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20 July 2017

Ref: CNVIS-Pitt Street

Dear Stuart

RE: Endorsement of Construction Noise and Vibration Impact Statement – Pitt Street (PS) Site, Sydney Metro City & Southwest

Thank you for providing the following document for Environmental Representative (ER) review and endorsement as required by the Condition of Approval A24(d) of the Sydney Metro City & Southwest project (SSI – 15_7400 January 9 2017).

- Construction Noise and Vibration Impact Statement (CNVIS) – Pitt Street (PS) Site, (Revision F dated 20 July 2017).

The document is required under Condition of Approval E33. As an approved ER for the Sydney Metro City & Southwest project, I have reviewed and commented on previous versions of the document. Comments have been addressed in the above version of the document. The review did not comprise a technical review, as the ER has relied upon the Acoustic Advisor's review of technical aspects of the document. On the basis of the revised document addressing ER comments, and the endorsement of the document by the Acoustic Advisor dated 20 July 2017, I endorse the document.

Yours sincerely



Michael Woolley
Environmental Representative – Sydney Metro – City and South West

**ENDORSEMENT
CITY & SOUTHWEST ACOUSTIC ADVISOR**

Review of	CNVIS for Delta demolition works at Pitt Street	Document reference:	Construction Noise & Vibration Impact Statement PITT STREET prepared by Osterman Consulting for Delta Pty Ltd
Prepared by:	Dave Anderson		Report number 0116-041-05, Rev F
Date of issue:	20 July 2017		

As approved Acoustic Advisor for the Sydney Metro City & Southwest project, I have reviewed and provided comment on the Construction Noise and Vibration Impact Statement for the Delta demolition works at Pitt Street, as required under A27 (d) of the project approval conditions.

I have met with Osterman Consulting to discuss earlier drafts of the impact statement and to discuss my formal comments. The impact statement has been revised to address my comments and I endorse Revision F of the statement.

I note that the impact statement adopts a precautionary approach for vibration criteria at heritage buildings, pending confirmation of the structural condition of these buildings. I endorse this approach.



Dave Anderson, interim City & Southwest Acoustic Advisor



Construction Noise & Vibration Impact Statement

PITT STREET

Sydney Metro

Prepared for: Delta Group

20 July 2017

Report number: 0116-041-05

Prepared by: Mark Della Sabina & Rauf Osterman



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Report Revision History				
Rev no.	Date	Description	Prepared by	Reviewed by
A	05/02/2017	Initial Draft	Mark Della Sabina	Rauf Osterman
B	02/03/2017	General update and revision following review by Delta and Project AA	Mark Della Sabina	Rauf Osterman
C	19/06/2017	Updated to incorporate comments from ER dated 21/02/2017 and additional comments from Project AA dated 13/02/2017.	Mark Della Sabina	Rauf Osterman
D	02/07/2017	Updated to incorporate comments from Project AA and ER dated 27/06/2017	Mark Della Sabina	Rauf Osterman
E	17/07/2017	Addition of evidence of consultation, including proposed working hours	Mark Della Sabina	Rauf Osterman
F	20/07/2017	Minor update to incorporate comments from Project AA dated 19/07/2017	Mark Della Sabina	Rauf Osterman

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1. Introduction

1.1 Context

This Construction Noise and Vibration Impact Statement (CNVIS) has been developed for Delta Pty Ltd (Delta) to assess the noise and vibration impacts associated with demolition and retention works at the Pitt Street site (the site) on the Sydney Metro City & Southwest Project (the project). This CNVIS exists as a sub-plan to the Construction Noise and Vibration Management Plan 0116-041-01 (CNVMP) for the project.

The principal issues addressed within this CNVIS include:

- Identification of noise sensitive receivers near to the site;
- Prediction of the level of noise and vibration impact on these sensitive receivers from construction activities including assessment of predicted compliance with project-imposed Noise and Vibration Management Levels;
- Details of the plant and equipment to be used on site including details of sound mitigation measures to be employed to reduce noise impacts on adjacent noise sensitive receivers.

1.2 Site Overview

The Pitt Street site is located below Pitt Street and Castlereagh Street, south of the Park Street intersection and north of the Bathurst Street intersection. Construction at the station is split across two sites, although only the northern site is included in Delta's scope of works.

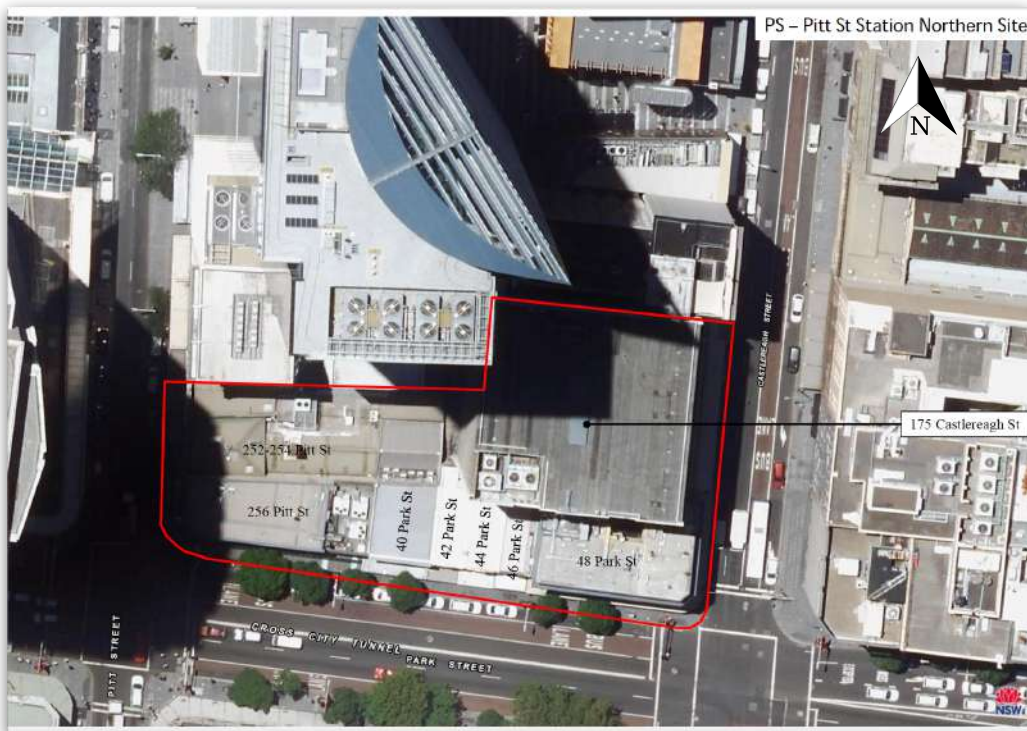


Figure 1: Pitt Street Site Overview

1.3 Site Layout and Access

Site layout and access is illustrated in Figure 2.

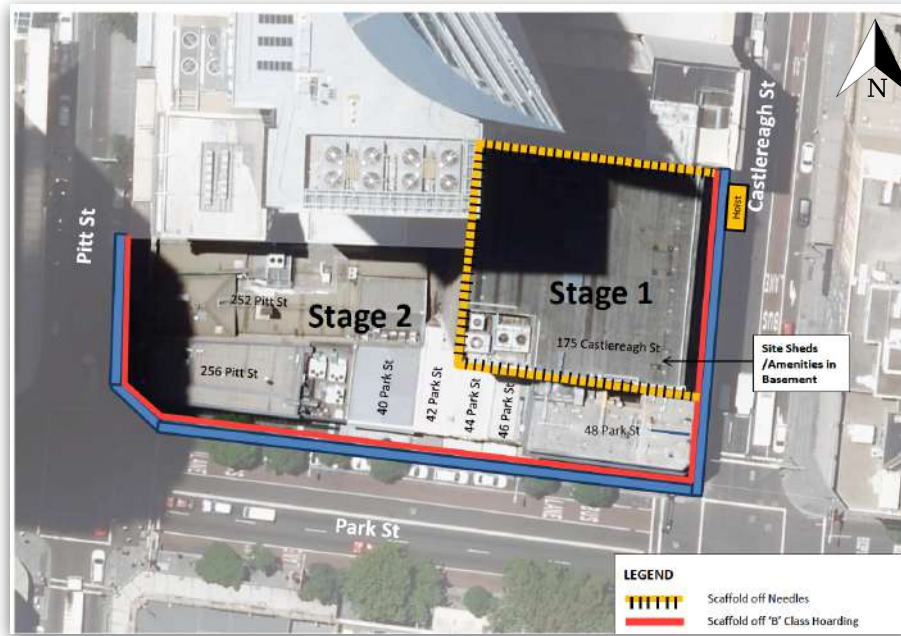


Figure 2: Pitt Street Site Layout and Access

1.4 Proposed Working Hours

As a result of extensive consultation with sensitive receivers, the following proposed working hours have been adopted on this site:

Table 1. Proposed Working Hours

No.	Period	Tasks Undertaken	Evidence	Notes
1	06:30-07:15	Pre-start briefing	Noise & vibration monitoring data	Minimal noise
2	07:15-09:00	Material transfer via chute Loading of trucks Demolition of slabs – pulveriser preferred	Noise & vibration monitoring data	Boutique Hotel breakfast period Low noise works
3	09:00-12:30	As per Period 2 Structural demolition of all elements	Noise & vibration monitoring data Attended monitoring as required.	
4	12:30-13:30	Material transfer via chute Loading of trucks Demolition of slabs – pulveriser preferred	Noise & vibration monitoring data	Boutique Hotel lunch period Low noise works
5	13:30-16:30	As per Period 2 Structural demolition of all elements	Noise & vibration monitoring data	
6	16:30-18:00	As per Period 2 Structural demolition of all elements	Noise & vibration monitoring data	
7	18:00-20:00	On application	Noise & vibration monitoring data	Application to extend hours

2. Applicable Criteria

2.1 Airborne Noise Management Levels

Conditions of Approval E37 and E38 for the project impose alternative requirements on Noise Management Levels for the Pitt Street site. These alternative requirements override the CNVS and therefore ICNG NML's and refer to internal noise levels only. The objective of these conditions is to allow for longer working hours whilst mitigating impact to sensitive receivers, and are predicated on consultation with the affected sensitive receivers to determine appropriate respite hours. These requirements are outlined in Table 2.

Assessment Period	% of Assessment Period	Hours in Assessment period	Internal Noise Criteria <small>(which must not be exceeded)</small>
07:00 - 20:00	50	6.5	$L_{eq}(15 \text{ minute})$ 60dB(A)
	25	3.25	$L_{eq}(15 \text{ minute})$ 55dB(A)

In addition to the above, CoA A2 states that works "must be carried out in accordance with all procedures, commitments, preventative actions, performance criteria and mitigation measures set out in the EIS as amended by the PIR unless otherwise specified". Therefore, where specific criteria are not set in the approval conditions (i.e. remaining 6.5 hours of the Assessment Period, external noise levels affecting outdoor uses, etc.), the criteria in the EIS, PIR and CNVS should be used.

Notwithstanding the above, at no time can noise generated by construction exceed the National Standard for exposure to noise in the occupational environment of an eight-hour equivalent continuous A-weighted sound pressure level of $LA_{eq,(8h)}$, of 85dB(A) for any employee working at a location near the CSSI.

2.2 Ground-borne Noise Management Levels

The Noise Management Levels given in Section 2.1 apply also for ground-borne noise.

2.3 Construction Vibration

Condition E28 of the Conditions of Approval for the project stipulate that vibration from construction activities shall not exceed the vibration limits set out in the British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration.

British Standard 7385: Part 2 1993 suggests levels of vibration at which 'cosmetic', 'minor' and 'major' damage may occur. This standard is based on data collated from a wide range of national and international sources which collectively saw relatively few cases of damage caused by vibration. BS7385 suggests that vibration levels up to the cosmetic damage level are considered 'safe' and have produced no observable damage for particular building types.

For the purposes of this standard, damage includes minor non-structural effects such as hairline cracks on drywall surfaces, hairline cracks in mortar joints and cement render, enlargement of existing cracks and separation of partitions or intermediate walls from load bearing walls.

BS7385 is based on peak particle velocity and specifies damage criteria for transient vibration within the range of frequencies usually encountered in buildings, being 4Hz to 250Hz. This criteria is reproduced in Table 3.

Table 3. BS7385: Part 2 Structural Damage Criteria					
Group	Type of Structure	Damage Level	Peak component particle velocity, mm/s		
			4 Hz - 15 Hz	15 Hz - 40 Hz	40 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	50 (all frequencies)		
		Minor	100 (all frequencies)		
		Major	200 (all frequencies)		
2	Unreinforced or light framed structures Residential or light commercial type buildings	Cosmetic	15 to 20	20 to 50	50
		Minor	30 to 40	40 to 100	100
		Major	60 to 80	80 to 200	200

Where dynamic loading caused by continuous vibration may result in magnification of vibration through a building structure the guideline values may need to be reduced by up to 50 per cent. Rock breaking, rock hammering and sheet piling activities are considered to have the potential to cause dynamic loading in some structures (eg residences).

For construction activities involving intermittent vibration sources such as rock breakers, piling rigs, vibratory rollers, excavators and the like, the predominant vibration energy occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, and consistent with the guidance from BS 7385, the following conservative vibration damage screening level per receiver type have been adopted for the project:

- Reinforced or framed structures: **25.0 mm/s**
- Unreinforced or light framed structures: **7.5 mm/s**

Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure.

With regards to heritage items, BS7385 states that “a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive”. Therefore determination of applicable limits shall specifically consider:

1. The structural condition of the building (in consultation with a structural engineer where required); and
2. The heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.

At the time of writing, the applicable vibration criteria for heritage structures have not yet been confirmed (pending confirmation of the structural condition of the buildings). A precautionary approach will therefore be adopted, with an interim vibration criterion of 2.5mm/s (consistent with section 3.1.9.2 of the Noise and Vibration Technical Paper in the EIS) and attended vibration monitoring during site trials of any high vibration activity (such as hammering) to determine safe working distances. Subject to structural engineering assessment, the applicable vibration limit will be revised to the conservative vibration damage screening level for heritage structures of 7.5mm/s.

2.3.1 Warning Levels

The INFRA Monitoring System used on this project features a number of real time alerts and alarms that enable instant notification where limits are approached or exceeded. Where vibration-intensive works are planned to occur in close proximity to sensitive receivers, and works are expected to approach the limits for cosmetic damage, monitoring equipment shall be equipped with visual and/or audible alarms that are triggered when the levels of vibration exceed the control criteria presented in Table 4.

Table 4. Operator Warning and Halt Levels

Structure	Site Control Criteria (PPV in any Orthogonal Direction)	
	Operator Warning Level	Operator Halt Level
Reinforced or framed structures	20 mm/s	25 mm/s
Unreinforced or light framed structures	5 mm/s	7.5 mm/s
Heritage structures (precautionary levels)	1.5 mm/s	2.5 mm/s
Heritage structures	5 mm/s	7.5 mm/s

3. Noise and Vibration Assessment

3.1 Sensitive Receivers

A full list of sensitive receivers surrounding the site are listed in Appendix A. A subjective classification of the noise & vibration impact has been evaluated for each sensitive receiver and documented as:

- Low Impact
- Moderate Impact
- High Impact

The classifications were determined on a case-by-case basis using the metrics defined in the CNVS, including:

- The location of the works in relation to the NSR's with consideration of the noise attenuation features such as distance to NSR's, noise barriers, attenuation factor of NSR's windows and elements, Topographical features etc.
- The type and sensitivity of the NSR's:
 - Lower impact: e.g. commercial buildings/scattered residential (low density)
 - Moderate impact: eg standard residential (typical density)
 - High impact: e.g residential home for elderly/high density unit blocks/persistent complainers/residents deemed to have "construction noise fatigue", highly sensitive commercial (jewellers, etc.) or health applications e.g. operating theatres, MRI's, Psychotherapy units, Audio & video production studios etc. and schools/childcare centres.
- Predicted noise and vibration levels and extent of noise exceedance above Noise Management Level
- The type of and intensity of noise emitted from works (ie tonal or impulsive):
 - Lower Impact: No high noise and/or vibration intensive activities
 - Moderate Impact: Short/intermittent high noise and/or vibration intensive activities
 - High Impact: Prolonged high noise and/or vibration intensive activities.
- The duration of any OOHW required.

Site plans illustrating the location of, and degree of impact to, sensitive receivers can be found in Appendix B.

3.2 Construction Activities and Sources of Noise

The degree of noise impact on adjacent sensitive receivers from demolition activities is highly dependent on the type and size of machinery used. In consultation with Delta Group, a list of the activities to be undertaken and the associated machinery is provided in Table 5.

Table 5. Construction Activities and Equipment Noise

Equipment	Number	Construction Activity	Assumed Sound Power* Level dB(A)
2T Excavators	2	Strip Out	88
5T Excavators	2	Structural Demolition	89
12T Excavators w/pulveriser	2	Structural Demolition	102
12T Excavators w/hammer	2	Structural Demolition	115
Mustang Bobcats	2	Strip Out	110
Powered Hand Tools		Strip Out	100
Trucks	4	Haulage	105
Concrete Cutters		Concrete Cutting	119

* Sound power levels provided in the table above should be verified against specifications of actual equipment used onsite.

+ Proposed for use on lower levels only. Hoarding may provide up to 10dB reduction in predicted noise levels

3.3 Airborne Noise Predictions

Using the sound power levels stated in Section 3.2, predicted noise levels have been calculated at representative locations around the site based on the distance between noise-emitting activities and the closest sensitive receivers for that location. These predictions assume that equipment is operating at the nearest point of works to the sensitive receiver and therefore represent worst-case scenarios. The predictions do not take into account any mitigation measures. Due to the staging of construction works and the expected spread of equipment across the full area of the site, cumulative noise impacts are expected to be minimal.

To convert the predicted noise level from external to internal, it is necessary to make an assessment of the degree of noise reduction between the outdoor and indoor environment. This assessment is made according to facade noise reduction values listed in Table 6.

Table 6. Typical Noise Reduction Values

Building Environment	Noise Reduction
Most building types - with windows open	10dB
Most building types - with windows closed	20dB
Commercial buildings - non-opening double-glazed windows, etc.	30dB

Due to the significant number of sensitive receivers across the project, and for the purposes of reducing the required number of monitors, sensitive receivers with like characteristics have been grouped into 'noise catchment areas' (NCAs) that can be represented by a single monitor. For the purpose of simplicity, NCA's have been defined according to their general direction relative to the site. These are defined in Table 7 along

with the applicable facade noise reduction values used for the purpose of converting external noise levels to internal noise levels.

Location	Receiver Type	Assumed Facade Noise Reduction (dBA)
North - 250 Pitt Street	Commercial office/retail building - non-opening windows	30
North - 169 Castlereagh Street	Residential hotel - single glazing	20
East - Opposite Castlereagh Street	Commercial office building - non-opening windows	30
South - Stage 2 Receivers	Commercial retail/residential hotel - single glazing	20
South - Opposite Park Street	Mixed commercial and residential - some opening windows	20
West - Opposite Pitt Street	Commercial office building - non-opening windows	30

Table 8 provides a general assessment of worst-case noise impacts from the site as a whole on each of the NCA's around the site. Predicted internal noise levels are highlighted according to the following:

Exceeds 25% limit of 55dB(A)
Exceeds 50% limit of 60dB(A)

Equipment	Noise Predictions $L_{eq(15\text{ minute})}$ (Based on Facade Noise Reductions in Table 6)				
	250 Pitt St	169 Castlereagh St	East	South	West
2T Excavators	36	46	22	31	25
5T Excavators	37	47	23	32	26
12T Excavators w/pulveriser	50	60	36	45	39
12T Excavators w/hammer	63	73	49	58	52
Mustang Bobcats	58	68	44	53	47
Powered Hand Tools	48	58	34	43	37
Trucks	53	63	39	48	42
Concrete Cutters	67	77	53	62	56

3.3.1 Stage 2 Receivers

Demolition works on this Site are split into two stages. Stage 1 is due to commence mid-July 2017 with Stage 2 buildings continuing to be tenanted until September 2017. Stage 2 receivers include a mix of commercial and retail receivers as well a residential hotel. Receivers feature single-glazed, normally closed windows, thus a facade noise reduction value of 20 dB(A) has been applied to these receivers.

Much of the impact to Stage 2 receivers shall be mitigated by the necessary adoption of pulverising methods on Stage 1 due to the adjacent heritage Castlereagh Boutique Hotel. Further, during the limited period where Stage 2 is still tenanted, demolition works on Stage 1 will occur mostly at upper floors of Stage 1 and will therefore be at a higher level than the Stage 2 receivers. As such, the sensitivity of Stage 2 receivers is essentially the same as that of the Castlereagh Boutique Hotel (including noise and vibration predictions) and therefore the same mitigation and management measures apply.

3.3.2 The Great Synagogue

The Preferred Infrastructure Report contains comments received from the Great Synagogue at 166 Castlereagh St to stop noise generating construction activities on Sabbath (specifically between 6-7pm on Fridays and 8:30am-12:30pm on Saturdays) at Pitt Street Station. Given the proximity of works to the heritage listed Castlereagh Boutique Hotel and the subsequent requirement to adopt pulverising methods, it must be noted that noise predictions in the direction of the Great Synagogue do not exceed even the lowest internal NMLs. Notwithstanding it may be necessary to conduct attended noise monitoring in this location if complaints are received.

3.4 Ground-borne Noise

As demolition and retention works generally do not involve ground excavation, ground-borne noise is expected to be an issue only where sensitive receivers are directly coupled to the works (structure-borne noise). On the Pitt Street site, this applies to:

- 250 Pitt Street (Commercial Office/Retail)
- 169 Castlereagh Street (Castlereagh Boutique Hotel)

250 Pitt Street is located on zero boundary to the North of 252-254 Pitt Street. Similarly, the front portion of 169 Castlereagh Street is located on zero boundary to the North of 175 Castlereagh Street. Depending on the degree of coupling between these structures, structure-borne noise may be experienced by these sensitive receivers where works occur in proximity to the northern site boundary. Demolition works in these locations shall therefore preference pulverising methods to mitigate the impacts of structure-borne noise.

3.5 Vibration Predictions

Vibration at the nearest sensitive receivers (adjacent to the building foundation) has been estimated using the formula from the FTA's Guideline "Transit Noise and Vibration Impact Assessment".

$$PPV_{Receiver} = PPV_{Ref} \times \left(\frac{d_{ref}}{d} \right)^{1.5}$$

Where: $PPV_{Receiver}$ = peak particle velocity at the receiver in mm/s

PPV_{Ref} = peak particle velocity of the source, measured at the reference distance (7.6 m)

d_{ref} = reference distance for the vibration source (7.6 m)

d = horizontal distance from the source to the receiver (m)

The values of PPV_{Ref} are based on a review of current literature and are provided in Table 9 for reference.

Table 9. Reference PPV's	
Equipment	PPV @ 7.6m (mm/s)
2T Excavators	2.5
5T Excavators	2.5
12T Excavators w/pulverisers	2.5
Mustang Bobcats	0.3
Powered Hand Tools	0.2
Trucks	1.9
Concrete Cutters	0.2

The levels of predicted vibration at the nearest sensitive receivers are provided in Table 10. Note that:

- these predictions assume that equipment is operating at the nearest point of works to the sensitive receiver and therefore represent worst-case scenarios.
- these predictions represent maximum instantaneous levels for the purpose of assessing the likelihood of cosmetic damage and are not applicable for the assessment of human comfort which is measured as vibration dose values.

Table 10. Predicted Ground Vibration

Equipment	Predicted PPV (mm/s)			
	North (250 Pitt & 169 Castlereagh St)	East (Opp. Castlereagh St)	South (Opp. Park St)	West (Opp. Pitt St)
2T Excavators	4.8	0.5	0.4	0.8
5T Excavators	4.8	0.5	0.4	0.8
12T Excavators w/pulveriser	4.8	0.5	0.4	0.8
12T Excavators w/hammer	7.1 ¹	0.7	0.5	1.1
Mustang Bobcats	0.5	<0.1	<0.1	0.1
Powered Hand Tools	0.3	<0.1	<0.1	0.1
Trucks	3.6	0.3	0.3	0.6
Concrete Cutters	0.3	<0.1	<0.1	0.1

¹Maximum theoretical value predicted at the closest point of 250 Pitt St/169 Castlereagh St on ground level only. Values will decrease rapidly when demolishing upper levels, or when operating away from the closest boundary at ground level. Note that hammering methods shall not be used for demolition of structures immediately adjacent to these premises.

The German Standard DIN 4150 Part 2 - 1975 presents information on the degree of human perception of various levels of motion. The threshold for 'noticeable' vibration is stated as 1mm/s, with 'easily noticeable' at 2.2mm/s. In light of this, and with reference to Table 10, it is evident that vibration from demolition works will at times be perceptible to persons occupying nearby sensitive receivers.

The highest levels of vibration are those associated with hard demolition works, namely hammering and pulverising. Unless otherwise coupled, vibration transmission from such works to adjacent sensitive receivers is via ground. Naturally then, vibration levels will only approach those values in Table 10 where demolition works are occurring at or near ground level. Similarly, vibration impacts will diminish rapidly on upper levels of adjacent sensitive receivers.

Much of the impact to 250 Pitt and 169 Castlereagh Streets shall be mitigated by adoption of pulverising methods for demolition of adjacent structures. Still, occupants of those premises closest to the works will likely experience perceptible levels of vibration though only for a short period.

4. Noise and Vibration Management

4.1 Environmental Monitoring

Noise and vibration monitoring shall be undertaken using permanent installations supplemented with short term attended and unattended monitoring at the nearest representative sensitive receivers around the site. Results from these monitors shall be reviewed on a weekly basis to ensure ongoing compliance. Where complaints are received, additional monitoring may be conducted at the specific location of complaint.

Monitor locations are detailed in Table 11 and illustrated in Appendix B.

Table 11. Monitoring Locations				
Property	Monitor Category	Installation Type	Location	
250 Pitt Street	Noise & Vibration	Permanent	Massage business in ground floor arcade	Representative monitor for compliance
169 Castlereagh Street	Noise & Vibration	Permanent	Foundation level of wall adjoining 175 Castlereagh St in light well	Representative monitor for compliance
23 - 35 Park Street	Noise & Vibration	Permanent	Building manager's balcony - Level 2 carpark.	Representative monitor for compliance

The number and location of monitoring points shall be reviewed after an initial period of 2 - 3 months. Where noise and vibration levels are negligible and, in consideration of the works still to be completed, those levels are not expected to increase for the remainder of the project, consideration shall be given to the removal of redundant monitoring points.

For further detail on environmental monitoring, refer to Section 6.3 of the CNVMP.

4.1.1 Heritage-listed Structures

Effective monitoring of heritage-listed structures can pose unique challenges where sensitive heritage fabrics are involved. CoA E31 stipulates that a heritage specialist shall provide advice regarding noise and vibration monitoring of heritage-listed structures. Such advice is provided in Appendix C.

4.2 Mitigation Measures

4.2.1 Standard Measures

A range of standard noise and vibration mitigation measures shall be adopted on the site so as to minimise the impact of works on neighbouring sensitive receivers. These are outlined in Table 12. Where it is predicted that NML's will be exceeded even with the implementation of standard mitigation measures, additional mitigation measures shall be put in place (See Section 4.2.2).

With regards to CoA E33 which states that specific mitigation measures must be identified through consultation with affected sensitive receivers, refer to 'Site-Specific' mitigation measures provided in Table 12. Further evidence of consultation is provided in the High Impact Receivers Consultation Register in Appendix D.

Table 12. Noise and Vibration Mitigation Measures

No.	Control	Anticipated Noise Reduction	Timing
Administration			
NVM1	Conduct a site induction addressing the requirements of this CNVMP for all new personnel undertaking site activities	N/A	Prior to starting works
NVM2	Educate staff on noise and the impacts of workers activities on the noise environment	N/A	Prior to starting works / following noise complaints
NVM3	Develop a complaints handling procedure and respond to complaints	N/A	Prior to starting works / as required
NVM4	Conduct regular toolbox talks to reiterate the appropriate noise and vibration management methodologies	N/A	Periodically
Procedural			
NVM5	Turn off machinery when not in use	Up to 10 dB	Daily
NVM6	Conduct regular noise measurements in the vicinity of the site to assess compliance with noise criteria	N/A	As needed / following changes in activities
NVM7	The coincidence of noisy plant working simultaneously close together to be avoided	Up to 10 dB	Daily
NVM8	Operate and maintain equipment according to manufacturers' specifications.	Up to 3 dB	Daily
NVM9	Do not use crane whistles, amplified external telephone ringers/ horns or alarms (excluding emergencies)	N/A	Daily
NVM10	Preference the use of the following in lieu of hydraulic hammers: <ul style="list-style-type: none"> • hydraulic concrete shears • hydraulic concrete pulverisers • saw cutting and lifting 	Up to 15 dB	At all times so far as is practicable
NVM11	Maximise offset of noisy plant to sensitive receivers as much as possible.	N/A	Where practicable
NVM12	Sequencing of demolition work to retain noise shields (walls, etc.) as long as possible ie floor by floor leaving the perimeter wall	5 to 15 dB	Where practicable
NVM13	Positioning of load out areas and dump chutes away from neighbouring walls and enclosing dump chutes	N/A	Where practicable
NVM14	Where vibration levels are predicted to exceed the screening criteria, a more detailed assessment of the structure and attended vibration monitoring would be carried out to ensure vibration levels remain below appropriate limits for that structure. For heritage items, the more detailed assessment would specifically consider the heritage values of the structure in consultation with a heritage specialist to ensure sensitive heritage fabric is adequately monitored and managed.		Ongoing
Engineering			

Table 12. Noise and Vibration Mitigation Measures

No.	Control	Anticipated Noise Reduction	Timing
NVM15	Use site offices, sheds as noise barriers during demolition works	5 to 15 dB	Prior to starting works
NVM16	Use equipment appropriately sized for each task.	Up to 2 dB	Daily
NVM17	Use a noise reduction kit on the jack hammer to limit its sound power level to 115 dBA.	6 dB per source	When selecting equipment
NVM18	Use smart broadband reversing alarm on mobile equipment where possible.	2 to 5 dB	When selecting equipment
NVM19	Removal of any points of contact between the buildings	Up to 15 dB	Where practicable
NVM20	Installation of carpet/ply on scaffold at level of demolition.	Up to 10 dB	Where practicable
Hours of Work			
NVM21	Operate during standard work hours wherever possible	N/A	Daily
NVM22	Introduce respite periods and/or take smoke and lunch breaks when noisy equipment is operating close to the site boundaries.	N/A	Daily
NVM23	Consultation shall be undertaken with affected sensitive receivers to determine sensitive periods. The business management plan shall be referred to in this instance.	N/A	Daily
NVM24	Noise-intrusive works shall not be timetabled within sensitive periods	N/A	Daily
Site-Specific			
NVMPS1	Acoustic barriers on scaffolding	10dB	Prior to starting works
NVMPS2	Construction of acoustic enclosure around dump chute	10dB	Prior to starting works
NVMPS3	Adoption of pulverising methods for demolition of 175 Castlereagh St structures which adjoin 169 Castlereagh street.	15dB	As required
NVMPS4	Vibration monitor installed on adjoining wall of 169 Castlereagh Street to assess vibration impacts to heritage listed building	N/A	Prior to starting works
NVMPS5	Place Manager to undertake ongoing consultation with noise and vibration sensitive businesses to ensure that work in the vicinity of critical working areas is timetabled outside of sensitive periods	N/A	Weekly
NVMPS6	Adoption of Proposed Working Hours based on consultation with Castlereagh Boutique Hotel, as outlined in Section 1.4	N/A	Weekly
NVMPS7	Consultation with Bauer Media Group at 54-58 Park Street found that while there is potential for 24/7 building use, the typical building use is Monday to Friday 7am to 7pm. Photography and occasional video shoots occur in the building. Bauer Media Group should be made aware of respite periods and notified of any unusually disruptive activities so they can schedule their events and meetings accordingly.	N/A	Weekly

Table 12. Noise and Vibration Mitigation Measures

No.	Control	Anticipated Noise Reduction	Timing
NVMPS8	Further reference to be given to Table 20 of the <i>Business Management Plan - Early Works</i> which provides 'specific approach to individual businesses where required'.	N/A	Prior to starting works

4.2.2 Additional Measures

The Sydney Metro Construction Noise and Vibration Strategy outlines additional mitigation measures that shall be adopted where exceedance of imposed limits is expected, with the level of measure commensurate with the degree of exceedance.

The latest version of the strategy, as referenced in Section 6, outlines the additional measures for works within standard construction hours:

Noise

- Letterbox Drops - Information to neighbours on expected duration of noise-intrusive activities
- Monitoring - Monitoring at the nearest affected sensitive receiver (may include attended monitoring where permanent monitors do not reflect the nearest affected sensitive receiver)

It is anticipated that these measures will be required where hammering activity approaches the boundaries of the site and where demolition works approach adjoining properties outlined in Section 3.4.

Vibration

- Letterbox Drops - Information to neighbours on expected duration of vibration-intrusive activities
- Monitoring - Monitoring at the nearest affected sensitive receiver (may include attended monitoring where permanent monitors do not reflect the nearest affected sensitive receiver)
- Project-specific respite offer - Consultation with affected receivers to determine appropriate means of respite

5. Conclusion

Located in an otherwise noisy CBD environment, and with demolition works being undertaken by smaller machinery, airborne noise is not expected to be a major impact to sensitive receivers to the East, South or West. To the North however, 250 Pitt Street and 169 Castlereagh Street are situated on zero boundary and are therefore likely to experience varying degrees of both noise and vibration.

Whilst much of the Boutique Hotel at 169 Castlereagh Street is separated from works by a light well, the front portion of the building adjoins 175 Castlereagh St which is to be demolished. Similarly, 250 Pitt Street adjoins 252-254 Pitt Street, also to be demolished. Structure-borne noise may pose a moderate yet localised impact on these receivers where works approach the northern site boundary, depending on the degree of coupling between the structures. Similarly, ground vibration may pose a moderate yet short-term impact to 250 Pitt and 169 Castlereagh Streets during demolition works at or near ground level. Demolition works immediately adjacent to these receivers shall preference pulverising methods to mitigate the impacts of structure-borne noise and vibration to these premises.

6. References

Additional guidelines and standards relating to the management of construction noise and vibration from this project include:

- NSW Interim Construction Noise Guideline (ICNG), Department of Environment and Climate Change 2009
- NSW Road Noise Policy, Dept. of Environment, Climate Change and Water 2011
- NSW Industrial Noise Policy, Environment Protection Authority 2000
- NSW Assessing Vibration – a technical guideline (AVTG), Department of Environment and Conservation 2006
- Australian Standard AS/NZS 2107:2000 Acoustics - Recommended design sound levels and reverberation times for building interiors
- Australian Standard 2834-1995 Computer Accommodation, Chapter 2.9 Vibration
- Australian Standard AS 2187.2 Explosives - Storage and use - Part 2 Use of explosives
- Australian Standard AS2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- British Standard BS 6472-2008, 'Evaluation of human exposure to vibration in buildings (1- 80Hz)
- British Standard 7385: Part 2-1993 'Evaluation and measurement of vibration in buildings'
- German Standard DIN4150-1999 Structural vibration Part 3: Effects of vibration on Structures
- Sydney Metro Construction Noise and Vibration Strategy, Report No. 610.14213-R3, Transport for NSW 2016
- Sydney Metro City and Southwest Environmental Impact Statement, Transport for NSW 2016
- Sydney Metro City and Southwest Submissions and Preferred Infrastructure Report, Transport for NSW 2016
- Sydney Metro City and Southwest Conditions of Approval, Department of Planning and Environment 2017
- Transit Noise and Vibration Impact Assessment, Federal Transit Administration 2006
- Environmental Noise Management Manual (ENMM), Roads and Traffic Authority 2001

Appendices

Appendix A - List of Sensitive Receivers

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
1	242 Pitt Street	ANZ	Public Buildings	2m	High Impact	High Impact	
2	260 Pitt Street	Criterion Hotel	Public Buildings	29m	Moderate Impact	Low Impact	
8	54-58 Park Street	Bambini On Park Espresso	Public Buildings	18m	Moderate Impact	Low Impact	
8	54-58 Park Street	Bauer Media Group	Office Buildings	18m	Moderate Impact	Low Impact	
8	54-58 Park Street	Fifty Four Park St Health And Wellbeing Club	Shop Buildings	18m	Moderate Impact	Low Impact	
8	54-58 Park Street	Hinkley's Diamonds	Shop Buildings	18m	Moderate Impact	Low Impact	
8	54-58 Park Street	Renya Xydis	Shop Buildings	18m	Moderate Impact	Low Impact	
9	50 Park Street	Bertrand Export Co Pty Ltd	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Clueless International	Shop Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	David M Carson Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Gells Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	John De Mestre & Co Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Martin P Board & Associates	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Mj Woods & Co Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Momentum Consulting Group Pty Ltd	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Moylan Family Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Rps Project Management	Office Buildings	19m	Moderate Impact	Low Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
9	50 Park Street	Streeterlaw	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Van Cooney Lawyers	Office Buildings	19m	Moderate Impact	Low Impact	
9	50 Park Street	Woods & Day Solicitors	Office Buildings	19m	Moderate Impact	Low Impact	
11	23-35 Park Street	Park Regis	Residential Buildings	29m	Moderate Impact	Low Impact	
11	23-35 Park Street	Park Regis City Centre Hotel	Public Buildings	29m	Moderate Impact	Low Impact	
3	262 Pitt Street	Pilgrim House	Office Buildings	39m	Low Impact	Negligible	
4	295-301 Pitt Street (Park House)	Clyde's Armc Aus Remedial Massage	Health Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Gem Studies Laboratory	Industrial Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Iventure Card Australia	Office Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Lowes	Shop Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Mk Clothing Alterations & Tailoring Service	Shop Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Opal & Pearl	Shop Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Open City Incorporated	Office Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Real Time - Open City Incorporated	Office Buildings	35m	Low Impact	Negligible	
4	295-301 Pitt Street	Realview Technologies	Office Buildings	35m	Low Impact	Negligible	
5	2 Park Street	Afex - Association Foreign Exchange	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street (Citigroup Centre)	Aig Australia	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Ark International Group PtyLtd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Arxxus Technology Partners	Office Buildings	19m	Low Impact	Low Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
5	2 Park Street	Auschain Investment Property	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Australian Select Mortgage	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Bernard Chiu Legal & Business Solutions	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Blackstone Waterhouse Lawyers	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Brightland International Group	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Brilliant Investment Group	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Chubb Insurance Company Of Australia	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Citigroup	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Citigroup Centre Management Office - JII	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Colin Biggers & Paisley	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Commonwealth Superannuation Corporation	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Ecomonos Chartered Accountants	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Espresso Bar	Public Building	19m	Low Impact	Low Impact	
5	2 Park Street	Fobasa Pty Ltd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Gilbert & Tobin	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Goldmate Group Pty Ltd	Office Buildings	19m	Low Impact	Low Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
5	2 Park Street	Hall Chadwick	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Hantec Markets (Australia) Pty Ltd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Harman Global	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Hicksons Lawyers	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Jll	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Kvb Kurlun Pty Ltd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Law Partners Solicitors & Barristers	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Lucian Capital City Limited	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Metlife Insurance Ltd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Perpetual Hlth Investment Group	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Qbe Australia & New Zealand	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Rbc Capital Markets	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Regus Business Centre	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Royal Bank Of Canada	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Samsung C & T Corporation	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Saxo Capital Markets	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Sportingbet Group Australia	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Sumitomo Metal Mining Oceania	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Turks Legal	Office Buildings	19m	Low Impact	Low Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
5	2 Park Street	Twitter Australia	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Two Eights (Australia) Pty Ltd	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Unilever	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	Universal World	Office Buildings	19m	Low Impact	Low Impact	
5	2 Park Street	William Hill Australia	Office Buildings	19m	Low Impact	Low Impact	
10	201 Elizabeth Street	Alliance Mortgage Solutions	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Anchor	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Armstrong Legal	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Australia Ymci Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Australian Energy Market Commission	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Australian Financial Security Authority (Afsa)	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Avec Global Sydney	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Beilby Poulden Costello Solicitors	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Bravuro Talent International	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Building Management Office	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Campaign Monitor	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	China Chilli Group	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Custom House Fund Services (Aust) Pty Ltd	Office Buildings	65m	Low Impact	Negligible	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
10	201 Elizabeth Street	Dahua Group Australia	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Dun & Bradstreet (Australia) Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Eataliano	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Elizabeth Street Early Learning Centre	Educational Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Energy Industries Superannuation Scheme	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Fin & Claw	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Four Seasons Massage Centre	Health Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Fragomen	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	G & C Mutual Bank	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Galileo Personal Training	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Godfrey Pembroke	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Goldwind Australia	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Gucci Australia	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Harlequine Enterprises (Aust)	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Harpercollins Publishers Australia Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Hdi Group	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Hodgkinson Mcinnes Legal	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Hodgkinson Mcinnes Patents	Office Buildings	65m	Low Impact	Negligible	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
10	201 Elizabeth Street	Hotelclub	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Independent Transport Safety Regulator (Itsr)	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Inform Group	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Information & Privacy Commission Nsw	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Ito's Malaysian	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Kinetic It Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Kreisson Legal	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Lederer Group	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Maurice Blackburn Lawyers	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	McInnes Wilson Lawyers Nsw	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Medico Legal Opinions/Uhg	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Milton Graham Lawyers Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Nsw Police Executive Offices	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Nsw Police Ministry	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Office Of Transport Safety Investigation	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Onward Group	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Pes-To Coffee	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Rcg Real Estate	Office Buildings	65m	Low Impact	Negligible	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
10	201 Elizabeth Street	Starbucks Coffee	Public Buildings	41m	Low Impact	Negligible	
10	201 Elizabeth Street	Study Group Australia Pty Ltd	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Sushi & More	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Taste	Public Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	The Lucky Charm Newsagents	Shop Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Thompson Cooper Lawyers	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Tmf Group	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Tom Executive Recruitment	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Umberventure Management	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Unicorp Partners	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Uniting Counselling and Meditation Uniform Sydney	Office Buildings	65m	Low Impact	Negligible	
10	201 Elizabeth Street	Xchanging	Office Buildings	65m	Low Impact	Negligible	
6	250 Pitt Street (Ashington Place)	Usa Outlet	Shop Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Penthouse Gentleman's Club	Shop Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	City Convenience Store	Shop Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Camera House	Shop Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Café Lido	Public Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Big Bite On Pitt	Public Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Cbd Bakery On Pitt	Public Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Kais Jewellery	Shop Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Remedial Massage Clinic	Health Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Kosmos Espresso Café	Public Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Deluxe Dry Cleaners	Shop Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	AMY Accountants	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Brain &Poulter	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Lucys Alterations	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	The Walter & Eliza Hall Trust	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Mackellers Lawyers	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	TW Agency	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Fone Fix Australia	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Study Central	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	OSIA International	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	ALAS abroad	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Diamond Traders	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Bannisters Lawyers	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Curate Bee/Clever Finance	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	OZ Education and Migration Specialist	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Livewell Physiotherapy	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Pillar Education Pty Ltd	Shop/office Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Beuline Laser Clinic	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Adina Jozsef Atelier	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Sydney Building Management	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Smart Education & Visa Services	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Hayel & Son Alteration & Tailoring	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Frank C. Adam	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Paul Sosinski Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Zhang's Chinese Medicine & accupuncture	Health Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Expert Watch Repairs	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Missy Mischief Public Relations	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	LA Jewellery Designs	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Johnson Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Symphony Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Tacca Hair Gallery	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Yang & Law Partners	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Morris & Watson	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Flying Kangaroo	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Twinkle Diamonds & Jewellery Designer	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Quintessential Health & Beauty Centre	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Opal Bliss Showroom & retail	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Metro Physiotherapy & Injury Clinic	Health Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	SH Education	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Mia & Eb body solutions	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Alloy Unique Metal	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	NCS Stone & Crafts	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Bizdata	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	KLZI Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Affection Diamonds	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Dam Jewellery / D&G Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Clifton	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Connection Brazil	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	West English	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Needs Migration	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Benjamin Hart Jewellery Yuna Diamond Setting	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	IVY Jewellers	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Bentex Suits - Custom Tailoring	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Watch Seller	Shop/office Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Sanford Properties	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	KMS Property Consultants	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Daniel Massey Solicitor & Consultant	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Diamond Setting Factory	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	Sydney Hair Professionals by Mounir	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Independent Gemmological Laboratory	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Didim Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Kwela Solutions	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Elevate Property Group	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Bridge Agency Overseas Education	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Olah Jewellers	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Diamond Micro Setting	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	Prudence Consulting	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Professional Education Migration	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	K&A Company	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Red Fire Engineers	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Jung Education	Shop/office Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Nevillee	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Kennedy Stamps	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Gugu Designer Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Elias Creations	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Mode Games	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Anjum Jewellers	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Marie Gemsetter Rey De Leon	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Little Paper pantry	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Health people Legal	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Pacifka Legal	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	New Land Magazine	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Jacques D Jewellers	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Jewel Laser Tech	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	EK Product	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Uhakpen	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Delphi Diamonds	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Sambe / Jayson Traurig	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	S&S/Jaxette Diamonds Setting	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	The Oak International Education	Shop/office Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Pirom Gem Trading	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Wissam Slailaty Diamond Setting	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	Sung Joon Kim Immigration Consultant	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Profound Services, Education & Migration	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Revenue Builder	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	China Blueprint Consultants	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Perfection Diamond Setters	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	G&J Sydney Jewellery	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Study Hub	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Antaky Jewellers	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Palak Trading Company	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Expiriti	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	My Pearls & Gems/Kuerida	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Student Easy	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Ozscs group Pty Ltd	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Tian Run Nature Health Products	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Anthony Scarcella Lawyer	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Lotus holidays	Shop/office Buildings	0m	High Impact	High Impact	

Property Numbers	Address	Business	Business Category	Distance	Impact		Sensitive Equipment
					Noise	Vibration	
6	250 Pitt Street	Wade Taranto	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	G Johnson & Associates Accountants	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Prestige Watch Repairs	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Hp Gems & Diamond Setting	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm & Equipment
6	250 Pitt Street	Genlik Jewellery Polishing	Shop/office Buildings	0m	High Impact	High Impact	Possible vibration alarm
6	250 Pitt Street	Not Doppler	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	The Creative Watchmaker	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	GS Economics	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	A&A Australia, Education & Migration	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	ECL Group	Shop/office Buildings	0m	High Impact	High Impact	
6	250 Pitt Street	Lambert & Cell	Shop/office Buildings	0m	High Impact	High Impact	
7	169 Castlereagh Street	Castlereagh Boutique Hotel	Hotel Buildings	0m	High Impact	High Impact	Heritage
7	169 Castlereagh Street	Pie Face	Public Buildings	0m	High Impact	High Impact	Heritage
7	169 Castlereagh Street	Hyde Park Jewellery	Shop Buildings	0m	High Impact	High Impact	Heritage
12	166 Castlereagh Street	The Great Synagogue	Public Buildings	20m	Moderate Impact	Moderate Impact	Heritage

Appendix B - Sensitive Receivers and Monitoring Points

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Impact Category

- Low Impact
- Moderate Impact
- High Impact
- Demolition Zone

Monitoring Category

- Noise
- Regenerated Noise
- Vibration
- Noise & Vibration

Sensitive Receiver Category

- Commercial
- Heritage
- Residential
- Place of worship
- Educational
- Industrial
- 5 Property no.
- Monitored RBL



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Sydney Metro Demolition - Pitt St North Noise and Vibration Receivers & Land Uses

Date: 27/05/2017
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 Report No: 0116 041 05



The contents within this document are based on third party data. The accuracy of the information can not be guaranteed

Appendix C - Heritage Specialist Advice on Monitoring Methods and Locations

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MEMO



DATE: 5 May 2017

AMBS Ref: 16278 VM

TO: Rauf Osterman, Director Osterman Consulting

FROM: Jennie Lindbergh, Director Historic Heritage, AMBS Ecology & Heritage

SUBJECT: Sydney Metro Demolitions – Vibration Monitoring, Masonic Hotel, Sydney

Background

The Sydney Metro City & Southwest Chatswood to Sydenham Metro was approved as a State Significant Development (SSD) on 7 January 2017. The Minister's Conditions of Approval (CoA) that are relevant to vibration monitoring on heritage structures are:

E30 The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.

E31 The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring of heritage-listed structures.

The standard equipment and methodology to be used for monitoring heritage structures adjacent to buildings to be demolished is described below.

Equipment

The noise and vibration monitoring equipment consists of:

- a logger for data storage, communication and power supply;
- a vibration sensor – Geophone;
- a Noise sensor – Microphone; and,
- associated data cables



Figure 1 The components of the vibration monitoring; the logger (left), geophone set on comfort plate (centre) and microphone (left).

The *logger* can be installed on a wall or a pole or at ground level.

The preferred installation of the *geophone* is on the foundation of the structure being monitored. The best level of coupling is achieved when the geophone is coupled using a bolt positioned through the centre of the geophone. The process requires an 8mm masonry brass expander to be inserted into an 8mm drill hole and the geophone fastened using a 6mm stainless bolt through the centre of the geophone. In rare cases when drilling into the foundation is not permitted, the geophone may be installed on nearby structures. There is also the option of fastening a plate to the foundation using a two part epoxy putty. The geophone is then screwed onto the plate. The least preferred option is the use of a comfort plate. A comfort plate is generally for internal use when measuring for human comfort and is not ideal for vibration monitoring for cosmetic/structural damage.

The *microphone* can be installed on a pole or wall using the bolt hole in the centre of the sensor or it can be zip tied to an object. There is also the possibility to install the microphone on a tripod when in a secure environment. The preferred height of installation is 1.5 metres but for practical reasons (to prevent theft or damage) the monitor can be positioned at a height of 2.5 to 3 metres.

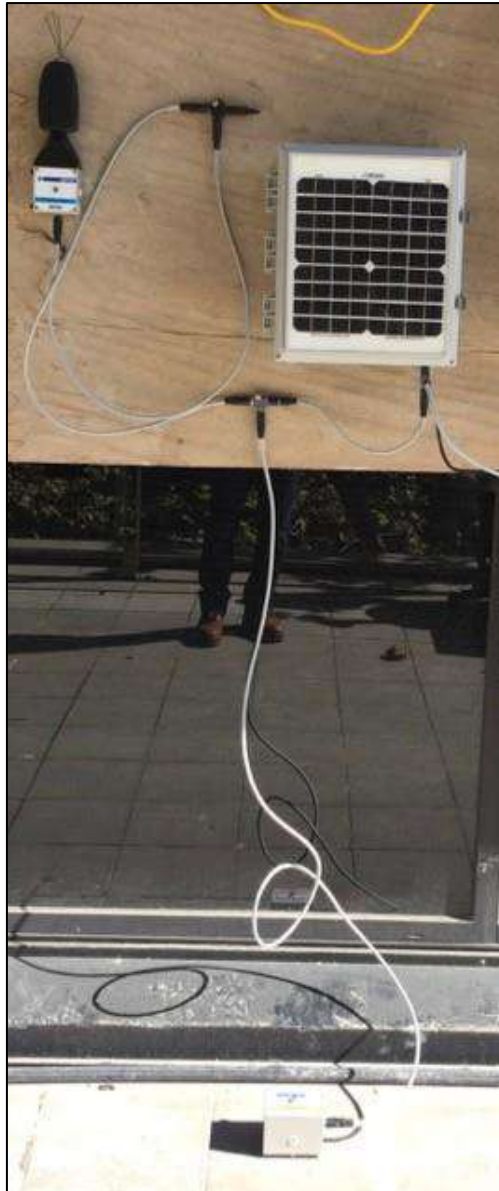


Figure 2 Typical layout of the vibration monitoring equipment.

Masonic Club

The following describes the methodology proposed to be used at the Masonic building (now a boutique hotel), 169–173 Castlereagh Street, Sydney. The New South Wales Masonic Club, built c.1925, is a twelve storey sandstone building, with a classically composed façade. It is a good example of the Inter-war Commercial Palazzo style. The Masonic Club, including its interiors, is Item 1699 on the heritage schedule of the Sydney Local Environmental Plan 2012, having historical, aesthetic, social and rarity significance with good integrity. The Statement of Significance is:

The Masonic Club is significant as a fine example of the Inter-war Commercial Palazzo style. It is a twelve storey sandstone building, symmetrical in its massing with three distinct sections that are fundamentally classical in composition. Designed and built by the Masonic Lodge in 1925, it is socially and historically significant for its continued associations with this nationally influential social organisation. Its skilfully designed

sandstone façade is an important contributor to the streetscape and reflects an important period of urban growth during the 1920s. Its interiors are both aesthetically and historically significant. The double volume main Dining Room is a fine example of a classically derived interior pertaining to the Gentleman's Club and features large recessed arched windows and a plaster ceiling with a deep, elaborate cornice incorporating classical dentils. The conversion of the upper levels to hotel type rooms reflects a growing need in the city during the later decades of the twentieth century.



Figure 3 Castlereagh Street façade.

Vibration Monitoring

The sensitive nature of the Masonic Club building is such that three options have been proposed; the final to be determined following consultation with the owners of the building.

The finally preferred option should be undertaken in accordance with the following principles:

- Fixings are not to be made through any flashings, waterproof membranes or roof sheeting.
- Care is to be taken to avoid damage during fixing and removal of the equipment and any damage is to be made good.
- Following removal of the monitoring equipment, any damage is to be made good based on the principle of like-for-like.

The locations of the monitoring equipment for each option is unobtrusive and the equipment would not be attached to significant building fabric, as described in Figure 4 – Figure 6 below.



Figure 4 View from the roof of the now vacant building at 175 Castlereagh Street into the Masonic Club lightwell. Option 1 is to locate the monitoring equipment on the floor of the lightwell.



Figure 5 View into a lightwell behind the parapet wall at the top of the building. Option 2 is to locate the monitoring equipment on the upstand wall as arrowed.



Figure 6 View into vacant shop at street level. Option 3 is to locate the monitoring equipment to attach to the wall abutting with the Masonic Club.

Conclusion

Installation of the vibration monitoring would have a negligible effect on the original fabric of the Masonic building which is mitigated by monitoring the building, in its entirety, against damage from vibration. There would not be an adverse effect on the local heritage significance of the building and as such, the work complies with the requirements of Conditions E30 and E31 of the Minister's Conditions of Approval.

Appendix D - High Impact Receivers Consultation Register

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Address	Building	Stakeholders	Adjoining structure?	Consultation
242 Pitt St	ANZ Tower	Rino Orlando, General Manager	Y	<p>Meetings with General Manager and briefing of tenants, involving representatives. Business survey conducted. Commercial tenants include: ANZ, Boston Consulting, Herbert Smith Freehills. Hours of operation are from 7am to 7pm, Monday to Friday. Legal firms have some activity later in the evenings and on Saturday and Sunday. Approximately 3500 staff access the building daily. No specific noise sensitivities identified.</p> <p>Meetings and phone calls with Building Manager. Doorknocking of retail businesses during EIS and in advance of works. Building houses 120 commercial businesses. This includes 39 jewellers and one laser clinic with possible vibration sensitive equipment. Building is typically in operation from 7am to 7pm, Monday to Friday, with individual businesses accessing the property at different times. The building is also open from 8am to 5pm on Saturdays. Basement tenant is in operation 24 hours a day. Building Manager noted that there were no significant issues during the recent ANZ tower development. Commitment made to follow up once Stage 1 structural demolition was underway. NOTE - As described in the Business Management Plan, engagement to date has focused on Stage 1 demolition activities. Further engagement with the ground floor retail tenants at 250 Pitt Street should be conducted prior to the commencement of Stage 2.</p>
250 Pitt St		Emilio Curcio, Building Manager	Y	<p>Sydney Metro have been holding weekly meetings with the Castlereagh Boutique Hotel since March 2017, attended by General Manager Paul Brasch and often other board members, including Peter Zelic and Stephen Bates. Paul Brasch regularly sends through updated hotel events calendars, which are forwarded through to Delta by the place managers. The hotel have requested that noisy works be scheduled from 9am onwards, to minimise impacts to their guests. The hotel also hosts business breakfasts on most weekdays, from 6.30-8.30am. They have a preference for noisiest works to occur in the afternoon, from 2pm onwards. They would like respite consideration to be given to functions held at lunchtime (12-2pm) particularly if there is a guest speaker.</p>
169 Castlereagh St		Castlereagh Boutique Hotel	Y	<p>Business survey conducted and regular doorknocking in advance of works. Ground floor retail tenant attached to Castlereagh Boutique Hotel. Hours of operation are Monday to Saturday 6am-11pm and Sunday 6am-6pm.</p>
169 Castlereagh St		Pie Face	Y	<p>Business survey conducted and regular doorknocking in advance of works. Ground floor retail tenant attached to Castlereagh Boutique Hotel. Hours of operation are Monday to Friday 9am-5pm.</p>
169 Castlereagh St		Hyde Park Jewellery	Y	<p>NOTE: this building is identified as medium impact. Consultation with Bauer Media Group at 54-58 Park Street found that while there is potential for 24/7 building use, the typical building use is Monday to Friday 7am to 7pm. Photography and occasional video shoots occur in the building. Bauer Media Group should be made aware of respite periods and notified of any unusually disruptive activities so they can schedule their events and meetings accordingly.</p>
54-58 Park Street		Bauer Media Group	N	