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23-41 Lindfield Avenue & 7 and 11 Havilah Lane, Lindfield

Noise Impact Assessment

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1 INTRODUCTION

This report presents our assessment of rail noise and vibration and traffic noise impact on the amenity of the proposed mixed use development at 23-41 Lindfield Avenue & 7 and 11 Havilah Lane, Lindfield.

Traffic noise and train noise and vibration has been assessed in accordance with requirements of NSW Government Department of Planning "Development Near Rail Corridors and Busy Roads"- Interim Guideline and the projects specified criteria and the Australian Standard AS2107:2000.

The assessment is based on the drawings provided by Crone Partners to this office and dated 30/1/2015.

This assessment has been conducted in conjunction with the requirement of Developments near Rail Corridors and Busy Roads and the Australian Standard AS2107:2000

2 SITE DESCRIPTION

The proposed development is a multi story mixed use development including 141 residential apartments in two (2) towers above the retail podium, Four (4) levels of parking for 255 vehicles, 898m^2 of communal open space at podium level between the two towers, associated landscaping, servicing and infrastructure, and fit-out and use of the proposed major retail tenancy as a supermarket.

The site is located in the block bound by Lindfield Avenue, Kochia Lane and Havilah Lane, Lindfield. The western aspect of the site faces the railway line which is separated from the site by Lindfield Avenue. This railway line carries passenger trains. A detailed site map and the noise and vibration measurement location is shown in Figure 1 below.

Figure 1 Site Map and Measurements Location

Figure 2 – Proposed Development Site

3 ASSESSMENT CRITERIA

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

3.1 TRAIN AND TRAFFIC NOISE AIRBORNE NOISE CRITERIA

Potential noise sources in the vicinity of the site includes the railway line to the west of the proposed site as well as other surrounding roadways.

As the development site is located within 60m of the railway line environmental noise is be required to comply with the with the requirements of the SEPP including Developments near Rail Corridors and Busy Roads.

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 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 at the source.

Conversely, the L_{10} 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.

3.2 ACOUSTIC OBJECTIVES

The determination of an acceptable level of traffic noise within the residential 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.

Traffic noise will be assessed to the following criteria:

- State Environmental Planning Policy 2007 – which includes the Developments near Rail Corridors and Busy Roads criteria.

3.2.1 State Environmental Planning Policy 2007

The State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') sets out internal noise levels for developments with the potential to be impacted by traffic or rail noise and vibration.

The Infrastructure SEPP defines busy roads that are subject to an acoustic assessment as:

> *"Roads specified in Clause 102 of the Infrastructure SEPP: a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA).*
>
> *Any other road – with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA).*
>
> *Any other road – with a high level of truck movements or bus traffic."*

The Infrastructure SEPP sets out the following criteria for internal noise levels from airborne traffic noise:

> *"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."*

Internal requirements are for residential units and are measured internally with windows closed.

3.2.2 Summary of Noise Intrusion Criteria

This assessment shall be conducted in accordance with the most stringent criteria specified above, which is the Infrastructure SEPP 2007 and Council requirements, as detailed in the table below.

Table 1 – Internal Noise Levels Criteria

LOCATION	CRITERIA
Bedroom	35dB(A)$L_{eq(9hour)}$
Living areas	40dB(A)$L_{eq(15hour)}$

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 is compliance with the relevant mechanical and ventilation codes.

3.3 TRAIN VIBRATION IMPACTS

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. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with the ground borne L_{Amax} noise ,limit of 40 dB(A) (day time) or 35 dB(A) (night time) measured using “slow” response time setting on a sound level meter.

As the development is not located directly above or on land adjacent and above a railway tunnel, impacts of structure bone vibrations are not required to be assessed further.

4 TRAIN NOISE AND VIBRATION MEASUREMENTS

As part of this assessment noise levels have been recorded at the site. Additionally the previously obtained noise logger data conducted at the site has been used in the assessment as attended noise levels conducted in 2-015 have confirmed the levels remain relevant.

4.1 ATTENDED MEASUREMENTS

Attended noise measurements were obtained at the site as detailed in Figure 1 of this report. Measurements were taken during a typical peak afternoon period of the 5th February, 2015.

4.1.1 Time of Measurements

The attended measurements were carried out from 4:00pm to 6:30pm on 5th February, 2015.

4.1.2 Measurement Equipment

Attended noise measurements were undertaken using a Norsonics Type 118 precision sound level analyser, set to A-weighted fast response. The precision sound level analyser was calibrated before and after the measurements using a Norsonics 1251 sound level calibrator. No significant drift was recorded.

For Vibration measurements a Svan958 four–channel sound and vibration meter and analyser fitted with a SV12L microphone. The analyser was set to fast response and calibrated before and after the measurements using a SV30A calibrator. No significant drift was noted.

4.2 UNATTENDED NOISE LOGGING

Unattended noise monitoring has previously conducted at the site between 18th August and 23rd August 2010 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 monitor was installed at the site as shown in figure 1 above, the location was selected to provide indicative existing background noise levels at the nearest potentially affected residents as well as noise impact from the adjacent railway line. The results of noise logging is included in Appendix A.

The results of noise monitoring have been confirmed as accurate for the site based on the results of attended noise measurements conducted in 2015 which recorded similar noise levels to that of the logging.

4.3 MEASURED NOISE LEVELS

The following calculated noise levels (refer Table 2) were determined from the measurement SEL data of each train passby and the frequency of trains presented in the current train time table.

Table 2 –Measured/Predicted Rail External Noise Levels

LOCATION	TIME OF DAY	$L_{Aeq\ (1\ hour)}$ dB(A)
Western Façade of the Future Development	Day (7am-10pm)	69
	Night (10pm-7am)	65

5 TRAFFIC NOISE MEASUREMENTS

5.1 MEASUREMENT POSITION

Traffic noise measurements were obtained at a number of locations surrounding the site as detailed in Figure 1 of this report. Measurements were taken during a typical peak afternoon period of the 27th May, 2010.

5.2 TIME OF MEASUREMENTS

The manned measurements were carried out from 3:00pm to 4:30pm on 27th May, 2010.

5.3 MEASUREMENT EQUIPMENT

A Svan958 four–channel sound and vibration meter and analyser fitted with a SV12L microphone. The analyser was set to fast response and calibrated before and after the measurements using a SV30A calibrator. No significant drift was noted.

5.4 MEASURED NOISE LEVELS

Traffic noise levels recorded at the façade of the future development, which will be used as the basis of this assessment are detailed in the table below.

Table 3 –Measured Traffic External Noise Levels

LOCATION	Measured Noise Level L_{Aeq} dB(A)
Location 1 – Lindfield Av (North)	66
Location 1 – Lindfield Av (South)	67
Kochia Lane	53

6 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 are to contain brickwork 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 8 reduces internal noise levels to within the nominated criteria for the various space types.

7 RAILWAY VIBRATION

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

7.1 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 4. For this project the aim will be for a low probability of adverse comment.

Table 4 – Vibration Dose Values (m/s1.75) 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

7.2 RAIL VIBRATION MEASUREMENTS

7.2.1 Measurement Positions

The train vibration measurements were obtained at the western boundary of the site as detailed in the figure in Section 2 above.

7.2.2 Time of Measurements

The manned measurements were carried out from 4:00pm to 4:30pm on 5th February, 2015.

7.2.3 Measurement Equipment

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

7.2.4 Measurement results: Vibration Dose Values

The maximum train passby ground vibration acceleration, the typical passby period (gained from both the noise and vibration measurements) and the estimated number of train passbys were used calculate the overall VDV values for each period of the day. The results are presented in Table 5.

Table 5 – Vibration Dose Values

Time Period	Calculated VDV $m/s^{1.75}$	Criteria VDV $m/s^{1.75}$	Complies
Day (7:00am – 10:00pm)	0.07	0.2	Yes
Night (10:00pm -7:00am)	0.05	0.13	Yes

7.3 STRUCTURE BORNE NOISE MEASUREMENTS

Internal noise levels as a result of structure born noise have been calculated for the development. Noise levels have been determined based on on-site measurements of rail induced vibration. The results of calculated structure borne noise are detailed in the table below.

Table 6 – Structure Borne Vibration Levels - Residential

Noise Level Criteria dB(A)L_{Max}	Location	Calculated Noise Level dB(A)L_{Max}	Complies
40 dB(A) – Day 35 dB(A) – Night	Potentially worst affected residential receiver	<35 dB(A)	Yes

8 RECOMMENDED CONSTRUCTIONS

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

8.1 GLAZED WINDOWS AND SLIDING DOORS

Table 7 lists the recommended glazing for this project to achieve the requirements regarding train and traffic 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 7 - Recommended Glazing for Windows and Doors

FACADE	ROOM	GLAZING THICKNESS	ACOUSTIC SEALS
Western Façade of building facing Lindfield Avenue	Bedrooms	10.38 laminated	Yes
	Living Areas	10.38 laminated	Yes
Northern and Southern Façades (both Buildings)	Bedroom	6.38 laminated	Yes
	Living	6.38 laminated	Yes
Western Façade of eastern building	Bedroom	6.38 laminated	Yes
	Living	6.38 laminated	Yes
Eastern Façade of both buildings	Bedroom	6.38 laminated	Yes
	Living	6.38 laminated	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 8 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-lon series.

Table 8 - Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Minimum STC of Installed Window
6.38mm laminated	Yes	31
10.38mm laminated	Yes	35

8.2 ROOF

The roof construction for the proposed residential development is to be constructed out of concrete and so will not require upgrading.

8.3 WALLS

The external walls are constructed of a mixture brick veneer, masonry or concrete with insulation will be acoustically acceptable without further upgrades.

9 VIBRATION ISOLATION

The results of the structure born and tactile vibration investigation indicate that internal structure borne noise levels and human comfort will comply with the relevant criteria without any additional acoustic treatments.

10 LOADING DOCK TREATMENTS

An acoustic assessment of the proposed loading dock has been conducted and providing the following acoustic treatments are installed noise impact to the surrounding areas of the future residential units within the development will not result.

This section of the report presents our assessment of the loading dock noise impact.

10.1 POTENTIAL LOADING DOCK NOISE SOURCES

The potentially significant loading dock noise sources are listed in Table 9 below along with noise emission levels. The emission levels in Table 9 have been obtained from noise monitoring carried out at similar warehouse and retail loading dock facilities. Noise measurements were obtained using a Norsonics SA 110 sound level meter, set to fast response. The sound level meter was calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was recorded.

Table 9 - Noise Source Emission Levels

Noise Source	Sound Emission Level dB(A) at 7m	Type of Noise Source
Small Truck Reversing alarm	75(1)	Quasi-Steady, tonal
Trucks Manoeuvring/Reversing	75	Quasi-Steady
Truck Air Brakes	89	Transient
Truck Door Closing	75	Transient
Truck Starting	72	Transient

(1) A 5 dB(A) penalty has been applied to this source to account for the tonal characteristic of noise produced.

10.2 PREDICTED NOISE LEVELS AT MOST AFFECTED RECEIVERS

Noise levels at the residences were predicted based on the noise emission levels in Table 9, which are typical for this type of development.

Table 10 summaries the predicted noise levels at the nearest surrounding residence. The noise levels below assume the acoustic treatments detailed in this report are adopted.

Table 10 – Assessment of Loading Dock Noise Emissions

Location/Activity	Receiver	Predicted Noise Level at Residence (at building façade externally) $L_{eq,15min}$	Predicted Noise Level Within Residence above (internal Noise levels) $L_{eq,15min}$	Discussion
Truck Loading/Unloading(1) Within Loading Dock	Potentially worst affected residence	42 dB(A) Day 42 dB(A) Evening	< 30 dB(A) <30 dB(A)	Acoustically Acceptable

1 - These activities include activities such as the delivery truck being idle in the dock, movement of pallet trucks, operation of compactors, etc.

10.3 RECOMMENDED LOADING DOCK DEVELOPMENT CONTROLS

It is recommended that the following management and physical controls be implemented into the design and operation of the proposed loading dock associated with the development:

- Operating hours for the loading docks, deliveries, garbage removals, etc not to be conducted during night time hours.
- Bail and/or garbage compactors are to be used only within the loading dock areas or wast room.
- Loading dock perimeter walls to fully enclosed from external environment.
- Neoprene rubber buffers should be installed on the vertical face of the loading dock where vehicles park to absorb impacts.
- A detailed assessment of noise emissions from plant and equipment associated with the loading dock is required to be conducted prior to installation in conjunction with EPA requirements.
- Vibration isolated floor matting to be installed to the areas of the loading dock where stacking of pallets and the like are required.
- All entry grates and grills to be securely fixed.
- The loading dock does not accept or depart trucks during night time hours.
- The roller shutter door should be closed during periods when loading and unloading is being undertaken.
- Trucks should not be stacked waiting for access to the dock adjacent to residential properties and the use of radio equipment should be used to ensure this does not happen.

11 CONCLUSION

This report provides the results of an assessment of train and traffic noise intrusion into the proposed mixed use retail and residential development at 23-41 Lindfield Avenue & 7 and 11 Havilah Lane, Lindfield. 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 project specifications The Australian Standard AS2107 and council requirements.

Railway vibration has been predicted for the residents in the future residential tenancies has also been assessed in accordance with "Development Near Rail Corridors and Busy Roads"- Interim Guideline.

Provided the recommendations in this report are implemented, noise and vibration levels will comply with the requirements of requirements of NSW Government Department of Planning "Development Near Rail Corridors and Busy Roads"- Interim Guideline.

Noise impacts have been assessed and will be acoustically acceptable providing treatments detailed in this report are incorporated into the project.

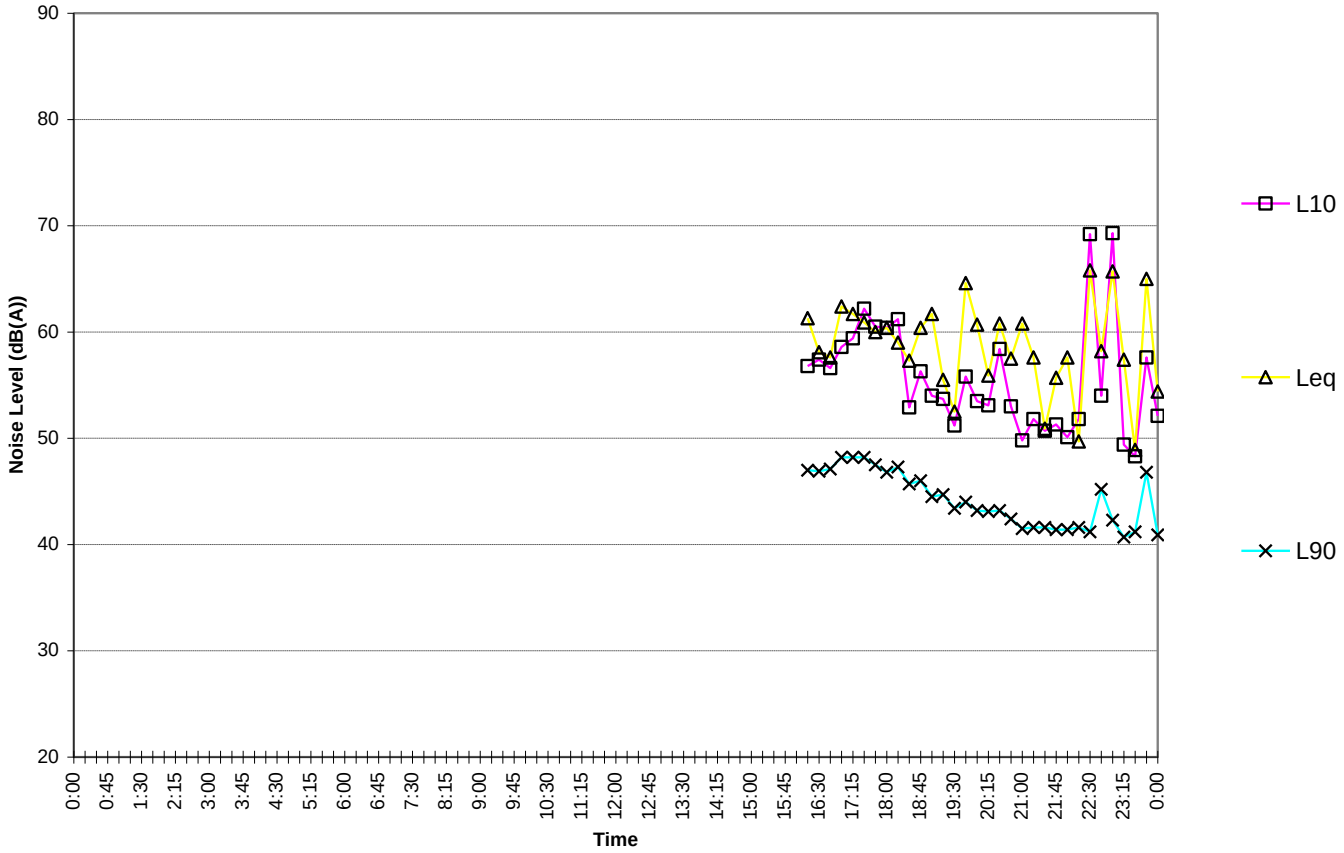
We trust this information is satisfactory. Please contact us should you have any further queries.

Report prepared by

ACOUSTIC LOGIC CONSULTANCY PTY LTD
Ben White

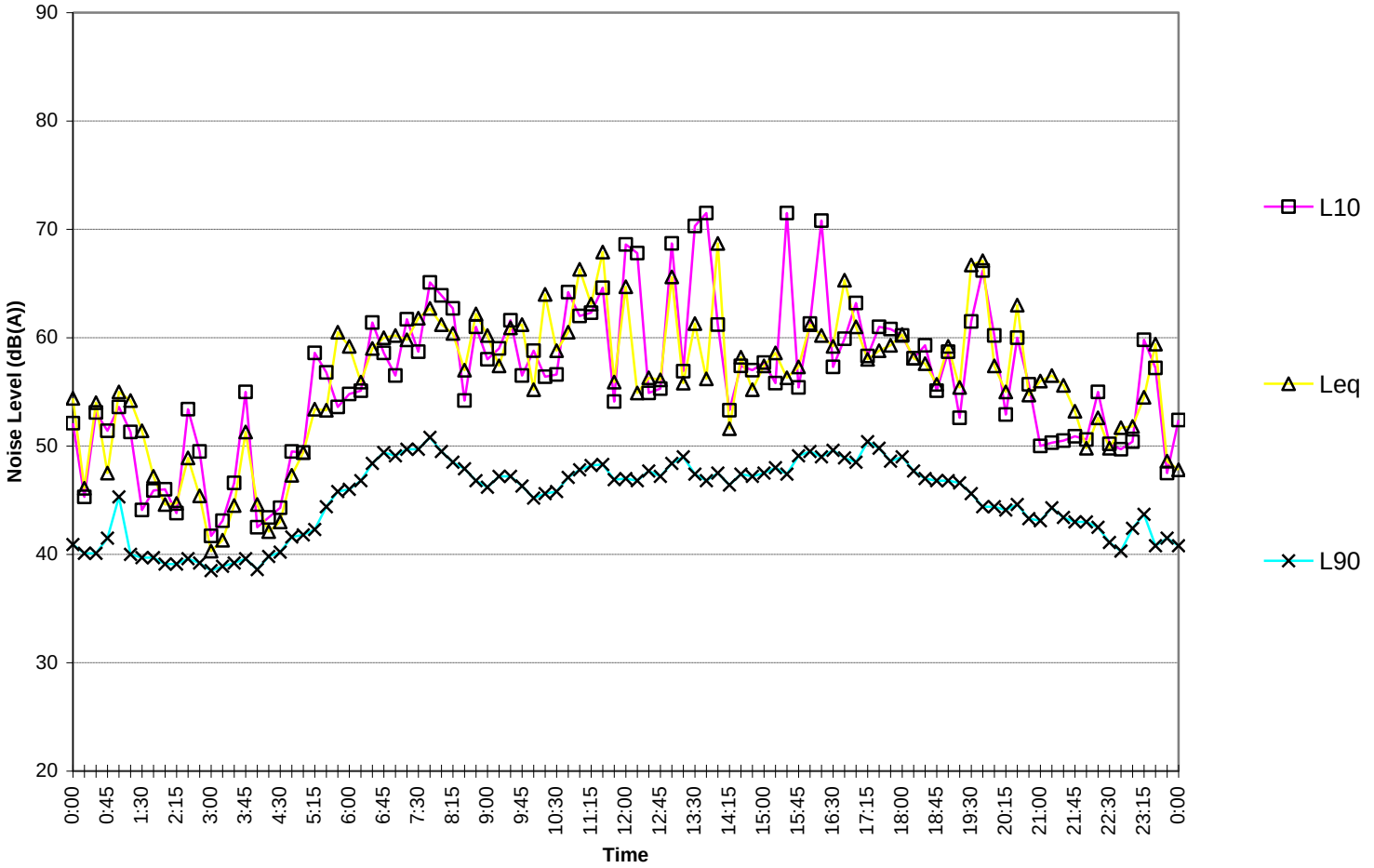
Lindfield Avenue

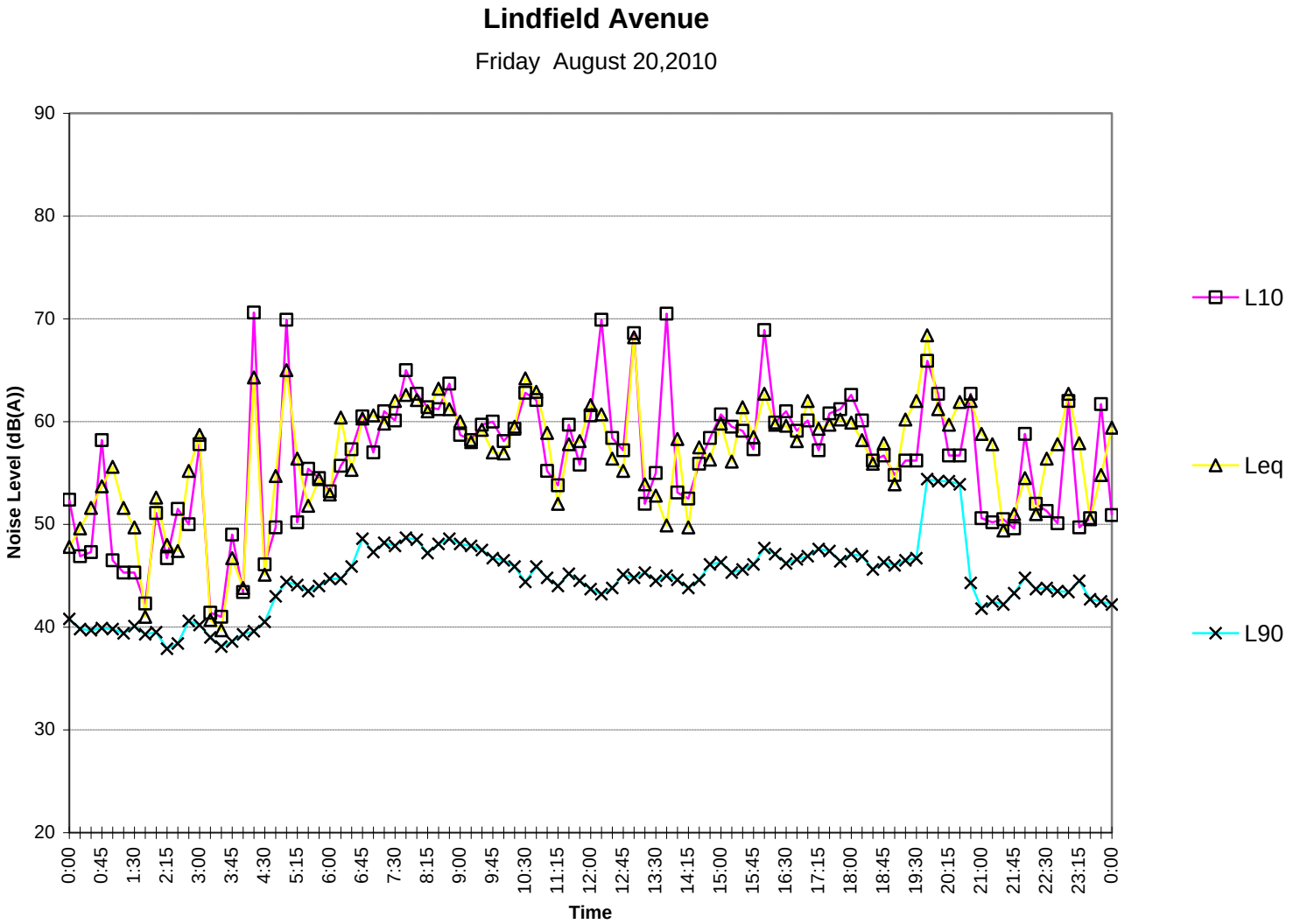
Wednesday August 18, 2010



Lindfield Avenue

Thursday August 19,2010

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Time
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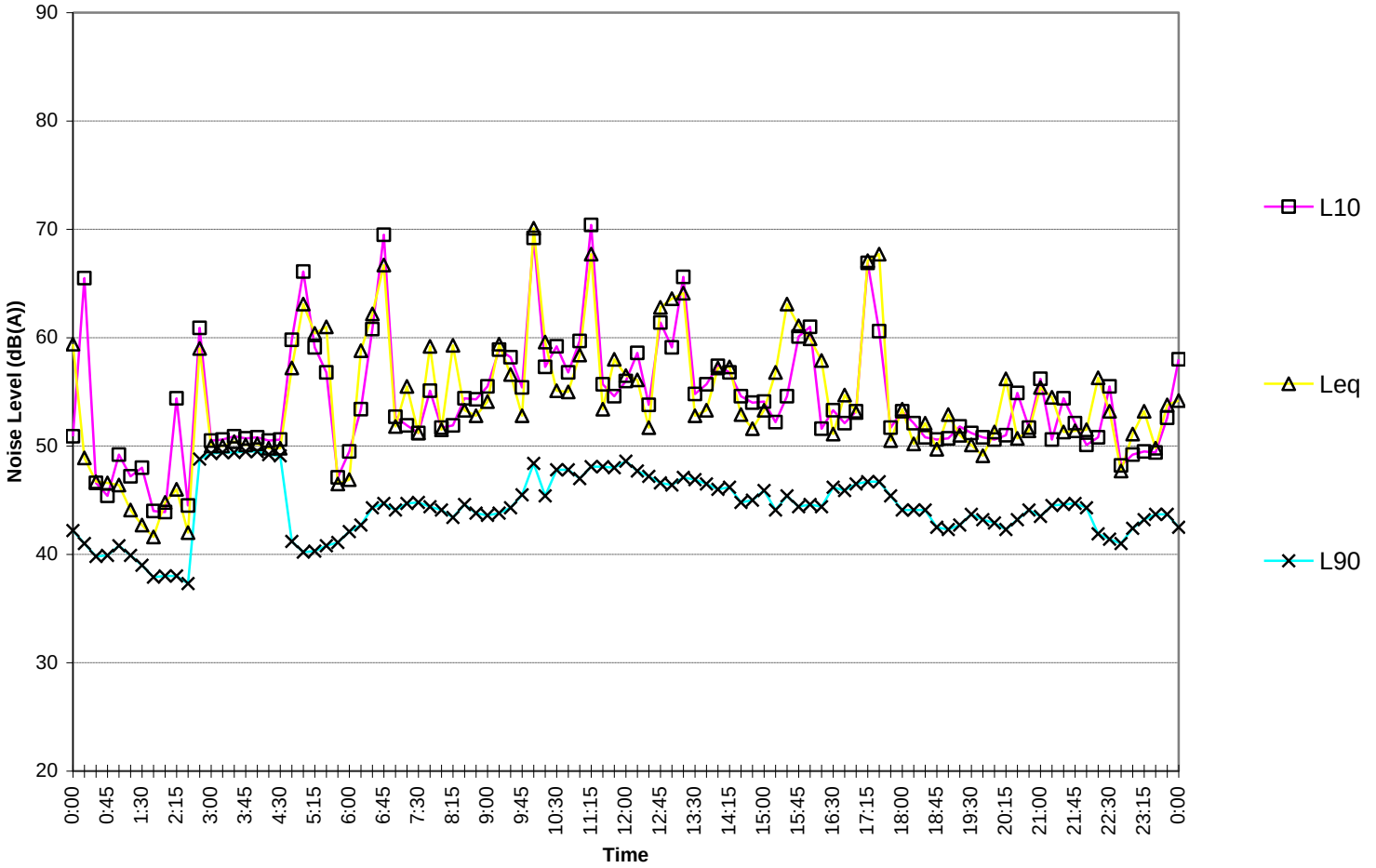
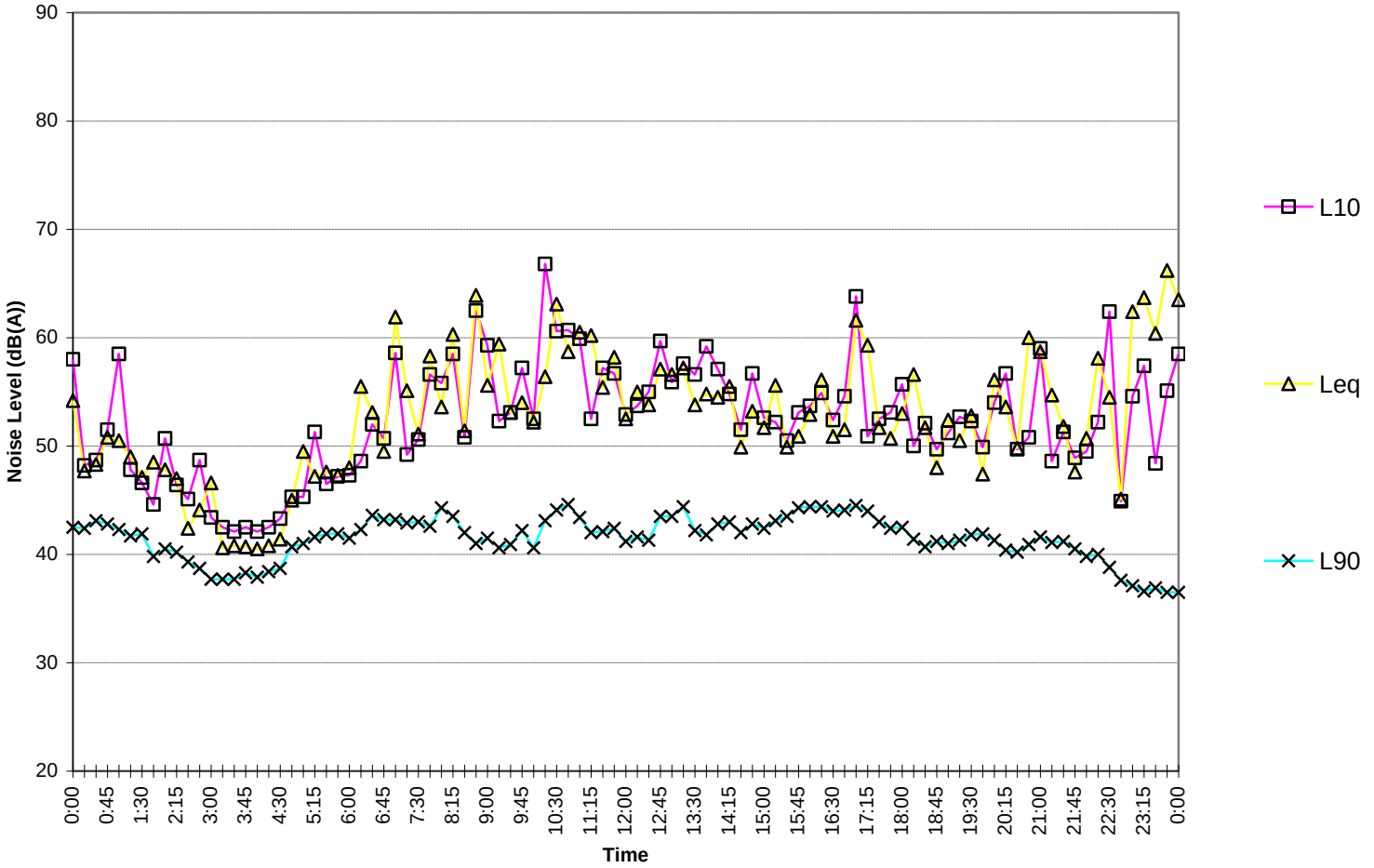
Lindfield Avenue

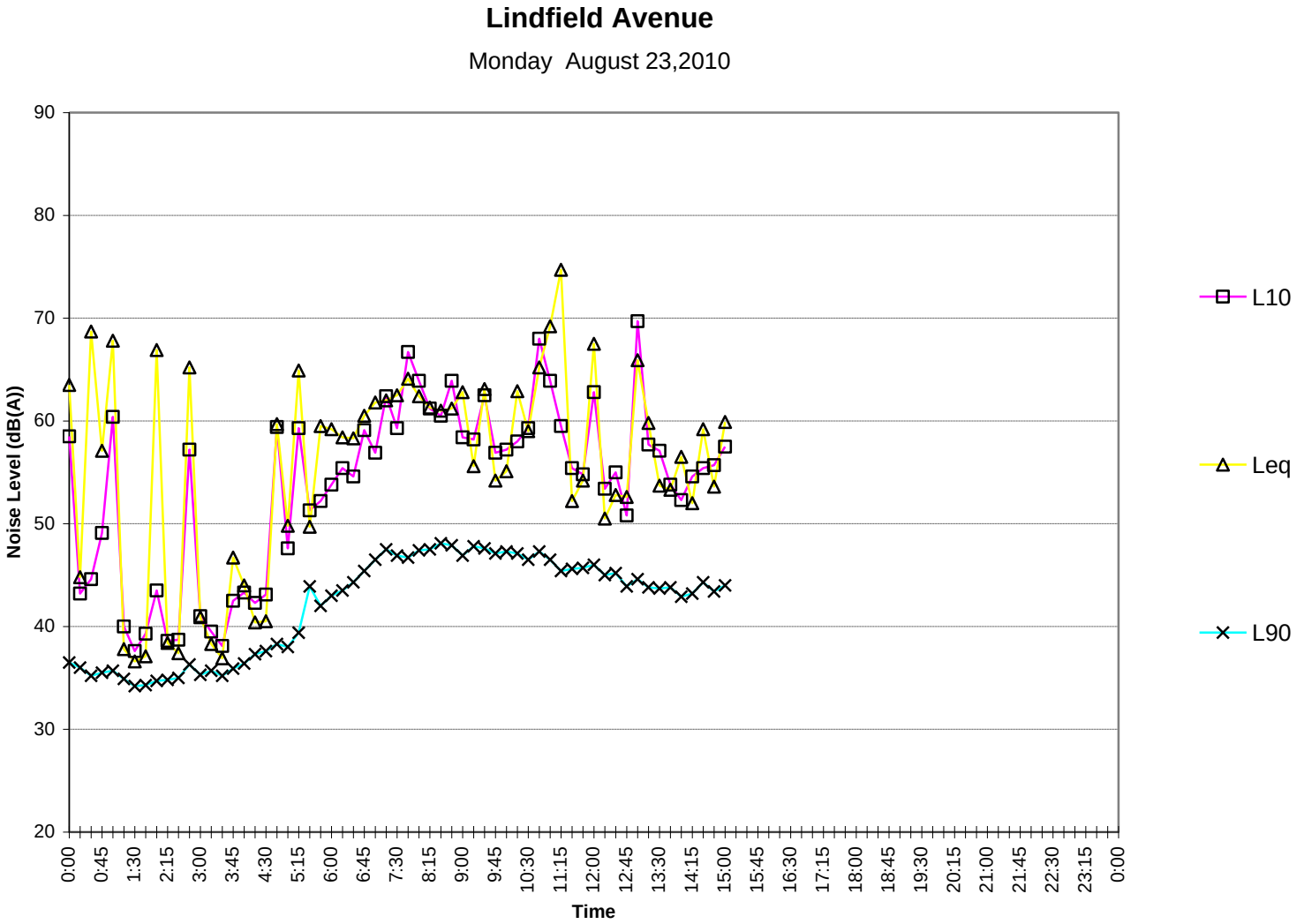
Saturday August 21,2010



Lindfield Avenue

Sunday August 22,2010




Lindfield Avenue
Monday August 23,2010
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Time
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Leq
L90

12