

Central Station Main Works

Construction Noise and Vibration Monitoring Program Report

August 2020 - January 2021

Document and Revision History

Document Details	
Title	Construction Environmental Monitoring Report
Client	Sydney Metro City & Southwest
Client reference no.	
CSM contract no.	K51

Revisions

Revision	Date	Description	Prepared by	Reviewed by
0		Issued to Sydney Metro and the Environmental Representative	EM	LD

Controlled:	NO	Copy no.:	Uncontrolled:	YES
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1. Introduction

Background

Sydney Metro City & Southwest – Chatswood to Sydenham Project is a new 30km metro line extending metro rail from the end of Sydney Metro Northwest at Chatswood under Sydney Harbour, through new CBD stations and southwest to Bankstown. It is due to open in 2024 with the capacity to run a metro train every two minutes each way through the centre of Sydney. The Central Station Main Works Project (CSMW) forms part of the Sydney Metro City & Southwest – Chatswood to Sydenham Project. The works are undertaken by Laing O'Rourke.

The CSMW include the installation of new platforms that will be constructed using sophisticated excavation techniques to create a cavern with an island platform, beneath Central Station's existing heavy-rail platforms 13, 14 and 15. The works include new infrastructure and the adjustments to existing infrastructure at Central Station to construct, operate and maintain the Metro Station Works. The key features of the Central Station works include:

- a new north-south concourse for Central Station which will link the new metro station with the existing northern entrance and north concourse, a new east concourse, and the existing southern baggage tunnel; and
- adjustments to the existing Grand Concourse, Olympic Tunnel, north concourse and northern entrance to Central Station.

The Central Walk works include the provision of infrastructure to provide improved connectivity and other operational enhancements throughout Central Station. The key features of the Central Walk works include:

- a new eastern entrance for Central Station on Chalmers St;
- a new east concourse for Central Station beneath existing platforms 16 to 23, which will link the new eastern entrance, the new north south concourse, existing platforms 16 to 23 and the existing Eastern Suburbs Railway (ESR) concourse; and
- provisions to enable the future construction (by others) of an extension of the Central Walk through a new west concourse and a new western entrance for Central Station.

Planning Requirements

In accordance with Minister's Condition of Approval (CoA) - C9, the Construction Monitoring Program was developed in consultation with the City of Sydney Council and the Environmental Protection Authority during the Construction Environmental Management Plan (CEMP) consultation and approval phase. Each construction monitoring program has been incorporated into the relevant CEMP sub-plan. The results of the Construction Monitoring Program will be submitted to the Secretary and relevant regulatory agencies for information. This Construction Noise and Vibration Monitoring Report covers the monitoring period from February 2020 to July 2020. The applicable CoA are shown in Table 1-1 and the applicable Environmental Protection Licence (EPL) Conditions are shown in Table 1-2 below.

Table 1-1: SSI 7400 Conditions relating to the Construction Monitoring Program

Condition	Requirement	Reference
C9	<p>The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each Construction Monitoring Program to compare actual performance of construction of the CSSI against predicted performance.</p> <p>Required Construction Monitoring Programs Relevant government agencies to be consulted for each Construction Monitoring Program</p> <p>Noise and Vibration - EPA and Relevant Council(s)</p> <p>Blasting - EPA and Relevant Council(s)</p> <p>Water Quality - EPA and Relevant Council(s)</p> <p>Groundwater - DPI Water/NRAR</p>	<p>Noise and Vibration – refer to the Construction Noise and Vibration Management Plan</p> <p>Blasting – Not applicable</p> <p>Water Quality – refer to the Construction Soil and Water Management Plan</p> <p>Groundwater - refer to the Construction Groundwater Management Plan</p>
C16	<p>The results of the Construction Monitoring Programs must be submitted to the Secretary for information, and relevant regulatory agencies, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program</p>	<p>The Construction Groundwater and Water Quality Monitoring Report will be submitted separately.</p> <p>The results of the Construction Noise and Vibration Monitoring Program are discussed in Section 3.</p> <p>In accordance with CoA C16, this report will be submitted to the following agencies for information:</p> <p>Department of Planning Industry and Environment</p> <p>NSW Environment Protection Authority</p> <p>City of Sydney Council</p> <p>The Independent Environmental Representative will review the reports prior to submission.</p>

Table 1-2: EPL 21148 Monitoring and reporting requirements

Condition	Requirement	Reference
M7.1	<p>Any noise monitoring must be undertaken in accordance with Australian Standard AS 2659.1 – 1998:</p> <p>Guide to the use of sound measuring equipment – portable sound level meters, or any revisions of that standard which may be made by Standards Australia, and the compliance monitoring guidance provided in the NSW Industrial Noise Policy.</p>	<p>Refer to the Construction Noise and Vibration Management Plan.</p> <p>Refer to S 2 for methodology and Appendix A of this report for Noise monitoring result summary.</p>
M7.2	<p>Any vibration monitoring must be undertaken in accordance with the technical guidance provided in the Environmental Noise Management Assessing Vibration: A Technical Guideline (DECC, 2006). All vibration monitoring results may be assessed and reported against the acceptable values of human exposure to vibration set out in Tables 2.2 and 2.4 of the guideline.</p>	<p>Refer to the Construction Noise and Vibration Management Plan.</p> <p>Refer to S 2 for methodology and Appendix B of this report for Vibration monitoring result summary.</p>

Submission Requirements

In accordance with condition C16, this report will be submitted to the following agencies for information:

- Department of Planning Industry and Environment
- NSW Environment Protection Authority
- City of Sydney Council

The Independent Environmental Representative and Acoustic Advisor will be provided with the report for information prior to submission.

Criteria

Standard Construction Hours

7:00am to 6:00pm Monday to Friday

8:00am to 1:00pm Saturday

Exceptional Construction Hours:

Due to the Government Gazette Notice No.75 – The standard construction hours at the Sydney Metro site at 20–28 Chalmers Street will change to 7am-6pm Mon-Sun including public holidays. Works past 13:00 on Saturday or anytime on Sunday would comprise lower impact works including material load out and canopy tube drilling.

Noise

The LAeq15min is the conventional unit of measure for construction noise impact. It is the continuous average energy over a 15-minute period, measured in decibels (dB). The LAeq15min can be either airborne or ground borne.

In accordance with the EPA's Interim Construction Noise Guidelines (ICNG) and the Project's Construction Noise and Vibration Impact Statement (CNVIS), the Highly Noise Affected Management Level (HNML) of 75 dBA will apply to residential (dwelling) receptors.

Internal Noise Criteria

Area	Receptor type	Condition of Approval (CoA)	Time Period	Criteria
Identified Precincts in the CNVIS	All	E37/38	0700-2000	Leq, 15 minute 60 dBA internal, If more than 50% of time (6.5 hours total) Leq, 15 minute 55 dBA internal, more than 25% of time (3.25 hours total)

CoA 37 - The Proponent must identify all receivers likely to experience internal noise levels greater than Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty, if rock breaking or any other annoying activity likely to result in regenerated (ground-borne) noise or a perceptible level of vibration is planned (including works associated with utility adjustments), between 7am – 8pm at Central.

CoA 38 - The Proponent must consult with all receivers identified in accordance with Condition E37 with the objective of determining appropriate hours of respite so that construction noise (including ground-borne noise), does not exceed internal noise levels of:

- Leq(15 minute) 60 dB(A) inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 50 percent of the time; and*
- Leq(15 minute) 55 dB(A) inclusive of a 5 dB penalty if rock breaking or any other annoying activity likely to result in ground-borne noise or a perceptible level of vibration is planned between 7am – 8pm for more than 25 percent of the time;*

unless an agreement is reached with those receivers. This condition does not apply to noise associated with the cutting surface of a TBM as it passes under receivers.

Note This condition requires that noise levels be less than Leq(15 minute) 60 dB(A) for at least 6.5 hours between 7am and 8pm, of which at least 3.25 hours must be below Leq(15 minute) 55 dB(A). Noise equal to or above Leq(15 minutes) 60 dB(A) is allowed for the remaining 6.5 hours between 7am and 8pm.

Vibration Criteria

Peak particle velocity (PPV) mm/s is the conventional unit of measure for construction vibration impacts for structural and cosmetic damage and can be applied to determine human comfort.

Vibration impacts for structural and cosmetic damage

The Sydney Metro Construction Noise and Vibration Strategy (CNVS) provides a conservative vibration damage screening level per receiver type given below:

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

This screening criteria relates Building Damage Vibration Management Levels (BS 7385) provided below.

Line	Type of Building	PPV (mm/s) in the Frequency Range of Predominant Pulse	
		4 Hz to 15 Hz	15 Hz & Above
L1	Reinforced or framed structures Industrial and heavy commercial buildings	50mm/s at 4 Hz and above	
L2	Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz	20mm/s at 15 Hz increasing to 50mm/s at 40 Hz and above

Source: BS 7385, CNVS

The building damage management level (BS 7385) has been presented in graph form to help with interpretation. The higher the frequency (x axis), the less stringent the criteria for velocity becomes (y-axis) up to 50mm/s. In the example below, all data points fall below both the Line 1 (L1) (less stringent) and the Line 2 (L2) (more stringent) criteria. An exceedance would be observed if data point were to be observed above the L1 or L2 lines on the graph below.

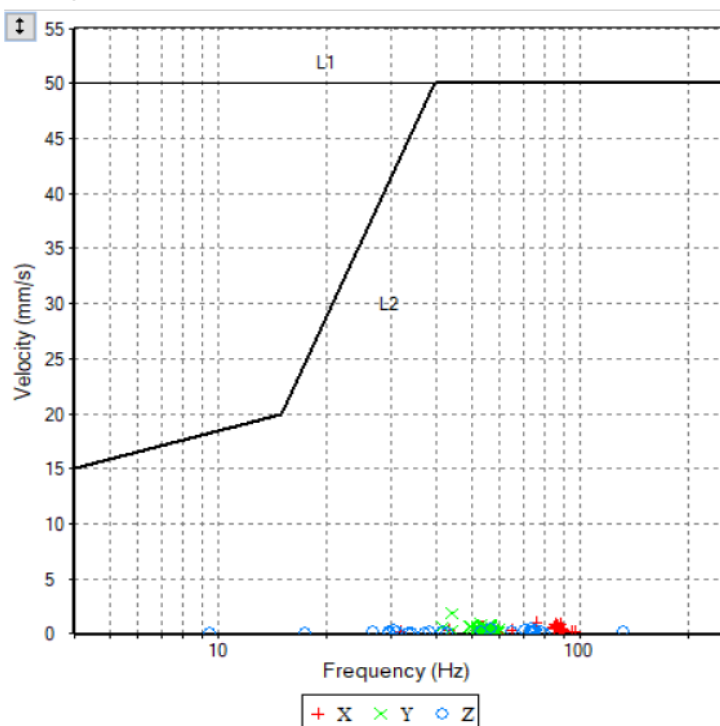


Figure 1: Example of criteria graphed. Note: All structures in the zone of potential construction impact of the Bounce Hotel demolition works are framed or reinforced, hence L1 criteria applies (50mm/s for all frequencies).

Human Comfort Criteria

The NSW Vibration Guideline provides guidance for assessing human exposure to vibration. The publication is based on British Standard BS 6472:1992.

Place	Time	Preferred PPV (mm/s)	Max PPV (mm/s)
Continuous Vibration			
Residences	Day	0.28	0.56
	Night	0.2	0.4
Offices	Day or night	0.56	1.1
Workshops	Day or night	1.1	2.2
Impulsive Vibration			
Residences	Day	8.6	17.0
	Night	2.8	5.6
Offices	Day or night	18.0	36.0

Workshops	Day or night	18.0	36.0
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Values given for the most critical frequency range >8Hz assuming sinusoidal motion. Source - Table C1.1 – The NSW Vibration Guideline

Vibration and its associated effects are usually classified as continuous, impulsive or intermittent as follows:

- Continuous vibration continues uninterrupted for a defined period (usually throughout daytime and/or night-time).
- Impulsive vibration is a rapid build up to a peak followed by a damped decay that may or may not involve several cycles of vibration (depending on frequency and damping). It can also consist of a sudden application of several cycles at approximately the same amplitude, providing that the duration is short, typically less than 2 seconds.
- Intermittent vibration can be defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous vibration that varies significantly in magnitude. It may originate from impulse sources (e.g. pile drivers and forging presses) or repetitive sources (e.g. pavement breakers), or sources which operate intermittently, but which would produce continuous vibration if operated continuously (for example, intermittent machinery, railway trains and traffic passing by). Assessing Vibration: a technical guideline, DEC NSW, February 2006. (Applicable for Vibration Dose Value (VDV)).

Vibration from the works can be subjectively considered as continuous or intermittent.

Conservatively and based on site observations and on what the receivers may experience, the vibration has been classified as continuous. As identified in Table 3 above, continuous vibration is measured in PPV. PPV is the preferred parameter for measuring vibration impacts as it can be obtained in real time, whereas VDV is more of a retrospective measure based on time exposure over a prolonged period of operation (i.e. 8hrs or 16hrs).

Perception relating to human comfort

An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other associations with the perceived source of the vibration. An indication of the human tactile perception of vibration of random motion is given in the table below.

Approximate Vibration Level	Degree of Perception
0.10 mm/s	Not Felt
0.20 mm/s	Threshold of Perception
0.35 mm/s	Barely Noticeable
1.0 mm/s	Noticeable
2.2 mm/s	Easily Noticeable
6.0 mm/s	Strongly Noticeable

Source: German Standard DIN 4150: Part 2-1975 - Note: These approximate vibration levels (in floors of buildings) are for vibration having a frequency content in the range of 8 Hz to 80 Hz.

The table above suggests that most people will be just able to feel continuous floor vibration at levels of about 0.20 mm/s, and that the motion becomes "noticeable" at a level of approximately 1.0 mm/s. The threshold for visible movement of susceptible building contents (e.g. plants,

hanging pictures, blinds, etc) is approximately 0.5 mm/s and the audible rattling of loose objects (e.g. crockery) generally occurs at levels of about 0.9 mm/s.

These levels are considerably lower than the BS 7385 criterion of 15mm/s and well below the cited 12.5 mm/s level corresponding to a near-zero probability of damage (refer Sydney Metro CNVS section 5.4.3).

In any premises, day-to-day activities (e.g. footfalls, doors closing, etc) will cause levels of vibration in floors and walls that exceed 1 mm/s (sometimes by quite considerable margins), and therefore visible movement and rattling are often observed. In most instances, however, such movement is considered normal and vibration levels of even much greater magnitude do not result in damage to the objects or building contents.

Because people are able to “feel” very low levels of vibration (even though they may not be disturbed by the motion), it is common to associate building damage with perceptible vibration, particularly when the source of vibration is outside the building and out of the occupants’ control. This largely subjective response is particularly accentuated when perceptible vibration is accompanied by high noise levels, or if there are other adverse effects associated with the source of vibration (e.g. inconvenience, dust, etc).

The NSW Vibration Guideline provides guidance for assessing human exposure to vibration. The publication is based on British Standard BS 6472:1992.

2. Methodology

The Construction Noise and Vibration Monitoring Program is designed to compare actual performance of construction of the CSSI against predicted performance and to assess the effectiveness of the mitigation measures applied during construction of the CSMW Project. The program has been executed in accordance with Section 10 of the Construction Noise and Vibration Management Plan (CNVMP) and recording requirements as specified in Section 10.2. The Construction Monitoring Program commenced 3 August 2018 and will continue for the duration of the project.

2.1 Sensitive Receivers

The CSMW Construction Noise and Vibration Impact Statement (CNVIS) assessed 50 sensitive receivers potentially affected by construction noise. The receiver locations are seen in the figure below.

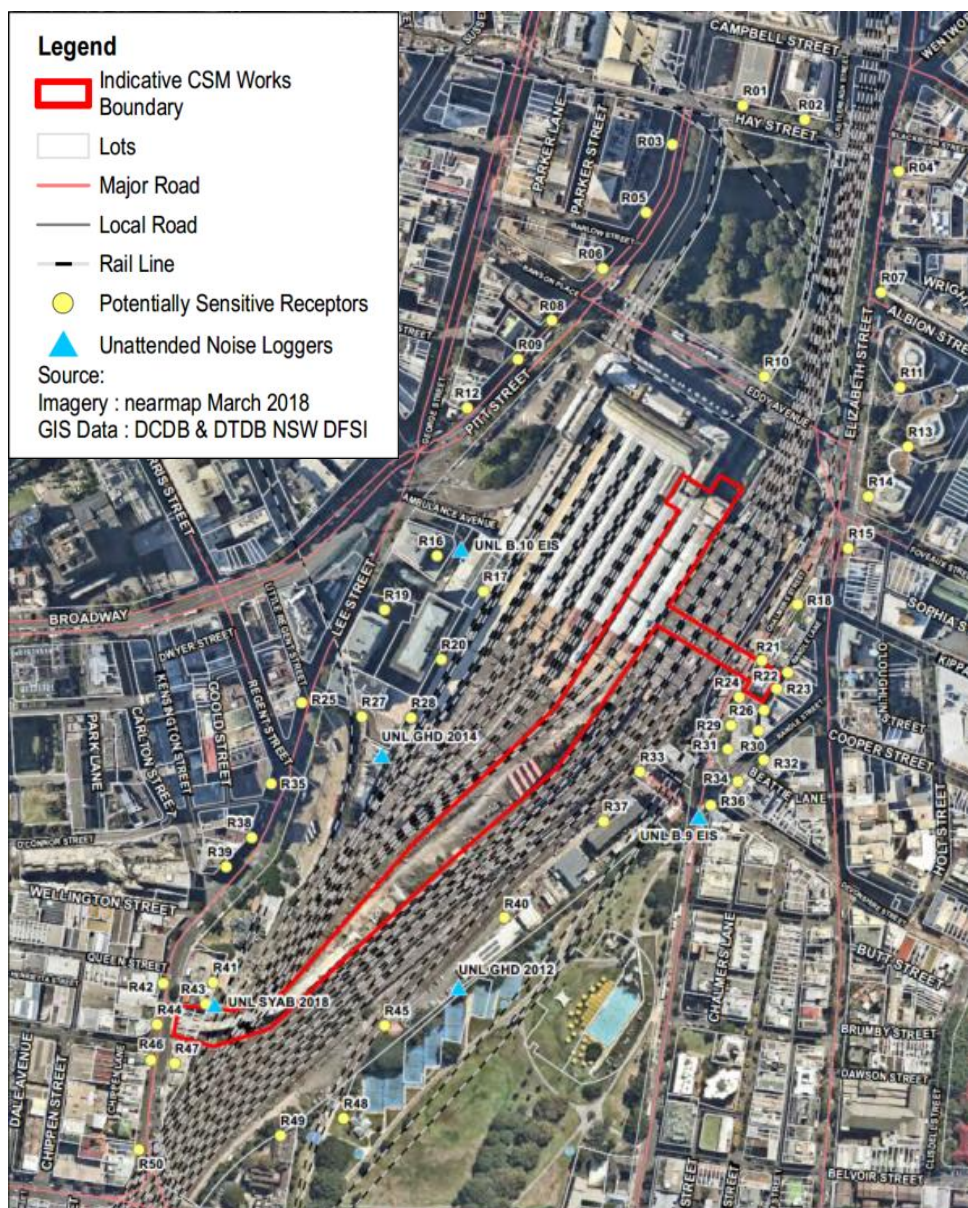


Figure 2-1: Location of Sensitive Receivers

CSM CNVIS

In accordance with CoA E33, ongoing consultation with sensitive receivers is undertaken as the project progresses based on the scenarios identified in the Construction Noise and Vibration Impact Statement (CNVIS). The scenarios are reviewed and refined with the input of construction detail to determine the potential impact and appropriate mitigation. All consultation with potentially affected receivers is undertaken prior to the start of the relevant portion of works. Additional mitigation measures are then tailored based on the consultation feedback.

2.2 Key Noise Monitoring Locations

Based on planned construction work, the area's most regularly impacted by construction noise and vibration during the reporting period are shown in Table 2-1 below:

Table 2-1: Estimated RBLs for Residential Receivers and NMLs for Non-Residential Receiver

Sensitive Receiver Category	Estimated RBLs (dBA)		
	Daytime	Evening	Night Time
Residential			
30 Chalmers St (R24)	56	53	45
38 Chalmers St (R29)	56	53	45
YHA (R17)	54	52	49
54 Regent St (R43)	50	50	44
Non- Residential	Daytime	Evening	Night Time
Dental Hospital _ A (north) - 2 Chalmers St (R18)	55	55	55

2.3 Monitoring

In accordance with CoA C11 unattended real-time noise and vibration monitoring will be the focus of monitoring however attended noise and vibration monitoring is undertaken where specific circumstances warrant. Real-time noise loggers were installed at:

- the rear of 54 Regent Street on 12 December 2018 (the closest to traffic movements on Sydney Yard Access Bridge and activities in Sydney Yard)
- on the hoarding at the Bounce Hotel site at 20-28 Chalmers Street on 11 January 2019 (being the closest to the proximity of the Eastern Entrance works and Central Walk works)
- at the YHA (Platform 1) on 24 October 2019

Real-time vibration loggers were installed at:

- Central Station at the State Significant Heritage listed Train Crew Assignment Centre (previously titled the Central Electric building) on 10 January 2019; and
- Façade of 30 Chalmers St on 14 October 2019.

As per CoA C11 real time monitoring data was made available to the LOR construction team, Sydney Metro, the Environmental Representative (ER), the Acoustic Advisor (AA), the Department of Planning, Industry and Environment (DPIE) and the Environment Protection Authority (EPA) via the project website <https://centralstationmetro.com/documents/>.

Impacts from vibration are considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (structural / cosmetic damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives. In accordance with CoA E28 and the requirements of the CNVIS, the vibration limits have been set in accordance with the British Standard BS 7385-2:1993. Where it has been identified that specific construction activities are likely to exceed the relevant noise or vibration goals (as is the case for select project works), noise or vibration monitoring is conducted at a nominated representative location (typically the nearest receptor where more than one receptor has been identified). Monitoring is also conducted in the event of a complaint being received or during OOHV where the Additional Mitigation Measures Matrix (AMMM) has identified monitoring as a requirement. In addition to monitoring required by the CoA and CNVMP, monitoring is conducted throughout Central Railway Station to assess the impact of construction activities on commuters and station staff with the results reported through a separate stakeholder management process. In the event of an exceedance of a predicted noise level, an investigation is undertaken followed by corrective actions as specified in the CNVIS and CNVMP if the exceedance was determined to be related to the project.

The results of the monitoring are communicated to relevant personnel when the noise or vibration goal is being approached so that work methodology or equipment being used can be altered, and / or additional management measures may be implemented where reasonable and feasible.

Table 2-2: Monitoring Equipment

Unit	Serial	Calibration Type	Frequency	Last calibration
Sound and Vibration Analyser				
Svantek 977 (noise logger)	36834	Factory	Biennial	12/12/19
Svantek SV33 (calibration unit)	43175	Factory	Biennial	28/06/19
Chalmers St	59643	Factory	Biennial	30/03/2020
54 Regent St	59644	Factory	Biennial	27/04/20
YHA	59636	Factory	Biennial	4/10/19
Ground vibration Logger				
Svantek 958A (vibration logger)	59157	Factory	Biennial	19/07/19
Svantek SV84 (transducer)	E3496	Factory	Biennial	19/07/19
Texcel (CEB)	7273	Factory	Biennial	10/12/2020
Texcel (30 Chalmers St)	7516	Factory	Biennial	27/09/19

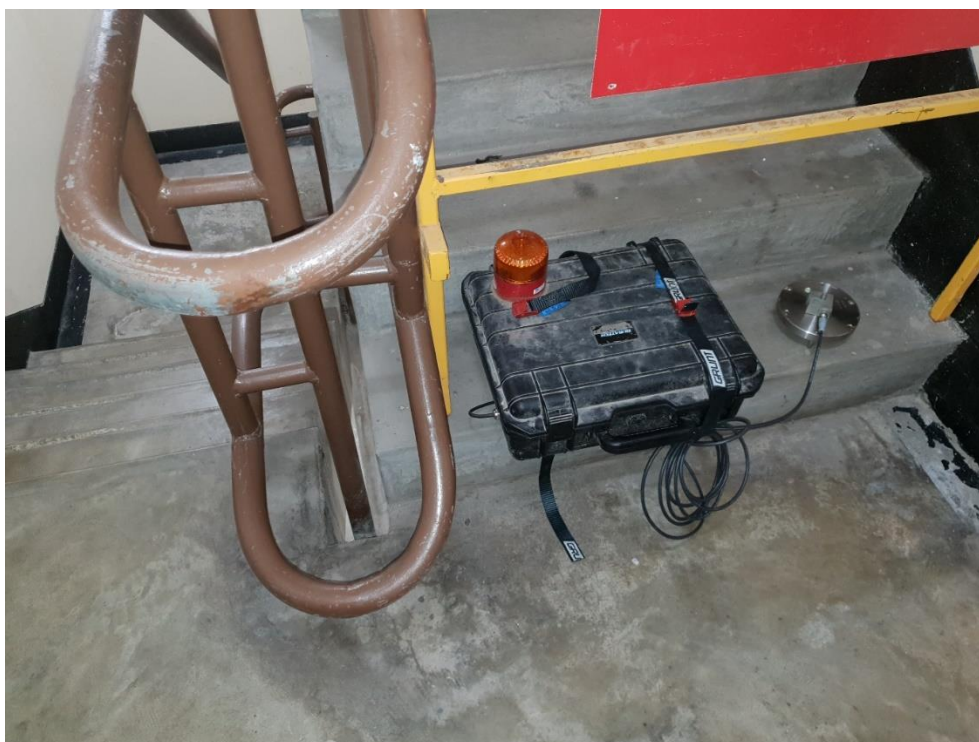


Figure 2-2: Unattended vibration Logger set up at the Dental Hospital southern stairwell



Figure 2-3: Attended noise logger setup on Chalmers St



Figure 2-4: Real time noise logger setup at the YHA (Platform 1), Installed 24 October 2019



Figure 2-5a: Real time vibration logger setup on the wall of 30 Chalmers St (installed 14 October 2019- January 2021)



Figure 2-5b: Real time vibration logger 30 Chalmers St relocated to centre of site January 2021)



Figure 2-6: Real time noise logger setup at 54 Regent St (in the process of being serviced), installed 12/12/2018



Figure 2-7: Real time noise logger Chalmers St, installed 11/01/2019



Figure 2-8: Real time vibration logger Central Electric Building, installed 11/01/19

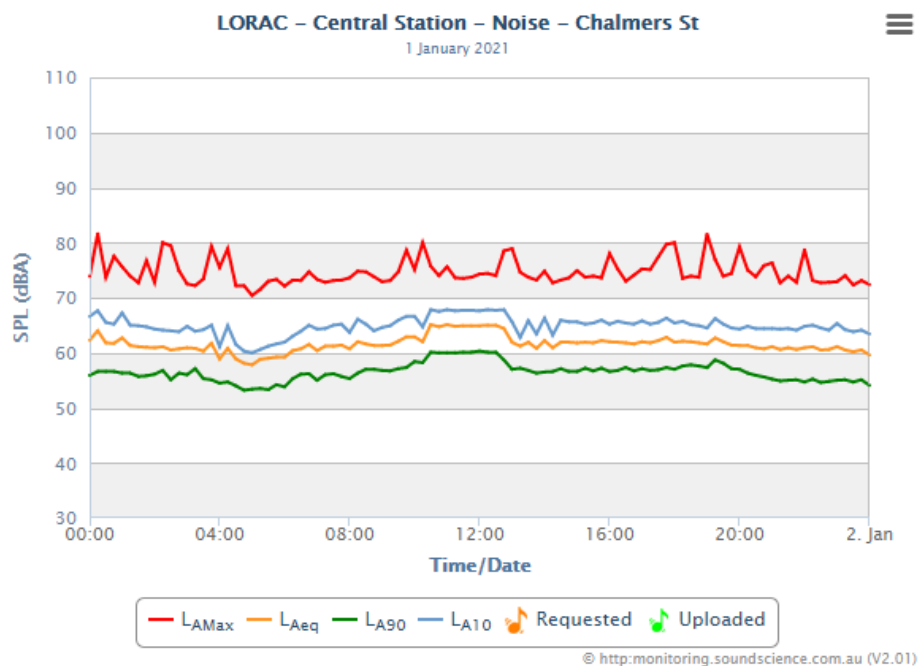


Figure 2-9: Example of real time noise monitoring data

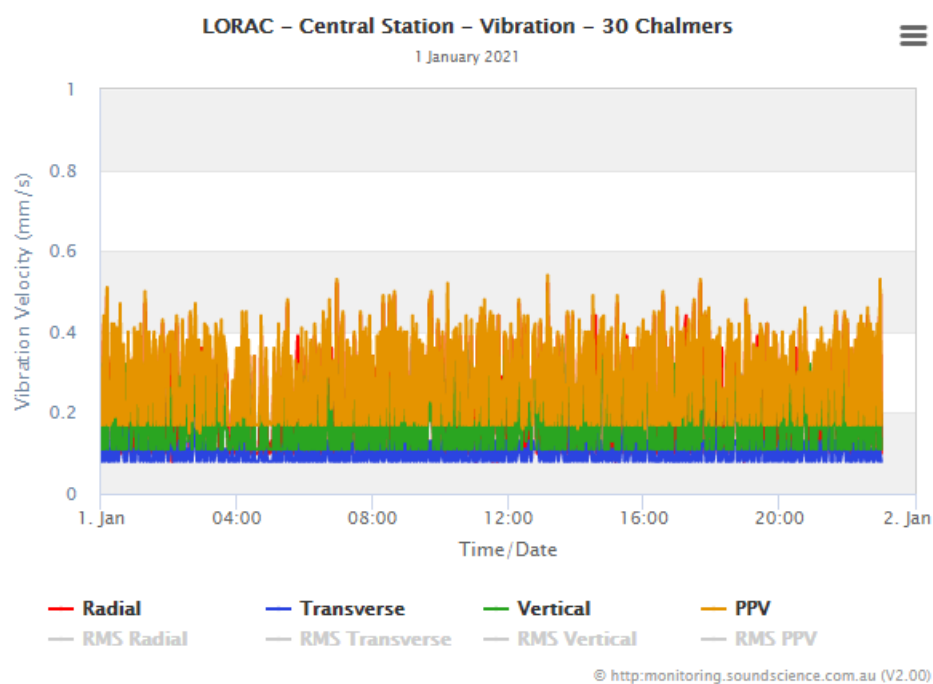


Figure 2-10: Example of real time vibration data. Graph showing general background vibration levels.

2.4 Noise Monitoring Frequency

Activities were assessed in the CNVIS under the following scenarios. During detailed planning of the activities to be conducted around rail possessions some of the activities were conducted concurrently. The potential noise impacts were reassessed on a monthly basis. Because the works are subject to an EPL, the Out of Hours Work Protocol as per CoA E47 is not applicable. To demonstrate due diligence and establish appropriate additional mitigation measures, the CSM works are assessed and documented on a monthly basis.

Table 2-3: Monitoring requirements for construction scenarios.

ID	Description	Frequency (as per AMMM)
SCN 01	Platforms & Sydney Yard: Stage 6 – Installing Services/Wiring	During OOH works
SCN 02	Platforms & Sydney Yard: Stage 7 – Installing Services / Hoarding / Offices	Daytime standard construction hours During OOH works
SCN 03	Platforms & Sydney Yard: Stage 7, 9 & 11 - Combine Services Route / Demolition of Sydney Yard Buildings / Salvage Canopy/ Remove Track / Remove Waste	During OOH work
SCN 04	Platforms & Sydney Yard: Stage 8 & 10 - OHW on Platform 11/12 / Replace Track Country End 12/13 / Installing CSR	During OOH works
SCN 05	Stage 12 - Piling Works / Removing Track	During OOH works
SCN 06	Platforms & Sydney Yard: Stage 13	Daytime standard construction hours/ During OOH work
SCN 07	Platforms & Sydney Yard: Stage 14, 16, 18 & 20	Daytime standard construction hours/ During OOH work
SCN 08	Platforms & Sydney Yard: Stage 15,17 & 19	Daytime standard construction hours/ During OOH work
SCN 09	Metro Box: Piling for the box perimeter and the plunge columns	Daytime standard construction hours/ During OOH work
SCN 10	Metro Box: FRP Capping Beam	Daytime standard construction hours/ During OOH work
SCN 11	Metro Box: Excavation to underside of Intercity Slab	Daytime standard construction hours/ During OOH work
SCN 12	Metro Box: FRP Platform and Intercity slab	Daytime standard construction hours
SCN 13	Metro Box: Excavation to underside of Metro Concourse	During OOH works
SCN 14	Metro Box: Ongoing Logistical support of Box Construction	During OOH works
SCN 15	Central Walk: Site investigation Works (Tracks 16-23)	Daytime standard construction hours/ During OOH work
SCN 16A	Central Walk: Construction of Olympic Stairs (Temp) - Platform 20/21 and 22/23	During OOH works
SCN 16B		
SCN 16C		
SCN 16D		
SCN 17		Daytime standard construction hours

ID	Description	Frequency (as per AMMM)
	Central Walk: Construction of the new Standby Guards Rooms / demolition of existing standby guards rooms	During OOH works
SCN 18	Central Walk: Construction of Platform Canopy Support System to Platforms 16 to 23 and Excavation of Launch Chambers	During OOH works
SCN 19	Central Walk: Platform works including works below the top slab	During OOH works
SCN 20	Central Walk: Platform Remodelling works including platform canopy modifications	During OOH works
SCN 21	ESR: Construction of Shaft to ESR Ghost Platform	Daytime standard construction hours
SCN 22	ESR: Surface Works and Underground works	During OOH works
SCN 23	East Entrance: Demolition of the Bounce Hotel	Daytime standard construction hours
SCN 24	East Entrance: Piling for East Entrance	Daytime standard construction hours
SCN 25	East Entrance: Excavation of East Entrance	Daytime standard construction hours
SCN 26	East Entrance: Excavation of Adit to ESR Concourse including Canopy Tube installation	Daytime standard construction hours
SCN 27	East Entrance: FRP works to East Entrance	Daytime standard construction hours
SCN 28	East Entrance: East Entrance Works and Underground Works	Daytime standard construction hours
SCN 29	Grand Concourse: Piling in Grand Concourse	During OOH works
SCN 30	Grand Concourse: FRP Pile caps	Daytime standard construction hours During OOH works
SCN 31	Grand Concourse: Removal of Existing Canopies	During OOH work
SCN 32	Grand Concourse: Installation of precast / in situ columns and arches	Daytime standard construction hours During OOH works
SCN 33	Grand Concourse: Installation of Roof Structure	Daytime standard construction hours/ During OOH work
SCN 34	Northern Concourse & North Entry: Demolition Southern Half	Daytime standard construction hours
SCN 35	Northern Concourse & North Entry: FRP of Structure (Floor, retaining wall, Columns)	Daytime standard construction hours
SCN 36	Northern Concourse & North Entry: Demolition Northern Half	Daytime standard construction hours
SCN 37	Northern Concourse & North Entry: FRP of Structure (Floor, retaining wall, Columns)	Daytime standard construction hours
SCN 38	Northern Concourse & North Entry: Installation of remaining precast columns and Arches	Daytime standard construction hours
SCN 39	Sydney Yard Access Bridge: Heavy Vehicle Traffic on the SYAB	Daytime standard construction hours During OOH works

The activities in Table 2-3 below were assessed against the scenarios in the CNVIS as show in Table 2-2 above through the OOH assessment process.

2.5 Out of Hours Works Summary

Generally, OOHW at Central Station are scheduled either when trains stop running or electrical isolation has been provided. OOHW are required to provide safe access for personnel and plant to the rail corridor to complete the required works. Additional Mitigation and Management Measures (AMMM) are adopted as required. OOHW are governed by the CoA and reflected in the EPL as required by Part 3.1 Section 45 (i). An EPL (EPL 21148) was issued for the Project on 28 November 2018. The LOR Environmental Manager provides internal approval for any Out of Hours Work (OOHW) conducted under the project EPL.

Table 2-4: Monitoring requirements for construction scenarios. Note Both CNVIS Scenario (SCN) predictions and OOHW Model predictions are presented in the far right column, as well as the receiver I.D (CH = Chalmers Street, RS = 54 Regent Street, YHA = Youth Hostel at 10 Lee Street (Platform 1)).

#	Activity	Monitoring requirement	SCN and prediction (dB)
25	August 2020 Weekend 5 – Weekday 9 – 01/08/20 to 31/08/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C		
	<u>Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)</u>		
	Throughout August – Eastern Entrance <ul style="list-style-type: none"> East Entrance Deliveries subject to comms notification. canopy tube drilling Central Walk Excavation/FRP: Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). Form, reo and pour. 	Real time monitoring Attended Monitoring at commercial businesses	SCN25: 83 Pred: 70 (CH)
	ESR Concourse, back of house and tunnels No OOH works in August	Noise impact determined to be inaudible at sensitive receivers.	
	Throughout August – Platform 16/17 <ul style="list-style-type: none"> Installation on temporary plates on top of skylight and lift void Excavation within southern hoarding including saw cutting, breaking, shotcrete and soil nails Hoarding, GRP Plates and temporary ramps maintenance work WE 05 August 1st and 2nd <ul style="list-style-type: none"> Removal of hoarding, GRP plates and platform furniture Saw cutting of existing slab and coping Break out of existing slab and coping Installation of form work including drilling for hold down bolts Installation of reinforcement Placement of concrete Installation of hoarding, tactiles, platform furniture 	Real time monitoring	SCN18: 72 Pred: 70 (CH)
	Throughout August – Platform 18/19 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works Installation on temporary plates on top of skylight and lift void WE 05 – Platform 18/19 drainage trench works on southern side <ul style="list-style-type: none"> Saw cut existing slab Break out existing slab Install pits and pipes Backfill trench and top up with concrete Hazmat cleaning of canopies on Platforms 17/17, 18/19, 20/21. <ul style="list-style-type: none"> Site establishment Wipe down canopy structure De-mob 	Real time monitoring	SCN22: 72 Pred: 70 (CH)

	Throughout August – Platform 20/21 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works 	Real time monitoring	SCN22: 72 Pred: 70 (CH)
	Throughout August – Platform 22/23 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting and breaking Form, reo pour Hoarding and GRP Plates maintenance works Canopy tube works WE 08 August 22nd and 23rd. Platform 22/23 relevening works: <ul style="list-style-type: none"> Removal of hoarding, GRP plates and platform furniture Saw cutting of existing slab and coping Break out of existing slab and coping Installation of form work including drilling for hold down bolts Installation of reinforcement Placement of concrete Installation of hoarding, tactiles, platform furniture 	Real time monitoring	SCN22: 72 Pred: 75 (CH)
Grand Concourse and Northern Concourse			
	Grand Concourse <i>OOH throughout August 2020</i> Installation of precast/in situ columns and arches <ul style="list-style-type: none"> Installation of precast columns and arches Scaffold removal Installation of roof structure <ul style="list-style-type: none"> Canopy roof – insitu beam structural pour Installation of roof canopy steelwork Steel work assembly WE05 – 1st – 2nd <ul style="list-style-type: none"> Structural Steel Installation and roof cassettes install to bay 6 and 7 WE06 – 8th – 9th <ul style="list-style-type: none"> Pour insitu beam Structural steel to bays 1 and 2 transitional roof and western canopy Roof works to bays 6 and 7 WE07 – 15th – 16th <ul style="list-style-type: none"> Pour insitu beam Structural steel to bays 1 and 2 transitional roof and western canopy Roof works to bays 6 and 7 	Real time monitoring	SCN32: 73 (CH) & 76 (YHA) Pred: 65 (CH & YHA) and SCN33: 53 (CH) & 56 (YHA) Pred: 50 (CH)
	Northern Concourse <i>OOH throughout August 2020</i> <ul style="list-style-type: none"> Escalator service fit -out and commissioning Lift enclosure installation FRP works to service trench and western staircase. Service investigations in lower northern concourse Cleaning of heritage sandstone at Station Masters Building Northern concourse floor slab FRP pour 4 Commence installation of lift enclosures. 	Real time monitoring	SCN35: 76 Pred 65 (CH)
Metro Box and Sydney Yard			

	<p><i>OOH throughout August 2020</i></p> <ul style="list-style-type: none"> Excavation (including rock breaking and use of 2x surface miners), shotcrete, grouting and installation of ground support in Metro Box N-S Concourse and basement levels. Commencement of steel raking column installation in basement levels. Waterproofing and FRP for Devonshire Street Tunnel underpinning structure. Installation of FRP within new stations basement box N-S Concourse and Basement levels. Operation of the permanent Water Treatment Plant Operation of the temporary ventilation system Operation of cranes on Traffic deck including newly constructed tower crane. Temporary deck installation and skylight infill. Site walkway and haul road preparation and maintenance. Survey and monitoring of tunnels, track and ground wells Spoil removal by Truck & Dogs General Yard works and plant movement/deliveries 	<p>Works occurring below ground are inaudible.</p> <p>Only air extraction units located behind noise attenuating hoarding on P12 and 16 will be used in sight.</p>	<p>SCN13: 67 Pred: 60 (CH & YHA) and SCN14: 71 Pred: 60 (CH & YHA)</p>
26	<p>September 2020 Weekday 9 – Weekday 13 – 01/09/20 to 30/09/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C</p>		
	<p><u>Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)</u></p>		
	<p>ESR Concourse, back of house and tunnels <i>No ESR works during September</i></p>	<p>Noise impact not assessed as works are inaudible at sensitive receivers</p>	
	<p>Platform 16/17</p> <ul style="list-style-type: none"> Installation on temporary plates on top of skylight and lift void Excavation within southern hoarding including saw cutting, breaking, shotcrete and soil nails Hoarding, GRP Plates and temporary ramps maintenance work 	Real time monitoring	<p>SCN18: 73 Pred: 70 (CH)</p>
	<p>Platform 18/19</p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works Installation on temporary plates on top of skylight and lift void 	Real time monitoring	<p>SCN18: 73 Pred: 70 (CH)</p>
	<p>Platform 20/21</p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works 	Real time monitoring	<p>SCN18: 73 Pred: 70 (CH)</p>
	<p>Platform 22/23</p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting and breaking Form, reo pour Hoarding and GRP Plates maintenance works Canopy tube works 	Real time monitoring	<p>SCN18: 73 Pred: 70 (CH)</p>
	<p>WE 11 – September 12th and 13th Platform 22/23 releveling works – on Southside slab: Activities include:</p> <ul style="list-style-type: none"> Removal of hoarding, GRP plates and platform furniture Saw cutting of existing slab and coping Break out of existing slab and coping Installation of form work including drilling for hold down bolts Installation of reinforcement Placement of concrete Installation of hoarding, tactiles, platform furniture <p>Platform 22/23 service installation works on canopies.</p>	Real time monitoring	<p>SCN20: 72 Pred: 75 (CH)</p>

	Throughout September at the East Entrance: <ul style="list-style-type: none"> Deliveries/removal of cranes and excavators subject to comms notification (likely 9th September). Canopy tube drilling, excavation and material load out. To occur between 13:00 – 18:00 Saturdays under Gazette 75. Throughout September within Central Walk Excavation/FRP: <ul style="list-style-type: none"> Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). Form, reo and pour. 	Real time monitoring Attended monitoring	SCN25/28: 83 Pred: 70, 75 (CH)
	<u>Grand Concourse and Northern Concourse</u>		
	<i>OOH throughout September 2020 – Grand Concourse</i> <ul style="list-style-type: none"> Piling adjacent to CENA 68 (When) – September 1st. 	Real time monitoring	SCN29: 69 (CH) & 72 (YHA) Pred: 60 (CH)
	<i>Throughout September in the Northern/Grand Concourse:</i> <ul style="list-style-type: none"> Installation of lift 25 and 26 Installation of roof canopy steelwork Canopy steel and cassette install Service investigations in lower northern concourse. WE 10 - 5th to 6th September Roads 8 - 12 Activities include: <ul style="list-style-type: none"> Install roof structural steel to western side (bays 1 and 2) WE 12 – 19th to 21st September Roads 8 - 12 Activities include: <ul style="list-style-type: none"> Installation of roof cassettes to the western side (Bays 1 and 2) 	Real time monitoring	SCN33: 54 (CH) & 56 (YHA) Pred: 50 (CH)
	Throughout September in the Northern Concourse: <ul style="list-style-type: none"> Demolition of existing escalators, timber canopy and slab – first 2 weeks of September. Removal of Class B Hoarding from southern side of SMO Building. 	Real time monitoring	SCN34: 74 Pred: 60 (CH)
	<u>Metro Box and Sydney Yard</u>		

	<p><i>OOH throughout September 2020</i></p> <ul style="list-style-type: none"> Excavation (including rock breaking and use of 2x surface miners), shotcrete, grouting and installation of ground support in Metro Box N-S Concourse and basement levels. Horizontal piling, waterproofing and FRP for Devonshire Street Tunnel underpinning structure. Installation of FRP within new stations basement box N-S Concourse and Basement levels. Operation of the permanent Water Treatment Plant Operation of the temporary ventilation system Operation of cranes on Traffic deck including newly constructed tower crane. Site walkway and haul road preparation and maintenance. Survey and monitoring of tunnels, track and ground wells Spoil removal by Truck & Dogs General Yard works and plant movement/deliveries 	Real time monitoring	<p>SCN13: 67 Pred: 60 (CH & YHA) and SCN14: 71 Pred: 60 (CH & YHA)</p>
27	<p>October 2020 Weekday 13 - Weekend 18 – 01/10/20 to 31/10/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C</p>		
	Suburban Tracks (Central Walk, Eastern Entrance, back of house and tunnel works)		
	<p>Sydney Yard Switch gear deliveries to Ambulance Avenue – between 20:00 – 04:00</p> <ul style="list-style-type: none"> 07/10/2020 08/10/2020 09/10/2020 <p>Removal of generator from Lee Street substation:</p> <ul style="list-style-type: none"> 4th or 5th October 2020 	Real time monitoring	<p>SCN2: 58 (CH) & 81 (YHA) Pred: 55 (YHA)</p>
	<p>Throughout October at Eastern Entrance:</p> <ul style="list-style-type: none"> Delivery and removal of excavators/crane for Eastern Entrance works from Randle Street during night shift in accordance with traffic approval (potentially multiple times a week, as required). This is required to occur OOH to minimise disruption to the road network. <p>Throughout October within Central Walk Excavation/FRP:</p> <ul style="list-style-type: none"> Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). Form, reo and pour 	<p>Real time monitoring</p> <p>Attended monitoring</p>	<p>SCN25/28: 83 (CH) Pred: 75 (CH)</p>
	<p>Throughout October at the East Entrance:</p> <ul style="list-style-type: none"> Saturdays in October between 1pm and 5pm: FRP works, and removal of spoil. 	<p>Real time monitoring</p> <p>Attended monitoring</p>	<p>SCN27: 80 (CH) Pred: 70 (CH)</p>
	<p>Railway institute driveway works: 11 – 27th October:</p> <ul style="list-style-type: none"> Approximately 3 – 4 night shifts (6pm-6am) over the two week period. Lifting and installing 12x pre-cast segments into the shaft. Welding Trenching for CSR (saw cutting) High Impact works are planned to be completed before 10pm. <p>ESR Wall demolition: WE 6th October</p> <ul style="list-style-type: none"> These works are occurring within the ESR behind hoarding and would be inaudible at the nearest sensitive receiver. 	Noise impact not assessed as works are inaudible at sensitive receivers	
	<p>Platform 16/17</p> <ul style="list-style-type: none"> Breaking out of existing canopy footings. Form, reo pour Load transfer – installation of temporary structure for support of existing canopy structure. Hoarding, GRP Plates and temporary ramps maintenance work 	Real time monitoring	<p>SCN18: 73 Pred: 73 (CH)</p>

	Platform 18/19 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works Make good FRP works 	Real time monitoring	SCN18: 73 Pred: 73 (CH)
	Platform 20/21 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails Form, reo pour Hoarding and GRP Plates maintenance works Make good FRP works. 	Real time monitoring	SCN18: 73 Pred: 73 (CH)
	Platform 22/23 <ul style="list-style-type: none"> Excavation within hoarding including saw cutting and breaking Form, reo pour Hoarding maintenance works Canopy tube works 	Real time monitoring	SCN18: 73 Pred: 73 (CH)
	Central Walk Excavation/FRP <ul style="list-style-type: none"> Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). Form, reo and pour. 	Real time monitoring Attended Monitoring	SCN18: 73 Pred: 73 (CH)
	WE 15 – October 10th – 11th Platform 20/21 relevelling works – on central slab section: Activities include: <ul style="list-style-type: none"> Removal of hoarding, GRP plates and platform furniture Saw cutting of existing slab and coping Break out of existing slab and coping Installation of form work including drilling for hold down bolts Installation of reinforcement Placement of concrete Installation of hoarding, tactiles, platform furniture Installation of drainage pit at southern end of the platform 	Real time monitoring	SCN20: 72 Pred: 73 (CH)
Grand Concourse and Northern Concourse			
	OOH throughout October in Grand Concourse Eddy Avenue works: <ul style="list-style-type: none"> Excavation works within the Eddy Avenue forecourt. 	Real time monitoring	SCN30: 73 (CH) & 76 (YHA) Pred: 55 (YHA)

	<i>OOH throughout October in Grand/Northern Concourse</i> <ul style="list-style-type: none">• Installation of lift 25 and 26• Service installation in lower northern concourse• Installation of roof canopy steelwork• Canopy steel and cassette install WE 14 - 3rd – 5th October Roads 8 – 12 Activities include: <ul style="list-style-type: none">• Roof installation to bays 1,2,6 and 7• Roof sheeting, soffit, glazing, precast install and joint sealant works.• Overhead wire transfer from temp structures onto permanent structure.• Removal of canopy units. WE 17 - 26th to 27th October Lift and escalator closure only Activities include: <ul style="list-style-type: none">• Roof sheeting, soffit, glazing to bays 6 and 7 western side (Bays 1 and 2)	Real time monitoring	SCN33: 53 (CH) & 56 (YHA) Pred: 53 (CH & YHA)
	<i>OOH throughout October in Northern Concourse</i> <ul style="list-style-type: none">• Demolition of existing concourse and excavation to lower concourse level.	Real time monitoring	SCN34: 74 (CH & YHA) Pred: 63 (CH & YHA)
Metro Box and Sydney Yard			
	<i>OOH throughout October 2020</i> <ul style="list-style-type: none">• Excavation (including rock breaking and use of 2x surface mining equipment), shotcrete, grouting and installation of ground support and waler beam in Metro Box N-S Concourse and basement levels.• Waterproofing and FRP for Devonshire Street Tunnel underpinning structure.• Atrium load transfer• Installation of FRP within new stations basement box N-S Concourse and Basement levels.• Operation of the temporary ventilation system• Operation of cranes on Traffic deck including newly constructed tower crane.• Site walkway and haul road preparation and maintenance.• Survey and monitoring of tunnels, track and ground wells• Spoil removal by Truck & Dogs• General Yard works and plant movement/deliveries	Real time monitoring	SCN13: 67 Pred: 60 (CH & YHA) and SCN14: 71 Pred: 60 (CH & YHA)
28	November 2020 Weekend 18 – Weekday 22 – 01/11/20 to 30/11/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C		
	Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works		
	Throughout November at the East Entrance: <ul style="list-style-type: none">• Potential removal and replacement of excavator during nightshift– will be subject to comms notification and ROL.• Likely to be only one heavy vehicle movement OOH in November, based on previous instances where there has been 1 OOH Vehicle movement per month. These have all occurred between 03:00 and 05:00 as per Traffic Approval.• Saturdays in November between 1pm and 5pm: FRP works, scaffolding, excavation (not hammering, or saw cutting), and loading out of spoil.	Real time monitoring Attended Monitoring	SCN25: 83 Pred: 70 (CH)

<p>ESR Concourse, back of house and tunnels (station fit out, largely inaudible) November 9th - 13th (18:00 – 06:00) Railway Institute Driveway - Drilling and coring between shaft and Ghost Platforms.</p> <p>WK20: November 16th - 20th: ESR:</p> <ul style="list-style-type: none"> • CCTV installation underground. • Core holing and HV cable feeding on ceiling of tunnel over tracks 24/25 <p>WE 21 – November 21st – 22nd Road 23 (Simultaneous with CW work)</p> <ul style="list-style-type: none"> • Road 23 concrete pad construction for future installation of new CRAC 134 condenser unit. • Installation of new CRAC 134 condenser unit to Road 23. 	<p>Noise impact not assessed as works are inaudible at sensitive receivers</p>	
<p>Platform 16/17 – throughout November</p> <ul style="list-style-type: none"> • Breaking out of existing canopy footings. • Form, reo pour • Load transfer – installation of temporary structure for support of existing canopy structure. • Hoarding, GRP Plates and temporary ramps maintenance work <p>WE 20</p> <ul style="list-style-type: none"> • Tile removal to the whole of platform 16/17 • Drainage works – deep pit installation at the north and south of the platform • Hazmat cleaning on platform 16/17 • Service installation works on Northern half of Platform 16/17 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>
<p>Platform 18/19 – throughout November</p> <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails • Form, reo pour • Hoarding and GRP Plates maintenance works • Make good FRP works <p>WE 19</p> <ul style="list-style-type: none"> • Saw cutting of existing slab and coping • Break out of existing slab and coping • Installation of form work including drilling for hold down bolts • Installation of reinforcement • Placement of concrete • Installation of hoarding, tactiles, platform furniture • Service installation works on northern half of platforms 18/19 and 20/21. 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>
<p>Platform 20/21 – throughout November</p> <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails • Form, reo pour • Hoarding and GRP Plates maintenance works • Make good FRP works 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>
<p>Platform 22/23 – throughout November</p> <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting and breaking • Form, reo pour • Hoarding maintenance works • Canopy tube works <p>WE 21</p> <ul style="list-style-type: none"> • Tile removal to the whole of platform 22/23 • Drainage works – deep pit installation at the north and south of the platform. • Hazmat cleaning on south end of Platform 22/23 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>

	Throughout November within Central Walk Excavation/FRP: <ul style="list-style-type: none"> Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). Form, reo and pour 	Works are inaudible as they occur from within the MB excavation.
	<u>Grand Concourse and Northern Concourse</u>	
	Throughout November in Grand Concourse Eddy Avenue works: <ul style="list-style-type: none"> Excavation works within the Eddy Avenue forecourt. Excavation Removal of spoil Installation of pipework Localised pressure testing Reinstatement works and make good 	Real time monitoring SCN30: 76 Pred: 55 (YHA)
	Throughout November in the Northern/Grand Concourse: <ul style="list-style-type: none"> Installation of lift 25 and 26 Service installation in lower northern concourse Installation of roof canopy steelwork Canopy steel and cassette install WE18 – 30th October – 1st November Roads 5 to 12 Activities Include: <ul style="list-style-type: none"> WLC and Bay 1-7 Roofing and cladding Canopy extension completion works WE 19 – November 7th – 8th Roads 16 Activities include: <ul style="list-style-type: none"> Bays 6 & 7 roof sheeting, soffit, glazing. 	Real time monitoring SCN33: 53 (CH) & 56 (YHA) Pred: 58 (CH/YHA) NB: Large interface with other works including Suburban Track works on WE19 and 20, however no cumulative impact. As such, monitoring at Chalmers should validate prediction for WE19 Suburban works.
	<u>Metro Box and Sydney Yard</u>	
	Throughout November: <ul style="list-style-type: none"> Excavation (including rock breaking and use of 2x surface mining equipment), shotcrete, grouting in Metro Box basement levels. Excavation of the Undercut and underneath the Devonshire Street Tunnel Waterproofing and FRP for Devonshire Street Tunnel underpinning structure. Atrium load transfer Installation of FRP within new stations basement box N-S Concourse and Basement levels. Installation of steelwork, finishes and services on NS Concourse Level 	Real time monitoring SCN13: 67 Pred: 67 (CH)
	Throughout November: <ul style="list-style-type: none"> Operation of the temporary ventilation system Operation of cranes on traffic deck including newly constructed tower crane Site walkway and haul road maintenance Survey and monitoring of tunnels, track and ground wells Spoil removal by Truck and Dogs General yard works and plant movement/deliveries 	Real time monitoring SCN14: 71 Pred: 67 (CH)
29	December 2020 Weekday 22 – Weekday 26– 01/12/20 to 31/12/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C	
	<u>Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)</u>	

	<p>Throughout December at the East Entrance:</p> <ul style="list-style-type: none"> Potential removal and replacement of excavator during nightshift – will be subject to comms notification and ROL. Likely to be only one heavy vehicle movement OOH in December, based on previous instances where there has been 1 OOH Vehicle movement per month. These have all occurred between 03:00 and 05:00 as per Traffic Approval. Saturdays in December between 1pm and 5pm: FRP works, scaffolding, excavation (not hammering, or saw cutting), and loading out of spoil. 	Real time monitoring	<p>SCN25/28: 83 Pred: 70 (CH) (Deliveries)</p> <p>SCN28: 80 Pred: 70 (CH) (FRP)</p>
	<p>Throughout December across all platforms 16-23 (Central Walk):</p> <p><i>Platform 16/17</i></p> <ul style="list-style-type: none"> Breaking out of existing canopy footings. FRP Load transfer – installation of temporary structure for support of existing canopy structure. Hoarding, GRP Plates and temporary ramps maintenance work <p><i>Platform 18/19</i></p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails FRP Hoarding and GRP Plates maintenance works Make good FRP works <p><i>Platform 20/21</i></p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails FRP Hoarding and GRP Plates maintenance works Make good FRP works. <p><i>Platform 22/23:</i></p> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting and breaking FRP Hoarding maintenance works Canopy tube works 	Real time monitoring	<p>SCN18: 73 (CH) Pred: 73 (CH)</p>
	<p>WE23 Possession: 5-6 December 2020</p> <ul style="list-style-type: none"> P20/21 - Removal of tiles and drainage installation P22/23 - building up and grading down existing sections of platform to new levels Service installation works on Platforms 20/21, Platform 22/23 <p>Possession Works reduced to between the yellow lines on Platforms only e.g. service installation & Hazmat removal (No Hi-rail plant or works on track).</p> <p>Interface:</p> <p>ST Track Reconstruction on Museum side of platform 22 (from 5.877km City Outer to 0.013km Down Illawarra Local (26m)) and work train will stable on platform 21 (Airport Line Up). Combine G train and ballast train (8 x G wagons & 7x ballast wagons).</p> <ul style="list-style-type: none"> Down Airport Rerail on Redfern side of Platform 23 (Between 625B & 636A Points). ELIP Project working on OHWS CE0+035 - Early OHW handback on Tracks 22 & 23 	Real time monitoring	<p>SCN20: 75 Pred: 72 (CH)</p>
Grand Concourse and Northern Concourse			

	Throughout December in Grand Concourse Eddy Avenue works: <ul style="list-style-type: none"> Excavation works within the Eddy Avenue forecourt. Excavation Removal of spoil Installation of pipework Localised pressure testing Reinstatement works and make good 	Real time monitoring	SCN 30: 56 Pred: 55 (YHA)
	Throughout December in the Northern/Grand Concourse: <ul style="list-style-type: none"> Installation of lift 25 and 26- Removal of CHS struts from escalators (demolition) Service installation in lower northern concourse Installation of roof canopy steelwork Canopy steel and cassette install Glazing, skylight flashing, welding, lighting speaker brackets, symphonic drainage Activities include: <ul style="list-style-type: none"> Installation of lighting on canopy spoiler adjacent to Road 16. Installation of columns to bays 4 and 5 Installation of roof structural steel and cassettes to bays 3 - 5 	Real time monitoring	SCN 33: 53 (CH) & 56 (YHA) Pred: 50 (YHA/CH)
33	WE24 Possession: 12-13 December 2020 Northern Concourse (Full closure of concourse for exclusion zones): <ul style="list-style-type: none"> Extending new roof canopy over the north end of Platforms 8-11 and continuing roof fit out Removal of Pedestrian Canopy Units Sawcut concourse Balustrade footings P9, 10, 11 Platform Roads 8 to 12 to be clear of trains for the duration of possession. Services- Removal of the services from the temporary canopy structures 	Real time monitoring	SCN 33: 53 (CH) & 56 (YHA) Pred: 50 (YHA/CH)
	WE25 Possession: 19-21 December 2020 Northern Concourse (Full closure of concourse for exclusion zones): <ul style="list-style-type: none"> Removing covered pedestrian walkway modules and temporary escalator roof. Installing balustrade footings on Platforms 9-11. Extending new roof canopy over the north end of Platforms 8-11 and continuing roof fit out. 	Real time monitoring	SCN 33: 53 (CH) & 56 (YHA) Pred: 50 (YHA/CH)

	<p>Throughout December in the Northern/Grand Concourse:</p> <p>Demolition, Excavation and Piling</p> <ul style="list-style-type: none"> Demo western Stair wall (7-9, Day/Night) FRP staircase and external wall above CENA68 <p>WK25-26 Intercity Slab Demo (Xmas shutdown)</p> <ul style="list-style-type: none"> Demo top slab to precast level Demo existing intercity floor slab 65 planks 3 support beams <p>Northern Concourse (Full closure of concourse for exclusion zones):</p> <ul style="list-style-type: none"> Completion of roof scope Pedestrian hoardings changes to stage 4 New Drainage channels Concourse releveling Concourse Tiling - area LNC, Balustrades to platform 9/10 & 11 & 12 CENA 68 Stair tiling and balustrades Road 16 possession each night □ eastern Canopy works 2300 - 0500 Track possession from road 7/8 to 12. 7/8 road for adjacent line working only. <p>Civil - Between Platforms 8 to 12:</p> <ul style="list-style-type: none"> Tiling and releveling of previously trenched areas for CSR works on Platforms 8 to 12 <p>Logistics:</p> <ul style="list-style-type: none"> Modification to site offices and facilities <p>Services:</p> <ul style="list-style-type: none"> Removal of services (temporary) in temp canopy units - Contingency MEP Services final fix to canopy & Commissioning of services in new canopy Works within Lee St Substation 	Real time monitoring	SCN 34: 74 Pred: 65 (YHA/CH)
	<u>Metro Box and Sydney Yard</u>		
	<p>Throughout December:</p> <ul style="list-style-type: none"> Excavation (including rock breaking and use of 2x surface mining equipment), shotcrete, grouting in Metro Box basement levels. Excavation of the Undercut and underneath the Devonshire Street Tunnel Waterproofing and FRP for Devonshire Street Tunnel underpinning structure. Atrium load transfer Installation of FRP within new stations basement box N-S Concourse and Basement levels. Installation of steelwork, finishes and services on NS Concourse Level Operation of the temporary ventilation system Operation of cranes on Traffic deck including tower crane. Site walkway and haul road maintenance. Survey and monitoring of tunnels, track and ground wells Spoil removal by Truck & Dogs General Yard works and plant movement/deliveries 	Real time monitoring	<p>(Belowground) SCN13: 67 Pred: 65 (CH)</p> <p>(Aboveground) SCN14: 71 Pred: 60 (CH)</p>
	Ongoing SYAB usage for OOH deliveries throughout December	Real time monitoring	SCN39b: 71 Pred: 66
30	January 2021 Weekday 26 – Weekend 31– 01/01/21 to 31/01/21 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C		

<u>Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)</u>			
	Throughout January at the East Entrance: <ul style="list-style-type: none"> Potential removal and replacement of excavator during nightshift– will be subject to comms notification and ROL. Likely to be only one heavy vehicle movement OOH in November, based on previous instances where there has been 1 OOH Vehicle movement per month. These have all occurred between 03:00 and 05:00 as per Traffic Approval. Saturdays in November between 1pm and 5pm: FRP works, scaffolding, excavation (not hammering, or saw cutting), and loading out of spoil. 	Real time monitoring	SCN25/28: 83 Pred: 70 (CH) SCN27: 80 Pred: 70 (CH)
	Throughout January across all platforms 16-23: <i>Platform 16/17</i> <ul style="list-style-type: none"> FRP Service tunnel base slab and wall Lift and escalator base Plenum base slab and wall Lift and escalator wall Hoarding, GRP Plates and temporary ramps maintenance work <i>Platform 18/19</i> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails FRP Hoarding and GRP Plates maintenance works <i>Platform 20/21</i> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails FRP Hoarding and GRP Plates maintenance works. <i>Platform 22/23</i> <ul style="list-style-type: none"> Excavation within hoarding including saw cutting and breaking FRP Hoarding maintenance works Canopy tube works Central Walk below Platforms and tracks: <ul style="list-style-type: none"> Excavate, grounds support, temporary prop installs, track slab support 	Real time monitoring	SCN18: 73 Pred: 73 (CH)
	WE29 Possession 16-17 January 2021 3rd WE for P18/19 Removal of Platform finishes <ul style="list-style-type: none"> 4th WE for Platform 20/21 Releveling and drainage 	Real time monitoring	SCN20: 72 Pred: 73 (CH)
	WE30 Possession 23-24 January 2021 5th WE for P20/21 Install new tiling to Platform <ul style="list-style-type: none"> 4th WE for P18/19 Releveling and drainage 	Real time monitoring	SCN20: 72 Pred: 73 (CH)
<u>Grand Concourse and Northern Concourse</u>			
	Northern/Grand Concourse works throughout January 2021 <ul style="list-style-type: none"> Installation of roof canopy WE25, 26 including roof fit out (Dec - Jan) (January Possessions WE29 & 30) Removal of tower crane 	Real time monitoring	SCN33: 53 (CH) & 56 (YHA) Pred: 58 (both)
	Works in Northern Concourse throughout January <ul style="list-style-type: none"> Lift 8 demolition TCAC Underpinning works inc excavation of foundations (Jan – Apr) Demolition of precast planks and slab, high impact noise with numerous Brokks in use 	Real time monitoring	SCN32: 76 Pred: 65 (YHA)

Metro Box and Sydney Yard			
	Throughout January: <ul style="list-style-type: none"> Excavation (including rock breaking and use of 2x surface mining equipment), shotcrete, grouting in Metro Box basement levels. Atrium load transfer Installation of FRP within new stations basement box N-S Concourse and Basement levels. Installation of steelwork, finishes and services on NS Concourse Level Operation of the temporary ventilation system Operation of cranes on Traffic deck including tower crane. Site walkway and haul road maintenance. Survey and monitoring of tunnels, track and ground wells Spoil removal by Truck & Dogs General Yard works and plant movement/deliveries 	Real time monitoring	(Belowground) SCN13: 67 Pred: 67 (CH)
			(Aboveground) SCN14: 71 Pred: 68 (CH)
	Ongoing SYAB usage for OOH deliveries throughout January	Real time monitoring	SCN39b: 71 Pred: 66
Site Wide CSR Works			
	WE29 Possession 16-17 January 2021 Civil - Between Platforms 8 to 12: <ul style="list-style-type: none"> Tiling and releveling of previously trenched areas for CSR works on Platforms 8 to 12 Logistics: <ul style="list-style-type: none"> Modification to site offices and facilities 	No Monitoring undertaken as not required by AMM's.	

3. Monitoring Results

3.1 Noise

Construction noise levels for some CSM work activities are predicted in the CNVIS to exceed the external noise management level at times, particularly during works outside of standard hours. Attended and unattended real time noise monitoring was undertaken during the reporting period as required for OOH, particularly during possessions where noise modelling predicted exceedance of noise management levels.

As identified by modelling in the CNVIS, the majority of noise impacts have occurred at the closest sensitive receivers predominantly on Chalmers Street and to a lesser extent the YHA on Platform Zero. Standard mitigation measures were implemented as per Section 8 of the CNVMP and Section 8 of the CNVIS. Additional mitigation and management measures were implemented as per the OOH approvals. Additional respite periods during high noise activities were provided to Sydney Trains staff and commuters by not undertaking high noise impact activities during peak hours as well as using one of three noisy work programs:

- 1) Working three hours on and one hour off, and then repeating this cycle, or;
- 2) Working 45 minutes on with 15 minutes off for three hours, followed by one-hour break and then repeating this cycle.
- 3) Working one hour on, half hour off

Specific respite periods were also negotiated with the Dental Hospital and Haven Specialist Coffee for works in standard construction hours (note: Haven Specialist Coffee closed down and Columbus & Co Central café opened at the same location in mid October 2020).

The real time noise data was reviewed at the time of potential high noise impact works by site supervisors. The playback function allowed for differentiation of construction noise from ambient noise levels. Notable high ambient noise levels were recorded during attended noise monitoring sessions and from playback recordings downloaded from the real time logger at Chalmers Street, Regent Street and the YHA. Common extraneous noise sources include:

- Other construction works on Chalmers and Elizabeth Streets, particularly maintenance works
- Residences or pedestrians near the measurement position
- Wind-blown vegetation and insects
- Road traffic on public roads, particularly applicable at 54 Regent Street
- A street sweeper going past on Chalmers St
- Light rail on Chalmers St
- Noise from trains passing, diesel trains idling in the intercity platforms, announcements, and train signalling horns at the YHA; and
- Noise from fauna; specifically, cockatoos and seagulls – the latter of which are often active throughout the night.

Noise monitoring results are detailed in Appendix A. Monthly noise data tables have been prepared for each sensitive receiver. The objective of the data tables is to validate the predictions for the specific activities as documented in the CNVIS. To obtain a greater understanding of the noise environment the 'adjusted' ($10 \times \log$ of the attribute) and 'non-adjusted' values are analysed. This is explained further below, and a quick reference table is provided in Table 3-1.

Table 3-1: $10 \times \log$ (attribute) quick reference table

Attribute: % Contribution of magnitude	$10 \times \log(\text{attribute})$ Reduction in dB	Attribute: Event duration (x mins per 15min measure)	$10 \times \log(\text{attribute})$ Reduction in dB
5	-13	1	-12
10	-10	2	-9
15	-8	3	-7
20	-7	4	-6
25	-6	5	-5
30	-5	6	-4
35	-5	7	-3
40	-4	8	-3
45	-3	9	-2
50	-3	10	-2
55	-3	11	-1
60	-2	12	-1
65	-2	13	-1
70	-2	14	0
75 to 85	-1	15	0
90 to 100	0		

Note 1: The Decibel (dB) is a relative unit of measurement corresponding to one tenth of a bel. It is expressed on a logarithmic scale, hence the ratio between decibels also need to be quantified logarithmically.

Note 2: The % Contribution of magnitude is a relatively subjective measure. To keep the methodology repeatable as is required by scientific method, only 5%, 50% and 100% contributions are used in the assessment.

Example: A noise file was reviewed that captured saw cutting. The unadjusted $L_{Aeq15min}$ was 64dB. When in operation the contribution of the saw was 50% to the noise environment due to the distance and use of noise attenuating screens. The other 50% was construction noise confirmed not to be associated with CSM. The saw cutting lasted for 6 minutes over the 15-minute period.

$$64dB + [10 \cdot \log(0.5)] + [10 \cdot \log(6/15)] = 57dB.$$

Therefore the 'unadjusted $L_{Aeq15min}$ ' is 64dB and the 'adjusted $L_{Aeq15min}$ ' is 57dB.

In this example regardless of the 7dB difference, the mitigation for the impact remains the same.

A precautionary approach is used as follows:

- The 'unadjusted $L_{Aeq15min}$ ' measure is used to determine potential noise impact in real time to adjust works in real time accordingly. The next $L_{Aeq15min}$ period can be improved from the last.
- The 'adjusted $L_{Aeq15min}$ ' measure is used as an indicative noise level. It is a tool used to better understand the noise impact contribution of the project on the surrounding noise environment. The adjusted measure was particularly useful when separating CSM works from rail operational noise, and other construction work in the local area not associated with the project.
- It is difficult to assign a percentage of magnitude, so typically 5% is assigned for no magnitude, 50% if other works or noises are still contributing, or 100% if no other works or impacts can be heard at the time of use of that equipment.
- Not all files are 'adjusted' as the corrections are not always applicable due to the dominant nature of the activity, or the works are considered inaudible.
- The $L_{Aeq15min}$ of highest noise period is selected for assessment.
- The data table is prepared to ensure results can be verified.

The real time data is reviewed by the night supervisors by smart phone at the time of a noisy activity with the potential to impact the community. This allows for a review of the $L_{Aeq15min}$ period against predictions. If required, the work methodology is adjusted where feasible. During scheduled rail possessions, options such as amending construction practices and schedules to reduce noise impacts by carrying out the works during less noise sensitive times is not feasible due to a large majority of complex works occurring in limited track and platform possession windows. Additional respite offers have been in the form of customised noise attenuating ear plugs and extensive communications.

Generally, exceedances of predicted noise levels were typically attributed to extraneous noise rather than construction activities (comparing adjusted to non-adjusted). Zero non-conformances were raised during the reporting period for an exceedance attributed to the incorrect implementation of noise mitigation measures or AMM's.

3.1.1 Possession based noise monitoring

During this reporting period between August 2020 and January 2021, 29 rail possessions were planned and executed – several of these involved possessions occurring simultaneously on the Suburban Tracks, Intercity Platforms, or the North/Grand Concourse. The possessions likely to be associated with the greatest impact were associated with platform resurfacing/relevelling and drainage works within the Suburban platforms (refer Scenario 18 and 22 in the CNVIS). The works occurring on site included temporary works, excavation, spoil removal, jackhammering and saw cutting.

While the edge beams and track slabs (scope of works mentioned in previous reports) allow for the undermining of the Central Walk Concourse – platform relevelling works will improve drainage, accessibility of the platforms by commuters moving between the platforms and trains, as well as improve the overall aesthetic of the platform surfaces. Re-leveling works typically comprise the removal of the upper layer of the platform surface (concrete, screed and tile) and coping edge, followed by the placement of a newly graded surface comprising concrete, screed and new tiles, as well as drainage channels and pits. The scope of works will occur in several stages across 2020 and 2021, and will require wall saws, road saws and excavators with hammer attachment's to remove the entire platform surface.

To address the potential for high noise impacts at the location of the receivers, the Surry Hills OOHW Engagement Strategy was prepared with the objective of limiting disruption at sensitive receivers in three residential buildings on Chalmers Street and Randle Street (a total of 110 residential properties facing Central Station) and one business on Chalmers Street that operates 24/7.

To achieve this, the following was conducted prior to each noisy possession:

- Proactively engage with residents in advance / during cumulative noisy activities to address any specific requirements of sensitive receivers.
- Offer custom made ear plugs to residents
- Offer Australian/NZ Standard ear plugs to Sydney Trains staff
- Help residents to understand the reasoning why the work is undertaken out of hours. (due to strict staged program)
- Help residents understand the future benefits (end state) of Central Walk construction.

The outcome of the objectives was measured as follows:

- Ratio of complaints against repetitive complaints: 83 complaints in total during the reporting period:
 - 82 were related to noise
 - At least 70 of the 82 were repetitive complaints from the same individual.
 - At least another 5 of the 82 were called in as anonymous complaints but were regarded to be from the same individual.
- Number of residential places/businesses spoken to:
 - Quarterly letter goes to +20,000 letterboxes
 - Monthly letter goes to +3,000 letterboxes
 - Each specific notification has been distributed to about 150 letterboxes adjacent to the site (businesses & residents),
 - Weekly email reminder to a distribution list of 1,300 email addresses.

Generally, exceedances of predicted noise levels were typically attributed to extraneous noise rather than construction activities (comparing adjusted to non-adjusted). Zero non-conformance reports were raised during the reporting period for an exceedance attributed to incorrect noise mitigation measures being emplaced or a failure to implement the correct AMMs as per the CNVIS predictions.

A total of 29 rail possessions occurred during the reporting period and are discussed in greater detail in table 3-2 below.

Table 3-2: Possession Monitoring Summary

Possession date and scope	Monitoring type and location	CNVIS prediction/ OOHW Prediction/ Observed result	Discussion of results
WE05 Possession 1-2/08/2020 Central Walk: <ul style="list-style-type: none"> Platform 16/17 relevelling Hazmat cleaning and service installation works on canopies of P18-22 Northern Concourse: <ul style="list-style-type: none"> Installation of roof structures and cassettes to eastern side 	Continuous	SCN20: 72 Pred: 70 Obs: 69.3 SCN33: 53 Pred: 50 Obs: 50	Possession noise levels within predictions.
WE06 Possession 7-9/08/2020 Central Walk: <ul style="list-style-type: none"> Canopy tube under track 23 on Sunday night under TOA Northern Concourse: <ul style="list-style-type: none"> Installation transitional roof and western lower canopy Span wire hoarding and canopy mods 	Continuous	SCN20: 72 Pred: 70 Obs: 67.3 SCN33: 53 Pred: 50 Obs: 50	Possession noise levels within predictions.
WE07 Possession 14-16/08/2020 Northern Concourse: <ul style="list-style-type: none"> Adjust hoarding for escalator ramp construction Drainage pit installation Scaffold removal Hazmat removal 	Continuous	SCN33: 53 Pred: 50 Obs: 50	Possession noise levels within predictions.
WE08 Possession 22-23/08/2020 Central Walk:	Continuous	SCN20: 72 Pred: 85 Obs: 81.6	High noise levels due to diamond saw present on P22/23, however levels within predictions.

<ul style="list-style-type: none"> 2nd WE for P22/23 releveling – replace southern 21m of new platform slab including drainage to the southern section on P22/23 Trench investigation for the future deep storm water pit on the south end of P22/23 Service installation works on the northern half of P22/23 			
WE12 Possession 19-20/09/2020 Northern Concourse: <ul style="list-style-type: none"> Structural steel and cassettes to bays 1 and 2 Bay 6 and 7 soffits Canopy closure steel Scaffold to bay 2 spoiler and transitional roof FDN lift 25 & 26 glazing Red8 western lower canopy transitional roof FT7 installation in LNC 	Continuous	SCN33: 53 Pred: 50 (CH) Obs: 50	Possession noise levels within predictions.
WE14 Possession 2-6/10/2020 Northern Concourse: <ul style="list-style-type: none"> Roof sheet installation OHW transfer on Roads 9 to 12 and removal of temp OHW structures Soffit spoiler install Precast joint sealing SMA Ongoing demolition, steel beam LNC Removal of canopy modules 8/9 & 10/11 Canopy ends Bay 6 Spoiler 	Continuous	SCN33: 53 Pred: 53 Obs: 50	Possession noise levels within predictions.
WE15 Possession 10-11/20/2020 Central Walk:	Continuous	SCN20: 63 Pred: 73 (CH) Obs: 72.3	Possession noise levels within predictions.

<ul style="list-style-type: none"> 1st WE for P20/21 relevelling – replace central 33m of new platform Excavate and pour blinding for drainage on WE19 works on south side of P20/21 Excavate and install deep drainage pit on north side of P20/21 Installation 20mm diameter hearing loop conduit on P20/21 Service installation works (CPG) on the northern half of P20/21 			
WE16 Possession 17-18/10/2020 Northern Concourse: <ul style="list-style-type: none"> Removal of CHS struts from escalators and pile wall demo 	Continuous	SCN33: 53 Pred: 53 Obs: 45	Possession noise levels within predictions.
WE18 Possession 30-31/10/2020 Northern Concourse: <ul style="list-style-type: none"> Canopy extension painting Spoiler soffit installation Hoarding modification on top of crash deck 	Continuous	SCN33: 53 Pred: 53 Obs: 49	Possession noise levels within predictions.
WE19 Possession 7-8/11/2020 Central Walk: <ul style="list-style-type: none"> 2nd WE for P20/21 relevelling – replace southern 15m of new platform slab 2nd WE for P18/19 relevelling – replace southern 15m of new platform slab Services: <ul style="list-style-type: none"> Southern slabs hearing loops and continuity testing Service installation works on northern halves of P18/19 and 20/21 		SCN20: 72 Pred: 73 (Ch) Obs: NA	Relevelling works were cancelled due to OHW fault which resulted in delayed outage. Southern slab scope also cancelled. New scopes CW team carried out on weekend: removal of coping angle & completion of lift cover on P18/19 and 20/21.

<p>Northern Concourse:</p> <ul style="list-style-type: none"> Bay 6 & 7 roof sheeting, soffit, glazing and RO:06 including eastern lower canopy 	Continuous	<p>SCN34:74 Pred: 63 Obs: 50</p>	Possession noise levels within predictions.
<p>WK19 Possession 10-13/11/2020 Northern Concourse:</p> <ul style="list-style-type: none"> Install columns and props to Bays 4 & 5 Installation of roof structural steel and cassettes to Bays 3-5 	Continuous	<p>SCN33: 56 Pred: 58 (YHA) Obs: 50</p>	Possession noise levels within predictions.
<p>WE20 Possession 14-15/11/2020 Central Walk:</p> <ul style="list-style-type: none"> Drainage works on the north and south sides of P16/17 Hazmat cleaning of canopy on P16/17 Grout the track slab beam on track 16 Tamp track 17 over 2m of track slab Expose the fastenings on tracks on the down sub ballast ramp for future ST inspections <p>Northern Concourse:</p> <ul style="list-style-type: none"> Installation of roof steel and cassettes to Bays 3-5 ELC glazing and cladding 	Continuous	<p>SCN20: 72 Pred: 73 (Ch) Obs: NA</p> <p>SCN33: 56 Pred: 58 (YHA) Obs: 50</p>	<p>P16 drainage scope and hazmat cleaning cancelled to ensure handback occurs on time. Tamping cancelled due to issue with tamping attachment.</p> <p>Possession noise levels within predictions.</p>
<p>WK20 Possession 16-20/11/2020 Northern Concourse:</p> <ul style="list-style-type: none"> Installation of roof steel and cassettes to Bay 3 <p>ESR:</p> <ul style="list-style-type: none"> Service investigation (fire hydrant route) on P24&25 using EWP 	Continuous	<p>SCN33: 56 Pred: 58 (YHA) Obs: 50</p> <p>SCN22: 69 Pred: 65 Obs: NA</p>	<p>Possession noise levels within predictions.</p> <p>ESR works below surface, noise levels not observed above surface.</p>
<p>WE21 Possession 21-22/11/2020 Central Walk:</p> <ul style="list-style-type: none"> Drainage works along the P22/23 including installation of 2 deep pits 	Continuous	<p>SCN20: 72 Pred: 75 (Ch) Obs: 73.8</p>	Possession noise levels within predictions.

WE22 Possession 28-29/11/2020 Northern Concourse: <ul style="list-style-type: none"> Civil works at grand/northern concourse including lifting activities 	Continuous	SCN33: 56 Pred: 58 (YHA) Obs: 50	Possession noise levels within predictions.
WE23 Possession 5-6/12/2020 Central Walk <ul style="list-style-type: none"> P20/21 southern escalator slab construction P20/21 northern section tiling removal Service installation on southern half of P22/23 	Continuous	SCN20: 72 Pred: 75 (Ch) Obs: 73.8	Possession noise levels within predictions.
WE24 Possession 12-13/12/2020 Northern Concourse: <ul style="list-style-type: none"> Removal of 22 pedestrian canopy units Roof canopy spoiler soffit Ongoing roof works Removal of roof to lift covered walkway 	Continuous	SCN33: 56 Pred: 50 (YHA) Obs: 50	Possession noise levels within predictions.
WE25 Possession 18-20/12/2020 Northern Concourse: <ul style="list-style-type: none"> Slab replacement as part of relevelling Ongoing roof fit out Precast plank demolition preparation 	Continuous	SCN33: 56 Pred: 50 (YHA) Obs: 58	Due to slab replacement, noise levels at YHA exceeded one LaEQ15 period. Adequate respite was provided.
WE26 and WK26 XMAS Shutdown 25-31/12/2020 Northern Concourse: <ul style="list-style-type: none"> Completion of roof scope Ped hoardings changes to Stage 4 New drainage channels Concourse relevelling Concourse tiling Balustrade foundations 	Continuous	SCN34: 74 Pred: 65 Obs: 65	Possession noise levels within predictions.

<ul style="list-style-type: none"> Decommissioning of lift 8 and demo prep Modify lift hoarding and ramp Tower crane demobilisation 			
WE30 Possession 23-24/02/2021 Central Walk: <ul style="list-style-type: none"> Replace southern 21m of new platform slab on P18/19 Drainage works along the P18/19 & 20/21 including installation deep pit on southern side of P20/21 Northern Concourse: <ul style="list-style-type: none"> Eastern canopy cladding framing adjacent to Road 16 (hi-rail EWO on track 16) 	Continuous	SCN18: 73 Pred: 73 (Ch) Obs: 73 SCN33: 56 Pred: 58 (YHA) Obs: 50	Possession noise levels within predictions. Although tile removal was underway, the distance from sensitive receivers did not cause any exceedances. Possession noise levels within predictions.
WE31 Possession 30-31/01/2021 Central Walk: <ul style="list-style-type: none"> Tile removal on northern & southern sides of P20/21 Northern fire hydrant route installation Painting trial on the north of platform 20/21 in front of the lift Drainage line works along the P20/21 Services: <ul style="list-style-type: none"> Existing canopy fire hydrant diversion on P20/21 for future lift 		SCN18: 73 Pred: 73 (Ch) Obs: NA	Central Walk painting scope and services diversion scopes cancelled.

3.1.2 Verification monitoring for CoA E37/38

During this reporting period, the potential for ground borne noise at sensitive receivers that may result in internal noise levels greater than $L_{Aeq15min}$ 60dB was identified to occur at 30-38 Chalmers Street. Key activities which occurred at these two work sites included excavation including pile detailing, hammering and material load out, and canopy tube drilling. CoA E38 was complied with during this reporting period.

Note: Government Gazette 75 has extended construction hours on weekends for all works which are not high impact, and as such some minor works progressed past 13:00 on Saturdays until 18:00 throughout this reporting period. Refer to Appendix C for results.

3.1.2.1 Eastern Entrance Works

The vibration from the works at the Eastern Entrance (20-28 Chalmers St) can be subjectively considered as continuous or intermittent. Conservatively and based on site observations and what the receivers may experience, the vibration has been classified as continuous when applicable. Continuous vibration is measured in PPV (mm/s). PPV is the preferred parameter for measuring vibration impacts as it can be obtained in real time, whereas VDV is more of a retrospective measure based on time exposure over a prolonged period of operation (i.e. 8hrs or 16hrs).

The measured vibration levels throughout this reporting period were below the screening criteria for cosmetic damage of 25mm/s for reinforced or framed structures. All readings that were measured throughout this period that were above 25mm/s were found to be transient, localised bumps of the geophone. The associated activities with the potential to cause ground borne noise were significantly less than the previous reporting period.

The CSM CNVIS identifies that works at 20-28 Chalmers Street would occur within the human comfort safe working distance of 7m. To minimise potential impacts to human comfort, additional mitigation and management measures were required. The following measures have been implemented in conjunction with community and stakeholder consultation and notification processes outlined in the Additional Mitigation Measures Matrix (AMMM) for ground-borne vibration in Section 8.2 of the CNVMP.

- In accordance with CoA E38, engagement with key stakeholders before the start of high noise/vibration generating activities with the potential to cause ground borne noise to inform, identify and discuss proposed respite periods was carried out. It was agreed with the café owner that respite would be provided for at least an hour around 12:00, and high vibration intensive works will be conducted after 14:30 where feasible.
- Ongoing real-time noise and vibration monitoring in place
- Real time notification of exceedance of vibration criteria
- Attended noise and vibration monitoring as required by the construction activities
- Engagement with key stakeholders before high noise/vibration generating activities.

For ease of interpretation, the continuous vibration data for 30 Chalmers Street has been divided into monthly intervals as presented in Appendix C. The monthly graphs were reviewed and days that appeared to have high vibration activity were selected for further assessment at a greater resolution.

Conservatively assuming that vibration levels $>0.56\text{mm/s}^*$ at the façade of 30 Chalmers St result in ground borne noise within Haven Specialty Coffee/Columbus & Co Central, the maximum level of the human comfort criteria (for residences) may be exceeded resulting in an internal noise level $L_{Aeq15min}$ greater than 60dB. As such, CoA E37/38 require internal noise limits (associated with ground borne noise) to remain below 60dB for 6.5hrs (or 50% of the time). The data collected throughout the reporting period verifies that works that may have the potential to generate ground borne noise resulting in an internal noise level of greater than 60dB has at no time exceeded 6.5hours per day.

The current reporting period experienced similar high impact activities overall when compared to previous reporting periods. High impact activities were less than those of the previous reporting periods during the first couple months. However, activities such as hammering or pile breakout, which occurred predominantly in the last two months of this reporting period, demonstrate an increase in high impact activity. The monitoring results are documented in Appendix C.

**Max exposure for residences as per Table C1.1- The NSW Vibration Guidelines and reproduced in the CSM CNVMP- Perceptible Vibration Criteria for Exposure to Continuous and Impulsive Vibration*

3.2 Vibration

Attended and unattended vibration monitoring was undertaken before and during construction activities during the reporting period where buildings or structures exist within the safe work distances of vibratory plant. In accordance with CoA E31, the project heritage specialist was consulted on locations and methods for installing vibration monitoring equipment on heritage structures at the beginning of the project. A real time vibration logger was installed on the southern façade of the Train Crew Assignment Centre (TCAC) (formerly known as the Central Electric Building) located to the north of Platforms 12/13 and 14/15 on 11 January 2019. It was programmed to log the peak data point every minute. A real time vibration logger was also installed on the northern façade of 30 Chalmers St 10 October 2019. It was programmed to log the peak data point every minute.

The environmental team would review the program/schedule and attend progress meetings to ascertain which construction works may have a vibration impact on the heritage fabric of Central Station and impacts to human comfort at Chalmers St. Predictions of vibration levels based on the safe working distances of various plant as described in Table 8.3 of the CNVMP were made and monitored closely. A screening criteria of 5mm/s peak particle velocity (PPV) was also set (later changed to 7.5 due to excessive number of alerts) at TCAC and 3mm/s for Chalmers St. Alerts are sent to key project team members by the real time vibration logger when vibration management criteria are exceeded. The data would be reviewed, and a determination made as to the risk of the exceedance. Isolated spikes that are spurious and most likely associated with transient events (e.g. footfall) near the vibration monitoring device would typically result in no action, however a general increase in vibration levels would prompt further assessment. The results indicated relatively high ambient vibration levels from the movement of trains.

For ease of interpretation, the continuous vibration data has been divided into monthly intervals (refer to Appendix B). A logarithmic scale has also been applied to declutter and make sense of approximately 43,200 individual data points within any one month as the majority of data points fall below 2mm/s, however interest lies in the higher end of the scale. The major gridlines of the x-axis indicate a 24hr period from 12-midnight to 12 midnight. The minor gridlines of the x-axis indicate 6-hour intervals. The cluster shift can be observed forming a pattern increasing in the day with increase station operations and decreasing at night once trains either stop running or reduce in frequency. Refer to Appendix B and C for vibration data and interpretation.

4. Complaints

There was a total of 83 complaints received during the reporting period, with 82 relating to noise and/or vibration. A break-down of these complaints is shown below:

Table 4-1: Complaints breakdown.

Month	Noise	Vibration	Monthly Total
August	5	1	5
September	7	0	7
October	12	5	12
November	22	8	22
December	16	9	16
January	21	7	21
Totals	83	30*	83

* Note: All vibration complaints were a part of a noise related complaint.

Over this reporting period, 99% of complaints were related to noise & vibration, with 86% of all the complaints being classified as 'unavoidable'. It should be noted that at least 84% of all noise and vibration related complaints were from the same individual complainant.

The table below summarised actions undertaken following complaints over the current and past reporting periods, as well as proactive actions undertaken to minimise the number of complaints. Actions listed are in addition to the monthly & quarterly notifications and email update to the overall project database. Any monitoring undertaken and listed below are in addition to the real time loggers installed around the construction site.

Table 4-2: Sensitive receiver monitoring

Sensitive receivers	Monitoring undertaken	Description of action
Sydney Trains / NSW TL	Yes – ongoing	Staff briefings and meetings to cascade information (Performed via virtual meetings due to COVID - restrictions)
GF01, 30 Chalmers St (Haven Specialty Coffee/Columbus & Co Central)	Yes - ongoing	Ad hoc noise monitoring inside the business as required by construction activities Regular catch up with business owner in person or via phone calls (less often due to COVID - restrictions) Weekly email (1WLA): Tailored communication to Café's owner with upcoming potential high noise/vibration impact activities. Note: the business is preparing its relocation to another suburb. Key reason is the lack of foot traffic on Chalmers Street, decision not related to CSM works. City Convenience store (from 38 Chalmers St) is taking over.
GF02, 30 Chalmers St (Gou Sushi)	Not required	Adhoc catch up with business owner, as required by construction activity (less often due to COVID-restrictions).
30 Chalmers St (Building owner/Strata company)	Yes - ongoing	Sharing monthly noise and vibration monitoring report with the building owner/strata manager.
GF, 38 Chalmers St (City Convenience Store, open 24/7)	Not required	Adhoc discussion with business owner (less often due to COVID – restrictions). Discussion with staff/owner about the status of Randle Lane and OOHW at Central Station as required.
2 Chalmers St (Dental Hospital)	Yes - ongoing	Weekly email (1WLA): Tailored email to Hospital's representative if upcoming high noise/vibration impact is scheduled Three work update briefings for key representatives during this reporting period.
GF, 1-5 Randle St (University Preparation College)	As required	Adhoc discussions with key representatives and staff (less often due to COVID – restrictions).
YHA	As required	Adhoc discussion with key representatives and staff (less often due to COVID – restrictions). Tailored email summary about work activities on Platform 1.
Lee Street buildings	As required	Tailored email summary about work activities on Platform 1 and in the Lee Street driveway.
30 Chalmers St + 38 Chalmers T + 1-5 Randle St (106 units)	Yes – real time only, offered as well if required	<ul style="list-style-type: none"> Specific notification and tailored email to provide update related to status of Randle Lane and OOHW at Central Station with the potential to generate high noise/vibration impact.
52 & 54 Regent Street	Yes – real time	<ul style="list-style-type: none"> Installation of specific real time noise monitoring at the start of the project and noise assessment of truck movements.

* As part of the engagement strategy, the Community Relations team delivered a presentation to workers at 20-28 Chalmers Street site to raise awareness of the surrounding neighbourhood, construction work implications and key mitigation measures.

5. Conclusion

The requirements for noise and vibration monitoring are detailed in the CNVIS and CNVMP. A combination of both real time and attended monitoring has occurred at the closest sensitive receiver locations on Chalmers St, Platform 1 for YHA and 54 Regent St during this reporting period. These receivers are considered representative of the area and were used to validate the modelled construction noise. Monitoring records have validated modelled noise and are generally consistent with the predicted impact of construction activities on noise sensitive receivers. As discussed in Section 4, there were a total of 83 complaints related to noise and vibration that were received during the reporting period – 70 of which were from the same repeat complainant.

Real time noise and vibration monitoring is conducted 24/7. The data is checked for compliance during relevant periods of construction including for the duration of rail possessions. Both real-time and attended noise and vibration monitoring has observed exceedances of noise predictions in the CNVIS due to non-construction sources, such as Sydney Trains operations, other non-CSM construction works, road, animal and pedestrian traffic noise.

As determined in the planning phase, the potential for physical at source mitigation was limited for platform releveling works on the eastern suburban platforms. Over the reporting period, there were a few minor exceedances of individual $L_{Aeq15min}$ periods, which did not change the application of the AMM's given the thorough notification and community engagement strategy emplaced by the Community and Stakeholder Management Team at CSM. The communications element governed partly by the Communications Strategy and partly by the AMM's was the key mitigation in meeting the best achievable performance objectives of the CNVIS and community expectation.

Appendix A – Noise Monitoring Summary

Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Observed LAeq15min (dB)	Sensitive Receiver	Period Day/Evening/Night	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
6/08/2020	10:41:00	delivery of B4 reo to P18/19, beam install Northern Concourse	A	21	65	Chalmers St	Night	56	16	0	0	Location: Southern Concourse, base of entrance stairs, adjacent to Subway Snacks. No exceedance identified.
7/08/2020	13:47:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	79.7	Chalmers St	Day	56	16	0	8	Location: Southern Concourse, base of entrance stairs, adjacent to Subway Snacks. No ground borne vibration felt. Most significant contributor to noise was perceived to be the chain rattling.
7/08/2020	14:02:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	79.3	Chalmers St	Day	56	16	0	7	Location: Southern Concourse, base of entrance stairs, adjacent to Subway Snacks. No ground borne vibration felt. Most significant contributor to noise was perceived to be the chain rattling.
13/08/2020	10:18:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	72.1	Chalmers St	Day	56	19	0	0	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Less than 1 minute of the driving works in the period.
13/08/2020	12:50:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	69.9	Chalmers St	Day	56	19	0	0	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Only welding and sporadic hammering, no driving work.
13/08/2020	13:05:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	74.6	Chalmers St	Day	56	19	0	0	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Only welding and sporadic hammering, no driving work.
13/08/2020	15:16:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	76.8	Chalmers St	Day	56	19	0	2	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about 1 minute.
13/08/2020	15:31:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	83	Chalmers St	Day	56	19	2	8	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about 3.5 minutes.
14/08/2020	8:20:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	80.9	Chalmers St	Day	56	19	0	6	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about 2.5 mins.
14/08/2020	8:38:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	72.2	Chalmers St	Day	56	19	0	0	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about less than a minute.
14/08/2020	8:54:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	80.4	Chalmers St	Day	56	19	0	5	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about 3 mins.
14/08/2020	9:09:00	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	75.5	Chalmers St	Day	56	16	0	4	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Driving works active for about 4 mins, although mostly more muffled due to being deeper.
26/08/2020	9:46:00	LOR works: concrete breaking at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	77.5	Chalmers St	Day	56	14	4	8	Muffled saw cutting, metal clanking and faint rattling heard sporadically. Peak noise in period is the street sweeper passing nearby.

26/08/2020	10:01:00	LOR works: some plant movement at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works.	A	21	69.6	Chalmers St	Day	56	19	0	0	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart.
27/08/2020	10:08:00	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk.	A	21	78.5	Chalmers St	Day	56	16	0	7	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Background level was captured during first 11 minutes of recording as 69dB and then went up to 69.6dB due to plant movement in final 4 minutes
27/08/2020	10:23:00	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk.	A	21	75.7	Chalmers St	Day	56	16	2	4	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart.
27/08/2020	12:38:00	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk.	A	21	74.8	Chalmers St	Day	56	16	0	3	Location: top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart. Only 3 minutes of breaking captured because the Brokk broke down.
28/08/2020	10:38:00	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include: fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk.	A	21	78.8	Chalmers St	Day	56	16	0	7	Engine noise heard very close by, inferred to not be LOR works due to proximity. Light rail wheel squeak also a significant contributor to noise.

Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Period Day/Evening/Night	Observed LAeq15min (dB)	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
5/09/2020	22:45:00	WE10 Possession: Northern Concourse- structural steel install. (interface with MTMS2 Project- vac truck investigation in metro box, Sydney Trains OHW maintenance)	C	33	Chalmers St	Night	67	45	35	0	0	Sound cannot be identified in recording. At this time, station heavy and light rail operations remain the dominant noise source- whistles, horns, doors opening closing, wheel squeal, trains accelerating/decelerating.
5/09/2020	23:15:00	WE10 Possession: Northern Concourse- structural steel install. (interface with MTMS2 Project- vac truck investigation in metro box, Sydney Trains OHW maintenance)	C	33	Chalmers St	Night	67.2	45	21	0	1	Sound cannot be identified in recording. At this time, station heavy and light rail operations remain the dominant noise source- whistles, horns, doors opening closing, wheel squeal, trains accelerating/decelerating.
7/09/2020	22:30:00	Suburban Platforms: excavator unloaded on P20/21, Northern Concourse: piling	C	29	Chalmers St	Night	67.3	45	21	0	1	At this time, station heavy and light rail operations remain the dominant noise source- whistles, horns, doors opening closing, wheel squeal, trains accelerating/decelerating. The unidentified sound is unlikely associated with CSM works as evidenced by nightshift handover notes.
7/09/2020	22:45:00	Suburban Platforms: excavator unloaded on P20/21, Northern Concourse: piling	C	29	Chalmers St	Night	66.4	45	35	0	0	At this time, station heavy and light rail operations remain the dominant noise source- whistles, horns, doors opening closing, wheel squeal, trains accelerating/decelerating. The unidentified sound is unlikely associated with CSM works as evidenced by nightshift handover notes.
8/09/2020	22:00:00	Suburbans: P20/21 B4 formwork, excavation P16/17	C	18	Chalmers St	Night	65.6	45	35	0	0	Response to complaint: jack hammering on Chalmers St. No hammering audible, just typical rail operations.
8/09/2020	23:00:00	Suburbans: P20/21 B4 formwork, excavation P16/18	C	18	Chalmers St	Night	66	45	5	0	16	Response to complaint: jack hammering on Chalmers St. No hammering audible, just typical rail operations.
12/09/2020	1:20:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	69	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/09/2020	1:35:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker.	A	20	Chalmers St	Night	61	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/09/2020	1:50:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	61	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/09/2020	2:10:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	CSM HN works commence @ 02:12. Road saw behind hoarding.
12/09/2020	2:25:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	70	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/09/2020	2:40:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	70	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible. Road saw on and off throughout the monitoring period.
12/09/2020	3:30:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	68	45	30	0	0	Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/09/2020	3:45:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	70	45	30	0	0	CSM road saw on and off, wall saws on P22 commence @ 03:53 and only audible when road saw stops.
12/09/2020	4:00:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	63	45	30	0	0	Works audible on occasion, no high noise impact.

12/09/2020	4:15:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	62	45	30	0	0	Works audible on occasion, no high noise impact.
12/09/2020	4:30:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	70	45	30	0	0	High noise impact audible.
12/09/2020	4:45:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	63	45	30	0	0	Works audible on occasion, no high noise impact.
12/09/2020	5:00:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	68	45	30	0	0	Works audible on occasion, no high noise impact.
12/09/2020	5:15:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	Light rail starts up again. At 05:17.
12/09/2020	5:30:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	CSM wall saw commences on P23. only audible when road saw stops.
12/09/2020	5:45:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	69	45	30	0	0	Hammer breaking starts at 05:55.
12/09/2020	6:00:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	72	49	26	0	0	No works audible.
12/09/2020	6:15:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	65	49	26	0	0	No works audible
12/09/2020	6:30:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	68	49	26	0	0	No works audible
12/09/2020	6:45:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	Hammering at 0645, 0658 road saw starts again.
12/09/2020	7:00:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	Road saw audible.
12/09/2020	7:15:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	68	45	30	0	0	Grinding activity on Chalmers St footpath- SLR constructing bike racks.
12/09/2020	7:30:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	72	45	30	0	0	Grinding activity on Chalmers St footpath- SLR constructing bike racks dominant noise source.
12/09/2020	7:45:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Night	71	45	30	0	0	07:50 CSM works cease, to be resumed @08:00.
12/09/2020	8:00:00	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker	A	20	Chalmers St	Day	75	45	30	0	0	Cumulative impact, CSM works and SLR.
21/09/2020	3:15:00	Scope (from CW what's app group): • installing new section of permanent hoarding on P22-23 overnight – drilling. • ATF movements on P18-19 • welding within P22-23 for canopy tubes	C	18	Chalmers St	Night	63	45	25	0	0	Occasional hand hammering observed.
21/09/2020	4:00:00	Scope (from CW what's app group): • installing new section of permanent hoarding on P22-23 overnight – drilling. • ATF movements on P18-19 • welding within P22-23 for canopy tubes	C	18	Chalmers St	Night	60.2	45	25	0	0	Occasional CSM works audible.

21/09/2020	4:15:00	Scope (from CW what's app group): • installing new section of permanent hoarding on P22-23 overnight – drilling. • ATF movements on P18-19 • welding within P22-23 for canopy tubes	C	18	Chalmers St	Night	61.8	45	25	0	0	Occasional CSM works audible.
24/09/2020	1:00:00	Platform 16/17- Skylight Platform 20/21- False work on the deck within the hoarding	C	18	Chalmers St	Night	66.2	46	29	0	0	Occasional CSM works audible.
24/09/2020	2:15:00	Platform 16/17- Skylight Platform 20/21- False work on the deck within the hoarding Platforms 22/23- Install hoarding remove ATF.	C	18	Chalmers St	Night	65.6	47	28	0	0	Pipes or ATF being moved is audible.
4/09/2020	14:17:00	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present.	A	27	Randle Lane	Day	86.4	56	14	16	16	Train movements (x3) heard as well as reversing alarms. Truck leaving site also audible ~30 seconds each (x2).
4/09/2020	14:34:00	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present.	A	27	Randle Lane	Day	74.4	56	14	4	4	Train (x2) movements highly audible as well as the reversing alarm of vehicles. Truck leaving site (1x)
4/09/2020	14:50:00	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present.	A	27	Randle Lane	Day	73	56	26	0	0	Location: at Eastern Entrance right next to the concrete pump truck and agitator trucks. Representative of concrete pouring works at source of noise. Main contributor of noise was the continuous hum of the pump truck, which remained fairly consistent.
3/09/2020	1:00:00	OSOM Vehicle delivery - Leaving site	C	39	Regent Street	Night	58.7	44	38	0	0	Location: in Randle Lane, outside the closest apartment block northwards, approximately 20m from works. Works were barely audible at the distance; air conditioner hum from adjacent Dental Hospital was the most significant contributor to noise.
3/09/2020	1:15:00	OSOM Vehicle entering site - delivery	C	39	Regent Street	Night	60.3	44	38	0	0	Location: in Randle Lane, outside the closest apartment block southwards, approximately 7m from works. Noise of works dissipated substantially even at the short distance.
20/09/2020	4:00:00	Northern Concourse works - including ceiling panel installation and escalator wall demolition - suspended slab on the upper concourse at the top of the TCAC building. Other works include heritage canopy steelwork.	C	29	YHA	Night	81.8	49	11	0	22	No CSM works audible - train parked near Platform 0 - 1. Steam release, ST announcements consistent throughout noise trace. No CSM works could be heard over the parked trains. Pressure release extremely loud - one was approximately 1.75minutes long.
20/09/2020	7:00:00	Northern Concourse works - including ceiling panel installation and escalator wall demolition - suspended slab on the upper concourse at the top of the TCAC building. Other works include heritage canopy steelwork.	C	29	YHA	Night	79.7	49	11	0	20	Train approaches at approximately 30 seconds - remains extremely loud for remainder of recording. No CSM works audible at all. Noting YHA noise attenuation is 30dB.
5/09/2020	7:00:00	NC: Installation of hockey sticks and cassettes as well as demolition works.	C	29	YHA	Night	74.3	49	11	6	14	Saw cutting audible < 30 seconds. Assumed to be CSM works. also pedestrians heard talking right near microphone. Sydney trains announcements very loud. - train movements dominate the remainder of the recording - largely masking any other notice including CSM works. Noting YHA noise attenuation is 30dB.
5/09/2020	6:45:00	NC: Installation of hockey sticks and cassettes as well as demolition works.	C	29	YHA	Night	62.3	49	11	0	2	No real CSM works distinctly audible. Overall consistent noise trace with ~3 random peaks which sound like an item being dropped or where the public were heard speaking next to the microphone. Generally higher ambient noise - sounds like a parked train. Noting YHA noise attenuation is 30dB.

Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Period Day/Evening/Night	Observed LAeq15min (dB)	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
3/10/2020	0:30:00	WE14 - Grand Concourse Roof installation to bays 1,2,6 and 7, roof sheeting, soffit, glazing, precast install and joint sealant works, overhead wire transfer from temp structures onto permanent structure, removal of canopy units	C	18	Chalmers St	Night	63.7	45	28	0	0	Trains heard idling in background - conductor whistles blowing, trains braking. Light rail passes at around 3 and 10 minute mark. Traffic heard in background. No construction noise audible.
4/10/2020	16:45:00	WE14 - Grand Concourse Roof installation to bays 1,2,6 and 7, roof sheeting, soffit, glazing, precast install and joint sealant works, overhead wire transfer from temp structures onto permanent structure, removal of canopy units	C	18	Chalmers St	Day	68.3	45	28	0	0	Trains heard in background, bird chirps immediately as recording starts next to recorder, indicating reason for spike. No other construction noise audible.
5/10/2020	8:15:00	Excavation and drilling in Central Walk.	C	18	Chalmers St	Day	72.3	45	28	0	0	LaMax Spike 101.8. Birds heard chirping and people talking in background. Trains and light rail activity also audible in background. No construction noise audible.
6/10/2020	3:00:00	Works in metro Box and Central Walk below slab, continue false work and decking 20/21.	C	18	Chalmers St	Night	65.2	45	28	0	0	Data reviewed. Works below predictions.
6/10/2020	22:45:00	Works in metro Box and Central Walk below slab.	C	18	Chalmers St	Night	65.6	45	28	0	0	Data reviewed. Works below prediction. Rail operations audible.
10/10/2020	4:00:00	WE15 Possession: P20/21- platform releveling works works included saw cutting using road saw, hand saw and wall saws, and breakers.	A	20	Chalmers St	Night	67.1	45	30	0	0	Data reviewed. Works below prediction. Rail operations audible.
10/10/2020	3:00:00	WE15 Possession: P20/21- platform releveling works works included saw cutting using road saw, hand saw and wall saws, and breakers.	A	20	Chalmers St	Night	69.8	45	30	0	0	A review of the real time noise logger data validated predictions. Additionally the construction team were able to delay some high impact noise activities until 8am to further mitigate noise level for nearby residents. While this was possible over this weekend with no impact to the possession and handback to Sydney Trains, this may not always be possible on future rail possession weekends for the platform releveling works
10/10/2020	7:00:00	WE15 Possession: P20/21- platform releveling works works included saw cutting using road saw, hand saw and wall saws, and breakers.	A	20	Chalmers St	Night	72.3	45	30	0	0	A review of the real time noise logger data validated predictions. Additionally the construction team were able to delay some high impact noise activities until 8am to further mitigate noise level for nearby residents. While this was possible over this weekend with no impact to the possession and handback to Sydney Trains, this may not always be possible on future rail possession weekends for the platform releveling works
12/10/2020	1:15:00	P20/21 and included hoarding and bracing install and door and lock install P22/23.	C	18	Chalmers St	Night	66	45	28	0	0	Slight increased noise level at 01:15 was found to be attributed to light rail passing by and an emergency siren. LOR nightshift diaries indicate works occurring on P20/21 and included hoarding and bracing install and door and lock install P22/23. No LOR works were audible.
14/10/2020	16:00:00	Breaking shale bench at East Entrance during standard construction hours.	C	27	Chalmers St	Day	74.5	56	19	0	0	Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. The data indicates that the breaking activity commenced at 15:15 and ceased at 16:15. The noise level did not exceed the threshold for 'high noise affected' as per the ICNG throughout the day. For this activity all feasible and reasonable work practices have been applied, including the time the works occur, respite periods observed, new plant that is well maintained and serviced regularly.
16/10/2020	15:15:00 PM	Breaking shale bench at East Entrance during standard construction hours.	C	27	Chalmers St	Day	76.8	56	25	0	0	Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. The data indicates that the breaking activity commenced at 15:00. The noise level during the time of breaking exceeded the threshold for 'high noise affected' by 2dB. For this activity the timing of the works was selected to occur in less sensitive periods, during standard construction hours within the allowable period for high noise impact, and respite periods observed. The plant is new, well maintained and serviced regularly.
17/10/2020	12:30:00	Breaking shale bench at East Entrance during standard construction hours.	C	27	Chalmers St	Day	82.5	56	25	2	2	Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. The data indicates that the breaking activity commenced at 11:30 and ceased at 13:00. The noise level during the time of breaking exceeded the threshold for 'high noise affected'. For this activity the timing of the works was selected to occur in less sensitive periods, during standard construction hours within the allowable period for high noise impact, and respite periods observed. The plant is new, well maintained and serviced regularly.

15/10/2020	3:15:00	Delivery of Roof cassette to CSM via SYAB (OSOM Departure)	C	39	Chalmers St	Night	61.3	44	37	0	0	Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. The data indicates that the breaking activity commenced after 08:45 and ceased before 09:30. The noise level during the time of breaking exceeded the threshold for 'high noise affected'. For this activity the timing of the works was selected to occur in less sensitive periods, during standard construction hours within the allowable period for high noise impact, and respite periods observed. The plant is new, well maintained and serviced regularly.
20/10/2020	9:00:00	Breaking shale bench at East Entrance during standard construction hours.	C	27	Chalmers St	Day	77.6	70	-4	0	12	Heavy vehicle delivery heard half way through recording. Occurs for only 45seconds. However train operating noises occur more than 3 times throughout recording. (Non CSM related).
22/10/2020	11:30:00	Breaking shale bench at East Entrance during standard construction hours.	C	27	Chalmers St	Day	76.7	70	-4	0	11	Single vehicle movement throughout recording. Train operating noises also audible in recording (2x events). Air brakes of trucks highly audible.
19/10/2020	9:00:00	Breaking shale bench at East Entrance during standard construction hours.	C	27	Regent St	Day	80.6	56	25	0	0	Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. Throughout the day the data indicates that the breaking activity commenced after 08:00 and ceased before 10:00.
14/10/2020	23:45:00	Delivery of Roof cassette to CSM via SYAB (OSOM Arrival)	C	39	Regent St	Night	59.4	44	37	0	0	Complaint at 11:38 Noise and vibration data was reviewed to validate the predictions. The noise and vibration levels were within the project limits. Throughout the day the data indicates that the breaking activity commenced after 10:45 and ceased before 11:45.
10/10/2020	4:00:00	WE15 Possession: P20/21- platform releveling works works included saw cutting using road saw, hand saw and wall saws, and breakers.	C	20	Regent St	Night	54.7	49	24	0	0	Noise and vibration data was reviewed to validate the predictions. Rain can be heard in background of recording - cars can also be heard on street. Train announcements also audible. Levels were well within the project limits during the time of the complaint.
16/10/2020	2:45:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	Night	59.2	44	16	0	0	Level on Chalmers St is 69.8dB. Works inaudible at YHA, just train idling sounds.
20/10/2020	3:45:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	Night	59	44	16	0	0	Level on Chalmers St is 67.1dB. Works inaudible at YHA, just train idling sounds.
26/10/2020	4:15:00	WE17 - Works on suburban platforms - roof sheeting, soffit, glazing	C	18	YHA	Night	61.7	45	21	0	0	Trucks heard at 12:05 and 12:40 into the recording. Traffic run sheet records trucks starting to arrive at 3.53.
10/10/2020	3:00:00	WE15 Possession: P20/21- platform releveling works works included saw cutting using road saw, hand saw and wall saws, and breakers.	C	20	YHA	Night	52.7	49	17	0	0	Truck heard at 2:00 into the recording. Traffic run sheet records truck arriving onsite at 3.00.

Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Observed LAeq15min (dB)	Sensitive Receiver	Period Day/Evening/Night	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
3/11/2020	21:45:00	Track 19/20 - Clear ground underneath T19/20, P18/19 Use of excavator underneath platform to scrape back stockpile and expose concrete/rock below for formwork.	C	18	73.2	Chalmers St	Evening	53	20	0	0	Light hammering with hand tool heard, light rail movements, rail operations. Main source of noise impact is jackhammering occurring ~7mins throughout the measure. 3 elevated periods above 70dB, 1 of which was in the night time period. The the periods are elevated due to jackhammering works. Check against night shift diaries indicates, subsurface excavation (below Track 19/20 and platform 18/19). No jackhammering was occurring due to CSM works.
4/11/2020	3:00:00	Track 19/20 - Clear ground underneath T19/20, P18/19 Use of excavator underneath platform to scrape back stockpile and expose concrete/rock below for formwork.	C	18	66	Chalmers St	Night	45	28	0	0	no works audible, alarm going off in distance throughout measure. Street sweeper or similar noise audible passing by very close to logger microphone. No LOR works audible.
4/11/2020	15:30:00	Eastern Entrance excavation work including excavator hammering.	C	25	78.9	Chalmers St	Day	56	25	0	0	Highest impact at 15:30 of 79dB. • 11:45-12:30 = 45MINS • 14:00 = ~15MINS • 15:30-16:30 = 1HR High noise activity ~2hrs. allowable 6.5hrs.
5/11/2020	3:15:00	16/17 Service Trenches, Finish hammering the 16/17 escalator trench (subsurface), Clear Adit Bridge- remove spoil ramp currently on either end of bridge, Excavation Face (subsurface) Hammer 19-4 to ensure that the steel beam can be installed	C	18	69.3	Chalmers St	Night	45	28	0	0	Street sweeper or similar noise audible passing by very close to logger microphone in the first 2 mins of measure. No LOR works audible.
5/11/2020	10:00:00	Eastern Entrance excavation work including excavator hammering.	C	25	79.5	Chalmers St	Day	56	25	0	0	Complaint at 09:55. highest impact at 15:30 of 79dB. • 11:45-12:30 = 45MINS • 14:00 = ~15MINS • 15:30-16:30 = 1HR
7/11/2020	3:00:00	WE19 Central Walk - P18/19 and P20/21 relevelling works. - Saw cutting and breakout of existing slab - Formwork installation, reinforcement, hoarding, tactile, platform furniture - Placement of concrete - Service installation Northern and Grand Concourse - Installation of lift 25 and 26 - Service installation - Roof canopy steelwork	C	18	69.1	Chalmers St	Night	45	28	0	0	Seagulls squawking in background relatively close to monitor. Sawcutting begins at 3:20 but stops after 10 seconds. Stops and starts periodically throughout recording. Trains, light rail and other traffic audible in background.
8/11/2020	21:30:00	WE19 Central Walk - P18/19 and P20/21 relevelling works. - Saw cutting and breakout of existing slab - Formwork installation, reinforcement, hoarding, tactile, platform furniture - Placement of concrete - Service installation Northern and Grand Concourse - Installation of lift 25 and 26 - Service installation - Roof canopy steelwork	C	18	71.4	Chalmers St	Day	56	25	0	0	Breaking begins around 1 minute mark, audible for the entire recording with sporadic pauses.
10/11/2020	2:30:00	Suburban: Hirail movement of equipment to and from platforms 18/19 and 20/21, general house keeping and edge protection install behind hoarding. Northern Concourse: various lifts using large crane and canopy install.	C	18	70.4	Chalmers St	Night	45	28	0	0	Generator or truck heard on Chalmers St. Not consistent with CSM works.
10/11/2020	3:00:00	Suburban: Hirail movement of equipment to and from platforms 18/19 and 20/21, general house keeping and edge protection install behind hoarding. Northern Concourse: various lifts using large crane and canopy install.	C	18	71.4	Chalmers St	Night	45	28	0	0	Similar noise to previous file, however different position.
12/11/2020	2:30:00	Suburban: subsurface excavation, P16/17 hirail movement associated with hoarding reconfiguration, P18/19 extending hoarding, P20/21 tidy material from behind hoarding. N.Concourse/Metro Box: strip RMD towers	C	18	62.5	Chalmers St	Night	45	28	0	0	File reviewed due to elevated Lmax of 80.1dB. 4 Loud clanks (sounds like steel on pavement) observed in 15min period. LAeq15mins was 62.5dB. Due to multiple projects, the source of the clanks cannot be determined, however LOR will continue to brief all night shift site personnel to try to minimise noise as avoidance cannot be eliminated with certainty.
12/11/2020	2:45:00	Suburban: subsurface excavation, P16/17 hirail movement associated with hoarding reconfiguration, P18/19 extending hoarding, P20/21 tidy material from behind hoarding. N.Concourse/Metro Box: strip RMD towers	C	18	62.3	Chalmers St	Night	45	28	0	0	Grinding/saw cutting audible close by (not associated with CSM works), occasional hammering, extractor fan audible.

12/11/2020	3:15:00	Suburban: subsurface excavation, P16/17 hirail movement associated with hoarding reconfiguration, P18/19 extending hoarding, P20/21 tidy material from behind hoarding. N.Concourse/Metro Box: strip RMD towers	C	18	65.1	Chalmers St	Night	45	28	0	0	Extractor fan, occasional hand hammering
12/11/2020	3:45:00	Suburban: subsurface excavation, P16/17 hirail movement associated with hoarding reconfiguration, P18/19 extending hoarding, P20/21 tidy material from behind hoarding. N.Concourse/Metro Box: strip RMD towers	C	18	65	Chalmers St	Night	45	28	0	0	Saw cutting audible- not consistent with LOR site diaries.
12/11/2020	21:45:00	Northern Concourse: Due to the thunderstorms the NC roof lifting did not start until 1.30am. Two cassettes were lifted into place and secured with a rattle gun Suburban: Highrail deliveries on Platforms 18-19-20 but that was after 2am. Benching inside hoarding P18/19, P20/21, house keeping.	C	18	65.1	Chalmers St	Night	45	28	0	0	Selected for Lamax: 86dB All peaks associated with light rail movements. No CSM works audible.
12/11/2020	22:30:00	Northern Concourse: Due to the thunderstorms the NC roof lifting did not start until 1.30am. Two cassettes were lifted into place and secured with a rattle gun Suburban: Highrail deliveries on Platforms 18-19-20 but that was after 2am. Benching inside hoarding P18/19, P20/21, house keeping.	C	18	65.5	Chalmers St	Night	45	28	0	0	Selected for Lamax: 86.2dB All peaks associated with light rail movements. No CSM works audible.
13/11/2020	0:45:00	Northern Concourse: Due to the thunderstorms the NC roof lifting did not start until 1.30am. Two cassettes were lifted into place and secured with a rattle gun Suburban: Highrail deliveries on Platforms 18-19-20 but that was after 2am. Benching inside hoarding P18/19, P20/21, house keeping.	C	18	66	Chalmers St	Night	45	28	0	0	Selected for Lamax: 93.7dB All peaks associated with light rail movements. No CSM works audible.
15/11/2020	1:30:00	WE20 CW: Platform 16/17 rellevelling works - Tile removal to the whole of platform - Drainage works - Service installation Northern/Grand Concourse - Installation of roof steel and cassettes, SMO glazing	C	18	66.4	Chalmers St	Night	45	28	0	0	Extraction fan heard running softly in background. Seagulls squawking close to monitor loudly. Trains and light rail heard intermittently throughout recording - likely accounts for loudest noise.
18/11/2020	8:30:00	Works on P18/19 and P20/21 - saw cut trenches, excavation of trench.	C	18	76.1	Chalmers St	Day	56	25	0	0	Light rail announcements, train activity audible. Breaking starts around 8 minute mark and continues throughout rest of recording with intermittent pauses.
21/11/2020	03:15-08:00	WE21: 22/23 rellevelling works Central Walk Tile removal to the whole platform, draignage works, deep pit installation, services work ESR - Road 23 concrete pad construction for future installation	A	20	70	Chalmers St	Night	45	28	0	0	4.5hrs of attended monitoring resulted in; Instantaneous Max = 79dB Max LAeq15mins = 70dB (associated with saw cutting @05:30) Median LAeq15mins = 65dB Mean LAeq15mins = 66dB Mode LAeq15mins = 62dB
21/11/2020	4:30:00	WE21: 22/23 rellevelling works Central Walk Tile removal to the whole platform, draignage works, deep pit installation, services work ESR - Road 23 concrete pad construction for future installation	C	18	73.8	Chalmers St	Night	45	28	0	1	Sawcutting audible throughout recording with sporadic pauses.
21/11/2021	8:15:00	WE21: 22/23 rellevelling works Central Walk Tile removal to the whole platform, draignage works, deep pit installation, services work ESR - Road 23 concrete pad construction for future installation	C	18	79.6	Chalmers St	Day	56	25	0	0	Trains and light rail heard in background. No construction noise audible.
22/11/2020	14:45:00	WE21: 22/23 rellevelling works Central Walk Tile removal to the whole platform, draignage works, deep pit installation, services work ESR - Road 23 concrete pad construction for future installation	C	18	72.1	Chalmers St	Day	56	25	0	0	The real time noise data was reviewed to validate the predictions. The noise levels were within the CNVIS predictions. Light Rail noise audible. Excavation occurring on platform 22/23. Faint reversing squawker heard and small kanga hammer used for a few minutes, consistent with ambient noise. All mitigation measures were in place.
23/11/2020	13:50:00	Eastern Entrance excavation work including excavator hammering. Noise mitigation measures include: sheath on excavator's hammer.	A	25	89.5	Chalmers St	Day	56	25	9	9	Location: In line of site of realtime noise logger, close proximity to works. Noise level was consistent throughout duration of breaking. (noise level representative of at source, not of impact on sensitive receiver).
23/11/2020	14:13:00	Eastern Entrance excavation work including excavator hammering.	A	25	87.3	Chalmers St	Day	56	25	3	6	Location: As above. Noise mitigation sheath on hammer removed for comparison. Noise level for the 5 minute period in which breaking was occurring was 90.5dB, in which the noise level was consistent (noise level representative of at source, not of impact on sensitive receiver).
24/11/2020	11:57:00	Eastern Entrance excavation work including excavator hammering.	A	25	62.5	Chalmers St	Day	56	25	0	0	Location: inside Sydney Dental Hospital, level 1 conference room B. Ground borne vibration felt, causing furniture and walls to make a slight noise.
26/11/2020	8:29:00	Eastern Entrance excavation work including excavator hammering.	A	25	93.5	Chalmers St	Day	56	25	13	13	Location: Adjacent to the realtime noise logger, in the line of sight of works. Only 5 minutes of noise monitoring conducted in order to ascertain the noise level for 2 hammers breaking concurrently for comparison (not a 15 minute period). Noise level was consistent throughout duration of breaking. Instantaneous level with just one hammer breaking was 91.5dB (noise level representative of at source, not of impact on sensitive receiver).

26/11/2020	8:38:00	Eastern Entrance excavation work including excavator hammering.	A	25	66.7	Chalmers St	Day	56	25	0	0	Location: In front of the façade of 38 Chalmers St. Noise contribution of works not prominent, blended into the background, subjectively at ~10% contribution. Light rail passing by and non-LOR street maintenance works (roughly equidistant with LOR works in opposite direction) were significant contributors to noise.
27/11/2020	12:27:00	Eastern Entrance excavation work including excavator hammering.	A	25	51.1	Chalmers St	Day	56	25	0	0	Location: inside Sydney Dental Hospital, level 1 conference room B. Ground borne vibration felt, causing furniture and walls to make a slight noise. However the noise contribution was low, subjectively at ~20% contribution, sounding very muffled. In comparison, the noise level sounded at ~90% contribution when inside the adjacent stairwell.
4/11/2020	1:30:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	61.6	Regent St	Night	44	29	0	0	LOR works not audible, only train idling noise.
11/11/2020	0:45:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	64.7	Regent St	Night	44	29	0	0	LOR works not audible, only train idling noise.
12/11/2020	1:00:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	64	Regent St	Night	44	29	0	0	LOR works not audible, only train idling noise.
13/11/2020	1:00:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	64	Regent St	Night	44	29	0	0	LOR works not audible, reverse beeper of a vehicle close by.
29/11/2020	19:00:00	WE22 STA Bus Depot: SYAB transformer delivery and lift from STA bus depot over to south of lee street substation	C	39	74.5	Regent St	Evening	50	23	0	2	Truck heard at 2:15 into the recording. Runsheet records truck arriving onsite at 1:30.
3/11/2020	21:45:00	Track 19/20 - Clear ground underneath T19/20, P18/19 Use of excavator underneath platform to scrape back stockpile and expose concrete/rock below for formwork.	C	18	78.7	YHA	Evening	52	21	0	6	Trucks heard at 0:30 and 11:30 into the recording. Runsheet records truck arriving onsite at 0:57 and 1:00. Passing trains also heard in recording.
5/11/2020	3:15:00	16/17 Service Trenches, Finish hammering the 16/17 escalator trench (subsurface) , Clear Adit Bridge- remove spoil ramp currently on either end of bridge, Excavation Face (subsurface) Hammer 19-4 to ensure that the steel beam can be installed	C	18	72	YHA	Night	49	24	0	0	Truck heard at 1:15 into the recording. Runsheet records truck arriving onsite at 1:00 and 1:10. Passing trains also heard in recording.
10/11/2020	3:00:00	Suburban: Hiral movement of equipment to and from platforms 18/19 and 20/21, general house keeping and edge protection install behind hoarding. Northern Concourse: various lifts using large crane and canopy install.	C	18	61.4	YHA	Night	49	24	0	0	Truck heard at 4:15 into the recording. Runsheet records truck arriving onsite at 1:06. Passing trains also heard in recording.
11/11/2020	3:00:00	Northern Concourse: removing RMD tower	C	18	61.3	YHA	Night	49	-49	0	0	Noise data monitored from loudest point of WE22. Trucks can be heard arriving onsite. Revving motorbike and trains in background. Sounds like something metal being unloaded from truck around 3:30 mark - very loud and likely correlates with OOH.

Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Period (Day/Evening/Night)	Observed LAeq15min (dB)	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
5/12/2020	3:00:00	WE23 Possession P20/21 - Removal of tiles and drainage installation P22/23 - building up and grading down existing sections of platform to new levels (Relevelling) Service installation works on Platforms 20/21, Platform 22/23	C	18	Chalmers St	Night	67.1	45	28	0	0	Saw cutting can be heard consistently throughout the 15 minute period.
10/12/2020	3:00:00	Central Walk: P18/19 - install door, ATF gate and laminated signs P20/21 - begin construction on permanent hoarding, strip formwork P18/19 - noise blanked installation Metrobox- excavation, pile detailing and floor/hanger pit excavation, surface mine SP3 trench excavation ESR - CW wall breakout continuing . Noise monitoring set up on ESR (receiver on Pedestrian Ramp and recorder in hoarding room adjacent to lift)	C	18	Chalmers St	Night	69.2	45	28	0	0	Extraction fan running. Saw cutting, hammering. Trucks driving/reversing noise. Construction noise spikes at 8:20 minutes until recording finishes. Background noise audible throughout - street sweeper or similar, voices, some cars.
12/12/2020	2:15:00	WE24 Possession: 12-13 December 2020 Northern Concourse (Full closure of concourse for exclusion zones): -Extending new roof canopy over the north end of Platforms 8-11 and continuing roof fit out -Partially removal of Pedestrian Canopy Units -Saw cut concourse -Balustrade footings P9, 10, 11 -Platform Roads 8 to 12 to be clear of trains for the duration of possession. -Services- Removal of the services from the temporary canopy structures	C	18	Chalmers St	Night	70.1	45	28	0	0	Extraction fan running. Saw cutting periodically, light periodic hammering. Background noise audible also - grinding noise, trucks/cars not associated with CSM works. Street sweeper heard around the 12 minute mark until end.
14/12/2020	9:40:00	Eastern Entrance: Breaking with 2 hammers	A	25	Chalmers St	Day	66.6	51	22	0	0	Location: Front of the façade of 34 Chalmers street café. Ground borne vibration felt. Non-LOR noise on Chalmers street including light rail passing was a significant contributor to noise.
15/12/2020	3:00:00	Central Walk: P22/23 bringing in material for skylight construction. Finish excavating P19-7. P18/19 excavation - slab breaking. Metro Box: ongoing excavation GL9-17. Jackhammering out stabilised sand at plunge columns Drilling into Top of Wall on Basement 1 and 2 level. ESR: continuing wall breakout works. Excavate material being existing ESR beam. Continuing drilling in ESR concourse West Wall. Northern Concourse: Continuing with installation of skylight panels in GNC. Demolition of Western Wall. Topping slab removal. Screed and tile removal. Juliet balcony slab demolition	C	18	Chalmers St	Night	66.6	45	28	0	0	Street sweeper or similar vehicle drives past at approx. 11 minute mark. Only very loud period during recording.
16/12/2020	10:22:00	Eastern Entrance: Breaking with 2 hammers	A	25	Chalmers St	Day	66	51	22	0	0	Location: Front of the façade of 34 Chalmers street café. Non-LOR noise on Chalmers street including light rail passing was a significant contributor to noise, therefore internal noise level <60dB.
17/12/2020	6:00:00	Central Walk: P22/23 moving camera, P20/21 moving help point, turning camera, P18/19 moving help point. Mag drill holes plus weld scaffold. Excavate Z1-3. P18/19 remove fence and brattice. Metro Box: GL10-15 - hammer trench and rock above tunnel linings on east bench to GL15. Waterproofing installation. ESR: Wall breakout works continued. Continuing drilling of TAM tubes in ESR concourse west wall. Nass break concrete down to top of brick riser walls.	C	18	Chalmers St	Night	73.8	45	28	0	1	External rail ops noise - trains braking on tracks, conductors blowing whistles. Birds chirping loudly near monitor. Trucks also driving past on Chalmers St - not CSM related.
19/12/2020	2:45:00	Northern Concourse: Removing covered pedestrian walkway modules and temporary escalator roof. Installing balustrade footings on Platforms 9 – 11. Extending new roof canopy over the north end of Platforms 8-11 and continuing roof fit out. P17/17 - demolition of 4 existing columns. ESR - continuing ESR/CW wall breakthrough. Complete excavation of Bay 2. Continue onto Bay 3 breaking out the concrete wall only.	C	18	Chalmers St	Night	69	45	28	0	0	Extraction fan running. Saw cutting and drilling sounds intermittently. Bicycle rings bell adjacent to monitor at approx. 13 minutes.
21/12/2020	1:30:00	Continue demolition of 4 existing columns. Crane on night shift & excavation of 19-3B. Metro box: 6 truck and dogs running. Bulk excavation ongoing. ESR: Continuation of wall breakout works. Northern Concourse: Concrete pour around top of new staircase completed.	C	18	Chalmers St	Night	65.7	45	28	0	0	Trains braking on tracks. Extraction fan running in background. Crows squawking at around 8-11 minutes creating majority of loud noise.

22/12/2020	1:00:00	Continue of demolition on P16/17 of 4 existing columns. Complete demo of the footing southern an northern side. Rubble clean up. Metro Box: excavation and hammer trench. ESR: wall breakout - continue wall saw cut and begin breakout of concrete/brick wall in Bay 1. Excavate material to depth of 1.6m behind the existing ESR Wall or 2.1m from face of existing ESR beam. Drilling in N. Concourse.	C	18	Chalmers St	Night	63.8	45	28	0	0	Extraction fan running. Trains can be heard on tracks. Rain can be heard in background throughout recording also.
23/12/2020	3:15:00	CW: drilling CT30 & CT18. Steel fix CT28. MB: GL7-10 - excavate rock between plunge columns NC: NASS removed noise blankets from hoarding and set them up along track 16.	C	18	Chalmers St	Night	67	45	28	0	0	Trains brake squeaking and street sweeper drives past monitor. Noise not related to CSM construction activities.
27/12/2020	1:15:00	Northern Concourse concrete breaking as part of Christmas shutdown.	C	18	Chalmers St	Night	63	45	28	0	0	Extraction fan running throughout. Breaking can be heard intermittently in background from 8 minutes onwards. Saw cutting can be heard in final minute. Trains braking on tracks also.
28/12/2020	3:15:00	MB: South DST - continue steel fixing. North DST - install blinding shutter and core tubes at east and west plunge columns	C	18	Chalmers St	Night	61.3	45	28	0	0	Extraction fan running. People talking close to receiver at approx. 10 minutes.
29/12/2020	3:00:00	MB: South DST - continue steel fixing. North DST - install blinding shutter and core tubes at east and west plunge columns. NC escalators back in service.	C	18/33	Chalmers St	Night	69.3	45	28	0	0	Some intermittent saw cutting. Trains braking on track. Something clattering on fence.
31/12/2020	2:45:00	No CSM activity.	C	18/33	Chalmers St	Night	64.9	45	28	0	0	Street sweeper drives past outside project footprint. No other CSM related sound.
9/12/2020	3:00:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	Night	61.9	44	19	0	0	Extractor fan possibly heard in background throughout recording. Platform announcement around 4 minute mark, 8 minute mark. Gate opening around 4:10 and 9:50 minute mark. No exceedance of predictions due to CSM works. Noise levels below 65dB for rest of night works.
10/12/2020	3:00:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	Night	62.4	44	19	0	0	All other night works below 60 dB. Extractor fan can be heard running in background softly. Large burst of saw cutting at 1:30 minute mark. Stops at 2:20 mark. Train pulls up at station at around 3 minute mark, trucks honking in background also. Saw cutting begins again at 8 minute mark, stops after 20 seconds. Quiet for rest of recording.
22/12/2020	0:15:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	Night	62.4	44	19	0	0	Saw cutting periodically (bursts every minute or so). Extractor fan can be heard softly in background during the recording. Trains can be heard in background. Only large spike in night works - all other night works below 60 dB. No exceedance of predictions due to CSM works.
23/12/2020	0:15:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB. 8T excavator and Brokk excavator delivered to Far North End on traffic deck.	C	39	Regent St	Night	62.3	44	19	0	0	Saw cutting in background periodically, extractor fan continuous. Large burst of saw cutting for approx. 1 minute - would account for large spike. Typical noise trace for rail environment. No exceedance of predictions due to CSM works.
5/12/2020	6:15:00	CW: Plenum, Lift Pit and Service tunnel area	C	18	YHA	Night	68.3	49	14	0	5	Extractor fan in background. Saw cutting continuously, sporadic pauses. Loudest at beginning of recording - from 30 seconds - approx. 2 mins. Noise works do not exceed 60 dB for rest of the 20th.
12/12/2020	1:15:00	CW: scaffold mobilisation, mobilise electrical spotter in place, remove current ATF cross braces, install braces to underside of platform canopy truss, install posts and connect to cross braces on underside of canopy truss Noise blankets installed at bottom of truss and to ATF fencing	C	18	YHA	Night	60.8	49	14	0	0	Noise relatively stable for rest of night works until handover. Breaking audible continuously, sporadic pauses. Extractor fan running throughout. Saw cutting audible periodically. Break at around 11 minute mark.
13/12/2020	0:25:00	CW: Excavate 21/6 heading, excavated bottom of C1 column. Works ongoing in canopy tubes. Refix-hoarding ATF down as per temp works design amendments on P18/19. Begin construction of permanent hoarding P20/21. Noise blankets installed on P18/19. MB: Ongoing excavation. Ongoing Vac truck works sucking out plunge columns basement 2. NC: ongoing possession works, hoarding. Continued slab demo, west wall demo	C	18	YHA	Night	67.9	49	17	0	2	Extractor fan running until 7 minute mark. Quiet after. No exceedance of predictions due to CSM works.
19/12/2020	4:00:00	Northern Concourse: Removing covered pedestrian walkway modules and temporary escalator roof. Installing balustrade footings on Platforms 9 – 11. Extending new roof canopy over the north end of Platforms 8-11 and continuing roof fit out.	C	18	YHA	Night	72.3	49	17	0	6	Truck drives in at 14 minutes into the recording. Run sheet records truck arriving onsite at 3:15. Passing cars can also be heard in recording, as well as short, relatively quiet alarm.
20/12/2020	2:30:00	MB: continued breaking eastern tunnel north and south. NC: hoarding installed, tower crane lifting. Removal of final section of topping slab.	C	18	YHA	Night	61.1	49	17	0	0	End of truck driving in can be heard on recording - consistent with run sheet. Loud train drives past at around 2 minute mark and 4 minute mark. Cars driving on street can be heard intermittently. Noise in recording not CSM related.
27/12/2020	3:45:00	Northern Concourse concrete breaking as part of Christmas shutdown.	C	18	YHA	Night	65.7	49	17	0	0	Truck can be heard driving in immediately and around the 9 minute mark - consistent with run sheet. Run sheet records truck arriving onsite at 00:10. Other cars driving past can be heard in background throughout recording. Rain can be heard throughout recording also. Motorbike revving near the end of the recording - loudest portion of the noise comes from this.

27/12/2020	9:45:00	Northern Concourse concrete breaking as part of Christmas shutdown.	A	18	YHA	Day	81.9	59	7	1	16	Cars can be heard in background of recording. Trains can also be heard going past - loudest at 4:14 - 4:30 minutes. Truck enters site 3 minutes into recording - consistent with run sheet which records truck arriving on site approx. 00:20.
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Date	Time	LOR Works (potentially noisy as per diary entry)	Continuous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Observed LAeq15min (dB)	NML for sensitive receiver (dB) (NML=RBL+5dB)	Period Day/Evening/Night	LAeq15min Exceedance of NML (dB)	RBL for Sensitive Receiver	Predicted Exceedance as per OOH for particular activity (RBL)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
7/01/2021	11:15:00	Excavation in Eastern Entrance - directly in the middle.	C	25	Chalmers St	79.2	56	Day	23	51	30	0	0	Extraction fan audible throughout the duration of recording. Intermittent hammering can be heard. Light rail activity can also be heard sporadically throughout recording. Around 9 minute mark, street sweeper drives past, likely accounting for the sharp increase in noise. Drives away at around 10 minute mark.
16/01/2021	8:45:00	WE29 Possession - Excavation in Eastern Entrance - southern side.	C	25	Chalmers St	78.5	56	Day	23	51	30	0	0	Breaking heard throughout recording with multiple pauses. Plant lifting excavated material into skip also heard intermittently. Trains can also be heard on suburban platforms from around 5:30 minute mark. Light rail can also be heard. Train noise is more frequent and at same audible noise level as construction noise.
7/01/2021	16:30:00	Excavation in Eastern Entrance - directly in the middle.	C	25	Chalmers St	78	56	Day	22	51	30	0	0	Light rail and trains can be heard throughout the recording. Cars can also be heard on street. Bird chirps directly next to monitor at very end of recording, likely accounting for noise spike. No other construction related noise audible previously.
16/01/2021	10:30:00	WE29 Possession - Excavation in Eastern Entrance - southern side.	C	25	Chalmers St	78	56	Day	22	51	30	0	0	Light rail and trains can be heard throughout the recording and likely account for majority of noise during the period. Very minor burst of what sounds like saw cutting towards the 12 minute mark of recording. No other construction related noise audible previously.
17/01/2021	16:45:00	WE29 Possession - Breaker and excavator in Eastern Entrance - southern side.	C	25	Chalmers St	74.3	56	Day	18	51	30	0	0	Breaking (continuous) - sporadic pauses. Ground borne vibration felt. Light rail passes at 2:40 mins and 9:07 mins.
16/01/2021	3:30:00	WE29 Possession - Central Walk: installation of misting system. ESR breakthrough works continued. Excavator present in Eastern Entrance.	C	18/25	Chalmers St	72.6	50	Night	23	45	36	0	0	Breaking and excavating heard continuously. Sporadic pauses. At around 7 minute mark, heavy breaking becomes audible again, ground borne vibration felt. Non construction related activity: light talking from Chalmers St, closing doors and talking on phone audible.
5/01/2021	8:15:00	Breaking and excavating in Eastern Entrance, predominantly in the southern side.	C	25	Chalmers St	71.7	56	Day	16	51	30	0	0	Loud breaking audible from about 30 second mark - continues throughout recording with sporadic pauses. Train and light rail can also be heard in background.
27/01/2021	3:15:00	Excavation of CB1 in P22/23. Loading/unloading of Hi-Rail - 6T of reo. Excavation continuing in Metro Box.	C	18	Chalmers St	70.4	50	Night	20	45	36	0	0	Loud breaking audible from about 30 second mark - continues throughout recording with sporadic pauses. Train and light rail can also be heard in background.
5/01/2021	3:00:00	Continued demo and excavation in Central Walk. Excavation and saw cutting in Metro Box. Breakthrough works in ESR.	C	18	Chalmers St	67.1	50	Night	17	45	28	0	0	Extraction fan can be heard in background for duration of recording. Children's voices can be heard around the 4 minute mark. Train and light rail activity also audible. Birds chirping close to noise logger from approx. 7:30 minute mark.
6/01/2021	11:51:00	Eastern Entrance: breaking with excavator on south side and with brokk on north side	C	25	Chalmers St	67.9	56	Day	12	51	22	0	0	Extraction fan can be heard in background for duration of recording. Mild hammering/breaking can also be heard. Overall general construction noise, no sharp spikes or periods off extremely loud activity.
6/01/2021	16:30:00	Breaking and excavating in Eastern Entrance, predominantly in the northern side.	C	25	Chalmers St	64.8	56	Day	9	51	22	0	0	Platform announcements can be heard. Train and light rail activity intermittent but consistent throughout recording. Very minor construction noise can be heard in background towards end of recording for a small amount of time. Main noise audible is from trains.
6/01/2021	15:45:00	Breaking and excavating in Eastern Entrance, predominantly in the northern side.	C	25	Chalmers St	64.4	56	Day	8	51	22	0	0	Platform announcements can be heard. Train and light rail activity intermittent but consistent throughout recording. Trains on eastern suburban platforms particularly loud.
7/01/2021	12:32:00	Eastern Entrance: breaking with 2 hammers and 1 brokk	A	25	Chalmers St	68.1	56	Day	12	51	9	8	8	SDH- Internal Noise check Hammering and breaking audible. No ground borne vibration felt for duration of session. Office noises - occasional chatting from SDH staff in hallway. Exceeds internal noise level of 60dB, however does not exceed allowable duration for the day.
7/01/2021	23:30:00	Breaking out shotcrete PP 16/17 Central Walk. Excavation up to lift shaft PP 20/21. Saw cutting and break out trench next to P17. Excavation ongoing in Metro Box. Two brokks in ESR for breakthrough works.	C	18	Chalmers St	64.7	50	Night	15	45	15	1	5	SDH- Internal Noise check Breaking audible throughout the recording with sporadic pauses. No ground borne noise felt. At around 1:30 mark, I click in front of monitor microphone to make sure that it is working (as during previous attended noise monitoring session the logger stopped working). At around 8 minute mark, a lift opens in the SDH. Exceeds internal noise level of 60dB, however does not exceed allowable duration for the day.

8/01/2021	2:00:00	Excavation P20/21. Strip south DST wall and remove material in Metro Box. Steel fixing to north DST wall. ESR breakthrough works continuing.	C	18	Chalmers St	67.2	50	Night	17	45	28	0	0	Extraction fan can be heard faintly in background. Ambulance siren also audible at very beginning of recording. Trains and light rail can be heard intermittently yet consistently - trains audibly the loudest part of recording.
8/01/2021	22:30:00	Excavation P20/21. 6x Truck and Dogs starting 6pm in Metro Box. Strip south DST wall and remove material in Metro Box. Steel fixing to north DST wall. ESR breakthrough works continuing.	C	18	Chalmers St	67	50	Night	17	45	28	0	0	Trains and light rail running in background. Seagulls chirping loudly close to monitor, people talking at points also. Extraction fan running - only indication of construction noise throughout recording.
10/01/2021	23:00:00	Clear rubble in escalator P16/17 area in Central Walk. Continued excavation on P20/21. Metro Box: saw cutting and excavation in main box. North DST steel fixing.	C	18	Chalmers St	64.5	50	Night	15	45	28	0	0	Extraction fan heard in background. Trains in background. Breaking train causes loud sharp noise at around 5:30 mark. Street sweeper drives past around 12 minute mark, likely accounting for loud noise burst. No other construction noise audible.
11/01/2021	11:38:00	Breaking in Eastern Entrance. 2 hammers, 1x 14t and 1x 5t. Monitoring taking place Level 1 conference room in SDH.	A	25	Chalmers St	47.1	56	Day	-9	51	30	0	0	Breaking and excavating audible - intermittent pauses.
12/01/2021	22:45:00	Concrete breakout P16/17 escalator area in Central Walk. Excavation ongoing P20/21. Metro Box: continued hammering in trench, saw cutting east wall ongoing. North DST steel fixing wall. ESR breakthrough works ongoing. Noise blankets reinstated before works commenced.	C	18	Chalmers St	65.5	50	Night	16	45	28	0	0	Location: SDH. Breaking and excavating audible - intermittent pauses.
13/01/2021	14:54:00 PM	Breaking and excavating in Eastern Entrance near northern wall.	A	25	Chalmers St	51.3	56	Day	-5	51	30	0	0	Birds chirping. Extraction fan can also be heard running. Trains and light rail in background - audibly louder than construction related noise. Whistle from trains can be heard. Loud train and whistle likely source of spike. General LAeq constant on the 17th except for spike at 16:45.
15/01/2021	23:15:00	Central Walk: Hammering, drilling P22/23. Rock excavation in Metro Box, saw cutting east wall heading south. ESR breakthrough works continued - brick wall removal using small robot combined with jackhammering. Noise blankets reinstalled before works commenced.	C	18	Chalmers St	66.7	50	Night	17	45	28	0	0	Construction work audible - extraction fan running. Train/light rail in background also. - significantly audibly louder than construction noise.
18/01/2021	13:35:00	Breaking and excavating. 1x 5t breaker operating continuously, 1x 20t breaker operating intermittently.	C	25	Chalmers St	46.9	56	Day	-9	51	9	0	0	SDH- Internal Noise check Construction work audible but light. No ground borne noise audible. No noise from within SDH heard. Exceeds internal noise level of 60dB, however does not exceed allowable duration for the day.
18/01/2021	1:15:00	Small excavator in Central Walk. Continued installation of false work deck in P18/19. Steel fixing south plenum. ESR breakthrough works continuing. NC: Finish excavation for underpinning footings. Lift cart structural demolition. Saw cut topping slab. Demolish brick wall. (NB - vibration monitoring done at TCAC for event). Tower crane removal continuing. MB excavation continuing.	C	18	Chalmers St	64.8	50	Night	15	45	28	0	0	One high noise event at 1:45. Trains braking on tracks, light rail audible. Braking likely accounts for high noise activity, particularly as no excavating was undertaken on the 20th. No other sharp spikes or irregular activity noted.
20/01/2021	1:45:00	Central Walk: Stepping hob false work and skylight modification on P20/21.	C	18	Chalmers St	63.7	50	Night	14	45	28	0	0	Location: SDH. Extraction fan heard in background. Light rail and train also heard - likely P22/23 as very close and loud. Seagulls squawking close to monitor.
21/01/2021	1:30:00	Central walk excavate heading. P18/19 completion of false work deck. P20/21 mod to the skylight.	C	18	Chalmers St	68.2	50	Night	18	45	28	0	0	Sharp squeal of train brakes audible until 1:30 mark and again at around 8 minute and 9 minute mark. Light rail goes past around 14 minute mark. Very faint sound of extraction fan running in background. No other construction noise audible.
22/01/2021	2:00:00	Conduit installation, coring in CW. Installation of waterproof membrane in Mole Hole 5.	C	18	Chalmers St	67	50	Night	17	45	28	0	0	Extraction fan can be heard running softly in background. Train and light rail activity also audible. Construction noise audible from the 5 minute mark but stops after 10 seconds. Noise audible with intermittent pauses throughout duration of recording.
23/01/2021	3:45:00	WE30 Possession Central Walk: P20/21 Installation of new tiling to platform P18/19 Releveling and drainage Grand Concourse: Installation of roof canopy, removal of tower crane	C	18	Chalmers St	67	50	Night	17	45	28	0	0	Spike noted at around 3:15 mark. Street sweeper drives past at approx. 11 minute mark. Noise loudest at beginning of recording - however, unclear as to whether the noise was construction related, traffic related or train/light rail related. Thus, could be a combination of extraction fan and train/light rail activity.
28/01/2021	1:45:00	P18/19 - painting of chevrons, bubbling tactiles, reinstalling barrier post adjacent to southern stairs.	C	18	Chalmers St	64.3	50	Night	14	45	28	0	0	Complaint received at 3:34 from 38 Chalmers Street about "vibration noise". Recording listened to - verify complaint. At around 1 minute mark, several response vehicles drive past (either ambulance, police or fire). At least two vehicles, maybe more. Rain can also be heard on recording. No other construction noise audible on recording. Highest dB captured during night works is 63.4 - well within CNVIS predicted scope.
30/01/2021	6:15:00	CW: Column and footing installation P22. Possession works on P21/22. Hammering in ESR.	C	18	Chalmers St	66.4	56	Day	10	51	30	0	0	Trains brakes squeaking on track. Birds squawking in background. General station noise - whistles blowing, train doors closing. Saw cutting begins around 1:45 minute mark with sporadic pauses. Light rail audible. At around 3:45 minute mark, an emergency response vehicle is audible close to recording.

31/01/2021	3:15:00	P21/22 works closed out. Works in Metro Box - waterproofing, removing under break. Hammering in ESR. Lift 8 demo in NC.	C	18	Chalmers St	66.5	50	Night	17	45	28	0	0	Truck reversing immediately audible. Hammering/breaking audible throughout recording with sporadic pauses.
30/01/2021	2:00:00	CW: Column and footing installation P22. Possession works on P21/22. Hammering in ESR.	C	18	Chalmers St	62.4	50	Night	12	45	19	0	0	Exceedance investigated. Trains idling, creating loud noise. No construction noise audible.
1/01/2021	0:15:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	63.1	49	Night	14	44	20	0	0	Exceedance investigated. Some construction noise audible for the first minute, however dwindles to a complete stop by the 3 minute mark. Trains heard idling. Train releasing steam heard approx. every 1 minute - very loud and in close proximity to monitor so likely to be on platform 1.
16/01/2021	23:45:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	64.6	49	Night	16	44	20	0	1	Exceedance investigated. Peaks in noise monitoring data consistent with LaMax, so likely to be a singular loud sharp event. No construction noise audible, some Sydney Train background noise. Loud burst of diesel train at 5:30 mark. No other loud noise for duration of recording so hypothesis correct.
28/01/2021	1:00:00	Arrival of truck & dogs for collection of spoil from CSM via SYAB	C	39	Regent St	65.1	49	Night	16	44	20	0	1	Super loud peak, however consistent with LaMax peak, so likely a one off loud noise event. Loud noise is monitor calibration, that happened that morning as requested.
3/01/2021	2:45:00	Works on P22/23: drilling and welding pipes.	C	18	YHA	74.4	54	Night	20	49	24	0	1	Train goes past at 1 minute mark, 8 minute mark and 12 minute mark. No other noteworthy noise events.
7/01/2021	2:30:00	Breaking out shotcrete PP 16/17 Central Walk. Excavation up to lift shaft PP 20/21. Saw cutting and break out trench next to P17. Excavation ongoing in Metro Box. Two brooks in ESR for breakthrough works. Excavation in eastern entrance.	C	18	YHA	76.5	54	Night	23	49	24	0	4	Exceedance investigated. Trains going past, loud squeaking on brakes. No construction related noise audible.
12/01/2021	3:00:00	Concrete breakout P16/17 escalator area in Central Walk. Excavation ongoing P20/21. Metro Box: continued hammering in trench, saw cutting east wall ongoing. North DST steel fixing wall. ESR breakthrough works ongoing. Noise blankets reinstated before works commenced.	C	18	YHA	73.7	54	Night	20	49	24	0	1	No construction noise audible. Only sound is loud trains idling on Platform 1.
16/01/2021	4:00:00	WE29 Possession - Central Walk: installation of misting system. ESR breakthrough works continued.	C	18	YHA	81.5	54	Night	28	49	24	0	9	Trains heard in background. Loud motorbike drives by at around 2:30.

Appendix B – Vibration Monitoring Summary

For ease of interpretation, the continuous vibration data has been divided into monthly intervals. A logarithmic scale has also been applied to meaningfully separate approximately 43,200 individual data points within any one month period as the majority of data points fall below 2mm/s, however interest lies in the higher end of the scale. Each data point represents the highest PPV (mm/s) within that particular one minute interval.

The major gridlines of the x-axis indicate a 24hr period from 12-midnight to 12 midnight. The minor gridlines of the x-axis indicate 6 hour intervals.

The residential criteria has conservatively been applied to present the monthly data at Chalmers St. The data points have been colour coded to represent the day time residential criteria for continuous vibration (refer to table 5.5 Perceptible Vibration Criteria for Exposure to Continuous and Impulsive Vibration of the CNVMP). The majority of data points fall below the preferred human comfort criteria of 0.28mm/s and below max criteria of 0.56mm/s during construction.

The TCAC building is located in a less sensitive area, and due to the nature of the works and sensitivity of the heritage fabric is monitored from a structural perspective in accordance with Table 5.6 Building Damage Vibration Management Levels (BS7385) of the CNVMP

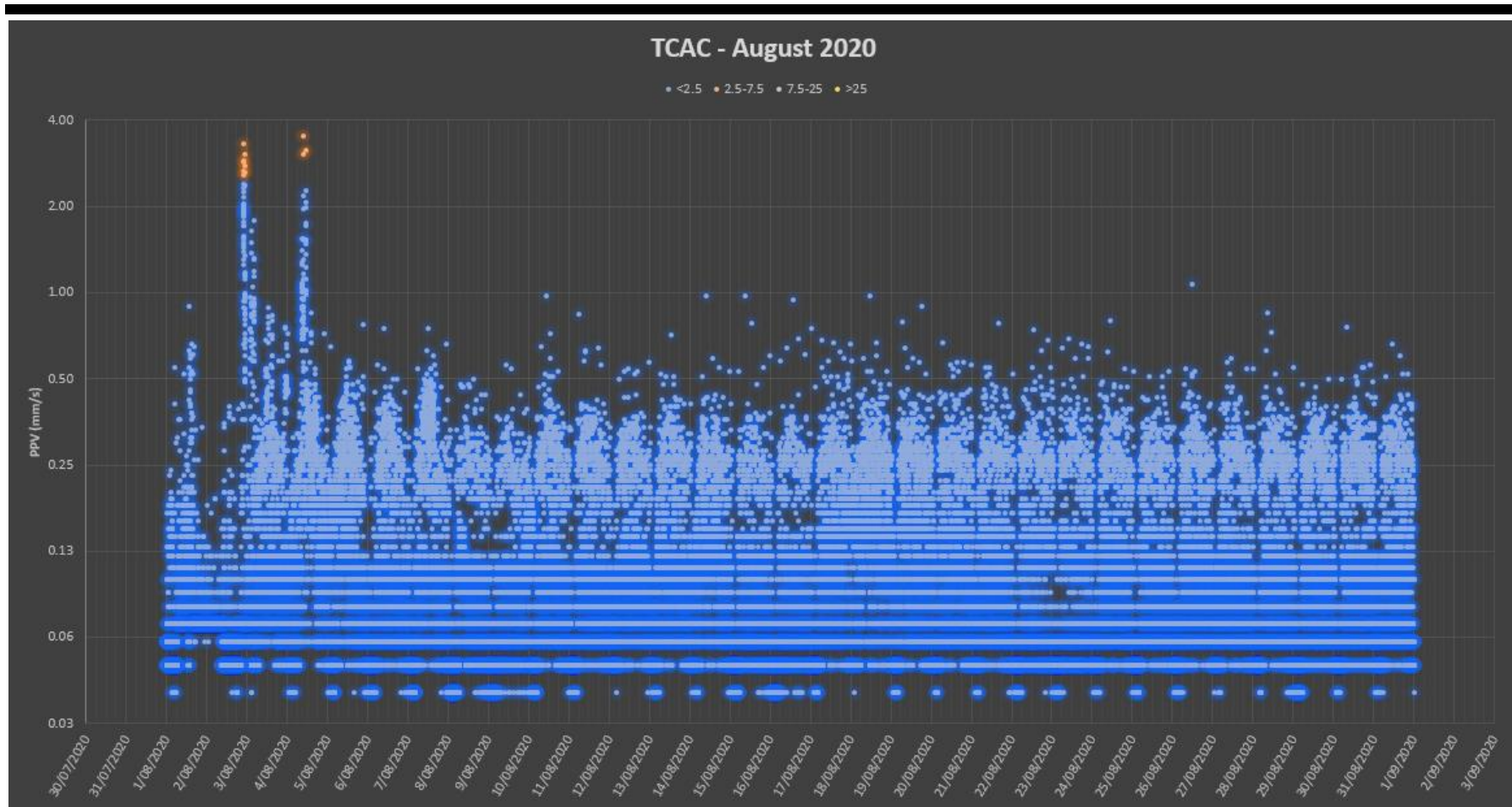


Figure B-1 TCAC - August 2020

The month of August had limited vibration intensive activities. The predominate scope of works occurring in the Northern Concourse involved installation of large steel elements.

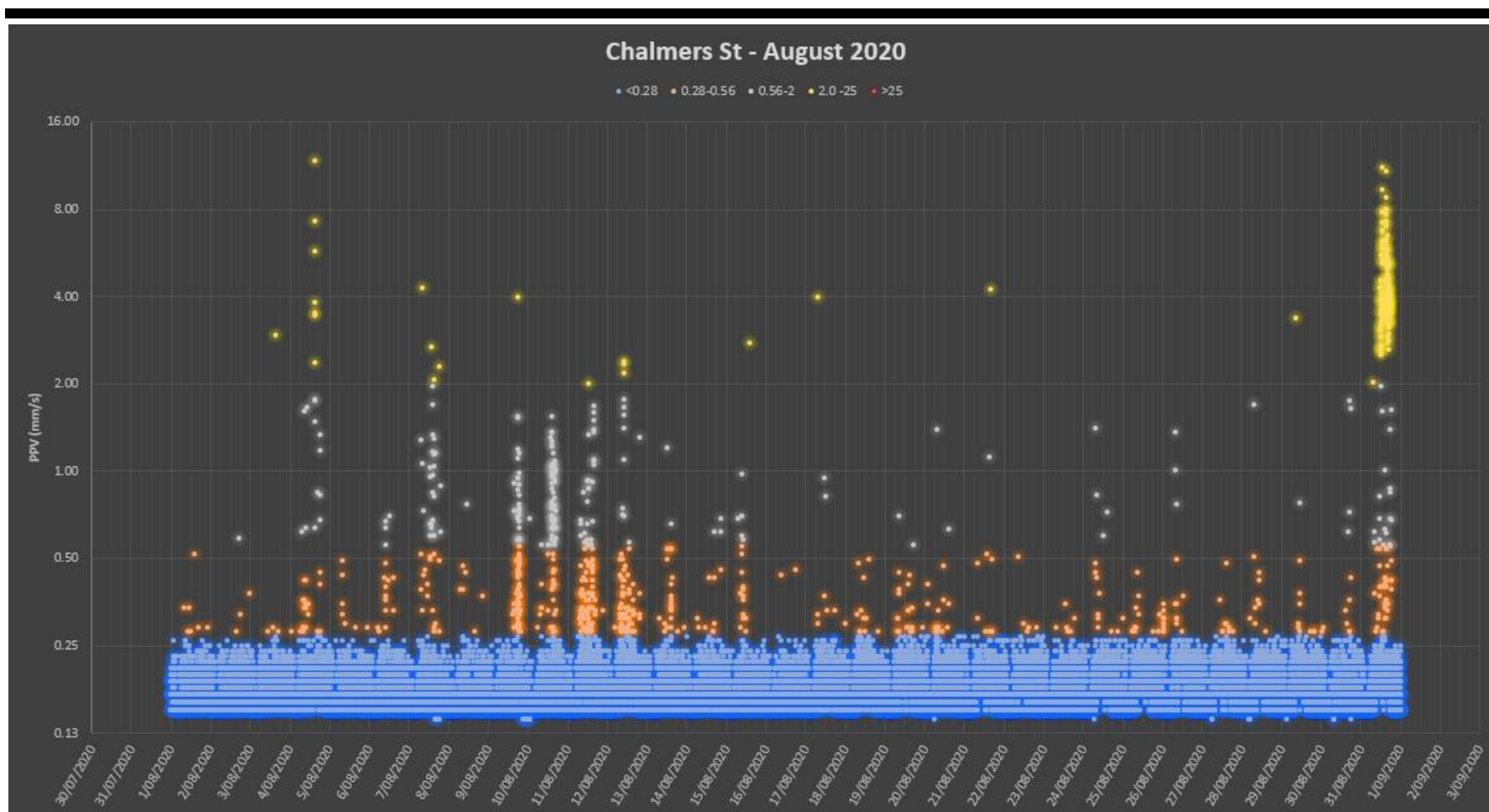


Figure B-2 Chalmers Street – August 2020

Works within Eastern Entrance throughout August consisted of some excavation activities, but primarily involved canopy tube drilling, waterproofing and concreting works. There were no instances where vibration exceeded the structural damage trigger value of 25mm/s throughout August 2020.

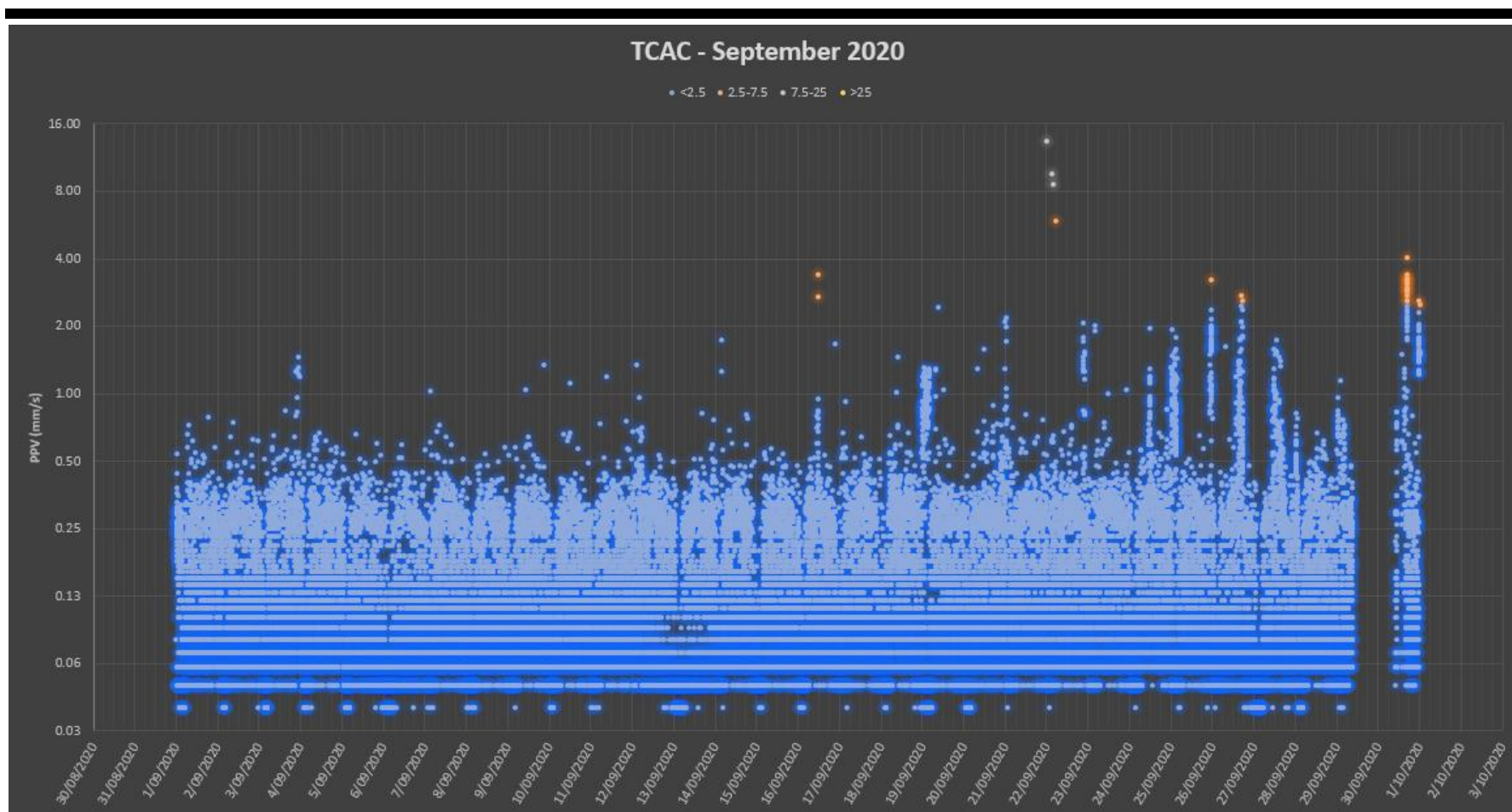


Figure B-3 TCAC - September 2020

The month of September had limited vibration intensive activities in close proximity to the Central Electric Building (CEB/ TCAC). The predominate scope of works occurring in the Northern Concourse involved installation of large steel elements. Breaking upper Northern Concourse was also occurring around the Station Masters Office, however outside of the area of influence for CEB.

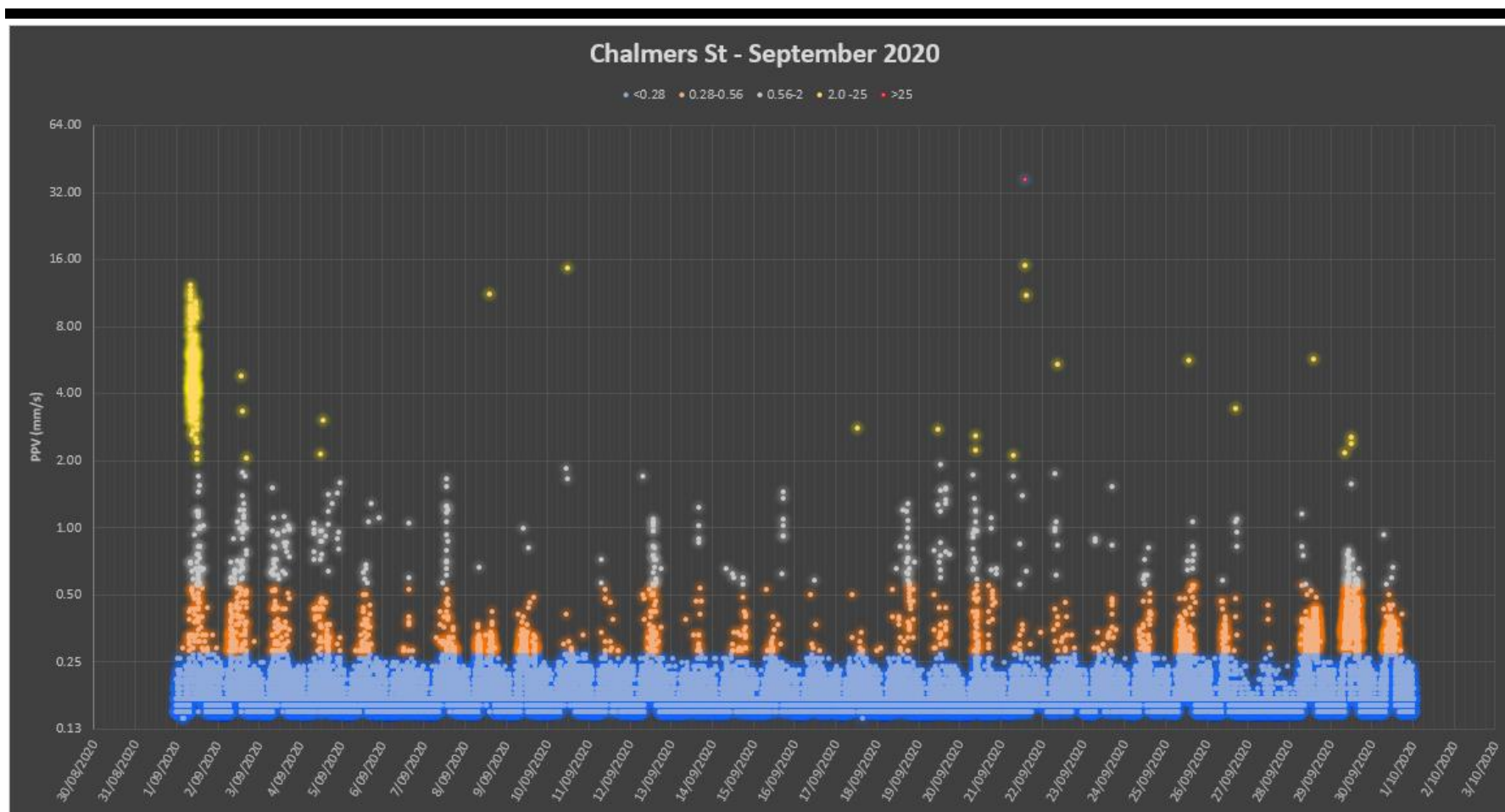


Figure B-4 Chalmers Street – September 2020

The works within the 20-28 Chalmers St site throughout September 2020 consisted of some excavation activities including the offloading of material into tipper trucks using a crane, but primarily of scaffolding and formwork. There was one instance where vibration exceeded the structural damage trigger value of 25mm/s, however this was identified as an extraneous vibration event.

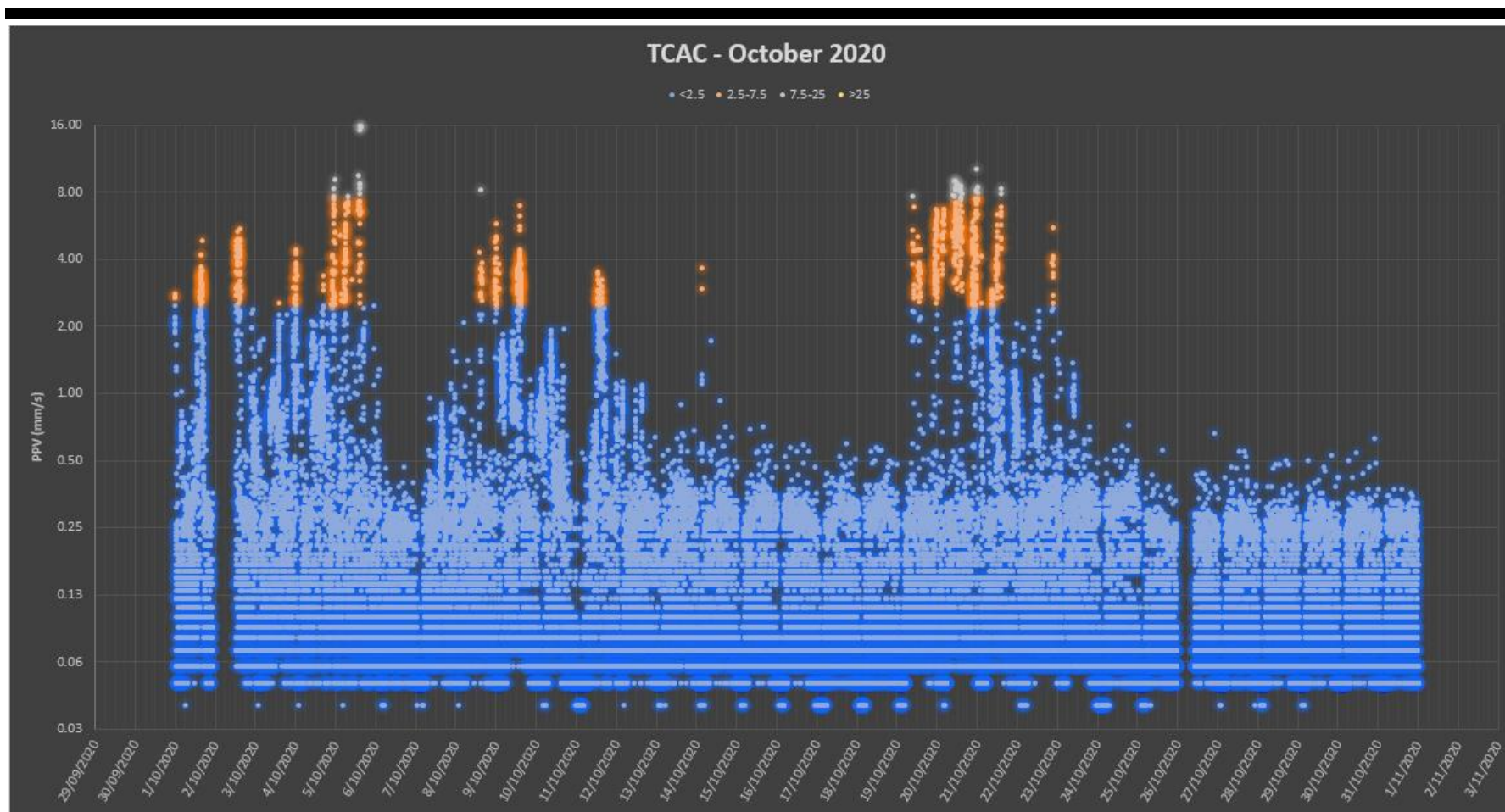


Figure B-5 TCAC – October 2020

Typical vibration although elevated from previous months for the month of October was typically below the cited 12.5 mm/s level corresponding to a near-zero probability of damage. Works in the Northern Concourse occurring consisted of breaking out piles working from west to east towards the TCAC building as well as window/door relocation on the southern and eastern elevation of the TCAC building.

Some of the elevated levels were attributed to non-vibration intensive activities occurring within the TCAC building in close proximity to the logger.

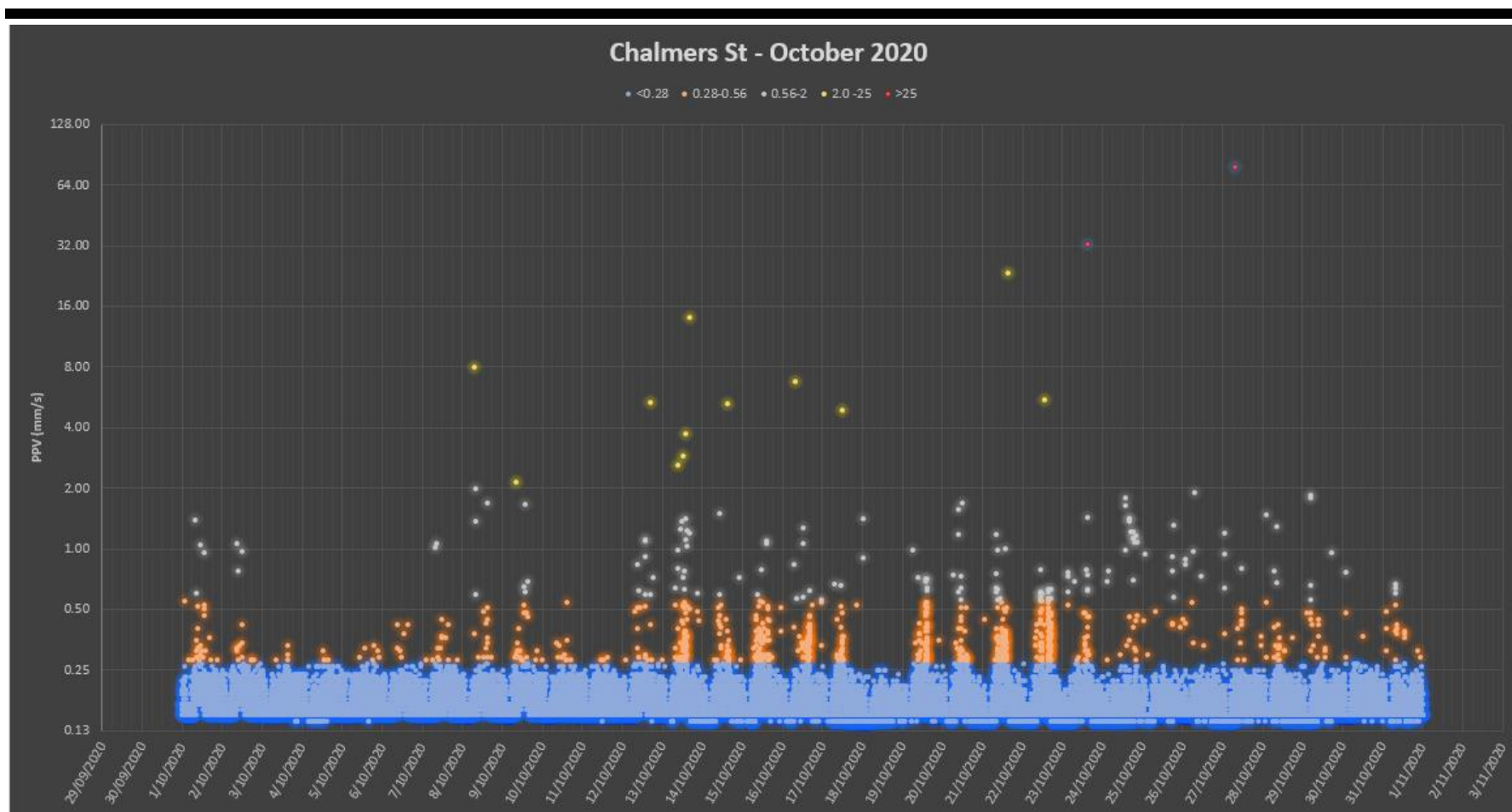


Figure B-6 Chalmers Street – October 2020

The works within the 20-28 Chalmers Street site throughout October 2020 consisted of some excavation activities including, breaking shale and sandstone, the offloading of material into tipper trucks using a crane, but primarily consisted of scaffolding and formwork. There were two instances where vibration exceeded 25mm/s, however these were identified as transient events.

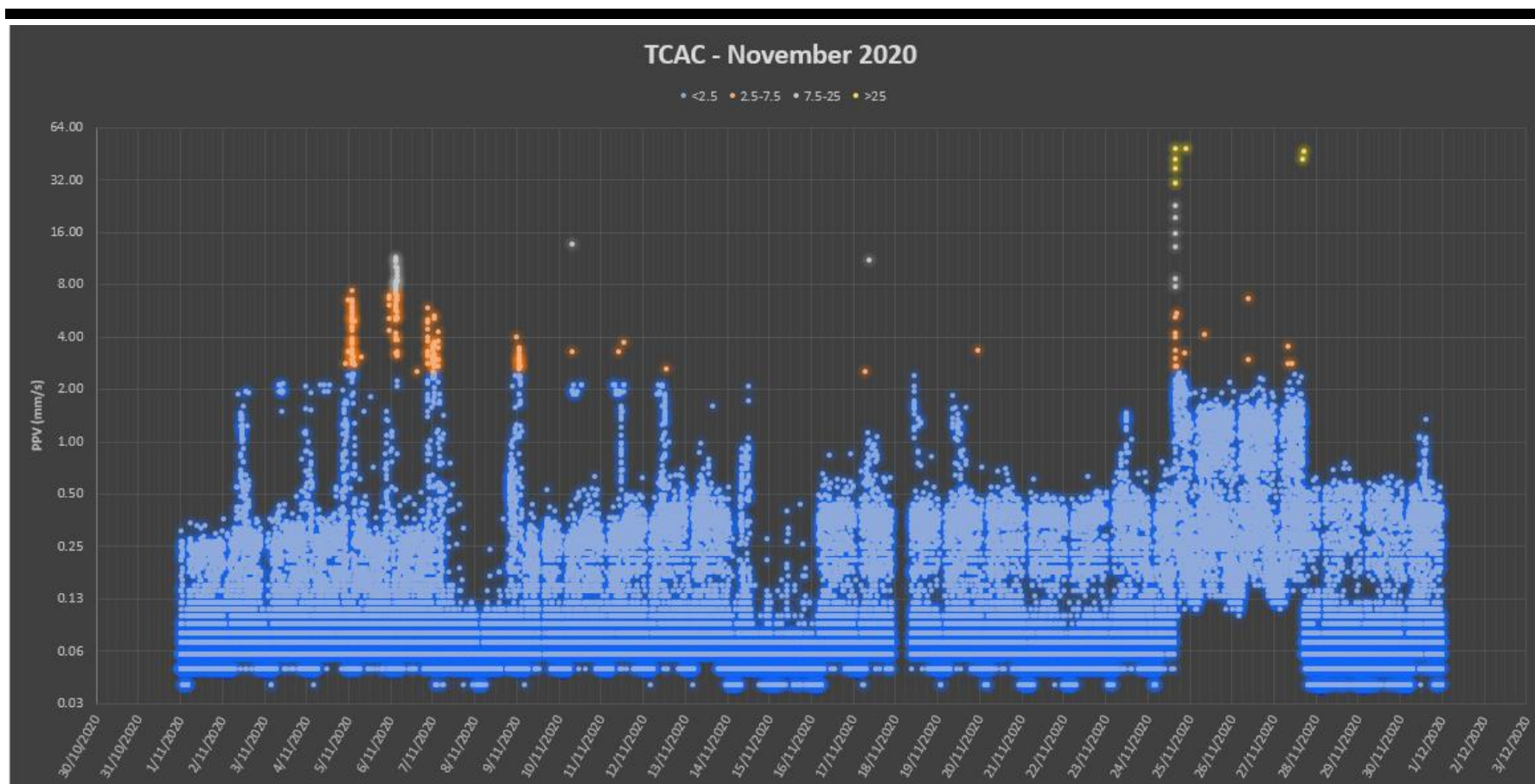


Figure B-7 TCAC – November 2020

Works in the Northern Concourse continue from the previous month for November and consisted of breaking out piles working from west to east towards the TCAC building as well as window/door relocation on the southern and eastern elevation of the TCAC building. Typically, vibration levels were below the cited 12.5 mm/s level corresponding to a near-zero probability of damage. The higher vibration activities occurred less frequently. Some of the elevated levels were attributed to non-vibration intensive activities occurring within the TCAC building in close proximity to the logger.

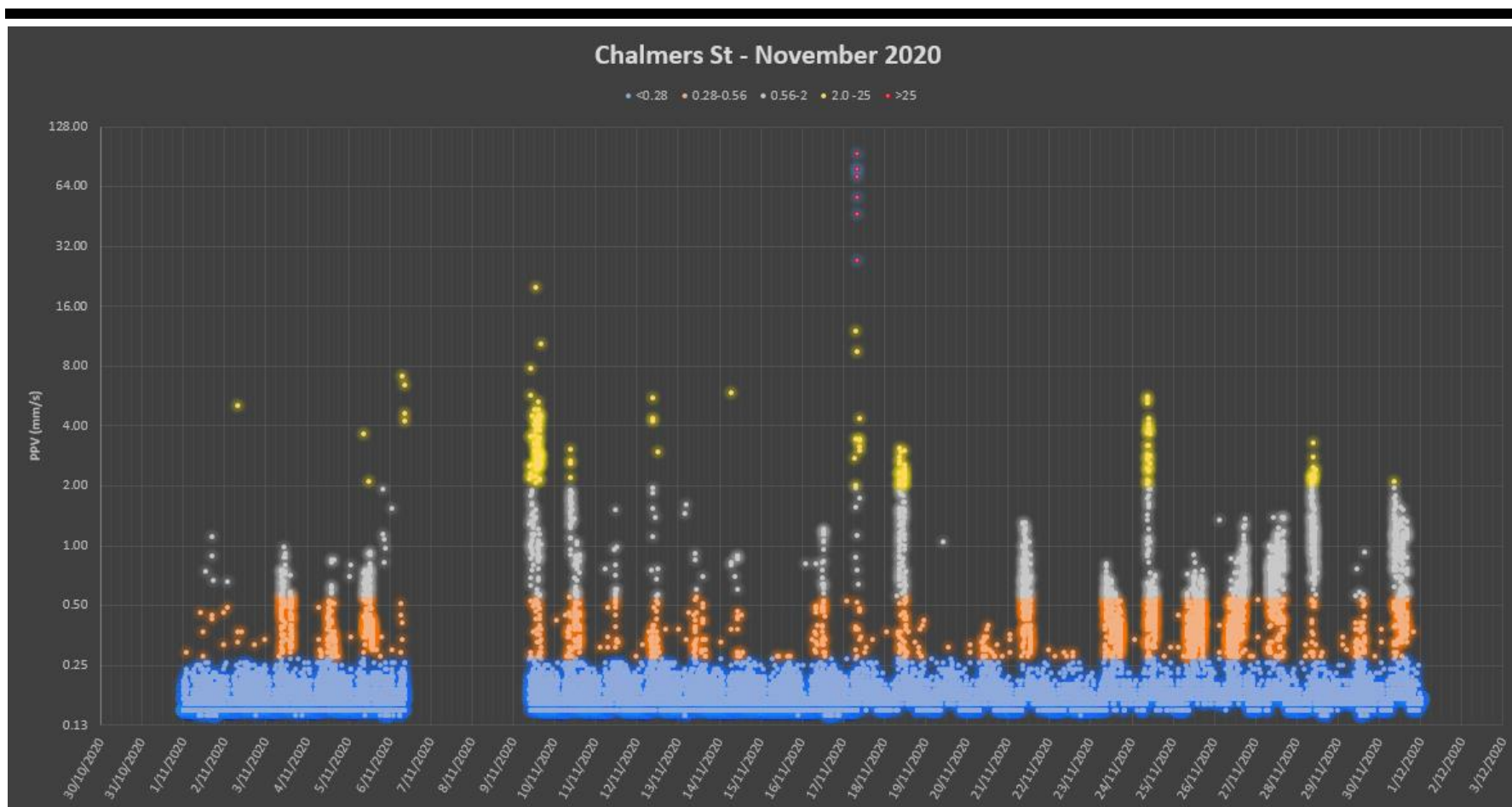


Figure B-8 Chalmers Street – November 2020

The works within the 20-28 Chalmers Street site throughout November 2020 consisted of excavation activities including, breaking shale and sandstone, the offloading of material into tipper trucks using a crane, and scabbling work. Data missing due to power issue between the 6th and 9th November 2020. There were a series of instance where vibration exceeded the structural damage trigger value of 25mm/s on the 17 November 2020. These have been identified as an extraneous vibration event occurring as a result of the logger being temporarily moved and replaced (while it continued logging) to facilitate works.

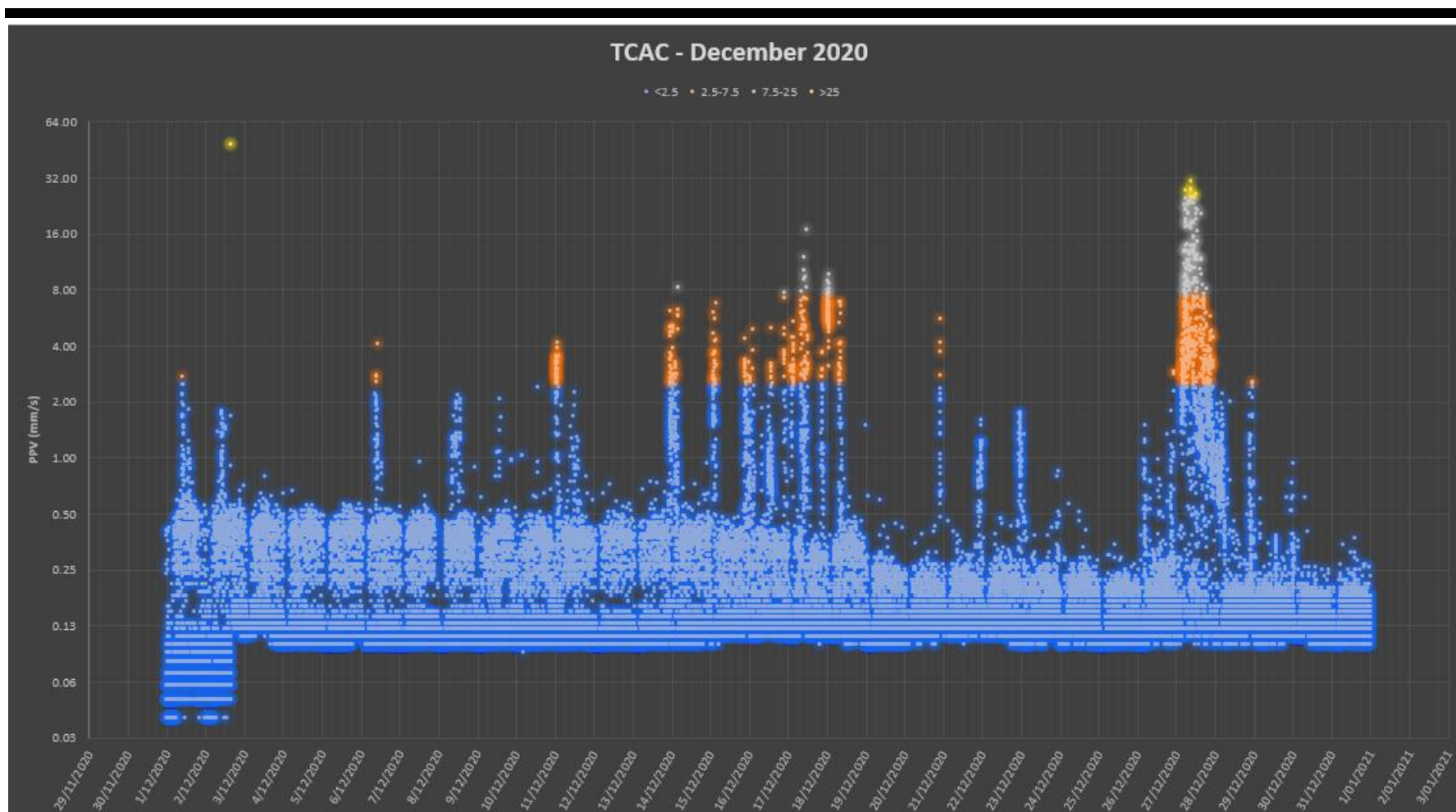


Figure B-9 TCAC - December 2020

The largest scope of vibration intensive activities commenced in the Northern Concourse in close proximity to the external façade of the Central Electric Building (CEB or TCAC). Elevated vibration levels were carefully monitored as large surface area breaking was occurring. Where possible, saw cutting occurred to reduce vibration traveling beyond localised area. The highest vibration intensive works occurred during OOH and possessions to reduce impact on commuters and Sydney Trains staff.

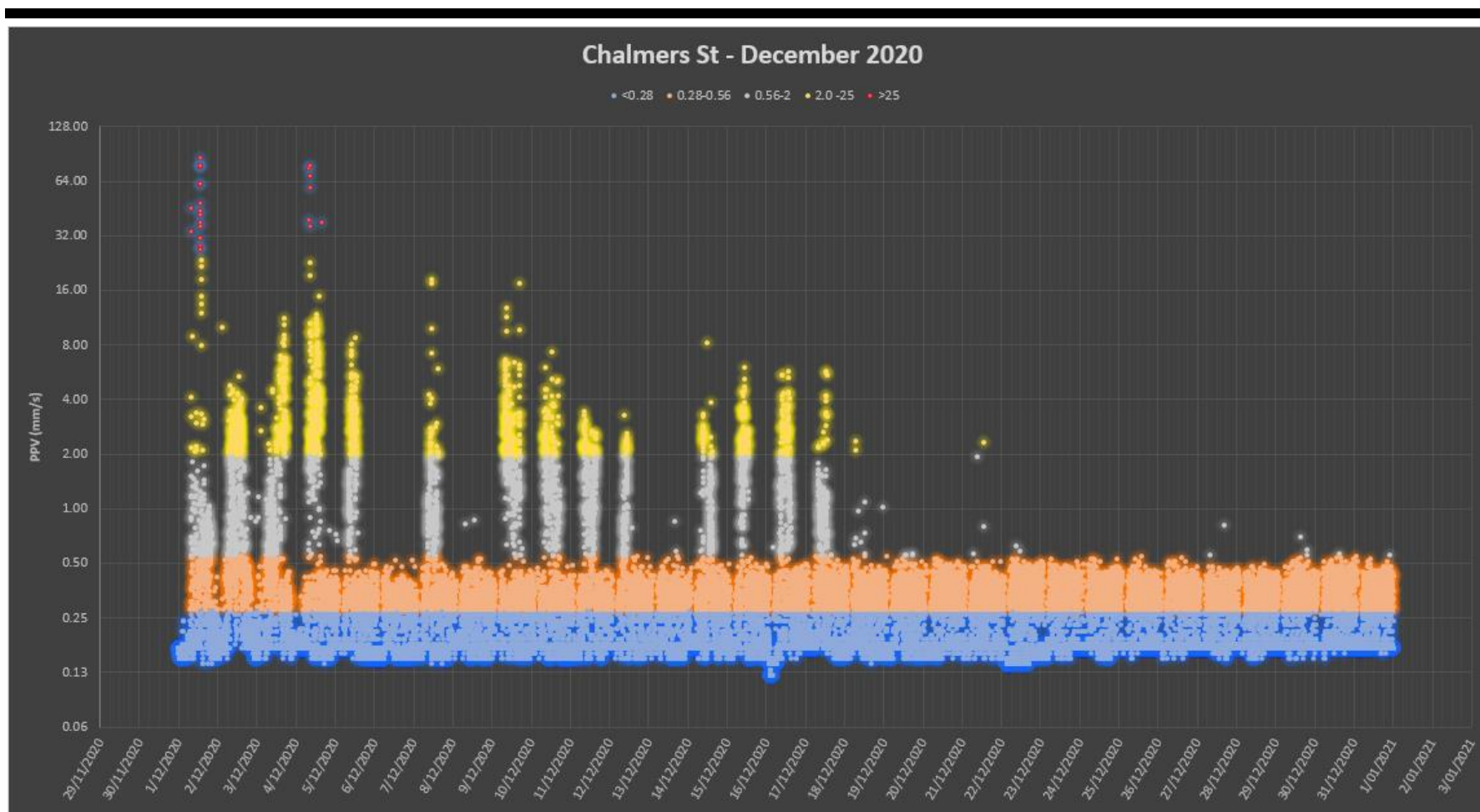


Figure B-10 Chalmers Street – December 2020

The works within the 20-28 Chalmers Street site throughout December 2020 consisted of excavation activities including, breaking shale and sandstone, and crane operations. Works at 20-28 Chalmers St finished on the 22nd of December. Typical vibration throughout the month was below 12.5 mm/s corresponding to a near-zero probability of damage. Several data points above 12.5mm/s were observed, the majority of which were determined to be associated with logger maintenance and relocation.

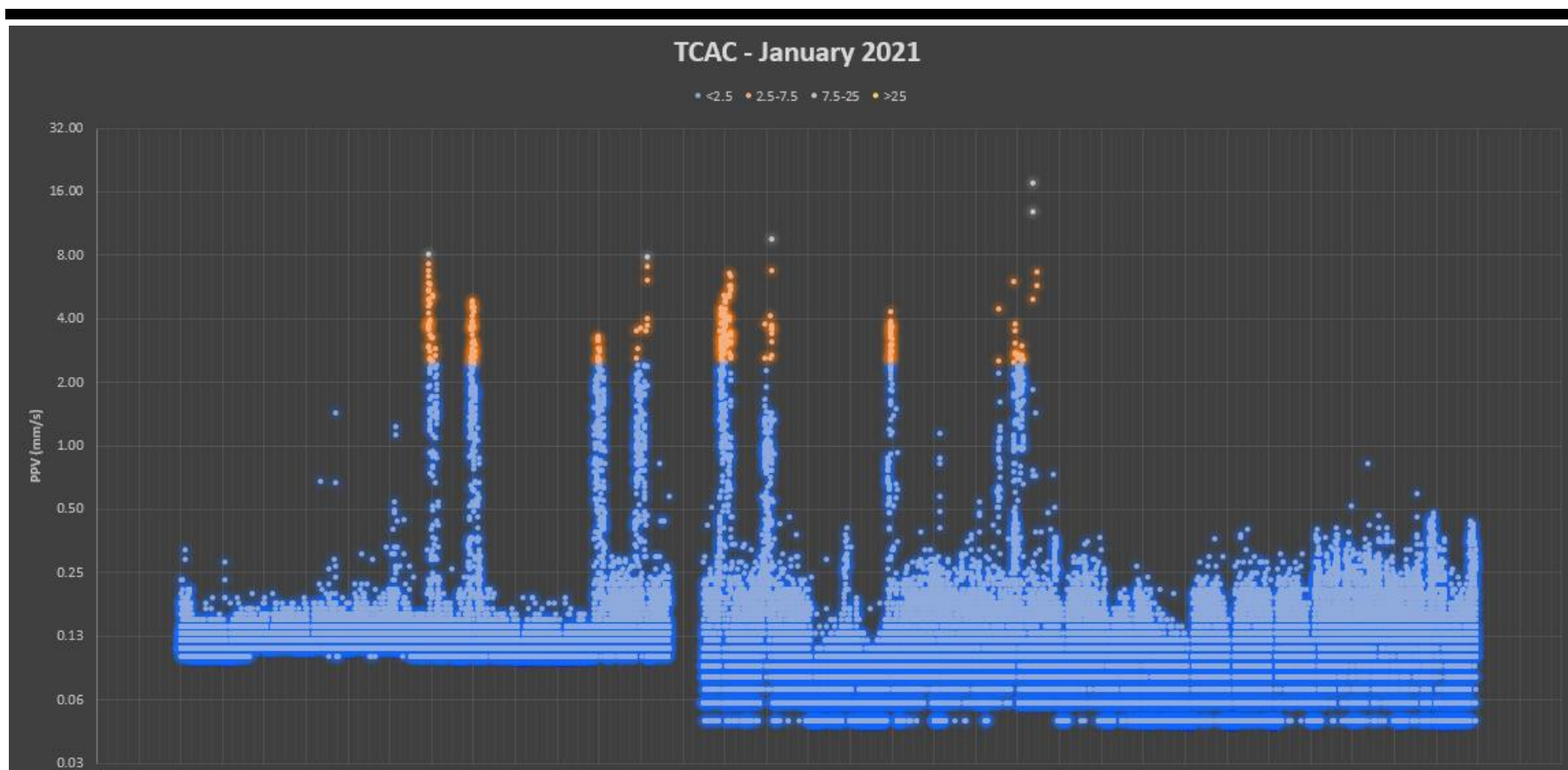


Figure B-2 TCAC – January 2021

The largest scope of vibration intensive activities continue in the Northern Concourse in close proximity to the external façade of the Central Electric Building (CEB or TCAC). Elevated vibration levels were carefully monitored as large surface area breaking was occurring. Where possible, saw cutting occurred to reduce vibration traveling beyond localised area. The highest vibration intensive works occurred during OOH and possessions to reduce impact on commuters and Sydney Trains staff.

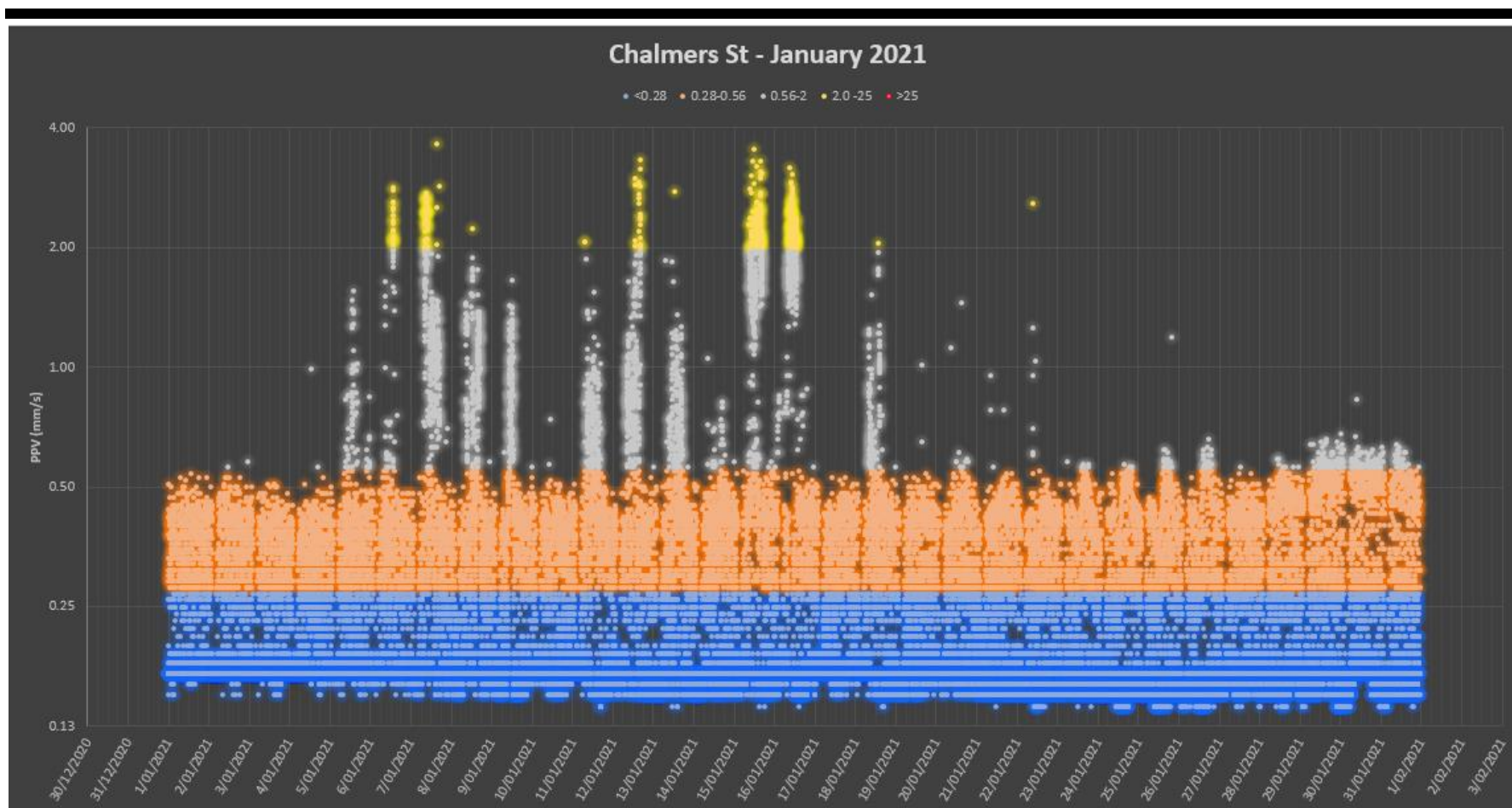


Figure B-3 Chalmers Street – January 2021

The works within the 20-28 Chalmers Street site throughout January 2021 consisted of excavation activities including breaking and excavating shale and sandstone, crane operations, and steel reo installation. Typical vibration throughout the month was well below the cited 12.5 mm/s level corresponding to a near-zero probability of damage.

Appendix C- CoA E37 / CoA E38 Monitoring Summary

The monthly data is reviewed and the days of highest vibration impact from each reporting month is selected to infer internal noise levels (shown below). The working day as defined by CoA E37 is graphed. This provides a greater resolution to be able to predict the potential for ground borne noise.

Conservatively assuming that vibration levels $>0.56\text{mm/s}$ (maximum level of the human comfort criteria-residences) at the façade of 30 Chalmers Street result in ground borne noise within Haven Specialty Coffee café (or Dental Hospital), resulting in a $L_{Aeq15min}$ greater than 60dB. CoA E37/38 require internal noise limits (associated with ground borne noise) to remain below 60dB for 6.5hrs. Therefore, compliance with CoA37/38 would be achieved if the PPV is less than 0.56mm/s for 6.5 hours.

Note: this is a conservative correlation that has been used. The PPV at the façade is likely to dissipate as it moves away from the noise source. As the internal noise limit is anticipated to be above 60dB from time to time as a result of the works at the Eastern Entrance, preferred respite in accordance with CoA E37 has been offered. The agreed respite time around 12:00 can typically be observed in each of the graphs during high impact activities, indicated by the reduction in white and yellow data points ($>0.28\text{mm/s}$) and an increase of blue data points ($<0.28\text{mm/s}$). Generally though, fewer high impact activities were required during this reporting period as works were generally low impact (i.e. material load out, excavation without hammering, canopy tube drilling and formwork).

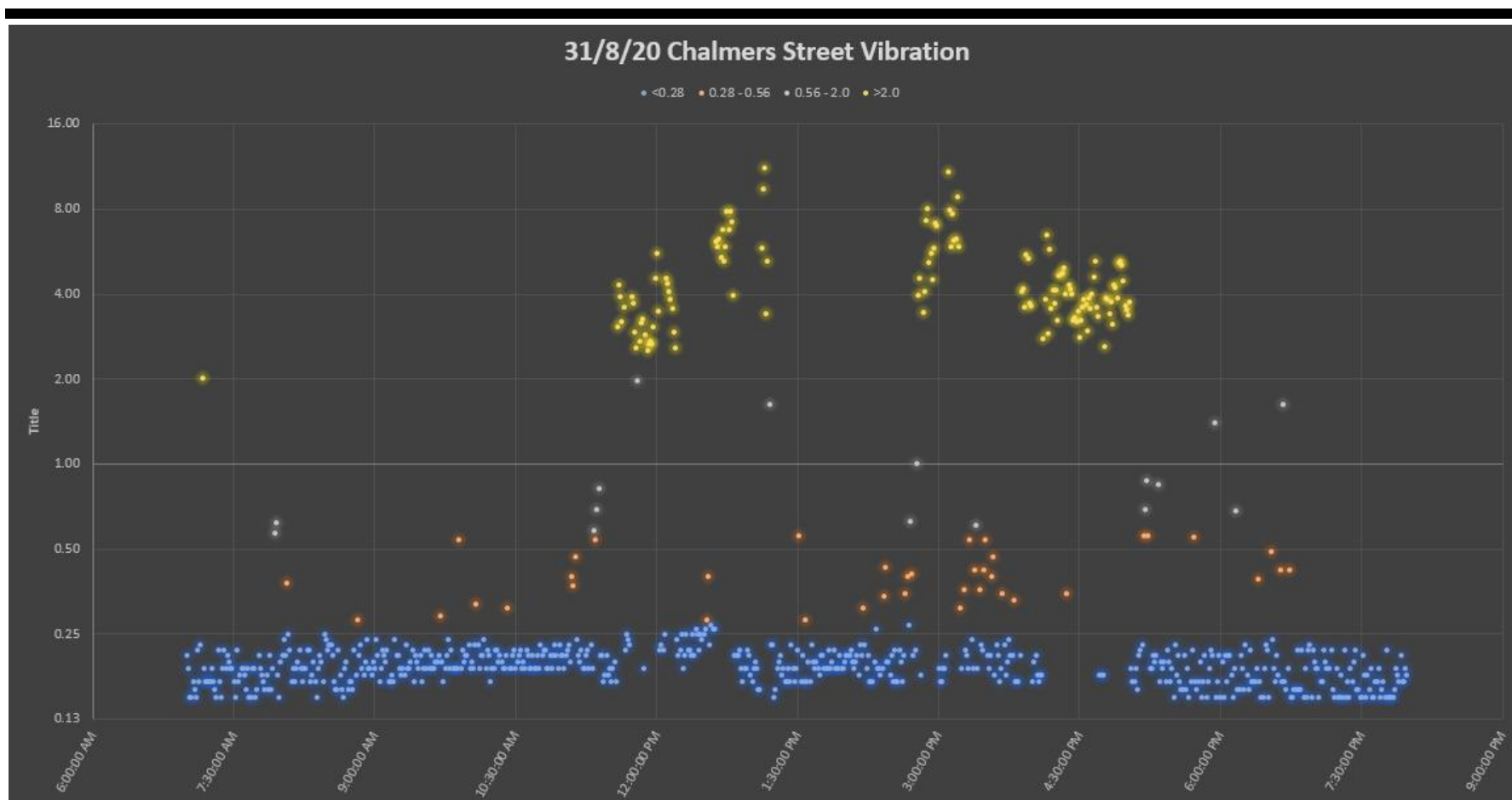


Figure C-1 31st August 2020

Typical activities that occurred on this day included canopy tube drilling and material load out using a crane, into a tipper truck parked in Randle Lane. These activities are not high vibration generating. The increase in vibration detected was attributed to renovation works occurring within Shop 1 on the ground floor of the 30-34 Chalmers St building.

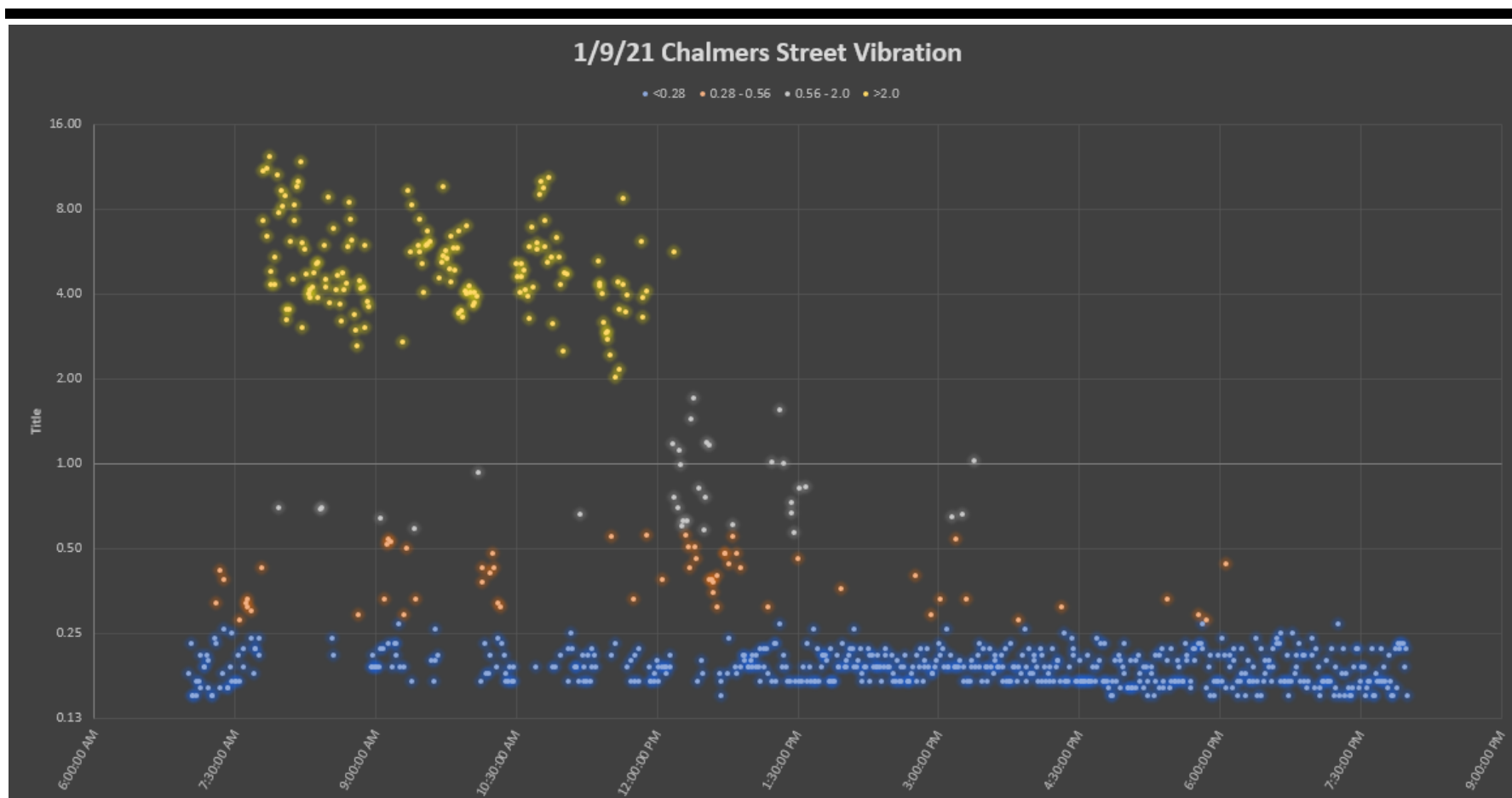


Figure C-2 1st September 2020

Typical activities on this day included cranafe of small material and supplies, as well as general site works (maintenance etc). The peak in vibration occurred between 07:50 and 11:50 and ranged from 0.17 and 12.27mm/s. Based on field notes, video surveillance and an understanding of other non-CSM construction works, the peaks in vibration were attributed to the renovation works within the former Haven Café (shop 01, Ground Floor, 30-34 Chalmers Street).

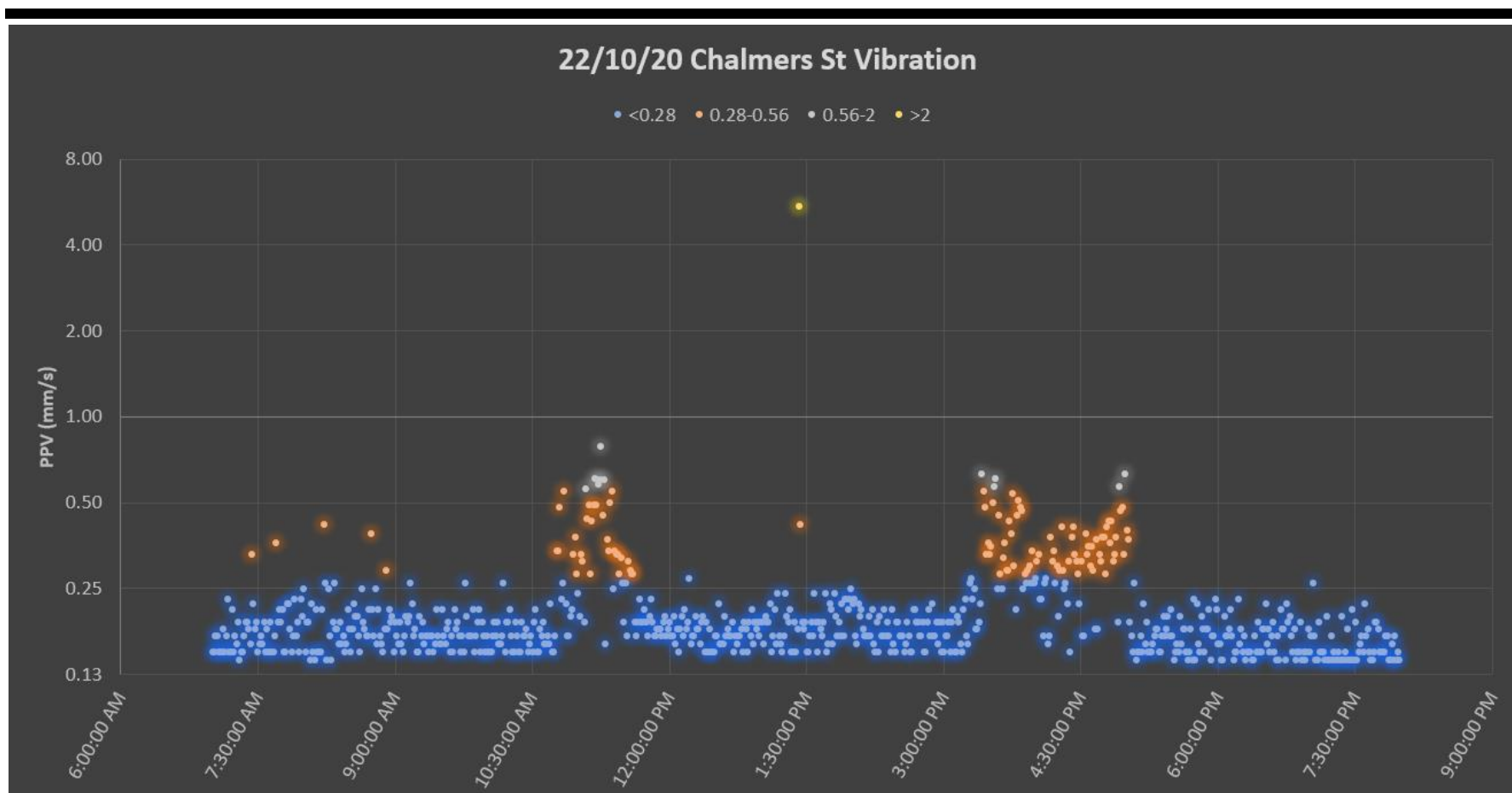


Figure C-3 22nd October 2020

Typical activities that occurred on this day included material delivery and unloading using a crane, as well as formwork and scaffold preparation. A single peak in vibration was observed. It was confirmed that the peaks in vibration occurred due to CSM construction personnel sitting and standing adjacent to the logger.

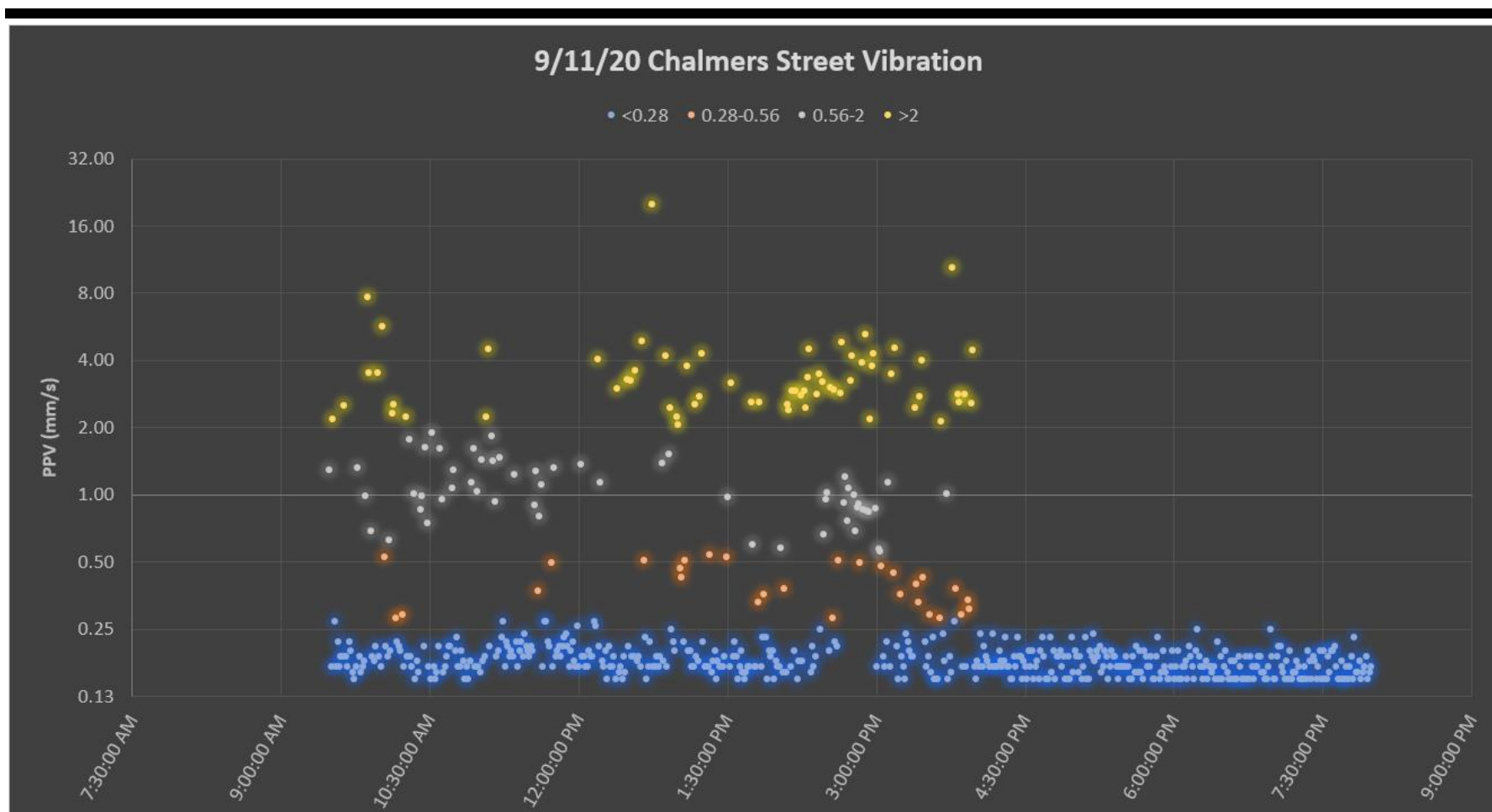


Figure C-4 9th November 2020

The main activity on site that resulted in elevated vibration levels was the localised scabbling work occurring in November 2020.

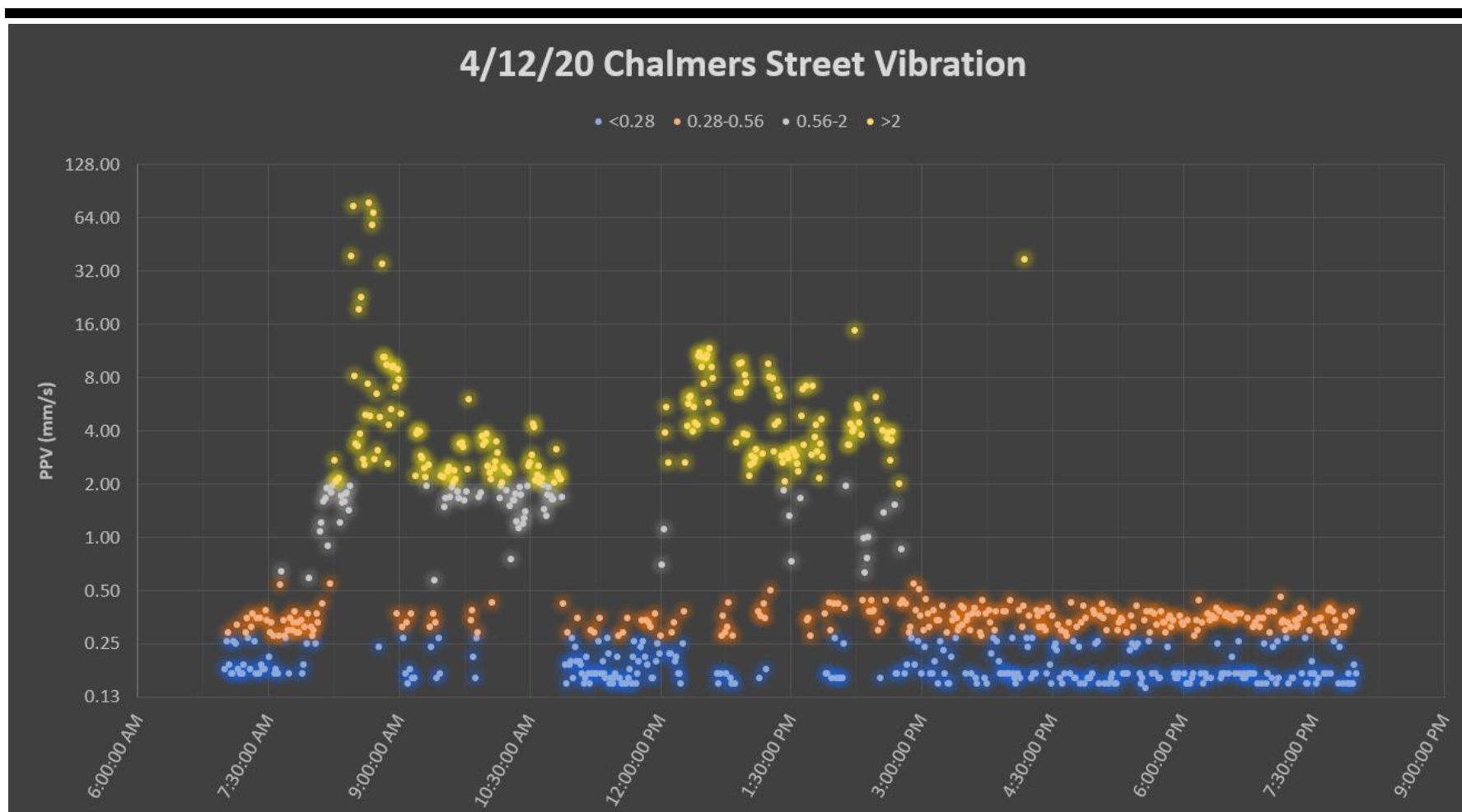


Figure C-5 4th December 2020

Main activity on site that resulted in elevated vibration levels was rock breaking and craneage into trucks occurring during December 2020.

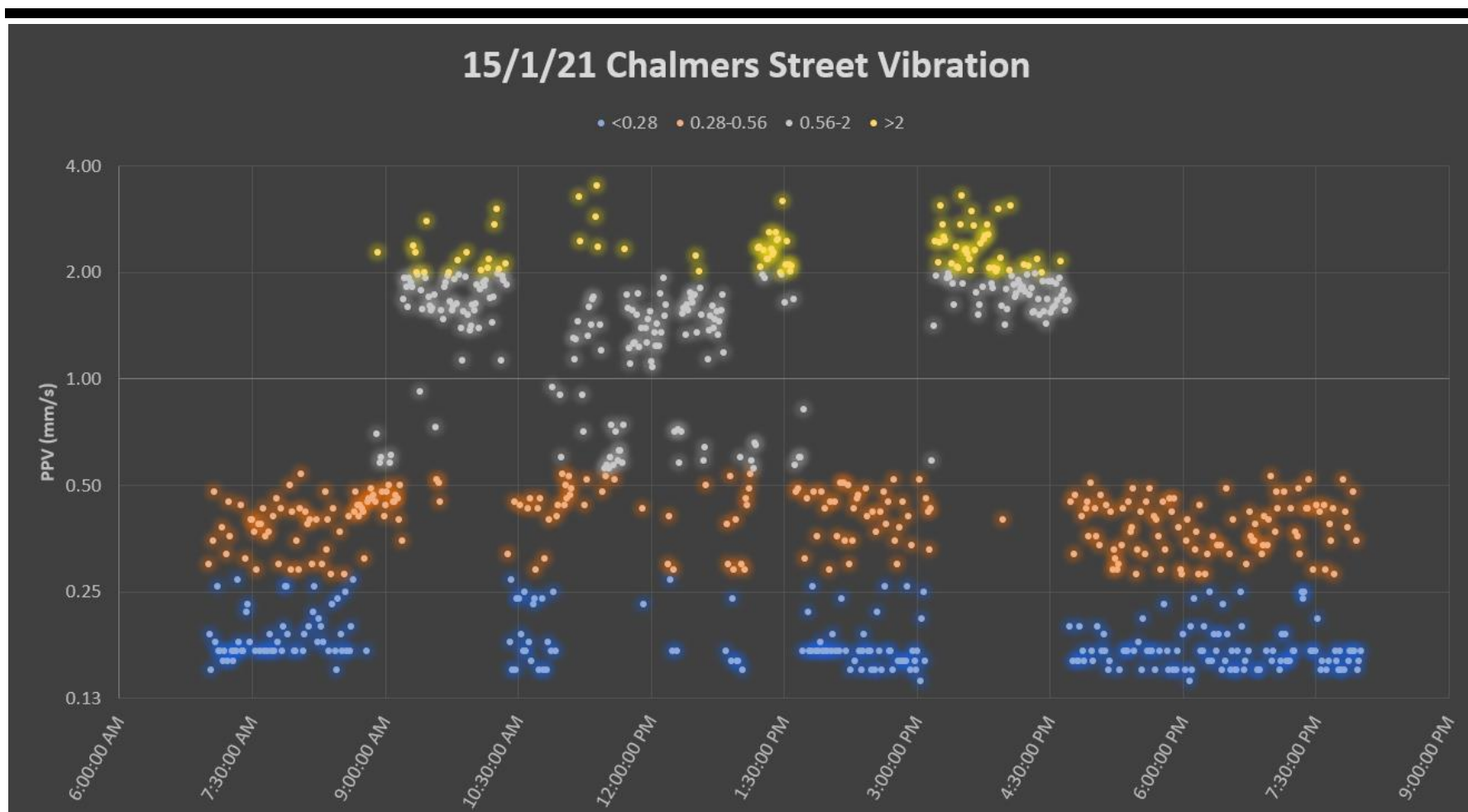


Figure C-6 15th January 2021

Main activity on site that resulted in elevated vibration levels was rock breaking and crange into materials occurring during January 2021.

Table C-1: Summary of duration of PPV distribution (all durations are h:mm)

Perceptible Vibration Criteria for Exposure to Continuous Vibration	PPV (mm/s) Distribution	Comment	Duration: 31 August 2020	Duration: 1 September 2020	Duration: 22 October 2020	Duration: 9 November 2020	Duration: 4 December 2020	Duration: 15 January 2021
Preferred human comfort level	<0.28mm/s	Typical vibration level in the absence of construction. Conservatively assuming that <0.28mm.	9:59	8:54	11:08	8:02	4:44	3:59
Maximum human comfort level	0.28- 0.56mm/s	Occasional transient events occur in this range in the absence of construction (assumed to be associated with Light rail and Central Station train operations). Some works may be perceivable within the café depending on frequency (Hz) of activity, location on site and substrate.	0:36	0:57	1:40	0:29	4:07	4:09
Above maximum human comfort level	0.56- 2mm/s	Transient and isolated events may occur in this range in the absence of construction, most likely with an impact in close proximity to the geophone (localised bump).	0:19	0:36	0:11	0:56	1:09	3:29
Above maximum human comfort level	>2mm/s	Typical vibration level associated with construction, subject to activity, frequency (Hz) location on site and substrate. Larger values are checked to determine whether the event is associated with construction or as a result of a transient event.	2:05	2:32	0:01	1:04	3:00	1:23

Perceptible Vibration Criteria for Exposure to Continuous Vibration	PPV (mm/s) Distribution	Comment	Duration: 31 August 2020	Duration: 1 September 2020	Duration: 22 October 2020	Duration: 9 November 2020	Duration: 4 December 2020	Duration: 15 January 2021
Total above maximum human comfort level	>0.56mm/s (assuming this level results in ground borne noise)	Complies with CoA E37/38; <6.5hrs of potential ground borne noise.	2:24	3:08	0:12	2:00	4:09	4:52

Table C-2: Internal Noise measures

Date	Time	Location	LAeq	Comments
7/8/20	13:47	Southern Concourse, base of entrance stairs, adjacent to subway snacks	79.7	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. No ground borne vibration felt. Most significant contributor to noise was perceived to be the chain rattling.
7/8/20	14:02	Southern Concourse, base of entrance stairs, adjacent to subway snacks	79.3	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. No ground borne vibration felt. Most significant contributor to noise was perceived to be the chain rattling.
13/8/20	10:18	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	72.1	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. About 10m away from works, equidistant with the coffee cart. Less than 1 minute of the driving works in the period.
13/8/20	12:50	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	69.9	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Only welding and sporadic hammering, no driving work.
13/8/20	13:05	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	74.6	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Only welding and sporadic hammering, no driving work. Only welding and sporadic hammering, no driving work.
13/8/20	15:16	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	76.8	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about 1 minute.
13/8/20	15:31	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	83	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about 3.5 minutes.
14/8/20	8:20	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	80.9	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about 2.5 mins.
14/8/20	8:38	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	72.2	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about less than a minute.
14/8/20	8:54	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	80.4	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about 3 mins.

14/8/20	9:09	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	75.5	LOR works: sheet piling at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Driving works active for about 4 mins, although mostly more muffled due to being deeper.
26/8/20	9:46	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	77.5	LOR works: concrete breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works. Muffled saw cutting, metal clanking and faint rattling heard sporadically. Peak noise in period is the street sweeper passing nearby.
26/8/20	10:01	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	69.6	LOR works: concrete breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works.
27/8/20	10:08	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	78.5	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk. Background level was captured during first 11 minutes of recording as 69dB and then went up to 69.6dB due to plant movement in final 4 minutes
27/8/20	10:23	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	75.7	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk.
27/8/20	12:38	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	74.8	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk. Only 3 minutes of breaking captured because the Brokk broke down.
28/8/20	10:38	Top of Railway Institute Drive, adjacent to the entrance of Southern Concourse. About 10m away from works, equidistant with the coffee cart	78.8	LOR works: Brokk breaking at Railway Institute Drive. Noise mitigation measures include fencing with noise blankets attached all around the perimeter of works, noise blanket over Brokk. Engine noise heard very close by, inferred to not be LOR works due to proximity. Light rail wheel squeak also a significant contributor to noise.
4/9/20	14:17	Eastern Entrance, right next to concrete pump truck and agitator trucks	86.4	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present. Representative of concrete pouring works at source of noise. Main contributor of noise was the continuous hum of the pump truck, which remained fairly consistent.
4/9/20	14:34	Randle Lane, outside the closest apartment block northwards, approximately 20m from works	74.4	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present. Works were barely audible at the distance; air conditioner hum from adjacent Dental Hospital was the most significant contributor to noise.
4/9/20	14:50	Randle Lane, outside the closest apartment block southwards, approximately 7m from works	73	LOR works: Concrete pouring at Eastern Entrance. Concrete pump truck and agitator truck present. Noise of works dissipated substantially even at the short distance.
12/9/20	1:20	Chalmers St Light Rail	69	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.

12/9/20	1:35	Chalmers St Light Rail	61	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/9/20	1:50	Chalmers St Light Rail	61	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/9/20	2:10	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. CSM HN works commence @ 02:12. Road saw behind hoarding.
12/9/20	2:25	Chalmers St Light Rail	70	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/9/20	2:40	Chalmers St Light Rail	70	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible. Road saw on and off throughout the monitoring period.
12/9/20	3:30	Chalmers St Light Rail	68	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Only minor CSM works, occasional mallet. Extraneous noise ST high pressure stair cleaner and generator at DST Stairs. Activity occurred all night. Light rail movements also audible.
12/9/20	3:45	Chalmers St Light Rail	70	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. CSM road saw on and off, wall saws on P22 commence @ 03:53 and only audible when road saw stops.
12/9/20	4:00	Chalmers St Light Rail	63	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Works audible on occasion, no high noise impact.
12/9/20	4:15	Chalmers St Light Rail	62	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Works audible on occasion, no high noise impact.
12/9/20	4:30	Chalmers St Light Rail	70	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. High noise impact audible.
12/9/20	4:45	Chalmers St Light Rail	63	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Works audible on occasion, no high noise impact.
12/9/20	5:00	Chalmers St Light Rail	68	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Works audible on occasion, no high noise impact.
12/9/20	5:15	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Light rail starts up again. At 05:17.
12/9/20	5:30	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. CSM wall saw commences on P23. only audible when road saw stops.
12/9/20	5:45	Chalmers St Light Rail	69	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Hammer breaking starts at 05:55.
12/9/20	6:00	Chalmers St Light Rail	72	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. No works audible.
12/9/20	6:15	Chalmers St Light Rail	65	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. No works audible.
12/9/20	6:30	Chalmers St Light Rail	68	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. No works audible.

12/9/20	6:45	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Hammering at 0645, 0658 road saw starts again.
12/9/20	7:00	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Road saw audible.
12/9/20	7:15	Chalmers St Light Rail	68	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Grinding activity on Chalmers St footpath- SLR constructing bike racks.
12/9/20	7:30	Chalmers St Light Rail	72	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Grinding activity on Chalmers St footpath- SLR constructing bike racks dominant noise source.
12/9/20	7:45	Chalmers St Light Rail	71	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. 07:50 CSM works cease, to be resumed @08:00.
12/9/20	8:00	Chalmers St Light Rail	75	WE11 Possession: P22/23 platform releveling work. Equipment used included, road saw, 2 x wall saws and breaker. Cumulative impact, CSM works and SLR.
10/10/20	3:00	Chalmers St	69.8	WE15 Possession: P20/21 platform releveling works included saw cutting using road saw, hand saw and wall saws, and breakers. Data reviewed. Works below prediction. Rail operations audible.
10/10/20	4:00	Chalmers St	67.1	WE15 Possession: P20/21 platform releveling works included saw cutting using road saw, hand saw and wall saws, and breakers. A review of the real time noise logger data validated predictions. Additionally, the construction team were able to delay some high impact noise activities until 8am to further mitigate noise level for nearby residents. While this was possible over this weekend with no impact to the possession and handback to Sydney Trains, this may not always be possible on future rail possession weekends for the platform releveling works.
10/10/20	7:00	Chalmers St	72.3	WE15 Possession: P20/21 platform releveling works included saw cutting using road saw, hand saw and wall saws, and breakers. A review of the real time noise logger data validated predictions. Additionally, the construction team were able to delay some high impact noise activities until 8am to further mitigate noise level for nearby residents. While this was possible over this weekend with no impact to the possession and handback to Sydney Trains, this may not always be possible on future rail possession weekends for the platform releveling works.
21/11/20	03:15 - 08:00	Chalmers St	70	WE21: 22/23 releveling works Central Walk. Tile removal to the whole platform, drainage works, deep pit installation, services work. ESR Road 23 concrete pad construction for future installation. 4.5hrs of attended monitoring resulted in: Instantaneous Max = 79dB Max LAeq15mins = 70dB (associated with saw cutting @05:30) Median LAeq15mins = 65dB Mean LAeq15mins = 66dB Mode LAeq15mins = 62dB
23/11/20	13:50	Chalmers St in line of site of real-time noise logger, in close proximity to works	89.5	Eastern Entrance excavation work including excavator hammering. Noise mitigation measures include sheath on excavator's hammer. Noise level was consistent throughout duration of breaking. (noise level representative of at source, not of impact on sensitive receiver).
23/11/20	14:13	Chalmers St in line of site of real-time noise logger, in close proximity to works	87.3	Eastern Entrance excavation work including excavator hammering. Noise mitigation sheath on hammer removed for comparison. Noise level for the 5 minute period in which breaking was occurring was 90.5dB, in which the noise level was consistent (noise level representative of at source, not of impact on sensitive receiver).
24/11/20	11:57	Sydney Dental Hospital	62.5	LOR works: Eastern Entrance excavation work including excavator hammering. Ground borne vibration felt inside SDH (level 1 conference room B). Furniture and walls making slight noise.

26/11/20	8:29	Chalmers St, adjacent to the real-time noise logger, in the line of sight of works	93.5	Eastern Entrance excavation work including excavator hammering. Only 5 minutes of noise monitoring conducted to ascertain the noise level for 2 hammers breaking concurrently for comparison (not a 15-minute period). Noise level was consistent throughout duration of breaking. Instantaneous level with just one hammer breaking was 91.5dB (noise level representative of at source, not of impact on sensitive receiver).
26/11/20	8:38	In front of the façade of 38 Chalmers St	66.7	Eastern Entrance excavation work including excavator hammering. Noise contribution of works not prominent, blended into the background, subjectively at ~10% contribution. Light rail passing by and non-LOR street maintenance works (roughly equidistant with LOR works in opposite direction) were significant contributors to noise.
27/11/20	12:27	Sydney Dental Hospital	51.1	LOR works: Eastern Entrance excavation work including excavator hammering. Ground borne vibration felt, however noise contribution low: subjectively at ~20% contribution and very muffled. In comparison the noise level sounded at ~90% contribution when inside the adjacent stairwell.
14/12/20	9:40	Front of the façade of 34 Chalmers street café	66.6	Eastern Entrance: breaking with 2 hammers. Ground borne vibration felt. Non-LOR noise on Chalmers street including light rail passing was a significant contributor to noise.
16/12/20	10:22	Front of the façade of 34 Chalmers street café	66	Eastern Entrance: breaking with 2 hammers. Non-LOR noise on Chalmers street including light rail passing was a significant contributor to noise, therefore internal noise level <60dB.
7/1/21	12:32	Sydney Dental Hospital	68.1	LOR works: Eastern entrance breaking with two hammers and one brokk. Breaking audible with sporadic pauses. Click in front of logger at 1:30 mark to make sure it is measuring properly (as last session logger stopped working). Background noise in SDH audible.
11/1/21	11:38	Sydney Dental Hospital	47.1	LOR works include breaking in Eastern Entrance. 2 hammers, 1x14t and 1x5t. Construction work audible from within SDH with intermittent pauses.
13/1/21	14:54	Chalmers St	51.3	Breaking and excavating in Eastern Entrance near northern wall. Construction work audible - extraction fan running. Train/light rail in background also - significantly audibly louder than construction noise.

ENDORSEMENT
CITY & SOUTHWEST ACOUSTICS ADVISOR

Review of	Central Station Main Works Construction Noise and Vibration Monitoring Program Report August 2020 - January 2021	Document reference:	Central Station Main Works Construction Noise and Vibration Monitoring Program Report August 2020 – January 2021
Prepared by:	Larry Clark, Alternate Acoustics Advisor		V2_CSM_Construction Monitoring Report_Aug20_Jan21.pdf
Date of issue:	9 June 2021		Revision 0, received 8 June 2021.

As approved Alternate Acoustics Advisor for the Sydney Metro City & Southwest project, I have reviewed and provided comment on the Construction Noise and Vibration Monitoring Program Report August 2020 – January 2021 for the Central Station Main Works, as required under A27 (d) of the project approval conditions.

The CSM Noise and Vibration Monitoring Report is to be submitted to the Department of Planning and Environment in accordance with Condition of Approval C16 and the CSM Construction Noise and Vibration Monitoring Program.

I have reviewed the monitoring report and am satisfied that it meets the requirements for construction noise and vibration monitoring for CSM, as outlined in the CSM CNVMP and CNVIS. I endorse the report.



Larry Clark, City & Southwest Alternate Acoustics Advisor