

11 FRIAR STREET, READING, RG1 1BD

Technical Note

Acoustic Assessment Report

11th March 2019

Peter Clark

1. INTRODUCTION

1.1 Vilais (Twister) LLP/Hawkstone Properties are to apply to Reading Borough Council (RBC) for Planning Permission for the *“Proposed conversion of existing upper floor offices to residential with partial demolition of listed building to form new access”*. The Application Site (11 Friar Street) is commercial/retail use at ground floor level with existing office use above and is located in Reading town centre. Friar Street is a busy road with a number of shops, bars, restaurants, public houses and night clubs nearby *“Walkabout”* and *“Yates”*). The side elevation runs along Wiston Terrace which is a day-time service/access to the garage behind and, evening/night-time access to *“Walkabout”*. *Yates* lies on the corner of Wiston Terrace and Friar Street. During the pre-application process, concern was raised by RBC planning and environmental health departments regarding the potential noise issues that may result from the proximity of nearby late night clubs and pubs. A noise assessment and report is therefore required to support Vilais (Twister) LLP application for their proposed residential development. The assessment includes noise associated with ALL sources in the area but particular attention is paid to night-time noise associated with *Walkabout* and *Yates*. *Walkabout* is open till 3am on Saturday and Sunday mornings whilst *Yates* closes at 2.30am. The noise survey and assessment has been completed by Dr Peter Clark

who is a Chartered Engineer and a Member of the Institute of Acoustics with 25 years professional experience.

1.2 The Application site lies on the corner of Friar Street and Wiston Terrace. There are two late night clubs/pubs nearby. There is a degree of noise associated with customers arriving/departing/using these premises and other noise sources in the area include traffic using Friar Street. In addition, many of the properties nearby have mechanical plant/equipment installations which are located to the rear of their premises. The most significant of these is the ventilation system which serves *Yates* and discharges at high level near the corner of Wiston Terrace and Friar Street. The general site location is given in Figure 1 below.



Figure 1: Site Location © Google earth

1.3 The noise assessment and report has been prepared in accordance with RBC Local Validation List as a noise impact assessment is required for “... noise sensitive uses in the vicinity of existing noise generating uses ... in areas with an existing noisy environment such as city centre”. Noise surveys, which were attended part-time, confirm that there are a number of significant noise sources in the area. These include noise from (a) the plant/equipment at the rear of *Yates* (b) during evening and night-time periods, customers arriving/departing nearby pubs, bars and restaurants and (c) customers using external areas of *Walkabout* night-club. The east elevation is exposed to higher noise levels due to its proximity to *Walkabout* and a very high performance glazing system is specified to meet internal noise level limits. Windows on the south elevation (Friar Street) will also be double glazed and a lower performance glazing system is specified. Background ventilation will be available to residents in the new development so that windows may be kept closed if required with ventilation air drawn in and expelled via acoustically treated ductwork and louvres which terminate away from Wiston Terrace and Friar Street. The construction of the building external walls and roof are also considered and recommendations are made to increase their sound insulation properties.

2.0 NOISE MEASUREMENTS

2.1 Environmental noise measurements were carried out from Friday 22nd February to Wednesday 27th February 2019. Sound level measurement equipment was installed at TWO locations on the site and used to log noise levels continuously over the 5 day period to encompass periods with

and without the neighbouring night-clubs in operation. One monitor (Location A) was positioned with microphone mounted on the flat roof overlooking Wiston Terrace and *Walkabout*. A second monitor (Location B) was positioned at the front of the Application Site overlooking Friar Street itself. During the attended noise measurements (11pm Friday 22nd to 4am Saturday 23rd February 2019), the surveyor logged specific noise events whilst located on the flat roof (close to Location A). The location of the monitors is shown more clearly in Figure A1 of Appendix A at the end of this report. Photographs showing the location of each of noise monitors in position are given in Figure A2a and A2b respectively. The measurement equipment is listed below in Table 1.0.

Table 1.0 Environmental Noise Measurement Instrumentation

No.	Description
1.	Larson Davis Model 820 Class 1 Sound Level Meter.
2.	Larson Davis Model 831 Class 1 Sound Level Meter
3.	2 off Larson Davis Model 377B02 ½" Diameter Condenser Microphone.
4.	Larson Davis Model CAL200 Sound Level Meter Calibrator.

2.2 All acoustic equipment conforms to the relevant parts of BS EN 60651:1994 (equivalent to BS 5969:1981) for the requirements of Type 1 acoustic accuracy. Additionally, the relevant equipment conforms to the

specifications contained within BS EN 60804:1994 (equivalent to BS 6698:1976) for integrating sound level meters.

2.3 In order to verify the correct operation of the equipment on site, an acoustic calibrator was applied during the course of the measurements. A maximum change of 0.2 dB(A) was noted, this can be considered as an insignificant change. The calibrator complies with the specifications of IEC 942:2003. The meters were previously laboratory calibrated in May and July 2018 respectively.

2.4 Fast meter response was used for all measurements carried out during the course of the survey.

2.5 Noise levels are expressed in terms of continuous equivalent noise levels (L_{Aeq}) over an appropriate time period. The use of L_{Aeq} allows non-steady and non-continuous noise to be assessed and compared to the existing noise climate. L_{Aeq} is referred to as the ambient noise level. Maximum (L_{AFmax}) and background noise levels were also measured and are expressed as L_{A90} . A full explanation of terminology commonly used in the measurement and assessment is given in Appendix B at the end of this report.

3.0 RESULTS

3.1 Noise measurements were carried out in terms of 5 minute intervals during the survey period. Ambient (L_{Aeq}) and background (L_{A90}) noise levels were measured. Minimum noise levels for the day-time (07:00 to

23:00 hrs), and night time period (23:00 to 07:00 hrs) have been determined.

Table 2: Summary Results

<u>L_{Aeq}</u>	<u>Day (07:00 to 23:00)</u>	<u>Night (23:00 to 07:00)</u>
<u>Location A (Wiston Terrace)</u>	64.8	66.4
<u>Location B (Friar Street)</u>	66.0	65.3

3.2 Although the survey was not attended on a full time basis, it was noted that general background noise levels are dominated by the ventilation plant which serves *Yates*. Intermittent noise sources included passing pedestrians and sirens from emergency vehicles on Friar Street. During night-time periods, on Friday and Saturday when *Walkabout* is open, noise from the club dominated. During these periods, the average night-time $L_{Aeq,8hour}$ (11pm to 7am) recorded was 69.5 dB, the corresponding spectrum is given below:

Average $L_{eq,8hour}$ night-time spectrum measured at Location A for Friday and Saturday nights (when Walkabout Club is open)

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	A
Noise Level (dB)	78	75	69	65	64	61	54	45	69.5

3.3 A full listing of noise data profile for two measurement locations is given in the graphs (Figures A3a, and b). Day and night time mean ambient noise levels are superimposed on each graph.

3.4 The noise measurements confirm that the Wiston Terrace (east elevation) is noisier due to the proximity of *Walkabout* and as such, this elevation (noise monitoring Location A) is considered critical in terms of potential noise issues. The noise data given in Figure A3a have been re-analysed concentrating on the night-time periods. This includes nights when the night-club was open/patrons leaving (i.e. 10pm to 3am on both Friday and Saturday nights). The results are shown in Figure A4 and includes $L_{Amax,f}$ noise data (i.e. maximum noise levels recorded) and short-term 5 minute average noise levels ($L_{Aeq,5min}$). The graphs indicate that Friday night was “noisier” than Saturday night even though the night-club was open on both nights. The results of the further analysis shows that for Friday night/Saturday morning period the 5 hour average noise level ($L_{Aeq,5hour}$) was 72.3 dB which compares to 61.2 dB for the corresponding periods when the night-club was not open.

$L_{eq,5hour}$ spectrum measured at Location A for the period 10pm to 3am with night-club open (Friday 22nd to Saturday 23rd February)

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	A
Noise Level (dB)	78	80	76	70	65	64	58	50	72.3

3.5 Figure A4 also shows the instantaneous maximum noise levels were recorded at Location A (in terms of $L_{Amax,f}$). Furthermore, the surveyor’s log (Appendix B) lists noise events during the attended survey period. When assessing the likelihood of sleep disturbance, it is usual to consider

the 10th highest maximum night-time noise level¹ - this is summarised in histogram in Table 3 below:

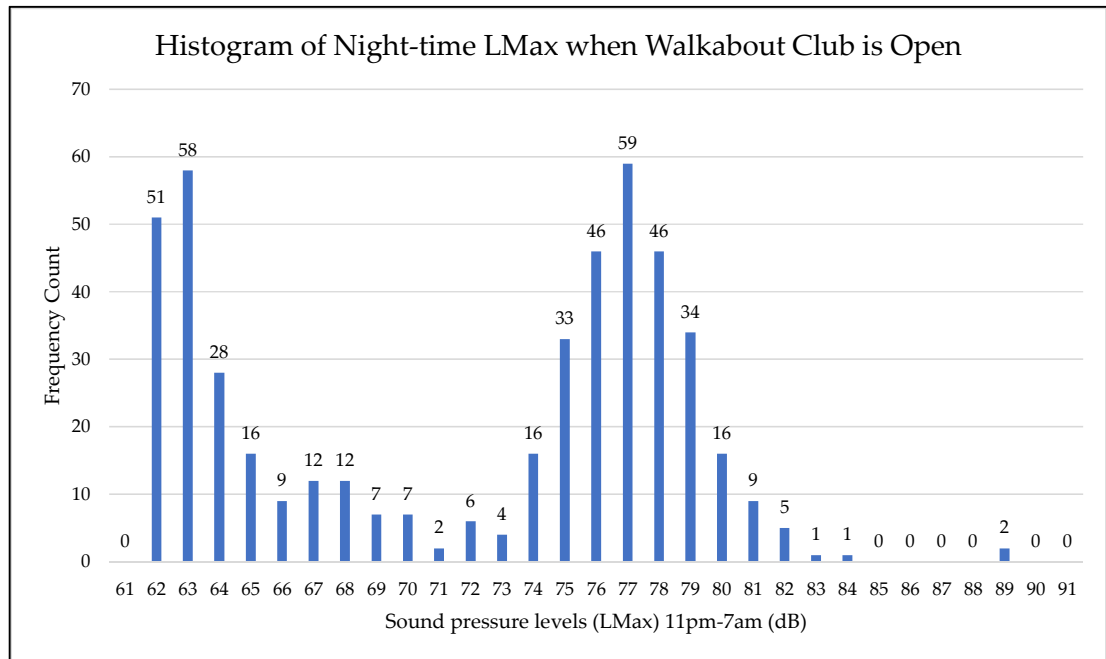


Table 3: 10th Highest of Maximum Noise Levels (when *Walkabout Club* is open)

3.6 The 10th highest occurring value in Table 3 is 82 dB(A). The octave band spectrum (L_{max}) measured was as follows:

L_{max} spectrum measured at Location A

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	A
Noise Level (dB)	89	87	79	80	78	73	68	64	82

3.6 For the south (Friar Street) elevation, average night-time ambient noise levels ($L_{Aeq8hour}$) are shown to be 65.3 dB with 10th highest maximum ($L_{Amax,f}$) is 84 dB.

¹ See for example BS8233: 1999 "Sound insulation and noise reduction in buildings" and WHO Guidelines.

3.7 The requirement for internal noise levels, as usually specified, is that *“...any new development meet the internal ambient noise levels as specified in Table 4, section 7.7.2 of BS8233:2014”*. That is to say bedroom and living room areas have day-time noise levels ($L_{Aeq,16\text{hour}}$) of 35 dB or less whilst at night-time, bedrooms have noise levels ($L_{Aeq,8\text{hour}}$) of 30 dB. In this application, the night time period is critical with respect to noise. The developer has proposed a double glazing system for the windows overlooking both Wiston Terrace and Friar Street. So that residents may reap the benefits of the enhanced acoustic insulation proposed, background ventilation will also be provided (so that windows may be closed if desired by the resident). The background ventilation system would be designed such that internal noise levels of 30 dBA (or NR25) are maintained.

Glazing Systems

3.8 A typical glazing system for each façade that may be specified is given in Appendix C. For Wiston Terrace, an example of a high performance system incorporates both 12.8mm and 16.8mm thick “acoustic glass” with 16mm cavity between. The performance of this system is such that (R_w) is 51 dB. Taking into the spectral shape of noise levels, this results in predicted internal night-time noise level of 26 dBA for the full 8-hour $L_{Aeq,8\text{hour}}$ night-time period when the club may be open whilst the internal noise level associated with the noisiest 5 hour (10pm to 3am) period ($L_{Aeq,5\text{hour}}$) becomes to 30.7 dB. The system proposed for Friar Street elevation incorporates both 10mm and 9.1mm thick “acoustic glass” with 16mm cavity between and the performance of this system is such that (R_w) is 45 dB. Internal night time noise levels would be 25 dB(A). As these levels

are below or around the expected internal background noise levels (i.e. from ventilation systems etc), general noise from the night-club would be pre-dominantly masked and inaudible. It is also important to consider the potential effects of noise events (i.e. $L_{Amax,f}$ criteria). To provide a reasonable standard in bedrooms, $L_{Amax,f}$ should not exceed 45 dB². Using the glazing system proposed, typical maximum night-time internal noise levels associated would be reduced to 40 dB(A) for bedrooms on the Wiston Terrace façade and 44 dB(A) on the Friar Street facade.

External Walls and Roof

3.9 External walls are 450mm thick brick at first floor level, reducing to 400mm at second floor and 300mm thick at third floor level. These walls are very heavy and will have a sound insulation performance of R_w 55 to 60 dB at first and second floor levels. Due to the reduced thickness at third floor level, the R_w is reduced to 50 to 55 dB. Furthermore, the existing mansard roof having a lighter-weight construction has R_w approximately 40 to 45 dB. The sound insulation of third floor external walls and mansard roof should be increased. These surfaces should be fitted with two additional layers of 15mm *soundbloc* plasterboard. The plasterboard should be mounted on an independent frame with acoustic insulation sandwiched between the existing wall and plasterboard layers such that the overall acoustic performance of these areas is increased by 10 dB to match that of the proposed glazing systems.

4.0 CONCLUSION

4.1 A noise measurement survey and assessment has been carried out at the proposed Application Site which is first, second and third floors of 11 Friar

Street, Reading. The site is to be developed to provide *a number of residential units* in the existing building. Friar Street is a busy road with pubs, restaurants and bars with patrons visiting/departing well into the night-time period. There is also a night-club (*Walkabout*) and a restaurant/bar (*Yates*) nearby. Both these premises are open late into the night-time period at weekends (*Walkabout* opens till 3am and *Yates* till 2.30am) and previously concern has been raised that patrons using these premises may cause a noise nuisance to the new residential development. As a result, noise levels have been assessed in terms of both ambient and maximum noise levels and the specification of a high performance glazing system to achieve required internal noise level limits is made.

- 4.2 The acoustic glazing systems proposed, when used in conjunction with the background ventilation system (to allow windows to be closed) will result in ambient noise levels from all major noise sources being largely inaudible within the residential apartments proposed. In addition to this, maximum noise levels would be substantially below recommended limits.
- 4.3 Recommendations are also made to increase the acoustic performance of third floor walls and the mansard roof. These surfaces should be internally lined with additional layers of *soundbloc* plasterboard with acoustic insulation fitted behind the plasterboard.
- 4.4 The noise assessment and report has been prepared in accordance with RBC Local Validation List as a noise impact assessment is required for “... *noise sensitive uses in the vicinity of existing noise generating uses ... in areas with an existing noisy environment such as city centre*”

APPENDIX A: GRAPHS & FIGURES.

Figure A1: Noise Monitor Locations & Site layout





Figure A2a: Noise Monitoring Location A (1st Floor Flat Roof) overlooking Wiston Terrace and *Walkabout* Night-club



Figure A2b: Noise Monitoring Location B (Friar Street)

Figure A3a: Environmental Noise Levels – Location A
 1st Floor Window Height – Overlooking Wiston Terrace (directly opposite
 Walkabout) $L_{Aeq,5min}$ and $L_{A90,5min}$ data

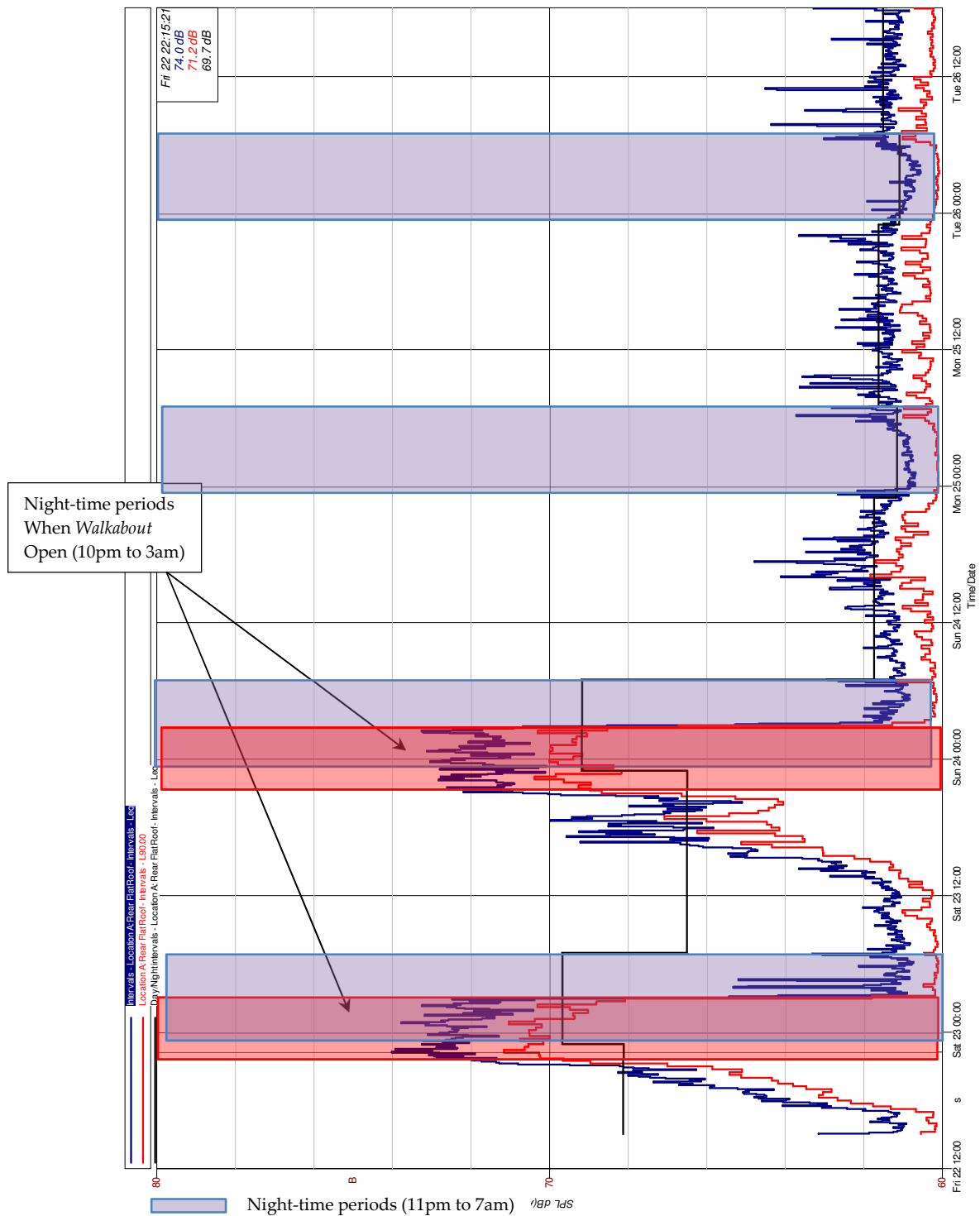


Figure A3b: Environmental Noise Levels – Location B

3rd Floor Window Height – Overlooking Friar Street $L_{Aeq,5min}$ and $L_{A90,5min}$ data

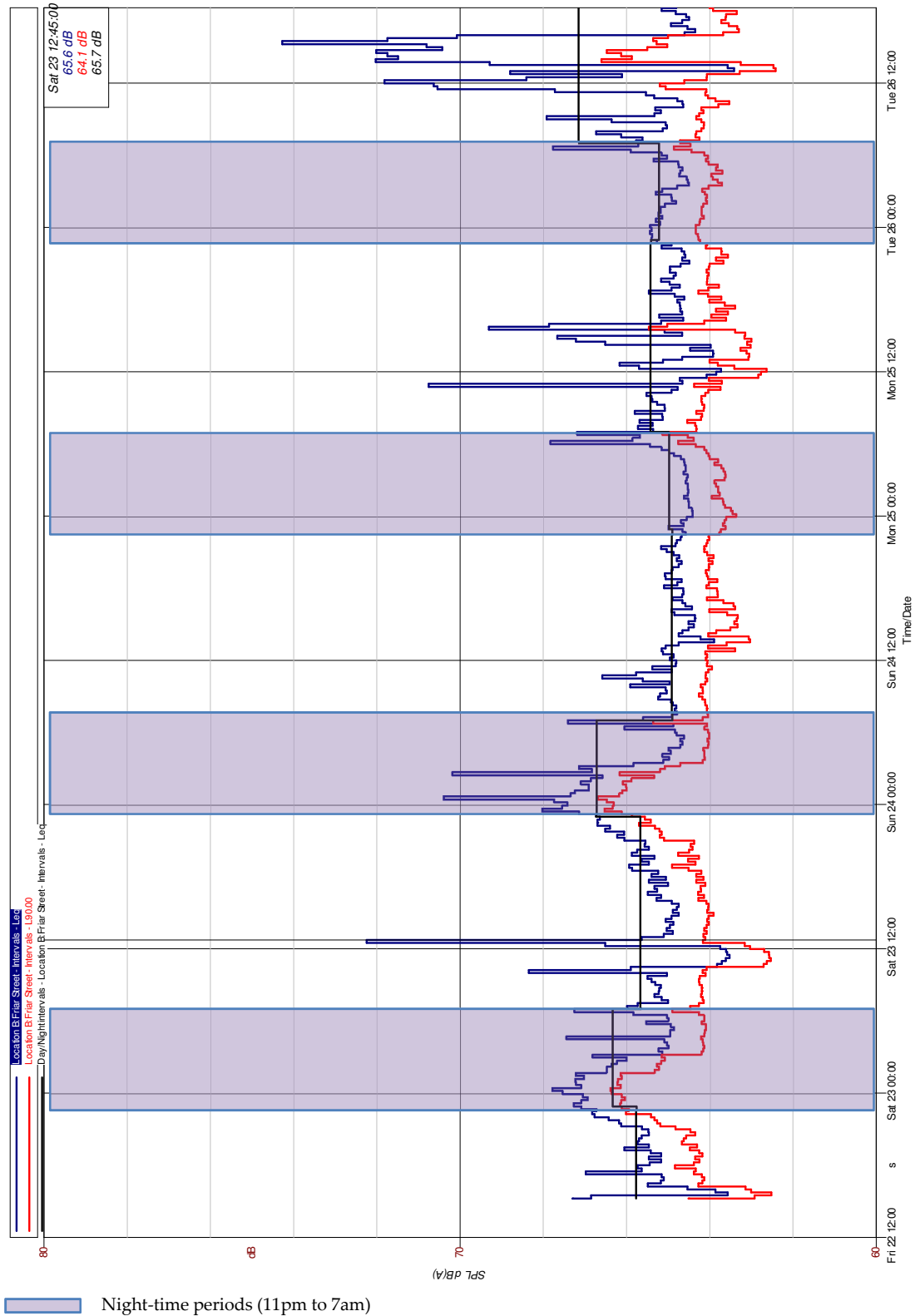
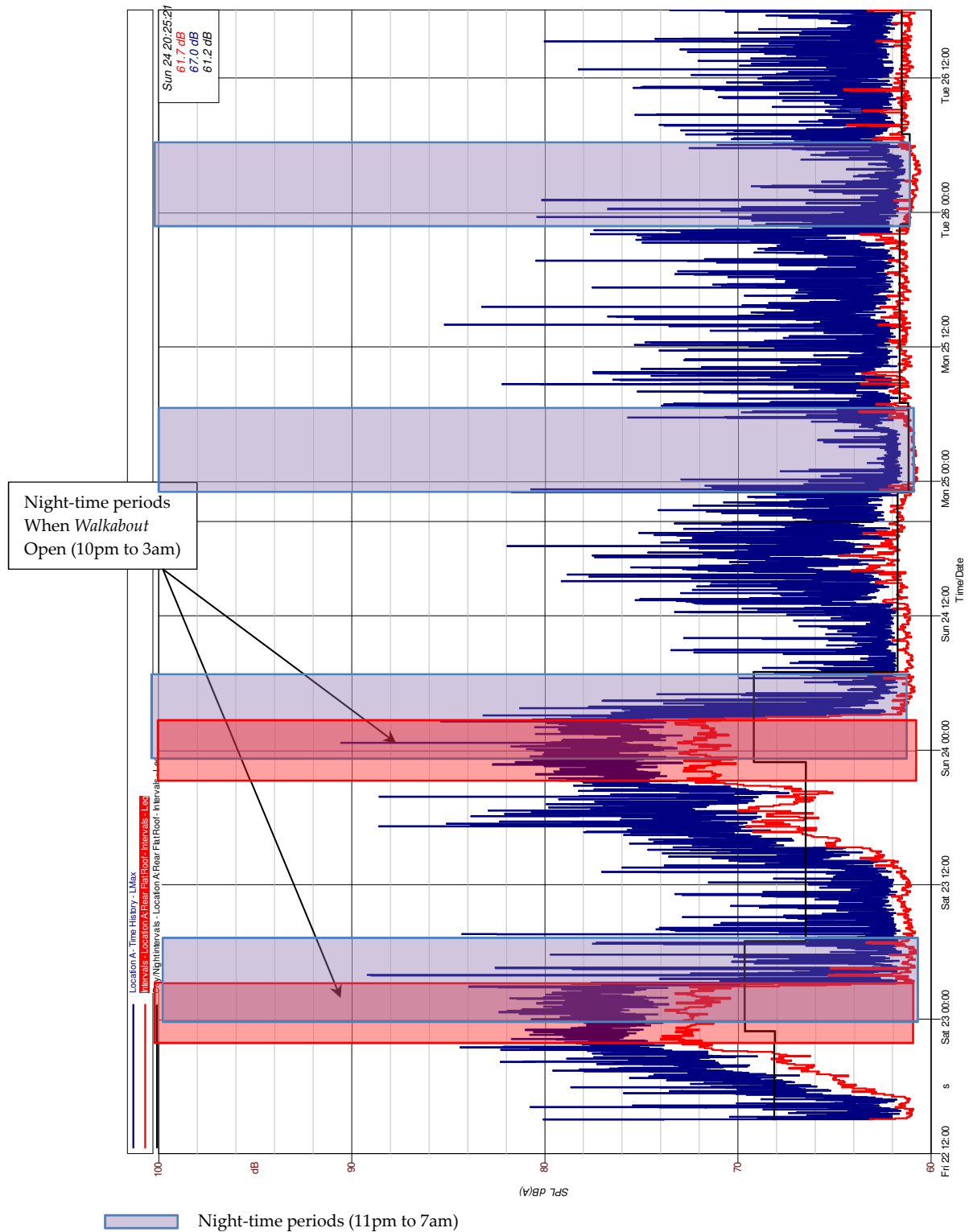


Figure A4: Environmental Noise Levels – Location A
 1st Floor Window Height – Overlooking Wiston Terrace (directly opposite
 Walkabout) $L_{Aeq,5min}$ and $L_{Amax,f}$ data



APPENDIX B: NOISE SURVEYORS LOG

Description of Specific Noise Events (Friday 22nd to Saturday 23rd February)

22:45 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind. General club noise and chatting
23:00 Hourly chimes from clock.
23:15 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind.
General club noise and chatting
23:30 same as above
23:45 same as above
23:50 alarm went off. Security investigated.
00:00 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind.
General club noise and chatting
00:15 same as above
00:30 same as above
00:42 shouting
00:43 shouting
00:45 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind. General club noise and chatting
01:00 same as above
01:15 Extract fans not noticeable.
01:30 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind. General club noise and chatting
01:33 shouting and fighting
01:45 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind. General club noise and chatting
02:00 same as above
02:05 horn
02:14 shouting a bit louder
02:15 loud music from walkabout and Yates. Extract fans from Yates. Extract fans from behind. General club noise and chatting
02:30 same as above / People outside Yates side entrance
02:30 Yates close
02:37 Extract fans at rear more noticeable
02:40 more people leaving walkabout
02:41 Yates lights off
02:44 door slam
02:45 loud music from walkabout. Extract fans from Yates. Extract fans from behind. General club noise and chatting
02:47 can hear bird song
02:56 bottle bin emptied x9
02:58 shouting

03:00 much quieter, music stopped. Walkabout closed/closing
03:04 shouting at people to leave
03:06 people leaving via alley
03:10 bottle bins being emptied
03:10 notably quieter. Extract fans to rear and at Yates can be heard loudly
03:13 loud car
03:14 shouting
03:15 some chatter and bottles being recycled
03:20 radio chatter. Door slammed
03:24 shouting in streets
03:29 noticed air con unit on
03:30 just Extract fan noise
03:35 kicking can or cup
03:37 walkabout door open, music playing for staff cleaning
03:41 car honking and shouting
03:43 shouting
03:44 car starting and leaving in alley
03:45 music from club - quieter
04:00 loud bangs lifting benches up and dropping them for cleaning

APPENDIX C: EXAMPLE GLAZING SPECIFICATIONS

Double Glazed Units – Wiston Terrace Facade



Insulating Glass Units and Acoustics

IGU	Frequency - Hertz						R_w	$R_w + C$	$R_w + C_{tr}$
	125	250	500	1000	2000	4000			
12.8A/16/16.8A*	34	41	47	53	61	68	51	50	46

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*A – In the above table denotes an acoustic PVB interlayer laminate

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Double Glazed Units – Friar Street Facade

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						$R_w(C;C_{tr})$	R_w	$R_w + C$	$R_w + C_{tr}$
	125	250	500	1000	2000	4000				
10 mm / 16 mm argon / 9.1 mm Pilkington Optiphon™	29	33	44	46	49	57	45 (-2; -5)	45	43	40

APPENDIX C: DESCRIPTION OF NOISE TERMS AND UNITS.

- 1.1 The sounds that we hear are as a result of successive air pressure changes. These air pressure changes are generated by vibrating sources, such as train engines or wheels, and they travel to a receiver, i.e. the human ear, as air pressure waves.
- 1.2. The human ear is capable of detecting a vast range of air pressures, from the lowest sound intensity that the normal ear can detect (about 10^{-12} watts/m²) to the highest that can be withstood without physical pain (about 10 watts/m²). If we were to use a linear scale to represent this range of human sensitivity it would encompass more than a billion units. Clearly this would be an unmanageable scale yielding unwieldy numbers.
- 1.3. The scale can be compressed by converting it to a logarithmic or Bel scale, the number of Bels being the logarithm to the base 10 of one value to another (as applied by Alexander Graham Bell to measure the intensity of electric currents). The Bel scale gives a compressed range of 0 to 12 units which in practice is a little too compressed. A more practical operating range of 0 to 120 is obtained by multiplying by 10, ie. 10 x Bel, which produces the scale units known as decibels or dB.
- 1.4. *Examples of typical sound intensity levels within the decibel range of 0 to 120 dB are listed below:*

Commercial four-engine jet aircraft at 100m	120dB
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Riveting of steel plate at 10m	105dB
Pneumatic drill at 10m	90dB
Circular wood saw at 10m	80dB
Heavy road traffic at 10m	75dB
Male speech, average, at 10m	50dB
Whisper at 10m	25dB
Threshold of hearing, 100Hz	0dB

- 1.5. Due to this logarithmic scale noise levels have to be combined logarithmically rather than arithmetically. For example, two equal sound sources of 70 dB each, when operated simultaneously, do not produce a combined level of 140 dB but instead result in a level of 73 dB, ie. A rise of 3dB for each doubling of sound intensity. Subjectively, a 3dB change does not represent a doubling or halving of loudness; to make a sound appear twice as loud requires an increase in sound pressure level of about 10dB.
- 1.6. The subjective loudness of noise can be measured by applying a filter or weighting which equates to the frequency response of the human ear. This is referred to as an A-weighting and when applied results in noise levels expressed as dB(A).
- 1.7. dB(A) noise levels can be measured using a variety of noise indices. The index which correlates best with human response due to machinery noise is the L_{Aeq} this is the A-weighted L_{eq} which is referred to as the 'equivalent continuous noise level' and is a measure of the total sound



energy generated by a fluctuating sound signal within a given time period.