NOISE MEASUREMENT SERVICES

Noise Monitoring Report
Brisbane Motorway Services
Clem Jones Tunnel Monitoring

Report 6 – November 2011

Report No 1529_2 (6) – 11 January 2012

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0	01/12/2011	Sixth Report November 2011		
1	11/01/2012	Correction to Table in Section 3.4	JD	

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REPORT FOR **Brisbane Motorway Services Pty Ltd**

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Signed

Dr Bob Thorne
(Principal)

DISCLAIMER

CONTENTS

1.0 INTRODUCTION

This is the sixth Report prepared for Brisbane Motorways Services in response to a request for the monitoring of road traffic noise levels for the Clem Jones Tunnel (also referred to as CLEM7 tunnel). The purpose of the survey was to present measured noise levels at residential locations near the roading network around the entry and exit points for the Clem Jones Tunnel. A summary of the locations follow:

- ML1: 153 Lambert Street, Kangaroo Point
- ML2: 6 Albert Street, Woolloongabba
- ML3: 6 Tufton Street, Bowen Hills
- ML4: 27 Northey Street, Windsor

This Report presents the monitoring results from a noise survey conducted from 15 to 22 November 2011 at locations ML1 to ML4.

This Report is intended to be read in conjunction with the first Report number 1529_1 dated 7 July 2010 which contains details of the measurement locations and results from an initial survey conducted in April 2010, and subsequent Reports which relate to subsequent tests in July and November/December 2010, and January and April 2011. Note that in the Reports 1 and 2, noise monitoring location ML4 was located at the Brisbane Motorway Services' air quality monitoring station on Northey St. For Report 3 through to the current Report this location has been moved to a nearby residence as shown above. This was organised to eliminate noise interference from the air quality monitoring station itself.

Report	Survey Dates	Report Issue Date	Revision
1529	April / May 2010	07/07/2010	1
1529 (2)	July 2010	30/07/2010	0
1529 (3)	October 2010	11/01/2012	3
1529 (4)	January 2011	11/01/2012	3
1529 (5)	April/May/June 2011	10/06/2011	1 Addenda

Photographs of the measurement locations are presented in **Appendix A.**

A glossary of terms used in this Report is presented in **Appendix B**.

2.0 NOISE CRITERIA AND LIMITS

The assessment criteria are contained in the Noise and Vibration Environmental Management Sub Plan for the *CLEM7 Operations & Maintenance Manual* which refers to the Environmental Protection (Noise) Policy 1997 and Department of Transport and Main Roads' *Road Traffic Noise Management Code of Practice*.

2.1 Environmental Protection (Noise) Policy 1997

In this Report, the Environmental Protection (Noise) Policy 1997 has been addressed. This policy states that the following planning levels for a public road are not to exceed:

- 68 dB(A) L10(18hr) for a State-controlled road,
- 60 dB(A) Leq(1hr) between 10pm and 6am,
- 80 dB(A) single event maximum sound pressure level.

Measurements were made by monitoring noise one metre in front of the most exposed part of an affected noise sensitive place.

This Noise Policy was superseded by the Environmental Protection (Noise) Policy 2008 (see below), which is promulgated pursuant to the Environmental Protection Act 1994. That policy (2008) establishes new acoustic quality objectives to protect or enhance stated environmental values (see **2.2** below).

2.2 Environmental Protection (Noise) Policy 2008

The Environmental Protection Noise Policy 2008 establishes new acoustic quality objectives to protect or enhance stated environmental values. The environmental values to be enhanced or protected under the policy are the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; the amenity of the community, human health and well-being and including ensuring a suitable acoustic environment for individuals to sleep, study and learn, as well as to be involved in recreation including relaxation and conversation.

The acoustic quality objectives do not apply to noise from aircraft movement, noise from the ordinary use of a public road or State-controlled road and noise from the ordinary use of a busway, light rail or rail transport infrastructure. This is a significant variation from the previous (1997) policy as that policy did apply to noise from road and rail.

The ambient observations for this Report indicate that the dominant noise character of the environment, apart from wind in trees and residential neighbour activity, is noise from "ordinary" rail / road traffic, distant industrial and commercial uses. Accordingly, the Environmental Protection (Noise) Policy 2008 would not apply to this assessment.

2.3 Department of Transport and Main Roads' Requirements

The Noise and Vibration Environmental Management Sub Plan for the CLEM7 *Operations & Maintenance Manual* refers to (the "desirable criteria" of) the Department of Transport and Main Roads' *"Road Traffic Noise Management Code of Practice"*. The Code is not a statutory document and has been developed by the Department for its own purposes.

This Sub Plan states that the following levels not to be exceeded:

- 68 dB(A) L10(18hr) for a State-controlled road

These levels were assessed by monitoring noise levels at one metre in front of the most exposed part of an affected noise sensitive place.

This is the same as the "68 dB(A) L10 (18hr) for a State-controlled road" set out in Section **2.1** above. The level is "façade affected', that is, it has a factor of 2.5 dB(A) built in to represent the level of reflected sound measured when recording near to a building. Where the location is not façade affected, it is considered to be in a "free-field", and an adjustment is made to readings to include this factor.

3.0 SURVEY RESULTS November 2011

3.1 Measurement of Noise Levels at 153 Lambert Street, Kangaroo Point (ML1)

The measurement location ML1 is located in the outdoor courtyard area on ground floor level at 153 Lambert Street, Kangaroo Point. The microphone was positioned 4 metres from the southern boundary and 1.9 metres above ground level, overlooking Shafston Avenue. The location is not considered to be façade affected and the assessment is adjusted accordingly.

The operation of the sound level measuring equipment was field calibrated before and after each measurement session and was found to match the reference signal. All sound level instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- Rion NL-21 Type 2 Environmental Noise Logger
- Digitech Weather Station
- Rion NC-73 Calibrator

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 – 'Acoustics - Description and Measurement of Environmental Noise - Part 1: General Procedures', and AS2702:1984 – 'Acoustics - Methods for the Measurement of Road Traffic Noise'. Ambient noise levels were recorded at 15 minute intervals over a seven day period from Tuesday 15 to Tuesday 22 November 2011 (**Figure 1** and **Table 1**).

Noise levels at this site are dominated by road traffic on Shafston Avenue.

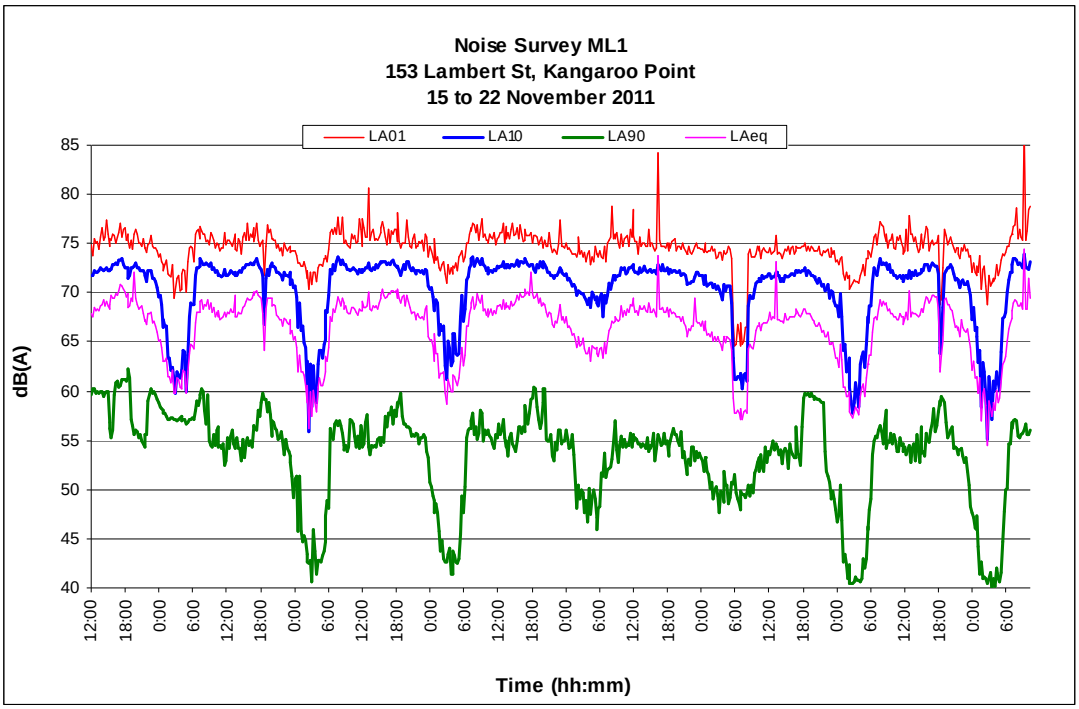

Figure 1: Exterior noise levels at location ML1 (levels free-field).

Table 1: Average ambient and background noise levels recorded at Location ML1 from 15 to 22 November 2011 (levels in dB(A), façade adjusted).

Site	Day	L10(18hr)	LAeq(1hr) Night	Event Maximum	Weather
ML1	Tuesday	74.8 (+)	69.0 (+)	80.0 (+)	Fine
ML1	Wednesday	74.7 (+)	70.2 (+)	78.9	Fine
ML1	Thursday	75.0 (+)	69.6 (+)	79.8	Fine
ML1	Friday	75.0 (+)	70.5 (+)	79.4	Fine
ML1	Saturday	74.3 (+)	70.3 (+)	78.7	Fine
ML1	Sunday	72.5 (+)	70.3 (+)	77.3	Fine
ML1	Monday	74.0 (+)	67.8 (+)	79.0	Fine

Note to Table 1:

(+) Levels exceed criteria

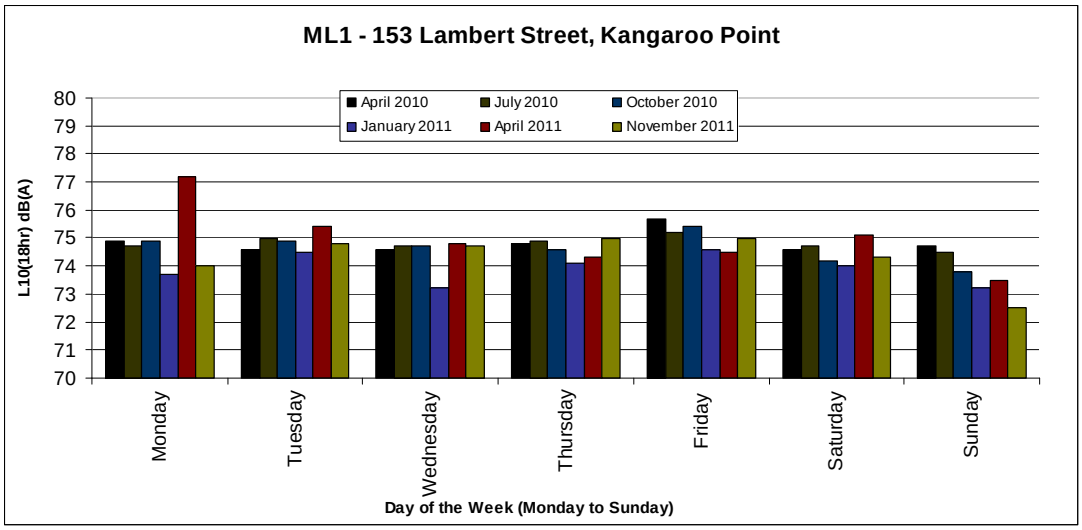

Figure 1.1: Cumulative L10 (18hr) noise levels measured quarterly from April 2010 to November 2011.

Table 1.1: Cumulative L10 (18hr) noise levels measured quarterly from April 2010 to November 2011.

ML1 (façade adjusted)	April 2010	July 2010	October 2010	January 2011	April 2011	November 2011
Monday	74.9 (^)	74.7	74.9	73.7	77.2 (^)	74
Tuesday	74.6	75	74.9	74.5	75.4	74.8
Wednesday	74.6	74.7	74.7	73.2 (*)	74.8	74.7
Thursday	74.8	74.9	74.6	74.1	74.3	75
Friday	75.7	75.2	75.4	74.6	74.5	75
Saturday	74.6	74.7	74.2	74	75.1	74.3
Sunday	74.7 (^)	74.5	73.8	73.2	73.5	72.5

^ Rain or otherwise adversely affected data

* Public Holiday

3.2 Measurement of Noise Levels at 6 Albert Street, Woolloongabba (ML2)

The measurement location ML2 is located on the first floor balcony at 6 Albert Street, Woolloongabba approximately 3.8 metres above ground level. This location overlooks the Ipswich Road underpass of the Pacific Motorway and the CLEM7 tunnel entrance. The measurements at this location are considered to be façade affected, and no adjustment is required to arrive at a façade affected level for the purposes of this analysis.

The operation of the sound level measuring equipment was field calibrated before and after each measurement session and was found to match the reference signal. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- Rion NL-21 Type 2 Environmental Noise Logger
- Rion NC-73 Calibrator

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - 'Acoustics - Description and Measurement of Environmental Noise - Part 1: General Procedures'. Ambient noise levels were recorded at 15 minute intervals over a seven day period from Tuesday 15 to Tuesday 22 November 2011 (**Figure 2** and **Table 2**).

Noise levels at this site are dominated by road traffic on Ipswich Road, Pacific Highway and the Clem7 tunnel entrance. Other sources of noise include vehicles and pedestrians on Albert and Dibley Street and occasional birds.

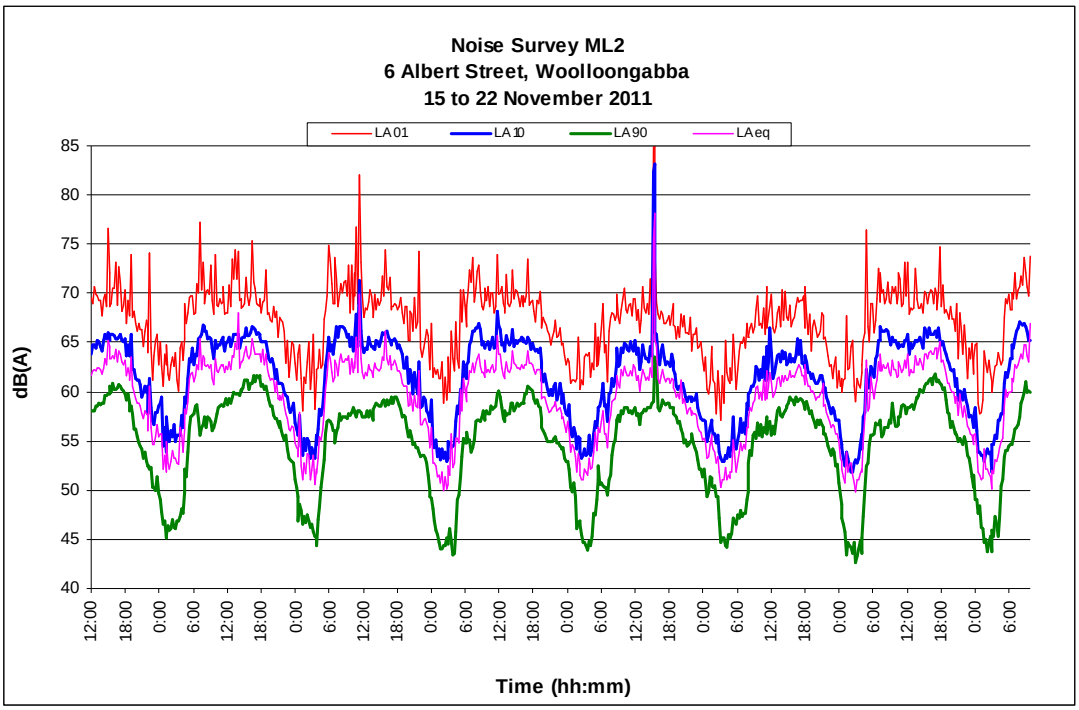

Figure 2: Exterior noise levels at location ML2 (façade affected).

Table 2: Average ambient and background noise levels recorded at Location ML2 from 15 to 22 November 2011 (levels in dB(A), façade affected).

Site	Day	L10(18hr)	LAeq(1hr) Night	Event Maximum	Weather
ML2	Tuesday	63.7	59.6	72.6	Fine
ML2	Wednesday	64.0	61.2 (+)	73.6	Fine
ML2	Thursday	63.9	61.5 (+)	73.2	Fine
ML2	Friday	63.8	60.1 (+)	72.4	Fine
ML2	Saturday	62.6	58.1	70.6	Fine
ML2	Sunday	61.3	57.8	69.7	Fine
ML2	Monday	63.7	60.8 (+)	72.2	Fine

Note to Table 2:

(+) Levels exceed criteria

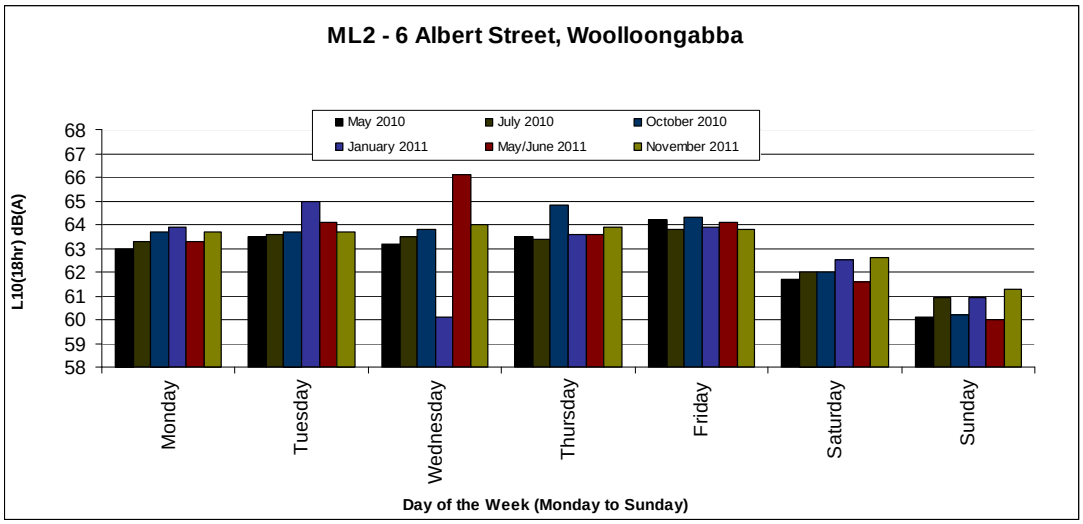

Figure 2.1: Cumulative L10 (18hr) noise levels measured quarterly from May 2010 to November 2011.

Table 2.1: Cumulative L10 (18hr) noise levels measured quarterly from May 2010 to November 2011.

ML2 (façade affected)	May 2010	July 2010	October 2010	January 2011	May/June 2011	November 2011
Monday	63.0	63.3	63.7	63.9	63.3	63.7
Tuesday	63.5	63.6	63.7	65	64.1	63.7
Wednesday	63.2	63.5	63.8	60.1 (*)	66.1	64
Thursday	63.5	63.4	64.8	63.6	63.6	63.9
Friday	64.2	63.8	64.3	63.9	64.1	63.8
Saturday	61.7	62	62	62.5	61.6	62.6
Sunday	60.1	60.9	60.2	60.9	60	61.3

(*) Public Holiday

3.3 Measurement of Noise Levels at 6 Tufton Street, Bowen Hills (ML3)

The measurement location ML3 is located in the car park at 6 Tufton Street, Bowen Hills. The microphone was positioned 2.7 metres from the northern boundary and 2.4 metres above ground level. This location is not considered to be façade affected, and the values are adjusted accordingly. It overlooks an adjacent rail line, and the CLEM7 road network and Inner City Bypass are visible.

The operation of the sound level measuring equipment was field calibrated before and after each measurement session and was found to be within 0.1 dB of the reference signal. All instrumentation used in this assessment hold a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- Rion NL-21 Type 2 Environmental Noise Logger
- Digitec Weather Station
- Rion NC-73 Calibrator

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - 'Acoustics - Description and Measurement of Environmental Noise - Part 1: General Procedures'. Ambient noise levels were recorded at 15 minute intervals over a seven day period from Tuesday the 15th to Tuesday the 22nd of November 2011 (**Figure 3** and **Table 3**).

Noise levels at this site are dominated by frequent train pass-bys on the adjacent rail line. Other sources of noise at this site include distant construction noise (see **Appendix A** photographs) and potential sounds from the residents on site such as vehicle movement, home theatre systems, voices, and other domestic noises.

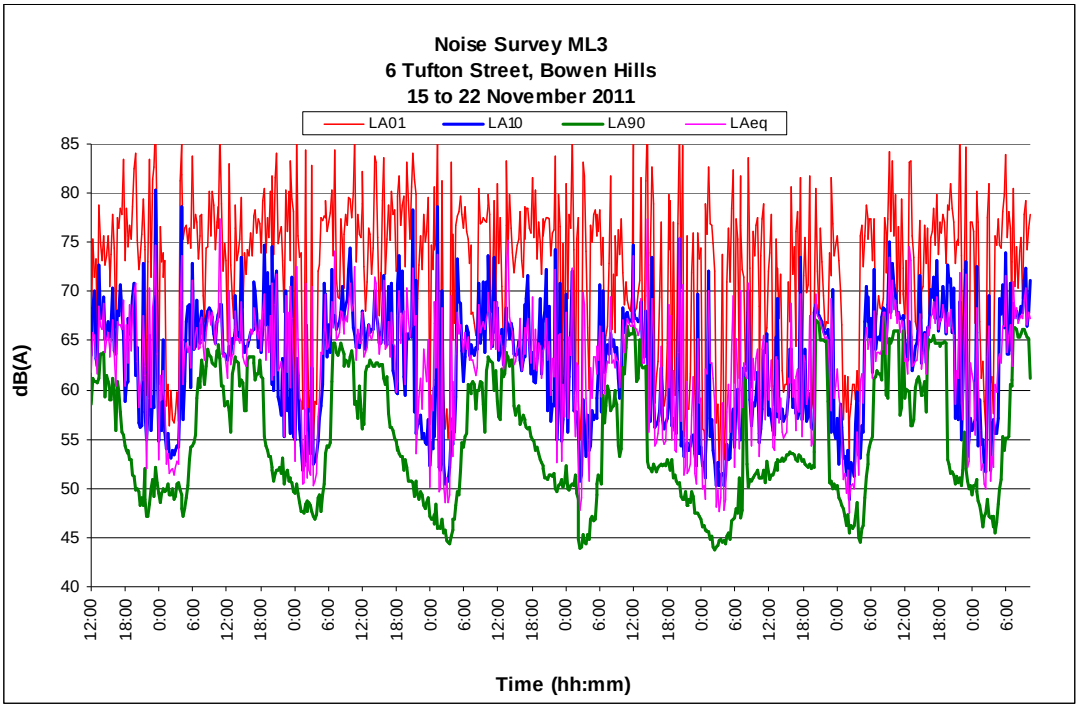

Figure 3: Exterior noise levels at location ML3 (free field).

Table 3: Average ambient and background noise levels recorded at Location ML3 from 15 to 22 November 2011 (levels dB(A), façade adjusted)

Site	Day	L10(18hr)^	LAeq(1hr) Night^	Event Maximum^	Weather
ML3	Tuesday	68.1 (+)	70.5 (+)	83.5 (+)	Fine
ML3	Wednesday	68.1 (+)	73.3 (+)	85.8 (+)	Fine
ML3	Thursday	67.8	70.4 (+)	85.1 (+)	Fine
ML3	Friday	67.3	72.3 (+)	83.0 (+)	Fine
ML3	Saturday	64.0	70.4 (+)	84.8 (+)	Fine
ML3	Sunday	62.9	68.4 (+)	81.0 (+)	Fine
ML3	Monday	68.5 (+)	67.9 (+)	82.4 (+)	Fine

Note to Table 3:

^ LAeq, Average Maximum Levels, and to a lesser extent, L10 (18hr) levels are elevated due to frequent train passes, approximately every five minutes.

(+) levels exceed criteria

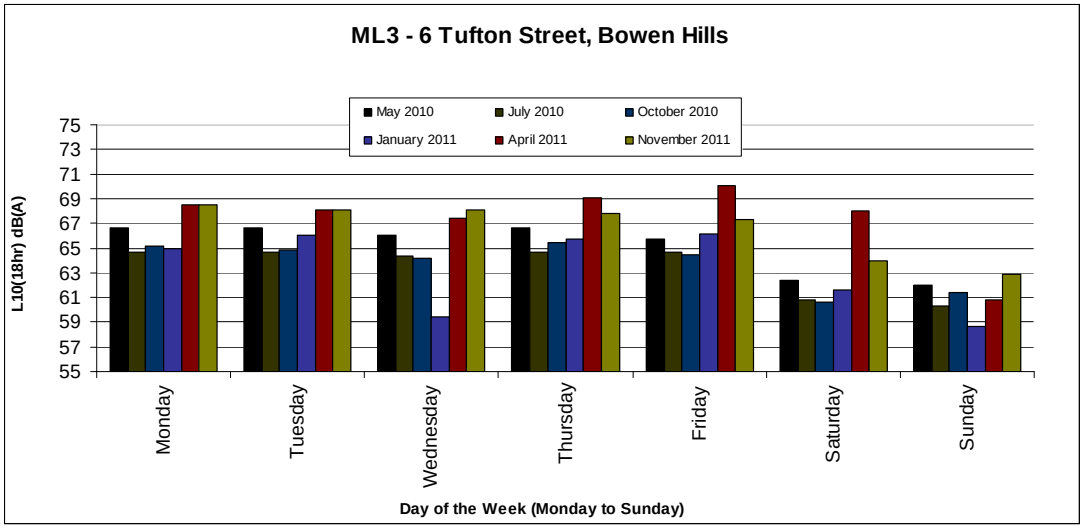

Figure 3.1: Cumulative L10 (18hr) noise levels measured quarterly from May 2010 to November 2011.

Table 3.1: Cumulative L10 (18hr) noise levels measured quarterly from May 2010 to November 2011.

ML3 (façade adjusted)	April 2010	July 2010	October 2010	January 2011	April 2011 (#)	November 2011 (#)
Monday	66.6	64.7	65.1	65	68.5 (^)	68.5
Tuesday	66.6	64.7	64.9	66	68.1 (^)	68.1
Wednesday	66	64.4	64.2	59.4 (*)	67.4	68.1
Thursday	66.6	64.7	65.4	65.7	69.1	67.8
Friday	65.7	64.7	64.5	66.1	70.1	67.3
Saturday	62.4	60.8	60.6	61.6	68	64
Sunday	62	60.3	61.4	58.6	60.8	62.9

^ Rain or otherwise adversely affected data

* Public Holiday

Data adversely affected by nearby construction

3.4 Measurement of Noise Levels at 27 Northey Street, Windsor (ML4)

The measurement location ML4 is located at 27 Northey Street, Windsor. The measurements at this location are considered to be façade affected, and no adjustment is required to arrive at a façade affected level for the purposes of this analysis. A correction of -2.5dB(A) has been made to the levels reported for Report 3 survey 3 to reconcile this methodology; surveys 1 and 2 (conducted at the CLEM Weather Station) have a +2.5dB(A) correction to façade adjust the recorded free field values (as previously recorded in Reports 1 and 2).

The Measurement Location and locality photograph of ML4 is shown in **Appendix A**.

The operation of the sound level measuring equipment was field calibrated before and after each measurement session and was found to match the reference signal. All instrumentation used in this assessment holds a current calibration certificate from a certified NATA calibration laboratory. The following instruments were used to measure the ambient noise levels-

- Rion NL-21 Type 2 Environmental Noise Logger
- Rion NC-73 Calibrator

Ambient sound pressure levels were measured generally in accordance with Australian Standard AS1055.1:1997 - 'Acoustics - Description and Measurement of Environmental Noise - Part 1: General Procedures'. Ambient noise levels were recorded at 15 minute intervals over a seven day period from Tuesday the 15th to Tuesday the 22nd of November 2011 (**Figure 4** and **Table 4**).

Noise levels at this site are dominated by road traffic noise from the Lutwyche Road, the M7 intersection and occasional vehicles on Northey Street. Other sources of noise may include sounds from the residents on site; such as vehicle movement, home theatre systems, voices, and other domestic noises. There is also a significant amount of construction and road work around the Lutwyche Road area and distant construction noise may potentially impact the site.

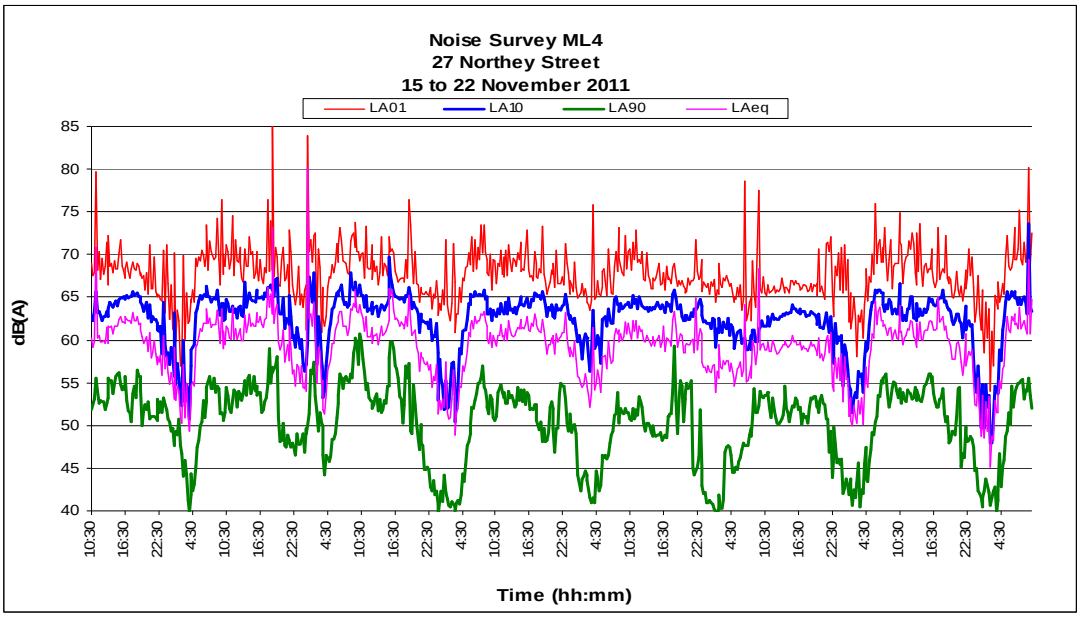

Figure 4: Exterior noise levels at location ML4 (façade affected).

Table 4: Average ambient and background noise levels recorded at Location ML4 from 15 to 22 November 2011 (levels dB(A), façade affected).

Site	Day	L10(18hr)	LAeq(1hr) Night	Event Maximum	Weather
ML4	Tuesday	63.8	60.8 (+)	71.5	Fine
ML4	Wednesday	64.0	60.2 (+)	73.4	Fine
ML4	Thursday	64.3	63.1 (+)	72.1	Fine
ML4	Friday	64.1	59.5 (+)	71.5	Fine
ML4	Saturday	63.7	61.5 (+)	70.9	Fine
ML4	Sunday	61.9	62.0 (+)	71.0	Fine
ML4	Monday	63.4	59.5 (+)	72.8	Fine

Note to Table 4:

(+) Levels exceed criteria, possible contribution to LAeq levels from local noise sources.

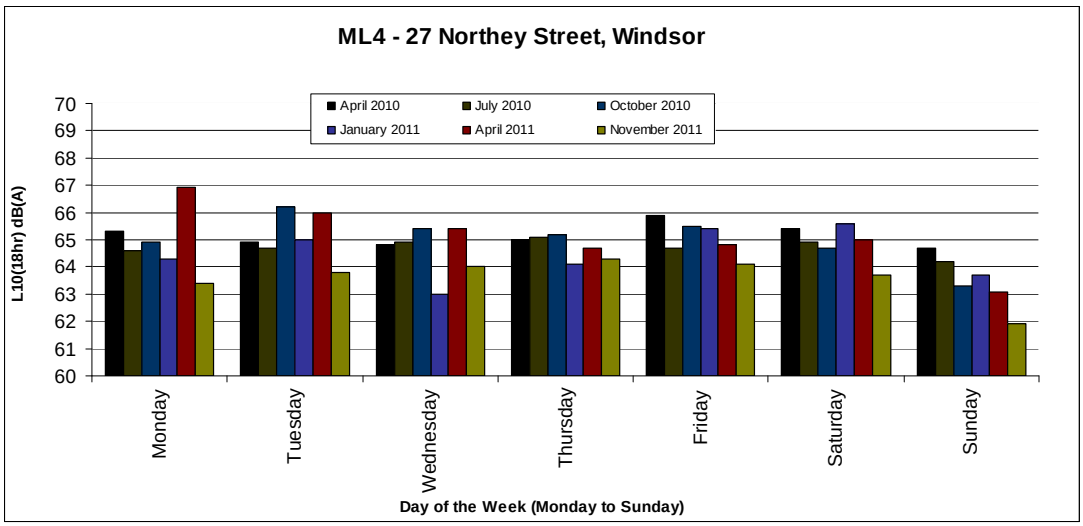

Figure 4.1: Cumulative L10 (18hr) noise levels measured quarterly from April 2010 to November 2011

Table 4.1: Cumulative L10 (18hr) noise levels measured quarterly from April 2010 to November 2011

ML4 (façade affected)	CLEM WS April 2010	CLEM WS July 2010	October 2010	January 2011	April 2011	November 2011
Monday	65.3 (^)	64.6	64.9	64.3	66.9 (^)	63.4
Tuesday	64.9	64.7	66.2	65	66	63.8
Wednesday	64.8	64.9	65.4	63 (*)	65.4	64.0
Thursday	65	65.1	65.2	64.1	64.7	64.3
Friday	65.9	64.7	65.5	65.4	64.8	64.1
Saturday	65.4	64.9	64.7	65.6	65	63.7
Sunday	64.7 (^)	64.2	63.3 (^)	63.7	63.1	61.9

^ Rain or otherwise adversely affected data

* Public Holiday

Appendix A Photographs

Photo A1: ML1 - Noise logger and weather station in the courtyard of 153 Lambert Street, Kangaroo Point.

Photo A2: ML2 – Noise logger at 6 Albert Street, Woolloongabba, with a view to Ipswich Road and the Clem7 tunnel entrance at the top left.

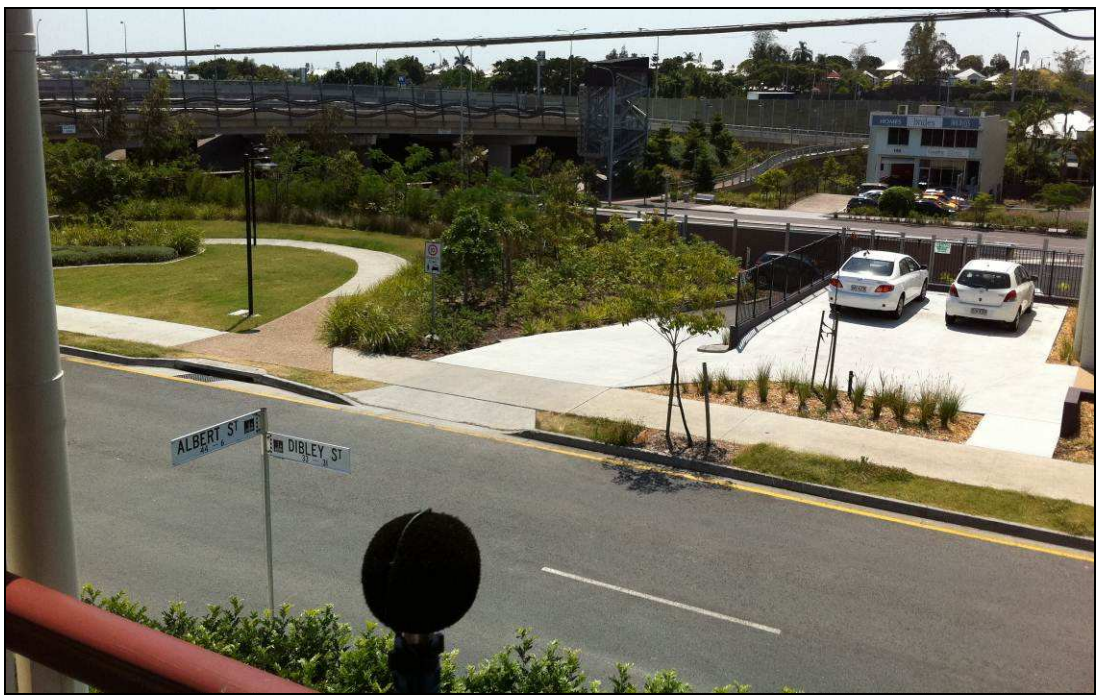

Photo A3: ML3 – Noise logger at 6 Tufton Street, Bowen Hills.

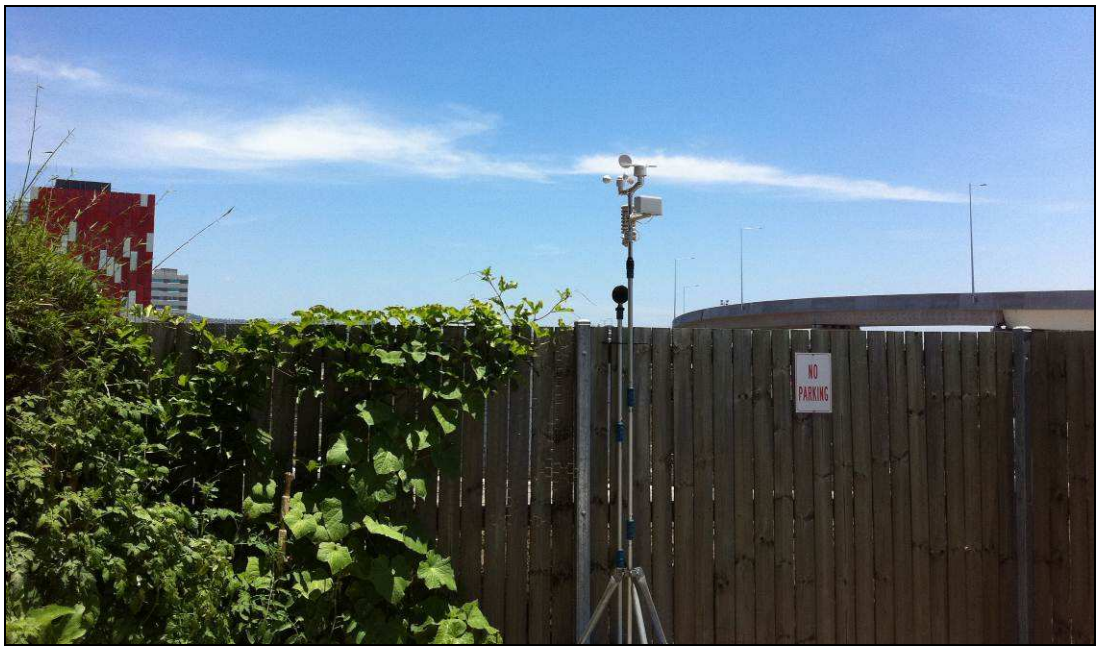

Photo A4: ML3 – Reverse view showing a nearby construction site.

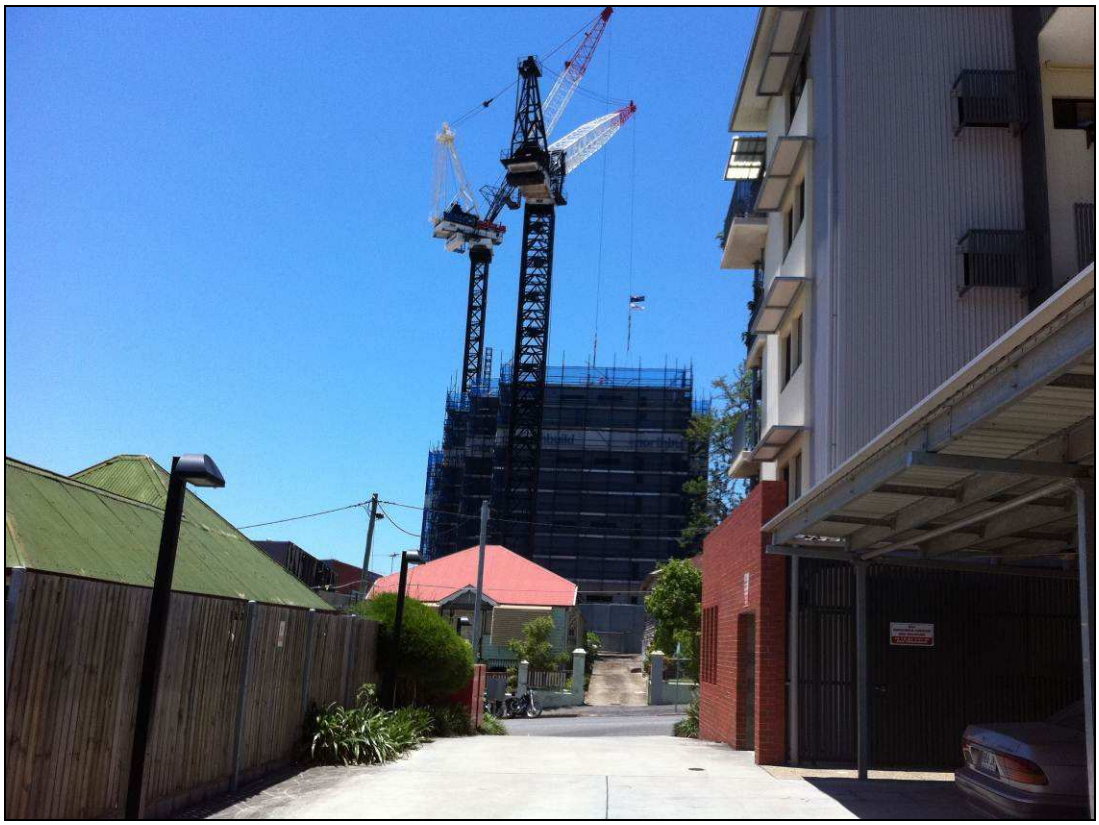

Photo A5: ML4 – Noise logger at 27 Northey Street, Windsor.

Appendix B Glossary

Event maximum sound pressure level (LA%,adj,T), L01

The L01 level is calculated as the noise level equalled and exceeded for 1% of the measurement time, for example 9 seconds in any 15 minute interval. L01 is an appropriate level to characterise single events, such as from impulsive or distinctive pass-by noise (example: rail noise). In this Report, the measured L01 levels for day/evening/night are not averaged but are arranged from low to high in the relevant day/evening/night interval and the value that is found at the 90th percentile (L10 of L01 sample) in the interval is recorded as its "L01" level. The level can be adjusted for tonality or impulsiveness.

Average maximum sound pressure level (LA%,adj, T), L10

The "L10" level is an indicator of "steady-state" noise or intrusive noise conditions from traffic, music and other relatively non-impulsive noise sources. The L10 level is calculated as the noise level equalled and exceeded for 10% the measurement time, for example 90 seconds in any 15 minute interval. The measured L10 time-intervals for day/evening/night are arithmetically averaged to present the "average maximum" levels of the environment for day/evening/night. The level can be adjusted for tonality or impulsiveness.

Background sound pressure level (LA90,T), L90

Commonly called the "L90" or "background" level and is an indicator of the quietest times of day, evening or night. The L90 level is calculated as the noise level equalled and exceeded for 90% the measurement time. The measured L90 time-intervals are arithmetically averaged to present the "average background" levels of the environment for day/evening/night. The level is recorded in the absence of any noise under investigation. The level is not adjusted for tonality or impulsiveness.

Equivalent Continuous or time average sound pressure level (LAeq,T), Leq

Commonly called the "Leq" level it is the logarithmic average noise level from all sources far and near. The maximum 1-hour levels within the day/evening/night time intervals are referenced. The level can be adjusted for tonality.

Façade-affected level

A sound level that is measured at a distance of 1.0 metres from a wall or facade. The level is nominally 2.5 dB higher than the free-field level.

Façade-adjusted level

A sound level that is measured more than 3.5 metres from a reflective façade and adjusted to represent a measurement at a façade (example: side of building) at a distance of 1.0 metre. The level is nominally 2.5 dB higher than the free-field level.

Free-field level

A sound level that is measured at a distance of more than 3.5 metres from a wall or facade.