

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

UNSW HEALTH TRANSLATION HUB

ACOUSTIC SERVICES



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1 INTRODUCTION

1.1 OVERVIEW

This Construction Noise and Vibration Management Plan (CNVMP) has been prepared by JHA Consulting Engineers on behalf of Hansen Yuncken to address the Conditions of Consent, of the State Significant Development Application (SSD-10822510) for the construction works of the UNSW Health Translation Hub (HTH). The site is located within the Randwick Hospital Campus (RHC) on the corner of High Street and Botany Street, Randwick.

The following documentation has been used for the preparation of this report:

- SSDA Acoustic Assessment Report UNSW Health Translation Hub (ref: AC01_v5_SSDA Acoustic Assessment Report), prepared by ARUP, 1st April 2021.
- Conditions of Consent SSD-10822510.
- Drawings and planning information for the proposed construction staging by Hansen Yuncken.

This document and related work have been prepared following JHA Consulting Engineers Quality and Environmental Management Systems, which are based on AS/NZS ISO 9001:2015 and ISO 14001:2015.

1.2 PURPOSE OF THE CNVMP

The purpose of this CNVMP is to ensure that noise and vibration impacts due to construction activities are appropriately managed in accordance with relevant legislation and standards, plus protection of nearby sensitive receivers. The objectives of this acoustic assessment are:

- Comply with the Conditions of Consent as per SSD-10822510.
- Identify noise sensitive receivers that will potentially be affected by the works.
- Establish the appropriate noise level and vibration criteria in accordance with the relevant standards, guidelines and legislation.
- Determine whether the relevant criteria can be achieved based on assumed construction works and plant for the noise assessments. Where applicable, provide recommendations for any necessary acoustic control measures that will need to be incorporated into the development or use in order to ensure with the assessment criteria.
- Provide recommendations for Construction Noise and Vibration Planning.

This CNVMP identifies the Contractor's obligations and the requirements to manage noise and vibration during construction such that the necessary allowances within the construction costs, programmes and work methodologies can be made. Relevant legislation, guidelines and standards are identified in this CNVMP.



1.3 NOISE AND VIBRATION ISSUES

This CNVMP addresses all works from construction works associated with the proposed development. The construction works will contribute noise and vibration emissions to the surrounding environment. Typically, this will comprise of continuous and intermittent noise and vibration from on-site construction equipment and plant equipment.

Construction noise associated with the project may include airborne and ground-borne noise impacts as follows:

- <u>Airborne Noise</u>: Proposed construction works will generate noise that will propagate through the air. Airborne noise generated by external construction activities is likely to impact on surrounding sensitive receivers.
- <u>Ground-borne noise and vibration impacts</u>: Construction and piling works have the potential to generate noise and vibration that propagates through the ground and building structural elements which is then radiated by vibrating wall and floor surfaces of nearby sensitive receivers.

1.4 **RESPONSIBILITIES**

The Main Contractor must be responsible for ensuring that the noise and vibration from activities carried out on site are minimised as far as practical.

The Main Contractor is responsible for:

- Ensuring that any site noise and vibration plus any complaints, are monitored, investigated, managed and controlled in accordance with the recommendations provided in this plan.
- Ensuring procurement documents specify any particular requirements in relation to the management of noise and vibration.
- Ensuring all works are undertaken in accordance with the requirements of the contract documents and this plan.
- Ensuring all project personnel and sub-contractors employed are aware of their responsibilities in regard to the management of noise and vibration during construction and assume the responsibilities assigned to them within the plan.
- Monitoring and managing noise and vibration impacts on sensitive receivers, in accordance with the requirements of the relevant guidelines and standards.
- Consulting with the occupants of surrounding buildings to inform them of the nature of the construction works, to determine any specific noise and vibration sensitivity they may have and to negotiate respite times during noisier works.



2 DESCRIPTION OF THE PROPOSAL

2.1 SITE DETAILS

Randwick is a suburb of Sydney, in the Local Government Area of the City of Randwick, approximately at 6km south-east of the Sydney CBD. The site is located on the corner of High Street and Botany Street, Randwick, NSW 2031.

This CNVMP addresses the construction works associated with the UNSW HTH building which consist of the following works:

- Excavation of areas of the site.
- Construction of the proposed UNSW HTH building.

Figure 1 shows the location of the site and the surrounding sensitive receivers identified in Noise Catchment Areas (NCAs).



Figure 1: Location of site (red dotted line and yellow shadow), healthcare receivers (blue shadow), future healthcare receiver (green shadow), residential receivers (purple shadow), educational receiver (orange Shadow).



2.2 NOISE AND VIBRATION SENSITIVE RECEIVER DETAILS

The surrounding area is a mixture of healthcare, education, and residential receivers and have been grouped into NCAs as follows:

- NCA 1 West: Educational (UNSW Building) across Botany Street.
- NCA 2 South: Healthcare (IASB Building).
- NCA 3 East: Healthcare (Children's Hospital) across Hospital Road and RHC.
- NCA 4 North: Medium Density Residential across High Street.
- NCA 5 North-West: Healthcare (Lifestyle Clinic) diagonally across High Street.

It should be noted that the future Sydney Children's Hospital Stage 1 and Children's Comprehensive Cancer Centre (green shadow in Figure 1), adjacent to the site, has not been identified as a sensitive receiver. The development is not yet built and, therefore, will not be affected by construction activities associated with the UNSW HTH building.

Refer to Table 1 for the details of the nearest noise sensitive receivers around the construction site, including the type of noise receiver, address, and approximate distances from the construction boundary to the receivers boundary.

Sensitive Receiver	Receiver Type	Address of nearest receiver	Approx. distance, m
NCA 1	Educational	Corner of High Street and Botany Street	20
NCA 2	Healthcare	Botany Street	5
NCA 3	Healthcare	High Street	60
NCA 4	Residential (R3 Medium Density)	46B High Street	20
NCA 5	Healthcare	175-179 Victoria Street	35

Table 1: Receivers surrounding the site and the approximate distances from boundaries.

It is noted that if noise and vibration impacts associated with the proposed development are controlled at the nearest sensitive receivers, then compliance with the recommended criteria at all noise sensitive receivers should be achieved.



3 NOISE ENVIRONMENT

Attended and unattended noise and vibration surveys were conducted for the SSD Acoustic Reports for the proposed and surrounding developments. This documentation has been reviewed to summarise the existing noise environment and vibration levels.

Noise survey information has been retrieved from the SSDA Acoustic Assessment Report prepared by Arup¹. Arup's SSDA Acoustic Report for UNSW HTH sourced High Street and Botany Street unattended traffic noise levels from Acoustic Studio SSDA Acoustic Report for IASB and attended noise surveys from Pulse Acoustic Consultancy SSDA Acoustic Report for SCH and CCCC.

Since the period in which Acoustic Studio undertook the unattended noise surveys, the surrounding area has been subject to significant change. Between the dates of unattended monitoring (between late 2017 and mid 2018), the construction of the Light Rail L2 Randwick Line has been completed and become operational. Existing vehicle movements along the previous roadways have been altered with the operation of the Light Rail. Pulse Acoustic Consultancy SSDA Acoustic Report for SCH and CCCC contains an unattended noise survey in High Street carried out on July-August 2020 which verified that results from Acoustic Studio unattended noise monitoring are similar to existing noise levels once the Light Rail is operational.

As per the report, long-term noise monitoring was carried out from 18th of October to 3rd 2017 and 18th of July to 25th of July 2018 at two monitoring locations. Details of the long-term noise monitoring results are shown in Section 3.1 of the Acoustic Assessment Report and Table 2, below shows the RBLs and ambient noise levels measured for locations around the site.

	Rating Back	ground Noise L	evels, dB(A)	L _{Aeq,period} Noise Levels, dB(A)			
Location	Day 0700-1800	Evening 1800-2200	Night 2200-0700	Day 0700-1800	Evening 1800-2200	Night 2200-0700	
12 Blenheim St. (in front yard – High Street frontage)	47	45	43	59	53	55	
7 Magill Street	46	44	43	55	51	51	

 Table 2: Results of long-term noise monitoring.

¹ SSDA Acoustic Assessment Report UNSW Health Translation Hub (ref: AC01_v5_SSDA Acoustic Assessment Report), prepared by ARUP, 1st April 2021.



4 NOISE AND VIBRATION CRITERIA

4.1 RELEVANT CODES AND STANDARDS

In preparing this CNVMP, the following documentation including legislation, codes, standards and guidelines have been considered:

- Regulatory Framework:
 - Environmental Planning and Assessment (EP&A) Act 1979.
 - Protection of the Environmental Operations (POEO) Act 1997.
- Construction Noise and Vibration
 - Development Conditions of Consent (SSD-10822510).
 - NSW Department of Environment and Climate Change (DECC) 'Interim Construction Noise Guideline' (ICNG) 2009.
 - NSW DECC Assessing Vibration: A Technical Guideline 2006.
 - NSW Transport Roads & Maritime Services (RMS) 'Construction Noise and Vibration Guideline' 2016.
 - Australian Standard AS 2436:2010 'Acoustics Guide to Noise Control on Construction, Maintenance & Demolition Sites'.
 - British Standards Institution BS 6472:2008 'Evaluation of human exposure to vibration in buildings (1 to 80 Hz)'.
 - British Standards Institution BS 7385.2:1993 'Evaluation and Measurement for Vibration in Buildings. Guide to Damage Levels from Ground-borne Vibration'.

4.2 REGULATORY FRAMEWORK

4.2.1 ENVIRONMENTAL PLANNING AND ASSESSMENT (EP&A) ACT 1979

The Environmental Planning and Assessment Act 1979 (EP&A Act) provides the regulatory framework for the protection of the environment in NSW. The EP&A Act is relevantly about planning matters and ensuring that "environmental impact" associated with the proposed development is properly considered and reasonable before granting development consent to develop.

The assessment of "environmental impact" relies upon the identification of acceptable noise criteria which may be defined in a Development Control Plan or derived from principles using guidelines like NSW EPA Noise Policy for Industry (NPI 2017) or Noise Guide for Local Government (NGLG 2013).

4.2.2 PROTECTION OF THE ENVIRONMENTAL OPERATIONS (POEO) ACT 1997

The Protection of the Environment Operations (POEO) Act 1997 has the objective to protect, restore and enhance the quality of the NSW environment. Abatement of noise pollution is underpinned by the definition of "offensive noise" as follows:

"...

(a) that, by reason of its level, nature, character or quality, or the time at which it is made, or any other circumstances:

(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or



(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or

(b) that is of a level, nature, character or quality prescribed by the regulations or that is made at a time, or in other circumstances, prescribed by the regulations.

Noise Guide for Local Government (NGLG) 2013, provides a consideration checklist to determine an "offensive noise".

4.3 DEVELOPMENT CONDITIONS OF CONSENT (SSD-10822510)

Development conditions of consent (SSD-10822510) states the following:

"…

Construction Environmental Management Plan

B18. The Construction Noise and Vibration Management Plan (CNVMP) must address, but not be limited to, the following:

- (a) be prepared by a suitably qualified and experienced noise expert;
- (b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009);
- (c) describe the measures to be implemented to manage high noise generating works in close proximity to sensitive receivers;
- (*d*) include strategies that have been developed with the community for managing high noise generating works;
- (e) describe the community consultation undertaken to develop the strategies in condition B18(d);
- (f) include a complaints management system that would be implemented for the duration of the construction; and
- (g) include a program to monitor and report on the impacts and environmental performance of the development and the effectiveness of the management measures in accordance with Condition D16(d).

Light Rail Requirements

B40. Prior to the commencement of any construction works or any preparatory, demolition or excavation works, whichever is the earlier, the following documentation must be provided for the review and endorsement of TfNSW:

(c) details of the vibration and movement monitoring system that will be in place before excavation commences.

Construction Hours

C3. Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:

- (a) between 7am and 6pm, Mondays to Fridays inclusive; and
- (b) between 8am and 5pm, Saturdays.

No work may be carried out on Sundays or public holidays.



C4. Construction activities may be undertaken outside of the hours in condition C3 if required:

- (a) by the Police or a public authority for the delivery of vehicles, plant or materials; or
- (b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or
- (c) where the works are inaudible at the nearest sensitive receivers; or
- (*d*) where a variation is approved in advance in writing by the Planning Secretary or her nominee if appropriate justification is provided for the works.

C5. Notification of such construction activities as referenced in Condition C4 must be given to affected residents before undertaking the activities or as soon as is practical afterwards.

C6. Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:

- (a) 9am to 12pm, Monday to Friday;
- (b) 2pm to 5pm Monday to Friday; and
- (c) 9am to 12pm, Saturday. ..."

Construction Noise Limits

C11. The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the management and mitigation measures identified in the approved CNVMP.

C12. The Applicant must ensure construction vehicles (including concrete agitator trucks) do not arrive at the site or surrounding residential precincts outside of the construction hours outlined under condition C3 and where permitted under condition C4.

C13. The Applicant must implement, where practicable and without compromising the safety of construction staff or members of the public, the use of 'quackers' to ensure noise impacts on surrounding noise sensitive receivers are minimised.

Vibration Criteria

C14. Vibration caused by construction at any residence or structure outside the site must be limited to:

- (a) for structural damage, the latest version of DIN 4150-3 (1992-02) Structural vibration Effects of vibration on structures (German Institute for Standardisation, 1999); and
- (b) for human exposure, the acceptable vibration values set out in the Environmental Noise Management Assessing Vibration: a technical guideline (DEC, 2006) (as may be updated or replaced from time to time).

C15. Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C14.

C16. The limits in conditions C14 and C15 apply unless otherwise outlined in a Construction Noise and Vibration Management Plan, approved as part of the CEMP required by condition B18 of this consent.



....″

4.4 NSW INTERIM CONSTRUCTION NOISE GUIDELINE

The following criteria has been applied to the construction works and the relevant procedures will be adopted into the management plan as described in this report.

The ICNG suggest construction noise management levels that may minimise the likelihood of annoyance being caused to noise sensitive residential receivers depending on the duration of works. The Noise Management Levels (NMLs) for long-term duration works are as follows for residential receivers:

Time of Day	NML L _{Aeq,15} min	How to Apply
ICNG Criteria for 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 predicted or measured L_{Aeq,15min} is greater that 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.
Mon-Fri 7am-6pm Sat 8am-1pm No work on Sundays or public holidays	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 may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise. 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
ICNG Criteria for Outside Recommended Standard Hours Refer to approved hours from the Consent Conditions	Noise affected: RBL + 5dB	 A strong justification would typically be required for work 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.

Table 3: ICNG construction airborne noise criteria for residential receivers surrounding the construction site.

In order to establish the airborne construction noise criteria, noise levels from the unattended noise monitoring have been used for the noise sensitive receivers – refer to Section 3. Table 4 below summarises the airborne construction noise criteria for most affected noise sensitive receivers surrounding the site.



Concitivo	Pacaivar	Airborne Construction Noise Criteria, L _{Aeq} dB(A)		
Serisuiver	TELEIVEN	Within Standard Hours	Outside Standard Hours	
NCA 1 (Educational))	When in use - External	55		
NCA 2, NCA 3, NCA 5 (Healthcare)	When in use - External	55		
NCA 4	Noise Affected	57	52	
(R3 Residential)	Highly Noise Affected	75		

 Table 4: ICNG construction airborne noise criteria at the receiver's boundary for noise sensitive receivers surrounding the site.

The ICNG recommends internal ground-borne noise maximum levels at residences affected by nearby construction activities. Ground-borne noise is noise generated by vibration transmitted through the ground into a structure and can be more noticeable than airborne noise for some sensitive receivers. The ground-borne noise levels presented below from the ICNG are for residential receivers during evening and night-time periods only, and assessed at the centre of the most affected habitable room. The objective of these criteria is to protect the amenity and sleep of people when they are at home.

- Evening: L_{Aeq,15min} 40dB(A) (internal)
- Night: L_{Aeq,15min} 35dB(A) (internal)

No assessments of ground borne noise have been conducted as no out of hours work is proposed to occur during evening time and night time.

4.5 VIBRATION CRITERIA

There are two items that shall be considered in the assessment of vibration impacts from construction works. These include vibration impacts in terms of human comfort and building damage.

4.5.1 HUMAN COMFORT

The Department of Environment and Climate Change (DECC) developed the document 'Assessing Vibration: A Technical Guideline' in February 2006 to assist in preventing people from exposure to excessive vibration levels within buildings. It is based on the guidelines contained in BS 6472.1:2008 'Guide to evaluation of human exposure to vibration in buildings – Vibration sources other than blasting'. The guideline does not however address vibration induced damage to structures or structure-borne noise effects.

Vibration and its associated effects are usually classified as follows:

- *Continuous vibration*. An uninterrupted vibration for a defined period. This type of vibration is assessed on the basis of weighted root-mean-squared (rms) acceleration values.
- *Impulsive vibration*. A vibration which has a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on the frequency and damping).
- Intermittent vibration. An interrupted periodic vibration of continuous or repeated periods of impulsive vibration, or continuous vibration that varies significantly in amplitude. This type of vibration is assessed on the basis of Vibration Dose Values (VDV).



Vibration criteria for continuous and impulsive vibration are presented in Table 5, in terms of vibration velocity levels. The values are assessed for the most critical frequency range (higher than 8 Hz assuming sinusoidal motion). When assessing intermittent vibration comprising a number of events, it is recommended that the Vibration Dose Value (VDV) is used Table 6 shows the acceptable VDV values for intermittent vibration.

		RMS velocity, mm/s [dB ref 10 ⁻⁶ mm/s]					
Receiver Type	Time	Continuous Vibration		Impulsive Vibration			
		Preferred	Maximum	Preferred	Maximum		
Decidences	Day-time	0.20 [106 dB]	0.40 [112 dB]	6.00 [136 dB]	12.00 [142 dB]		
Residences	Night-time	0.14 [103 dB]	0.28 [109 dB]	2.00 [126 dB]	4.00 [132 dB]		
Hospitals – critical areas	When in use	0.10 [100 dB]	0.20 [106 dB]	0.10 [100 dB]	0.20 [106 dB]		
Offices, schools, educational and worship	When in use	0.40 [112dB]	0.80 [118dB]	13 [142dB]	26 [148dB]		

 Table 5: Continuous and impulsive vibration criteria applicable to the site. Note: Day-time is 07:00am to 10:00pm and night-time is 10:00pm to 07:00am.

Diese	Time -	Vibration Dose Values, m/s ^{1.75}		
Place	nime –	Preferred	Maximum	
Desidences	Day-time	0.20	0.40	
Residences	Night-time	0.13	0.26	
Hospitals – critical areas	When in use	0.10	0.20	
Offices, schools, educational and worship	When in use	0.40	0.80	

Table 6: Intermittent vibration criteria applicable to the site.

4.5.2 STRUCTURAL BUILDING DAMAGE

Ground vibration from construction activities can damage surrounding buildings or structures. For occupied buildings, the vibration criteria given in previous section for Human Comfort shall generally form the limiting vibration criteria for the Project.

For unoccupied buildings, or during periods where the buildings are unoccupied, the vibration criteria for building damage suggested by German Standard DIN 4150.3:2016 *'Vibration in Buildings – Effects on Structures'* are to be adopted. Guideline values from DIN 4150.3:2016 are presented in Table 7.



	Vibration velocity, mm/s (Peak Particle Velocity - PPV)						
Structural type	Foundation			Plane of floor uppermost full storey in horizontal direction	Floor slabs, vertical direction		
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies	All frequencies		
Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	20		
<i>Type 2: Residential buildings and buildings of similar design and/or occupancy</i>	5	5 to 15	15 to 20	15	20		
Type 3: Structures that because of their particular sensitivity to vibration, cannot be classified under Type 1 and 2 and are of great intrinsic value (e.g., heritage buildings)	3	3 to 8	8 to 10	8	20		

 Table 7: DIN 4150.3:2016 Guideline values of vibration velocity (PPV) for evaluating the effects of short-term vibration.

4.5.3 VIBRATION CRITERIA FOR SENSITIVE AREAS – VC CURVES

The VC (Vibration Criteria) curves were developed in the early 1980s by Ungar and Gordon. They were originally developed as a generic vibration criteria for vibration-sensitive equipment for use in the semiconductor, medical and biopharmaceutical industries.

Despite being developed with these industries' needs in mind, the vibration criteria have now been accepted and adopted by many industries that use vibration-sensitive equipment, as the basis for designing facilities, mounts, and vibration-dampening systems to meet required vibration levels.

The criteria take the form of a set of one-third octave band velocity spectra, together with the International Standards Organization (ISO) guidelines for the effects of vibration on people in buildings. The criteria apply to vibration as measured in the vertical and two horizontal directions.

It is important to note that for sensitive equipment, acceptable vibration values specified by equipment manufacturers should be used. Figure 2 presents the vibration curves in terms of velocities (μ m/s) which should be applicable to each different type of environment.





Figure 2: VC Curves with four ISO guidelines related to the effects of vibration on people in various types of buildings or environments.

In conjunction with the vibration criteria (VC) curves, a table was developed to define the maximum level, or amplitude, for each criterion and to describe how and where each criterion is deemed to be most applicable.



Curve Criterion	Amplitude µm/s	Detail Size µm	Description of Use	
Workshop (ISO)	800	N/A	Distinctly perceptible vibration. Appropriate for workshops and non-sensitive areas.	
Office (ISO)	400	N/A	Perceptible vibration, Appropriate to offices and non- sensitive areas.	
Residential Day (ISO)	200	75	Barely perceptible vibration. Appropriate to sleep areas in most instances. Usually adequate for computer equipment, hospital recovery rooms, semiconductor probe test equipment, and microscopes less than 40x.	
Operating Theatre (ISO)	100	25	Vibration not perceptible. Suitable in most instances for surgical suites, microscopes to 100x and for other equipment of low sensitivity.	
VC-A	50	8	Adequate in most instances for optical microscopes to 400x, microbalances, optical balances, proximity and projection aligners, etc.	
VC-B	25	3	Appropriate for inspection and lithography equipment (including steppers) to 3μ m line width.	
VC-C	12.5	1-3	Appropriate standard for optical microscopes to 1000x, lithography and inspection equipment (including moderately sensitive electron microscopes) to 1µm detail size, TFT-LCD stepper/scanner processes.	
VC-D	Suitable in most instances 6.25 0.1-0.3 including many electron m and E-Beam systems.		Suitable in most instances for demanding equipment, including many electron microscopes (SEMs and TEMs) and E-Beam systems.	
A ch adeu <i>VC-E</i> 3.12 < 0.1 Beau and stab		< 0.1	A challenging criterion to achieve. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems, E- Beam lithography systems working at nanometer scales, and other systems requiring extraordinary dynamic stability.	

Table 8: VC Curves application and interpretation.



5 CONSTRUCTION ACTIVITIES

A construction noise and vibration assessment has been carried out based on the following information supplied by the Main Contractor which includes construction phases and potential plant. The Main Contractor will be responsible for preparing a Works Plan and Schedule which include all relevant noise and vibration information.

5.1 DESCRIPTION OF WORKS

Refer to Table 9 for the stages of work as provided by the Contractor that have been assessed, and which construction activities will occur during those stages.

Stage of Works	Construction Activities		
Civil Works	Excavation, earth movement, concrete pouring		
Structure	General Construction		
Façade and Base Fit-out	Façade construction and internal works		

Table 9: Stages of work.

5.2 PROPOSED CONSTRUCTION WORKING HOURS

Section 4.3 of this report contains the constructions hours defined in the development conditions of consent.

5.3 TYPICAL EQUIPMENT AND NOISE LEVELS

In accordance with the information provided and general construction methodology and to assess the potential noise and vibration impacts during works from a quantitative point of view, the construction noise sources for the works occurring during the project and the associated equipment noise levels are listed in Table 10.

Sound power levels are based on the databases published by Australian Standard 2436:2010 'Guide to Noise Control on Construction, Maintenance & Demolition Sites', UK Department for Environmental, Food and Rural Affairs (DEFRA) and the Roads Maritime Services 'Construction Noise and Vibration Guideline'.



Stage of works	ltem	Typical Sound Power Level _{LwAeq} (dB ref 1pW)	Typical Sound Pressure Level L _{Aeq} at 10m (dB ref 20µРа)
	Excavator with hammer	110	82
	Excavator with bucket 20Tn	104	76
Civil Works	Piling rig (bored)	108	80
CIVIL WORKS	Telehandler	111	83
	Rigid Truck	104	76
	Mobile Crane 500Tn	110	82
	Rigid Truck	104	76
	Franna Crane 25Tn	99	71
Structure	Mobile Crane 55Tn	101	73
Structure	Concrete truck	105	77
	Concrete pump	110	82
	Tele handler	111	83
	Truck 20Tn	104	76
Facado and Paco Fit out	Franna Crane 25Tn	99	71
ruçude und duse fil-oul	Tele handler	111	83
	Hand tools	99	71

Table 10: Anticipated maximum airborne noise levels for equipment / plant used during the proposed works.



6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

A construction noise and vibration assessment has been carried out based on the proposed plant and machinery throughout the works associated with the stages as per Section 5.

6.1 ASSESSMENT METHODOLOGY

An assessment of the likely noise and vibration impacts of the assumed stage of works on the most affected receiver catchments surrounding the site has been carried out. The assessment has considered the following:

- Construction activities considered in the noise impact are detailed in Section 5.1.
- Proposed construction hours as per Condition of Consent C3.
- Typical noise source levels considered in the noise impact are detailed in Section 5.3.
- Project specific noise and vibration criteria at sensitive receivers as outlined in Section 4.4.
- Assuming a typical 2.4m high solid hoarding is installed as per Figure 3.
- The noise predictions consider continuous operation of the construction plant over the 15-minute assessment period plus a range of distances from the site boundaries.



Figure 3: Proposed 2.4m solid hoarding (blue line) around construction site.

It should be noted that the predicted noise levels generated during the construction works may vary depending on many factors including:

- Final selection of plant and equipment which could differ from the plant presented in Table 10.
- Exact location of equipment and plant on site relative to the noise sensitive receivers.
- Shielding of noise provided by hoardings on and around the site.



6.2 NOISE ASSESSMENT

The predicted noise levels for the stages of work detailed in Table 9 are presented in the following Sections.

These predicted noise levels are typically representative of the worst case 15 minutes that it would be expected. The predicted noise levels at receiver locations are calculated to 1.5m above ground level, at the most affected point externally to each receiver that has been identified as the most affected.

A range of construction noise received at the boundary each receiver NCA is conveyed in the following tables based on mechanical plant operating close to the site boundary (5 metres) and far from the site boundary (40 metres).

The ICNG requires, and it is usual practice, to predict the reasonable worst-case noise level. For constructiontype activities this will typically be when plant is operating close to an assessment location. However, it shall be considered that on larger construction sites (such as this one) where plant moves around, noise will not be at the reasonable worst-case noise level throughout the entire duration of the activity: it will be lower when the plant is further away. Therefore, it can be stated that noise levels will be lower at times throughout the construction activity.



6.2.1 CIVIL WORKS

Table 11 shows the predicted range of sound pressure levels at the boundary of the nearest noise sensitive receivers due to the construction plant for the proposed civil works. Allowances have been made for distance attenuation and shielding.

	Typical Noise Level L _{WA} dB	Predicted Noise Levels L _{Aeq,15min} , dB(A) (re. 20µPa)				
ltem		NCA 1 Educational	NCA 2 Healthcare	NCA 3 Healthcare	NCA 4 Residential	NCA 5 Healthcare
Excavator with hammer	110	60 – 65	60 – 76	55 – 57	60 – 65	58 — 60
Excavator with bucket 20Tn	104	54 – 59	54 – 70	49 – 51	54 – 59	52 – 54
Piling rig (bored)	108	58 – 63	58 – 74	53 – 55	58 – 63	56 – 58
Telehandler	111	60 - 66	61 – 77	56 – 57	60 - 66	59 – 61
Rigid Truck	104	54 – 59	54 – 70	49 – 51	54 – 59	52 – 54
Mobile Crane 500Tn	110	60 - 65	60 - 76	55 - <mark>5</mark> 7	60 - 65	58 — 60
Cumulative	116	66 – 71	66 – 83	61 – 63	66 – 71	64 – 67

Table 11: Predicted airborne noise levels for the proposed civil works at the nearest noise receivers.

Results show that predicted noise levels from all civil activities are expected to exceed the NMLs (orange font) for Receiver NCA1, NCA2, NCA4 and NCA5 when works will be carried out in close proximity to the boundaries of the receivers.

The excavator with hammer attachment and tele handler activities are expected to exceed the NMLs of all the receiver NCAs at close and far proximity to the receivers' boundaries. The bored piling rig activity is expected to exceed the NMLs of receiver NCA1, NCA2, NCA4 and NCA5 when operating at close and far proximity to the site receivers' boundaries.

The predicted exceedance of the NMLs in the surrounding receivers triggers the Contractor to apply all reasonable and feasible work practices to minimise the noise as much as possible, and community consultation, as per the requirements of the NSW ICNG. Refer to Section 7 for details.

6.2.2 STRUCTURE

Table 12 shows the predicted range of sound pressure levels at the boundary of the nearest noise sensitive receivers due to the construction plant for the proposed structural works. Allowances have been made for distance attenuation and shielding.



	Typical	Predicted Noise Levels L _{Aeq,15min} , dB(A) (re. 20µPa)				
ltem	Noise Level L _{WA} dB	NCA 1 Educational	NCA 2 Healthcare	NCA 3 Healthcare	NCA 4 Residential	NCA 5 Healthcare
Rigid Truck	104	54 — 59	<mark>54</mark> — 70	49 – 51	54 – 59	52 – 54
Franna Crane 25Tn	99	49 – 54	<mark>49</mark> – 66	45 – 46	49 – 54	47 — 50
Mobile Crane 55Tn	101	51 56	<mark>51 – 67</mark>	46 – 48	51 — 56	49 – 51
Concrete truck	105	54 – 60	55 – 71	50 – 51	54 – 60	52 – 55
Concrete pump	110	59 – 65	60 – 76	55 – 57	60 – 65	58 – 60
Tele handler	111	60 – 66	61 – 77	56 – 57	60 – 66	59 – 61
Cumulative	115	64 – 70	65 – 81	60 – 62	64 – 70	62 – 65

Table 12: Predicted airborne noise levels for the proposed structure works at the nearest noise receivers.

Results show that predicted structural works noise levels are expected to exceed the NMLs (orange font) for certain receiver NCAs when works will be carried out in close proximity to the boundaries of the receivers.

The tele handler activity is expected to exceed the NMLs of all of the surrounding receiver NCAs when operating at close and far proximities to the receivers' boundaries. The concrete pump activity is expected to exceed the NMLs of all the surrounding receivers when operating at close proximity to the receivers' boundaries.

The predicted exceedance of the NMLs in the surrounding receivers triggers the proponent to apply all reasonable and feasible work practices to minimise the noise as much as possible, and community consultation, as per the requirements of the NSW ICNG. Refer to Section 7 for details.

6.2.3 FAÇADE AND BASE FITOUT

Table 13 shows the predicted range of sound pressure levels at the boundary of the nearest noise sensitive receivers due to the construction plant for the proposed façade and base fit out works. Allowances have been made for distance attenuation and shielding.

ltem	Typical Noise Level L _{WA} dB	Predicted Noise Levels L _{Aeq,15min} , dB(A) (re. 20µPa)					
		NCA 1 Educational	NCA 2 Healthcare	NCA 3 Healthcare	NCA 4 Residential	NCA 5 Healthcare	
Truck 20Tn	104	54 — 59	54 - 70	49 <mark>– 5</mark> 1	54 — 59	52 – 54	
Franna Crane 25Tn	99	49 – 54	49 - 66	45 – 46	49 – 54	47 — 50	
Tele handler	111	60 - 66	61 – 77	56 – 57	60 - 66	59 – 61	
Hand tools	99	49 – 54	49 - 65	44 – 46	49 – 54	47 – 49	
Cumulative	112	62 – 67	62 – 78	57 – 59	62 – 67	60 - 62	

Table 13: Predicted airborne noise levels for the proposed façade and base fit out works at the nearest noise receivers.



Results show that predicted façade and fit out noise levels are expected to exceed the NMLs (orange font) for certain receiver NCAs when works will be carried out in close proximity to the boundaries of the receivers.

The tele handler activity is expected to exceed the NMLs of all the surrounding receiver NCAs when operating at close and far proximities to the receivers' boundaries.

The predicted exceedance of the NMLs in the surrounding receivers triggers the proponent to apply all reasonable and feasible work practices to minimise the noise as much as possible, and community consultation, as per the requirements of the NSW ICNG. Refer to Section 7 for details.

6.3 VIBRATION ASSESSMENT

The vibration intensive plant used during the construction works has the potential to impact adjacent sensitive receivers. In order to assess the construction vibration impact due to heavy construction plant, the NSW RMS *'Construction Noise and Vibration Guideline'* provides safe working distances for vibration intensive plant and are quoted for both 'cosmetic' damage (in accordance with BS 7385.2:1993) and human comfort (in accordance with DEC's 'Assessing Vibration: A Technical Guideline'). These levels have been corrected such that safe working distances can be provided for DIN4150 vibration limits for dwellings, which are lower criteria than BS7385. The recommended safe working distances are provided in Table 14 for expected equipment.

Plant Item	Description	Structural Damage DIN4150	Human Response
	4-6 Tonne	12m	40m
Vibraton (Dollar	7-13 Tonne	15m	100m
vibratory koller	13-18 Tonne	20m	100m
	>18 Tonne	25m	100m
Small Hydraulic Hammer	5-12 Tonne	8m	7m
Medium Hydraulic Hammer	12-18 Tonne	28m	23m
Pile Boring	<800mm	8m	4m

Table 14: Recommended minimum working distances for vibration intensive plant from sensitive receivers.

The minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to damage of typical buildings under typical geotechnical conditions.

In relation to human comfort (response), the minimum working distances in Table 14 relate to intermittent vibration (VDV parameter) as for most construction activities, vibration emissions are intermittent in nature. Where the predicted vibration levels will exceed the human comfort objectives, the procedures Section 7.3.2 are to be followed in order to mitigate the potential impacts at sensitive receivers.

If the contractor has concerns for the disruptions at the nearest sensitive receivers due to vibration intensive plant use, it is recommended that prior to the commencement of the works, to undertake a preliminary vibration survey on each key vibration generating activity / equipment.

Receiver 2 – IASB building, to the south, is at close proximity to the site. The IASB building will share a boundary with the site and will, potentially, be at the greatest risk of vibrations associated with construction activities.



The safe work distances of vibration intensive plant should be closely observed when plant of this nature is used at close proximity to the IASB building.

The development conditions of consent C15 in SSD-10822510 relating to vibratory compactors states the following:

"…

C15. Vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified in condition C14.

The nearest residential receivers are located in NCA 4 along High Street. These receivers are approximately 20m from the boundary of the site. Therefore, according to condition of consent C15, vibration monitoring is required at the boundary of the nearest residential receivers along High Street if vibratory compactors are to be used within 10m of the site's northern boundary.



... "

7 SITE SPECIFIC NOISE AND VIBRATION CONTROL RECOMMENDATIONS

This section of the Construction Noise and Vibration Planning provides general recommendations only and provides applicable criteria together with best noise and vibration control practices to be observed during the proposed works.

Any noise from construction activities to be carried out on site must not result in 'offensive noise' to any noise sensitive receiver. To this end, the Contractor employed to undertake the construction works is responsible for ensuring that any site noise and, in particular, any complaints shall be monitored, investigated, managed and controlled.

7.1 ACOUSTIC SCREENING

Acoustic screening shall be provided during all phases of the construction works covered in this report as shown in Figure 3. The acoustic screening should be 2.4m high acoustic screen (Class A hoarding or equivalent) and constructed from minimum 17mm thick plywood plus minimise any air gaps.

7.2 **RESPITE PERIODS**

Respite periods should generally be implemented into the work methodology in order to reduce the impact onto the surrounding NCA's, as detailed in Section 7.7. As per the development's Conditions of Consent C6, high noise generating activities such as rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:

- 9:00am to 12:00pm, Monday to Friday;
- 2:00pm to 5:00pm Monday to Friday; and
- 9:00am to 12:00pm, Saturday.

Based on the predicted exceedances of the NMLs, the proponent shall apply time mitigation practices – i.e respite periods – to minimise noise when this plant is in use – particularly the excavator with hammer, bored piling rig, and tele handler, and use community consultation, as per best practices.

7.3 GENERAL CONTROLS FOR NOISE AND VIBRATION

According to DECC's ICNG and AS2436:2010 '*Guide to Noise Control on Construction, Maintenance & Demolition Sites*', the following techniques could be applied to minimize the spread of noise and vibration to the nearest sensitive receivers.

7.3.1 NOISE

If a process that generates significant noise levels cannot be avoided, the amount of noise reaching the receiver should be minimised. Two ways of achieving this are to either increase the distance between the noise source and the receiver or to introduce noise reduction measures such as screens.

Physical methods to reduce the transmission of noise between the site works and residences, or other sensitive land uses, are generally suited to works where there is longer-term exposure to the noise. Practices that will reduce noise from the site include:



- Increasing the distance between noise sources and sensitive receivers.
- Reducing the line-of-sight noise transmission to residences or other sensitive land uses.
- Constructing barriers that are part of the project design early in the project to introduce the mitigation of site noise.
- Installing purpose-built noise barriers and enclosures.

7.3.2 VIBRATION

Vibration can be more difficult to control than noise, and there are few generalizations that can be made about its control. It should be kept in mind that vibration may cause disturbance by causing structures to vibrate and radiate noise in addition to perceptible movement. Impulsive vibration can, in some cases, provide a trigger mechanism that could result in the failure of building components that had previously been in a stable state.

During the erection of new structures, some vibrations (transmitted through the existing structures nearby the construction site) are expected, being more of a concern for the surrounding sensitive receivers.

It can also trigger annoyance being elevated into action by occupants of exposed buildings and should therefore be included in the planning of communication with impacted communities. It should be remembered that failures, sometimes catastrophic, can occur as a result of conditions not directly connected with the transmission of vibrations, e.g. the removal of supports from retaining structures to facilitate site access.

Where site activities may affect existing structures, a thorough engineering appraisal should be made at the planning stage.

General principles of seeking minimal vibration at receiving structures should be followed in the first instance. Predictions of vibration levels likely to occur at sensitive receivers are recommended when they are relatively close, depending on the magnitude of the source of the vibration or the distance associated. Relatively simple prediction methods are available in texts, codes of practice or other standards, however it is preferable to measure and assess site transmission and propagation characteristics between source and receiver locations.

Guidance for measures available for the mitigation of vibration transmitted can be sought in more detailed standards, such as BS5228.2:2009 'Code of practice for noise and vibration control on construction and open sites. Vibration' or policy documents, such as the NSW DEC 'Assessing Vibration: A technical guideline'.

Identifying the strategy best suited to the control of vibration follows a similar approach to that of noise avoidance, control at the source, control along the propagation path, control at the receiver, or a combination of these. It is noted that vibration sources can include stationary plants (pumps and compressors), portable plants (jackhammers and pavement vibrators), mobile plants, pile-drivers, tunneling machines and activities, and blasting, amongst others. Unusual ground conditions, such as a high water-table, can also cause a difference to expected or predicted results, especially when considering the noise propagated from piling.



7.4 UNIVERSAL WORK PRACTICES

To minimise construction noise complaints due to preventable activities at any time of the day, the following work practices shall be considered:

- Regularly train workers and contractors (such as a toolbox talks) to use equipment in ways to minimise noise.
- Ensure site managers periodically check the site and nearby residences and other sensitive land use for noise problems so that solutions can be quickly applied.
- Include in tenders, employment contracts, subcontractor agreements and work method statements clauses that require minimisation of noise and compliance with directions from management to minimise noise.
- Avoid the use of radios or stereos outdoors where neighbours can be affected.
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices.
- Workers may at times need to discuss or negotiate practices with their managers.
- Schedule high noise generating works outside of exam time to ensure the acoustic amenity of students in collaboration with UNSW.

For work practices during night-time, the following shall be considered:

- Avoid the use of equipment which generates impulsive noise.
- Minimise the need for reversing or movement alarms.
- Avoid dropping materials from a height.
- Avoid metal-to-metal contact on equipment.
- Schedule truck movements to avoid residential streets if possible.
- Avoid mobile plant clustering near residences and other sensitive land uses.
- Ensure periods of respite are provided in the case of unavoidable maximum noise level events.

7.5 CONSULTATION AND NOTIFICATION

The community is more likely to be understanding and accepting of noise if the information provided is frank, does not attempt to understate the likely noise level, and if commitments are firmly adhered to. Community Consultation shall be as per Environmental Impact Statement (EIS) requirements.

Refer to Appendix A for the Community Consultation and Complaints Handling included in the Construction Management Plan (CMP).

7.6 MANAGING NOISE LEVELS AND MAINTENANCE PROGRAM FOR PLANT AND EQUIPMENT

In terms of both cost and results, controlling noise at the source is one of the most effective methods of minimising the noise impacts from any construction activities. Recommendations for managing noise levels from plant and equipment are as follows:

- Use quieter methods:
 - Examine and implement, where feasible and reasonable, alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and



concrete splitting, and controlled blasting such as penetrating cone fracture. The suitability of alternative methods should be considered on a case-by-case basis.

- Use alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electric controlled units where feasible and reasonable. Where there is no electricity supply, use an electrical generator located away from residences.
- Use quieter equipment:
 - Examine different types of machines that perform the same function and compare the noise level data to select the least noisy machine. For example, rubber wheeled tractors can be less noisy than steel tracked tractors.
 - Noise labels are required by NSW legislation for pavement breakers, mobile compressors, chainsaws and mobile garbage compactors. These noise labels can be used to assist in selecting less noisy plant.
 - Pneumatic equipment is traditionally a problem select super silenced compressors, silenced jackhammers and damped bits where possible.
 - When renting, select quieter items of plant and equipment where feasible and reasonable.
 - When purchasing, select, where feasible and reasonable, the most effective mufflers, enclosures and low-noise tool bits and blades. Always seek the manufacturer's advice before making modifications to plant to reduce noise.
- Operate plant in a quiet and efficient manner:
 - Reduce throttle setting and turn off equipment when not being used.
 - Examine and implement, where feasible and reasonable, the option of reducing noise from metal chutes and bins by placing damping material in the bin.

The Contractor shall prepare and implement a regular plant and equipment use and maintenance program. This is to ensure that 'noisy' equipment or tools are not used. This program should ensure that the contractor will:

- Regularly inspect and maintain equipment to ensure it is in good working order. Also check the condition of mufflers.
- Equipment must not be operated until it is maintained or repaired, where maintenance or repair would address the annoying character of noise identified.
- For machines with enclosures, check that doors and door seals are in good working order and that the doors close properly against the seals.
- Return any hired equipment that is causing noise that is not typical for the equipment the increased noise may indicate the need for repair.
- Ensure air lines on pneumatic equipment do not leak.

7.7 WORKS TIMING RESTRICTIONS AND SCHEDULING

Works should be carried out during periods specified by the approved Construction Hours outlined in the Conditions of Consent – see Section 4.3. Scheduling noisy work during periods when people are least affected reduces noise impact on those. Recommendations for work scheduling are as follows:

- Provide respite periods.
- Schedule activities to minimise noise impacts.



- Organise work to be undertaken during the recommended standard hours where possible.
- When works outside the recommended standard hours are planned, avoid scheduling on Sundays or public holidays.
- Schedule work when neighbours are not present (for example, commercial neighbours).
- Schedule noisy activities around times of high background noise (local road traffic or when other local noise sources are active) where possible to provide masking or to reduce the amount that the construction noise intrudes above the background.
- Consult with affected neighbours about scheduling activities to minimise noise impacts.
- Organise deliveries and access.
 - Nominate an off-site truck parking area, away from residences, for trucks arriving prior to gates opening.
 - Amalgamated loads can lead to less noise and congestion in nearby streets.
 - Optimise the number of vehicle trips to and from the site movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
 - Inform, and consult where possible, the potentially noise-affected residences or other sensitive land uses of designated access routes to and from site, and make drivers aware of nominated vehicle routes.
 - Schedule deliveries to nominated hours only.

7.8 ADDITIONAL NOISE AND VIBRATION CONTROLS

There will likely be times or situations when construction works exceed the stated criteria at the nearest receivers, particularly when works occur in the areas closer to the receiver(s). Therefore, all feasible and reasonable noise control measures should be considered.

If, during construction, an item of equipment exceeds either the noise criteria at any location or the equipment noise level limits, the following noise control measures, together with construction best practices presented in this Section shall be considered to minimise the noise and vibration impacts of the project on the surrounding noise sensitive receivers:

- Schedule noisy activities to occur outside of the most sensitive times of the day for each nominated receiver. For example, the residential receivers are likely to be more sensitive to noise before 8am and after 6pm.
- Consider implementing equipment specific temporary screening for noisy equipment, or other noise control measures recommended in Appendix C of AS2436:2010. This will most likely apply to noisier hand-held items such as jackhammers and circular saws.
- Locate specific activities such as carpentry areas (use of circular saws, etc.) to internal spaces or where shielding is provided by existing structures or temporary screening.
- Limit the number of trucks and heavy vehicles on site at any given time through scheduling deliveries at differing times.
- Traffic rules should be prepared to minimise the noise impact on the community.
- When loading and unloading trucks, adopt best practice noise management strategies to avoid materials being dropped from height.



- Avoid unnecessary idling of trucks and equipment. Vehicles and equipment to be turned off when not in use.
- Ensure that any miscellaneous equipment (extraction fans, hand tools, etc.) not specifically identified in this plan incorporates silencing/shielding equipment as required to meet the noise criteria.

If the measured construction vibration levels exceed the appropriate criteria during the works, one or more of the following measures should be taken:

- Modifications to construction equipment used.
- Modifications to methods of construction.
- Rescheduling of activities to less sensitive times.

If the measures given cannot be implemented or have no effect on noise or vibration levels or impact generated, a review of the criteria should be undertaken and the noise and vibration strategy amended.

7.9 MONITORING PROGRAM

7.9.1 GENERAL

Noise and vibration monitoring should be performed inside the premises of the affected property and on site adjacent to the affected receivers.

Monitoring is to be undertaken by an experienced noise and vibration monitoring professional or an acoustic consultant. The results of any noise or vibration 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 and vibration monitoring can take two forms:

- <u>Short-term monitoring</u>: 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 and vibration criteria are exceeded allowing the selection of alternative method on construction or equipment selection in order to minimise noise and vibration impacts.
- Long-term monitoring: Similarly long-term monitoring uses noise and vibration loggers providing realtime alerts to the builder / site manager when the noise and vibration criteria are exceeded. Typically, the noise and vibration loggers stay on site for a period of several months for the critical construction stages of the project. Sometimes the period of construction noise and vibration monitoring is dictated by the local authorities through the Conditions of Consent if applicable.

Both methodologies 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 and vibration generating exceedances via the short-term or attended monitoring.

The following may be included in a noise monitoring report:

- The type of monitoring conducted (for example, at a particular project stage or following complaints) and a brief statement of the measurement method.
- The noise / vibration conditions on the consent / licence, or the relevant noise management objectives.
- Descriptions of the nearest affected residences and other sensitive land uses or, in the case of complaints, description of the complainant location and complaint.



- Plan or diagram showing the location of the monitoring and the noise generating works.
- Description of the instrumentation used.
- Name and relevant qualifications or professional memberships of monitoring personnel.
- The weather conditions during monitoring.
- The time(s) and duration(s) of monitoring, including dates in the case of complaints.
- A clear description of the construction activities taking place during the monitoring.
- The results of monitoring at each monitoring location, including a comparison with the consent conditions or relevant noise management objectives.
- A clear statement outlining the project's compliance or non-compliance with the conditions or objectives.
- Where the monitored level is higher than the conditions or objectives, the reasons for non-compliance should be stated, strategies for minimising noise identified and stated, and the appropriate actions to implement the strategies.

7.9.2 NOISE

Noise monitoring will be done on a complaint-only basis on the affected premises. When a noise compliant is received, the Main Contractor will investigate the source of the complaint. If necessary, the Main Contractor will produce a noise monitoring report to close out the complaint.

7.9.3 VIBRATION

Vibration monitoring is required under SSD - 10822510 Conditions of Consent C15 and B40, as vibratory compactors could be used within 30 metres of a residential receiver and Light Rail requirements. Based on this requirement of Condition of Consent C15 and B40 and in order to confirm compliance with the vibration criteria established in Section 4.5, the following vibration monitoring is proposed:

- 1-off vibration monitor in the boundary of a residential receiver in High Street to the North. This location is mandatory to confirm compliance with Conditions of Consent C15 and B40.
- 1-off vibration monitor in IASB building to the South.
- 1-off vibration monitor in UNSW Medicine building to the West.

It shall be noted that the vibration monitoring will be only required during the Civil Works stages, as construction of other stages will not generate high vibration levels. Figure 4 below shows the proposed locations of the vibration loggers around the site.





Figure 4: Proposed locations for vibration monitors around construction site.

7.10 COMPLAINTS

To assist in the management of noise and vibration complaints, various procedures are to be followed.

These include:

- Clearly visible signage identifying any key personnel along with their contact details to be erected along the perimeter of the building site including a 24 hour contact name, phone number and email address provided for the resident to address any complaint.
- Give complaints a fair hearing.
- Have a documented complaint process, including an escalation procedure so that if a complaint is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems.
 Call back at night-time only if requested by the complainant to avoid further disturbance.
- Try to ascertain from the complaint which equipment / plant is causing the problem.
- Where necessary, establish from the monitoring equipment and or attended monitoring if the allowable noise and vibration levels have been complied with.
- Establish if the equipment / plant positioning has previously been highlighted as a problem area. If not, and the noise levels are above the allowable limits, then the equipment / plant and its position shall be noted.
- Implement all feasible and reasonable measures to address the source of the complaint.



- The Communications Register is to be kept by the Contractor to keep a record of complaints and detail any information associated with them. The registration of a particular item will remain open until the compliant has been appropriately dealt with. The contents of the register will include:
 - The name and the address of the complaint
 - Time and date of the complaint
 - The nature of the complaint (Noise/Vibration)
 - Subsequent details
 - Remedial action undertaken

The contents of the Communications Register will be maintained and updated with any new complaint without delay. The report will be reported to both Authority and the Contractor. The investigation of the complaint and any remedial actions will be performed by the builder and/or client representative.

In the event of noisy works scheduled, the builder will notify residents in advance.

7.11 WORKERS' TRAINING AND AWARENESS

The Contractor shall provide all project personnel and subcontractors with training on the environmental obligations through project inductions, toolbox talks, and through Safety Works Methods (SWMs).

All Project work personnel and subcontractors shall undergo a general project induction prior to commencing work. This should include a noise component to reinforce the importance of noise issues and the measures that will be implemented to protect the environment.

All inductions shall be carried out by the site manager, or his designate in the site office as appropriate. During the induction, each contractor / worker shall be notified about the site to ensure they are fully aware of the exclusion zones and site-specific environment.

Site inductions and SWMs and toolbox talks will highlight the specific environmental requirements and activities being undertaken at each work area which will include relevant noise management matters.

7.12 OCCUPATIONAL HEALTH AND SAFETY

In addition to potential noise and vibration impacts on the community and structures, construction noise and vibration can also have an adverse impact upon the health of workers. It is important that Contractors adopt noise management strategies to prevent or minimise worker exposure to excessive noise and vibration. Such measures will also assist in reducing noise and vibration impacts on the surrounding community.

The National Occupational Health and Safety Commission (NOHSC) recommends a maximum acceptable workplace noise exposure level of 85dB(A) (L_{Aeq,Bh}) for an eight-hour time period.

Personnel involved in operations should be issued with ear plugs or ear muffs which must be used whenever noise levels interfere with normal speech when individuals are standing at a distance of 1m from each other, or when the $L_{Aeq,8hr}$ exceeds 85dB(A).

Signs should be erected and made visible at the entry to all areas where noise levels will exceed 85dB(A).

7.13 CONSTRUCTION TRAFFIC ROUTES

The contractor shall establish and implement traffic routes for deliveries to the site, which minimise the noise impact on surrounding noise sensitive receivers as best possible.



Deliveries will be scheduled and distributed to ensure avoidance of congestion to surrounding roads networks and within the precinct. Materials handling will be conducted within the construction site perimeter reducing any impacts on traffic flows within the area.



8 CONCLUSIONS

A construction noise and vibration assessment has been carried out for the proposed construction works of the UNSW Health Translation Hub (HTH) project located within the Randwick Hospital Campus (RHC). This report addresses the Condition of Consent of the State Significant Development Application SSD-10822510.

In particular, this report identifies the Contractor's obligations and the requirements to manage noise and vibration during construction such that Contractor can make the necessary allowances within the construction costs, programmes and work methodologies.

The responsibilities of all stakeholders are identified and a framework for the management of noise and vibration during construction works is provided.

This report establishes relevant noise level criteria, details the acoustic assessment and provides comments and recommendations for the proposed development.

Potential construction noise and vibration impacts on the surroundings have been presented in this report and recommendations based on the relevant guidelines are provided. It is expected that the predicted exceedance of the NMLs in the surrounding receivers triggers the proponent to apply all reasonable and feasible work practices to minimise the noise as much as possible, and community consultation, as per the requirements of the NSW ICNG. Refer to Section 7 for details.

For each of the work stages and associated plant, assuming that they are exceeding the noise level criteria, the noise control measures presented in Section 7 shall be considered and implemented wherever reasonable and feasible in order to minimise any potential noise impact. Operation time restrictions shall be applied to 'noisy' construction plant to minimise noise impact to the nearest sensitive receivers.

The information presented in this report shall be reviewed if any modifications to selection of equipment / machinery, construction methodologies and modifications to the works construction program.

Based on the information presented in this report, relevant objectives will be satisfied and therefore approval is recommended to be granted.



APPENDIX A: COMMUNITY COMMUNICATION STRATEGY

HANSENYUNCKEN

Construction Management Plan (CMP) Project name: UNSW Health Translation Hub

4.16 External Lighting

In accordance with condition B15a (vii) of SSD 10822510, the external lighting to the proposed Health Translational Hub complies with AS4282-2019 – Control of the Obstructive Effects of Outdoor Lighting.

All external construction lighting will be established and operated in compliance with AS 4282:2019 Control of the obtrusive effects of outdoor lighting. Lighting will be installed in coordination with the objective of minimising light spill by directing lighting away from residential receivers where possible. In order to ensure lighting does not impact on sensitive receivers, the following will be implemented:

- Lights will be located as far away as possible and directed away from neighbouring properties, with
 consideration given to current Crime Prevention Through Environmental Design principles. For safety
 and security purposes during nights and periods of low light temporary lighting will be required for
 work areas and traffic detours.
- Lighting will be directed to illuminate the target areas. Baffles or shield will be utilised where
 practicable and feasible to reduce potential of light spill.

4.17 Community consultation and complaints handling

In accordance with condition B15a (viii) of SSD 10822510, community consultation and complaints handling will be primarily the responsibility of Hansen Yuncken will provide assistance where possible to ensure that the community consultation and complaints handling process is as efficient and effective as possible.

All complaint and enquiries will be managed in accordance with this plan. All external communication will be issued through the principal's representative

4.17.1 Community Consultation

Community consultation is the responsibility of both council and Hansen Yuncken. Hansen Yuncken will ensure that the relevant strategies/outcomes are incorporated within the relevant management plans and construction process where possible. The main channels that Hansen Yuncken is planning on conducting consultation is through the following:

- Works notifications
- Letterbox drops

The use of the above listed channels will be decided on a case-by-case basis and can involve a culmination of community consultation methods.

Community consultation has also been undertaken by UNSW prior to the commencement of the HTH works. Prior to any construction activities the following strategies were put into place:

- Community information sessions held
- Formal and informal briefings and feedback sessions held
- Where required, face-to-face engagement with neighbouring residents and businesses
- Distribution of project community information resources
- Established communication channels for feedback including website, project community contact number and project email account.

The following highlights stakeholders and community consultation outcomes for managing high noise generating works:

- · Stop works procedures and lines of communication where works may affect sensitive receivers
- Complaints management processes for noise and vibration

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 Identification of preferred communication channels with key stakeholders and neighbouring residents for works notification

Impacted Stakeholders will be kept informed of the project status and key activities throughout the project duration via:

- Community notification notifications circulated via letter box drop, email and project website to
 communicate upcoming construction activity to the local community and affected stakeholders.
- Site hoarding or notices on the hoarding will also identify Hansen Yuncken as the site operators.

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4.17.2 Complaints Handling

The primary form of assistance that Hansen Yuncken will provide is through the complaints handling process. During the project delivery phase, a complaint defined as regarding construction impacts – such as – safety, dust, noise, traffic, congestion, loss of parking, contamination, loss of amenity, hours of work, property damage, property access, service disruption, conduct or behaviour of construction workers or other environmental impacts.

All queries and complaints can be sent to the below email address:

HTHenquiries@hansenyuncken.com.au

For enquiries and complaints received in person or via the 02 9770 7600 contact number managed by Hansen Yuncken will be:

- Responded to within the timeframes outlined below
- Recorded in Stakeholder spreadsheet within 48 hours of receipt
- Reported monthly in the complaints register, with information about any resolution reached and published on the project website in accordance with the SSD 10822510 condition A22

Once identified, investigations of the complaint will be undertaken as soon as possible with rectification to follow (if required).

If the complaint is made to council, council are to forward the complaint to Hansen Yuncken Management (Project Director/Project manager). Upon receipt of the complaint from the Project Director, Hansen Yuncken will endeavour to close out the complaint in a timely manner. The complaint will be logged as per the above.

Responses to complaints received will be provided to Plenary and UNSW for review and approval prior to issuing to the community as outlined below:



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