# Construction Noise and Vibration Management Plan

## Augusta Street – Warehouse and Distribution Centre

### The Trustee for Huntingwood Property Trust

Level 18, 123 Pitt Street
Sydney, NSW, 2000

Prepared by:

**SLR Consulting Australia**

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## Revision Record

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# Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with The Trustee for Huntingwood Property Trust (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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# Acronyms and Abbreviations

| | |
|---|---|
| AS | Australian Standard |
| BS | British Standard |
| dBA | A-weighted decibel (referenced 20 µPa) |
| CNVMP | Construction Noise and Vibration Management Plan |
| DEC | Department of Environment and Conservation |
| DECC | Department of Environment and Climate Change (now NSW EPA) |
| DECCW | Department of Environment, Climate Change & Water |
| DIN | Deutches Institut für Normung (German Institute for Standardisation) |
| EPA | NSW Environment Protection Authority |
| Hz | Hertz |
| ISO | International Standards Organisation |
| $L_{Aeq}$ | Equivalent continuous noise level, providing a representation of the cumulative level of noise exposure over a defined period. |
| $L_{Aeq\ (15minute)}$ | The equivalent continuous noise level over a 15 minute period. |
| $L_{Aeq\ (Day)}$ | The equivalent continuous noise level for the daytime period of 7.00 am to 6.00 pm |
| $L_{Aeq\ (Evening)}$ | The equivalent continuous noise for the evening period of 6:00 pm to 10:00 pm |
| $L_{Aeq\ (Night)}$ | The equivalent continuous noise for the night-time period of 10.00 pm to 7.00 am |
| $L_{Aeq(1hour)}$ | The equivalent continuous noise for the busiest 1-hour period. |
| $L_{Amax}$ | The maximum noise level during the measurement or assessment period. The $L_{AFmax}$ or Fast is averaged over 0.125 of a second and the $L_{ASmax}$ or Slow is averaged over 1-second. |
| m | Metres |
| mm | Millimetres |
| mm/s | Millimetres per second |
| m/s | Metres per second |
| NML | Noise Management Level. |
| NSW | New South Wales |
| PPV | Peak Particle Velocity |
| RBL | Rating Background Level. Background level representing each assessment period (day/evening/night) over the whole monitoring period. |
| VDV | Vibration Dose Value |

# 1.0 Introduction

## 1.1 Background

SLR Consulting Australia Pty Ltd (SLR) has been engaged by the Trustee for Huntingwood Property Trust (the Client) to prepare a Construction Noise and Vibration Management Plan (CNVMP) for construction works associated with the State Significant Development Application (SSDA) at Augusta Street, Huntingwood.

The CNVMP addresses the potential noise and vibration impacts associated with the construction of the development and details the mitigation and management procedures for dealing with potential impacts. Construction noise and vibration impacts were previously assessed for the site as part of the SSDA Noise Impact Assessment 610.30770-R01-v2.1 prepared by SLR in May 2024 (SSDA NVIA).

SLR is suitably qualified to produce this CNVMP is a member firm of the Association of Australasian Acoustical Consultants (AAAC). Specific acoustic terminology is used in this report, an explanation of common acoustic terms is provided in **Appendix A**.

## 1.2 Development Description

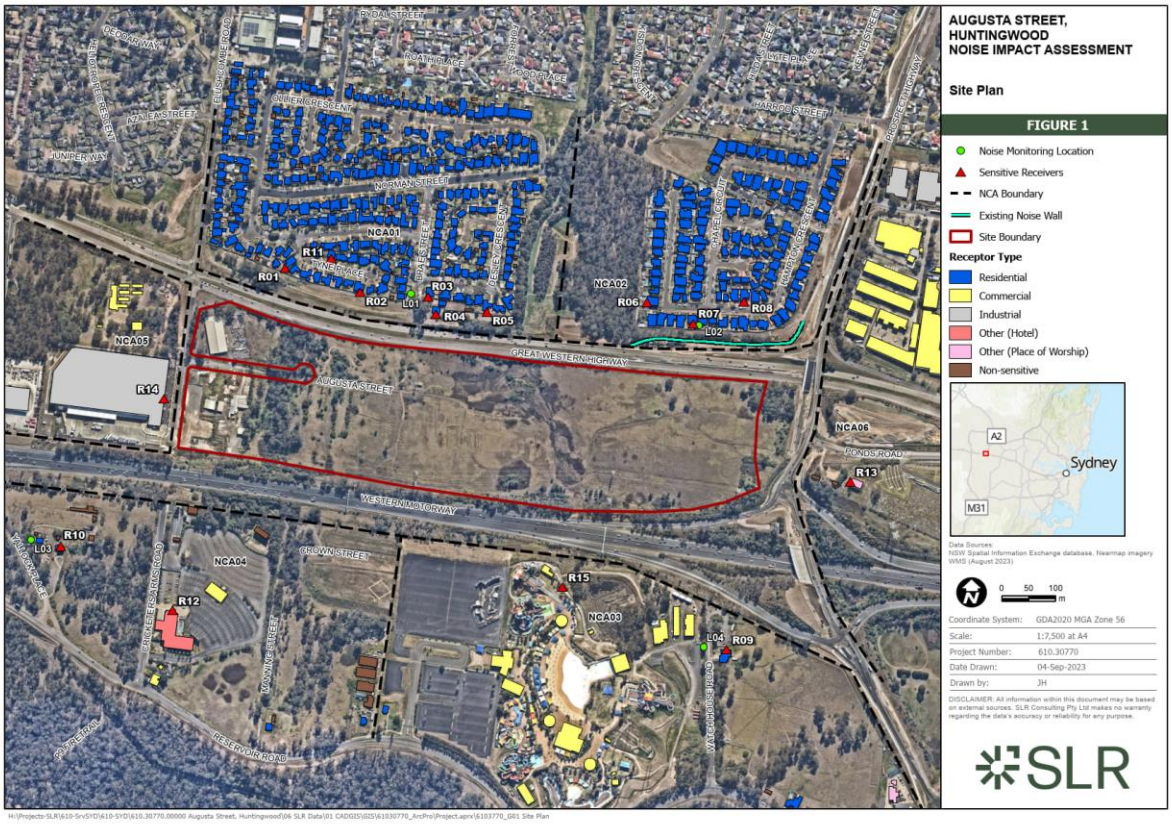
The development comprises the construction of a warehouse and distribution centre including;

- Site establishment works, including vegetation clearing, excavation and bulk earthworks;
- Construction and operation of four (4) new warehouse buildings comprising a multi-level warehouse building on the eastern portion of the site (WH5) and three single storey warehouse buildings on the western portion of the site. The warehouse buildings will include ancillary office space and indicative warehouse fit out works including warehouse racking. one ancillary office space and one warehouse dispatch office;
- Other associated works including landscaping, at-grade car parking and general site improvements.
- Business and building identification signage including wayfinding signage.

Vehicle access provided via Augusta Street and a new proposed access from the Great Western Highway.

The location of the development and surrounding receivers are shown in **Figure 1**.

**Figure 1 Development Location and Sensitive Receivers**




## 1.3 Nearest Receivers

The nearest receivers are commercial developments located 30 m to the west of the site. The nearest residential receivers are located around 65 m to north of the site with the nearest residential receivers to the south 260 m from the site. The area surrounding the site has been divided into six Noise Catchment Areas (NCAs). The NCAs group together sensitive receivers with similar existing noise environments. The assessment has considered noise impacts at all the sensitive receivers within each NCA. The sensitive receivers identified with the highest potential impacts within each NCA are shown in **Figure 1** and detailed in **Table 1**.

**Table 1 Surrounding Sensitive Receivers**

| Receiver | NCA | Receiver Type | Distance (m) | Direction | Address |
|---|---|---|---|---|---|
| R01 | NCA01 | Residential | 95 | North | 4 Tyne Place, Prospect |
| R02 | NCA01 | Residential | 90 | North | 18 Tyne Place, Prospect |
| R03 | NCA01 | Residential | 95 | North | 39 Desley Crescent, Prospect |
| R04 | NCA01 | Residential | 65 | North | 21 Brae Street, Prospect |
| R05 | NCA01 | Residential | 80 | North | 31 Desley Crescent, Prospect |
| R06 | NCA02 | Residential | 130 | North | 61 Hampton Crescent, Prospect |
| R07 | NCA02 | Residential | 100 | North | 49 Hampton Crescent, Prospect |
| R08 | NCA02 | Residential | 140 | North | 30 Hampton Crescent, Prospect |

| Receiver | NCA | Receiver Type | Distance (m) | Direction | Address |
|---|---|---|---|---|---|
| R09 | NCA03 | Residential | 260 | South | 24 Watch House Road, Prospect |
| R10 | NCA04 | Residential | 290 | Southwest | 2 Yallock Place, Prospect |
| R11 | NCA01 | Residential | 140 | North | 5 Tyne Place, Prospect |
| R12 | NCA04 | Hotel | 300 | Southwest | 32 Cricketers Arms Road, Prospect |
| R13 | NCA06 | Place of Worship | 170 | East | St Bartholomew's Church, Ponds Road, Prospect |
| R14 | NCA05 | Industrial | 35 | West | 421-427 Flushcombe Road, Blacktown |
| R15 | NCA03 | Commercial | 150 | South | Raging Waters Sydney, 427 Reservoir Road, Prospect |

# 2.0 Development Consent Conditions

The Development is to be constructed in accordance with SSD 36138263 Development Consent and in accordance with the documents referenced under Condition A2.

The conditions which apply to construction noise and vibration and where they have been addressed are identified in **Table 2**.

**Table 2 Development Consent Conditions**

| Development Consent Conditions | Where Addressed |
|---|---|
| **Hours of Work**<br>B19. The Applicant must comply with the hours detailed in Table 2.<br>*Table 2 Hours of Work*<br>Activity / Day / Time<br>Earthworks and construction / Monday – Friday / 7 am to 6 pm<br>Earthworks and construction / Saturday / 8 am to 1 pm<br>Operation / Monday – Sunday / 24 hours<br>B20. Works outside of the hours identified in condition B19 may be undertaken in the following circumstances:<br>(a) works that are inaudible at the nearest sensitive receivers;<br>(b) works agreed to in writing by the Planning Secretary;<br>(c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or<br>(d) where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm. | **Section 5.1.1**<br>**Section 5.1.1** |
| **Construction Noise Limits**<br>B21. The development must be constructed to achieve the construction noise management levels detailed in the Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time). 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 in the Appendix 2. | **Section 4.0**<br>**Section 5.0**<br>**Section 6.0** |

| Development Consent Conditions | Where Addressed |
|---|---|
| **Construction Noise and Vibration Management Plan** | **This CNVMP** |
| B22. The Applicant must prepare a Construction Noise Management Plan for the development to the satisfaction of the Planning Secretary. The Plan must form part of a CEMP in accordance with condition C2 and must | |
| (a) be prepared by a suitably qualified and experienced noise expert; | **Section 1.0** |
| (b) describe procedures for achieving the noise management levels in EPA's Interim Construction Noise Guideline (DECC, 2009) (as may be updated or replaced from time to time); | **Section 6.0** |
| (c) describe the measures to be implemented to manage high noise generating works such as piling, in close proximity to sensitive receivers; | **Section 6.0** |
| (d) include strategies that have been developed with the community for managing high noise generating works; | **Section 6.0** |
| (e) describe the community consultation undertaken to develop the strategies in condition B22(d); and | **Section 6.3** |
| (f) include a complaints management system that would be implemented for the duration of the development. | **Section 6.2** |
| B23. The Applicant must: | |
| (a) not commence construction of any relevant stage of the development until the Construction Noise Management Plan required by condition B22 is approved by the Planning Secretary; and | **This CNVMP** |
| (b) implement the most recent version of the Construction Noise Management Plan approved by the Planning Secretary for the duration of construction. | |

# 3.0 Existing Noise Environment

Unattended noise monitoring was completed in May 2022 as part of the SSDA NVIA. This monitoring was undertaken at the locations shown in **Figure 1** to measure the background noise levels in the identified residential receiver areas to the north and south of the site.

A summary of the noise monitoring results is presented in **Table 3**. Further information regarding the monitoring, including methodology and detailed data, is provided in the SSDA NVIA.

**Table 3 Summary of Ambient Noise Levels**

| ID | Address | Measured Noise Levels (dBA)[1] | | | | | |
|---|---|---|---|---|---|---|---|
| | | Background Noise (RBL) | | | Average Noise ($L_{Aeq}$) | | |
| | | Day | Evening | Night | Day | Evening | Night |
| L01 | 18 Brae Street, Prospect | 48 | 50 | 44 | 55 | 55 | 53 |
| L02 | 47 Hampton Crescent, Prospect | 47 | 46 | 39 | 55 | 53 | 51 |
| L03 | 10 Yallock Place, Prospect | 55 | 55 | 48 | 59 | 59 | 57 |
| L04 | Watch House Road, Prospect | 49 | 49 | 45 | 55 | 54 | 52 |

Note 1: The assessment periods are the daytime which is 7 am to 6 pm Monday to Saturday and 8 am to 6 pm on Sundays and public holidays, the evening which is 6 pm to 10 pm, and the night-time which is 10 pm to 7 am on Monday to Saturday and 10 pm to 8 am on Sunday and public holidays. See the NSW EPA Noise Policy for Industry.

# 4.0 Assessment Criteria

## 4.1 Construction Noise and Vibration Guidelines

The standards and guidelines relevant to the development are listed in **Table 4**. These guidelines aim to protect the community and environment from excessive noise and vibration impacts during construction of projects.

**Table 4 Construction Noise and Vibration Standards and Guidelines**

| Guideline/Policy Name | Where Guideline Used |
|---|---|
| Interim Construction Noise Guideline (ICNG) (DECC, 2009) | Assessment of airborne noise impacts on sensitive receivers |
| Construction Noise and Vibration Guideline (Roads) (CNVG-R) (Transport for NSW, 2023) | Assessment and management protocols for noise and vibration impacts |
| Road Noise Policy (RNP) (DECCW, 2011) | Assessment of construction traffic impacts |
| BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2, BSI, 1993 | Assessment of vibration impacts (structural damage) to non-heritage sensitive structures |
| DIN 4150:Part 3-2016 Structural vibration – Effects of vibration on structures, Deutsches Institute fur Normung, 2016 | Screening assessment of vibration impacts (structural damage) to heritage sensitive structures, where the structure is found to be unsound |
| Assessing Vibration: a technical guideline (DEC, 2006) | Assessment of vibration impacts on sensitive receivers |

## 4.2 Interim Construction Noise Guideline

The NSW *Interim Construction Noise Guideline* (ICNG) is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project-specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from the construction of a project are predicted and then compared to the NMLs in a 15-minute assessment period to determine the likely impact of the project.

The NMLs are not mandatory limits, however, where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated.

### Residential Receivers

The ICNG approach for determining NMLs at residential receivers is shown in **Table 5**.

**Table 5 ICNG NMLs for Residential Receivers**

| Time of Day | NML $L_{Aeq(15minute)}$ | How to Apply |
|---|---|---|
| Standard Construction Hours<br>Monday to Friday 7:00 am to 6:00 pm<br>Saturday 8:00 am to 1:00 pm<br>No work on Sundays or public holidays | Noise affected RBL[1] + 10 dB | The noise affected level represents the point above which there may be some community reaction to noise<br>Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level<br>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details. |
| | Highly Noise Affected 75 dBA | The Highly Noise Affected (HNA) level represents the point above which there may be strong community reaction to noise<br>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restructuring the hours that the very noisy activities can occur, taking into account:<br>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<br>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |
| Outside Standard Construction Hours | Noise affected RBL + 5 dB | A strong justification would typically be required for works outside the recommended standard hours<br>The proponent should apply all feasible and reasonable work practices to meet the noise affected level<br>Where all feasible and reasonable practises have been applied and noise is more than 5 dB above the noise affected level, the proponent should negotiate with the community. |

Note 1: The RBL is the Rating Background Level and the ICNG refers to the calculation procedures in the NSW Industrial Noise Policy (INP). The INP has been superseded by the NSW EPA Noise Policy for Industry (NPfI).

### Other Sensitive' Land Uses and Commercial Receivers

Non-residential land uses have been identified in the study area. The NMLs for 'other sensitive' receivers are shown in **Table 6**.

**Table 6 ICNG NMLs at 'Other Sensitive' Land Uses**

| Land Use | Noise management level $L_{Aeq(15minute)}$ (dBA) (applied when the property is in use) | |
|---|---|---|
| | Internal | External |
| **ICNG 'other sensitive' receivers** | | |
| Classrooms at schools and other educational institutions | 45 | 55[1] |
| Hospital wards and operating theatres | 45 | 65[2] |
| Places of worship | 45 | 55[1] |

| Land Use | Noise management level $L_{Aeq(15minute)}$ (dBA) (applied when the property is in use) | |
|---|---|---|
| | Internal | External |
| Active recreation areas (characterised by sporting activities and activities which generate noise) | - | 65 |
| Passive recreation areas (characterised by contemplative activities that generate little noise) | - | 60 |
| Commercial | - | 70 |
| Industrial | - | 75 |
| **Non-ICNG 'other sensitive' receivers** | | |
| n/a | n/a | n/a |

Note 1: It is assumed that these receivers have windows partially open for ventilation which results in internal noise levels being around 10 dB lower than the external noise level.

Note 2: It is assumed that these receivers have fixed windows which conservatively results in internal noise levels being around 20 dB lower than the external noise level.

**Sleep Disturbance**

A method for assessing sleep disturbance is contained in the NPfI. Although the NPfI sleep disturbance criteria relates to industrial noise, it is also considered relevant for reviewing potential impacts from construction noise as a screening criterion to identify the need for further assessment. The NPfI notes that a detailed maximum noise level assessment should be undertaken where a project results in night-time noise levels that exceed 52 dBA $L_{AFmax}$ or the prevailing background level plus 15 dB, whichever is the greater.

It is assumed that hours of construction are between Monday to Friday 7:00am to 6:00pm. Saturday 8:00am to 1:00pm, with no construction work taking place on Sundays and Public Holidays. If any works outside of the standard daytime construction hours are proposed, they should be assessed separately, consequently sleep disturbance will not be considered further within this CNVMP.

### 4.2.1 NML Summary

The NMLs for the project have been determined in accordance with the requirements of the ICNG and are shown in **Table 7**. Further information regarding the NMLs is provided in the SSDA NVIA.

**Table 7 Project Specific Noise Management Levels (dBA)**

| NCA | Receiver Type | Monitoring Location | Noise Management Level (LAeq(15minute) – dBA) | | | | Sleep Disturbance Screening Level (RBL+15 dB) (LAmax dBA) |
|---|---|---|---|---|---|---|---|
| | | | Standard Construction (RBL +10 dB)[1] | Out of Hours (RBL +5 dB) | | | |
| | | | Daytime | Daytime[2] | Evening | Night-time | Night-time |
| NCA01 | Residential | L01 | 58 | 53 | 53 | 49 | 59 |
| NCA02 | Residential | L02 | 57 | 52 | 51 | 44 | 54 |
| NCA03 | Residential | L04 | 59 | 54 | 54 | 50 | 60 |
| NCA04 | Residential | L03 | 65 | 60 | 60 | 53 | 63 |
| - | Hotel | - | 70 | 70 | 70 | 60 | 60 |
| - | Place of Worship | - | 55 | 55 | 55 | 55 | - |
| - | Commercial | - | 70 | 70 | - | - | - |
| - | Industrial | - | 75 | 75 | - | - | - |

Note 1: RBL = Rating Background Level.

Note 2: Daytime out of hours is 7 am to 8 am and 1 pm to 6 pm on Saturday, and 8 am to 6 pm on Sunday and public holidays.

## 4.3 Construction Road Traffic Noise Guidelines

The potential impacts from construction traffic on public roads are assessed under the NSW EPA *Road Noise Policy* (RNP).

An initial screening test is first applied to evaluate if existing road traffic noise levels are expected to increase by more than 2.0 dB as a result of construction traffic. Where this is considered likely, further assessment is required using the RNP base criteria shown in **Table 8**.

**Table 8 RNP Criteria for Assessing Construction Vehicles on Public Roads**

| Road Category | Type of Project/Land Use | Assessment Criteria (dBA) | |
|---|---|---|---|
| | | Daytime (7 am – 10 pm) | Night-time (10 pm – 7 am) |
| Freeway/ arterial/ sub-arterial roads | Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments | $L_{Aeq(15hour)}$ 60 (external) | $L_{Aeq(9hour)}$ 55 (external) |
| Local roads | Existing residences affected by additional traffic on existing local roads generated by land use developments | $L_{Aeq(1hour)}$ 55 (external) | $L_{Aeq(1hour)}$ 50 (external) |

Based on the SSDA NVIA, the proposed construction traffic indicates that the construction traffic is expected to be minimal, hence the potential noise impacts from development related

construction traffic on public roads are expected to be negligible (ie <2.0 dB) due to high existing traffic volumes. As such, construction traffic noise has not been addressed further in this plan.

## 4.4 Vibration Guidelines

The effects of vibration from construction works can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

### 4.4.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction works are located close to occupied buildings.

Vibration from construction works tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDVs for human comfort are shown in **Table 9**.

**Table 9 Vibration Dose Values for Intermittent Vibration**

| Building Type | Assessment Period | Vibration Dose Value[1] ($m/s^{1.75}$) | |
|---|---|---|---|
| | | Preferred | Maximum |
| Critical Working Areas (eg operating theatres or laboratories) | Day or night-time | 0.10 | 0.20 |
| Residential | Daytime | 0.20 | 0.40 |
| | Night-time | 0.13 | 0.26 |
| Offices, schools, educational institutions and places of worship | Day or night-time | 0.40 | 0.80 |
| Workshops | Day or night-time | 0.80 | 1.60 |

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

### 4.4.2 Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, are located in buildings near construction works. No such equipment has been identified in the study area.

### 4.4.3 Structural and Cosmetic Damage Vibration

**Buildings**

In terms of the most recent relevant vibration damage criteria, Australian Standard AS 2187: Part 2-2006 *Explosives - Storage and Use - Part 2: Use of Explosives* recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings Part 2* as they "are applicable to Australian conditions".

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where the minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the Standard include demolition, piling, ground treatments (eg compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are shown in **Table 10** and **Figure 2**.

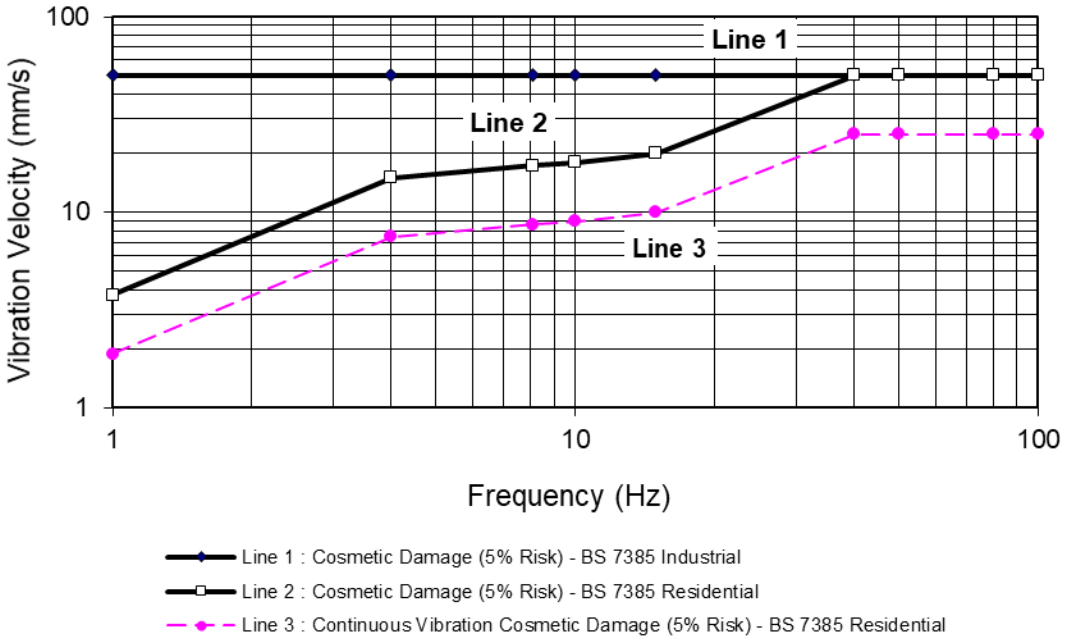
**Table 10 Transient Vibration Guide Values - Minimal Risk of Cosmetic Damage**

| Line | Type of Building | Peak Component Particle Velocity in Frequency Range of Predominant Pulse | |
|---|---|---|---|
| | | 4 Hz to 15 Hz | 15 Hz and Above |
| 1 | Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50 mm/s at 4 Hz and above | |
| 2 | Unreinforced or light framed structures<br>Residential or light commercial type buildings | 15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |

The standard states that the guide values in **Table 10** relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in **Table 10** may need to be reduced by up to 50%. The proposed activities are considered to have the potential to cause dynamic loading in some structures (eg neighbouring commercial developments) and it may therefore be appropriate to reduce the transient values by 50%.

**Figure 2 Graph of Transient Vibration Guide Values for Cosmetic Damage**




In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for building types corresponding to Line 2 are reduced. Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard goes on to state that minor damage is possible at vibration magnitudes that are greater than twice those given in **Table 10**, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard and it is concluded that unless calculation indicates that the magnitude and number of load reversals are significant (in respect of the fatigue life of building materials) then the guide values in **Table 10** should not be reduced for fatigue considerations.

In order to assess the likelihood of cosmetic damage due to vibration, AS 2187 specifies that vibration measured should be undertaken at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) should be compared with the criteria curves presented in **Table 10**.

It is noteworthy that extra to the guide values nominated in **Table 10**, the standard states that:

> *"Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK."*

Also that:

> *"A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

#### 4.4.3.1 German Standard DIN 4150: Part 3-2016

For continuous long-term vibration or repetitive vibration with the potential to cause fatigue effects, DIN 4150 provides the following Peak Particle Velocity (PPV) values as safe limits,

below which even superficial cosmetic damage is not to be expected. The limits are shown in **Table 11**.

**Table 11 Cosmetic Damage – DIN 4150 Guideline Values for Short-term Vibration on Structures**

| Group | Type of Structure | Guideline Values Vibration Velocity (mm/s) | | | | |
|---|---|---|---|---|---|---|
| | | Foundation, All Direction at a Frequency of | | | Topmost Floor, Horizontal | Floor Slab, Vertical |
| | | 1 to 10 Hz | 10 to 50 Hz | 50 to 100 Hz | All Frequencies | All Frequencies |
| 1 | Buildings used for commercial purposes, industrial buildings and buildings of similar design | 20 | 20 to 40 | 40 to 50 | 40 | 20 |
| 2 | Residential buildings and buildings of similar design and/or occupancy | 5 | 5 to 15 | 15 to 20 | 15 | 20 |
| 3 | Structures that, because of their particular sensitivity to vibration, cannot be classified as Group 1 or 2 and are of great intrinsic value (eg heritage listed buildings) | 3 | 3 to 8 | 8 to 10 | 8 | 201 |

Note 1: It may be necessary to lower the relevant guideline value markedly to prevent minor damage.

#### 4.4.3.2 General Vibration Screening Criteria

The Transport for NSW (TfNSW) *Construction Noise and Vibration Strategy* elaborates on the vibration criteria in the Roads and Maritime Services (RMS, now TfNSW) *Construction Noise and Vibration Guideline* (CNVG) and specifies general vibration screening criteria based on BS 7385: Part 2 – 1993. It notes that for most construction activities involving intermittent vibration such as rock breakers, piling rigs, vibratory rollers, excavators and the like, vibration predominantly occurs at frequencies greater than 4 Hz and therefore specifies the following conservative vibration damage screening levels:

- Reinforced or heavy frame structures: 25 mm/s
- Unreinforced or light frame structures: 7.5 mm/s

At locations where the predicted and/or measured vibration levels are greater than shown above, a more detailed analysis of the building structure, vibration source, dominant frequency and dynamic characteristics of the structure would be required to determine the applicable safe vibration levels.

#### 4.4.3.3 Heritage

Heritage structures are also assessed against the above screening criteria as they should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound following an inspection. Where they are found to be unsound a 2.5 mm/s criterion can be applied in accordance with DIN 4150. One heritage item, St Bartholomew's Church, is located in the vicinity of the site, 180 m to the west, however, it is expected to be sufficiently distant from the site to be outside the minimum working distance for heritage items (ie 50 m for a large vibratory roller) and impacts are not considered likely.

### 4.4.4 Minimum Working Distances for Vibration Intensive Works

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are shown in **Table 12**. The minimum working distances are for both cosmetic damage (from BS 7385 and DIN 4150) and human comfort at residential receivers (from the NSW EPA Vibration Guideline. The minimum working distances are based on empirical data which suggests that where works are further from receivers than the quoted minimum distances then impacts are not considered likely.

**Table 12 Recommended Minimum Working Distances from Vibration Intensive Equipment**

| Plant Item | Rating/Description | Minimum Distance | | |
|---|---|---|---|---|
| | | Cosmetic Damage | | Human Response (NSW EPA Guideline) |
| | | Residential and Light Commercial (BS 7385) | Heritage Items (DIN 4150, Group 3) | |
| Vibratory Roller | <50 kN (1–2 tonne) | 5 m | 11 m | 15 m to 20 m |
| | <100 kN (2–4 tonne) | 6 m | 13 m | 20 m |
| | <200 kN (4–6 tonne) | 12 m | 25 m | 40 m |
| | <300 kN (7–13 tonne) | 15 m | 31 m | 100 m |
| | >300 kN (13–18 tonne) | 20 m | 40 m | 100 m |
| | >300 kN (>18 tonne) | 25 m | 50 m | 100 m |
| Small Hydraulic Hammer | 300 kg (5 to 12 t excavator) | 2 m | 5 m | 7 m |
| Medium Hydraulic Hammer | 900 kg (12 to 18 t excavator) | 7 m | 15 m | 23 m |
| Large Hydraulic Hammer | 1,600 kg (18 to 34 t excavator) | 22 m | 44 m | 73 m |
| Vibratory Pile Driver | Sheet piles | 2 m to 20 m | 5 m to 40 m | 20 m |
| Piling Rig – Bored | ≤ 800 mm | 2 m (nominal) | 5 m | 4 m |
| Jackhammer | Hand held | 1 m (nominal) | 3 m | 2 m |

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

# 5.0 Construction Noise and Vibration Assessment

## 5.1 Construction Activities

The SSDA NVIA presented construction noise predictions from a number of construction scenarios likely to occur on site. These construction scenarios are representative of a number of activities which will be required during the construction of the site.

The assessment used ‘realistic worst-case’ scenarios to determine the impacts from the noisiest 15-minute periods that are likely to occur for each work scenario, as required by the ICNG. The impacts represent construction noise levels without mitigation applied.

**Table 13** details the construction scenarios assessed in the SSDA NVIA together with a list of equipment likely to be used during those scenarios.

**Table 13 Construction Scenarios and Equipment**

| Scenario | Works Activity[1] | Equipment |
|---|---|---|
| W.01 | Vegetation clearing | Chainsaw, chipper, dozer, dump truck, excavator, front end loader, water truck |
| W.02 | Site Compounds | Flatbed truck, generator, light vehicles, franna crane, hand tools |
| W.03 | Earthworks and Retaining wall construction | Dozer, dump truck, excavators, front end loader, grader, vibratory roller, water truck, scraper, compactor |
| W.04 | Foundation works and Retaining wall construction | Piling - Bored, excavator, concrete truck, concrete pump, franna crane, truck |
| W.05 | Warehouse construction and fitout | Mobile crane, elevated work platform, flatbed truck, hand tools, franna crane |
| W.06 | Construction of roads and hardstands | Bitumen spray truck, line marking plant, paving machine, vibratory roller, concrete pump, concrete truck/agitator, concrete vibrator, mobile crane |
| W.07 | Intersection Works | Bitumen spray truck, line marking plant, paving machine, roller, concrete pump, concrete truck/agitator, concrete vibrator |

Note 1: Demolition activities assessed as part of the SSDA have already been completed and have not been considered further.

### 5.1.1 Hours of Construction

Construction activities for the proposal are expected to be undertaken during the following hours:

- 7:00 am to 6:00 pm, Mondays to Fridays
- 8:00 am to 1:00 pm on Saturdays
- At no time on Sundays or Public Holidays.

As detailed in Condition B20, works outside of the hours identified in Condition B19 may be undertaken in the following circumstances:

(a) works that are inaudible at the nearest sensitive receivers;

(b) works agreed to in writing by the Planning Secretary;

(c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or

(d) where it is required in an emergency to avoid the loss of lives, property or to prevent environmental harm.

## 5.2 Construction Noise Predictions

A summary of the predicted noise levels (without additional mitigation) at the nearest receivers for the various work activities is presented in **Table 15** and exceedances of the NMLs are shown in **Table 16**. Construction noise impacts have been assessed only for standard daytime construction hours. The predictions represent a realistic worst-case scenario where the equipment in each scenario is working concurrently and the nearest location to each

receiver. It is expected that noise levels would frequently be lower than the worst-case levels presented.

The assessment shows the predicted impacts based on the exceedance of the NMLs, as per the categories in **Table 14**.

**Table 14 Exceedance Bands and Impact Colouring**

| Exceedance of NML | Subjective Classification | Impact Colouring |
|---|---|---|
| No exceedance | Negligible | |
| 1 to 10 dB | Clearly audible | |
| 11 dB to 20 dB | Moderate intrusive | |
| >20 dB | Highly intrusive | |

## Table 15 Predicted Construction Noise Levels at Nearest Receivers

| Receiver | NCA | Receiver Type | NML | Predicted Noise Level - LAeq(15 minutes) (dBA) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Site Establishment & Compounds | | Intersection Works | Warehouse 1 | | | | Warehouse 2 | | | | Warehouse 3-4 | | | | Warehouse 5 | | | |
| | | | | W.01 | W.02 | W.07 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 |
| R01 | NCA01 | Residential | 58 | 67 | 46 | 69 | 65 | 60 | 59 | 64 | 59 | 54 | 53 | 58 | 61 | 56 | 54 | 60 | 37 | 32 | 30 | 36 |
| R02 | | Residential | 58 | 68 | 43 | 65 | 63 | 57 | 54 | 61 | 61 | 54 | 52 | 58 | 66 | 61 | 58 | 65 | 55 | 50 | 49 | 54 |
| R03 | | Residential | 58 | 69 | 49 | 60 | 61 | 55 | 52 | 59 | 60 | 52 | 51 | 56 | 67 | 62 | 60 | 66 | 53 | 48 | 46 | 52 |
| R04 | | Residential | 58 | 71 | 52 | 59 | 59 | 52 | 50 | 56 | 59 | 51 | 50 | 55 | 69 | 64 | 62 | 68 | 59 | 54 | 52 | 58 |
| R05 | | Residential | 58 | 70 | 49 | 59 | 54 | 46 | 45 | 50 | 55 | 47 | 46 | 51 | 68 | 63 | 61 | 67 | 65 | 60 | 56 | 64 |
| R11 | | Residential | 58 | 64 | 43 | 66 | 65 | 57 | 56 | 61 | 63 | 55 | 54 | 59 | 62 | 57 | 55 | 61 | 51 | 46 | 45 | 50 |
| R06 | NCA02 | Residential | 57 | 67 | 38 | 65 | 52 | 44 | 43 | 48 | 51 | 44 | 42 | 48 | 57 | 52 | 50 | 56 | 65 | 60 | 59 | 64 |
| R07 | | Residential | 57 | 68 | 36 | 67 | 50 | 42 | 41 | 46 | 50 | 41 | 41 | 45 | 55 | 50 | 49 | 54 | 66 | 61 | 58 | 65 |
| R08 | | Residential | 57 | 66 | 34 | 62 | 49 | 42 | 40 | 46 | 49 | 41 | 40 | 45 | 53 | 48 | 46 | 52 | 64 | 59 | 58 | 63 |
| R09 | NCA03 | Residential | 59 | 60 | 33 | 53 | 47 | 39 | 38 | 43 | 49 | 41 | 40 | 45 | 50 | 45 | 43 | 49 | 58 | 53 | 50 | 57 |
| R10 | NCA04 | Residential | 65 | 60 | 35 | 52 | 56 | 48 | 47 | 52 | 60 | 53 | 51 | 57 | 54 | 49 | 47 | 53 | 48 | 43 | 42 | 47 |
| R12 | | Hotel | 70 | 62 | 37 | 55 | 58 | 51 | 49 | 55 | 62 | 55 | 53 | 59 | 58 | 53 | 51 | 57 | 50 | 45 | 44 | 49 |
| R13 | NCA06 | Place of Worship | 55 | 63 | 30 | 60 | 47 | 39 | 38 | 43 | 47 | 39 | 38 | 43 | 50 | 45 | 44 | 49 | 61 | 56 | 55 | 60 |
| R14 | - | Industrial | 75 | 77 | 55 | 67 | 69 | 63 | 60 | 67 | 77 | 70 | 68 | 74 | 59 | 54 | 53 | 58 | 49 | 44 | 42 | 48 |
| R15 | - | Commercial | 70 | 68 | 40 | 59 | 53 | 46 | 44 | 50 | 55 | 47 | 46 | 51 | 65 | 60 | 57 | 64 | 66 | 61 | 56 | 65 |

## Table 16 Predicted Exceedance at Nearest Receivers

| Receiver | NCA | Receiver Type | NML | Predicted Exceedance - (dBA) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Site Establishment & Compounds | | Intersection Works | Warehouse 1 | | | | Warehouse 2 | | | | Warehouse 3-4 | | | | Warehouse 5 | | | |
| | | | | W.01 | W.02 | W.07 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 | W.03 | W.04 | W.05 | W.06 |
| R01 | NCA01 | Residential | 58 | 9 | - | 11 | 10 | 2 | 1 | 6 | 4 | - | - | - | 3 | - | - | 2 | - | - | - | - |
| R02 | | Residential | 58 | 10 | - | 7 | 5 | - | - | 3 | 3 | - | - | - | 8 | 3 | - | 7 | - | - | - | - |
| R03 | | Residential | 58 | 11 | - | 2 | 3 | - | - | 1 | 2 | - | - | - | 9 | 4 | 2 | 8 | - | - | - | - |
| R04 | | Residential | 58 | 13 | - | 1 | 1 | - | - | - | 1 | - | - | - | 11 | 6 | 4 | 10 | 3 | - | - | - |
| R05 | | Residential | 58 | 12 | - | 1 | - | - | - | - | - | - | - | - | 10 | 5 | 3 | 9 | 9 | 2 | - | 6 |
| R11 | | Residential | 58 | 6 | - | 8 | 7 | - | - | 3 | 5 | - | - | 1 | 4 | - | - | 3 | - | - | - | - |
| R06 | NCA02 | Residential | 57 | 10 | - | 8 | - | - | - | - | - | - | - | - | - | - | - | - | 10 | 3 | 2 | 7 |
| R07 | | Residential | 57 | 11 | - | 10 | - | - | - | - | - | - | - | - | - | - | - | - | 11 | 4 | 1 | 8 |
| R08 | | Residential | 57 | 9 | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | 9 | 2 | 1 | 6 |
| R09 | NCA03 | Residential | 59 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - |
| R10 | NCA04 | Residential | 65 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| R12 | | Hotel | 70 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| R13 | NCA06 | Place of Worship | 55 | 8 | - | 5 | - | - | - | - | - | - | - | - | - | - | - | - | 8 | 1 | - | 5 |
| R14 | - | Industrial | 75 | 2 | - | - | - | - | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - |
| R15 | - | Commercial | 70 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

As detailed in the SSDA NVIA and shown in **Table 16** above, the construction noise impacts for the scenarios in **Table 13**, Minor exceedances of the NMLs are predicted at receivers in NCA01 and NCA02 during most construction works when noise intensive activities are being completed close to the site boundaries, relative to each receiver.

The highest impacts are expected during work that uses noise intensive equipment such as chippers and chainsaws during clearing works (W.01 – Vegetation Clearing), where exceedances of up to 13 dB in NCA01 (R04) and 11 dB in NCA02 (R07), are predicted. These items of equipment are, however, expected to only be required infrequently, with noise levels and corresponding impacts being much lower when they are not in use. Moderate exceedances are also predicted at these receivers during bult earthworks when work is being completed close to the receivers. When work is in central areas of the site, or when less noise intensive equipment is being used, noise levels are predicted to be lower due to increased separation distance.

A minor exceedance of up to 1 dB is predicted at the nearest residential receiver (R09) to the south during the noisiest works (W.01 – Vegetation Clearing and W.02 – Earthworks).

Construction noise levels are predicted to exceed the NMLs by up to 8 dB at St Bartholomew's Church, (R13) however this is only predicted to occur when construction works associated with Warehouse 5 to the east are undertaken.

Best practise noise management measures will be undertaken for all construction works. Additional feasible and reasonable noise mitigation and management measures will be applied for works where an exceedance of the NMLs is identified, with the aim of achieving the applicable NMLs.

Mitigation and management measures are outlined in **Section 6.0**.

## 5.3 Construction Vibration Impacts

Vibration intensive items of plant proposed for use during the construction of the development would include piling rigs and vibratory rollers. These items of equipment are proposed to be used during various stages of works across the project.

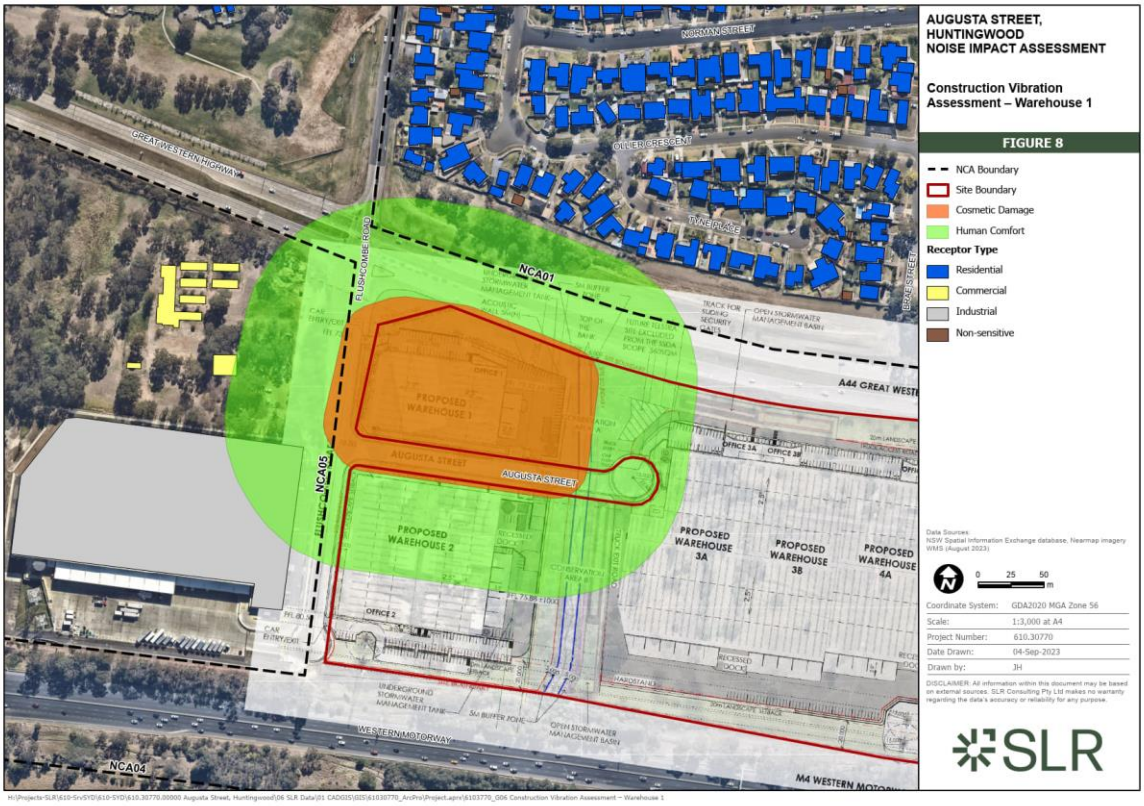
During construction vibratory rollers and piling have the potential to be operated within the recommended minimum working distances of the nearest industrial receivers to the west, which are located around 35 m from the nearest point of works and the closest residential receivers to the north, located around 65 m from the nearest point of works.

The separation distance from these buildings will be maximised, where possible, and all feasible and reasonable mitigation and management measures undertaken. Mitigation and management measures are outlined in **Section 6.0**.

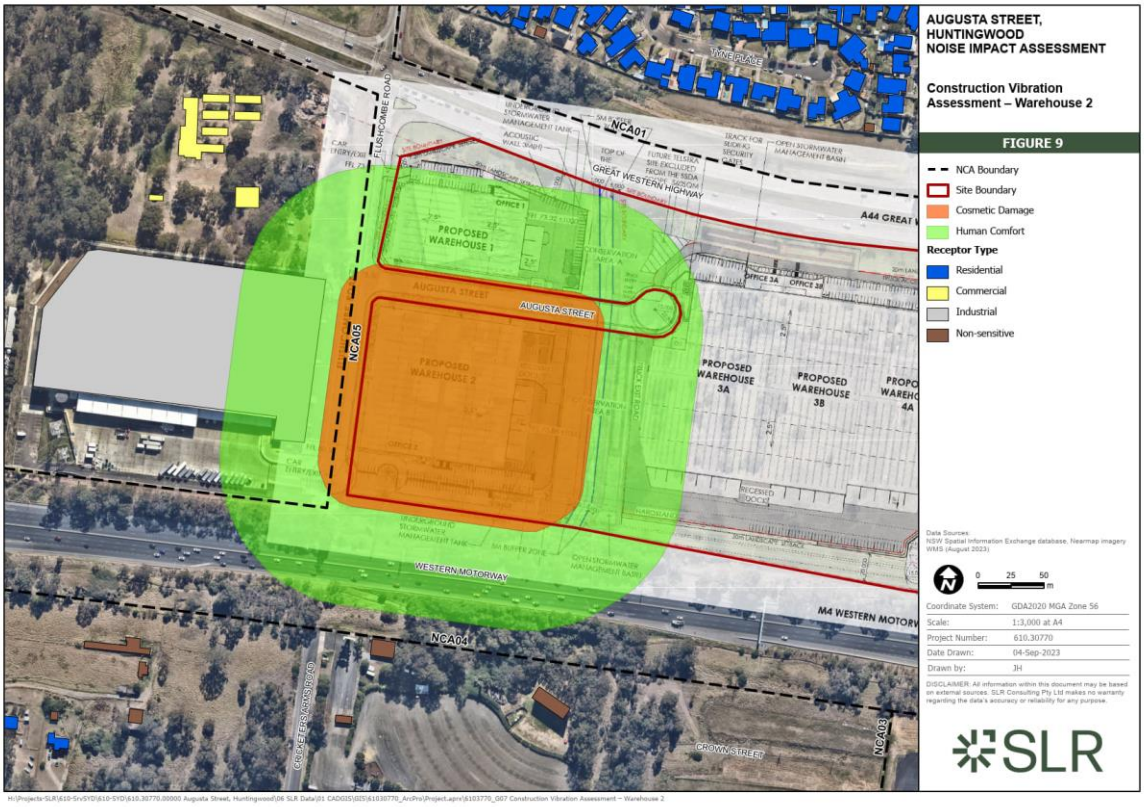
Buildings within the minimum working distances are shown in **Figure 3** to **Figure 6**. These figures assume that vibration intensive works are occurring at each of the site boundaries.

Vibration at the nearest receivers is likely to be perceptible at times during the works when vibration intensive activities are being carried out nearby.

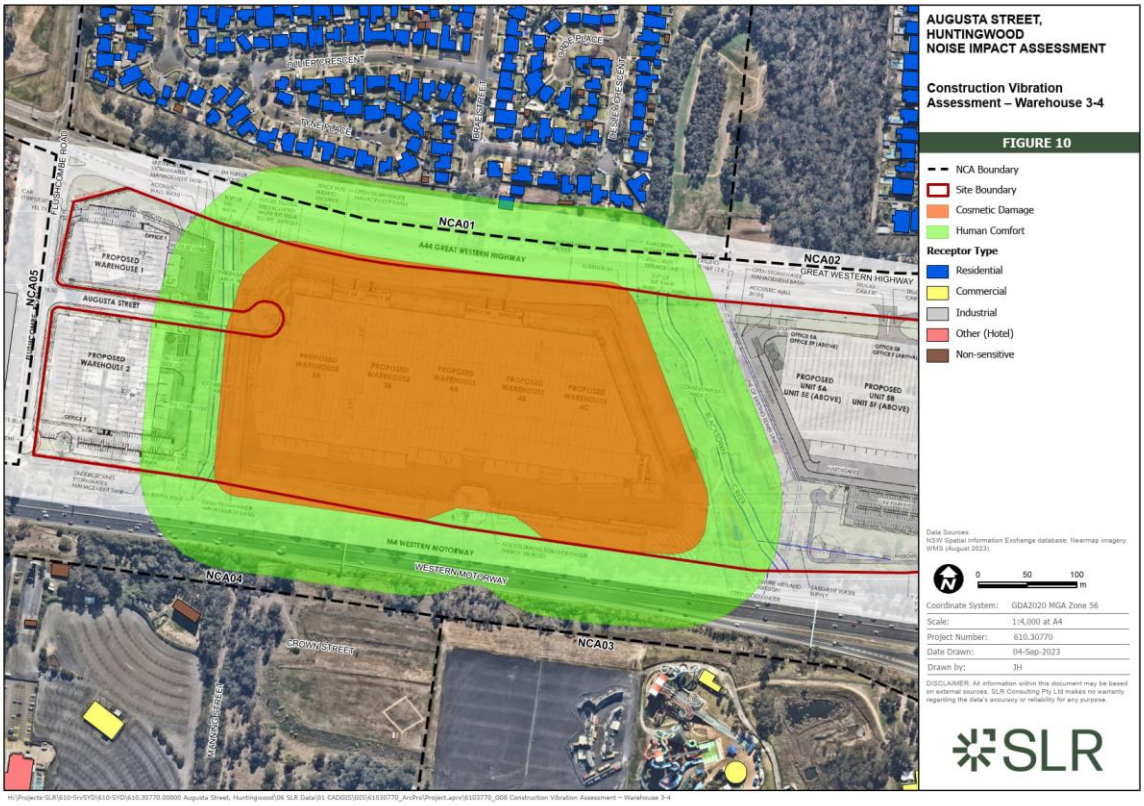
## Figure 3 Construction Vibration Assessment – Building 1



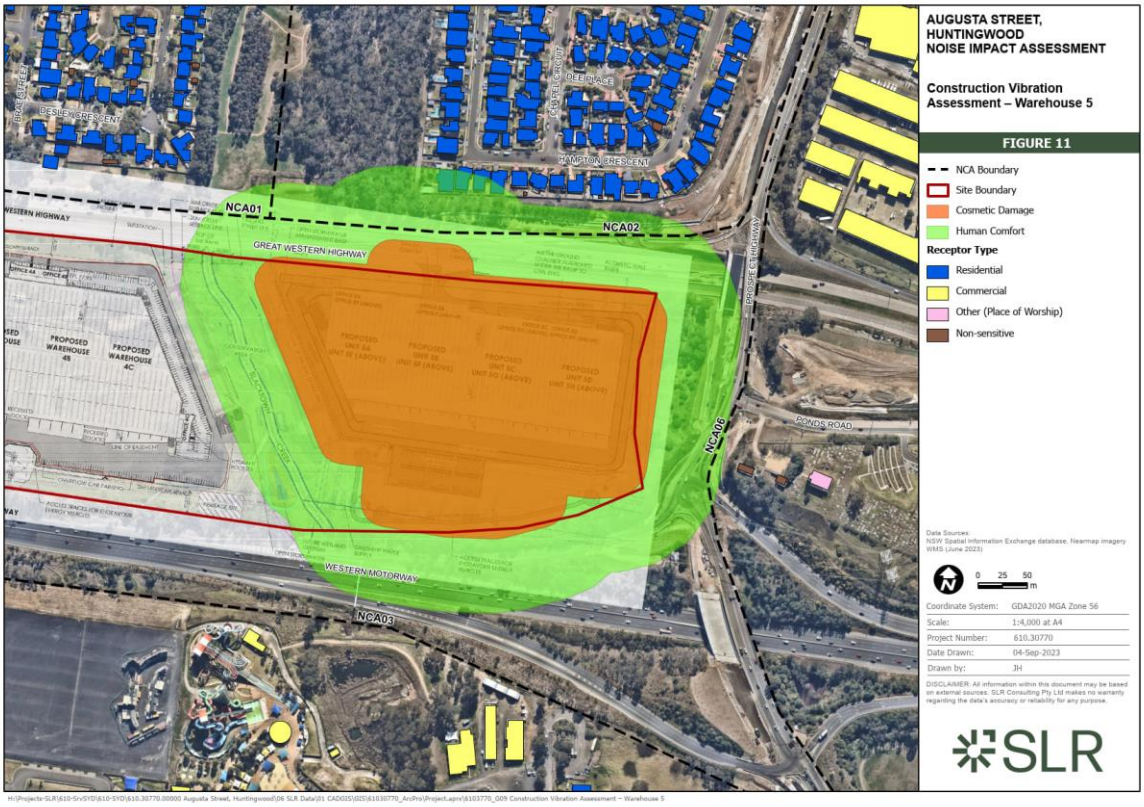

## Figure 4 Construction Vibration Assessment – Building 2



## Figure 5 Construction Vibration Assessment – Building 3-4




## Figure 6 Construction Vibration Assessment – Building 5



# 6.0 Mitigation and Management Measures

In order to minimise noise impacts during works, the construction contractor will take all reasonable and feasible measures to mitigate noise effects. Impacts from the works will be minimised and managed in accordance with the procedures detailed below in **Table 17**.

**Table 17 Environmental Management Controls for Construction Noise and Vibration**

| Measure | Person Responsible | Timing / Frequency | Reference / Notes |
|---|---|---|---|
| **Project Planning** | | | |
| Use quieter and less vibration emitting construction methods where feasible and reasonable. | Project Manager | Ongoing | Best practice |
| Works will be completed during standard daytime construction hours outlined in **Section 5.1.1**. | | | |
| Truck routes to site will be limited to major roads. | | | |
| **Scheduling** | | | |
| Respite offers should be considered where high noise and vibration generating activities are near receivers. As a guide, work should be carried out in blocks that do not exceed three hours, with a minimum respite period of one hour between each block. | Project Manager/ Communications and Community Liaison Representative | Ongoing | Best practice |
| Consult with the affected community to determine the need for respite periods. | | | |
| **Site Layout** | | | |
| Compounds and worksites will be designed to promote one-way traffic and minimise the need for vehicle reversing. | Project Manager | Ongoing | Best practice |
| Where practicable, work compounds, parking areas, and equipment and material stockpiles will be positioned away from noise-sensitive locations and take advantage of existing screening from local topography. | | | |
| Equipment that is noisy will be started away from sensitive receivers | | | |
| **Training** | | | |
| Training will be provided to all personnel on noise and vibration requirements for the project. Inductions and toolbox talks to be used to inform personnel of the location and sensitivity of surrounding receivers. | Project Manager | Ongoing | Best practice |
| **Plant and Equipment Source Mitigation** | | | |
| All plant and equipment must be maintained in a proper and efficient condition, operated in a proper and efficient manner, and feature standard noise amelioration measures where applicable. | Project Manager | Ongoing | Best practice |
| Where practicable, tonal reversing alarms (beepers) will be replaced with non-tonal alarms (squawkers) on all equipment in use (subject to occupational health and safety requirements). | | | |

| Measure | Person Responsible | Timing / Frequency | Reference / Notes |
|---|---|---|---|
| Noisy equipment will be sited behind structures that act as barriers, or at the greatest distance from the noise-sensitive area. Equipment will be oriented so that noise emissions are directed away from any sensitive areas, where possible. | | | |
| Noise generating equipment will be regularly checked and effectively maintained, including checking of hatches/enclosures regularly to ensure that seals are in good condition and doors close properly against seals. | | | |
| Dropping materials from a height will be avoided. | | | |
| Loading and unloading will be carried out away from noise sensitive areas, where practicable. | | | |
| Trucks will not queue outside residential properties. Truck drivers will avoid compression braking as far as practicable. | | | |
| Truck movements will be kept to a minimum, i.e. trucks are fully loaded on each trip. | | | |
| **Screening** | | | |
| Where possible, install purpose-built screening or enclosures will be used around long-term fixed plant that has the potential to impact nearby receivers | Project Manager | Ongoing | Best practice |
| The layout of the site will take advantage of existing screening from local topography, where possible. Site huts, maintenance sheds and/or containers will be positioned between noisy equipment and the affected receivers. | | | |
| **Community Consultation** | | | |
| Notifications will be provided to the affected community where high impacts are anticipated or where out of hours works are required. Notification will be a minimum of 24 hours. | Communications and Community Liaison Representative | Ongoing | Best practice |
| Where complaints are received, work practices will be reviewed and feasible and reasonable practices implemented to minimise any further impacts. Refer to **Section 6.2**. | | | |
| **Monitoring** | | | |
| Noise and/or vibration monitoring will be conducted (as appropriate) in response to any complaints received to verify that levels are not substantially above the predicted levels. Refer to **Section 6.1** for full details of monitoring requirements. | Environmental Coordinator | Ongoing | Best practice |
| **Vibration** | | | |
| If vibration generating works are required within the minimum cosmetic damage working distances and considered likely to exceed the criteria: | Environmental Coordinator | Ongoing | Best practice |

| Measure | Person Responsible | Timing / Frequency | Reference / Notes |
|---|---|---|---|
| • Different construction methods with lower source vibration levels will be investigated and implemented, where feasible.<br>• Attended vibration measurements will be undertaken at the start of the works to determine actual vibration levels of the item. Works will cease if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria. | | | |

The mitigation and management measures detailed in **Table 17** are considered to be appropriate to minimise impacts on the potentially affected receivers.

These measures will be implemented and refined as informed by the results of monitoring and ongoing community consultation.

Specific consultation with the potentially affected receivers to determine suitable respite periods and management measures will be undertaken, where deemed necessary. This will occur during the planning stage of high-noise generating works once specific details of the works have been identified, such as the location of the works, activities proposed to be undertaken and required equipment.

## 6.1 Monitoring

### 6.1.1 Construction Noise Monitoring

Noise monitoring may be required in response to any formal complaints received to verify that levels are not substantially above the predicted levels. Should monitoring be required in the case of receipt of a complaint regarding noise or vibration, monitoring will be conducted by suitably qualified specialists. The location and extent of attended monitoring will be determined in consultation with project staff and would be dependent on the activities taking place.

Noise monitoring will take place during the expected noisiest construction periods and be representative/indicative of the impacts at the potentially affected sensitive receivers. A noise monitoring report will be prepared after each attended monitoring survey.

All items of acoustic instrumentation utilised will be designed to comply with AS/NZS *IEC 61672.1-2004 Electroacoustics – Sound level meters* (AS IEC 61672) and carry current calibration certificates.

### 6.1.2 Construction Vibration Monitoring

#### 6.1.2.1 Human Comfort Monitoring

Attended vibration monitoring should be conducted in response to complaints where vibration intensive works are undertaken within the minimum working distances for human comfort presented in **Table 12**. Attended vibration monitoring will be conducted by an Acoustical Consultant, to ensure acceptable levels of vibration are satisfied. This monitoring will provide direct feedback to the operators in order to allow appropriate modification of construction techniques.

#### 6.1.2.2 Structural Damage Monitoring

As detailed in the SSDA NVIA, all sensitive receiver buildings are sufficiently distant to be outside of the cosmetic damage minimum working distance for vibration intensive equipment.

Therefore, cosmetic damage impacts are not considered likely. As a result, vibration monitoring should be carried out in response to complaints. This monitoring will provide direct feedback to the operators in order to allow appropriate modification of construction techniques.

All items of vibration instrumentation will be designed to comply with applicable guidelines and carry current calibration certificates.

### 6.1.3 Monitoring Reports

Noise and/or vibration monitoring reports will be provided to the relevant regulatory authorities after review, unless otherwise agreed by the relevant regulatory authorities. Monitoring reports would include the following details, as a minimum:

- Noise/vibration monitoring/measurement locations
- Date, time and length of noise monitoring/measurements
- Weather conditions during the measurements
- Name and position of personnel undertaking measurements
- Serial number of monitoring/measurement equipment
- Construction activities being undertaken during measurements
- Locations of construction equipment and distance from monitoring location
- Measured $L_{Aeq}$ and $L_{Amax}$ noise levels during construction works (for each activity) along with a comparison to the predicted noise levels and notes identifying the noise levels from individual construction sources should be included (noise monitoring only)
- Measured $L_{A90}$ background noise level in absence of the construction works along with notes on the noise sources driving the levels (noise monitoring only)
- Measured vibration levels during construction works (for each activity) along with a comparison to the relevant vibration criteria together with notes identifying the principal vibration sources (vibration monitoring only)
- Measured background vibration level in absence of the construction works (vibration monitoring only)
- Operator observations noting any extraneous noise/vibration sources or other points of relevance.

## 6.2 Complaints Management

A detailed description of the complaints handling procedure is outlined in Section 2.3 of the CEMP. Complaints related to noise and vibration are to be recorded in the Development complaints register and are to include the following details:

- Date and time of complaint
- Method by which complaint was made
- Nature of complaint
- Details of and initial response to complaint
- Potential causes of the complaint
- Action taken and any follow up actions
- Weather conditions corresponding to the time of the complaint.

All complaint details are to be captured and logged in a stakeholder contact register. Where required, noise/vibration monitoring will be undertaken as per **Section 6.1**.

## 6.3 Community Consultation

As required by Condition B22(e), prior to the commencement of works, the Applicant must prepare a CNVMP in consultation with owners of adjoining residential properties to develop strategies to manage high noise generating works, as required by Condition B22(d).

As detailed in **Section 5.2**, no high exceedances of the NMLs during daytime standard hours are predicted at any of the surrounding receivers during any of the works and no receivers are predicted to be Highly Noise Affected (>75 dBA). As such, it is considered that there are no high noise generating works near sensitive receivers and consent conditions B22(d) and (e) do not require specific measures to be implemented. Regardless, community notification has been undertaken in accordance with the Community Communication and Complaints Handling Strategy (refer to the CEMP).

### 6.3.1 Consultation Undertaken to Date

The Consultation activities undertaken to date are summarised below:

- A newsletter was distributed to 441 properties on 5 June 2023 which outlined key features of the proposal and invited feedback. It included an email, phone number and website managed by Urbis Engagement to answer questions and collect feedback. The fact sheet also included an invitation to attend the community information session.
- On 10 and 17 June 2022, approximately 84 residences were door knocked to:
    - Provide a fact sheet
    - Invite them to the community information session
    - Answer questions, and
    - Collect initial feedback.
    - The door knock included a focus on talking through the potential impacts of the proposal in detail. This involved explaining the potential noise and traffic impacts. Explanation of noise impacts included discussing the approach to design with loading zones located away from residential neighbours, facing the M4 Motorway. Newsletters and a “Sorry we missed you” card were left in the letter boxes of those residents who were not home. These included information on how to contact the Urbis Engagement team.
- A one-hour online information session was held on Wednesday 22 June at 5pm, online via Zoom. The community was notified about the session via the door knock and the newsletter. Attendees were presented with information about the project, and then given the opportunity to ask questions of the project team. In total, three residents attended the online information session.
- A project website was established and provided information about the proposed development, the planning process and contact details for enquires.
- A letter was distributed to 441 residents on 9 May 2023 providing an update on the project regarding the new vehicle access pathways resulting from the Prospect Highway upgrades.

## 6.4 Contingency Plan

If inspections, monitoring and/or auditing indicate that the construction noise and vibration management measures listed in this CNVMP are not effective in managing environmental impacts from the Development, the management measures detailed in **Table 18** are to be implemented.

In the event of an incident, response will be carried out as detailed below. All Condition Amber and Condition Red occurrences will be recorded in the Construction Contractor's Monthly Report to the Principal and discussed during the toolbox talks.

The following events constitute an incident in terms of noise and vibration:

- Trigger of Condition Red for noise impacts during the standard daytime construction hours
- Any works occurring outside the standard daytime construction hours, where those works have not been agreed in writing by the relevant regulatory authority
- Trigger of Condition Red for vibration impacts at sensitive receivers.

**Table 18 Contingency Management Plan**

| Key Element | Trigger / Response | Condition Green | Condition Amber | Condition Red |
|---|---|---|---|---|
| Noise impacts at sensitive receiver locations | Trigger | Noise levels do not exceed applicable NMLs | Noise levels exceed applicable NMLs | Noise levels exceed Highly Noise Affected criteria (75 dBA for residential receivers) |
| | Response | On-going best practice management measures to minimise noise emissions | Undertake all feasible and reasonable mitigation and management measures to minimise noise impacts (aiming to achieve NMLs) | Works exceeding the Highly Noise Affected criteria will be managed in accordance with the strategies for high-noise generating works determined through community consultation. |
| Vibration impacts at sensitive receiver locations | Trigger | Vibration intensive works undertaken outside minimum working distance for the specific equipment in use | Vibration intensive works undertaken within minimum working distance for the specific equipment in use | Vibration levels exceed applicable vibration limits |
| | Response | On-going best practice management measures to minimise vibration emissions | Undertake vibration monitoring for the duration of the works to confirm vibration levels. | Stop work.<br>Undertake all feasible and reasonable mitigation and management measures to ensure vibration levels are below applicable limits.<br>If vibration levels cannot be kept below applicable limits then a different construction method or equipment must be utilised. |

## 6.5 Internal Audits

Environmental auditing is described in Section 5.3 of the CEMP. Audits would involve a review of all environmental documents, records and reports to verify compliance with the CEMP (and this CNVMP) to satisfy Condition C14.

## 6.6 Roles and Responsibilities

The key responsibilities specifically for noise and vibration management are as follows:

### 6.6.1 Contractor's Project Manager

- Ensuring appropriate resources are available for the implementation of this CNVMP
- Assessing data from inspections and providing project-wide advice to ensure a consistent approach and outcomes are achieved
- Providing necessary training for project personnel to cover noise and vibration management
- Reviewing and update of this CNVMP, where necessary
- Commissioning suitably qualified consultants to complete noise and vibration monitoring. Ensuring environmental coordinators appropriately undertake attended noise and vibration measurements required by this CNVMP
- Assessing and (as required) mitigating risks of high noise and vibration levels before commencing works and ensuring that the appropriate controls are implemented
- Ceasing works in the event of excessive noise and vibration generation in the event that a noise or vibration complaint is received, implementing the procedure outlined in **Section 6.2**.

### 6.6.2 Environmental Coordinator

- Coordinating noise and/or vibration monitoring program, where required
- Review control measures in accordance with the CNVMP
- Identifying and reporting any high or non-compliant noise and vibration emissions.

### 6.6.3 All Workers on Site

- Observing any noise and vibration emission control instructions and procedures that apply to their work
- Taking action to prevent or minimise noise and vibration emission incidents
- Identifying and reporting noise and vibration emission incidents.

# 7.0 Review and Improvement of Noise Management Plan

This CNVMP is to be reviewed in accordance with Section 5.8 of the CEMP. The Development will bi-annually review the adequacy of the environmental management measures within this CEMP and sub-plans (including this CNVMP) as well as the effectiveness of their implementation to determine whether they are still applicable to the activities being carried out on site. This review is to be undertaken by the Environmental Manager in consultation with the Development Manager and LOGOS Representative. This CNVMP should be updated in the following circumstances:

- Significant changes to the equipment, machinery and plant operated within the site
- Where it is identified via monitoring that the performance of the project is not meeting the objectives of the CNVMP

Condition C8 also states that all strategies, plans and programs required under the SSD 36138263 Development Consent would be reviewed and the Planning Secretary notified of the review within three months of:

- the submission of an incident report under Condition C10;
- the approval of any modification of the conditions of this consent; or
- the issue of a direction of the Planning Secretary under Condition A2(b) which requires a review.

As per Condition C9, where documents are revised under the above reviews, the revised documents would be sent to the Planning Secretary for approval within six weeks of the review.

All employees and contractors are to be informed of any revisions to the CNVMP during toolbox talks. The most recent version of the CNVMP as approved by the Planning Secretary, will be implemented for the duration of construction works.

# Appendix A Acoustic Terminology

## Construction Noise and Vibration Management Plan

**Augusta Street – Warehouse and Distribution Centre**

**The Trustee for Huntingwood Property Trust**

SLR Project No.: 610.031926.00001

28 November 2024

## Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is $2 \times 10^{-5}$ Pa.

## 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

| Sound Pressure Level (dBA) | Typical Source | Subjective Evaluation |
|---|---|---|
| 130 | Threshold of pain | Intolerable |
| 120 | Heavy rock concert | Extremely noisy |
| 110 | Grinding on steel | |
| 100 | Loud car horn at 3 m | Very noisy |
| 90 | Construction site with pneumatic hammering | |
| 80 | Kerbside of busy street | Loud |
| 70 | Loud radio or television | |
| 60 | Department store | Moderate to quiet |
| 50 | General Office | |
| 40 | Inside private office | Quiet to very quiet |
| 30 | Inside bedroom | |
| 20 | Recording studio | Almost silent |

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

## Sound Power Level

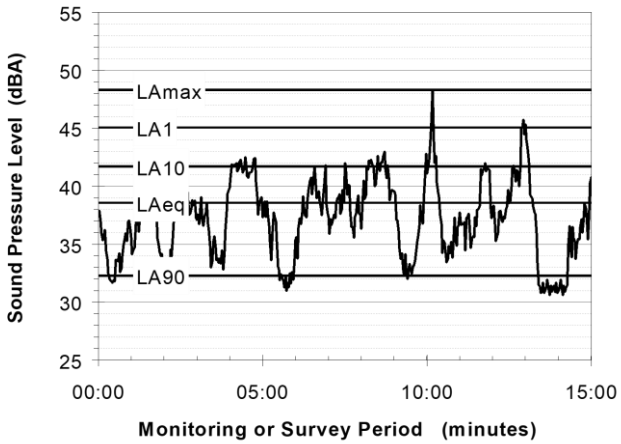
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit $10^{-12}$ W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

## Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels $L_{AN}$, where $L_{AN}$ is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the $L_{A1}$ is the noise level exceeded for 1% of the time, $L_{A10}$ the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.




Of particular relevance, are:

$L_{A1}$ The noise level exceeded for 1% of the 15 minute interval.

$L_{A10}$ The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

$L_{A90}$ The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

$L_{Aeq}$ The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

## Frequency Analysis

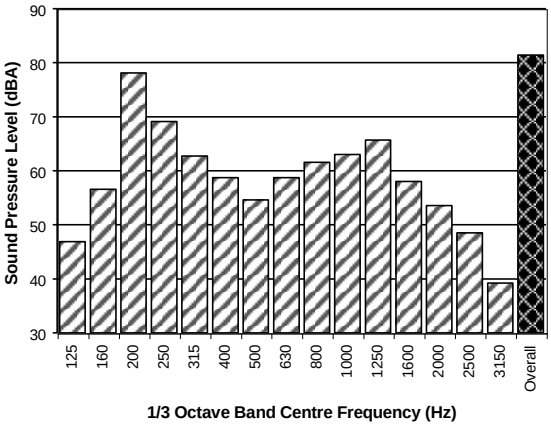
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.




## Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

## Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level ($10^{-9}$ m/s). Care is required in this regard, as other reference levels may be used.

## Human Perception of Vibration

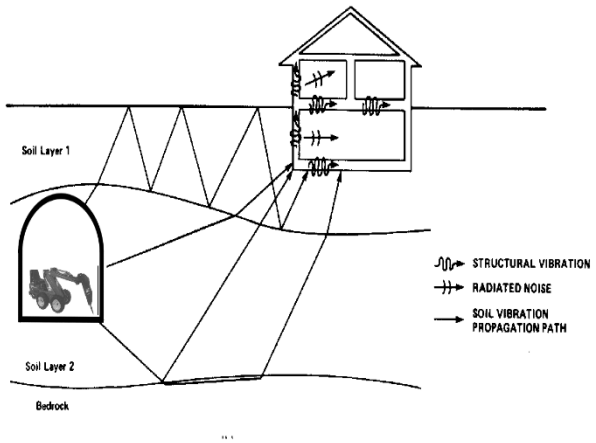
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

## Ground-borne Noise, Structure-borne Noise and Regenerated Noise

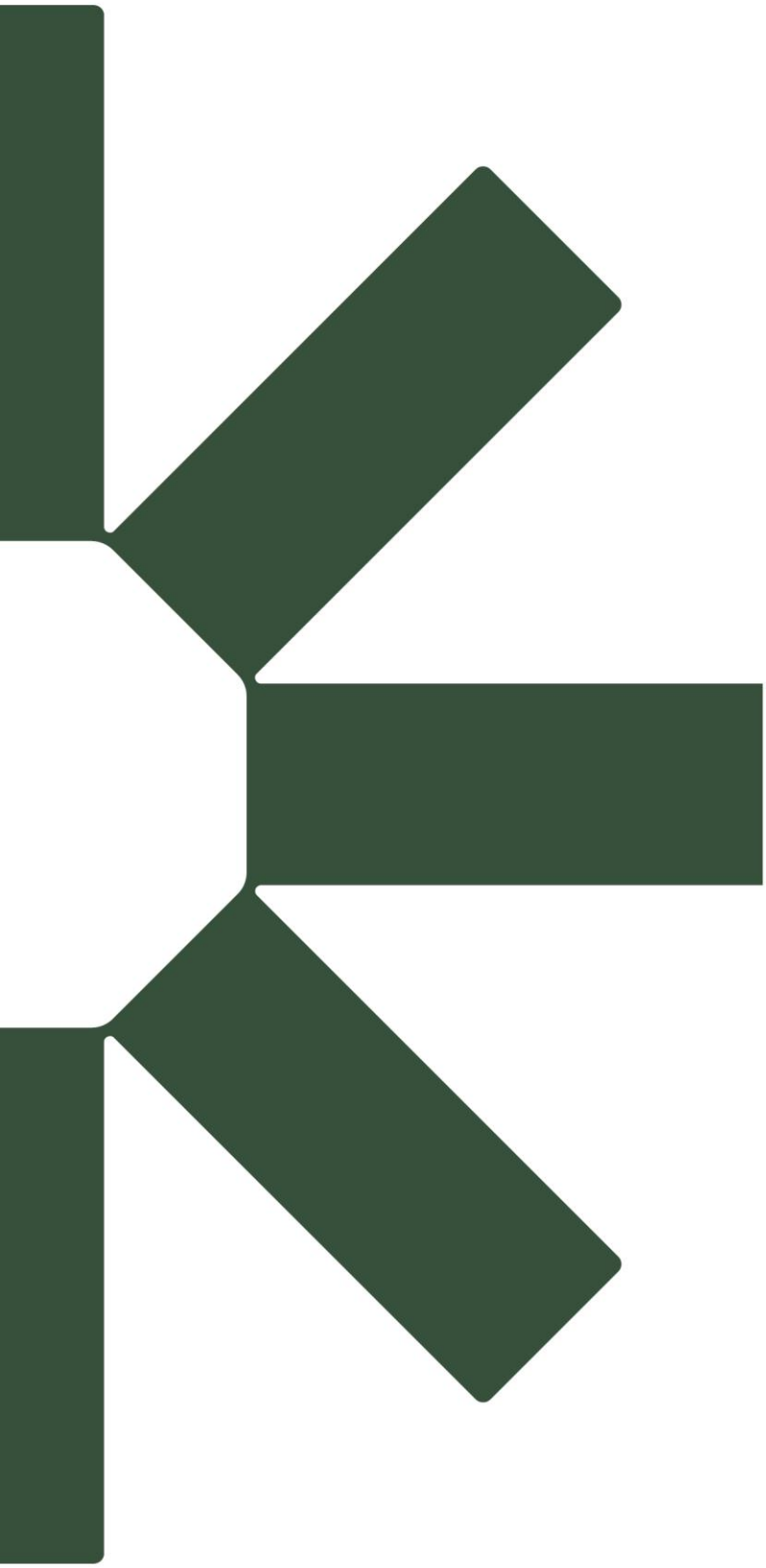
Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.




The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.



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