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1 INTRODUCTION

This report presents an analysis an acoustic assessment associated with the proposed mixed use development at 500 Pacific Highway, St Leonards.

In this report we will:

- Conduct an external noise impact assessment (primarily traffic noise) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future users and occupancies of the building.
- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Council acoustic requirements to ensure that nearby developments are not adversely affected.

This report has been conducted in conjunction with the DA drawings provided to this office from Sissions Architects with project number 14-026.

2 SITE DESCRIPTION / PROPOSED DEVELOPMENT

The proposed development consists of a mixed-use building with podium levels of commercial/retail facilities and a 39 levels of residential apartments, as well as 7 basement levels of car parking.

Potential noise sources on the site are primarily traffic noise from surrounding roadways, most notably the Pacific Highway, which carries medium to heavy flows of traffic.

Noise potentially generated by the site will consist of:

- Building services equipment include noise emissions from mechanical plant.

Noise impacts associated with these noise sources will be investigated.

The nearest potentially affected noise receivers are:

- Commercial buildings within the vicinity of the site in all directions.

Refer to Figure 1 below, which is an aerial photo of the existing development.

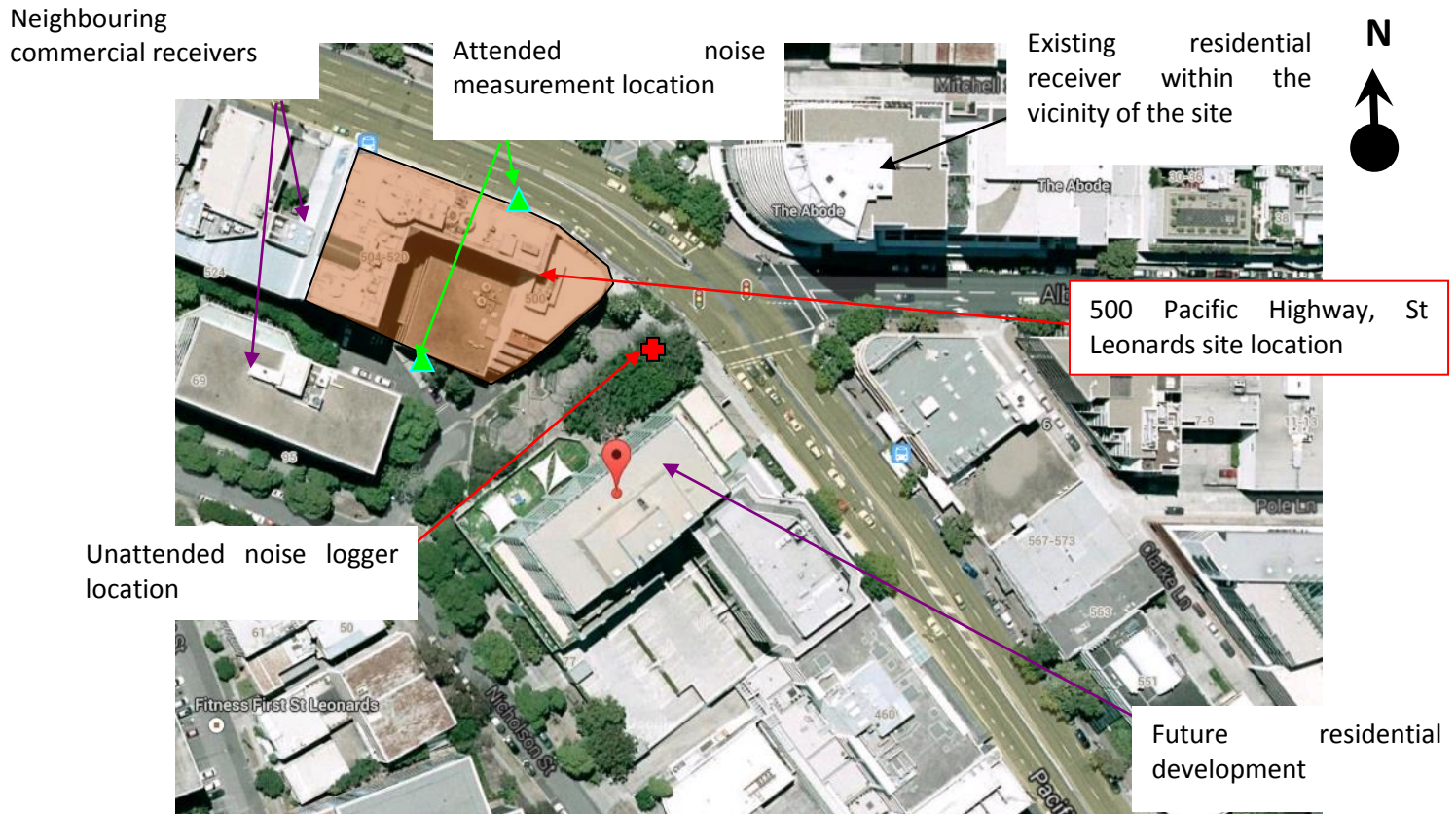


Figure 1 – Site Plan and Measurement Locations

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 ASSESSMENT

Significant noise sources in the vicinity of the site are as follows:

- Pacific Highway, on the eastern property boundary, which carries heavy traffic flows.

Noise impacts should comply with the requirements of NSW State Environment Planning Policy (SEPP (Infrastructure) or State Environmental Planning Policy (Infrastructure) 2007) and Lane Cove Council requirements.

4.1 NOISE MEASUREMENTS

Measurement of traffic noise was conducted using both attended measurements and unattended monitoring.

4.1.1 Attended Measurements

Attended measurements were conducted at the boundary of the site to the Pacific Highway using a Norsonics Type 140 Precision Sound Level Analyser. The Precision Sound Level Analyser was calibrated at the beginning and the end of the measurement using a Norsonics Type 1251 Precision Sound Level Calibrator. No significant drift was noted. All measurements were conducted on A-weighted fast response mode. There were no significant periods of adverse weather conditions during the measurement period.

Traffic noise measurements were conducted on 26th October, 2015. Figure 1 above details the attended measurement positions.

4.1.2 Unattended Monitoring

Measurements of traffic noise from Pacific Highway were recorded using an Acoustic Research Laboratories Pty Ltd noise logger. The logger was programmed to store 15-minute statistical noise levels throughout the unmanned monitoring period. The equipment was calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected.

All measurements were taken on A-weighted fast response mode. Unattended measurements were conducted between 26th October and 2nd November, 2015. Figure 1 details the unattended monitoring position.

4.1.3 Measured Noise Levels

The measured noise levels as a result of attended measurements and unattended monitoring are presented in the table below.

Table 1 – Measured Traffic Noise Levels

Location	Time	Measured Noise Level dB(A) _{L_{eq}} (worst 1 hour)
Pacific Highway Façade	24 Hour	72
	Night (10pm-7am)	68

4.2 ACOUSTIC OBJECTIVES

The determination of an acceptable level of traffic noise within the residential/commercial spaces requires consideration of the activities carried out within the space and the degree to which noise will interfere with those activities

As sleep is the activity most affected by traffic noise, bedrooms are the most sensitive rooms. Higher levels of noise are acceptable in living areas without interfering with activities such as reading, listening to television, etc. Noise levels in utility spaces such as kitchens, bathrooms, laundries, etc can be higher.

Noise impacts will be in conjunction with the requirements of NSW State Environment Planning Policy (SEPP (Infrastructure) or State Environmental Planning Policy (Infrastructure) 2007) and Lane Cove Council.

4.2.1 NSW SEPP Requirements

The SEPP (Infrastructure) or State Environmental Planning Policy (Infrastructure) 2007 Condition 102 states:

“(1) This clause applies to development for any of the following purposes that is on land in or adjacent to the road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or child care centre.

(2) Before determining a development application for development to which this clause applies, the consent authority must take into consideration any guidelines that are issued by the Director-General for the purposes of this clause and published in the Gazette.

(3) If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

(a) in any bedroom in the building--35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)--40 dB(A) at any time”.

Note that the noise level criteria detailed above are based on the requirements of the EPA's 'Developments Near Rail Corridors and Busy Roads' policy.

4.2.2 Lane Cove Council DCP

The Lane Cove Council DCP does not include acoustic criteria which is more stringent than the requirements of the SEPP (Infrastructure) or State Environmental Planning Policy (Infrastructure) 2007 (which include the Developments Near Rail Corridors and Busy Roads).

4.2.3 Internal Noise Criteria

Pursuant to these requirements, internal traffic noise criteria are presented in the table below.

Table 2 - Internal Traffic Noise Criteria

Space/Activity Type	Noise Level
Living Area (24 hours)	40 dB(A) L_{eq} (15 hour)
Bedroom (10pm-7am)	35 dB(A) L_{eq} (9 hour)
Commercial Areas	45 dB(A) L_{eq} (24 hour) *

*Note: Based on the Australian Standard AS2107:2000

4.3 RECOMMENDATIONS

Traffic noise intrusion into the proposed development is assessed using the measured external noise levels reported above as a basis. 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. Noise transfer through the masonry elements will not be significant and need not be considered further.

A preliminary review of traffic noise intrusion has revealed that compliance with acoustic guidelines is achievable.

Indicatively, on the eastern (Pacific Highway) façade some bedrooms will require up to 12.38mm thickness glass, and some living rooms will require up to 10.38mm thickness glass in order to comply with design noise levels, as detailed in Section 4.2 above. Other facades will require glazing of reduced thickness. Exact glazing thicknesses to be determined after window sizing and room layouts are finalised and will be provided as part of the Construction Certificate.

Indicative glazing constructions required to comply with the traffic noise objectives are listed below.

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.

Table 3 – Recommended Glazing Constructions

Level	Façade	Room Type	Glazing	Seals
Commercial Levels	Pacific highway	Commercial/Retail	10.38mm laminated	Yes
	All other facades	Commercial/Retail	6.38mm laminated	Yes
Residential Levels (All Levels)	Pacific Highway East Façade	Bedroom	12.38mm laminated	Yes
		Living Rooms	10.38mm laminated	Yes
	East and West façades	Bedroom	10.38mm laminated	Yes
		Living Rooms	10.38mm laminated	Yes
	Southern Façade	Bedroom	10.38mm laminated	Yes
		Living Rooms	6.38mm laminated	Yes

The indicative glazing thicknesses above will satisfy all acoustic requirements as 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.

In addition to complying with the minimum scheduled glazing thickness, the STC rating of the glazing fitted into open-able frames and fixed into the building opening should not be lower than the values listed in Table 3 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of open-able 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 awning windows and mohair seals in windows and doors are not acceptable where acoustic seals are required.

Table 4 – Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC of Installed Window
12.38mm Laminated	Yes	36
10.38mm Laminated	Yes	35
6.38mm Laminated	Yes	30

5 TRAIN NOISE AND VIBRATION ASSESSMENT

Based on the requirements of the Development Near Rail Corridors and Busy Roads (section 3.5.1) developments within the proximity to railway corridors is required to be assessed as detailed in the figures below:

Noise

Figure 3.1 provides a guide as to the level of assessment required when noise sensitive developments are located in the vicinity of existing rail lines. Zones A and B are indicative acoustic assessment zones where sensitive land-uses are likely to be adversely affected. Where there are noise maps available based on actual rail movements the noise map information should be used in preference to **Figure 3.1**.

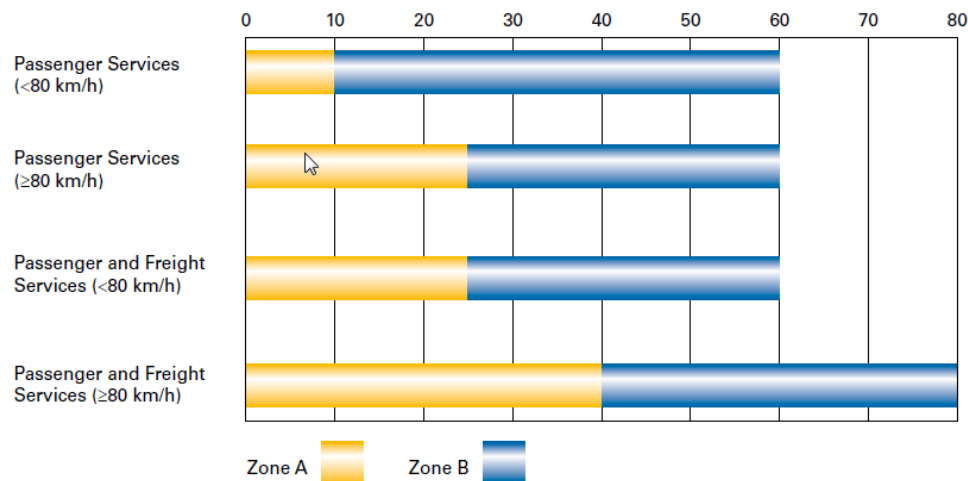


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

Rail Vibration

The vibration assessment zone for typical development sites adjacent to rail corridors or above rail tunnels is shown in **Figure 3.2**. The assessment zone may need to be increased for specific areas where vibration issues are known to already exist. Refer to section 3.6.3 vibration criteria for additional information. Developments within this zone will need a vibration assessment.

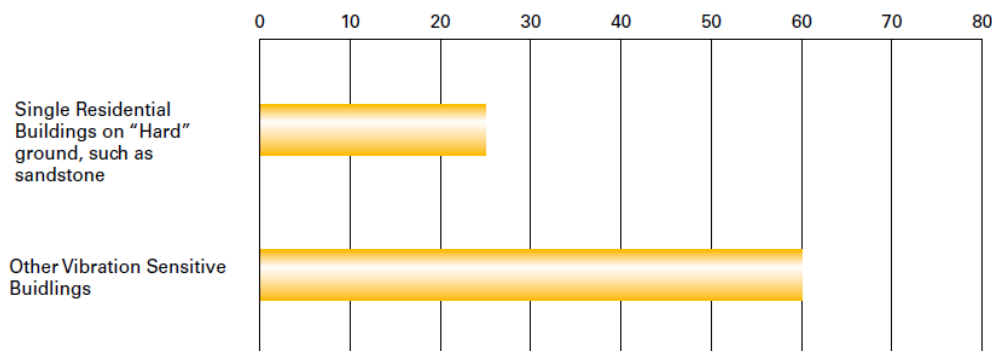


Figure 3.2: Distance from the nearest operational track (m)

As the proposed development is located with distance greater than 80m horizontally from the rail corridor no future acoustic (noise or vibration) assessment is required.

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.

Criteria for the following noise sources will be calculated:

- Building services including mechanical plant noise.

6.1 BACKGROUND NOISE MONITORING

Long term monitoring was conducted using a monitor installed on site as shown in Figure 1 above. Monitoring was conducted during the period of 26th January to 1st February 2011 using an Acoustic Research Laboratories noise monitor set to A-weighted fast response. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix 1.

Measured background noise levels are presented below at locations indicated in Figure 1 above.

Table 5 - Measured Background Noise Levels

Description	Day Noise Level 7am to 6pm (dB(A)L₉₀)	Evening Noise Level 6pm to 10pm (dB(A)L₉₀)	Night Noise Level 10pm to 7am (dB(A)L₉₀)
Background L _{90,15min}	57	56	43

6.2 ACOUSTIC OBJECTIVES

The Lane Cove Council's Development Control Plan does not include specific noise emission requirements and as such the requirements of the NSW Environmental Protection Authority (EPA) Industrial Noise Policy (INP) has been used to specific noise criteria as detailed below.

The NSW Environmental Protection Authority (EPA) Industrial Noise Policy (INP) provides guidelines for assessing noise impacts from development sites. The recommended assessment objectives vary depending on the potentially affected receivers, the time of day, and the type of noise source. The EPA's Industrial Noise Policy has two requirements which both have to be complied with, namely an amenity criterion and an intrusiveness criterion. In addition, the EPA in its Environmental Noise Control Manual states that noise controls should be applied with the general intent to protect residences from sleep arousal.

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the Environmental Criteria for Road Traffic Noise (ECRTN).

6.3 EPA INTRUSIVENESS CRITERION

The EPA 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.

6.4 EPA AMENITY CRITERION

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

The EPA's 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 5 of the INP 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 6 – EPA Recommended Amenity Noise Levels

Type of Receiver	Time of day	Recommended Acceptable Noise Level dB(A) L_{eq}
Residential	Day	55
	Evening	45
	Night	40

6.5 SLEEP AROUSAL

To minimise the potential for sleep arousal the L_1 (1 minute) noise level of any specific noise source does 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. The L_1 noise level is the level exceeded for 1 per cent of the time and approximates the typical maximum noise level from a particular source. Where the typical repeatable existing L_1 levels exceed the above requirement then the existing L_1 levels form the basis for, sleep disturbance criteria.

6.6 SUMMARY OF ASSESSMENT CRITERIA FOR PROPOSED SITE

The EPA's INP intrusiveness, amenity and sleep arousal criteria for this project have been determined using these guidelines and the noise monitoring results. These are summarised below. We note that the formulation of the assessment criteria has been based on the lowest ambient levels determined from all monitoring data.

The criteria for the monitoring have been considered and assessed for the surrounding receivers. Table 7 below details the noise level criterion for properties surrounding the proposed development. In all cases, if a discrepancy in attended and unattended noise levels were obtained at two nearby locations within a residential grouping the more conservative noise level criterion has been adopted.

Table 7 – Noise Objectives for Surrounding Receivers

Location	Day time Noise Objective dB(A) L_{eq}	Evening Noise Objective dB(A) L_{eq}	Night time Noise Objective dB(A) L_{eq}	Noise Objective for Intermittent Activities dB(A) L_1 (1 Min) (Background + 15 dB(A))
500 Pacific Highway, St Leonards	55	45	40	58

*Note: Noise level criteria above includes noise levels impacting the future residential receivers proposed within the development as result of the operation of the proposed facilities within the development.

6.7 ASSESSMENT

Noise emissions from the site will be assessed against the acoustic objectives presented in Section 5.2 above.

Noise sources that require assessment are:

- Mechanical plant servicing the development.

6.7.1 Mechanical Plant

Mechanical plant items are not typically selected at DA stage as detailed design and selection of plant and equipment has not been conducted at this time.

Detailed review of all external mechanical plant will be undertaken during design development (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 5.2 of this report.

A review of the proposed plant locations has been conducted and it is both possible and practical for the equipment to 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. Experiences with similar developments indicate that suitable acoustic treatments are both possible and practical.

A detailed assessment of all mechanical plant will be conducted as part of the detailed design prior to CC to determine acoustic treatments (if any) required to ensure plant noise does not exceed acoustic criteria based on Lane Cove Council and the EPA INP criteria.

7 CONCLUSION

Having undertaken a noise assessment relating to the proposed development at 500 Pacific Highway we are of the view that noise impacts within apartments can be made to comply the relevant criteria with the use of suitable glazing and seals where required.

With respect to plant and equipment servicing the development, we are of the view that there is nothing untoward which cannot be dealt with as part of the normal detailed design and specification process which would preclude the development from meeting the required standards.

Yours faithfully,

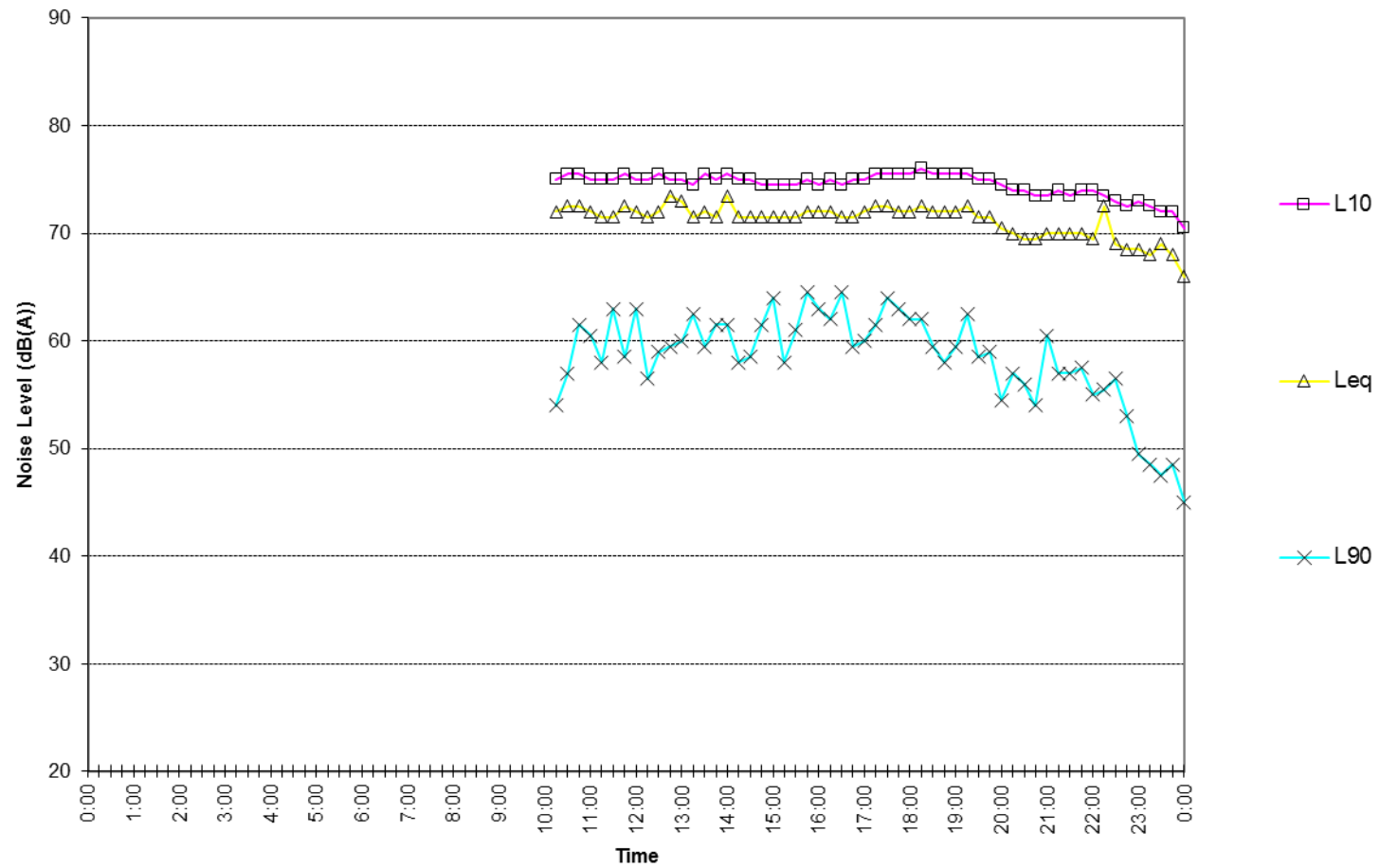
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Acoustic Logic Consultancy Pty Ltd
Ben White

Appendix A – Noise Logging Results

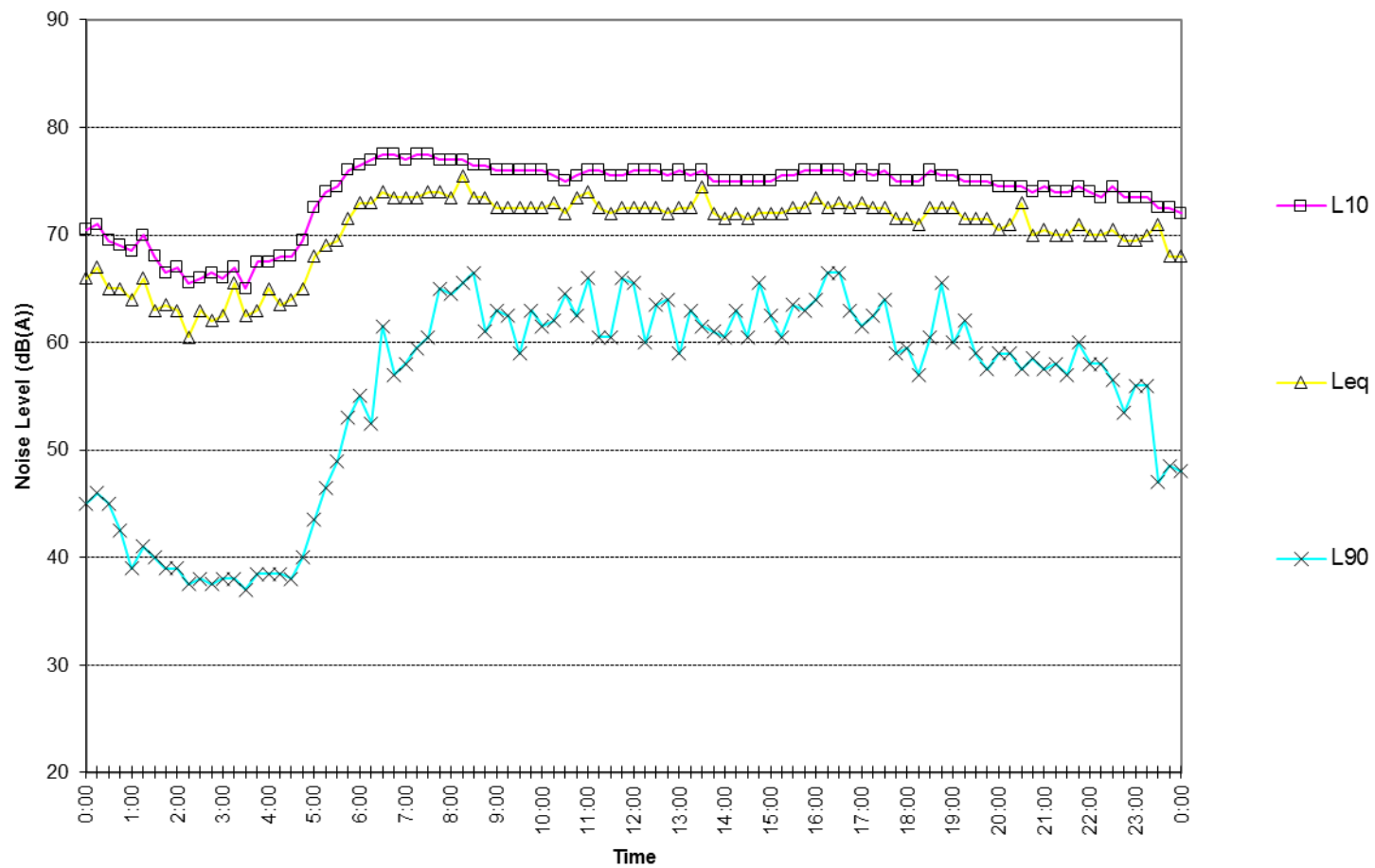
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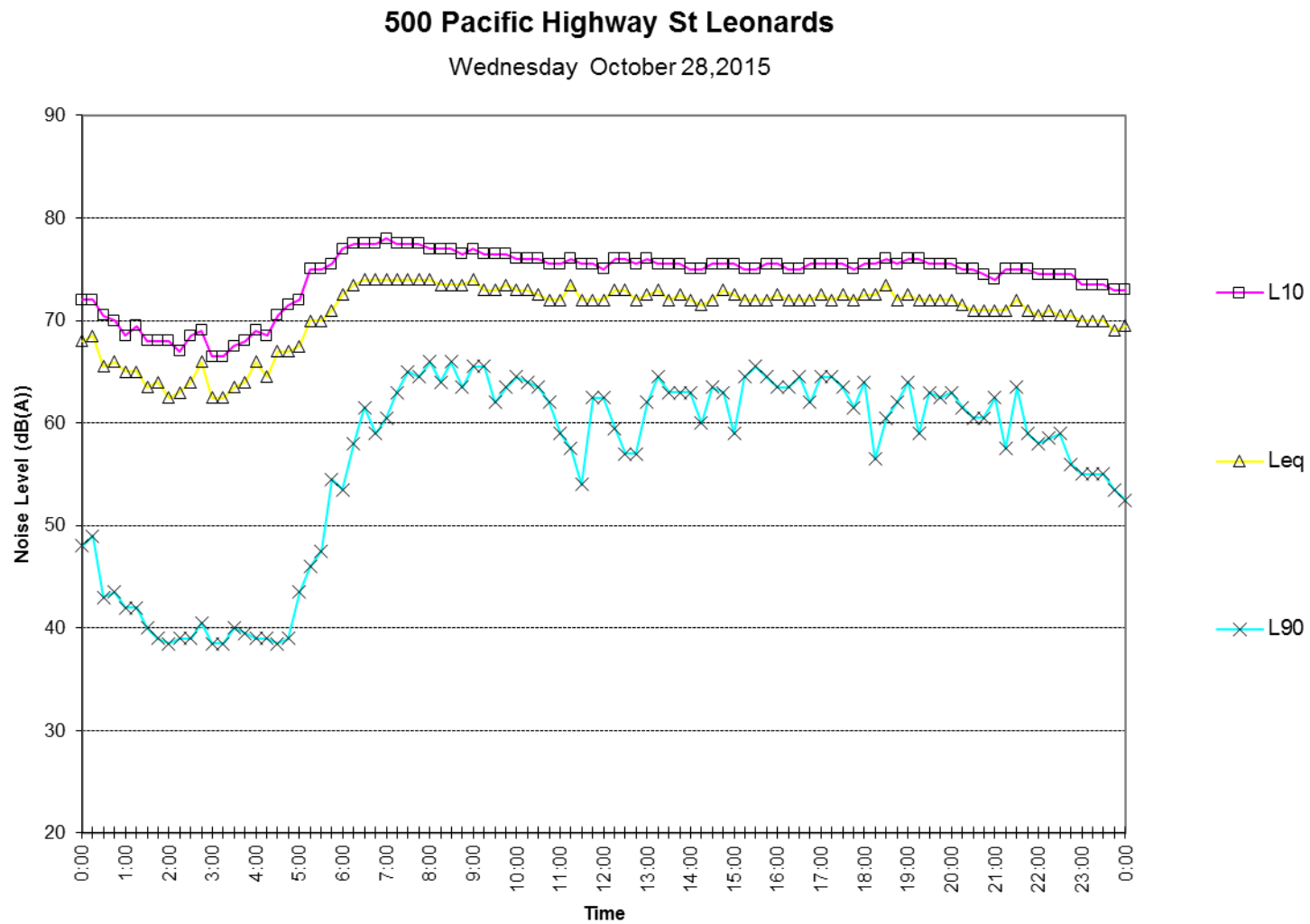
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500 Pacific Highway St Leonards

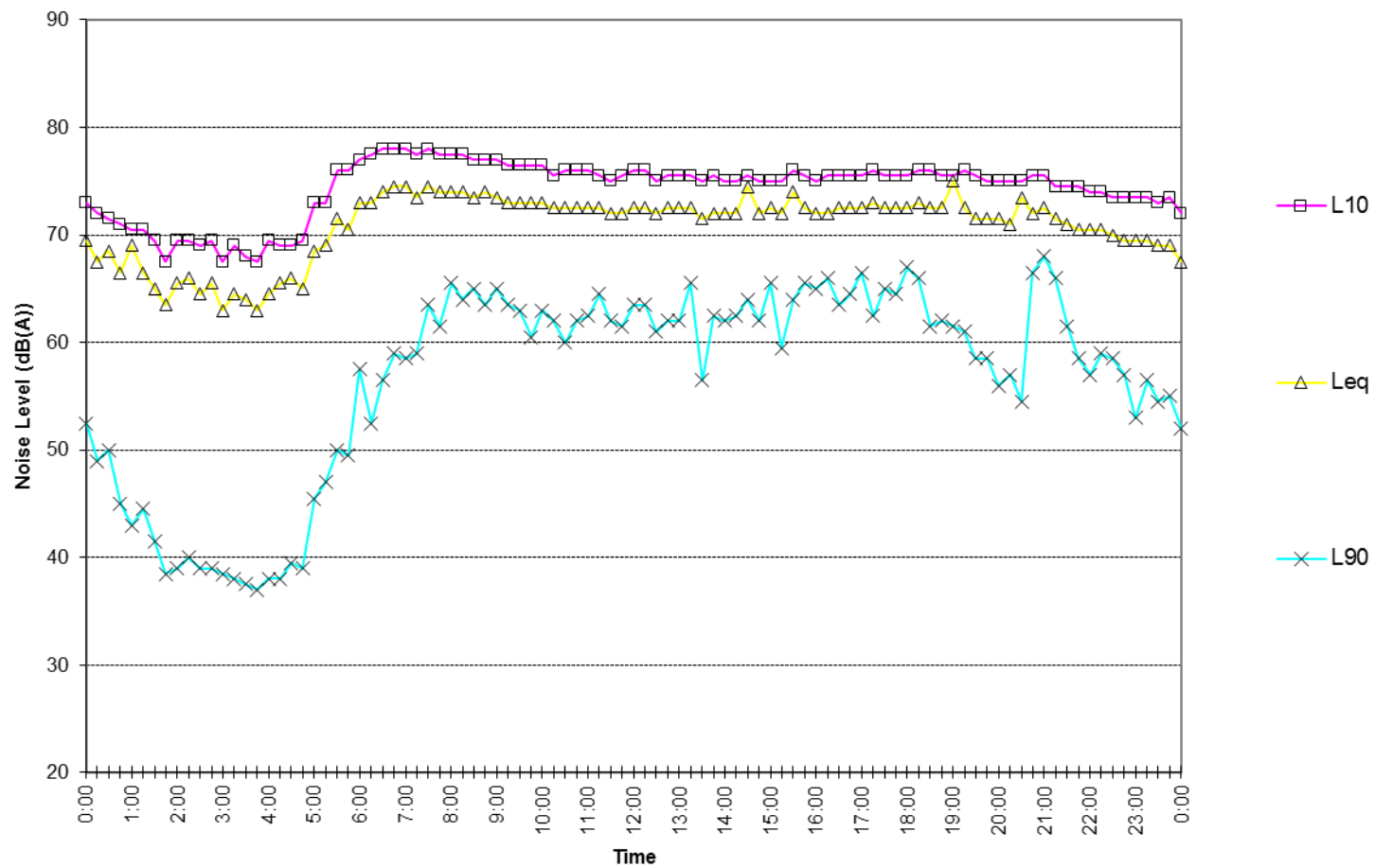
Tuesday October 27, 2015





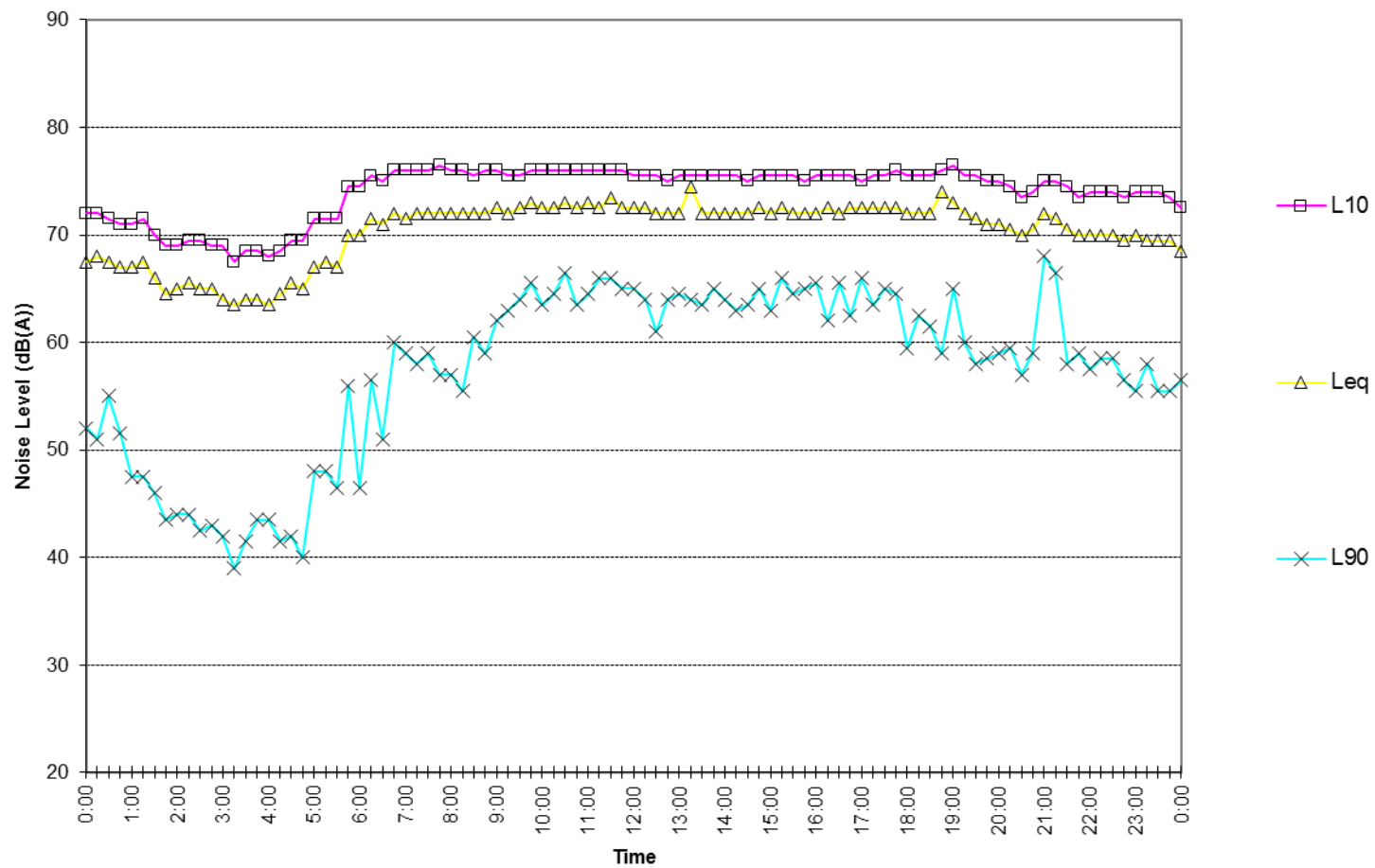
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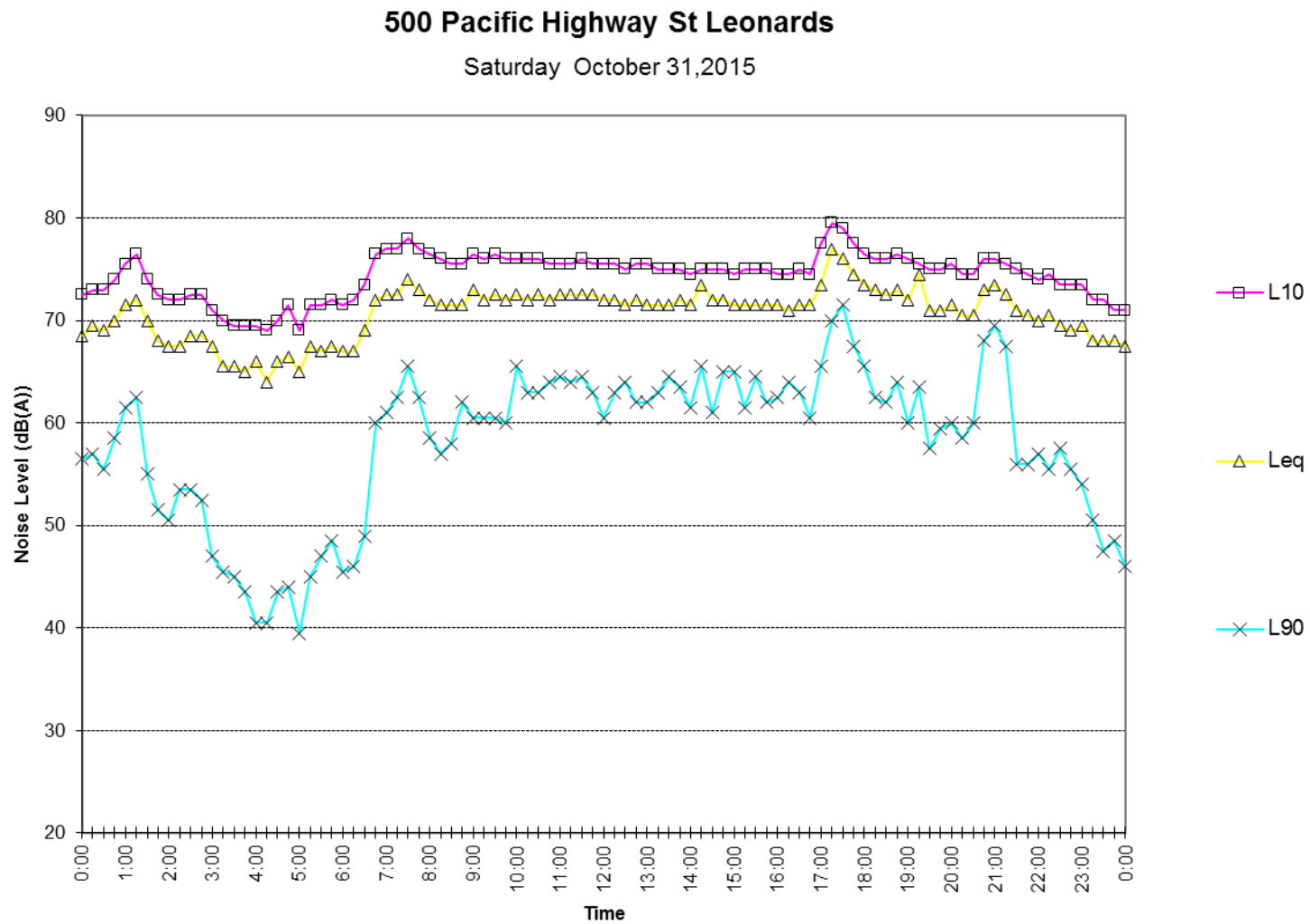
Thursday October 29, 2015



500 Pacific Highway St Leonards

Friday October 30, 2015





500 Pacific Highway St Leonards

Sunday November 1, 2015

