KAREENA PRIVATE HOSPITAL REDEVELOPMENT

NOISE ASSESSMENT

ACOUSTICS AND AIR

REPORT NO. 07079
VERSION B

WILKINSON MURRAY

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PREPARED FOR

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1 INTRODUCTION

This report presents a noise study of the proposed redevelopment of the Kareena Private Hospital at Miranda.

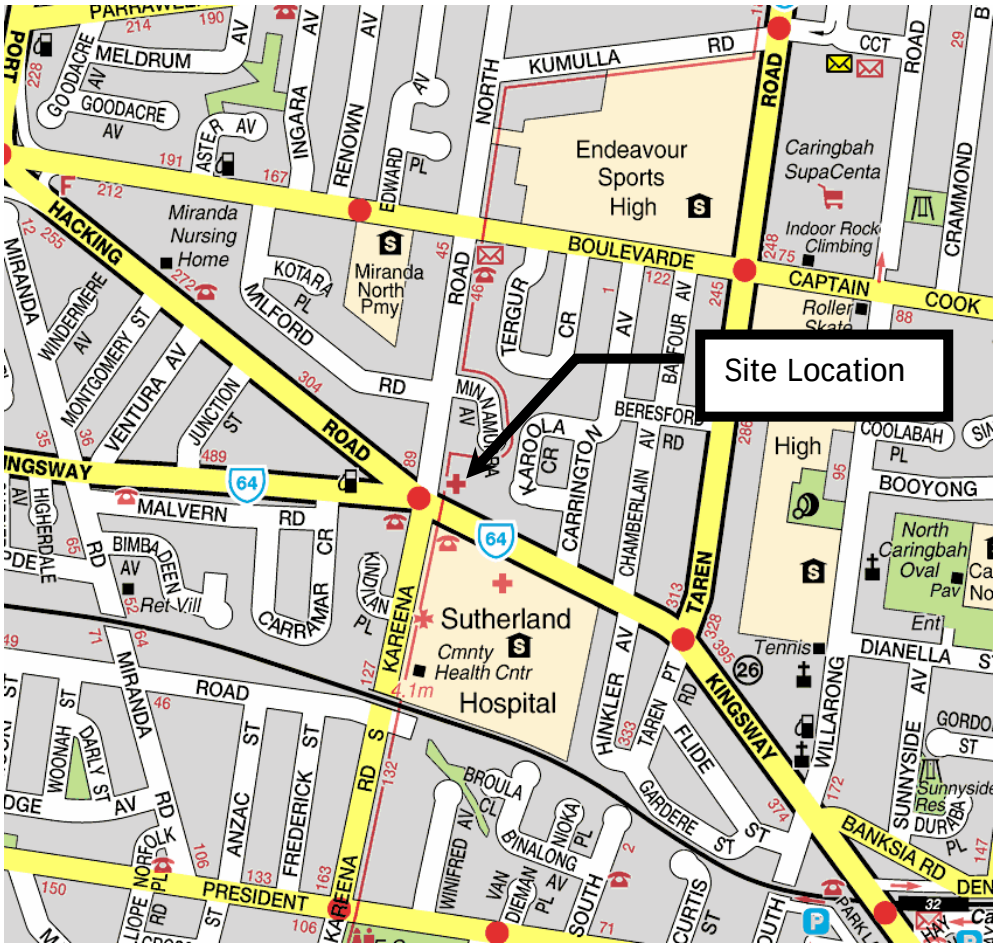
The proposal includes the construction of two additional wards, two operating suites and hydro therapy pool and gymnasium. As part of the proposal the existing car parking capacity will be increased. Most of the carparking will be moved to underground carparking as part of the proposal.

This report assesses the noise impact of the proposal, particularly with respect to the possible increase in traffic generated by the development, and the new mechanical services associated with development.

2 DESCRIPTION OF THE DEVELOPMENT

The site is located at the corner of Kareena Road and Kingsway, Miranda. The site location is shown in Figure 2-1.

Figure 2-1 Location of proposed development



The Kareena Private Hospital is located next to the Kingsway, a busy arterial road. The traffic on Kareena Road itself will be discussed on the section on traffic noise. Across the road from the Kareena Private Hospital is the Southerland Community Hospital.

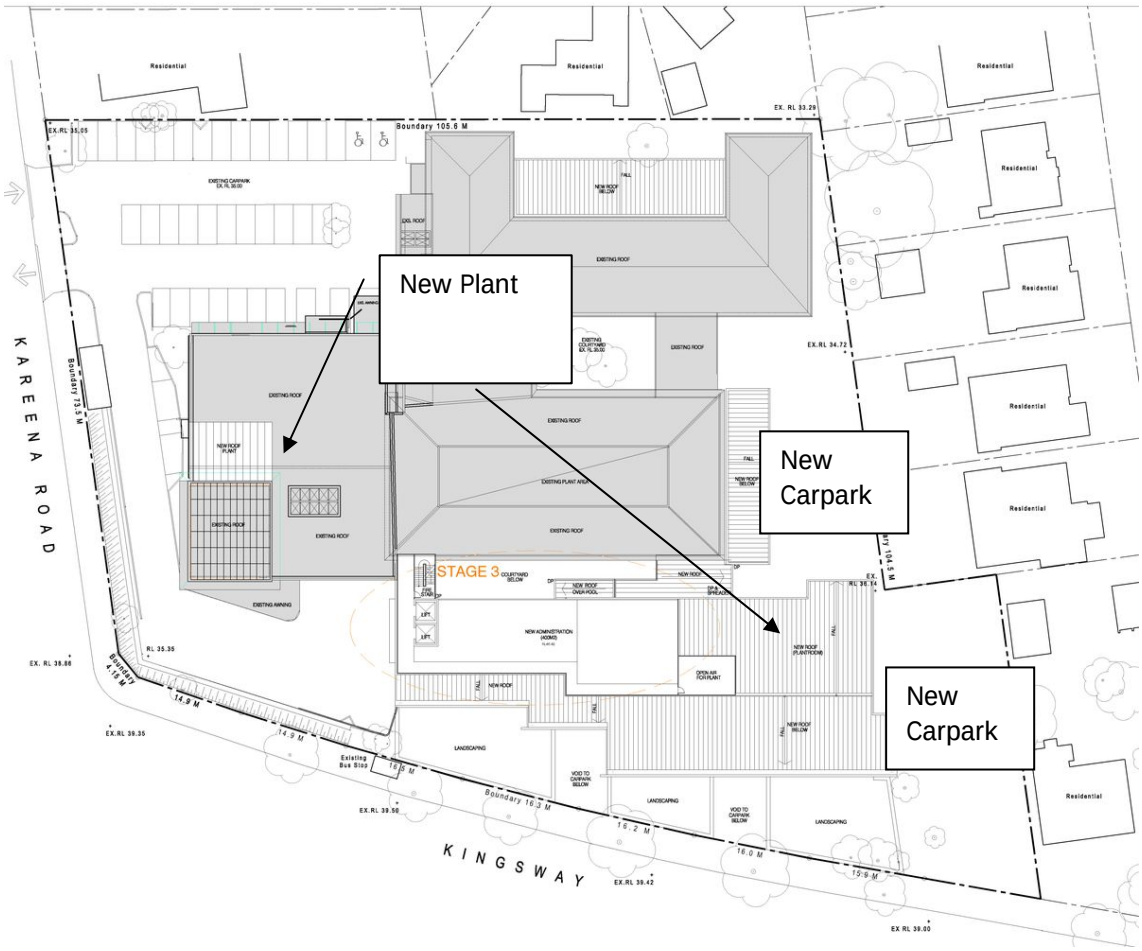
Residential properties near the Kareena Private Hospital are along Kareena Road to the north, adjacent to the hospital to the east along Kingsway, and to the northeast on Karoola Crescent. The location of the residences will be discussed further in the next section on existing noise environment.

As part of the developments there will be two new wards built on the southern part of the site. Two new rooftop plantrooms will be built.

A new underground carpark will be built to replace part of the existing at-grade carpark. Further carparking will be provided to the east of the building: this will be an two open air carparks, approximately 1.5m below grade level.

The location of the new plantrooms and carpark are shown on Figure 2-2.

Figure 2-2 Proposed Second Floor Plan and location of new carpark



2.1 Noise Mitigation

The noise assessment in this report assumes that the eastern boundary beside the new carparks will have an appropriate fence. A 1.8m high fence is assumed. A timber fence, lapped and capped, would be suitable material for the fence.

3 NOISE CRITERIA

3.1 Existing Noise Levels

Noise criteria are related to the existing noise environment in the area surrounding a development. For this project it is required to assess mechanical services and traffic noise, Hence the existing noise environment from traffic noise and other industrial noise sources in the area. The existing background noise was measured from 27 February to 6 March 2007. The measurements were taken in the front garden of the residence at 77 Kareena Road. This is directly opposite the hospital as shown on the overhead photograph of the area on Figure 3-1.

Attended monitoring was also done at the nearest residence on the Kingsway. This was done to determine the existing traffic noise levels at residences on the Kingsway.

Figure 3-1 Location of noise logger

The noise monitoring equipment used for these measurements consisted of an environmental noise loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Appendix A for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period.

Noise criteria for mechanical services are based on the Rating Background Level (RBL – see Appendix A for a description of how this is derived). Noise criteria for traffic noise are based on the existing L_{Aeq} traffic noise in the area.

The measured RBLs at the site are given in Table 3-1. The full charts of the noise measurements are shown in Appendix B of the report.

Noise will be assessed at two other locations to the east of the site. The long-term method of noise monitoring was not done at these locations. The RBLs have been estimated based on the measurements at Kareena Road and the attended monitoring on Kingsway. The estimated levels are less than or equal to the estimated levels given in Australian Standard 1055-2997 *Acoustics – Description and Measurement of Environmental Noise* for areas with medium density transport or some with some commerce or industry. The assessment locations are shown on Figure 3-2.

Table 3-1 Measured and estimated Background Levels

Location No	Noise Level RBL (dBA)		
	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
1 – Kareena Road (measured)	43	42	37
2 – 33 Karoola Cr (estimated)	43	42	37
3 – 439 The Kingsway (estimated)	50	45	40

Figure 3-2 Location of assessment points

3.2 Existing traffic noise levels

The existing daytime L_{Aeq} traffic noise at Kareena Road residences is typically $L_{Aeq,1hr}$ 55dBA. The daytime noise level on the Kingsway in line with a residential façade was typically $L_{Aeq,1hr}$ 68dBA.

3.3 Operational Noise Criteria

Operational Noise refers to the noise from all sources on the site, including mechanical services and the carpark.

Criteria for noise are derived from the DECC's *Industrial Noise Policy (INP)*. The *INP* seeks to appropriately control the noise emission of industrial noise sources through its "intrusiveness" and "amenity" criteria.

The intrusiveness criterion requires that the L_{Aeq} noise emission level over a period of 15-minutes not exceed the RBL by more than 5dBA in any period

The amenity criterion sets an absolute limit on the value of the total L_{Aeq} noise level measured over a day, evening or night period. In this case, the subject receiver locations are in a

suburban area. Consequently, the acceptable level of noise from all industrial noise sources for such receivers is 55, 45 and 40dBA for the daytime, evening and night time periods respectively.

In this case the intrusiveness criterion is below the amenity criterion at all times and there is little or no industrial noise in the area. The intrusiveness criterion will therefore be adopted for operational noise emission. The criteria for different periods are summarised in Table 3-2.

Table 3-2 Noise criteria for operational noise

	Time Period		
	Day (7am-6pm)	**Evening (6pm-10pm)**	**Night (10pm-7am)**
1 – Kareena Road	48	47	42
2 – 33 Karoola Cr	48	47	42
3 – 439 The Kingsway	55	50	45

3.4 Sleep Disturbance Criteria

For noise between 10.00pm and 7.00am it is also necessary to assess the potential impact of sleep arousal from activities at the loading dock. The DECC recommends that the L_{A1} noise level should not exceed the background L_{A90} level by more than 15dBA.

This gives the criteria shown in Table 3-3.

Table 3-3 Sleep Disturbance Criteria

	Criteria, L_{A1} dBA
	Night (10pm-7am)
1 – Kareena Road	52
2 – 33 Karoola Cr	52
3 – 439 The Kingsway	55

4 OPERATIONAL NOISE ASSESSMENT

4.1 Source Noise Levels

The sources of operational noise are mechanical services and the carpark.

4.1.1 Mechanical Services Source Noise Levels

The locations of the proposed new plant are shown on Figure 2-2.

Noise predictions are based on manufacturer's data for the chillers (Trane Type 85180 – sound power level of 90dBA) and a generic carpark exhaust fan with a sound power level of 73dBA. The probable location of the carpark exhaust is at the north east corner of the new building at roof level – that is to the right of the eastern chiller.

Both chillers will be well shielded from residences. The western chiller will have a parapet wall around it to a height of at least 1m above the chiller. The eastern chiller will be enclosed in a roofless plant room. Residences are further shielded from this chiller by the bulk of the building itself.

4.1.2 Carpark Source Noise Levels

While the carparking capacity of the hospital will be increased, most of the cars will now use an underground carpark. Noise from the existing at-grade portion of the carpark will consequently be decreased. As residences will be shielded from the carpark entry by the building itself, no noise impact is predicted from the entry to the underground carpark.

There is a proposed open air carpark at the east of the site. It is expected that most visitors and staff would use the underground carpark, which would not have significant noise emissions. At night the hospital would not be easily accessed from the external carpark. Staff would enter the hospital using the lifts in the underground carpark.

Hence it is expected that the open air carpark would be used during the daytime, and only when the underground carpark is full. Night time noise emission from the external carpark is therefore expected to be minimal. (We are considering here only the $L_{Aeq,15\ min}$ noise level to compare it to the INP intrusiveness criterion. The possibility of sleep disturbance from occasional short – term noises is considered in Section 4.3.) There would also be some noise emission from the entrance between the underground carpark and the new external carpark.

From the traffic report of TEF Consulting it is estimated that the parking demand at the hospital would be at most 155 vehicles per hour daytime, and 80 vehicles per hour night time, and that the proposal would generate an estimated 25-35 trips per hour at the busiest times. To predict noise emission it was estimated that the number of movements in the carpark would be approximately 80 per hour in the daytime, and 40 per hour at night time.

Most of these movements would be accommodated in the underground carpark. For assessment purposes it is assumed that there would be at most 5 vehicles per 15 minute period in the new external carpark during daytime and evening hours. For night time it is assumed that there would be no movement in the external carpark.

Section 4.1.5 of the draft Traffic Report by Arup (October 2008) states that:

> "Car park activity within the hospital site peaks at approximately 3pm, during the afternoon staff handover. In the early evening up to 8pm, visitor demand peaks, and then drops away by around 10pm. Any vehicles arriving after 10pm will be able to find parking in the western and southern portions of the site. This will mean that the eastern region of the site adjacent to the residential properties will not need to be utilised until after 7am the next day."

Discussions with administrative staff at Kareena Private Hospital further indicated that use of the eastern external carparks would be used during night time hours. There would be no pedestrian access to the hospital from those carparks (that is without reentering the underground carpark).

To predict noise level from the carpark we need the source noise level of a typical car movement. The $L_{Aeq,15min}$ source noise level associated with carpark activity is assumed to be 48dBA at 7m per car. This includes noise from car doors closing, car starting and cars accelerating, and is based on Wilkinson Murray measurements in similar carparks.

4.2 Predicted Noise Levels and Assessment

Table 4-1 shows the predicted noise levels during daytime and evening. It is assumed that chillers were operating at full capacity and the carpark fan was operational.

The total noise is the sum of noise from mechanical services and carpark noise. As location 3 is a two storey house, noise levels for night time were calculated to the upper floor. Noise from the carpark would not be shielded to the upper floor of that house. Carpark noise is a summation of noise from the external and internal carparks. Because there is an exit ramp from the internal carpark near the eastern boundary, noise can break out of that opening.

The noise is predicted to comply with the criteria at all times.

Table 4-1 Predicted Noise Daytime and Evening

Assessment Location	**Worst case - Noise from mechanical services,** $L_{Aeq,15min}$ dBA	**Carpark Noise, Daytime and Evening,** $L_{Aeq,15min}$ dBA[1]	**Total Noise Level,** $L_{Aeq,15min}$ dBA	**Evening Criteria,** $L_{Aeq,15min}$ dBA	**Compliance**
1 – Kareena Road	35	-	35	47	Yes
2 – 33 Karoola Cr	37	43	44	47	Yes
3 – 439 The Kingsway[2]	37	41	43	50	Yes

Note 1: 3 cars per 15 minutes external, 20 cars per 15 minutes inside carpark
Note 2: Calculated to ground floor

Table 4-2 Predicted Noise Night time

Assessment Location	Worst case - Noise from mechanical services, $L_{Aeq,15min}$ dBA	Carpark Noise, Daytime and Evening, $L_{Aeq,15min}$ dBA[1]	Total Noise Level, $L_{Aeq,15min}$ dBA	Night time Criteria, $L_{Aeq,15min}$ dBA	Compliance
1 – Kareena Road	35	-	35	42	Yes
2 – 33 Karoola Cr	37	40	42	42	Yes
3 – 439 The Kingsway[2]	37	39	41	45	Yes

Note 1: 10 cars per 15 minutes inside carpark
Note 2: Calculated to upper floor

4.3 Sleep disturbance Assessment

The predicted L_{A1} noise levels from the internal air carparks are given in Table 4-3. As discussed it is unlikely that the external carparks would be used during night time hours. It is recommended that signage be installed at appropriate locations in the carpark ask visitors and staff not to park in those sections after 10.00pm.

Table 4-3 L_{A1} Noise from Internal Carparks

	Predicted Level, L_{A1} dBA	Criteria, L_{A1} dBA
1 – Kareena Road	-	-
2 – 33 Karoola Cr	45-50	52
3 – 439 The Kingsway	40-45	55

While the noise levels exceed the criteria it is noted that visitors and staff are unlikely to use this carpark during night time hours. Also, the levels at Location 3 are below those already experienced at those locations due to traffic on The Kingsway. The L_{A1} measured at the façade of that location was 76dBA.

Further, a discussion in the NSW DECC's *Environmental Criteria for Road Traffic Noise (ECRTN)* concludes that one or two events of 65dBA would not be likely to cause awakening reactions.

5 TRAFFIC NOISE ASSESSMENT

An assessment of potential traffic impacts has been prepared by Arup dated October 2008. The report states that the new development has the potential to increase two way traffic movements in the area by at approximately 25 vehicles per hour in its peak hours.

5.1 Noise criteria for traffic

Traffic noise criteria are based on recommendations of the NSW RTA *Environmental Criteria for Road Traffic Noise (ECRTN)*. They are different for Kareena Road and Kingsway.

For land use developments with potential to create additional traffic on collector roads (such as Kareena Road) the criteria are measured over a 1 hour period. For arterial roads such as Kingsway they are measured over an entire day or night time period. The criteria are summarised in Table 5-1. If existing noise levels are above the criteria, it is not reasonable and feasible to reduce traffic noise, the ECRTN states that in all cases the development should not increase traffic noise levels by more than 2dBA.

Table 5-1 Traffic Noise criteria

Location	Time Period	
	Day (7am-10pm)	Night (10pm-7am)
Kareena Road - L_{Aeq}, 1hour	60	55
Kingsway, $L_{Aeq,period}$	60	55

5.2 Traffic noise on Kareena Road

The traffic report from TEF Consulting (February 2007) found that the typical flow on Kareena Road is a maximum of 300 vehicles per hour in both directions. Both that and the more recent Arup traffic report state that the development has the potential to increase traffic movements in the area by 25 vehicles per hour in the hospital peak hours.

If it is assumed that, say, 10 vehicles of this join Kareena Road (as opposed to the Kingsway) then the flow on Kareena Road would increases from 300 vehicles per hour to 310 vehicles per hour. This is an insignificant increase and would cause negligible noise impact, increasing the traffic noise on Kareena Road by less than 0.5dBA. As the traffic noise on Kareena Road is currently below the noise criteria of the ECRTN then no noise impact is expected from Kareena Road.

It is noted that the quoted 300 vehicles per hour is a maximum expected flow during school finishing hours. If a reduced flow of 100 vehicles per hour was assumed during the rest of the day, the extra 10 vehicles per hour would increase the noise levels by only 0.4dBA. This too is a negligible increase and would cause no noise impact.

4-1 Traffic Noise on The Kingsway

The average annual daily traffic (AADT) flow on The Kingsway was published by the RTA in 2002. The AADT for Kingsway is approximately 25,000 vehicles per day. Although hourly traffic flow data was not given in the publication, it estimated from this that the typical traffic flows on Kingsway would be 1,000 - 2,000 vehicles per hour during the daytime and 100 – 200 vehicles per hour during night time periods. The addition of the extra traffic from the development would increase the traffic flow on Kings Way by at most 30 vehicles per hour at the busiest time. This is an insignificant increase in traffic and would result in an increased noise of less than 0.2dBA during the daytime or 0.4 dBA if it occurred at quietest period of night which is unlikely. Hence, although the existing traffic noise on Kingsway is above the noise criteria at the residences near the Kareena Private Hospital, the extra traffic from the proposal would result in negligible noise impact and is considered acceptable.

6 CONCLUSION

Noise emissions from the proposed redevelopment of the Kareena Private Hospital have been assessed.

The development will increase traffic on the local roads by at most 35 vehicles per hour. This results in a negligible increase in noise. On Kareena Road noise will be increased by less than 0.5dBA in the busiest hour.

While traffic noise on the Kingsway is already above the noise criteria, the addition of these few vehicles from the hospital redevelopment will result in negligible noise increase and no noise impact is predicted.

A fence 1.8m high is recommended for the eastern boundary beside the new carparks. A timber fence, lapped and capped, would be suitable. Signage to request visitors and staff to not park outside after 10.00pm is recommended.

Noise from the new underground and open air carparks is predicted to comply with the criteria of the INP. There may be some exceedances of the sleep disturbance criterion if the external carpark is used during night time hours. However, it was discussed visitors and staff are unlikely to use this carpark at night.

Noise from new mechanical services has been assessed. Because the new rooftop chillers will be well shielded from residences, noise emissions will be below the criteria even if the chillers work at full capacity during night time. The noise predictions included noise from the new carpark exhaust fan. No noise impact is predicted from mechanical services.

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2000 “Quality Management Systems – Requirements”. This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Final	16 March 2007	George Jenner	Roman Haverkamp
B	Draft	29 October 2008	George Jenner	Roman Haverkamp
B	Final	19 November 2008	George Jenner	Roman Haverkamp

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

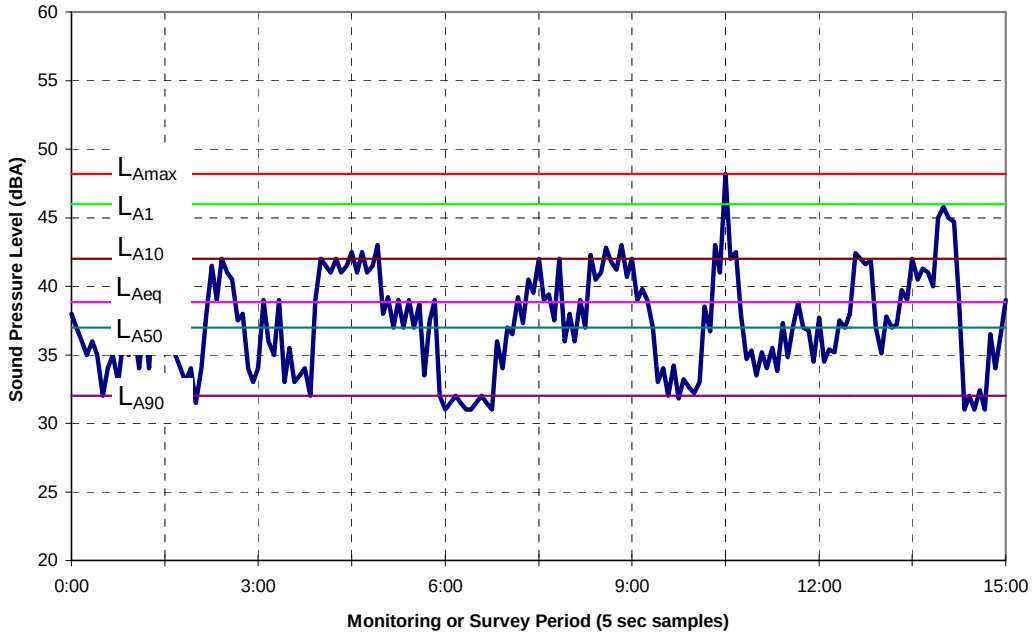
L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period **–** daytime, evening and night time.


60
55
50
45
40
35
30
25
20
Sound Pressure Level (dBA)
LAmax
LA1
LA10
LAeq
LA50
LA90
0:00
3:00
6:00
9:00
12:00
15:00
Monitoring or Survey Period (5 sec samples)

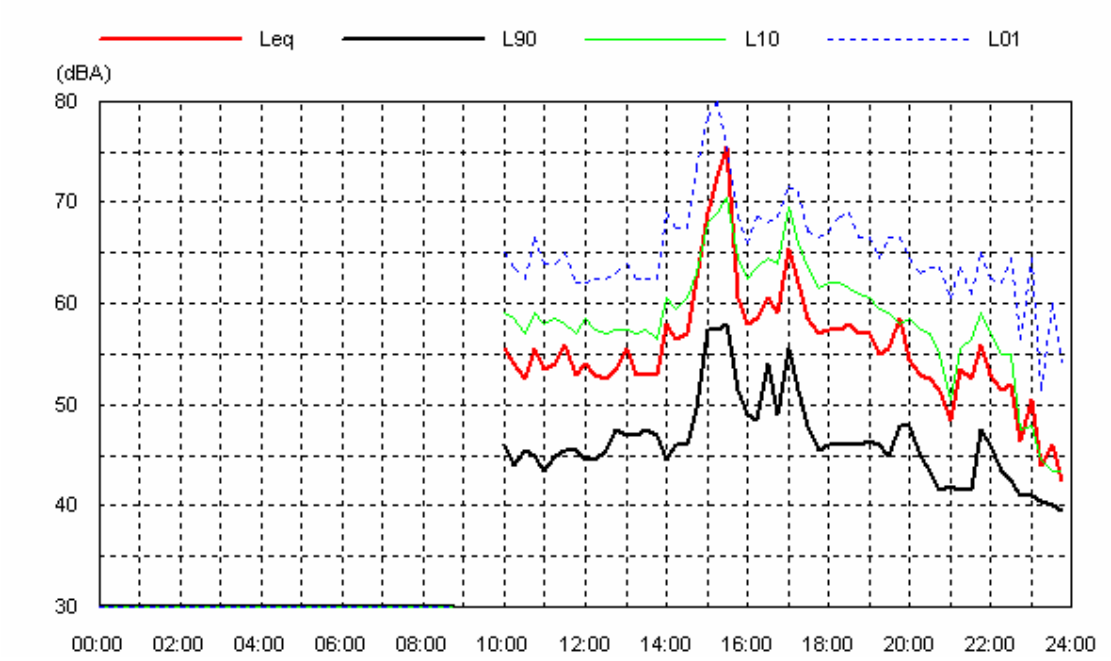
APPENDIX B

NOISE MEASUREMENT RESULTS

Location: 77 Kareena Road

Mon 27 Feb 06

Tue 28 Feb 06



Location: 77 Kareena Road

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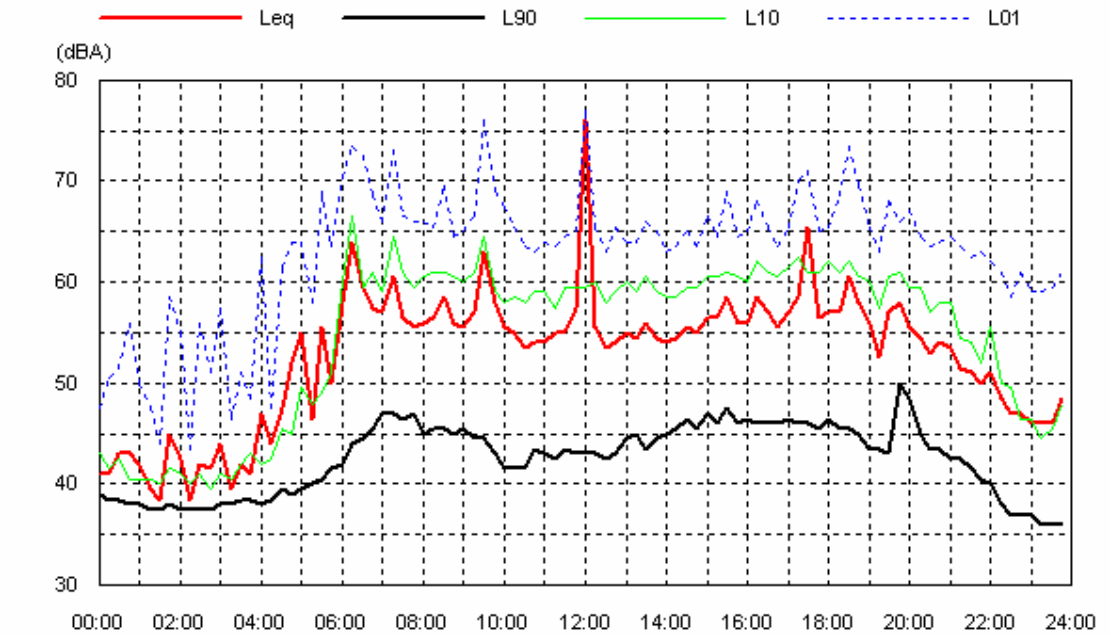
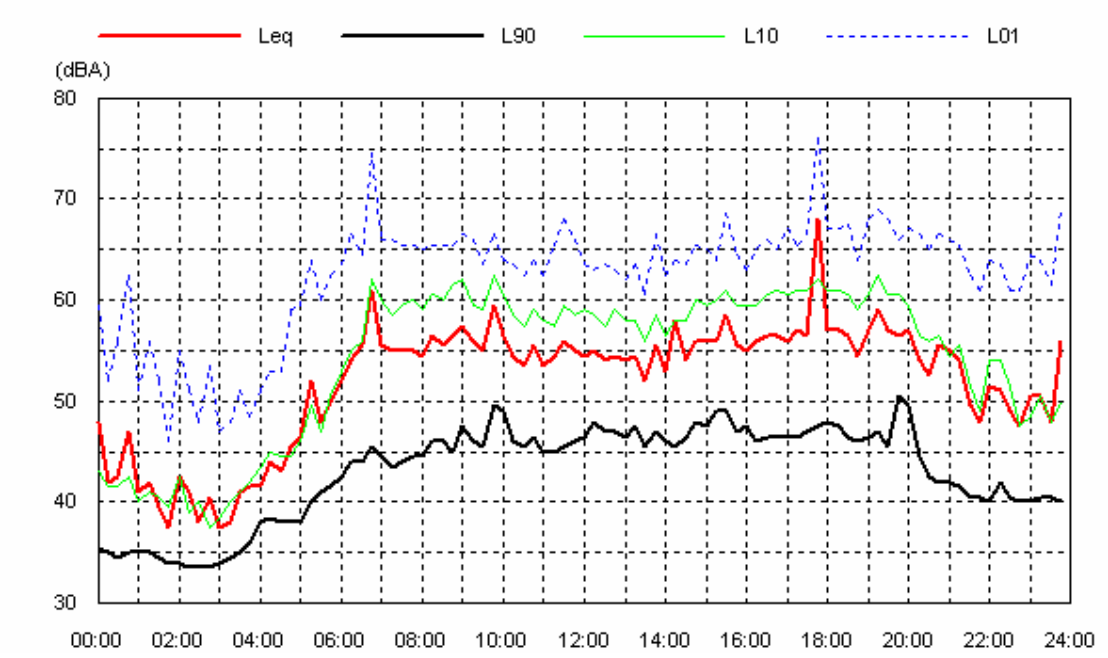
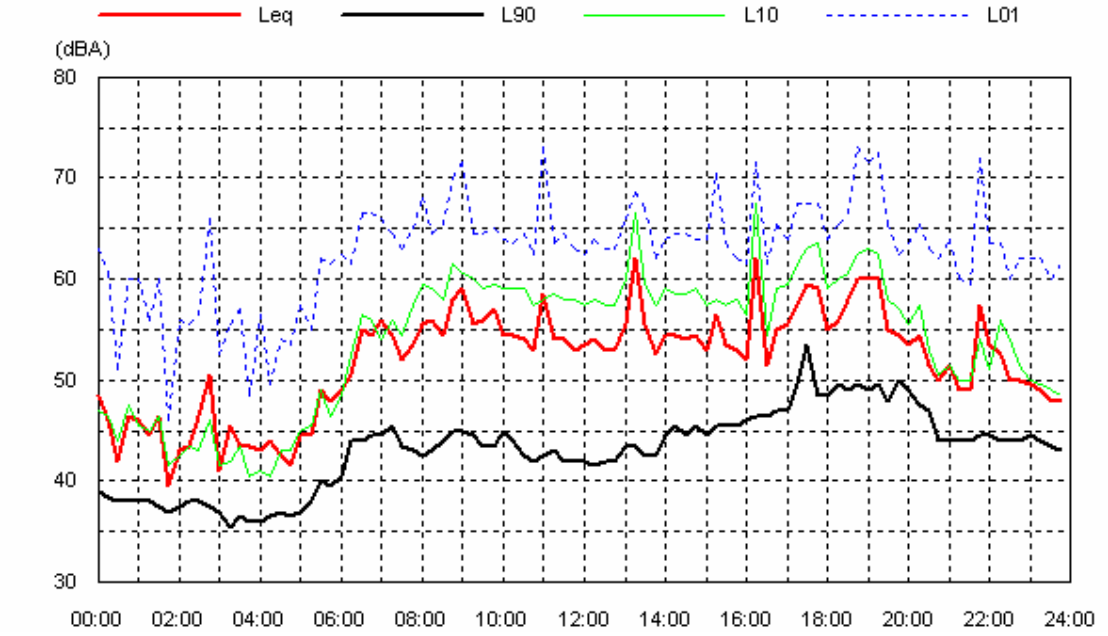


Thu 02 Mar 06

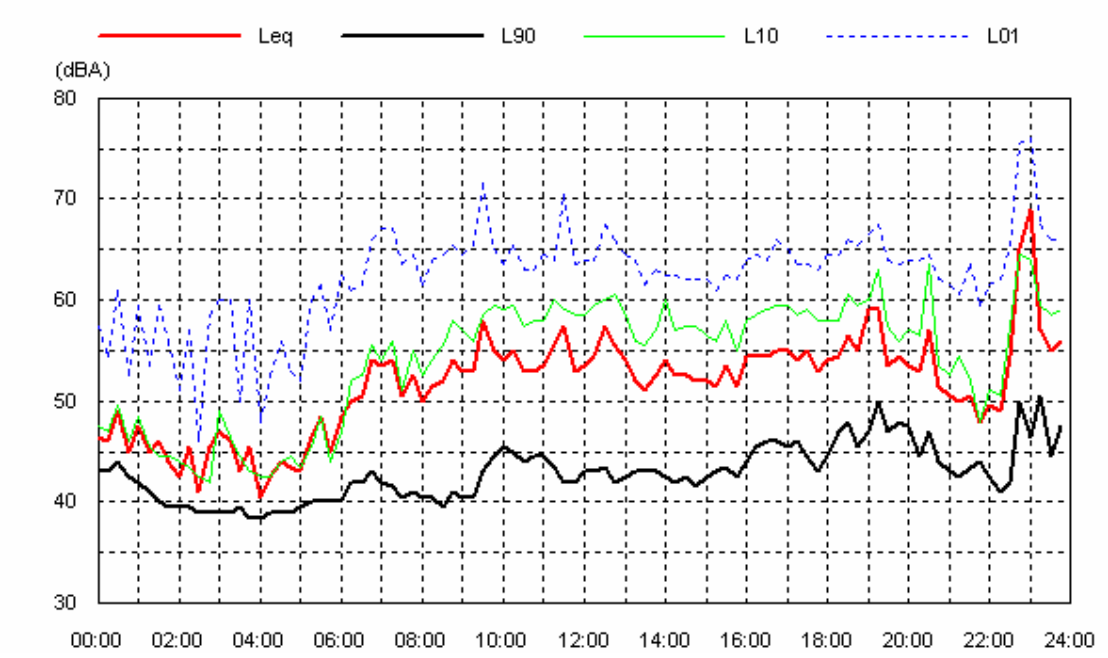


Location: 77 Kareena Road

Fri 03 Mar 06

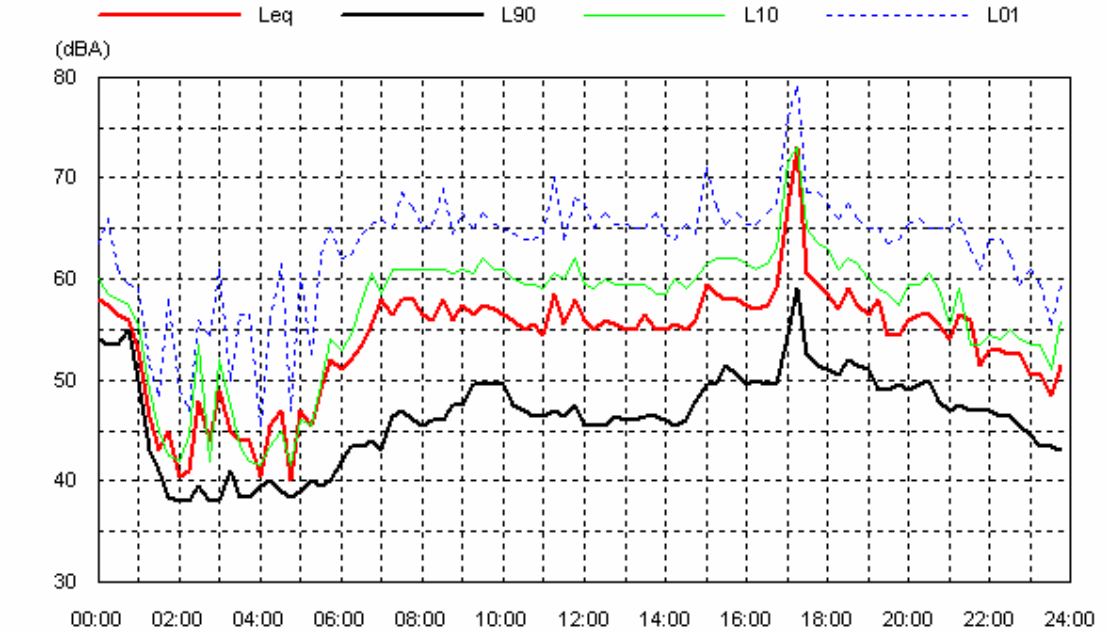


Sat 04 Mar 06

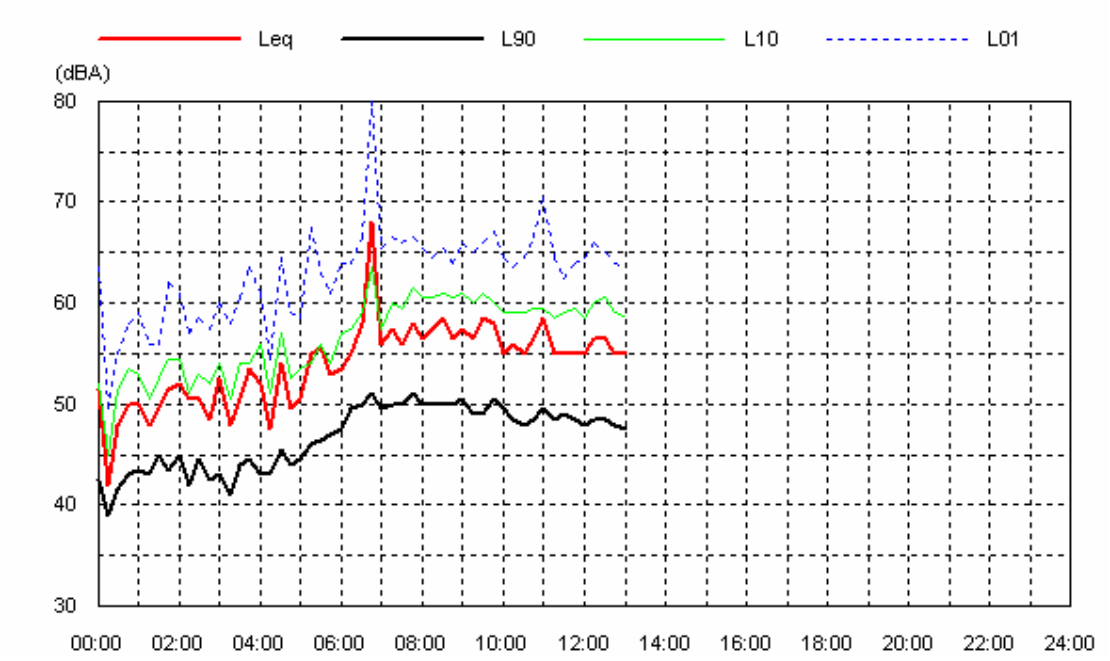


Location: 77 Kareena Road

Sun 05 Mar 06



Mon 06 Mar 06


Leq
L90
L10
L01
(dBA)
80
70
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50
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