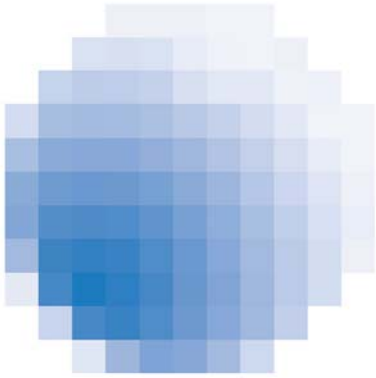

sol
acoustics

Albion Wharf, Albion Street, Manchester, M1 5LN

tel 0161 923 4844
fax 0161 923 4833
email info@solacoustics.co.uk

Corn Exchange, Manchester

Environmental Noise Study

July 2013

PROJECT:	Corn Exchange, Manchester
CLIENT:	CIP Property (AIPT) Ltd (as nominee for Aviva Investors Property Trust) No1 Poultry London EC2R 8EJ
DOCUMENT REFERENCE:	P1500-REP01 REV C-MPF
SIGNED:	_____ MATTHEW FISHER
CHECKED:	_____ SIMON FERENCZI
DATE:	July 2013

CONTENTS

1.0 INTRODUCTION 2

2.0 DESCRIPTION OF SITE AND PROPOSED DEVELOPMENT 3

3.0 RELEVANT GUIDANCE DOCUMENTS 8

4.0 ENVIRONMENTAL NOISE SURVEYS 11

5.0 NOISE EGRESS FROM PROPOSED COMMERCIAL UNITS 13

6.0 POTENTIAL NOISE LEVEL FROM EXTERNAL SEATING 17

7.0 EXTERNAL NOISE LEVELS DUE TO BUILDING SERVICES 19

8.0 SERVICE VEHICLES 20

Table 1: Summary of measured environmental noise levels 12

Table 2: Maximum allowable external music noise levels due to commercial units 13

Table 3: Maximum allowable internal noise levels within each commercial unit; noise egress, doors closed 15

Table 4: Maximum allowable internal noise levels within each commercial unit; noise egress, doors open 16

Figure 1: Site plan showing development in context of surroundings roads and buildings 4

Figure 2: Proposed Lower Ground floor plan – retail units 5

Figure 3: Proposed Upper Ground floor plan – food & beverage units 5

Figure 4: Proposed First floor plan – food & beverage units 6

Figure 5: Roof top plant zones (existing and proposed) 7

Figure 6: Noise Survey Measurement Locations 11

APPENDIX A: NOISE SURVEY DETAILS AND SUMMARY RESULTS 21

SUMMARY

Sol Acoustics Ltd has been commissioned by CIP Property (AIPT) Ltd to conduct an environmental noise study relating to proposed commercial units at the Corn Exchange, Manchester.

Environmental noise surveys around the proposed Development site have identified the pre-existing environmental noise levels during the day and night.

The maximum allowable external noise levels due to commercial activity to comply with the recommendations of Manchester City Council have been identified. Hence, the maximum allowable noise levels within the commercial units have been identified, given the proposed facade glazing to the units. Compliance with the identified internal noise levels is fully expected to maintain the amenity of the surrounding noise-sensitive buildings.

An assessment of potential external noise levels due to the external seating areas has been carried out. No loss of amenity to the surrounding noise-sensitive properties is expected.

The approach to determine the maximum allowable noise levels due to new building services plant such that noise nuisance can be avoided is discussed.

1.0 INTRODUCTION

Sol Acoustics Ltd has been commissioned by CIP Property (AIPT) Ltd to conduct an environmental noise study relating to the proposed redevelopment of the Corn Exchange, Manchester.

In particular, the proposed redevelopment involves the following:

- Application for change of use and associated refurbishment and reconfiguration of the Corn Exchange to incorporate, retailing and leisure proposals within the following Use Classes: Use A1 at the Lower Ground Floor, A1 and A3 at the Upper Ground Floor and A3 at the First Floor, together with new shopfronts and associated access points into the Corn Exchange, reconfigured entrances, glazed extensions at the ground floor to the Fennel Street elevation, public realm/landscaping works to the surrounding streets and spaces on all three sides of the building, highways and servicing arrangements, introduction of new canopies to the Upper Ground Floor Units of Hanging Ditch and Cathedral Street, external seating areas, and associated works.

This report identifies the results of environmental noise surveys around the site and the determination of the maximum allowable external noise levels due to commercial activity and building services plant at the Development. Internal activity noise limits are given for the proposed commercial units.

The steps undertaken in compiling this study are as follows:

- Carry out an environmental noise survey to determine the typical levels of noise at and around the site during daytime and night time periods
- Determination of allowable maximum noise level at sensitive receptors to comply with Manchester City Council's requirements
- Calculation of noise egress from the proposed commercial units at the Development
- Determination of allowable maximum noise level within the commercial units to comply with the allowable external noise levels
- Determination of allowable maximum noise level at sensitive receptors due to building services plant at the Development to comply with Manchester City Council's requirements
- Assessment of potential external noise levels due to use of external seating areas

2.0 DESCRIPTION OF SITE AND PROPOSED DEVELOPMENT

The Corn Exchange is a large multi-use building in the centre of Manchester. The Corn Exchange is bounded by Exchange Square and Corporation Street to the south east, Fennel Street to the north and Cathedral Street to the west.

Fennel Street and Cathedral Street are side streets with restricted vehicular access. Exchange Square is a pedestrianised zone with a single lane restricted access zone for vehicles. Corporation Street is a two-way road through the centre of Manchester that is normally used by passenger vehicles and buses. Corporation Street is currently closed to traffic due to works relating to the Metrolink 'Second City Crossing'. Corporation Street will be open to Metrolink trams in approximately 2016.

Withy Grove shares a junction with Fennel Street and Corporation Street. Withy Grove carries passenger vehicles and buses.

The existing buildings around the Development site include Manchester Cathedral, the National Football Museum, Chetham's School of Music, the Printworks, the Arndale Centre, public houses, a hotel, night clubs and shops.

The current uses within the Corn Exchange include retail units and food & beverage units at lower ground and upper ground floors, and retail units at first floor. The proposed Development will involve the refurbishment of the lower ground, ground and first floors of the Corn Exchange to provide the following:

- Lower ground floor: Food retail unit of total approximate gross internal area 30 307 ft^2, food and beverage units of total approximate gross internal area 10 722 ft^2, Landlord's Plant space of total approximate gross internal area 5 899 ft^2.
- Ground floor: Food retail unit of total approximate gross internal area 3 223 ft^2, Food & Beverage units of total approximate gross internal area 28 526 ft^2
- 1st floor: Food & Beverage units of total approximate gross internal area 34 728 ft^2

The proposed opening hours of the commercial units are as follows:

- Retail (A1 Planning Class): 0900 to 2100
- Food & Beverage (A3 Planning Class): 0800 to 0000

The upper floors (Second Floor and above) of the building will remain unchanged.

Figure 1 shows the development site in the context of the surrounding roads and buildings.

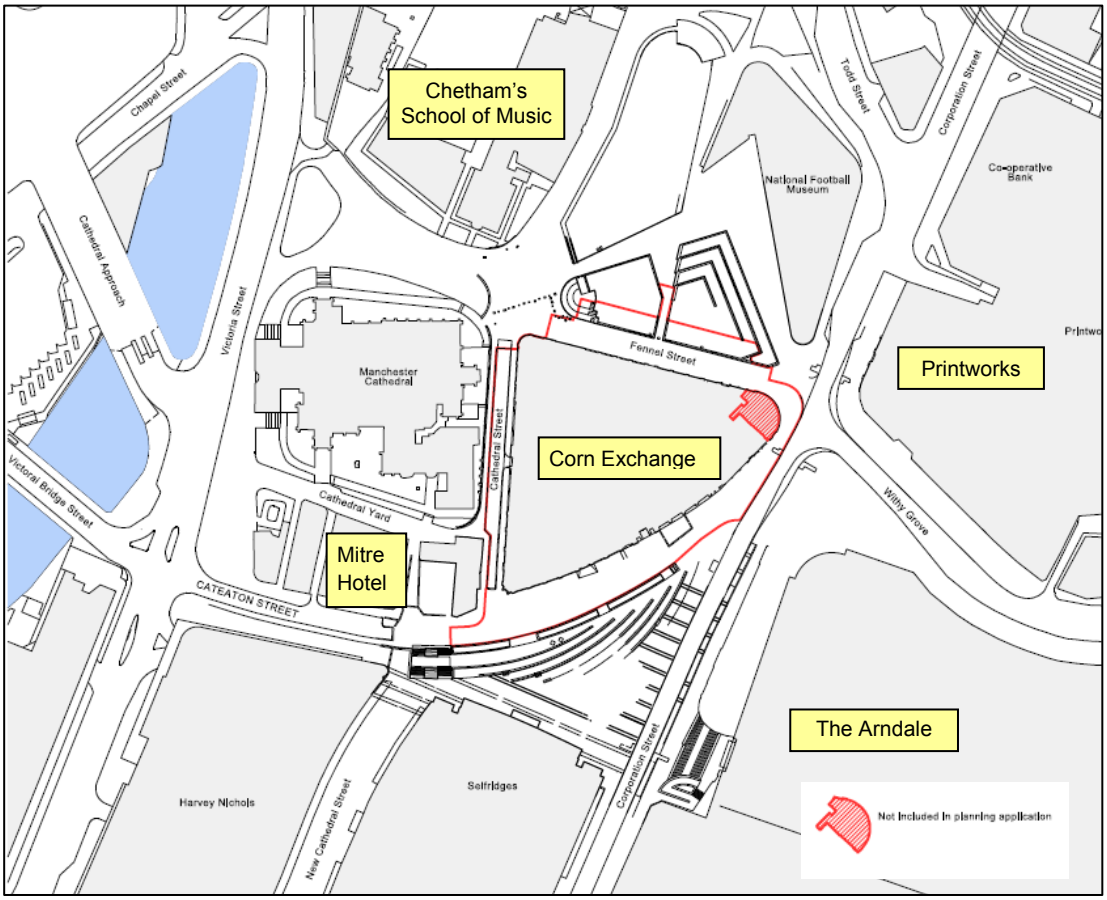

Figure 1: Site plan showing development in context of surroundings roads and buildings

Figures 2, 3 and 4 show the proposed layouts of the Development at lower ground, ground and first floor levels and includes the proposed Unit number.

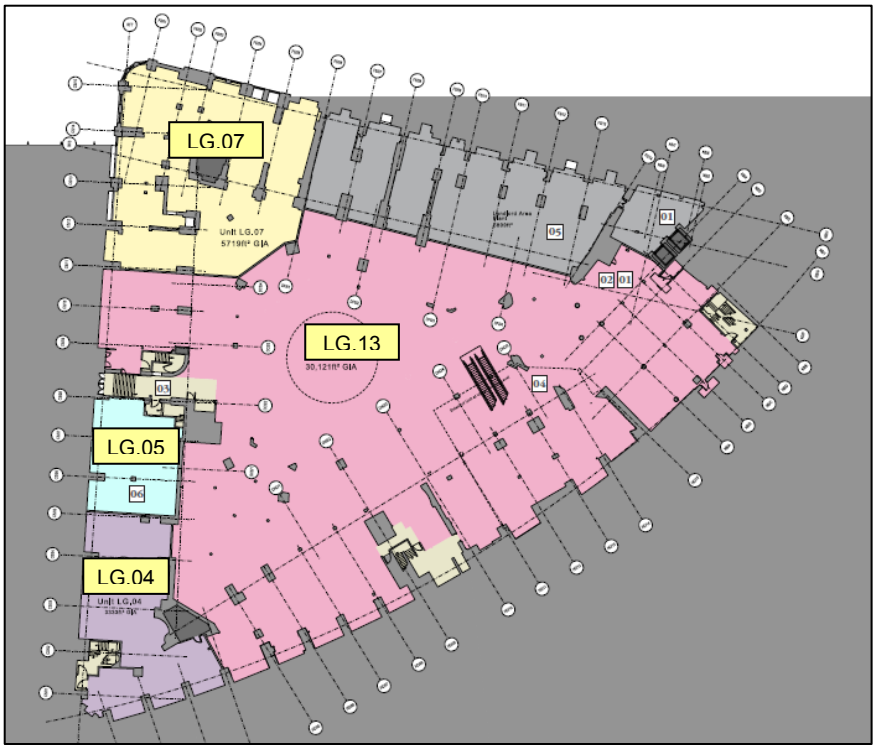

Figure 2: Proposed Lower Ground floor plan – retail units

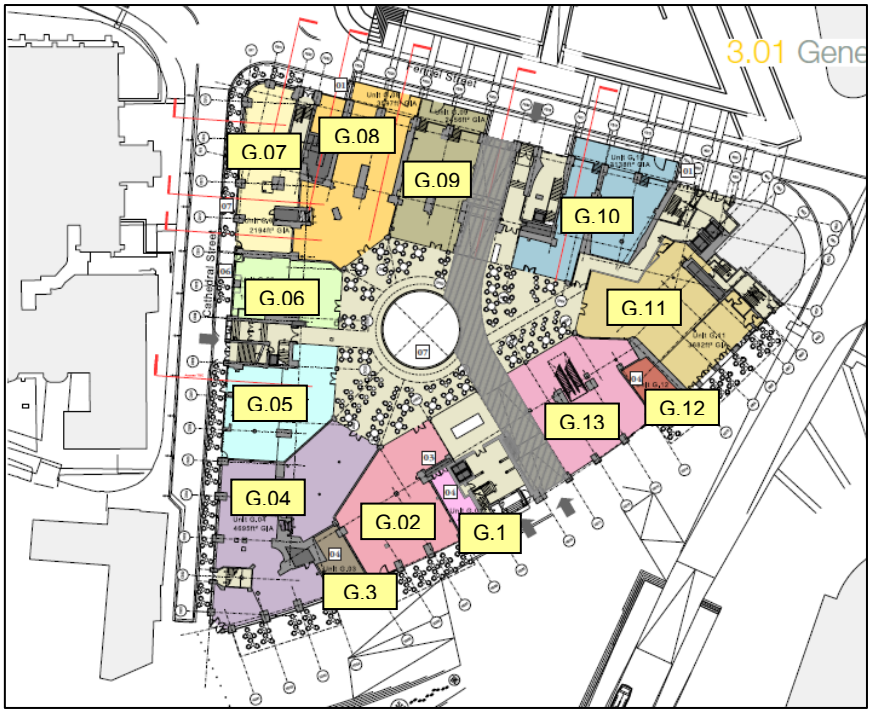

Figure 3: Proposed Upper Ground floor plan – food & beverage units

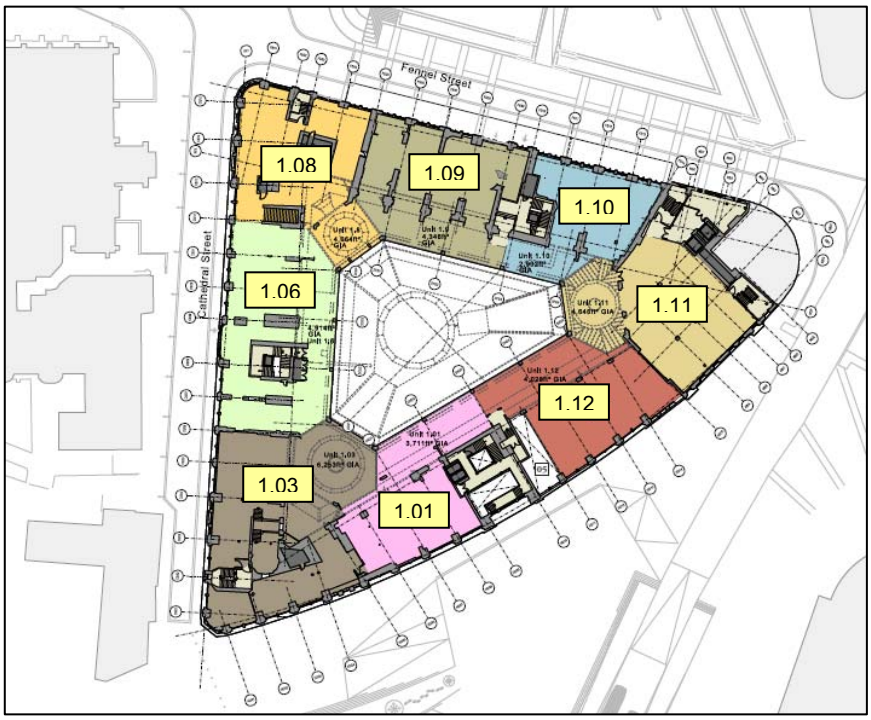

Figure 4: Proposed First floor plan – food & beverage units

It can be seen that only one of the units at lower ground floor, to the north west corner of the building, has external glazing. All of the units at upper ground and first floor level have external glazing. The proposed A1 unit at the lower ground floor does not have an external facade.

Building services plant

The outline proposals for building services systems at the Development are as follows:

- Heating

  Heating to the centre shall be provided from existing gas fired boilers located in the sub-basement plantroom areas and distributed to the individual retail tenants via piped systems.

- Cooling

  Cooling to the centre shall be provided by new air cooled chillers to replace the existing units, located at roof level, and distributed to the individual retail tenants via piped systems

- Ventilation

  New air handling units, generally replacing the existing units in the same location, together with new units in the lower Ground floor plant areas shall provide tempered general supply and extract ventilation to each of the retail units.

Therefore, it is not expected that there would be additional external plant items to those already in operation at the Development, as the existing units are to be replaced.

Figure 5 shows the location of the existing, and hence the proposed, rooftop plant spaces.

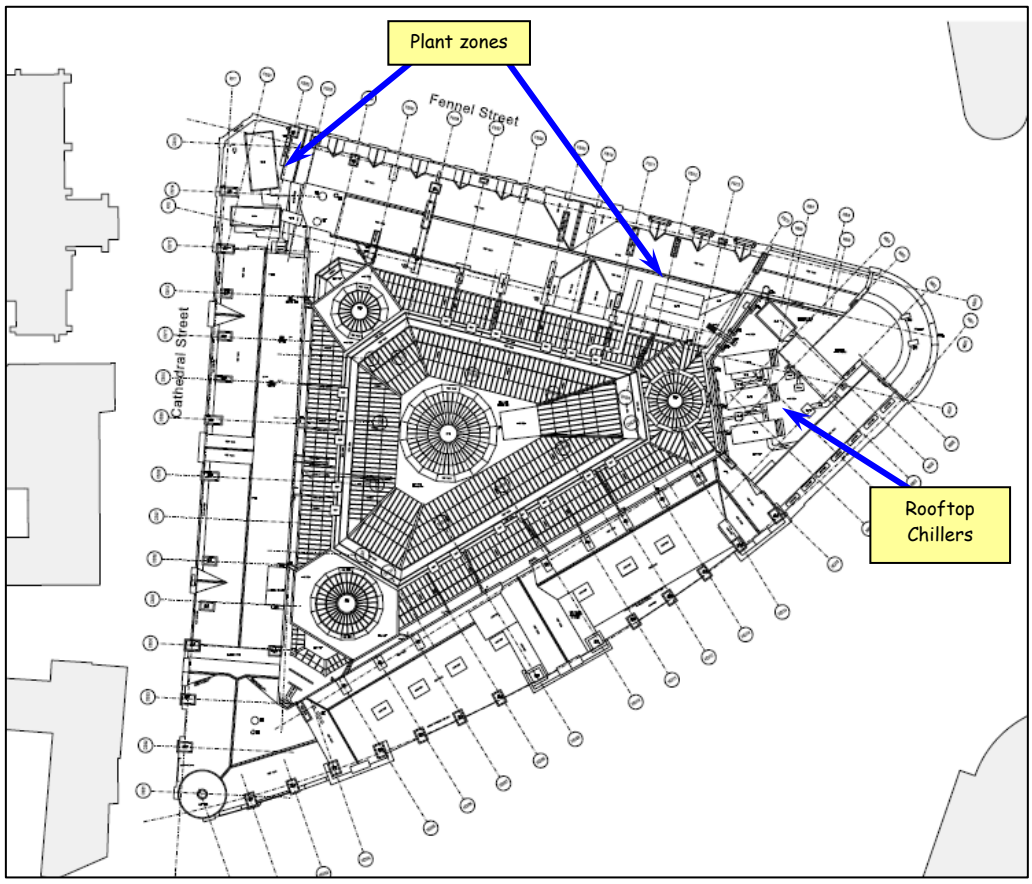

Figure 5: Roof top plant zones (existing and proposed)

3.0 RELEVANT GUIDANCE DOCUMENTS

The National Planning Policy Framework (NPPF), published in March 2012 by the Department for Communities and Local Government supersedes previous Planning guidance documents, such as PPG 24 'Planning and Noise'. The NPPF 'sets out the Government's planning policies for England and how these are expected to be applied'.

Clause 109 of the National Planning Policy Framework states that 'The planning system should contribute to and enhance the natural and local environment by…preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by …unacceptable levels of …noise pollution.

Clause 123 of the National Planning Policy Framework states that 'Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason'.

The National Planning Policy Framework document cross references the 'Explanatory Note to the Noise Policy Statement for England'. The 'Noise Policy Statement for England' (NPSE) was published by the Department for Environment Roof and Rural Affairs in March 2010.

The NPSE does not give suggested external noise criteria for commercial Developments. In the absence of specific criteria, reference shall be made in this document to established guidance and principles, as established in British Standards and the local Planning policy.

Manchester City Council's Core Strategy was adopted on 11th July 2012 and is the key Development Plan Document in the Local Development Framework (LDF).

Section 13.6 'Development Management' of the Core Strategy states that 'all new developments should follow the 'Development Principles' and accord with the design guidance set out in the Supplementary Planning Documents.

Policy DM 1, 'Development Management' of the Core Strategy states that:

- All development should have regard to the following specific issues for which more detailed guidance may be given within a supplementary planning document:- Effects on amenity, including …..noise, vibration…. This could also include proposals which would be sensitive to existing environmental conditions, such as noise.

Guidance Note GD3 has been issued by the City Wide Environmental and Public Protection Section of Manchester City Council. The document gives guidance on the preferred approach to environmental noise assessments. With regard to entertainment venues, GD3 states:

- 'When considering the potential impact of a proposal for an entertainment venue consultants should consider the overall noise level (LAeq) and the 63 Hz and 125 Hz octave band noise levels (Leq). Music noise in the 63 Hz and 125 Hz octave bands, which is often described as "bass noise", is particularly difficult to contain and the impulsive character of this low frequency music noise is particularly disturbing for local residents exposed to it.
- A planning application for an entertainment venue should demonstrate that music noise from the proposal will not be audible inside residential properties nearby assuming that the residential properties in question have their windows open. The target (external) noise criteria here should be 10dB (LAeq) below the existing (external) LA90 in each octave band.
- Applicants and consultants should note that although a particular business model may require a "chilled out" or "acoustic" venue Planning Approval for an entertainment venue will remain in place as long as the development exists. Subsequent owners or tenants may wish to provide much louder entertainment in the future. For this reason applicants and consultants should predict the noise impact of a proposed entertainment venue using noise levels that are representative of those found in "typical" venues of the kind being applied for. Consultants should provide their rational for using particular noise levels and reference the source of the noise levels used during their predictions'.

It is considered by Sol Acoustics that the target external noise criterion given above that the L_{Aeq} music noise level from entertainment venues should be 10 dB lower than the L_{A90} external noise level in each octave band is more stringent than would be required to achieve inaudibility of entertainment noise in a dwelling with an open window.

Sol Acoustics has previously applied a similar criterion to that described above, although the recommended allowable music noise level (Leq) is 5 dB below the pre-existing background L_{90} external noise level in each octave band. This criterion is considered to allow the inaudibility of music noise.

With regard to external noise due to new building services plant, GD3 states

- Any application for fixed plant, equipment or machinery must demonstrate that the noise will:

  a) Achieve a noise level (LAeq) of at least 5 dB below the background noise level (LA90) at the nearest noise sensitive location at the quietest time the equipment will be in operation;

  b) Not contain any discernable tonal characteristics at the nearest noise sensitive location at the quietest time the equipment will be in operation.

4.0 ENVIRONMENTAL NOISE SURVEYS

A survey of the existing noise environment at the proposed Development site has been carried out over an extended weekday and weekend daytime and night time period. The noise survey was conducted between Friday 7 June and Tues 11 June 2013. In addition, a noise survey was conducted on a Sunday night to confirm that the noise levels directly external to Chetham's School of Music and The Mitre Hotel are similar to the noise levels measured on Cathedral Street.

The measurement locations used during the surveys are suitable for the determination of the prevailing ambient noise level at the existing noise-sensitive buildings. Measurement locations for the noise surveys are shown in Figure 6.

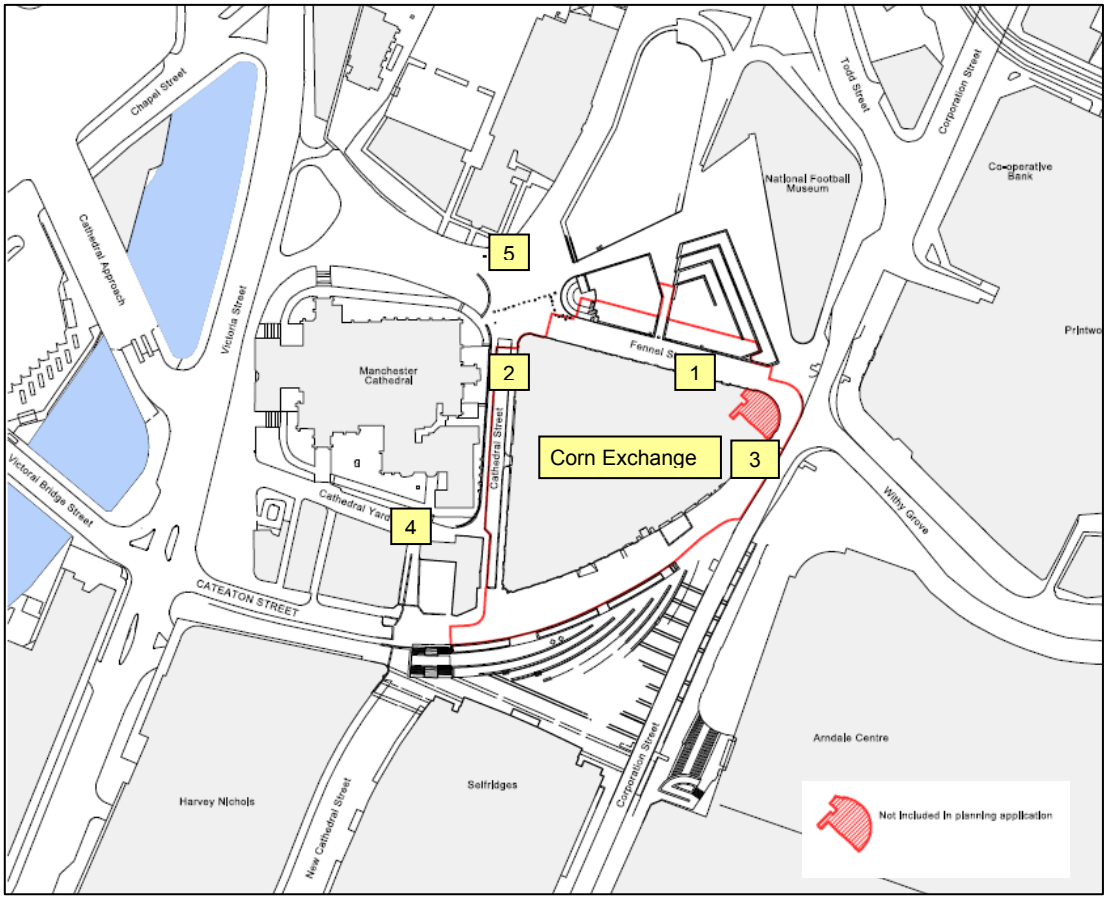

Figure 6: Noise Survey Measurement Locations

Full details and results of the noise surveys, including graphical representations of the measured noise levels at measurement locations 1 to 3 , are given in Appendix A.

The general noise environment at and around the Application Site is determined by road traffic and building services plant. Maximum noise levels (described by the 'LAmax' measurement) are typically generated by road traffic movements.

The measured noise levels during the day and night at the Application Site are summarised in Table 1.

	Measured Noise Level					
	Daytime (defined as 0700 to 2300)			**Night time (defined as 2300 to 0700)**		
Location	**dB, L_{Aeq} (range)**	**dB,L_{Amax} (range)**	**dB L_{A90} (lowest typical)**	**dB, L_{Aeq} (range)**	**dB,L_{Amax} (range)**	**dB L_{A90} (lowest typical)**
1 – Fennel Street	60 to 65	55 to 102	51	54 to 58	48 to 94	47
2 – Cathedral Street	56 to 60	49 to 89	50	45 to 53	45 to 82	43
3 – Corporation Street	63 to 65	58 to 98	52	59 to 65	49 to 95	48
4 – Fennel Street	-	-	-	50 to 51	55 to 64	48
5 – Cathedral Yard	-	-	-	49 to 51	51 to 66	49

Table 1: Summary of measured environmental noise levels

5.0 NOISE EGRESS FROM PROPOSED COMMERCIAL UNITS

In order to avoid potential noise nuisance to residents, activity noise egress from the proposed commercial units must be controlled

As detailed in Section 3, Manchester City Council suggests that external music noise levels (measured as an L_{eq} noise level) external to a residential property due to a venue should be 10dB lower than the prevailing background noise level in each octave band.

The closest existing residential receptors are at Chetham's School of Music and The Mitre Hotel at 1-3 Cathedral Gates, Cateaton Street. These premises are both approximately 35 metres from the closest façade of the Corn Exchange.

The closest non-residential noise sensitive receptor is Manchester Cathedral. In order to avoid potential disturbance of the Cathedral due to music noise, it is recommended that the free-field music noise level (L_{eq}) at the façades of the Cathedral is 5 dB below the pre-existing background L_{90} external noise level in each octave band.

Table 2 identifies the maximum allowable cumulative daytime and night time free-field noise level at the closest residential façades due to music noise from the proposed commercial units to comply with the guidance of Manchester City Council and with the recommended criterion given above for Manchester Cathedral.

Location/period	Sound Pressure Level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Chetham's School of Music (0700 to 2300)	46	43	42	40	37	32	24
Chetham's School of Music (2300 to 0000)	46	43	38	36	36	32	24
Manchester Cathedral (0700 to 2300)	51	48	47	45	42	37	29
Manchester Cathedral (2300 to 0000)	49	44	41	38	38	34	25
The Mitre Hotel (0700 to 2300)	52	45	39	37	34	29	22
The Mitre Hotel (2300 to 0700)	52	45	39	37	34	29	22

Table 2: Maximum allowable external music noise levels due to commercial units

At this stage, operational noise levels for the proposed commercial units are not known. However, guidance can be given based on the potential acoustic performance of façade elements. The façades of the proposed commercial units are to be predominantly glazed. The principal determinant of noise egress from the development will therefore be the sound reduction index of the installed glazing.

The glazed shop fronts to the commercial units will comprise the following expected glazed units:

- Glazed extensions – 12 mm float / 18 mm cavity / 13.5 mm laminated. Expected Sound Reduction Index of 40dB Rw
- Retained glazing to existing shop fronts:
  - Unit 13: 10.8 mm laminated single glazed (35dB Rw)
  - Unit 22: 14.8 mm laminated (40 dB Rw)
  - Unit 18: 12.8 mm laminated (37 dB Rw)
  - All remaining units: 10 mm float single glazed (assumed worst case) (35 dB Rw)

Environmental noise egress calculations have been carried out in order to determine the expected external noise levels due to internal noise within the commercial units.

The calculations have initially assumed that the outer entrance door to each commercial unit is closed.

Table 3 identifies the calculated internal noise levels that could be generated in the areas close to the external facades of each of the commercial units, without exceeding the external noise levels given in Table 2. It should be noted that the allowable noise internal noise levels are based on acceptable external noise levels at night time (i.e. up to midnight).

Retail Unit	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
G.01	86	88	86	87	88	82	85
1.01	86	88	86	87	88	82	85
G.02	86	88	86	87	88	82	85
G.03	86	88	86	87	88	82	85
1.03	81	83	81	82	83	77	80
G.04	81	83	81	82	83	77	80
G.05	81	83	81	82	83	77	80
G.06	81	83	81	82	83	77	80
1.06	81	83	81	82	83	77	80
LG.07	88	90	84	87	87	85	86
G.07	82	85	80	83	83	81	81
G.08	82	88	82	84	87	87	85
1.08	82	88	82	85	85	83	84
G.09	86	88	84	87	87	85	86
1.09	86	88	84	87	87	85	86
G.10	86	88	84	87	87	85	86
1.10	86	88	84	87	87	85	86
G.11	86	88	86	87	88	82	85
1.11	86	88	86	87	88	82	85
G.12	86	88	86	87	88	82	85
1.12	86	88	86	87	88	82	85
G.13	86	88	86	87	88	82	85

Table 3: Maximum allowable internal noise levels within each commercial unit; noise egress, doors closed

The noise levels detailed in Table 3 would allow typical retail outlets or 'lively' restaurants with relatively high levels of background music replay to be accommodated.

If the external door to each unit is opened without the benefit of an internal lobby, then the sound insulation of the envelope to each unit will be reduced.

Table 4 identifies the calculated internal noise levels that could be generated in the areas close to the external facades of each of the commercial units, without exceeding the external noise levels given in Table 2, on the basis that the entrance door to each unit is open. It should be noted that the allowable noise internal noise levels are based on acceptable external noise levels at night time (i.e. up to midnight).

Retail Unit	Spatially averaged sound pressure level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
G.01	82	80	78	77	78	75	70
1.01	86	88	86	87	88	82	85
G.02	82	80	78	77	78	75	70
G.03	82	80	78	77	78	75	70
1.03	81	83	81	82	83	77	80
G.04	72	69	67	65	65	66	54
G.05	72	69	67	65	65	66	54
G.06	72	69	67	65	65	66	54
1.06	81	83	81	79	79	77	80
LG.07	86	88	84	87	87	85	86
G.07	82	75	75	71	71	63	57
G.08	82	80	75	73	73	70	63
1.08	82	88	80	79	79	83	84
G.09	82	80	75	73	73	70	63
1.09	86	88	84	87	87	85	86
G.10	82	80	74	73	73	69	64
1.10	86	88	84	87	87	85	86
G.11	82	80	78	77	78	75	70
1.11	86	88	86	87	88	82	85
G.12	82	80	78	77	78	75	70
1.12	86	88	86	87	88	82	85
G.13	82	80	78	77	78	75	70

Table 4: Maximum allowable internal noise levels within each commercial unit; noise egress, doors open

For the ground floor of the units that face Cathedral Street, It is expected that typical retail outlets or restaurants with discrete background music replay could be accommodated within the allowable noise levels. However, it is expected that operators that wish to generate higher levels of noise than those identified in Table 4 would need to introduce a door lobby onto Cathedral Street to prevent an intermittent excess of external noise whilst the external door is open.

Given compliance with the above noise limits, it is expected that the proposed commercial units will be able to operate within the proposed Planning Classes without causing disturbance to the existing noise-sensitive receptors around the Development.

6.0 POTENTIAL NOISE LEVEL FROM EXTERNAL SEATING

Each food and beverage unit is to be provided with a small amount of external space for tables and chairs. The number of chairs is principally governed by the length of the frontage to each unit. The unit at the junction of Fennel Street and Cathedral Street is the worst case in terms of proximity to the most noise-sensitive existing properties and the number of external covers. In particular, this unit could accommodate approximately forty external covers, the closest of which would be approximately ten metres from the rear of Manchester Cathedral and thirty two metres from Chetham's School of Music.

The external seating areas would not be in use after 11pm.

No formal published guidance is available that gives recommended assessment criteria for noise due to restaurant patrons in an external area. However, reference can be made to the 'Draft Code of Practice on the Control of Noise from Pubs and Clubs' published by the Institute of Acoustics in 1999. This suggested that the $L_{Aeq,5\ min}$ noise level external to a dwelling, including the noise contribution from a bar, should be no greater than the typical pre-existing $L_{Aeq,5\ min}$ noise level (i.e. without the contribution from the bar). To achieve this would require that the noise level at the nearest dwelling due to noise from the bar alone is 10dB(A) below the pre-existing ambient noise level.

Whilst no criteria were given in the final version of the Code of Practice on the Control of Noise from Pubs and Clubs, this criterion has been applied successfully by some Local Authorities.

The typical measured external noise level at the junction of Fennel Street and Cathedral Street late on a Sunday evening (i.e. up to 11 pm) is 50dB $L_{Aeq,5\ min}$.

If it is assumed that all of the available external seats to every unit are occupied and that half of the Patrons are talking, then the calculated noise level at the closest facade of Chetham's School of Music is 41dB L_{Aeq} from the seating areas alone. The potential noise level noise level external to Chetham's School of Music, including the noise contribution from the proposed external seating areas, is therefore 50.5 dB L_{Aeq}. This noise level is a negligible increase over the pre-existing noise level and is considered to be acceptable.

With regard to potential noise levels at Manchester Cathedral, BS8233: 1999 suggests that to maintain 'good' listening conditions within a church, internal noise levels should not exceed 30dB L_{Aeq}. Given an external stone facade with sealed glazing, it is estimated that external noise levels on Cathedral Street are reduced by approximately 25dB(A) when entering the Cathedral.

This would suggest that external noise levels on Cathedral Street of no greater than 55dB L_{Aeq} should lead to acceptable noise levels within the Cathedral.

If it is assumed that all of the available external seats are occupied, and that half of the Patrons are talking, then the calculated noise level at the closest facade of Manchester Cathedral is 50dB L_{Aeq} from the seating areas alone. This result suggests that no loss of amenity would result to the Cathedral due to the proposed external seating area. It should be noted that this result assumes that the conduct and hence noise level of the external diners is in keeping with the proposed 'Premium Casual' dining to be offered by the proposed commercial units.

On the basis of the above discussion, disturbance due to potential noise from the proposed external seating areas is not expected.

7.0 EXTERNAL NOISE LEVELS DUE TO BUILDING SERVICES

Non-emergency Plant

As described above, the proposed new plant serving the development will be replacing existing plant. Therefore, if the new plant is no noisier than the existing plant, then the environmental noise levels will not increase, and residential amenity will not be affected.

It is therefore recommended that the levels of noise from the existing plant be measured at the external perimeter of the plant zones in question (e.g. close to the roof edge). Any new plant must then be specified such that building services plant noise levels at the same locations are no greater than that generated by the existing plant.

The above methodology has been discussed and agreed with Rick Knightley of the Environmental and Public Protection Team at Manchester City Council.

Care will need to be taken to ensure that the plant is in 'maximum noise' mode when carrying out the recommended pre-Contract noise level measurements and when evaluating the operational noise levels of the new plant. For instance, Chillers must be under a full cooling load, and Air Handling Units must be operating at their full design duty.

Emergency plant

There is no new emergency plant to be introduced to the Development.

8.0 SERVICE VEHICLES

With regard to the times and type of service vehicles at the Development, the proposed strategy is unchanged from the current situation. In particular, it is proposed that deliveries will be restricted to between 0500 hrs and 1000 hrs, seven days a week. A loading bay is proposed along Fennel Street. Units that face Cathedral Street will be serviced from the street. Units fronting Exchange Square will be serviced from either Cathedral Street or Fennel Street. Refuse collection times will be seven days a week from 0500 hrs to 0800 hrs.

As the proposed times and types of deliveries are unchanged from the current strategy, the Application does not present any additional implications relating to noise from service vehicles.

.

APPENDIX A: NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Corn Exchange, Manchester.

DATES AND TIMES

0910 hrs, Fri 7 June 2013 to 09.40 hrs, Tues 11 June 2013

2325 hrs to 0025 hrs Sun 14 July 2013

Weather during survey

Fri 7 June 2013	1/8 cloud cover, 5mph breeze, no rain, 17°c to 22°c
Sat 8 June 2013	2/8 cloud cover, 4mph breeze, no rain, 11°c to 19°c
Sun 9 June 2013	1/8 cloud cover, 4mph breeze, no rain, 10°c to 20°c
Mon 10 June 2013	2/8 cloud cover, 3mph breeze, no rain, 10°c to 18°c
Tues 11 June 2013:	5/8 cloud cover, 3mph breeze, no rain, 12°c to 16°c
Sun 14 July 2013	2/8 cloud cover, 4mph breeze, no rain, 17°c

Personnel present during surveys

Matthew Fisher – Sol Acoustics

Darren Clucas – Sol Acoustics

Instrumentation

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meters (x 3) (serial nos. 28260, 28957, 31498)

Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrators (x3) (serial nos. 29917, 31041, 31971)

Measurement methodology

Before and after the noise surveys the Norsonic Type 118 sound level metres were check calibrated to an accuracy of ±0.3dB using the Norsonic Type 1251 Calibrators - no drift in sensitivity was detected. The measurement microphones at location 1 to 3 were installed on poles that projected one metre from the external façade at each measurement position. Noise levels were measured continuously over the survey period using one minute sample periods. The measurement microphones at location 4 and 5 were installed on a tripod at a height of 1.4 metres in free-field conditions.

Figures A1 to A3 show the 'free-field' results obtained from the long-term noise surveys. Table A1 identifies the results obtained from the short-term Sunday night noise survey at measurement locations 4 and 5. Measurement locations are shown on Figure 5.

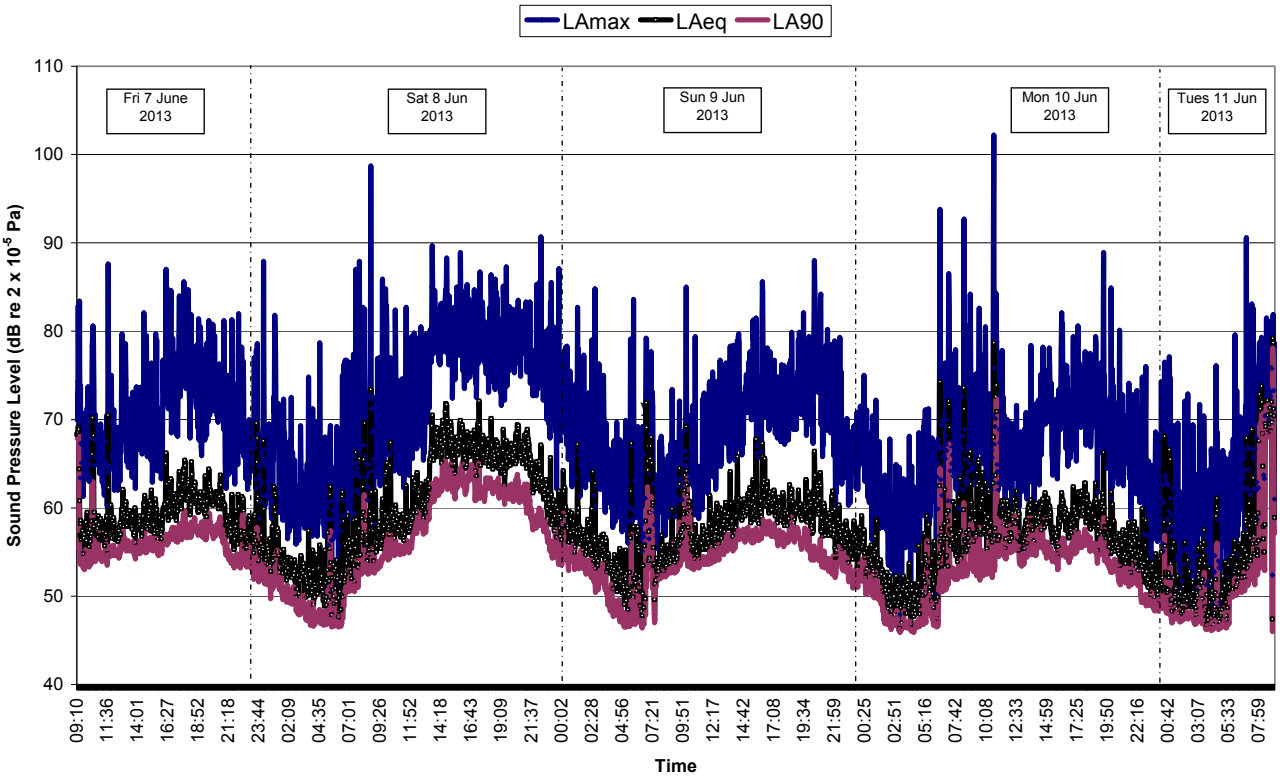

Figure A1: Position 1, Fennel Street, noise survey results

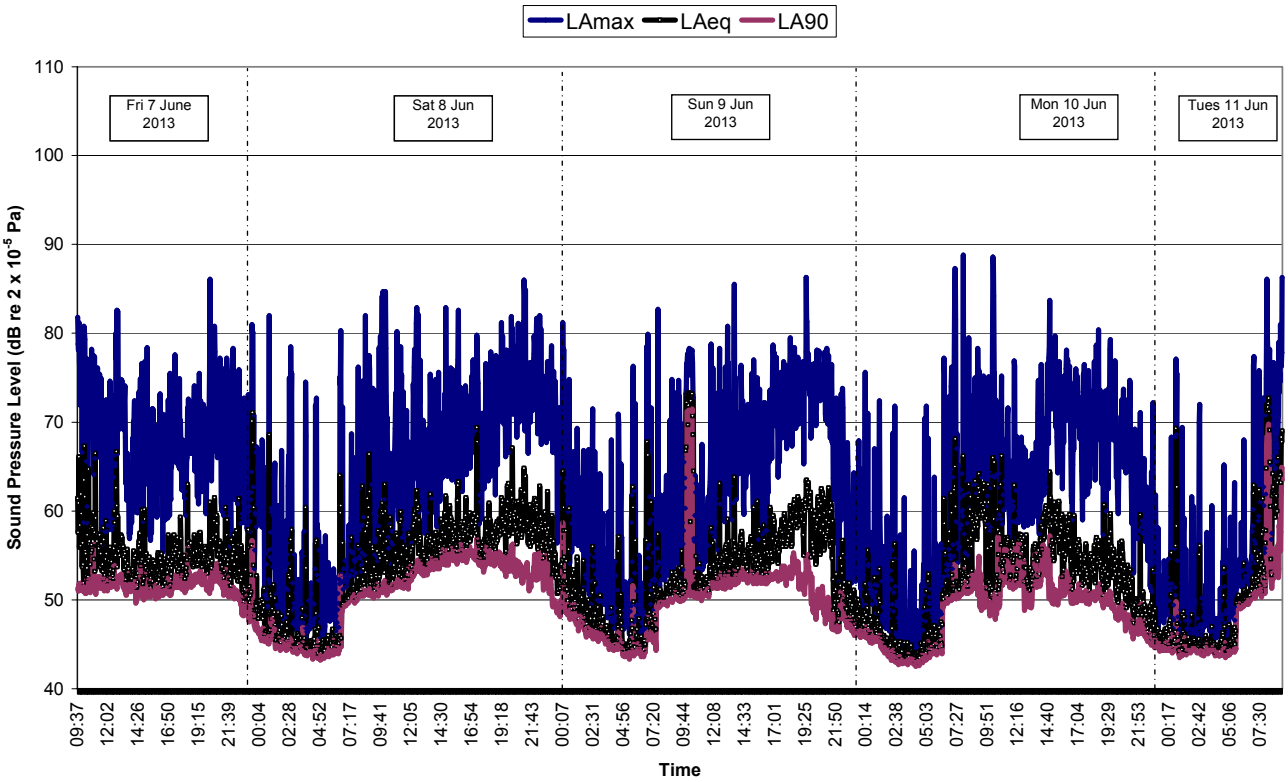

Figure A2: Position 2, Cathedral Street, noise survey results

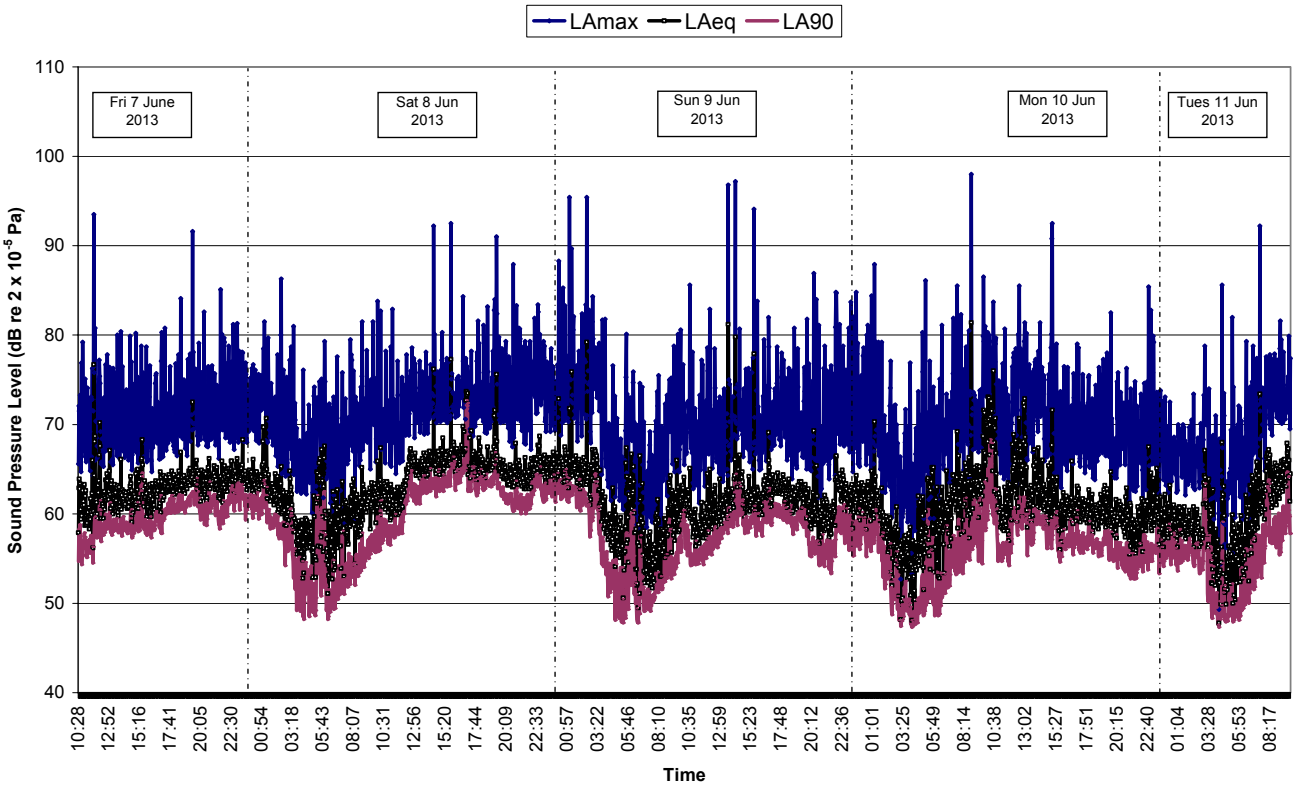

Figure A3: Position 3, Exchange Square, noise survey results

Measurement Location	Start Time	Measured Noise Levels, dB				Noise sources
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90}	
4	23:25	49.5	51.7	50.6	48.2	Distant road traffic, distant plant
4	23:30	50.5	66.2	51.4	49.1	"
4	23:35	50.4	65.8	51.6	48.4	"
5	23:42	50.3	64.3	51.2	48.2	Distant road traffic, distant plant, water feature
5	23:47	50.7	59.6	52.3	48.9	"
5	23:52	50.2	56.3	51.2	48.9	"
5	23:57	50.3	55.1	51.2	49.2	"
5	00:05	50.9	56.3	51.8	49.8	"
4	00:07	48.9	51.2	49.5	48.3	Distant road traffic, distant plant
4	00:12	49.5	52.4	50.4	48.6	"
4	00:17	49.0	53.4	50.6	47.7	"

Table A1: Summary Statistical Noise Levels 25 June 2012, Position 2