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Noise Impact Assessment

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1 INTRODUCTION

This report presents an analysis an acoustic assessment associated with the proposed mixed use development at 472 and 486 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 two towers of 36 and 29 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.

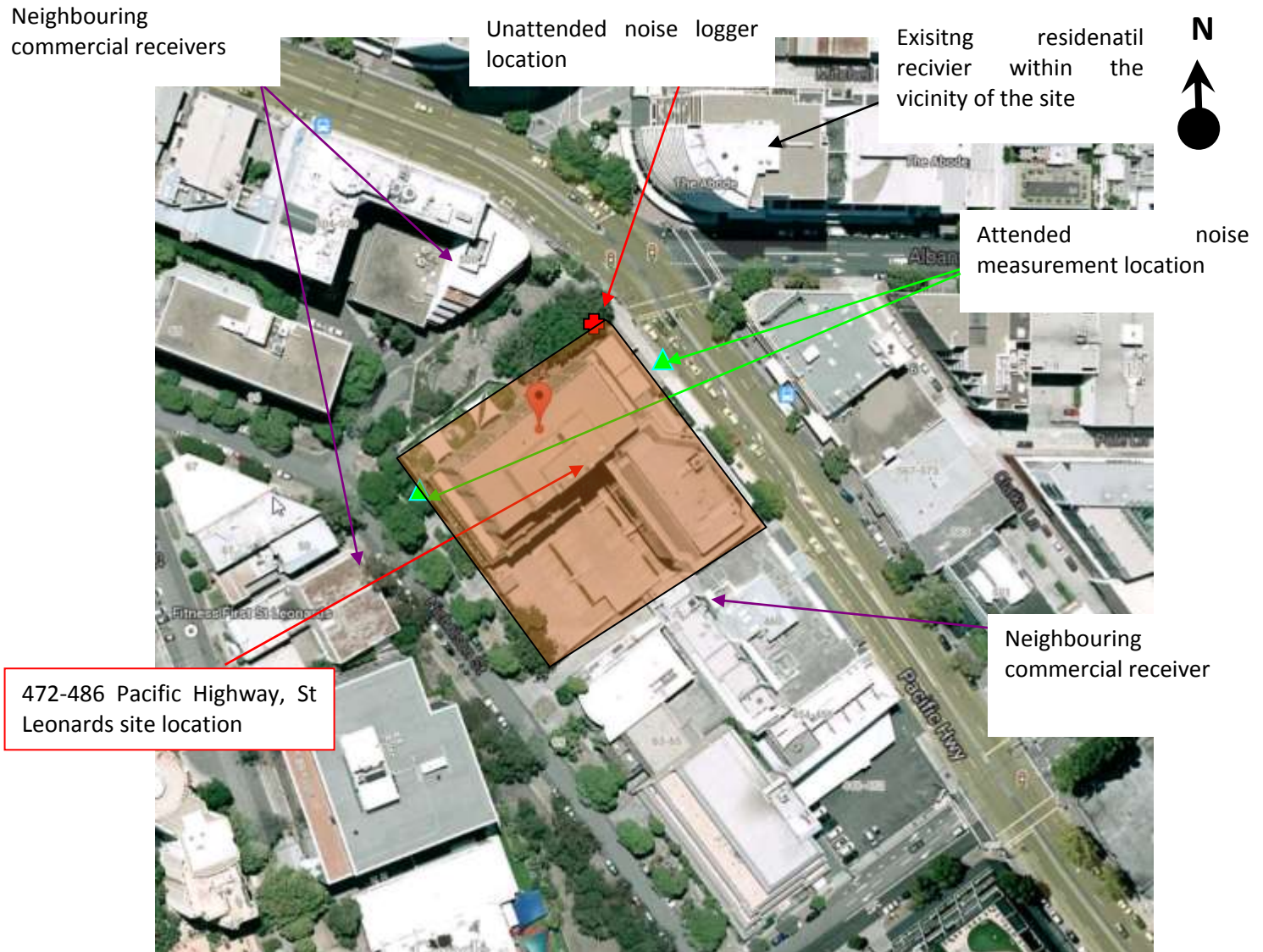


Figure 1 – Site Plan and Measurement Locations

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 14th December, 2014. Figure 1 above details the attended measurement position and again on the 16th July, 2015 to confirm the previous measurements are acoustically accurate.

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 10th and 16th December, 2014. Figure 1 details the unattended monitoring position and have been confirmed as accurate based on the attended noise level measurements conducted at the site on the 16th July, 2015.

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)	70
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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
	North and South façades	Bedroom	10.38mm laminated	Yes
		Living Rooms	10.38mm laminated	Yes
	Eastern 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**.

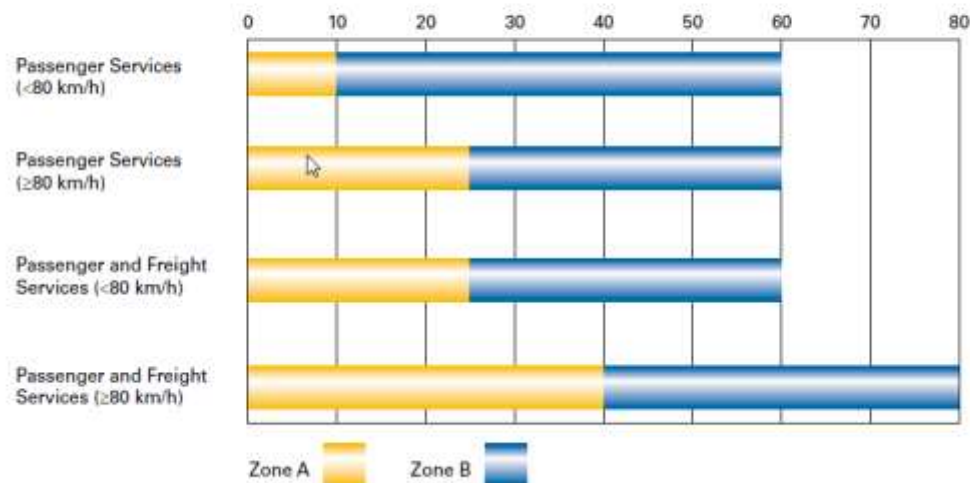


Figure 3.1: Acoustic Assessment Zones based on distance (m) of noise-sensitive development from operational track (not corridor)

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.

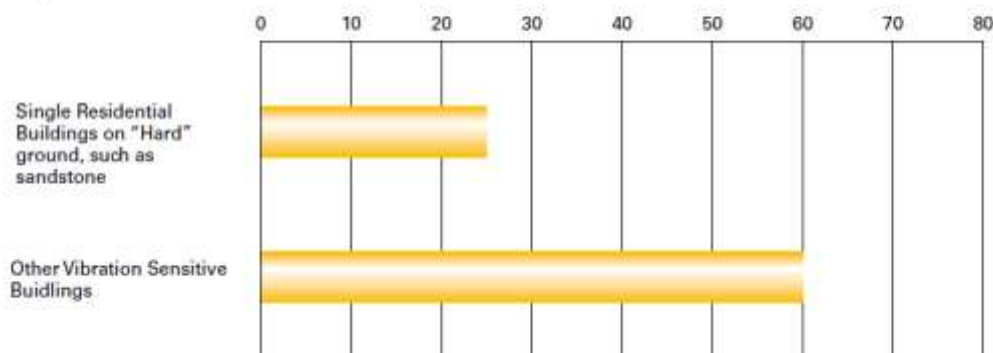


Figure 3.2: Distance from the nearest operational track (m)

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	50

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))
472 and 486 Pacific Highway, St Leonards	55	45	40	65

*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.

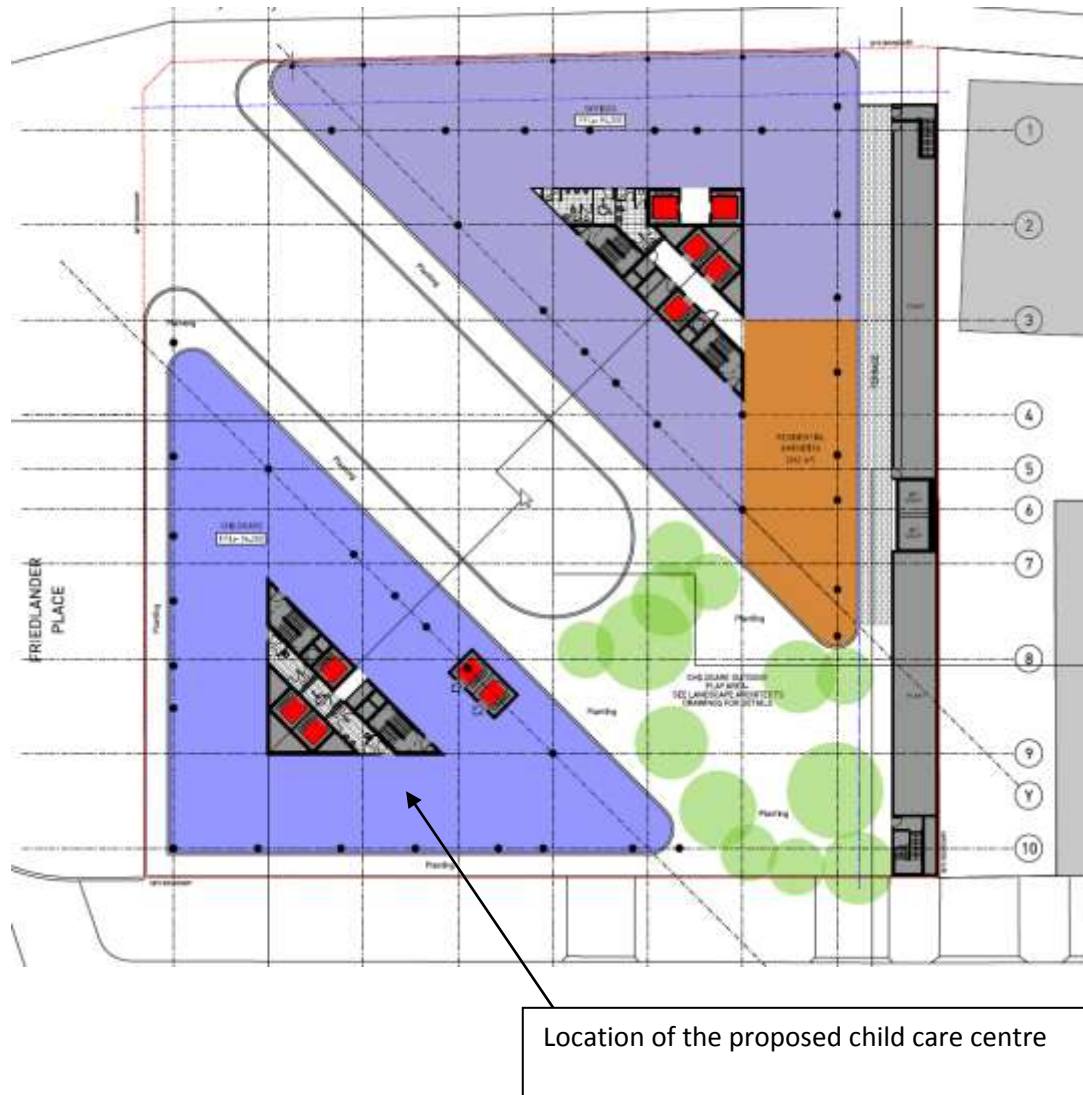
A detailed assessment of all mechanical plant will be conducted as part of the detailed design prior to CC to determine acoustic treatments (if any) required to ensure plant noise does not exceed acoustic criteria based on Lane Cove Council and the EPA INP criteria.

7 CHILDCARE CENTRE

As part of the proposed there is a provision for a childcare centre to be built on the 2nd floor of the podium of the development which has been assessed in this section of the report.

This section of the report details the assessment of environmental noise impact into the proposed child care centre.

The proposed child care centre is to be located within the commercial areas of the west tower and the external areas as detailed in the figure below.



7.1 INTERNAL NOISE CRITERIA

The Australian Standard 2107:2000 details the following control for external noise intrusion to childcare facility. The applicable criteria from that standard are as follows:

Table 8 – Recommended Design Sound Level

Type of Occupancy/Activity	Recommended Design Sound Level dB(A) $L_{eq, 1hour}$
Sleeping Rooms	35
Indoor Play Areas	40

The recommended acoustic treatments to the building façade to ensure internal noise levels comply with the criteria above is 6.38mm laminated glass to the perimeter of the proposed childcare centre.

7.2 NOISE EMISSION PREDICTIONS

The assessment of noise emissions from the proposed child care centre has been assessed as follows:

1. The centre will cater for up to 120 children within the centre.
2. The centre including external play areas within the external podium area between the proposed towers as detailed in the figure above.
3. Internal areas as detailed in the architectural plan of the development.

7.2.1 Noise Source Data

This section of the report details the source noise data which has been used as the basis of this report and the recommended treatments are those required to comply with the noise level criteria detailed in the Sections above.

7.2.1.1 Outdoor Play Area Noise Measurements

Outdoor play area noise measurements were undertaken at a typical Child Care Centre for the purpose of using a source noise level in this assessment. Noise measurements were taken of the 3 to 6 year age group with 8 kids at play which have then been corrected to the sound power level for 1 child and used as the basis of the noise source in this assessment.

This group represents the most active of the age groups and hence are likely to generate the maximum noise levels and has been used as the basis of this assessment and adjusted for the a likely number of children that could be accommodated within the 472-486 Pacific Highway development.

The noise level recorded by this play group has been corrected for the sound power level of 1 child at play and then corrected for the assessment of the proposed number of children within the development.

7.2.1.2 Measurement Equipment

Noise measurements were obtained using a CEL-593 Type 1 Sound Level Analyser, set to A-weighted fast response. The sound level meter 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.

7.2.1.3 Measured Noise Levels

The measured activity noise levels from the 8 children playing are listed below in table below.

Table 9 - Measured Children Activity Noise Levels dB(A) L_{A10}

LOCATION	Activity	Distance	NOISE LEVEL dB(A) SPL
Outdoor Play Area	Bikes + Sandpit play	3m	66
	Blocks + Sandpit play	4m	64
	Stepping Blocks + Sandpit play	4m	57
	Play gym + Sand pit play	3-4m	65

The noise levels detailed above will be used as the basis of noise emissions from the proposed site.

7.2.2 Predicted Noise Levels

7.2.2.1 Outdoor Noise

Noise emissions from the play areas are predicted based on the following assumptions:

- The measured typical kids' play noise data above
- Play areas are assumed to be operating at the nominated capacity, and the children are distributed evenly across the outdoor play area.
- Outdoor playing time will be restricted to between 8am and 6pm
- The recommended constructions and management controls presented in Section 6 of this report have been implemented in the building.

The noise level at the nearest residents was predicted using the above data and by taking into account any expected noise reduction provided by the building fabric, distance losses, directivity, barrier effects, number of children playing etc.

Table below shows the predicted noise levels from the children in outdoor play area to the future residential receivers within the development on the levels above.

Table 10 - Predicted Noise Levels from Outdoor Play (Day time only as this is when external play area will be used)

Receptor	Predicted Noise Level $L_{eq, 15min}$ dB(A)	Criteria $L_{eq, 15min}$ dB(A)	Complies
Future residence within the development	55 External	55 External	Yes

7.2.3 Indoor Noise Impact to Future Residence Above

Noise Levels generated from indoor structured activities (i.e. lessons) are based on a raised speech sound power level of 78dB(A) for the teacher.

The noise level at the nearest residents was predicted using the above data and by taking into account any expected noise reduction provided by the building fabric, distance losses, directivity, barrier effects, etc. Table below shows the predicted noise levels from lessons.

The assessment has been conducted assuming a minimum concrete construction of the floor slab above of 200mm.

Table 11 - Predicted Noise Levels from Indoor Play

Receptor	Predicted Noise Level $L_{eq, 15min}$ dB(A)*	Criteria $L_{eq, 15min}$ dB(A)	Complies
Future residential receivers above the child care centre	< 30 External	30 (internally)	Yes

*Note: Predicted noise levels assume windows are fitted with 6.38mm laminated glazing with acoustic seals and a concrete slab of 200mm.

7.3 RECOMMENDED CHILDCARE CENTRE TREATMENTS AND CONTROL

The following building and management controls are required to control noise impact from the proposed child care centre on Level 2 of the proposed development to the surrounding receivers, including the future residential receivers within the development.

- Children's outdoor play area to be operational between 8am and 6pm on any given day.
- Minimum 6.38mm laminated glazing with acoustic seals around perimeter of the internal areas of the centre is required, with minimum R_w of 30.
- Signs reminding staff and visitors to minimise noise at all times shall be installed at ingress/egress points from the child care centre.
- The underside of the building structure to the over the external area is to be acoustically absorptive treatment such as envirospray, absorptive insulation or the like. Treatments should be to a minimum of 40% of the soffit area. Details to be provided at the CC stage of the project.
- Management is to ensure children are supervised at all times to minimise noise generated by the children whenever practical and possible.
- Install a contact phone number at the front of the centre so that any complaints regarding centre operation can be made.
- A canopy is requested to be located above the external play areas of the centre. Canopy to be constructed from the shade material or other solid type structure.

8 CONCLUSION

Having undertaken a noise assessment relating to the proposed development at 472 and 486 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,

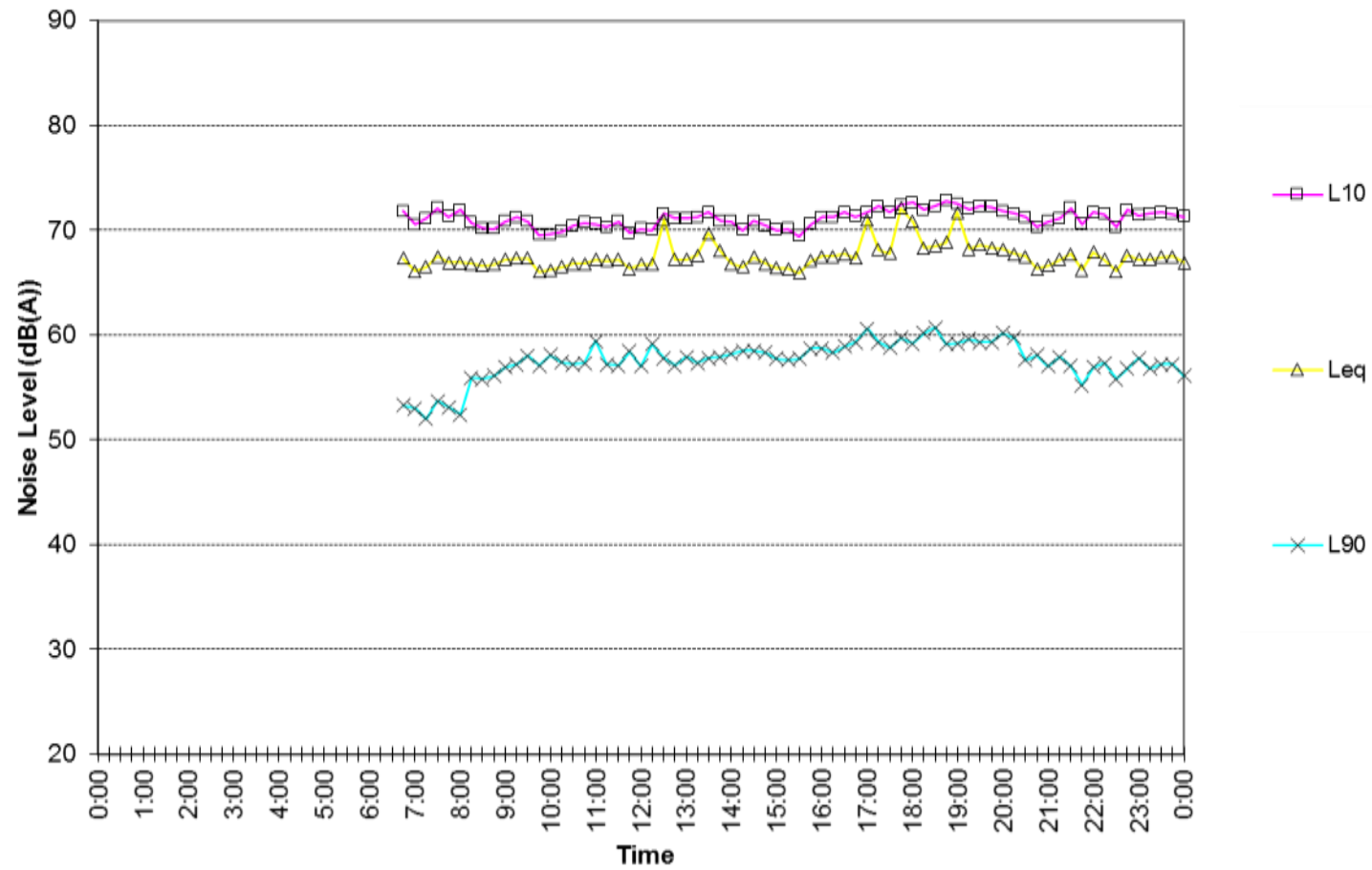
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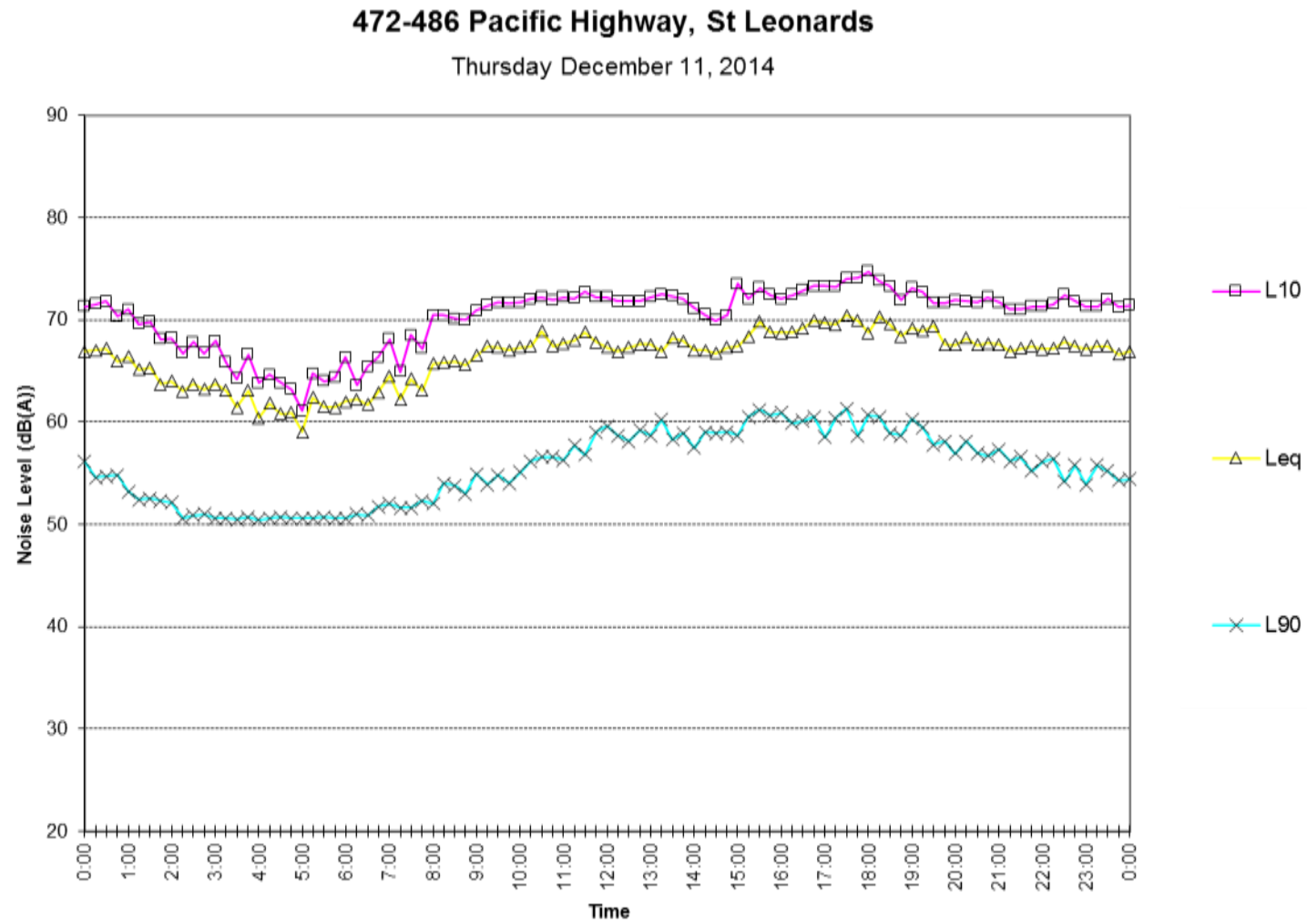
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Appendix A – Noise Logging Results

472-486 Pacific Highway, St Leonards

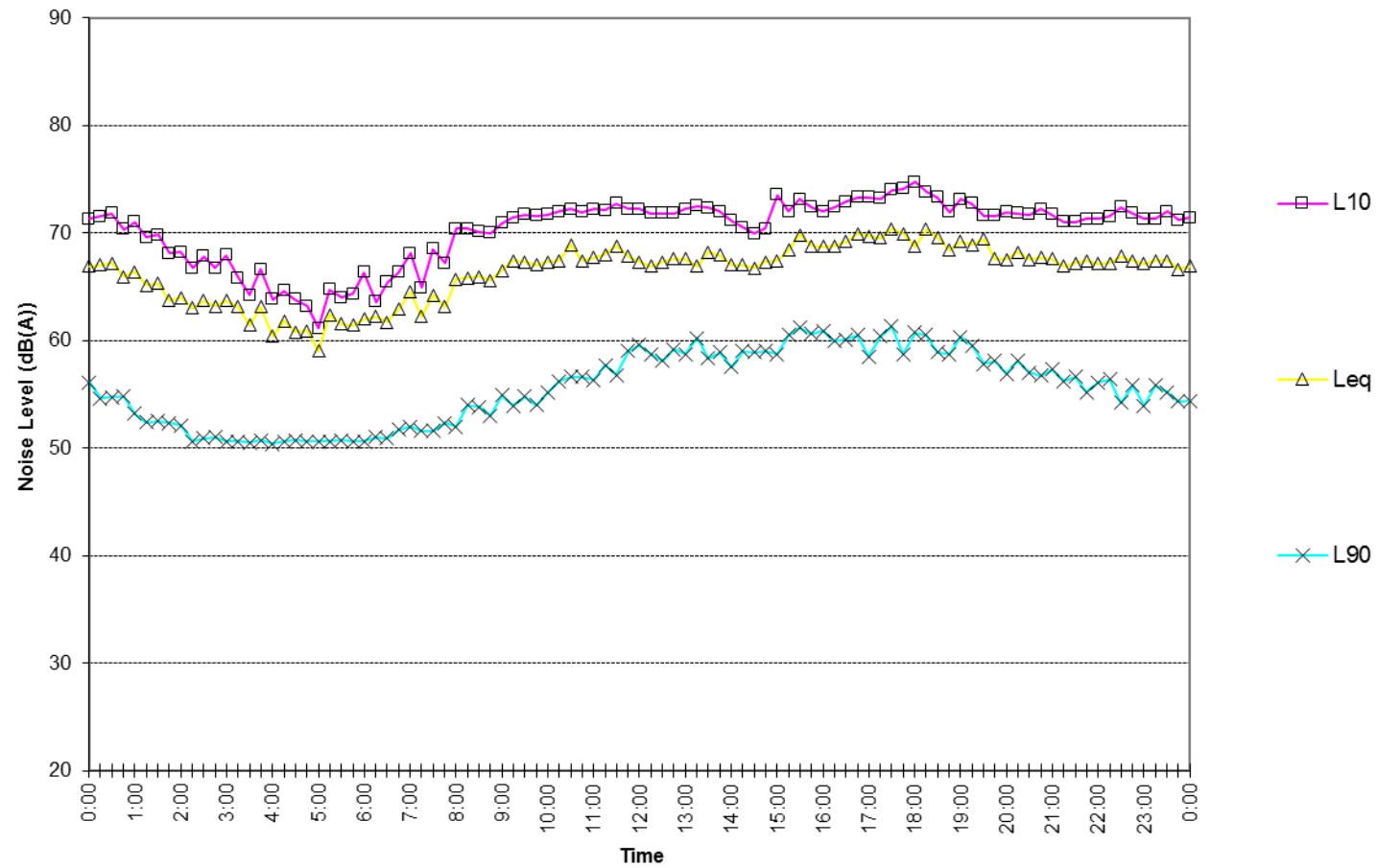
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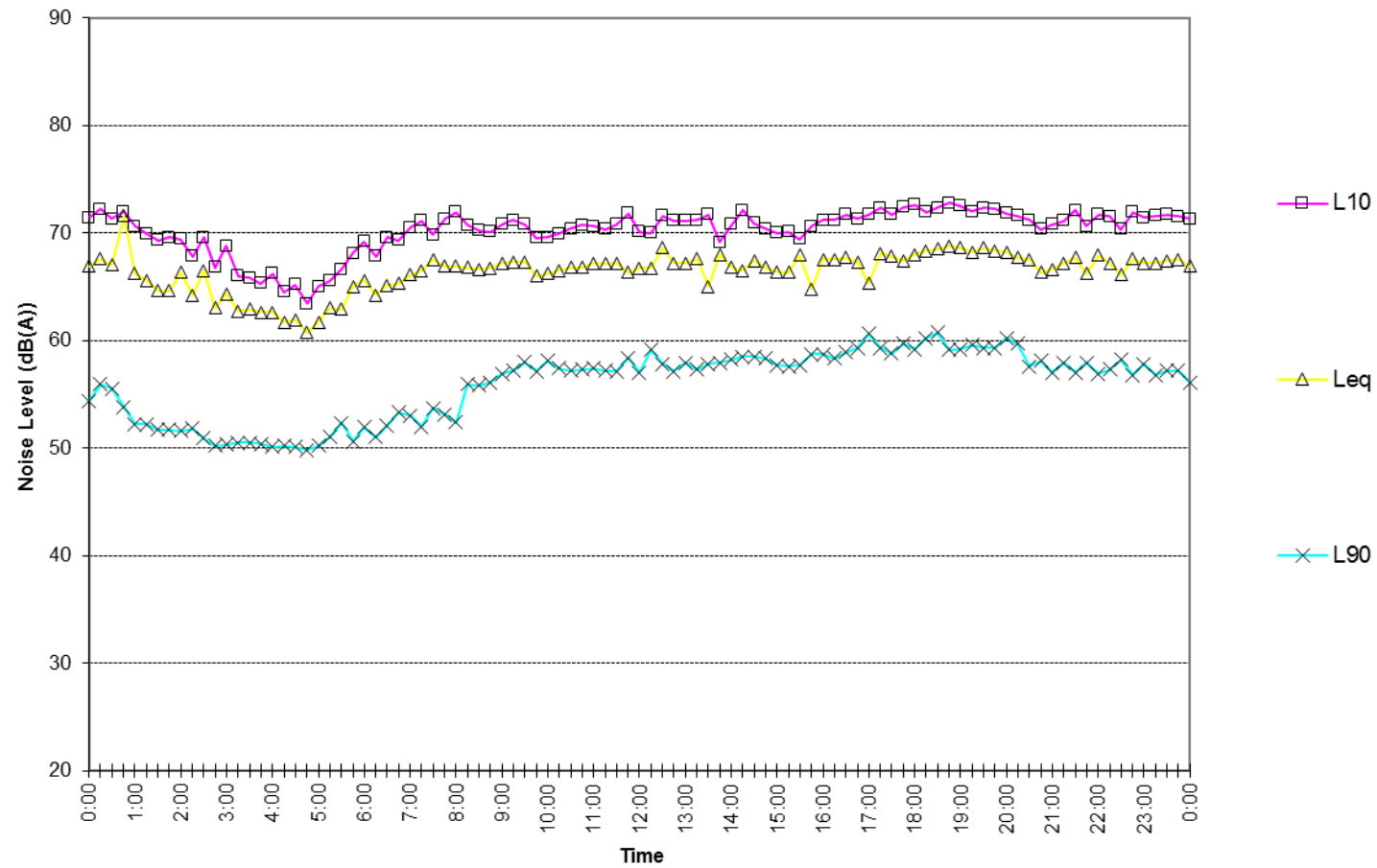
472-486 Pacific Highway, St Leonards

Friday December 12, 2014



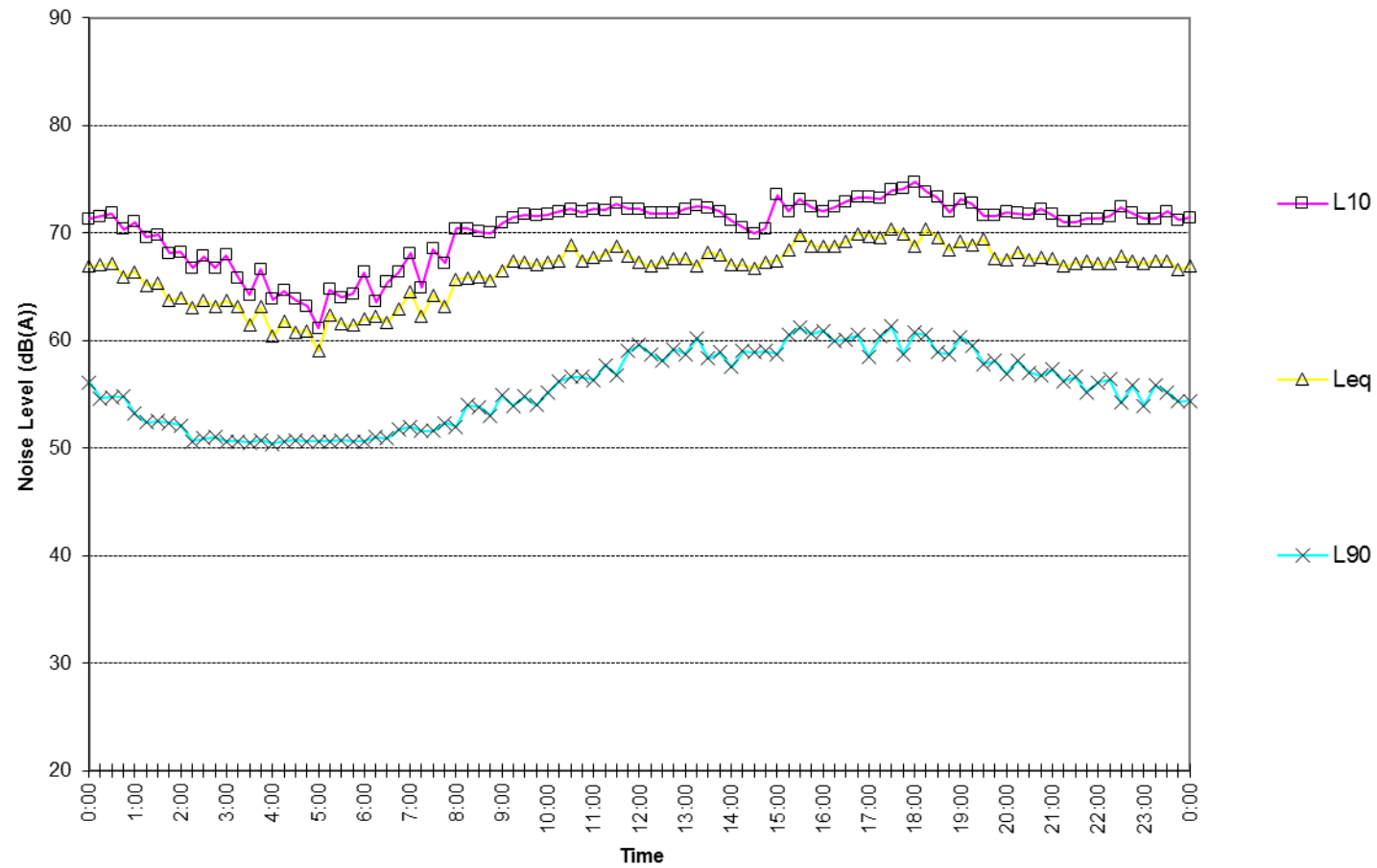
472-486 Pacific Highway, St Leonards

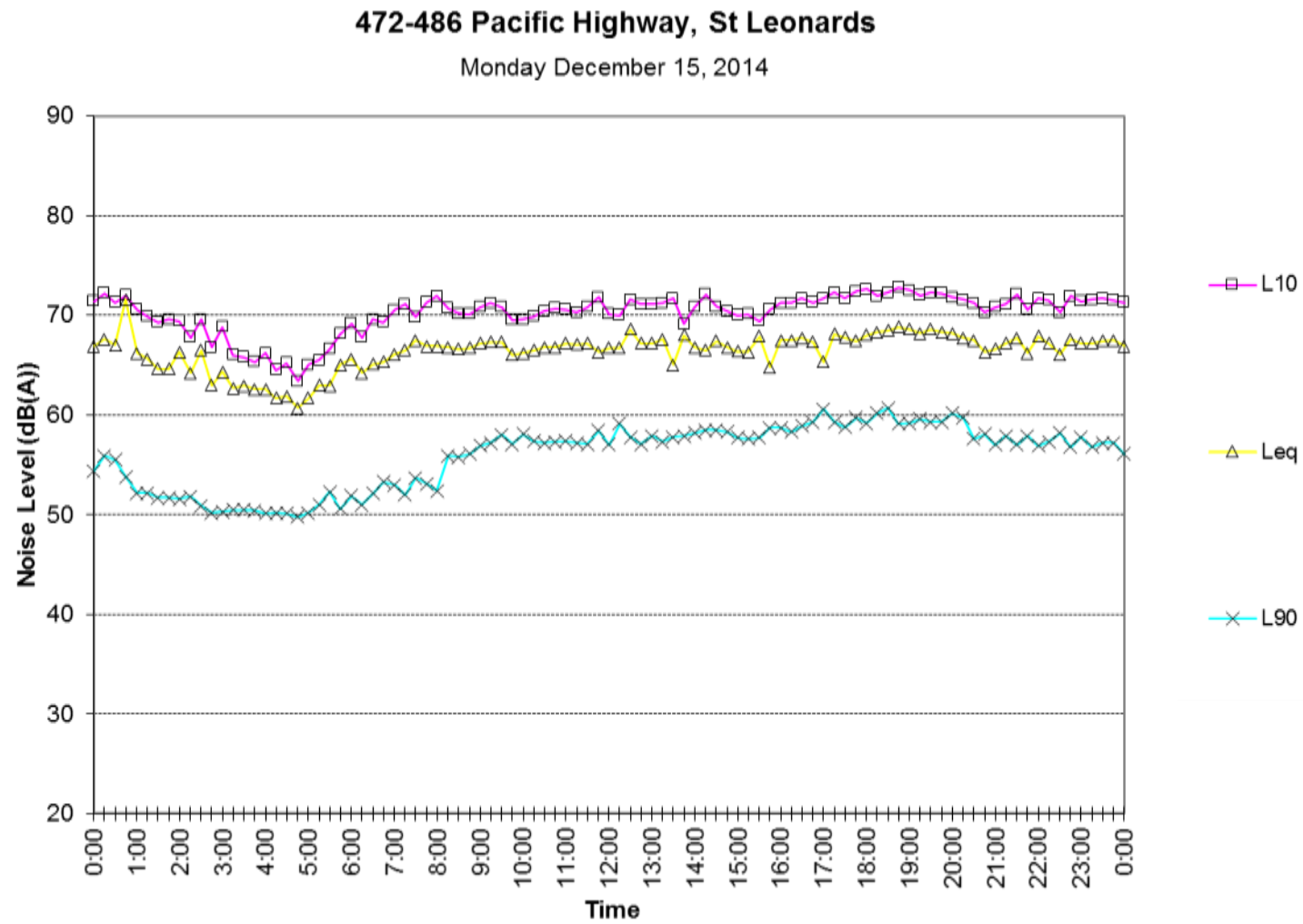
Saturday December 13, 2014



472-486 Pacific Highway, St Leonards

Sunday December 14, 2014





472-486 Pacific Highway, St Leonards

Tuesday December 16, 2014

