Appendix K – Asbestos, Air, Dust & Vibration Monitoring

Goulburn Hospital Redevelopment

Acoustic Report

Construction Noise Monitoring Program

Attended Measurements January 2021

Prepared for: Hansen and Yuncken

Attention: Dean Katsikaros
Date: 5 February 2021

Prepared by: Claire Graham-White

Ref: 41136

Stantec Australia Pty Ltd
Level 6, Building B, 207 Pacific Highway, St Leonards NSW 2065
Tel: +61 2 8484 7000 Web: www.stantec.com

P:\41136\PROJECT DOCUMENTATION\ACOUSTICS\CONSTRUCTION\NOISE MONITORING REPORTS\AC-NMRE-202101_001.DOCX

WOOD & GRIEVE ENGINEERS

NOW PART OF

Stantec

Revision

Revision	Date	Comment	Prepared By	Approved By
01	05/02/2021	For comment	Claire Graham-White	Olivier Gaussen

WGE is a proud member of the Association of Australian Acoustical Consultants (AAAC).

AAAC members are competent and capable in the acoustic field. Members of the AAAC provide professional unbiased advices and recommendations in order to deliver practical innovative and cost effective solutions to their clients.

AAAC members are bind to a specific code of professional conduct which can be consulted on the AAAC website: http://www.aaac.org.au/au/aaac/ethics.aspx

Contents

1. Introduction

Stantec Engineers have been engaged by Hansen and Yuncken to conduct Construction Noise Monitoring for the ongoing construction works taking place at Goulburn Hospital, located at 130 Goldsmith Street, Goulburn NSW.

This report addresses the monitoring requirements established within the Construction Noise and Vibration Management Plan (CNVMP) for the project. Monitoring results will be presented to confirm the noise criteria have been met during the construction period.

The Stantec CNVMP provided:

- Criteria for the noise and vibration generated during each phase.
- A quantitative assessment of the airborne and ground-borne noise and vibration generated by the works and its impact on nearby receivers.
- Strategies to mitigate the noise and vibration generated during each phase.

This report discusses the criteria and the noise monitoring results for post-excavation stages of construction, as well as an analysis of the impact of this noise on the nearest receivers.

This report has been prepared in alignment with and with respect to the following documents:

- Interim Construction Noise Guideline (NSW Department of Environment and Climate Change)
- AS/NZS 2107:2016 “Acoustics – Recommended design sound levels and reverberation times for building interiors”
- Transport for NSW’s Construction Noise Strategy 2013
- AS2436:2010 “Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites”
- NSW Noise Policy for Industry 2017
- British Standard BS5228: Part 1:1997 “Noise and Vibration Control on Construction and Open Sites.”
- Wood and Grieve Engineers Construction Noise and Vibration Management Plan (CNVMP) –October 2019

.

2. Project Description

2.1 Site Description and Noise Sensitive Receivers

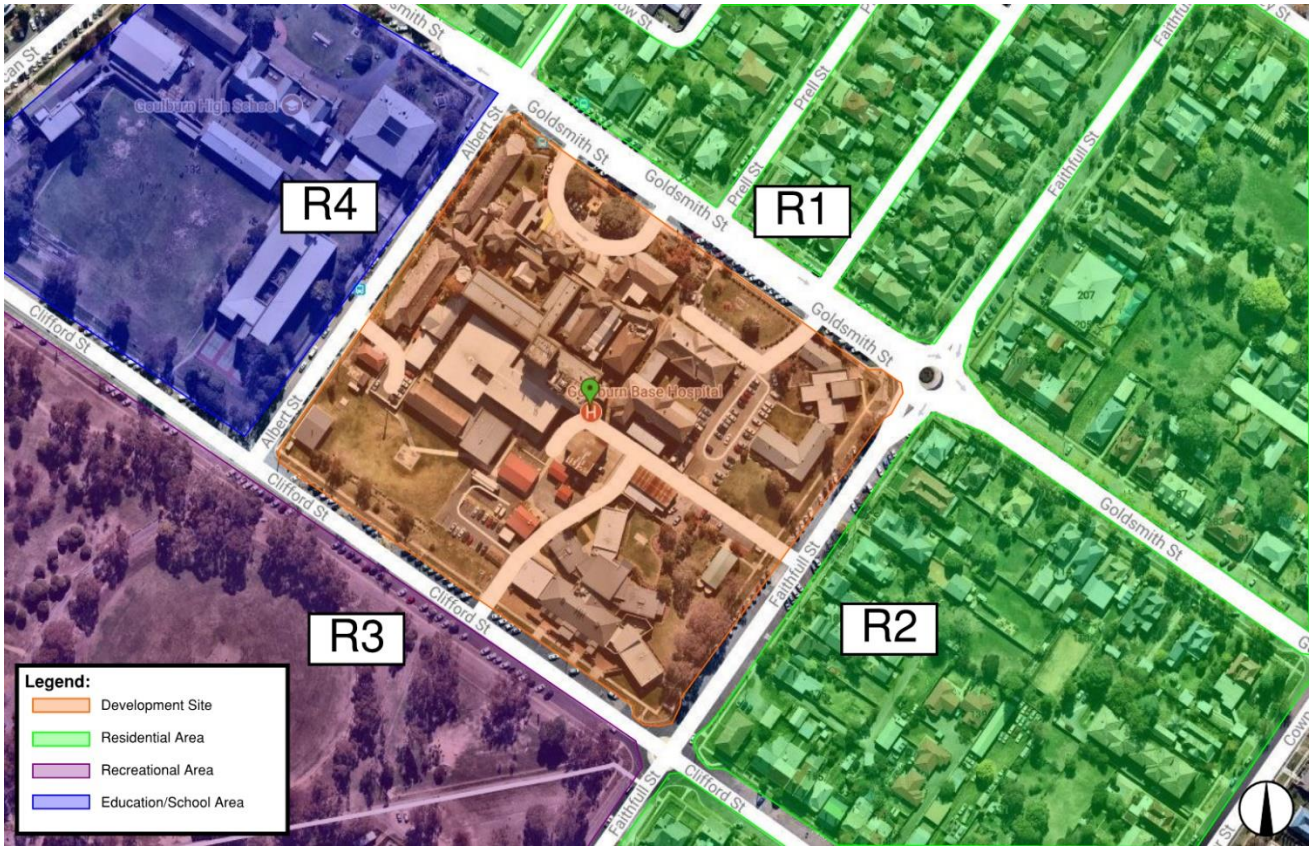
The proposed redevelopment of Goulburn hospital is required to satisfy noise emission goals in accordance with the NSW Interim Construction Noise Guideline (ICNG July 2009) by the NSW Environment Protection Authority (NSW EPA).

The site is bound by residential properties to the northeast and southeast, Goulburn Aquatic and Leisure Centre to the southwest, and Goulburn High School to the northwest. The nearest potentially affected noise receivers are shown in Figure 1 and located as follows:

- R1, Residential properties across Goldsmith Street
- R2, Residential properties across Faithful Street
- R3, Victoria Park recreational area across Clifford Street
- R4, Goulburn High School across Albert Street

Of these receivers the most noise sensitive receivers are the residential receivers R1 and R2

Figure 1: Nearest Receivers



2.2 Existing Noise Environment

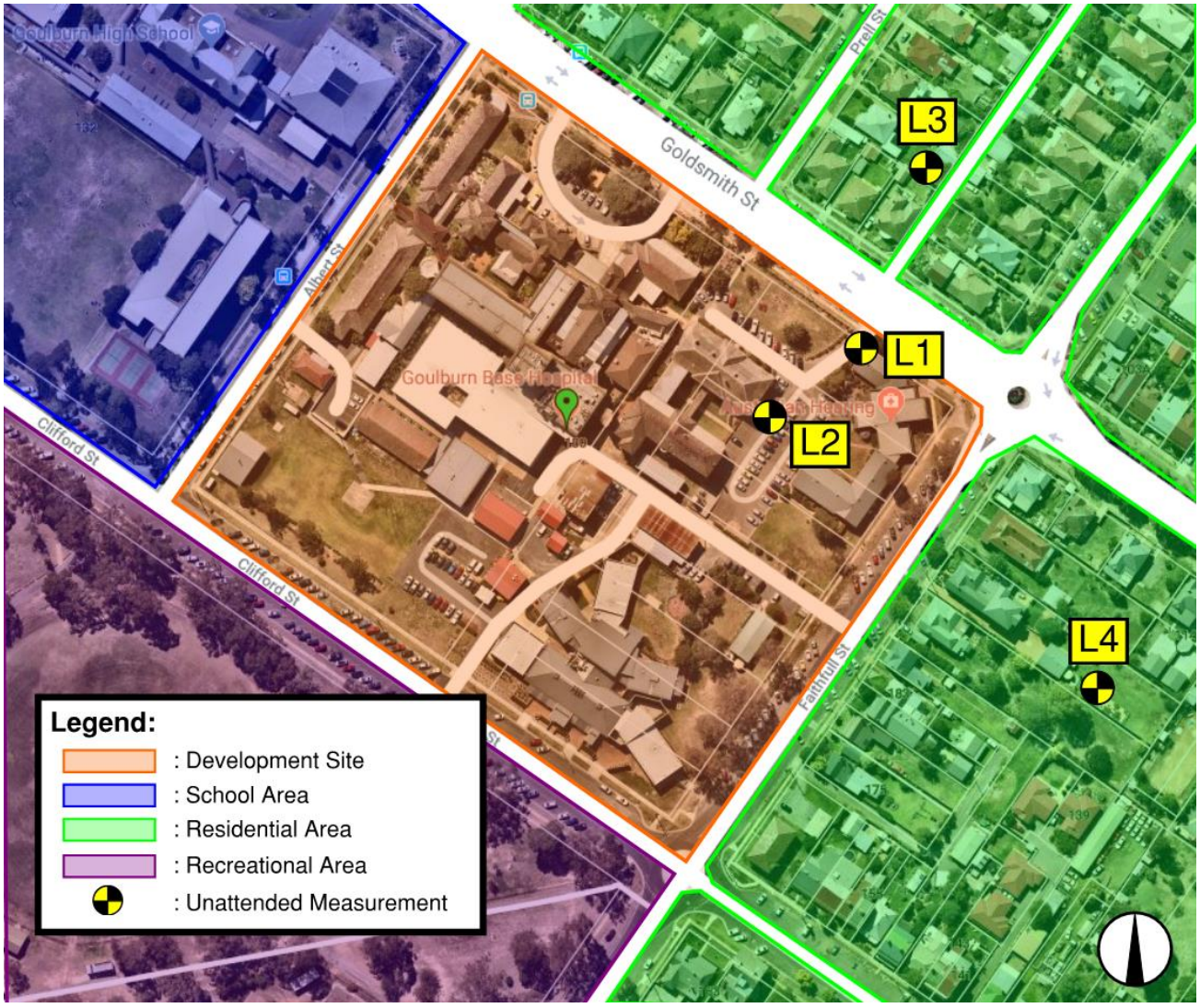
A summary of the existing background and ambient noise environment from the long-term (unattended) background noise monitoring is presented in Table 1. The locations of each monitoring site are presented in Figure 2. This monitoring was completed as part of the DA application, also conducted by Stantec Engineers (formerly WGE). Note that monitoring site L1 was to assess the level of traffic noise and is not relevant to this report.

Table 1: Background Noise Monitoring Results

		Rated background noise level RBL			$L_{Aeq,period}$		
Location	Month/Year of Monitoring	Day	Evening	Night	Day	Evening	Night
L2	December 2015	43	40	33	56	54	48
L3	August-September 2018	38	32	30	61	41	40
L4	August-September 2018	40	35	30	51	42	43

Note: Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays. Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays.

Figure 2: Overview of the Site and Measurements Location



Source: nearmap.com

3. Acoustic Criteria

3.1 Interim Construction Noise Guideline (ICNG)

The noise criteria for construction sites are established in accordance with the Interim Construction Noise Guideline (ICNG July 2009) by the Office of Environment and Heritage (OEH) which is now under the NSW Environment Protection Authority (NSW EPA). This document is accepted as EPA's standard policy for assessing construction noise on new projects.

The key components of the ICNG 2009 incorporated within this assessment include:

1. Use of LAeq as the noise metric for measuring and assessing construction noise

In recent years, NSW noise policies including EPA NPI and the NSW Environmental Criteria for Road Traffic Noise (ECRTN) have selected the LAeq to be the primary noise metric when measuring and assessing construction noise. Consistent with ICNG 2009, the use of the LAeq as a key descriptor for measuring and assessing construction noise may follow a 'best practice' approach.

2. Application of feasible and reasonable noise mitigation measures

As stated in the ICNG 2009, 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 requires one to determine whether the overall noise benefit of applying the measure outweighs the overall social, economic and environmental effects, including the cost of the measure.

3. Quantitative and qualitative assessment

The ICNG 2009 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 short-term duration where works are not likely to affect an individual or sensitive land use for more than three weeks in total. It focuses on minimizing noise disturbance through the implementation of feasible and reasonable work practice, and community notification.

Given the significant scale of the construction works proposed for this Project, a quantitative assessment is carried out herein, consistent with the ICNG 2009 requirements.

4. Management levels

The ICNG sets out the calculation of noise management levels for sites and action that should be taken at each management level. The guidelines intend 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 rated 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).

The noise criteria for residential receivers in the vicinity of construction work and related activities are shown in Table 2, reproduced from Table 2 in Section 4.1.1 of the ICNG. The noise criteria for non-residential receivers as outlined in the ICNG (section 4.1.3) is reproduced in Table 3. In this report, it is assumed that all works are performed during ICNG standard hours of construction listed below.

- Monday to Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and public holidays: no work

Table 2: Construction Noise Criteria at Residences

Time of Day	Management Level $L_{Aeq,15min}$	How to Apply
Recommended Standard Hours	Noise Affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,15min}$ 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 residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
	Highly Noise Affected 75 dB(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 in, taking into account: 1. 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) 2. 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 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 5 dB(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

Note: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30m away from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 3: Construction Noise Criteria for Other Land Uses

Land Use	Management Level, $L_{Aeq,15min}$ – applies when land use is being utilised
Classrooms at schools and other educational institutions	Internal noise level 45 dB(A)
Active recreation, parks	External noise level 65 dB(A)

For recreational areas, the external noise level should be assessed at the most affected point within 50 metres of the area boundary.

3.2 Construction Noise Goals

The Project Specific Construction Noise Management Levels for all receivers are summarised in Table 4, assuming works occur only during standard construction hours.

Table 4: Project Specific Construction Noise Management Levels ($L_{Aeq,15min}$)

Land Use	Receivers	Management Level $L_{Aeq,15min}$
Residential	R1	*Noise Affected Level* 38 dB(A) + 10 dB = **48 dB(A)**
	R2	*Noise Affected Level* 40 dB(A) + 10 dB = **50 dB(A)**
	All	*Highly Noise Affected Level* 75 dB(A)
Park	R3	External noise level **65 dB(A)**
Schools	R4	Internal noise level **45 dB(A)**

4. Construction Noise Monitoring

4.1.1 Noise Monitoring Strategy General Method

Noise levels should be monitored at various stages of construction to ensure that noise generated as a result of remediation and construction activities does not unduly disturb local residents.

Monitoring may be in the form of regular checks by the builder or indirectly by an acoustic consultant engaged by the builder or in response to any noise complaints. Where noise criteria are being exceeded or in response to valid complaints, noise monitoring should be undertaken. This can be performed inside the premises of the affected property or on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise monitoring professional or an acoustic consultant. The results of any noise monitoring are to be provided to the relevant party or person in a timely manner allowing the builder to address the issue and respond to the complaints.

Noise monitoring can be either short-term or long-term:

Short-term monitoring

Short-term monitoring consists of attended monitoring when critical stages of the construction are occurring. This normally provides real-time assistance and guidance to the subcontractor on site letting them know when the noise criteria are exceeded allowing the selection of alternative method on construction or equipment selection in order to minimise noise impacts.

Long-term monitoring

Similarly, long-term monitoring uses noise loggers providing real-time alerts to the builder/site manager when the noise criteria are exceeded.

Typically, the noise loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise monitoring is dictated by the local authorities through the DA conditions.

Both methods are complementary and normally used simultaneously providing a significant of amount of data via the long-term monitoring but also providing information on the sources of noise generating exceedances via the short-term or attended monitoring.

4.2 Project Specific Proposed Monitoring

The CNVMP for the project proposed noise monitoring at locations capturing the noise impact to residential receivers along Goldsmith Street and Faithful Street.

Unattended monitoring for this stage of the project has been completed. Attended noise monitoring was to be conducted during all construction and excavation stages until the north-western and north-eastern facades are installed.

This report presents the results of attended monitoring conducted on the 28th of January 28, 2021.

4.3 Attended Monitoring Results

The levels measured at each of the measurement locations are presented in Table 5, compared with the Project Specific Construction Noise Management Levels for residential receivers. All measurements were conducted at the street boundary of the residential property.

Table 5: Attended Measurement Noise Levels ($L_{Aeq,15min}$)

			Noise Management Level $L_{Aeq,15min}$	
Location	**Time of measurement**	**Recorded Level**	**Noise Affected**	**Highly Noise Affected**
185 Faithfull St.	28/01/2021 12:38	61.7 dB(A)	48 dB(A)	75 dB(A)
113 Goldsmith St.	28/01/2021 12:55	62.0 dB(A)	50 dB(A)	75 dB(A)

The ambient noise was a mixture of site noise and road noise unconnected to the development. Along Faithfull Street, broadband construction noise was sometimes masked by the noise of vehicles passing by. Along Goldsmith Street, broadband construction noise was regularly masked by the noise of vehicles passing by. Tonal construction noise (reversing beepers) was not masked along either street, but was at a sound pressure level below the majority of the construction site sources.

5. Conclusion

The attended noise monitoring data recorded between 12:38pm and 1:10pm on the 28th of January 2021 exceeded the noise affected level, but did not exceed the highly noise affected construction noise level.

Appropriate measures have been taken where possible by Hansen and Yuncken, including consideration of 'noisy' works being completed at appropriate times of the day. However, due to the nature of construction work and the low ambient noise level in Goulburn, a significant increase in noise levels for the period of construction is unavoidable.

It is the conclusion of this assessment that the noise generated from the development is generally exceeding the noise affected level, and all reasonable efforts must be made to reduce noise from the site. However, as the site is not exceeding the highly noise effected level, no additional specific action is required. The adverse effects that stem from overexposure to long term excessive noise are insignificant in all cases, and the noise emitted from the site is deemed not to be harmful to its surroundings.

Glossary of Acoustic Terms

NOISE	
Acceptable Noise Level:	The acceptable LAeq noise level from industrial sources, recommended by the EPA (Table 2.1, INP). Note that this noise level refers to all industrial sources at the receiver location, and not only noise due to a specific project under consideration.
Adverse Weather:	Weather conditions that affect noise (wind and temperature inversions) that occur at a particular site for a significant period of time. The previous conditions are for wind occurring more than 30% of the time in any assessment period in any season and/or for temperature inversions occurring more than 30% of the nights in winter).
Acoustic Barrier:	Solid walls or partitions, solid fences, earth mounds, earth berms, buildings, etc. used to reduce noise.
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 Location	The position at which noise measurements are undertaken 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.
Decibel [dB]:	The units of sound pressure level.
dB(A):	A-weighted decibels. Noise measured using the A filter.
Extraneous Noise:	Noise resulting from activities that are not typical of the area. Atypical activities include construction, and traffic generated by holidays period and by special events such as concert or sporting events. Normal daily traffic is not considered to be extraneous.
Free Field:	An environment in which there are no acoustic reflective surfaces. Free field noise measurements are carried out outdoors at least 3.5m from any acoustic reflecting structures other than the ground
Frequency:	Frequency is synonymous to pitch. Frequency or pitch can be measured on a scale in units of Hertz (Hz).
Impulsive Noise:	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:	Level that drops to the background noise level several times during the period of observation.
LAmax	The maximum A-weighted sound pressure level measured over a period.
LAmin	The minimum A-weighted sound pressure level measured over a period.
LA1	The A-weighted sound pressure level that is exceeded for 1% of the time for which the sound is measured.
LA10	The A-weighted sound pressure level that is exceeded for 10% of the time for which the sound is measured.
LA90	The A-weighted 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).
LAeq	The A-weighted “equivalent noise level” is the summation of noise events and integrated over a selected period of time.

LAeqT	The constant A-weighted sound which has the same energy as the fluctuating sound of the traffic, averaged over time T.
Reflection:	Sound wave changed in direction of propagation due to a solid object met on its path.
R-w:	The Sound Insulation Rating R-w is a measure of the noise reduction performance of the partition.
SEL:	Sound Exposure Level 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 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.

Design with
community in mind

Level 6, Building B
207 Pacific Highway
St Leonards NSW 2065
Tel +61 2 8484 7000
E sydney@wge.com.au

For more information please visit
www.wge.com.au

WOOD & GRIEVE ENGINEERS

NOW PART OF

Stantec