HEGGIES

REPORT 10-8765-R1

Revision 0

Proposed Residential Development
Discovery Point - Concept Plan
Acoustic & Vibration Assessment

PREPARED FOR

Australand Holdings Limited
Level 3, 1C Homebush Bay Drive
RHODES NSW 2138

17 JUNE 2010

HEGGIES PTY LTD
ABN 29 001 584 612

Proposed Residential Development
Discovery Point - Concept Plan
Acoustic & Vibration Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
10-8765-R1	Revision 0	17 June 2010	Howard Gwatkin	John Sleeman	Howard Gwatkin

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1 INTRODUCTION

Heggies Pty Limited has been engaged by Discovery Point to prepare an acoustic and vibration report that will form part of the Environment Assessment (EA) in relation to the preparation of a Concept Plan.

1.1 Director-General's Environmental Assessment Requirements (DGRs)

The DGRs were received from the NSW Department of Planning on 23 March 2010. The "Issues" relating to acoustics and vibration are outlined below, using the DGR's "Issue No." reference.

1 Planning EPI's, Policies and Guidelines

The EA must address planning provisions applying to the site, including permissibility and the provisions of all plans and:

- Development Near Rail Corridors and Busy Roads - Interim Guideline.

5b Environmental and Residential Amenity

- The EA must address acoustic privacy and achieve a high level of environmental and residential amenity.
- The EA should consider appropriate separation distances to any adjacent residential buildings.
- The EA shall address the issue of noise from the airport and railway line and provide details of how this will be managed and ameliorated through the design of the building, in compliance with relevant Australian Standards.

6 Environmental and Residential Amenity

- The EA shall address the issue of noise and vibration impacts from the railway corridor and provide detail how this will be managed and ameliorated through the design of the building, in compliance with relevant Australian Standards and the Department's Development near Rail Corridors and Busy Roads - Interim Guidelines.

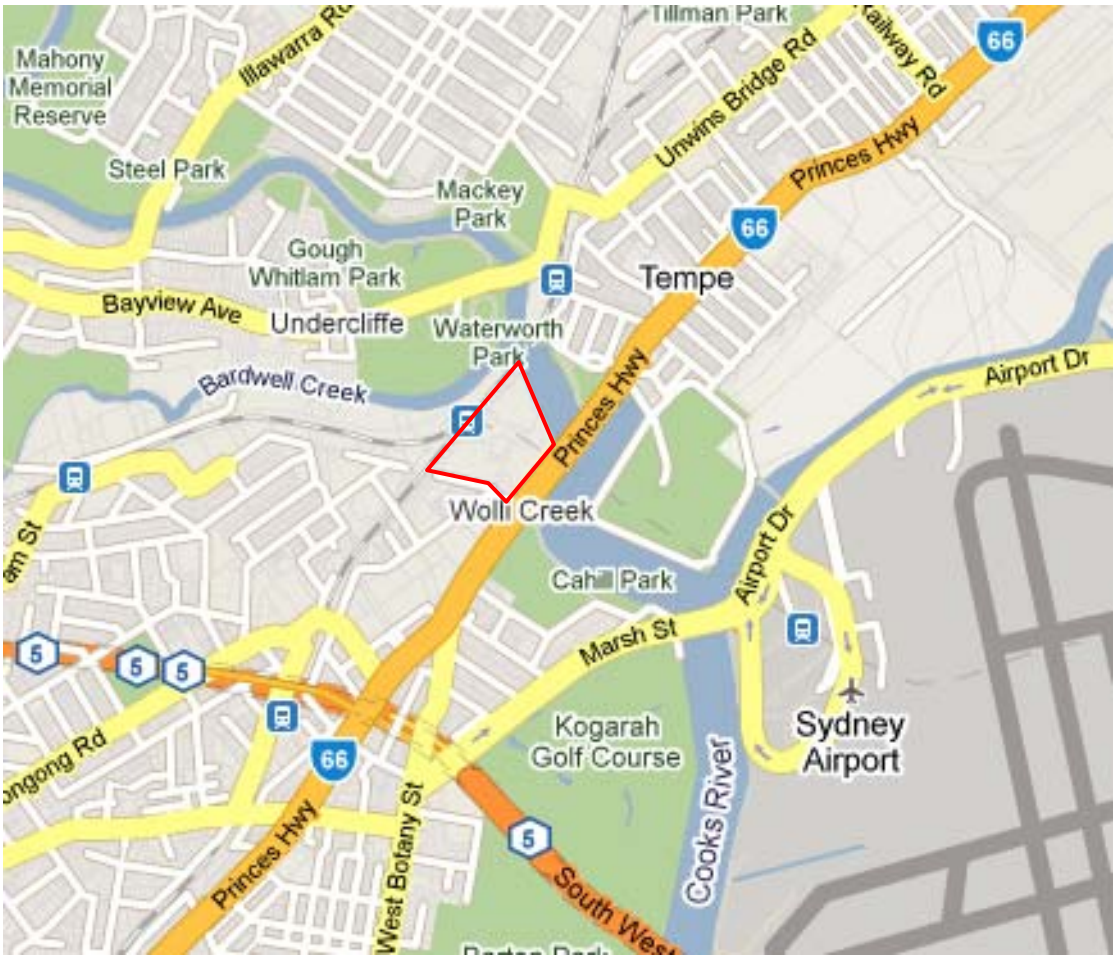
1.2 Purpose of this Report

The purpose of this report is to assess potential noise and vibration impacts associated with the proposed Concept Plan, and the surrounding noise environment, and to outline appropriate design criteria to be considered in future project applications.

2 SITE DESCRIPTION

Discovery Point is a mixed use development site located at 1 Princes Highway, Wolli Creek. The site is bound by Princes Highway, Cook's River, Illawarra Railway Line, Magdalene Terrace and Brodie Spark Drive.

Figure 1 Site Location Map for the Proposed Development



The following noise sources have been identified as potential sources of intrusive noise at the site:

- Aircraft
- Road traffic on Princes Highway
- Internal road traffic noise
- Rail traffic on the Illawarra Line and East Hills Line (surface track)
- Rail traffic on the Airport Link (underground track)
- Station announcements

Likely mechanical noise associated with the development may include:

- Air-conditioning and ventilation plant
- Carpark ventilation systems
- Toilet exhaust systems
- Rooftop exhaust fans
- Car parking and vehicle movements
- Waste handling, deliveries and associated building services

3 PROPOSED DEVELOPMENT

The proposed Concept Plan comprises a mix of residential, commercial, retail and open space uses.

Buildings sites Greenbank, Verge and Vine have been completed. The proposed development will consist of Building 1B, Building 1C, and Buildings 2 to 14 as shown in **Figure 2**. These are located to the north and south of Wolli Creek Station.

4 NOISE AND VIBRATION CRITERIA

4.1 Development Near Rail Corridors and Busy Roads – Interim Guideline

Noise (and vibration) assessments should be undertaken in accordance with the requirement of NSW Department of Planning (DoP), *"Development Near Rail Corridors and Busy Roads – Interim Guideline*".

Where the nearest buildings are within 25 m from the freight track (as for those close to the Illawarra Line) the Dop "*Interim Guideline*" requires "a full noise assessment" to be undertaken at the project application stage.

4.1.1 Airborne Noise – Road and Rail Traffic

The Department of Planning's *Interim Guideline* provides criteria for the internal noise levels due (separately) to both road and rail traffic within single dwelling and multi-unit residential buildings, as presented in **Table 1**.

The criteria apply separately to road and rail noise sources.

Table 1 Road and Rail Noise Assessment Criteria

Internal Space	Time period	Internal noise level (Windows closed guideline)
Sleeping area	Night (10.00 pm to 7.00 am)	35 dBA
Other habitable room	At any time	40 dBA

Note: Airborne noise is calculated as Leq (9h) (night) and Leq (15h)(day).

The document also provides criteria for internal noise levels due to road and rail noise contribution with windows or doors open. These state:

> "*If internal noise levels with windows or doors open exceed the criteria by more than 10 dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*".

4.1.2 Regenerated Noise – Rail

Residential buildings should be designed so that the 95th percentile of train pass-bys complies with a groundborne L_{Amax} noise limit of 40 dBA (daytime) or 35 dBA (night-time) measured using the "slow" response time setting on a sound level meter

4.2 Rail Vibration

The NSW Department of Planning (DoP) *Interim Guideline* requires that vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in *Assessing Vibration: a technical guideline* (DECC 2006, now DECCW).

In turn, the DoP "*Assessing Vibration"* guideline requires the vibration dose value (VDV) be used when assessing intermittent vibration.

The VDV accumulates the vibration energy received over the daytime and night-time periods. Acceptable values of vibration dose are presented in **Table 2**.

Table 2 Acceptable Vibration Dose Values for Intermittent Vibration (m/s$^{1.75}$)

Location	Daytime (7.00 am – 10.00 pm)		Night-time (10.00 pm – 7.00 am)	
	Preferred Value	**Maximum Value**	**Preferred Value**	**Maximum Value**
Critical areas [1]	0.1	0.2	0.10	0.20
Residences	0.2	0.4	0.13	0.26
Offices, schools, educational institutions and places of worship	0.4	0.8	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note 1 Examples include hospital operating theatres and precision laboratories where sensitive operations are occurring. These criteria are only indicative, and there may be a need to assess intermittent values against the continuous or impulsive criteria for critical areas

4.3 AS 2107

The internal noise levels recommended in AS2107 are reflected in the criteria given in the DoP's *Development Near Rail Corridors and Busy Roads – Interim Guideline.* Compliance with the *Interim Guideline* will mean compliance with AS2107. **Section 4.1** refers.

4.4 AS 2021-2000

Refer to **Section 4.5** "Aircraft Noise".

4.5 Aircraft Noise

Australian Standard 2021-2000 "*Acoustics - Aircraft Noise Intrusion - Building Siting and Construction*" defines the acceptability of a variety of building types and land uses within varying ANEF categories.

A summary of the acceptability of differing building types within various ANEF categories is presented in **Table 3** (as reproduced from AS 2021-2000).

Table 3 Building Site Acceptability Based on ANEF Zones

Building Type	ANEF Zone of Site		
	Acceptable [1]	**Conditionally acceptable [2]**	**Unacceptable [3]**
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
Public building	Less than 20 ANEF	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF

Note 1: Acceptable — No need for the building to provide specific protection from aircraft noise.
Note 2: Conditional — Buildings within the ANEF zone which has a conditional status are required to comply with internal noise levels appropriate for the intended use of the space.
Note 3: Unacceptable — Building site classified as unacceptable should not normally be considered.

The site falls between the ANEF 20 and ANEF 25 contours (for the year 2023/2024) for Kingsford Smith Airport.

4.5.1 Residential Buildings

From **Table 3,** the site is classified as "conditionally acceptable" for residential buildings. As such the maximum aircraft noise levels for the relevant aircraft and the required noise reductions for the various building envelope elements should be determined in accordance with the requirements of AS2021-2000.

4.5.2 Commercial and Retail Buildings

From **Table 3,** the site is classified as "acceptable" for commercial and retail buildings and there is therefore no requirement for building envelopes to be designed in accordance with the requirements of AS2021-2000.

4.6 Industrial Noise Policy

The noise emission from industry, or *industrial*-type noise sources, associated with the development (such as mechanical services and, eg loading dock activity) must be controlled to protect the acoustic amenity of the residences within, and close to, the development.

Industrial noise emissions should aim to comply with the DECCW's *Industrial Noise Policy* (INP), as described in Appendix A.

4.7 Internal Acoustic Isolation – Building Code of Australia

The internal acoustic isolation requirements must, as a minimum, comply with those of the Building Code of Australia (BCA).

The numerical requirements (in-situ where possible) contained in BCA Section F5, are summarised in **Table 4**.

Table 4 BCA Acoustic Ratings

Issue	BCA Requirements 1
Floors	
Sound Insulation between Units	$D_{nT,w} + C_{tr}$ not < 45
	$L'_{nT,w} + C_I$ not > 62
Walls	
Unit to Unit	
Unit to plant, lift shaft, stairway, public corridor or hallway or the like	DnT,w + Ctr not < 45
Between, laundry or kitchen and habitable room in adjoining units	(Plus impact isolation)
Doors	
Unit and a stairway, public corridor, public lobby or the like	$D_{nT,w}$ not < 25
Soil and Waste Pipes	
Habitable rooms	Rw + Ctr not < 40
Kitchens and other rooms	Rw + Ctr not < 25

Note 1 Refer to Appendix D for an explanation of the terms

5 NOISE MEASUREMENTS

Unattended noise logging was conducted on site, together with operator-attended noise measurements. **Figure 2** refers. Operator-attended measurements were necessary to identify events that would otherwise not be discernable by unattended noise logging.

Figure 2 Noise and Vibration Measurement Locations

5.1 Unattended Noise Logging

Unattended noise logging was conducted on the site between Tuesday 20 April 2010 and 27 April 2010. Two ARL Type 215 noise loggers were deployed on the site during this period to continuously record the ambient noise levels. The noise loggers were calibrated before and after the noise monitoring with a drift in noise levels not exceeding ±0.5 dBA. The sample time interval was set at 15 minutes.

The noise loggers were located at the following locations:

Location 1: On the north-western side of the site to measure ambient noise levels not directly affected by Princes Highway road traffic noise.

Location 2: On the south-eastern side of the site, to measure the ambient noise levels in the vicinity of the Princes Highway – on earth mound, approximately 4m above local ground level.

5.2 Attended Noise and Vibration Monitoring

Operator-attended noise and vibration monitoring was conducted in the vicinity of the two logger monitoring positions. **Figure 2** refers.

Noise measurements were undertaken using a calibrated Brüel & Kjær Type 2260 Precision Sound Level Meter (serial number 2335703) together with vibration equipment. The measurements were conducted to establish noise levels of individual sources.

Measurement of ground vibration due to train pass-bys was undertaken using a calibrated Brüel and Kjær 2260 Precision Sound Level Meter (serial number 2335703) a Brüel & Kjær Type 4370 accelerometer (1068050) and a Brüel & Kjær Type 2635 charge amplifier (735382). The vibration signal, together with an airborne noise signal, was recorded on a Rion DA-20 digital data recorder. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding the acceptable variation of ±0.5 dBA.

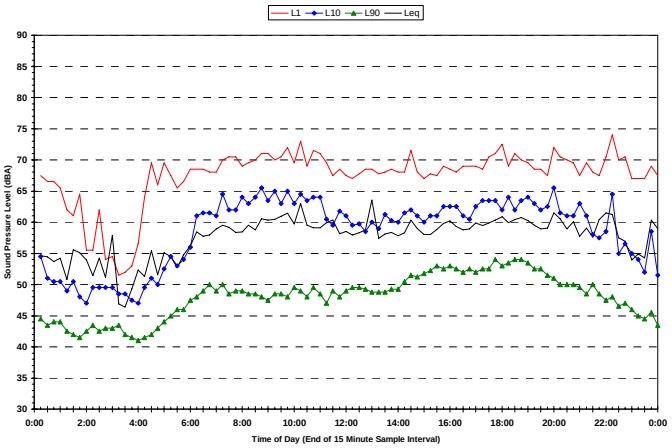
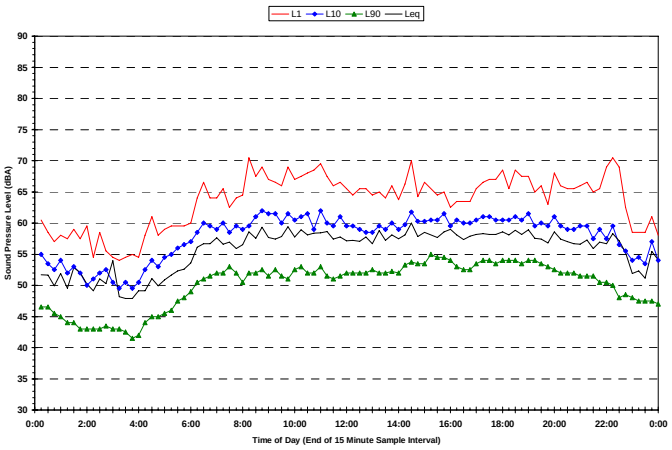
The results are reported in **Section 6**.

6 NOISE SURVEY RESULTS

The results of the unattended and attended noise surveys are summarised in **Table 5**, together with the observations made at the time of setting up (or) picking up the noise loggers and during the vibration measurements.

Whilst there were clear indications of short-term noise attributable to nearby industrial sources, the major long-term noise at all sites was due to traffic noise from the surrounding road network.

Table 5 Overview of Attended and Unattended Noise Monitoring

Monitoring Location	**Observed Noise Attributes** (during attended monitoring)	**Long term profile of Noise Levels**
1 – NW, near railway	• 747 Aircraft take-off 65 LAmax • Station platform announcements – just audible and intelligible • Freight train 75 LAmax • Horn as train leaves station 64 LAmax • Background road traffic ~54 dBA Underlying background noise at was influenced mainly from traffic from the Princes Highway.	
2 – NE, closer to Princes Highway	• 747 Aircraft take-off 74 LAmax • Passenger train 64 LAmax • Trucks climbing bridge 63 LAmax • Background road traffic ~58 dBA Underlying background noise at was influenced mainly from traffic from the Princes Highway.	

Noise Level Descriptors shown on the graphs are:

- **LA1** The noise level exceeded for 1% of the sample time (15 minutes) and representative of the highest noise level events (eg passing heavy vehicles, aircraft, etc).
- **LA10** The noise level exceeded for 10% of the sample time (15 minutes) and is typically described as the average maximum noise level.
- **LAeq** The LAeq is the energy-average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.
- **LA90** The LA90 is the level of noise exceeded for 90% of the sample time (15 minutes). The LA90 noise level is described as the average minimum background sound level or simply the background level.

6.1 Industrial Noise

To assess noise emission from existing or future *industrial*-type noise sources associated with the proposed development (such as the development's own mechanical services plant) the data obtained from the noise loggers has been processed in accordance with the procedures contained in the NSW DECCW's *Industrial Noise Policy* (INP) and are presented in **Table 6**.

Table 6 Measured Ambient Noise Levels Corresponding to Defined INP Periods

Noise Monitoring Location	Measured RBL[1]			Measured L_{Aeq} Noise Level		
	Day	Evening	Night	Day	Evening	Night
Location 1	48 dBA	48 dBA	42 dBA	60 dBA	60 dBA	56 dBA
Location 2	51 dBA	51 dBA	42 dBA	58 dBA	58 dBA	53 dBA

Note 1 Rating Background Level

The background (L_{A90}) noise levels are consistent at both locations during the night-time period. However, during the day and evening periods, background noise levels at Location 2 are marginally higher due to the road traffic on the Princes Highway.

Ambient (L_{Aeq}) noise levels are marginally higher at Location 1, and this is probably due to the rail traffic.

The results of the unattended noise monitoring are presented graphically in **Appendices B** and **C**.

6.2 Road Traffic Noise

The data obtained from the noise loggers has been processed in accordance with the time periods contained in the NSW *Department of Planning* "*Development Near Rail Corridors and Busy Roads – Interim Guideline"* and are presented in **Table 7**.

Table 7 Summary of Traffic Noise Indices

Noise Monitoring Location	Main Traffic Noise Indices			
	$L_{Aeq(15hour)}$	$L_{Aeq(9hour)}$	$L_{Aeq(1hour)}$ – Daytime	$L_{Aeq(1hour)}$ – Night-time
Location 1	60 dBA	56 dBA	62 dBA	59 dBA
Location 2	58 dBA	53 dBA	60 dBA	57 dBA

6.3 Other Noise Sources

Noise and vibration from other sources (railway noise and vibration and aircraft noise) are discussed in **Sections 7.2** and **7.3** respectively.

7 ASSESSMENT AND RECOMMENDATIONS

7.1 Noise Ingress through Residential Facade

7.1.1 Road Traffic Noise Intrusion

The site has the potential to be impacted from existing traffic on the Princes Highway and also from the creation of internal roads to be constructed as part of the development (although noise control from the latter will likely be catered for by the need to control aircraft noise).

The selection and extent of specific glazing solutions would be developed and detailed at the relevant Project Application stage.

Preliminary indications are that conventional 4 mm glazing would achieve the *Interim Guideline* criteria (**Section 4.1**) where less than 33% of the facade is glazed.

7.2 Railway Noise

7.2.1 Airborne Rail Noise

At Attended Monitoring Location 1, (approximately 14 m from the nearest track) the maximum noise levels from 36 passenger train pass-bys ranged from 61 dBA to 82 dBA, with an average level of 74 dBA.

At the same location, the maximum noise levels from 4 freight train pass-bys ranged from 71 dBA to 87 dBA, with an average level of 80 dBA.

Indicative calculations suggest noise levels in the order of 60 L_{Aeq} from the Illawarra Line during the day and 57 L_{Aeq} during the night, suggesting that some kind of "performance" glazing may be required for facades facing the Line (similar to the facades facing traffic on the Princes Highway).

However, it is likely that the need to control aircraft noise may require higher performance glazing Thus, amelioration of airborne rail noise will likely be addressed by the higher specification.

7.2.2 Rail Regenerated Noise

For buildings located above railway tunnels, it is normally the regenerated noise (a secondary effect of the vibration) that provides the limiting case for design rather than the tactile vibration, itself. This noise is initially propagated as vibration through the ground and building structure, and is then radiated as noise from vibrating building elements, such as walls and floors. It is also sometimes referred to as structure-borne noise.

For buildings located at grade, adjacent to railways, regenerated noise is not normally an issue.

Illawarra Line

Indicative regenerated structureborne noise levels from passenger train pass-bys at Attended Monitoring Location 1 are predicted to range from 7 dBA to 27 dBA, while regenerated noise from the freight train pass-bys are predicted to range from 14 dBA to 21 dBA.

These levels are well beneath the 35 dBA night-time criterion and, as such the buildings are unlikely to require isolation from the Illawarra Railway Line.

Airport Line

Indicative regenerated structureborne noise levels from passenger train pass-bys at Attended Monitoring Location 2 are predicted to be in the order of 35 dB – ie equal to the 35 dBA night-time criterion.

It is therefore likely that Buildings 6, 13 and 14, or parts thereof, will require vibration isolation from the Airport Line. This may involve rubber vibration isolation bearings above the pile caps to support the vertical loads. Additional bearings may also be required to support the horizontal design loads.

It is also possible that vibration isolation measures may be required for parts of Buildings 7 and 11.

A detailed assessment will be required at the relevant project application stage(s).

7.2.3 Railway Vibration

Illawarra Line

At Attended Monitoring Location 1, the vibration levels are well below the respective VDV criteria for both day and night periods.

During measurements on site, an average of about 12 passenger train movements per hour occurred and we understand 19 freight train movements are timetabled throughout the day period. On this basis, the predicted VDV is 0.008 – well below the 0.020 criterion.

For the night period, adopting the daytime average of 12 train movements per hour and the timetabled 19 freight train movements throughout the night period, the predicted VDV is also 008 – again, well below the 0.013 night criterion.

These levels indicate the buildings are unlikely to require vibration isolation from the Illawarra Railway Line, but this should be assessed in detail at the project application stages.

Airport Line

At Attended Monitoring Location 2, the vibration levels are well below the respective VDV criteria for both day and night periods.

We understand the Airport Link carries 4 trains per hour, in each direction. On this basis, the predicted daytime VDV is 0.005 – well below the 0.020 criterion.

For the night period, the VDV is 0.004 – again, well below the 0.013 night criterion.

These levels indicate that the buildings are unlikely to require vibration isolation from the Airport Line – notwithstanding the need to satisfy the regenerated rail noise (**Section 7.2.2**). However, this should be assessed in detail at the relevant project application stages.

7.3 Aircraft Noise

The development lies between the ANEF 20 and the ANEF 25 contour and, as such, acoustic treatments specifically addressing aircraft noise intrusion will be required for future applications.

Indicative calculations suggest laminated and or secondary glazing may be required, together with an alternative means of ventilation, in certain locations – to be established in future project applications.

7.4 External Plant Noise Emissions (INP)

7.4.1 Project Specific Noise Levels

The *project specific noise levels are* show in **Table 8**. (Appendix D refers)

Table 8 Criteria for Mechanical Noise Emissions to Nearby Residences

Time of Day	Noise Level dBA re 20 µPa
	Limiting Criteria
Day	52 dBA (11 hour)
Evening	48 dBA (4 hour)
Night	43 dBA (15 minutes)

It is noted that this criteria is provided for immediate guidance at the Concept Plan level of detail, and should be reviewed during the detailed project planning stages to take into account potential shielding from the built environment.

7.4.2 Potential Noise Sources

The potential for noise impacts from the proposed development, once occupied, on the surrounding community could arise from the following:

- Air-conditioning and ventilation plant
- Carpark ventilation systems
- Toilet exhaust systems
- Rooftop exhaust fans
- Car parking and vehicle movements
- Waste handling, deliveries and associated building services /loading dock activities

With the exception of loading dock activities (which may also require management control) the above sources should be controllable by common engineering methods and should be assessed at the individual project application and detail design stages.

7.5 Internal Acoustic Requirements – BCA

The internal acoustic isolation requirements must, as a minimum, comply with those of the BCA, as outlined in **Section 4.7**.

The required acoustic ratings will be achieved at the detail design stage using materials such as plasterboard, resilient mounts, separate studs, masonry panels or blocks and acoustic insulation.

8 CONCLUSION

The DGR's require the assessment of potential noise and vibration impacts associated with the proposed Concept Plan, and the surrounding noise environment.

The DGR's require the assessment with reference to:

- *Development Near Rail Corridors and Busy Roads - Interim Guideline*
- relevant Australian Standards

Appropriate noise and vibration criteria have been established, for use in future project applications.

Conventional noise and vibration controls can be implemented to ensure compliance with the acoustic design criteria contained within the *Interim Guideline*. Such measures would be developed and detailed during the relevant project application stages.

To control regenerated structureborne noise from passenger trains on the Airport Line, it is likely that Buildings 6, 13 and 14 (or parts thereof) will require some degree of vibration isolation from that Line. It is also possible that vibration isolation may be required for parts of Buildings 7 and 11.

The site falls within the ANEF 20 contour and indicative calculations suggest laminated and or secondary glazing may be required to control aircraft noise, in certain locations.

A detailed assessment of aircraft, road traffic and rail traffic, including regenerated structureborne noise, will be required at the relevant project application stages, against the criteria cited in this report.

The internal acoustic isolation requirements must, as a minimum, comply with those of the BCA This would occur during the detail design stage.

Introduction

The noise emission from industry, or *industrial*-type noise sources, must be controlled to protect the acoustic amenity of the residences within, and close to, the development.

Industrial noise emissions should aim to comply with the DECCW's *Industrial Noise Policy* (INP), which provides a framework and process for deriving noise criteria. The INP criteria for industrial noise sources from stationary or mobile plant and equipment have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

Assessing Intrusiveness (Residential Receivers)

For assessing intrusiveness, the background noise needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than 5 dBA above the measured Rating Background Level (RBL), over any 15 minute period.

Assessing Amenity (All Receivers)

The amenity criterion is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The criteria relate only to industrial-type noise sources and do not include road, rail, aircraft or community noise. The existing noise level from industry (or *industrial*-type noise sources) is measured. If it approaches the criterion value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the criterion. For areas of high road traffic, there are further considerations that influence the selection of the noise criterion.

8.1.1 Area Classification

Heggies has deemed this area to fall under the "Urban Area" classification. The INP characterises an urban area as an area with an acoustical environment that:

- is dominated by "urban hum" or industrial source noise – where urban hum means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.
- has through traffic with characteristically heavy and continuous traffic flows during peak periods
- is near commercial districts or industrial districts
- has any combination of the above

Having defined the area type, the processed results of the unattended noise monitoring are used (**Section Table 9**) to generate project specific noise criteria.

8.1.2 Project Specific Noise Levels

The noise environment at the site is not controlled by noise from industry – rather, it is largely transportation noise. As such, the project specific noise levels, which are shown in bold in **Table 9**, are the lower of the ANL or intrusive criteria, for each of the assessment periods.

Table 9 Criteria for Mechanical Noise Emissions to Nearby Residences

Location	Time of Day	Noise Level dBA re 20 µPa					
		ANL[1] L_{Aeq} (period)	Measured RBL[2] $L_{A90(15minute)}$	Measured Ambient $L_{Aeq(15minute)}$	Criteria for New Industrial Sources		
					Intrusive	Amenity Criteria [3]	Limiting Criteria [4]
					$L_{Aeq(15minute)}$	L_{Aeq} (period)	
1 – NW, near railway	Day	60	48	60	53	52	**52** dBA (11 hour)
	Evening	50	48	60	53	50	50 dBA (4 hour)
	Night	45	42	56	47	46	46 dBA (15 minutes)
2 – NE, closer to Princes Highway	Day	60	51	58	56	56	56 dBA (11 hour)
	Evening	50	51	58	56	48	**48** dBA (4 hour)
	Night	45	42	53	47	43	**43** dBA (15 minutes)

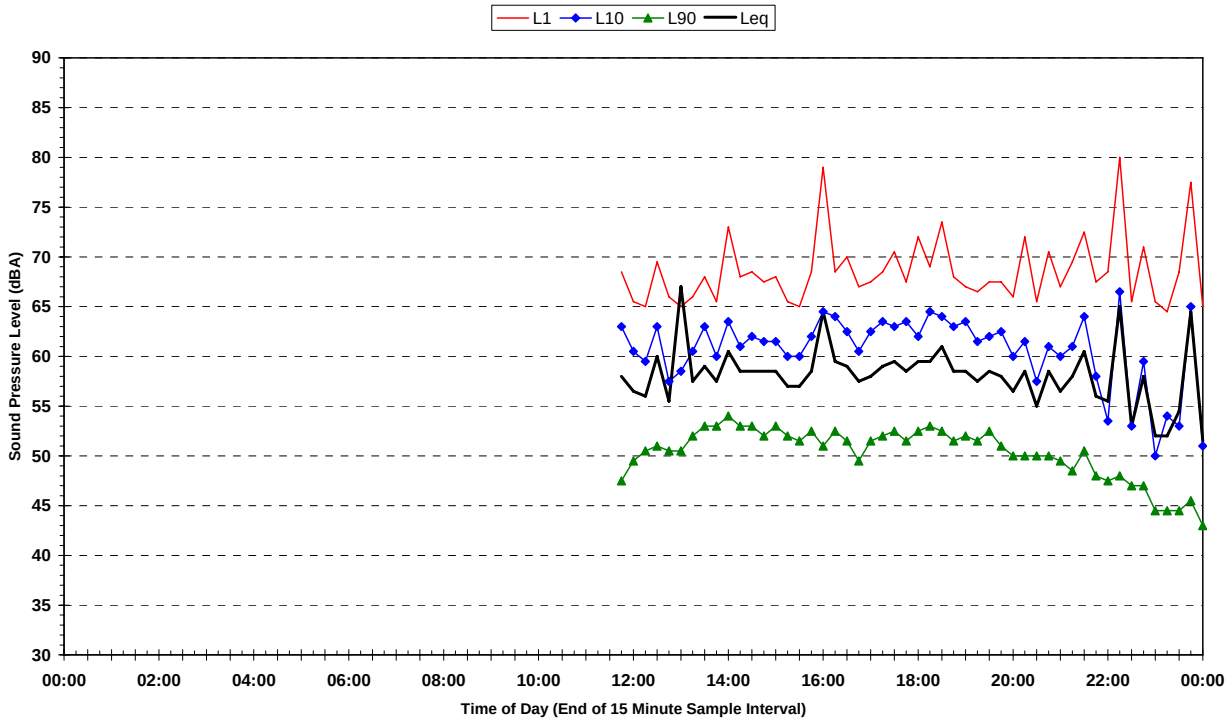
Note 1: ANL Acceptable Noise Level for a urban area
Note 2: RBL Rating Background Level
Note 3: Assuming existing noise levels unlikely to decrease in the future, and assuming no existing industrial noise
Note 4: Project Specific Criteria are shown in bold

The criteria provided in the right-hand column of **Table 9**, applies to the noise contribution from *industrial*-type sources associated with the development.

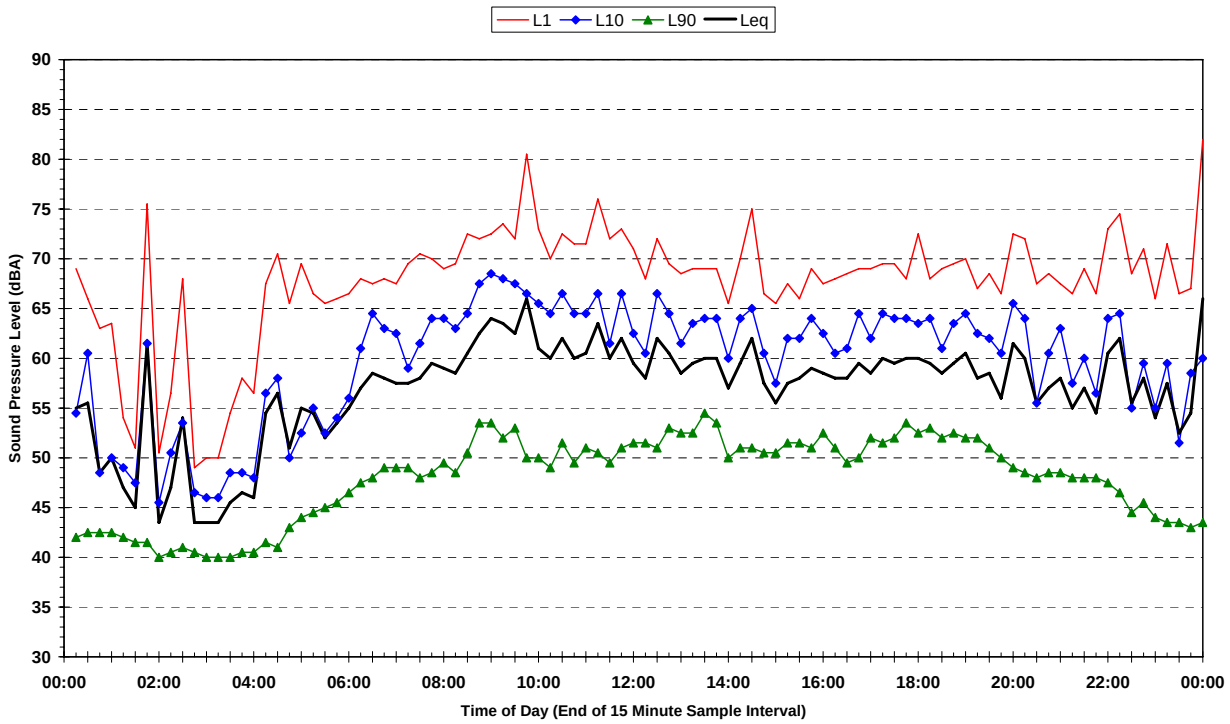
It is noted that this criteria is provided for immediate guidance at the Concept Plan level of detail, and should be reviewed during the detailed project planning stages to take into account potential shielding from the built environment.

Noise Logging Results – Location 1

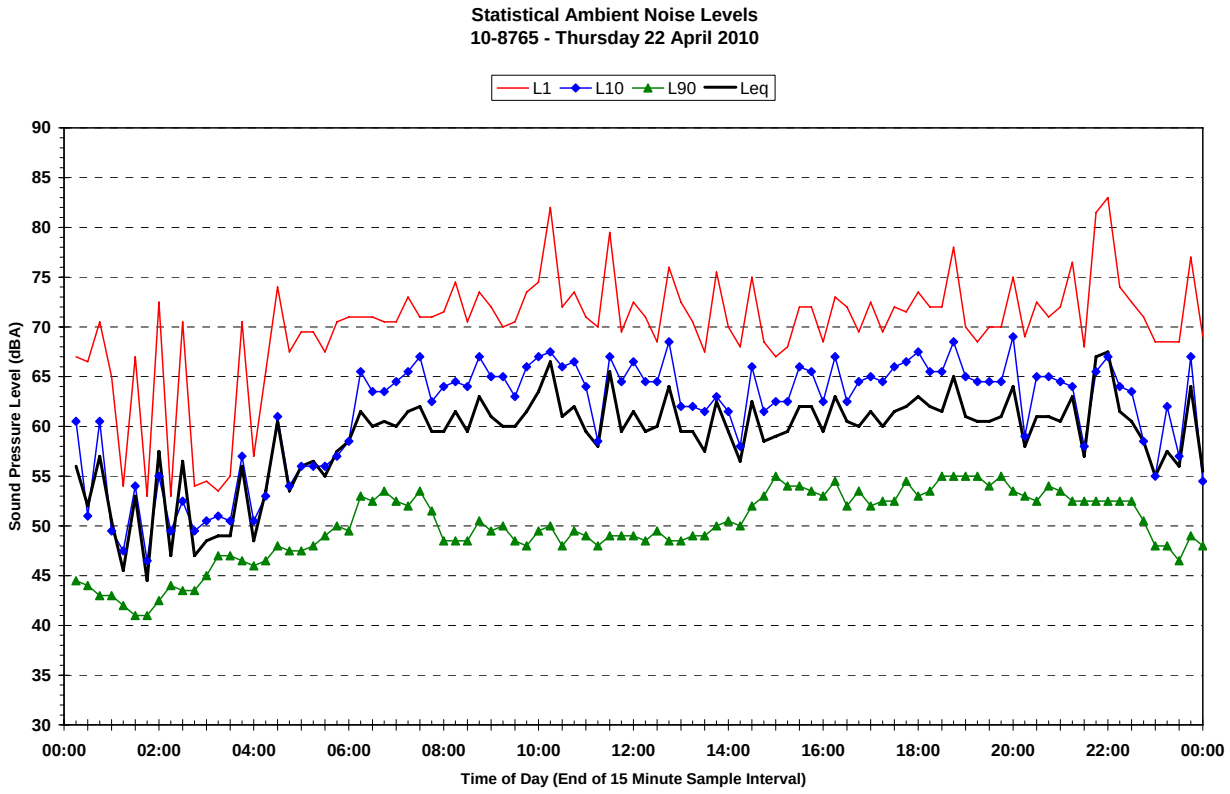
Statistical Ambient Noise Levels
10-8765 - Tuesday 20 April 2010

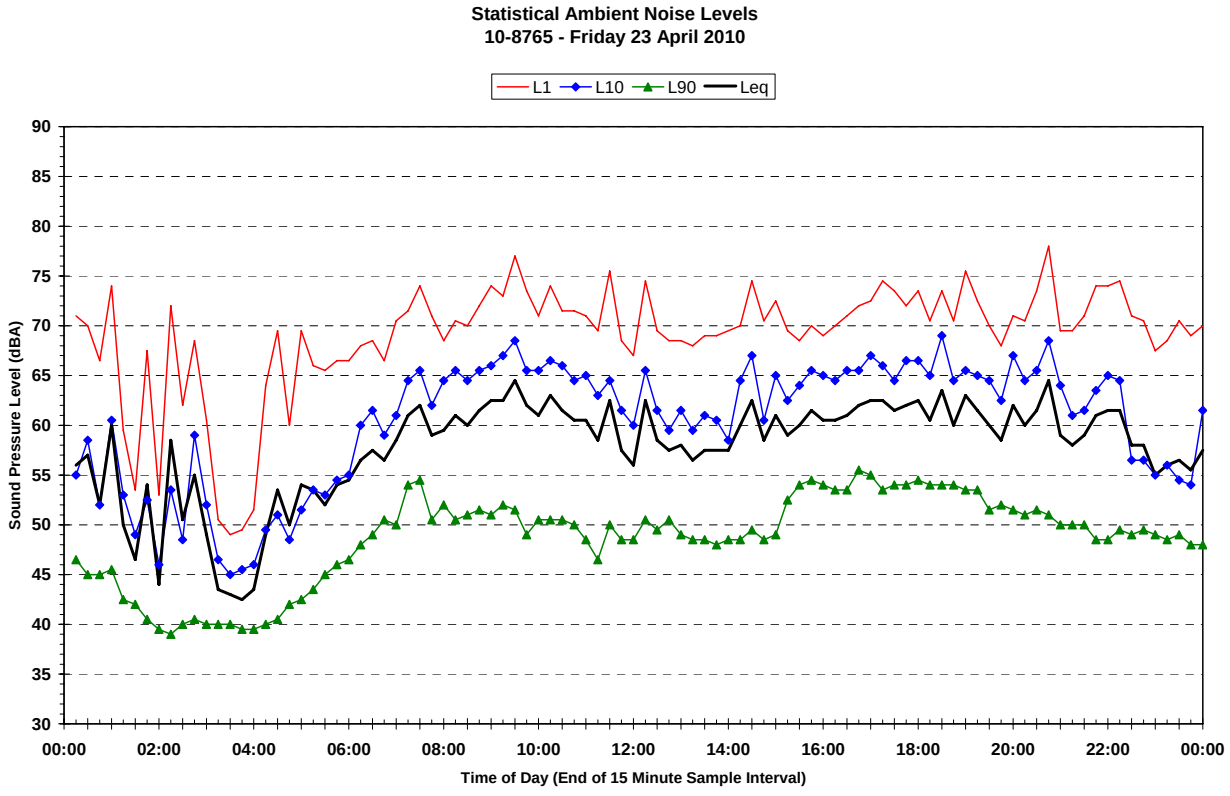


Statistical Ambient Noise Levels
10-8765 - Wednesday 21 April 2010



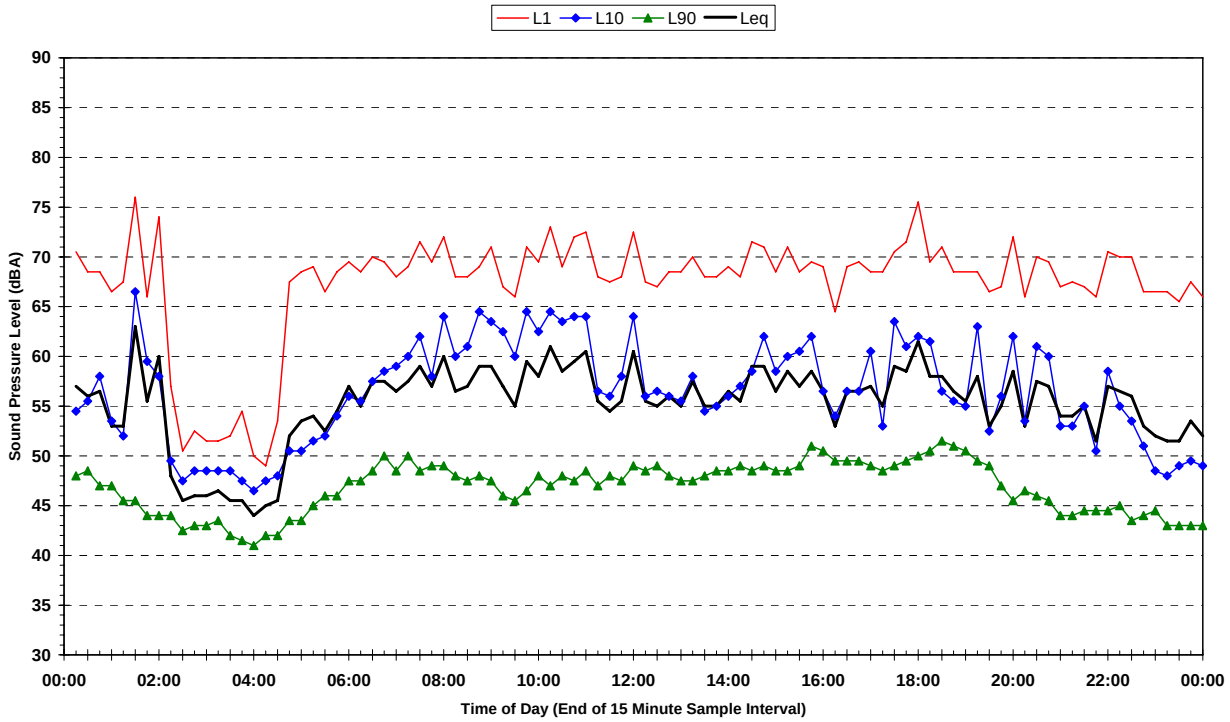
Noise Logging Results – Location 1



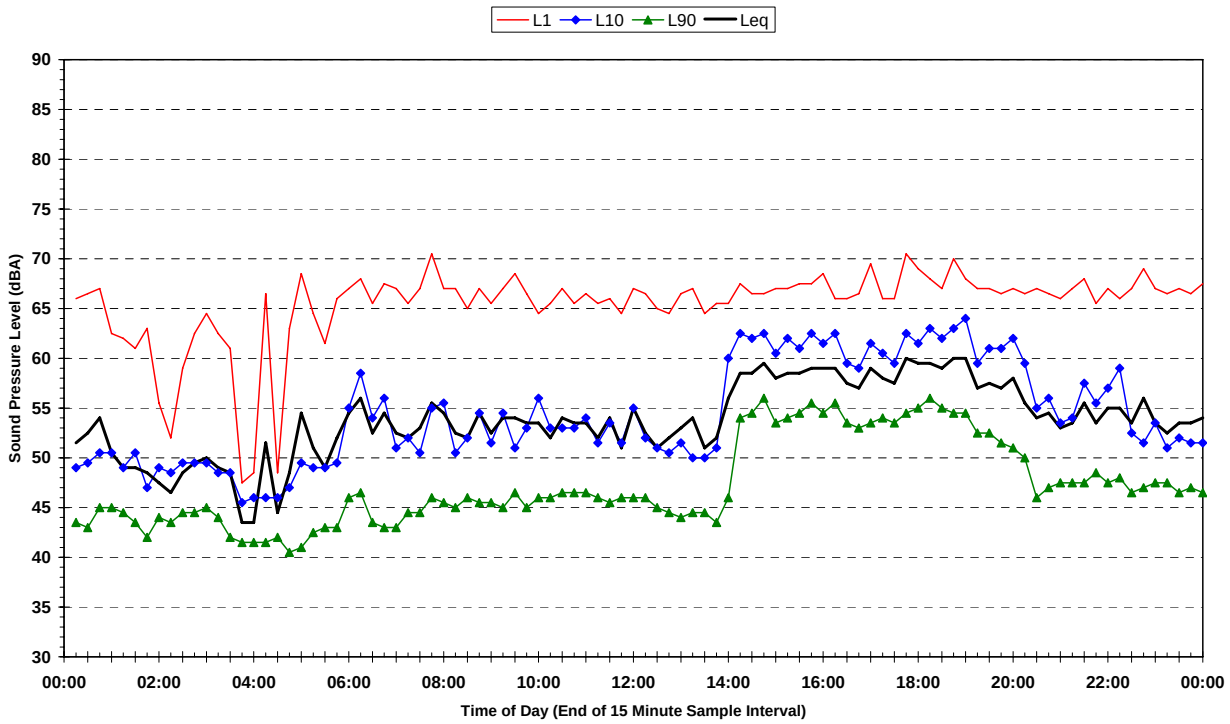


Noise Logging Results – Location 1

Statistical Ambient Noise Levels
10-8765 - Saturday 24 April 2010

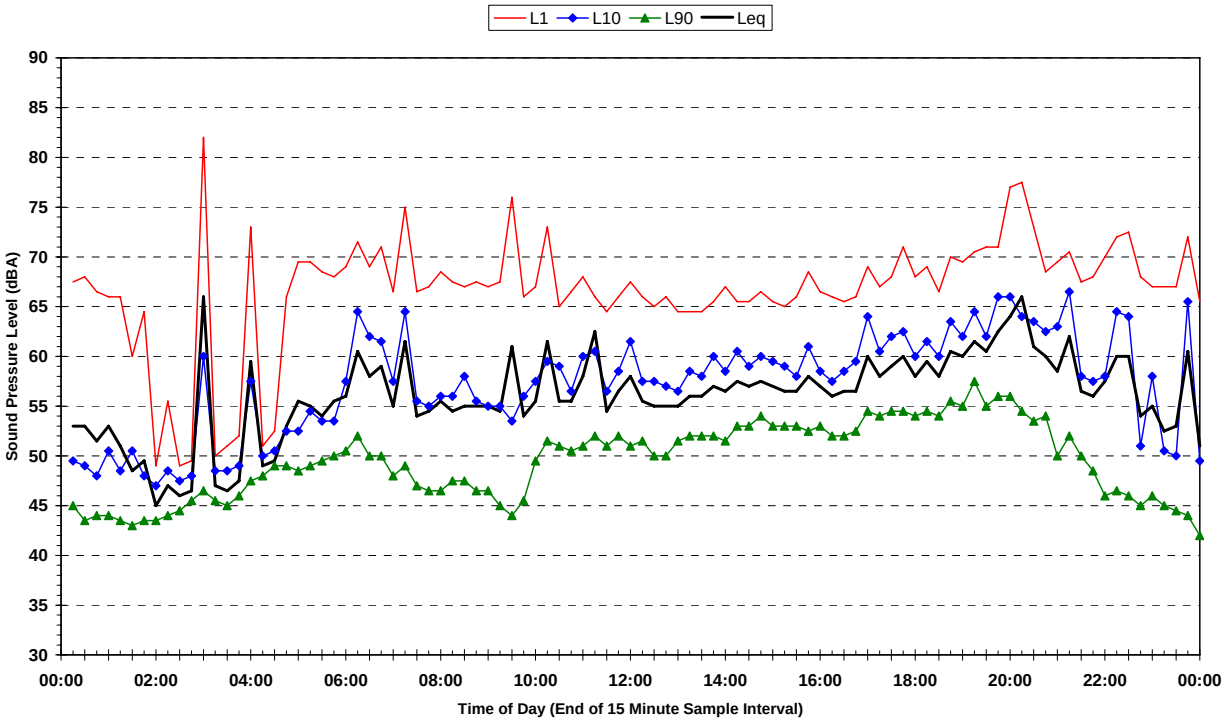


Statistical Ambient Noise Levels
10-8765 - Sunday 25 April 2010

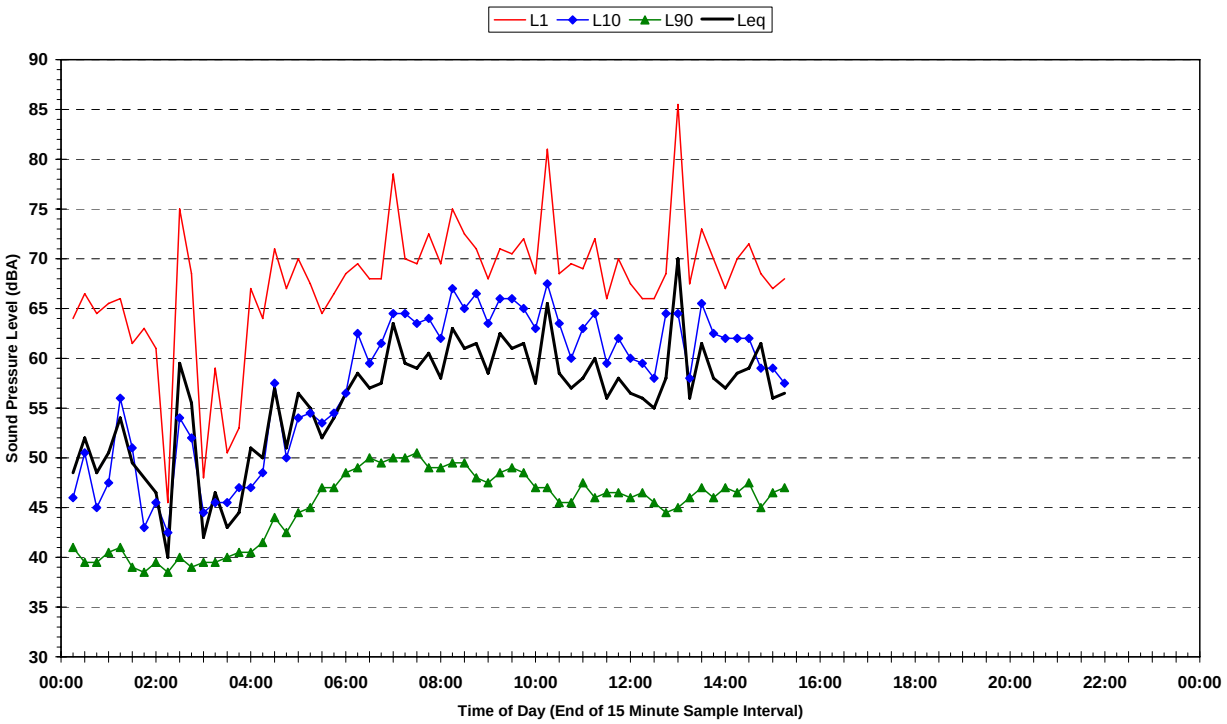


Noise Logging Results – Location 1

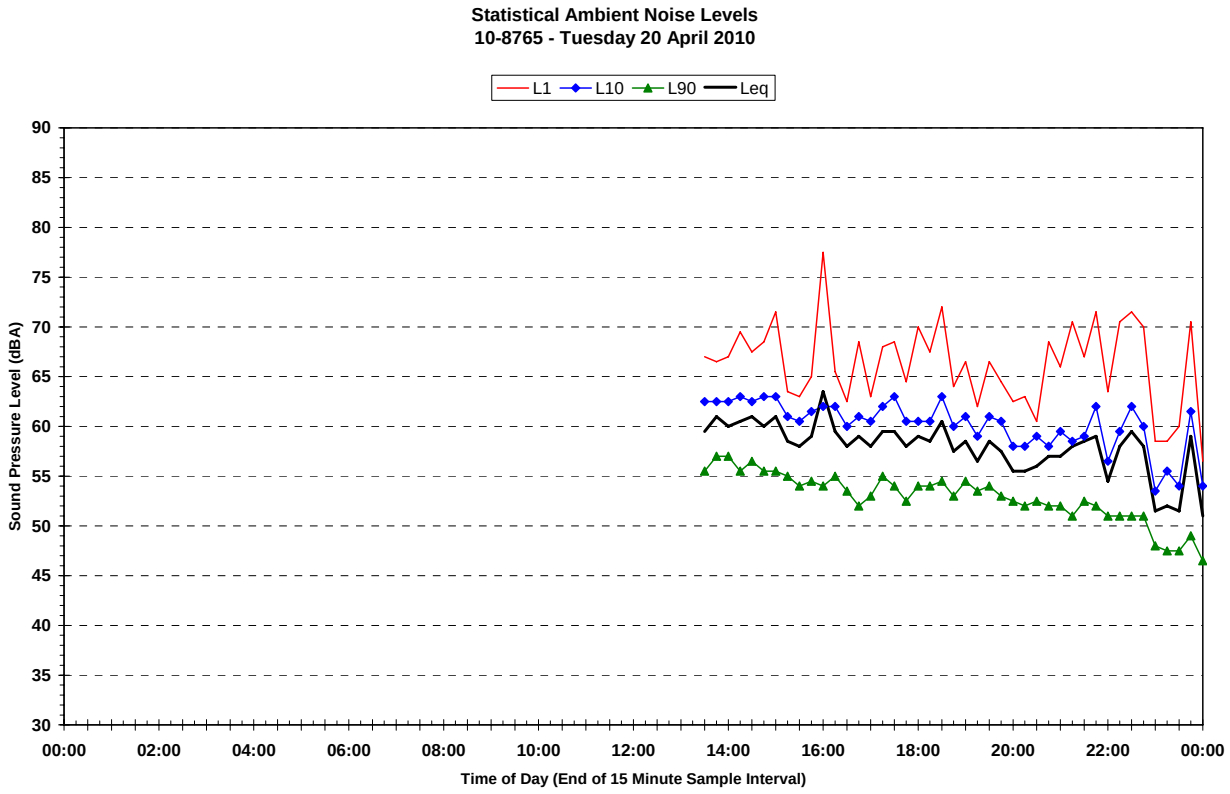
Statistical Ambient Noise Levels
10-8765 - Monday 26 April 2010

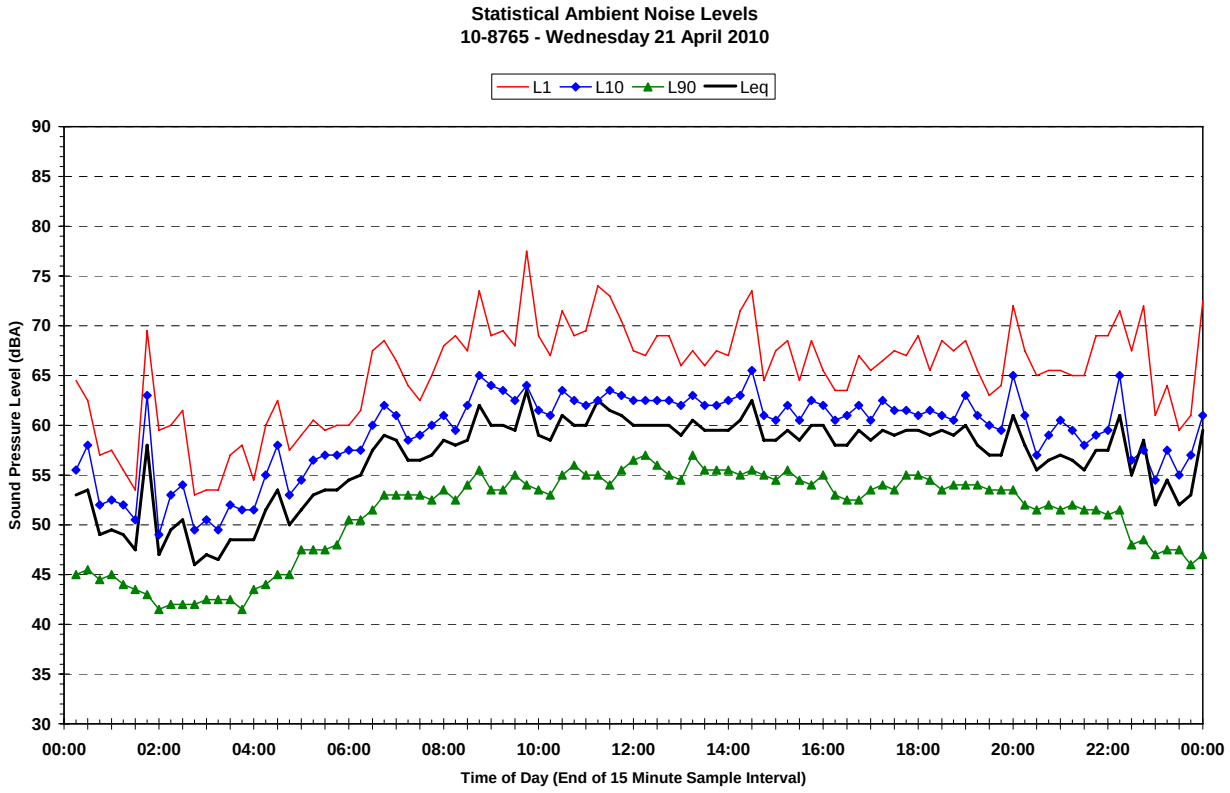


Statistical Ambient Noise Levels
10-8765 - Tuesday 27 April 2010



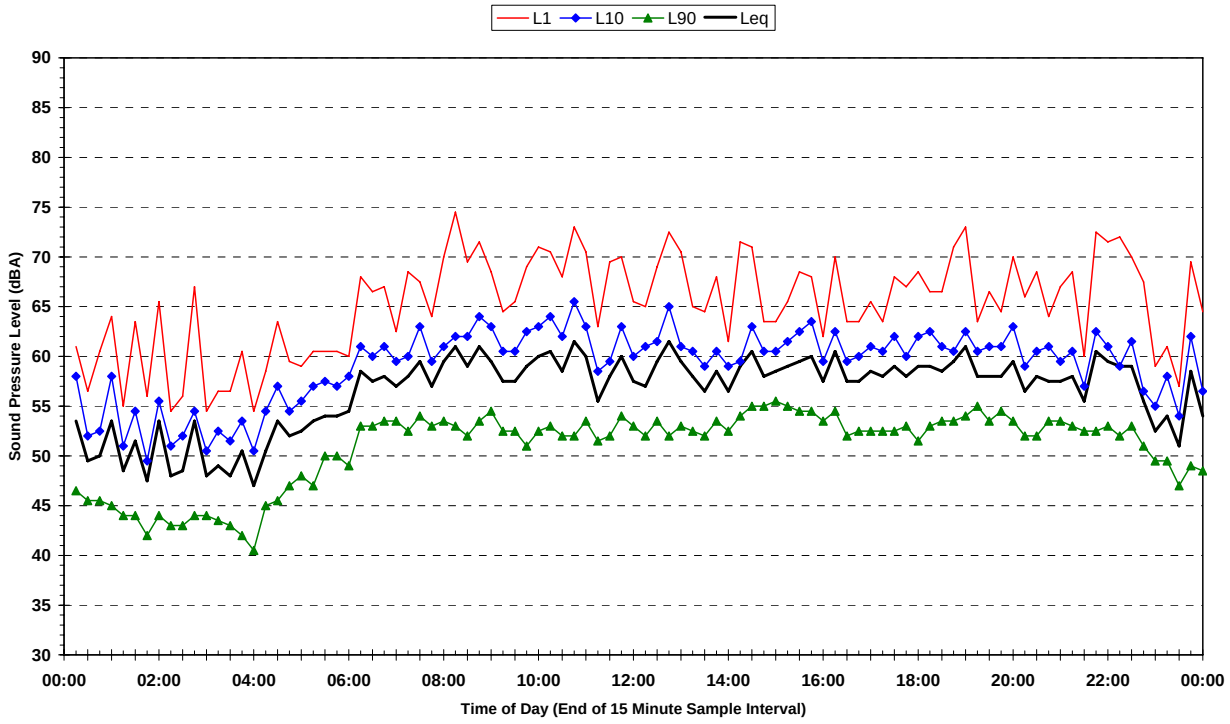
Noise Logging Results – Location 2



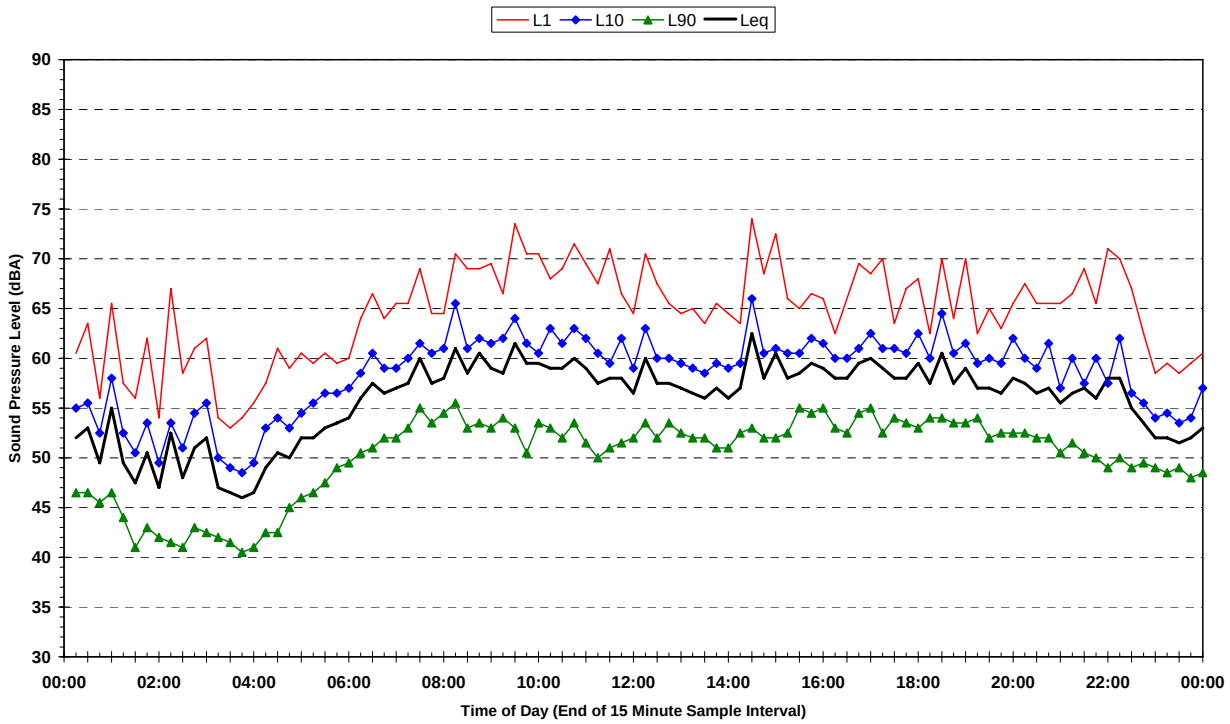


Noise Logging Results – Location 2

Statistical Ambient Noise Levels
10-8765 - Thursday 22 April 2010

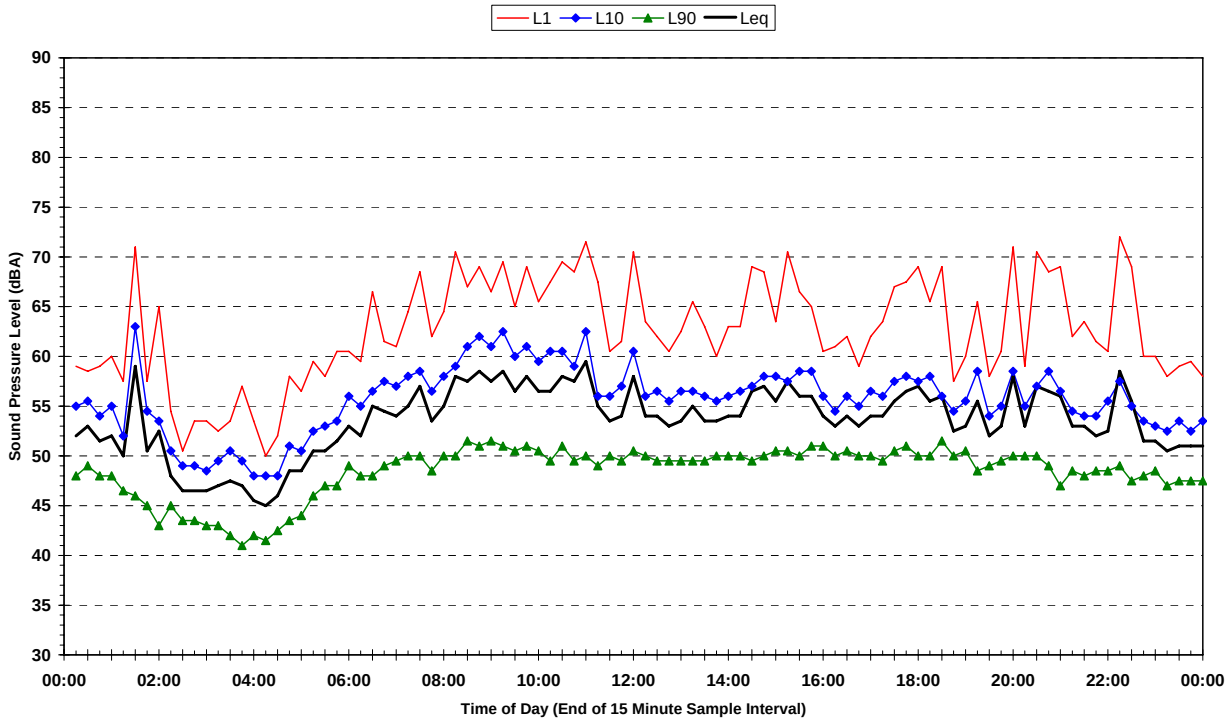


Statistical Ambient Noise Levels
10-8765 - Friday 23 April 2010

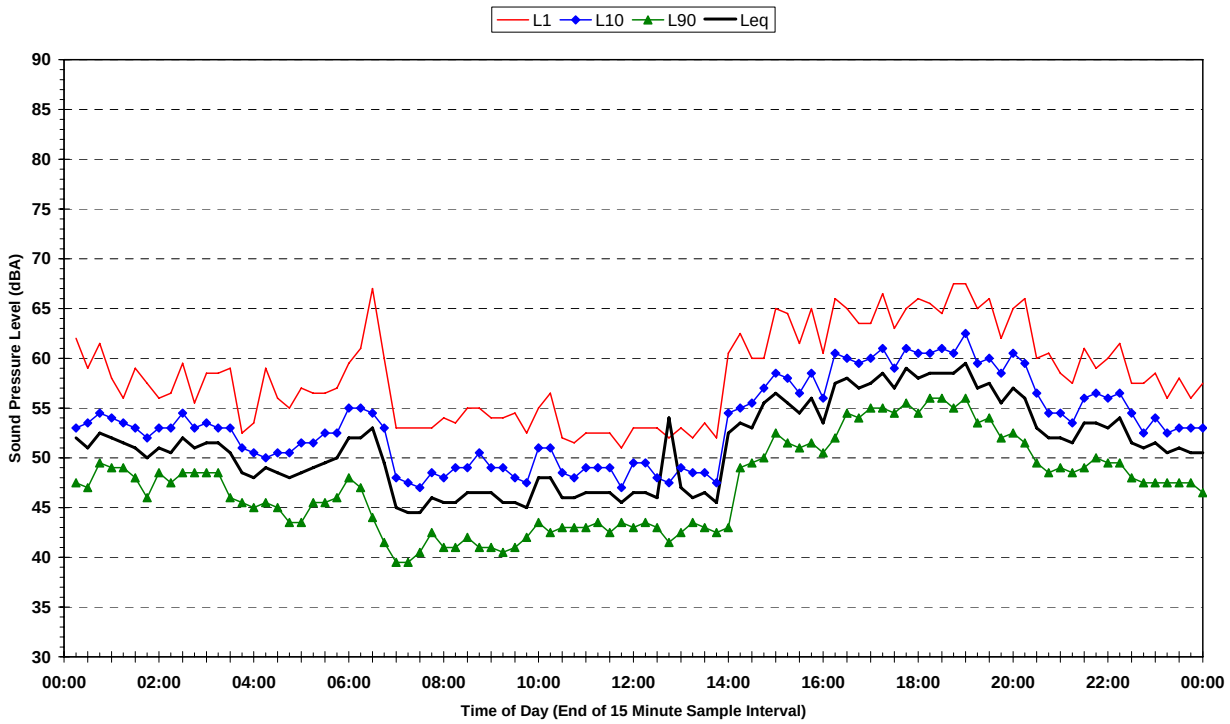


Noise Logging Results – Location 2

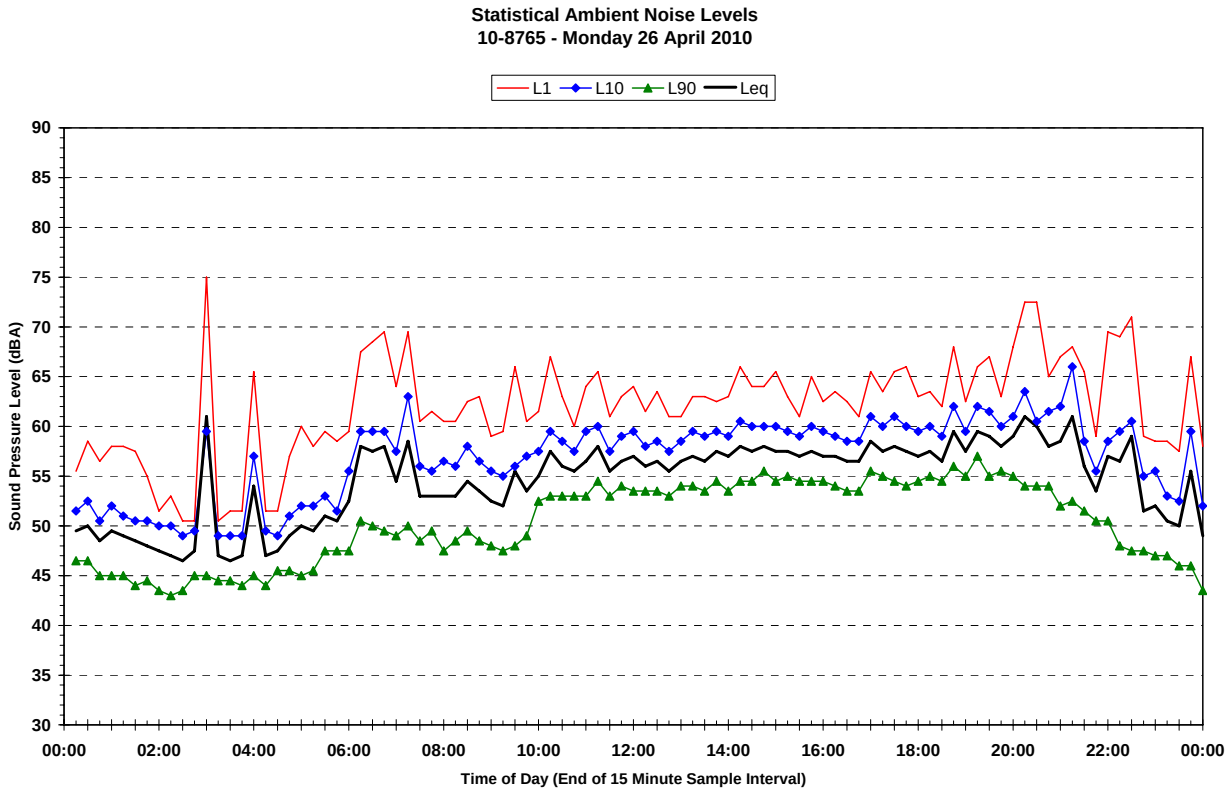
Statistical Ambient Noise Levels
10-8765 - Saturday 24 April 2010

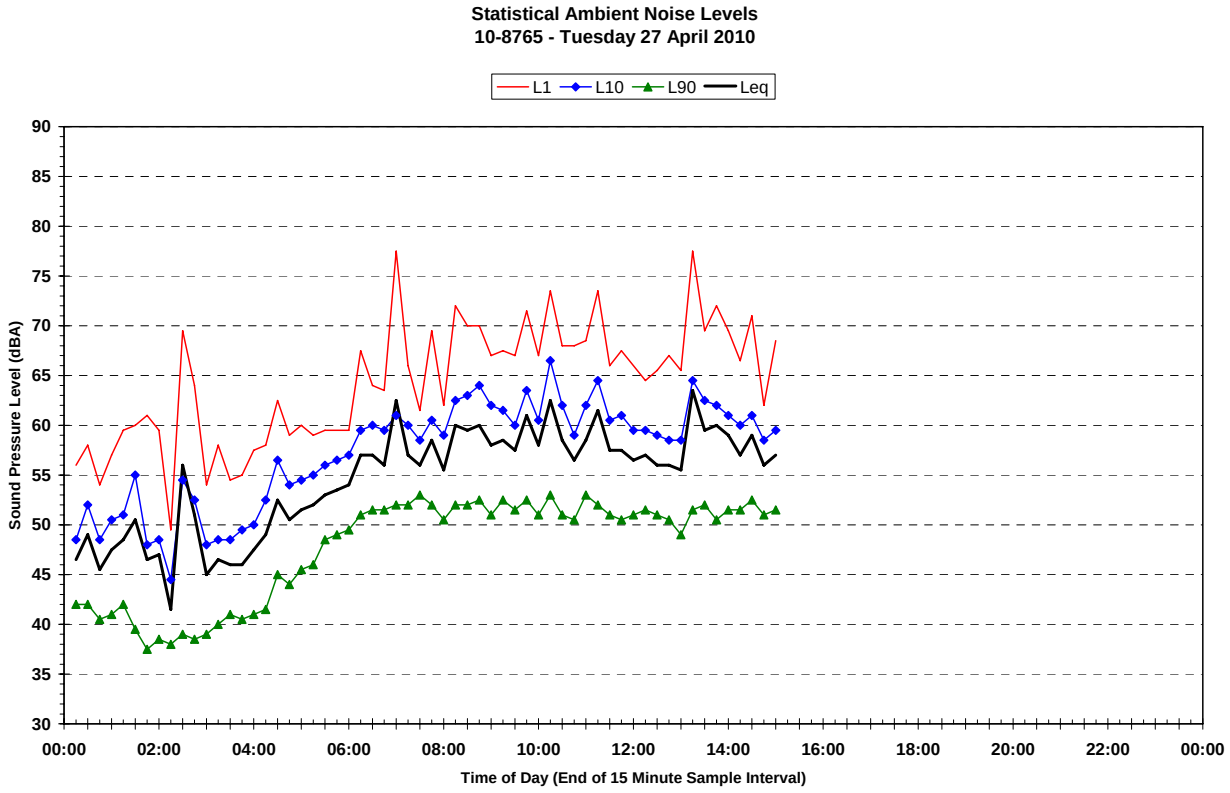


Statistical Ambient Noise Levels
10-8765 - Sunday 25 April 2010



Noise Logging Results – Location 2





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BCA Sound Insulation Terminology

The key terminology used in the Building Code of Australia (BCA) to describe acoustic ratings of building elements is presented in **Table 10**.

Table 10 Acoustic Terminology

Term	Meaning	Relevance
R	Sound reduction index	Airborne Noise: walls, floors, doors, hydraulic risers.
R_w	Weighted sound reduction index (measured in a laboratory)	
R'_w	Apparent weighted sound reduction index (measured in the field)	
D	Level difference	
D_w	Weighted level difference	
D_{nTw}	Weighted standardised level difference (to a reference reverberation time of 0.5 s)	
Ctr	Spectrum adaptation, “weighted urban traffic noise”[1]	
L	Impact sound pressure level	Impact Noise: floors.
$L'_{n,T,w}$	Weighted standardised impact sound pressure level	
CI	Spectrum adaptation term	

Note 1: Although this is the definition of Ctr, its inclusion in the rating of a wall between units is to control low frequency noise sources, such as stereo and home cinema systems.