008 - Mar - 18	20 : 50	52
2008 - Mar - 18	21 : 00	53
2008 - Mar - 18	21 : 10	51
2008 - Mar - 18	21 : 20	52
2008 - Mar - 18	21 : 30	52
2008 - Mar - 18	21 : 40	50
2008 - Mar - 18	21 : 50	52
2008 - Mar - 18	22 : 00	53
2008 - Mar - 18	22 : 10	52
2008 - Mar - 18	22 : 20	52
2008 - Mar - 18	22 : 30	50
2008 - Mar - 18	22 : 40	50
2008 - Mar - 18	22 : 50	51
2008 - Mar - 18	23 : 00	51
2008 - Mar - 18	23 : 10	51
2008 - Mar - 18	23 : 20	48
2008 - Mar - 18	23 : 30	48
2008 - Mar - 18	23 : 40	47
2008 - Mar - 18	23 : 50	49

Location 3 – continued

2008 - Mar - 19	00 : 00	46
2008 - Mar - 19	00 : 10	47
2008 - Mar - 19	00 : 20	46
2008 - Mar - 19	00 : 30	46
2008 - Mar - 19	00 : 40	47
2008 - Mar - 19	00 : 50	46
2008 - Mar - 19	01 : 00	46
2008 - Mar - 19	01 : 10	46
2008 - Mar - 19	01 : 20	46
2008 - Mar - 19	01 : 30	47
2008 - Mar - 19	01 : 40	46
2008 - Mar - 19	01 : 50	46
2008 - Mar - 19	02 : 00	45
2008 - Mar - 19	02 : 10	45
2008 - Mar - 19	02 : 20	45
2008 - Mar - 19	02 : 30	46
2008 - Mar - 19	02 : 40	45
2008 - Mar - 19	02 : 50	46
2008 - Mar - 19	03 : 00	46
2008 - Mar - 19	03 : 10	45
2008 - Mar - 19	03 : 20	44
2008 - Mar - 19	03 : 30	45
2008 - Mar - 19	03 : 40	44
2008 - Mar - 19	03 : 50	45
2008 - Mar - 19	04 : 00	45
2008 - Mar - 19	04 : 10	44
2008 - Mar - 19	04 : 20	44
2008 - Mar - 19	04 : 30	45
2008 - Mar - 19	04 : 40	44
2008 - Mar - 19	04 : 50	44
2008 - Mar - 19	05 : 00	45
2008 - Mar - 19	05 : 10	45
2008 - Mar - 19	05 : 20	45
2008 - Mar - 19	05 : 30	47
2008 - Mar - 19	05 : 40	48
2008 - Mar - 19	05 : 50	48
2008 - Mar - 19	06 : 00	50
2008 - Mar - 19	06 : 10	50
2008 - Mar - 19	06 : 20	51
2008 - Mar - 19	06 : 30	50
2008 - Mar - 19	06 : 40	54
2008 - Mar - 19	06 : 50	53

Location 3 - continued

Date	Time	L_{A90}
2008 - Mar - 19	07 : 00	54
2008 - Mar - 19	07 : 10	56
2008 - Mar - 19	07 : 20	56
2008 - Mar - 19	07 : 30	55
2008 - Mar - 19	07 : 40	57
2008 - Mar - 19	07 : 50	59
2008 - Mar - 19	08 : 00	59
2008 - Mar - 19	08 : 10	57
2008 - Mar - 19	08 : 20	60
2008 - Mar - 19	08 : 30	59
2008 - Mar - 19	08 : 40	58
2008 - Mar - 19	08 : 50	60

Location 4

Date	Time	L_{A90}
2008 - Mar - 23	15 : 00	50
2008 - Mar - 23	15 : 10	50
2008 - Mar - 23	15 : 20	50
2008 - Mar - 23	15 : 30	50
2008 - Mar - 23	15 : 40	51
2008 - Mar - 23	15 : 50	51
2008 - Mar - 23	16 : 00	51
2008 - Mar - 23	16 : 10	51
2008 - Mar - 23	16 : 20	51
2008 - Mar - 23	16 : 30	51
2008 - Mar - 23	16 : 40	50
2008 - Mar - 23	16 : 50	50
2008 - Mar - 23	17 : 00	50
2008 - Mar - 23	17 : 10	50
2008 - Mar - 23	17 : 20	49
2008 - Mar - 23	17 : 30	50
2008 - Mar - 23	17 : 40	50
2008 - Mar - 23	17 : 50	49
2008 - Mar - 23	18 : 00	50
2008 - Mar - 23	18 : 10	49
2008 - Mar - 23	18 : 20	48
2008 - Mar - 23	18 : 30	49
2008 - Mar - 23	18 : 40	50
2008 - Mar - 23	18 : 50	50
2008 - Mar - 23	19 : 00	50
2008 - Mar - 23	19 : 10	50
2008 - Mar - 23	19 : 20	49
2008 - Mar - 23	19 : 30	49
2008 - Mar - 23	19 : 40	49
2008 - Mar - 23	19 : 50	50
2008 - Mar - 23	20 : 00	50
2008 - Mar - 23	20 : 10	50
2008 - Mar - 23	20 : 20	49
2008 - Mar - 23	20 : 30	50
2008 - Mar - 23	20 : 40	49
2008 - Mar - 23	20 : 50	50
2008 - Mar - 23	21 : 00	51
2008 - Mar - 23	21 : 10	50
2008 - Mar - 23	21 : 20	50
2008 - Mar - 23	21 : 30	49
2008 - Mar - 23	21 : 40	49
2008 - Mar - 23	21 : 50	49
2008 - Mar - 23	22 : 00	50
2008 - Mar - 23	22 : 10	51
2008 - Mar - 23	22 : 20	50
2008 - Mar - 23	22 : 30	51
2008 - Mar - 23	22 : 40	51
2008 - Mar - 23	22 : 50	50

Location 4 – continued

Date	Time	L_{A90}
2008 - Mar - 23	23 : 00	51
2008 - Mar - 23	23 : 10	51
2008 - Mar - 23	23 : 20	52
2008 - Mar - 23	23 : 30	51
2008 - Mar - 23	23 : 40	49
2008 - Mar - 23	23 : 50	50
2008 - Mar - 24	00 : 00	50
2008 - Mar - 24	00 : 10	51
2008 - Mar - 24	00 : 20	50
2008 - Mar - 24	00 : 30	49
2008 - Mar - 24	00 : 40	48
2008 - Mar - 24	00 : 50	48
2008 - Mar - 24	01 : 00	49
2008 - Mar - 24	01 : 10	48
2008 - Mar - 24	01 : 20	47
2008 - Mar - 24	01 : 30	47
2008 - Mar - 24	01 : 40	47
2008 - Mar - 24	01 : 50	48
2008 - Mar - 24	02 : 00	46
2008 - Mar - 24	02 : 10	46
2008 - Mar - 24	02 : 20	46
2008 - Mar - 24	02 : 30	46
2008 - Mar - 24	02 : 40	46
2008 - Mar - 24	02 : 50	45
2008 - Mar - 24	03 : 00	45
2008 - Mar - 24	03 : 10	45
2008 - Mar - 24	03 : 20	44
2008 - Mar - 24	03 : 30	45
2008 - Mar - 24	03 : 40	44
2008 - Mar - 24	03 : 50	44
2008 - Mar - 24	04 : 00	44
2008 - Mar - 24	04 : 10	43
2008 - Mar - 24	04 : 20	45
2008 - Mar - 24	04 : 30	44
2008 - Mar - 24	04 : 40	42
2008 - Mar - 24	04 : 50	42
2008 - Mar - 24	05 : 00	42
2008 - Mar - 24	05 : 10	42
2008 - Mar - 24	05 : 20	46
2008 - Mar - 24	05 : 30	44
2008 - Mar - 24	05 : 40	44
2008 - Mar - 24	05 : 50	44
2008 - Mar - 24	06 : 00	47
2008 - Mar - 24	06 : 10	46
2008 - Mar - 24	06 : 20	46
2008 - Mar - 24	06 : 30	46
2008 - Mar - 24	06 : 40	47
2008 - Mar - 24	06 : 50	48

Location 4 – continued

Date	Time	L_{A90}
2008 - Mar - 24	07 : 00	48
2008 - Mar - 24	07 : 10	48
2008 - Mar - 24	07 : 20	49
2008 - Mar - 24	07 : 30	49
2008 - Mar - 24	07 : 40	49
2008 - Mar - 24	07 : 50	49
2008 - Mar - 24	08 : 00	49
2008 - Mar - 24	08 : 10	49
2008 - Mar - 24	08 : 20	49
2008 - Mar - 24	08 : 30	49
2008 - Mar - 24	08 : 40	50
2008 - Mar - 24	08 : 50	50
2008 - Mar - 24	09 : 00	49
2008 - Mar - 24	09 : 10	50
2008 - Mar - 24	09 : 20	49
2008 - Mar - 24	09 : 30	50
2008 - Mar - 24	09 : 40	50
2008 - Mar - 24	09 : 50	51

Location 5

Date	Time	L_{A90}
2008 - Mar - 18	16 : 30	67
2008 - Mar - 18	16 : 40	66
2008 - Mar - 18	16 : 50	66
2008 - Mar - 18	17 : 00	67
2008 - Mar - 18	17 : 10	67
2008 - Mar - 18	17 : 20	67
2008 - Mar - 18	17 : 30	66
2008 - Mar - 18	17 : 40	67
2008 - Mar - 18	17 : 50	66
2008 - Mar - 18	18 : 00	66
2008 - Mar - 18	18 : 10	66
2008 - Mar - 18	18 : 20	66
2008 - Mar - 18	18 : 30	66
2008 - Mar - 18	18 : 40	66
2008 - Mar - 18	18 : 50	66
2008 - Mar - 18	19 : 00	66
2008 - Mar - 18	19 : 10	66
2008 - Mar - 18	19 : 20	66
2008 - Mar - 18	19 : 30	65
2008 - Mar - 18	19 : 40	66
2008 - Mar - 18	19 : 50	63
2008 - Mar - 18	20 : 00	61
2008 - Mar - 18	20 : 10	60
2008 - Mar - 18	20 : 20	58
2008 - Mar - 18	20 : 30	58
2008 - Mar - 18	20 : 40	59
2008 - Mar - 18	20 : 50	59
2008 - Mar - 18	21 : 00	58
2008 - Mar - 18	21 : 10	58

Location 5 – continued

Date	Time	L_{A90}
2008 - Mar - 23	15 : 00	58
2008 - Mar - 23	15 : 10	58
2008 - Mar - 23	15 : 20	57
2008 - Mar - 23	15 : 30	58
2008 - Mar - 23	15 : 40	58
2008 - Mar - 23	15 : 50	58
2008 - Mar - 23	16 : 00	59
2008 - Mar - 23	16 : 10	58
2008 - Mar - 23	16 : 20	58
2008 - Mar - 23	16 : 30	58
2008 - Mar - 23	16 : 40	58
2008 - Mar - 23	16 : 50	58
2008 - Mar - 23	17 : 00	58
2008 - Mar - 23	17 : 10	58
2008 - Mar - 23	17 : 20	57
2008 - Mar - 23	17 : 30	58
2008 - Mar - 23	17 : 40	58
2008 - Mar - 23	17 : 50	57
2008 - Mar - 23	18 : 00	58
2008 - Mar - 23	18 : 10	57
2008 - Mar - 23	18 : 20	57
2008 - Mar - 23	18 : 30	57
2008 - Mar - 23	18 : 40	58
2008 - Mar - 23	18 : 50	57
2008 - Mar - 23	19 : 00	58
2008 - Mar - 23	19 : 10	57
2008 - Mar - 23	19 : 20	57
2008 - Mar - 23	19 : 30	57
2008 - Mar - 23	19 : 40	57
2008 - Mar - 23	19 : 50	57
2008 - Mar - 23	20 : 00	57
2008 - Mar - 23	20 : 10	58
2008 - Mar - 23	20 : 20	57
2008 - Mar - 23	20 : 30	58
2008 - Mar - 23	20 : 40	57
2008 - Mar - 23	20 : 50	57
2008 - Mar - 23	21 : 00	58
2008 - Mar - 23	21 : 10	58
2008 - Mar - 23	21 : 20	57
2008 - Mar - 23	21 : 30	57
2008 - Mar - 23	21 : 40	57
2008 - Mar - 23	21 : 50	57
2008 - Mar - 23	22 : 00	58
2008 - Mar - 23	22 : 10	59
2008 - Mar - 23	22 : 20	58
2008 - Mar - 23	22 : 30	58
2008 - Mar - 23	22 : 40	58
2008 - Mar - 23	22 : 50	58

Location 5 - continued

Date	Time	L_{A90}
2008 - Mar - 23	23 : 00	59
2008 - Mar - 23	23 : 10	59
2008 - Mar - 23	23 : 20	59
2008 - Mar - 23	23 : 30	58
2008 - Mar - 23	23 : 40	57
2008 - Mar - 23	23 : 50	58
2008 - Mar - 24	00 : 00	57
2008 - Mar - 24	00 : 10	58
2008 - Mar - 24	00 : 20	57
2008 - Mar - 24	00 : 30	57
2008 - Mar - 24	00 : 40	57
2008 - Mar - 24	00 : 50	56
2008 - Mar - 24	01 : 00	57
2008 - Mar - 24	01 : 10	56
2008 - Mar - 24	01 : 20	56
2008 - Mar - 24	01 : 30	56
2008 - Mar - 24	01 : 40	56
2008 - Mar - 24	01 : 50	56
2008 - Mar - 24	02 : 00	55
2008 - Mar - 24	02 : 10	55
2008 - Mar - 24	02 : 20	56
2008 - Mar - 24	02 : 30	55
2008 - Mar - 24	02 : 40	55
2008 - Mar - 24	02 : 50	55
2008 - Mar - 24	03 : 00	55
2008 - Mar - 24	03 : 10	55
2008 - Mar - 24	03 : 20	55
2008 - Mar - 24	03 : 30	55
2008 - Mar - 24	03 : 40	55
2008 - Mar - 24	03 : 50	55
2008 - Mar - 24	04 : 00	54
2008 - Mar - 24	04 : 10	55
2008 - Mar - 24	04 : 20	55
2008 - Mar - 24	04 : 30	55
2008 - Mar - 24	04 : 40	54
2008 - Mar - 24	04 : 50	54
2008 - Mar - 24	05 : 00	54
2008 - Mar - 24	05 : 10	54
2008 - Mar - 24	05 : 20	54
2008 - Mar - 24	05 : 30	55
2008 - Mar - 24	05 : 40	55
2008 - Mar - 24	05 : 50	55
2008 - Mar - 24	06 : 00	61
2008 - Mar - 24	06 : 10	61
2008 - Mar - 24	06 : 20	61
2008 - Mar - 24	06 : 30	61
2008 - Mar - 24	06 : 40	61
2008 - Mar - 24	06 : 50	61

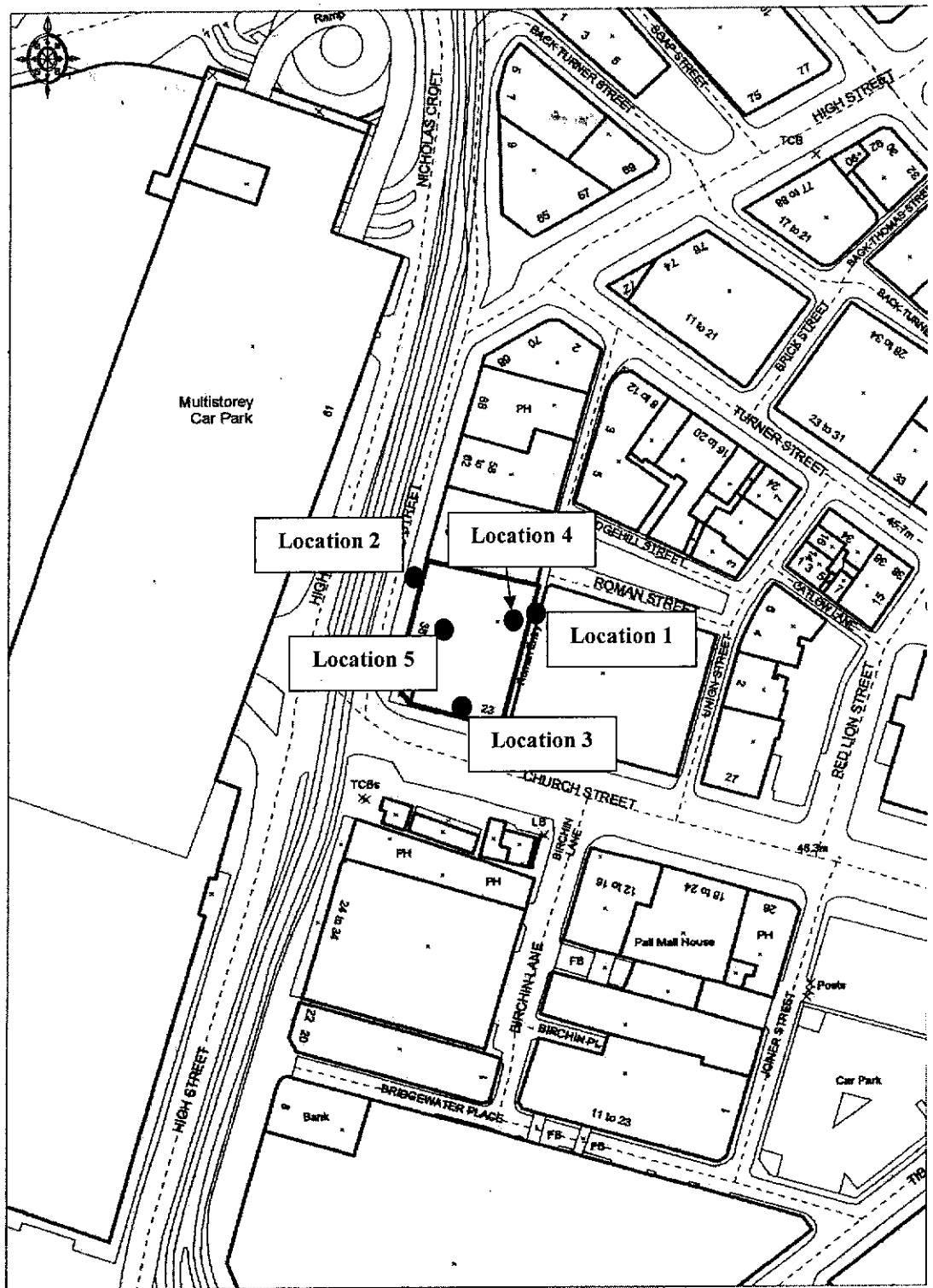
Location 5 – continued

Date	Time	L_{A90}
2008 - Mar - 24	07 : 00	61
2008 - Mar - 24	07 : 10	61
2008 - Mar - 24	07 : 20	61
2008 - Mar - 24	07 : 30	61
2008 - Mar - 24	07 : 40	61
2008 - Mar - 24	07 : 50	61
2008 - Mar - 24	08 : 00	61
2008 - Mar - 24	08 : 10	61
2008 - Mar - 24	08 : 20	61
2008 - Mar - 24	08 : 30	61
2008 - Mar - 24	08 : 40	62
2008 - Mar - 24	08 : 50	61
2008 - Mar - 24	09 : 00	61
2008 - Mar - 24	09 : 10	62
2008 - Mar - 24	09 : 20	62
2008 - Mar - 24	09 : 30	62
2008 - Mar - 24	09 : 40	62
2008 - Mar - 24	09 : 50	62

Appendix E – site map annotated with the environmental noise monitoring positions

38 High Street, Manchester

GLH/J018702/01 (Site Location Plan)



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