

**Barber Avenue, Kingswood**

**Acoustic Assessment**

**DOCUMENT CONTROL REGISTER**

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<b>Attention To</b>	Aesthete No.3 Pty Ltd Mr. Farshad Amirbeaggi
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## 1 INTRODUCTION

This report presents our acoustic assessment in order to satisfy Director General's Requirement 8; regarding noise and vibration at Barber Avenue, Kingswood.

The report assesses the acoustic impacts, specifically we will:

- Conduct an external noise and vibration impact assessment (rail and traffic) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future tenants.
- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Director General acoustic requirements to ensure that nearby developments are not adversely impacted.

## 2 SITE DESCRIPTION

The proposed development is located at Barber Avenue, Kingswood.

The development includes 3 separate buildings in two stages. Stage 1 consists of an 8 storey retail and commercial building and an 8 storey mixed retail and residential building. The second stage consists of a 12 storey building with retail on the lower ground and ground levels and residential on the levels 1-11.

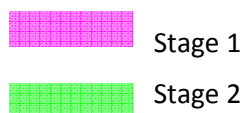
The site is bounded to the north by the Great Western Highway and to the west by Parker Street; both carry high volumes of traffic. Across the Great Western Highway is the Western Railway line which carries suburban and freight trains.

Located to the south east of the development site is the Nepean Private Hospital.

A detailed site map of the development site and measurement locations is shown in Figure 1 below.



**Figure 1 Site Map and Measurements Location**



### 3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

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 interval.

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 will depend 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 traffic noise.

Current practice favours the  $L_{eq}$  parameter as a means of measuring traffic noise, whereas the  $L_{10}$  parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the  $L_{90}$  parameter is not used to assess traffic noise intrusion.

## 4 NOISE INTRUSION ASSESSMENT

The major noise sources affecting the amenity of the residents and tenants at the proposed development at Barber Street Kingswood are as follows:

- Traffic noise from the Great Western Highway and Parker Street
- Train noise from the western railway line across the Great Western Highway

### 4.1 NOISE INTRUSION CRITERIA

This section of the report presents the assessment criteria for air borne and structure borne vibration into the proposed development.

#### 4.1.1 Residential Development

The noise intrusion into the residential sections of the development is assessed in accordance with the Penrith City Council DCP and the NSW Government Department of Planning Criteria for Developments near Rail Corridors and Busy Roads.

##### 4.1.1.1 Penrith Council Criteria

The Penrith city council DCP states:

I. The amenity of residential development is influenced substantially by privacy. Privacy is affected by:

- a) External sources of noise such as major roads and railways; and
- b) Within residential developments: rooms and areas that are sources of noise and overlooking;  
and
- c) Rooms within dwellings that tend to be sensitive to noise and overlooking;
- d) Orientation and screening of windows;
- e) Internal zoning of dwellings

II. Recommended night-time internal noise levels in living and sleeping areas is 35-40 dB(A)

##### 4.1.1.2 NSW Government Department of Planning Criteria

The Development Near Rail Corridors and Busy Roads – Interim Guideline states the following:

**\*For Clauses 87 (Rail) and 102 (Road):**

If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- in any bedroom in the building : 35dB(A) at any time 10pm–7am
- anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.



#### 4.1.2 Commercial and Retail

The noise intrusion into the commercial and retail areas of the development is assessed based on the internal noise requirements of AS2107:2000 and are summarised in Section 3.1.3.

#### 4.1.3 Summary of Traffic and Train Noise Airborne Criteria

The noise criteria for the subject development for road and rail noise are specified in the table below. The criterion has been adopted from the Penrith City Council, SEPP and AS2107:2000 requirements.

**Table 1 - Internal Noise Criteria**

TYPE OF OCCUPANCY	APPLICABLE TIME PERIOD	NOISE LEVEL $L_{Aeq}$ dB(A)*
Sleeping Areas (bedroom)	Night (10pm-7am)	35
Other Habitable Rooms (excl. garages, kitchens, bathrooms and hallways)	Day (7am-10pm)	40
Retail	At any time	50
Commercial (General Office Areas)	At any time	45

\*Internal Noise Level Criteria based on the time period as follows; Bedroom-Night time  $L_{eq}$ (9 hour) and Living Areas- Day time  $L_{eq}$ (15 hour)

If internal noise levels with windows or doors open exceed the criteria by more than 10 dB(A), the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also provide an alternative outside air source or air conditioning in compliance with the relevant mechanical and ventilation codes.

#### 4.1.4 Structure Borne Noise

Generally, ground borne noise is associated more closely with rail operations than roads. Where buildings are constructed over or adjacent to land over tunnels, ground borne noise may be present without the normal masking effect of airborne noise.

The NSW Government Department of Planning, Development Near Rail Corridors and Busy Roads – Interim Guideline states the following:

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

As the proposed development site is not located on or adjacent to land over a rail tunnel the structure borne noise will not need to be assessed.

## 4.2 NOISE MEASUREMENTS

Attended and unattended noise measurements were undertaken on site to measure the train and traffic noise levels and the background noise levels.

### 4.2.1 Attended Noise Monitoring

Attended monitoring was conducted at two locations on the proposed site. The first location was on the boundary of the Great Western Highway and the second was on the boundary of Parker Street. Both measurement positions are detailed in figure 1 of this report.

The attended measurements were carried out on 6<sup>th</sup> August 2010.

Measurements were taken using a Norsonic-140 precision sound level analyser, set to A-weighted slow response. The sound level meter was calibrated before and after the measurements using a RION NC73 precision sound calibrator and no significant drift was recorded.

### 4.2.2 Unattended Monitoring

Unattended monitoring was also conducted at the site on the Great Western Highway boundary.

The monitoring period was from Tuesday 27<sup>th</sup> July till Friday 6<sup>th</sup> August 2010, using an Acoustic Research Laboratories Pty Ltd noise monitor. The monitor was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of the measurements using a Rion NC-73 calibrator, no significant drift was detected. Measurements were taken on an A-weighted fast response mode.

### 4.2.3 Measured Noise Levels

The noise levels from attended and unattended monitoring are presented below. Monitor results are also presented in Appendix 1.

**Table 2 – Attended and Unattended Traffic Noise Monitoring Data**

LOCATION	TIME OF DAY	CALCULATED NOISE LEVEL $L_{Aeq}$ dB(A)*
Great Western Highway (approx 8m from curb)	Day (7am-10pm)	67
	Night (10pm-7am)	63
Parker Street (approx 5m from curb)	Day (7am-10pm)	65
	Night(10pm-7am)	62

\*Noise Level Measurements based on the time period as follows; Night time  $L_{eq}$ (9 hour) and Day time  $L_{eq}$ (15 hour)

### **4.3 EVALUATION OF NOISE INTRUSION**

For the proposed development, internal noise levels will primarily be as a result of noise transfer through the windows and doors, as these are relatively light building elements that offer less resistance to the transmission of sound. The walls and roof are of masonry construction and will not require upgrading.

The predicted noise levels through the windows, doors, walls and roof are discussed below. The predicted noise levels have been based on the expected level and spectral characteristics of the external noise, the area of building elements exposed to train and traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

Calculations were performed taking into account the orientation of windows, barrier effects (where applicable), the total area of glazing, facade transmission loss and the likely room sound absorption characteristics. In this way the likely interior noise levels can be predicted.

In all cases, the selected glazing type detailed in section 3.4.1 reduces internal noise levels to within the nominated criteria for the various space types.

### **4.4 RECOMMENDED CONSTRUCTIONS**

These constructions are recommended to comply with the noise and vibration objectives stated in the sections above.

#### **4.4.1 Glazed Windows and Doors**

Table 3 lists the recommended glazing for this project to achieve the requirements regarding train noise intrusion. In all cases, the selected glazing type reduces internal noise levels to within the nominated criterion for the various space types.

The proposed glazing thickness will satisfy all acoustic requirements of the criteria detailed in this report. Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than scheduled, this will also be acoustically acceptable.

It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

**Table 3 – Recommended Glazing for Windows and Doors**

Building	FAÇADE	ROOM	GLAZING THICKNESS	ACOUSTIC SEALS
A	Northern (facing Great Western Highway)	Retail	6.38mm laminated	Yes
		Commercial	10.38mm laminated	Yes
	Eastern and Western	Retail and Commercial	6.38mm laminated	Yes
	Southern	Retail and Commercial	6mm float/toughened	Yes
B	North/East/West	Bedrooms	6.38mm laminated	Yes
	All other rooms	All other rooms	6mm float / toughened	Yes
Stage 02	Northern (facing Great Western Highway)	Bedroom	10.38mm laminated	Yes
		Living Areas and Retail	6.38mm laminated	Yes
	Eastern (facing Parker Street)	Bedroom – North of gridline B	10.38mm laminated	Yes
		Bedroom – South of gridline B	6.38mm laminated	Yes
		Living Areas and Retail	6mm float / toughened	Yes
	Western and Southern	Bedroom – North of gridline B	10.38mm laminated	Yes
		Bedroom – South of gridline B	6.38mm laminated	Yes
		Living Areas and Retail	6mm float / toughened	Yes
	Southern	All	6mm float / toughened	Yes

In addition to complying with the minimum scheduled glazing thickness, the STC rating of the glazing fitted into openable frames and fixed into the building opening should not be lower than the values listed in Table 4 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of openable frames and the frame will need to be sealed into the building opening using a flexible sealant. Note that all these windows are assumed as aluminium openable windows and mohair seals in windows and doors are not acceptable where acoustic seals are required. Acoustic seals shall be equal to Schlegel Q-Ion series.

**Table 4 – Minimum STC of Glazing**

GLAZING ASSEMBLY	ACOUSTIC SEALS	MINIMUM STC OF INSTALLED WINDOW
6mm float / toughened	Yes	29
6.38mm laminated	Yes	31
10.38mm laminated	Yes	35

#### **4.4.2 Roof**

The proposed concrete construction for the roof will be acoustically acceptable without further upgrades.

#### **4.4.3 Walls**

The external walls are constructed of masonry and will be acoustically acceptable without further upgrades.

### **5 RAILWAY VIBRATION ASSESSMENT**

Trains induce ground borne vibration that is transmitted through the subsoil. This vibration can be perceptible close to railways.

#### **5.1 TACTILE VIBRATION CRITERIA**

As the site is located within 60m of the railway tunnels, a vibration assessment is recommended by the Rail Infrastructure Corporation “Interim Guidelines for Councils - Consideration of rail noise and vibration in the planning process”. This Guideline recommends that habitable rooms of serviced apartments and office spaces of commercial buildings should comply with the criteria in British Standard BS 6472:1992 “Evaluation of Human Exposure to Vibration in Buildings (1Hz to 80Hz)” as this standard includes guidance for the assessment of human response to building vibration including intermittent vibrations such as that caused by trains.

Human response to vibration has been shown to be biased at particular frequencies which are related to the orientation of the person. This standard provides curves of equal annoyance for various orientations. These curves are applied as correction filters such that an overall weighted acceleration level is obtained. As the orientation of the resident is unknown or varying the weighting filter used is based on the combined base curve as given in ISO 2631 & Australian Standard 2670 “Evaluation of Human Exposure to Vibration and Shock in Buildings (1 to 80Hz)”.

The standard assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the “Daytime” (7am-10pm) and “Night time” (10pm-7am). The overall value is then compared to the levels in Table 5. For this project the aim will be for a low probability of adverse comment.

**Table 5 – Vibration Dose Values ( $\text{m/s}^{1.75}$ ) above which various degrees of adverse comment may be expected in residential buildings**

PLACE	LOW PROBABILITY OF ADVERSE COMMENT	ADVERSE COMMENT POSSIBLE	ADVERSE COMMENT PROBABLE
Residential Buildings 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential Buildings 8hr night	0.13	0.26	0.51

## 5.2 RAIL VIBRATION MEASUREMENTS

The train vibration measurements were obtained at the development site boundary facing the Great Western Highway, as detailed in figure 1.

The attended measurements were carried out on Friday 6<sup>th</sup> August 2010.

A Svan958 four-channel sound and vibration meter and analyser fitted with a Dytran triaxial accelerometer was used for the vibration measurements.

### 5.2.1 Measured Vibration Levels

The maximum train pass-by ground vibration acceleration, the typical pass-by period (gained from both the noise and vibration measurements) and the estimated number of train pass-bys were used calculate the overall VDV values for each period of the day as detailed in the British and Australian Standards. The results are presented in Table 6.

**Table 6 – Vibration Dose Values**

TIME PERIOD	CALCULATED VDV $\text{m/s}^{1.75}$	CRITERIA VDV $\text{m/s}^{1.75}$	COMPLIES
Day (7am-10pm)	< 0.05	0.2	Yes
Night (10pm-7am)	< 0.05	0.13	Yes

## 5.3 EVALUATION OF RAILWAY VIBRATION

The result of the tactile vibration investigation indicates that internal levels of human comfort will comply with the relevant criteria without any additional acoustic treatments.

## **6 NOISE EMISSION ASSESSMENT**

Noise emissions goals for the site will be developed to ensure that the amenity of nearby land users (both new occupants in the development and residents in nearby properties) is not adversely affected.

The nearest affected properties are the residential properties to the west of the development across Parker Street and the Nepean Hospital to the south east of the site.

Criteria for the following noise sources will be calculated:

- Mechanical plant noise
- Noise from the loading dock

### **6.1 BACKGROUND NOISE MONITORING**

Unattended monitoring was conducted at the site on the Great Western Highway boundary.

The monitoring period was from Tuesday 27<sup>th</sup> July till Friday 6<sup>th</sup> August 2010, using an Acoustic Research Laboratories Pty Ltd noise monitor. The monitor was programmed to store 15-minute statistical noise levels throughout the monitoring period. The equipment was calibrated at the beginning and the end of the measurements using a Rion NC-73 calibrator, no significant drift was detected. Measurements were taken on an A-weighted fast response mode.

The measured background levels are shown in Section 6.2.1, Table 7 below.

### **6.2 ACOUSTIC OBJECTIVES**

As there are no specific noise emission guidelines in the Penrith City Council DCP the criteria will be obtained from the DECCW Industrial Noise Policy.

The Industrial Noise Policy provides guidelines for assessing noise impacts from industrial developments. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion.

### 6.2.1 Intrusiveness Criteria

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.

Table 7 below provides the measured background noise levels and the resulting intrusiveness criteria. 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 7 – Intrusiveness Criteria Acceptable Levels**

TIME OF DAY	MEASURED BACKGROUND LEVELS – dB(A) $L_{90}$	RECOMMENDED ACCEPTABLE NOISE LEVEL - dB(A) $L_{eq(15min)}$ BACKGROUND + 5dB(A)
Day (7am-6pm)	56	61
Evening (6pm-10pm)	51	56
Night (10pm-7am)	38	43

### 6.2.2 Amenity Criterion

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

The 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 8 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 8 – Industrial Noise Policy Recommended Acceptable Noise Levels**

TYPE OF RECEIVER	TIME OF DAY	RECOMMENDED ACCEPTABLE NOISE LEVEL dB(A) $L_{eq}$
Residential (Suburban)	Day	55
	Evening	45
	Night	40
Hospital		
- Internal	Noisiest 1-hour period	35
- External	Noisiest 1-hour period	50

## 6.3 RECOMMENDATIONS

### 6.3.1 Mechanical Plant

Mechanical plant items are not typically selected at selected at DA stage.

Detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Acoustic treatments should be determined in order to control plant noise emissions to the levels set out in section 6.1 of this report.

All plant can be satisfactorily attenuated to levels complying with noise emission criteria through appropriate location and (if necessary) standard acoustic treatments such as noise screens, enclosures, in-duct treatments (silencers/lined ducting) or similar.

### 6.3.2 Loading Dock

We note that the loading dock will be accessed via a driveway from Barber Avenue. It is proposed that the loading dock will be used only during business hours (between 7am and 10pm) and will not adversely impact nearby developments (Building C, and the Nepean Private Hospital).

## **7 DEMOLITION AND CONSTRUCTION NOISE**

With any major construction site there will be noise associated with demolition and construction. The management of impacts arising from these activities is now routine practice, both to address impacts to surrounding properties, and for commercial reasons, to limit impacts on nearby tenancies.

The requirement for a noise management plan to be developed prior to works commencing is not uncommon and may be considered in this case for inclusion into the consent conditions.

If required this is typically done at Construction Certificate Stage once a construction programme and methodology has been determined.

Adequate control of construction noise can be achieved through the development of a Demolition and Construction Noise Management Plan which may be required to be undertaken prior to works commencing.

## 8 CONCLUSION

This report provides the results of our acoustic assessment for the proposed development located at Barber Avenue, Kingswood. Noise at the site has been measured and noise goals have been set in accordance with the Director Generals Requirements.

Assessment of noise emissions has been conducted with reference to the Penrith City Council and DECCW acoustic requirement. Provided recommendations set out in section 6.2 are adopted, noise impacts on nearby properties will be acceptable.

Railway vibration and train and traffic noise intrusion into the proposed mixed use development has been assessed. The assessment has been conducted in accordance with the requirements of NSW Government Department of Planning "Development Near Rail Corridors and Busy Roads"- Interim Guideline and The Australian Standard AS2107 and council requirements.

Provided noise intrusion recommendations in section 4.4 are adopted external noise impacts will be satisfactory.

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

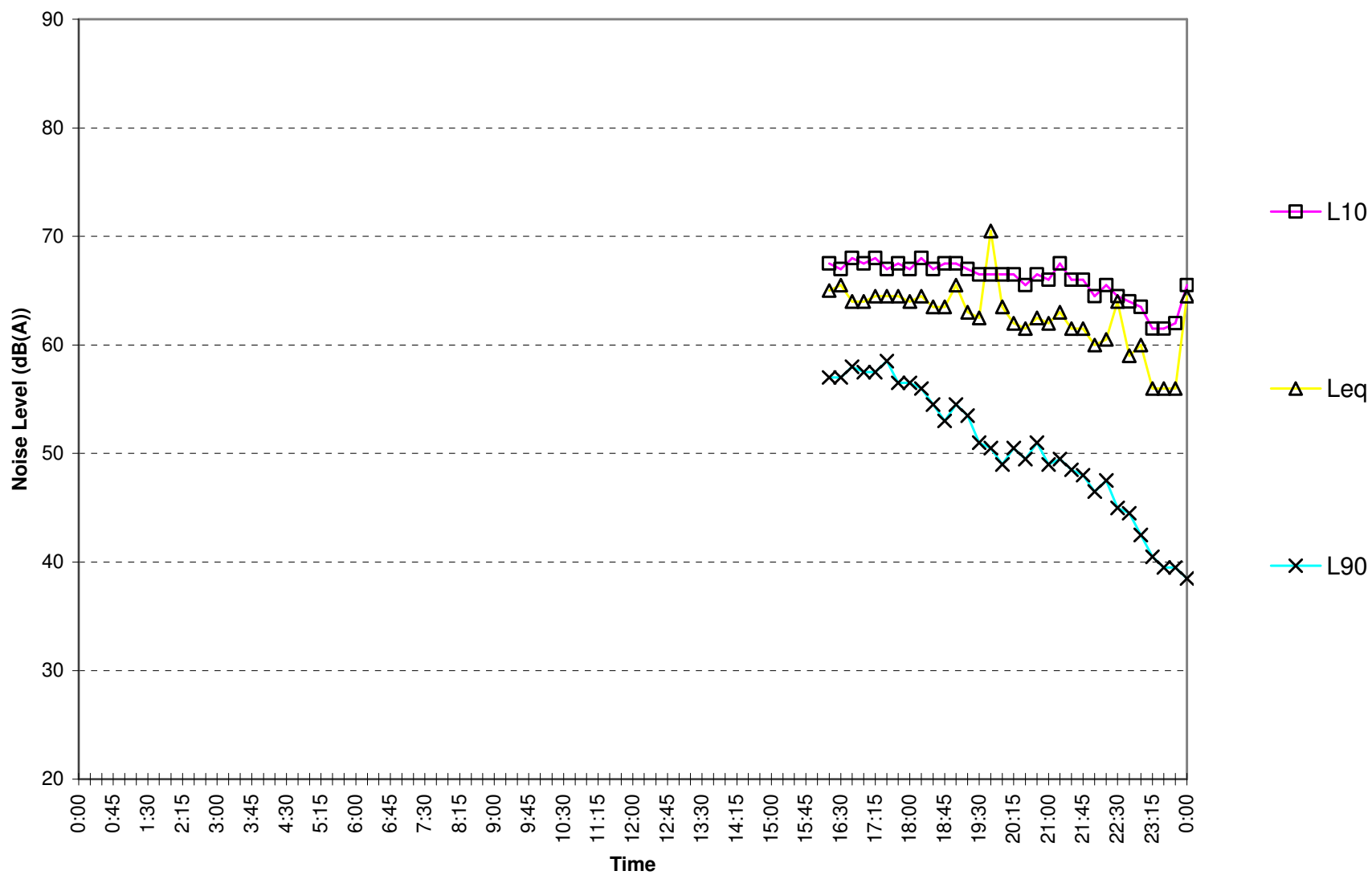
Yours faithfully,

Acoustic Logic Consultancy Pty Ltd  
Katherine Stewart

# APPENDIX 1

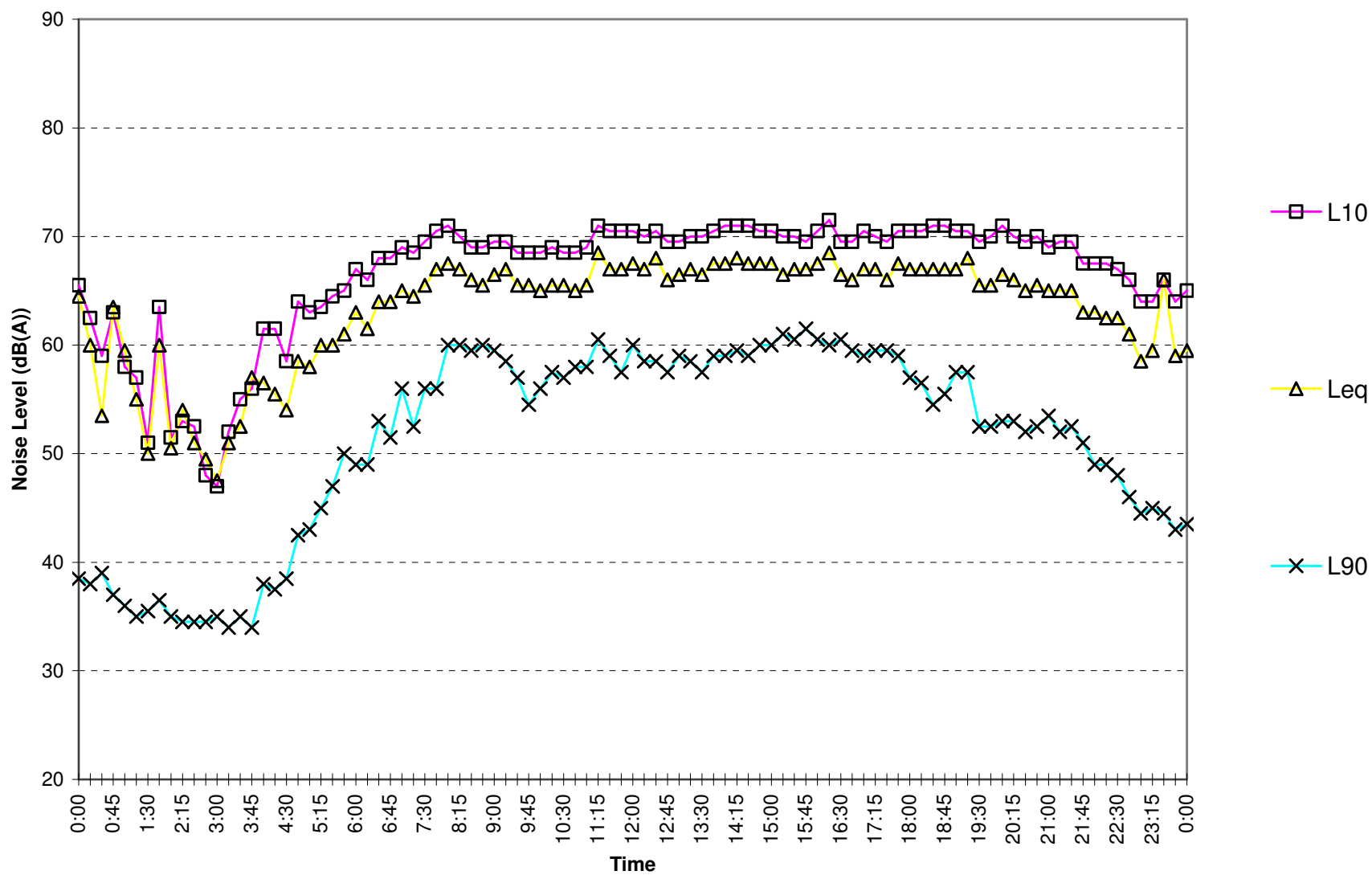
## Barber Avenue - Penrith

Tuesday July 27, 2010



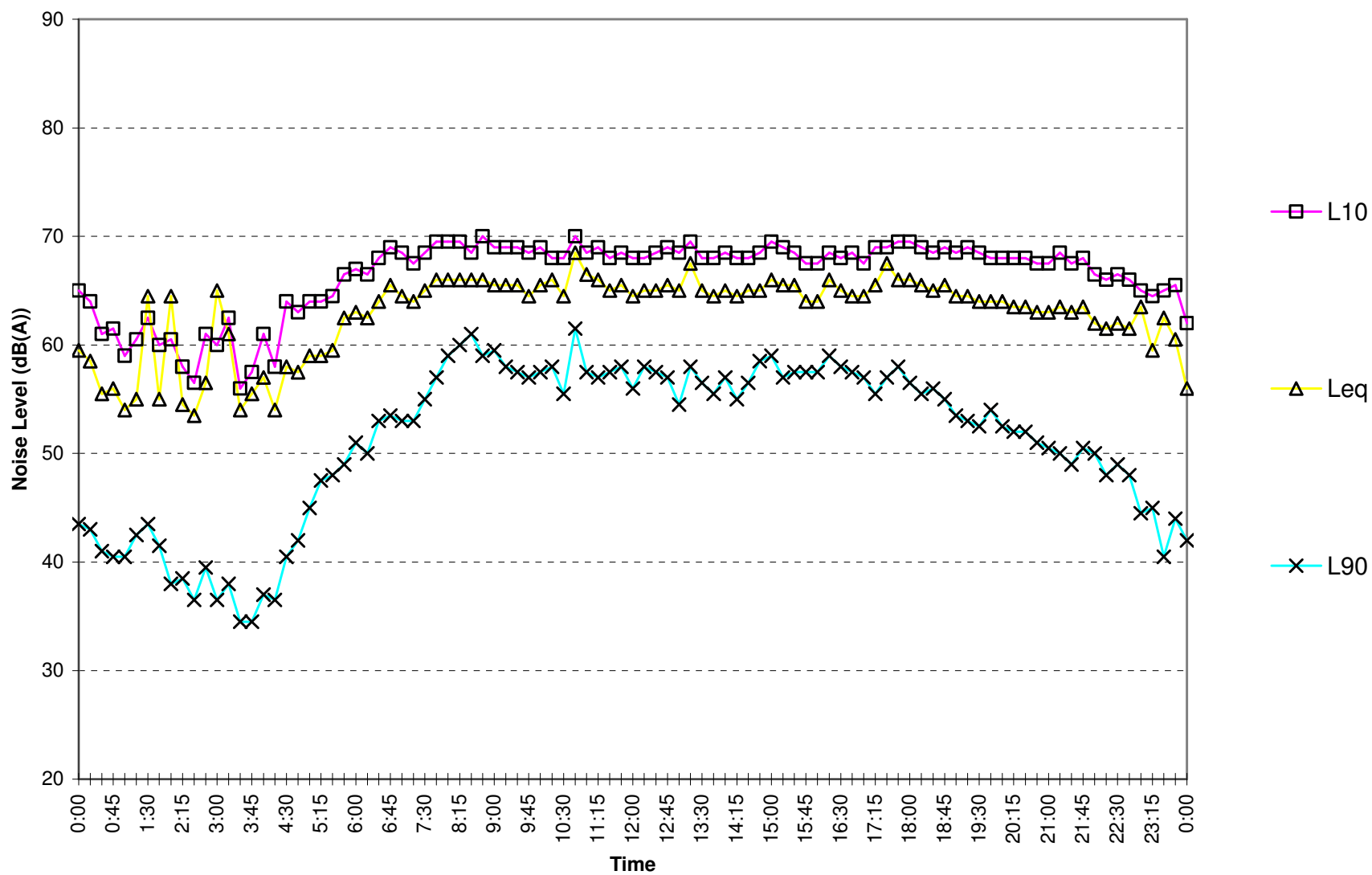
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Wednesday July 28, 2010



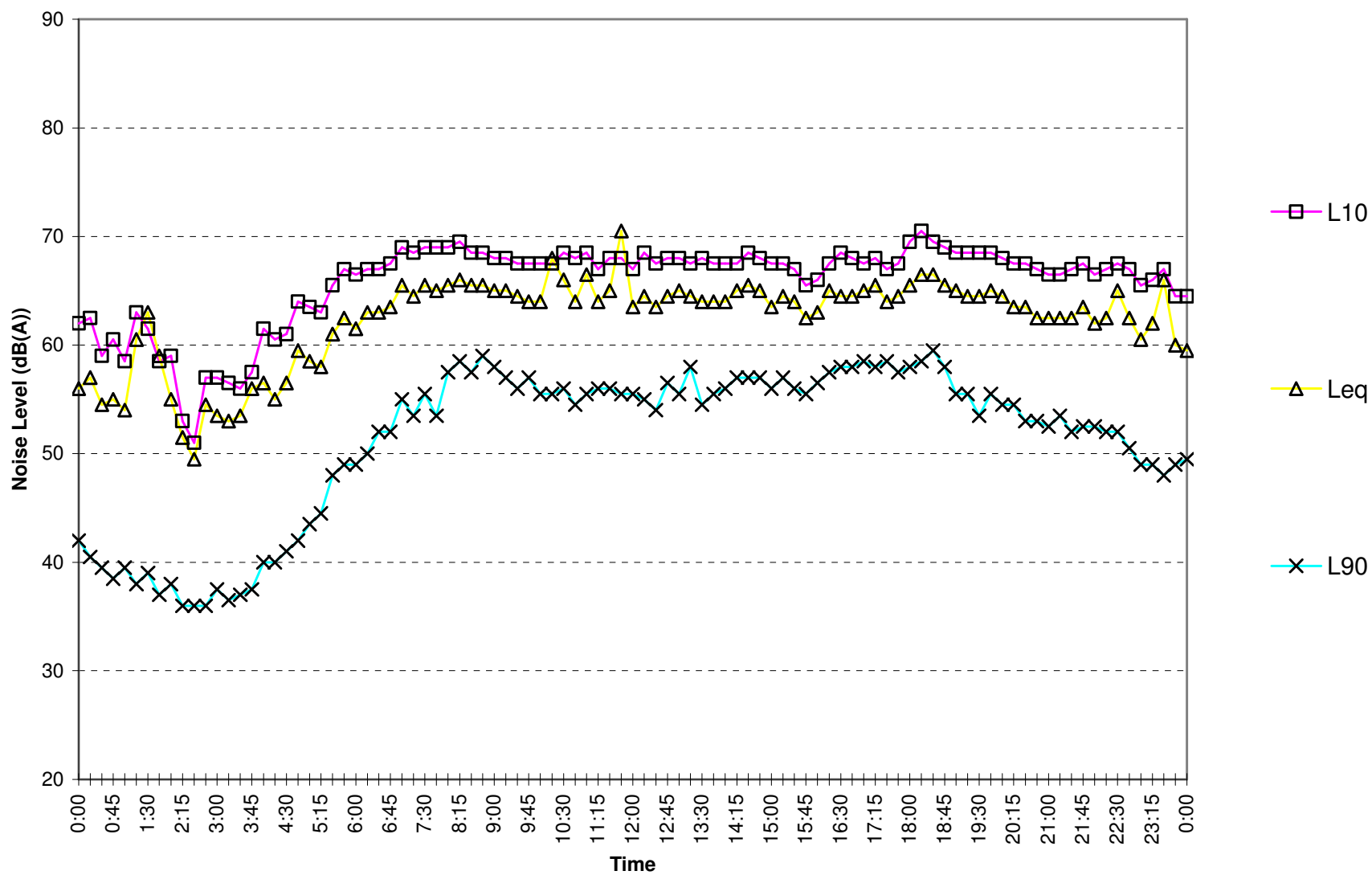
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Thursday July 29,2010



## Barber Avenue - Penrith

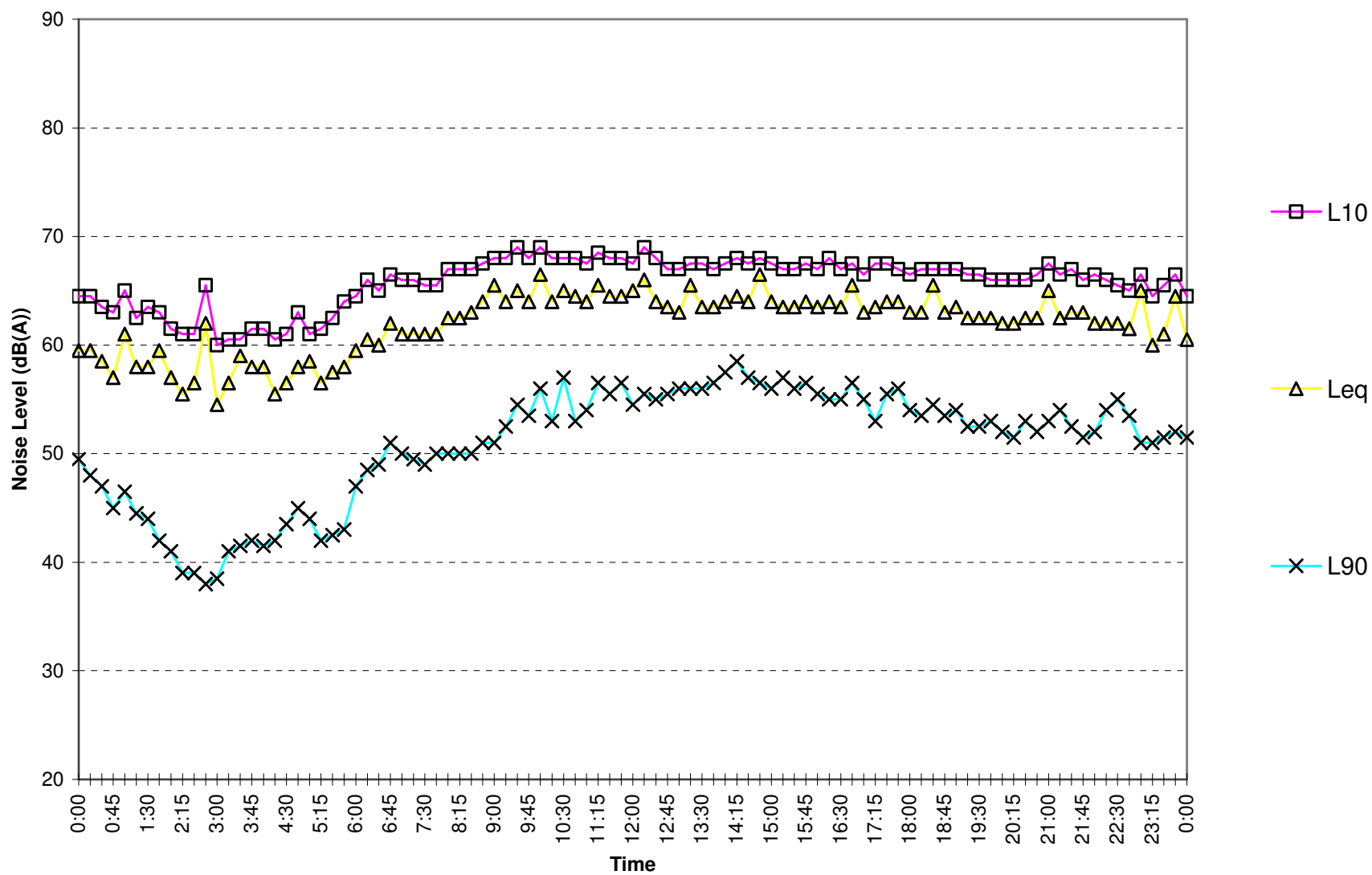
Friday July 30,2010





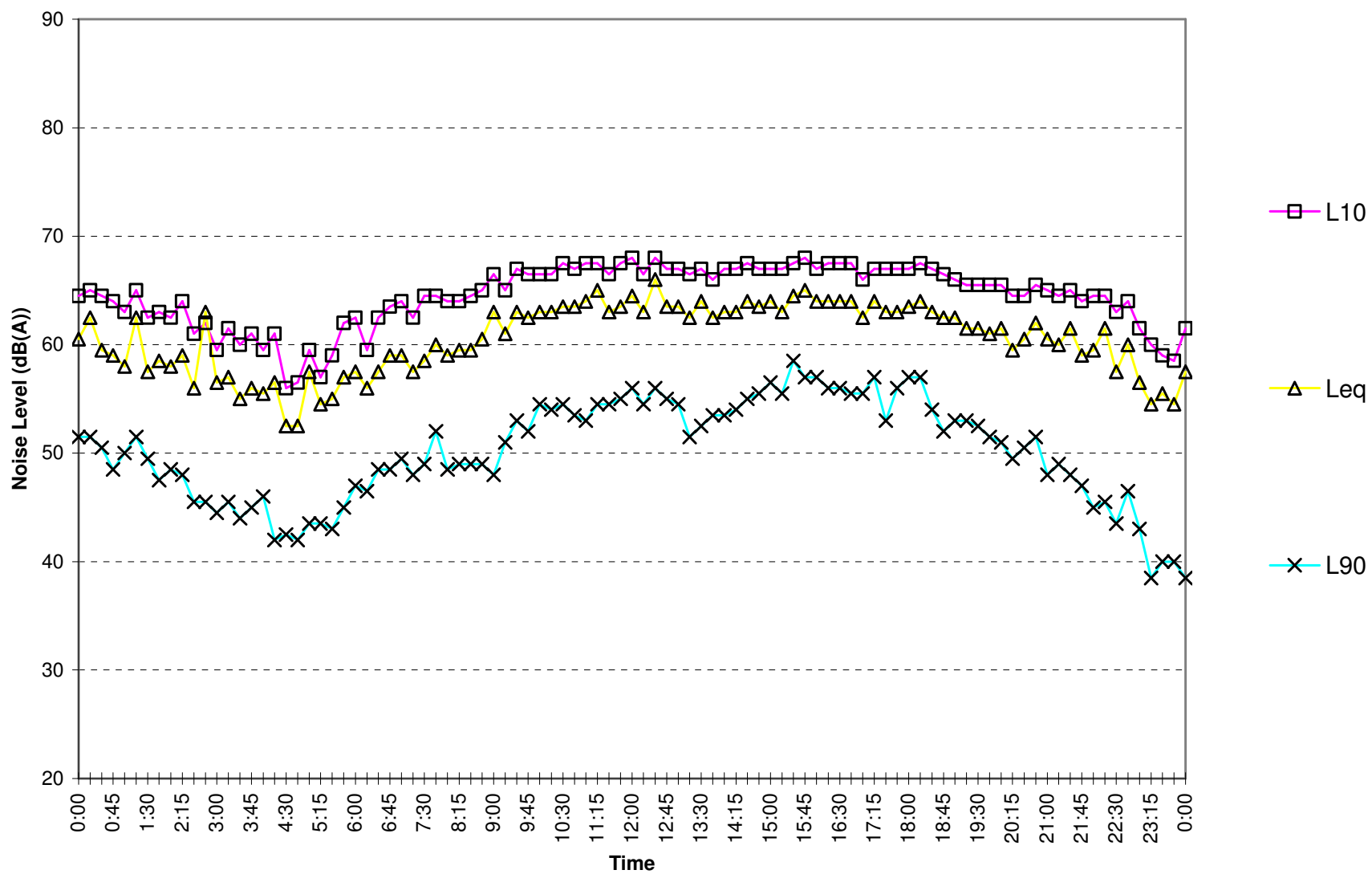
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Saturday July 31, 2010



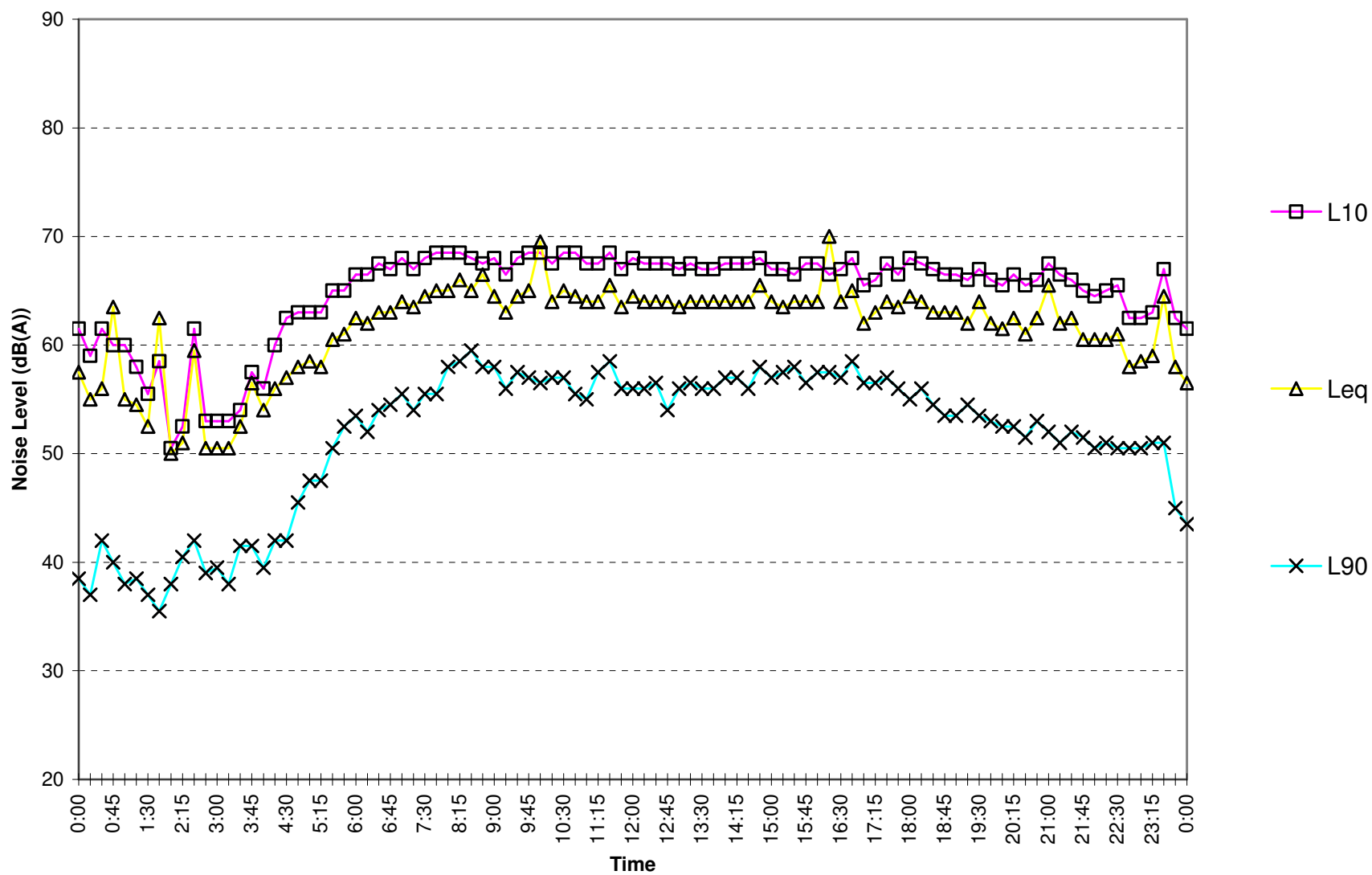
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Sunday August 1, 2010



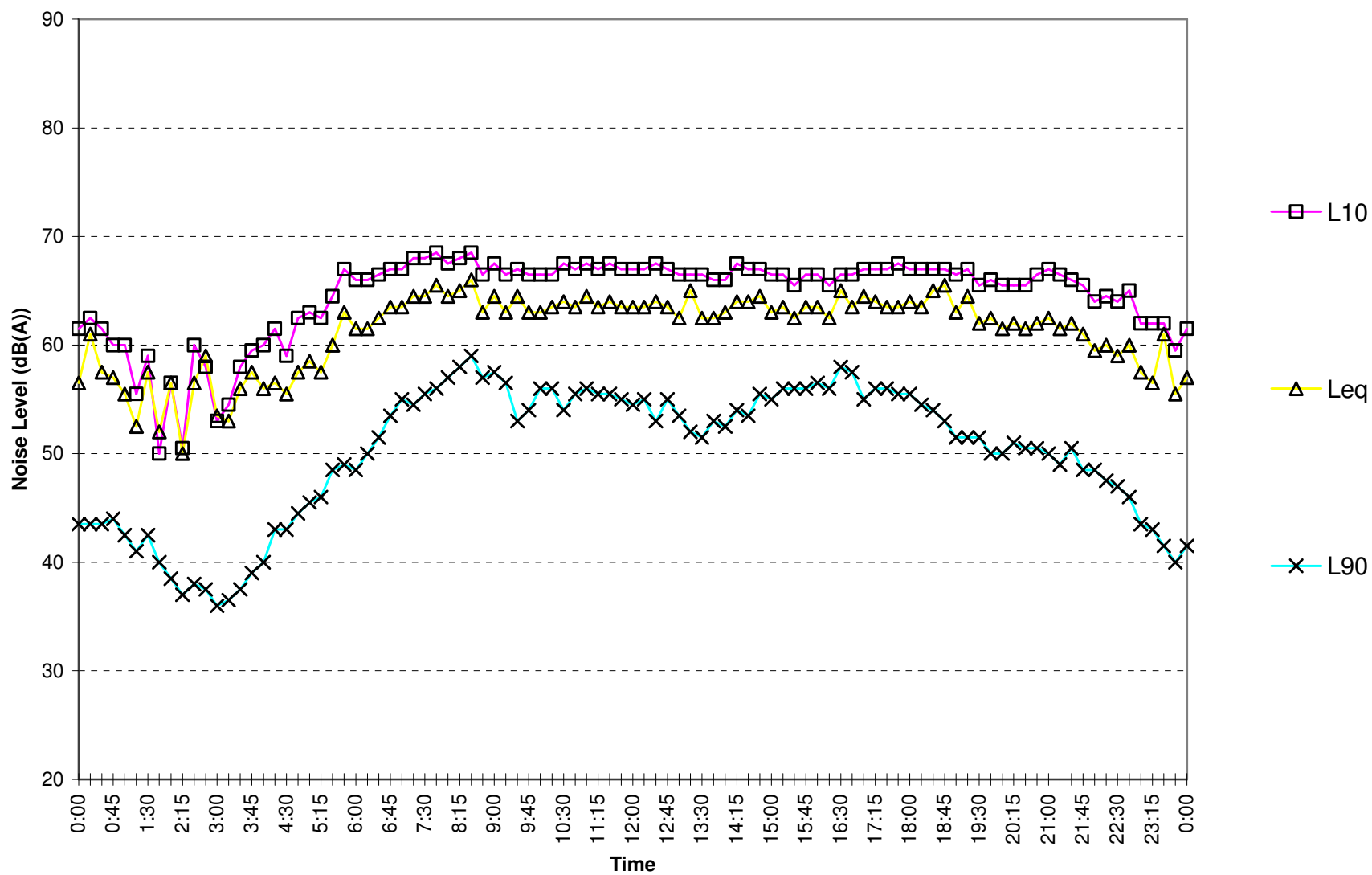
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Monday August 2,2010



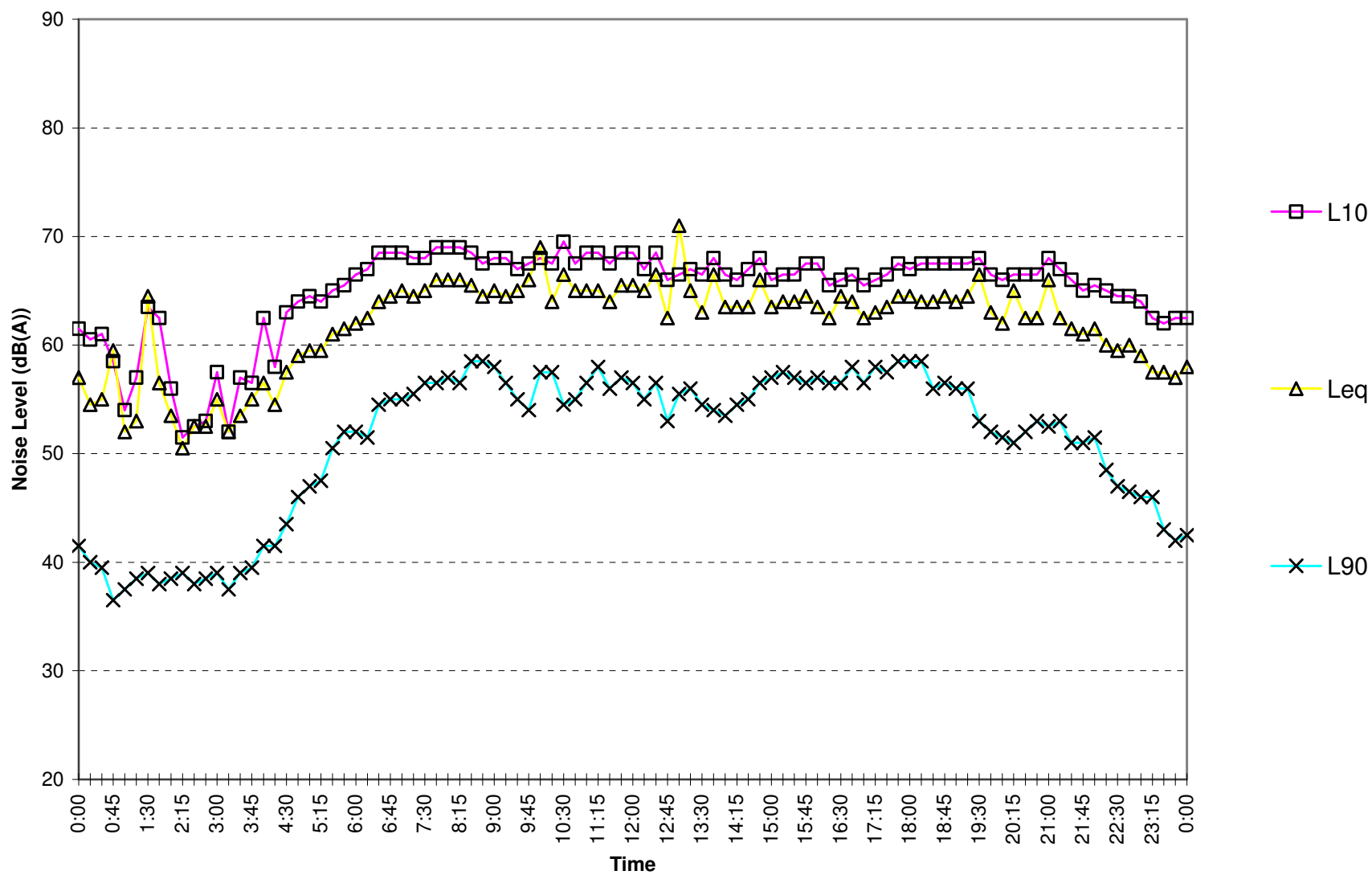
## Barber Avenue - Penrith

Tuesday August 3, 2010



## Barber Avenue - Penrith

Wednesday August 4,2010



## Barber Avenue - Penrith

Thursday August 5, 2010



## Barber Avenue - Penrith

Friday August 6, 2010

