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noise and vibration consultants
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Report: 2008686.5/2701A/R0/BW_Block 2

Prepared for: Frasers

FRASERS BROADWAY
BLOCK 2

PROJECT APPLICATION
ENVIRONMENTAL NOISE ASSESSMENT

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1. INTRODUCTION

Acoustic Logic Consultancy Pty Ltd has been engaged by Frasers Developments in order to conduct a Concepts Plan, Environmental Noise Study on Block 2 of the Frasers Broadway development for the purpose of assessing the potential impacts on the acoustic amenity of the proposed residents from both external and internal noise sources as part of the Planning Application submission. The noise sources investigated are as follows:

- The site perimeter roadways including Broadway, Abercrombie Street and Regent Street.
- Noise emissions associated with traffic generated from the site.
- Mechanical plant noise emissions from the site such as air conditioning plant noise and fan noise.

Traffic noise will be covered first as it will most significantly influence the development. Attended noise monitoring was conducted in order to determine the existing traffic noise levels around the perimeter of the site.

The final part of the report will address inter development noise from occupants. At this early stage no detailed design has been conducted for mechanical plant. This cursory study will set the goal assessment criteria applicable to the project based on Environmental Protection Authority (EPA) and other relevant statutory/regulatory requirements.

2. SITE DESCRIPTION

Figure 1 below illustrates the location of the Frasers Broadway Block 2 development.

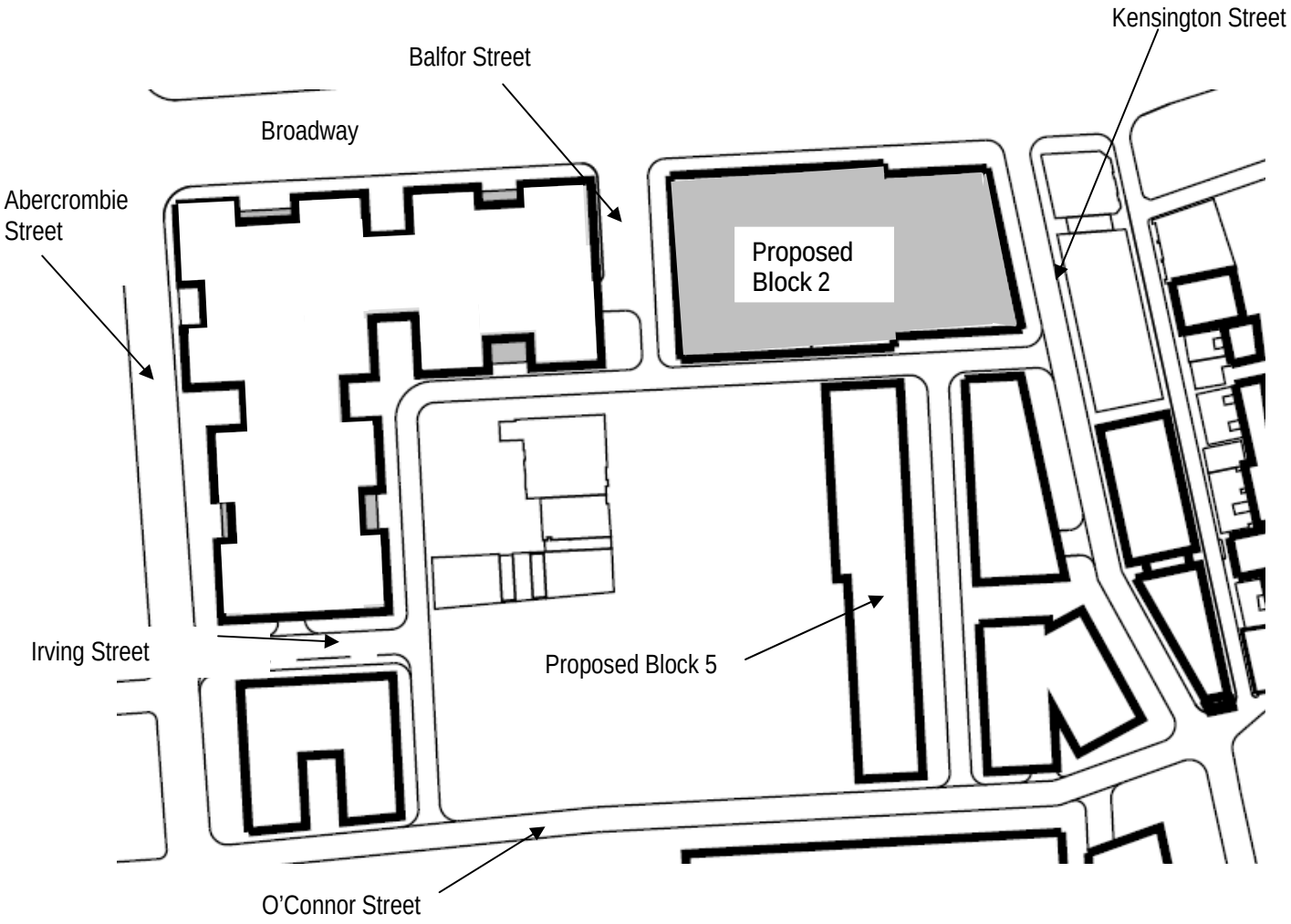


Figure 1 – Frasers Broadway Block 2

The existing environmental noise sources affecting the site are as follows:

- The development is affected by traffic noise on the site perimeter roadways including Broadway, Regent and Abercrombie Streets.

It is anticipated that the future acoustic environment impacting the proposed Frasers Broadway Site Development will not be altered significantly.

The environmental noise source outlined above has varying degrees of impact upon the proposed development which will be outlined in Section 3 of this Report.

The proposed development includes a mix of commercial, retail and residential tenancies.

3. EXISTING ACOUSTIC ENVIRONMENT

Traffic noise from the surrounding perimeter roadways are the main source of noise impacting upon the proposed development.

Broadway, Regent Street and Abercrombie Street carry medium to high volumes of traffic. Other surrounding streets such as O'Connor, Wellington and Kensington Streets carry low traffic volumes and will not significantly impact the proposed site.

3.1 TOPOGRAPHY

The topography of the site and surrounding land of the proposed development is generally undulating and the acoustic assessment has taken the varying topography into account.

4. ACOUSTIC SURVEY

As part of this assessment an acoustic survey of the proposed Frasers Broadway Site has been conducted.

The acoustic survey included attended and unattended noise logging which is detailed in this section of the report.

4.1 ENVIRONMENTAL NOISE LEVELS

Environmental noise constantly varies in level, due to fluctuations in local noise sources including road traffic. Accordingly, a 15 minute measurement interval is normally utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters.

In the case of environmental noise three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced by the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source depends on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of industrial noise.

4.2 ATTENDED NOISE MEASUREMENTS

Attended noise level measurements conducted as part of this assessment are detailed in this section of the report.

4.2.1 Measurement Equipment

Attended noise measurements were obtained using a CEL-593 Type 1 Sound Level Analyser, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a RION NC-73 Sound Level Calibrator. No significant drift was recorded.

4.2.2 Measurement Period

Noise monitoring was conducted at the locations detailed in Figure 2 below during the following periods:

1. Peak afternoon conditions between 3.30pm and 7pm on the 13th of November, 2008
2. Evening and night time periods between 7pm and 11pm on the 13th November, 2008.
3. Morning peak periods between 6am and 9am on the 14th November, 2008.

4.3 UNATTENDED NOISE MONITORING

Unattended noise monitoring conducted as part of this assessment is detailed in this section of the report. The results of unattended noise logging are included in Appendix A.

4.3.1 Unattended Monitoring Period

Unattended noise monitoring was conducted during the period of 17th November to 24th November 2008 in order to measure the existing background noise levels.

The noise level monitor was located to the rear of the site, screened form traffic noise sources on Broadway, Abercrombie and Regent Streets to obtain minimum background noise levels at the site. The location of noise monitoring is detailed in Figure 2 below.

4.3.2 Monitoring Equipment

Unattended noise measurements were obtained using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noises monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator. No significant drift was detected. All measurements were taken on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period.

4.4 MONITORING LOCATION

Figure 2 below presents the locations where both attended and unattended noise measurements and logger has been conducted as part of this assessment.

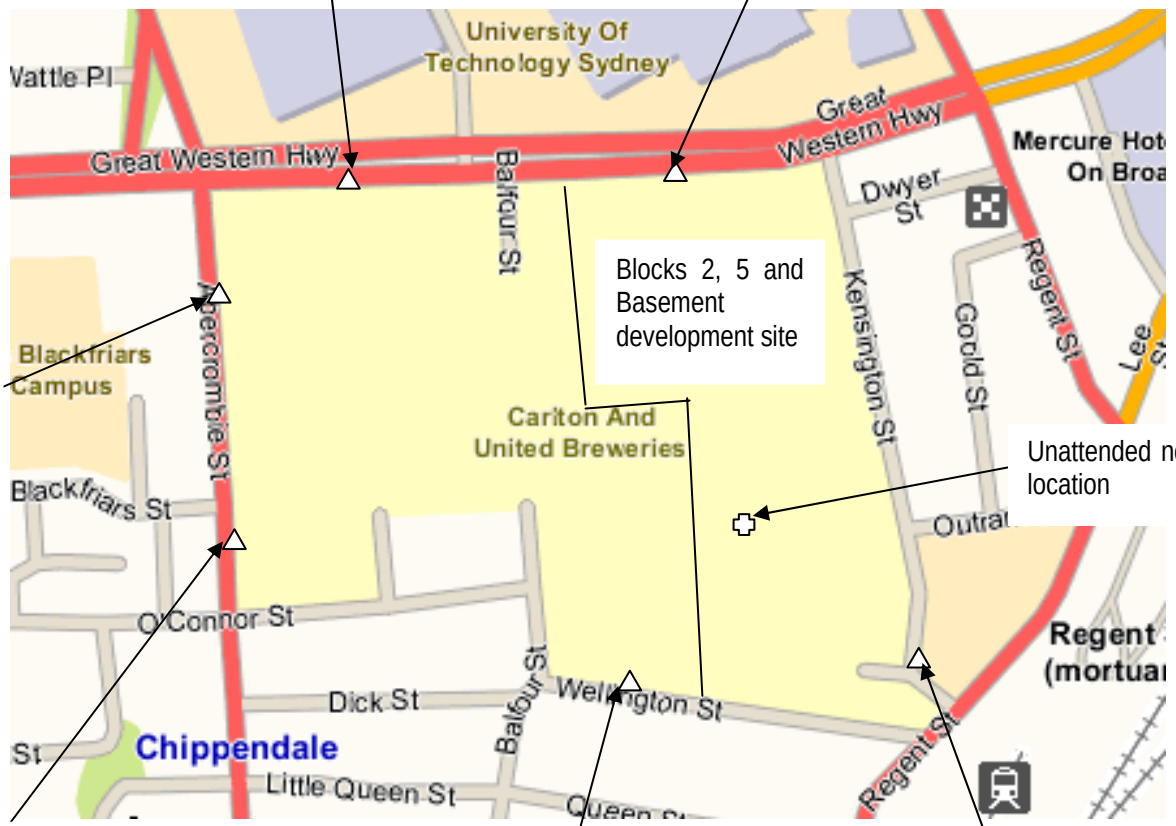


Figure 2 – Noise Survey Measurement Locations

4.5 RESULTS OF THE ACOUSTIC SURVEY

An acoustic survey was undertaken at the proposed Frasers development site in order to determine the existing acoustic environment. The unattended monitor results will be used to determine the variation between day, evening and night time noise levels. Attended measurements will be compared with the unattended monitoring data during the same measurement period so that relative differences between the attended and unattended locations can be formed thereby providing a comprehensive study of existing noise levels around the proposed site.

4.5.1 Existing Background Noise Levels

Background noise levels during day time are dominated by general vehicular traffic movements. The EPA NSW Industrial Noise Policy details specific steps in determining the background noise level for assessment of the day, evening and night time periods. Table 1 summarises the background determined at the monitoring location, based on the guidelines set out in the EPA NSW Industrial Noise Policy and the results of unattended noise monitoring.

Table 1 – Measured Ambient Noise Levels

Location	Description	Day Noise Level 7am to 6pm (dB(A))	Evening Noise Level 6pm to 10pm (dB(A))	Night Noise Level 10pm to 7am (dB(A))
Subject Site	Background $L_{90,15min}$	50	48	45

In addition to the background levels obtained at the unattended monitoring position presented above, attended noise monitoring was conducted at 6 locations around the perimeter of the subject site as detailed in the section above. The results of the attended noise measurements are presented in Table 2.

Table 2 – Measured Environmental Noise Levels

Location	Measured Noise Levels dB(A)L_{Aeq}		
	Afternoon/Evening Peak (3.30pm to 6pm)	Evening/Night Time (7pm to 11pm)	Morning Peak (6am to 9am)
Location 1 – East Broadway	71	68	70
Location 2 – West Broadway	71	69	71
Location 3 – North Abercrombie Street	72	70	70
Location 4 – South Abercrombie Street	73	69	70
Location 5 – Wellington Street	65	64	64
Location 6 – Regent Street	70	70	71

It is noted that the existing background noise levels are dominated by general transportation noise in the vicinity of the site.

5. NOISE EMISSION LIMITS – NOISE GENERATED ON THE SITE

The Environment Protection Authority (EPA) Industrial Noise Policy provides guidelines for assessing noise impacts from development sites. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion. In addition, the EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect residences from sleep arousal.

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the EPA Environmental Criteria for Road Traffic Noise (ECRTN).

5.1 INTRUSIVENESS CRITERION

The guideline is intended to limit the audibility of noise emissions at residential receivers and requires that noise emissions measured using the L_{eq} descriptor not exceed the background noise level by more than 5 dB(A). Where applicable, the intrusive noise level should be penalised (increased) to account for any annoying characteristics such as tonality.

5.2 AMENITY CRITERION

The guideline is intended to limit the absolute noise level from all industrial noise sources to a level that is consistent with the general environment.

The EPA's Industrial noise policy sets out acceptable noise levels for various localities. Table 2.1 on page 16 of the policy indicates 4 categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface.

Table 5 provides the recommended ambient noise levels for the suburban residential receivers for the day, evening and night periods. For the purposes of this condition:

- Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sundays and Public Holidays;
- Evening is defined as the period from 6pm to 10pm; and
- Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sundays and Public Holidays.

Table 3 – EPA Recommended Amenity Industrial Noise Levels

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residential	Day	55
	Evening	45
	Night	40

5.3 SLEEP AROUSAL

To minimise the potential for sleep arousal the $L_{1\ (1\ minute)}$ noise level of any specific noise source does not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. The L_1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source. Where the typical repeatable existing L_1 levels exceed the above requirement then the existing L_1 levels form the basis for, sleep disturbance criteria.

5.4 SUMMARY OF ASSESSMENT CRITERIA FOR PROPOSED SITE

The intrusiveness, amenity and sleep arousal criteria for this project have been determined using these guidelines and the noise monitoring results. These are summarised below. We note that the formulation of the assessment criteria has been based on the lowest ambient levels determined from all monitoring data.

5.4.1 EPA Day Period

The following table sets out the measured L_{eq} amenity and L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The day period applies between 7am and 6pm Monday to Saturday; and 8am to 6pm Sundays and public holidays.

Table 4 – Measured L_{eq} & L_{90} Noise Levels and Criteria - Daytime

Location	Measured L_{eq} Noise Level dB(A)*	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Location 1 – East Broadway	71	57	55	62
Location 2 – West Broadway	71	56	55	61
Location 3 – North Abercrombie Street	72	54	55	59
Location 4 – South Abercrombie Street	73	56	55	61
Location 5 – Wellington Street	65	50	55	55
Location 6 – Regent Street	70	53	55	58

* Unless otherwise stated the existing noise level is due to transportation noise and noise from plant serving the existing buildings on the site, which will be removed once the development is constructed.

5.4.2 EPA Evening Period

The following table sets out the measured L_{Aeq} and L_{90} background noise levels, and the assessment criteria based on the suburban criteria. The evening period applies between 6pm and 10pm.

Table 5 –Measured L_{eq} & L_{90} Noise Levels and Criteria - Evening Period

Location	Measured L_{eq} Noise Level dB(A)*	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}
Location 1 – East Broadway	68	55	45	60
Location 2 – West Broadway	69	54	45	59
Location 3 – North Abercrombie Street	70	55	45	60
Location 4 – South Abercrombie Street	69	56	45	61
Location 5 – Wellington Street	64	48	45	53
Location 6 – Regent Street	70	50	45	55

* Unless otherwise stated the existing noise level is due to transportation noise and noise from plant serving the existing buildings on the site, which will be removed once the development is constructed.

5.4.3 EPA Night Period

The night period (that is, between 10pm and 7am) is the period where noise emissions can have the most significant effect on residential amenity. In addition to the quasi-steady state criteria the L_1 noise emission level should not exceed the background noise level by more than 15 dB(A) to prevent sleep arousal from intermittent events. The night time period applies between 10pm and 7am.

Table 6 –Measured L_{eq} & L_{90} Noise Levels and Criteria - Night Time Period

Location	Measured L_{eq} Noise Level dB(A)	Measured L_{90} Noise Level dB(A)	Amenity Criterion dB(A) L_{eq}	Intrusiveness Criterion dB(A) L_{eq}	Noise Objective for Intermittent Activities dB(A) $L1_{(1\ Min)}$ (Background + 15 dB(A))
Location 1 – East Broadway	70	51	40	56	66
Location 2 – West Broadway	71	52	40	57	67
Location 3 – North Abercrombie Street	70	53	40	58	68
Location 4 – South Abercrombie Street	70	52	40	57	67
Location 5 – Wellington Street	64	45	40	50	60
Location 6 – Regent Street	71	48	40	53	63

5.4.4 Assessment Criteria Summary

The table below provides a summary of the assessment criteria applicable to the proposed development based on the information documented above.

Table 7 – Noise Objectives for Residential Receivers near Proposed Development

Location	Daytime Noise Objective dB(A) L_{eq}	Evening Noise Objective dB(A) L_{eq}	Night Time Noise Objective dB(A) L_{eq}	Night Time Sleep Disturbance for Intermittent Activities dB(A) $L_{1\ (1\ Min)}$ (Background + 15 dB(A))
Location 1 – East Broadway	55	45	40	66
Location 2 – West Broadway	55	45	40	67
Location 3 – North Abercrombie Street	55	45	40	68
Location 4 – South Abercrombie Street	55	45	40	67
Location 5 – Wellington Street	55	45	40	60
Location 6 – Regent Street	55	45	40	63

The criteria for the various monitoring locations have been considered to the applicable receiver groupings in

Table 8 below. As a number of locations were identified as containing noise associated with mechanical plant the following table presents noise level criterion for areas surrounding the proposed development. In all cases, if a discrepancy in attended and unattended noise levels were obtained at two nearby locations within a residential grouping the more conservative noise level criterion has been adopted.

Table 8 – Noise Objectives for Residential Receivers near Proposed Development

Location	Daytime Noise Objective dB(A) L_{eq}	Evening Noise Objective dB(A) L_{eq}	Night time Noise Objective dB(A) L_{eq}	Noise Objective for Intermittent Activities dB(A) $_{L1\ (1\ Min)}$ (Background + 15 dB(A))
Broadway	55	45	40	66
Abercrombie Street	55	45	40	67
Regent Street	55	45	40	63
Wellington Street and O'Conner Street	55	45	40	60

Noise level criteria are to be applied to commercial traffic levels generated from vehicle movements on the site only, as presented by the Industrial Noise Policy. Noise levels generated from the movement of vehicles entering and exiting the site on ramps are generally required to comply with levels presented in the presented tables for surrounding receivers.

5.5 ASSESSMENT CRITERIA – ADDITIONAL TRAFFIC GENERATION

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the EPA ECRTN. Criteria applicable to the development are detailed below. It is noted that the surrounding streets of Broadway, Abercrombie and Regent Streets are collector roads. O'Conner and Wellington Streets are deemed as local. If existing noise levels exceed those in Table 9 a 2 dB increase in noise is allowed.

Table 9 - Criteria for Traffic Noise for New Developments

Time of day	Criteria for Acceptable Traffic Noise Level dB(A)
Day (7am to 10pm)	60 $L_{Aeq(1hr)}$ – Collector Road 55 $L_{Aeq(1hr)}$ – Local Road
Night (10pm to 7am)	55 $L_{Aeq(1hr)}$ – Collector Road 50 $L_{Aeq(1hr)}$ – Local Road

Attended traffic noise levels measurements were conducted at a number of locations surrounding the development including locations as detailed in the table below.

Table 10 - Criteria for Traffic Generation

Location	Criteria for Acceptable Traffic Noise Level dB(A) $L_{eq\ (1hr)}$	
	Day (7am to 10pm)	Night (10pm to 7am)
Broadway	73	72
Abercrombie Street	74	72
Regent Street	72	73
Wellington Street and O'Conner Street	67	66

Note: Noise levels calculated to potentially worst affected residential facades from results of on site testing.

5.6 COMPLIANCE WITH CRITERIA

Based on experience with similar developments and the existing high traffic volumes and noise on surrounding roadways noise associated with additional traffic volumes will comply with criteria detailed above. For a significant increase in noise (2 dB(A) increase) from traffic associated with the site volumes would need to increased flows on surrounding streets by more than 40%. As Broadway, Regent Street and Abercrombie Streets already carry high traffic volumes an increase of this amount will not occur.

6. INTERNAL ENVIRONMENTAL ACOUSTIC OBJECTIVES

Currently there are no environmental noise level criteria as a DA for the project has not been received. Internal environmental noise level criteria have been developed for the project based on the Australian Standard AS2107:2000, and Green Star requirements.

6.1 TRAFFIC NOISE OBJECTIVES

Project internal environmental noise level criteria which have been used as the basis for this report are detailed in the table below.

Table 11 – Internal Traffic Noise Level Objectives (Retail and Commercial)

Room Type	Time Period	Internal Noise Level criteria
Private Offices	Day time	40 dB(A) $L_{Aeq\ (9\ hour)}$
General Offices	Day time	45 dB(A) $L_{Aeq\ (9\ hour)}$
Retail Areas	Day time	50 dB(A) $L_{Aeq\ (9\ hour)}$
Shopping Malls	Day time	50 dB(A) $L_{Aeq\ (9\ hour)}$

Table 12 – Internal Traffic Noise Level Objectives (Residential)

Room Type	Time Period	Internal Noise Level criteria
Bedrooms	Night Time Only (10pm to 7am)	35dB(A)$L_{Aeq\ (1\ hour)}$
Living areas	24 hours	45dB(A)$L_{Aeq\ (1\ hour)}$
Bathrooms and Laundries	Day time	50 dB(A) $L_{Aeq\ (15\ hour)}$

6.2 COMPLIANCE WITH INTERNAL NOISE LEVELS

Experience with similar projects indicates that compliance with internal noise level criteria detailed in this section of the report is both possible and practical. The external façade of the future buildings will be acoustically treated where necessary to ensure internal noise levels comply with specified noise levels. Acoustic treatment will include the upgrading of glazing and other façade elements based on noise level measurements conducted at the site. Masonry and other high mass elements of the façade will not require additional acoustic treatments.

The environmental noise impact assessment on future tenancies within the site will include an investigation into noise associated with traffic movements on internal roads on the development site. Acoustic treatments to future tenancies will include upgrading of external façade elements to ensure internal noise level criteria detailed within this report are achieved within the development.

7. MECHANICAL PLANT TREATMENTS

As detailed plant selections have not been conducted at this time a acoustic assessment of noise impact can not be conducted.

A detailed mechanical noise assessment will be conducted once plant selections and services drawings have been finalised as part of the construction documentation. Based on experience with similar development acoustic treatments are both possible and practical using acoustic treatments such as lining of ductwork, acoustic silences, variable speed controllers, time switches, acoustic screens etc.

8. CONCLUSION

This report provides the results of Environmental Noise Study for the proposed Frasers Block 2 development Broadway. Noise at the site has been measured and noise goals have been set in accordance with the requirements of the relevant statutory/regulatory authorities.

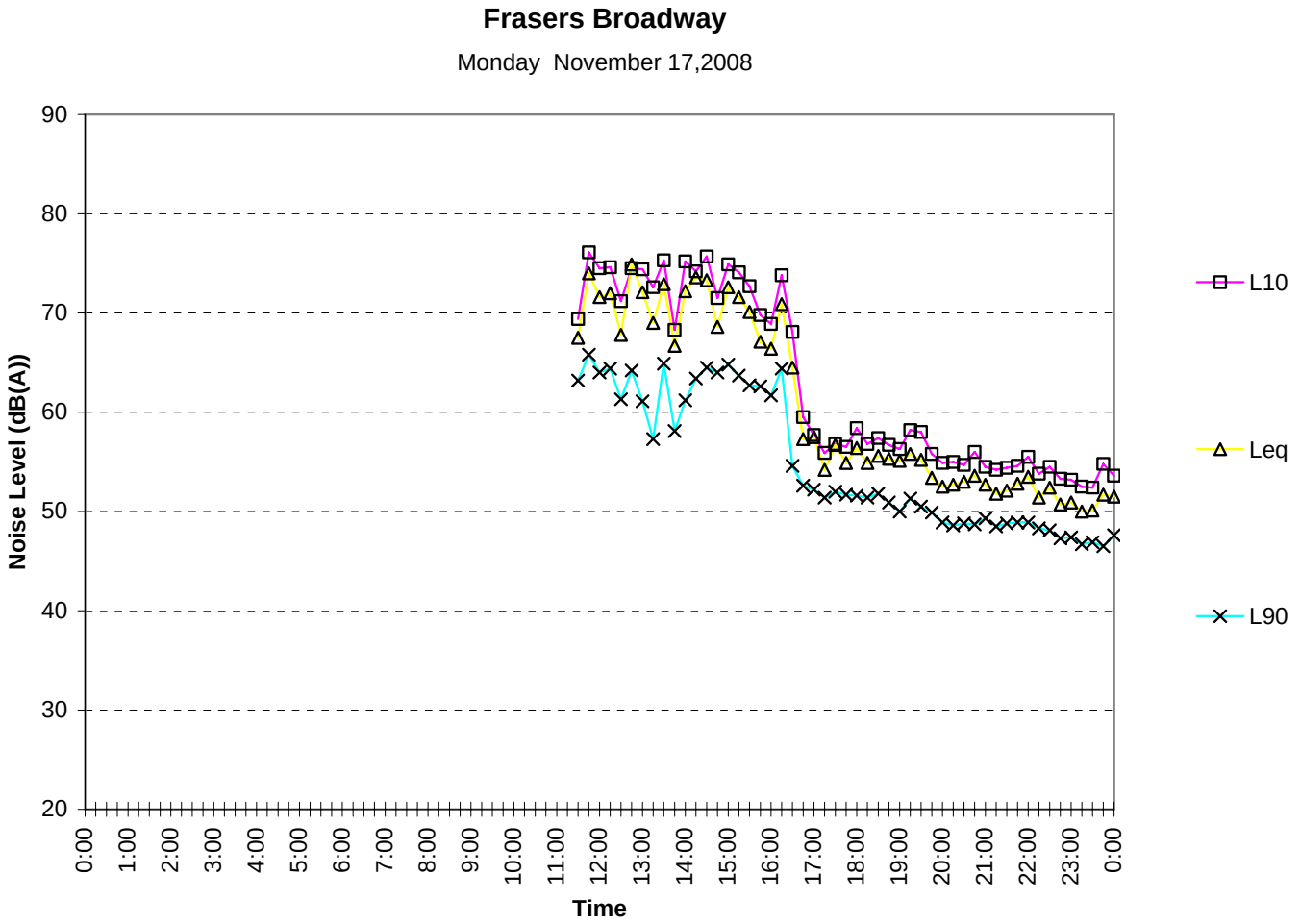
Determination of noise assessment criteria based on the EPA's Industrial Noise Policy and ECRTN have been determined based on both unmanned and manned noise monitoring conducted at the proposed development.

We trust this information is satisfactory. Please contact us should you have any further queries.

Report prepared by,

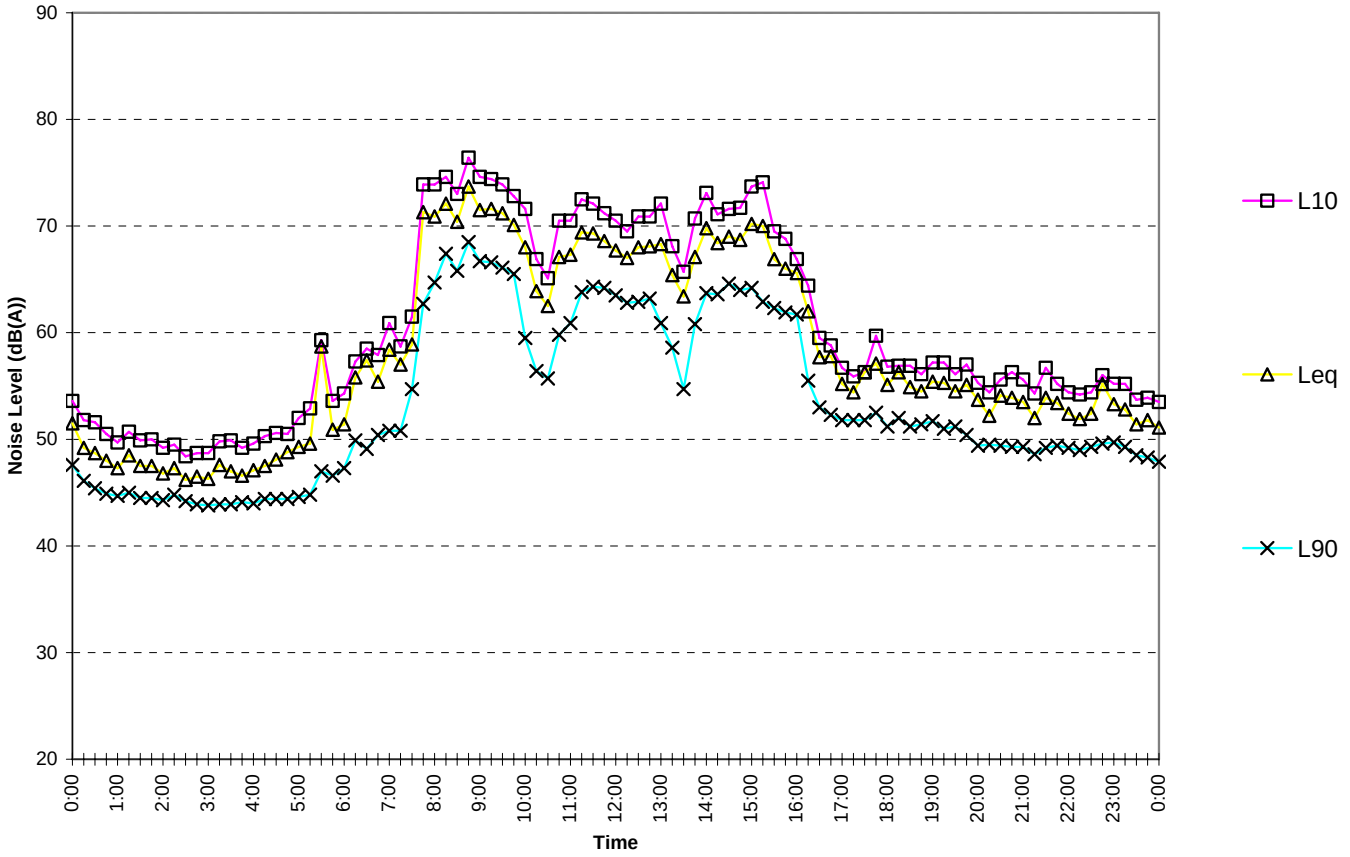
ACOUSTIC LOGIC CONSULTANCY PTY LTD
Ben White

APPENDIX A
UNATTENDED NOISE MONITORING RESULTS


Frasers Broadway
Monday November 17,2008
Noise Level (dB(A))
90
80
70
60
50
40
30
20
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
0:00
Time
L10
Leq
L90

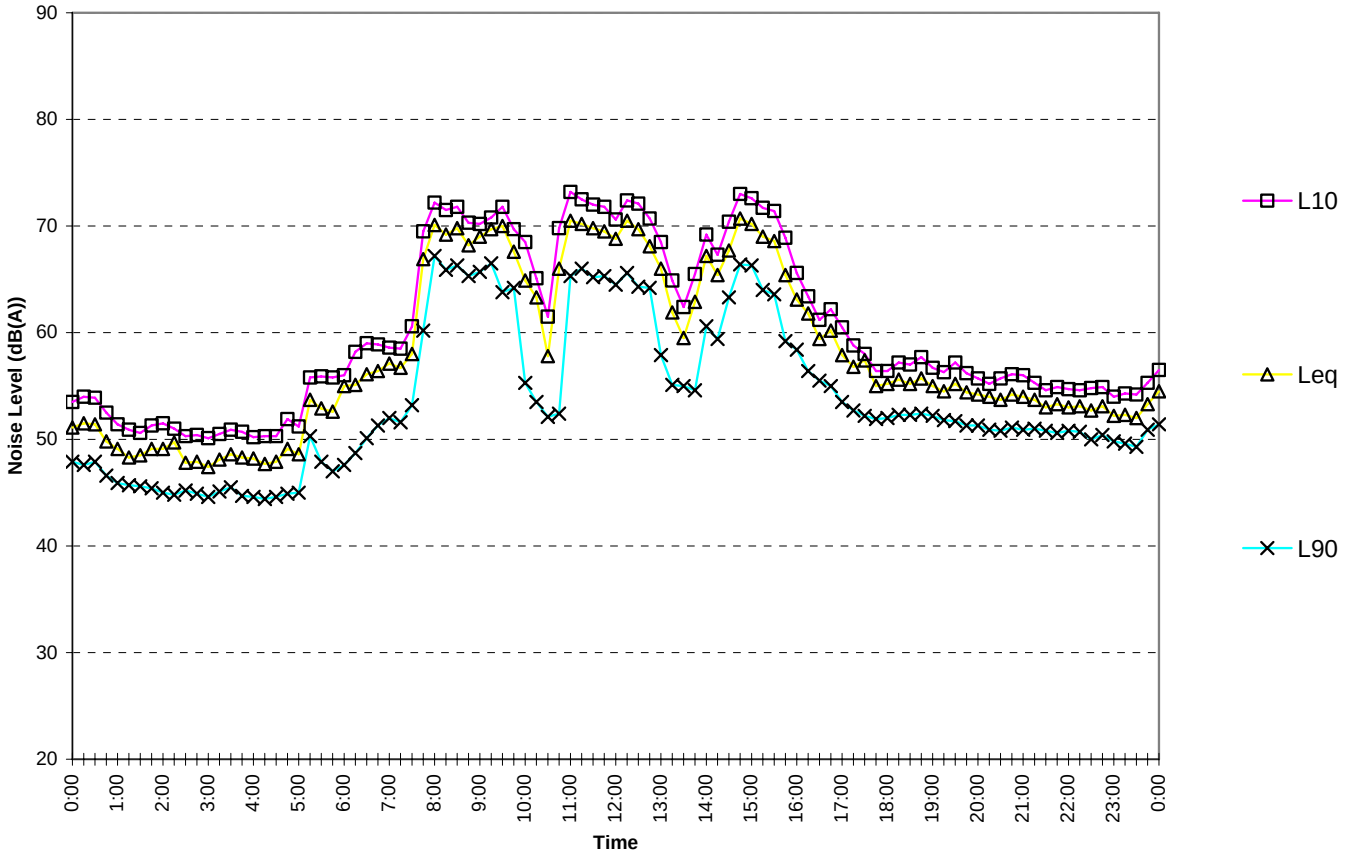
Frasers Broadway

Tuesday November 18,2008



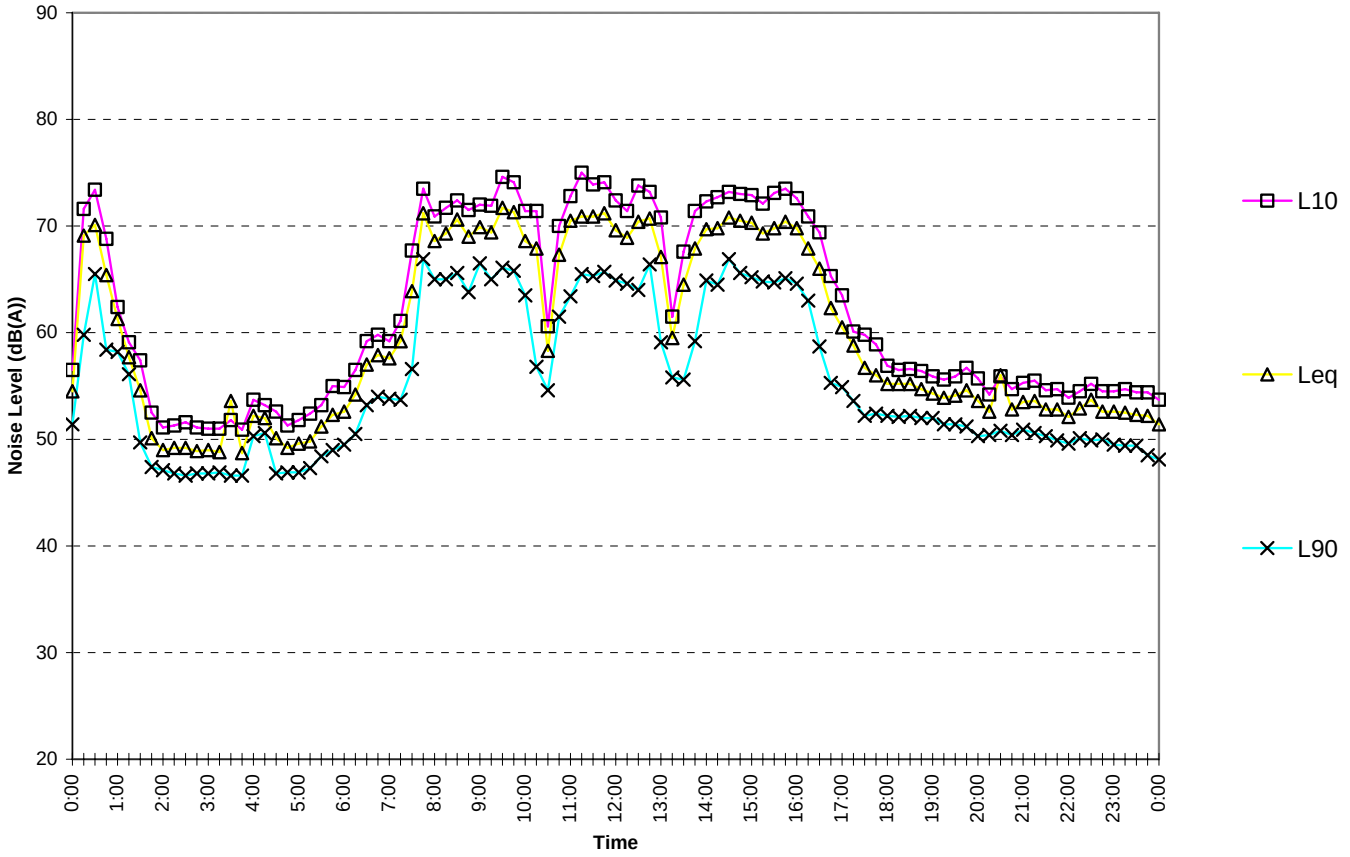
Frasers Broadway

Wednesday November 19,2008



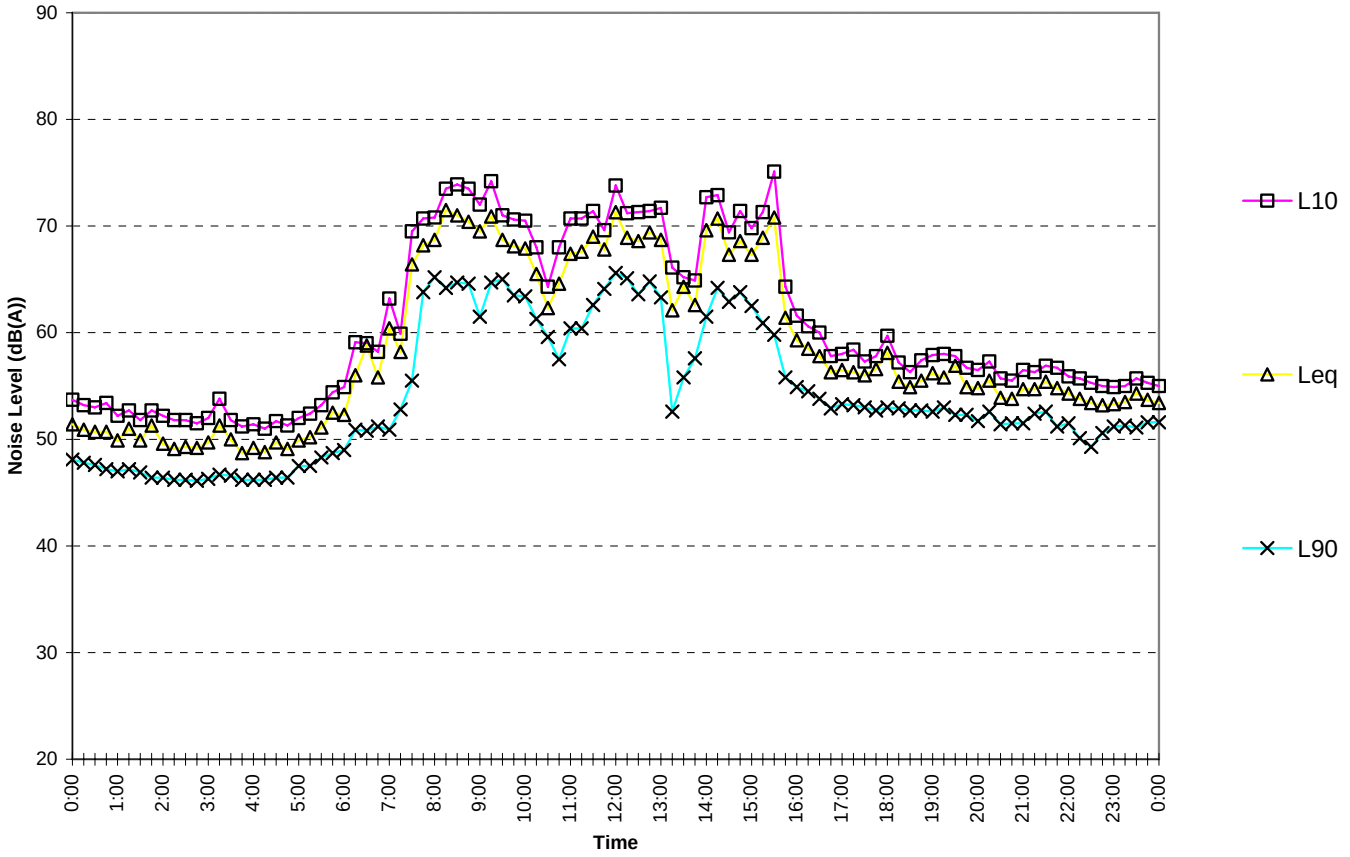
Frasers Broadway

Thursday November 20,2008



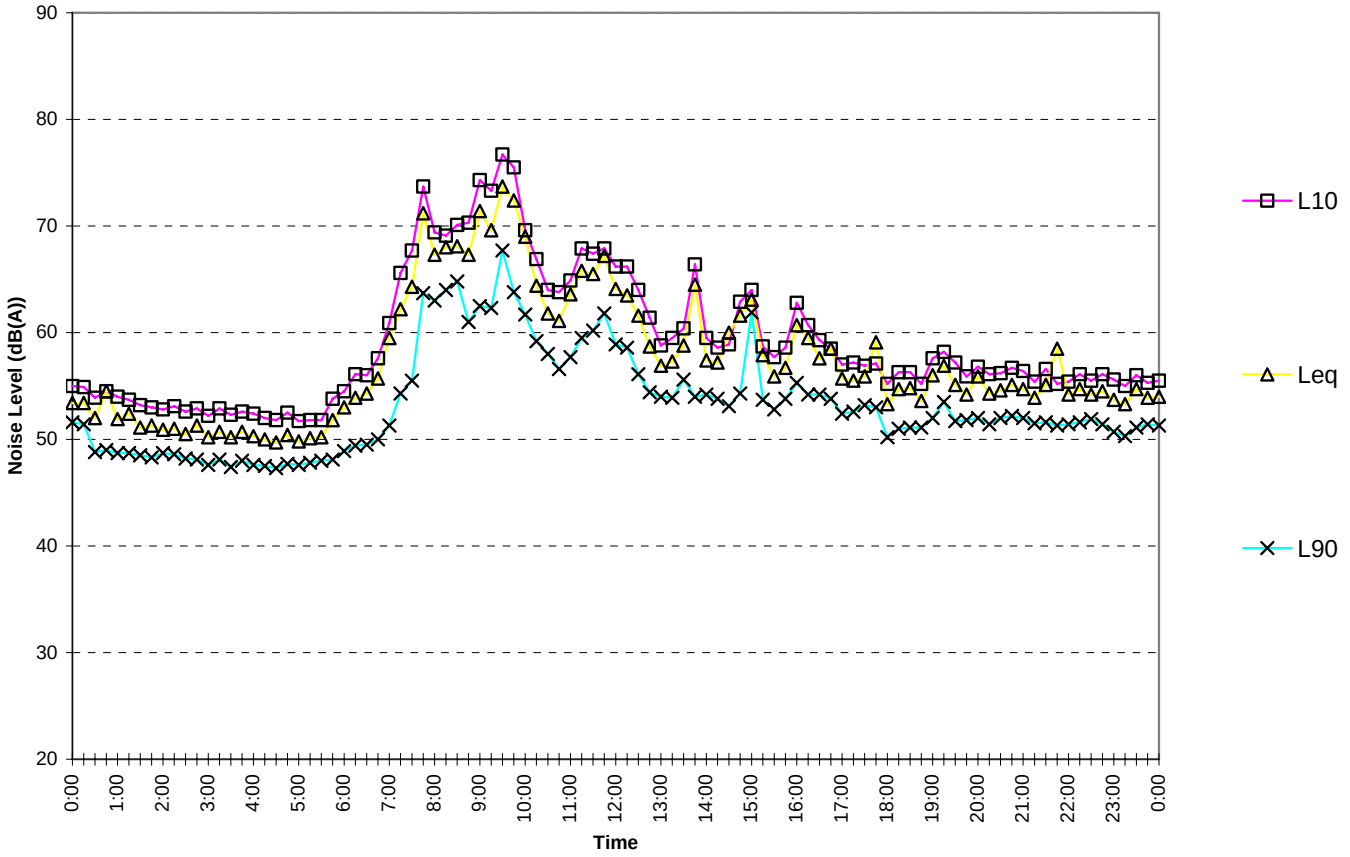
Frasers Broadway

Friday November 21,2008



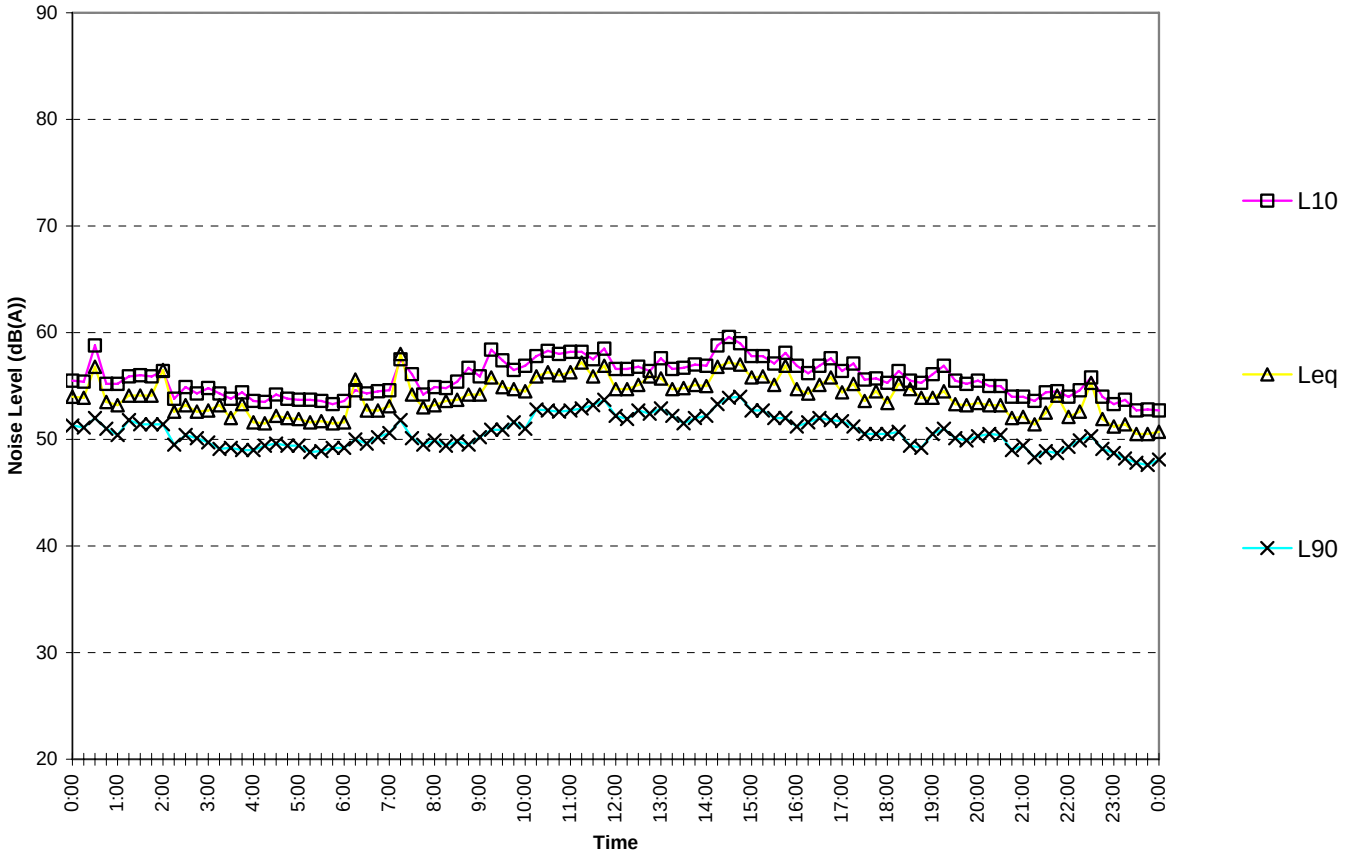
Frasers Broadway

Saturday November 22,2008



Frasers Broadway

Sunday November 23,2008



Frasers Broadway

Monday November 24,2008