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Project 5371
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Dear Mr Abouhamad

ST IGNATIUS COLLEGE WINGARU PROJECT – VIBRATION MONITORING – WEEKS 5-8
SUMMARY OF VIBRATION MONITORING RESULTS

1 INTRODUCTION

Acoustic Dynamics is engaged by **Belmadar** to undertake unattended vibration monitoring for the above project, within the site, for the duration of excavation works.

The subject site is located on Tambourine Bay Road, Lane Cove NSW.

2 CRITERIA

Structural and cosmetic damage vibration criteria are guided by the vibration levels presented within the standards BS 7385 and DIN 4150 and the NSW EPA document *"Assessing Vibration - a technical guide"*.

In terms of the most recent relevant vibration damage criteria, British Standard 7385: Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2 - Guide to damage levels from ground-borne vibration" *represents a definitive standard against which the likelihood of building damage from ground vibration can been assessed.*

Although there is a lack of reliable data on the threshold of vibration-induced damage in buildings both in countries where national standards already exist, and in the UK, BS 7385: Part 2 has been developed from an extensive review of UK data, relevant national and international documents and other published data.

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 minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration, which are considered in the standard, include blasting (carried out during mineral extraction or construction excavation), excavation, piling (sheet, bored, contiguous), ground treatments (e.g. compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The guide values from this standard for transient vibration judged to result in a minimal risk of cosmetic damage to residential buildings and industrial buildings are presented numerically in **Table 2.1** and graphically in **Figure 2.1**.

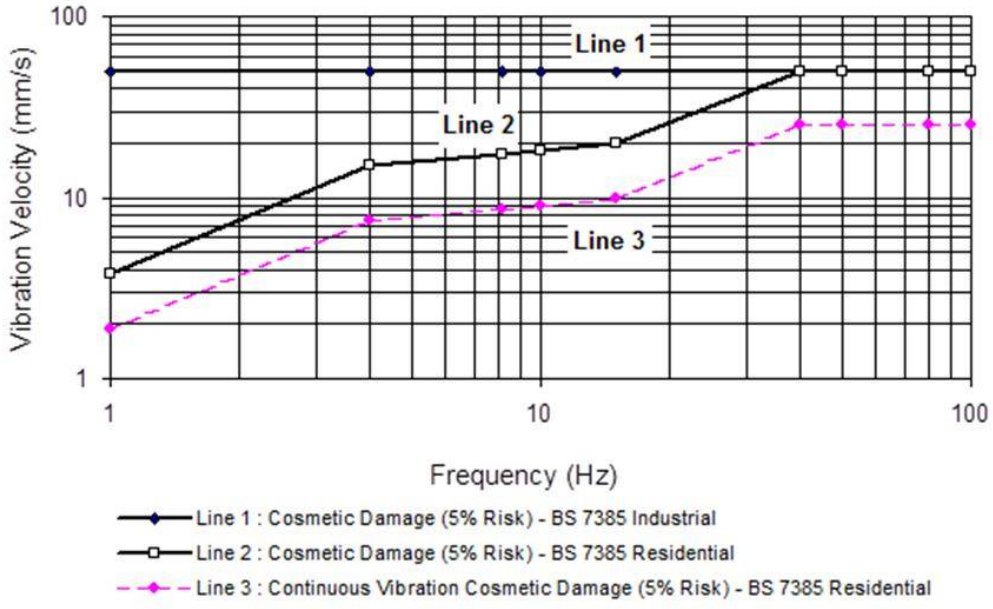
Table 2.1 Transient Vibration Guide Values – Minimal Risk of Cosmetic Damage

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 Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	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 15 Hz increasing to 50 mm/s at 40 Hz and above

In relation to guide values for continuous vibration relating to cosmetic damage, the standard states that the guide values in **Table 2.5** relate predominantly to transient vibration, which does not give rise the resonant responses in structures, and to 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 lower frequencies where lower guide values apply, then the guide values in **Table 2.5** may need to be reduced by up to 50%, as is the case with continuous vibration from rock breaking.

Figure 2.1 Graph of Transient Vibration Guide Values for Cosmetic Damage



The standard goes on to state that minor damage is possible at vibration magnitudes, which are greater than twice those given in **Table 2.1**, and major damage to a building structure may occur at values greater than four times the tabulated values.

It is noteworthy that in addition to the guideline values presented in **Table 2.1**, the standard also states the following:

> *"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."*

Note is made that **cosmetic damage** to buildings occurs at vibration levels significantly lower than those causing **structural damage**.

- British Standard 7385 indicates a 5% risk of **cosmetic damage** to commercial/industrial buildings at 50 mm/s from transient vibration and at 25 mm/s from continuous vibration; and

- British Standard 7385 indicates a 5% risk of **cosmetic damage** to residential and light framed structures at 15 mm/s at 4 Hz from transient vibration and at 7.5 mm/s at 4 Hz from continuous vibration.

In addition to the above standard, the German Standard DIN 4150 provides guideline values of vibration velocity for evaluating the effects of short-term vibration. Table 1 of DIN 4150 is reproduced as **Table 2.2** below.

Table 2.2 Guideline values of vibration velocity, vi, for evaluating the effects of short-term vibration

Line	Type of structure	Vibration Velocity, v_i, in mm/s			
		Foundation			Plane of floor of uppermost full storey
		At a frequency of			Frequency mixture
		Less than 10 Hz	10 to 50 Hz	50 to 100)* Hz	
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8
*) For frequencies above 100 Hz, at least the values specified in this column should be applied.					

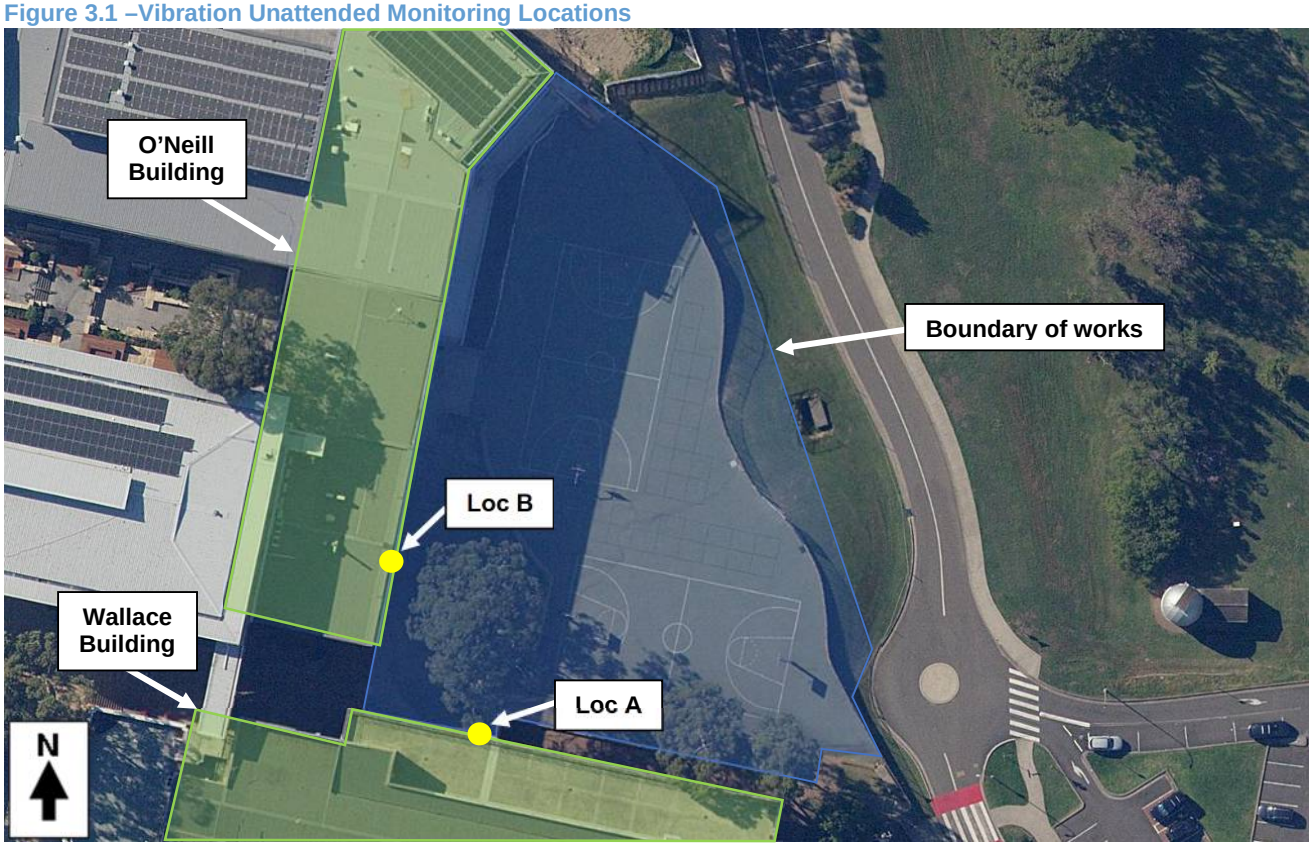
3 VIBRATION MONITORING

At the request of **Belmadar**, Acoustic Dynamics attended the subject site on 10 July 2023 and installed two unattended vibration loggers on the O'Neill building to the west, and the Wallace Building to the south of the works, to monitor vibration exposure levels resulting from demolition and excavation works associated with the subject site. We note the locations were chosen

The unattended vibration logger were installed to assess transmitted vibration from the subject site, and its compliance with the relevant criteria. Acoustic Dynamics notes that measured vibration levels are likely higher than levels received by the adjacent properties, as the monitors are sometimes in locations that are coupled to the structures being demolished within the subject site, while also being marginally closer to the works.

The vibration monitoring location is presented in **Figure 3.1** below.

Figure 3.1 –Vibration Unattended Monitoring Locations



Tables 3.1 to **3.4** below presents the vibration levels measured by Acoustic Dynamics' unattended vibration monitors at each monitoring location.

Table 3.1 Measured Vibration Levels – Week 5

Date	Construction Peak Vector Sum (PVS) Velocity Levels [mm/s]		Vibration Criteria/Objectives [mm/s]	
	Max PVS		Site Control Limit	Complied?
	Loc A	Loc B		
Mon 7/8/23	5.877	1.108	< 5.0	No (Yes)[2]
Tue 8/8/23	4.115	0.249		Yes
Wed 9/8/23	0.645	0.874		Yes
Thu 10/8/23	1.222	1.799		Yes
Fri 11/8/23	0.438	0.543		Yes
Sat 12/8/23	0.160	0.239		Yes
Sun 13/8/23	0.217	0.193		Yes[1]

Note: 1) No construction works.

2) FFT Analysis confirms the vibration levels are below Line 3 (Fig 2.1).

Table 3.2 Measured Vibration Levels – Week 6

Date	Construction Peak Vector Sum (PVS) Velocity Levels [mm/s]		Vibration Criteria/Objectives [mm/s]	
	Max PVS		Site Control Limit	Complied?
	Loc A	Loc B		
Mon 14/8/23	**0.539**	0.202	< 5.0	Yes
Tue 15/8/23	1.099	1.280		Yes
Wed 16/8/23	1.079	2.143		Yes
Thu 17/8/23	0.876	0.508		Yes
Fri 18/8/23	0.575	0.382		Yes
Sat 19/8/23	0.199	0.230		Yes
Sun 20/8/23	0.607	0.213		Yes[1]

Note: 1) No construction works.

2) FFT Analysis confirms the vibration levels are below Line 3 (Fig 2.1).

Table 3.3 Measured Vibration Levels – Week 7

Date	Construction Peak Vector Sum (PVS) Velocity Levels [mm/s]		Vibration Criteria/Objectives [mm/s]	
	Max PVS		Site Control Limit	Complied?
	Loc A	Loc B		
Mon 21/8/23	1.425	0.264	< 5.0	Yes
Tue 22/8/23	0.381	0.328		Yes
Wed 23/8/23	0.982	0.342		Yes
Thu 24/8/23	0.475	0.518		Yes
Fri 25/8/23	2.541	0.402		Yes
Sat 26/8/23	0.876	0.209		Yes
Sun 27/8/23	0.220	0.214		Yes[1]

Note: 1) No construction works.

2) FFT Analysis confirms the vibration levels are below Line 3 (Fig 2.1).

Table 3.4 Measured Vibration Levels – Week 8

Date	Construction Peak Vector Sum (PVS) Velocity Levels [mm/s]		Vibration Criteria/Objectives [mm/s]	
	Max PVS		Site Control Limit	Complied?
	Loc A	Loc B		
Mon 28/8/23	0.705	0.342	< 5.0	**Yes**
Tue 29/8/23	0.493	0.326		**Yes**
Wed 30/8/23	1.002	3.729		**Yes**
Thu 31/8/23	2.242	4.455		**Yes**
Fri 1/9/23	0.529	0.253		**Yes**
Sat 2/9/23	0.295	0.219		**Yes**
Sun 3/9/23	0.171	0.210		**Yes**[1]

Note: 1) No construction works.
2) FFT Analysis confirms the vibration levels are below Line 3 (Fig 2.1).

4 DISCUSSION OF VIBRATION MONITORING RESULTS

The measured vibration levels indicate that the site control vibration limit of 5 mm/s combined direction (Peak Vector Sum (PVS)) velocity, was generally complied with during Weeks 5 to 8.

5 CONCLUSION

At the request of **Belmadar**, Acoustic Dynamics has undertaken unattended vibration monitoring in relation to the excavation works being performed at St Ignatius College, Riverview.

Summary

The measured vibration levels indicate that the site control vibration limit of 5 mm/s combined direction (Peak Vector Sum (PVS)) velocity, was generally complied with at all locations.

We trust the above information is sufficient for your present purposes. Please do not hesitate to contact us on 02 9908 1270 should you require more information.

Kind Regards
ACOUSTIC DYNAMICS

JAMES COLLA
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6102L004.JC.230914	0	15 September 2023	JC	RH	RH	