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1 INTRODUCTION

Acoustic Logic Consultancy have been engaged to conduct an acoustic assessment of the proposed commercial development at 4 Murray Rose Avenue, Sydney Olympic Park.

This report has been prepared in order to satisfy the acoustic reporting requirements of the Director General.

In this report we will:

- Identify environmental noise sources with the potential to impact the site (noise from major events in the Sydney Olympic Park precinct, rail noise) and recommend acoustic treatments to reduce these impacts to acceptable levels.

- Identify noise emissions which will be generated by the site (primarily noise from external mechanical plant and construction noise) and recommend acoustic and management controls in order to reduce noise impacts on nearby properties to levels complying with relevant acoustic criteria.

In each case, relevant acoustic criteria to be used in assessment will be identified.

This report is based on the architectural plans by Turner and Associates dated July 2013.

2 SITE DESCRIPTION / PROPOSAL

The site is located at the eastern end of Parkview Drive, Homebush (on the eastern side of Parkview Drive, between the future extension of Murray Rose Ave and the future extension of Dawn Fraser Ave).

4 Murray Rose Avenue is the third proposed building in a mixed use development consisting of five buildings containing a mixture of commercial, retail and residential development.

4 Murray Rose Avenue will consist of a six storey development comprising with three levels basement car park.

The site is bounded as follows:

- To the north by Murray Rose Avenue. Further to the north, on the opposite site of Murray Rose Avenue, lies 5 Murray Rose Avenue (commercial development, in operation) and 3 Murray Rose Avenue (commercial development, under-construction).

- To the west and south by existing commercial development.

- To the east by an existing car park.

The nearest residential development to the site is:

- The proposed developments at 1 and 2 Murray Rose Avenue (to the east of the site) and

- Existing commercial development on the intersection of Australia Ave and Parkview Drive, approximately 250m to the west.

Development in the vicinity of the site with the potential to create an acoustic impact is as follows:

- The car park adjoining the site to the west, particularly when used for amusement rides during the Royal Easter Show.
- ANZ Stadium and the Sydney Showground, to the west of the site.
- Noise from the rail line serving the Olympic Park train station.

Potential sources of noise generation associated with the development are:

- Noise from external mechanical plant (primarily roof top plant) which has the potential to adversely impact adjoining (existing and future) development.
- Noise created during construction.

See aerial photo below.

Figure 1: SiteAerial Photograph

3 NOISE DESCRIPTORS

Environmental noise constantly varies. Accordingly, it is not possible to accurately determine prevailing environmental noise conditions by measuring a single, instantaneous noise level.

To accurately determine the environmental noise a 15 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.

In analysing environmental noise, three-principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

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

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

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source 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 15 minute 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 environmental noise.

L_1(1min) is the noise level exceeded for only one percent of the time over (when measured over a 1 minute period). The L_1(1min) is used in the assessment of peak noise events (intermittent, short duration events).

4 BACKGROUND NOISE MONITORING

Ambient noise levels in the vicinity of the site were determined using long term, unattended noise logging conducted on site.

Unattended noise monitoring was conducted between 11 and 16 March 2008 using an Acoustic Research Laboratories monitor set on A-weighted fast response mode. The monitor was calibrated before and after the measurements using a Rion Type NC-73 calibrator. No significant drift was recorded.

The long term noise logger was installed near the eastern property boundary of the site (away from existing commercial development in the vicinity of the site) at the approximate location of the future residential building at 1 Murray Rose Ave.

The long term logging data was collected as part of an assessment for 5 Murray Rose Ave and background noise levels measured at this time will still be applicable now.

Supplementary manned measurements of ambient noise levels were undertaken on 13 July 2012 to ensure previously measured levels remain applicable.

Measured background noise levels from long term logging are presented below. Refer to Appendix 1 for unmanned noise monitoring data.

Table 1 – Measured Background Noise Levels – Long Term Noise Logging

Location	Background noise level dB(A)L_{90}		
Unattended noise logger	Daytime (7am-6pm)	Evening (6pm-10pm)	Night time (10pm-7am)
	49	49	41

5 ASSESSMENT REQUIREMENTS AND ACOUSTIC CRITERIA

Director General requirement 7 states:

- *Identify the main noise and vibration generating sources and activities at all stages of construction, and any noise sources during operation. Outline measures to minimise and mitigate potential noise and vibration impacts on surrounding occupiers of land.*

- *Demonstrate how the proposed development aims to manage any impact from major event noise on the building occupants.*

The following assessment will be made to meet the requirements presented above:

- Noise impacts from major events and other external noise sources. Noise from ANZ stadium, the Sydney Showground, the use of the car park for Easter Show amusement rides and from rail movements at Sydney Olympic Park station will be assessed. Appropriate acoustic treatments will be determined to mitigate these impacts. Assessment will be conducted with reference to AS2107 and NSW Planning document *Development Near Rail Corridors and Busy Roads*.

- Noise impacts generated by the site. The only significant noise source which will be generated by the site will be from external mechanical plant, which will be assessed with reference to the EAP Industrial Noise Policy.

- In addition, a discussion of construction noise impacts and relevant EPA guidelines (Interim Construction Noise Guidelines and Assessing Vibration – A Technical Guideline) will be presented.

5.1 NOISE IMPACTS FROM MAJOR EVENTS AND OTHER EXTERNAL NOISE SOURCES

Major events such as use of ANZ Stadium, the Showground and noise generated by rides during the Royal Easter Show will be assessed to ensure there is no unacceptable impact on the proposed development.

Acoustic objectives to be adopted for the proposed development have been determined with reference to Australian Standard 2107 "Acoustics-Recommended Design Sound Levels and Reverberation Times for Building Interiors", as presented below.

Table 2 – Internal Noise Level Goals for External Noise Impacts

Space type	Time	Criteria
Commercial / Retail Spaces	When in Use	45dB(A)$L_{eq(Worst\ 1\ hour)}$

The following noise sources will not be assessed:

- Noise from the rail line. As the rail line lies more than 80m from the site, the Planning NSW document *Development Near Rail Corridors and Busy Roads* does not require assessment of potential noise and vibration impacts.

- Noise from the V8 Supercar Street circuit. Proposed circuit layout shows that the closest the circuit will come to the site is as it runs along Australia Ave (at the western end of Murray Rose Avenue, approximately 250m from the site). We note that this circuit will be used for a three day event only once per year, with only one day of the event expected to be on a weekday (and therefore affecting the commercial spaces). Given the infrequency of the event, the building will not be designed to address this noise.

5.2 OPERATIONAL NOISE GENERATED BY THE SITE

Operational noise will consist primarily of noise from mechanical plant.

Noise from mechanical services should comply with the EPA Industrial Noise Policy and the Noise Control Manual Sleep Disturbance Guidelines, as summarised below.

Noise emissions to both nearby (future and existing) residential and commercial development will be assessed).

As is consistent with the EPA Noise Control Manual, noise from emergency plant (generators) may be an additional 5dB(A) louder than the levels allowed for plant running during standard operation (as documented below)

5.2.1 EPA Industrial Noise Policy - Intrusiveness Criteria (Residential Receivers Only)

The Intrusiveness guideline is intended to limit the audibility of noise emissions at a residential property and requires that noise emissions measured using the $L_{eq(15min)}$ descriptor not exceed the background noise level by more than 5 dB(A) (i.e- noise from a particular noise source, when averaged over a 15 minute period, must not exceed background noise levels by more than 5dB(A).

The allowable noise level for all times of day is set out below.

Table 3 – EPA Intrusiveness Criteria

PERIOD/TIME	BACKGROUND NOISE LEVEL dB(A)L_{90}	ACCEPTABLE LEVEL dB(A)$L_{eq(15min)}$
Daytime (7am-6pm)	49	54
Evening (6pm-10pm)	49	54
Night (10pm-7am)	41	46

5.2.2 EPA Industrial Noise Policy - Amenity Objectives

Noise emission objectives for "suburban" receivers based on the Industrial Noise Policy "Amenity Criteria" are presented below. Amenity criteria are assessed using the $L_{eq(Period)}$ descriptor – ie noise from the a particular noise source is average over the entire daytime/evening/night time period. Acoustic criteria are as follows:

Table 4 - Amenity Objectives

Location	Time of Day	Amenity Noise Objective dB(A)$L_{eq(Period)}$
Potentially Affected Residential Properties.	Day Time (7am – 6pm)	55
	Evening (6pm – 10pm)	45
	Night (10pm-7am)	40
Potentially Affected Commercial Properties	When in use	65

5.2.3 Noise Control Manual – Sleep Disturbance Guidelines (Residential Receivers Only)

Potential sleep arousal impacts should be considered for noise generated after 10pm.

Sleep arousal is a function of both the noise level and the duration of the noise.

As recommended in the Application Notes to the EPA Industrial Noise Policy, to assess potential sleep arousal impacts, a two stage test is carried out:

- Step 1 - An "emergence" test is first carried out. That is, the L_1 noise level of any specific noise source should not exceed the background noise level (L_{90}) by more than 15 dB(A) outside a resident's bedroom window between the hours of 10pm and 7am. If the noise events are within this, then sleep arousal impacts are unlikely and no further analysis is needed. This is consistent with the Noise Guide for Local Government. The guideline level is set out below.

Table 5 – Sleep Arousal Emergence Criteria

Location	Background Noise Level dB(A)L_{90}	Emergence Level dB(A) $L_{1(1min)}$
All Potentially Affected Residential Properties	41	56

- Step 2 - If there are noise events that could exceed the emergence level, then an assessment of sleep arousal impact is required to be carried out taking into account the level and frequency of noise events during the night, existing noise sources, etc. This test takes into account the noise level and number occurrences of each event with the potential to create a noise disturbance. As is recommended in the explanatory notes of the EPA Industrial Noise Policy, this more detailed sleep arousal test is conducted using the guidelines in appendix B of the EPA *Environmental Criteria for Road Traffic Noise*.

5.3 NOISE GENERATED DURING CONSTRUCTION.

Where possible, noise generated by construction should comply with EPA *Interim Construction Noise Guidelines*. Where exceedances of recommended levels are likely, noise impacts on nearby properties should be minimised through appropriate noise management controls.

EPA guidelines adopt differing strategies for noise control depending on the predicted noise level at the nearest residences:

- *"Noise affected" level*. Where construction noise is predicted to exceed the "noise effected" level at a nearby residence, the proponent should take reasonable/feasible work practices to ensure compliance with the "noise effected level". For residential properties, the "noise effected" level occurs when construction noise exceeds ambient levels by more than 10dB(A)$L_{eq(15min)}$.

- "*Highly noise affected level".* Where noise emissions are such that nearby properties are "highly noise effected", noise controls such as respite periods should be considered. For residential properties, the "highly noise effected" level occurs when construction noise exceeds 75dB(A)$L_{eq(15min)}$ at nearby residences.

A summary is presented below.

Table 6 – Construction Noise Emission Criteria

Location	"Noise Affected" Level - dB(A)$L_{eq(15min)}$	"Highly Noise Affected" Level - dB(A)$L_{eq(15min)}$
Residential Development	59	75
Commercial Development	70	N/A

6 EXTERNAL NOISE IMPACT ASSESSMENT

The following noise sources will be assessed in order to determine their impact on the development:

- Noise from ANZ Stadium and the Sydney Showground.
- Noise from rides during the Sydney Easter Show.

6.1 NOISE LEVELS USED FOR ASSESSMENT

6.1.1 ANZ Stadium and Sydney Showground

These venues will potentially have large crowds (during sporting events etc) and amplified music performances.

Noise from ANZ Stadium was measured on Parkview Drive on 4 October 2009 during the Rugby League Grand Final (approximately 80,000 crowd, amplified music). This will be indicative of a peak period of operation of the stadium. Given that the size of the Sydney Showground and the distance between the Showground and the site is similar, noise from the Showground is expected to be similar in noise level to that from ANZ Stadium.

During the site visit, noise from ANZ stadium (crowd/music) was inaudible at Parkview Drive. The only audible noise associated with the event was that from the media helicopters flying over the stadium, generating noise levels of 61-64dB(A)L_{eq}. Given that other noise was inaudible over the helicopter noise, it is the helicopter noise which will be the loudest typical noise level associated with the use of the stadium / showground. Satisfactory attenuation of helicopter noise will also provide sufficient protection against the other noise sources.

6.1.2 Noise from the Easter Show Rides.

This is the most significant potential noise impact on the site, as amusement rides will be located as close as (approximately) 60m from the northern façade of 4 Murray Rose Avenue. In order to determine the noise levels likely to be generated, a noise survey of the Luna Park amusement park (Milsons Point) was undertaken. The loudest typical noise sources are presented below.

Table 7 – Measured Noise Levels

Ride	Primary Noise source	Measured Noise Level – dB(A)$L_{eq(15min)}$
Power Surge Ride (high speed ferris wheel)	Motor noise, screaming	77dB(A) at 10m
Wild Mouse (single carriage roller-coaster)	Motor noise, noise from carriage on track	70dB(A) at 25m

In determining the acoustic treatments, it will be assumed that one of these rides (loudest typical noise source based on our survey) is located near the eastern boundary of the rides area, as close possible to the western façade of 4 Murray Rose Drive.

6.2 RECOMMENDED TREATMENTS

Recommended glazing constructions for control of external noise impacts to levels complying with the acoustic guidelines presented above are presented below:

Table 8 – Recommended Glazing*

Location	Required Glazing	Acoustic Seals Required
North and west	Minimum : 8mm/12mm airgap/6mm	Yes
Remaining	Minimum : 6mm /12mm airgap/6mm	Yes

*If thicker glazing is required for thermal or structural reasons, this is also acceptable.

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 the table below 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 mohair seals in windows and doors are not acceptable where acoustic seals are required. The proposed suppliers should provide evidence that the window systems proposed have been tested in a registered laboratory with the recommended glass thicknesses and comply with the minimum STC requirements listed in the table below, and that they will be constructed and installed in a manner equal to the test samples.

Table 9 – Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC of Installed Window
6.38mm laminated/12mm airgap/6mm	Yes	33
6mm/12mm airgap/6mm	Yes	31

Provided that these treatments are installed, noise levels will comply with the acoustic criteria set out in section 5.1.

7 NOISE EMISSION ASSESSMENT

7.1 NOISE FROM MECHANICAL PLANT

7.1.1 Equipment Selection

Primary roof top mechanical plant is as follows (indicative selections only at this stage):

- Chillers (typical sound pressure level up to 80dB(A) at 1m).
- Cooling towers.
- Air handling plant (air handling units, exhaust fans, outside air fans etc).

7.1.2 Recommendations

Detailed review of noise from mechanical plant should be undertaken once plant selections and layouts are finalised. However, preliminary analysis indicates that noise emissions from plant items can be adequately addressed using standard acoustic treatments, as discussed below:

- Chiller – to be located within an enclosed plant room.
- Cooling towers – If practicable, cooling towers should be located on the western side of the plant room, as far as practicable future residential properties (and no line of site between cooling tower and the residential properties to the east of the site). If located on the eastern side, it is likely that acoustic treatment to cooling tower intake and discharge will be required (detailed treatment to be determined once towers are selected).
- All plant items should be installed using vibration isolation mounts to prevent structure borne noise transfer to offices below (to be detailed following equipment selection).

7.2 NOISE GENERATED DURING CONSTRUCTION

As with any major construction site there will be noise associated with 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 retail tenancies. We note that there will be no residential development on the Murray Rose site prior to the construction of 4 Murray Rose Avenue, meaning the nearest residential development will be on the corner Parkview Drive and Australia Avenue, approximately 250m to the west of the site.

Adequate control of construction noise can be achieved through the development of a Construction Demolition Noise Management Plan which may be required to be undertaken prior to works commencing and (if required) and be undertaken at construction certificate stage (once a construction program has been determined).

8 CONCLUSION

Potential noise impacts associated with proposed development at 4 Murray Rose Avenue have been assessed to address the Director Generals Requirements.

Both an assessment of noise impacts on the site (from major events and other local noise sources) and noise generated by the site have been assessed against appropriate acoustic criteria.

Compliance with appropriate acoustic goals is achievable provided that the recommendations in sections 6.2, 7.1 and 7.2 are adopted.

Yours faithfully,

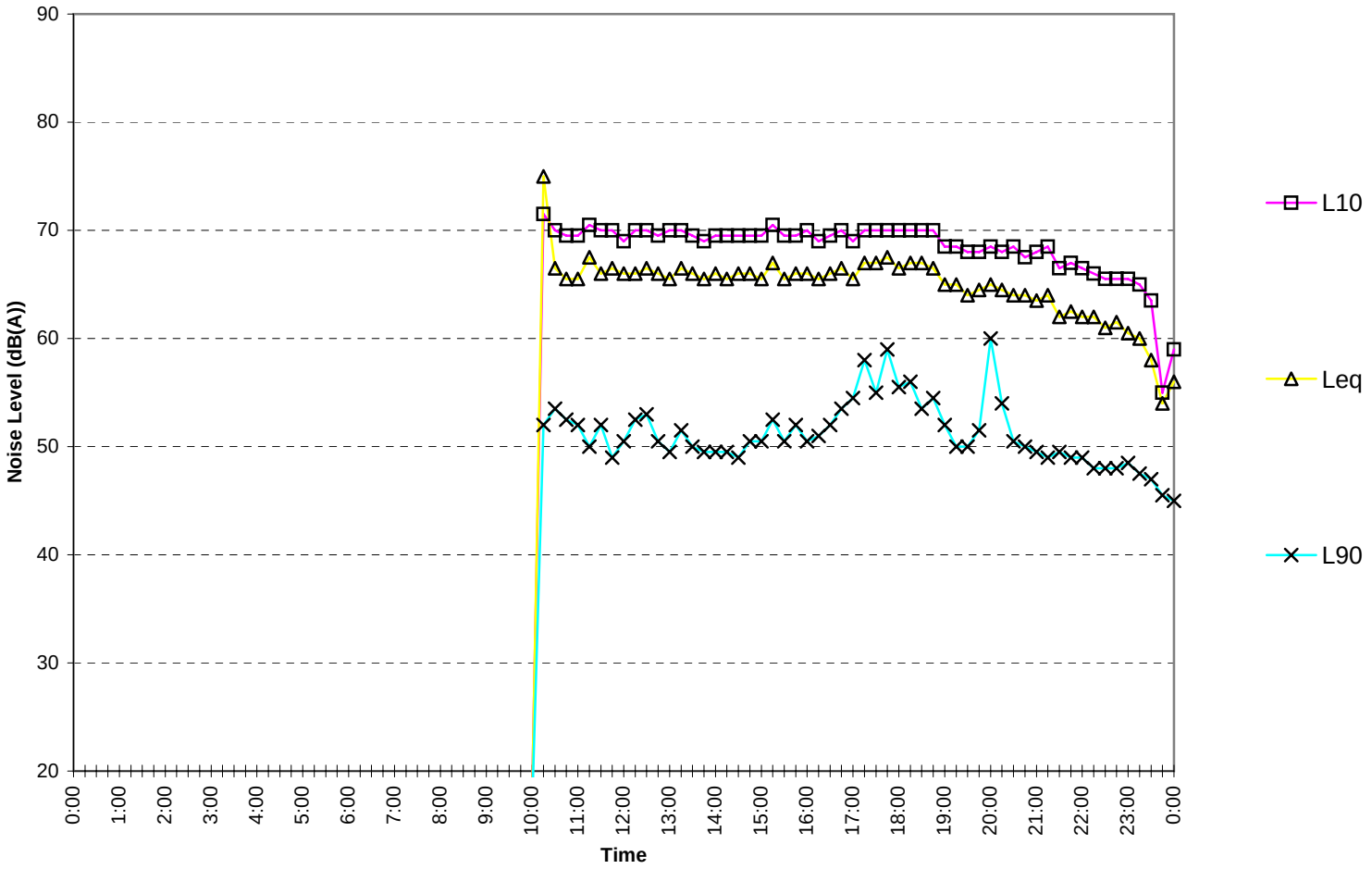
Acoustic Logic Consultancy Pty Ltd
Thomas Taylor

Appendix 1

Background Noise Logging Data

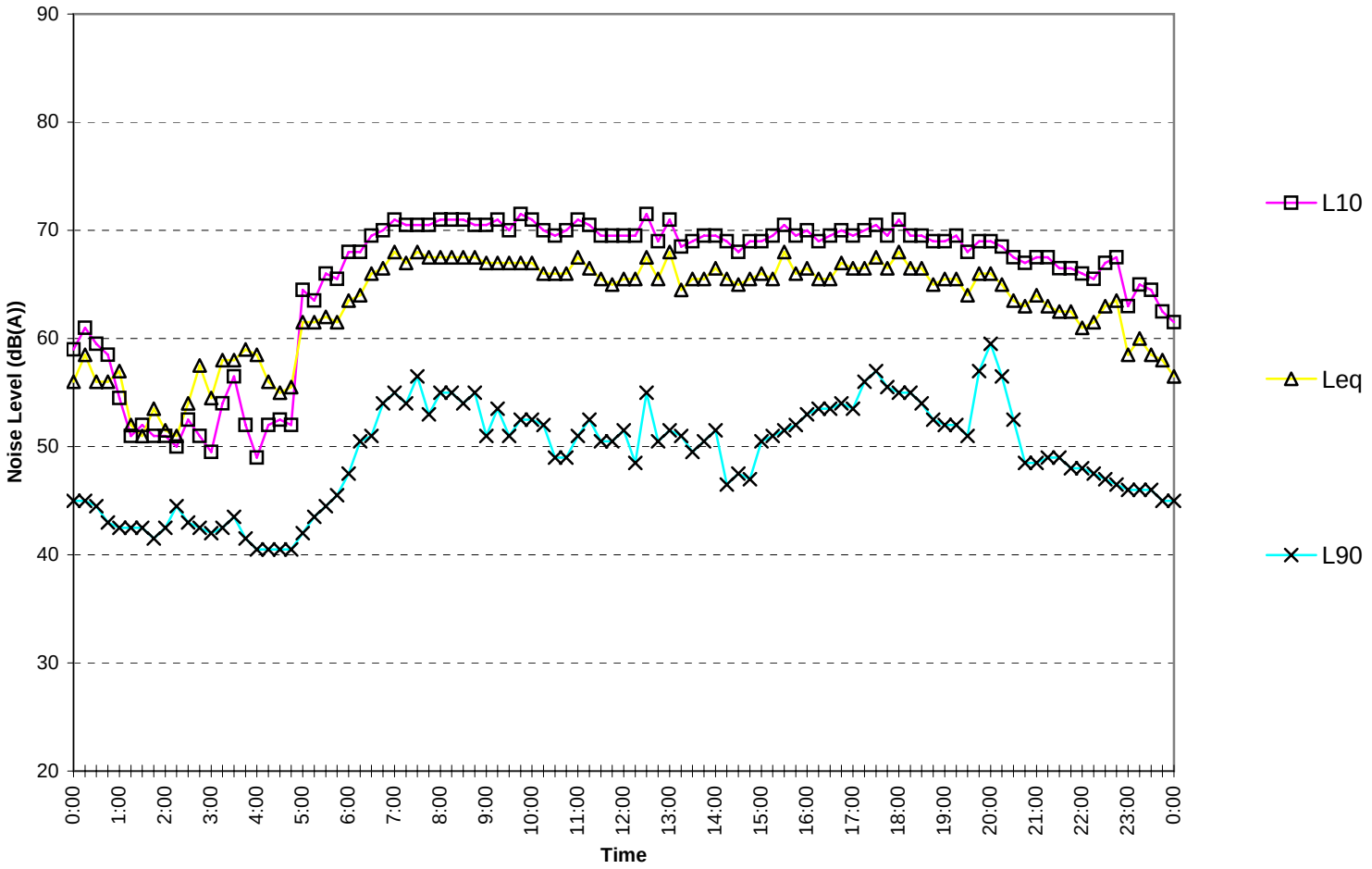
Parkview Drive

Tuesday March 11,2008



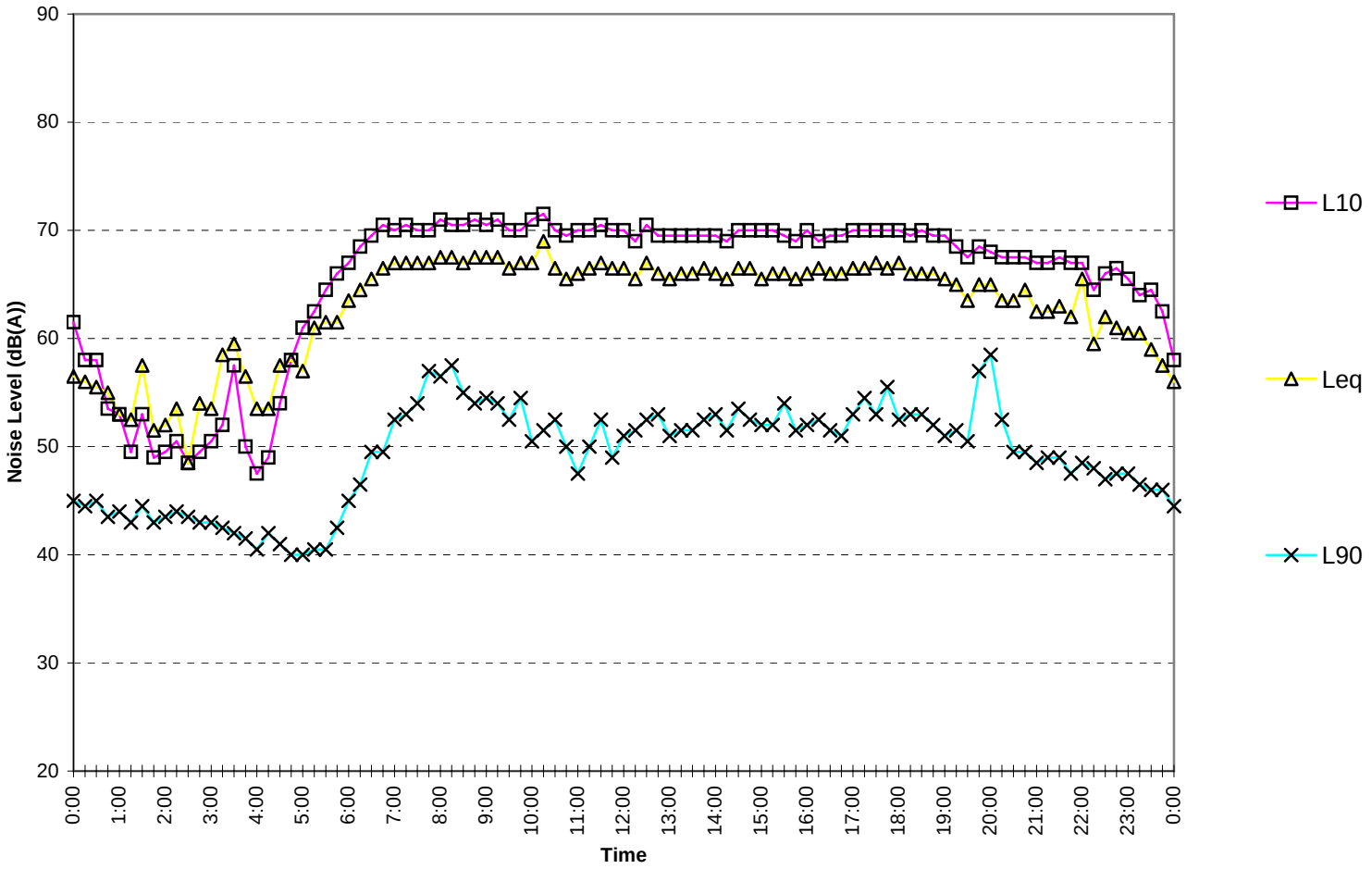
Parkview Drive

Wednesday March 12,2008



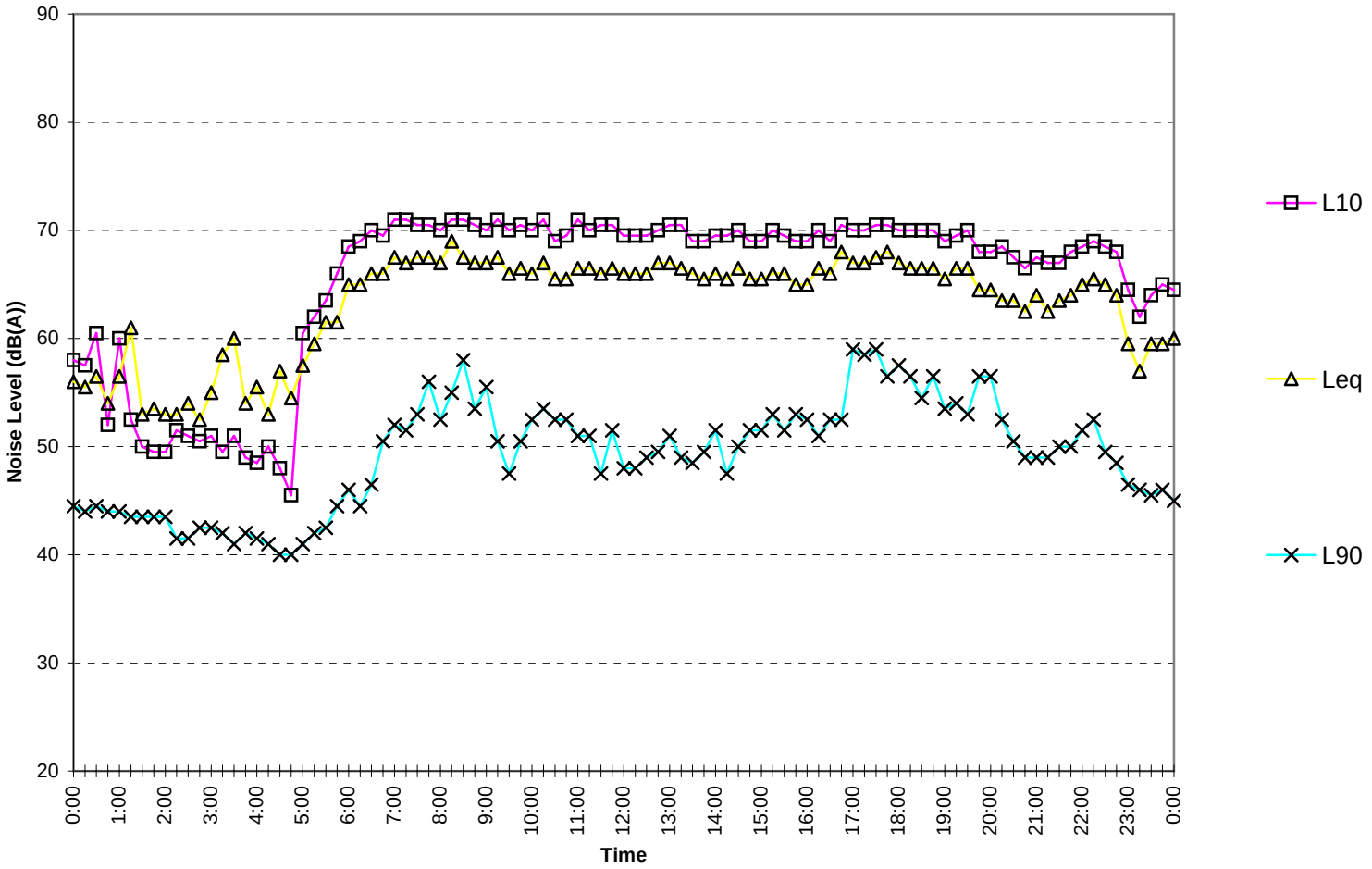
Parkview Drive

Thursday March 13,2008



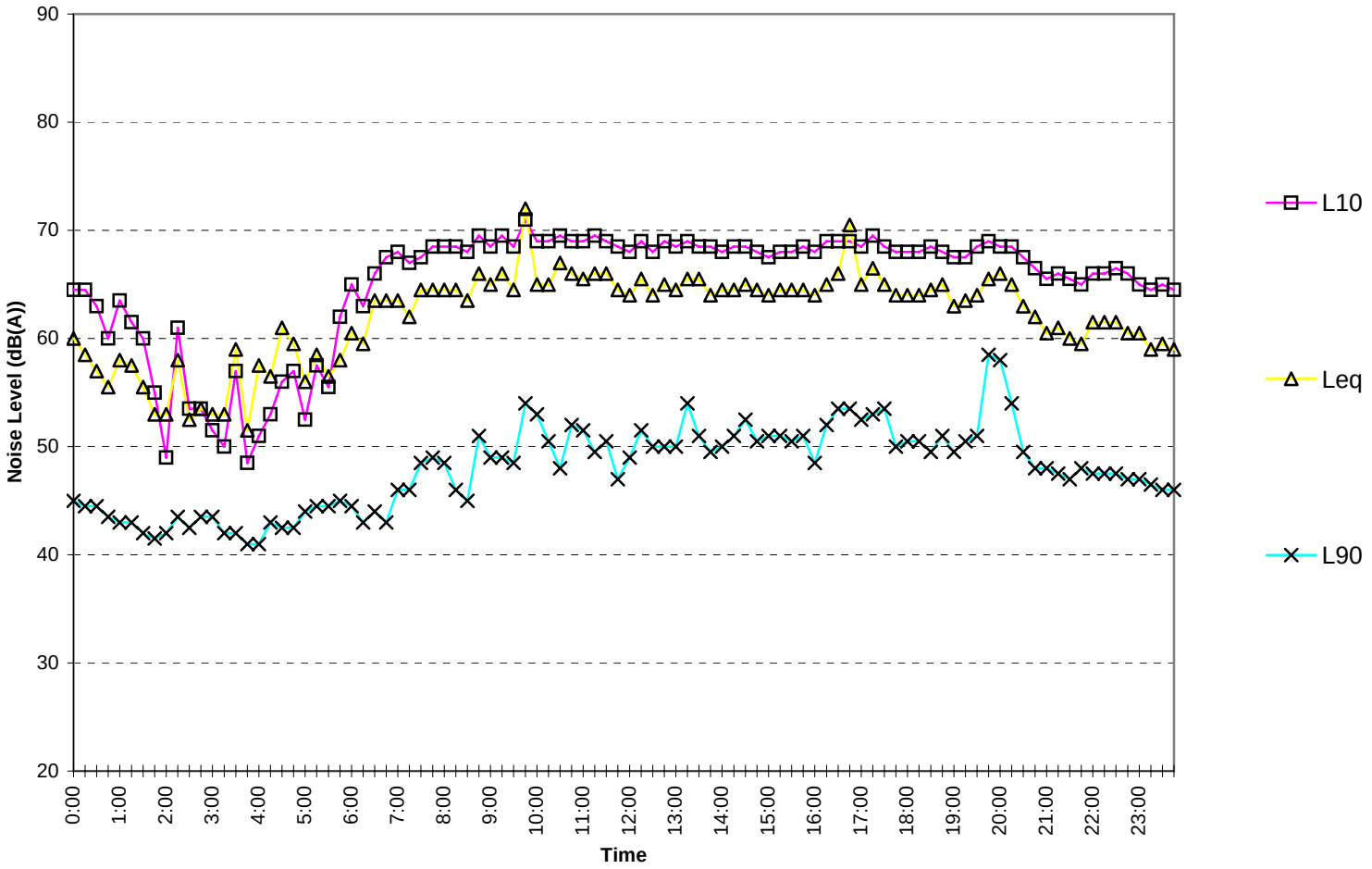
Parkview Drive

Friday March 14,2008



Parkview Drive

Saturday March 15,2008



Parkview Drive

Sunday March 16,2008