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71-75 VICTORIA ROAD, DRUMMOYNE

Acoustic Assessment for DA

13 September 2022

Olter Investments Pty Ltd

TL592-01F02 Acoustic Assessment for DA (r5)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

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1 Introduction

Renzo Tonin & Associates were engaged to assess noise impacts onto and the proposed mixed-use, residential development at 71-75 Victoria Road, Drummoyne. This report is intended to accompany the Development Application submission.

This study examines the effects of external noise intrusion onto the proposed development from aircraft and road traffic noise. Noise surveys were carried out on site by Renzo Tonin & Associates on 25th August 2020 and correlated to previous long term noise monitoring at the site from Friday 12th December to Wednesday 17th December 2014, to establish the existing levels of external noise affecting the development. These noise levels were used to predict noise levels inside the future apartments and then assessed against the recommended internal noise criteria for the project.

In addition an assessment of aircraft noise intrusion was conducted in accordance to Australian Standard AS2021:2015.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Site and surrounds

The proposed development is located 71-75 Victoria Road, Drummoyne. The development is to consist of ground floor retail and apartments on Levels 1-5 over common basement carparking.

The site is bounded by Victoria Road to the north, Formosa Street to the south, Day Street to the east and existing residential apartments to the West. Ground floor retail is consistent along Victoria Road.

Long-term noise monitoring has been undertaken opposite the proposed development site at as indicated in Figure 1 below to determine existing acoustic environment.

Figure 1: Site, Surrounds and Monitoring Locations

3 Acoustic Design Criteria

3.1 Road Traffic Noise Criteria

The internal noise criteria for this development are based on the following relevant Standards, Government Policies, Guidelines and Council Development Control Plans.

1. City of Canada Bay Development Control Plan (DCP) 2017
2. State Environment Planning Policy (Traffic and Infrastructure 2021)
3. Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008
4. Australian Standard AS/NZS 2107:2000 "Acoustics – Recommended design sound pressure levels and reverberation times for building interior"

The Canada Bay DCP does not provide any internal noise criteria for mixed used developments along busy roads. Therefore, the SEPP (Traffic and Infrastructure) and Department of Planning's guideline on assessing noise and vibration impacts from rail corridor or busy road has been adopted for this assessment.

The assessment is mandatory for busy roads with an Annual Average Daily Traffic (AADT) volume exceeding 20,000. Table 3.1 of the guideline is presented in APPENDIX B outlines the interior noise criteria for road traffic.

The Roads and Maritime Services (RMS) publishes traffic volume maps for ISEPP (superseded by SEPP Traffic and Infrastructure 2021) identifying which major roads within the Sydney Metropolitan area have AADT greater than 40,000 and roads with AADT between 20,000 and 40,000. Victoria Road is identified as road having an AADT greater than 40,000 AADT and therefore an acoustic assessment is mandatory.

The recommended internal noise criteria for the development is summarised in Table 1 below.

Table 1: Recommended Maximum Internal Road Traffic Noise Levels

Occupancy	Period	Maximum Noise Level
Living areas (includes open-plan kitchens, dining, family room, media and study rooms)	7am – 10pm	40 dB(A) $L_{Aeq, 15hr}$
Sleeping areas	10pm – 7am	35 dB(A) $L_{Aeq, 9hr}$

Relevant sections of the State Environment Planning Policy, Council's DCP, and Government Policies are presented in APPENDIX B of this report.

3.2 Aircraft Noise Criteria

The site is located approximately 8km to the north of the Sydney's Kingsford Smith Airport. From our site inspections it was observed that the development is potentially affected by aircraft movement on

the main north-south runway, namely landings on runway 16R. The Australian Standard AS2021-2015 – "Acoustics – Aircraft Noise Intrusion – Building Siting and Construction" provides internal design noise levels, zoning information and guideline for evaluating aircraft noise impacts on residential and commercial buildings.

Table 2 below is an extract of Table 2.1 in AS2021-2015 with the building types relevant to this assessment.

Table 2: Building Site Acceptability Based on ANEF Zones (Table 2.1 – AS2021-2015)

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than ANEF 20	20 to 25 ANEF	Greater than 25 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF

The Standard also recommends the following internal design noise levels for the proposed residential development:

Table 3: Recommended Maximum Internal Aircraft Noise Levels (Table 3.3 – AS2021-2015)

Building Type and Activity	Indoor design aircraft sound level, $L_{A,max}$ dB(A)
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Commercial buildings, offices and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75

The above sound levels are the maximum levels from an aircraft flyover which, when heard inside the specified area by the average listener will be judged as not intrusive or annoying by that listener. Owing to the variability of subjective responses to aircraft noise, these figures may not provide sufficiently low interior noise levels for occupants who have a particular sensitivity to aircraft noise. Relevant sections of the AS2021 are presented in APPENDIX B of this report.

3.3 ANEF Zoning

The current ANEF map for Kingsford Smith Airport is the ANEF 2039, approved by the Federal Minister for Infrastructure, Transport and Regional Development and Local Government.

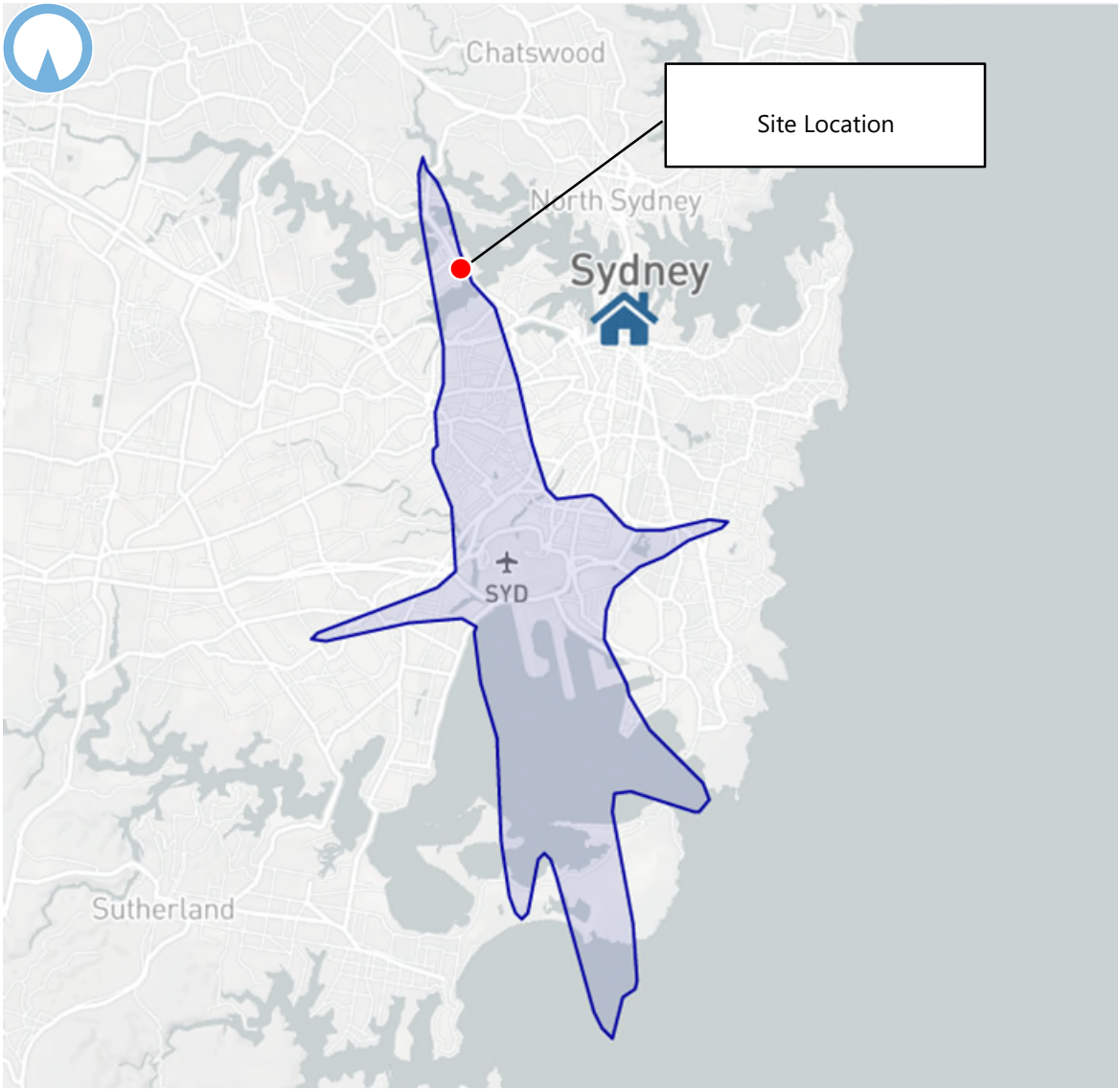
The applicable noise exposure zones obtained from the ANEF contours are summarised in Table 4

Table 4: Location of Site Relevant to Aircraft Noise Exposure Charts

Assessment Chart	ANEF Zone
ANEF 2039	20-25

According to the ANEF map, the residential component of the property lies within the **Conditionally Acceptable** zone nominated in Australian Standards AS2021-2015 – "Acoustics – Aircraft Noise Intrusion – Building Siting and Construction".

Figure 2: Site Location and ANEF 20 Contour



3.4 Aircraft Noise Levels

Aircraft noise exposure levels were calculated for the development site based on Australian Standard AS2021-2015.

To determine resultant aircraft noise levels the following factors were considered as specified in the Standard;

- The site's position relative to each runway, including take-off and landing distances and runway centre line offsets;
- Elevation of the site compared with the elevation of the runways; and,
- Type of aircraft and associated maximum noise level during take-off and landing.

Using these factors, the resultant maximum noise levels were determined for each aircraft type. This calculation is not based on ANEF contours but on the location of the site relative to the runways.

It has been determined that the aircraft operation on the main north-south runway (runway 16R for arrivals) impacts most onto the proposed development site.

Clause 3.1.4 of the Standard, *"where there is evidence that the particular aircraft type and movement which produced that noise level do not constitute a typical operation, then the noise level can be ignored and the next lowest noise level selected"*.

In accordance to the above Clause, aircraft operations not constituting a typical operation have been excluded from this study. In this case, the upper 5% of movements are assumed to *"not constitute a typical operation"* and were excluded.

Based on published aircraft noise levels in the Standard AS2021-2015, the maximum external noise levels resulting from aircraft flyovers has been determined.

The table below shows the maximum design noise level at the development site.

Table 5: Maximum Noise Levels at Assessment Location as per AS2021

Aircraft Type	Maximum Noise Level dB(A)
	Arrivals (Runway 16R)
Boeing 777-200	**72**
Airbus A380	**72**
Boeing 737-800	71
Airbus A330	71

The maximum external aircraft noise levels resulting from aircraft flyovers have been calculated in accordance with AS2021-2015. Accordingly, the design noise level at the subject site is 72dB(A).

It should be noted that variations in flight paths and aircraft operational characteristics may generate external noise levels greater than calculated here. The accuracy of noise calculations made in accordance with the AS2021-2015 has been the subject of discussion by the Association of Australian Acoustical Consultants (AAAC) and communicated to various Council's affected by aircraft noise.

The required aircraft noise reductions (ANR) for areas in the proposed development are as follows:

Table 6: Required Aircraft Noise Reduction for the Proposed Development

Area	Required ANR
Residential	
Sleeping areas, dedicated lounges	22
Other Habitable spaces	17
Bathrooms, toilets, laundries	12
Commercial	
Shop	0

The external noise levels are used to calculate the expected internal noise level by taking into account the sound attenuation provided by the building facade. Where internal noise levels exceed the criteria nominated in AS2021-2015, noise mitigation can be implemented using well-established noise control methods such laminated glass and treatment to the facades, roof and ceiling.

4 Measured Noise Levels

It was observed that there were no safe locations to install noise monitors on the Site, since Victoria is a busy road and that there were no areas within the Site to hide the noise monitors from the public. Additionally, the development site is currently occupied and therefore noise monitors could not be installed within the Site. Given that there were no safe locations and access could not be provided to install the noise monitors, historical noise measurements from 2014 conducted near the subject site was used.

4.1 Long-term Noise Survey

Noise monitoring was previously undertaken by Renzo Tonin & Associates at two locations at 103 Victoria Road, Drummoyne. One noise monitor was installed on the front awning facing Victoria Road, while the other noise monitor was installed in the carpark at the rear of the site facing Formosa Street, as shown in Figure 1. The noise survey was conducted between 12th December and 17th December 2014.

The noise logger records noise levels on a continuous basis and stores data every fifteen minutes. The noise logger was calibrated before and after measurements and no significant deviation in calibration was noted. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as Type 2 instruments suitable for field use.

The measured traffic noise levels are presented in Table 7 and the measured background and ambient noise levels are presented in Table 8.

Table 7: Day and Night Traffic Noise Levels, dB(A)

Measurement Location	Measured Maximum Traffic Noise Level $L_{eq,\,T}$ [1,2]	
	Day	Night
103 Victoria Road - Front Awning	71	68
103 Victoria Road - Rear	61	54

Notes:
1. Noise levels presented are facade corrected.
2. Representative day time road traffic noise given by the measured L_{Aeq} between 7am and 10pm and the night time road traffic noise level given by the measured L_{Aeq} between 10pm and 7am.

Table 8: Measured Background and Ambient Noise Levels, dB(A)

Noise Monitoring		Representative L_{A90} Background Noise Levels in dB(A)			L_{Aeq} Ambient Noise Levels		
Location	Duration	Day[1]	Evening[2]	Night[3]	Day[1]	Evening[2]	Night[3]
103 Victoria Road, Drummoyne (Front	12/12/14 to 17/12/14	62	61	42	68	68	66
103 Victoria Road, Drummoyne (Rear)	12/12/14 to 17/12/14	51	48	37	58	57	52

Noise Monitoring		Representative L_{A90} Background Noise Levels in dB(A)			L_{Aeq} Ambient Noise Levels		
Location	**Duration**	**Day[1]**	**Evening[2]**	**Night[3]**	**Day[1]**	**Evening[2]**	**Night[3]**

Notes:

Day, Evening & Night assessment periods are defined in accordance NSW OEH's Industrial Noise Policy as follows.

1. Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. As results were affected by construction noise weekend day and Saturday morning, Sunday results have been presented for the Day time period
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays

4.2 Short-term Attended Noise Measurements

In addition to the 2014 noise survey, attended noise measurements were conducted at multiple locations surrounding the site. Attended noise measurements were undertaken on the 25/08/2020 between 2:45pm and 3:15pm. Attended measurements were taken at three separate locations (S1-S3) surrounding the Site as shown in Figure 1.

The results of the short-term noise survey were correlated with the results of the long term noise survey previously undertaken and the noise levels were adjusted accordingly.

4.3 Traffic Noise Levels Used for this Assessment

The results of the long-term and short-term noise measurements undertaken were used to determine the representative L_{Aeq} sound pressure levels for the week during the day (7am to 10pm) and night time period (10pm to 7am). The representative L_{Aeq} sound pressure levels were used as the design external traffic noise level and are presented in Table 9 below. These external noise levels will be used in determining the building facade treatment to achieve compliance with interior noise levels defined in Table 1.

Table 9: Representative Day and Night Traffic Noise Levels

Assessment Location	Traffic Noise Level $L_{Aeq, T}$ [1,2]	
	Day, LAeq, 15hr, dB	**Night, LAeq, 9hr, dB**
71-75 Victoria Road (Facing Victoria Road)	73	70
71-75 Victoria Road (Facing Day Street)	68	65
71-75 Victoria Road (Facing Formosa Street)	63	56

Notes:

4. Noise levels presented are façade corrected.
5. Representative day time road traffic noise given by the measured L_{Aeq} between 7am and 10pm and the night time road traffic noise level given by the measured L_{Aeq} between 10pm and 7am.

5 Recommendations

Results from the noise surveys were used to calculate internal noise levels within the proposed development. Noise calculations were conducted using the OutsideIn Glazing Spreadsheet developed in this office which take into account external noise levels, facade transmission loss and room sound absorption characteristics. Noise levels were calculated for each building facade to account for any variation in the external noise levels affecting different parts of the building.

Glazing constructions required to comply with the nominated noise criteria are presented in the body of this report.

5.1 Glazing Design Requirements

Table 10 below presents recommended glazing treatment for the building facades to achieve compliance with the maximum noise levels nominated in Table 1 and Table 3 above.

Table 10: Recommended Glazing Treatment

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Laboratory Test Reference
Retail				
Ground Floor	Victoria Road and Day Street Facades	Retail	Standard commercial glass (no minimum acoustic requirement)	-
Apartments				
All Levels	Western Facade facing Vitoria Road – including corner units	Bedrooms	Rw 45	ESTIMATE
		Living/Dining/Kitchen	Rw 45	ESTIMATE
	Southern Façade facing Day Street	Bedrooms	Rw 38	ESTIMATE
		Living/Dining/Kitchen	Rw 38	ESTIMATE
	Eastern façade facing Formosa Street	Bedrooms	Rw 32	ESTIMATE
		Living/Dining/Kitchen	Rw 32	ESTIMATE
	Façade facing internally into the site	Bedrooms	Rw 32	ESTIMATE
		Living/Dining/Kitchen	Rw 32	ESTIMATE

By way of explanation, the Sound Insulation Rating Rw is a measure of the noise reduction property of the partition, a higher rating implying a higher sound reduction performance.

Note that the Rw rating of systems measured as built on site (R'w Field Test) may be up to 5 points lower than the laboratory result.

Level	Facade	Occupancy Type	Recommended Minimum Sound Insulation Rating of Glazing Assembly	Laboratory Test Reference

LEGEND where no appropriate test certificate exists:

1. ESTIMATE: The client is advised not to commence detailing or otherwise commit to partition construction systems which have not been tested in an approved laboratory or for which an opinion only is available. Testing of partition construction systems is a component of the quality control of the design process and should be viewed as a priority because there is no guarantee the forecast results will be achieved thereby necessitating the use of an alternative which may affect the cost and timing of the project. No responsibility is taken for use of or reliance upon untested partition construction systems, estimates or opinions. The advice provided here is in respect of acoustics only.
2. ESTIMATE – APPROVED FOR CONSTRUCTION: Use of the form of construction is approved prior to laboratory certification. To complete the quality control of the design process and confirm the acoustical performance of the construction, we recommend testing in a laboratory to confirm the Rw rating as soon as practicable. In the case of impact rating for floor systems, no particular impact rating is guaranteed to comply with either the Building Code of Australia or Strata Scheme Management Act and hence carpet runners may still be required.
3. ESTIMATE – TEST NOT REQUIRED: Use of the form of construction is approved without laboratory certification. The STC/Rw of the form of construction exceeds the project requirements.
4. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

NOTES FOR GLAZING CONSTRUCTIONS:

5. The information in this table is provided for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant.
6. The design in this table is preliminary and a comprehensive assessment shall be conducted prior to Construction Certification.
7. Before committing to any form of construction or committing to any builder, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction where only an "estimate" is available for the sound insulation properties of recommended materials.
8. The glazing supplier shall ensure that installation techniques will not diminish the Rw performance of the glazing when installed on site.
9. All openable glass windows and doors shall incorporate full perimeter acoustic seals equivalent to Q-Lon, which enable the Rw rating performance of the glazing to not be reduced.
10. The above glazing thicknesses should be considered the minimum thicknesses to achieve acoustical ratings. Greater glazing thicknesses may be required for structural loading, wind loading etc.

GENERAL

11. The sealing of all gaps in partitions is critical in a sound rated construction. Use only sealer approved by the acoustic consultant.
12. Check design of all junction details with acoustic consultant prior to construction.
13. Check the necessity for HOLD POINTS with the acoustic consultant to ensure that all building details have been correctly interpreted and constructed.
14. The information provided in this table is subject to modification and review without notice.
15. The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

5.2 Ventilation

In accordance with the Department of Planning publication "Development Near Rail Corridors & Busy Roads – Interim Guideline" 2008:

If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia

In addition, Australian Standard AS2021:2015 Clause 3.3 states:

If it is necessary to close windows and doors to comply with this Standard, building ventilation should be in accordance with the National Construction Code on the assumption that windows and doors are not openable. Mechanical ventilation or air conditioning systems complying with AS1668.2 should be installed.

Based on measured and predicted external noise levels, the internal noise goals with windows opened cannot be achieved for the site for apartments facing Victoria Road. Therefore, an acoustically treated ventilation system is required to achieve the requirements of the National Construction Code and Australian Standard AS1668.2.

The proposed ventilation system, which is to serve the apartments facing Victoria Road (including corner rooms) is to consist of full height ventilation channels as shown on the architectural plans. The channels, which are a minimum depth of 2m, are to be internally lined with 50mm acoustic insulation (48kg/m3) on all internal faces for the entire depth of the channels. The channels are to incorporate closable, solid louvres at the room so the occupier of the space may control airflow as desired. The channels are designed to comply with the 'windows open' criteria when open and the 'windows closed' criteria when closed.

6 Internal Sound Insulation between Tenancies

Internal walls and floors shall comply with the National Construction Code Building Code of Australia 2019. All service pipes and entrance doors shall comply with the requirements of the NCC 2019. APPENDIX C presents a summary of acoustic provisions outlined in Part F5 of the NCC 2019.

7 External Noise Emission from Building Services

7.1 Noise Policy for Industry (NPfI)

The NSW EPA Noise Policy for Industry assessment has two components:

1. Controlling intrusive noise impacts in the short-term for residences; and
2. Maintaining noise level amenity for particular land uses for residences and other land uses;

7.1.1 Project intrusive noise levels

According to the NPfI, the intrusiveness of a noise source may generally be considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the $L_{Aeq,15min}$ descriptor) does not exceed the background noise level measured in the absence of the source by more than 5dB(A). The project intrusiveness noise level, which is only applicable to residential receivers, is determined as follows:

$L_{Aeq,15minute}$ Intrusiveness noise level = Rating Background Level (RBL) plus 5dB(A)

7.1.2 Amenity noise trigger levels

The NPfI amenity trigger levels are designed to maintain noise level amenity for particular land uses, including residential and other land uses. The NPfI recommends base acceptable noise levels for various receivers, including residential, commercial, industrial receivers and other sensitive receivers in Table 2.2 of the NPfI. To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area a project amenity noise level applies for each new source of industrial noise as follows:

Project amenity noise level for industrial developments = recommended amenity noise level (NPfI Table 2.2) minus 5 dB(A)

Table 11: NPfI Amenity Criteria - Recommended L_{Aeq} noise levels from industrial noise sources [NSW NPfI Table 2.2]

Type of receiver	Indicative Noise Amenity Area	Time of day	Recommended amenity noise level $L_{Aeq(Period)}$
Residence	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60

Type of receiver	Indicative Noise Amenity Area	Time of day	Recommended amenity noise level $L_{Aeq(Period)}$
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks	See column 4	See Column 4	5dB(A) above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School classrooms - internal	All	Noisiest 1 hour period when in use	35
Hospital ward	All	Noisiest 1 hour period	
- internal			35
- external			50
Place of worship - internal	All	When in use	40
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50
Active recreation area (e.g. school playground, golf course)	All	When in use	55
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
Industrial interface (applicable only to residential noise amenity areas)	All	All	Add 5dB(A) to the recommended noise amenity area

Note:

Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am

On Sundays and Public Holidays, Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 8.00 am.

The LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

7.1.3 Project amenity noise levels

The project amenity noise levels for different time periods of a day are determined in accordance with Section 2.4 of the NPfI. The NPfI recommends amenity noise levels ($L_{Aeq,\ period}$) for various receivers including residential, commercial, industrial receivers and sensitive receivers such as schools, hotels, hospitals, churches and parks. These "recommended amenity noise levels" represent the objective for **total** industrial noise experienced at a receiver location. However, when assessing a **single** industrial development and its impact on an area, "project amenity noise levels" apply.

To ensure that the total industrial noise level (existing plus new) remain within the recommended amenity noise levels for an area, the project amenity noise level that applies for each new industrial noise source is determined as follows:

$L_{Aeq,period}$ Project amenity noise level = $L_{Aeq,period}$ Recommended amenity noise level – 5dB(A)

Furthermore, given that the intrusiveness noise level is based on a 15 minute assessment period and the project amenity noise level is based on day, evening and night assessment periods, the NPfI provides the following guidance on adjusting the $L_{Aeq,period}$ level to a representative $L_{Aeq,15minute}$ level in order to standardise the time periods.

$L_{Aeq,15minute} = L_{Aeq,period} + 3dB(A)$

The following table presents the site-specific noise production criteria from industrial noise sources, namely mechanical plant from the site as a whole. Noise from mechanical plant and equipment associated with future retail/ commercial spaces are to cumulatively comply with the nominated criteria for the whole site along with residential plant and equipment.

Table 12: Project noise trigger level for nearby residential receivers with line of sight to Victoria Road (EPA NPfI)

Time of Day	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
	Rating Background Level (RBL) L_{A90}	Intrusiveness Trigger Level, $L_{Aeq, 15minute}$ (RBL+5)	Recommended Amenity Noise Level (RANL), $L_{Aeq, period}$	Project Amenity Noise Level (PANL), $L_{Aeq, period}$	Measured $L_{Aeq, period}$ existing noise levels	Traffic noise exceed the RANL by more than 10dB?	Existing noise level likely to decrease in future?	Exceptions to PANL?	Project Noise Trigger Level $L_{Aeq, 15minute}$ dB(A)
Day (7am to 6pm)	62	67	60	55	68	No	No	None	58
Evening (6pm to 10pm)	61	66	50	45	68	Yes	No	Existing LAeq, period minus 15 = 53 dB(A)	56
Night (10pm to 7am)	42	47	45	40	66	Yes	No	Existing LAeq, period minus 15 = 51 dB(A)	47

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in the results of the long-term noise monitoring has been summarised in accordance with NPfI requirements and are presented in Table 8 above.

Column 4 – Project Amenity Noise Level determined based on 'Residential - urban' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB

Column 5 – Measured in accordance with the NPfI

Column 8 - Determined in accordance with Section 2.4 of the NPfI.

Column 9 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level. In accordance with Section 2.2 of the NPfI, $L_{Aeq, 15minute}$ is calculated as $L_{Aeq, period}$ + 3dB(A)

Table 13: Project noise trigger level for nearby residential receivers with no line of sight to Victoria Road (EPA NPfI)

Time of Day	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
	Rating Background Level (RBL) L_{A90}	Intrusiveness Trigger Level, $L_{Aeq, 15minute}$ (RBL+5)	Recommended Amenity Noise Level (RANL), $L_{Aeq, period}$	Project Amenity Noise Level (PANL), $L_{Aeq, period}$	Measured $L_{Aeq, period}$ existing noise levels	Traffic noise exceed the RANL by more than 10dB?	Existing noise level likely to decrease in future?	Exceptions to PANL?	Project Noise Trigger Level $L_{Aeq, 15minute}$ dB(A)
Day (7am to 6pm)	51	56	60	55	58	No	No	None	56
Evening (6pm to 10pm)	48	53	50	45	57	No	No	None	48
Night (10pm to 7am)	37	42	45	40	52	No	No	None	42

Explanatory notes:

Column 1 – RBL measured in accordance with the NPfI and outlined in the results of the long-term noise monitoring has been summarised in accordance with NPfI requirements and are presented in Table 8 above.

Column 4 – Project Amenity Noise Level determined based on 'Residential - urban' area in Table 2.2 (Amenity noise levels) of the EPA's NPfI minus 5dB

Column 5 – Measured in accordance with the NPfI

Column 8 - Determined in accordance with Section 2.4 of the NPfI.

Column 9 – Project Noise Trigger Level is the lower value of project intrusiveness noise level and project amenity noise level. In accordance with Section 2.2 of the NPfI, $L_{Aeq, 15minute}$ is calculated as $L_{Aeq, period}$ + 3dB(A)

7.2 Recommended noise control measures for mechanical plant

Where necessary, noise amelioration treatment will be incorporated in the design to ensure that noise levels comply with the recommended NPfI noise emission criteria noted above.

Although at this stage details of mechanical plant have not been finalised, the following in-principle advice is provided.

Acoustic assessment of mechanical services equipment will need to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in NPfI and Council's requirements.

As noise control treatment can affect the performance of the mechanical services system, it is recommended that consultation with an acoustic consultant be made during the initial phase of mechanical services system design in order to reduce the need for revision of mechanical plant and noise control treatment;

Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following:

- procurement of 'quiet' plant,
- strategic positioning of plant away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises,
- commercially available silencers or acoustic attenuators for air discharge and air intakes of plant;
- acoustically lined and lagged ductwork;
- acoustic screens and barriers between plant and sensitive neighbouring premises; and/or
- Partially-enclosed or fully-enclosed acoustic enclosures over plant.
- Mechanical plant shall have their noise specifications and their proposed locations checked prior to their installation on site; and
- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery – Mechanical Vibration".

8 Communal Areas

8.1 Rooftop Communal Area

The use of the rooftop communal area has the potential to cause loss of amenity to residential receivers in the vicinity of the development as well as apartments within the new development.

The rooftop area has been carefully designed to limit the acoustic impacts to residential receivers including the separation of seating areas using the services area and lift shaft overrun and raised planter bed and vegetation surrounding the rooftop area.

In addition, the communal open space is located in the centre of the rooftop area and away from the facades of the proposed building and the neighbouring residential building to the west does not have any windows located on the façade adjoining the rooftop area.

We proposed the following management procedures should also be considered to reduce noise impacts on residential receivers.

- Amplified music should not be used in the outdoor common area.
- The number of people allowed in the rooftop area should be restricted to 80 persons or based on accessibility limits, whichever is the lower.
- Use of the outdoor space for socialising should be restricted after 10pm and before 7am.

8.2 Ground Level Communal Area

The use of the ground floor communal area has the potential to cause loss of amenity to residential receivers in the vicinity of the development as well as apartments within the new development. This is due to the overlooking of apartments within the new development along with existing residents and the lack of intervening structure. The ambient noise levels at the rear building are lower than those at the front of the site, impacting the amenity on apartments and existing residents.

The ground floor communal area is to be used for passive recreation and the following management procedures implemented.

- Amplified music should not be used in the outdoor common area.
- The number of people allowed in the ground floor communal area should be restricted to 30 persons.
- Use of the outdoor space should be restricted to daytime hours only (7am -6pm daily).

9 Construction Noise

The nature of the construction processes proposed for the development does not present difficulties in ensuring that the associated noise limits at surrounding properties are achieved. The major construction activities proposed on this site are excavation works, concrete pours and general building works.

Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment.

Noise generated by construction activities will comply with the Department of Environment Climate Change & Water's Interim Construction Noise Guide (ICNG). APPENDIX D presents a summary ICNG's standard construction times and conditions.

10 Conclusion

Renzo Tonin & Associates have completed an acoustic assessment of road traffic and aircraft noise impacts onto the proposed mixed-use, residential development at 71-75 Victoria Road, Drummoyne.

The study of external noise intrusion into the subject development has found that appropriate controls can be incorporated into the building design to achieve a satisfactory accommodation environment consistent with the intended quality of the building and relevant standards, including State Environmental Planning Policy (Infrastructure) and Australian Standard AS2021.

Recommendations to comply with noise emission criteria for the site, including mechanical plant and construction noise have also been presented in the body of this report.

Recommendations have been made in Section 5 of this report to comply with the nominated internal noise criteria.

APPENDIX A Glossary of Terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment Point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our daytime environment:

threshold of hearing	0 dB	The faintest sound we can hear
	10 dB	Human breathing
almost silent	20 dB	
	30 dB	Quiet bedroom or in a quiet national park location
generally quiet	40 dB	Library
	50 dB	Typical office space or ambience in the city at night
moderately loud	60 dB	CBD mall at lunch time
	70 dB	The sound of a car passing on the street
loud	80 dB	Loud music played at home
	90 dB	The sound of a truck passing on the street
very loud	100 dB	Indoor rock band concert
	110 dB	Operating a chainsaw or jackhammer
extremely loud	120 dB	Jet plane take-off at 100m away
threshold of pain	130 dB	
	140 dB	Military jet take-off at 25m away

dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.

Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Assessment and Design Methodology

B.1 Canada Bay DCP

Within Canada Bay's DCP for Mixed Use Areas and Neighbourhood Centres the following items relates to acoustics:

F1.4 Visual and acoustic privacy

C.4 New development containing dwellings along a major road or along a railway corridor should incorporate noise attenuation measures.

B.2 State Environmental Planning Policy (Transport and Infrastructure) 2021

The NSW State Environmental Planning Policy (Transport and Infrastructure) 2021 replaces the State Environmental Planning Policy (Infrastructure) – ISEPP and facilitates the effective delivery of infrastructure across the State. 0The aim of the policy includes identifying the environmental assessment category into which different types of infrastructure and services development fall and identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure.

2.119 Impact of road noise or vibration on non-road development

(1) This section 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 transitway or any other road with an annual average daily traffic volume of more than 20,000 vehicles (based on the traffic volume data published on the website of TfNSW) and that the consent authority considers is likely to be adversely affected by road noise or vibration—

(a) residential accommodation,

(b) a place of public worship,

(c) a hospital,

(d) an educational establishment or centre-based child care facility.

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

(3) If the development is for the purposes of residential accommodation, 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 residential accommodation—35 dB(A) at any time between 10 pm and 7 am,

(b) anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.

(4) In this section, freeway, tollway and transitway have the same meanings as they have in the Roads Act 1993.

B.2.1 Department of Planning publication 'Development near rail corridors and busy roads – Interim guideline'

To support the Infrastructure SEPP, the NSW Department of Planning released the *Development in Rail Corridors and Busy Roads – Interim Guideline* (December 2008). The Guideline assists in the planning, design and assessment of developments in, or adjacent to, major transport corridors in terms of noise, vibration and air quality. While the SEPP applies only to roads with an AADT greater than 20,000 vehicles, the guideline is also recommended for other road traffic noise affected sites.

B.2.2 Clarification of SEPP noise limits

The Guideline clarifies the time period of measurement and assessment. Section 3.4 '*What Noise and Vibration Concepts are Relevant*' and Table 3.1 of Section 3.6.1 confirms that noise assessment is based over the following time periods:

Daytime	7:00am - 10:00pm	$L_{Aeq(15hr)}$
Night-time	10:00pm - 7:00am	$L_{Aeq(9hr)}$

The noise criteria nominated in the SEPP apply to internal noise levels with windows and doors closed. However as the preliminary noise assessment is based on measurements/predictions at external locations, equivalent external noise criteria has been established. The equivalent external noise criterion is used to determine which areas of the development may require acoustic treatment in order to meet the internal noise requirements of the SEPP. The equivalent external goals have been determined on the following basis:

The Guideline states: "*If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia*." The internal criteria with windows open is therefore 10dB(A) above the criteria explicitly outlined in the SEPP.

The generally accepted noise reduction through an open window from a free-field external position is 10dB(A). Windows/doors are assumed to be open no more than 5% of room floor area, in accordance with the Building Code of Australia (BCA) ventilation requirements.

Table 14 presents the SEPP internal noise criteria along with the equivalent external noise criteria for residential premises.

Table 14: ISEPP noise criteria for new residential development

Room	Location	$L_{Aeq,\ 15hr}$ Day 7am – 10pm	$L_{Aeq\ 9hr}$ Night 10pm – 7am
Living rooms*	Internal, windows closed	40	40
	Internal, windows open	50	50
	External free-field (allowing windows to remain open)^	60	60
Bedrooms*	Internal, windows closed	40	35
	Internal, windows open	50	45
	External free-field (allowing windows to remain open)^	60	55

Notes: * Requisite for 40,000AADT Roads only under ISEPP 2007.

^ ISEPP Guideline states that where internal noise criteria are exceeded by more than 10dB(A) with windows open mechanical ventilation is required. External goals have been calculated on the basis of nominal 10dB(A) reduction through an open window to a free-field position. Windows open to 5% of floor area in accordance with the BCA 2011 requirements.

B.3 Australian Standard AS2021:2015

B.3.1 Zoning

Table 2.1 of Australian Standard AS2021:2015 – "Acoustics – Aircraft Noise Intrusion – Building Siting and Construction" provides zoning information for sites subjected to aircraft noise. The table lists three ANEF Zones, namely, Acceptable, Conditionally Acceptable and Unacceptable, and recommends suitable ANEF levels for different types of buildings.

Table 15: Building Site Acceptability Based on ANEF Zones (Table 2.1 AS2021)

Building Type	ANEF Zone of Site		
	Acceptable	Conditionally Acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

Note: within 20 ANEF to 25 ANEF, some people may find that land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate.

In Acceptable zones there is usually no need for the building construction to provide protection specifically against aircraft noise.

In Conditionally Acceptable zones the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedures of Clause 3.1 and 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3.

In Unacceptable zones – construction of the proposed development should not normally be considered.

B.3.2 Aircraft Noise Internal Criteria for Residential Development

Australian Standard AS2021-2015 – "Acoustics – Aircraft Noise Intrusion – Building Siting and Construction" recommends the following internal design noise levels for this development:

Table 16: Indoor Design Sound Levels (Table 3.3 AS2021)

Building Type and Activity	Max Noise Level, Lmax dB(A)
Residential	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Commercial Buildings, Offices and Shops	
Private Offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
Commercial/ Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80
Heavy machinery, warehouse, maintenance	85

Notes:

The above internal sound design levels are the maximum levels from an aircraft flyover which, when heard inside the specified area by the average listener, will be judged as not intrusive or annoying by that listener while carrying out the specified activity. Owing to the variability of subjective responses to aircraft noise, these figures will not provide sufficiently low interior noise levels for occupants who have a particular sensitivity to aircraft noise.

Some of these levels, because of the short duration of individual aircraft flyovers, exceed some other criteria published by Standards Australia for indoor background noise levels (See AS 2107).

APPENDIX C Internal Sound Insulation

C.1 National Construction Code of Australia 2019

The National Construction Code of Australia (NCC) outlines minimum requirements for inter-tenancy (party) walls and ceiling/ floors to maintain privacy. This includes the incorporation of penetration of a service through a floor or through more than one sole-occupancy unit.

NCC 2016 nominates required Weighted Sound Reduction Indexes (Rw) and spectrum adaptation factor (Ctr) for partition constructions, of different space/ activity types in adjoining units. The Rw and Rw + Ctr are single number descriptors for quantifying the attenuating performance of partitions for typical intrusive noises produced inside residences. The higher the rating, the greater the isolation provided by the partition.

Spectrum adaptation factors are commonly used to compensate for the fact that certain kinds of sounds are more readily transmitted through insulating materials than others insulate.

The adaptation factor Ctr has now been introduced for most building elements which require an airborne sound insulation rating. The only exception is a wall which separates a dwelling from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification. Therefore, both the Ctr factor and the Rw of the building element will need to be considered in most cases.

The Ctr factor takes into account lower frequency level sounds, and has been chosen in large part, in recognition of the problem of the high bass frequency outputs of modern home theatre systems and music reproduction equipment.

The Deemed-to-Satisfy Provisions also have impact sound insulation requirements for floors. The terms to describe the impact sound insulation of the floor is the weighted normalised impact sound pressure level (Ln,w) plus the spectrum adaptation term (CI). The lower the Ln,w + CI of the floor, the better the performance of the floor in terms of impact sound insulation.

The following section represents a summary of acoustic provisions outlined in the Part F5 of the NCC 2016.

C.2 Sound Insultion Provision of NCC of Australia 2019

The acoustic provisions for inter-tenancy walls in Class 3 buildings are outlined in the National Construction Code of Australia and the following is an extract from the NCC:

"F5.2 Determination of airborne sound insulation ratings

A form of construction required to have an airborne sound insulation rating must –

have the required value for weighted sound reduction index (R_w) or weighted sound reduction index with spectrum adaptation term ($R_w + C_{tr}$) determined in accordance with AS/NZS 1276.1 or ISO 717.1 using results from laboratory measurements; or

comply with Specification F5.2.

F5.3 Determination of impact sound insulation ratings

A floor in a building required to have an impact sound insulation rating must –

have the required value for weighted normalised impact sound pressure level (Ln,w) determined in accordance with AS/ISO 717.2 using results from laboratory measurements; or

comply with Specification F5.2.

A wall in a building required to have an impact sound insulation rating must –

for a Class 2 or 3 building be of discontinuous construction;

For the purposes of this part, discontinuous construction means a wall having a minimum 20 mm cavity between 2 separate leaves, and

for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and

for other than masonry, there is no mechanical linkage between leaves except at the periphery.

F5.4 Sound insulation rating of floors

A floor in a Class 2 or 3 building must have an $R_w + C_{tr}$ (airborne) not less than 50 and an Ln,w (impact) not more than 62 if it separates –

sole-occupancy units; or

a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.

F5.5 Sound insulation rating of walls

A wall in a Class 2 or 3 building must –

have an $R_w + C_{tr}$ (airborne) not less than 50, if it separates sole-occupancy units; and

have an R_w (airborne) not less than 50, if it separates a sole-occupancy unit from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification; and

comply with F5.3(b) if it separates:

(A) a bathroom, sanitary compartment, laundry or kitchen in one sole-occupancy unit from a habitable room (other than a kitchen) in an adjoining unit; or

(B) a sole-occupancy unit from a plant room or lift shaft.

A door may be incorporated in a wall in a Class 2 or 3 building that separates a sole-occupancy unit from a stairway, public corridor, public lobby or the like, provided the door assembly has an R_w not less than 30.

Where a wall required to have sound insulation has a floor above, the wall must continue to –

the underside of the floor above; or

a ceiling that provides the sound insulation required for the wall.

F5.6 Sound insulation rating of services

If a duct, soil, waste or water supply pipe, including a duct or pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the duct or pipe must be separated from the rooms of any sole-occupancy unit by construction with an $R_w + C_{tr}$ (airborne) not less than –

40 if the adjacent room is a habitable room (other than a kitchen); or

25 if the adjacent room is a kitchen or non-habitable room.

If a storm water pipe passes through a sole-occupancy unit it must be separated in accordance with (a)(i) and (ii).

F5.7 Sound insulation of pumps

A flexible coupling must be used at the point of connection between the services pipes in a building and any circulating or other pumps."

APPENDIX D Construction Noise

D.1 Environmental Protection Authority's Construction Noise Guideline

The Environmental Protection Authority (EPA) recently released its Interim Construction Noise Guideline (ICNG) in 2009. This document is being referred to as EPA's standard policy for assessing construction noise on new projects.

The key components of the guideline that are incorporated into this assessment include:

Use of L_{Aeq} as the descriptor for measuring and assessing construction noise.

NSW noise policies, including the INP, RNP and RING have moved to the primary use of L_{Aeq} over any other descriptor. As an energy average, L_{Aeq} provides ease of use when measuring or calculating noise levels since a full statistical analysis is not required as when using, for example, the L_{A10} descriptor.

Application of reasonable and feasible noise mitigation measures

As stated in the ICNG, a noise mitigation measure is feasible if it is capable of being put into practice, and is practical to build given the project constraints.

Selecting reasonable mitigation measures from those that are feasible involves making a judgement to determine whether the overall noise benefit outweighs the overall social, economic and environmental effects.

The ICNG provides two methods for assessment of construction noise, being either a quantitative or a qualitative assessment. A quantitative assessment is recommended for major construction projects of significant duration, and involves the measurement and prediction of noise levels, and assessment against set criteria. A qualitative assessment is recommended for small projects with a duration of less than three weeks and focuses on minimising noise disturbance through the implementation of reasonable and feasible work practices, and community notification.

Table 17 below (reproduced from Table 2 of the ICNG) sets out the noise management levels and how they are to be applied for residential receivers. The guideline intends to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

The rating background level (RBL) is used when determining the management level. The RBL is the overall single-figure background noise level measured in each relevant assessment period (during or outside the recommended standard hours).

Table 17: Noise management levels at residential receivers

Time of day	Management level $L_{Aeq\ (15\ min)}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected RBL + 5dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Sensitive Land Use

Table 18 below (reproduced from Table 3 of the ICNG) sets out the noise management levels for various sensitive land use developments.

Table 18: Noise management levels at other noise sensitive land uses

Land use	Where objective applies	Management level $L_{Aeq\ (15\ min)}$
Classrooms at schools and other educational institutions	Internal noise level	45 dB(A)
Hospital wards and operating theatres	Internal noise level	45 dB(A)
Places of worship	Internal noise level	45 dB(A)
Active recreation areas	External noise level	65 dB(A)
Passive recreation areas	External noise level	60 dB(A)
Community centres	Depends on the intended use of the centre.	Refer to the 'maximum' internal levels in AS2107 for specific uses.
Commercial premises	External noise level	70 dB(A)
Industrial premises	External noise level	75 dB(A)

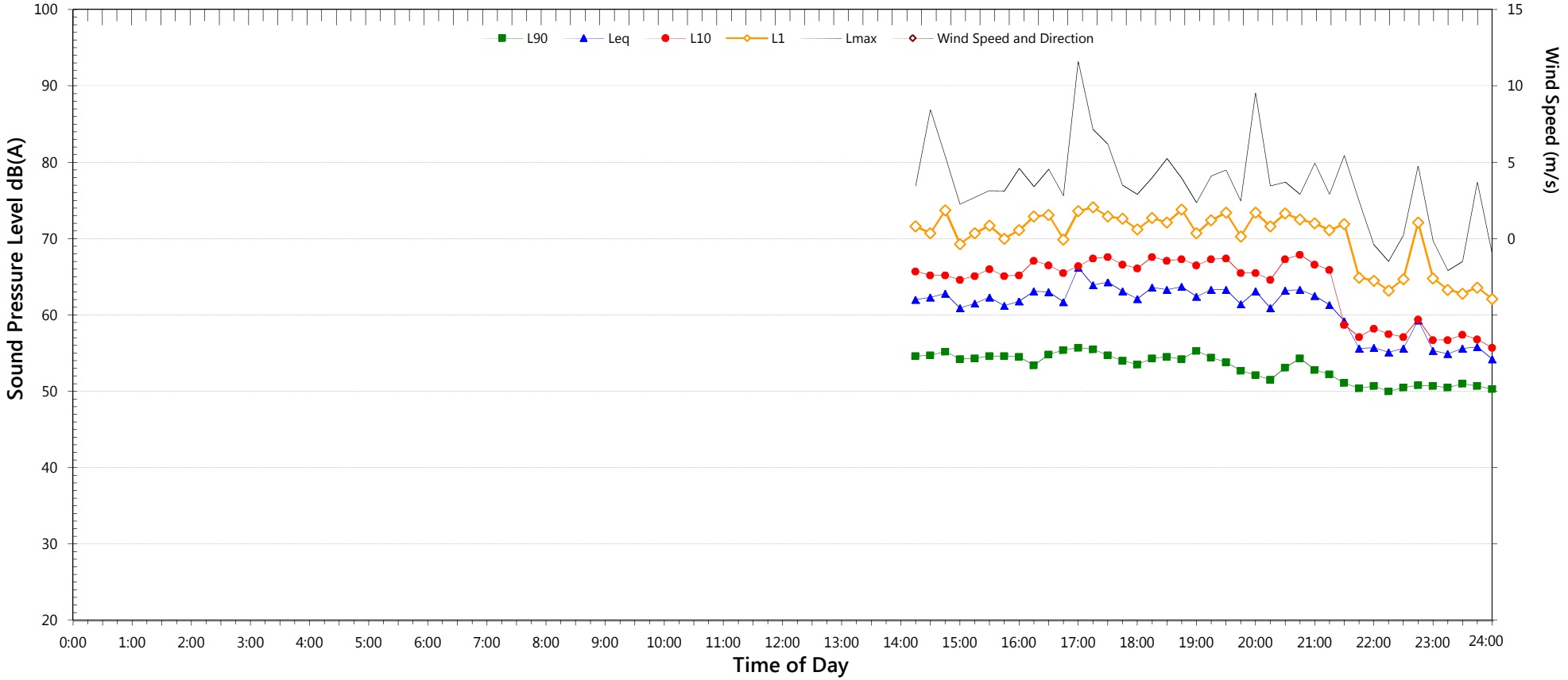
Notes: Noise management levels apply when receiver areas are in use only.

APPENDIX E Noise monitoring results

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Friday, 12 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	50.7	41.0
Leq (see note 3)	-	59.7	51.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

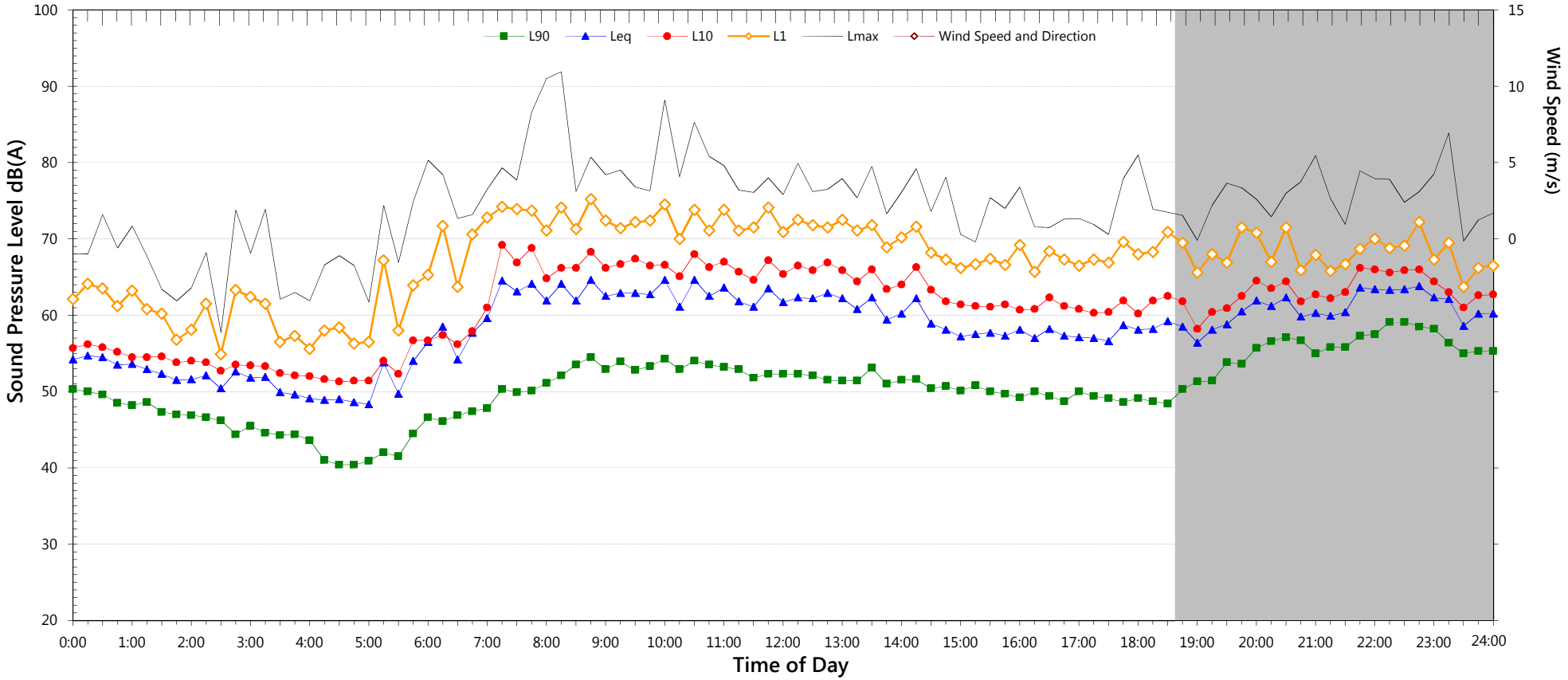
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62.5	54.3
$L_{eq\ 1hr}$ upper 10 percentile	63.8	57.9
$L_{eq\ 1hr}$ lower 10 percentile	58.6	48.7

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	67.7	to	80.3
Lmax - Leq (Range)	15.6	to	26.2

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Saturday, 13 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	49.2	-	-
Leq (see note 3)	59.1	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

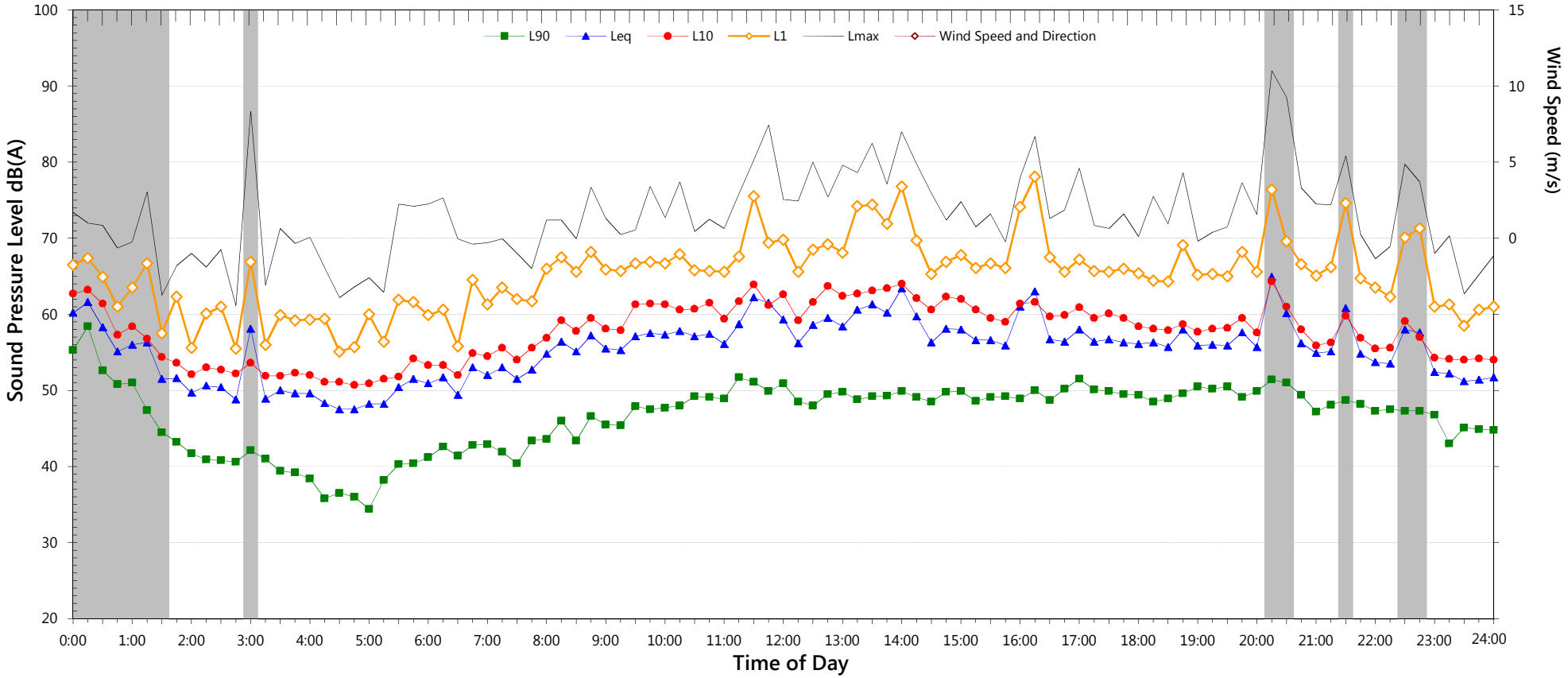
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	61.5	50.8
$L_{eq\ 1hr}$ upper 10 percentile	63.5	51.7
$L_{eq\ 1hr}$ lower 10 percentile	57.5	47.9

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	66.1	to	75.3
Lmax - Leq (Range)	17.2	to	24.1

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Sunday, 14 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	46.3	-	34.3
Leq (see note 3)	56.1	-	49.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

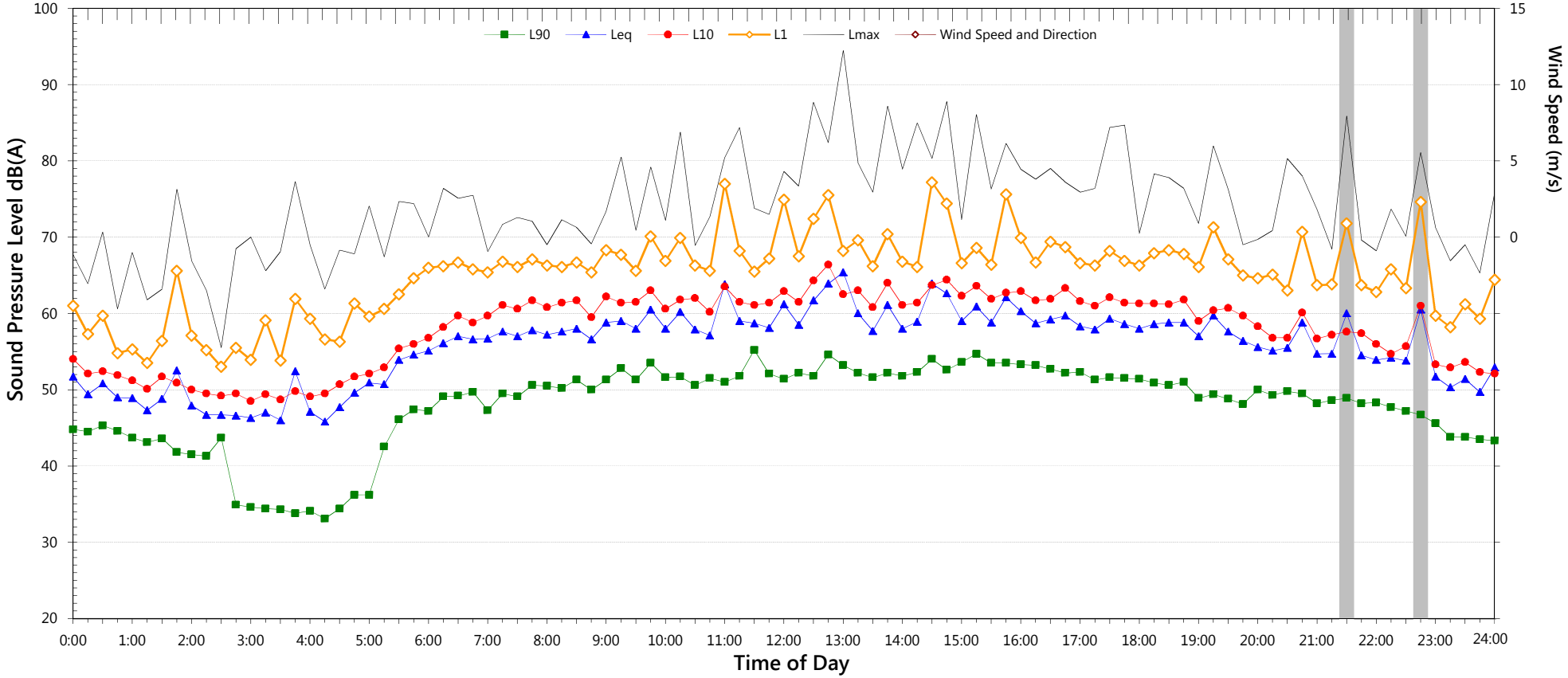
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	57.9	52.0
$L_{eq\ 1hr}$ upper 10 percentile	61.1	56.6
$L_{eq\ 1hr}$ lower 10 percentile	53.9	46.6

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	68.9	to	77.3
Lmax - Leq (Range)	15.9	to	28.3

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Monday, 15 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	50.5	48.2	33.4
Leq (see note 3)	57.5	54.6	49.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

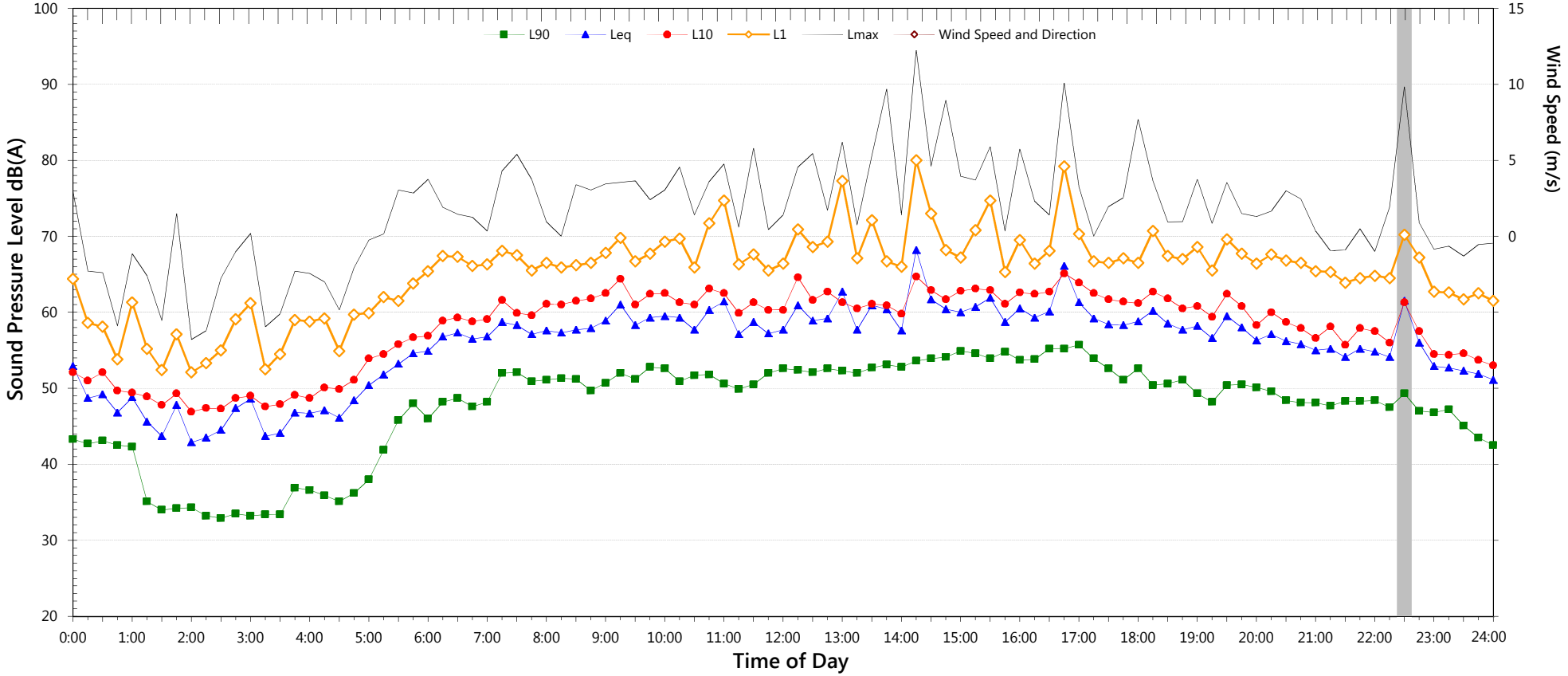
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59.4	51.6
$L_{eq\ 1hr}$ upper 10 percentile	62.4	56.9
$L_{eq\ 1hr}$ lower 10 percentile	55.5	45.4

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	65.4	to	77.5
Lmax - Leq (Range)	16.9	to	27.6

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Tuesday, 16 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	50.7	48.1	36.5
Leq (see note 3)	57.9	54.6	54.9

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

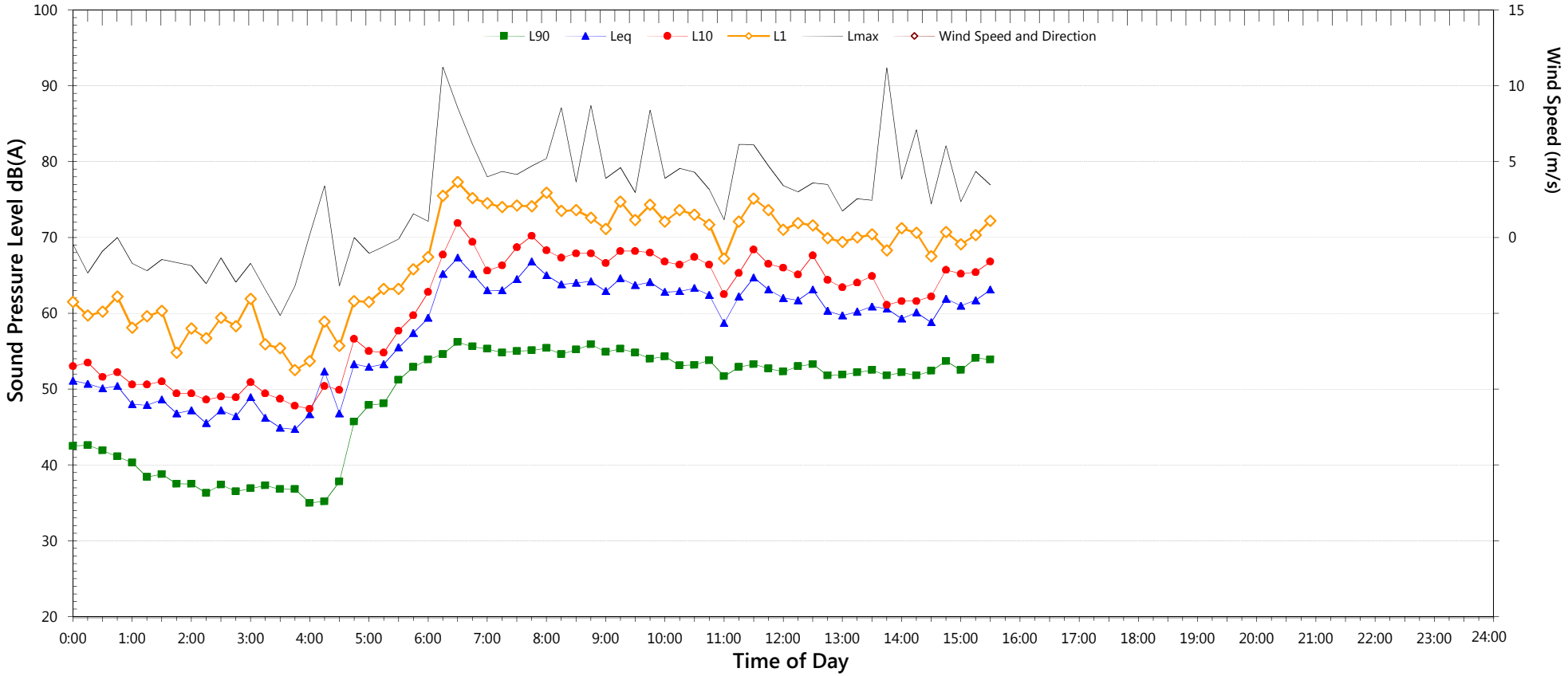
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	59.7	57.4
$L_{eq\ 1hr}$ upper 10 percentile	63.4	65.4
$L_{eq\ 1hr}$ lower 10 percentile	55.5	45.7

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	67.1	to	92.5
Lmax - Leq (Range)	16.1	to	27.1

Unattended Noise Monitoring Results

8m from boundary on rear carpark 103 Victoria Road, Drummoyne

Wednesday, 17 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

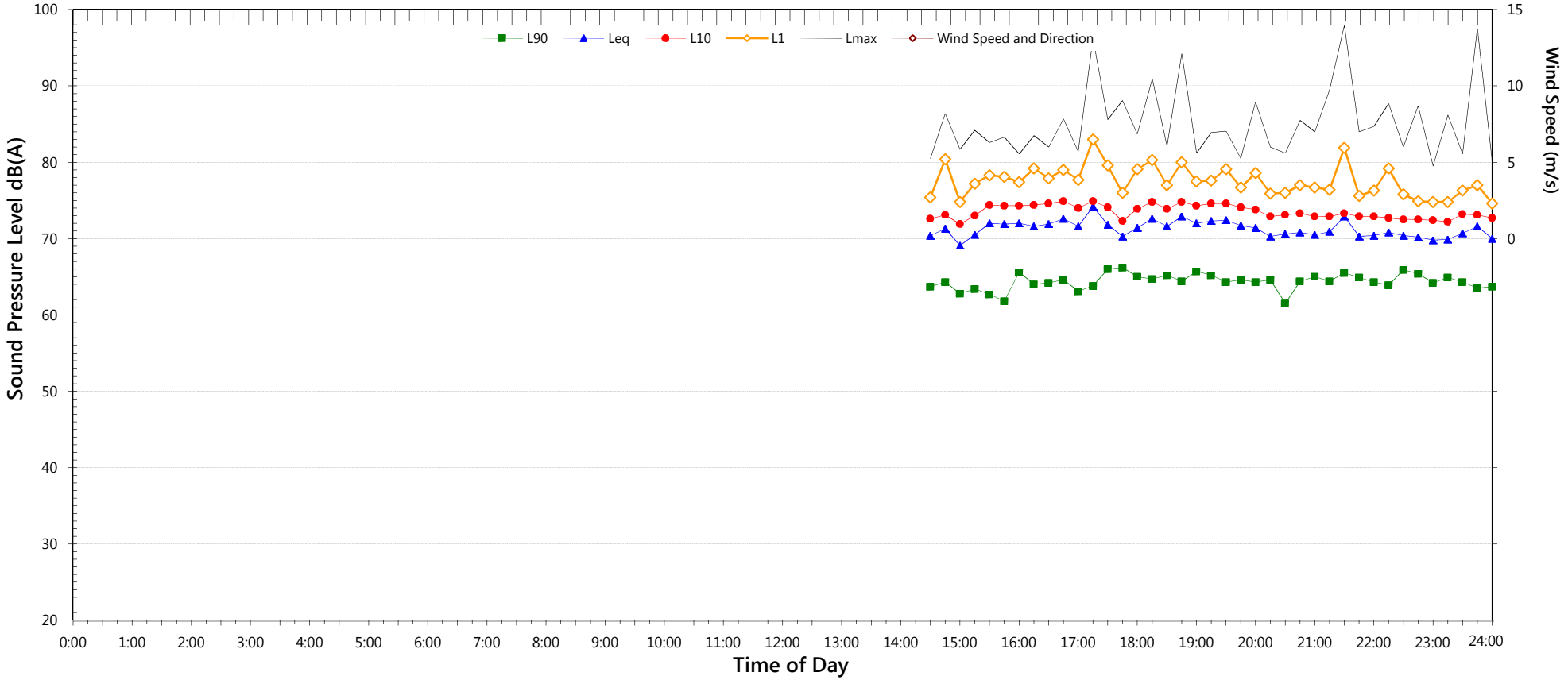
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	62.8	-
$L_{eq\ 1hr}$ upper 10 percentile	65.0	-
$L_{eq\ 1hr}$ lower 10 percentile	60.3	-

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Friday, 12 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	64.3	49.6
Leq (see note 3)	-	69.1	66.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

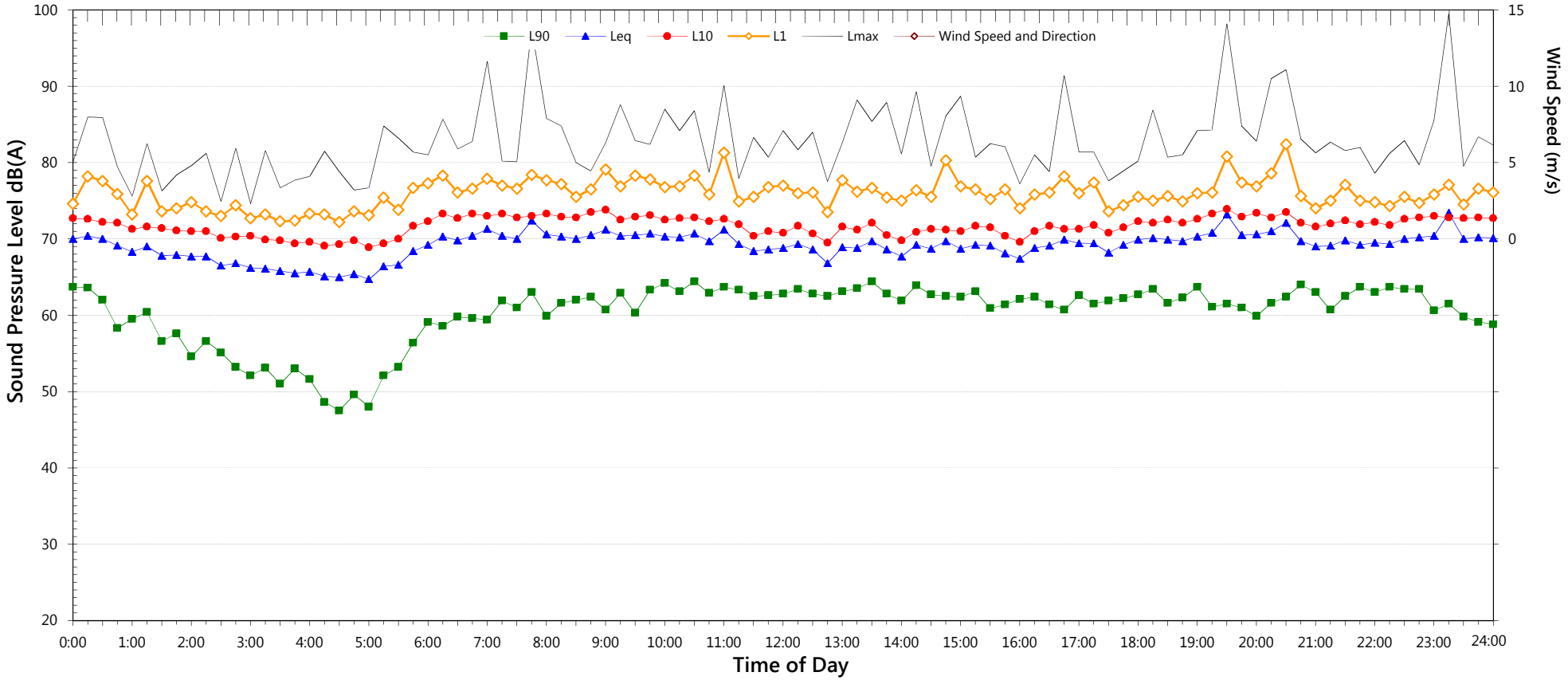
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	71.6	68.7
$L_{eq\ 1hr}$ upper 10 percentile	72.3	70.6
$L_{eq\ 1hr}$ lower 10 percentile	70.4	65.1

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	81.5	to	97.5
Lmax - Leq (Range)	15.1	to	26.9

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Saturday, 13 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	60.9	60.7	50.3
Leq (see note 3)	67.1	67.9	65.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

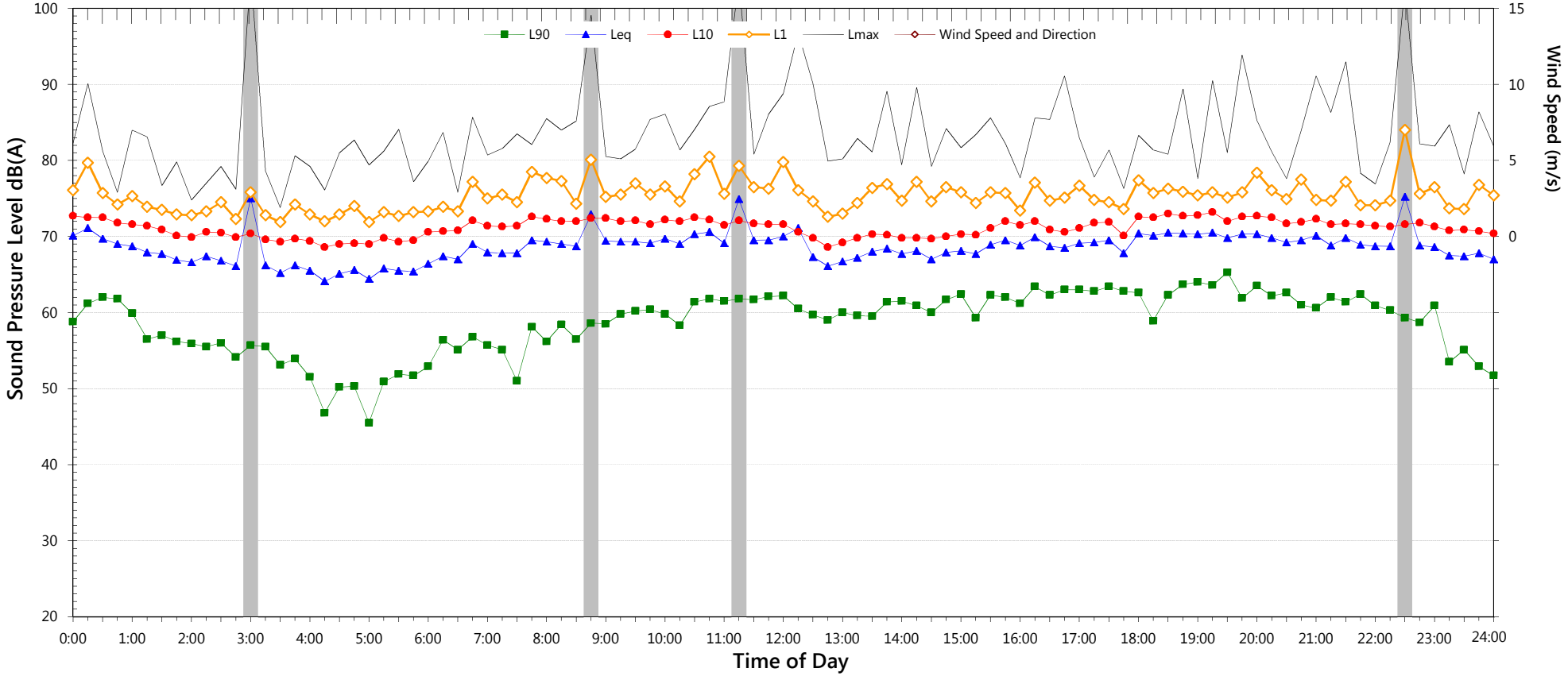
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	69.8	68.3
$L_{eq\ 1hr}$ upper 10 percentile	71.2	71.2
$L_{eq\ 1hr}$ lower 10 percentile	68.5	64.8

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	82.7	to	99.5
Lmax - Leq (Range)	15.5	to	28.3

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Sunday, 14 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	58.5	60.6	41.6
Leq (see note 3)	66.4	67.4	65.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

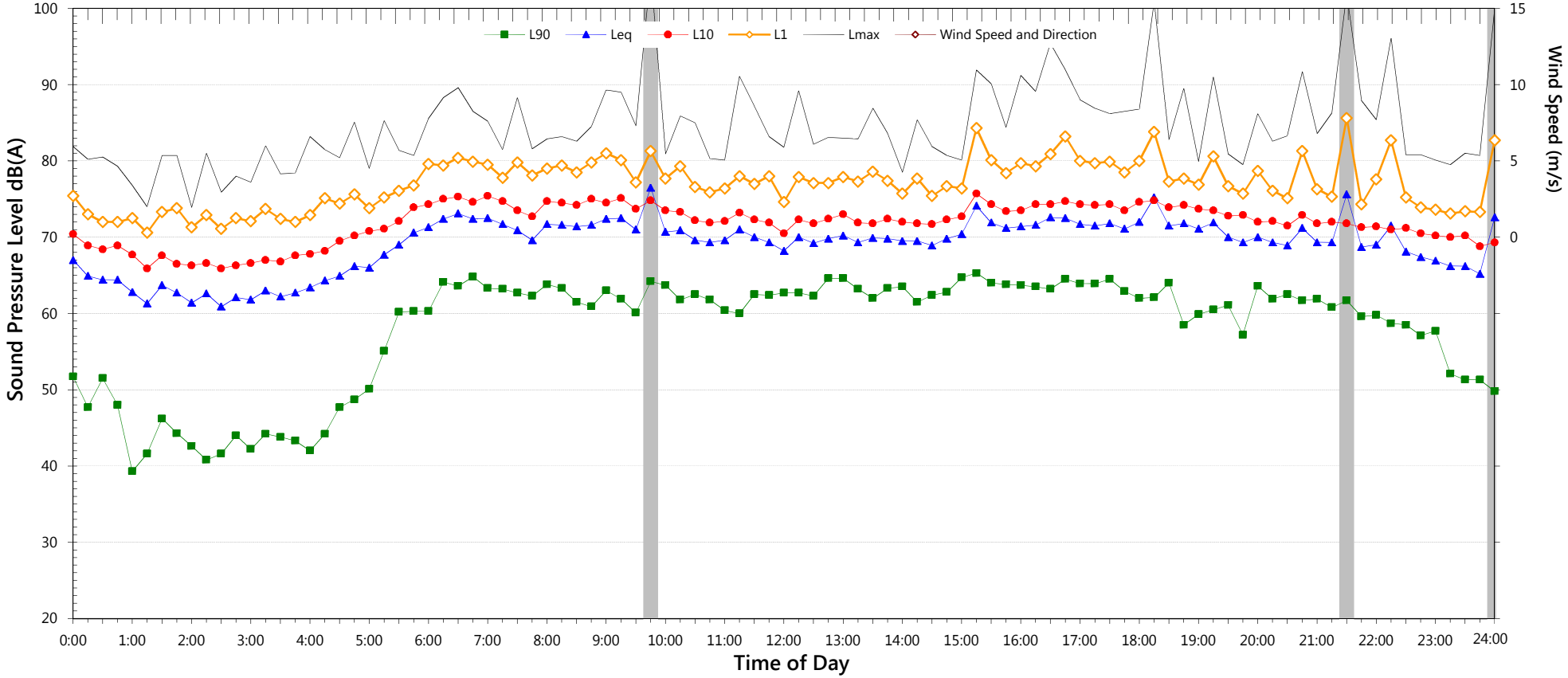
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	69.2	67.6
$L_{eq\ 1hr}$ upper 10 percentile	70.3	72.6
$L_{eq\ 1hr}$ lower 10 percentile	67.8	61.9

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	80.5	to	89.6
Lmax - Leq (Range)	15.7	to	20.4

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Monday, 15 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	61.5	58.5	38.4
Leq (see note 3)	68.4	68.3	64.9

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

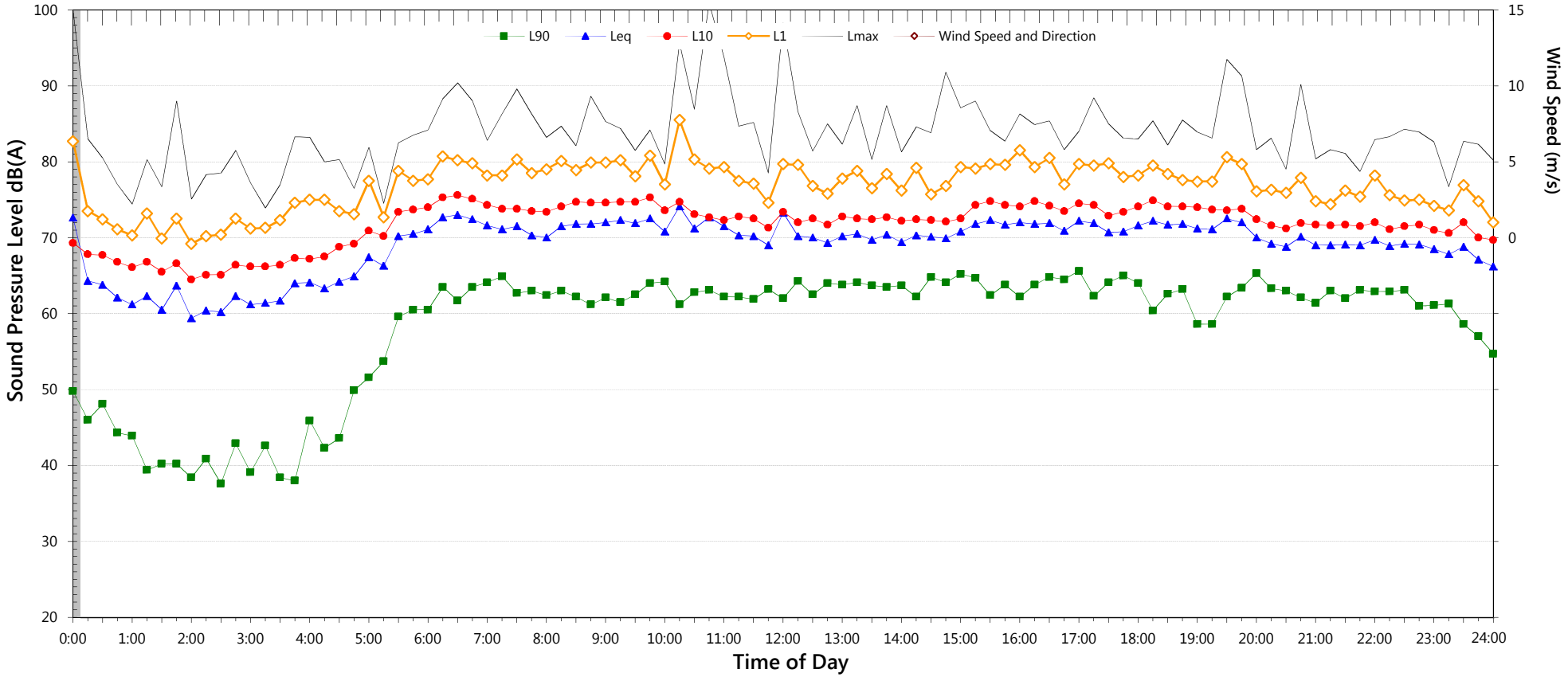
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	70.9	67.4
$L_{eq\ 1hr}$ upper 10 percentile	72.5	72.5
$L_{eq\ 1hr}$ lower 10 percentile	69.3	61.1

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	81.0	to	96.1
Lmax - Leq (Range)	15.1	to	27.2

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Tuesday, 16 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	62.0	58.6	41.1
Leq (see note 3)	68.8	68.1	65.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

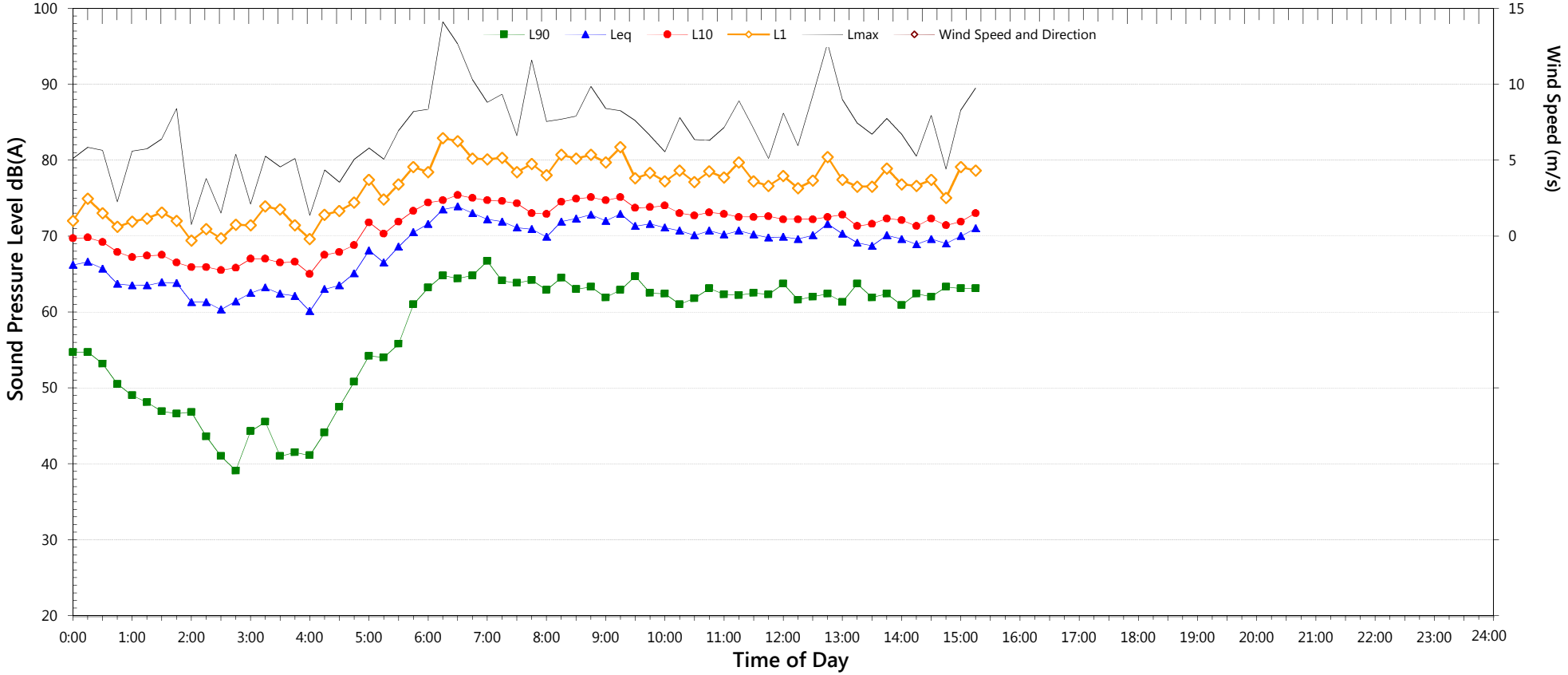
NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	71.1	67.9
$L_{eq\ 1hr}$ upper 10 percentile	72.3	73.2
$L_{eq\ 1hr}$ lower 10 percentile	69.3	61.4

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	80.5	to	98.2
Lmax - Leq (Range)	15.1	to	25.0

Unattended Noise Monitoring Results

1m from facade on shop awning of 103 Victoria Rd, Drummoyne

Wednesday, 17 December 2014



NSW Industrial Noise Policy (Free Field)			
Descriptor	Day	Evening	Night[2]
	7am-6pm	6pm-10pm	10pm-7am
L_{90}	-	-	-
Leq (see note 3)	-	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.
2. "Night" relates to period from 10pm on this graph to 7am on the following graph.
3. Graphed data measured 1m from facade; tabulated results free-field corrected
4. Night time Lmax values are shown only where Lmax >65dB(A) and where Lmax- Leq ≥15dB(A)

NSW Road Noise Policy (1m from facade)		
Descriptor	Day	Night[2]
	7am-10pm	10pm-7am
$L_{eq\ 15\ hr}$ and $L_{eq\ 9\ hr}$	70.7	-
$L_{eq\ 1hr}$ upper 10 percentile	72.3	-
$L_{eq\ 1hr}$ lower 10 percentile	69.4	-

Night Time Maximum Noise Levels			(see note 4)
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-