

Central Station Main Works

Construction Noise and Vibration Monitoring Program Report

February 2020 - July 2020

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		

Controlled: NO Copy no.: Uncontrolled: YES

Table of Contents

- 1. Introduction3**
- Background3
- Planning Requirements.....3
- Submission Requirements.....5
- 2. Methodology6**
- 2.1 Sensitive Receivers6
- 2.2 Key Noise Monitoring Locations.....7
- 2.3 Monitoring7
- 2.4 Noise Monitoring Frequency 13
- 2.5 Out of Hours Works Summary 15
- 3. Monitoring Results..... 30**
- 3.1 Noise 30
- 3.2 Vibration 41
- 4. Complaints..... 42**
- 5. Conclusion..... 44**
- Appendix A – Noise Monitoring Summary 45**
- Appendix B – Vibration Monitoring Summary 47**
- Appendix C- CoA E37 / CoA E38 Monitoring Summary..... 60**

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.

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.

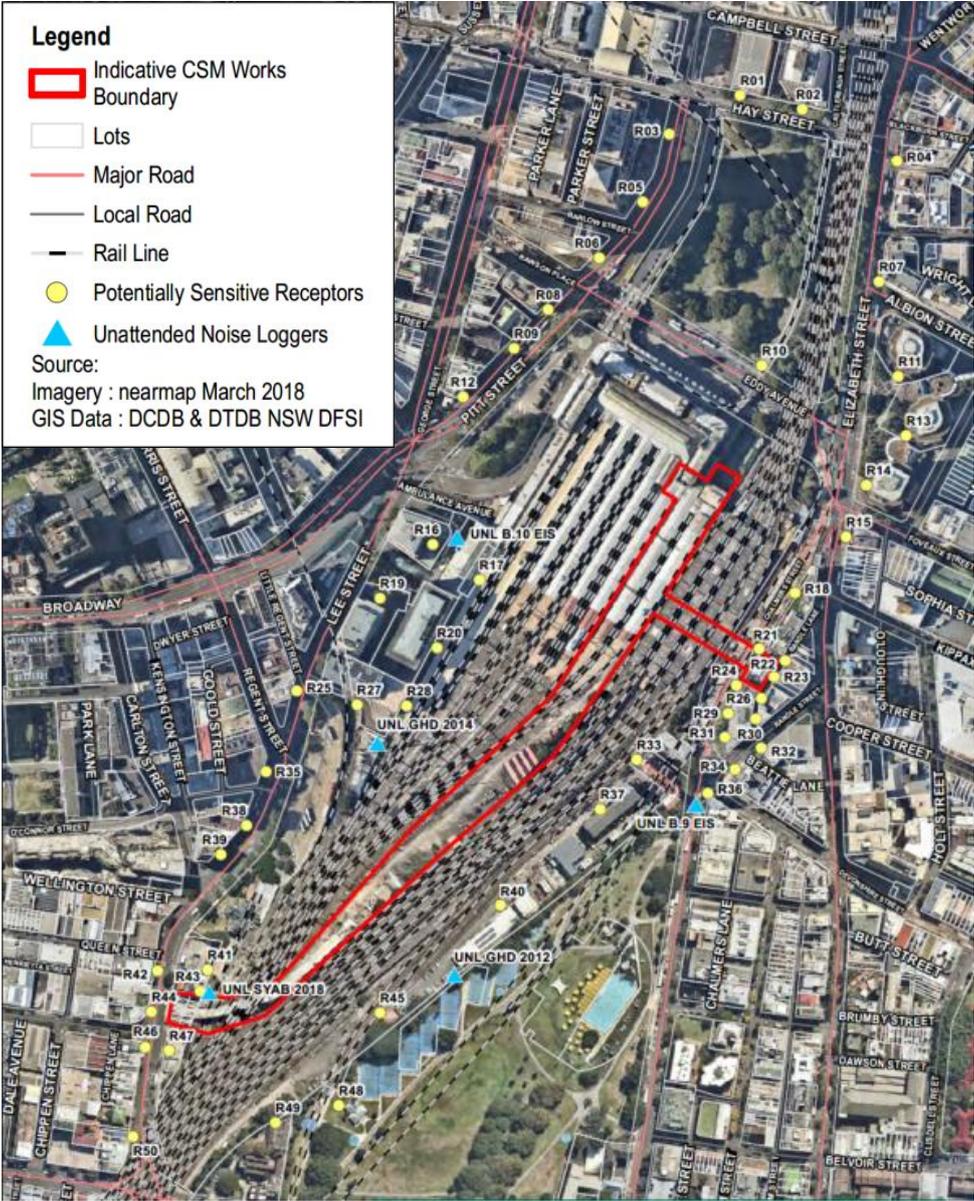


Figure 2-1: Location of Sensitive Receivers

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			
38 Chalmers St (R29)	56	53	45
YHA (R17)	54	52	49
54 Regent St (R43)	50	50	44
30 Chalmers St (R24)	56	53	45
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).

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 OOHW 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	27/06/19
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	29/11/18
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 2-5: Real time vibration logger setup on the wall of 30 Chalmers St (installed 14 October 2019)



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

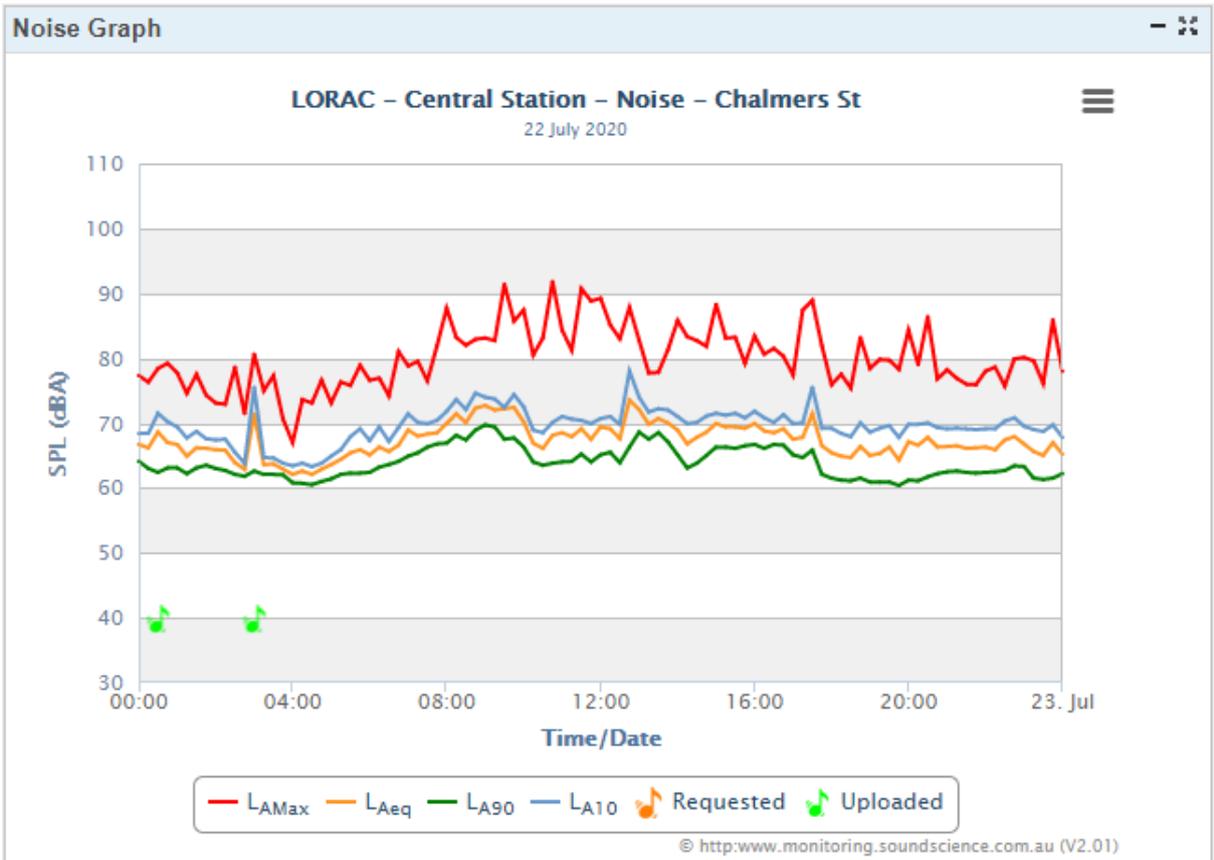


Figure 2-9: Example of real time noise monitoring data

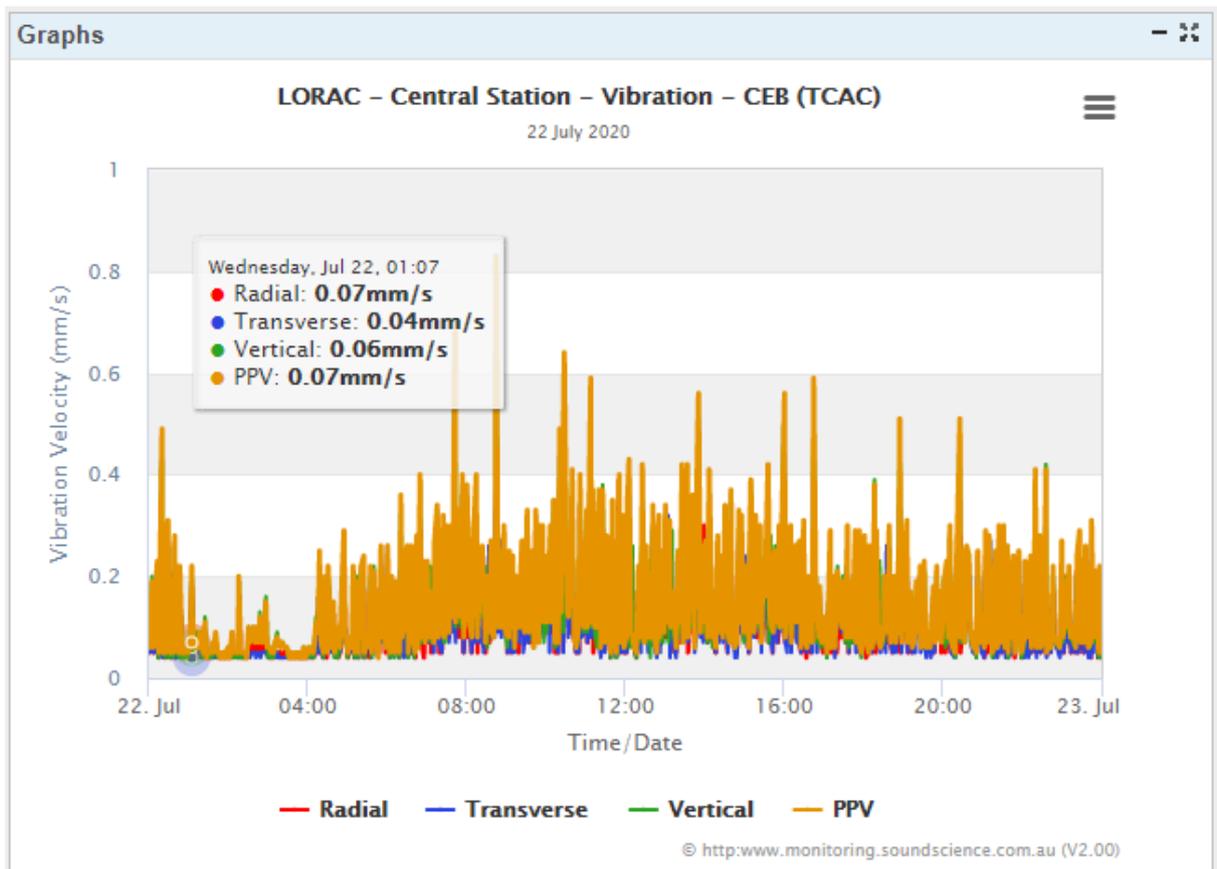


Figure 2-10: Example of real time vibration data. Graph showing general background vibration levels.

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.

ID	Description	Frequency (as per AMMM)
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	Central Walk: Construction of the new Standby Guards Rooms / demolition of existing standby guards rooms	Daytime standard construction hours.
		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.

ID	Description	Frequency (as per AMMM)
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)
19	February 2020 Weekend 31 – Weekend 35 – 01/02/20 to 28/02/20 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)		

<p>Eastern Entrance</p> <ul style="list-style-type: none"> • Delivery and removal of excavators, piling equipment and cranes for Eastern Entrance works from Randle Lane during night shift in accordance with traffic approval. <i>Specific notification will be issued in the appropriate time frame.</i> <p>Saturday Day OOH: February 1st, 8th, 15th, 22nd, 29th between 1pm and 5pm.</p> <ul style="list-style-type: none"> • Installation of plunge column steel and concrete pour • Form, reo, pour works – <p>NB: Steel rods will be cut to correct length before 1pm so that manual hand tools are only used between 1pm and 5pm.</p>	<p>Real time monitoring</p> <p>Attended Monitoring at commercial businesses</p>	<p>SCN25: 83 Pred: 70 (CH)</p>
<p>ESR Concourse, back of house and tunnels <i>(Station fit out, largely inaudible).</i> <i>24hr works throughout February 2020.</i></p> <ul style="list-style-type: none"> • Hazmat removal in concourse areas • Material and waste removal via Pitt Street • On-going construction of new back of house (BOH) rooms adjacent to the ESR Concourse. Pedestrian Tunnels are used to transport material at night-time to and from Pitt Street. Ongoing service installation and commissioning for the Ghost platforms • Service investigations and diversions and removal at ESR Concourse & back of house • Commencement of installation of new services at ESR Concourse & back of house • Platform strengthening in ESR Ghost platform (Access via Olympic Tunnel for deliveries) <p>Hoarding/hoist and steelwork installation BOH</p>	<p>Noise impact determined to be inaudible at sensitive receivers.</p>	
<p>Platform 16/17</p> <ul style="list-style-type: none"> • Excavation within hoarding (saw cutting and breaking) • Form, reo pour • GRP Plates maintenance works 	<p>Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>Platform 18/19</p> <ul style="list-style-type: none"> • Drop shaft installation (from Adit up to the platforms) • Excavation (saw cutting and breaking) • Form, reo pour • GRP Plates maintenance works 	<p>Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>Platform 20/21</p> <ul style="list-style-type: none"> • Hoarding installation • Furniture relocation • Drop shaft installation (from Adit up to the platforms) • Formwork, reo pour • GRP Plates maintenance works 	<p>Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>Platform 22/23</p> <ul style="list-style-type: none"> • Hoarding installation • Excavation (saw cutting and breaking) • GRP plates maintenance work <p>Drop shaft installation (from adit up to platforms)</p>	<p>Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>WE 31 Possession <i>(Start at SAT 01/02/20 00:00, end at MON 03/02/20, 00:00)</i> <u>B2/B3 Beams: Inside hoarding on Platform 16/17 and 18/19</u></p> <ul style="list-style-type: none"> • Slab removal • Excavation including saw cutting and breaking 	<p>Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>

<p>WE 34 Possession (Start at SAT 22/02/20 00:00, end at Mon 24/02/20 00:00) <u>Platform 22/23 Edge beam construction</u></p> <ul style="list-style-type: none"> Excavation including saw cutting and breaking Form, reo, pour. Installation GRP Plates Erection of hoarding 	<p>Real time monitoring Attended Monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>Advanced adit (from Metro box towards ESR)</p> <ul style="list-style-type: none"> Excavation using road header/excavator with breaker Shotcrete installation Rock bolt installation Lattice girder installation Breakthrough to ESR Vertical reaming <p>Note: Advanced adit is being constructed from inside the Metro Box, beneath the trackslab. Only 2x 40 cube scrubbers will be above, and behind noise attenuating hoarding on P12 and P16.</p>	<p>Real time monitoring</p>	
Grand Concourse and Northern Concourse		
<p><i>OOH throughout February 2020</i></p> <ul style="list-style-type: none"> Construction of northern concourse ground slabs and walls Installation of columns and structures FRP works to Northern Concourse service trench Completion of FRP works to lower escalator pit & FT8 FRP works to FT14 Install false work deck for intercity Slab Construction of CENA140 room (Lower Northern Concourse) HAZMAT removal to lower northern concourse Service investigations in lower northern concourse Decommission and disconnect all cameras and speaker, lighting and power within demo zone Demolition of Olympic tunnel stairs Installation of Hoist within Olympic tunnel stairs Demolition of existing platform structures Removal of existing canopy Scaffold erection 	<p>Real time monitoring</p>	<p>SCN31: 74 Pred: 55 (CH) and SCN32: 74 Pred: 55 (CH)</p>
Metro Box and Sydney Yard		
<p><i>OOH throughout February 2020</i></p> <ul style="list-style-type: none"> Archaeological Investigation HV Cutover works south of metro box Excavation of gasworks area within metro box Operation of the permanent Water Treatment Plant Excavation (including rock breaking), shotcrete and installation of ground support and waler beam then waterproofing behind waler beam at North South concourse level and below Installation of FRP within new stations basement box Temp traffic 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 Southern baggage tunnel maintenance works as required. Olympic Tunnel maintenance works as required. 	<p>Works occurring below ground and are inaudible.</p> <p>Only air extraction units located behind noise attenuating hoarding on P12 and 16 will be used an in sight.</p>	<p>SCN14: 71 Pred: 60 (CH & YHA)</p>
<p>20 March 2020 Weekend 35 – Weekday 40 – 28/02/20 to 31/03/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C</p>		
Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)		

<p>Eastern Entrance Delivery and removal of excavators for Eastern Entrance works from Randle Lane during night shift in accordance with traffic approval. <i>Specific notification will be issued in the appropriate time frame.</i></p> <p>March between 1pm and 5pm.</p> <ul style="list-style-type: none"> • Form, reo, pour works – 7th, 14th, 21st, 28th March <ul style="list-style-type: none"> ○ NB: Steel rods will be cut to correct length before 1pm so that manual hand tools are only used between 1pm and 5pm. 	Real time monitoring	SCN 25: 83 Pred: 70 (CH)
<p>ESR Concourse, back of house and tunnels <i>(Station fit out, largely inaudible)</i> 24hr works throughout March 2020</p> <ul style="list-style-type: none"> • Hazmat removal in concourse areas • Material and waste removal via Pitt Street • On-going construction of new back of house (BOH) rooms adjacent to the ESR Concourse. Pedestrian Tunnels are used to transport material at night-time to and from Pitt Street. Ongoing service installation and commissioning for the Ghost platforms • Service investigations and diversions and removal at ESR Concourse & back of house • Commencement of installation of new services at ESR Concourse & back of house • Platform strengthening in ESR Ghost platform (Access via Olympic Tunnel for deliveries) <p>Hoarding/hoist and steelwork installation BOH Canopy load transfers will occur during mid-week possessions between the last and first trains.</p>	Noise impact not assessed as works are inaudible at sensitive receivers	
<p>Advanced adit (From Metro box towards ESR)</p> <ul style="list-style-type: none"> • Excavation using road header/excavator with breaker • Shotcrete installation • Rock bolt installation • Lattice girder installation • Breakthrough to ESR • Vertical reaming 	Works are belowground and therefore inaudible at the sensitive receiver.	
<p>Platform 16/17</p> <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails • Form, reo pour <p>Hoarding and GRP Plates maintenance work Canopy Load Transfer</p>	Real time monitoring	SCN18: 73 Pred: 70 (CH)
<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 <p>Canopy Load Transfer</p>	Real time monitoring	SCN18: 73 Pred: 70 (CH)
<p>Platform 22/23</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 <p>Canopy Load Transfer</p>	Real time monitoring	SCN18: 73 Pred: 70 (CH)

<p>WE 36 Possession (Start at FRI 06/03/20: 18:00, end at MON 09/03/20: 0000) <u>Track 16, 17/18 Track Slab construction:</u></p> <ul style="list-style-type: none"> Track removal Excavation including saw cutting and breaking Track slab construction Installation of pre-cast sections 	<p>Real time monitoring Attended monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p>WE 39 Possession (Start at SAT 28/03/20: 18:00, end at MON 30/03/20: 0000) <u>Tracks, 19/20 Track Slab construction:</u></p> <ul style="list-style-type: none"> Track removal Excavation including saw cutting and breaking Track slab construction Installation of pre-cast sections 	<p>Real time monitoring Attended monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
<p><u>Grand Concourse and Northern Concourse</u></p>		
<p><i>OOH throughout March 2020</i></p> <ul style="list-style-type: none"> Construction of northern concourse ground slabs and walls Installation of columns and structures FRP works to Northern Concourse service trench Completion of FRP works to lower escalator pit & FT8 FRP works to FT14 Install false work deck for intercity Slab Construction of CENA140 room (Lower Northern Concourse) Service investigations in lower northern concourse Decommission and disconnect all cameras and speaker, lighting and power within demo zone Demolition of Olympic tunnel stairs Installation of Hoist within Olympic tunnel stairs Demolition of existing platform structures Removal of existing canopy Scaffold erection outside TCAC 	<p>Real time monitoring</p>	<p>SCN31/32: 74 Pred: 55 (CH)</p> <p>SCN32: 76 Pred: 60 (YHA)</p>
<p>WE 35 Possession (Start FRI 29/02/20 at 22:00, end at MON 02/03/20 at 00:00) Pedestrian tunnels. <u>Northern/Grand Concourse</u> <i>Activities include:</i></p> <ul style="list-style-type: none"> Canopy Demolition - remove roof sheeting. And soft stripping. Trenching for services at the new escalator pit Olympic Tunnel Stair demolition Service trenching and concrete infill works. Eddy Avenue investigation works – Nearing NC. 	<p>Real time monitoring</p>	<p>SCN31/32: 74 Pred: 55 (CH) SCN32: 76 Pred: 60 (YHA)</p>
<p>WE 36 Possession (Start at FRI 06/03/20 18:00, end at MON 09/03/20 00:00) <u>TCAC and Northern Concourse</u> <i>Activities Include:</i></p> <ul style="list-style-type: none"> Removal of two noise wall panels and posts in preparation for precast installation. Install steel beams and columns to TCAC roof. 	<p>Real time monitoring</p>	<p>SCN31/32: 74 Pred: 55 (CH) SCN32: 76 Pred: 60 (YHA)</p>

	<p>WK 36 and WK 37 <i>March 9th - 12th & March 16th – 19th (Start at 22:00, end at 03:45)</i> <u>Platform 8/9 – Northern Concourse</u> <i>Activities include:</i></p> <ul style="list-style-type: none"> Removal of platform 8 roofing sheets and timber awning as well as exiting services in preparation for demolition of platform 8/9 canopy on WE38. Installation of hand rails system to concourse hoarding. Material laydown. 	Real time monitoring	<p>SCN31/32: 74 Pred: 55 (CH) SCN32: 76 Pred: 60 (YHA)</p>
	<p>WE 38 Possession <i>(Start FRI 20/03/20 at 22:00, end at MON 23/03/20 00:00)</i> <u>Platforms 9/10 and 11/12 (roads 8 - 12).</u> <i>Activities include:</i></p> <ul style="list-style-type: none"> Canopy Demolition and any remaining trenching on Platform 8. Modify Platform 12 hoarding. Hoist installation. Station master sandstone wall cleaning - scaffolding to be erected. 	Real time monitoring	<p>SCN31/32: 74 Pred: 55 (CH) SCN32: 76 Pred: 60 (YHA)</p>
Metro Box and Sydney Yard			
	<p><i>OOH throughout March 2020</i></p> <ul style="list-style-type: none"> HV Cutover works south of metro box Excavation of gasworks area within metro box Operation of the permanent Water Treatment Plant Operation of the temporary ventilation system Excavation (including rock breaking), shotcrete, grouting and installation of ground support and waler beam then waterproofing behind waler beam at North South concourse level and below Installation of FRP within new stations basement box Temp traffic 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 Southern baggage tunnel maintenance works as required. Olympic Tunnel maintenance works as required. 	Real time monitoring	<p>SCN14: 71 Pred: 60 (CH)</p>
Site Wide CSR Works			
	<p>WE 36 Possession <i>(Start at FRI 06/03/20 18:00, end at MON 09/03/20 00:00)</i> <u>Platform 23</u> <i>Activities include:</i></p> <ul style="list-style-type: none"> Removal of asbestos troughing and slewing cable onto GST above. Installation of new troughing and slewing cables Underground conduit install under 631 feeder 	<p>Real time monitoring Attended monitoring</p>	<p>SCN22: 72 Pred: 70 (CH)</p>
21	<p>April 2020 Weekend 39 - Weekday 44 – 01/04/20 to 30/04/20 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>Eastern Entrance:</p> <ul style="list-style-type: none"> Delivery and removal of excavators for Eastern Entrance works from Randle Lane during night shift in accordance with traffic approval. Specific notification will be issued in the appropriate time frame. Excavating, pile breakout and hammering. 	<p>Real time monitoring Attended monitoring</p>	<p>SCN24: 85 SCN25: 83</p>

<p>ESR Concourse, back of house and tunnels (Station fit out, largely inaudible)</p> <ul style="list-style-type: none"> • HV Cutover works south of metro box • Excavation of gasworks area within metro box • Operation of the permanent Water Treatment Plant • Operation of the temporary ventilation system • Excavation (including rock breaking), shotcrete, grouting and installation of ground support and waler beam then waterproofing behind waler beam at North South concourse level and below • Installation of FRP within new stations basement box • Temp traffic 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 • Southern baggage tunnel maintenance works as required. • Olympic Tunnel maintenance works as required. 	<p>Noise impact not assessed as works are inaudible at sensitive receivers</p>	
<p>Platform 16/17</p> <ul style="list-style-type: none"> • Excavation within hoarding including breaking, installing shotcrete and soil nails, • Form, reo pour • Hoarding and GRP Plates maintenance work 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (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 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (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 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (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 Load Transfer 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>
<p>WE 42 Possession (Start at FRI 18/04/20: 22:00, end at MON 20/04/20: 0000) <u>Track 21/22 Track Slab construction:</u></p> <ul style="list-style-type: none"> • Cut rails and remove sleepers • Remove ballast • Excavation • Place stab sand • Install SHS and Precast panels • Grouting • Place ballast • Reinstate track (sleepers and rail) 	<p>Real time monitoring Attended Monitoring</p>	<p>SCN18: 73 Pred: 73 (CH)</p>
<p>Grand Concourse and Northern Concourse</p>		

	<p><i>OOH throughout April</i></p> <ul style="list-style-type: none"> • Construction of northern concourse ground slabs and walls • Installation of columns and structures • FRP works to Northern Concourse service trench • Completion of FRP works to lower escalator pit & FT8 • FRP works to FT14 • FRP for intercity Slab • Installation of services for CENA140 Room (Lower Northern Concourse) • Service investigations in lower northern concourse • Decommission and disconnect all cameras and speaker, lighting and power within demo zone • Installation of Hoist within Olympic tunnel stairs • Demolition of existing platform structures • Removal of existing canopy • Scaffold erection outside TCAC 	Real time monitoring	SCN37: 76 Pred: 63 (CH & YHA)
	<p>WE 42 Possession (Start FRI 18/04/20 at 23:00, end at MON 20/04/20 00:00) TCAC and roads 8 - 12. <i>Activities include:</i> Installation of Tower crane Installation of structural steel to TCAC building and in the lower Northern Concourse roof</p>	Real time monitoring	SCN37: 76 Pred: 63 (CH & YHA)
Metro Box and Sydney Yard			
	<p><i>OOH throughout April 2020</i></p> <ul style="list-style-type: none"> • HV Cutover works south of metro box • Excavation of gasworks area within metro box • Operation of the permanent Water Treatment Plant • Operation of the temporary ventilation system • Excavation (including rock breaking), shotcrete, grouting and installation of ground support and water beam then waterproofing behind water beam at North South concourse level and below • Installation of FRP within new stations basement box • Temp traffic 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 • Southern baggage tunnel maintenance works as required. • Olympic Tunnel maintenance works as required. 	Real time monitoring	SCN13: 67 Pred: 60 (CH)
Site Wide CSR Works			
	<p>WE 42 Possession (Start SAT 18/04/20 at 13:00, end at SAT 18/04/20 18:00) Track 23. <i>Activities include:</i></p> <ul style="list-style-type: none"> • GST steel cutting and installation 	Real time monitoring Attended Monitoring	SCN18: 73 Pred: 73 (CH)
22	May 2020 Weekday 44 – Weekend 48 – 01/05/20 to 31/05/19 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			

<p>Eastern Entrance Delivery and removal of excavators, piling equipment and cranes 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> <p>Saturdays in May between 1pm and 5pm.</p> <ul style="list-style-type: none"> Form, reo, pour and canopy tube works. <p>NB: Steel rods will be cut to correct length before 1pm so that manual hand tools are only used between 1pm and 5pm.</p>	<p>Real time monitoring Attended Monitoring</p>	<p>SCN25: 83 Pred: 70 (CH)</p>
<p>ESR Concourse, back of house and tunnels <i>(station fit out, largely inaudible)</i></p> <ul style="list-style-type: none"> Hazmat removal in concourse areas Material and waste removal via Pitt Street Ongoing service installation and commissioning for the Ghost platforms Service investigations and diversions and removal at ESR Concourse & back of house Platform strengthening in ESR Ghost platform (Access via Olympic Tunnel for deliveries) Hoarding/hoist and steelwork installation BOH. 	<p>Noise impact not assessed as works are inaudible at sensitive receivers</p>	
<p>Platform 16/17</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 work 	<p>Real time monitoring</p>	<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 	<p>Real time monitoring</p>	<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 	<p>Real time monitoring</p>	<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 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred: 70 (CH)</p>
<p>Central Walk Excavation</p> <ul style="list-style-type: none"> Pile breaking Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). 	<p>Works are inaudible as they occur from within the MB excavation.</p>	
<p>WE 44 Possession <i>(Start at FRI 02/05/20: 22:00, end at MON 04/05/20: 0000)</i></p> <p><u>Platform 20/21</u> – Investigation for future access hatch:</p> <ul style="list-style-type: none"> Set up scaffold Concrete cores and path. <p><u>Platform 18/19</u> – Pile breaking south of existing hoarding:</p> <ul style="list-style-type: none"> Removal of GRP plates Brokk to break up slab, excavate and breakdown piles Forming up beam Drainage works – diversion of existing canopy drainage Extending hoarding to the south 	<p>Real time monitoring</p>	<p>SCN18: 73 Pred:70 (CH)</p>

<p>WE 45 Possession (Start at FR 08/05/20: 22:00, end at MON 11/05/20: 0000) Platform 16/17 – Releveling works</p> <ul style="list-style-type: none"> • Removal of hoarding and GRP plates • Breakout of coping and existing slab • Form, reo and pour • Tie-in to existing levels including ramps due to level differences. <p>Track 16/17/18 – Track works:</p> <ul style="list-style-type: none"> • Welding and track adjustments • Form, reo and pour 	Real time monitoring	SCN18: 73 Pred:70 (CH)
<p>WE 46 Possession (Start at FRI 15/05/20: 22:00, end at MON 18/05/20: 0000) Platform 16/17 – Releveling works</p> <ul style="list-style-type: none"> • Removal of hoarding and GRP plates • Break out of coping and existing slab • Form, reo and pour • Tie-into existing levels including ramps due to level differences • Re-instatement of hoarding. 	Real time monitoring	SCN18: 73 Pred:70 (CH)
<u>Grand Concourse and Northern Concourse</u>		
<p>OOH throughout May 2020</p> <ul style="list-style-type: none"> • Construction of northern concourse ground slabs and walls • Installation of columns and structures • FRP for intercity Slab • Installation of services for CENA140 Room (Lower Northern Concourse) • Service investigations in lower northern concourse • Decommission and disconnect all cameras and speaker, lighting and power within demo zone • Demolition of existing concourse and platform canopy structures • Cleaning of heritage sandstone at Station Masters Building • Installation of precast columns and beams. 	Real time monitoring	SCN37: 74 Pred: 60 (CH/YHA)
<p>WE 46 Possession (Start at FRI 15/05/20: 22:00, end at MON 18/05/20: 0000) TCAC</p> <ul style="list-style-type: none"> • Installation of beams to TCAC roof. Will include closure of part of the NC, lift and escalators and suburban tunnel • Installation of precast columns within MetroBox area. Suburban tunnel to be closed. 	Real time monitoring	SCN37: 74 Pred: 60 (CH/YHA)
<u>Metro Box and Sydney Yard</u>		
<p>OOH throughout May 2020</p> <ul style="list-style-type: none"> • HV Cutover works south of metro box • Operation of the permanent Water Treatment Plant • Operation of the temporary ventilation system • Operation of cranes on Traffic deck including newly constructed tower crane. • Excavation (including rock breaking), shotcrete, grouting and installation of ground support and waler beam then waterproofing behind waler beam at North South concourse level and below • Installation of FRP within new stations basement box • Temp traffic 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 • Southern baggage tunnel maintenance works as required. • Olympic Tunnel maintenance works as required. 	Real time monitoring	SCN13: 67 Pred: 60 (CH)
<u>Site Wide CSR Works</u>		
No CSR works for May 2020.		

23	June 2020 Weekday 48 – Weekday 52– 01/06/20 to 30/06/20 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>			
	Eastern Entrance <ul style="list-style-type: none"> • Delivery and removal of excavators, piling equipment and cranes 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. • Saturdays in June between 1pm and 5pm: FRP works, canopy tube drilling and concrete, removal of spoil. 	Real time monitoring	SCN25: 83 Pred: 75 (CH) (Deliveries) SCN26: 84 Pred: 65 (CH) (Canopy tubes)
	ESR Concourse, back of house and tunnels (<i>station fit out, largely inaudible</i>)	Noise impact not assessed as works are inaudible at sensitive receivers	
	Platform 16/17 <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails • Form, reo pour • Hoarding, GRP Plates and temporary ramps maintenance work 	Real time monitoring	SCN18: 73 Pred: 60 (CH)
	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 	Real time monitoring	SCN18: 73 Pred: 60 (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 	Real time monitoring	SCN18: 73 Pred: 60 (CH)
	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 	Real time monitoring	SCN18: 73 Pred: 60 (CH)
	Central Walk Excavation/FRP <ul style="list-style-type: none"> • Pile breaking • Excavation, ground support (shotcrete, soils nails) and temporary props (steel frames). • Form, reo and pour. 	Inaudible as works occur below ground	
<u>Grand Concourse and Northern Concourse</u>			
	<i>OOH throughout June 2020.</i> <ul style="list-style-type: none"> • Installation of precast columns and beams • FRP for intercity slab • Installation and fit out of pedestrian modules • Demolition of piles/shear wall and underpinning works to existing escalator. • Groundworks and excavation to upper escalator pit. • FRP to upper excavation pit • FRP works to service trench and western staircase. • Service investigations in lower northern concourse • Decommission and disconnect all cameras and speaker, lighting and power within demo zone • Demolition of existing concourse and platform canopy structures • Cleaning of heritage sandstone at Station Masters Building • Canopy roof – insitu beam structural pour 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)

<p>WK 48 Possession <i>(Start on Sat 01/06/20 at 00:00, end at MON 04/06/20 at 00:00)</i> <u>Roads 5 - 12</u> Activities include:</p> <ul style="list-style-type: none"> • Removal of glass panels/ full closure for each night. • Insitu FRP to precast beams • Install pedestrian modules 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<p>WE49 Possession <i>(Start on SAT 05/06/20 at 00:00, end on MON 09/06/20 at 00:00)</i> <u>Roads 9 - 12</u> Activities include:</p> <ul style="list-style-type: none"> • Demolition of glass canopy in sections • Installation of precast platform 8/9 to 12 • Diversion of pedestrians • Strip services and lining to bridges • Remove bridge. 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<p>WK 49 Possession <i>(Start on TUE 09/06/20 at 00:00, end on FRI 12/06/20 at 23:00)</i> <u>Northern Concourse</u> Activities include:</p> <ul style="list-style-type: none"> • Removal of king post piles – to occur day and night. 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<p>WE 50 Possession <i>(Start on SAT 13/06/20 at 00:00, end on MON 15/06/20 at 00:00)</i> <u>Roads 9 – 12</u> Activities include:</p> <ul style="list-style-type: none"> • Pre-cast installation • FRP column stitch pour 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<p>WK 51 Possession <i>(Start on MON 22/06/20 at 00:00, end on THU 25/06/20 at 22:00)</i> <u>Roads 9 – 12</u> Activities include:</p> <ul style="list-style-type: none"> • FRP works to escalator pit including material movement during night shift. 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<p>WE 52 Possession <i>(Start on SAT 27/06/20 at 00:00, end on MON 29/06/20 at 00:00)</i> <u>Roads 9 – 12</u> Activities include:</p> <ul style="list-style-type: none"> • Pre-cast installation • FRP to pit including material movement during night shift. 	Real time monitoring	SCN 32/37: 83/76 Pred: 60 (YHA/CH)
<u>Metro Box and Sydney Yard</u>		

	<p><i>OOH throughout June 2020</i></p> <ul style="list-style-type: none"> • Operation of the permanent Water Treatment Plant • Operation of the temporary ventilation system • Operation of cranes on Traffic deck including newly constructed tower crane. • Excavation (including rock breaking and use of a surface mining equipment), shotcrete, grouting and installation of ground support and waler beam in Metro Box N-S Concourse level. • Waterproofing and FRP for Devonshire Street Tunnel underpinning structure. • Installation of FRP within new stations basement box N-S Concourse level. • Temp traffic 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 	Real time monitoring	<p>(Belowground) SCN13: 67 Pred: 65 (CH)</p> <p>(Aboveground) SCN14: 71 Pred: 60 (CH)</p>
<u>Site Wide CSR Works</u>			
	<p>06/06/20 – 07/06/20 ; (07:00 – 18:00) <u>Mortuary Sidings and Sydney Yard</u> Activities include:</p> <ul style="list-style-type: none"> • CSR construction (GST construction and underground route) 	Real time monitoring	SCN3: N/A Pred: 70 (RS)
	<p>13/06/20 – 14/06/20 ; (07:00 – 18:00) <u>Mortuary Sidings and Sydney Yard</u> Activities include:</p> <ul style="list-style-type: none"> • CSR construction (GST construction and underground route) 	Real time monitoring	SCN3: N/A Pred: 70 (RS)
	<p>20/02/20 – 21/06/20 ; (07:00 – 18:00) <u>Mortuary Sidings and Sydney Yard</u> Activities include:</p> <ul style="list-style-type: none"> • CSR construction (GST construction and underground route) 	Real time monitoring	SCN3: N/A Pred: 70 (RS)
24	<p>July 2020 Week 52 – Week 4– 01/07/20 to 31/07/20 Platforms and Sydney Yard Works as per CNVIS Rev5, Annex B and C</p>		
<u>Suburban Tracks (Central Walk, Eastern Entrance, ESR, back of house & tunnel Works)</u>			
	<p>Eastern Entrance:</p> <ul style="list-style-type: none"> • Delivery and removal of excavators, piling equipment and cranes 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. • Concrete pour of pre-drilled piles. (1pm – 5pm Saturdays) • Sewer relocation works within EE on 7th July 2020 – between 23:00 and 05:00. 	<p>Real time monitoring</p> <p>Attended monitoring</p>	<p>SCN25: 83 Pred: 75 (CH) (Deliveries)</p> <p>SCN26: 84 Pred: 75 (CH) (Sewer)</p>
	<p>ESR Concourse, back of house and tunnels (<i>station fit out, largely inaudible</i>)</p>	Noise impact not assessed as works are inaudible at sensitive receivers	
	<p>Platform 16/17</p> <ul style="list-style-type: none"> • Excavation within hoarding including saw cutting, breaking, shotcrete and soil nails • Form, reo pour • Hoarding, GRP Plates and temporary ramps maintenance work 	Real time monitoring	SCN18: 73 Pred: 60 (CH)
	<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 	Real time monitoring	SCN18: 73 Pred: 60 (CH)

<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	SCN18: 73 Pred: 60 (CH)
<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 Site establishment for canopy tube works 	Real time monitoring	SCN18: 73 Pred: 60 (CH)
<p>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. 	Noise impact assessed as inaudible at sensitive receivers	
<p>WE 03 Possession (Start on SAT 18/07/20 at 00:00, end on MON 20/07/20 at 00:00) <u>Platform 18/19 releveling works.</u> 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 	Real time monitoring	SCN20: 72 Pred: 70 (CH)
<u>Grand Concourse and Northern Concourse</u>		
<p><i>OOH throughout July 2020</i></p> <ul style="list-style-type: none"> Precast beam installation Completion of FRP to upper excavation pit. FRP works to service trench and western staircase. Service investigations in lower northern concourse Cleaning of heritage sandstone at Station Masters Building Canopy roof – insitu beam structural pour Northern concourse floor slab FRP pour 4 Installation of escalators Installation of roof canopy steelwork Commence installation of lift enclosures. Escalator installation works including underpinning. Southern service trench wall and soffits Steel work assembly 	Real time monitoring	SCN32: 76 Pred: 65(YHA)
<p>WE 01 Possession (Start on SAT 04/07/20 at 00:00, end on 06/07/20 on MON 00:00) <u>Roads 12</u> Activities include:</p> <ul style="list-style-type: none"> Escalator installation works and crane lifts into work area. 	Real time monitoring	SCN32: 76 Pred: 65(YHA)

<p>WE 02 Possession <i>(Start on SAT 11/07/20 at 23:00, end on SUN 12/07/20 at 02:00)</i> <u>Lee Street Substation:</u> Activities include:</p> <ul style="list-style-type: none"> • ST Transformer delivery to Lee St Substation. (as Roads 1-4 OHW are isolated). 	Real time monitoring	SCN3: 56 Pred: 46 (RS)
<p>WE 03 Possession <i>(Start on SAT 18/07/20 00:00, end on MON 20/07/20 at 00:00)</i> <u>Roads 16 – 18 – bays 6 & 7</u> <i>Structural steel installation to Bay 6 & 7.</i> Activities include:</p> <ul style="list-style-type: none"> • Structural steel installation to bay 6 & 7. • Installation of 6 cassettes 	Real time monitoring	SCN32: 76 Pred: 65 (YHA)
<p>WE 04 Possession <i>(Start on SAT 25/07/20 at 00:00, end on MON 27/07/20 at 00:00)</i> <u>Roads 1 - 12</u> Activities include:</p> <ul style="list-style-type: none"> • Precast beam installation and beam FRP. • Service trenching in the concourse • Demolition activities around lift 	Real time monitoring	SCN32: 76 Pred: 65 (YHA)
Metro Box and Sydney Yard		
<p><i>OOH throughout July 2020</i></p> <ul style="list-style-type: none"> • Operation of the permanent Water Treatment Plant • Operation of the temporary ventilation system • Operation of cranes on Traffic deck including newly constructed tower crane. • 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. • Installation of FRP within new stations basement box N-S Concourse and Basement levels. • Temp traffic 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 	Real time monitoring	SCN 3: 67 Pred: 60 (CH)
Site Wide CSR Works		
<p>July 3rd, 10th, 17th, 24th and 31st. <i>Works to be between 13:00 and 18:00.</i> <u>Sydney Yard</u> Activities include:</p> <ul style="list-style-type: none"> • ULX and GST works. 	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 OOHW, 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 on Chalmers Street and 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 OOHW 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

Note: As a result of COVID station operations have been reduced by ~70% during this reporting period. As such LOR, in consultation with Sydney Trains and Sydney Metro have been able to expedite some aspects of the construction program.

Specific respite periods were also negotiated with the Dental Hospital and Haven Specialist Coffee for works in standard construction hours.

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 (although this has reduced significantly from the previous reporting period)
- Residences or pedestrians near the measurement position;
- Wind-blown vegetation and insects;
- Road traffic on public roads, particularly applicable at 54 Regent Street;
- 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' ($10 \cdot \log$ 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*log (attribute) quick reference table

Attribute : % Contribution of magnitude	10*log(attribute) Reduction in dB	Attribute: Event duration (x mins per 15min measure)	10*log (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.

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.

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

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 construction work in the local area not associated with the project.
- It is difficult to assign a percentage of magnitude, so typically 10% is assigned for no magnitude, 50% if other works or noises are still contributing, or 100% if no other works or impacts are heard.

- 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 February 2020 and July 2020, 26 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 included edge beam works, track slab construction, or platform releveling works within the Suburban Tracks (refer Scenario 18 and 22 in the CNVIS). Edge beams are reinforced beams that are installed inside the station platforms, while the track slabs are perpendicular hollow concrete slabs that sit under the tracks and connect the edge beams. The edge beams tie in with track slabs and canopy tubes directly above the Central Walk. Once linked, these structures reinforce the platforms and tracks to prevent subsidence during tunnelling works associated with the Central Walk. The works occurring on site included temporary works, excavation, spoil removal, jackhammering and saw cutting.

A 36m long excavation within each suburban platform is required to construct the edge beams. The saw cutting is required to be conducted OOH when trains have stopped for safety and rail operation reasons. The noisiest part of the works are associated with saw cutting and breaking out concrete during excavation. The outer brick platform wall is heritage listed and must remain undamaged except for the coping edge which is removed during platform releveling works. The works are located at various distances to the sensitive receivers depending on which platform the works are occurring. Due to operational constraints noise attenuating barriers cannot be erected at the source of noise on the easternmost platforms. As noise could not be reduced at the source for the eastern platforms, pre sawing the platform surface in the week prior to the possession was undertaken to reduce the duration of continuous saw cutting.

Similarly, track slab construction can only be undertaken during rail possessions due to safety and rail operation reasons. Unlike edge beam construction where pre-sawing could be undertaken prior to the possessions, saw cutting and relocation of the rail lines can only be undertaken during OOH. Saw cutting of the rail is the key high impact activity, as removal of sleepers and rail, as well as excavation of ballast and fill does not generate significant noise. Similarly, placement of the square hollow concrete sections for the track slabs, backfill and realignment of sleepers and rail does not generate a high noise impact risk. Like the edge beam construction, providing noise attenuation at source for the eastern most tracks could not be emplaced due to operational constraints, however each high impact activity (saw cutting) was precise in nature, with each individual cut occurring for no more than 10 minutes at a time.

While the edge beams and track slabs allow for the undermining of the Central Walk Concourse – platform releveling 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 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
- 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 were measured as follows:

- Ratio of complaints against repetitive complaints : 35 complaints in total during the reporting period:
 - 29 were related to noise
 - 24 of these were repetitive complaints 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 26 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
WE 31 Possession <i>(Start at SAT 01/02/20 00:00, end at MON 03/02/20, 00:00)</i> B2/B3 Beams: Inside hoarding on Platform 16/17 and 18/19 Slab removal Excavation including saw cutting and breaking. Back fill Concrete pour	Chalmers Street Real time monitoring	SCN22: 72 Pred: 70 (CH) Obs: 64	No observed exceedance of the predicted noise impact. All appropriate AMMM's were applied.
WE 32 Possession <i>(Start at SAT 08/02/20 00:00, end at MON 10/02/20, 00:00)</i> Track slab P17/18	Chalmers Street Real time monitoring	SCN22: 72 Pred: 70 (CH) Obs: 62	Works rescheduled. Plan and equipment utilised for urgent track repair.
WE 34 Possession <i>(Start at SAT 22/02/20 00:00, end at Mon 24/02/20 00:00)</i> Platform 22/23 Edge beam construction Excavation including saw cutting and breaking Form, reo, pour. Installation GRP Plates Erection of hoarding	Chalmers Street Real time monitoring Attended Monitoring	SCN22: 73 Pred: 73 (CH) Obs:77	Exceedance of predicted noise impact = 4dB. All appropriate noise mitigation measures were implemented. The attenuation properties of the building is 20dB (as specified in the CNVIS), which suggest internal noise levels would be ~55dB. A complaint was received for works on the second night, however specific notification was issues and the complainant did not take up CSM's offer for customised ear plugs. Works conducted to achieve best achievable noise performance objectives as identified in the Construction Noise and Vibration Impacts Statements
WE 35 Possession <i>(Start FRI 29/02/20 at 22:00, end at MON 02/03/20 at 00:00)</i> NC - Pedestrian tunnels. Activities include: Canopy Demolition - remove roof sheeting. And soft stripping. Trenching for services at the new escalator pit Olympic Tunnel Stair demolition Service trenching and concrete infill works. Eddy Avenue investigation works – Nearing NC.	Chalmers Street Real time monitoring	SCN32: 73 Pred: 55 (Chalmers) Obs: 65	Exceedance of predicted noise impact was 10dB, however was not attributed to construction noise. No exceedance of CNVIS prediction observed. Appropriate AMMs were applied. Note: No CSM works were audible – noise impacts attributed to non-CSM works.

<p>WE 36 Possession (Start at FRI 06/03/20: 18:00, end at MON 09/03/20: 0000) Track 16, 17/18 Track Slab construction: Track removal Excavation including saw cutting and breaking Track slab construction Installation of pre-cast sections Platform 23 <i>Activities include:</i> Removal of asbestos troughing and slewing cable onto GST above. Installation of new troughing and slewing cables Underground conduit install under 631 feeder</p> <p>WE 36 Possession (Start at FRI 06/03/20 18:00, end at MON 09/03/20 00:00) TCAC and Northern Concourse <i>Activities Include:</i> Removal of two noise wall panels and posts in preparation for precast installation. Install steel beams and columns to TCAC roof.</p>	<p>Chalmers Street Real time monitoring Attended monitoring Chalmers Street Real time monitoring</p>	<p>SCN22: 72 Pred: 70 (CH) Obs: 61 - 66</p> <p>SCN31/32: 74 Obs: 62-67</p>	<p>No exceedance of predicted noise impact. Significant proportion of noise heard was non CSM related, and included squealing from vehicles, light rail, rain, and seagulls. Observed values are below predictions and the CNVIS. Appropriate AMM's were applied.</p> <p>Works inaudible due to the distance from the receivers and quiet nature of the completed works.</p>
<p>WK 36 and WK 37 March 9th - 12th & March 16th - 19th (Start at 22:00, end at 03:45) NC - Platform 8/9 <i>Activities include:</i> Removal of platform 8 roofing sheets and timber awning as well as exiting services in preparation for demolition of platform 8/9 canopy on WE38. Installation of hand rails system to concourse hoarding. Material laydown.</p>	<p>YHA Real time monitoring</p>	<p>SCN32: 76 Pred: 60 (YHA) Obs: 64</p>	<p>Observed adjusted $L_{Aeq15mins} = 64dB$. OOH Prediction was below typical background level in the absence of construction. No exceedance of CNVIS prediction observed. Appropriate AMMs were applied. Note: No CSM works were audible – noise impacts attributed to non-CSM works. Appropriate AMMs were applied as per the CNVIS prediction.</p>
<p>WE 38 Possession (Start FRI 20/03/20 at 22:00, end at MON 23/03/20 00:00) NC - Platforms 9/10 and 11/12 (roads 8 - 12). <i>Activities include:</i> Canopy Demolition and any remaining trenching on Platform 8. Modify Platform 12 hoarding. Hoist installation.</p>	<p>Chalmers Street Real time monitoring</p>	<p>SCN31: 74 (CH) Pre: 55dB Obs: 61</p>	<p>No LOR works audible. Peak noise heard is due to wheel squeal from a tram and a police siren. Appropriate AMMs applied despite works being inaudible at the receiver.</p>

<p>Station master sandstone wall cleaning - scaffolding to be erected.</p>			
<p>WE 39 Possession <i>(Start at SAT 28/03/20: 18:00, end at MON 30/03/20: 0000)</i> Tracks, 19/20 Track Slab construction: Track removal Excavation including saw cutting and breaking Track slab construction Installation of pre-cast sections</p>	<p>Chalmers Street Real time monitoring Attended monitoring</p>	<p>SCN22: 72 Pred: 70 (CH) Obs: 60 – 67</p>	<p>Road sawing could be heard but discernible. Observed noise values were lower than the CNVIS and OOHW predictions (i.e exceedance of predicted Noise impact was 7dB at most). Appropriate AMMMs were implemented including noise blankets and specific notification.</p>
<p>WE 42 Possession <i>(Start at FRI 18/04/20: 22:00, end at MON 20/04/20: 0000)</i> Track 21/22 Track Slab construction: Cut rails and remove sleepers Remove ballast Excavation Place stab sand Install SHS and Precast panels Grouting Place ballast Reinstate track (sleepers and rail) <i>(Start SAT 18/04/20 at 13:00, end at SAT 18/04/20 18:00)</i> Track 23. Activities include: GST steel cutting and installation</p> <p>WE 42 Possession <i>(Start FRI 18/04/20 at 23:00, end at MON 20/04/20 00:00)</i> NC - TCAC and roads 8 - 12. Activities include: Installation of Tower crane Installation of structural steel to TCAC building and in the lower Northern Concourse roof</p>	<p>Chalmers Street Real time monitoring Attended Monitoring</p> <p>Chalmers Street & YHA Real time monitoring</p>	<p>SCN18: 73 Pred: 73 (CH) Obs: 65</p> <p>SCN37: 76 Pred: 73 (CH & YHA) Obs: 67</p>	<p>Cutting of rail was momentary in practice – a total of precise cuts were made between 02:00 and 02:30. Works were audible at the receiver, however noise impact was below the predicted OOHW model and CNVIS. AMMs for an impact of 73dBA were implemented.</p> <p>Construction noise audible close to microphone at Chalmers St.</p>
<p>WE 44 Possession <i>(Start at FRI 02/05/20: 22:00, end at MON 04/05/20: 0000)</i> Platform 20/21 – Investigation for future access hatch: Set up scaffold Concrete cores and path.</p>	<p>Chalmers Street Real time monitoring</p>	<p>SCN18: 73 Pred:70 (CH) Obs: 70</p>	<p>Observed noise values did not exceed the prediction, Noisy works were scheduled for the Saturday morning with saw cutting of the platform beginning at 07:00. Appropriate AMMM'S were applied.</p>

<p>Platform 18/19 – Pile breaking south of existing hoarding: Removal of GRP plates Brokk to break up slab, excavate and breakdown piles Forming up beam Drainage works – diversion of existing canopy drainage Extending hoarding to the south</p>			
<p>WE 45 Possession <i>(Start at FR 09/05/20: 22:00, end at MON 11/05/20: 0000)</i> Platform 16/17 – Releveling works Removal of hoarding and GRP plates Breakout of coping and existing slab Form, reo and pour Tie-in to existing levels including ramps due to level differences. Track 16/17/18 – Track works: Welding and track adjustments Form, reo and pour</p>	<p>Chalmers Street</p> <p>Real time monitoring</p>	<p>SCN18: 73 Pred:70 (CH) Obs: 58</p>	<p>Observed noise impact was considerably lower than the CNVIS and OOHW Model predictions. AMMs for an impact of 70dB was implemented regardless.</p>
<p>WE 46 Possession <i>(Start at FRI 16/05/20: 22:00, end at MON 18/05/20: 0000)</i> Platform 16/17 – Releveling works Removal of hoarding and GRP plates Break out of coping and existing slab Form, reo and pour Tie-into existing levels including ramps due to level differences Re-instatement of hoarding.</p> <p>WE 46 Possession <i>(Start at SAT 16/05/20: 22:00, end at MON 18/05/20: 0000)</i> NC - TCAC Installation of beams to TCAC roof. Will include closure of part of the NC, lift and escalators and suburban tunnel Installation of precast columns within MetroBox area. Suburban tunnel to be closed.</p>	<p>Chalmers Street</p> <p>Real time monitoring</p> <p>YHA</p> <p>Real time monitoring</p>	<p>SCN18: 73 Pred:70 (CH) Obs: 59</p> <p>SCN37: 76 Pred: 55 (YHA) Obs: 53</p>	<p>Work was audible at the closest sensitive receiver however impacts were significantly lower than predicted in OOHW Modelling or the CNVIS. AMMs for an impact of 73dB were however implemented.</p> <p>Works in NC could be heard intermittently at YHA – however masked well by the hoarding being installed. AMM's as per the CNVIS prediction were emplaced.</p>
<p>WK 48 Possession</p>	<p>YHA</p>	<p>SCN36: 76 Pred: 60 (YHA)</p>	<p>Works are inaudible at YHA given the scope of works.</p>

<p><i>(Start on FRI 01/06/20 at 00:00, end at MON 04/06/20 at 00:00)</i> NC - Roads 5 - 12 Activities include: Removal of glass panels/ full closure for each night. Insitu FRP to precast beams Install pedestrian modules</p>	<p>Real time monitoring</p>	<p>Obs: 63</p>	
<p>WE49 Possession <i>(Start on SAT 05/06/20 at 00:00, end on MON 09/06/20 at 00:00)</i> NC - Roads 9 - 12 Activities include: Demolition of glass canopy in sections Installation of precast platform 8/9 to 12 Diversion of pedestrians Strip services and lining to bridges Remove bridge.</p>	<p>YHA Real time monitoring</p>	<p>SCN36: 76 Pred: 60 (YHA) Obs: 63</p>	<p>No CSM works audible in 15 minute recording. Prominent noises recorded included the air release from trains. Appropriate AMMM's were applied.</p>
<p>WK 49 Possession <i>(Start on TUE 09/06/20 at 00:00, end on FRI 12/06/20 at 23:00)</i> Northern Concourse Activities include: Removal of king post piles – to occur day and night.</p>	<p>YHA Real time monitoring</p>	<p>SCN36: 76 Pred: 60 (YHA) Obs: N/A</p>	<p>Noisier works were scheduled for the day time period. Works were inaudible at YHA.</p>
<p>WE 50 Possession <i>(Start on SAT 13/06/20 at 00:00, end on MON 15/06/20 at 00:00)</i> NC - Roads 9 – 12 Activities include: Pre-cast installation FRP column stitch pour</p>	<p>YHA Real time monitoring</p>	<p>SCN37: 76 Pred: 60 (YHA) Obs: 68.5</p>	<p>No CSM works were audible at the sensitive receivers. Adjusted LA_{eq15min} = 44dB for YHA. AMMs for noise impact of 76dB was implemented.</p>
<p>WK 51 Possession <i>(Start on MON 22/06/20 at 00:00, end on FRI 26/06/20 at 22:00)</i> NC - Roads 9 – 12 Activities include: FRP works to escalator pit including material movement during night shift.</p>	<p>YHA Real time monitoring</p>	<p>SCN37: 76 Pred: 60 (YHA) Obs: N/A</p>	<p>Minor scope of works – inaudible at the closest sensitive receiver as all works occur behind hoarding.</p>
<p>WE 52 Possession <i>(Start on SAT 28/06/20 at 00:00, end on MON 29/06/20 at 00:00)</i> NC - Roads 9 – 12 Activities include: Pre-cast installation FRP to pit including material movement during night shift.</p>	<p>Chalmers Street Real time monitoring</p>	<p>SCN37: 76 (CH) Pred: 60 (CH) Obs: 63.8</p>	<p>Observed noise level was significantly lower than the predicted noise level as per the CNVIS and OOHW Noise modelling. AMMs for an impact of 76dB was implemented.</p>

<p>WE 01 Possession (Start on SAT 04/07/20 at 00:00, end on 06/07/20 on MON 00:00) NC - Roads 12 Activities include: Escalator installation works and crane lifts into work area.</p>	<p>YHA Real time monitoring</p>	<p>SCN37: 76 Pred: 65 (YHA) Obs: 60</p>	<p>CSM works inaudible due to the type of works and their distance from the sensitive receiver. AMMs for a noise impact of 76dB was implemented.</p>
<p>WE 02 Possession (Start on SAT 11/07/20 at 23:00, end on SUN 12/07/20 at 02:00) Lee Street Substation: Activities include: ST Transformer delivery to Lee St Substation. (as Roads 1-4 OHW are isolated).</p>	<p>Regent Street Real time monitoring</p>	<p>SCN3: 56 Pred: 46 (RS) Obs: N/A</p>	<p>Inaudible at the sensitive receiver due to the distance.</p>
<p>WE 03 Possession (Start on SAT 18/07/20 at 00:00, end on MON 20/07/20 at 00:00) Platform 18/19 releveling works. Activities include: 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>	<p>Chalmers Street Real time monitoring</p>	<p>SCN20: 72 Pred: 70 (CH) Obs: 65.3</p>	<p>Observed noise level was considerably lower than the OOHW noise model and CNVIS predictions. AMMs for a noise impact of 70dB was implemented.</p>
<p>WE 03 Possession (Start on SAT 18/07/20 00:00, end on MON 20/07/20 at 00:00) NC - Roads 16 – 18 – bays 6 & 7 Structural steel installation to Bay 6 & 7. Activities include: Structural steel installation to bay 6 & 7. Installation of 6 cassettes</p>	<p>YHA Real time monitoring</p>	<p>SCN32: 76 Pred: 65 (YHA) Obs: 54.1</p>	<p>Works are generally inaudible at the sensitive receiver. AMMs for a predicted noise impact of 76dB were utilised.</p>
<p>WE 04 Possession (Start on SAT 25/07/20 at 00:00, end on MON 27/07/20 at 00:00) NC Roads 1 - 12 Activities include: Precast beam installation and beam FRP. Service trenching in the concourse</p>	<p>YHA Real time monitoring</p>	<p>SCN32: 76 Pred: 65 (YHA) Obs: 61</p>	<p>No construction works audible in recording given the distance from the works. AMMs for an anticipated noise impact of 76dBA was implemented.</p>

Demolition activities around lift			
-----------------------------------	--	--	--

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. 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 (ie 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, the maximum level of the human comfort criteria (for residences) may be exceeded resulting in an internal noise level $L_{Aeq15\text{min}}$ 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 fewer high impact activities overall when compared to previous reporting periods. Activities such as hammering or pile breakout occurred predominantly in the first two months of this reporting period. 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 in to 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 were a total of 35 complaints received during the reporting period, with 29 relating to noise and vibration. A break-down of these complaints is shown below:

Table 4-1: Complaints breakdown.

Month	Noise	Vibration	Monthly Total
February	2	0	2
March	3	0	3
April	7	1	7
May	6	1	6
June	10	0	10
July	1	0	1
Totals	29	2*	29

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

Over this reporting period, 82.9% of complaints were related to noise & vibration, with 86% of all the complaints being classified as 'unavoidable'. It should be noted that 79.3% 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)	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 29 complaints related to noise and vibration that were received during the reporting period – 23 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 the edge beam, and track slab earlier in the reporting period and platform releveling works later in the reporting period for 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 employed 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.

One non-conformance report was raised on the 20/05/20 during the reporting period following a complaint received from a member of the public. This NCR, was a result of high impact works at the Eastern Entrance starting before 08:00, not due to an exceedance of noise or vibration limits as set out by the CoA or CNVIS. This was captured in the R4.1 Report.

Appendix A – Noise Monitoring Summary

Date	Time	LOR Works (potentially noisy as per diary entry)	Continous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Observed LAeq15min (dB)	Predicted Noise level as per OOHW Noise Model and or CNVIS Predictions	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments for data review
2/02/2020	12:30:00	LOR Night Works: cutting and excavation works on platform 18/19.	C	22	Chalmers Street	64	70	45	25	0	0	Distant banging heard mostly train related noise. Low variability in dB reading across day and night (average around 60dB)
2/02/2020	23:30:00	LOR Night Works: cutting and excavation works on platform 18/19.	C	22	YHA	67	70	49	21	0	0	Train related noise and idling. Low variability in dB reading across day and night (average around 60dB) .
3/02/2020	22:00:00	LOR Night Works: cutting and excavation works on platform 20/21.	C	22	Chalmers Street	63	70	45	25	0	0	Distant banging heard mostly train related noise and sirens. Peaks in mid to late morning around 78 dB then lowering to 60dB average in evening
3/02/2020	3:30:00	Early truck arriving (20 truck and dogs)	C	39	Regent Street	58	71	44	27	0	0	train and passing car audible- no bridge activity audible.
3/02/2020	12:30:00	LOR Night Works: cutting and excavation works on platform 20/21.	C	22	YHA	57	70	49	21	0	0	Train idling and sounds of rain. Peaks in mid to late morning around 78 dB then lowering to 60dB average in evening
4/02/2020	2:00:00	LOR Night Works: cutting and excavation works on platform 20/21.	C	22	Chalmers Street	69	70	45	25	0	0	Distant banging heard mostly train related noise and sirens. 2 peaks in early morning that relate to Jackhammering around 70 dB, dropping to 55dB from 3:30am.
4/02/2020	3:00:00	Early truck arriving (14 truck and dogs)	C	39	Regent Street	67	71	44	27	0	0	1 elevated LAeq15min noise trace reviewed. No bridge activity audible
4/02/2020	3:45:00	Early truck arriving (14 truck and dogs)	C	39	Regent Street	60	71	44	27	0	0	1 elevated LAeq15min noise trace reviewed. Truck movement audible at end of file at 14:50mins.
4/02/2020	3:15:00	LOR Night Works: Jackhammer work on platform 16/17, signage on platform 21 and floor repair platform 22-23.	C	22	YHA	75	70	49	21	0	5	Train idling audible. 2 peaks in early morning linked to train idling (68dB)
5/02/2020	4:30:00	LOR Night Works: High rail delivery, excavation works platform 18-19 and grouting on platforms.	C	22	Chalmers Street	61	70	45	25	0	0	No works heard . Average reading around 60dB all night with two peaks after mid-night around 65dB
5/02/2020	3:30:00	Early truck leaving	C	39	Regent Street	57	71	44	27	0	0	2 elevated LAeq15min noise trace reviewed. Truck movement audible at end of file at 7mins.
5/02/2020	3:30:00	LOR Night Works: High rail delivery, excavation works platform 18-19 and grouting on platforms.	C	22	YHA	79	70	49	21	0	9	Distant drilling heard . Night Laeq steady around 60 dB a
6/02/2020	0:30:00	LOR Night Works: High rail delivery, excavation works platform 18-19 and grouting on platforms.	C	22	Chalmers Street	61	70	45	25	0	0	Distant works heard - drilling and machinery . relatively steady Laeq reading around 60 dB all night
6/02/2020	4:15:00	Early truck leaving	C	39	Regent Street	61	71	44	27	0	0	train and passing car audible- no bridge activity audible.
6/02/2020	1:00:00	LOR Night Works: High rail delivery, excavation works platform 18-19 and grouting on platforms.	C	22	YHA	80	70	49	21	5	10	Drilling/machinery noise heard very loud and continuous . Heavy rain affecting reading. Reading invalid.
7/02/2020	4:15:00	LOR Night Works : excavation on platforms 22/23.	C	22	YHA	77	70	49	21	0	7	Rain sounds heard as well as idling train. No LOR heard - Train idling from 20:00 to 20:30 and heavy rain affecting recording
8/02/2020	1:15:00	WE32: Track slab cancelled on P16, instead emergency works on P12.	C	14	Chalmers Street	61	60	45	15	0	1	Distant works heard - drilling and machinery . relatively steady Laeq reading around 60 dB all night
8/02/2020	23:15:00	WE32: Track slab cancelled on P16, instead emergency works on P12.	C	14	Chalmers Street	62	60	45	15	0	2	Distant works heard - drilling and machinery . relatively steady Laeq reading around 60 dB all night
9/02/2020	1:15:00	WE32: Track slab cancelled on P16, instead emergency works on P12. LOR Night Works: Pumping of water from flooded areas of Metro Box, Ghost platform and Olympic Tunnel	C	14	Chalmers Street	74	60	45	15	0	14	Microphone glitching no LOR work heard just train sounds. High Rainfall contribution to noise recording, therefore reading invalid.
9/02/2020	3:45:00	LOR Night Works: Pumping of water from flooded areas of Metro Box, Ghost platform and Olympic Tunnel.	C	22	YHA	75	70	49	21	0	5	No LOR works heard just train idling . Steady Laeq reading across evening and day time averaging 60dB
10/02/2020	0:45:00	LOR Night Works: High rail delivery	C	22	Chalmers Street	71	70	45	25	0	1	Microphone glitching no LOR work heard just train sounds. Relatively steady Laeq reading. Reading invalid due to rain.
10/02/2020	4:15:00	LOR Night Works: High rail delivery	C	22	YHA	80	70	49	21	0	10	Microphone glitching due to rain. no LOR work heard just train sounds. Progressively increasing Laeq reading from early morning to midnight with a peak around 23:45 due to rainfall event. Invalid reading due to rain.
11/02/2020	4:00:00	LOR Night Works: High rail delivery	C	22	Chalmers Street	63	70	45	25	0	0	Train related noise heard, distant banging from works heard. High pitched drilling noise heard intermittently. Relatively steady Laeq reading in evening with peaks in late afternoon
11/02/2020	4:00:00	LOR Night Works: Steel trusses installed on platforms behind hoarding	C	22	YHA	74	70	49	21	0	4	Distance machinery noise heard, train idling dominating the sound heard. No LOR heard - Train idling from 20:00 to 20:30
12/02/2020	1:00:00	LOR Night Works: jackhammering on footings of hoarding platform 16/17.	C	22	Chalmers Street	60	70	45	25	0	0	Relatively steady Laeq reading. Sirens heard at 5min and shouting
12/02/2020	3:45:00	LOR Night Works: jackhammering on footings of hoarding, platform 16/17.	C	22	YHA	77	70	49	21	0	7	Train related noise heard. Minimal LOR heard - Train idling from 20:00 to 20:30
14/02/2020	14:22:00	Drilling in Eastern Entrance, near the Dental Hospital side of site	A	24	Haven Café	68	95	70	25	0	0	Location: Inside the Haven Café located next to works. Works inaudible. Note: 75dB is the external noise level. Internal level subject to E38. Due to data issue, E38 criteria can only be estimated. E38 based on estimate is thought to be compliant.
16/02/2020	22:30:00	LOR Night Works : pile breaking on platform 18/19.	C	22	Chalmers Street	62	70	45	25	0	0	No works heard just train movement.
16/02/2020	20:15:00	LOR Night Works : pile breaking on platform 18/19.	C	22	YHA	85	70	49	21	0	15	No LOR works heard - train idling. Peak around 8:15 pm due to train idling, levels out due to train leaving.
17/02/2020	4:00:00	LOR Night Works : pile breaking on platform 18/19.	C	22	Chalmers Street	62	70	45	25	0	0	Continuous repetitive machinery noise heard . Two peaks in early morning related to works around 63dB, average level was 55dB throughout night
17/02/2020	1:00:00	LOR Night Works : pile breaking on platform 18/19.	C	22	YHA	65	70	49	21	0	0	No LOR works - distant machinery noise heard . After 1:00 Laeq decreases to 50dB - works ceased
19/02/2020	3:30:00	LOR Night Works: works within hoarding	C	22	Chalmers Street	58	70	45	25	0	0	Drilling heard intermittently. Average Laeq at night was around 57 with small peaks up to 60-61 dB

19/02/2020	22:00:00	LOR Night works: install of footings for beams in hoarding on platforms	C	22	Chalmers Street	65	70	45	25	0	0	No LOR works heard. Average Laeq at night was around 57 with small peaks up to 63-65 dB
19/02/2020	10:18:00	No works (hammering complete prior to monitoring)	A	24	Haven Café	71	95	70	25	0	0	Location: Inside the Haven Café located next to works. 70% patron capacity.
19/02/2020	13:28:00	LOR works: hammering near the wall of the café, and in the north east corner of site.	A	25	Haven Café	68	95	70	25	0	0	Location: Inside the Haven Café located next to works. 40% patron capacity, works inaudible inside.
19/02/2020	14:57:00	LOR works: hammering near the wall of the café.	A	25	Haven Café	69	95	70	25	0	0	Location: Inside the Haven Café located next to works. Café mostly empty, some ground borne vibration felt, however not very audible.
20/02/2020	2:00:00	LOR Night works: preparation for excavation works on platform 22/23- removal of signage, seating, high rail movements and cleaning.	C	22	Chalmers Street	74	70	45	25	2	4	Drilling, cleaning and machinery noise heard. Two peaks over 70dB around 2 am - average dB around 65dB. No exceedance of the best achievable noise performance objectives identified in the CNVIS.
20/02/2020	8:20:00	LOR works: hammering near the wall of the café.	A	25	Haven Café	74	95	70	25	0	0	Location: Inside the Haven Café located next to works. Ground borne vibration felt, 100% patron capacity.
20/02/2020	8:35:00	LOR works: hammering (pile breaking) near the wall of café.	A	25	Haven Café	75	95	70	25	0	0	Location: Inside the Haven Café located next to works. Ground borne vibration felt considerably, patrons at 90% capacity.
20/02/2020	13:52:00	LOR works: excavator hammering (stab sand breaking) near the wall of café, as well as some hand held jackhammering.	A	25	Haven Café	72	95	70	5	0	0	Location: Inside the Haven Café located next to works. Ground borne vibration felt only very slightly. Café patrons 95% capacity.
21/02/2020	2:30:00	P23 Edge Beams prep	C	22	Chalmers Street	72	73	45	28	0	0	LOR night works: loud talking heard, and loud machinery buzz/drilling . Saw cutting audible - average evening dB around 60-65 increasing to 75dB from 1 - 3 am
21/02/2020	2:45:00	P23 Edge Beams prep.	C	22	Chalmers Street	75	73	45	28	2	2	LOR night works: Loud continuous machinery buzz/drilling. Saw cutting audible - average evening dB around 60-65 increasing to 75dB from 1 - 3 am. No exceedance of the best achievable noise performance objectives identified in the CNVIS.
21/02/2020	8:54:00	LOR works: jackhammering x2 (pile breaking) near the wall of café.	A	25	Haven Café	75	95	70	25	0	0	Location: Inside the Haven Café located next to works. Ground borne vibration felt. 100% patronage, very noisy, 5% contribution of noise from works.
21/02/2020	2:29:00	LOR: Edge beam construction of platform 23 - saw cutting on platform.	A	22	Chalmers Street	73	70	45	25	1	3	Outside 34 Chalmers street - apartment residences, directly opposite the platform works. Saw cutting audible
22/02/2020	2:30:00	WE34 Possession: P23 Edge Beams LOR Night works : wall barrier between station & light rail (eastern side) next to platform 22/23 reinforcement	C	22	Chalmers Street	76	73	45	28	1	3	Loud continuous drilling/ machinery buzz heard. Saw cutting audible - 3 peaks in early morning linked to cutting works. No exceedance of the best achievable noise performance objectives identified in the CNVIS.
22/02/2020	2:45:00	WE34 Possession: P23 Edge Beams LOR Night works : wall barrier between station & light rail (eastern side) next to platform 22/23 reinforcement	C	22	Chalmers Street	77	73	45	28	3	4	Loud continuous drilling/ machinery buzz heard. Saw cutting audible - 3 peaks in early morning linked to cutting works No exceedance of the best achievable noise performance objectives identified in the CNVIS.
22/02/2020	5:00:00	WE34 Possession: P23 Edge Beams LOR Night works : wall barrier between station & light rail (eastern side) next to platform 22/23 reinforcement	C	22	Chalmers Street	76	73	45	28	2	3	Loud continuous drilling/ machinery buzz heard. Saw cutting audible - 3 peaks in early morning linked to cutting works. No exceedance of the best achievable noise performance objectives identified in the CNVIS.
23/02/2020	0:15:00	WE34 Possession: P23 Edge Beams LOR Night works: removal of platform panels, concrete cutting.	C	22	Chalmers Street	62	73	45	28	0	0	LOR Night works: removal of platform panels, concrete cutting, machinery movement/noises, drilling and talking
23/02/2020	21:45:00	WE34 Possession: P23 Edge Beams LOR Night works: removal of platform panels, concrete cutting.	C	22	Chalmers Street	74	73	45	28	0	1	LOR Night works: removal of platform panels, concrete cutting, machinery movement/noises, drilling and talking
23/02/2020	20:45:00	WE34 Possession: P23 Edge Beams LOR Night works: removal of platform panels, concrete cutting.	C	22	Chalmers Street	75	73	45	28	1	2	LOR Night works: removal of platform panels, concrete cutting, machinery movement/noises, drilling and talking. Saw cutting audible. No exceedance of the best achievable noise performance objectives identified in the CNVIS.
29/02/2020	4:45:00	WE35 NC -install modules for new canopy	C	32	Chalmers Street	65	55	45	10	0	10	Inaudible. Morning trace typically below 60dB.

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)	Predicted Noise level as per OOHW and/or CNVIS	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments for data review
1/03/2020	1:00:00	WE35 NC- installation of modules for new canopy	C	31	Chalmers Street	64	55	45	10	0	9	Unusual trace until 02:45. Each 15min period increasing decreasing by 5dB. No LOR works heard. Peak noise is wheel squeak from trams for about a minute. Other noises include trains and commuters talking on the platforms.
1/03/2020	1:45:00	WE35 NC- installation of modules for new canopy	C	31	Chalmers Street	59	55	45	10	0	4	Unusual trace until 02:45. Each 15min period increasing decreasing by 5dB. No LOR works heard. Peak noise is wheel squeak from trams for about a minute. Other noises include trains and commuters talking on the platforms.
1/03/2020	2:20:00	WE35 NC- installation of modules for new canopy	C	31	Chalmers Street	67	55	45	10	0	12	Unusual trace until 02:45. Each 15min period increasing decreasing by 5dB. No LOR works heard. Peak noise is wheel squeak from trams for about a minute. Other noises include trains and commuters talking on the platforms.
1/03/2020	1:00:00	WE35 NC- installation of modules for new canopy	C	32	YHA	64	60	49	11	4	4	typical LAeq15min noise trace
1/03/2020	1:45:00	WE35 NC- installation of modules for new canopy	C	32	YHA	63	60	49	11	3	3	typical LAeq15min noise trace
3/03/2020	3:15:00	WE35 NC- installation of modules for new canopy	C	31	Chalmers Street	63	55	45	10	1	8	Distant CSM saw cutting heard for about 6 minutes. Peak noise was police sirens for about 3 minutes, which has influenced LAeq15min. Trace is general around 60dB with a 30 minute peak of around 63dB.
7/03/2020	22:30:00	WE36: Track slab T16, T17/18 and canopy load transfer P16/17	C	22	Chalmers Street	62	70	45	25	0	0	No LOR works heard. Peak noise is about a minute of sudden rain, and about 2 minutes of wheel squeaking from trams. Trace typically below 60dB. Note: measure not valid due to rain.
7/03/2020	13:02:00	Track slab construction on Platform 16, 17/18	A	22	Chalmers Street	66	70	56	14	0	0	. Key items include 5x excavators, concrete agitators, angle grinder and a cable puller. typical LAeq15min noise trace
8/03/2020	4:30:00	WE36: Track slab T16, T17/18 and canopy load transfer P16/17	C	22	Chalmers Street	67	70	45	25	0	0	No LOR works heard. Peak noise is heavy rain for about 7 minutes. Trace typically <60dB. Note: measure not valid due to rain.
9/03/2020	0:15:00	WE36: Track slab T16, T17/18 and canopy load transfer P16/17	C	22	Chalmers Street	73	70	45	25	0	3	Non LOR saw cutting heard close by on Chalmers street for 8 minutes. Other noises include sporadic plant reversing signal heard close by. Trace is generally below 65db, with two sharp peaks going over 70db.
9/03/2020	3:00:00	3 VENM/GSW truck and dog pick up	C	39	Regent Street	63	71	44	27	0	0	typical LAeq15min noise trace, one spike at time of measure. Vehicle passing on road, police siren, reverse squawker audible
11/03/2020	4:00:00	4 VENM/GSW truck and dog pick up	C	39	Regent Street	59	71	44	27	0	0	typical LAeq15min noise trace train wheel squeal audible, beeper suspected from road.
14/03/2020	22:45:00	WE37: NC- precast column install, rd. 8 canopy demo	C	31	Chalmers Street	61	55	45	10	0	6	Musical drumming heard close by on street for 5 minutes. Peak noise is about 2 and a half minutes of wheel squeak from passing trams. Trace typically <60dB.
14/03/2020	1:15:00	WK37: NC- precast column install, rd. 8 canopy demo	C	32	YHA	64	60	49	11	4	4	typical LAeq15min noise trace
15/03/2020	21:00:00	WE37: NC- precast column install, rd. 8 canopy demo	C	31	Chalmers Street	79	55	45	10	2	24	No LOR works heard. Peak noise is police siren driving close by for about a minute, and about 2 minutes of wheel squeak from trams. Trace typically <60dB.
15/03/2020	3:45:00	WK37: NC- precast column install, rd. 8 canopy demo	C	32	YHA	63	60	49	11	3	3	typical LAeq15min noise trace
19/03/2020	1:30:00	Metro Box Ventilation Extractors, excavation (breaking in exc with 1.5t breaker and hand breakers from time to time) behind hoarding P18/19	C	14	Chalmers Street	63	60	45	15	3	3	Distant saw cutting heard throughout whole 15 minute period. Peak noise is wheel squeak from trams for about 1 and a half minutes. Trace typically <60dB. Noise check in response to complaint. No exceedance of the best achievable noise performance objectives identified in the CNVIS. Exceedance does not change AMMs. (NML selected lower than background noise level).
20/03/2020	3:45:00	Metro Box Ventilation Extractors, excavation (breaking in exc with 1.5t breaker and hand breakers from time to time) behind hording P18/20	C	14	Chalmers Street	62	60	45	15	2	2	Metro box extractor sudden noises heard distantly and sporadically within the 15 minute period. Peak noise is wheel squeak from tram for about 15 seconds and slow vehicle moving close by for 40 seconds. Trace typically <60dB. Response to complaint. No exceedance of the best achievable noise performance objectives identified in the CNVIS. Exceedance does not change AMMs. (NML selected lower than background noise level).
21/03/2020	21:30:00	WE38- Canopy Demo P 8 &9, OS hoist install	C	31	Chalmers Street	61	55	45	10	0	6	No LOR works heard. Peak noise is about 2 minutes of wheel squeaking from trams. Other noise heard is people talking on the street. Trace typically <60dB. Response to complaint
22/03/2020	0:00:00	WE38- Canopy Demo P 8 &9, OS hoist install	C	31	Chalmers Street	61	55	45	10	6	6	No LOR works heard. Peak noise is about 30 seconds of wheel squeak from a tram and about a minute of a police siren. Trace typically <60dB. Response to complaint
24/03/2020	4:30:00	6 VENM/GSW truck and dog pick up	C	39	Regent Street	61	71	44	27	0	0	heavy rain audible, invalidated reading.

25/03/2020	3:30:00	Metro Box Ventilation Extractors, excavation (breaking in exc with 1.5t breaker and hand breakers from time to time) behind hording P16/17	C	14	Chalmers Street	62	60	45	15	2	2	Trace typically <60dB. Response to complaint, could not hear audio. Audio malfunction.
26/03/2020	21:45:00	Metro Box Ventilation Extractors, excavation (breaking in exc with 1.5t breaker and hand breakers from time to time) behind hording P16/17	C	14	Chalmers Street	65	60	45	15	5	5	Trace has a number of small peaks going up to around 65db every hour or so. Audio file malfunction.
27/03/2020	0:30:00	Prep work for Track slab weekend	C	18	Chalmers Street	63	70	45	25	0	0	Relatively steady trace reading, between around 60-64db. Audio malfunction.
28/03/2020	1:15:00	WE39- Track slabs P19/20	C	22	Chalmers Street	60	70	45	25	0	0	Trace typically <60dB. File failed to download
28/03/2020	9:30:00	Track slab construction 19/20	A	22	Chalmers Street	61	70	56	14	0	0	excavator, circular saw, hi rail pad
28/03/2020	14:47:00	Track slab construction 19/20	A	22	Chalmers Street	58	70	56	14	0	0	excavator, hand tools and hi rail pad.
29/03/2020	4:00:00	WE39- Track slabs P19/21	C	22	Chalmers Street	67	70	45	25	0	0	No LOR works heard. Peak noise is very heavy rain for about 9 minutes. Only discernible noise in 15 minute period is sound of rain. Trace is relatively steady, typically <63db, with the exception of the sharp peak to 67dB. Invalid measure due to rain.
31/03/2020	1:30:00	WE39-Track slabs P19/21	C	22	Chalmers Street	71	70	45	25	1	1	Some distant saw cutting heard for the duration of the 15 minute period. Peak noise was wheel squeal from trams, for 1min 15 seconds. Sound file incomplete, invalid reading. Trace generally below 65dB with one sharp peak above 70dB
31/03/2020	3:15:00	12 VENM/GSW truck and dog pick up	C	39	Regent Street	59	71	44	27	0	0	typical LAeq15min trace through out the morning shoulder period. 1 truck movement audible.

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)	Predicted Noise level as per OOH model and CNVIS	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments for data review
1/04/2020	1:00:00	WE40 (3/4-5/4) works Lee St	C	3	YHA	61.9	63	49	14	0	0	typical LAeq15min noise trace due to high LA Max event not associated with CSM works
1/04/2020	1:45:00	WE40 (3/4-5/4) works Lee St	C	3	YHA	62.3	63	49	14	0	0	typical LAeq15min noise trace
7/04/2020	15:32:00	LOR works: breaking stab sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site.	A	25	Dental Hospital	61.9	82	56	26	0	0	82dB predicted at external faced. Location: Dental Hospital ambulance bay; this is the entrance point for staff, and therefore an important point for communication as staff need to be asked questions regarding their exposure to coronavirus. Staff complained to us that when the works were loud it was affecting their ability to communicate. Note: Real time was 14:32, but the noise logger had not yet been adjusted for daylight savings ending.
7/04/2020	16:32:00	LOR works: breaking stab sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site.	A	25	Dental Hospital	62.3	82	56	26	0	0	Location: Dental Hospital level 1, in an open office space, on the south side of the building (closest to works). Staff complained that when works were louder earlier, they could feel vibrations and noise was disrupting communication. No vibrations were felt during this monitoring session, and works were barely audible. Note: Real time was 15:32, but the noise logger had not yet been adjusted for daylight savings ending.
8/04/2020	15:32:00	LOR works: breaking stab sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site.	A	25	Dental Hospital	64.8	82	56	26	0	0	Location: Dental Hospital ambulance bay; this is the entrance point for staff, and therefore an important point for communication as staff need to be asked questions regarding their exposure to coronavirus. Staff complained to us that when the works were loud it was affecting their ability to communicate. Note: Real time was 14:32, but the noise logger had not yet been adjusted for daylight savings ending.
8/04/2020	16:32:00	LOR works: breaking stab sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site.	A	25	Dental Hospital	78.7	82	56	26	0	0	Location: Dental Hospital level 1, in an open office space, on the south side of the building (closest to works). Staff complained that when works were louder earlier, they could feel vibrations and noise was disrupting communication. No vibrations were felt during this monitoring session, and works were barely audible. Note: Real time was 15:32, but the noise logger had not yet been adjusted for daylight savings ending.
9/04/2020	3:45:00	early morning VENM/GWS pick up (2 trucks)	C	39	Regent Street	61.9	71	44	27	0	0	Typical trace for morning shoulder period for 54 Regent St. siren audible bring up LAeq15min
10/04/2020	4:45:00	early morning VENM/GWS pick up (2 trucks)	C	39	Regent Street	61.9	71	44	27	0	0	Typical trace for morning shoulder period for 54 Regent St. motor bike passing on street.
14/04/2020	1:15:00	T21/22, canopy load transfer P22/23 NO LOR	C	18	YHA	64.8	73	49	24	0	0	Typical LAeq15min noise trace
15/04/2020	3:45:00	WE 42 (17/4-20/4) Possession- Track slab T21/22, canopy load transfer P22/23 NO LOR works around YHA	C	18	YHA	78.7	73	49	24	0	6	Typical LAeq15min noise trace due to high LA Max event not associated with CSM works
16/04/2020	1:45:00	drop of tower crane throughout the night and 8 truck and dogs	C	39	Regent Street	56.2	71	44	27	0	0	Typical trace for morning shoulder period for 54 Regent St. People being loud in either apartments or street.
16/04/2020	4:30:00	drop of tower crane throughout the night and 8 truck and dogs	C	39	Regent Street	60	71	44	27	0	0	Typical trace for morning shoulder period for 54 Regent St. Truck audible using bridge at start of measure
17/04/2020	4:45:00	drop of tower crane throughout the night and 8 truck and dogs	C	39	Regent Street	66.4	71	44	27	0	0	Typical trace for morning shoulder period for 54 Regent St. Truck audible using bridge at start of measure
18/04/2020	1:30:00	WE 42 (17/4-20/4) Possession- Track slab T21/22, canopy loads transfer P22/23	C	18	Chalmers Street	64.5	73	45	28	0	0	CSM saw cutting audible in distance
18/04/2020	1:15:00	WE 42 (17/4-20/4) Possession- Track slab T21/22, canopy loads transfer P22/24	C	18	Chalmers Street	63.1	73	45	28	0	0	No CSM works Audible except reverse squawker.
18/04/2020	1:45:00	WE 42 (17/4-20/4) Possession- Track slab T21/22, canopy loads transfer P22/25	C	18	Chalmers Street	64.5	73	45	28	0	0	No CSM works audible

18/04/2020	4:04:00	WE42 Track 21/22 slab construction. Cutting and dragging of rail observed.	A	18	Chalmers Street - recorded on the platform.	75.6	73	45	28	2	3	Recording undertaken on Platform 22 itself. Works were recorded while on the platform and not at the sensitive receiver to better understand the at source noise impact. Extrapolated
18/04/2020	2:00:00	WE42 Track 21/22 slab construction - cutting rail	A	18	Chalmers Street	64.5	73	45	28	0	0	Drilling noises are apparent. Saw cutting was very momentary in practice.
18/04/2020	1:45:00	WE42 Track 21/22 slab construction - cutting rail highly apparent.	A	18	Chalmers Street	64.4	73	45	28	0	0	Several saw cutting events are recorded. Other construction works also apparent in recording.
19/04/2020	2:30:00	WE42 (17/4-20/4) Possession- Track slab T21/22, canopy loads transfer P22/23	C	18	Chalmers Street	63.4	73	45	28	0	0	Reverse squawker audible, distant rare hammering
19/04/2020	3:30:00	WE42 (17/4-20/4) Track slab T21/22, canopy loads transfer P22/23	C	18	Chalmers Street	67.2	73	45	28	0	0	Saw cutting or leaf blowing audible close to microphone- very audible

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)	Predicted Noise level as per OOH Model or CNVIS	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments for data review
2/05/2020	6:00:00	WE44: Platform 18/19 releveling works - breakout of slab commenced.	C	18	Chalmers	62.2	70	45	25	0	0	No works audible
2/05/2020	7:00:00	WE44: Platform 18/19 releveling works - breakout of slab commenced.	C	18	Chalmers	66.4	70	45	25	0	0	No works audible.
2/05/2020	7:15:00	WE44: Platform 18/19 releveling works - breakout of slab commenced.	C	18	Chalmers	70.1	70	56	14	0	0	Lots of noise unrelated to construction works audible - i.e. birds (mynah) and passing trains and light rail. Cutting noise and vehicle movements only audible towards the end of the works.
9/05/2020	4:00:00	WE45: Platform 16/17 releveling works: saw cutting consistent.	C	18	Chalmers	57.6	70	45	25	0	0	Saw cutting audible from beginning of recording. Consistent noise, and not impulsive.
14/05/2020	10:37:00	Breaking at East Entrance using smaller exc, loading our spoil	A	25	Randle Lane	52.5	75	56	19	0	0	U404/1-5 Randle Lane- Internal noise level. Complies with E38.
14/05/2020	10:57:00	Breaking at East Entrance using smaller exc, loading our spoil	A	25	Randle Lane	75	75	56	19	0	0	U404/1-5 Randle Lane- External noise level. All IAMM's in place for high noise affected receivers.
16/05/2020	0:00:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	59.8	70	45	25	0	0	No CSM works at time of measure. Train/LR movements influencing LAeq15min reading from ~50dB to 60dB if there is 1 or 2 LR movements.
16/05/2020	0:35:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	37	YHA	52.1	70	49	21	0	0	Timber saw and or drill, hand held impact driver intermittently audible from P1 VIP entrance heritage protection installation.
16/05/2020	1:45:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	58.1	70	45	25	0	0	No CSM works audible. Station announcements every 2 mins or so, pedestrian crossing beeping. Noisy works commence and are audible, however only increasing instantaneous by 1-2dB. General background level ~50dB. SLR increases LAeq15min by ~10dB. No wheel squeal audible.
16/05/2020	2:00:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	57.9	70	45	25	0	0	CSM works audible.
16/05/2020	2:15:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	50.6	70	45	25	0	0	CSM works audible.

16/05/2020	2:30:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	57.8	70	45	25	0	0	CSM works audible.
16/05/2020	2:42:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St (measured at P18/19)	76.7	70	45	25	7	7	P18/19, sweeper operating on P18/19, saw cutting behind hoarding on P16/17, rattle guns and hammers removing hoarding. At 2.5min in to measure saw starts up again. 20dB difference. (this is the noise level at the façade of Chalmers anticipated when doing works on P22/23) noise on Chalmers from P22/23 would be = 76.6-
16/05/2020	3:16:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	37	YHA	51.8	70	49	21	0	0	Saw cutting barely audible and not increasing dB.
16/05/2020	4:12:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St (measured at P22/23)	71.7	70	45	25	2	2	P22/23- most direct line of sight selected for monitoring works on P16/17. (Assumed to be ~67dB on Chalmers). Multiple plant and saws operating simultaneously. Noise on Chalmers from P16/17= 72-20log(88/52)= 67dB (59dB at real time logger) Noise on Chalmers from P22/23 would be = 72-20log(37/52)= 75dB
16/05/2020	4:27:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St (measured at P22/23)	65.8	70	45	25	0	0	P22/23- most direct line of sight selected for monitoring works on P16/17. (Assumed to be ~59.8dB on Chalmers).
16/05/2020	4:42:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St (measured at P22/23)	66.6	70	45	25	0	0	P22/23- most direct line of sight selected for monitoring works on P16/17. (Assumed to be ~61.6dB on Chalmers).
16/05/2020	5:02:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St	58.9	70	45	25	0	0	Measure on Chalmers- works audible.
16/05/2020	5:26:00	WE46 P16/17 resurfacing works. Saw cutting using road saw, 4x wall saws and petrol saw. Noise blankets in place. Northern Concourse works include setting up heritage fabric protection and installing temporary work platform/canopy at the southern façade of the station masters building	A	18	Chalmers St (measured at P18/19)	74.8	70	45	25	5	5	Measure from P18/19 direct line of sight. Wall saw loudest when not under load. Possibly some rebound noise from hoarding. Wall saw below platform level reducing line of sight to sensitive receiver. Real time noise logger shows 60dB on Chalmers St. Noise on Chalmers from P22/23= 75-20log(37/15)= 67 +5dB= 72dB
19/05/2020	3:00:00	Old platform wall break out P22/23	C	18	Chalmers St	65.5	81	45	36	0	0	CSM jack hammer audible from Chalmers St, however an unaccounted noise (continuous hum that sounds like it is moving towards and away from logger on Chalmers St)
20/05/2020	1:30:00	Old platform wall break out P22/23	C	18	Chalmers St	66	81	45	36	0	0	CSM jack hammer audible from Chalmers St, however an unaccounted noise (continuous hum that sounds like it is moving towards and away from logger on Chalmers St)
20/05/2020	2:00:00	Old platform wall break out P22/23	C	18	Chalmers St	66.3	81	45	36	0	0	CSM jack hammer audible from Chalmers St, however an unaccounted noise (continuous hum that sounds like it is moving towards and away from logger on Chalmers St)
20/05/2020	3:00:00	Old platform wall break out P22/23	C	18	Chalmers St	65.5	81	45	36	0	0	CSM jack hammer audible from Chalmers St, however an unaccounted noise (continuous hum that sounds like it is moving towards and away from logger on Chalmers St)

20/05/2020	7:30:00	Eastern Entrance (EE) breaking out n/w corner	C	25	Chalmers St	80.4	81	56	25	0	0	NCR raised due to starting HN prior to 08:00 EPL (L4.5)-issued to EPA Compliant with CoA E46 rock breaking and other particularly annoying activities are permitted within standard construction hours only.
20/05/2020	14:25:00	Eastern Entrance (EE) loading out material into trucks on Randle Lane (inaudible).	A	25	Chalmers St	49.7	81	56	25	0	0	Attended monitoring location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works).
20/05/2020	14:40:00	Eastern Entrance (EE) loading out material into trucks on Randle Lane (inaudible).	A	25	Chalmers St	49.3	81	56	25	0	0	Attended monitoring location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works).
20/05/2020	15:52:00	Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works.	A	25	Chalmers St	61.8	81	56	25	0	0	Attended monitoring location: Sydney Dental Hospital level 1 occupied meeting room on the south side of the building (closest to works). All works noise was ground borne vibration, which creates noise from the room's furniture. Meeting room contained a staff meeting, which is inferred to accounted for about +4dB when compared to subsequent monitoring in adjacent empty room.
20/05/2020	16:07:00	Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works.	A	25	Chalmers St	58.2	81	56	25	0	0	Attended monitoring location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works). All works noise was ground borne vibration.
21/05/2020	9:50:00	Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works, at shale level.	A	25	Chalmers St	56	81	56	25	0	0	Attended monitoring location: Sydney Dental Hospital level 1 unoccupied meeting room on the south side of the building (closest to works). All works noise was ground borne vibration.
21/05/2020	10:10:00	Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works, at shale level.	A	25	Chalmers St	70.6	71	56	15	0	0	Attended monitoring location: Sydney Dental Hospital ground floor ambulance bay on the south side of the building (closest to works). Works noise clearly heard, as it was very close by. Location of monitoring was requested by Dental Hospital staff as noise affects the supervisor of that entrance.
22/05/2020	10:45:00	Eastern Entrance (EE) breaking with the smaller 8t exc northern (Dental Hospital) side of works, at shale level.	A	25	Chalmers St	45.6	71	56	15	0	0	vibration from hammer audible from time to time but faint. Instantaneous measure is low, and not affected by breaking activity. Aircon audible and dominant noise source.
25/05/2020	13:30:00	23t exc working at Eastern Entrance	C	25	Chalmers St	76.4	70	56	14	2	6	<ul style="list-style-type: none"> • 25/05 the noise level was elevated above 71.8dB between 12:45 and 14:00. • Within the above period, the highest recorded noise level for the day was 76.4dB @ 13:45. • Conservatively this is the only period that would be above the criteria set by CoA E38. 26 periods (6.5hrs) permissible >60dB • At U4/1-5 Randle Lane the internal noise level would have unattended noise measure inside uninhabited room within the dental hospital representative of habitable areas. Highest period recorded was 57.9dB
25/05/2020	11:54:00	23t exc working at Eastern Entrance	C	25	Chalmers	57.9	81	56	25	0	0	
25/05/2020	4:00:00	As per site delivery schedule	C	39a and b	54 Regent St	60.9	70	44	26	0	0	Typical noise trace observed for the morning shoulder period at 54 Regent St.
26/05/2020	5:15:00	As per site delivery schedule	C	39a and b	54 Regent St	60.9	70	45	25	0	0	Typical noise trace observed for the morning shoulder period at 54 Regent St.

26/05/2020	23:30:00 AM	breaking on P16/17 as part of releveling works	C	18	Chalmers	61.5	70	45	25	0	0	Time stamp of continuous real time noise monitor checked to correlate to time of complaint. SLR very audible when in operation (some wheel squeal), Train Station audible in background, birds in close proximity to logger audible when no other operations can be heard. Jackhammering commences 8:52mins into measure. Jackhammering faint and distant (~90% magnitude contribution). Continues for the duration of the rest of the measure (6mins) on and off and WHEN is on occasion masked by SLR movements.
27/05/2020	9:43:00	large 23t excavator breaking concrete above eastern capping beam	A	25	Randle Lane	45.4	70	56	14	0	0	U404/1-5 Randle Lane. This time balcony closed completely. Some ground borne noise perceived towards the measure from prolonged breaking. External real time noise logger: 09:30 was 76.6dB 09:45 was 77.5dB 10:00 was 76.6 dB therefore ~32.1dB noise attenuation.
29/05/2020	3:00:00	breaking on P16/17 as part of releveling works- CSR cable pulling, Concourse general works	C	18	YHA	76.7	70	49	21	0	7	Pressure release, train horn, no works audible
29/05/2020	0:30:00	breaking on P16/17 as part of releveling works	C	18	Chalmers	68.1	70	45	25	0	0	Wheel squeal audible, electric hand tool audible in close proximity to logger
29/05/2020	3:00:00	breaking on P16/17 as part of releveling works	C	18	Chalmers	65.7	70	45	25	0	0	hand tool in close proximity to logger
29/05/2020	3:00:00	breaking on P16/17 as part of releveling works- CSR cable pulling, Concourse general works	C	18	Regent	59.5	70	44	26	0	0	reverse squawker, in distance, maybe on road, train squeal

Date	Time	LOR Works (potentially noisy as per diary entry)	Continous Real Time or Attended (C or A)	CNVIS SCN	Sensitive Receiver	Observed LAeq15min (dB)	Predicted Noise level as per CNVIS	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments for data review
2/06/2020	1:30:00	P16/17 breaking 2m below top of platform using 3t exc	C	18	Chalmers St	67	60	45	15	0	7	petrol powered high pressure gurney audible. No CSM works audible, wheel squeal audible
2/06/2020	1:30:00	LOR Truck movements.	C	39	54 Regent St	71	71	44	27	0	0	unknown noise source audible - unrelated to construction works or vehicle movements.
2/06/2020	5:45:00	LOR Truck movements.	C	39	54 Regent St	62	71	44	27	0	0	Road noise, UHF radio, reverse beeper, train, truck using bridge at end of measure.
3/06/2020	3:45:00	P16/17 wall saw using 3t exc	C	18	Chalmers St	69	60	45	15	0	9	works sound like they are occurring on Chalmers St. No CSM works on Chalmers. No CSM works audible.
6/06/2020	3:30:00	WE49 Possession- Northern Concourse glass canopy demo, exc of upper escalator pit. Note: Interface with works occurring at Mortuary sidings.	C	34	YHA	63	60	49	11	0	3	Air release from train, typically very quiet. No CSM works audible.
10/06/2020	3:45:00	LOR Truck movements	C	39	54 Regent St	69	71	44	27	0	0	very loud noise, - not attributed to construction works due to irregular nature of the noise.
12/06/2020	1:45:00	unloading hirail delivery to P22	C	18	Chalmers St	65	60	45	15	5	5	SLR audible, some breaking- very faint and in the background. Reverse squawker, faint sound of work men, sound of unloading hirail truck (conservative check in terms of adjusted calculation). No exceedance of the best achievable noise performance objectives identified in the CNVIS. Exceedance does not change AMMs. (NML
12/06/2020	2:00:00	unloading hirail delivery to P23	C	18	Chalmers St	64	60	45	15	4	4	Check in response to complaint. SLR passing by, unloading hirail truck. No exceedance of the best achievable noise performance objectives identified in the CNVIS. Exceedance does not change AMMs. (NML selected lower than background noise level).
13/06/2020	2:15:00	WE50 Possession- Northern Concourse works, sandstone remediation, FRP escalator pit	C	37	YHA	69	60	49	11	0	9	No CSM works audible, train idling most of measure, then moves away.
13/06/2020	0:30:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	61	60	45	15	0	1	Check in response to complaint. Peak of LAeq15min noise trace selected although low and flat trace hovering around 60dB. Activities included saw cutting and hammering on P16-17. LAeq15min below predictions. All appropriate AMM's in place. No CSM works audible
14/06/2020	0:30:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	63	60	45	15	0	3	No complaint- comparison check to complaint on 13/06/20. wheel squeal and SLR movement and seagulls audible. As observed WE36 night shift, 1 SLR movement increases LAeq15min by 5dB NO CSM works audible.

14/06/2020	1:00:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	64	60	45	15	0	4	No complaint- comparison check to complaint on 13/06/20. wheel squeal and SLR movement and seagulls audible. As observed WE36 night shift, 1 SLR movement increases LAeq15min by 5dB NO CSM works audible.
14/06/2020	21:30:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	64	60	45	15	0	4	Check in response to complaint. Peak of LAeq15min noise trace selected. activities included saw cutting and hammering on P16-17. LAeq15min below predictions. All appropriate AMM's in place.
15/06/2020	0:30:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	63	60	45	15	0	3	NO CSM works audible.
15/06/2020	20:45:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	62	60	45	15	0	2	Check in response to complaint. Peak of the evening/night trace selected to be conservative. No CSM works audible. Elevated LAeq15min period due to emergency service sirens. Typical trace below 65dB.
16/06/2020	2:45:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	67	60	45	15	0	7	Check of peak in noise trace. Faint distant drilling heard may be associated with CSM, short duration. Suspected cleaning works by ST on P22/23 typical for short duration every Tuesday for the last 6 weeks.
18/06/2020	21:45:00	General works within the suburban platforms.	C	18	Chalmers St	66	73	45	28	0	0	Response to complaint. No construction work audible.
20/06/2020	1:15:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	Chalmers St	66	73	45	28	0	0	Response to complaint. SLR audible- multiple movements, cars beeping, distant wheel squeal, distant siren, NO construction work audible.
20/06/2020	3:30:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	YHA	64	73	49	24	0	0	spike in noise trace. No CSM works Audible.
21/06/2020	4:00:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	YHA	55	73	49	24	0	0	heavy rain- measure invalid
21/06/2020	1:30:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	Chalmers St	66	73	45	28	0	0	Response to complaint. SLR audible- multiple movements, very loud wheel squeal No construction work audible.
21/06/2020	2:15:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	Chalmers St	64	73	45	28	0	0	Response to complaint. Loud train or LR. No construction work audible.
21/06/2020	3:30:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	Chalmers St	66	73	45	28	0	0	Response to complaint. Road sweeper on Chalmers No construction work audible.
22/06/2020	1:15:00	WE51- P20/21 releveling prep work General ST maintenance work.	C	18	Chalmers St	65	73	45	28	0	0	trolley on Chalmers, SLR audible. No CSM works audible.

27/06/2020	1:00:00	WE52 Possession- Northern Concourse; precast install, canopy demo, install escalator pit struts ST maintenance works	C	32	Chalmers St	64	60	45	15	0	4	Construction works are barely audible in the noise file. Some maintenance works can be heard as short abrupt bursts of noise - but barely.
30/06/2020	1:15:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	67	70	45	25	0	0	Wheel Squeal. In the back ground, constant sound of pump or pressure hose
30/06/2020	2:45:00	included saw cutting and hammering within hoarding, below ground level on P16-17.	C	18	Chalmers St	70	70	45	25	0	0	loud blower or air pressure hose street sweeper

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)	Predicted Noise level as per OOHW Model or CNVIS	RBL for Sensitive Receiver (or NML)	Predicted Exceedance as per OOH for particular activity RBL (or NML)	Exceedance of Predicted OOH (adjusted)	Exceedance of Predicted OOH (non-adjusted)	Comments
1/07/2020	3:00:00	LOR Works - Suburban platform works from within hoarding. Adjustments to hoarding audible (occasional banging and dropping of material at heights).	C	18	Chalmers St	73	70	45	25	0	3	Exceedance investigated. Banging of materials audible. Light rail movements highly noisy. Heavy vehicle noise - on Chalmers street. Vehicle parked up and revving near microphone - unrelated to CSM.
3/07/2020	3:45:00	OSOM vehicle departure from SYAB (Escalators) - inbound	C	39	Regent St	55	71	44	27	0	0	Excavator movements audible.
3/07/2020	5:45:00	OSOM vehicle departure from SYAB (Escalators) - outgoing	C	39	Regent St	61	71	44	27	0	0	Construction within CSM slightly audible. Screeching of trains highly apparent.
5/07/2020	1:45:00	WE01: Escalator install in the NC	C	32	Chalmers St	62	65	45	20	0	0	Light rail and rail ops audible. CSW works occurring but inaudible.
5/07/2020	2:15:00	WE01: Escalator install in the NC	C	32	Chalmers St	60	65	45	20	0	0	Largely inaudible works due to the distance from the NC.
5/07/2020	2:00:00	WE01: Escalator install in the NC. Crane operation audible.	C	32	YHA	60	65	49	16	0	0	Non CSM related works predominantly audible.
7/07/2020	1:25:00	LOR: Sewer relocation works in EE.	A	25	Chalmers St	66	75	45	30	0	0	Light rail dominant noise source. Works largely inaudible.
7/07/2020	5:30:00	LOR Works - Suburban platform works i.e. - hammering, excavation.	C	18	Chalmers St	63	70	45	25	0	0	Hammering from within hoardings is audible Light rail and train screeching also highly audible.
11/07/2020	4:45:00	Suburban Platform works.	C	18	Chalmers St	59	70	45	25	0	0	Construction works inaudible over ambient noise.
15/07/2020	5:00:00	LOR Works - Suburban platform works i.e. - excavation.	C	18	Chalmers St	61	70	45	25	0	0	construction works barely audible over ambient noise including trains and light rail.
17/07/2020	23:15:00 PM	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	62	70	45	25	0	0	Light rail and rail ops audible. No CSM WORKS OCCURING

18/07/2020	2:00:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	32	YHA	54	65	49	16	0	0	Breaking behind hoarding p22/23, extraction vent also audible. Noise mat set up p18/19 and hoarding removal using hammers.
18/07/2020	2:15:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	C	20	Chalmers St	65	70	45	25	0	0	drilling audible. Light rail movements consistent. Hammering occurring intermittently. Saw cutting is barely audible.
18/07/2020	2:40:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	60	70	45	25	0	0	Hammering to remove hoarding (extrapolated from measure on P22/23)
18/07/2020	3:00:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	63	70	45	25	0	0	Hammering to remove hoarding (extrapolated from measure on P22/23)
18/07/2020	3:30:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	58	70	45	25	0	0	No works audible
18/07/2020	3:45:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	58	70	45	25	0	0	No works audible
18/07/2020	4:15:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	59	70	45	25	0	0	No works audible
18/07/2020	5:20:00	WE03 Possession: NC: Structural steel install. CW: Platform 18/19 releveling works.	A	20	Chalmers St	68	70	45	25	0	0	Saw cutting behind hoarding. Announcements and other station operations are dominant noise source. Once train moved 10mins in to measure, Measured from P22/23. instantaneous measure increased by 3dB to 75.dB. LAeq15min 75.1dB. 68dB extrapolated from measure.
21/07/2020	22:00:00	P22/23-wall clean prep for shotcrete (breaking) P20/21- coring P18/19- tactile install/maintenance P16/17- general works behind hoarding	C	20	Chalmers St	68	70	45	25	0	0	LOR works audible, however peak noise would be light rail wheel squeal and station operations. Appropriate AMM's in place. Best achievable noise objectives as described in the CNVIS achieved. Note: prediction of 60dB < L90 of 62.1dB.
21/07/2020	22:15:00	P22/23-wall clean prep for shotcrete (breaking) P20/21- coring P18/19- tactile install/maintenance P16/17- general works behind hoarding	C	20	Chalmers St	66	70	45	25	0	0	LOR works audible from time to time, however peak noise would be light rail wheel squeal and station operations. Appropriate AMM's in place. Best achievable noise objectives as described in the CNVIS achieved.
22/07/2020	0:15:00	P22/23-wall clean prep for shotcrete (breaking) P20/21- coring P18/19- tactile install/maintenance P16/17- general works behind hoarding	C	20	Chalmers St	66	70	45	25	0	0	Distant LOR works may be audible from time to time, rail movement audible. Appropriate AMM's in place. Best achievable noise objectives as described in the CNVIS achieved.
22/07/2020	2:45:00	P22/23-wall clean prep for shotcrete (breaking) P20/21- coring P18/19- tactile install/maintenance P16/17- general works behind hoarding	C	20	Chalmers St	71	70	45	25	0	1	Distant LOR works may be audible from time to time, rail movement audible. Appropriate AMM's in place. Best achievable noise objectives as described in the CNVIS achieved.

23/07/2020	5:30:00	LOR Works - Suburban platform works i.e. - excavation and material unloading. Grinding/saw cutting from within hoarding.	C	18	Chalmers St	65	70	45	25	0	0	Light rail is highly apparent. Some grinding noise from CSM is audible but is masked by light rail.
24/07/2020	15:15:00	LOR works Eastern Entrance day works	C	26	Chalmers St	68	70	56	14	0	0	E38b check- 44/39. HN penalty removed.
24/07/2020	17:30:00	LOR works Eastern Entrance day works	C	26	Chalmers St	67	70	56	14	0	0	E38b check- 44/39
24/07/2020	3:00:00	LOR Works - Suburban platform works i.e. - excavation and material unloading. Grinding/saw cutting from within hoarding.	C	18	Chalmers St	67	70	45	25	0	0	Suburban track works inaudible. Only MB Air ventilation system audible.
25/07/2020	18:45:00	LOR works Eastern Entrance day works	C	26	Chalmers St	65	70	45	25	0	0	E38b check- 44/39
25/07/2020	7:45:00	WE04: NC - Breakout of column. Saw cutting and trenching ongoing.	C	32	YHA	61	65	59	6	0	0	No construction works audible in recording. Lots of noise from Cockatoos and other birds. Trains also operational and contributing to noise readings.
25/07/2020	8:45:00	WE04: NC - Breakout of column. Saw cutting and trenching ongoing.	C	32	Chalmers St	70	65	56	9	0	5	Drilling audible (rattle gun). Also highly apparent is the light rail (every 2 mins) - may account for spike.
31/07/2020	15:00:00	LOR works Eastern Entrance day works	C	26	Chalmers St	76	70	56	14	1	6	E38b check- 50/39 and E38a 6/26. Peak period checked. High noise included, however high noise only applies to peaks.



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.

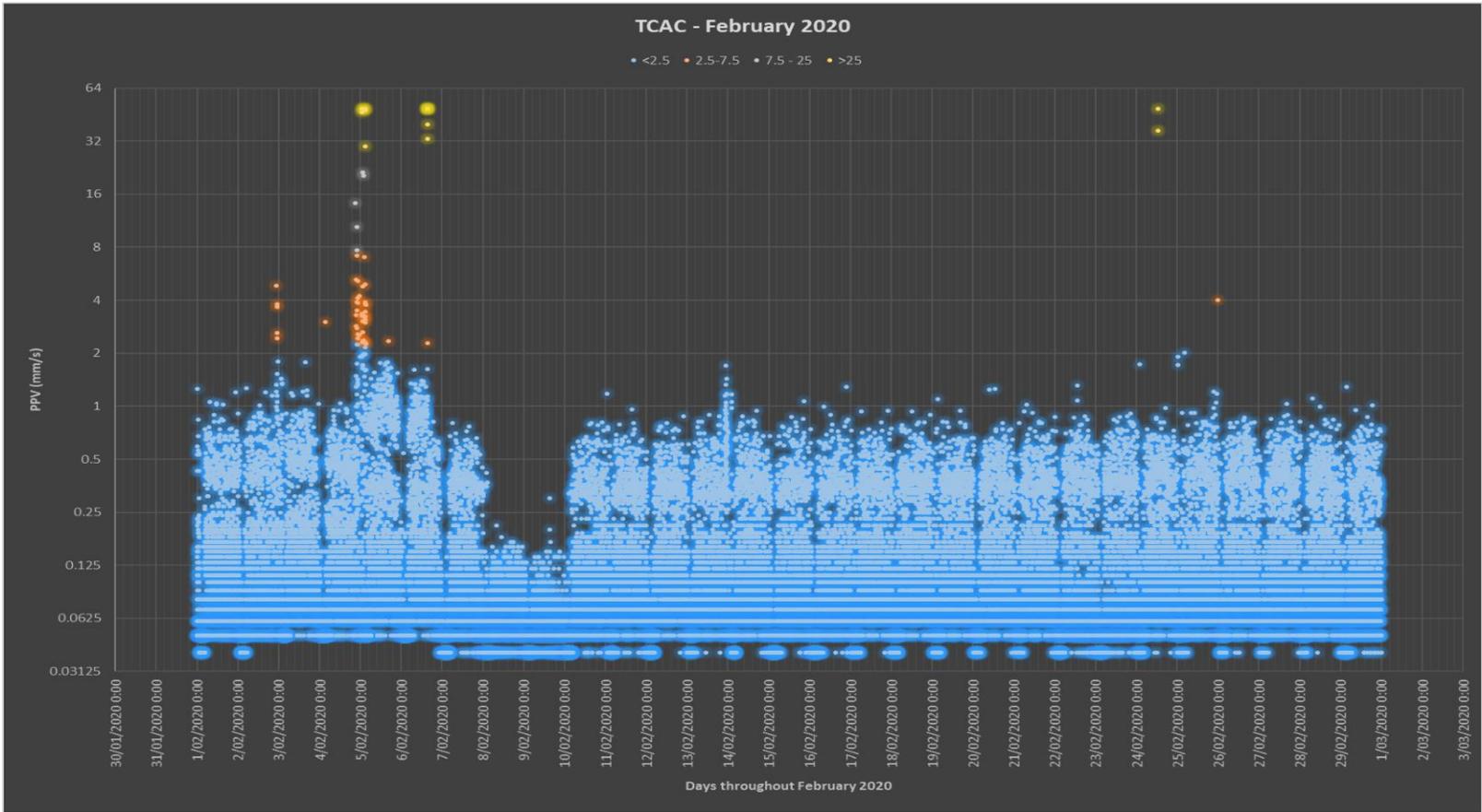


Figure B-1 TCAC - February 2020: Key activities in the vicinity of the Northern Concourse included the demolition of the Olympic tunnel stairs and existing platform structures, the removal of the canopy and construction of the Northern Concourse ground slabs and walls. There were a few isolated events where detected vibration exceeded the screening criteria for structural damage to buildings. These peaks in vibration occurred on the 5th, 6th and 24th of February 2020. It is likely that the observed peaks in vibration are attributed to non-construction related sources including foot traffic or workers bumping the geophone due, due to the discontinuous nature of the detected peaks, as well as the time that they occurred (midnight).

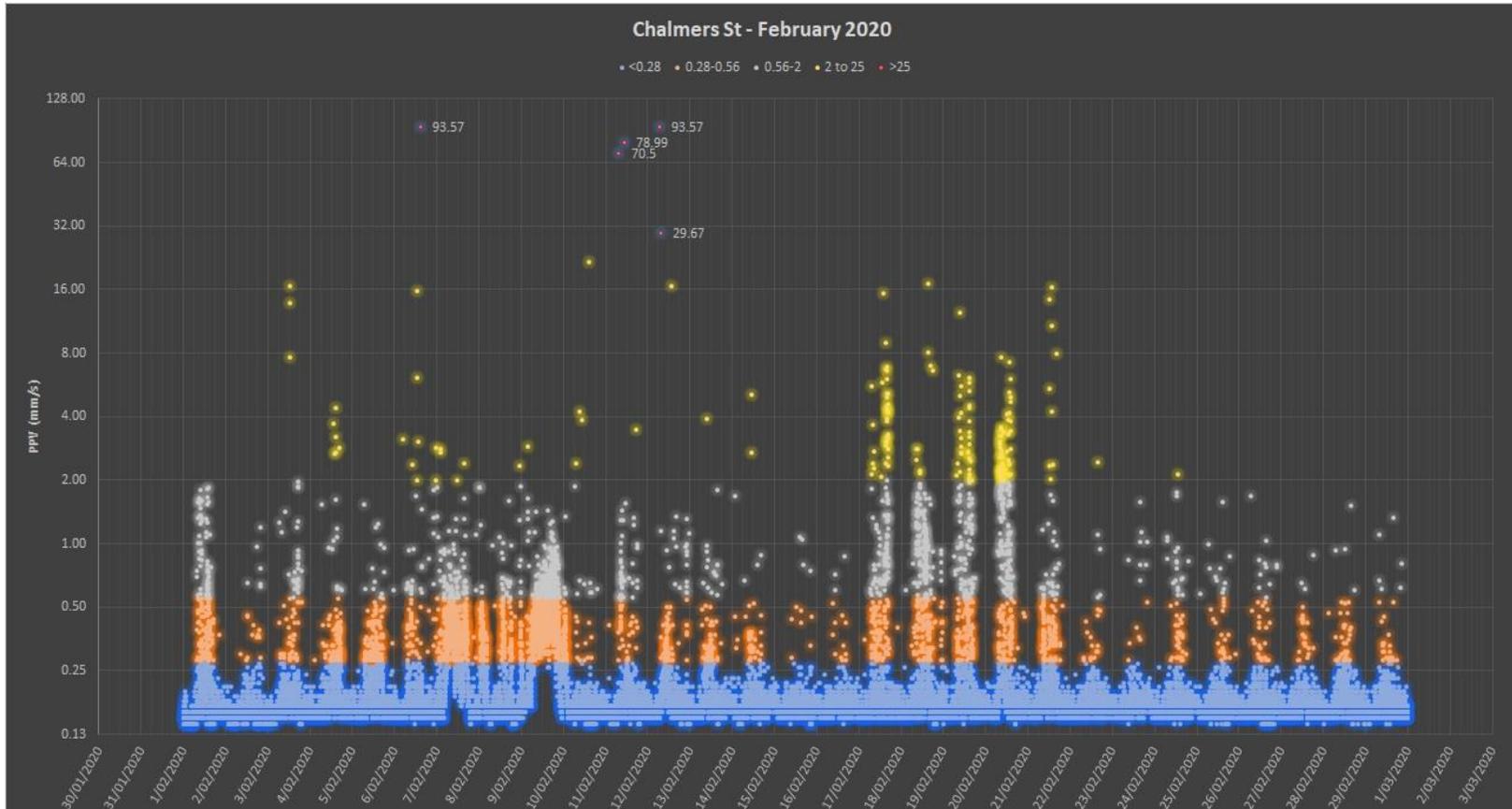


Figure B-2 Chalmers Street – February 2020: Key activities for the month included pile breakout and some minor excavation. The majority of data points fall below 2mm/s, and all but 5 individual data points record vibration greater than the structural damage screening criteria, implying these are localised events and therefore likely due to bumps of the geophone by construction personnel.

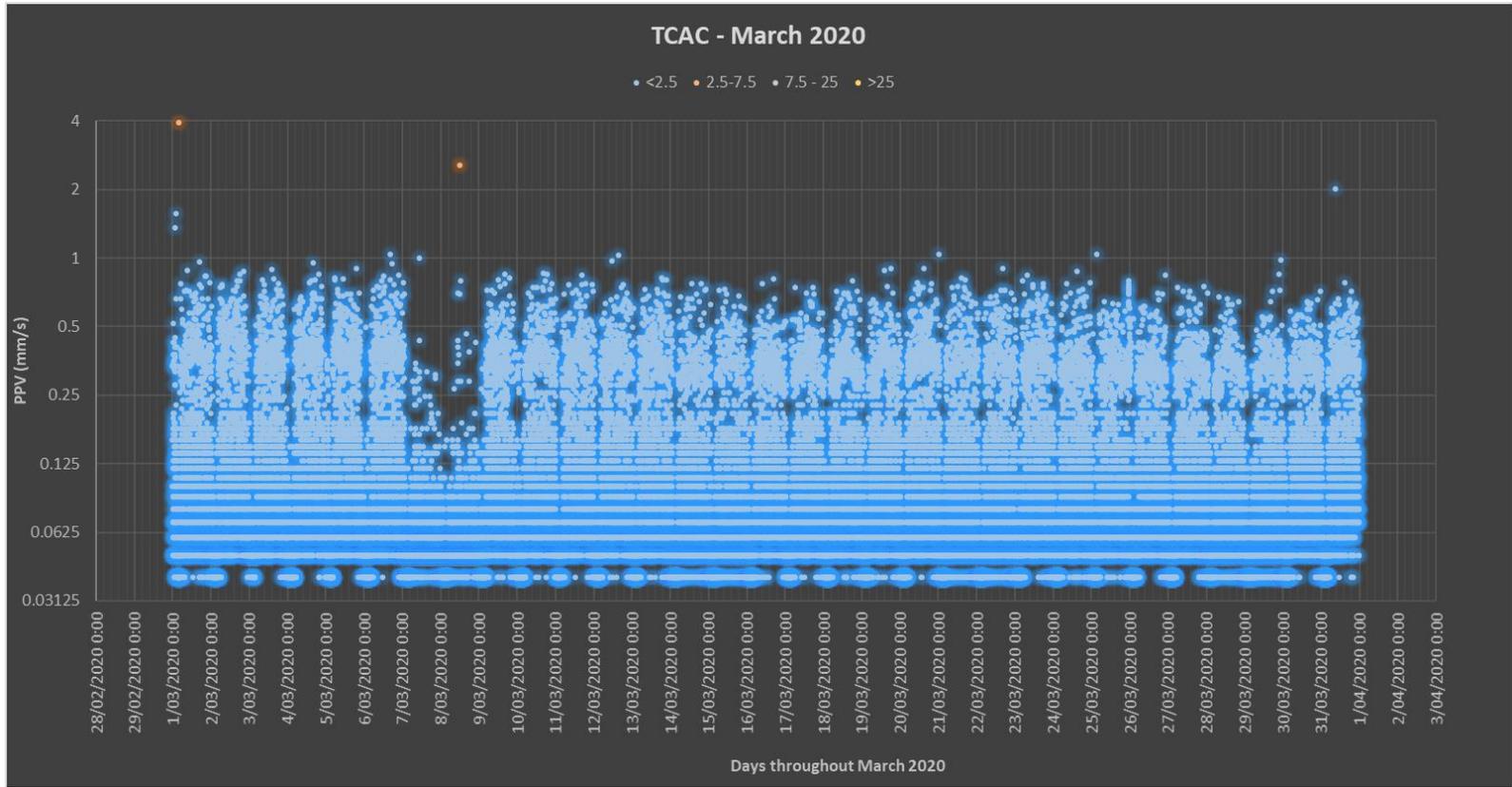


Figure B-3 TCAC - March 2020: Key activities within the Northern Concourse and surrounds included scaffold erection around TCAC, Construction of CENA 140 room, demolition of the Olympic tunnel stairs and installation of columns and arches. All vibration points were <5mm/s, which is considerably lower than the screening criteria for structural damage.

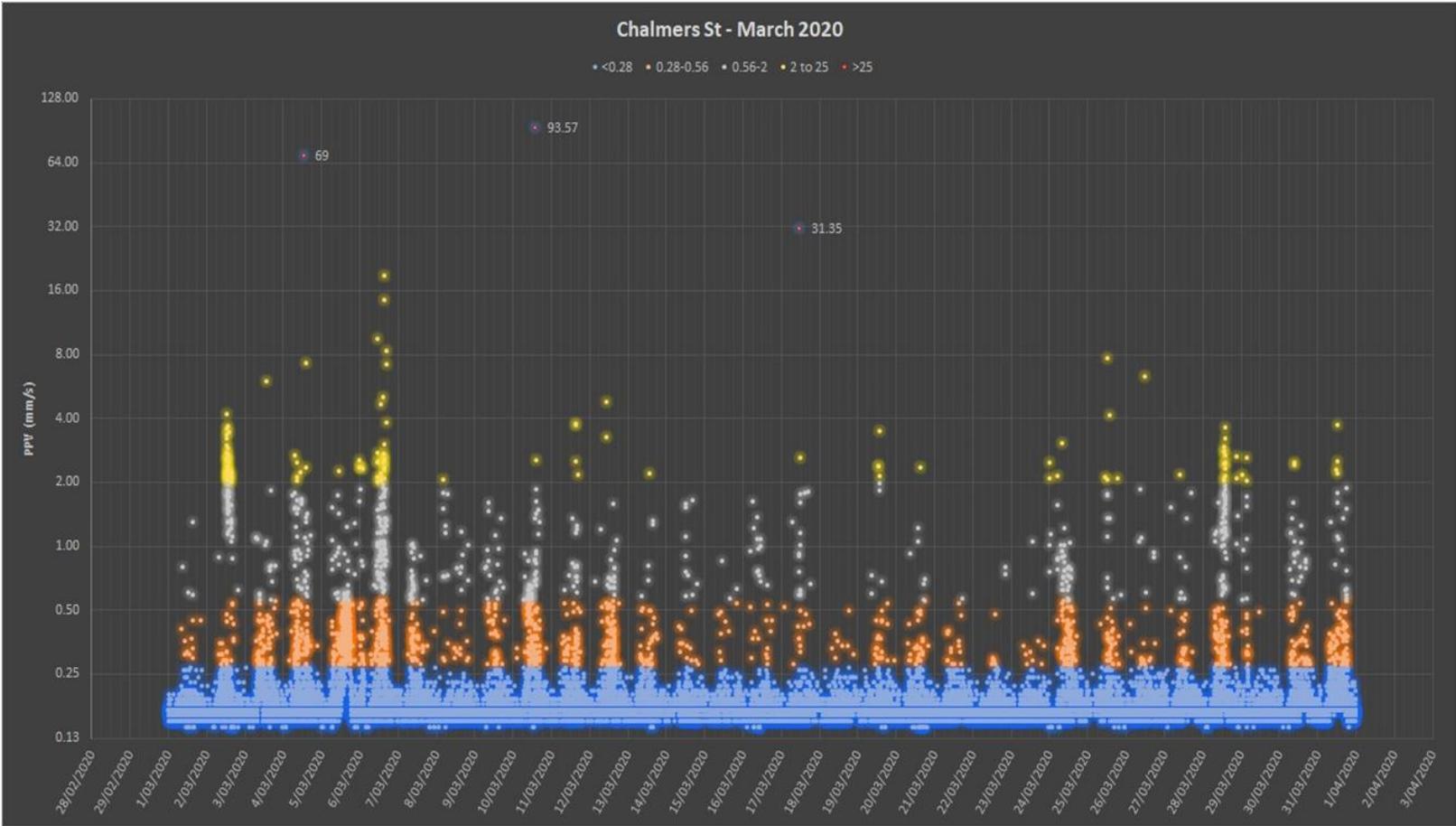


Figure B-4 Chalmers Street – March 2020: Activities throughout March included pile breakout, earth works and stabilised sand breakout. A total of three individual data points recorded vibration greater than 25mm/s. Given the isolated nature of these three recordings, these peaks in vibration suggests that they were caused by localised bumps of the geophone and not construction related works.

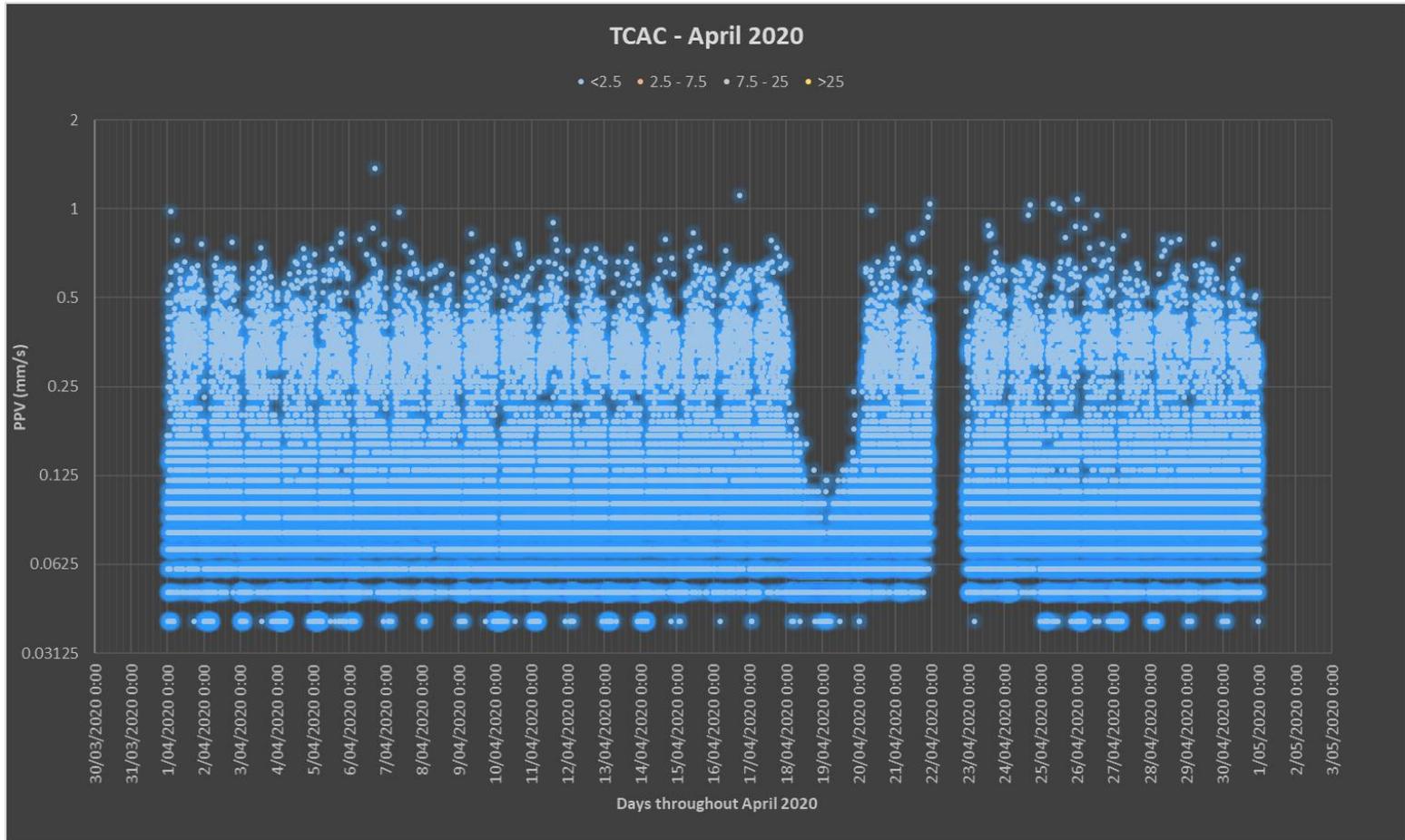


Figure B-5 TCAC – April 2020: Key activities within the Northern Concourse and surrounds includes the construction of ground slabs and walls, installation of columns and arches, as well as demolition and removal of any existing canopy. All vibration data points for the period of April were below 2.5mm/s and therefore within the screening criteria for structural damage. There is however a data gap on the 22nd April (Wednesday) – this would be attributed to a power outage.

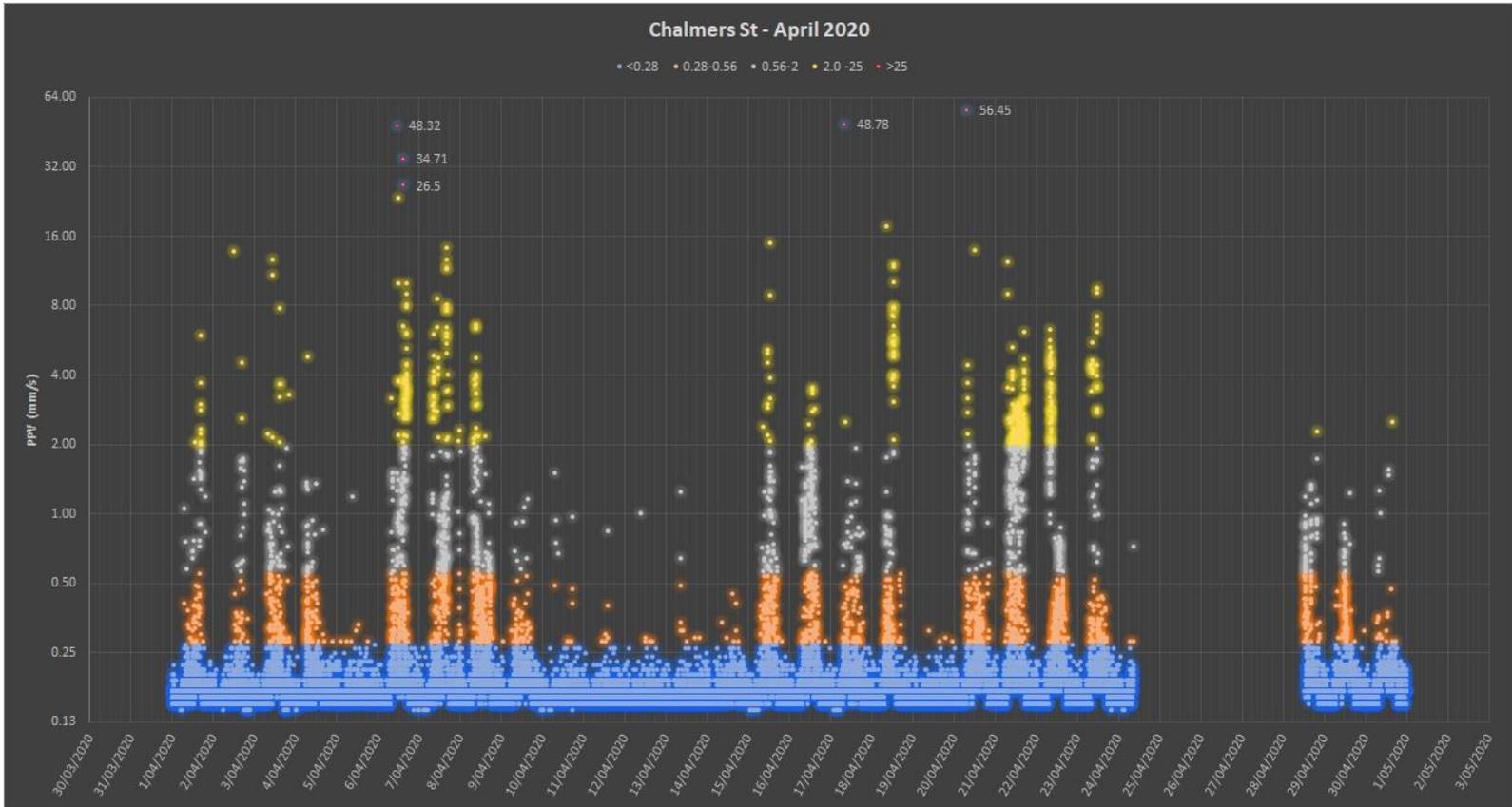


Figure B-6 Chalmers Street – April 2020: Key activities for April 2020 comprised of excavation including the use of jackhammers and excavators with hammer extensions for pile detailing. There was a noticeable data gap between April 25th and 28th – likely due to a power outage to the site. Note – both the 25th and 26th of April were a weekend. A total of 5 data points recorded vibration > 25mm/s. Given the isolated nature of these events, these peaks in vibration are likely attributed to a localised, transient event such as a bump of the geophone by construction personnel or foot traffic.

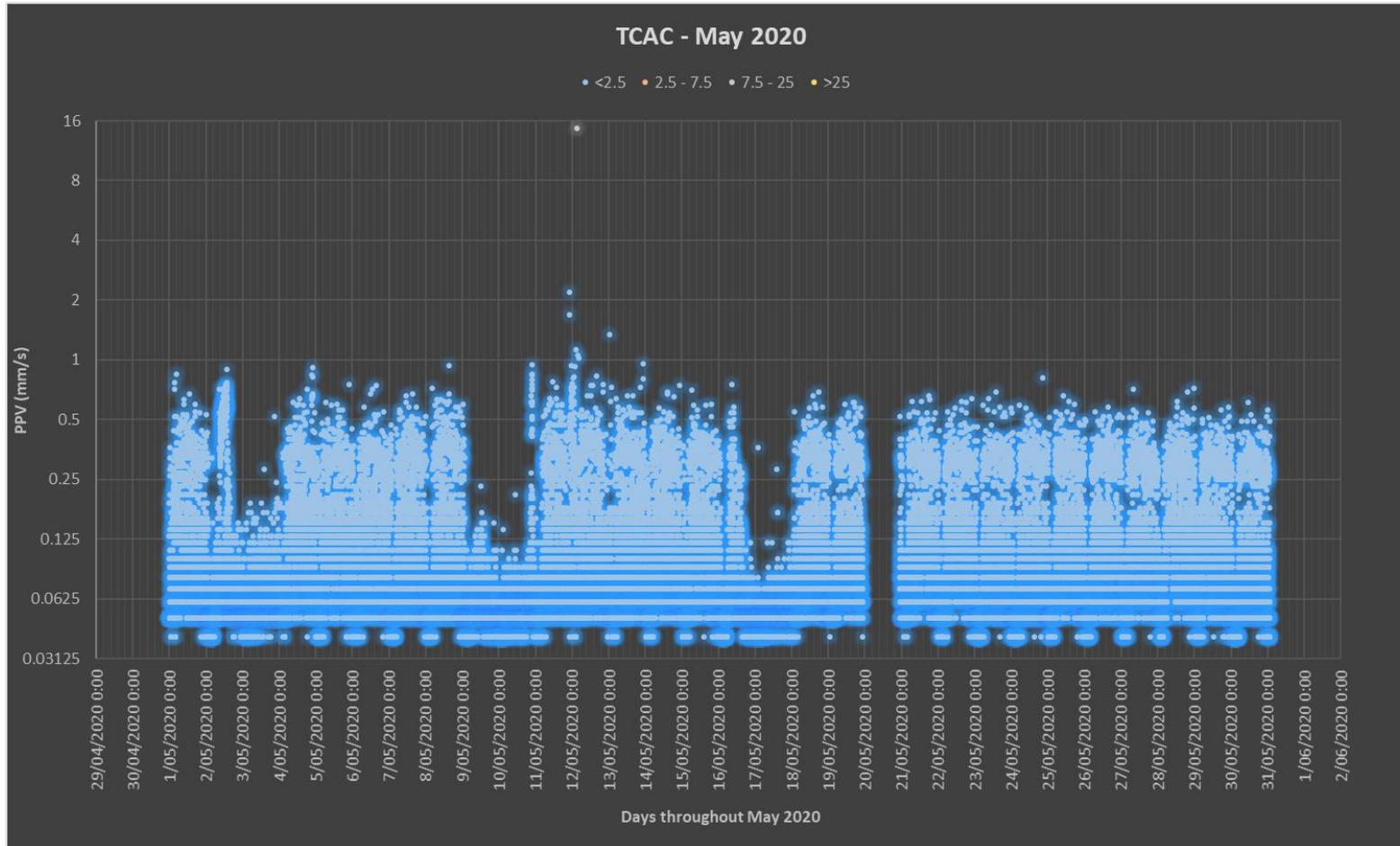


Figure B-7 TCAC – May 2020: Key activities in the Northern Concourse and surrounds included the installation of beams to the TCAC roof, installation of precast columns and service investigations in the lower Northern Concourse. All vibration measurements taken for the period of May 2020 were below the structural damage criteria of 25mm/s. Only one event recorded vibration greater than 7.5mm/s.

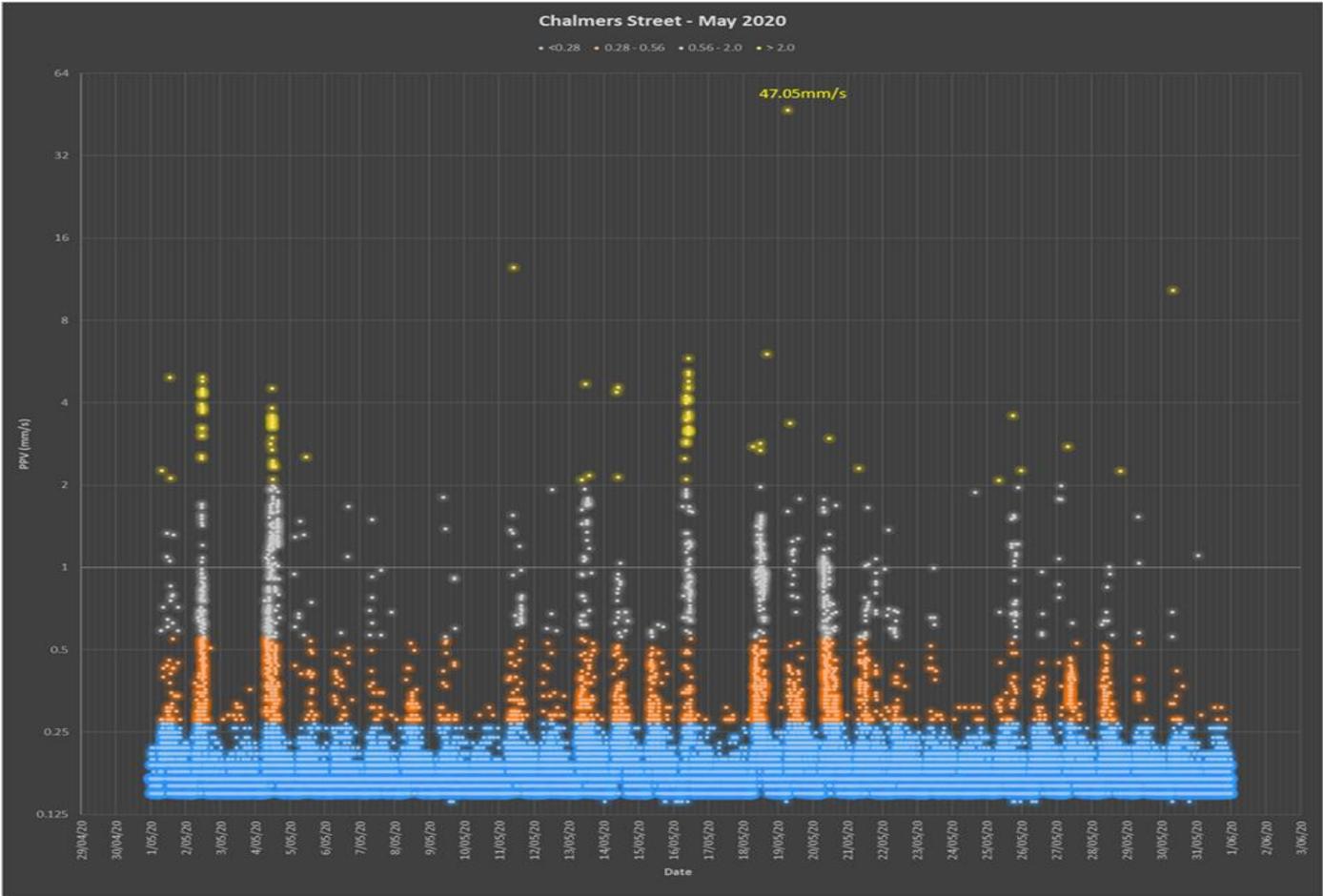


Figure B-8 Chalmers Street – May 2020: Works in the Eastern Entrance predominantly consisted of excavation activities including the use of jackhammers and excavators with hammering attachments, as well as coring into perimeter piles to install steel reinforcements. All vibration data points apart from one individual recording presented vibration values of less than 25mm/s. Given the isolated nature of the event greater than 25mm/s, this recording can be attributed to a localised bump of the geophone by construction personnel.

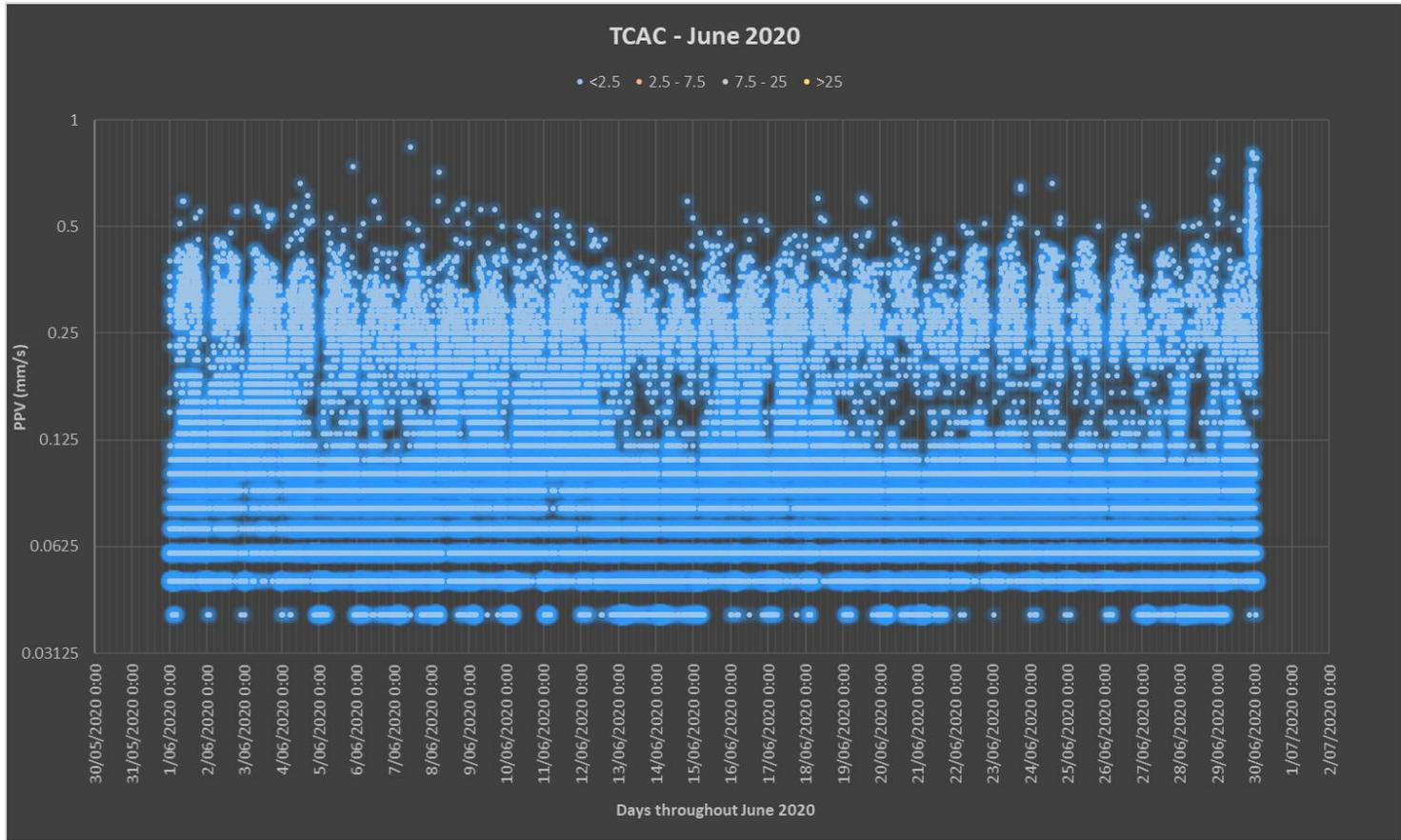


Figure B-9 TCAC - June 2020: Key activities between the Northern Concourse, TCAC and the Grand Concourse included the removal of king post piles, demolition of the glass canopy, demolition of sheer wall and cleaning of the heritage sandstone. All data points recorded for June 2020 presented vibration values of less than 1mm/s, which is significantly lower than the screening criteria for structural damage.

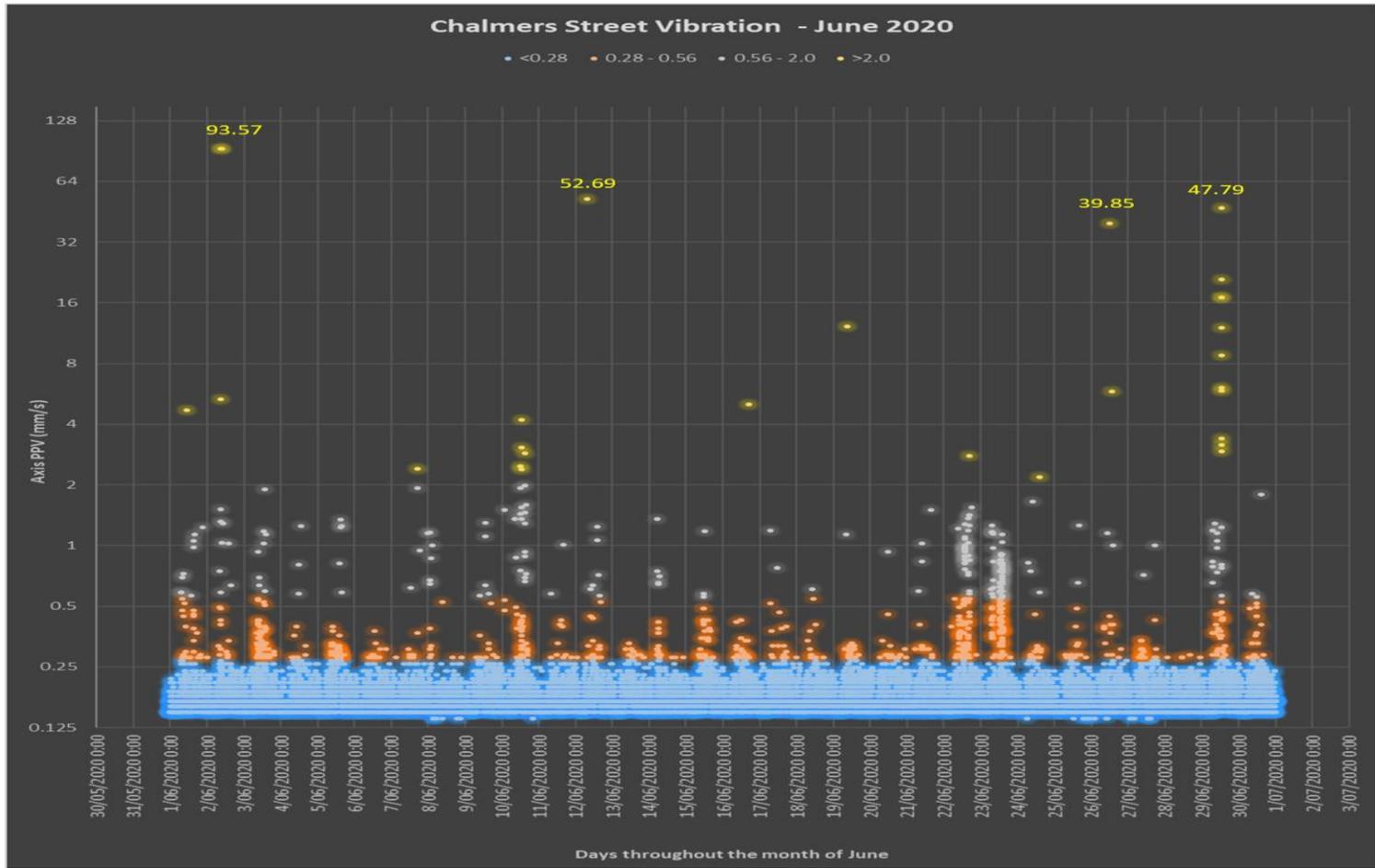


Figure B-10 Chalmers Street – June 2020: Works in the Eastern Entrance predominantly consisted of excavation activities, including the offloading of material into tipper trucks using a crane, as well as canopy tube drilling into the western wall of the site. Four isolated events recorded vibration greater than 25mm/s. However, due to the isolated nature of these events and upon further investigation of video surveillance, it was determined that these peaks were attributed to localised bumps of the geophone by construction personnel.

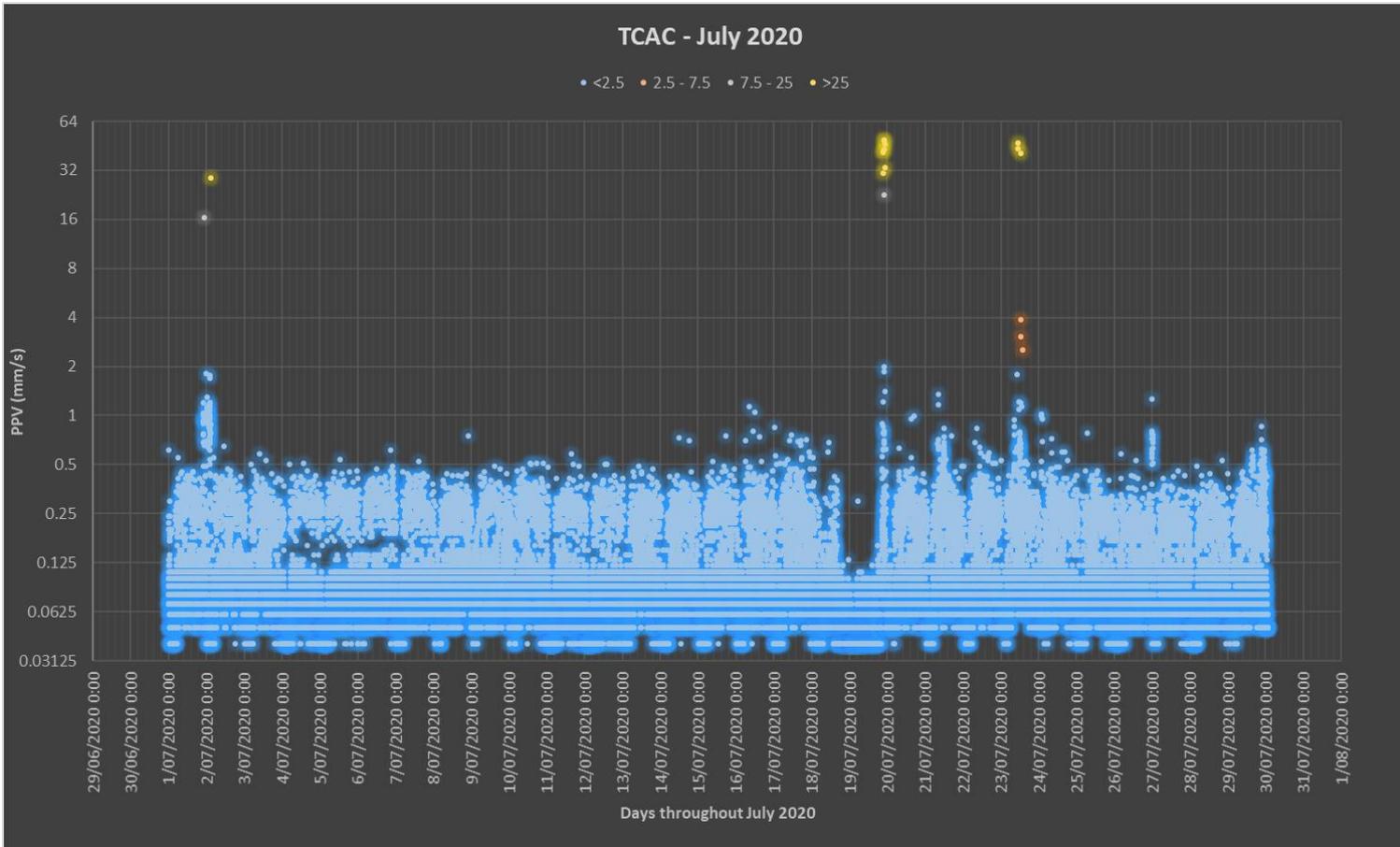


Figure B-1 TCAC – July 2020: Key activities within the Northern Concourse and surrounds included the installation of new escalators, service trenching, structural steel installation and canopy installation. There were 12 instances where the vibration recorded exceeded 25mm/s, and 11 occurred on the 19th and 23rd of July. The vibration detected did not occur consecutively on these days, but were sporadic – suggesting that these peaks are likely attributed to heavy foot traffic. Similarly, the 19th was a Sunday and marked the end of a key possession weekend.

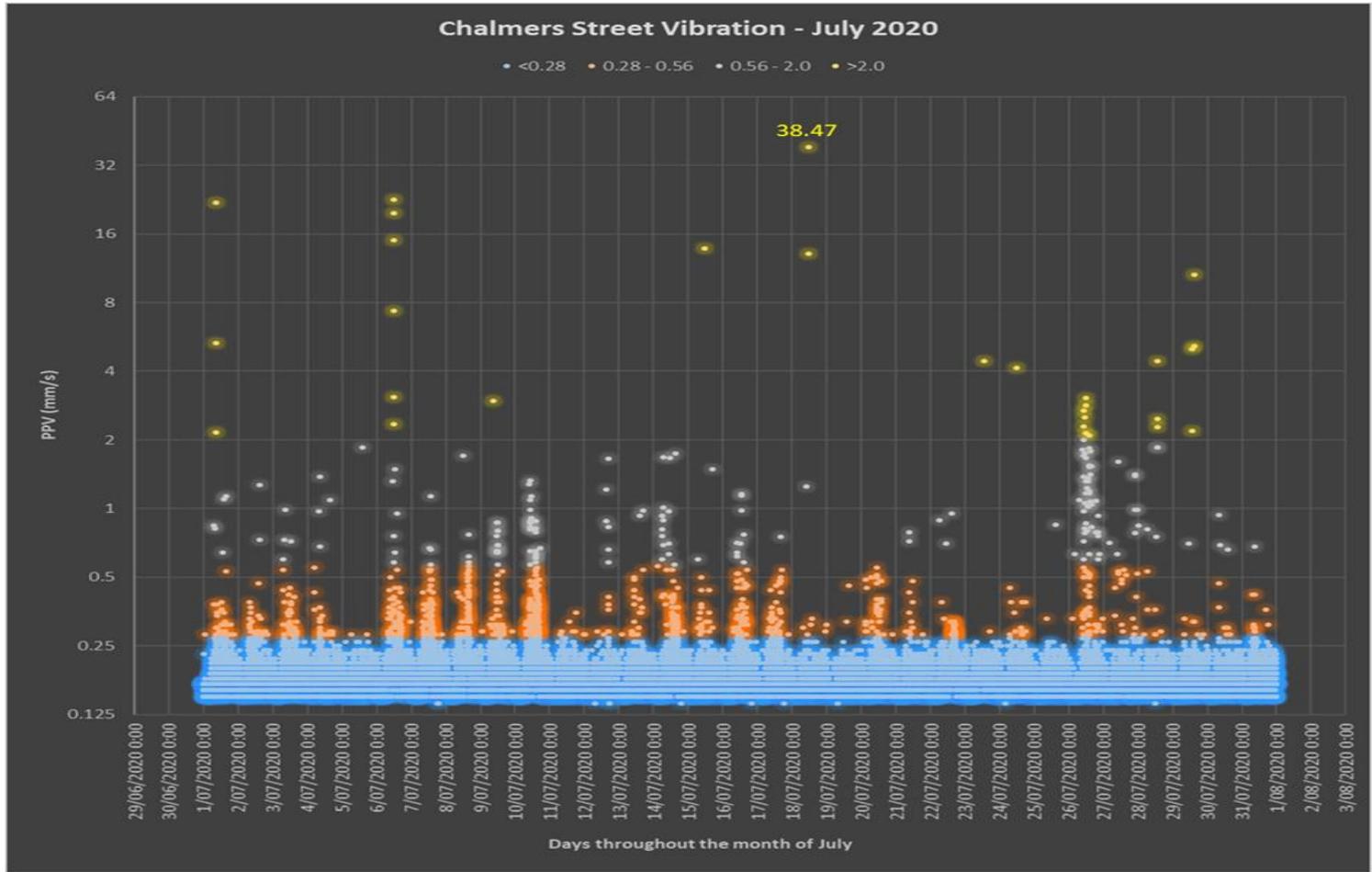


Figure B-2 Chalmers Street – July 2020: Works at the Eastern Entrance consisted of some excavation activities including the offloading of material into tipper trucks using a crane, but primarily involved canopy tube drilling, water proofing and concrete works. There was only one event where vibration exceeded the screening criteria for structural damage. Investigation using field diaries and video surveillance showed several instances where workers were observed sitting adjacent to the geophone.

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 $L_{Aeq15min5}$ 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).

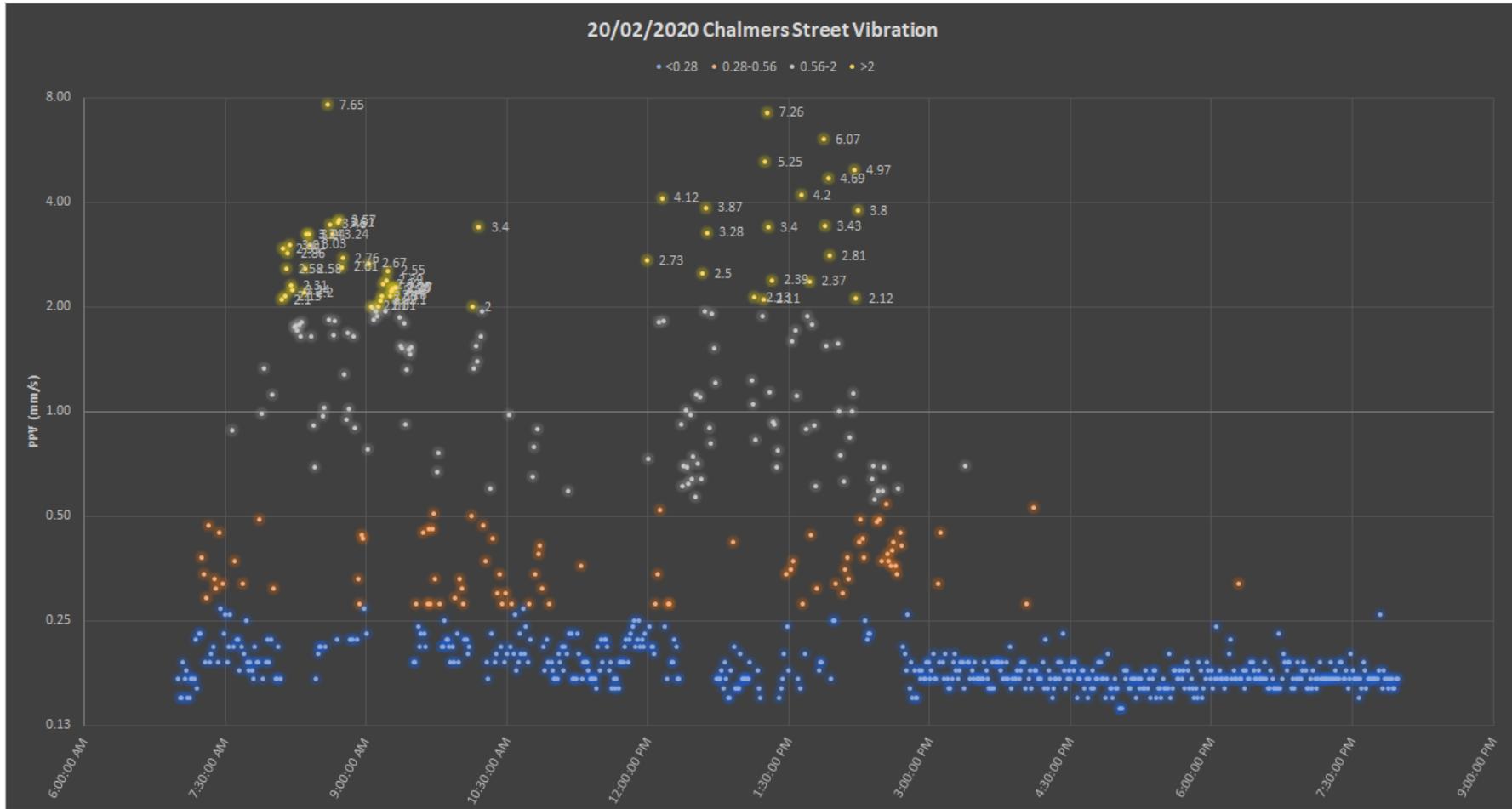


Figure C-1 February 20th 2020: Key activity for this period included pile breakout. The agreed respite can be observed around 12:00. Note: all vibration measured < 8mm/s and therefore less than the structural damage criteria.

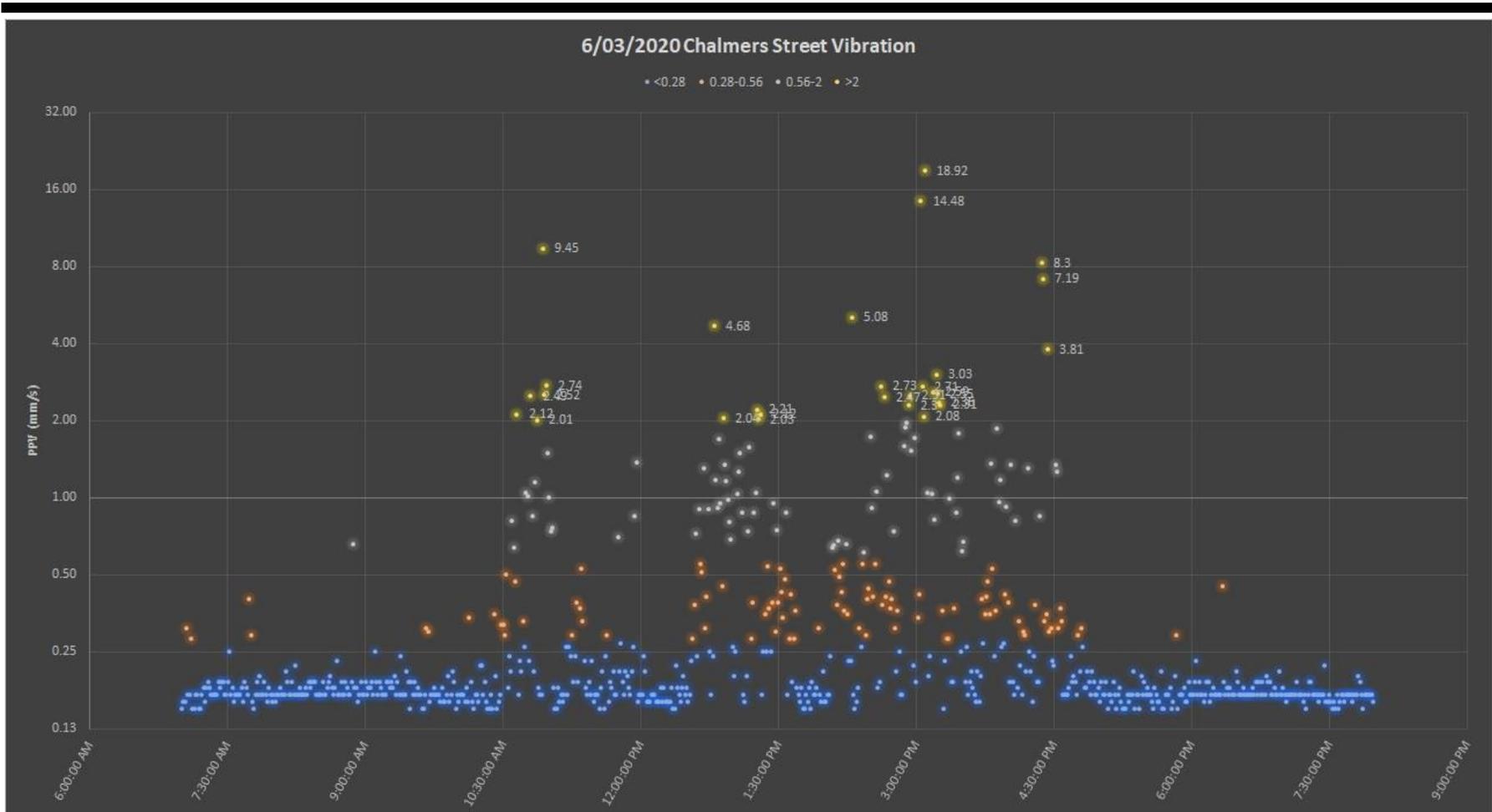


Figure C-2 March 6th 2020: Key activities included stabilised sand breakout, excavation and pile breakout. The agreed respite around 12:00 can also be observed.

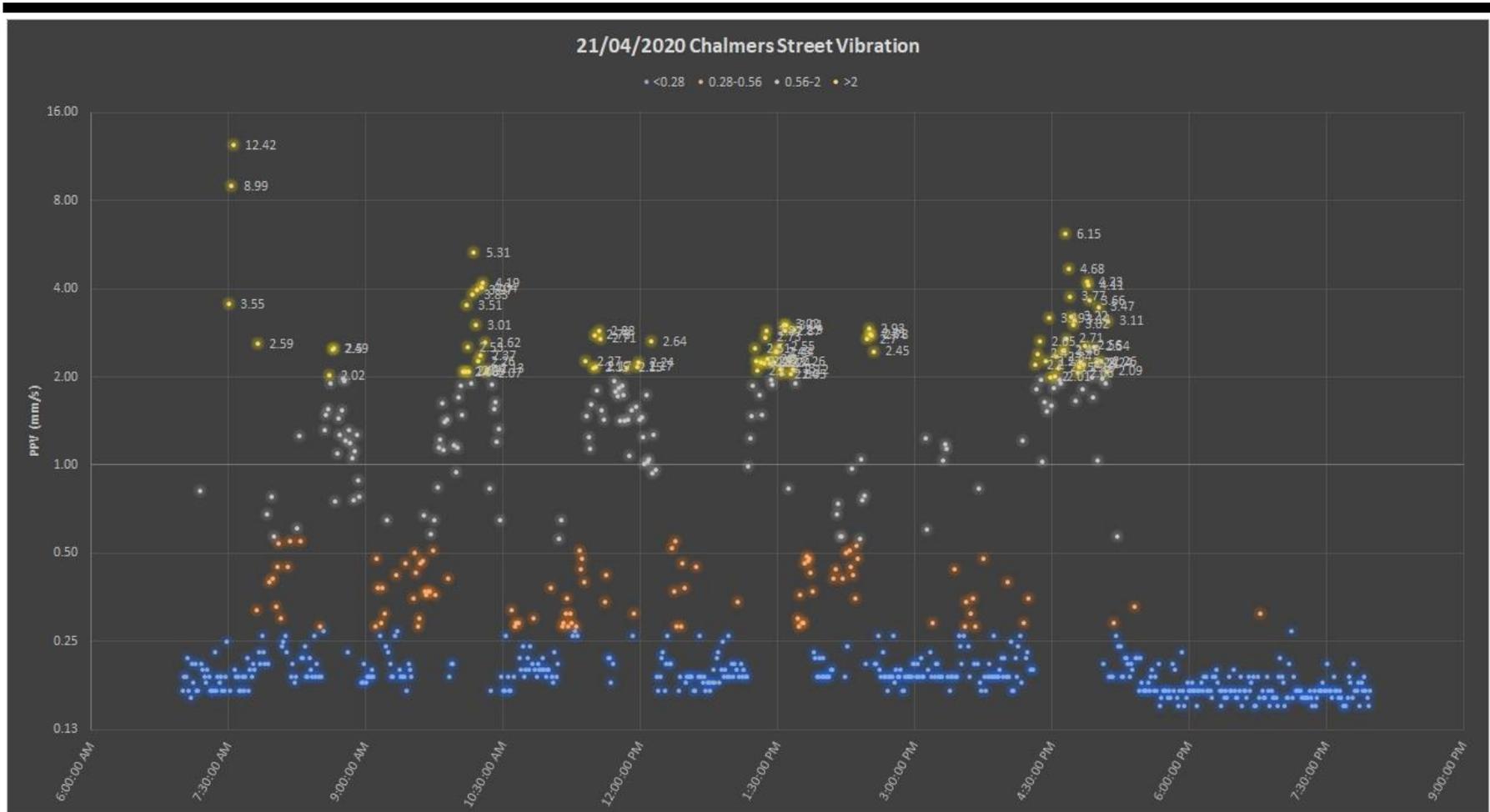


Figure C-3 April 21st 2020: Key activities during this period included excavation using jackhammers and excavators for pile detailing. Note: the consistent respite period of 1 hour being used by the project.

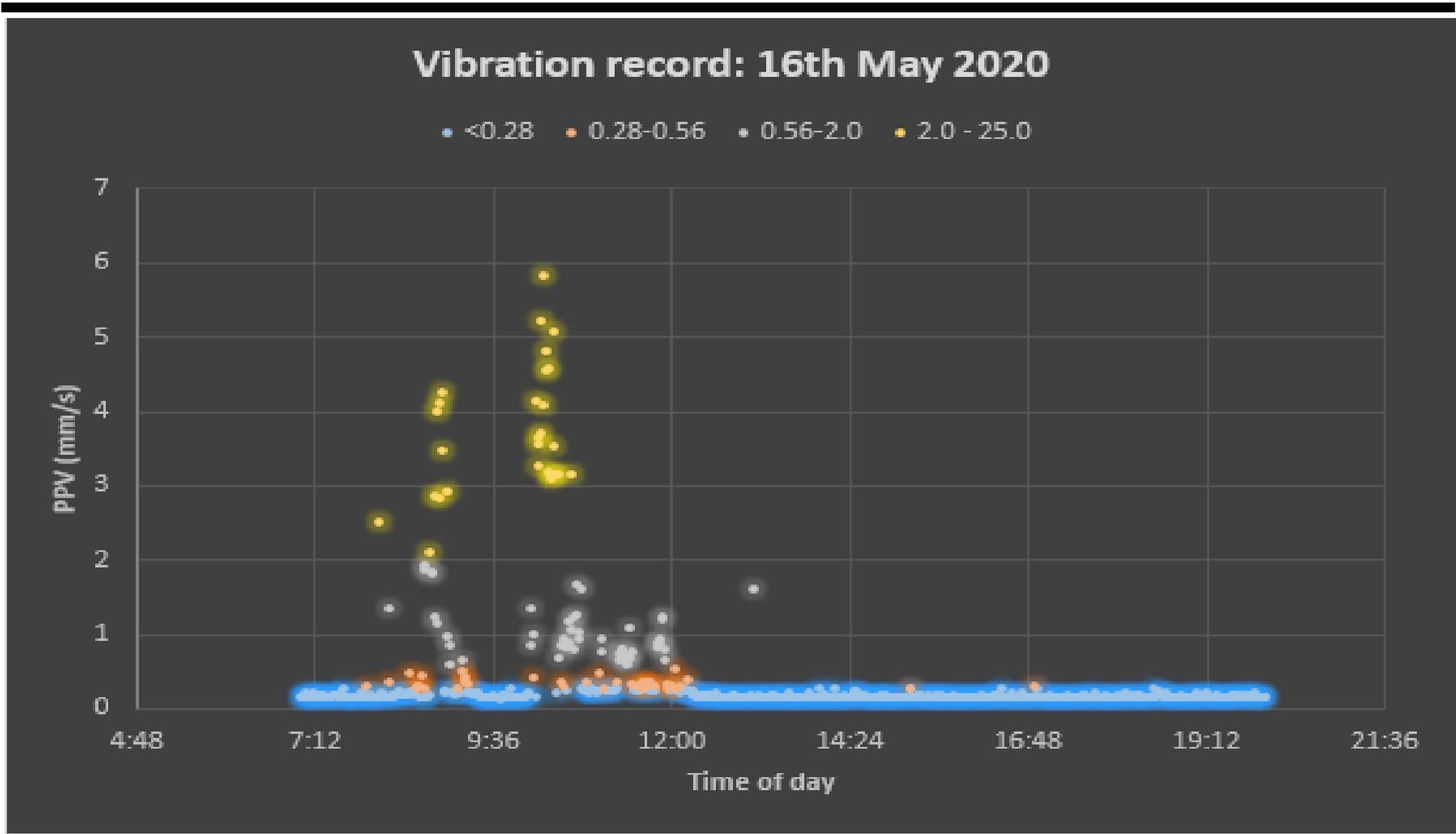


Figure C-4 May 16th 2020: Key activities included excavation, and formwork to perimeter piles. Note the reduction in high impact activities and therefore the reduced variability in vibration detected.

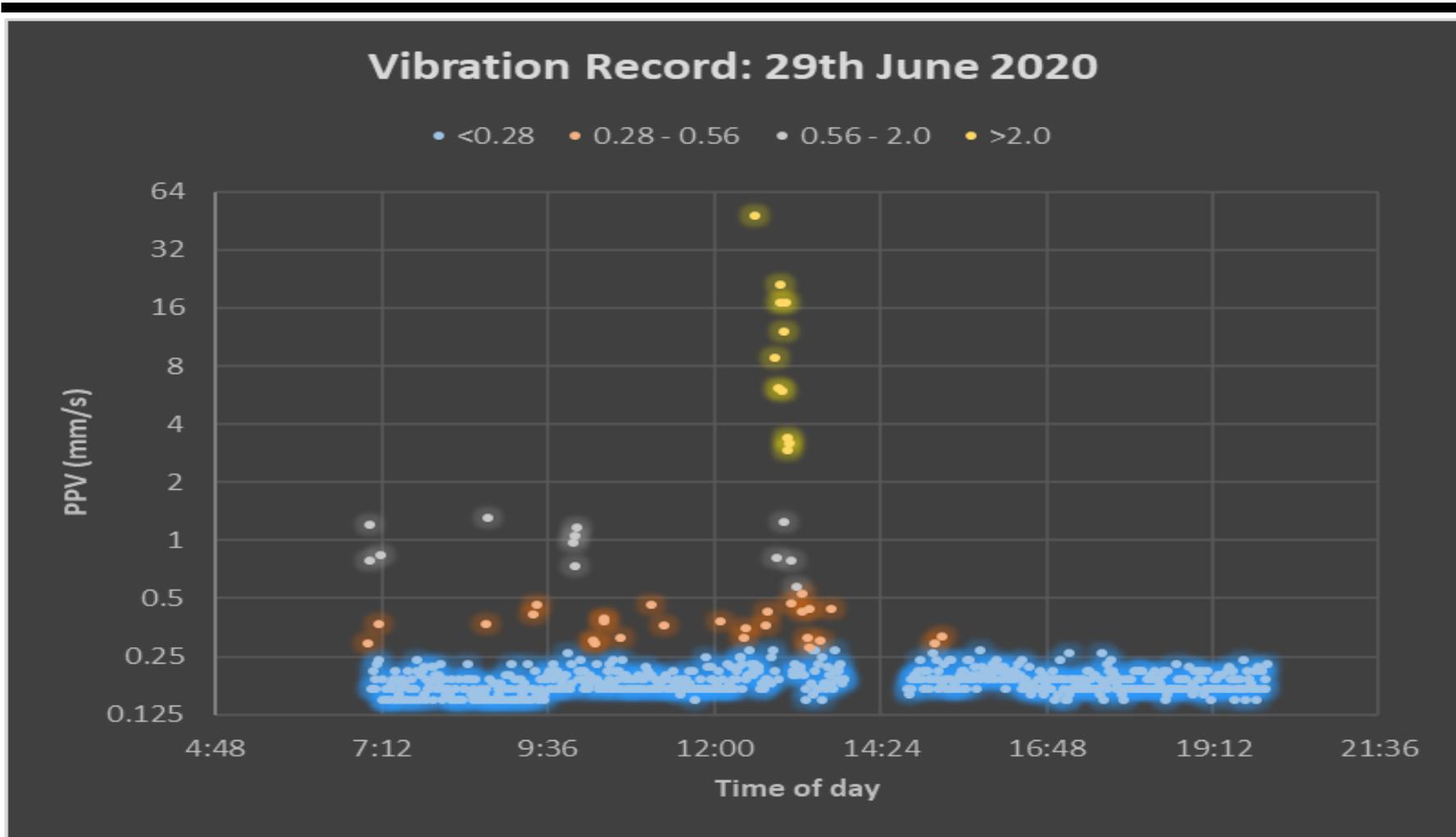


Figure C-5 June 29th 2020: Key activities during this month included excavation and material load out, as well as canopy tube drilling. Note, limited high impact activities throughout June 2020. 29th of July involved no CSM works and instead, heavy rain.

TableC-1: Summary of duration of PPV distribution (all durations are hh:mm)

Perceptible Vibration Criteria for Exposure to Continuous Vibration	PPV (mm/s) Distribution	Comment	Duration:	Duration:	Duration:	Duration:	Duration:	Duration:
			20 February 2020	6 March 2020	21 April 2020	16 May 2020	29 June 2020	26 July 2020
Preferred human comfort level	<0.28mm/s	Typical vibration level in the absence of construction. Conservatively assuming that <0.28mm.	08:52	09:44	07:45	11:04	11:16	11:48
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.	01:24	01:35	01:38	00:38	00:27	00:29
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).	01:48	01:13	02:05	00:50	00:12	00:36
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.	00:56	00:28	01:32	00:28	00:12	00:07

Perceptible Vibration Criteria for Exposure to Continuous Vibration	PPV (mm/s) Distribution	Comment	Duration: 20 February 2020	Duration: 6 March 2020	Duration: 21 April 2020	Duration: 16 May 2020	Duration: 29 June 2020	Duration: 26 July 2020
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.	02:22	01:41	3:37	01:18	01:15	00:43

Table C-2: Internal Noise measures

Date	Time	Location	LAeq	Comments
14/02/2020	14:22:00	Haven Café	67.7	LOR Works: Drilling in Eastern Entrance, near the Dental Hospital side of site. Location: Inside the Haven Café located next to works. Works inaudible. Observed noise values attributed to customers and operation of the business.
19/02/2020	10:18:00	Haven Café	70.9	LOR Works: No works (hammering complete prior to monitoring). Location: Inside the Haven Café located next to works. Works inaudible. Observed noise values attributed to customers and operation of the business.
19/02/2020	13:28:00	Haven Café	67.9	LOR works: hammering near the wall of the café, and in the north east corner of site. Location: Inside the Haven Café located next to works. 40% patron capacity, works inaudible inside and masked by customers noise.
19/02/2020	14:57:00	Haven Café	68.6	LOR works: hammering near the wall of the café. Location: Inside the Haven Café located next to works. Café mostly empty, some ground borne vibration felt, however not very audible.
20/02/2020	8:20:00	Haven Café	74.4	LOR works: hammering near the wall of the café. Location: Inside the Haven Café located next to works. Ground borne vibration felt, 100% patron capacity, causing significant noise and masking construction noise.
20/02/2020	8:35:00	Haven Café	74.7	LOR works: hammering (pile breaking) near the wall of café. Location: Inside the Haven Café located next to works. Construction noise not overly prominent over the noise from customers at the Café. Ground borne vibration could be felt, patrons at 90% capacity.
20/02/2020	13:52:00	Haven Café	71.6	LOR works: excavator hammering (stabilised sand breaking) near the wall of café, as well as some hand held jackhammering. Location: Inside the Haven Café located next to works. Airborne noise not heard greatly, however ground borne vibration felt only very slightly. Café patrons 95% capacity.
21/02/2020	8:54:00	Haven Café	75.3	LOR works: jackhammering x2 (pile breaking) near the wall of café. Location: Inside the Haven Café located next to works. Ground borne vibration felt. 100% patronage, very noisy, 5% contribution of noise from works (barely audible).
7/04/2020	15:32:00	Dental Hospital	61.9	LOR works: breaking stabilised sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site. Location: Dental Hospital ambulance bay; this is the entrance point for staff, and therefore an important point for communication as staff need to be asked questions regarding their exposure to coronavirus. Staff complained to us that when the works were loud it was affecting their ability to communicate. Note: Real time was 14:32, but the noise logger had not yet been adjusted for daylight savings ending. Works not largely audible in ambulance bay.
7/04/2020	16:32:00	Dental Hospital	62.3	LOR works: breaking stabilised sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site. Location: Dental Hospital level 1, in an open office space, on the south side of the building (closest to works). Staff complained that when works were louder earlier, they could feel vibrations and noise was disrupting

				communication. No vibrations were felt during this monitoring session, and works were barely audible. Note: Real time was 15:32, but the noise logger had not yet been adjusted for daylight savings ending.
8/04/2020	15:32:00	Dental Hospital	64.8	LOR works: breaking stabilised sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site. Location: Dental Hospital ambulance bay; this is the entrance point for staff, and therefore an important point for communication as staff need to be asked questions regarding their exposure to coronavirus. Staff complained to us that when the works were loud it was affecting their ability to communicate. Works barely audible. Note: Real time was 14:32, but the noise logger had not yet been adjusted for daylight savings ending.
8/04/2020	16:32:00	Dental Hospital	78.7	LOR works: breaking stab sand with hammer in the south east corner of the site (farthest away from dental hospital). Noise mitigation measures include: noise barriers around the site. Location: Dental Hospital level 1, in an open office space, on the south side of the building (closest to works). Staff complained that when works were louder earlier, they could feel vibrations and noise was disrupting communication. No vibrations were felt during this monitoring session, and works were barely audible. Note: Real time was 15:32, but the noise logger had not yet been adjusted for daylight savings ending.
14/05/2020	10:37:00	Randle Lane	52.5	LOR Works: Breaking at East Entrance using smaller excavator loading out spoil Location: U404/1-5 Randle Lane – Balcony window kept closed – works largely inaudible.
14/05/2020	10:57:00	Randle Lane	75	LOR Works: Breaking at East Entrance using smaller excavator loading out spoil Location: U404/1-5 Randle Lane. Balcony window kept open – greater impact of construction noise. Advised occupants to keep windows closed when works are most audible.
20/05/2020	14:25:00	Chalmers St (Dental Hospital)	54.7	LOR works: Eastern Entrance (EE) loading out material into trucks on Randle Lane (inaudible). Location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works). Works largely inaudible
20/05/2020	14:40:00	Chalmers St (Dental Hospital)	54.3	LOR works: Eastern Entrance (EE) loading out material into trucks on Randle Lane (inaudible). Location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works). Works inaudible.
20/05/2020	15:52:00	Chalmers St (Dental Hospital)	66.8	LOR works: Eastern Entrance (EE) breaking with the big hammer at the northern (Dental Hospital) side of works. Location: Sydney Dental Hospital level 1 occupied meeting room on the south side of the building (closest to works). All works noise was ground borne vibration, which creates noise from the room's furniture. Meeting room contained a raucous staff meeting, which is inferred to account for about +4dB when compared to subsequent monitoring in adjacent empty room. Noise and vibration levels were compliant.
20/05/2020	16:07:00	Chalmers St (Dental Hospital)	63.2	LOR works: Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works. Location: Sydney Dental Hospital level 1 unoccupied office space on the south side of the building (closest to works). All works noise was ground borne vibration. Noise from the meeting room was inferred to cause an increase in approximately 4dB.
21/05/2020	9:50:00	Chalmers St (Dental Hospital)	61	LOR works: Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works, at shale level.

				Location: Sydney Dental Hospital level 1 unoccupied meeting room on the south side of the building (closest to works). All works noise was ground borne vibration – which was insignificant with no airborne noise audible.
21/05/2020	10:10:00	Chalmers St (Dental Hospital)	75.6	LOR works: Eastern Entrance (EE) breaking with the big hammer on the northern (Dental Hospital) side of works, at shale level. Location: Sydney Dental Hospital ground floor ambulance bay on the south side of the building (closest to works). Works noise clearly heard, as it was very close by (<10m). Location of monitoring was requested by Dental Hospital staff as noise affects the supervisor of that entrance. Works were not extensive in duration and the duration of internal noise impacts were compliant with CoA38.
27/05/2020	9:43:00	Randle Lane	50.4	LOR works: large 23t excavator breaking concrete above eastern capping beam U404/1-5 Randle Lane. This time balcony closed completely. Some ground borne noise perceived towards the measure from prolonged breaking. External real time noise logger: 09:30 was 76.6dB 09:45 was 77.5dB 10:00 was 76.6 dB therefore ~32.1dB noise attenuation.

ENDORSEMENT CITY & SOUTHWEST ACOUSTIC ADVISOR

Review of	Central Station Main Works Construction Noise and Vibration Monitoring Program Report February 2020 - July 2020	Document reference:	Central Station Main Works Construction Noise and Vibration Monitoring Program Report February 2020 – July 2020
Prepared by:	Larry Clark, Alternate Acoustic Advisor		V2_CSM_Construction Monitoring Report_Feb20-Jul20_Rev2.pdf
Date of issue:	10 February 2021		Revision 0, received 20 January 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 February 2020 – July 2020 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