Report

DEVELOPMENT APPLICATION - ACOUSTIC ASSESSMENT

Netball Central
Netball NSW

CONFIDENTIAL

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NORMAN DISNEY & YOUNG

CONSULTING ENGINEERS

NDY Management Pty Limited trading as Norman Disney & Young
ABN 29 003 234 571
60 Miller Street
North Sydney NSW 2060

Telephone: +61 2 9928-6800
Facsimile: +61 2 9955-6900

www.ndy.com

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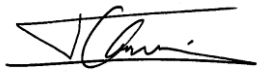

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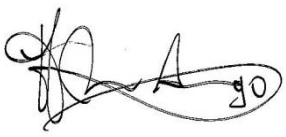

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1. EXECUTIVE SUMMARY

This report has been prepared as part of the Development Application for the Netball Central project proposed at the corner of Sarah Durack Avenue and Olympic Boulevard, Sydney Olympic Park, NSW.

This report discusses the findings of an unattended noise survey conducted to define acoustic criteria in accordance with the relevant statutory guidelines. This report also recommends:

- Criteria for noise generated by use of the proposed netball courts to limit impacts at noise sensitive locations adjacent to the proposed Netball Central site.
- Traffic noise criteria for vehicle movements generated by the development.

Based on the investigations and findings discussed herein, it is found that no acoustic measures are required to achieve compliance with the acoustic criteria listed in Section 5 of this report.

Provided that at the detailed design stage the acoustic considerations discussed in this report are noted and developed further, it is our opinion that the acoustic criteria listed in Section 5 of this report will be satisfied.

This report also discusses the Construction Noise and Vibration criteria applicable for a project of this type and recommends that a *Construction Noise and Vibration Impact Statement* is undertaken once the details of the construction methodologies are properly defined for the project. The Impact Statement report will inform the appropriate management and noise controls for inclusion in the site Construction Management Plan.

2. BACKGROUND

2.1. Authorisation

Authorisation to conduct this project and prepare this report was provided by Josh Malin of Crown Projects on behalf of Netball NSW.

2.2. Information Sources

The following references have been used for this assessment.

- Department of Environment. Climate Change and Water (DECCW) *Industrial Noise Policy* (INP, 2000)
- Department of Environment. Climate Change and Water (DECCW) *Road Noise Policy* (RNP, 2011)
- Traffic flow information provided by Arup via email dated 16th May 2012.
- Indicative mechanical services information provided by Arup via email dated 15th June 2012

2.3. Revision

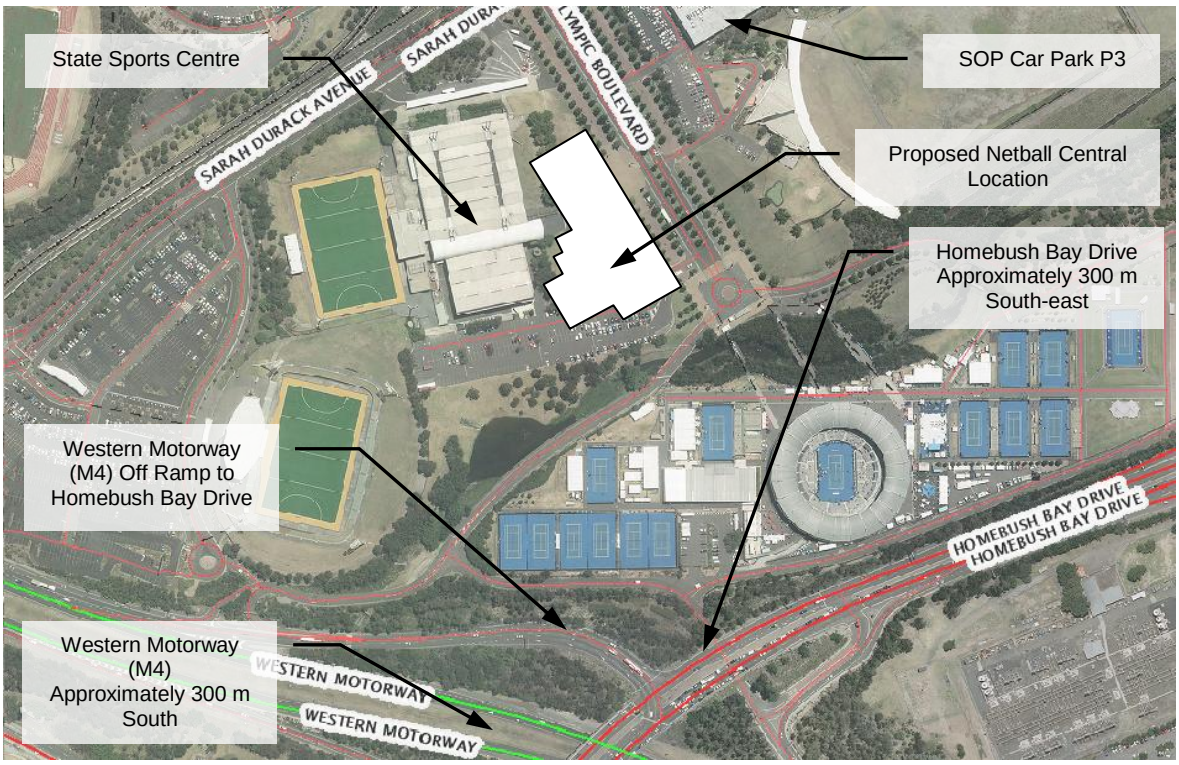
Rev.	Date Issued	Comment
1.0	18th May 2012	Preliminary
2.0	18th June 2012	Final

3. INTRODUCTION

As part of Netball Central project, NDY Sound has been engaged to produce a DA report addressing external noise emission form the proposed new building. The proposed Netball Central development site is located between the existing State Sports Centre and Olympic Boulevard. The predominant source in terms of noise intrusion is considered to be road traffic noise and a site visit has confirmed this is the case. Olympic Boulevard is subject to only moderate and intermittent traffic flows and therefore is limited in terms of potential noise intrusion.

The site is positioned approximately 300 m north of the Western Motorway (M4) and 300 m north-west of Homebush Bay Drive. These roads are subject to heavy, continuous traffic flows and are therefore the dominant source of noise in the local environment. Refer to Figure 1:

Figure 1 - Location Map



The results of the unattended noise logging procedure are shown in Table 1. These results take into account the prevailing meteorological conditions during each 15 minute noise measurement interval, using half-hourly data obtained from Sydney Olympic Park Weather Station (Station number 066212).

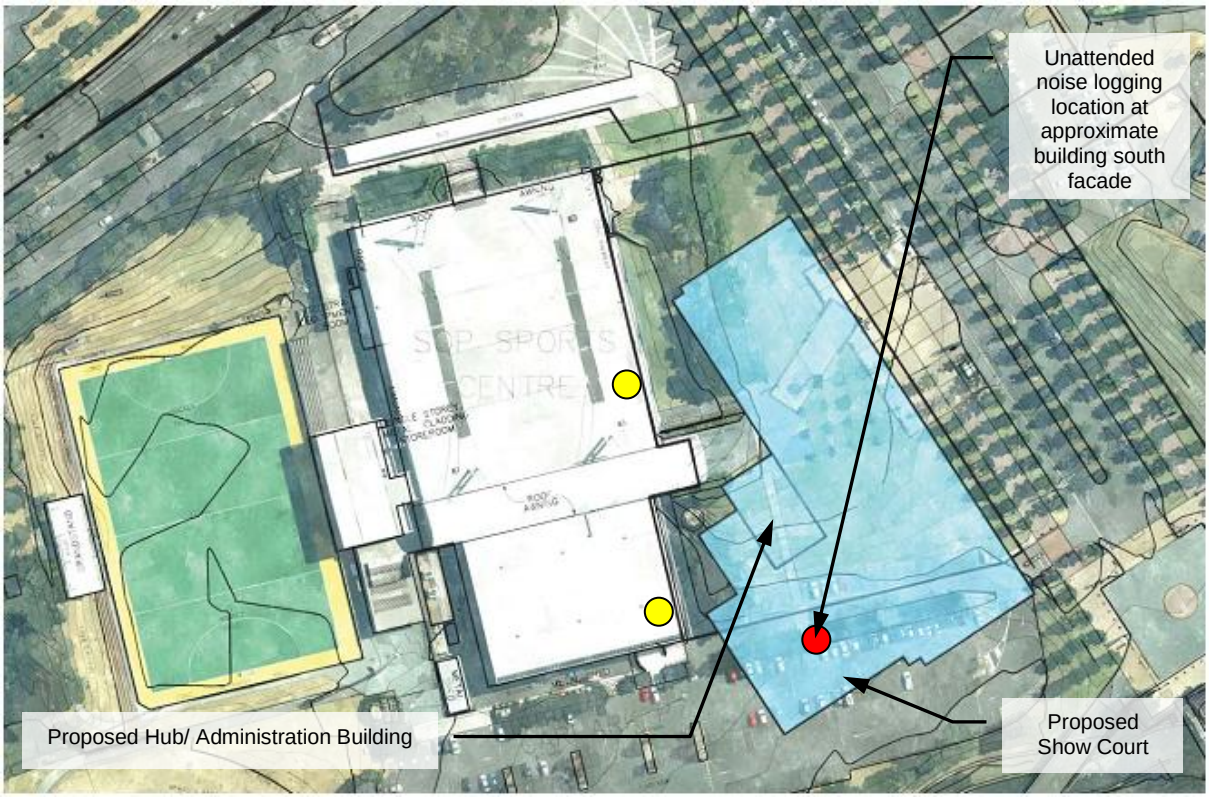
If rain was experienced, the data from that interval is excluded. If the wind speed at 1.5 m above ground level exceeded 5 m/s (derived by halving the Bureau of Meteorology data measured at 10 m above ground), again the data has been excluded.

4. NOISE MONITORING

4.1. Methodology

Unattended noise measurements were conducted to determine existing ambient noise levels in the area. Noise measurements were taken for a period of one (1) week from the 1st February 2012 until the 9th February 2012. The noise logger was set up near the proposed southern facade location, adjacent to the existing car park. This location has been used to determine daytime, evening and night-times noise levels of the local environment. The noise logging location is identified in Figure 2:

Figure 2 – Unattended Noise Logging and Attended Noise Measurement Locations



The equipment used to conduct these unattended measurements was a Svan 958 Type 1 Noise Logger (serial number: 15801). The equipment calibration was checked prior to, and after the noise survey. The noise monitor was configured to record all relevant noise indices including background noise (L_{A90}) and equivalent continuous noise levels (L_{Aeq}). Samples were recorded at 15 minute continuous intervals. The noise monitor response was set to *fast*.

4.2. Weather Data

In order to verify that noise data was obtained during suitable meteorological conditions, weather data was obtained from the Bureau of Meteorology (BOM). Rain and wind speed data was used from the meteorological site at Sydney Olympic Park (ID 066212) as representative of the proposed Netball Central site.

Noise data has been excluded from the results if:

- Rain was observed during the fifteen minute noise measurement period and/or

- Wind speed exceeded 5 m/s at the measurement height of 1.5 m above ground. Wind data obtained from the BOM is presented as the value at 10 m above ground, and the measured values are halved for the purpose of assessing wind speed at 1.5 m above ground.

4.3. Measured Noise Levels

For the purpose of assessment, the measured data was processed into time the NSW INP periods as follows:

- Daytime: 0700 to 1800 hrs
- Evening: 1800 to 2200 hrs
- Night-time: 2200 to 0700 hrs[1]

The measured background (L_{A90}) and equivalent continuous (L_{Aeq}) noise levels during these defined time periods are presented in Table 1.

The L_{A90} noise levels presented are *Rating Background Levels* (RBLs), being the median of the lowest 10th percentile of the background L_{A90} samples in each daytime, evening and night-time measurement period, for each 24 hour period during the noise survey.

The L_{Aeq} noise levels presented are the logarithmic average of all the L_{Aeq} samples taken in each of the daytime, evening and night-time periods.

Table 1. Measured Noise Levels

Date	L_{A90} Background Noise Levels (dB re 20 µPa)			L_{Aeq} Ambient Noise Levels (dB re 20 µPa)		
	Daytime	Evening	Night-time	Daytime	Evening	Night-time
Wed 1 Feb	56	54	49	60	59	56
Thu 2 Feb	55	Rain	Rain	59	Rain	Rain
Fri 3 Feb	51	51	48	55	54	55
Sat 4 Feb	50	52	48	58	56	54
Sun 5 Feb	50	50	48	*62*	55	54
Mon 6 Feb	52	54	51	*64*	59	60
Tue 7 Feb	56	53	50	60	57	54
Wed 8 Feb	52	54	48	59	58	54
Thu 9 Feb	52	-	-	56	-	-
RBL / L_{Aeq}	**52**	**53**	**48**	**60**	**57**	**56**

The noise logging data was visually inspected for atypical noise events. Any such data was manually excluded from the measurement data.

A summary of the noise logging data is provided in Appendix A.

[1] Sundays and public holidays are adjusted by extending the night-time period to 0800 hrs as per the NSW INP.

5. OPERATIONAL NOISE - CRITERIA

5.1. NSW Industrial Noise Policy (INP)

Operational noise level criteria for mechanical plant noise emission have been derived in accordance with the NSW Industrial Noise Policy (INP, 2000), issued by NSW Environmental Protection Authority (EPA) which is now the NSW Office of Environment and Heritage (OEH). The NSW INP provides assessment methodologies, criteria and detailed information on the assessment of stationary mechanical plant items in NSW.

The NSW INP criteria for industrial-type noise sources addresses two components; being the management of *intrusive* noise impacts (for residential premises only) and maintaining noise *amenity* for all noise-sensitive land uses.

A review of the site location reveals that the nearest residences are located south of Parramatta Road, approximately 490 m to the south. This is a large separation results in a correspondingly large attenuation of sound (approximately 61 dB from hemispherical propagation alone).

The control of noise emission from mechanical plant items to the adjacent commercial and active recreation land uses (albeit with less stringent criteria than for residential land uses) will result in compliance at the much more distant residential receivers. Therefore, residential receivers need not be considered any further in this report, or the project as a whole.

For this project, only the INP *amenity* criteria are of relevance. The amenity criteria are based on the sensitivity of a particular land use to industrial-type noise. The cumulative effect of noise from industrial sources needs to be considered. The existing noise level from industrial sources is measured. If it approaches the amenity value for the land use, noise levels from new industrial-type noise sources need to be controlled so that the cumulative effect does not result in aggregate noise levels that would significantly exceed the criterion.

Nearby receivers include:

- Commercial premises
- Active recreation areas

The criteria for these land uses are presented in Table 22:

Table 2 - External Noise Level Criteria – Non-Residential Land Uses

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB	
			Acceptable	Recommended Maximum
Commercial Premises	All	When in use	65	70
Active Recreation Area	All	When in use	55	60

5.2. Traffic Noise Criteria

The NSW Road Noise Policy (RNP, 2011) issued by the Office of Environment and Heritage (OEH) governs the assessment and control of road traffic noise in NSW.

The aim of the RNP is to identify strategies that address the issue of road traffic noise from existing roads, new road projects, road development projects and new traffic-generating developments. Netball Central fits the latter category.

NDY Sound understands that the large majority of traffic generated by the development would be netball event spectators (those that do not arrive by train or other public transport). Spectator vehicles would use the existing Sydney Olympic Park Car Park P3, at the corner of Sarah Durack Avenue and Olympic Boulevard. The most immediate land uses likely to be affected by vehicle movements to and from this location are classified as Open Space (active use) according to the RNP. The relevant criteria are summarised in Table 2:

Table 3 - Road Traffic Noise Emission Criteria – Active Use Open Space

Existing Sensitive Land Use	Assessment Criteria dB(A)		Additional Considerations
	Day (7am – 10pm)	Night 10pm – 7am)	
Open Space (Active Use)	$L_{Aeq(15\ Hour)}$ 60 External When in Use	-	Active recreation is characterized by sporting activities and activities that generate their own focus for participants, making them less sensitive to external noise intrusion.

It is considered highly unlikely that additional vehicle movements generated by the development have the potential to affect residential premises further away from the development – such as those adjacent to Homebush Bay Drive. The likely volumes of project-related traffic would be insignificant compared to existing flows on this road and as such no further consideration of this aspect is presented in this report.

5.3. Netball and Related Activities

There are no specific criteria that govern the control of netball and related activity noise emission from the proposed building, in this location. Therefore, in the absence of any guidelines or standards we proposed to assess the emission of noise from netball and related activities in line with the NSW INP amenity criteria as discussed above in Table 1.

6. OPERATIONAL - ACOUSTIC ASSESSMENT

A computer noise model of the site was created. This model was used as the basis for noise predictions at the nearest receivers due to noise emission from mechanical services, traffic noise and netball related activities.

6.1. Mechanical Services Noise

The mechanical consultants for the proposed development have provided *indicative* plant selections for the major plant items associated with the new buildings. These are:

- 5 x AHUs - roof mounted
- 1 x kitchen exhaust fan
- 1 x toilet exhaust fan
- 5 x condensing units

The indicative Sound Power Levels, L_w, for the equipment are given below:

Table 4 – Indicative Equipment Sound Power Levels

Equipment	Overall Sound Power Level, dBA
AHUs	89
Condenser Units	80
Kitchen Exhaust	85
Toilet Exhaust	70

This equipment has been used to predict the environmental noise emission from the site to the nearest noise sensitive receivers or land uses. The predicted noise levels have assumed the following (conservative acoustic assessment):

- Approximately 30 m to the nearest noise sensitive receiver
- Hemispherical propagation
- Nil ground absorption
- Acoustic shielding from the building edge (i.e. line-of-sight acoustic shielding)
- Major plant items run continuously at one duty

The predicted noise level at the nearest receiver is given in the table below and is compared against the applicable criteria for that land use / receiver.

Table 5 – Predicted Mechanical Services Noise Levels at the Nearest Noise Sensitive Receiver

Land Use / Receiver	INP Amenity Criteria, L_{Aeq} dB	Predicted Noise Level, L_{Aeq} dB	Compliance
Active Recreation Area Closest: State Sports Centre	55	55	Yes

The untreated mechanical plant was found to satisfy the environmental noise emission criteria. The mechanical plant should be further assessed during the detailed design to ensure this compliance is maintained.

No further measures are required as a result. However if the number of plant items is increased or louder plant items are selected (i.e. those which have higher sound power levels), then the acoustic assessment should be reviewed.

6.2. Traffic Noise on Local Roads

As observed from the unattended noise survey (refer to Section 4 of this report), it is found that a typical $L_{Aeq(15\ hours)}$ noise level is approximately equal or less than 60 dBA. This concurs with the traffic criteria listed in Table 3.

Additionally, we have assessed the traffic flow information provided by Arup for the nearest "collector" roads (as per email dated 16th May 2012). These "collector" roads comprise Sarah Durack Avenue, Olympic Boulevard and Shirley Strickland Avenue.

The traffic flow information included average daily traffic as well as event average daily traffic volumes for both existing and future scenarios (i.e. after the project has been completed). Based on this information it is concluded that the increase on traffic volumes will produce a negligible increase on the existing traffic noise generated by the "collector" roads.

As a result, no further measures are required.

6.3. Netball and Related Activities

NDY has surveyed numerous netball courts and related activities. The average Sound Pressure Level, L_p , for Netball sports activities are given in the table below. This includes courts with multiple refereed games and whistles:

Table 6 – Indicative Netball Sound Pressure Levels

Activity	Overall Sound Pressure Level, dBA
Multiple netball games with whistles (internal noise level)	80-85

This sound pressure level has been used to predict the environmental noise emission from the site to the nearest noise sensitive receivers / land uses. The predicted noise levels have assumed the following (conservative acoustic assessment):

- Transmission loss through the louvered facade
- Direct line of sight exists between source and receiver

- Hemispherical propagation
- Nil ground absorption
- No acoustic shielding – neither designed nor incidental

The predicted noise level at the nearest receiver is given in the table below and is compared against the applicable criteria for that land use / receiver.

Table 7 – Predicted Noise Levels due to Netball Activities at the Nearest Noise Sensitive Receiver

Land Use / Receiver	INP Amenity Criteria, L_{Aeq} dB	Predicted Noise Level, L_{Aeq} dB	Compliance
Active Recreation Area Closest: State Sports Centre	55	<50	Yes

The noise from netball activities was found to satisfy the environmental noise emission criteria. This noise source should be further assessed during the detailed design to ensure this compliance is maintained. No further measures are required as a result.

7. CONSTRUCTION NOISE - CRITERIA

7.1. The Interim Construction Noise Guideline (ICNG)

The Interim Construction Noise Guideline (ICNG) is aimed at managing noise from construction works regulated by the NSW Office of Environment and Heritage. It is also the de facto guideline for acoustic practitioners and other interested parties, used to assist in the assessment of noise emission from construction activities.

On this basis, the ICNG is used in this document to assess potential noise emission from proposed construction activities at the Netball Central site.

With reference to Section 1.3 of the ICNG, the main objectives of the Guideline are to:

- Use Noise Management Levels (NML's) to identify demolition, excavation and construction noise sources or scenarios that require engineering controls or administrative management (The term criteria is specifically not used in the ICNG).
- Promote a clear understanding of ways to identify and minimise noise from construction works.
- Focus on applying all feasible and reasonable work practices to minimise construction noise impacts.
- Encourage construction to be undertaken only during the recommended standard hours unless approval is given for works that cannot be undertaken during these hours.
- Streamline the assessment and approval stages and reduce time spent dealing with complaints at the project implementation stage.
- Provide flexibility in selecting site-specific and reasonable work practices in order to minimise noise impacts.

The sections below present important concepts and procedures to be followed in the application of the ICNG.

7.2. Feasible and Reasonable

Two salient concepts in the ICNG are those of what are 'Feasible' and 'Reasonable' measures to minimise noise impacts. The guideline defines these concepts as follows:

Feasible

"A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements".

Reasonable

"Selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the measure.

The regulatory authority may review the information on feasible and reasonable work practices provided by the proponent, and compare the practices against those applied on similar projects. The regulatory authority may negotiate additional work practices that it considers may also be feasible and reasonable".

7.3. Qualitative and Quantitative Assessment

The ICNG provides for both a quantitative and a qualitative method of assessing the impact of construction noise.

The guideline states that a qualitative assessment method may be used for short-term maintenance work, and the definition of short-term is that the "*works are not likely to affect an individual or sensitive land use for more than three weeks in total*".

The proposed Netball Central facilitiy will take longer than three weeks; hence, we consider that a quantitative assessment is the most appropriate for this project.

7.4. Noise Management Levels for Residences

A review of the site location reveals that the nearest residences are located south of Parramatta Road, approximately 490 m to the south. This is a large separation results in a correspondingly large attenuation of sound (approximately 61 dB from hemispherical propagation alone).

The control of noise emission from construction activities to the adjacent commercial and active recreation land uses (albeit with less stringent criteria than for residential land uses) will result in compliance at the much more distant residential receivers. Therefore, residential receivers need not be considered any further in this report, or the project as a whole.

7.5. Noise Management Levels for Other Noise Sensitive Receivers

It is necessary to establish construction noise management levels for noise-sensitive receivers within the Olympic Park campus. These are based on the ICNG and identified in Table 8.

Table 8 – NMLs for other noise sensitive receivers

Land Use	Management Level $L_{Aeq\ (15\ min)}$ (applies when properties are being used)
Active Recreation Area Closest: State Sports Centre	External Noise Level 65 dB
Offices / Commercial	External Noise Level 70 dB

8. CONSTRUCTION VIBRATION - CRITERIA

This section presents the benchmarks used to assess vibration impacts due to the construction works. The criteria discussed below are non-mandatory. Instead they are goals that should be sought to be achieved through the application of all feasible and reasonable mitigation measures. Where all feasible and reasonable measures have been applied and vibration values are still beyond the maximum value, the operator would need to negotiate directly with the affected stakeholders in the Olympic Park campus[2].

Ground vibration impacts for buildings near construction sites may be defined by four (4) categories for this development, in increasing order of subjective intensity:

- **Ground Borne Noise** – vibration which travels through the ground and into building structures. The vibrating building structures generate airborne noise inside the rooms.
- **Human Comfort** (*Nuisance*) – perceptible vibration in which building occupants are inconvenienced or disturbed.
- **Cosmetic Damage** – vibration where the building surfaces begin to show cosmetic cracks.
- **Building Damage** – long or short term vibration in which the integrity of a building or structure itself is placed at risk.

In occupied buildings, achieving criteria for minimising nuisance / ground borne noise infers compliance with building damage criteria.

The following subsections provide a brief review of applicable Standards and vibration criteria for the minimisation of nuisance and building risk. The criteria are applicable in the z-axis (vertical direction) and vibration levels shall be appropriately weighted for this axis[2].

8.1. Ground Borne Noise

Ground-borne noise occurs when energy associated with vibration intensive activity causes surfaces within a room to vibrate. The energy is then imparted into the air within the room and can result in audible noise (dependent upon ambient background noise levels and the level of airborne noise intrusion associated with nearby construction activities).

Based on the guidance given in the NSW DECCW Interim Construction Noise Guidelines (ICNG), we propose the following noise management levels for ground borne noise.

Table 9 – Ground Borne Noise Targets, LAeq dB

Location	Ground Borne Noise Management Level L_{Aeq} (dB re 20 µPa)
Offices	55

Notes:
1. Management levels applicable during the construction hours discussed NSW ICNG.
2. Time weighting for ground borne noise should be set to *Slow* (1s)

8.2. Human Comfort

With regard to human perception and annoyance, ground vibration from construction activities is assessed as three (3) separate components; intermittent[3] vibration, impulsive and continuous vibration.

[2] As per NSW DECCWs *Assessing Vibration - A Technical Guideline*.

[3] The term 'intermittent' is used to collectively refer to impulsive or short term events, including vehicle pass-bys, pile driving or hammering.

Applying a Peak Particle Velocity (PPV) limit of 0.2 mm/s (referred to in DIN 4150) is intended to correspond to the human threshold of vibration perception. However, it poorly accounts for the likely human response to intermittent vibration over extended time periods.

On this basis criteria founded on ISO and Australian Standards are therefore presented as an improved benchmark for physical monitoring of compliance. The applicable human comfort vibration goals for continuous, intermittent and impulsive vibration sources are provided in the tables below. In all cases, the vibration goals are expressed in terms of the RMS vibration velocity level in mm/s, measured in the most sensitive direction (z-axis).

Table 10 – RMS vibration velocity values for continuous vibration, mm/s

Location	Time period	Preferred values	Maximum values
Offices / Commercial / Staff Areas	All hours	0.4	0.8
Active Recreation Areas (external)	All hours	0.8	1.6

Table 11 – RMS vibration velocity values for impulsive vibration, mm/s

Location	Time period	Preferred values	Maximum values
Offices / Commercial / Staff Areas	All hours	13.0	26.0
Active Recreation Areas (external)	All hours	13.0	26.0

For intermittent vibration (typical of construction activities such as rock breakers, piling, excavators and the like) the fourth-power Vibration Dose Value (VDV) is submitted as an improved metric. The VDV is measured over each diurnal period as a cumulative dose value. The VDV is more sensitive to peaks in vibration, and also includes weightings to account for the variation in human sensitivity to vibration with frequency. The table below provides the applicable goals for intermittent vibration.

Table 12 – Acceptable vibration dose values for intermittent vibration, m/s1.75

Location	Time period	Preferred values	Maximum values
Offices / Commercial / Staff Areas	All hours	0.4	0.8
Active Recreation Areas (external)	All hours	0.8	1.6

The DECCW vibration guideline notes the following in relation to the preferred and maximum vibration levels:

> *There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Activities should be designed to meet the preferred values where an area is not already exposed to vibration. Where all feasible and reasonable measures have been applied, values up to the maximum value may be used if they can be justified. For values beyond the maximum value, the operator should negotiate directly with the affected community. Situations exist*

where vibration above the preferred values can be acceptable, particularly for temporary disturbances and infrequent events of short term duration.

In circumstances where work is short term, feasible and reasonable mitigation measures have been applied, and the project has a demonstrated high level of social worth and broad community benefits, then higher vibration values (above the maximum) may apply. In such cases, best management practices should be used to reduce values as far as practicable, and a comprehensive community consultation program should be instituted.

8.3. Cosmetic Damage

Australian Standard AS 2187.2:2006 *'Explosives - Storage and Use - Part 2: Use of Explosives'* recommends frequency dependent values and assessment methods as given in BS 7385.2:1993 and is considered the most recent and relevant standard for vibration damage goals.

The standard sets values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are considered to give a minimum risk of vibration-induced damage, where a 95% probability of *no* effect is regarded as the lowest risk scenario.

The standard typically considers transient vibration events such as demolition, blasting and piling etc. Activities such as rock breaking / hammering and sheet piling are considered to have the potential to cause dynamic loading (from continuous / intermittent sources of vibration), so the transient vibration level criteria are reduced by 50%.

For most construction activities involving continuous or intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 30 Hz range). On this basis, a conservative vibration damage screening level of **7.5 mm/s** will be adopted for assessment purposes.

In order to assess the likelihood of cosmetic damage due to vibration, evaluation should be undertaken at the base of the building and the highest of the vibration components (transverse, longitudinal and vertical directions) should be compared with the guidance curves in AS 2187.2:2006

If vibration levels are predicted to exceed 7.5 mm/s, then more detailed analysis of the building structure, vibration source, dominant frequencies and dynamic characteristics of the building structure will be required.

8.4. Structural Damage

DIN 4150 Part 3 provides guidance on vibration velocity levels for both intermittent and continuous long-term events to prevent structural damage to buildings. These criteria are summarised in the table below. We recommend adherence to (and have applied criteria from) the 1999 version of this Standard.

Table 13 – DIN Part 3 4150:1999 structural damage safe limits for building vibration, mm/s

Group	Type of Structure	Intermittent vibration limit by frequency range [4]			Continuous vibration [5], all frequencies
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	10
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	5
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	2.5

With regard to the above table, application of overall (broad frequency spectrum) vibration velocity limits of the following are considered suitable in lieu of more detailed analysis of spectral content:

- 5mm/s for both continuous and intermittent vibration at residential locations,
- 5-20mm/s for intermittent vibration at commercial locations, and
- 2.5mm/s for continuous and 3mm/s for intermittent vibration at sensitive locations

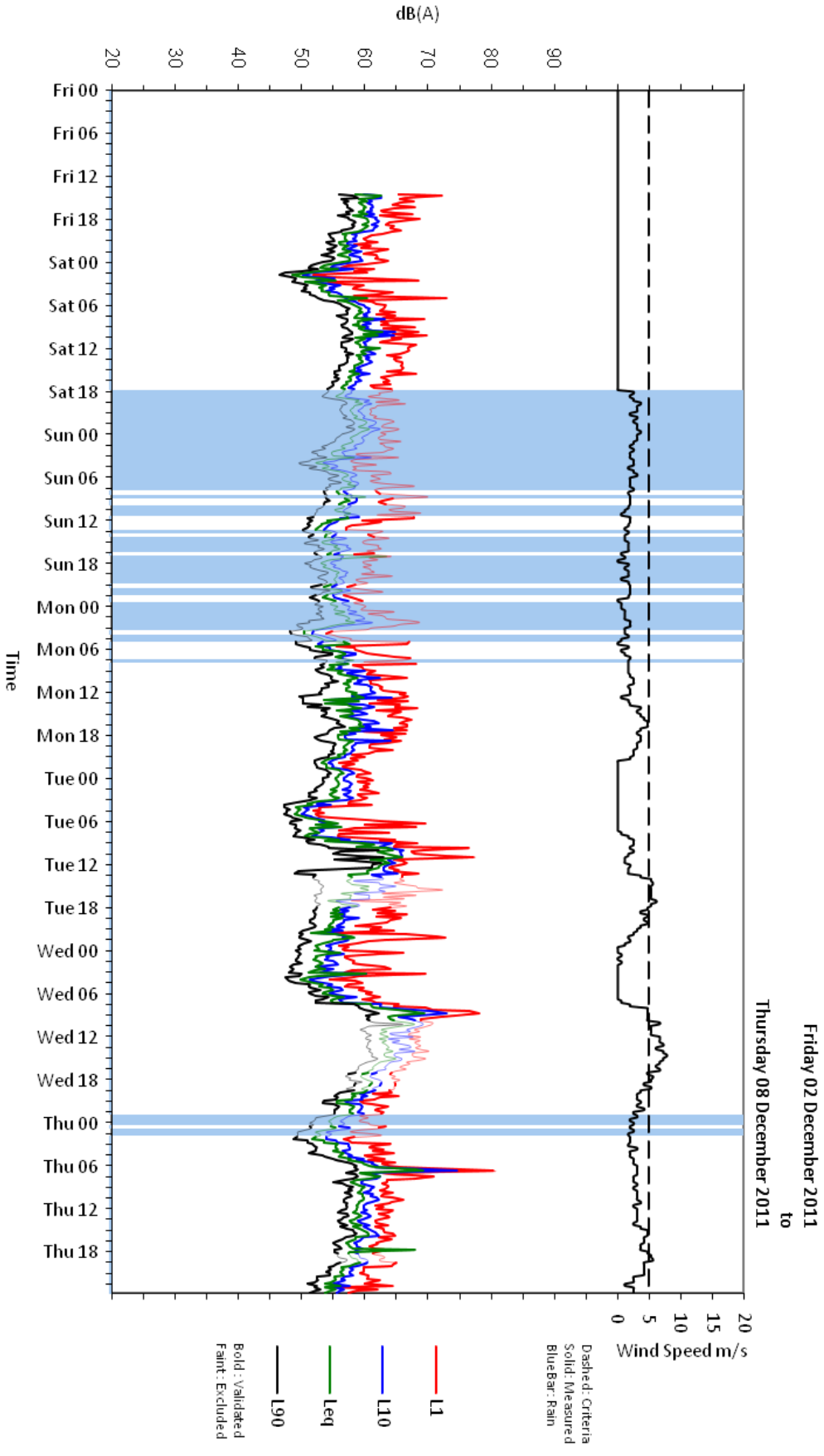
[4] When evaluated at the foundation
[5] When evaluated in the horizontal plane of floor of uppermost storey.

9. CONSTRUCTION NOISE AND VIBRATION – FUTURE ASSESSMENT

The noise and vibration criteria detailed in this report in Sections 7 and 8 should form the basis of a Construction Noise and Vibration Impact Statement Report, once the details of the construction methodologies for the project are more defined and understood. The Construction Noise and Vibration Impact Statement will inform the *reasonable and feasible* noise and management control measures for the Construction Management Plan for the project.

We recommend that a *Construction Noise and Vibration Impact Statement Report* – with appropriate noise and management control measures is provided for this project, once the construction methodologies for the development are properly defined.

APPENDIX A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Faint : Excluded