



31st January 2023

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RE: Vibration Monitoring – Coral Sea Park, Maroubra NSW

1 Introduction

Sydney Environmental Group (SEG) have been engaged by Randwick City Council (hereafter referred to as ‘the client’), to advise the client on vibration generating activities undertaken during the Coral Sea Park Synthetic Sports Field Upgrade Project, located at Coral Sea Park, Maroubra NSW (hereafter referred to as the ‘site’).

SEG have been advised by the client that the project involves the redevelopment of a portion of Coral Sea Park into a synthetic turf sporting field. As part of the scope of works, the client will utilise vibratory rollers to compact soil materials.

Following the receipt of concerns lodged by a neighbouring resident with regard to vibration generated by the site, SEG was engaged to conduct on-site to assess ground-borne vibration levels at from the site boundary.

Considerations into vibration impacts have been made using the NSW Department of Environment and Conservation’s Assessing Vibration: a technical guideline (AVTG 2006), British Standard BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2. (BS), and German Standard DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures (DIN). SEG note that there are no relevant Australian Standards for vibration.

2 Sampling Methodology

SEG installed three (3) ‘Profound Vibra’ vibration monitors fitted with tri-axis geophones on the 23rd of January 2023 along the western site boundary along Chester Avenue. The siting of monitors was selected to address particular resident concerns. Monitors were mounted to solid fixtures affixed to the ground. Refer to **Figure 1** for monitor locations.

Mounting of the monitors was undertaken in accordance with DIN 45669-2 Measurement of vibration emission – Part 2: Measuring method June 2005. Geophones were affixed using the supplied mounting bracket and screws to solid structures in contact with the ground. The location of monitors is provided in **Figure 1**.

SE note that generally vibration monitors must be affixed to the structure requiring monitoring. In this case, monitors were unable to be affixed to nearby residential structures. As there is currently no easily agreed upon calculation to accurately determine vibration attenuation through ground over short distances, all results associated with the vibration monitoring are considered to be conservative, in that results are significantly higher than if vibration had been measured at the residential receptor as is industry practice.

3 Construction Vibration Guidelines

The effects of vibration on buildings can be divided into the following main assessment categories:

- Those in which the occupants or users of the building are inconvenienced or possibly disturbed (‘tactile vibration’);
- Those where a building’s contents may be affected (for example, the operation of vibration sensitive equipment such as microscopes in hospitals); and
- Vibration affecting the buildings and structures in terms of their susceptibility to damage (‘structural damage’).

3.1 Vibration Causing Equipment

Based on an assessment of site activities, SEG considers the highest impact vibratory activities on-site will be caused by the use of vibratory rollers for compaction. **Table 1** details minimum recommended working distances for vibratory rollers.

Table 1 Minimum recommended working distances

Plant Item	Rating / Description	Recommended Minimum Working Distance (m)	
		Cosmetic Damage	Human Comfort
Vibratory Roller	< 50 kN (1 – 2 tonnes)	5	15 – 20
	< 100 kN (2 – 4 tonnes)	6	20
	< 200 kN (4 – 6 tonnes)	12	40
	< 300 kN (7 – 13 tonnes)	15	100
	> 300 kN (> 13 tonnes)	20 +	100 +

Notes: Working distances listed are approximate and guidance values only.

3.2 Human Comfort Vibration

The Department of Environment and Conservation’s (DEC) Assessing Vibration: a technical guideline (2006) provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV) rather than a continuous vibration level. The VDV is dependent upon the level and duration of the vibration event, as well as the number of events occurring during the daytime or night-time period. SEG note that as vibration monitors could not be mounted to receptors, vibration dose values could not be measured or calculated and therefore comparison with guideline values was not considered appropriate.

3.3 Effects on Building Contents

People can perceive floor vibration at levels well below those likely to cause damage to building contents or affect the operation of typical equipment found in most buildings that is not particularly vibration sensitive. For most receivers, the controlling vibration criterion is the human comfort criterion, and it is therefore not normally required to set separate criteria in relation to the effect of construction vibration on typical building contents. Where appropriate, objectives for the satisfactory operation of vibration sensitive critical instruments or manufacturing processes should be sourced from manufacturer’s data and/or other published objectives.

3.4 Structural Damage Vibration

Structural damage vibration limits are based on Australian Standard AS 2187: Part 2-2006 Explosives - Storage and Use - Part 2: Use of Explosives and British Standard BS 7385 Part 2-1993 Evaluation and measurement for vibration in buildings Part 2. These standards provide frequency-dependent vibration limits related to cosmetic damage, noting that cosmetic damage is very minor in nature, is readily repairable and does not affect the structural integrity of the building.

The recommended vibration limits from BS 7385 for transient vibration for minimal risk of cosmetic damage to residential and industrial buildings are shown in **Table 2**. The vibration guide values are for the base of the building. SEG note that no vibration monitors are affixed directly to residential structures and as such, no direct comparison can be made between results obtained from this assessment and guideline values.

Table 2 British Standard 7385 Transient Vibration Levels for Minimal Cosmetic Damage Risk

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures (Industrial and/or heavy commercial buildings)	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15Hz increasing to 50 mm/s at 40 Hz and above

3.5 Vibration Monitoring Results

A summary of maximum vibration values recorded within an hour interval are presented in **Appendix A**. SE note that data recorded around 12 pm – 1 pm on the 23rd of January 2023 was a test of the 12 tonne vibratory roller at maximum vibration within 5 m of each monitor. Vibration measured and correlated to the vibratory rollers indicated a frequency of

around 20 – 30 Hz. Figures in Appendix A detail the highest Peak Particle Velocity measured noting that this is generally in the 20 – 30 Hz range where measurements are above 1 mm/s.

4 Vibration Management and Mitigation Strategies

Based on the assessment undertaken, current ongoing vibration mitigation strategies are considered appropriate and adequate.

There are several strategies for managing vibration impacts from construction sites. The most influential and effective mitigatory strategy is increasing distance between the vibration source and receiver. SEG also note that when short-term works (\approx 1 week).

Based on the site assessment undertaken on the 23rd of January 2023 and in consultation with the contractor on-site, the following change in site methodologies was agreed upon and implemented:

- Use smaller vibratory rollers (5 tonne) for works nearing the western site boundary, and using lower vibration settings (where practical); and
- Utilisation of pulverisers to break larger sandstone boulders used as fill to reduce the operating time of the vibratory rollers.

Additional strategies that may be considered should there be ongoing complaints from nearby residents may include the following:

- General Management Measures – I.e. use of smaller equipment and/or using heavier equipment further away from relevant receptors.
- Verification Monitoring – Currently implemented.
- Complaints Management System – Currently implemented.
- Community Notification – Currently implemented. Informing nearby residents when works producing heavy vibrations will occur and for how long.
- Respite Offer – Offer may be provided to stakeholders subjected to an ongoing impact. The offer could include meal vouchers, or gift cards as an example.
- Alternative Accommodation – Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts. This would be determined on a case-by case basis. Based on vibration levels on-site, this is not considered relevant.

5 Conclusion

SEG have reviewed site data (refer **Appendix A**), and available guideline values available. Based on the assessments undertaken so far, SEG conclude the following:

- Vibration levels measured at the site boundary on the 24th and 25th of January 2023 were found to be below relevant criteria, and therefore, vibration experienced in off-site receptors is assumed to be below criteria;
- The client has introduced effective vibration mitigation methodologies to reduce vibration on-site;
- Due to the constraints of monitor positioning, vibration dose parameters could not be calculated; and
- Vibration reduction methodologies implemented on-site are considered adequate and above industry best practice, and as such, no further controls are recommended.

Should you have any further questions regarding information provided in this letter, please do not hesitate to contact the undersigned.

Sincerely yours,



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FIGURES



Figure 1 – Vibration Monitoring Locations

APPENDIX B

VIBRATION RESULTS SUMMARY TABLES



